TENDER DOCUMENT

FOR

CONSTRUCTION OF MULTI STOREYED OFFICE BUILDING

AT

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED,

REGIONAL INSTITUTE-IV, NAGPUR

OCTOBER 2017

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LTD,

GONDWANA PLACE, KANKE ROAD,

RANCHI- JHARKHAND

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1.0 NOTICE INVITING TENDER

&

INSTRUCTION TO BIDDERS

सेन्ट्रल माईन प्लानिंग एण्ड डिजाइन इन्स्टीच्यूट लिमिटेड
(कोल इण्डिया लिमिटेड की अनुषंगी कम्पनी / भारत सरकार का एक लोक उपक्रम)
गोन्दवाना प्लेस, कॉके रोड, राँची - 834 031, झारखंड (भारत)
Central Mine Planning & Design Institute Limited
(A Subsidiary of Coal India Limited / Govt. of India Public Sector Undertaking)
Gondwana Place, Kanke Road, Ranchi - 834 031, Jharkhand (INDIA)
Corporate Identity Number (CIN): U14292JH1975GOI001223

NIT No: CE(C)/Tender/RI-IV/306(N)/ 2017/E- 20089 **Date:15.11.2017**

E-Tender-notice

1. Name of Work:

Tenders are invited on-lineon the websitehttp://coalindiatenders.nic.infrom the eligible bidders having Digital Signature Certificate (DSC) issued from any agency authorized by Controller of Certifying Authority (CCA), Govt. of India and which can be traced up to the chain of trust to the Root Certificate of CCA, for the following work.

Name of work	Estimated cost (In INR)	Earnest Money (In INR)	Completion Period
CONSTRUCTION OF MULTI STOREYED OFFICE BUILDING AT CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED, REGIONAL INSTITUTE-IV, NAGPUR	₹ 182503100/-	₹ 2281300/-	670 days

Tender Inviting Authority	**Contact Person(s)/Tender Dealing Officer(s)**
General Manager(CIVIL) CMPDIL, KANKE ROAD, RANCHI Contact no: 0651-2230070, 08987789067	K A PANDIAN, HOD(CIVIL), CMPDIL,RI-IV, JARIPATKA, NAGPUR(MH) Contact No: 0712-2642533, 09421995355, 09421995389

2. Time Schedule of Activities:

Sl. No.	**Particulars**	**Time Schedule**
a.	Tender e-Publication date	
b.	Document download/ Sale Start Date	

c.	Document download & Bid submission End Date	Date & Time as mentioned in the website: https://coalindiatenders.nic.in
d.	Bid Submission Start Date	
e.	Start Date for seeking Clarification on-line	
f.	Last Date for seeking Clarification on-line	
h.	Date of Pre-Bid Meeting (If required)	
i.	Bid Opening Date	

NOTE (Important):

i. If the due date of opening falls on a holiday, the Tender will be opened on the next working day.

ii. In case minimum 03 (three) bids are not received within originally stipulated time, the *Bid Submission End Date* will be extended initially for 02 (two) days and if still less than 03 bids are received, the *Bid Submission End Date* will be extended by another 05 (five) days automatically by the system.

iii. There will be no physical / manual sale of the Tender Document.

iv. There is no tender fee and the bidders can download the Tender Document free of cost.

v. Bidders are advised to download the complete set of the Tender Document, including the tender details.

3. Bid Security/ Earnest Money Deposit (EMD):

The bidder will have to make the payment of EMD through **ONLINE** mode only.

a. For Domestic Bidders:

In Online mode the bidder can make payment of EMD either through net banking from designated Bank/s or through NEFT/ RTGS from any scheduled Bank. In case of payment through net-banking, the money will be immediately transferred to CMPDIL's designated Account.

In case of payment through NEFT/RTGS the bidder will have to make payment as per the Challan generated by system on e-Procurement portal and will have to furnish online the UTR Numbers before submission of bid. Bidder will be allowed to submit his / her bid only when the EMD is successfully received in CMPDIL's account and the information flows from Bank to e-Procurement system.

The Earnest Money/ Bid Security of the unsuccessful bidder will be refunded and will not bear any interest.

NOTE:

The process of submission of EMD should be initiated preferably at least 24 hours before End Date and Time of Bid Submission to avoid any system related problems or issues in the payment gateway.

Clarification*:* No exemption of EMD for any bidder. However, in the online portal if option of exemption of EMD is mentioned as YES, then it is only to facilitate the bidder to upload detail of EMD in case of foreign currency.

4. Pre-bid Meeting:

The pre-bid meeting shall be held in the office of Tender Inviting Authority on the scheduled date & time, only if specified online. Non-attendance of pre-bid meeting will not be a cause for disqualification of the bidder and it shall be presumed that the bidder does not require any clarification. The purpose of the pre-bid meeting will be to clarify issues.

5. Clarification of Bid:

The bidder may seek clarification on-line within the specified period. However, the management will clarify, as far as possible, only the relevant queries.

6. User Portal Agreement:

The bidders have to accept unconditionally the online user portal agreement which contains the acceptance of all the Terms and Conditions of NIT including '*General Terms & Conditions'* and *'Special Terms & Conditions'* and other conditions, if any, along with on-line undertaking in support of the authenticity of the declarations regarding the facts, figures, information and documents furnished by the Bidder on-line through https://coalindiatenders.nic.in in order to become an eligible bidder. No conditional bid shall be accepted .

7. Eligible Bidders:

In order to submit the bid, the bidders have to get themselves registered online on e-Procurement portal of CIL (https://coalindiatenders.nic.in) with valid Digital Signature Certificate (DSC). The bidders should have a Digital Signature Certificate (DSC) issued from any agency authorized by Controller of Certifying Authority (CCA), Govt. of India and which can be traced up to the chain of trust to the Root Certificate of CCA .The invitation for bid is open to all bidders including an individual, proprietorship firm, partnership firm, company registered under company's act or a Joint Venture having eligibility to participate as per eligibility criteria stipulated in **Clause No: 8** of the NIT.

NOTE:

Joint Venture shall be allowed for participation in the bid with estimated cost above ₹ 2.0 Crores.

7.1 Requirements of any Joint Venture:

Two or three (but not more than three) companies/ contractors may participate in the tender as Joint Venture (JV). Joint Ventures must comply the following requirements:

i. Following are the minimum qualification requirements for a joint venture.
   a. The minimum qualification requirements for Joint Venture: The qualifying criteria parameters e.g. experience, financial resources etc. of the individual partners of the J.V. will be as deliberated under **Clause No. 8** of the NIT towards fulfillment of qualification criteria related to the experience.
   b. The qualifying criteria parameter e.g. financial resources (turnover) of the individual partners of the JV will be added together, for the relevant period, and the total criteria should not be less than as deliberated under **Clause No. 8** of the NIT towards fulfillment of qualification criteria related to financial turn over.

ii. The formation of Joint Venture or change in the Joint Venture character/ partners after submission of the bid and/ or any change in the bidding regarding Joint Venture will not be permitted.

iii. The bid, and in case of a successful bid, the agreement shall be signed, so as to legally bind all partners jointly and severally and bid shall be submitted with a copy of the Joint Venture Agreement providing the joint and several liabilities with respect to the contract.

iv. The pre-qualification of a joint venture does not necessarily pre-qualify any of its partners individually or as a partner in any other joint venture or association. In case of dissolution of a joint venture, each one of the constituent firms may pre-qualify if they meet all the pre-qualification requirements, subject to written approval of the employer.

v. The JV Agreement must include the relationship between joint venture partners in the form of JV Agreement to legally bind all partners jointly and severely for the proposed agreement which should set out the principles for the constitution, operation, responsibilities regarding work and financial arrangements, participation (percentage share in the total) and liabilities (joint and severally) in respect of each and all of the firms in the joint venture. Such JV Agreement must evidence the commitment of the parties to bid for the facilities applied for (if pre-qualified) and to execute the contract for the facilities if their bid is successful.

vi. One of the partners shall be nominated for being in charge of the contract and shall be

designated as **Lead Partner**. This authorization shall be evidenced by a Power of Attorney signed by legally authorized signatories of all the partners at the time of bidding.

vii. The JV Agreement must provide that the Lead Partner shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the Joint Venture and the entire execution of the contract shall be done with active participation of the Lead Partner.

viii. The contract agreement should be signed jointly by each Joint Venture Partners. Subsequent declaration/ letters/ documents shall be signed by the lead partner authorized to sign on behalf of the Joint Venture or by the authorized signatory on behalf of the JV.

ix. The bid should be signed by all the partners of the Joint Venture.

x. An entity can be a partner in only one Joint Venture. Bid submitted by Joint Ventures including the same entity as partner will be rejected.

xi. The JV agreement may specify the share of each individual partner for the purpose of execution of this contract. This is required to fulfill eligibility and also for the purpose of apportioning the value of the contract to that extent to individual partner for subsequent submission in other bids if he intends to do so for the purpose of the qualification in the bid.

xii. The Earnest money/ Bid security/ Bank guarantee can be submitted by the JV/one or more partners of the JV.

xiii. The JV agreement must be specific that it is valid for the project for which the bidding is done. If the JV breaks up midway before award of work/during bid validity period the bid will be rejected.

If the JV breaks up midway before award of work/ during bid validity/ after award of work/ during pendency of the contract; in addition to normal penalties as per provisions of the bid document, all the partners of the JV shall be debarred from participating in future bids for a minimum period of 12 months in CMPDIL.

xiv. JV agreement shall be registered in accordance with the law so as to become legally valid and binding on the members before making any payment.

xv. JV shall open a Bank Account in the name of JV and all payments due to the JV shall be credited by employer to that account only. To facilitate statutory deductions all statutory documents like PAN/GSTIN, etc. in the name of the Joint Venture shall be submitted by JV before making any payment.

8. Eligibility Criteria:

8.1 Work Experience:

The Intending bidder must have in its name or proportionate share as a member of Joint Venture experience of having successfully **completed similar** works, as a prime contractor, during last 7(seven) years ending last day of month previous to the one in which bid applications are invited (i.e. eligibility period) should be any of the following:-

i. **Three similar completed works** each costing not less than the amount **equal to 40%** of the estimated cost put to tender.

Or

ii. **Two similar completed works** each costing not less than the amount **equal to 50%** of the estimated cost put to tender.

Or

iii. **One similar completed work** costing not less than the amount **equal to 80%** of the estimated cost put to tender.

In case the bidder is not a prime contractor but a sub-contractor, the bidder's experience as sub-contractor will be taken into account, against suitable document, that the contract in support of qualification is a sub-contract in compliance with the provision of such sub-contract in the original contract awarded to the prime contractor). The document may be issued by the Owner/ Govt. department on behalf of the Owner.

The work experience of only those works shall be considered for evaluation purpose, which are completed on or before the last day of the month previous to one in which e-Tender has been invited i.e. **31.10.2017.** **The experience of incomplete/ ongoing works as on the last date of eligibility period will not be considered for evaluation. If the referred work includes construction as well as maintenance after construction, the experience of such work may be considered as acceptable, if the construction part is completed on last day of eligibility period, even if, maintenance work is going on, and the certificate issued clearly stipulates the same.**

While considering the value of completed works, the full value of completed works will be considered whether or not the date of commencement is within the said 7 (seven) years period.

The cost of previous completed works shall be given a weightage to bring them at current price level by adding 5% for each completed year (total number of days/365 considering 365 days per year).This weightage will be applicable after the end date of experience (date of completion of work) before the last day of month previous to one in which e- tender has been invited.

In case the bidder is not a prime contractor but a sub-contractor, the bidder experience as sub-contractor will be taken into account, against suitable document that the contract in support of

qualification is a sub contract in compliance with the provision of sub contracts in the original contract awarded to a prime contractor. The documents may be issued by owner/ Govt Department on behalf of the owner.

The definition of similar work shall be as follows:

"Multi storied building (minimum, G+5) Construction, with Heating, ventilation and Air conditioning (HVAC) System, Fire fighting and electrification works."

In respect of the above eligibility criteria the bidders are required to furnish the following information on-line:

i. Start date & End date of each qualifying experience (similar work).

ii. Work Order Number / Agreement Number of each experience.

iii. Name and address of Employer/ Issuing authority for such Work Order for each experience certificate.

iv. Percentage (%) share of each experience (100% in case of an individual/ Proprietorship firm or a partner in a partnership firm and the actual percentage (%) of share in case of a Joint-Venture/Consortium).

v. Executed Value of Work against each experience.

vi. Confirmation in the form of **Yes/No** regarding submission of similar work experience as defined in the NIT.

NOTE:

In case the bidder is a Joint Venture, the work experience of any one, two or three of the individual partners of JV shall be deliberated here-in-after towards fulfillment of qualification criteria related to the work experience in the following manner:**[Joint Venture, shall be allowed for participation in the bid with estimated cost above Rs. 2.0 Crores only.]**

a) In case of completion of **single work of similar nature** costing not less than the amount equal to 80% of the estimated cost put to the tender:

   (i) Any JV partner shall have the experience of having completed successfully a single work of similar nature equal to 80% of the estimated cost put to the tender.

OR,

b) In case of completion of **two works of similar nature** each costing not less than the amount equal to 50% of the estimated cost put to the tender:

   i) Any one partner of JV can match the above requirement.

OR,

ii) At least two partners should each have completed at least one work of similar nature each costing not less than the amount equal to 50% of the estimated cost put to the tender.

OR,

c) In case of completion of three works of similar nature each costing not less than the amount equal to 40% of the estimated cost put to the tender:

i) Any one partner of JV can match the above requirement.

OR,

ii) Any two partners shall match the above requirement through completion of at least one work of similar nature each costing not less than the amount equal to 40% of the estimated cost put to the tender.

OR,

iii) All the three partners shall match the above requirement through completion of at least one work of similar nature each costing not less than the amount equal to 40% of the estimated cost put to the tender.

However, during fulfillment of any of the above criteria one of the partners, who is the **Lead Partner** shall have:

i) More than 50% share in the Joint Venture, and

ii) Experience of having completed successfully a single work of similar nature equal to at least 40% of the estimated cost put to tender.

Scanned copy of documents to be uploaded by bidders (CONFIRMATORY DOCUMENT):

For work experience, the intending bidder must submit documentary evidence in support of above in the form of:

i. Certified copy of *Work Order*,
ii. *Completion Certificate* indicating value and period of work,
iii. In case of sub-contractor suitable document as per provision of eligibility- if applicable.

The TDS certificate /Bill of Quantity may be submitted during clarification, if sought.

Technical evaluation by the System:

i. The system shall calculate the period of 7 years backwards starting from the last day of month previous to the e-Publication date of NIT.

ii. The system shall check the End date of each experience (The system shall not allow more than 3 entries for experience) and accept it as a qualifying experience if the end date of experience falls within the 7 years computed by the system.

iii. The system shall calculate the value of each qualifying experience by multiplying the value with the % share of experience and adding 5% for each completed year (total No. of days/365) after the end date of experience of work till the last date of month previous to one in which the NIT has been published on e-Procurement portal.

iv. The system shall check the experience with highest value whether it exceeds 80% of ECV. In case it does not, it shall check the top 2 experiences whether each of them is greater than 50% of ECV. In case, it still does not, the system shall check all 3 qualifying experiences whether each of them exceeds 40% of ECV. The system shall regard the bidder as 'Eligible' if it meets any of the aforementioned criteria or else it shall consider the bidder as 'Ineligible'.

v. The weightage of 5% every year will be on simple rate and will not be compounded on yearly basis for the purpose of calculating the value of each qualifying experience.

vi. The work experience of the bidder for those works only shall be considered for evaluation purposes, which are completed before the last date of month previous to one in which NIT has been published on e-Procurement portal. Hence, the works which are incomplete/ongoing, as on the last date of month previous to one in which NIT has been published on e-Procurement portal, shall not be considered against eligibility.

vii. In case the work is started prior to the eligibility period of 7 years (counted backwards starting from the last day of month previous to the e-Publication date of NIT) and completed within the said eligibility period of 7 years, then the full value of work shall be considered against eligibility.

viii. In case the experience has been earned by the bidder as an individual or proprietor of a proprietorship firm or partner of a partnership firm, then 100% value of the experience will be considered against eligibility. But if the experience has been earned by the bidder as a partner in a Joint Venture firm then the proportionate value of experience in proportion to the actual share of bidder in that Joint Venture will be considered against eligibility.

8.2 Financial-Turnover:

Average annual financial turnover during the last 03 (three) years, ending 31st March of previous financial year should be at least 30% of the estimated cost put to tender.

(The **"Previous Financial Year i.e. 31st March 2017"** shall be considered)

In respect of the above eligibility criteria the bidders are required to furnish the following information on-line:

i. Annual turnover of each of the last 3 years ending 31st March of the previous financial year.

ii. Name of the Chartered Accountant issuing the Profit and Loss A/c or the Turnover certificate.

iii. Membership Number of the CA

iv. In case the bidder is a Joint Venture, the turnover of the individual partners of the JV will be added together for each financial year and is to be furnished as the turnover of the bidder for that particular financial year

Scanned copy of documents to be uploaded by bidders (CONFIRMATORY DOCUMENT):

The intending bidder must submit *Turnover Certificate* from Practicing Chartered Accountant of India containing information as furnished by bidder on-line.

Technical evaluation by the System:

i. The system will calculate the 30 % of the estimated value (ECV) as the required average turnover of the bidder.

ii. The system will calculate the average of the financial turnover of 3 years furnished by the bidder by adding 5% for each completed year (total number of days/365) after the end of respective Financial Year (i.e. 31st March) till the last day of month previous to one in which e-Tender has been invited.

iii. The average shall be compared with the minimum requirement to ascertain the eligibility status of the bidder.

iv. If any bidder does not submit the Turnover value for any of the 3 years, the system will not disqualify him and instead shall consider all 3 years for computing the average by assuming a value of 'zero' for the year for which no information is given by bidder.

8.3 **Permanent Account Number (PAN):**

The bidder should possess Permanent Account Number (PAN) issued by Income Tax Department, Govt. of India.

In respect of the above eligibility criteria the bidders are required to furnish the following information on-line:

Confirmation in the form of **Yes / No** regarding possessing of Permanent Account Number (PAN) issued by Income Tax Department, Govt. of India.

NOTE:

In case, the bidder is a *Joint Venture/ Consortium*, PAN Card issued by the Income Tax Department, Govt. of India for each Indian Partner of JV/ Consortium and verifiable *Tax Residency Certificate* of respective country for each foreign partner or JV/Consortium itself).

Scanned copy of documents to be uploaded by bidders (CONFIRMATORY DOCUMENT):

Photocopy of the PAN Card issued by Income Tax Department, Govt. of India OR the Tax Residency

Certificate of the respective country as the case may be.

Technical evaluation by the System:

The system will evaluate "Yes" as eligible and "No" as not eligible.

8.4 Goods and Service Tax (Not Applicable for Exempted Goods/Services):

The bidder should be either

i. GST Registered Bidder/ (**but not under composition Scheme**)

OR

ii. GST unregistered Bidder.

Registration:

The bidder is liable to be registered under GST unless they are specifically exempt from registration under specific notification / circular / section / rule issued by statutory authorities.

The bidder claiming exemption in this respect shall submit supporting documents as well as certificate from Practicing CA/CMA/CS to the effect that Bidder is fulfilling all the conditions prescribed in notification to make him exempt from registration.

For Example: If the bidder is exempt from Registration under CGST ACT, 2017 due to his aggregate turnover in the relevant financial year being less than INR 20/10 lakhs; then bidder shall submit the copy of Notification along with Certificate from Practicing CA/CMA/CS to the effect that Aggregate turnover from his all business operation during the relevant financial year is less than INR 20/10 Lakhs and hence the bidder is exempt from Registration under GST Act, 2017.

The expression "**aggregate turnover**" shall include all supplies made by the taxable person, whether on his own account or made on behalf of all his principal.

Composition Scheme:

Where the bidder has opted for composition levy under Sec 10 of CGST, he should declare the fact while bidding (In the BOQ).

In respect of the above eligibility criteria, the bidders are required to furnish the following information on-line:

i. Confirmation in the form of **Yes/No** regarding possessing of required document as enlisted in NIT with respect to GST status of the bidder.

ii. Status of the bidder in the BOQ excel sheet being uploaded by the bidder during bid submission.

Scanned copy of documents to be uploaded by bidders (CONFIRMATORY DOCUMENT):

The scanned copy of documents regarding status w.r.t GST to be uploaded by bidders in support of information/ declaration furnished online by the bidder in the BOQ sheet against Eligibility Criteria.

I. Status: GST registered Bidder**(but not under Composition Scheme)** :

Document: GST Registration Certificate (i.e. GST Identification Number) issued by appropriate authority.

II. Status: GST unregistered bidder/ Dealer:

Document: A Certificate from a practicing Chartered Accountant having membership number with Institute of Chartered Accountants of India certifying that the bidder is GST unregistered bidder in compliance with the relevant GST rules.

NOTE:

In case of JV, a Certificate from a practicing Chartered Accountant having membership number with Institute of Chartered Accountants of India; confirming the status of JV w.r.t GST in compliance with relevant GST rules or GST Registration Certificate of JV.

[In case the works contract is awarded to a Joint Venture participating in the tender they have to submit PAN, GST registration (as applicable in the tender and for the bidder status) etc. in the name of the Joint Venture after Award of Works contract at the time of execution of agreement/ before the payment of first running on account bill.]

Important: If turnover of bidder exceeds exemption limit, the bidder must obtain GST registration as per GST Act and Rules.

Technical evaluation by the System of tender and L-1 status:

a) The evaluation of tender shall be done based on cost to company. The cost to company shall be ascertained by reducing the total Value (including taxes and duties) quoted by the bidder by the amount of CGST & SGST or IGST, GST (Compensation to state) cess eligible for input tax credit. The L1 shall be decided based on cost to company ascertained in manner suggested above.

Where the bidder is an unregistered one i.e. (exempt from registration under GST) supplying taxable goods/service causing CMPDIL liable to deposit tax under reverse charge, the CGST & SGST or IGST and GST (Compensation to state) cess, as applicable and payable by CMPDIL under reverse charge, shall be added to cost, while ascertaining the landed price. However, in this case also The L1 shall be decided based on cost to company ascertained after deducting the CGST & SGST or IGST and GST (Compensation to state) cess amount eligible for input tax credit, if any, from the total value including tax arrived as above.

b) The rate quoted by the bidder/supplier shall be exclusive of CGST, SGST, IGST and GST (Compensation to state tax) cess and it should be strictly as per the format of BOQ. Item wise each element of cost shall be indicated in respective column specifically provided for that. Item wise rate of CGST & SGST or IGST and GST (Compensation to state tax) Cess, applicable at the time of bidding, shall be indicated by the bidder in respective column of the BOQ. If the bidder has opted for composition levy, no tax under GST shall be charged by him.

c) The Tax Invoice raised by the supplier must be in compliance of relevant GST Acts, rules & notifications made thereunder and should bear the GSTIN number for the supply to CMPDIL HQ and its Regional Institutes located at different states as given below:

State	Unit / HQ	City	GSTIN (Provisional ID)
Maharashtra	RI-IV	Nagpur	**27AAACC7475N1Z4**

The rate and amount of CGST, SGST, IGST, and GST (Compensation to state) Cess, related to supply of goods, shall be shown separately in tax invoice. In case the bidder has opted for composition levy, the Bill of Supply shall be raised by him in compliance of relevant GST Acts, rules & notifications made thereunder.

d) Bill form given at Appendix -12 of Manual for Civil Engineering Works - 2015 (Part I) shall form an annexure (**Annexure-A - 13**) to the tax invoice raised by the supplier/bidder in compliance of relevant GST Acts, rules & notifications made thereunder.

e) The CGST & SGST, IGST and GST (Compensation to state tax), as applicable at the time of supply , shall be paid extra against submission of proper Tax invoice, as referred above, by the supplier/bidder; so that CMPDIL could be able to avail Input tax credit of such CGST, GST, IGST, GST (compensation to state cess) reflected in the invoice.

f) If CMPDIL fails to claim Input Tax Credit (ITC) on eligible Inputs and Capital Goods or the ITC claimed is disallowed due to failure on the part of supplier of goods and services in incorporating the tax invoice issued to CMPDIL in its relevant returns under GST, payment of CGST & SGST or IGST, GST (Compensation to State) Cess shown in tax invoice to the tax authorities, issue of proper tax invoice or any other reason whatsoever, the applicable taxes & cess paid based on such Tax invoice shall be recovered from the current bills or any other dues of the supplier.

g) The amount of CGST & SGST or IGST and GST Cess, as indicated in the Tax Invoice shall be paid only when they appear in GSTR 2A of CMPDIL and the supplier has filed the valid return in accordance with the provisions of the GST Act and the rules made there under.

h) In the event of any additional tax liability accruing on the supplier of goods and / or services due to classification issue or for any other reason, the liability of CMPDIL shall be restricted to the amount of GST charged on the original tax invoice issued by the supplier.

NOTE: Tax Invoice should be raised exactly as per the GST rate declared by the bidder in the BOQ sheet while submitting Price Bid.

i) In addition to above, if any other tax/duties are levied over supply of such goods or services in future, it shall be paid extra.

j) **E-way Bill:** The e-way bill required in connection with supply of goods or services, if any, shall be arranged by the supplier. However, the e-way bill will be arranged by CMPDIL if the contractor/supplier/Vendor is unregistered one or if provisions of the relevant Act and the rules made there under specifically states that the e-way bill is required to be issued by recipient of goods.)

k) **TDS:** The TDS, if applicable, shall be made at applicable rate from the payment made or credited to the supplier.

l) **Evidence in support of import of goods**: In case of supply of imported goods as per terms of supply order, the supplier shall provide the following documents as evidence in support of import of goods:

i. A certificate from their auditor to the effect that they have paid Rs…… as custom duty against the import of goods under supply order…… and that refund of custom duty, if any, shall be passed on to the buyer.
ii. Self-attested copy of Principal's invoice / packing list.
iii. Self-attested copy of bill of lading / Airway bill.
iv. Self-attested copy of bill of entry.
v. Certificate of origin.

The supplier shall provide clear linkage of items as per order with documents furnished under clause (ii), (iii) and (iv).

9. Submission of Bid:

9.1 Online Registration:

In order to submit the Bid, the bidders have to get themselves registered online on the e-Procurement portal of CIL (https://coalindiatenders.nic.in) with valid Digital Signature Certificate (DSC) issued from any agency authorized by Controller of Certifying Authority (CCA), Govt. of India and which can be traced up to the chain of trust to the Root Certificate of CCA. The online Registration of the Bidders on the portal will be free of cost and one time activity only. The registration should be in the name of bidder, whereas DSC holder may be either bidder himself or his duly authorized person. All the bids are to be submitted online and on the website https://coalindiatenders.nic.in. No bid shall be accepted offline.

9.2 User Portal Agreement:

The bidders have to accept unconditionally the online user portal agreement which contains the acceptance of all the Terms and Conditions of NIT including General and Special Terms & Conditions and other conditions, if any, along with on-line undertaking in support of the authenticity of the declarations regarding the facts, figures, information and documents furnished by the Bidder on-line in order to become an eligible bidder. No conditional bid shall be accepted.

The bidder should strictly comply with following instructions:

i. The bidders are requested to submit offers online giving reference to this tender notice number and date containing offers in two parts in the links Cover-I, OID and Cover-II.

ii. Two parts of the bid should contain the details as follows:

Part-I / Cover-I and OID:

i) Letter of bid
ii) Details of Earnest Money
iii) Information on Eligibility/ Qualifying criteria as detailed under **Clause No.8** including necessary scanned documents as elaborated there.

Part II / Cover-II:

i) Prices only in the Excel format as indicated in the Bid document.

9.3 Confirmatory Documents:

All the confirmatory documents as enlisted in the NIT in support of online information furnished by the bidder are to be uploaded in Cover-I & OID (if asked) by the bidder while submitting the bid online.

All the bidders are to submit the information in objective manner confirmed by the uploaded documents. The documents related to the furnished online information, based on which the auto

evaluation takes place will be considered. If the bidder uploads any other document, it will be given no cognizance.

The scanned copy of following documents will be submitted by the bidder online while submitting bid under Cover-I (Part-I).

Sl No	**Documents related to Eligibility Criteria**	**Scanned copy of documents to be uploaded by bidder in support of information/ declaration furnished online by the bidder against Eligibility Criteria as Confirmatory Documents.**
1	Letter of Bid (LoB)	Letter of Bid (LoB) on the bidder's letter head, in prescribed format (**Annexure- A1**). Note: In case of JV the LoB is to be signed by all partners
2	Earnest Money Deposit (Ref. Clause No. 3 of NIT)	Refer Clause No. 3 of NIT. NOTE: In case of Foreign Bidders the offline bid submission method may be referred to Clause 3(b) [if applicable].
3	Work Experience (Ref. Clause No. 8.1 of NIT)	Bidders required to submit Satisfactory Work Completion Certificate issued by the employer against the Experience of similar work containing all the information as sought on-line. In case of Sub-contractor suitable document as per provision of eligibility, if applicable. Work order, BOQ and/or TDS may be sought during clarification or along with deficient documents. **Note:** In case of JV, above documents of partner(s).
4	Financial Turnover (Ref. Clause No. 8.2 of NIT)	Financial Turnover certificate for last 3 (three) financial years issued by a Practicing Chartered Accountant having a membership number with Institute of Chartered Accountants of India. (In case of JV, turnover certificate for each individual partner of JV).
5	Integrity-Pact (Applicable for tendered value of Rs.2.00 Crore & above).	Duly signed and witnessed Integrity Pact in the prescribed format (**Annexure-A7**). **Note:** In case of JV, Integrity Pact shall be signed by all the partners.
6	Authorization for Digital Signature Certificate	1. If the bidder himself is the DSC holder bidding on-line then no document is required.

		However 2. If the DSC holder is bidding online on behalf of the bidder then the Power of Attorney or any sort of legally acceptable document for the authority to bid on behalf of the bidder
7	Undertaking	A commitment is to be uploaded in the form of UNDERTAKING on Bidder's letter head as per the format given in the bid document (**Annexure-A2**). Undertaking is about the genuineness of information furnished online, authenticity of scanned copy of documents uploaded and about other commitments.
8	Legal Status of the bidder	Any one of the following documents: 1. Affidavit or any other document to prove proprietorship/ Individual status of the bidder. 2. Partnership deed containing name of partners 3. Memorandum & Article of Association with certificate of incorporation containing name of bidder. 4. Joint Venture Agreement containing name of partners and lead partner, power of attorney to the lead partner and share of each partner. **(The partnership firm / JV / Consortium is required to submit written consent of all the partners to Arbitration clause as under Clause 16 & 16 A of GTC)**
9	Permanent Account Number (PAN)	Copy of PAN card issued by Income Tax Department, Govt. of India. (In case of JV/Consortium, PAN Card for each Indian Partner of JV/Consortium and verifiable tax residency certificate of respective country for each foreign partner or JV/ Consortium itself).
10	Goods and Service Tax (Not Applicable for Exempted Services) (Ref. Clause No. 8.4 of NIT)	The following documents establishing the status of bidder w.r.t GST as declared by Bidder in the BOQ sheet: Status: GST registered Bidder (but not under Composition Scheme) -

		Document: GST Registration Certificate (i.e. GST identification Number) issued by appropriate authorityof India. Status: GST unregistered bidder / Dealer - Document: A Certificate from a practicing Chartered Accountant having membership number with Institute of Chartered Accountants of India certifying that the bidder is GST unregistered bidder in compliance with the relevant GST rules of India. If Turnover of bidder exceeds exemption limit, the bidder must have GST registration as per GST Act and Rules.
11	Mandate Form for Electronic Fund Transfer.	Confirmation in form of Yes/No. Copy of Mandate form duly filled in as per Performa**.** (As per**Annexure-A3**).
Note: Only one file in .pdf format can be uploaded against each eligibility criteria. Any additional/ other relevant documents to support the information/declaration furnished by bidder online against eligibility criteria may also be attached by the bidder in the same file to be uploaded against respective eligibility criteria.		

9.4 Letter of Bid:

The format of Letter of Bid (as given 'ANNEXURE-A1') will be downloaded by the bidder and will be printed/ typed on his letter head. This document will be signed by the bidder or any authorized person of bidder or a DSC holder, bidding online with authorization from the bidder and scanned copy of the same will be uploaded during bid submission in cover-I. This will be the covering letter of the bidder for his submitted bid. The content of the "Letter of Bid" uploaded by the bidder must be the same as per the format downloaded from website and it should not contain any other information, which contradicts the content and spirit of the original format of LOB.

The Letter of bid will be digitally signed by DSC holder submitting bid online and it does not require any physical signature. However, if the Letter of Bid (LOB) bears the physical signature in addition to the digital signature of DSC holder, it will be accepted without questioning the identity of person signing the Letter of Bid.

NOTE:

If there is any change in the contents of Letter of Bid uploaded by bidder as compared to the format of Letter of Bid uploaded by the department with NIT document, then the LOB shall be requested

under the head Confirmatory documents and subsequently accepted or rejected as applicable.

9.5 Price- Bid/ Cover-II/ Part-II:

The Price bid containing the Bill of Quantity will be in .xls format (password protected) and will be uploaded during tender creation. This will be downloaded by the bidder and he will quote the rates for all items on this Excel file. Thereafter, the bidder will upload the same Excel file during bid submission in Cover-II. The Price-bid will be in Item Rate or Percentage Rate BOQ format and the bidder will have to quote for all the tendered items and the L-1 will be decided on overall quoted value (i.e. Cost to Company). The Price-bids of the tenderers will have no condition. The Price Bid which is incomplete and not submitted as per instruction given above will be rejected. Any alteration/modification in the Excel format may lead to rejection of bid.

The L-1 bidder will be decided based on cost to the Company. Prior to quoting the rates in the BOQ file, the bidder will select the appropriate Goods and Service tax (GST), status from the following list given in the BOQ:

I). GST Registered Bidder
II) GST Unregistered Bidder.

The Price bid file will be digitally signed and uploaded by the bidder in Part-II / Cover-II.

SYSTEM FOR DECISION OF L-1:

The L1 bidder will be decided based on Overall Quoted Value (i.e. Cost to the Company). The system for decision of L-1 bidder will be as follows:

Case – 1: Works / Services for which INPUT TAX CREDIT is not available to the Company.

The overall bid price (Cost to Company) will be rates quoted by the bidder plus applicable rate of GST (Goods & Service Tax). The ranking of the Bidders will be decided based on 'Cost to Company' price. The lowest cost to company price will be ranked as L-1, the next higher price as L-2 and so on calculated by the system.

Case – 2: Works / Services for which INPUT TAX CREDIT is available to the Company.

The overall bid price (Cost to Company) will be rates quoted by the bidder only; GST (Goods & Service Tax) will not be added in this case. The ranking of the Bidders will be decided based on 'Cost to Company' price. The lowest cost to company price will be ranked as L-1, the next higher price as L-2 and so on calculated by the system.

The Contract Value will be the value of the 'Rates quoted by bidder plus amount of GST. The liability of payment of GST by the contractor registered under GST will lie with the contractor. The payment of GST would be made to the contractor only on submission of Bill / Invoice in accordance with the

provision of GST Rules. In case of unregistered bidder, the applicable GST will be paid by CMPDIL directly to the concerned Tax Authority.

The Price-bids of the tenderers shall have no condition. The Price Bid which is incomplete and not submitted as per instruction given above will be rejected.

10. Bid Submission:

All bids are to be submitted on-line on the website https://coalindiatenders.nic.in . No bid shall be accepted off-line unless otherwise specified.

11. System Requirement:

It is the bidder's responsibility to comply with the system requirement i.e. hardware, software and internet connectivity at bidder's premises to access the e-tender website. Under any circumstances, CMPDIL shall not be liable to the bidders for any direct/indirect loss or damages incurred by them arising out of incorrect use of the e-tender system or Internet connectivity failures.

12. Auto Extension of Critical Date:

If number of bids received online is found to be less than 03 (three) on End Date of bid submission, then the following critical dates of the Tender will be automatically extended initially for a period of 02 (two) days; and, if the number of bids still remains less than 03 (three), then for another 05 (five) days:

- Last date of submission of Bid.
- Last date of receipt of EMD.
- Date of Opening of Tender.

If any of the above extended Dates falls on Holiday i.e. a non-working day as defined in the e-Procurement Portal then the same is to be rescheduled to the next working day.

This extension will be also applicable in case of receipt of zero bid.

NOTE:

1. The validity period of tender shall be decided based on the final end date of submission of bids.
2. The auto extension shall work on the basis of number of bids received only. It may so happen that any of these bids may be eventually rejected during Tender Opening, Technical evaluation or further process of evaluation resulting the total number of valid bids becoming less than 03(three).
3. After two extensions, the tender shall be opened irrespective of available number of bids on the extended date of opening of tender.

13. Opening of Bid:

i) Tenders [**Cover-I (Technical-bid)** and **Cover-II (Price-bid**)] will be decrypted and opened online by the Bid Openers with their Digital Signature Certificate (DSC) on the pre-scheduled date & time

of tender opening. The bidder can view bid opening remotely on their personalized dash board under “Bid Opening (Live)” link.

ii) The e-Procurement/tender system will evaluate the Technical bids automatically on the basis of relevant data provided by the bidder, while submitting the bid online. If the parameters furnished by bidder online, in an objective and structured manner, does not confirm to the required eligibility criteria as specified in the NIT, the bid will be automatically rejected by the system and the Price-bid of such bidders shall not be opened by the system.

iii) After decryption and opening of bids, the system will show the lowest price (Cost to Company) quoted by L-1 bidder without disclosing the identity of any bidder and the total number of bids received/opened.

14. Evaluation of Tender:

i) Bid evaluation shall be done after taking into consideration overall quoted price by the bidder and effect of Goods and Services Tax (GST), GST Compensation Cess etc. as applicable. L1 will be decided on the basis of Cost to Company.

ii) After completion of process, the documents submitted by L-1 bidder in Cover-I will be downloaded by the Evaluator and shall be put up to the Tender Committee. The Tender Committee will examine the uploaded documents against information/declarations furnished by the L-1 bidder online. If it confirms to all of the information/ declarations furnished by the bidder online and does not change the eligibility status of the bidder then the bidder will be considered eligible for award of Contract.

iii) In case the Tender Committee finds that there is some deficiency in uploaded documents by L-1 bidder then the same will be specified online by Evaluator, clearly indicating the omissions/shortcomings in the uploaded documents and indicating start date and end date allowing 10 days (10 x 24 hours) time for online re-submission by L-1 bidder. The L-1 bidder will get this information on their personalized dash board under “Upload confirmatory document” link. Additionally, information shall also be sent by system generated email and SMS, but it will be the bidder’s responsibility to check the updated status/information on their personalized dash board regularly after opening of bid. No separate communication will be made in this regard. Non-receipt of e-mail and SMS will not be accepted as a reason of non-submission of documents within prescribed time. The bidder will upload the scanned copy of all those specified documents in support of the information/ declarations furnished by them online within the specified period of 10 days. If the L1 bidder fails to submit the specified document/s in 10 (ten) days’ time or the uploaded documents still contain some deficiency, additional time of 10 days (10 x 24 hours) may be given to the L-1 bidder for re-submission, indicating start date and end date for re-submission of such document/s. It must be noted that maximum 2 chances, each of 10days x 24 hour duration shall be given.

iv) <u>The tender will be evaluated on the basis of documents uploaded by L-1 bidder online. The L-1 bidder is not required to submit hard copy of any document through offline mode. Any document submitted offline will not be given any cognizance in the evaluation of tender.</u>

v) In case the L-1 bidder submits requisite documents online as per NIT, then the bidder will be considered eligible for award of Contract.

vi) In case the L-1 bidder fails to submit requisite documents online as per NIT; or, if any of the information/declaration furnished by L-1 bidder online is found to be incorrect by Tender

Committee during evaluation of scanned documents uploaded by bidder, which changes the eligibility status of the bidder, then his bid shall be rejected and EMD of L-1 bidder will be forfeited.

vii) In case the L-1 bidder is technically eligible but rejection is due to high rate quoted by him then the tender shall be cancelled and retendered.

viii) In case the L-1 bidder is rejected due to non-compliance of confirmatory documents, then the L-2 bidder will become L-1 bidder and Confirmatory Documents of L-2 bidder shall be evaluated by Tender Committee and the process shall be followed as mentioned in Clause no.(i) to (v) above.

ix) The process as mentioned at Clause no. (vii) shall be repeated till the work is either awarded or all the eligible bidders are exhausted

x) In case none of the bidders complies the technical requirement, then re-tender will be done.

xi) It is responsibility of Bidders to upload legible/clearly readable scanned copy of all the required documents as mentioned above.

15. Tender cum Reverse Auction:

For work value of INR 100 lakh and above, tender evaluation process will be done through Reverse Auction Process (RAP) and process will be as follows:

A. The Reverse Auction Process will require option of selection of "Tender cum Auction" in 'Form of Contract' in the e-Procurement portal of CIL, at the time of creation of tenders of value INR 100 lakh and above.

B. Reverse Auction will be initiated after opening of price-bids. Bid opening time normally will be 11.00 AM on any working day as mentioned in the NIT. Upon opening of the price bids, a reverse auction platform will be created within 2 hours of opening of bids. The system will display L1 cost to company automatically in auction creation form and allows TIA to edit the value as 'start bid price'. The **'Start Bid'** price will be either of the following, which one is lower:

Landed cost quoted by the L-1 bidder

OR

Approved Estimate / Justified price + 10% + applicable GST including GST Compensation Cess, if any, taking into consideration Input Tax Credit (ITC), if applicable.

NOTE: Server time shall be the basis of Start time & Closing time for bidding and shall be binding for all. This would be visible to all concerned. However, during the auction process bidders names will not be displayed.

C. **H-1 bid will be eliminated during price bid opening, if more than three techno-commercially acceptable bids are available as per the evaluation done by system and such bidder will not be allowed to participate in reverse auction.** If two or three bidders have quoted same H-1 landed cost (i.e. Cost to Company), the bidder(s) who submitted / frozen the bid later, shall be rejected and will not be allowed to participate in reverse auction.

D. The L-1 price/start bid price is landed / cost to the company price on which the auction will be initiated.

E. If the L-1 price is higher than the Start Bid Price (Estimated / Justified price + 10% + Applicable

GST taking into consideration Input Tax Credit, if applicable) and the RAP is not triggered within the scheduled time, it will be retendered.

F. Initial period of reverse auction will be two hours. There will be auto extension of time by ten minutes in case any reduction is recorded in last ten minutes. The reverse auction will end only when there is no further reduction recorded in the last ten minutes slot.

G. The Reverse Auction is an auto-generated process, no claim of bidder on outcome of evaluation will be entertained.

H. **Decremental Value**: The decrement value will be 0.5 % of the start bid price. The reduction by the bidder shall have to be made as per decrement value or in multiple thereof. The Maximum **SEAL PERCENTAGE** will be fixed as 2% of start bid price / last quoted price during reverse auction, whichever is lower.

   In order to have ease of submission in reverse auction by the bidders, it is suggested that decrement values may be rounded off to the nearest value as under:

   a. For decrement value upto INR 10, the rounding off may be made to nearest INR 1.
   b. For decrement value upto INR 11 to INR 100, the rounding off may be made to
   c. For decrement value upto INR 1001 to INR 10,000, the rounding off may be made to nearest INR 1000: and so on……..

I. System protects bid and bidder information till auction gets over and displays current L1 price to the bidder in auction hall/process. The system provides bidders' detail along with bid documents at the end of revers auction process. The log details of entire reverse auction process will be generated by the system, once the process of reverse auction gets completed.

J. If a bidder does not submit his bid in Reverse Auction, the price quoted by him in the price bid shall be considered as the valid price of the bidder. The status of (L-1, L-2, etc.) bidder shall be evaluated considering either the bid price submitted in Reverse Auction or the price quoted in the price bid, whichever is lower.

K. Since reverse auction is a sequel to e-tender, the process of finalizing the tender upon completion of the reverse auction will be the same as the tender without reverse auction.

L. The L-1 bidder after reverse auction has to proportionately reduce the item rates while submitting the breakup of composite price.In case the L-1 bidder fails to submit the break-up of landed price within the stipulated period, the company will be at liberty to place order on the basis of break-up prepared as per para 'F' above for the composite price and the same will be binding on the bidder.

M. On expiry of the closing of the auction, the bid history showing all the last valid bids offered along with name of the bidders shall be published. All bidders shall have the facility to see and get a print of the same for their record.

N. The bid history shall reflect only the landed price. The landed price shall also not be same for two bidders even if any bidder makes such an attempt.

O. All electronic bids submitted during the reverse auction process shall be legally binding on the bidder. The chronologically last bid submitted by the bidder till the end of the auction will be considered as the valid price bid offered by that bidder and acceptance of the same by ECL will form a binding contract between ECL and the bidder for entering into a contract. Any bid submitted earlier by the bidder prior to submission of his last bid will not be considered as the valid price bid.

P. Conditional discounts shall not be considered. If a bidder offers a discount unilaterally after submission of bid, the discount will not be considered for evaluation of offers but will be availed if order is placed on such tenderer.

Q. At the end of the reverse auction, the bidder(s) who has participated in the reverse auction has to upload the breakup of Cost to Company prices in the confirmatory documents. In case of item rate composite works tenders, the reverse auction will be conducted on the composite cost to company price.

R. The bidder(s) after reverse auction will be responsible to ensure that the cost to company rate as per the breakup of prices provided by him after the reverse auction and cost to company rate offered by him in the reverse auction is exactly same. The bidder will not be allowed to increase the rate of any item while submitting the break up. While giving the break up, the bidder will have to consider same rate of taxes and duties as quoted while submitting the e-price bid. In case the bidder(s) fail(s) to submit the break-up of cost to company price within stipulated period or the break up given by bidder does not match with total offered price, the Company will be at liberty to place order by proportionately reducing item rates on the basis of the breakup of the e-Price Bid submitted by the bidder along with the initial offer and the same will be binding on the bidder.

S. If the lowest price received during reverse auction is unreasonable or it is unacceptable on ground of being too high or too low compared with estimated price, the management reserves right to seek justification of the price from lowest bidder. If the price is not considered reasonable, management may not accept such bid and go for another tender process.

T. If the L-1 bidder, after issue of Letter of Award (LoA), does not start the work within the time specified in LOA, the work may be awarded to L-2 bidder, while L-1 bidder will be penalized in terms of the NIT as explained above.

U. In case of disruption of service at the service provider's end while the RAP is online, due to any technical snag or otherwise attributable to the system failure at the server end, the RAP process will start all over again. In such a situation, the last recorded lowest price of prematurely ended RAP, will be the 'Start Bid' price for the restarted RAP. The prices quoted in the prematurely

ended RAP will be binding on all the bidders for consideration, if the restarted RAP does not trigger within the stipulated time. A provision to this effect should be made in the NIT.

Disruption and restarting of RAP shall be intimated to all the bidders through system/SMS/e- mail through e procurement portal. All the time stipulations of normal RAP will be applicable to the restarted RAP.

16. One Bid per Bidder:

Each Bidder shall submit only one Bid, either individually, or as a partner in a partnership firm or a Public Limited / Private Limited Company or any legal entity. A Bidder who submits or participates in more than one Bid (other than as a sub-contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the bidders' participation to be disqualified.

17. Refund of EMD:

a. If EMD is paid by the bidder in online mode (Direct Debit/NEFT/RTGS) then the EMD of rejected bidders will be refunded at any stage directly to the account from where it had been received (except the cases where EMD is to be forfeited).

b. No claim from the bidders will be entertained for non-receipt of the refund in any account other than the one from where the money is received.

c. If the refund of EMD is not received by the bidder in the account from which the EMD has been made due to any technical reason then it will be paid through conventional system of e-payment. For this purpose, if required, Tender Inviting Authority will obtain the Mandate-Form from the Bidder.

d. In case the tender is cancelled then EMD of all the participating bidders will be refunded unless it is forfeited by the department.

e. If the bidder withdraws his/her bid online (i.e. before the end date of submission of tender) then his/her EMD will be refunded automatically after the opening of tender.

f. The EMD of successful bidder (on award of Contract) will be retained by CMPDIL and will be adjusted to Performance Security Deposit.

18. Site- visit:

18.1 The bidder, at the Bidder's own responsibilities, cost and risk, is encouraged to visit and examine the Site of Works and its surrounding, approach road, soil condition, investigation report, existing works, if any, connected to the tendered work, drawings connected to the work, if / as available and obtain allinformation that may be necessary for preparing the Bid and entering into a contract for execution of theworks. The cost of visiting the Site shall be at the Bidder's own expense.

18.2 It shall be deemed that the Bidder has visited the Site/Area and got fully acquainted with the workingconditions and other prevalent conditions and fluctuations thereto whether he/she/they actually visitsthe Site /Area or not and has taken all the factors into account while quoting his/her/their rates.

18.3 The Bidder is expected, before quoting his rate, to go through the requirement ofmaterials/workmanship, specification, requirements and conditions of contract.

18.4 The Bidder, in preparing the bid, shall rely on the site investigation report referred to in the biddocument (if available), supplemented by any information available to the Bidder.

19.0 Taxes and Duties:

All duties, taxes [excluding Goods and Services Tax (GST) and GST Compensation Cess (if applicable) only] and other levies,royalty, building and construction workers cess (as applicable in states), payable by the bidder/Contractor under the Contract, or for any other cause as applicable on the last date of submission of Bid, shall be included in the rates, prices and the total Bid Price submitted by the Bidder. Applicable GST either payable by bidder or by company under reverse charge mechanism shall be computed by system in BOQ sheet as per pre-defined logic. All investments, operating expenses, incidentals, overheads leads, lifts, carriages, tools, and plants etc. as may be attendant upon execution and completion of works shall also be included in the rates, prices and total Bid price submitted by the bidder.

However, such duties, taxes, levies etc. which is notified after the last date of submission of Bid and/ or any increase over the rate existing on the last date of submission of Bid shall be reimbursed by the company on production of documentary evidence in support of payment actually made to the concerned authorities.

Similarly if there is any decrease in such duties, taxes and levies the same shall become recoverable from the contractor. The details of such duties, taxes and other levies along with rates shall be declared by the bidder.

The item wise rate quoted by bidder shall be inclusive of all taxes, duties & levies but excluding GST & GST Compensation Cess, if applicable. The payment of GST and GST Compensation Cess by service availer (i.e. CMPDIL) to bidder/contractor (if GST payable by bidder/contractor) would be made only on the latter submitting a Bill/invoice in accordance with the provision of relevant GST Act and the rules made thereunder and after online filing of valid return on GST portal. Payment of GST & GST Compensation Cess is responsibility of bidder/contractor.

However, in case contractor is GST unregistered bidder in compliance with GST rules, the bidder shall not charge any GST and/or GST Compensation Cess on the bill/invoice. In such case, applicable GST will be deposited by CIL/Subsidiary directly to concerned authorities.

Input tax credit is to be availed by Paying Authority as per rule.

If CMPDIL fails to claim Input Tax Credit (ITC) on eligible Inputs, input services and Capital Goods or the ITC claimed is disallowed due to failure on the part of bidder / vendor of goods and services in incorporating the tax invoice issued to CMPDIL in its relevant returns under GST, payment of CGST & SGST or IGST, GST (Compensation to State) Cess shown in tax invoice to the tax authorities, issue of proper tax invoice or any other reason whatsoever, the applicable taxes &cess paid based on such Tax invoice shall be recovered from the current bills or any other dues of the bidder / vendor along with interest, if any. The rates and prices quoted by the Bidder shall be fixed for the duration of the contract and shall not be subject to variations on any account except to the extent variations allowed as per the conditions of the contract of the bidding document. The Company reserved the right to deduct / withheld any amount towards taxes, levies etc. and to deal with such amount in terms of the provisions of the Statute or in terms of the direction of any statutory authority and the Company

shall only provide with certificate towards such deduction and shall not be responsible for any reason whatsoever.

In case of collection of minor minerals in area (both virgin and non-virgin), acquired by the company under the Coal Act, the contractor will have to produce a royalty clearance certificate from the District Authorities before full and final payment.

20. Recovery of any Claim from Contractor/Vendor/Supplier:

In the event of recovery of any claim towards LD Charges, Penalty, fee, fine or any other charges from the supplier/vendor, the same will be recovered along with the applicable GST and the amount shall be adjusted with the payment to be made to the supplier/vendor against their bill/invoice or any other dues.

Further Earnest Money/ Performance Security forfeited will be inclusive of GST.

21. Cost of Bidding:

The bidder shall bear all costs associated with the preparation and submission of his bid and the Employer will in no case be responsible or liable for those costs.

22. Technical Specifications:

The tenderer shall closely study all specifications in detail, which govern the rates for which he is tendering.

23. Currencies of Bid and Payment:

The unit rates and prices shall be quoted by the Bidder entirely in Indian Rupees only.

24. Commencement of Work:

The work should be completed within the stipulated period and the date of commencementshall be reckoned from the next working day of execution of agreement.

25. Handing Over of Site:

On completion of the work all rubbish, debris, brick bats etc. shall be removed by the contractorat his/their own expense and the site cleaned and handed over to the company and he/they shall intimate officially of having completed the work as per contract.

26. Deployment of Manpower and Machineries:

The tenderer(s) will deploy sufficient number and size of equipment /machineries/vehicles and the technical/ supervisory personnel required for execution of the work.

27. Change in Constitution of the Contracting Agency:

Prior approval in writing of the company shall be obtained before any change is made in the constitution of the contracting agency, otherwise it will be treated as a breach of Contract.

28. **Canvassing in Tender:**

Canvassing in connection with the tenders in any shape or form is strictly prohibited and tenders submitted by such tenderers who resort to canvassing shall be liable for rejection.

29. **Letter of Acceptance (LOA)/Work Order/Agreement:**

The Bidder, whose Bid has been accepted, will be notified of the award on-line and also by registered post/speed post by the employer prior to expiration of the bid validity period. The L-1 bidder will get the information regarding award of work on their personalised dash-board on-line. On receipt of Letter of Acceptance (LOA)/Work Order of the tender issued by the Company, the successful tenderer shall execute contract agreement in the company's prescribed form for the due fulfillment of the contract. Failure to enter into the required contract within the specified period in the work order shall entail cancellation of LOA/work order and forfeiture of the Earnest Money. The written contract to be entered into between the contractor and the company, shall be the foundation of the rights of both the parties and the contract shall not be deemed to be executed until the contract is signed by both the parties i.e. Contractor and the Company.

30. **Bid Validity:**

The Bid Validity Period will be **120 (one hundred twenty) days** from the end date of bid submission. The validity period of tender shall be decided based on the final end date of submission of bids. In exceptional circumstances, prior to expiry of the original time limit, the Employer may request the bidders to extend the period of validity for a specified additional period. The employer's request and the bidder's responses shall be made in writing. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid. The tenderer shall not, during the said period or within the period extended by mutual consent, revoke or cancel his tender or alter the tender or any terms/conditions thereof without consent in writing of the company. In case the tenderer violates to abide by this, the Company will bethe Company will be entitled to take action as per Clause No.31 (Modification and Withdrawal of Bid) of NIT

31. **Modification and Withdrawal of Bid:**

Modification of the submitted bid shall be allowed on-line only before the deadline of submission of tender and the bidder may modify and resubmit the bid on-line as many times as he/she/they may wish.

Bidders may withdraw their bids online within the end date of bid submission and their EMD will be refunded. However, if the bidder once withdraws his bid, he will not be able to resubmit the bid in that particular tender. For withdrawal of bid after the end date of bid submission, the bidder will have to make a request in writing to the Tender Inviting Authority. Withdrawal of bid may be allowed till issue of work order/LOA with the following provision of penal action:

1. The EMD will be forfeited and
2. The bidder will be debarred for *1(One)* year from participating in tenders in CMPDIL/Subsidiary.

The Price-bid of all eligible bidders including this bidder will be opened and action will follow as under:

i). If the bidder withdrawing his bid is other than L 1, the tender process shall go on.

ii). If the bidder withdrawing his bid is L-1, then re-tender will be done.

Penal action against clauses above will be enforced from the date of issue of such order.

iii) The standard operating procedure to handle withdrawal of bid after end date of submission is shall be as follows:

Standard Operative Procedure (SOP) for managing the cases of Withdrawal of Bids in e-Procurement System of CIL/Subsidiary

I. The Mode of Withdrawal:

A. Online Withdrawal of Bids:

a. The system of online withdrawal is available on the portal up to end date of bid submission, where any bidder can withdraw his/her bid which will attract no penal action.

b. The system of online withdrawal beyond end date of bid submission and till award of contract is **not** available. The bidder can withdraw their bid only offline, which may be considered except for some exceptional cases as mentioned in clause below, either with or without imposition of penalty.

B. Offline Withdrawal of Bids :

a. A partner of bidder(in case of JV and partnership firms) whose DSC is registered on the e-Procurement portal can access the portal for online withdrawal but when there is a split in the business relationship, the partners whose DSC is not registered on the portal do not have the option of online withdrawal of bid. Hence such partners may opt to use offline method of withdrawal of his/her offer (or express his disassociation from the bidder organization).

b. Offline withdrawal of bid, beyond end date of bid submission and till award of contract, may be considered by the tender committee.

II. Acceptance of withdrawal by Tender Committee:

Every case of withdrawal under Clause I-(A)(b) and Clause I-(B) shall be put up to Tender Committee for deliberation and further course of action.

The decision of Tender Committee will be binding on the tenderer.

32. Performance Security:

32.1 Performance Security would be **5.0 %** of contract amount and should be submitted within 28 days of issuance of LOA by the successful bidder in any of the form given below:

- A Bank Guarantee in the form given in the bid document from any Scheduled bank. The BG issued by outstation bank shall be operative at its local branch at Ranchi or branch at Ranchi, Jaharkhand state.

NOTE: Bank Guarantee against Performance Security shall be applicable if the amount of Performance Security exceeds Rs. 5.0 lakhs.

The Bank Guarantee shall be issued by a Scheduled Bank / Nationalised Bank on **SFMS platform** and shall be irrevocable and unconditional. CMPDI shall have the powers to invoke it notwithstanding any dispute or difference between contractors and CMPDI pending before the court, tribunal, arbitrator or any other authority. The issuing Bank have to send the BG details through SFMS platform to our bank the details of which are as below:

Name of Bank: State Bank of India,
Branch: CMPDI Branch,
IFSC: SBIN0005598,

A/c No: 10106155087,
Address: Gondwana Place, Kanke Road, CMPDIL Campus, Ranchi – 834008.

- Govt. Securities, FDR or any other form of deposit stipulated by the owner and duly pledged in favour of owner.
- Demand Draftdrawn in favour of CMPDI Ltd on any Scheduled Bank payable at its Branch at …Ranchi

The Earnest Money/ Bid Security deposited shall be discharged when the Bidder has signed the Agreement and furnished the required Performance Security / 1st part of security deposit.

The bid security deposited may be adjusted against the Performance security (1st part of security deposit) at bidder's option.

If performance security is provided by the successful bidder in the form of bank guarantee it shall be issued either –

a. at Bidder's option by a Scheduled Bank , or
b. by a foreign bank located in India and acceptable to the employer.
c. The validity of the Bank Guarantee shall be for a period of one year or ninety days beyond the period of contract /extended contract period (if any), whichever is more.

Failure of the successful bidder to comply with the requirement as above shall constitute sufficient ground for cancellation of the award of work and forfeiture of the bid security/ earnest money.

In addition to the above penal measures, the bidder will not be allowed to participate in the re-tendering process. The bidder may also be debarred from participating in future tenders in the subsidiary for a minimum period of 12 Months.

32.2 **5%** Performance Security will be refunded within 14 days of the issue of defect liability certificate (taking over certificate with a list of defects).

33. Postponement of Scheduled Date(s):

The Company reserves the right to postpone the date of receipt and opening of tenders or tocancel the tenders without assigning any reason whatsoever.

34. Public Enterprises preference:

The Company reserves its right to allow Public Enterprises purchase preference facility as per prevalent policy.

For withdrawal of bid after the end date of bid submission, the bidder will have to make a request in writing to the Tender Inviting Authority. Withdrawal of bid may be allowed till issue of work order/LOA with the following provision of penal action:

35. Contract Agreement Document(s):

This Tender Notice shall be deemed to be part of the Contract Agreement. The "General Terms &Conditions", Additional Terms & Conditions, Special Terms & Conditions(if any), TechnicalSpecifications, drawings(if any) and any other document uploaded on portal as NIT documentform an integral part of this NIT and shall also form a part of the contract agreement.

36. **Sub-letting of Work:**

No subletting of work as a whole by the contractor is permissible. Subletting of work in piece ratedjobs is permissible with the prior approval of the department.The Contract Agreement will specify major items of supply or services for which thecontractor proposes to engage sub-contractor/sub-vendor. The contractor may from time to timepropose any addition or deletion from any such list and will submit proposals in this regard to theEngineer-in -Charge/Designated Officer-in-charge for approval well in advance so as not toimpede the progress of work. Such approval of the Engineer-in-Charge/Designated Officer-in-Charge will not relieve the contractor from any of his obligations, duties and responsibilities under the contract.

37. **Prohibition of Child Labour engagement:**

The contractor/contractual Agencies must not engage any Child Labour during the course of execution of the contract work within the meaning and scope of the Child Labour Prohibition & Regulation Act-1986 and its relevant Act and Rules amended from time to time by the Govt. of India.

38. Compliance of Applicable Labour Laws:

a. The contractor shall abide by the rules & regulations of Labour's Laws applicable in their case relating to weekly holidays, overtime allowance, leave with wages and compensatory holidays etc.

b. The contractor shall strictly implement all relevant provisions enumerated under Contract Labour (Regulation & Abolition) Act. 1970 and will submit all statutory documents and records as applicable to concerned authorities and shall take full responsibility for obtaining labour license from Central/State Authority as per the Act. He/she/they will also ensure timely submission of statutory returns as applicable in their case.

c. **The contractor shall not pay less than the specified category of minimum wages to the labour engaged by him/her/them as per Minimum Wages Act, 1948 notified by the State Govt. or Central Govt. whichever is higher and as may be in force and the payment has to be released under the Payment of Wages Act 1936. In this matter the decision of the department shall be final and binding. The contractor shall provide benefits / facilities to its employees in accordance with the applicable laws to this locality i.e. Nagpur, MAHARASHTRA. CMPDI shall be kept completely indemnified against any liability and consequences thereof. The contractor will be responsible to maintain records/documents pertaining to payment of wages to its workmen as desired by State/Central Govt. Laws including Payment of Wages Act, 1936, Equal Remuneration Act, 1976 & Payment of Bonus Act 1965.**

d. The Contractor should maintain all records in Hindi or English as per the provision made in the various statutes including Contract Labour (Regulation & Abolition) Act, 1970 and the Contract Labour (Regulation & Abolition) Central Rules, 1971, Minimum Wages Act, 1948, Workmen Compensation Act, 1923, Employees State Insurance/Act, 1948 etc. and latest amendment thereof. Contractor shall also maintain all such records on Contract Labour Information Portal (CLIP) of the Coal India Ltd. (in website: http://210.212.20.44:50005/ CLIP/Forms/ ContractorRegistration.php). and shall be open for inspection by the Engineer-in-charge or by the nominated representative of the Principal Employer. Any violations of this clause shall be treated as breach of contract and action shall be taken accordingly.

e. The contractor will strictly regulate the terms of employment of his/her/their employees and manage the discipline as per Industrial Employment (standing orders) Act. 1946.

f. The contractor shall get himself registered under Employees Provident Funds/ Coal Mine Provident Fund, ESI and miscellaneous provisions registration no. or Code no. allotted for the specific establishment within reasonable time and submit the same to the employer, which are to be obtained before payment of 1st on a/c bill. The contractor shall maintain records/document in compliance with the payment of bonus Act 1965.

g. The contractor shall be solely responsible for the payment of wages, including overtime wages to the workmen and ensure its timely payment thereof through Bank.

h. The Contractor shall abide the rules and regulations of Pradhan Mantri Suraksha Yojana.

i. The contractor or its workmen shall not at any point of time have any claim whatsoever against the CMPDI.

j. The contractor shall indemnify the CMPDI in so far as liability incurred by the CMPDI on account of any default by the contractor.

k. Neither the contractor nor his workmen can be treated as employees of the CMPDI for any purposes. They are not entitled for any claim, right, preference etc. over any job/regular employment of the CMPDI.

l. If the contractor fails to discharge his duties or neglects to perform the work agreed to done under the agreement, the CMPDI is entitled to terminate this agreement as per clause and get the work done by / through other means and claim reimbursement of actual expenses incurred and also damages for the loss incurred on account of failure on the part of the contractor to discharge the duties or to perform the work under the agreement.

m. The Contractor shall in addition to any indemnity provided by the relevant clauses of the agreement or by law, indemnify and keep indemnified, the CMPDI against all claims, damages or compensation under the provisions of Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employer's Liability Act, 1938, Workmen's' Compensation Act, 1923, Employees provident fund, Employees State Insurance or any modification thereof or any other law relating thereto and rules made there under from time to time, as may be applicable to the contract which may arise out of or in consonance of the construction or maintenance or performance of the work under the contract and also against costs, charges and expenses of any suit, action or proceedings arising out of any accident or injury or death.

39. Splitting up of the work:

The Company does not bind itself to accept the lowest tender and reserves the right to reject any or all the tenders without assigning any reasons whatsoever and to split up the work between two or more tenderer(s) or accept the tender in part and not in its entirety**.**

40. Settlement of Disputes:

It is incumbent upon the contractor to avoid litigation and disputes during the course of execution. However, if such disputes take place between the contractor and the department, effort shall be made first to settle the disputes at the company level.

The contractor should make request in writing to the Engineer-in-charge for settlement of such disputes/ claims within 30 (thirty) days of arising of the cause of dispute/ claim failing which no disputes/ claims of the contractor shall be entertained by the company.

Effort shall be made to resolve the dispute in two stages.

In first stage dispute shall be referred to GM / HoD of the concerned department for the tenders of HQ and to the Regional Director of the respective Regional Institute of CMPDIL for the tenders of RIs. If difference still persist the dispute shall be referred to a committee constituted by the owner. The committee shall have one member of the rank of Director of the company who shall be chairman of the committee.

If differences still persist, the settlement of the dispute shall be resolved in the following manner:

Disputes relating to the commercial contracts with Central Public Sector Enterprises / Govt. Departments (except Railways, Income Tax, Customs & Excise duties)/ State Public Sector Enterprises shall be referred by either party for Arbitration to the PMA (Permanent Machinery of Arbitration) in the department of Public Enterprises.

In case of parties other than Govt. Agencies, the redressal of the dispute may be sought through Arbitration (THE ARBITRATION AND CONCILIATION ACT, 1996 as amended by AMENDMENT ACT of 2015).

41. Settlement of Disputes through Arbitration:

If the parties fail to resolve the disputes/ differences by in house mechanism, then, depending on the position of the case, either the employer/owner or the contractor shall give notice to other party to refer the matter to arbitration instead of directly approaching Court.

The contractor shall, however, be entitled to invoke arbitration clause only after exhausting the remedy available under the Clause 40.

i. In case of parties other than Govt. agencies, the redressal of disputes/ differences shall be sought through Sole Arbitration as under.

   Sole Arbitration:

   "In the event of any question, dispute or difference arising under these terms & conditions or any condition contained in this contract or interpretation of the terms of, or in connection with this Contract (except as to any matter the decision of which is specially provided for by these conditions), the same shall be referred to the sole arbitration of a person, appointed to be the arbitrator by the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be). The award of the arbitrator shall be final and binding on the parties of this Contract."

   a) In the event of the Arbitrator dying, neglecting or refusing to act or resigning or being unable to act for any reason, or his/her award being set aside by the court for any reason, it shall be lawful for the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be) to appoint another arbitrator in place of the outgoing arbitrator in the manner aforesaid.

   b) It is further a term of this contract that no person other than the person appointed by the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be) as aforesaid should act as arbitrator and that, if for any reason that is not possible, the matter is not to be referred to Arbitration at all.

ii. In case of Govt. agencies, the redressal of disputes/ differences shall be sought through Sole Arbitration as under.

   Sole Arbitration:

"In the event of any dispute or difference relating to the interpretation and application of the provisions of the contracts, such dispute or difference shall be referred to either party for Arbitration to the sole Arbitrator in the Department of Public Enterprises to be nominated by secretary to the Govt. 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 further reference for setting aside or revision of the award to the Law Secretary. Department of Legal Affairs, Ministry of Law & Justice / Additional Secretary, when so authorized by the Law Secretary, whose decision shall bind the parties finally and conclusively. The Parties to the dispute shall equally the cost of arbitration as intimated by the Arbitrator".

42. Legal Jurisdiction:

Matters relating to any dispute or difference arising out of this tender and subsequent contract awarded based on this tender shall be subject to the jurisdiction of District Court of the **Nagpu**r.

43. Drawing:

The drawings are uploaded with this NIT.

All relevant drawings regarding the subject work are available in the office of the General Manager(Civil)/CMPDIL. The bidders who wish to see any other drawing not available in the tender document may do so in the office of the General Manager (Civil)/ CMPDIL before the end date of Bid Submission. All the relevant drawings regarding the subject work available in the office of General Manager (Civil)/CMPDIL shall be a part of the Agreement of the subject.

44. Non-disclosure/ Confidentiality clause:

The bidder will not at any time during pendency of contract or afterwards, disclose to any person anyinformation as to documents, components, parts, information, drawings, data, sketches, plans,programs, specifications, techniques, processes, software, inventions and other materials, both writtenand oral, of a secret, confidential or proprietary nature, including without limitation any and allinformation relating to finance ,invention, research, design or development of information system andany supportive or incidental subsystems, and any and all subject matter claimed in or disclosed by anypatent application prepared or filed by or on behalf of CMPDI, in any jurisdiction, and any amendmentsor supplements thereto. The bidder should understand that any breach of this clause would constitute

a serious offence for which appropriate legal action may be taken to ensure the enforcement ofconfidentiality clause.CMPDI also desires that the bidder shall hold in trust and confidence, and not disclose to others or usefor its own benefit or for the benefit of other, any Proprietary Information which is disclosed to the bidderby CMPDI in NIT at any time during the agreement / award of work / execution of work and thereafter.

The bidder shall disclose Proprietary Information received under the contract to person within itsorganization only if such persons (i)have a need to know and (ii) are bound in writing to protect theconfidentiality of such Proprietary Information.

This clause shall survive and continue after any expiration or termination of the contract and shall bindthe contractor, its employees, agents, representatives, successors, heirs and assigns.

45. **Pre-Contract Integrity Pact:**

The bidder is required to go through the integrity pact which is the part of bid document. The bidder, submitting the bid shall accept the Integrity Pact as given in the bid document. Name, address and contact No. of the Independent External Monitor (IEM) nominated for this tender:

Sl. No.	Name	Address	Contact Number
i	Prof (Dr) L.C. SINGH, IAS(Retd)	L-31, Third Floor, Kailash Colony, New Delhi.	Ph. No: 91-11-29237274. Mob. No: +919968073976 e-mail: lcsinghi@yahoo.com& lcsinghi@gmail.com
ii	Dr S. M. Jharwal, IES (Retd).	Flat No: 69, IES Apartment, Plot No: 9, Sector: 4, Dwarka, New Delhi.	e-mail: jharwal@nic.in

(Tender Inviting Authority)
Designation, Department,
Address.

2.0 SCOPE

&

DESCRIPTION OF WORK

BRIEF DESCRIPTION OF WORK

i) **Name of Work** :- Construction of Multistorey Office Building at CMPDIL RI-IV,Jaripatka, Nagpur

ii) Location/Land:- **CMPDIL Colony Complex, Jaripatla, Kasturba Nagar, Kh 53, to 57 Mouza Mankapur.**

iii) **Details of the Project**:- As per Tender documents and Drawings.

iv) **Total Built up Area for Construction**: - 4405 square meters

v) **Completion period** : 24 months

Tenderer should consider the above while quoting the rates.

- Contractor has to construct Multi storeyed Office Building for CMPDIL(Ground+5 Storey,) at CMPDIL Colony Complex, Jaripatka, and Nagpur as per drawings, technical specifications, scope of work & other conditions and Terms of contract as per Green Building norms laid down by GRIHA for achieving 4-star rating.
- All items of work, part of work or work itself shown on the drawings or mentioned in the tender document are to be executed by the contractor. Non appearance of any of the items either in the drawings or in the tender shall not vitiate the purpose for which the building shall be constructed. Any extra items shall be dealt appropriately in terms of provision of the contract/GTC.
- Time for completion shall be reckoned from the date of issue of Fax/ Letter of Intent/Work Order by CMPDIL, actual handing over of site/ issue of drawings, which ever is later.

BRIEF SCOPE OF WORK

The brief scope of work includes the below items:-

1) Clearing of Site
2) Barricading the site area by using GI sheets supported suitably by MS Structures up to 6mt Height
3) Name Boards for safety and site development display
4) Excavation and Top soil preservation
5) Pile/pier Foundation
6) Anti-termite Treatment
7) PCC and soling
8) Backfilling and Compaction
9) RCC Substructure and Superstructure including staircase
10) Plinth beam and plinth area construction
11) Masonary in AAC Blocks
12) Internal and External plaster
13) Water supply including water meters, sewage disposal system, plumbing fittings and sanitary fixtures
14) Waterproofing of toilets, terrace, chajjas, balconies, refuge area, and other sunk areas etc.
15) Flooring, Bathroom and kitchen tiling
16) Wooden Doors, Anodised Aluminium windows, ventilators including locks and associated accessories
17) Strom water drainage
18) Rain water harvesting
19) Internal and external painting,
20) Electrical Conduiting, Wiring, switchboards, Electrical Fittings & fixtures
21) Fire fighting wet riser, sprinkler, smoke detection system, Fire extinguishers, exit signage, Sand Buckets etc. as per Fire department NOC
22) HVAC system and Ducting etc
23) Lifts with Machine room as per local municipality (NMC) norms

24) Roof top grid connected solar panel system. Developing and maitaining automatic dust cleaining system (like wiper or water sprinkler or automatic cleaning system along with sensors) on the inclined roof solar roof panel.
25) Underground and overhead tanks including fire water tanks with associated plumbing works
26) Telephone, DTH Cabling and data cabling works
27) Fire Pumps, Water Supply pumps, panels and pump room
28) Meter room, feeder pillar, main cabling, Earth pits, and Lightning arrester etc.
29) Stilt lighting, External lighting and electrical works
30) Landscaping, Horticulture work etc.
31) Glass Reinforced Concrete (GRC) works for duct areas and external part elevation
32) Site office, site laboratory, temporary store room, Construction Machineries, First aid box, safety material, sanitary facilities for labour, temporary lightingfor site area while executing works, water supply arrangements.
33) Associated works related to GRIHA
34) Obtaining all statutory NOC/approvals as applicable in the Maharastra State.

Above items are only indicative and for guidance & brief description of jobs, but should not be considered limited to this list. Tenderer should refer to the detailed tender documents, technical specifications and drawings for detailed items and scope of work included in this project. Any discrepancy in the above shall be brought to the notice of CMPDIL in the pre-bid meeting.

GENERAL SCOPE/COMPLAINCE FOR GRIHA WORKS

Introduction:

1.1 Ministry of New and Renewable Energy, Govt. of India (MNRE) has developed a comprehensive building rating system called Green Rating for Integrated Habitat Assessment (GRIHA).

1.2 The proposed building envisages incorporation of eco-concepts at all levels. It is an endeavor to achieve best standards as per Green building norms for the proposed building. CMPDIL intends to acquire a minimum of GRIHA 4- STAR RATING for the proposed project.

1.3 CMPDIL has registered the proposed project with GRIHA Council; institution authorized by MNREto process and evaluates the buildings under GRIHA.

1.4 CMPDIL has engaged consultant for providing Comprehensive services for Architectural, Green building Consultancy services, herein further referred as Architect-Consultant. The contractors has to follow the instruction given by Architect-consultant.

1.5 Proposed project is comprehensively designed in association with the Architect-Consultant and their Green Building Consultants by suitably incorporating green building requirements to achieve desiredGreenBuilding Rating. However, if there are certain items which are not detailed out or mentioned in the tender shall also be required to be executed as per the instructions of CMPDILand Architect-Consultant in order to get the Green Building rating.

1.6 CMPDIL along with Architect-Consultant and their consultants has incorporated possible GRIHA criteriain the design, specification, BOQ and scope of work.However, the achievement of GRIHA 4 Star rating is possible only upon contractor's commitment and compliance of relevant GRIHA criteria.

1.7 The bidders shall understand the GRIHA rating system and its evaluation process concept, thescope of their works and assist CMPDIL in all aspects to achieve the proposed rating. For a more detailed understanding the bidders are advised to refer to the relevant portions of the GRIHA manuals.

1.8 Most of the activities under GRIHA are already included in tender. The specifications for activities are already covered under different sections up to certain extent. However, contractor should evaluate his own requirements for

the same and assess his costs to comply with GRIHA requirements.

1.9 Contractor to submit a narrative, supported with Invoices and certificate from manufacturer and test certificate and Photographs for the same for showing the compliance of GRIHA Conditions.

2.0 Commitment, Compliance & Appraisal of GRIHA Criteria:

The contractor shall commit and comply with the GRIHA guidelines, advice and instructions of CMPDIL, Architect-Consultant and their Green Building Consultants. Photos to be taken daily and especially to support the following GRIHA conditions and submitted along with narratives. Failure to do so will be considered as non-compliance to GRIHA and result in charging of penalty. Some of the important GRIHA Criteria's along with their requirements have been briefly indicated hereunder:-

a) Preserve and protect landscape during construction/compensatory depository forestation:

1. Construction activities to been planned in a way that excavation & construction work, up toplinth level is not coinciding with rainy season and the site disruption is restricted to pre-designated areas.
2. Construction work and erosion control applications to be scheduled and sequenced during dry weather periods when the potential for erosion is the lowest.
3. Measures such as collecting runoff from construction areas and material storage sites; diverting water flow away from such polluted areas, so that pollutants do not mix with storm water runoff undisturbed areas.
4. Temporary drainage channels, perimeter dike/swale, etc. shall be constructed to carry the pollutant-laden water directly to treatment device or facility. The plan shall indicate how theabove is accomplished on site, well in advance of the commencing of the construction activity.
5. Topsoil removal and preservation to be compulsorily done. Topsoil shall be stripped to a depthof 200 mm from areas proposed to be occupied by buildings, roads, paved areas and external services. Topsoil is rich in organic content and is essential to establish new vegetation. It shallbe stockpiled to a height of 400 mm in designated areas and shall be reapplied to site during plantation of the proposed vegetation. Topsoil shall be separated from sub-soil debris andstones

larger than 50 mm diameter. The stored topsoilmay be used as finished grade forplanting areas. If the topsoil is not stored on site, it can be alternatively given to the nursery or for gardening purposes. Documentation of topsoil preservation has to be maintained at site as per the requirement of Architect-Consultant/CMPDIL.

6. Spill prevention and control plans to be made and submitted, clearly stating measures to stopthe source of the spill, to contain the spill, to dispose the contaminated material and hazardouswastes, and stating designation of personnel trained to prevent and control spills. Hazardouswastes include pesticides, paints, cleaners, petroleum products, fertilizers and solvents.
7. Protect & Preserve existing trees, if any, as per directions of Engineer-in-charge.
8. Slope construction techniques to control erosion to be used when construction during wet season is unavoidable.Sedimentation collection systems, drainage systems and runoffdiversion systems shall be installed before construction activity. The Architect-Consultant/ Engineer-in-charge shall monitor the site conditions and progress of work and schedule appropriate timing and sequencing of construction.
9. Soil erosion to be avoided by maintaining a protective cover on the soil, and creating a barrierto the erosive agent (i.e., wind and water).
10. Stabilize bare soils on the site: by using erosion control mats, seeding / planting.
11. Remove sediment from runoff before it leaves the site: use stabilized construction entrances/exits,silt fences, sediment traps, check dams etc.
12. Plan soil disturbance activities for the dry season.
13. Making Silt fences to hold water, allowing sediment to settle out as an effective sediment controlmeasure.

b) **Provide minimum level of sanitation/safety facilities for construction workers**:

1. Ensure the health and safety of workers during construction, with effective provisions for the basic facilities such as sanitation and drinking water, and safety PPEs/equipment's for workers, first aid box, etc. at site.
2. Ensure cleanliness of workplace with regard to the disposal of waste and effluent; provide clean drinking water and latrines and urinals as per applicable standard.

c) Reduce Air and Noise pollution during construction:

1. Cover skips and trucks loaded with construction materials and continually damp

down with low levels of water.

2. Segregate, tightly cover and monitor toxic substances to prevent spills and possible site contamination.
3. Cover up and protect all drains on site.
4. Collect any wastewater generated from site activities in settlement tanks, screen, discharge theclean water, and dispose of remaining sludge according to environmental regulations.
5. Use low-sulphur diesel oil in all vehicle and equipment engines, and incorporate the latest specifications of particulate filters and catalytic converters. PUC of vehicles to be submitted.
6. No burning of materials on site.
7. Noise pollution to be reduced through careful handling of materials; modern, quiet power tools,equipment and generators; low impact technologies; and wall structures as sound shields.

d) Efficient water use during construction:-

1. The use of potable water during construction to be minimized.
2. Materials such as pre-mixed concrete for preventing loss during mixing or use recycled treated water and control the waste of curing water to be used.
3. Gunny bags to be used for column, plinth beams concrete curing and slabs to be cured by waterponding.

e) Utilization of fly ash in the building structure:

1. Use of low-embodied energy industrial-waste fly ash as the construction material. Use fly ash for RCC (reinforced cement concrete) structures, brickwork, plaster, screed, mortar, block-work, etc. in the building.

f) Reduce volume, weight, and time of construction by adopting an efficient technology:

1. Use pre-cast systems, ready-mix concrete, etc.
2. Replace a part of the energy-intensive materials with less energy-intensive materials and/or utilize regionally available materials, which use low-energy/energy-efficient technologies.

g) Use low-energy material in the interiors:

1. Out of the total quantity of all interior finishes and products used in each of the categoriesmentioned below, a minimum of 70% should be low-energy finishes/

materials/ products, whichminimize wood as a natural resource or utilize industrial waste by using products in any category as listed.

1.1 Sub-assembly/internal partitions/false ceiling/in-built furniture

1.2 Flooring

1.3 Doors/windows and frames

2. Before ordering materials contractor to ask Green Building Certificate from manufacturer or dealer and submit the same to Architect-Consultant and CMPDIL for approval or While ordering materialsfollowing should be considered:-

2.1 Purchasing materials that have a recycled content

2.2 Ordering paints with low odour and VOC emissions

2.3 Minimize packaging

2.4 Ordering in standard sizes to minimize on site cutting and wastage

2.5 Provide adequate storage that is weatherproof and secure

2.6 Follow suppliers' storage instructions

2.7 Keep harmful chemicals in secure areas

2.8 Protect lightweight materials from wind

2.9 Store liquids and sand away from drains and water courses

h) Water recycle and reuse (including rainwater):

1. Rainwater storage and recharge system to be implemented at site including ground water recharge where potable municipal water is normally used, to reduce the load on municipal supplies and to improve the groundwater level.

i) Reduction in waste during construction:

1. Ensure maximum resource recovery and safe disposal of wastes generated during constructionand reduce the burden on landfill.
2. Keep record of the waste generated and take pictures.
3. Designate separate areas for storage of recyclables
4. Submit records tabulating the total waste material generated and the quantities which were diverted from landfills.
5. A minimum of 4% of the total site area should be allocated for storage of the waste. This storagearea should be covered and the pollutants from the waste should not affect the surrounding.

j) Efficient waste segregation:

1. Different types of waste to be segregated in different categories of waste sections /areas during construction to promote the segregation of waste.

k) Use of low-VOC (volatile organic compounds) paints/ adhesives / sealants:

1. VOC Limits for Materials

Please follow the type of material & their VOC Limit as mentioned below:-

Paints:-

Non-flat paints	-	150 g/L
Flat (Mat) paints	-	50 g/L
Anti-corrosive/ anti-rust paints	-	250 g/L
Varnish	-	350 g/L
Adhesives:		
Tile adhesives	-	65 g/L
Wood	-	30 g/L

l) Reduce the water use by the building:

1. Flow rates of Water Fixtures:-

Select water fixtures whose average flow rates / capacities should not exceed the valuesmentioned below. Baseline Flow Rates / Capacity for Water Fixtures in a Typical Household are:-

1. Flush fixtures - LPF 6/3
2. Flow fixtures - LPM 12

At a flowing water pressure of 3 bar

2. Flow fixtures include faucets, basin mixer, taps, showers, shower mixers.The baseline flows canbe demonstrated at flowing water pressure of 3 bar. Flowing water pressure of 3bar does not mean that the water supply in the building is at 3 bar.

3. The building fixtures can operate at lower pressures but to show compliance under this credit, thedesign flow rates are to be submitted at 3 bar. The average flow rate is a simple arithmetic average of all the respective flush / flow fixtures

m) Minimize ozone - depleting substances:

1. Halon-free fire suppression and fire extinguishing systems to be used to eliminate or control the release of ozone-depleting substances into the atmosphere wherever applicable.

n) Ensure water quality:

1. Ensure groundwater and municipal water meet the water quality norms as prescribed in the IndianStandards for various applications (Indian Standards for drinking [IS 10500-1991], irrigationapplications [IS 11624-1986]. In case the water quality cannot be ensured, provide necessary treatment to raw water for achieving the desired concentration for various applications.

o) Energy efficient lighting:

1. The lighting fixtures installed should meet the required Lighting Power Densities. The selected fixtures shall be approved by the Architect-CONSULTANT/CMPDIL before installation.
2. Ensure that the external lighting sources are 100% on automatic controls and as per thebelow mentioned specifications:

   Minimum allowable values of luminous efficiency of outdoor lighting system

Light Source	Minimum allowable luminousefficiency (lm/W)
CFL (compact florescent lamp)	50
FL (Fluorescent lamps)	75
MH (metal halide)	75
HPSV (high pressure sodium vapour lamp)	90
LEDs	50

3. TheLighting power densities in internallighting shall have minimumallowablevaluesas follows:

Space Function	LPD (W/m2)
Office	5.0
Corridors	4.0
Staircases	6.5
Reception Lobby	8.0
Parking area lighting	2.2

p) Optimize energy performance of building:

1. Ensure that the glass used for the project has a minimum thickness of 6mm. The glass shall not exceed the U value of 5.5 W/m2K and SC of 0.62. A minimum VLT (Transmittance) of 50% shall be required.
2. Ensure that energy efficient Pumps and motor are installed which would follow efficiency not less than mentioned in IS 12615.

q) Renewable energy:

1. Solar panels of 80 kW or 15% of connected load for Air-conditioning and Interior Area Lighting (whichever is more) shall be installed on the rooftop on a MS erected structure.
2. The Solar PV's shall be of approved make and as required by Architect-Consultant/CMPDIL However, the project shall not provide battery storage and the excess energy generated shall be given back to the grid through net-metering/ as decided by Architect-Consultant/CMPDIL .

r) Metering and Monitoring:

1. Ensure that Electrical meters are used to measure energy units purchased from utility and energy generated on site. Energy sub-metering should be opted to measure energy consumption of indoor lighting, outdoor lighting, Lifts and common areas, etc
2. Provision of Water meter to be installed at all main supply points to measure total water consumption of building.

3. Documentation, Evaluation & Appraisal:

1. The facilitation with GRIHA Council/Secretariat shall be undertaken by Architect-Consultant and theirGreen Building Consultant on behalf of the CMPDIL. All necessary cooperation shall be extended to them.
2. The contractor shall submit documents, photographs, narratives, certificates and any documents from statutory authorities, and any other proof in requisite formats, demonstratingcompliance to the GRIHA norms both in hard copy and soft copy forms as per requirement and as decided by CMPDIL Engineer-In-charge/ Architect-Consultant and their Green building Consultant.
3. The evaluation team from GRIHA Council/Secretariat or their authorized representative shallbe conducting periodic and surprise checks at site for assessing compliance to GRIHA norms. The contractor shall demonstrate compliance through actual site situation, documents, photographs and certificates as per their requirements.
4. The contractor shall take all necessary actions to ensure that there are no adverse remarks oncompliance.
5. Upon completion of the building, all documents, photographs, narratives and

also certificates if any from statutory authorities shall be submitted for evaluation and appraisal to GRIHA Council/Secretariat, who shall issue provisional rating. This provisional rating shall be ratified finalized upon suitable audit and verification upon occupation of the building.

3.0 SPECIAL TERMS AND CONDITION (STC)

1.0 GENERAL

1.1 Special Terms and Conditions of Contract(STC) shall be read in conjunction with theGeneral Terms and Conditions of Contract (GTC) also referred to as General Terms &Conditions of Works Contract, Schedule of Quantities, specifications of work, drawings and any other document forming part of this Contract wherever the context so requires.

1.2 Notwithstanding the sub-division of the document into these separate sectionsand volumes, every part of each shall be deemed to be supplementary of every other part and shall be read with and into the Contract so far as it may be practicable to do so.

1.3 Where any portion of the GTC is repugnant to or at variance with anyprovisions of the Special Conditions of Contract, then unless a different intention appears, the provision(s) of the Special Terms and Conditions of Contract shall be deemed to override the provision(s) of GTC only to the extent that such repugnancy or variations in the Special Conditions of Contract are not possible of being reconciled with the provisions of GTC.

1.5 SAFETY, FIRE FIGHTING AND SPECIFIC REQUIREMENTS

a Contractor shall provide adequate number of standard lengths of IS Stamped Fire hoses, IS Stamped DCP Fire extinguishers, fire buckets with sand and nozzles. These items can be taken back by the Contractor after completion of work. Sand shall also be maintained dry by the Contractor with fresh supply, whenever required. Work permit may not be issued by CMPDIL in the absence of above items.

b Safety Helmets shall be provided to all the employees of Contractor including that of his labour contractors.

c Safety Belts and Harnesses shall be provided by the Contractor in adequate number for the workers working at heights and proper safety nets around thebuilding.

d Proper earthing shall be provided for all equipment and generators.

PROVIDENT FUND, LABOUR, LABOUR LAWS AND SITE REQUIREMENTS

2.1 Provident Fund

a The Contractor shall strictly comply with the provisions of Employees Provident Fund Act and register himself with Employer Provident Fund Commissioner (EPF) /CMPF before commencing work. The Contractor shall deposit Employees and Employers contributions to the RPFC/CMPF every month. The Contractor shall furnish along with each Running bill, the challan / receipt for the payment made to the EPF/CMPF for the preceding month. The Contractor shall furnish the codenumber allotted by the RPFC/CMPF Authority to the Engineer-in-Charge before commencing the work.

b In case the EPF/CMPF challan / receipt, as above, is not furnished, Owner shalldeduct 16% (sixteen percent) of the payable amount from Contractor's running bill and retain the same as a deposit. Such retained amounts shall be refunded to Contractor on production of EPF/CMPF Challan / receipt for the period covered by the related running bill.

3.0 Site Facilities

3.1 The Contractor shall arrange for the following facilities at site, for workmen deployed/engaged by him / his sub-contractor, at his own cost:

i) Arrangement for First Aid.

ii) Arrangement for clean & potable drinking water.

iii) Any other facility/utility as may be required under the Contract as per theexisting legislation/regulations.

4.0 Contractor's Site Office and Stores

4.1 Owner shall provide land only for contractor's site office and stores and fabrication yard, if any at site. However, same shall be dismantled prior to submission of Final Bill. Also the office/stores, etc. to be relocated if found hindering the project in a planned manner.

4.2 The Contractor shall remove all temporary buildings / facilities etc., before leaving the site after completion of works in all respect.

4.3 Construction Power and Water

4.3.1 Owner shall not provide power and the Contractor shall be exclusivelyresponsible to make his own arrangements for supply of power, without any extra cost to the Owner.

4.3.2 Water required for the works shall be arranged by the Contractor. The contractor has to make all necessary arrangement for drawing water including making temporary storage, pumping etc.

4.4 Construction

4.4.1Rules and Regulations

4.4.2 Contractor shall observe in addition to Codes specified in respective specification, all national and local laws, ordinances, rules and regulations and requirements pertaining to the work and shall be responsible for extracosts arising from violations of the same.

5.0 Procedures

5.1 Various procedures and method statements to be adopted by Contractorduring the construction as required as per the respective specifications shallbe submitted to Engineer-in-Charge in due time for approval.

5.2 Security

5.2.1 As the premises will be protected area, entry into the area shall be restricted and may be governed by issue of photo gate passes. The Contractor shall arrange to obtain through the Engineer-in-Charge, well in advance, all necessary entry permits/gate passes for his staffs and labourers and entry and exit of his men and materials shall be subject to vigorous checking by the security staff. The Contractor shall not be eligible for any claim or extension of time whatsoever on this account.

5.2.2 It shall be the responsibility of the contractor to safeguard all his materials/ownedfrom theft, damage etc. For this purpose the contractor shall be allowed to keephis own security inside CMPDIL premises

5.3 Coordination with other agencies

5.3.1 Contractor shall be responsible for proper coordination with other agenciesoperating at the site of work so that work may be carried out concurrently, without any hindrance to others. The Engineer - in - Charge shall resolve disputes, if any, in this regard, and his decision shall be final and binding on the Contractor.

5.4 Underground and overhead structures

5.4.1 The Contractor will familiarize himself with and obtain information and details from the Owner in respect of all existing structures, and utilities

existing at the job site before commencing work. The Contractor shall execute the work in such a manner that the said structures, utilities, etc. are not disturbed or damaged, and shall indemnify and keep indemnified the Owner from and against any destruction thereof or damages thereto.

5.5 Working hours

5.5.1 Depending upon the requirement, time schedule / drawing/ programme andthe target set to complete the job in time, the works may also have to continue beyond normal working hours/night hours / holidays or during such periods without causing any inconvenience to the neighbours/others with due permission from EIC, for which no extra claim shall be entertained. However for all such working contractor's responsible representative shall be available at site to receive the work permit to be issued by CMPDIL. Without responsible representative of the contractor, no work shall be allowed inside the premises.

6.0 Inspection of Supply Items

6.1 All inspection and tests on bought out items shall be made as required byspecifications forming part of this contract. Various stages of inspectionand testing shall be identified after receipt of Quality Assurance Programmefrom the contractor / manufacturer.

6.2 Inspection calls shall be given for association of Owner, as per mutually agreed programme in prescribed proforma , giving details of equipment and attaching relevant test certificates and internal inspection report of the contractor. All drawings, general arrangement and other contract drawings, specifications, catalogues etc. pertaining to equipment offered for inspection shall be got approved by Owner and copies shall be made available to Owner before hand for undertaking inspection.

6.3 The contractor shall ensure full and free access to the inspection engineer of Owner at the contractor's or their sub-contractor's premises at any time during contract period to facilitate him to carry out inspection and testing assignments.

6.4 The contractor / sub - contractor shall provide all instruments, tools, necessary testing and other inspection facilities to inspection engineer of Owner free of cost for carrying out inspection.

6.5 Where facilities for testing do not exist in the contractor's / sub-contractor'slaboratories, samples and test pieces shall be drawn by the

contractor / sub-contractor in presence of Inspection Engineer of Owner and duly sealed by the later and sent for tests in Government approved test house or any other testing laboratories approved by the Inspection Engineer at the contractor's cost.

6.6 The contractor shall comply with the instructions of the Inspection Engineer fully and with promptitude.

6.7 The contractor shall ensure that the equipment / assemblies / component of the plant and equipment required to be inspected are not assembled or dispatched before inspection.

6.8 The contractor shall not offer equipment for inspection in painted conditions unless otherwise agreed in writing with the Owner.

6.9 The contractor shall ensure that the parts once rejected by the inspection engineer are not used in the manufacture of the plant and equipment. Where parts rejected by the inspection engineer have been rectified or altered, such parts shall be segregated for separate inspection and approval, before being used in the work.

6.10 On satisfactory completion of final inspection and testing, all accepted part of the work and equipment shall be stamped suitably and inspection certificate shall be stamped suitably and inspection certificate shall be issued in requisite copies for all accepted items. For stage inspection and for rejected items, only inspection memo shall be issued indicating there in the details of observations and remarks.

6.11 All inspections and tests shall be made as required by the specifications forming part of this contract. Contractor shall advise CMPDIL in writing at least fifteen days in advance of the date of final inspection / tests. Manufacturer's inspection or testing certificate for equipment and materials supplied may be considered for acceptance, at the discretion of Engineer-in-Charge. All costs towards testing etc. shall be borne by the contractor within their quoted rates.

6.12 Documentation

6.12.1 Completion Documents

The following documents shall also be submitted by the Contractor intriplicate as part of completion documents:

a) Test certificate for materials supplied by the Contractor.

b) All statutory documents like NOC/licence/approval from Govt. agency shall be sumitted.

c) Invoice of all procured materials/ Bills , Royalty paid bills etc.

b) Certified records of field tests on materials / equipment, as applicable.

c) Material appropriation statement as required.

d) Six sets of drawings showing therein the as built conditions of the work duly approved by the Engineer-in-Charge along with one set of reproducible on polyester film (drawings prepared by Contractor) along with soft form of the same. No extra payment will be made.

e) Other documents as mentioned in Technical Specification.

7.0 Project Scheduling and Monitoring

The following schedules / documents / reports shall be prepared and submittedby the CONTRACTOR for review / approval at various stages of thecontract.

7.1 After placement of Work Order

Upon placement of Work Order, Contractor has to furnish a detailed bar chartwithin 15 days of issue of FOI/LOI.

7.2 Project Review Meetings

7.2.1The CONTRACTOR shall present the programmed and status at variousreview meetings as required.

Monthly Review Meeting

Level of Participation: Senior Officers of Owner & Contractor.

Agenda

a) Progress Status/ statistics.

b) Completion Outlook

c) Major hold ups / slippages.

d) Assistance required.

e) Critical issues.

f) Client query / approval.

Venue : Site

7.3 Progress Reports

I) Monthly Progress Report

This report shall be submitted in three copies on a monthly basis within Ten calendar days from cut-off date as agreed upon, covering overall scenario of the work. The report shall include but not be limited to the following :

a) Brief introduction of the work.

b) Activities executed / achievements during the month.

c) Scheduled vs. Actual percentage progress and progress curves for sub-ordering, manufacturing / delivery, sub-contracting, constructionactivities and overall quantum wise status of Work orders againstscheduled.

d) Areas of concern / problems / hold ups, impact and action plans.

e) Resource deployment status.

f) Annexure giving status summary for Material Requisitions anddeliveries sub-contracting and construction

Distribution: To the owner-Two copies & One at Site.

II) Daily Report:

Daily report in duplicate as out lined in 2.2.4 of SCC and any other additionalinformation/data/guideline/job procedure sought by Engineer-in-Charge shall besubmitted without fail to CMPDIL at site by contractor.

7.3 General Environment Requirement

The contractor has to ensure efficient use of natural resources like water, fuel oil and lubricants. The contractor should ensure proper awareness to workers to maintain a green and clean environment inside / outside the building premises. The contractor must collect and dispose of all the waste and scrap materials at the designated place only as directed by Engineer - in - Charge.

7.4 DEFECT LIABILITY PERIOD/Warranty Period

As per clause of GTC.

4.0 TECHNICAL SPECIFICATIONS

TECHNICAL SPECIFICATION
OF CIVIL WORKS

1.0 Introduction

1.1. The intent of this technical specification covers all construction of all civil works as covered in the scope of contract as per drawings supplied by Owner.

1.2. All civil works shall be carried out as per design/drawings standardized by the Consultant / Owner and the specification provided by the Consultant / Owner. All standard drawings are enclosed with the tender documents. In case any item is not covered under specification then the same shall be carried out as per CPWD specification and applicable Standards and Codes. Any item for which specification is not provided herein and is not covered under CPWD specification shall be executed as per manufacturer guidelines. All materials shall be of best quality conforming to relevant Indian Standards and Codes. In case of any conflict between Standards/ Code and Technical Specification, the provisions of Technical Specification shall prevail, and the Architect's decision on interpretation shall be final.

1.3. The Contractor shall furnish all labour, tools, equipment, materials, temporary works, constructional plant and machinery, fuel supply, transportation and all other incidental items not shown or specified but as may be required for complete performance of the Works in accordance with drawings, specifications and direction of Owner.

1.4. Excavated earth is to be disposed from site as instructed, only into approved landfill areas and dump yard, and the contractor will indemnify CMPDIL from any liability towards the same. The cost of excavation to include for necessary lead and lift as specified.

1.5. All materials including cement, reinforcement steel and structural steel etc. shall be arranged by the Contractor. All testing required shall be arranged by the Contractor at his own cost. The contractor shall execute the work as per the standard Field Quality Plan (FQP) of CMPDIL.

1.6. The bidder shall fully apprise himself of the prevailing conditions at the proposed

site. Climatic conditions including monsoon patterns, local conditions and site specific parameters and shall include for all such conditions and contingent measures in the bid, including those which may not have been specificallybrought out in the specifications. All considerations under the Government's Green Rating of Integrated Habitat Assessment- GRIHA - to be mandatorily followed by the contractor while executing all aspects of the works.

1.7. Level and date of concreting shall be marked on the building from outside ate very floor level with proper paint, etc.

1.8. All levels and survey work shall be measured by total station and electronic level machine at all floors and places.

2.1 TECHNICAL SPECIFICATIONS FOR CIVIL ENGINEERING WORKS:

Latest CPWD specification shall be adopted. Presently CPWD specifications 2009 volume I& II is in vogue which may be followed. These specifications cover all type of Building Works.

These specifications are available as printed documents of CPWD and also in soft copies on CPWD website.

2.2 TECHNICAL SPECIFICATIONS FOR ELECTRICAL ENGINEERING WORKS:

Latest **MAHARASHTRA COMMON SCHEDULE OF RATES (ELECTRICAL) SPECIFICATIONS / CPWD** specification shall be adopted and followed.

2.3 TECHNICALSPECIFICATIONS FOR ROADS AND BRIDGES:

Standard specifications issued by Ministry of Surface Transport may be followed.

Presently MORTH specifications on roads and bridges 2013 is available. These specifications exhaustively cover various roads and bridge works.

In case of items not adequately covered by above mentioned Indian Standards, the CPWD / NBO practices shall be followed.

2.4 SAFETY MEASURES FOR CIVIL WORKS

In addition to safety code mentioned above, in respect of safety, Part – 7 Constructional Practices & Safety of National Building Code – 2005 shall also be followed. All necessary safety measures to be adopted as recommended by relevant IS / BIS code to protect adjunct/ nearby structure, workmen etc.

All works shall be carried out as per the item description and design & drawing supplied byte company, as per the relevant IS / BIS / NBC and as per direction of the Engineer-in Charge.

TECHNICAL SPECIFICATION FOR PASSENGER LIFTS/ELEVATOR

SCOPE:-

1. **Supply, Installation, Testing and Commissioning of New and latest model of 2 Nos of Gearless elevators for 884 Kg Capacity, 13 passenger, 1 M/S speed and 6 Stoppages 6 openings consist of following specifications and Comprehensive Annual Maintenance contract for 5 years after defective liability period of one year shall be done by the successful bidder.**
2. **The contractor shall obtain all necessary statutory licence/NOC/approvals for commissioning of Elevator/Lift from PWD, Maharashtra. All fees and cost for obtaining license shall be borne by the contractor.**
3. **The installation of elevator/lifts shall be executed only by registered valid authorised licensed contractor of Maharashtra with appropriate Class.**
4. **The contractor shall procure all equipment's/ fittings/items etc. required for elevator/lifts through manufacturer/ authorized dealer/agent/ Channel partner only. Contractor should submit all necessary documents of technical specifications, installation, operation manual and invoices as required by GRIHA norms. The maximum warranty of the product should be passed on to the owner with appropriate agreement/certificates.**
5. **The necessary training shall be provided to the owner's employee pertaining to door opening in case of emergency.**

Features:

Drive : - Variable Voltage Variable Frequency,

Type of machine: - Gearless,

Car Travel: - 17.5 meter,

Floor Designation : - G.1, 2, 3, 4, 5,

Car Design: -Classique. Half-length mirror on rear wall cross flow fan for ventilation,

Car suspended ceiling: -Stainless steel hairline finish with square LED, The car roof shall have stainless steel sheet to be able to support adequate weight to withstand without causing permanent deformation. Recessed ceiling Fan with heavy duty metal diffuser. Ceiling lights shall be recessed type. Two energy efficient compact square LED luminaries for adequate illumination.

Car Size - (WxDxH :) -1600X1350X 2200mm, ;

Pit Depth: -1500mm,

Elevator well (WxD) -2500x 2500mm,;

Door opening (WxH) -900X2000mm,;

Overhead -4200mm, ;

Machine room -Not applicable;

Handrail type - one handrail on rear wall of car;

Car flooring type- 20mm recess for granite/ marble,

Car Entrance -Automatic canter opening with VVVF drive in stainless steel hairline finish , Landing door - Automatic centre opening-6 stainless steel hairline finish,;

Car indicators - in all landing,

Power supply -Main: 415 Volts (+_10%), 3 phase, 50Hz (+_3%), AC Auxiliary: 230 Volts (+_10%), 1 phase, 50Hz (+_3%), AC, LCD/LED display for UP and

Other Feature:-

1) Door open, door close and alarm buttons in COP
2) Auto circuit light & fan
3) Overload device
4) Infra-red screen for car door
5) Pit Ladder
6) Door nudging
7) Fireman's control switch
8) Automatic Rescue Device (ARD)
9) Display in COP: matrix red
10) Intercom
11) Mirror half height Full Car Width
12) Type of Controller: Microprocessor based programmed logic control

Service Condition: All electrical, electronic and mechanical equipment shall suit the tropical climate for use in service conditions. Temperature range: (-) 5^{o}C to (+) 52oC

Warranty: The contractor shall give a warranty/guarantee of satisfactory performance of the lifts along with other accessories for a period of **12 months** from the date of handing over the lifts after successful installation and commissioning. As a warranty the tenderer shall render free maintenance service including free supply of all spares and all consumables.

Finish:Stainless steel Hairline:

All metal work supplied by the Contractor in out of the way locations such as the lift shaft, lift pit, machine room and on the outside of the lift car shall be properly wire-brushed, cleaned of rust, scale, dirt and grease prior to the application of one coat of rust inhibiting primer, with particular attention paid to the priming of outer surfaces of car doors, inner surfaces of landing doors, metal work associated with door assemblies, the underside and the framework of lift cars. Any part of the equipment, including guide rails, which requires greasing or oiling and any components that are supplied unpainted by the manufacturers due to functional reasons shall not be painted. All normally visible metal surfaces, other than stainless steel and non-ferrous surfaces, shall be finished with one coat of rust inhibiting primer, one under coat/finishing coat and one finishing coat of enamel paint to a colour to be selected by the Engineer-In-Charge.

THE LIFT MUST COMPLY WITH ISO 9001:2008 (CERTIFICTE ENCLOSED FOR QUOTED MODEL OF THE LIFT)

1) The installation of the lift shall comply with the requirement of the Indian Electricity Act, 2003 and the Indian Electricity Rules 1956 as amended from time to time and the Regulations / Specifications as laid down by the Indian Railways or Railway Electrification Authority, Post & Telegraph department, roadways or navigation or aviation authorities, local governing bodies, fire regulations, defence authorities and power and telecommunication co-ordination committee, wherever applicable. The installation, operation and maintenance of Lift should be carried out in conformity with lift acts and rules in force.
2) The device should operate automatically without any human intervention within a period of one minute when a running lift suddenly stops due to power failure or system failure of the lift.
3) The device should move the halted lift slowly and safely in upward or downward direction(depending upon the load condition of the lift) to reach the nearest floor/landing door and then to open the door automatically as well as to park the lift there with door enabling the trapped personnel to exit.
4) In case the normal power supply resumes, during the ARD in operation, the lift should continue to run in the ARD mode until it reaches the nearest landing and the doors are fully opened. It the normal power supply resumes, when the lift is at the landing, it should automatically be switched to the normal power operation.
5) All the safety devices of the lift should remain active, during the ARD mode of operation.
6) The device should have Batteries for power back up during the periods of power failure and the backup time should be enough to provide at least 04 rescue operations within a period of 01 hour.
7) Sealed maintenance free batteries, which require no maintenance, should be used.

All relevant is codes shall be followed .some of the codes are given below:

I. 14665 (Part-3, Sec-1&2): 2000 : Safety Rules
II. 14665 (Part-4, Sec-1 to 9): 2001 : Components
III. 14665 (Part- 5): 1999: Specification, Inspection Manual
IV. 7754-1975: Design, Installation, Testing & Operation.
V. 732: Code of practice for electrical wiring installations
VI. 2365 : Steel wire suspension ropes for Lifts, Elevators & hoists
VII. 8216: Guide for inspection of lift wire ropes besides the above, other internationally acceptable Standards, which ensure equal and higher performance & safety than those specified above, shall also be acceptable.

Operating Manual

a) The Contractor shall, unless otherwise specified, provide three (3) hard copies and three (3) soft copies in CD-ROMs of approved software format of the operating & maintenance manual of the whole installation. All commissioning and testing results, certificates and photographs as necessary shall be included in the final manuals.
b) The whole of the lift machinery including the opening and closing of the car and landing doors shall be quiet in operation, and sound reducing rubber pads or other means shall be provided by the Contractor where necessary to eliminate vibration and noise transmission.

Performance Tests

The tests and examination undertaken by the Engineer shall include those specified in the Code of Practice on the Design and Construction of Lifts and Escalators, the Code of Practice for Lift Works and Escalator Works and those recommended by the lift/escalator/passenger conveyor manufacturer. The relevant forms/certificates as required shall be signed and submitted to the Engineer-In-Charge on completion of the passenger /stretcher cum passenger lift. Tests which purely demonstrate the performance characteristics of the lift shall be performed in the presence of the Engineer-In-Charge or his/her Representative at the acceptance of the installation. All instruments used in the testing and commissioning shall be calibrated as required. The period between calibration and testing shall not exceed the calibration period as recommended by the instrument manufacturer or twelve (12) months whichever is shorter. At the end of the period of free maintenance, a thorough test shall be carried out by the Contractor and any defects found shall be rectified by the Contractor without charge to the Employer.

Statutory examination and testing

(1) To carry out the periodic examination and periodic testing of the safety equipment and to provide such copies of the test certificates, duly signed by the Service Engineer.

(2) All works under this maintenance provision shall be performed by the Contractor's directly employed competent workers under the supervision of the Contractor.

The Contractor shall at his own expense, make all suitable arrangements to avoid damage to the installations and works provided by others.

Installation and commissioning of Elevator/Lift

The Contractor shall commission the installation and carry out complete performance tests for all equipment and systems installed by him, making all necessary adjustments including setting all controls and checking the operation of all protective and safety devices in accordance with the manufacturers' instructions, the requirements of the statutory rules and regulations and to the satisfaction of the Engineer-In-Charge. Prior to any tests, the Contractor shall submit detailed procedures and a programme for testing and commissioning to the Engineer-In-Charge for approval.

The Contractor shall employ his authorised Engineer to undertake examination, testing and commissioning of the complete installation. All labour, materials, tools and instrument necessary for carrying out the work shall be provided by the Contractor.

PREFERABLE VENDORS FOR ELEVATORS

1. MITSUBHUSHI
2. SCHINDLER
3. OTIS
4. KONE
5. JHONSON

TECHNICAL SPECIFICATION

ELECTRICAL WORKS

2.1 GENERAL INFORMATION

2.1.1 The supply and installation of electrical equipment specified herein are required for both indoor and outdoor.

2.1.2 The successful tenderer shall furnish all, but not limited to, equipment, materials and accessories and services specified herein to complete this work. The work shall have to be completed and operative in all details.

2.1.3 The successful tenderer shall supply and/or erect the addition or modification as will be agreed upon in writing after mutual discussion.

2.1.4 The equipment to be furnished under this specification shall be packaged for shipment so as to meet the space and weight limitations to transport facilities, right up to destination.

2.1.5 STANDARDS

2.1.5.1 Items under specified in the Bill of quantity as per specification of **PWD MAHARASHTRA CSR (Electrical)** shall be strictly followed. In case, specification of items are not available in the specification of **PWD MAHARASHTRA CSR (Electrical), refer relevant IS code, CPWD specification or elsewhere specified/stipulated in the Technical specification of Tender document.**

All workmanship, materials and work items shall conform to relevant Indian Standards. In case of items not covered by Indian Standards, other relevant Indian Standards shall be followed. In case of items not covered either by Indian Standards or other relevant Standards, the PWD MAHARASHTRA CSR (Electrical) / CPWD practices shall be followed.

All materials, instruments, equipment's should be new one, to support, proper evidence like date of manufacture with invoice will be verified. In any case, old material will not be allowed to use in the work

2.1.5.2 The equipment covered under these specifications shall comply with all the latest applicable statutory rules, regulations, acts and safety codes which may be in force during the period of execution and which are related with design, construction and operation of equipment in the locality where the equipment is to be installed.

2.1.5.3 The electrical installation shall meet the requirement of Indian Electricity Act 1910 and Indian Electricity Rules, 1956 as amended up-to-date and also the applicable section of the latest revision of the relevant IS code of practice.

2.1.5.4 All works shall be carried out as per design / drawing supplied by the company and / or as per the direction of the Engineer-In-Charge.

2.1.5.5 Distribution Transformers above 200 kVA, Ceiling Fans, etc. shall bear minimum 3 star BEE labeling, whereas, LT motors shall be of EFF2 type for ratings specified by BEE and should comply with criteria of Green Building Norms/GRIHA norms.

2.1.5.6 In addition, any relevant regulations applicable to the work shall be followed. In case of any discrepancy, the decision of owner/ Engineer in charge will be final.

2.1.6 SERVICE CONDITIONS

Ambient air temperature	:	5^0Cto 50^0C.
Altitude	:	Maximum upto 1000 M above MSL.
Relative Humidity	:	Approximately 90 %.
Pollution degree	:	Degree 4 as per IS : 13947 (Part I) (i.e. the pollution generates persistent conductivity caused by conductive dust)

2.1.7 INSPECTION

The bidder/manufacturer shall carry out a comprehensive inspection and testing program during manufacture for all bought out items and also workmanship during this stage. The bidder/manufacturer shall submit the inspection program at least four weeks prior to the owner/Engineer 0n Charge.

The bidder/manufacturer shall carry out all standard routine tests in accordance with relevant IS. The bidder/manufacturer shall also carry out type tests in accordance with relevant IS on one piece of one rating. While the routine tests shall be carried out at manufacturer's works under prior information to purchaser, the type test certificates from reputed test houses shall be submitted for purchaser's approval giving details of each test and evaluation of test data.

Tests which are common to both type and routine tests may be covered under routine test in the presence of purchaser's representative, if required.

2.1.8 TEST CERTIFICATE

The equipment covered under these specifications shall be Type tested in accordance with relevant codes. The bidder shall supply at the time of execution the routine test certificates from the manufacturer indicating the type of tests conducted and the test results in accordance with relevant codes.

2.1.9 OPERATING CONDITIONS

Nominal system Voltage	415 V (+/- 10%)	11 kV (+/- 10%)
Supply Frequency	50 Hz (-5% to +3%)	50 Hz (-5% to +3%)
Highest Fault Level	31 MVA	250 MVA
System earthing	Effectively earthed	Effectively earthed

2.1.10 the electrical works shall be executed only by registered valid electrical licensed contractor of Maharashtra with appropriate Class. The scope of work also includes obtaining all necessary NOC/Licence/approvals from competent authority and also cost shall be borne by the contractor and no extra cost will be paid.

2.1.11 the contractor shall procure all equipment's/ fittings/items etc. required for electrical works through manufacturer/ authorized dealer/agent/Channel partner only. Contractor should submit all necessary documents of technical specifications, installation, operation manual and invoices as required by GRIHA norms. The maximum warranty of the product should be passed on to the owner with appropriate agreement/certificates.

TECHNICAL SPECIFICATION

AMF CONTROL PANEL:

Cubicle type, floor mounting Control Panel, with dust and vermin proof for accommodating the following:

a) Suitable Moulded Case Circuit Breaker, Ammeter with Selector switch

b) Voltmeter with Selector Switch, 500 Volts

c) Frequency Meter

d) KWH Meter

e) KW Meter

f) Current Transformers

g) Indicating Lamps for Supply "ON" & Load "ON"

h) Instrument fuses

FANS (FG/FN)

Ceiling Fans (As per BEE spec.)

Specification No (FG-FN/CF)

Scope:

Supplying and erecting Ceiling fan of 1200 mm sweep with all accessories and necessary materials, erected in provided hook/clamp.

Material:

Ceiling Fan:

1)This Fan specifies the requirements for participating in the energy efficiency standards and labelling for ceiling fans covering 1200mm sweep. The referred Indian Standard are IS 374 : 1979 (Specification for Ceiling Type fans and regulators) with all amendments, as applicable

2) Parameters for initial, verification and challenge testing are the mandatory type tests listed under clause 10 of IS 374: 1979 and including all amendments as of date relevant to the determination of service value. These tests would generally include- Air delivery Fan speed & power input

3) The performance requirements will be in accordance with clause 8 of prevalent IS 374:1979. For compliance with the requirements of this standard, the values of service factor & air delivery are as listed in table below for 1200mm sweep operating at rated voltage and rated frequency at full speed.

4)**Star Rating Index Calculation for Ceiling Fans**

Star Rating Service Value for Ceiling Fans*

1 Star _ 3.2 to < 3.4

2 Star _ 3.4 to < 3.6

3 Star _ 3.6 to < 3.8

4 Star _ 3.8 to < 4.0

5 Star _ 4.0

*Where x is the base service value as per IS 374:1979. BEE has proposed a base service

*All ceiling fans covered under this standard shall comply with minimum Air Delivery of 210 cu m/min.

5. Tolerance limits:

The performance values are minimum values & shall subject to any tolerance as per IS 374.1979. The products should conform to all the requirements of IS 374:1979 with all its amendments to participate in BEE labelling Program.

Method of Construction:

Blades of ceiling fan shall be properly fixed. Down rod, clamp shall be carefully fixed with nut bolt and split pin. Canopies shall be tightened on down rod keeping sufficient clearance. Wiring connections shall be made with required wire leads. Regulator of fan shall be erected on provided switchboard with required wire leads.

Testing:

After erection fan shall be tested by connecting to supply at all positions of regulator. Also steadiness of fan shall be checked at full speed, so that there is no wobbling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

9-1-5 Earthing system

Mobilized Earth (Mob-EA)

Specification No (Mobi-EA)

Scope:

Supply, installation and testing of Mobilized Earthing system at specified location as per drawing and design. Mobilized Earth is a respite to all mobile Electrical, Electronic & Communication equipment's. Mobilized Earth provides quick & efficient earthing. Proper or effective earthing ensures reference voltage (GND) for its functional needs. It is also the only safe path to conduct VHF, Harmonics, Surges, Spikes, Unbalances, Short Circuit current & other faults into the ground mass.

Technical Parameters

Resistance in vertical setting	32.45 % of soil resistivity
Resistance in horizontal setting	21.05 % of soil resistivity

Unbalance withstand capability	6.28 A
Short term duty for 1 sec.	596.60 A
Material	
Body	SS 304L 250 µ Molecularly Bonded Copper cover
Central Conduction	Steel
Infill Compound	
Presentation	In granular form
Granulometry	0.85 mm to 4 mm
Colour / Smell	Grey / Inodorous
Volumetric Mass	500 to 650 Kg/m3 compressed 450 to 500 Kg/m3 uncompressed
Solubility in Water	Partially miscible
PH Value	6.9 to 7.2 of 1000 gm/lit at 20° C
Number of operations	75 Times or 2 Years whichever is earlier

LED LAMPS/ TUBE LIGHTS

Electrical Specifications:

1. ELECTRICAL CONNECTION SYSTEM & 2 WIRE SYSTEM

2. INSTANT START

3. THERE SHALL BE ELECTRICAL ISOLATION BETWEEN INPUT AND OUTPUT CIRCUITS OF THE DRIVER. THE DRIVER SHALL BE INBUILT.

Note: Party shall submit LM79 (Latest)/ related IS standard test report through NABL accredited laboratory.

Since light output and life of LED is dependent on the driver current and junction temperature, Indian standards for the LED are now available and luminaires efficacy and life cycle of T5 lamp selectively for indoor applications in business/ institutional building only with prior approval of Engineer concerned as consideration of CRI in these areas is of prime

importance. Engineer –in charge shall approve the type and make of LED fittings keeping in view of the specific applications and IS.

Inbuilt Protections:

The tube-lights shall have the following inbuilt protections:

- Over Temperature
- Over Voltage Protection
- Short Circuit. (The output circuit shall have inbuilt short circuit and open circuit protection to the driver unit)
- Transients (Surge Voltage & Current)

Permanent Markings in addition to the standard markings

1. DSM PROGRAMME 2015-16
2. DISCOM NAME
3. A/T NUMBER
4. MANUFACTURER CUSTOMER CARE NUMBER
5. NOT FOR SALE

Additionally, the product being offered by the vendor should meet our technical parameters. This would be ascertained through the technical information provided by the vendor. The equipment offered should have certifications issued by NABL and valid as on the due date of the tender, for critical technical specifications and compliance to standards. The minimum certifications required are:

a. Type test certificates
b. Acceptance test certificates
c. Lumen Depreciation Curve of LEDs used as per L70
d. Test report as per LM79 by vendor
e. LM 80 report for the LEDs used from manufacturer
f. IP-20 certification report as per IS: 10322 (part-2)-1982

Compliance to the following standards:

1) EN 60598 (General Requirements & Tests)
2) Transient voltages, Voltage dips and fluctuations, shall conform to EN 61547 or equivalent
3) EN 61000-3-3 (flicker)
4) EN 55015 (RFI < 30 MHz)

Note:

Following are the BIS criterion for LED and LED based equipment.

1. IS: 513 Cold-rolled low carbon steel sheets and strips
2. IS 12063 Classification of degree of protections provided by enclosures.
3. IS 6873(Part 5) Limits and methods of measurement of radio disturbance characteristic of electrical lighting and similar equipment.
4. IS 6873 (Part 5) Equipment for General lighting purposes - EMC immunity requirement.
5. IS 13021 (Part 2) Performance, AC supplied electronics ballast for tubular fluorescent lamps performance requirement.
6. IS 10322 (Part 5/sec 1) Fixed general purpose luminaries.
7. IS 10322 (Part 1) Luminaires - General requirement and tests.
8. IS 14700 (Part 3/sec2) Electro Magnetic compatibility (EMC) -Limits for Harmonic current emission -THD< 15% (equipment input current ≤ 16 Amps. per phase.
9. IS 9000 (Part 6) Environmental Testing : Test Z- AD: composite temperature/ humidity cyclic test.
10. IS 15885 (Part 2/Sec13) particular safety requirements for electronic control gear for use on d.c. supplies.
11. IS 10322 Specification for the luminaries.
12. IS 4905 Method for random sampling.
13. 16101: 2012 General Lighting - LEDs and LED modules - Terms and Definitions
14. 16102(Part 1): 2012 Self- Ballasted LED Lamps for General Lighting Services Part 1 Safety Requirements
15. 16102(Part 2): 2012 Self-Ballasted LED Lamps for General Lighting Services Part 2 Performance Requirements
16. 16103(Part 1): 2012 Led Modules for General Lighting Part 1Safety Requirements
17. 16103(Part 2): 2012 Led Modules for General Lighting Part 2 Performance Requirements
18. 15885(Part2/Sec13): 2012 Safety of Lamp Control Gear Part 2 Particular Requirements Section 13 d.c. or a.c. Supplied Electronic Control gear for Led Modules
19. 16104 : 2012 d.c. or a.c. Supplied Electronic Control Gear for LED Modules - Performance Requirements
20. 16105 : 2012 Method of Measurement of Lumen Maintenance of Solid State Light (LED) Sources
21. 16106 : 2012 Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Products
22. 16107 Part 1:2012 Luminaires Performance Part 1 General Requirements
23. 16107-1:2012 Luminaires Performance Part 2 Particular Requirements Section 1 LED Luminaire
24. 16108: 2012 Photo biological Safety of Lamps and Lamp System.

TECHNICAL SPECIFICATION

LAN Cabling (COC)

A) UTP Networking Cable General:

All material shall conform to relevant standard as per ISO/IEC11801, CENELEC EN50173 & TIA/EIA 568-B2-1; CUL listed & ETL verified. Material and Work not qualifying to provision mentioned above shall be to the satisfaction of Engineer in Charge**.**

Scope: The work shall be executed as per Bill of quantity, specifications. The technical specification of PWD MAHARASHTRA CSR (Electrical) shall be applicable. In case items are not covered in PWD CSR specification, relevant IS codes, other latest standards and CPWD specification shall be followed.

To lay the cables for Computers on surface of wall or ceiling concealed in slab, wall, under flooring etc., through existing metallic conduits, rigid PVC conduits, PVC trunking, with all necessary hardware, material, etc. as specified. The cable shall be used only for connections between Information Outlet & Patch/ Multimax Panel. (Exception: For making MDIX patch cord)

The Category 6 cable and Category 6 channel components shall be manufactured by a single manufacturer of reputed brand to be approved by EIC.

Information Outlet Flush/ Surface type:

Spring shuttered front access, high impact plastic body FR grade with high performance unshielded RJ-45 keystone jack (conforming to EIA/TIA 568-B Cat 6/Fibre optic cable standards). The Category 6 outlets shall be backward compatible with Category 5E, multi cords and cables**.**

The contractor shall procure all equipment's/ fittings/items/cords etc. for LAN/WiFi system through manufacturer/ authorized dealer/agent/channel partner only. The maximum warranty of the product should be passed on to the owner with appropriate agreement/certificates.

TECHNICAL SPECIFICATION

On Line UPS (UPS)

General

This part of the specifications covers the technical aspects of the Online UPS system for
1 - 30 kVA capacity.

REFERENCE STANDARDS

The static uninterruptible power system must be designed and produced in compliance with the following

international standards:

• EN 62040-1 “General and safety requirements for UPS used in operator access areas"

• EN 62040-2 “Electromagnetic compatibility requirements (EMC)”

• EN 62040-3 “Performance requirements and test methods”

The UPS must have CE marking in accordance with European Directives 73/23, 93/68, 89/336, 92/31,93/68.

Scope:

Specification No (AP-UPS)

Supplying, erecting, testing & commissioning of Online UPS with necessary safeties, etc. and comprehensive AMC as specified in the BOQ after defective liability period of 1 year.

Material:

Equipment manufactured as per standard manufacturer’s specification and as tabulated in Table No. 3.7/2. The unit housed in powder coated CRCA sheet enclosure with following fault protection on mains / UPS mode:

- Under voltage on mains mode
- Over voltage on mains mode
- Charger protection on mains mode
- Overload on UPS mode
- Short circuit on UPS mode
- Low battery on UPS mode
- Battery reverse on UPS mode
- Under voltage on UPS mode
- Over voltage on UPS mode
- LED & LCD display for above fault protection
- Alarm for above fault protection
- Batteries shall be of Sealed Maintenance Free type (Tubular).

The selection of number of batteries required shall be 15 mins. Back up complete with all the accessories & rack (12V 26 AH X 30 nos.)

A) The Batteries considered are Sealed Maintenance Free Batteries (SMF)

B) The Batteries need to be placed in Ambient Temperature of 20Deg C - 25Deg C

C) The UPS is considered to be working @ 90% Load of its capacity

Specifications & Standard Parameters of On Line UPS

The UPS shall comply with specifications as indicated in the following table:

S.No.	Specifications / Features	Standard Parameters
1	**Technology**	**:** True online Double Conversion design (DSP / Microprocessor based)
2	**Input voltage range**	**;**160 V to 270 V for **1 Phase Input** 335 V to 477 V for **3 Phase Input**
3	**Input power factor**	Near unity Power factor > 0.93 for **1 Phase input**
4	**Generator compatibility**	Yes (**1.2 times the UPS rating**)
5	**Nominal input frequency**	50 Hz +/- 6 %
6	**Rectifier type :**	Advance Rectifier with inbuilt APFC (Advance Power Factor Compensated) for**1 Phase.** IGBT charger Advance Rectifier with inbuilt APFC (Advance Power Factor Compensated) for **3 Phase.**
7	**Output Voltage :**	**230 V AC +/- 1 % for 1 Phase Output. 400 V AC (380/415 selectable) for 3 Phase & Neutral.**
8	**Total Harmonic distortion**	**1 Phase Output** **< 3 % for Linear load** **< 5 % for Non-linear load** **3 Phase Output** **< 2 % for Linear load** **< 5 % for Non-linear load**
9	**Overload Capacity**	**: 110 % for 10 Seconds & 130 % for 2 Seconds for 1 & 2 kVA UPS.** **:125 % for 10 Minutes & 150 % for 60 Seconds for 3 to 10 kVA UPS.** **:125 % for 5 Minutes & 150 % for 30 Seconds for 30 kVA UPS.**
10	**Inverter**	IGBT based PWM with Digital control (Microprocessor based)
11	**Crest Factor**	3: 1 for **1 & 2 kVA UPS.**According to IEC 62040-3 5: 1 for **3 to 10 kVA UPS.** 3: 1 for **30 KVA UPS**
12	**Static Bypass**	Automatic bypass switch facility
13	**Display**	Should be User friendly with LED & LCD display with showing important parameters.

14	**Output Power factor**	0.7 lag to Unity within kVA & kW rating.
15	**Battery type**	SMF / Thick plate / Tubular
16	**DC Voltage**	1 kVA – 36 V, 2 kVA – 96 V, 3 & 5 kVA – 192 V, 8 to 10 kVA – 240 V, 30 kVA - 400 V
17	**Ambient temperature**	450 C
18	**Noise level**	< 50 db @ 3 metres
19	**Testing standards**	IEC 62040 Part III
20	**Isolation Galvanic**	Isolation transformer from 3 to 30 kVA

Technical Details

General Specification

item	***data***
UPS Topology	On line double conversion VFI SS 111
Architecture of the UPS	Modular, scalable, redundant based on 5kVA Power Modules
In/Out phase Configuration	Three phase-Three phase
Neutral	Neutral Passing through
Output wave form on mains run	Sinusoidal
Output wave form on battery run	Sinusoidal
Bypass type	Static and electro mechanic
Transfer time	Zero

Input

item	***data***
Nominal Voltage	400 V three phase / 230V single phase
Voltage range	-20% +15%
Frequency	50 Hz o 60Hz (autosensing)
THDIin	< 3% al 100% of nominal load
Power Factor	> 0.99 from 50% to 100% of nominal load

Output with mains (AC-AC)

item	***data***
Nominal voltage	400 V three phase
Nominal power	30.000 VA
Active power	27.000 W
Voltage variation (static)	± 1%
Voltage variation (dynamic 0-100%; 100-0%)	± 1%
THDv on nominal power (linear load)	< 0,5 %
THDv on nominal power (not linear load P.F.=0,7)	< 1 %
Frequency	50 Hz o 60 Hz (autosensing or selectable)
Frequency tolerance	:Synchronized with input frequency or ± 1% free run

Current Crest Factor	3:1 accordingly with IEC 62040-3
Overload capability:	
• 5 min	125% load rate with no bypass intervention
• 30 sec	150% load rate with no bypass intervention

<u>Output in battery run (DC-AC)</u>

item	***data***
Nominal voltage	400 V three phase
Nominal power	30.000 VA
Active power	27.000 W
Voltage variation (static)	± 1%
Voltage variation (dynamic 0-100%; 100-0%)	± 1%
THDv on nominal power (linear load)	< 0,5 %
THDv on nominal power (not linear load P.F.=0,7)	< 1 %
Frequency	50 Hz o 60 Hz (autosensing or selectable)
Frequency tolerance	± 1% free run
Current Crest Factor	3:1 accordingly with IEC 62 040-3
Overload capability:	
• 5 min	125% load rate with no bypass intervention
• 30 sec	125% load rate with no bypass intervention

Battery

item	***data***
Type	Lead Acid, sealed, free maintenance VRLA
Unit Capacity	7,2 or 9 Ah (12V)
Nominal UPS Battery Voltage	240 Volt DC
Battery charger type	PWM hi efficiency, one in each power module
Charging Cycle	Intelligent with boost charge and advanced management
Max Charging Current	1,5 A each power module

Environmental Specs

item	***data***
Noise level	@ 1m 42 ÷ 46 dBA
Working temperature range	from 0°C to +40°C
Stock temperature range	from -20°C to +50°C (excluded batteries)
Humidity range	20-80% not condensing
Protection degree	IP21

Mechanical an Miscellaneous

item	***data***
Net Weight without batteries4	130 kg

Dimensions (W×HxD)5	(414 x 1345 x 628 (mm)

The weigh depends by the number of the installed batteries accordingly with the required autonomy. The battery cabinet dimension can change depending battery set accordingly with the required autonomy

Colour	RAL 7016
Technology rectifier/booster/inverter	MOSFET/IGBT
Communication Interface	2 serial port RS232, 1 logic level port, 4 Dry contacts port
Input/output connections	3P + N + PE Connectors on omega bar
Number of Installed Power Modules	6 of 5000 VA
Standards	EN 62040-1, EN 62040-2, EN 62040-3

The contractor shall procure all equipment's/ fittings for UPS through manufacturer/ authorized dealer/agent/channel partner only. The maximum warranty of the product should be passed on to the owner with appropriate agreement/certificates.

The UPS Manufacturer Company must have ISO9001 certification for development, production, and services.

Warranty : Minimum One Year

Comprehensive **AMC**: After one year warranty period, 5 years comprehensive AMC will be applicable

Mode of Measurement: Executed quantity will be measured on number basis. (I.e. Each)

TECHNICAL SPECIFICATION

Ceiling-mounted Dual Technology Occupancy Sensor

Introduction : Ceiling Mounted Occupancy Sensors are ideal for use in office settings to accurately detect occupancy and automatically control lighting. The ceiling mount design of these low profile sensors allows the greatest possible motion sensitivity. An adjustment panel is conveniently located on the front of the sensor, providing ready access to setting controls after the sensor is installed. The work shall be executed as per Bill of quantity and specification.

SPECIFACTIONS AND FEATURES : 360° Sensor Specifications and Features

Description	SLSCDS2001	SLSCDS1001	SLSCDS501

Coverage area	2000 sq. ft.	1000 sq. ft.	500 sq. ft.
Field of view		360°	
Ambient light level sensing		0.5-250 foot candles	
Adjustable time delay		15 sec.-30 min.	
Adjustable sensitivity	200-2000 sq. ft. (10-100% of max. coverage)	100-1000 sq. ft. (10-100% of max. coverage)	50-500 sq. ft. (10-100% of max. coverage)
Isolated relay		Form C contacts for Class 2 signalling	
LED motion indicators		PIR (red) Ultrasonic (green)	

180°Sensor Specifications and Features

Description	**SLSCDS801**
Coverage area	1000 sq. ft.
Field of view	180°
Ambient light level sensing	0.5-250 foot candles
Adjustable time delay	15 sec.-30 min.
Adjustable sensitivity	600-1000 sq. ft. (10-100% of max. coverage)
Isolated relay	Form C contacts for Class 2 signalling
LED motion indicators	1 (red)

Standards and Electrical Specifications

Standards	**SLSCDS2001 and SLSCDS1001**	**SLSCDS501 and SLSCDS801**
	UL and cUL Listed FCC Part 15, Home and Office Use (Class B) California Title 24 Certified	
Specifications		
Current Consumption @ 24VDC*	Active: 22mA	Active: 22mA
Isolated relay	Contact rating: 1A @24Vdc Resistive	
Operating Temperature	32 to 122°F (0 to 50°C)	
Humidity	0 to 90% RH non-condensing	

CLASS B FCC STATEMENT

This device shall comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation. This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help. Changes or modifications to this device that are not expressly approved by Schneider Electric could void the user's authority to operate this equipment.

SAFETY PRECAUTIONS

This section contains important safety precautions that must be followed before attempting to install or maintain electrical equipment. Follow the safety precautions as below.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.
- This equipment must be installed and serviced by qualified electrical personnel.
- Turn off all electrical power supplying this equipment before working on or inside the equipment.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Replace all devices, doors, and covers before turning on power to this equipment.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not connect line voltage to the wiring leads of the sensor.

Failure to follow this instruction can result in personal injury or equipment or property damage.

INSTALLING THE SENSOR : The sensor mounts directly to ceilings or ceiling junction boxes. The sensor can be mounted to a variety of ceiling surfaces, such as acoustical tile, drywall, plywood, etc. There are three options for mounting the sensor are described below. Choose the method for your application and follow the steps for mounting the sensor.

NOTE: Install the sensor at least five feet away from sources of air flow, such as HVAC vents, ceiling fans, etc.

NOTE: The 180° sensor (only) has a small directional arrow (A) to indicate the coverage direction. Determine the direction to mount the sensor and point the arrow in desired coverage direction. See the figure "Orienting the 180° Sensor".

However the bidder shall be followed the instruction manual of the Manufacturer.

OPERATING THE SENSOR

1. Turn on the circuit breaker and any wall switches that may be supplying power to the sensor's power pack.

2. Whenever motion is detected, the LED(s) on the sensor housing will flash on for approximately 0.5 seconds, and the lights will turn or remain on.

NOTE: When first installed, the sensor may have to warm up for a few minutes before it is fully operational.

3. Set the Time Delay to the Test setting of 15 seconds.

4. Vacate the room until the lights turn off.

5. Re-enter the room. Lights should turn on immediately. If lights do not turn on immediately, verify correct sensor wiring.

6. Once the sensor is operational, adjust the settings.

Modes and Sensitivity

Mode: Determines when lights are turned on or will remain on.

Sensitivity Modes

Sensor	Mode	Description
Dual Technology	1	Instant ON setting. Either PIR or ultrasonic detection will turn the lights on or cause the lights to remain on.
	2	Normal, default setting. Only PIR detection will turn the lights on. Either PIR or ultrasonic detection will cause the lights to remain on.
	3	Override ON setting. Lights are always on.

Sensitivity: Determines the amount of movement required to trigger the sensor and the distance from which movement can be detected. Rotate the sensitivity dial to enter a value (Clockwise = increase, Counter clockwise = decrease).

PIR: 10% - 100% of max. The default sensitivity setting is approximately 100%.

Ultrasonic: 10% -100% of max. The default sensitivity setting is approximately 50%. *NOTE: Consider the characteristics of the room when adjusting the sensitivity of the Ultrasonic and Dual Technology sensors. Hard surfaces (concrete, tile, glass) are reflective and will create a higher sensitivity for ultrasonic detection.*

NOTE: Soft surfaces (carpet, drapes, acoustical tile) will absorb some of the ultrasonic energy and reduce the unit's sensitivity. Building additions, such as cubicles and walls, may also require a higher sensitivity setting.

Both ultrasonic and PIR sensitivity are independently adjustable, from 10% to 100% of maximum sensitivity to increase or decrease the distance and movement required to trigger the sensor. The sensitivity adjustments applies to both dials for the Ultrasonic and PIR detection circuits.

Photocell: Sets the level above which ambient light will not trigger the sensor. The ambient light level can be set from 0.5–250 foot-candles. Turn the dial to the desired setting: from 0.5 foot-candles (fully counter clockwise) to 250 foot-candles (fully clockwise). The default setting is 250 foot-candles. This setting also disables the photocell, i.e., ambient light will not inhibit sensor operation.

The contractor shall procure all equipment's/ fittings/items etc. required for occupancy sensor through manufacturer/ **authorized dealer/agent/**Channel partner only. Contractor should submit all necessary documents of technical specifications, installation, operation manual and invoices as

required by GRIHA norms. The maximum warranty of the product should be passed on to the owner with appropriate agreement/certificates.

TECHNICAL SPECIFICATION

Closed Circuit Television System

1. General

The Closed Circuit Television System (CCTV system) shall provide an on-line display of video images on monitor. Cameras with suitable lenses shall be used to view specific areas of interest. The primary objective of implementing a CCTV system is to ensure effective surveillance of an area and also create a record for post event analysis.

2. Equipment

The CCTV System shall comprise of Dome Cameras, Digital Multiplex Recorder and other associated accessories.

3. Dome Camera

3.1 All Cameras shall be of the Fixed Type and shall be of 1/3" CCD type Colour using solid-state circuitry. The Cameras shall provide a minimum of 460 TV lines resolution. It shall be possible to use lenses of 3.6mm/6mm focal length. The complete unit shall be housed in a single mountable container with a base unit, both preferably made from injection moulded plastic. It shall be possible to adjust the camera head inside the housing so that it can be wall or ceiling mounted. The camera shall operate on 24V AC. Necessary transformer to step down the voltage from 240V AC to 24V ac shall be provided along with the camera.

3.2 The camera shall have a minimum range of 20meters.

3.3 The camera shall deliver clear, high-resolution colour picture without geometric distortion.

3.4 The Camera shall comply with the enclosed specifications

3.5 **Lenses: -** The lenses shall be Fixed/Motorized Zoom lens type with preset capability. The lens should not be made from plastic. The zoom lenses shall be remote controlled and all the lenses shall be of auto iris type with internal spot filter.

3.6 **Weather Proof Housing: -** The Housing shall be made of extruded aluminium and weather proof to IP 66. It shall have demister, sun shield internal and external fan for cooling.

3.7 The minimum internal dimensions of the housing shall be 400 x 110 x 95mm and shall be capable of housing the camera and zoom lens.

3.8 Data Sheet:

Sr. No	**Parameters Provided By Vendor**
1.	Manufacturer/ Model No.
2.	Mode (CCIR)
3.	Pick up Element (1/3” Colour CCD)
4.	Number of pixels
5.	Power supply (240VAC/24 VAC)
6.	Scanning System
7.	Horizontal Resolution (not less than 480 TV lines)
8.	Sensitivity (not more than 1 lux)
9.	Range in (meters)
10.	Output (Composite Video)
11.	Lens mount
12.	Operating Temperature
13.	Power Consumption

4. DIGITAL VIDEO RECOREDER CUM MULTIPLEXER:

4.1 The digital video multiplexer shall provide multiplexed field recording of up to sixteen monochrome video inputs. The multiplexer shall offer selectable live multi-screen displays while recording to DVD recorder.

4.2 The unit shall provide a user-programmable twelve-character title for each camera and shall also record time and date with each video image.

4.3 The multiplexer shall feature dual monitor outputs. The primary or “main” monitor which shall display selectable full screen/sequencing full screen/ multi-screen video images while recording is taking place and selectable full screen/ sequencing full screen /multi-screen video when playing back previously recorded images. The secondary or “spot” monitor shall display live full screen video from any camera and shall offer sequencing video from selected cameras.

4.4 Live video and playback functions shall include the following selectable options: full screen from any camera, sequencing full screen from selected cameras, four way “quad” screen display from any camera, nine-way split screen and sixteen way split screen.

4.5 The multiplexer shall provide a digital freeze frame and 2X electronic zoom in full screen live and playback modes.

4.6 The unit shall provide programmable function keys. Each function key shall be capable of performing a customized series of commands, to be executed with the touch of one key.

5. DIGITAL VIDEO RECORDERS:

5.1 Digital Video Recorder provided shall have the following features.

Sr. No	**Parameter Desired Values**
1.	Camera Inputs 16
2.	Audio Inputs 16
3.	Operating Systems Windows 2000 or higher
4.	Password Protection Minimum 3 levels
5.	Recording Video Standard PAL and NTSC
6.	Image Type Colour
7.	Image Resolution 752x582 pixels
8.	Image Colour Resolution 16-bit or higher
9.	Image Compression MPEG-3 or higher
10.	Continuous Record Mode Yes
11.	Maximum Recording Rate 400fps PAL / 480fps NTSC
12.	Maximum IPS per Camera 25fps per camera PAL / 30fps per camera NTSC

13. Time Stamp on Image Yes

14. Camera No. on Image Yes

15. Recording during Viewing Yes

16. Live View Yes

17. Playback Speed at least 4 speeds (user selectable)

18. Playback Image Size 752x582 pixels in multiple modes (1/4/8/16)

19. Ability to Print Image Yes

20. Search facility By Date/ Time and / or Camera Number

21. Archiving facility to be provided.

22. Date / Time Stamping To be Provided

6. MONITOR:

6.1 The Colour monitor shall be suitable with the standards of the selected cameras. It shall be solid state and modular in design. It shall provide a bright, clear and well defined picture display on the screen.

6.2 All controls for brightness, contrast etc. shall be provided on the front panel for readily adjusting the levels of the video signal. The rear panel shall be provided with input and output BNC connectors for coupling the video output to other Monitors. The video monitors installed shall be at least 14" size or more and shall comply with the specification

6.3 **Data Sheet:**

Sr. No	**Parameters Provided By Vendor**
1.	Manufacturer/ Model No.
2.	Input Signal
3.	Resolution (More than 700 lines at center)
4.	Video Bandwidth
5.	Power Supply
6.	Power Consumption

7. Cable

Cables should conform to IS: 1554 and carry ISI certification mark.

6.1 **Control Cable** **:** - All Control Cable shall be RG-11 coaxial cable.

Materials : - Conductor: Copper clad steel (CCS)

Dielectric : low density cellular polyethylene

Shield : aluminium foil and copper wire braid

Jacket material : PVC (polyvinylchloride)

Technical characteristics: -

Wave impedance : 75 Ohm

Conductor diameter : 1.62 mm (0.06") (14 AWG)

Dielectric diameter : 7.11 mm (0.28")

Shield : 0.18 mm (0.007"), cover – 60% minimum, aluminium foil

Test frequency : up to 3 GHz

Capacitive resistance : 53.1 pF/m

Signalling rate : 83%

6.2 **Power Cable: -**

All power cables shall be copper conductors PVC insulated, Armoured and PVC sheathed of 1.1 KV grade all cables shall have standard conductors. The cables shall be supplied in drums as far as possible and bear the manufacturer's identification mark. All cable joints shall be made in an approved manner as per accepted practice.

The contractor shall procure all equipment's/ fittings/items etc. required CCTV through manufacturer/ authorized dealer/agent/Channel partner only. Contractor should submit all necessary documents of technical specifications, installation, operation manual and invoices as required by GRIHA norms. The maximum warranty of the product should be passed on to the owner with appropriate agreement/certificates.

GENERAL HVAC SPECIFICATIONS FOR VRV/HVAC

SCOPE :

a. **The work shall be executed as per specification of Bill of quantity and instruction of engineer in charge. The contractor shall procure all equipment's/ fittings/items etc. required for HVAC system through manufacturer/ authorized dealer/agent/Channel partner only. Contractor should submit all necessary documents of technical specifications, installation & operation manual and invoices as required by GRIHA norms. The maximum warranty of the product should be passed on to the owner with appropriate agreement/certificates.**

b. Includes supply, installation, testing and commissioning of new and latest model of Main Equipment's along with the associated sub-equipment, accessories and ancillaries.

c. Includes assembly of main equipment components, accessories and ancillaries at site required to complete the unit.

d. Includes providing factory test/inspection certificates/NOC/approvals wherever required, start-up & performance test run at site along with manufacturer's factory representatives' supervision and services. No extra cost will be paid.

e. Includes supply, installation testing & commissioning of New and latest model of Electrical Control Panels for the main equipment's along with the related interconnections and accessories required between the control Centre and unit (only) to complete the system.

f. Excludes all nature of civil / structural work viz, foundation, drainage, wall cut outs, unit rooms, lofts etc. however details of layout/location will be provided by the HVAC Contractor

g. Excludes supply of incoming electrical points/ power wiring to the HVAC Unit / HVAC Panel, however details of load and location will be provided by the HVAC Contractor.

h. The work shall be executed only through valid authorized contractor/ technician/engineer as applicable in Maharashtra State..

i. Comprehensive AMC for 5 years for HVAC system after warranty period of 1 year

Specifications for VRV System

VRV System.

The system selected is a modular system, with number of indoors connected to centrally located outdoor units, as per detail designing given in the tender. The outdoor units for all the system shall be air cooled type and mounted on terrace of the building. Indoor units in various areas shall be as per enclosed drawings/ Bill of Quantities.

All the VRV air conditioners shall be fully factory assembled, wired, internally piped & tested. The outdoor unit shall be precharged with first charge of R 410A refrigerant. Additional charge shall be added as per refrigerant piping at site. All the units shall be suitable for operation with 415 V + 10%, 50 Hz + 3%, 3 Phase supply for outdoor units & 220 V + 10%, 50 Hz + 3%, 1 Phase supply for in door units.

The VRV system shall provide stable, trouble free & safe operation, with flexibility of operating desired indoor units. The outdoor units must be capable of delivering exact capacity proportional to the number of indoor units switched on & the heat load in the air conditioned area. The proportional operation shall be achieved by varying speed of the compressor in the outdoor units.

The operation of the VRV system shall be through independent wired/ wireless remote controllers as specified. The entire system shall be integrated with intelligent building management system of leading vendors like Honeywell/ Johnson Controls/ Staefa etc, through BAC Net Gateway. The detailing of operation required through BMS system are detailed under specifications of BMS system.

Specification of Outdoor units.

Outdoors units of the VRV system shall be compact air cooled type.

All the compressors of the outdoor units must be hermetically sealed scroll type. Each module of outdoor unit must have separate with latest inverter technology, suitable to operate at heat load proportional to indoor requirement.

”Coated PE Fins (with special acryl pre-treatment) “for Al fins of Condenser Coils is mandatory for increased durability to salt corrosion.

The outdoor units must be suitable for up to 150 m(straight length) refrigerant piping between outdoor unit & the farthest indoor units, total piping of 510 m for all the indoor units. Allowable level difference between outdoor unit & indoor units shall be 50 m in case of outdoor unit on top & 40 m in case of outdoor unit at bottom. Allowable level difference between various indoor units connected to one out door unit shall be up to 15 m.

Back up operation, in case of failure of one of the compressors of outdoor unit, for single module outdoor units or failure of one of the modules in case of multiple module outdoor units shall be possible. The VRV outdoor unit shall always be supplying at least 33% of back up operation, of the full load capacity.

The outdoor unit shall employ system of equal run time for all the compressors, inverter or on/ off type, within each out door unit – Single Module or Multi Module.

The outdoor units shall be suitable to operate within an ambient temperature range of – 5 Deg C to 50 Deg C, in cooling mode & -20 Deg C to 15 Deg C in heating mode.

Air cooled condenser shall have Axial Flow, upward throw fan, directly coupled to fan motors with minimum IP 55 protection. The outdoor unit condenser fan shall be able to develop external static pressure up to 6 mm of H2O.

The entire operation of outdoor units shall be through independent remotes of indoor units. No separate Start/ Stop function shall be required.

Starter for the Outdoor Unit compressor shall “Direct on Line” type. Inverter compressor of the unit shall start first & at the minimum frequency, to reduce the inrush current during starting.

Refrigerant control in the outdoor unit shall be through Electronic Expansion Valve. Complete refrigerant circuit, oil balancing/ equalizing circuit shall be factory assembled & tested.

Noise level of outdoor units shall not exceed 63 dB (A) at a distance of 1.5 m from the unit.

The outdoor units shall confirm to Technological Guideline for Harmonic Suppression – JAEG 9702-1995. High Harmonic Environmental Target Level for Power Distribution system shall be 5%.

Outdoor units shall be complete with following safety devices:

High pressure switch

Fan driver overload protector

Over current relay

Inverter Overload Protector

Fusible Plug

Unit shall be supplied with

Installation manual

Operation Manual

Connection Pipes

Clamps

Units shall be available in following configuration

5 HP -60HP forming a single circuit

Specifications for Indoor Units

Cassette type indoor units.

These units shall be installed between the bottom of finished slab & top of false ceiling. The maximum allowable height for the cassette type units shall be 288 mm.

The unit must have in built drain pump, suitable for vertical lift of 750 mm.

The unit casing shall be Galvanized Steel Plate.

Unit must be insulated with sound absorbing thermal insulation material, Polyurethane foam. The noise level of unit at the highest operating level shall not exceed 42 dB(A), at a vertical distance of 1.5 m from the grille of the unit.
Unit shall have provision of connecting fresh air without any special chamber & without increasing the total height of the unit (288 mm maximum).
The unit shall be supplied with suitable decorative panel.
The unit shall be supplied with Resin Net filter with Mold Resistance. The filter shall be easy to remove, clean & re install.
The unit will be connected in series to a suitable out door unit & it must be possible to operate the unit independently, through corded/ cordless remote specified in the “Bill of quantities”. The unit will be further connected to Intelligent Building Management System (To be supplied by other vendors) & it shall be possible to operate the unit through this IBMS system.
The unit shall be supplied with following from the factory

Operation Manual
Installation Manual
Paper pattern for installation
Drain hose/ Clamp metal/ Washer fixing plate/ Sealing pads/ Clamps/ Screws/

Washer for hanging bracket/ Insulation for fitting
The unit must be available in following class –
1 HP, 1.25 HP, 1.6 HP, 2.0 HP, 2.5 HP, 3.2 HP, 4 HP, 5 HP

Ceiling Mounted duct type units.

These units shall be ceiling suspended with suitable supports to take care of operating weight of the unit, without causing any excessive vibration & noise. The cold air supplied by these units will be supplied to the area to be air conditioned, through duct system specified in the tender.

Each indoor unit must have electronic expansion valve operated by microprocessor thermostat based temperature control to deliver cooling/ heating as per the heat load of the room.

The unit casing shall be Galvanized Steel Plate.

Unit must be insulated with sound absorbing thermal insulation material, Glass Fiber. The noise level of unit at the highest operating level shall not exceed 49 dB(A), at a vertical distance of 1.5 m below the units with duct connected to the unit.
The unit must be able to develop external static pressure of 25 mm, at the specified air quantities.
Unit must have Thermal Fuse for fan motor protection, in case of motor heating.

The unit will be connected in series to a suitable out door unit & it must be possible to operate the unit independently, through corded/ cordless remote specified in the bill of quantities. The unit will be further connected to Intelligent Building Management System (To be supplied by other vendors) & it shall be possible to operate the unit through this IBMS system.

The unit shall be supplied with following from the factory

Operation Manual

Installation Manual

Paper pattern for installation

Drain hose/ Clamp metal/ Insulation for fitting/ Sealing pads/ Clamps/ Screws

The unit must be available in following class –

1.6 HP, 2.0 HP, 2.5 HP, 3.2 HP, 4 HP, 5 HP, 8 HP, 10 HP

Wall Mounted Units.

Wall mounted units must be compact & stylish design that does not detract from the décor of the room.

Each indoor unit must have electronic expansion valve operated by microprocessor thermostat based temperature control to deliver cooling/ heating as per the heat load of the room.

The unit must have provision of adding drain pump kit if required & specified. The drain pump must be suitable to lift drain up to 1000 mm from the bottom of the unit.

Unit must be insulated with sound absorbing thermal insulation material, Polystyrene/Polyethylene foam. The noise level of unit at the highest operating level shall not exceed 46 dB(A), at a vertical distance of 1.5 m from the grille of the unit.

The unit shall be supplied with Resin Net filter with Mold Resistance. The filter shall be easy to remove, clean & re install.

The unit grille must be washable with soap solution.

It shall be possible to set minimum 5 steps of discharge angle by remote controller.

It shall be possible to fit drain pipe from either side of the unit (Left or right)

The unit will be connected in series to a suitable out door unit & it must be possible to operate the unit independently, through corded/ cordless remote specified in the bill of quantities. The unit will be further connected to Intelligent Building Management System (To be supplied by other vendors) & it shall be possible to operate the unit through this IBMS system.

The unit shall be supplied with following from the factory

Operation Manual

Installation Manual

Installation panel

Paper pattern for installation

Insulation tape/ Clamps/ Screws

The unit must be available in following class –

0.8 HP, 1 HP, 1.25 HP, 1.6 HP, 2.0 HP, 2.5 HP

Ceiling mounted Built – In type.

These units shall be ceiling suspended with suitable supports to take care of operating weight of the unit, without causing any excessive vibration & noise. The cold air supplied by these units will be supplied to the area to be air conditioned directly through duct collar & grille or , through duct system specified in the tender.

Each indoor unit must have electronic expansion valve operated by microprocessor thermostat based temperature control to deliver cooling/ heating as per the heat load of the room.

The unit casing shall be Galvanized Steel Plate.

Unit must be insulated with sound absorbing thermal insulation material, Glass Fiber. The noise level of unit at the highest operating level shall not exceed 48 dB(A), at a vertical distance of 1.5 m below the units with duct connected to the unit.

The unit must have provision to set external static pressure in three stages from max 10 mm to min 2 mm, depending on the air supply system.

The unit must include as standard equipment, maintenance free long-life filter, resin net with mold resistant.

The unit must include as standard equipment, a drain pump kit suitable to lift drain water up to 250 mm from the drain pipe opening.

Unit must have Thermal Fuse for fan motor protection, in case of motor heating.

The unit will be connected in series to a suitable out door unit & it must be possible to operate the unit independently, through corded/ cordless remote specified in the bill of quantities. The unit will be further connected to Intelligent Building Management System (To be supplied by other vendors) & it shall be possible to operate the unit through this IBMS system.

The unit shall be supplied with following from the factory

Operation Manual

Installation Manual

Paper pattern for installation

Drain hose/ Clamp metal/ Insulation for fitting/ Sealing pads/ Clamps/ Screws

The unit must be available in following class –

0.8 HP, 1 HP, 1.25 HP, 1.6 HP, 2.0 HP, 2.5 HP, 3.2 HP, 4 HP, 5 HP

Specification for Controls System for VRV air conditioning system

Wired Remote Controller.

Wired remote controller shall be supplied as specified in the “Bill of Quantities”

The controller must have large crystal display screen, which displays complete operating status.
The digital display must allow setting of temperature with 1 Deg C interval.
Remote shall be able to individually program by timer the respective times for operation start and stop within a maximum of 72 hours
Remote must be equipped with thermostat sensor in the remote controller that will make possible more comfortable room temperature control
The remote shall be able to monitor room temperature & preset temperature by microcomputer & can select cool/ heat operation mode automatically.
The remote must constantly monitor malfunctions in the system & must be equipped with a “self-diagnosis function” that let know by a message immediately when a malfunction occurs.
It shall be possible to wire the remote up to 500 RMT.
Wireless Remote Controller.
Wireless remote controller shall be supplied as specified in the “Bill of Quantities”
The same operation modes & settings as with wired remote controllers must be possible.
Compact light receiving unit to be mounted into wall or ceiling shall be included.
Central Remote Controller.
Central Remote controller shall be supplied as specified in the “Bill of Quantities”
Following functions shall be possible
Control Max 64 Groups (128 indoor units)
Zone control
Malfunction code display
All the functions available with wired remote controller
It should be possible to wire the remote to 1000m

Building Management System (BAC Net gateway)

The VRV system supplied must be suitable for communication between VRV & intelligent building management system of other reputed vendors, like STAEFA, Honeywell, Johnson Controls, through BAC Net gateway. The BAC Net gate way shall utilize the standard communication protocol for the HVAC industry, to provide easy connection between VRV system & BMS. The joint Matching Test shall be conducted by DAIKIN personnel with the selected BMS vendor & entire be commissioned & balance.
Complete operation & monitoring of VRV air conditioning system shall be possible through the BMS system.
Following major functions shall be possible via BAC net interface on BMS

Monitoring	Air conditioning status monitoring
	Indoor unit error monitoring
	Indoor air inlet temperature monitoring

	Filter choke sign monitoring
Control, Operation & Setting	Start/ Stop control Temperature adjustment mode setting Remote control setting Temperature setting Filter sign reset
Display	Air conditioner operation setting & status Set temperature Indoor unit error Indoor air inlet temperature Filter sign

The BAC Net gate way shall be as per ASHRAE 135, Data link - IEE802.3, BACnet/IP, conformance Class 3, with RS232C port.

BAC Net gateway hard ware shall be suitable for operation between -10 Deg C to 50 Dg C & humidity range between 0% to 98%, without condensation.

Air conditioning Management System

The VRV system supplied must be provided with PC based air conditioning management system, form the supplier of VRV equipments. The required hard ware must be selected, suitable for up to minimum 128 indoor units.

The air conditioning management system, in broad terms must undertake following functions

Energy efficiency functions

Control & optimization of system

Operation & monitoring

Expanded network functions

Complete operation & monitoring of VRV air conditioning system shall be possible through this PC based system.

Following major functions shall be possible:

Monitoring	Air conditioning status monitoring Indoor unit error monitoring Indoor air inlet temperature monitoring Filter choke sign monitoring
Control, Operation & Setting	Start/ Stop control

	Temperature adjustment mode setting Remote control setting Temperature setting Filter sign reset
Display	Air conditioner operation setting & status Set temperature Indoor unit error Indoor air inlet temperature Filter sign
Measurement	Accurate operation time Number of switching times Power consumption (Optional with KWH meter) Room temperature Outdoor temperature
Printing	History Statistics Setting information

The A/C management system must be able to connect to existing LANs. Remote monitoring of the complete HVAC system shall be possible. System shall be capable to take external signal like Security/ Fire for forced shut off. Required hardware shall be suitable for operation between -10 Deg C to 50 Dg C & humidity range, of 0% to 98%, without condensation.

Handing over of the VRV system

Following reading/ data shall be generated as a part of handing over of the VRV air conditioning system, apart from the handing over data for air side & indoor design conditions.

Outdoor units

- Inlet temperature
- Discharge pipe temperature
- Suction pipe temperature
- Oil pressure
- Condensing Pressure
- Evaporating Pressure
- Power supply voltage

Inverter compressor frequency

Inverter current

Fan operating current

Total ODU current

Indoor Units

Indoor unit operation – On/ off from remote

Indoor unit operation – On/ off from thermostat

Remote control presser temperature

Suction temperature

Indoor liquid pipe temperature

Indoor gas pipe temperature

Electronic expansion valve opening

Fan operating current

TECHNICAL SPECIFICATION

(FIRE FIGHTING SYSTEM)

SCOPE:

a) The work shall be executed as per specification of Bill of quantity and instruction of engineer in charge. The supply and installation of new and latest model of Firefighting equipment's required for the work shall be executed through registered valid licence holder of Maharashtra fire Deptt with appropriate class for all categories.

b) **The contractor shall procure all equipment's/ fittings/items etc. required for firefighting system through manufacturer/ authorized dealer/agent/Channel partner only. Contractor should submit all necessary documents of technical specifications, installation, operation manual and invoices as required by GRIHA norms. The maximum warranty of the product should be passed on to the owner with appropriate agreement/certificates.**

c) Includes supply, installation, testing and commissioning of Main Equipment's along with the associated sub-equipment, accessories and ancillaries.

d) Includes assembly of main equipment components, accessories and ancillaries at site required to complete the unit.

e) Includes providing factory test/inspection certificates, NOC, approvals, licence wherever required, start-up & performance test run at site along with manufacturer's factory representatives' supervision and services. No extra cost will be paid.

f) Includes supply, installation testing & commissioning of Electrical Control Panels for the main equipment's along with the related interconnections and accessories required between the control Centre and unit (only) to complete the system.

g) All statutory training for firefighting shall be done in free of cost to the concerned employees of owner.

Section 1

General Instructions

1.1 Fire suppression works specified in the tender have to be executed in accordance with:

1.1.1 The rules and regulations of Fire Service as per the statutory regulations applicable for obtaining the occupation certificate from the Fire Service.

1.1.2 The contractor has also to ensure compliance of the Rules of the Tariff Advisory Committee (TAC) of the Insurance Association of India, as amended up to date to enable the Engineer In Charge to apply for getting the maximum rebate on insurance premium for the building. Contractor's responsibility for compliance will be only with respect to the items of work put to tender. He will prepare and submit a set of drawings and calculations and such other information as required for making the application. He will also assist the Engineer In Charges in providing all technical clarifications, corrections to drawings and calculations as required by the TAC.

1.1.3 Applicable norms laid down by the National Building Code of Bureau of Indian Standards (B.I.S.) shall be followed as applicable.

1.1.4 The codes of the National Fire Protection Association of USA (N.F.P.A.) shall use as a general guide for good engineering practice, design and workmanship norms. No certificate of compliance to NFPA codes will be required.

1.2 All materials used in the works shall have Bureau of Indian Standards valid certification stamped, marked or cast on the material in an acceptable and approved manner.

1.3 It is the contractor's responsibility to ensure the competence of design to meet the above requirements.

1.4 Drawings issued with the tenders are schematic and indicate the concept. Contractor shall make his shop drawings on basis of Architectural and Interior design drawings issued by the Engineer-in-Charge. Work will be executed only as per approved shop drawings.

1.5 Quantities in the tender document and on drawings are approximate and for reference only.

1.6 Contractors are invited to highlight any aspects of the contract document that may need revision or reconsideration before the work is started. He must furnish a details of any variations in the specifications or drawings that may be necessary for him to comply with the Code and statutory requirements. These may be identified and approval of the Engineer In Charges taken before the start of the work.

2. System Design

2.1 Fire suppression system for the complex is based on the concept of "total protection" by the wet riser hydrant and sprinkler system for the entire premises with excepted areas identified on the drawings or as instructed by the Engineer In Charges.

2.2 Water Storage & Pump House

2.2.1 A static underground RCC water storage tank in two compartments having gross water storage capacity of (as per drawing) will be provided. The tank will be provided with manholes, inserts, puddle flanges, ladders inside and outside the tanks by the civil contractor.

2.2.2 One overhead water storage tank of capacity as per drawing. As secondary water source for the sprinkler system will be provided on the terrace.

2.2.3 The pump house is located in basement (as per U.G. tank & pump room drawing) so as to provide net positive suction to all pumps. Test lines from pumps shall discharge back into the fire tank to conserve water.

2.2.4 Configuration and operating conditions of pumps are given in the Specifications.

2.3. Wet Riser Hydrant System

2.3.1 The building will be provided with a wet riser hydrants are fed from the main fire pump with designed pipe. The ring main will be provided with fire brigade inlet connection and isolation valves to enable at least a part of the main to provide water in case a section is under repairs.

2.3.2 External fire hydrants with sluice isolation valves will be provided on the ring main. Hydrants shall be located at least 2 m away from the building. Internal wet risers for the building shall be connected to the ring main with an isolation butterfly valve for each connection.

2.3.3 Hydrant stations and cabinets shall be provided at all designated locations inside and along with the external hydrants. The hydrant stations shall be located in a MS steel fire cabinets as per drawing sand will contain all items described in the BOQ and specifications.

2.4. Sprinkler System

2.4.1 A separate and independent wet riser fire sprinkler shall be provided a shown on the drawings. The system will be divided in several zones with their own installation valves, located in the basement or near the fire pump room.

2.4.2 The entire building is protected with automatic sprinkler system with permitted exceptions e.g. electrical switch rooms, power transformers and medical areas as identified.

2.4.3 Types of sprinklers to be used shall be as given in specifications, drawings and approved by the Engineer In Charges

2.5. Pumping System

2.5.1 The pumping system shall provide the water supply and pressure to the wet riser fire and sprinkler mains. Diesel Engine will be a common stand by.

2.5.2 Provide a full bore test valve on the bypass line with rate of flow meter on the common pump header to discharge in the water tank. Also provide an isolation valve on heads outlet to each circuit to enable pressure setting and testing of pumps.

Section -2

Fire Hydrant & Automatic Sprinkler System

2.1 Scope of work

2.1.1 Wet riser fire hydrant system (internal & external)

2.1.2 Automatic sprinkler system

2.1.3 Fire hydrant & sprinkler pumps.

2.1.4 Valves, suction and delivery connections, and headers.

2.1.5 Pipe protection, painting, sleeves & minor civil works other than specifically mentioned in the tender.

2.1.6 Electrical installations.

2.1.7 Specialized protection as specified.

2.1.8 Testing and commissioning.

2.2. General Requirements

2.2.1 All materials shall be new and latest model of the best quality conforming to the specifications and subject to the approval of the Engineer In Charges.

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

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

2.2.4 Pipes shall be securely fixed to walls, and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for RCC ceilings and walls.

2.2.5 Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

2.3 Pipes

2.3.1 All pipes within and outside the building in exposed locations and shafts including connections buried under floor shall be M.S. Pipes as follows:

2.3.2 Pipes 150 mm die and below IS: 1239 Heavy Class

2.3.3 Pipe 200 mm dia and above IS 3589 of thickness specified.

2.4 Pipe Fittings

2.4.1 Pipes and fittings means tees, elbows, couplings, flanges, reducers etc. and all such connecting devices that are need to complete the piping work in its totality.

2.4.2 Screwed fittings shall be approved type malleable or cast iron with reinforced ring on all edges of the fittings suitable for screwed joints.

2.4.3 Forged steel fittings of approved type with “V" groove for welded joints.

2.4.4 Fabricated fittings shall be not being permitted for pipe diameters 50 mm and below.

2.4.5 When used, they shall be fabricated, welded and inspected in workshops under supervision of Engineer In Charges whose welding procedures have been approved by the TAC as per TAC rule 4102 for sprinkler system and applicable to hydrant and sprinkler system. For "T" connections, pipes shall be drilled and reamed. Cutting by gas or electrical welding will not be accepted.

2.5 Jointing

2.5.1 **Screwed (50 mm dia pipes and below)**

Joint for black steel pipes and fittings shall be metal to metal thread joints. A small amount of red lead may be used for lubrication and rust prevention. Joints shall not be welded or caulked.

2.5.2 **Welded (65 mm dia and above)**

Joints between M.S. and pipes and fittings shall be made with the pipes and fittings having "V" groove and welded with electrical resistance welding in an approved manner. Butt welded joints are not acceptable. Buried pipes will be subject to x ray test from an approved agency as per the TAC norms.

2.5.3 **Flanged**

Flanged joints shall be provided on:

a) Straight runs not exceeding 30 m on pipe lines 80 mm dia. and above.

b) Both ends of any fabricated fittings e.g. bend tees etc. of 65 mm dia or larger diameter.

c) For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and required as good for engineering practice.

Flanges shall be as per I.S. with appropriate number of G.I. nuts and bolts, 3 mm insertion neoprene gasket complete.

2.5.3 Unions

2.5.4 Provide approved type of dismountable unions on pipes lines 65 mm and below in similar places as specified for flanges.

2.6 Excavation

2.6.1 Excavation for pipe lines shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipe lines shall be buried to a minimum depth of 1.2 meter or as shown on drawings.

2.6.2 Wherever required contractor shall support all trenches or adjoining structures with adequate timber supports.

2.6.3 On completion of testing and pipe protection, trenches shall be refilled with excavated earth in 15 cm. layers and consolidated.

2.6.4 Contractor shall dispose off all surplus earth within a lead of 200 m or as directed by Engineer In Charge.

2.7 Anchor Thrust Blocks

2.71 Contractor shall provide suitably designed anchor blocks in cement concrete to encounter excess thrust due to water hammer & high pressure.

Thrust blocks shall be provided at all bends & tees & such other location as determined by the Engineer In Charge.

Exact location, design, size and mix of the concrete block shall be approved by the Engineer In Charge prior to execution of work.

2.8 Valves

2.8.1 **Gunmetal Valves**

a) Valves 65 mm dia & below shall be heavy gunmetal full way valves or globe valves conforming to I.S. 778-1971 class II with female screwed ends. Valves shall be carry I.S. certifications mark.

b) All valves shall be approved by the Engineer In Charge before they are allowed to be used on work.

2.8.2 **C.I. Iron Butterfly Valves**

a) All valves 80 mm dia and above shall be C.I. Double flanged butterfly valves with rising spindle. Each sluice valve shall be provided with wheel for valves in

exposed positions and cap top for underground valves. Contractor shall provide suitable operating keys for Sluice Valves with tops.

b) Butterfly valves shall be of best quality conforming to I.S.13095 of class specified.

2.8.3 **Non-return valves (Check Valves)**

Non-return valves shall be cast iron double flanged with cast iron body and gunmetal internal parts conforming to IS:5312.

2.8.4 **Air cushion Tank**

Provide air cushion tank with 25 mm dia. screwed inlet, on all high points (each tower terrace) in the system or as shown on drawings.

2.8.5 **Orifice Flanges**

Provide orifice flanges fabricated from 6 mm thick stainless steel plate to reduce pressure on individual hydrants to restrict the operating pressure to 3.5 Kg/sq.cm. And allow a discharge of 560 lpm. The contractor shall submit design of the orifice flanges for approval before installation.

2.8.6 **Drain Valve**

Provide 50 mm dia black steel pipe to IS: 1239 (heavy class) with 50 mm gunmetal full way valve for draining any water in the system in low pockets.

2.8.7 **Inspection & testing assembly**

Inspection and testing of the sprinkler system shall be done by providing an assembly consisting of gunmetal valves, gunmetal sight glass, bye-pa Contractor shall provide suitably designed anchor blocks in cement concrete to encounter excess thrust due to water hammer & high pressure. ss valve. The drain pipe beyond the valve up to the drainage point shall be measured with the pipe.

2.8.8 **Pump test assembly**

Provide on the main fire sprinkler header a 150 mm dia bye pass valve located in an accessible manner along with a rate of flow odometer calibrated in lpm and able to read 200 % of the rated pump capacity. The delivery shall be connected to the fire tank.

2.8.9 **Pressure Gauge**

Gauge shall be provided near all connections to hydrant system and isolation valves of sprinkler system and where required. Pressure gauge shall be 100 mm dia gunmetal Burden type with gunmetal isolation cock, tapping and connecting pipe and nipple. The

gauge shall be installed at appropriate level and height for easy readability.

2.9 Hydrant/valve chambers

2.9.1 Contractor shall provide suitable brick masonry chambers in cement mortar 1:5 (1 cement: 5 coarse sand) on cement concrete foundations 150 mm thick 1:5:10 mix (1 cement: 5 fine sand: 10 graded stone aggregate 40 mm nominal size) 15 mm thick cement plaster inside and outside finished with a floating coat of neat cement inside with cast iron surface box approved by fire brigade including excavation, back filling complete.

2.9.2 Valve chambers shall be 120x120 cm. for depths 100 cm. and beyond

2.10 Flow switch

Flow switches shall be provided on sectional mains and branch lines of sprinkler systems where indicated on drawings, or necessary and required and directed by the Engineer In Charge.

Flow switch should be suitable to actuate for opening of a single sprinkler and shall be suitable for connection to a central annunciation panel.

2.11 Fire brigade connections

Provide as shown on drawings separate gunmetal 2 way collecting head with two 63 mm instantaneous type inlets with built in check valves and 100 mm dia outlet connected to the fire and sprinkler main . Collecting head shall be installed on a stand post and provided with horizontal C.I. Reflux valve and location to be approved by Engineer In Charge. Provide etched gunmetal label plates with mm height letter. The plates should be firmly fixed to the FB connection and any support system.

2.12 Fire hydrants

2.12.1 **External hydrants**

Contractor shall provide external hydrants. The hydrants shall be controlled by a cast iron sluice valve installed in underground lockable chambers. Hydrants shall have instantaneous type 63 mm dia outlets. The hydrants shall be single outlet conforming to I.S.908-1975 with C.I duck foot bend and flanged riser of required height to bring the hydrant to correct level above ground.

Contractor shall provide for each external fire hydrant two numbers of 63 mm dia. 15 m long rubberized permaline hose pipe with gunmetal male and female instantaneous type couplings machine wound with G.I. wire (hose to I.S. 636 Type 2 and couplings to I.S: 903 with M.S. Certification), gunmetal branch pipe with nozzle to I.S. 903.

2.12.2 Internal hydrants

a) Contractor shall provide on each landing and other locations as shown on the drawings two single headed gunmetal landing valve with 63 mm dia outlet mounted on a common 80 mm inlet (I.S.5290-1969). Landing valve shall have flanged inlet and instantaneous type outlets as shown on the drawings.

Instantaneous outlets for fire hydrants shall be of standard pattern approved and suitable for fire brigade hoses.

a) Contractor shall provide for each internal fire hydrant station two numbers of 63 mm dia. 15 m long rubberized fabric linen hose pipes with gunmetal male and female instantaneous type coupling machine wound with G.I. wire (hose to I.S. 636 Type 2 and couplings to I.S. 903 with I.S. Certification), fire hose reel, gunmetal branch pipe with nozzle I.S. 903 and Fire man's axe.

b) Each hose box shall be conspicuously painted with the letters "FIRE HOSE".

2.13 Fire hose reels

2.14 Contractor shall provide standard fire hose reels with 20 mm dia high pressure Dunlop rubber hose 36.5 m long with gunmetal nozzle and control valve, shut off valve, all mounted on circular hose reel of heavy duty mild steel construction and cast iron brackets. Hose reel shall be connected directly to the wet riser. Hose reel shall conform to IS: 884-1969 and rubber hose to IS: 5132.

2.14 Hose Cabinets

2.14.2 Provide hose cabinets for all internal fire hydrants. Hose cabinets shall be fabricated from 16 gauge M.S. sheet of fully welded construction with hinged double front door partially glazed with locking arrangement, stove enameled fire red paint with "FIRE HOSE" written on it prominently.

2.15 Pipe protection

a) All pipes above ground and in exposed locations shall be painted with one coat of zinc chromate primer and two or more coats of synthetic enamel paint of approved shade.

b) Pipes in chase or buried underground shall be painted with two coats of zinc chromate primer and wrapped with one layer of 4 mm thick PYPCOAT multilayer sheet as per standard manufacturer's specifications.

2.16 Pipe Supports

2.16.1 All pipe clamps and supports shall be galvanized steel. When fabricated from M.S. steel sections, the supports shall be factory galvanized before use at site. Welding of galvanized clamps and supports will not be permitted.

2.16.2 Pipes shall be hung by means of expandable anchor fastener of approved make

and design (Dash Fasteners or equivalent). The hangers and clamps shall be fastened by means of galvanized nuts and bolts. The size/diameter of the anchor fastener and the clamp shall be suitable to carry the weight of water filled pipe and dead load normally encounter.

Pipe Spacing Table

		<---------- Pipe commercial dia. -----					---------- -	---------- -	-------- →
S.No.	**Pipes & Position**	15/20	20/25	32/40	50	75/80	100/110	150/160	200
1	**Vertical**								
1.1	GI /MS	2.4	2.4	3	3.6	4.5	4.5	5.4	5.4
1.2	CI Pipes IS 1729/3989	X	x	<---------- 3 m ----------→					
1.3	CI Heavy Duty IS 1536	X	x	<---------- 3.6 m ----------→					
2	**Horizontal**								
2.1	GI /MS	2.0	2.0	2.4	3.0	3.6	4.0	4.5	4.5
2.2	CI Pipes IS 1729/3989			<---------- 3 m ---------->					
2.3	CI Heavy Duty IS 1536					3.0	3.6	3.6	4.5

2.17. Installation Valve

2.17.1 Installation valves shall be installed on the sprinkler circuits as shown on the drawings.

2.17.2 Contractor shall submit his detailed shop drawings showing the exact location, details of installation of the valve and alarm in all its respects.

2.17.3 Installation valve shall comprise of a cast iron sluice valve with gunmetal trim, pressure gauge, double seated clapper check valves as alarm valve with pressure gauge, test valve and orifice assembly and drain pipe with pressure gauge, bye pass on check valve to regulate differential pressure and false alarm, turbine water gong including all accessories necessary and required and as supplied by original equipment manufacturer and required for full and satisfactory performance of the system.

2.18 Sprinkler Heads

2.18.1 Sprinkler heads shall be quartzite bulb type with gunmetal body fully approved and having current certification of the fire laboratory of the C.B.R.I. Rookie, Underwriter's laboratory (UL) and under the approved certified list of the Fire Office Committee (FOC) of U.K. or NFPA of USA. Any one of the certification as acceptable to the local fire authorities obtained prior to the procurement and approved and accepted by the Engineer In Charge.

2.18.2 Sprinkler heads shall be installed in conformity with approved shop drawings and in co-ordination with electrical fixtures, ventilation ducts, cable galleries and other services along the ceiling.

2.18.3 Following type of sprinklers shall be used:

S.No.	Type of Sprinkler	Temp rating
1.	Pendant or upright	68^0 C
2.	Special application side wall type with throw suitable for Room size of 5 m length (Extended throw type)	68^0 C
3.	Pendent type (recessed in rosette)	68^0C

2.18.4 Spacing and coverage of sprinkler shall be in accordance with risk classification of area in which they are installed, design density and TAC regulation.

2.19 Spare Sprinklers

2.19.1 Provide lockable enamel painted steel cabinet including following type of spare sprinklers

a) Pendent type 30 nos.

b) Upright 20 nos.

c) Sidewall 10 nos.

2.19.2 The cabinet should also contain one pair of wrenches (of each size of the same are different) for the sprinklers.

2.19.3 Spare sprinklers shall be of the same specifications as that of the original sprinklers specified.

2.20 Testing

2.20.1 All piping in the system shall be tested to a hydrostatic pressure of 1.5 times the working pressure or 14 kg/sq.cm(whichever is more) without drop in pressure for at-least 2 hours.

2.20.2 Rectify all leakages, make adjustments and retest as required and directed.

2.21 Cables

2.21.1 Contractor shall provide control cables from supervisory valves and switches to the annunciation panels.

2.21.2 All control cables shall be copper conductor PVC insulated armoured and PVC sheathed 1100 volt grade.

2.21.3 All cables shall have stranded conductors. The cables shall be in drums as far as possible and bear manufacturer's name.

2.21.4 All cable joints shall be made in an approved manner as per standard practice.

2.22 Cable Trays

2.22.1 All cables shall be routed in approved locations in coordination with all other services in a proper manner.

2.22.2 Cable trays shall be of galvanized steel and hung from the ceiling by galvanized rods supported by appropriate size and type of expandable expansion fasteners drilled into the slabs and walls by an electric drill.

2.23 Annunciation Panel

a) Provide one solid state electronic annunciation panel, fully wired with visual display unit to indicate:

b) Flow condition in any flow indicating valve

c) The panel should give a visual and audible alarm for any of the above conditions.

d) The panel should be standard manufacturer’s factory made. All details shall be submitted with the tender.

2.24. Measurement

a) All Rates are on lump sum basis and measured as per main contract terms and conditions.

Section -3

Fire Pumps & Ancillary Equipment

3.1. Scope of Work

3.1.1 Work under this section shall consist of furnishing all labor, materials, equipment and appliances necessary and required to completely install electrically operated and diesel driven new and best quality pumps as required by the drawings and specified hereinafter or given in contracts.

3.1.2 Without restricting to the generality of the foregoing, the pumps and ancillary equipment shall include the following:-

a) Electrically operated and diesel driven pumps with motors, base plates and accessories.

b) Alarm system with all accessories wiring and connections

c) Pressure gauges with isolation valves & piping bleed and block valves.

d) M.S. Pipes, valves, suction strainers, delivery headers & accessories.

e) Foundations, vibration eliminator pads and foundation bolts.

3.2 General Requirements

3.2.1 Pumps shall be installed true to level on suitable concrete foundations. Base plate shall be firmly fixed by foundation bolts properly grouted in the concrete foundations.

3.2.2 Pumps and motors shall be truly aligned by suitable instruments.

3.2.3 All pump connections shall be standard flanged type with appropriate number of bolts. In case of non standard flanges companion flanges shall be provided with the pumps.

3.2.4 Manufacturer's instructions regarding installation, connections and commissioning shall be followed with respect to all pumps and accessories.

a) Contractor shall provide necessary test certificates and performance charts with NPSH requirement of the pumps from the manufacturer. The contractor shall provide facilities to the Engineer In Charge or their authorized representative for inspection of equipment during manufacturing and also to witness various tests at the manufacturers works without any cost to the owners.

b) Each pump shall be provided with a 150 mm dia pressure gauge, isolation cock and connecting piping, bleed and block valve.

c) Provide vibration eliminating pad and connectors for each pump.

3.2.5 The Contractor shall submit with this tender a list of recommended spare parts for two years of normal operation and quote the prices for the same.

3.3 Fire, Sprinkler & Jockey Pumps

3.3.1 **Pumping Sets**

3.3.1.1 Pumping sets shall be single stage horizontal centrifugal single outlet with cast iron body and bronze dynamically balanced impellers. Connecting shaft shall be stainless steel with bronze sleeve and grease lubricated bearings.

3.3.1.2 Pumps shall be connected to the drive by means of spacer type love joy couplings which shall be individually balanced dynamically and statically.

3.3.1.3 The coupling joining the prime movers with the pump shall be provided with a sheet metal guard.

3.3.1.4 Pumps shall be provided with approved type of mechanical seals.

3.3.1.5 Pumps shall be capable of delivering not less than 150% of the rated capacity of water

at a head of not less than 65% of the rated head. The shut off head shall not exceed 120% of the rated head.

3.3.1.6 The pump shall meet the requirements of the Tariff Advisory Committee and the unit shall be design proven in fire protection services.

3.4 Electric drive

3.4.1 Electrically driven pumps shall be provided with totally enclosed fan cooled induction motors. For fire pumps the motors should be rated not to draw starting current more than 3 times normal running current.

3.4.2 Motors for fire protection new and best quality pumps shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge and shall be designed for continuous full load duty and shall be design proven in similar service.

3.4.3 Motors shall be wound for class B insulation and winding shall be vacuum impregnated with heat and moisture resistant varnish glass fiber insulated.

3.4.4 Motors for fire pumps shall meet all requirements and specifications of the Tariff Advisory Committee.

3.4.5 Motors shall be suitable for 415 + 10% volts, 3 phase 50 cycles a/c supply and shall be designed for 38 deg C ambient temperature. Motors shall conform to I.S. 325.

3.4.6 Motors shall be designed for two start system.

3.4.7 Motors shall be capable of handling the required starting torque of the pumps.

3.4.8 Contractor shall provide inbuilt heating arrangements for the motors for main pumps to ensure that motor windings shall remain dry.

3.4.9 Speed of the motor shall be compatible with the speed of the pump.

3.5 DIESEL FIRE PUMP

3.5.1 **General**

The diesel pump set shall be suitable for automatic operation complete with necessary automatic starting gear, for starting on wet battery system and shall be complete with all accessories. Both engine and pump shall be assembled on a common bed, fabricated mild steel channel type.

3.5.2 **Drive**

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided. The speed shall be 1500 RPM as specified.

3.6 **Fire Pump**

a. The fire pump shall be horizontally mounted centrifugal end suction / spilt casing type. It shall have a designed capacity, head as specified, and developing adequate head so as to ensure a minimum pressure of 3.5 Kg/Sq.cm at the highest and the farthest outlet. The pump shall be multistage stage as specified. The pump shall be capable of giving a discharge of not less than 150% of the rated discharge at a head of not less than 65% of the rated head. The shut off head shall be within 120% of the rated head.

b. The pump casing shall be of cast iron to grade FG 200 to IS 210 and parts like impeller, shaft sleeves, wearing-ring etc. shall be of non-corrosive metal like bronze/brass/gun metal. The shaft shall be provided with mechanical seal.

c. The pump casing shall be designed to withstand 1.5 times the working pressure.

d. Bearing of pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

3.7 DIESEL ENGINE

3.7.1. Engine Rating

The engine shall be new and best quality of cold starting type without the necessity of preliminary heating of the engine cylinders or combustion chamber (for example, by wicks, cartridge, heater, plugs etc.). The engine shall be multi cylinder/vertical 4 stroke cycles, water cooled, diesel engine, developing suitable HP at the operating speed specified to drive the fire pump. Conditions capacity available for the load shall be exclusive of the power requirement of auxiliaries of the diesel engine, and the after correction for altitude, ambient temperature and humidity for the specified environmental conditions. This shall be at least 20% greater than the maximum HP required to drive the pump at its duty point. It shall also be capable of driving the pump at 150% of the rated discharge at 65% of rated head. The engine shall be capable of continuous non-stop operation for 8 hours and at least 3000 hours of operation before major overhaul. The engine shall have 10% overload capacity for one hour in any period of 12 hours continuous run. The engine shall accept full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform to BS 649/IS 1601/IS 10002, all amended up to date.

Engine Accessories

The engine shall be complete with the following accessories:-

i) Fly wheel dynamically balanced.

ii) Direct coupling for pump and coupling guard.

iii) Corrosion Resister.

iv) Air cleaner, oil bath type/Dry type.

v) Fuel service tank support and fuel oil filter with necessary pipe work.

vi) Elect. Starting battery.

vii) Exhaust silencer with necessary pipe work.

viii) Governor

ix) Instrument panel housing all the gauges, including Tachometer, hour meter and starting switch with key (for manual starting).

x) Necessary safety controls.

3.7. 2. Fuel System

The fuel shall be gravity fed from the engine fuel tank to the engine driven fuel pump. The engine fuel tank shall be mounted either over or adjacent to the engine itself or suitably wall mounted on bracket. The fuel filter shall be suitably located to permit easy servicing.

All fuel tubing to the engine shall be with copper, with flexible hose connections where required. Plastic tubing shall not permit.

The fuel tank shall be of welded steel construction (3 mm. thick) and of capacity sufficient to allow the engine to run on full load for at least 8 hours. The tank shall be complete with necessary wall mounted supports, level indicator (protected against mechanical injury) inlet, outlet, overflow connections and drain plug and piping to the engine fuel tank. The outlet should be so located as to avoid entry of any sediment into the fuel line to the engine.

As semi rotary hand pump for filling the daily service tank together with hose pipe 5 Mtr. long with a foot valve etc. shall also form part of the scope of work.

3.7.3. Lubricating Oil System

Forced feed Lube. Oil system shall be employed for positive lubrication. Necessary Lube. Oil filters shall be provided, located suitably for convenient servicing.

3.7.4. Starting System

The starting system shall comprise necessary batteries(1x24v), 24 volts starter motor of adequate capacity and axle type gear to match with the toothed ring on the fly wheel. By metallic relay protection to protect starting motor from excessively long cranking runs suitably integrated with engine protection system shall be included within the scope of the work. The capacity of the battery shall be suitable for meeting the needs of the starting system. The battery capacity shall be adequate for 10 consecutive starts without

recharging with cold engine under full compression. The scope shall cover all cabling, terminals, initial charging etc.

3.7.5. Exhaust System

The exhaust system shall be complete with silencer suitable for outdoor installation, and silencer piping including bends and accessories needed for a run of 15 meter from the engine manifold.(Adjustment rates for extra lengths shall also be given).The total back pressure shall not exceed the engine manufacture's recommendation. The exhaust piping shall be suitably lagged.

3.7.6. Engine shut down mechanism

This shall be auto/manually operated and shall return automatically to the starting position after use.

3.7.7. Governing System

The engine shall be provided with an adjustable governor to control the engine speed within 5% of its rated speed under all conditions of load up to full load. The governor shall be set to maintain rated pump speed at maximum pump load.

3.7.8. Engine Instrumentation

Engine instrumentation shall include the following:-

i) Lub. Oil pressure gauge.
ii) Lub. oil temperature gauge.
iii) Water pressure gauge.
iv) Water temperature gauge.
v) Tachometer.
vi) Hour meter.

The instrumentation panel shall be suitably resident mounted on the engine.

3.7.9. Engine Protection Devices

Following engine protection and automatic shutdown facilities shall be provided:-

i) low lub.oil pressure.
ii) High cooling water temp.
iii) High lub.oil temperature.
iv) Over speed shut down.

3.7.10. Pipe Work

All pipe lines with fittings and accessories required shall be provided for fuel oil, lub.oil and exhaust systems, copper piping of adequate sizes, shall be used for Lub.oil and fuel oil. M.S. piping will be permitted for exhaust.

3.7.11. Anti-Vibration Mounting

Suitable anti-vibration mounting shall be from approved list of suppliers duly approved by Engineer's Representative shall be employed for mounting the unit so as to minimize transmission of vibration to the structure. The isolation efficiency achievable shall be clearly indicated.

3.7.12 Battery Charger

Necessary float and boost charger shall be incorporated in the control section of the power and control panel, to keep the battery under trim condition. Voltmeter to indicate the state of charge of the batteries shall be provided.

3.7.13DAY OIL TANKS

Day oil tanks shall be for 16 hours operation of pumps and made out of minimum 3 mm thick MS sheets, duly welded and painted as per requirements. It should be attached with level indicator with signals compatible to computer.

The day oil tank shall be equipped with an air breather, shielded level gauge, strainer and a hand hole of not less than 150 mm diameter, beside the required fuel connections and a drain plug. The inside surface of the fuel tank shall be coated with Enamel Red or Black of LCI or its equivalent and the outside surface to be given two coats of the oil resistant primer paint. The fuel tank shall be hydro- statically tested at a pressure not less than 0.35 Kg/sq. cm/g. The fuel tank shall be equipped with fuel piping and valves, overflow pipes, vent & sludge trap, drain valve, inspection and cleaning hole, fill connection, etc. The fuel tank shall have the calibration facility. An adequate size soil tray shall be provided. The fuel tank shall have both vertical & horizontal reinforcements with suitable size angle sections.

3.8 STANDARDS:

The most stringent of the conditions shall apply. If there is any ambiguity or inconsistency, the contractor should report the same to the Engineer's Representative and obtain clarification before submitting his tender.

All equipment's, cables etc. shall be adequately rated for the switch ratings to suit the climatic conditions experienced in the vicinity of installation and other similar installations.

3.9MAKES:

The Contractor shall use the material as mentioned in list of approved make in the tender. If however, the material or equipment specified or shown on the drawings is not available due to any genuine reason, the contractor shall prior to order get the written

approval of the Engineer's Representative for the particular material/equipment. If there is delay in ordering of material on the part of contractor, the same shall not amount to genuine reason. It shall be the contractor's responsibility for the safe custody of all the materials at site, till handing over the total installation.

All materials shall be inspected by the contractor to ensure that finishes are in accordance with these specifications. Engineer's Representative reserve the right to inspect the materials /equipment's during manufacturing at contractor's expense.

3.10 WORKMANSHIP:

The workmanship and method of installation shall conform to the best standard of practice. All work shall be performed by skilled tradesmen and to the satisfaction of the Engineer's Representative.

Any work that in the opinion of the Engineer's Representative does not conform to the best standard practices shall be removed and reinstated by the Contractor at his expense. Permits, Certificates and Licenses must be held by all tradesmen for the type of work in which they are involved, where ever applicable.

3.11 PROCEDURE:

Throughout all stages of work, the contractor shall maintain a close liaison with the Engineer's Representative and with all other Contractors associated with the work. He shall also allow sufficient freedom and access to other contractors to carry out their work.

Site work shall commence immediately when the site is ready and shall proceed expeditiously and in harmony with the building work so as not to delay the latter in any way. All equipment's to be supplied and work to be done under this specification shall be manufactured and executed in the manner set out in these specifications. The Contractor shall have to arrange and intimate the Engineer's Representative for inspection of panel at works.

3.12 LABLES, CIRCUIT CHARTS AND INDEXING:

The control panel including circuit breakers, fuse/switches and isolators shall be provided with labels suitably engraved with legible characters (not less than 5mm high) indicating the use of the equipment and its reference numbers.

The Contractor shall show details of labels on his working drawing which should be submitted to the Engineer's Representative for approval prior to the labels being manufactured.

Labels inscribed with 6mm minimum size lettering red on a white background and the words "**DANGER 415 VOLTS"** in English and Hindi shall be provided and fixed externally on terminal lids, covers and doors of bus-bar chambers, link boxes and all equipment which are connected to more than one phase of a medium voltage supply.

The control panels shall be fitted with circuit charts mounted to the inside cover. These charts shall consist of a typed list giving the designation of each circuit and the size of the breaker required, and shall be protected by a sheet of Perspex 2mm thick; Labels shall also be attached to the barriers of breaches indicating the number of each individual circuit shown on the list.

On AC systems, the phase sequences shall be maintained throughout the installation and all phase connections shall be in the order of Red, Yellow, Blue from top to bottom and / or left to right. Neutral connections, links and / or bus bars shall always be located above / below or to the side, not between the phase connection, links or bus-bars. The particular phase connected to fuse banks and bus-bars shall be clearly indicated by marking with the appropriate color. The use of self-adhesive PVC insulating tape is not acceptable for this purpose.

All labels and Perspex circuit chart protective sheets shall be fixed on boards so as not to either damage the boards or disfigure them.

All the phase wires shall be colored - RED, YELLOW, BLUE and neutral BLACK. Taping of wires, color coding or sleeping of wire shall not be acceptable.

3.13 <u>TYPE</u> :

The control panels shall be floor/wall mounted, free standing, totally enclosed, dust and vermin proof construction or alternatively of compartmentalized cubicle rigid construction type as specified in the tender specifications. In either case, the panel shall be vermin proof and suitable for tropical climatic conditions. The design shall include all provisions for safety of operating and maintenance personnel.

The panel shall be totally enclosed 14 SWG CRCA sheet steel cubicles, indoor type, dead front, floor mounted. The panel shall be vermin proof. The panel shall be as per IP 54 enclosure. Gaskets shall be provided between all adjacent units and beneath all covers to render the joints dust proof. The panel shall be arranged in multi-tier formation. All doors and covers shall be hinged and latched and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded. All welding slag shall be ground smooth and welding pits wiped smooth with Plumber metal.

All panels and covers shall be properly fitted and secured with the frame and holes in the panels correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with nuts. Self-threading screws shall not be used in the construction of control panels. Base channel of 75mm x 75 mm x 5 mm thick shall be provided at the bottom. Minimum clear space of 200 mm between the floor of the control panel and bottom most units (Switchgear or Bus Bar) shall be provided. In other words the bottoms most unit shall be 275 mm clear off the finished floor level.

Knockout holes of appropriate size and number shall be provided in the control panels, distribution boards etc. in conformity with the location of incoming and outgoing conduits / cables. All equipment's such as meters and indicating lamps etc. shall be located adjacent to the unit with which it is associated and care shall be taken to achieve a neat and symmetrical arrangement. Facility shall be provided for termination of cables from both above and below the panel. Where cables enter from below, cable boxes shall be fitted at the rear end arranged in tiers to facilitate making connections to the upper and lower units. Clamps shall be provided to support the weight of the cables. All power wiring inside the control panel shall be color coded. Circuit diagram showing the arrangement of circuits shall be pasted on the inside of panel door and covered with transparent Perspex sheet 2 mm thick. All labeling shall be provided in engraved anodized aluminium / Bakelite strips on the front face of the panel board. The total height of the panel shall be limited to 2350 mm including the base channel.

The panel shall be of cubicle construction of sheet steel (minimum 14 SWG thick) enclosed complete with all internal wiring comprising of the following:

a) MCCB rated as called in schedule of quantities.
b) 96mm x 96 mm volt meter with 3-way and `OFF' selector switch.
c) C T operated 96mm x 96 mm ammeter of suitable range with 3 nos. suitable IC amps ratio CT's with selector switch.
d) Phase indicating neon lamps each backed up with 5 amps fuse and toggle switch.
e) Signal lamp indicating "running".
f) All power and control cabling.
g) Earthling system.
h) Breaker ON/OFF indication lights
i) Under voltage protection.

There also shall have the facility to charge from the mains supply in order to make sure the battery is under fully charged state.

3.14 TESTING:

The panel shall be tested at manufacturer's works and shall be got approved by Engineer's Representative before dispatch to site. The panel shall be tested again at site as directed by Engineer's Representative.

3.15 CABLE TRAYS

All cables shall be laid in factory fabricated cable trays /Ladder type saddle comprising of M.S channels and rungs duly painted. The channels and rungs shall be perforated and shall be of minimum 3 mm thickness. Sufficient care shall be taken at the time of fabrication for derusting before painting. Mild steel hangers shall be provided from structural steel rods with double nuts and washers at one meter distance or welding to suspension plate provided in the building concrete roof.

3.16 AMF PANEL

The automatic mains failure control panel shall be such that to start the Diesel pump automatically when there is failure of main supply/Emergency supply and other main fire pumps. The panel will have suitable rated bus bars, internal wiring, and fuses, with suitable provision for connections incoming/outgoing / out coming loads. It will include the following accessories:

a) One set of main supply voltage monitor to identify low voltage complete failure and initiate necessary signal for operation of automatic control gear.

b) Mains supply failure timer.

c) Restoration timer.

d) Control unit incorporating engine start/stop and 3 impulse starting relay and failure to start lock out.

e) Master switch for auto/manual/test/off.

f) Counter to indicate the number of times the set started.

g) sq. mm flush mounted voltmeter with selector switch and fuses to read voltage on mains/load/set

h) sq. mm flush mounted ammeter with selector switch

i) Relay section will comprise a set of relays for followings:

i. Automatic starting of the diesel pumping the event of mains voltage failing/main fire pump fails subject to interlocking as specified below a present value.

ii. In the event of failure of Diesel pump to start on failure of mains supply/main fire pump subject to interlocking as specified on one attempt two more starting impulse will be automatically given and if still the engine does not start due to some defects within 30

seconds of first starting impulse. it will get disconnected and locked out automatically and necessary audio and visual signal given.

iii. In the event of failure of diesel pump due to faulty starting, the main supply contactor will get energized without any time delay on the restoration of the main supply and the interlocking shall be open to main fire pumps.

iv. The circuitry will make use of minimum number of relays and control wiring will be neatly provided with adequate size of copper conductor cable of suitable cross section, voltage grading and tag numbered at either end.

v. Control relays both DC and AC monitor will be of sturdy construction.

j) One audio Alarm.

k) All control fuses will be so located as to be easily accessible for replacement.

l) Battery charger for charging batteries when set is not operating connected to the load side so that it will get on energized from the mains. This will consist of

i) Transformer of adequate rating.

ii) Rectifier.

iii) D.C. Ammeter.

iv) D.C. Voltmeter.

v) Charge rate selector switch for trickle or high charge.

vi) A Lamp indicating that battery is being charged.

In the manual operation the diesel pump will be started by the attendants by pressing the start push button and stopped by pressing stop push button irrespective of the conditions of the main supply. Thus with this arrangement it will be possible to exercise routine test of the diesel generating set on the load without interrupting the supply of essential circuit**.**

In the test mode of operation conditions similar to mains failure will be stimulated by operating the Master switch on the test position.

3.17 Air Vessel

3.17.1 Provide one air vessel fabricated shell from 8 mm M.S. sheet and dished ends from 10 mm M.S. sheet and suitable supporting legs. Air vessel shall be provided with a 100 mm dia flanged connection from pump, one 25 mm dia drain with valve, one gunmetal water level gauge and 15 mm sockets for pressure switches. The vessel shall be 450 mm dia x 2000 mm high and tested to 20 kg/sq cm pressure.

3.17.2 The pump operating sequence shall be arranged in a manner to start the pump automatically but should be stopped manually by starter push buttons only.

3.17.3 Operating conditions for fire & sprinkler pumps.

		Cut in	Cut out
	For fire hydrant pumps		
a)	Operating pressure	<---------- 10 Kg/sq cm ---------->	
b)	Jockey pump	9.5 kg/sq cm	10 kg/sq. Cm
c)	Fire Electric Pump	9.0 Kg/sq cm	manual
d)	Sprinkler Electric Pump	8.5 Kg/sq cm	manual
e)	Diesel engine Driven pump	7.0 kg/sq cm	manual

Notes:

a) Jockey pump shall start and stop through pressure switch automatically.

b) Jockey pump shall stop when main pump starts.

c) Main pump shall start automatically on fall of pressure but stopping shall be manual.

3.18.1 Vibration Eliminators

Provide on all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connector shall be as per manufactures details.

3.19 Measurements:

a) All Rates are on lump sum basis and measured as per main contract terms and conditions.

Section -4

Commissioning and Guarantees

4.1 Scope of work

Work under this section shall consist of pre commissioning, commissioning, testing and providing guarantees for all equipment, appliances and accessories supplied and installed by the contractor under this contract.

4.2 General requirements:

4.2.1 The rates quoted in this tender shall be inclusive of the works given in this section.

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

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

4.3 Pre commissioning

4.3.1 On completion of the installation of all pumps, piping, valves, pipe connections, and water level controlling devices the contractor shall proceed as follows:-

AFire protection system:

i) Check all hydrant valves and close if any valve is open. Also check hat all suction and delivery connections are properly made.

ii) Test run and check rotation of each motor and correct the same if required.

BPipe work

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

ii) Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specifications. If any leakage is found, rectify the same and retest the pipes.

4.4 Commissioning & testing

A. Fire hydrant system

i) Pressurize the fire hydrant system by running the main fire pump and after attaining the required pressure shutoff the pump.

ii) Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts out at the pre-set pressures. If necessary adjust the pressure switch for the jockey pump. Close bye-pass valve.

iii) Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in at the pre-set pressure and should not cutout automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However the jockey pump should cut-out as soon as the main pump starts.

iv) Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.

v) When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage. The electrically driven pump should run continuously for eight hours so that its performance can be checked.

vi) Check each landing valve, male and female couplings and branch pipes for compatibility with each other. Any fitting which is found to be incompatible and does not fit into the other properly shall be replaced by the contractor. Landing valves shall also be checked by opening and closing under pressure.

B. Sprinkler system:

i) Start the sprinkler pump and develop the required pressure in the sprinkler pipes.

ii) Open the test valve to test the automatic starting of the pump. If necessary, make necessary adjustments in the setting of pressure switch. The sprinkler fire alarm should also operate when the test valve is open.

iii) After satisfactory operation of the pump the contractor shall set up mock fire and test the system.

C. Handing over

1) All commissioning and testing shall be done by the contractor to the complete satisfaction of the Engineer In Charge, and the job handed over to the Engineer In Charge, or his authorized representative.

2) Contractor shall also handover, to the Engineer In Charge, all maintenance & operation manuals and all other items as per the terms of the contract.

D. Guarantees

1) The contractor shall submit a warranty for all equipment, materials and accessories supplied by him against manufacturing defects, malfunctioning or under capacity functioning.

2) The form of warranty shall be as approved by the Engineer In Charge.

3) The warranty shall be valid for a period of one year from the date of commissioning and handing over.

4) The warranty shall expressly include replacement of all defective or under capacity equipment. Engineer In Charge may allow repair of certain equipment if the same is found to meet the requirement for efficient functioning of the system.

5) The warranty shall include replacement of any equipment found to have capacity lesser that the rated capacity as accepted in the contract. The replacement equipment shall be approved by the Engineer In Charge.

Section- 5

ELECTRICAL INSTALLATION

5.1 MAIN DISTRIBUTION BOARDS

1.1 The boards shall be divided into distinct vertical section of :-

a) Completely enclosed bus bar compartment running horizontally / vertically.

b) Individual feeder modules in multi-tier fixed execution arrangement.

c) Enclosed vertical bus bar serving all the modules.

d) Vertical cable alley covering entire height.

5.1.2 General Construction

The switch board shall be floor mounted free standing totally enclosed and extensible type. The switch board shall be vermin proof and shall be suitable for the ambient conditions as specified. The design shall include all provisions for safety of the operating and maintenance personnel. The general construction shall conform to IS: 8623 for factory assembled switch board. The switch board shall be naturally convection cooled. Cubicle type switch board shall be fabricated out of CRCA sheet steel 2.0 mm thick. Wherever necessary, such sheet steel member shall be stiffened by angle iron frame work.

General construction shall employ the principle of compartmentalization and segregation for each circuit. Each section of the rear accessible type board shall have hinged doors. In case of boards which are to be mounted against a wall or where no rear access is available, cable alley will have to be in the front. Overall height of the board shall not exceed 2.0 meters. Operating levers, handle etc. of highest unit shall not be at a height more than 1.7 m, and that of the lowest unit at a height not less than 300 mm above finished floor level. Multi-tier mounting of feeders is permissible. The general arrangement for multi-tier construction shall be such that the horizontal tiers formed present a pleasing and aesthetic look. The general arrangement shall be got approved before fabrication. Cable entries for various feeders shall be either rear or from the front through cable alleys located in between two circuit sections. All cable entries shall be through gland plates. There shall be a separate gland plate for each cable entry so that there will not be any dislocation of already wired circuit when new feeders are added. Cable entry plates shall therefore be sectionalized. The construction shall include necessary cable supports for clamping in the cable alley for rear cable chamber.

Partitions and compartments will be plated and solidly connected to eliminate vibration problems and ensure grounding integrity. Enclosure shall be such that special tool is required to open it. Doors shall be grounded to frame for grounding integrity. Sufficient clearance shall be provided at the bottom for cooling airflow.

5.1.3 Indicator Lamps

On all incomers of main distribution boards, ON/OFF indicator lamps shall be provided suitable for operation on AC 230 Volts supply. Necessary filter G/Y/R/A shall be provided depending upon the function. All lamps shall be protected by proper HRC fuses.

5.1.4 Control Wiring

Control wiring for indication etc. shall be with stranded copper conductor PVC insulated cable conforming to IS : 1554 Part I. Wiring shall be suitably protected within the switchboard. Runs of wires shall be neatly bunched and suitably supported and clamped. Where wires are drawn through steel conduits, the works shall conform to IS 732. Identification ferrules shall be used at both ends of the wires. All control wiring meant for external connection are to be bought out on terminal boards. Size of wires used for control circuits and current Transformer circuits shall be 2.5 Sq.mm. Copper Lugs, insulation tapes etc. shall be provided at joints and terminations as required.

5.1.5 Bus Bar & Bus Bar Chambers

The bus bar shall be of high conductivity Aluminium alloy of E 91 grade of not less than 97% conductivity and of adequate section With Max. Current density of Aluminium shall be 1 Amps / Sq. mm and for Copper 1.6 Amps / Sq. mm respectively. The bus bar system may comprise of a system of totally enclosed horizontal bus bars run at top and vertical bus bars serving all modules in vertical section on either side in cable alleys. All connections to individual circuits from the bus bar shall be with solid connections. All bus bars and connections shall be suitably sleeved with heat shrinkable PVC sleeves. Maximum temperature of bus bars shall not exceed 85°C i.e. 35°C temperature rise over 50°C.

5.1.6 Bus Bar Supports and Attachments

Bus bar shall be firmly fixed on supports constructed from SMC (glass fiber reinforced thermosetting plastic). The supports shall be sufficiently robust to effectively withstand electro-mechanical stresses produced in the event of short circuit.

5.1.7 Connection to Bus Bar

Connections to bus bar shall be made with use of holes drilled into bus bar with bolts and nuts.

The bolts and nuts used for connections to bus bars shall be of Aluminium alloy, tinned forged brass or galvanized iron. Suitable precaution shall be taken against heating due to bi-metallic contact.

Further for tapping off connections from bus bars PVC insulated wire may be used for current capacities upto 100 amps and for higher current capacities solid conductors/strips suitably insulated with PVC sleeves/tape shall be used.

5.1.8 Clearances

The minimum clearances to be maintained for open and closed indoor air insulated bus bars/electrically non-exposed and working at system voltage upto 600 volts shall be as follows:

For AC bus bars and Main connections

Between	Minimum Clearances
Phase to Earth	26 mm
Phase to Phase	32 mm

5.1.9 Bus Bar Marking

The colors and letters (or symbols) for bus bars:

Main bus bar connections and auxiliary wiring etc. shall conform to relevant Indian Standard. A brief from I.S. 375-1963 (revised) is given below :

For AC bus bars and Main connections

S. No.	Bus Bar & Main Connection	Colour	Letter	Symbol
1.	Three Phase	Red, Yellow, Blue.	R, Y, B.	
2.	Two Phase	Red, Blue	R, B	
3.	Single Phase	Red	R	
4.	Neutral Connection	Black	N	
5.	Connection to earth	Green	E	

5.1.10 Phase Sequence and Polarity

Bus bars and main connections, when marked shall be marked in accordance with the following table to indicate the order in which the voltages in phases reach their maximum values.

System	As indicated by Colors or letters	Phase sequence as indicated Vectorially
Three Phase	Red, Yellow, Blue	R, Y, B.
Two Phase	Red, Blue	R, B.

5.1.11 Arrangement of Bus Bars & Main Connections:

Bus bars and main connections which are substantially in one plane shall be arranged in order given as follows:

a. A.C. System

i The order of phase connections shall be Red, Yellow and Blue.

ii When the run of the conductors is horizontal, the red shall be on the top or farthest away from the centre line as viewed from the front.

iii When the run of the conductor is vertical, the red shall be on the extreme left.

iv When the system has a neutral connection in the same plane as the phase connections, the neutral shall occupy an outer position.

v Unless the neutral connections can be readily distinguished from the phase connections, the order shall be red, yellow, blue and black.

b. Instruments

All voltmeters and ammeters shall be flush mounted type of size 96 mm x 96 mm conforming to Class 1.5 of IS : 1248. All voltmeters shall be protected with HRC cartridge fuses.

5.1.12 Operational Requirements

The indoor type main distribution board shall conform to the following :

(a) The board shall comprise of incomers, outgoing feeders and bus couplers as specified. The incomer shall be moulded case circuit breaker as specified. The outgoing feeders shall be molded case circuit Breakers or miniature Circuit Breakers as specified.

(b) Bus bar for phase and neutral should have a rating as specified in Bill of Quantities.

(c) The entire switch board shall be industrial type conforming to IS : 8623 for factory assembled switch board.

(d) The incomer panel shall be suitable for receiving bus trunking or MV cable of size specified.

(e) The entire board shall have a common earth bar of size as specified with two terminals for earth connections.

5.1.13 Space Heater-

The Space Heater switchboard shall have in each panel thermostatically controlled space heater with 15 A mps 230 Volt switch-socket outlet to eliminate condensation.

5.1.14 Ventilation

Ventilation Fan to be provided for proper cooling of the board.

5.1.15 Outdoor type distribution

Outdoor type distribution feeder pillar details to be mentioned.

5.1.16 Inspection

Inspection of switchboard by client /consultant at Vendor's workshop prior to dispatch to be clearly mentioned in specification.

5.2 RATING AND REQUIREMENTS

5.2.1 Moulded Case Circuit Breakers

The MCCB should be current limiting type with trip time of less than 10 msec under short circuit conditions. The MCCB should be either 3 or 4 poles as specified in BOQ. MCCB shall comply with the requirements of the relevant standards IS13947 – Part 2/IEC 60947-2 and should have test certificates for Breaking capacities from independent test authorities CPRI / ERDA or any accredited international lab.

MCCB shall comprise of Quick Make -break switching mechanism, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses.

The breaking capacity of MCCB shall be as specified in the schedule of quantities. The rated service breaking capacity (Ics) should be equal to rated ultimate breaking capacities (ICU). MCCBs for motor application should be selected in line with Type-2 Co-ordination as per IEC-60947-2, 1989/IS 13947-2. The breaker as supplied with ROM should meet IP54 degree of protection.

a. **Current Limiting & Coordination**

- The MCCB shall employ maintenance free minimum let-through energies and capable of achieving discrimination up to the full short circuit capacity of the downstream MCCB. The manufacturer shall provide both the discrimination tables and let-through energy curves for all.

b. **Testing**

- Original test certificate of the MCCB as per IEC 60947-1 &2 or IS13947 shall be furnished.
- Pre-commissioning tests on the switch board panel incorporating the MCCB shall be done as per standard specifications.

c. Interlocking

Moulded, case circuit breakers shall be provided with the following interlocking devices for interlocking the door of a switch board.

i) Handle interlock to prevent unnecessary manipulations of the breaker.

ii) Door interlock to prevent the door being opened when the breaker is in ON position.

iii) Defeat-interlocking device to open the door even if the breaker is in ON position.

- The MCCB shall be current limiting type and comprise of quick make – Break switching mechanism. MCCBs shall be capable of defined variable overload adjustment. All MCCBs rated 200 Amps and above shall have adjustable over load & short circuit pick-up both in Thermal magnetic and Microprocessor Trip Units.
- All MCCB with microprocessor based release unit, the protection shall be adjustable Overload, Short circuit and earth fault protection with time delay.
- The trip command shall override all other commands.

MCCB's upto 250 amps shall be with thermal magnetic and above 250 amps electronic release shall be provided.

5.2.2 Circuit Compartments

Each circuit breaker shall be housed in separate compartments and shall be enclosed on all sides. CRCA sheet steel hinged lockable doors shall be duly interlocked with the breaker in 'ON' and 'OFF' position. Safety interlocks shall be provided for air circuit breakers to prevent the breaker from being drawn out when the breaker is in 'ON' position. The instruments and indicating lamp shall not be mounted on the air circuit breaker compartment door. Sheet steel barriers shall be provided between the tiers in a vertical section.

5.2.3 Instrument Accommodation

Separate and adequate compartments shall be provided for accommodating instruments, indicating lamps, control contactors and control fuses etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of circuit breaker, bus bars or connections.

5.2.4 Terminals

The outgoing terminals of the breaker and neutral link shall be brought out to a terminal block suitably located at the rear side of the panel. Separate cable compartments shall be provided for incoming and outgoing cables.

5.2.5 Wire Ways

A horizontal wire way with screwed covers shall be provided at the top to take interconnecting control wiring between different vertical sections.

5.2.6 Current Transformers

Current transformers shall be provided for main distribution boards carrying current in excess of 30 amps wherever shown in drawing. The current transformers shall have accuracy class I and suitable VA burden to operate associated metering. Current transformers shall be in accordance with IS 2705. Separate C.T.'s shall be used for protective devices.

5.2.7 Earthing

G.I. earth bars of size 25 mm x 6 mm for shall be provided for the full length of the panel and connected to the frame work. Provisions shall be made for connection from this earth bar to the main earthing bar on both sides of Distribution Panel.

5.2.8 Labels

Anodised aluminium PVC coated labels shall be provided on all incoming and outgoing feeder switches. Circuit diagram showing the arrangement of the circuit inside the distribution board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet. All the distribution boards shall be subject to tests specified in relevant Indian Standards and test certificates shall be furnished.

5.2.9 Meters

All the meters shall be housed in a separate compartment and accessible from front only. Lockable doors shall be provided for the metering compartments. All meters and indicating instruments shall be in accordance with relevant Indian Standard. The meters shall be flush mounted and draw out type. Indicating lamps shall be filament type and of low burden with in built resistors. Meter boards with space provision for dual energy meters are to be provided by contractor. All single phase dual meters for 2 BHK and three phases dual energy meter for 3 BHK and 4 BHK shall be installed by JAL.

5.2.10 Painting

All CRCA sheet steel shall undergo process of degreasing, pickling in acid, cold rinsing, and phosphating, passivating and then sprayed with a high corrosive resistant primer. The primer shall be baked in an oven. the finishing treatment shall be by application of two coats of epoxy paint of approved colour and stoved.

5.2.11 Cable Compartments

Cable compartments of adequate size shall be provided in the cubical type boards for easy termination of all incoming and outgoing cables. Adequate supports shall be provided in cable compartments to support cables. All incoming and outgoing switches, terminals shall be brought out to terminal blocks in cable compartments. The Boards shall be suitable for both top and bottom cable entry.

5.2.12 MCB Distribution Boards (Sub Distribution boards)

Distribution Boards shall be suitable for operation on 3 phase/single phase 415/230 Volts, 50 Hz neutral grounded at Transformer.

The Distribution Boards shall comply with the relevant Indian Standards and Indian Electricity Rules and Regulations.

5.2.13 Construction Features

The Distribution Boards shall be metal enclosed, CRCA sheet steel cubical, indoor, dead front, wall mounting type. The Distribution board shall be totally enclosed, completely dust and vermin proof. Gaskets between all adjacent units and beneath all covers shall be used to render the joints dust proof. Doors and covers shall be fully casketed with foam rubber and/or rubber strips and shall be lockable. Sheet steel used in the construction of Distribution Boards shall be 16 guage CRCA sheets and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal.

The distribution boards shall be mounted at height of 1200 mm from floor to bottom of panel. All the panels and covers shall be properly fitted square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with hank nuts. Self-threading screws shall not be used in the construction of Distribution boards.

Knockout holes of appropriate size and number shall be provided at top and bottom to drill holes for cables entry as required, as per site conditions.

Removable sheet steel gland plates shall be provided at top and bottom to drill holes for cables entry as required, as per site conditions.

The distribution boards shall be installed by the contractor in recess or surface on walls by fastening to suitably grouted studs of not less than 12 mm diameter.

The distribution boards shall be provided with 3 pole neutral miniature circuit breaker (TPN MCB) or double pole miniature circuit breakers (DP MCB) of appropriate capacity

as incoming as per the Schedule of Quantities. The distribution boards shall be provided with 3 numbers double pole earth leakage circuit breakers (DP ELCB) or four pole residual current circuit breaker on the incomer as per Schedule of Quantity. The distribution board shall be provided with single pole miniature circuit breakers (SP MCB) or TPN MCB as outgoing, as per Bill of Quantities.

MCB's shall be provided on the phases of each circuit. The individual banks of MCB's shall be detachable. There shall be ample space behind the banks of MCB's to accommodate all the wiring. All the distribution boards shall be completely factory wired, ready for connections. All the terminals shall have adequate current rating and size to suit individual feeder requirements. Each circuit shall be clearly numbered from left to right to correspond with wiring diagram. All the switches and circuits shall be distinctly marked with a small description of the service installed.

5.2.14 Miniature Circuit Breakers

Miniature Circuit Breaker shall comply with IS-8828-1996/IEC898-1995. Miniature circuit breakers shall be quick make and break type for 240/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B,C,D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values.MCB shall ensure complete electrical isolation & downstream circuit or equipment when the MCB is switched OFF.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP, TPN and 4 Pole miniature circuit breakers shall have a common trip bar independent to the external operating handle.

5.2.15 Earth Leakage Circuit Breakers

All live parts of earth leakage breakers shall be totally enclosed in an insulated heat resistant housing. The operating mechanism shall be quick make and break, trip free and shall be able to isolate automatically the electrical circuit under sustained earth fault. The rated sensitivity shall be 100 mA, with a maximum permissible earth fault loop impedance of 1650 Ohms.

5.2.16 Drawing and Data

The following minimum information shall be furnished with the Shop Drawings :-

a. Overall dimensions showing front view, plan, elevation and cross section.
b. Complete bill of material module wise.
c. Complete one line diagram.

5.2.17 Instruction Manuals

Contractor shall furnish 10 copies of instruction manual which shall contain detailed instruction for installation, testing, commissioning, and operation and maintenance requirements.

5.2.18 Testing and Commissioning

Commissioning checks and tests shall include all wiring checks and checking up of connections.

a. Operation checks and lubrication of all moving parts.
b. Continuity checks of wiring, fuses etc. as required.
c. Insulation test: When measured with 500 V meggar, the insulation resistance shall not be less than 100 mega ohms.
d. Primary and secondary injection tests of relays and CT's.
e. Checking of Interlocking Function.

5.2.19 Starters

Each motor shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant BIS Codes. All Star Delta and ATS Starters shall be fully automatic.

Starter's contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta / Reduced Voltage Starters. The insulation for contactor coils shall be of class "B". Operating coils of contactors shall be suitable for 230 / 415 + 10% volts AC, 50 cycles supply system. The contactors shall drop out when voltage drops to 90% of the rated voltage. The housing of the contactors shall be heat resistant and having high impact strength. Each starter shall have thermal overload protection on all three phases.

5.2.20 Over Load Relays

Contactors shall be provided with a three element, positive acting ambient temperature compensated time lagged hand-reset type thermal over load relays with adjustable setting. Hand-reset button shall be flush with the front door for resetting with

starter compartment door closed. Relays shall be directly connected for motors up to 35 HP capacities. C.T operated relays shall be provided for motors above 35 HP capacities. Heater circuit contactors may not be provided with overload relays.

5.2.21 Current Transformers

Current transformers shall be of accuracy class I and suitable VA burden for operation of the connected meters and relays. These shall be resin bonded and epoxy coated.

5.2.22 Single Phase Preventers

Single phase preventers shall be provided as per Bill of Quantities and shall be in conformity with relevant BIS Standards. Single phase preventers shall act when the supply voltage drops down to 90% of the rated voltage or on failure of one or more phases.

5.2.23 Time Delay Relays

Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connections.

5.2.24 Indicating Led (22 mm dia) and Metering

All meters and indicating lamps shall be in accordance with BS 37 and BS 39. The meters shall be flush mounted and draw out type. The indicating lamp shall be of LED type. Each main panel shall be provided with voltmeter 0-500 volts with three way and off selector switch, CT operated ammeter of suitable range with three Nos. CTs of suitable ratio with three ways and off selector switch, phase indicating lamps, and other indicating lamps as called for. Each phase indicating lamp shall be backed up with 5 amps fuse. Other indicating lamps shall be backed up with fuses as called for.

5.2.25 Toggle Switch

Toggle switches, where called for, shall be in conformity with relevant BIS Codes and shall be of 5 amps rating.

5.2.26 Push Button Stations

Push button stations shall be provided for manual starting and stopping of motors / equipment as called for. Green and Red color push buttons shall be provided for `Starting' and `Stopping' operations. `Start' or `Stop' indicating flaps shall be provided for push buttons. Push buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for `Stop' push buttons. The push button contacts shall be suitable for 6 amps current capacity.

5.2.27 Conduits

Conduits shall be of mild steel and shall be Hard drawn, stove enameled inside and outside with minimum wall thickness of 1.6 mm for conduits upto 32mm diameter and 2 mm wall thickness for conduits above 32 mm diameter. GI pull wires shall be installed in the conduit while laying the conduit.

5.2.28 Cables

M.V. cables shall be PVC insulated aluminum conductor and armoured cables conforming to BIS Codes. Cables shall be armoured and suitable for lying in trenches, duct, and on cable trays as required. M.V Cables shall be termite resistant. Control cables and indicating panel cables shall be multi core PVC insulated copper conductor and armoured cables.

5.2.29 Wires

1100 volts grade PVC insulated copper conductor wires in conduit shall be used.

5.3. Cable Laying

Cable shall be laid generally in accordance with BIS Code of Practice. Cables shall be laid on 14 gage perforated MS sheet cable trays, and cable drops / risers shall be fixed to ladder type cable trays fabricated out of steel angle. Access to all cables shall be provided to allow cable withdrawal / replacement in the future. Where more than one cable is running, proper spacing shall be provided to minimize the loss in current carrying capacity. Cables shall be suitably supported with Galvanized saddles when run on walls / trays. When buried, they shall be laid in 350 mm wide and 750 mm deep trench and shall be covered with 250 mm thick layer of soft sifted sand & protected with bricks, tiles. Special care shall be taken to ensure that the cables are not damaged at bends. The radius of bend of the cables when installed shall not be less than 12 times the diameter of cable. 1.1 KV cable shall be buried 600 mm below ground level.

5.4 Wire Sizes

For all single phase / 3 phase wiring, 1100 volts grade PVC insulated copper conductor wires shall be used. The equipment inside plant room and AHU room shall be connected to the control panel by means of insulated aluminium conductor wires of adequate size. An isolator shall be provided near each motor / equipment wherever the motor / equipment is separated from the supply panel through a partition barrier or through ceiling construction. PVC insulated single strand aluminium conductor wires shall be used inside the control panel for connecting different components and all the wires

inside the control panel shall be neatly dressed and plastic beads shall be provided at both the ends for easy identification in control wiring.

. The minimum size of control wiring shall be 1.5 sq.mm PVC insulated stranded soft drawn copper conductor wires drawn through conduit to be provided for connecting equipment and control panels.

Power wiring cabling shall be of the following sizes :

i.	Upto 5 HP motors/5 KW heaters.	3 x 4 sq.mm copper conductor wires.
ii	From 6 HP to 10 HP motors 6 KW to 7.5 KW heaters.	3 x 6 sq.mm copper conductor wires.
iii.	From 12.5 HP to 15 HP Motors.	2 Nos. 3 x 6 sq.mm copper conductor wires.
iv.	From 20 HP to 25 HP motors.	2 Nos. 3 x 10 sq.mm aluminium conductor armoured cables.
v.	From 30 HP to 35 HP motors.	2 Nos. 3 x 16 sq.mm aluminium conductor armoured cables.
vi.	From 40 HP to 50 HP motors.	2 Nos. 3 x 25 sq.mm aluminium conductor armoured cables.
vii.	From 60 HP to 75 HP motors.	2 Nos. 3 x 50 sq.mm aluminium conductor armoured cables.
viii.	100 HP motors.	1 No. 3 x 150 sq.mm aluminium conductor armoured cables.
ix.	150 HP motor.	1 No.3 x 240 sq.mm aluminium conductor armoured cables.

All the switches, contactors, push button stations, indicating lamps shall be distinctly marked with a small description of the service installed. The following capacity contactors and overload relays shall be provided for different capacity motors.

TYPE OF	CONTACTOR	OVERLOAD RELAY

STARTER		CURRENT CAPACITY	RANGE
5 HP Motors	D O L	16 amps	6-10 amps
7.5HP Motors	D O L	16 amps	10-16 amps
10 HP Motors	D O L	32 amps	3-21 amps
12.5HP Motors	Star Delta	16 amps	10-16 amps
15 HP Motors	Star Delta	25 amps	10-16 amps
20 HP Motors	Star Delta	32 amps	13-21 amps
25 HP Motors	Star Delta	32 amps	13-21 amps
30 HP Motors	Star Delta	40 amps	20-32 amps
35 HP Motors	Star Delta	40 amps	20-32 amps
40 HP Motors	Star Delta	40 amps	28-42 amps
45 HP Motors	Star Delta	63 amps	28-42 amps
50 HP Motors	Star Delta	63 amps	28-42 amps
60 HP Motors	Auto Transformers/ Reduced Voltage.	125 amps	45-70 amps
75 HP Motors	-do-	125 amps	90-150 amps
100 HP Motors	-do-	200 amps	operated Relay
135 HP Motors	-do-	300 amps	-do-
150 HP Motors	-do-	300 amps	-do-

5.5 Earthing

a) Shall be copper strips / wires the main panel shall be connected to the main earthing of the building by means of 2 Nos. 25 mm x 3 mm copper tapes. All single phase metal clad switches and control panels be earthed with minimum 2 mm diameter copper conductor wire. All 3 phase motors and equipment shall be earthed with two numbers distinct and independent copper wires / tapes as follows:

i. Motors up to and including 10 HP. rating. — 2 Nos 3 mm dia copper Wires.

ii. Motors 12.5 HP to 40 HP Capacity. — 2 Nos.4 mm dia copper Wires.

Iii. Motors 50 to 75 HP Capacity. — 2 Nos 6 mm dia copper wires.

iv. Motors above 75 HP. — 2 Nos 25 mm x 3 mm copper tapes.

b) All switches shall be earthed with two numbers distinct and independent copper wires/tapes as follows :

i. 3 phase switches and control panels upto 60 amps rating.	2 Nos 3 mm dia copper wires.
ii. 3 phase switches and control panels 63 amps to 100 amps rating.	2 Nos 4 mm dia copper wires.
iii. 3 phase switches and control panels 125 amps to 200 amps rating.	2 Nos 6 mm dia copper wires.
iv. 3 phase switches, control panels, bus ducts, above 200 Amps rating	2 Nos 3 mm x 25 mm copper tapes.

c) The earthing connections shall be tapped off from the main earthing of electrical installation. The over-lapping in earthing strips at joints where required shall be minimum 75 mm. These straight joints shall be riveted with brass rivets & brazed in approved manner. Sweated lugs of adequate capacity and size shall be used for all termination of wires. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substance and properly tinned.

5.6 Drawings

Shop drawings for control panels and wiring of equipment showing the route of conduit/cable shall be submitted by the contractor for approval of Engineer In Charges/ Consultant before starting the fabrication of panel and starting the work. On completion, four sets of complete "As-installed" drawings incorporating all details like, conduits routes, number of wires in conduit, location of panels, switches, junction/pull boxes and cables route etc. shall be furnished by the Contractor.

5.7 Testing

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with relevant BIS Codes and test report furnished by a qualified and authorized person. The entire electrical installation shall be got approved by Electrical Inspector and a certificate from Electrical Inspector shall be submitted. All tests shall be carried out in the presence of Supervisor.

5.8 Painting

All sheet steel work shall undergo a process of degreasing, thorough cleaning, and painting with a high corrosion resistant primer. All panels shall then be backed in an oven. The finishing treatment shall be by application of synthetic enamel paint of approved shade.

5.9 Labels and Tags

Engraved PVC labels shall be provided on all incoming and outgoing feeders' switches. Circuit diagram showing the arrangements of the circuit inside the control panel shall be pasted on inside of the panel and covered with transparent plastic sheet. All cables terminations at panels and at equipments shall be provided with tags as approved by Engineer In Charges.

5.10 All panels to have provision for padlocking and all MCCB's/MCB's to have provision for locking in off position.

5.11 Measurement

a) All Rates are on lump sum basis and measured as per main contract terms and conditions.

Section- 6

Hand Appliances

6.0 Scope of work

6.1.1 Work under this section shall consist of furnishing all labour, material, appliances and equipment necessary and required to install fire extinguishing hand appliances.

6.1.2 Without restricting to the generality of the foregoing the work shall consist of the following:-

Installation of fully charged and tested fire extinguishing hand appliances CO_2 foam, dry chemical powder type as required by these specifications and/drawings.

6.2 General requirements

6.2.1 Fire extinguishers shall conform to the following Indian Standard Specifications and shall be with ISI approved stamp as revised and amended up to date:-

6.2.2 Fire extinguishers shall be installed as per Indian Standard "Code of Practice for Selection, Installation and Maintenance of Portable First Aid Appliances" I.S.2190-1962.

6.2.3 Hand appliances shall be installed in readily accessible locations with the appliance brackets fixed to wall by suitable anchor fasteners.

6.2.4 Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

6.2.5 All appliances shall be fixed in a true workmanlike manner truly vertical and at correct locations.

6.3 Measurement

a) All Rates are on lump sum basis and measured as per main contract terms and conditions.

Section -7

I.S. Codes and Reference Standards

Following codes and Indian Standards shall be applicable with amendments up to date:

7.1 Codes of Practice.

7.1.1	Code of practice for fire safety of building (general) Firefighting equipment and maintenances.	I.S.1648
7.1.2	Code of practice for installation of internal fire hydrant in multistory buildings	I.S.3844
7.1.3	Recommendations for providing first aid and fire Fighting arrangement in public buildings	I.S.2217
7.1.4	Code of practice for selection, installation and Maintenance of portable first aid fire appliances.	I.S.2190
7.1.5	National building code	

7.2. Firefighting appliances

7.2.1	External fire hydrants	I.S.5290
7.2.2	Internal landing valves	I.S.5290
7.2.3	2 & 3 Way suction collecting heads	I.S.904
7.2.4	First aid hose reel	I.S.884
7.2.5.	Dunlop high pressure rubber pipe	I.S.5132

7.3. Electrical equipment

7.3.1	Marking & arrangement for switchgear bus bars Main connections and auxiliary wiring	I.S.375
7.3.2	Direct acting electrical indicating Instruments	I.S.1248
7.3.3	Metal enclosed switchgear and control gear.	I.S. 3427
7.3.4	A.C.Contactors of voltage not exceeding 1000 volts.	I.S. 2959
7.3.5	A.C. Motor starters of voltage not	

	exceeding 1000 volts.	I.S. 1822
7.3.6	Air break isolation for voltages not exceeding 1000 volts.	I.S. 2607
7.3.7	Heavy duty air break switches and composite unit of air break switches and fuses for voltage not exceeding 1000 volts.	I.S. 4047
7.3.8	HRC cartridge fuse links upto 650 volts.	I.S. 2208
7.3.9	PVC insulated cables (for voltage upto 1100 volts with copper/ aluminium conductors).	I.S. 694 (Part I & II)
7.3.10	Normal duty air break switches and composite units exceeding 1000 volts.	I.S. 4064
7.3.11	Code of practice for earthing	I.S. 3043
7.4.	**Pumps & Motors**	
7.4.1	Centrifugal pumps	I.S. 1520
7.4.2	Electrical motors	I.S. 7538
7.5.	**Piping & valves**	
7.5.1	M.S.Tubes upto 150 mm dia	I.S. 1239
7.5.2	M.S. Tubes 200 mm & above	I.S. 3589
7.5.3	Cast Iron centrifugally spun pipes	I.S. 1536
7.5.4	C.I. Double flanged sluice Class 1 & 2 valves	I.S. 780
7.6	**C.I. Double flanged non return valves**	**I.S. 5312**

Section - 8

TECHNICAL SPECIFICATIONS FOR FIRE FIGHTING SYSTEM

Shall be submitted

8.0 FIRE HYDRANT & SPRINKLER SYSTEM

8.1	Pumps	Elec. Driven Fire Pump	Diesel Driven	Pump	Jockey
a)	Makes				
b)	Model No.				
c)	Rated Discharge (LPM)				
d)	Rated Head (M)				
e)	Speed (RPM)				
f)	No. of Stages				
g)	Efficiency at rates				

Capacity & head

h) KW required at rated
Capacity & head

i) KW required at 150%
Rated discharge

j) Shut off head (M)

k) Material of Construction

i) Body

ii) Impeller

iii) Shaft

l) Whether pump is capable
Of discharging 150% of
Rated capacity at a head
not less than 65% of rated
head.

m) Whether Automatic Priming
Arrangement included.

8.2 Pipes

a) Make

b) Standard/Class

c) Thickness

d) Painting details
for above ground
& exposed pipes

e) Wrapping & coating
(Make/Thickness)

f) Whether ISI marked

8.3 Fittings

a) Type

b) Make

c) Material

d) Type of ends

e) Pressure rating

f) Whether ISI marked

8.4 Sluice Valves/Butterfly Valves

a) Make & Type

b) Type of ends

c) Material of construction

d) Test Pressure

e) Provided with all
Accessories including
gear system as per relevant IS

f) Whether ISI marked/ TAC approved

8.5 Engine/Motors	Engine	Main Pump	Jockey Pump
a) Make			

Type & Model No

b) Frame Size

c) Speed (RPM)

d) Rated Cap. (KW)

e) Efficiency (%)

8.6 Control Panel (MCC)

a) Manufacturer

b) Dimensions

c) Type of construction & mounting

d) Sheet Metal Enclosure

i) Material

ii) Thickness

e) Electrical Rating

f) Make of starters/ Contactors

g) Rating of Contactors

h) Size & material of Bus bar

i) Annunciation system

j) Approx. weight

k) Painting details

l) Whether all equipment/ Components as per Specification included

8.7 Slum Seal Flap type Non Return Valves/

a) Make & Type

b) Type of ends

c) Material of construction

d) Test Pressure

e) Provided with all Accessories including gear system as per relevant IS

f) Whether ISI marked/TAC approved

8.7 G.M. Gate /Globe/Check Valve

a) Make & Type

b) Type of ends

c) Whether confirm to to& marked IS:778

8.8 Make & Type

a) Material of construction

b) Details of Flange

O.D. (MM)

P.C.D (MM)

No. of Holes

c) Whether ISI marked/TAC approved

8.9 Hose Pipes C.P.Hose RRL (Type A)

a) Make

b) Test Pressure

c) Dia (MM)

d) Length (M)

e) Material of couplings

f) Where hose &
Couplings ISI marked

8.10 Branch Pipes & Nozzles

8.10.1 Make

8.10.2 Material

8.10.3 Dia. of Coupling

8.10.4 Dia of Nozzle

8.10.5 Where ISI marked

8.11 Hose Cabinet

8.11.1 Size

8.11.2 Material

8.11.3 Thickness of sheet

8.11.4 Thickness of glass

8.11.5 Whether Rubber Gasket
Provided

8.11.6 Painting Details

8.12 First Aid Hose Reel

8.12.1 Make & Material

a) Drum

b) Hose

8.12.2 Size of Drum
(Dia x length)

8.12.3 Size of Hose
(Dia x length)

8.12.4 Hose test pressure

8.12.5 Size & material of
Nozzle

8.12.6 Size & material of
Shut off valve

8.12.7 Whether complete unit
Strictly confirms to
And marked IS: 884
TAC approved

8.13 Pressure Switch

8.13.1 Make & Type

8.13.2 Type of ends

8.13.3 Test Pressure

8.13.4 Electrical Rating

8.13.5 Whether ISI marked/ TAC/UL approved

8.13.6 Whether complete with Gland or other accessories

8.14 Pressure Gauge

8.14.1 Make & Type

8.14.2 Dial size (mm)

8.14.3 Range (kg/cm.sq.)

8.14.4 Whether ISI marked/ TAC/UL approved

8.15 Level Switch

8.15.1 Make & Type

8.15.2 Electrical Rating

8.15.3 Whether ISI marked/ TAC/UL approved

8.15.4 Whether complete with gland or other accessories

8.16 Flow Switch

8.16.1 Make & Type

8.16.2 Pressure Rating

8.16.3 Electrical Rating

8.16.4 Whether ISI marked/ TAC/UL approved

8.17 Sprinkler Head

	Conventional	**Pendant**	**Side wall**	**Concealed**
a) Make				
b) Material				
c) Type of sensing Element & temperature Rating (C)				
d) Orifice size (MM)				
e) Type (UPRIGHT/PENDENT/ CONVENTIONAL/SIDEWALL /EXTENDED RANGE)				
f) Whether listed / Approved by UL/FH				

8.18 Wet Alarm Valve

a) Make

b) Material

c) Size (MM)

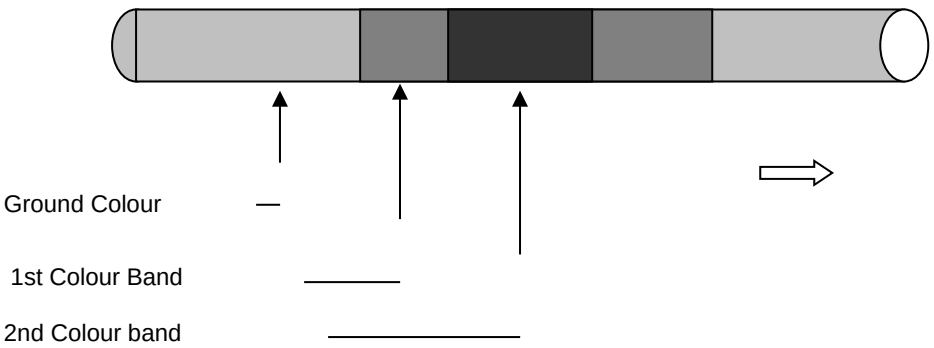
d) Whether provided with Electric bell, test valve, drain valve, & all other training connections

e) Whether approved
hydraulic alarm motor & gong provided

f) Whether valve & alarm
Motor & gong listed/
approved byUL/FM/FOC/TAC

Section -9

Pipe Colour Code



Proportional width of band 4:1

Note:-Arrow indicating the direction of flow.

Pipe lines	Ground Colour	1st Colour Band	2nd Colour Band
Fire services	Fire red		

This Colour Code is as per I.S. 2379.

TECHNICAL SPECIFICATION

ROOF TOP SOLAR PANEL

Scope:

1. **The supply and installation of new and latest technology of roof top solar panel should be executed through only MNRE approved agencies/Institutions/Govt. Nodal agency/authorised dealer/agent etc.**

2. **All statutory approval/ NOC required for commissioning to be obtained for Net metering by the contractor in free of cost.**
3. **The contractor shall procure all solar panels/ fittings/items etc. required for Roof top solar panel system through MNRE approved manufacturer/ authorized dealer/agent/ Channel partner only. Contractor should submit all necessary documents of technical specifications, installation, operation manual and invoices as required by GRIHA norms. The minimum solar panel warranty period should be satisfied with MNRE norms.**
4. **The maximum warranty of the product should be passed on to the owner with appropriate agreement/certificates. .**
5. **System shall be designed for 83Kwp for Roof top Mounted & .60KWp Opaque Solar panels of 300Wp & 23KWp BIPV panels of 150Wp**
6. **scope of work includes for terminal connections at the time of evacuation of power into local grid.**
7. **LT panel connection shall be done nearer to the available point.**
8. **Comprehensive Annual maintenance contract for 5 years after defective liability period of 1 year.**

9. Design, Engineering, Supply, installation & Commissioning

- Complete design of the system containing structure layout, Electrical layout, Civil, shadow analysis, regular cleaning system of panel etc.
- Technology selection- Solar Modules, Inverter, Cables, Mounting Structure, Layout optimization.
- Supply & Installation of Solar Power Modules as per specified bill of material.
- Supply, Installation & Commissioning of PCU(Power Conditioning Unit)
- Installation of DC/AC cabling for entire plant under the scope.
- Plant Trials prior to Commissioning
- Commissioning with Synchronization of Solar Power Plant with grid and evacuation of solar power into local grid.
- Routine Maintenance of Solar power System on followings routine basis.
    - Checking of module connections, LT connections & Inverter setting
    - Review on routine maintenance
    - Unscheduled maintenance in case of failure of system
- Training on system operations in the initial period of commissioning.

- Developing and maintaining automatic dust cleaning system (like wiper or water sprinkler or automatic panel cleaning system along with sensors) on the inclined roof solar roof panel. The cost will be included solar system. Accordingly, the bidder may quote their rate.

CRITICAL COMPONENTS OF SOLARPOWER PLANT

- Solar Module
- Solar Inverter
- Mounting Structure

Details of Critical Component

Features

1. 300Wp Multicrystalline Solar Module from Plant.
2. With more than 15% module efficiency, these modules should be used..
3. 72 cells module with Low iron anti-refractive coated glass which gains additional 2% energy.
4. Resistance to PID (Potential Induced degradation)
5. Modules with high reliability test (IEC61215, 61730-I&2, 62804, 61701)
6. Up to 25 years true linear power output warranty from Manufacturer
7. 10 Years global workmanship warranty

Peak Power	: 300Wp (Navisol 300)
Max. Power Current	: 8.3Amps
Short Circuit Current	: 8.87Amps
No.of Cells	: 72
Max Power Voltage	: 36.1V
Open Circuit Voltage	: 44.6V
Module Efficiency (STC)	: 15.6%
Glass	: High Transmission low iron tempered glass 3.2mm ARC Glass
Frame	: Anodized Aluminium alloy
Junction Box	: IP65 or IP67.
By pass diode	: 3Nos.

Power Conditioning Unit (Inverter)

Features:

The outdoor type PCU (Inverter) technology

String Inverters: Froniusorany equivalent make.

- Enhance power output than conventional inverter-6-8%
- Designed to with stand extreme weather conditions
- Design life of 10-12years
- More than 98.2% efficiency at peak Power.
- Harmonics below 2.00%
- Data logging systems allow continuous monitoring of energy generation
- Anti-Islanding Protection
- Standard warranty 5 Years from the supplier
- MPPT Inputs – 1
- Protective devices DC-side disconnection device/ Ground fault monitoring/ grid monitoring/ DC reverse polarity protection/ AC short-circuit current capability/
- Protection class (according to IEC 62109 - 1) / over voltage category (according to IEC 62109-1)

TECHNICAL SPECIFICATIONS GREEN BUILDING-GRIHA COMPLIANCE

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT (GRIHA).

1.0. Introduction:

1.1 Ministry of New and Renewable Energy, Govt of India (MNRE) has developed a comprehensive building rating system called Green Rating for Integrated Habitat Assessment (GRIHA).

1.2 The proposed buildings envisage incorporation of eco concepts at all levels. It is the vision of CMPDIL to achieve best standards as per Green building norms for the proposed building. CMPDIL intends to acquire a minimum of GRIHA 3- STAR or higher rating for its buildings.

1.3 CMPDIL has registered the proposed North Central Zone Office building with GRIHA Secretariat, the institution authorized by MNRE to process and evaluate the buildings under GRIHA.

1.4 CMPDIL is engaging consultants for providing Comprehensive services for Architectural, Engineering and Design Works & Services, herein further referred as Architect / Designer.

1.5 In order to comprehensibly design the new buildings in association with the architect by suitably incorporating green building requirements and to address issues involved at various stages of the project, in achieving the Green rating, CMPDIL is availing Green building Advisory Services from a Competent Agency, herein further referred as Green Building Advisor.

1.6 In association with the architect and Green building designer, the Owner has incorporated possible GRIHA criteria in the design, specification and BOQ. However the achievement of GRIHA 3 Star rating is possible only upon Contractor's commitment and compliance of relevant GRIHA criteria. Accordingly the criteria and points assigned for achievement by the contractor are indicated.

1.7 Manual Volume - I (Introduction to National Rating System) published by The Energy and Resources Institute and MNRE available in its website should be read with this specification. The bidders shall understand the rating system and its evaluation process concept, the scope of their works and assist the owner in all aspects to achieve the proposed rating. The details provided in the manual are indicative. Best practices of the industry shall be implemented. For a more detailed understanding the bidders are advised to refer to the relevant portions of the entire set of five volumes of the GRIHA manual. These manuals are available for Work with The Energy Resources Institute (TERI), Bangalore and New Delhi.

1.8 A few activities under GRIHA are already included in GCC. This specification is for activities over above that are already covered under different sections. The contractor shall consider the same and assess his costs to comply with this specification.

2.0 Commitment, Compliance & Appraisal of GRIHA Criteria :

The contractor shall commit and comply with the GRIHA guidelines, advise and instructions of the Green Building Advisor, Architectural Consultant and Owner. The criteria and the points to be achieved during appraisal are indicated hereunder.

2.1 Criteria 2: Preserve and protect landscape during construction

2.1.1 Objective: To preserve the existing landscape and protect it from degradation during the process of construction.

2.1.2 No. of Points to be achieved : 3

Activity	Points
Confine construction activity to pre-designated areas.	1
Proper implementation of staging and spill prevention plan and Effective erosion and sedimentation control to prevent erosion.	1
Preserve top soil by employing suitable measures	1

Protect & Preserve existing tress if any as per directions of Engineer in charge	
Total	3

2.2 Criteria 3: Soil Conservation till post construction

2.2.1 Objective : Conserve top soil till completion of construction activity.

2.2.2 No. of Points to be achieved : 2.

Activity	Points
Proper top soil laying for vegetative growth	1
Proper stabilization of soil	1
Total	2

2.3 Criteria 8: Provide Minimum level of sanitation and safety facilities for construction workers.

2.3.1 Objective : To ensure the health and safety of workers during construction, with effective provisions for the basic facilities such as sanitation and drinking water, and safety of equipment or machinery.

2.3.2 No. of Points to be achieved : 2

Activity	Points
Compliance with Latest National Building Code norms on construction safety for ensuring safety during construction	1
Provision for health and sanitation facilities	1
Total	2

2.4 Criteria 9 : Reduce air pollution during construction.

2.4.1 Objective : The dust generated by various construction site activities can

contribute significantly to air pollution. Dust and outdoor air pollutants can cause respiratory problems. Good construction practices involve major mitigation measures for prevention or minimization of air pollution from construction activities. This criterion aims to reduce air pollution due to on-site construction.

2.4.2 No. of Points to be achieved : 2

Activity	Points
Demonstrated use of air pollution preventive measures	2
Total	2

2.5 Criteria 12 : Efficient Water use during Construction

2.5.1 Objective : To minimize use of potable water during construction activity

2.5.2 No. of Points to be achieved : 1

Activity	Points
Efforts to minimize potable water use for construction	1
Total	1

2.6 Criteria 22 : Reduction in waste during construction

2.6.1 Objective : To ensure maximum resource recovery and safe disposal of wastes generated during construction, and to reduce the burden on the landfill.

2.6.2 No. of Points to be achieved : 1

Activity	Points
Segregation of inert and hazardous wastes and	1
recycling and safe disposal of segregated wastes	
Total	1

3.0 Documentation, Evaluation & Appraisal:

3.1 The facilitation with MNRE / GRIHA Secretariat shall be undertaken by Green Building advisor on behalf of the owner. All necessary cooperation shall be extended to them.

3.2 The contractor shall submit documents, photographs, narratives and certificates if any from statutory authorities, and any other proof in requisite formats, demonstrating compliance to the GRIHA norms both in hard copy and soft copy forms as per requirement and as decided by Engineer In charge / Architect / Green building Advisor. The guidelines issued by Green building Advisor time to time at various stages of the Project shall be binding on the contractor.

3.3 The evaluation team from MNRE / GRIHA Secretariat or their authorized representative shall be conducting periodic and surprise checks at site for assessing compliance to GRIHA norms. The contractor shall demonstrate compliance through actual site situation, documents, photographs and certificates if any from statutory authorities.

3.4 The contractor shall take all necessary actions to ensure that there are no adverse remarks on compliance.

3.5 Upon completion of the building, all documents, photographs, narratives and also certificates if any from statutory authorities shall be submitted for evaluation and appraisal by GRIHA Secretariat, who shall issue provisional rating shall be ratified finalized upon suitable audit and verification upon occupation of the building.

4.0 Bill of Quantities, Method of Measurement & Terms of Payment:

4.1 The Bill of Quantities is enclosed with the bidding documents. The contractor shall assess the requirements and quote accordingly.

4.2 The units of measurement shall be lump sum and payable upon achievement of all the points and receipt of provisional rating certificate from GRIHA Secretariat /MNRE.

5.0 General guidelines:

5.1 PROTECTION OF LANDSCAPE:

5.1.1 Trenching, placing backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other material detrimental to plant health. These activities should be restricted to the areas outside of the canopy of the trees.

5.1.2 Trees should not be used for support; their trunks should not be damaged by cutting

and carving, by nailing posters and advertisements or in any other way.

5.1.3 Lighting of fires or carrying out heat or gas emitting construction activity within the ground covered by canopy of the tree should not be permitted.

5.1.4 Young trees or saplings identified for preservation within the construction site must be protected using tree guards of approved specification.

5.1.5 Existing drainage patterns through or into any preservation area should not be modified unless specifically directed by the landscape architect/ architect/ engineer-in-charge.

5.2 SOIL CONSERVATION:

5.2.1 Existing grades of soil should be maintained around existing vegetation. Lowering or raising the levels around the vegetation should not be allowed unless specifically directed by the landscape architect/architect/engineer-in-charge.

5.2.2 Staging should be done to separate undisturbed land from land disturbed by construction activity and material storage.

5.2.3 The staging areas/construction areas should be barricaded to prevent spilling of contaminated areas.

5.2.4 Segregate waste during construction on site into inert, chemical or hazardous waste.

5.2.5 Recycle the unused chemical/ hazardous wastes such as oil, paint, asbestos etc.

5.2.6 Contaminated material and hazardous wastes like pesticides, paints, cleaners, and petroleum products should be separated and contain safely in the constructed area.

5.2.7 Inert waste should be disposed of by municipal corporations/ local bodies at landfill sites.

5.2.8 Drainage channel should be made for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas.

5.2.9 Topsoil should be stripped to a depth of 20 cm from the areas proposed for buildings, roads, paved areas, and external services and stored plus preserved in a stockpiled to a height of 40 cm in designated areas.

5.3 SANITATION/SAFETY FACILITIES SANITATION/SAFETY FACILITIES FOR CONSTRUCTION WORKERS.

5.3.1 Comply with the safety procedures, norms and guidelines (as applicable) as outlined in NBC 2005 (BIS 2005c).

5.3.2 Adopt additional best practices and prescribed norms as in NBC 2005 (BIS 2005).

5.3.3 Provide clean drinking water to all workers.

5.3.4 Provide adequate number of decentralized latrines and urinals to construction workers.

5.4 REDUCE AIR POLLUTION DURING CONSTRUCTION

5.4.1 There should be adequate water supply/storage for dust suppression on site.

5.4.2 Water should be sprayed at regular interval to suppress the dust during construction activity.

5.4.3 Devise and arrange methods of working and carrying out the work in such a manner so as to minimize the impact of dust on the surrounding environment.

5.4.4 Clear vegetation only from the areas where work will start right away.

5.4.5 Limit vehicular speed on-site to 10 km/h when construction is in progress.

5.4.6 Water should be sprayed on any dusty materials before transferring, loading, and unloading.

5.4.7 Spray water in areas where demolition work is being carried out .

5.4.8 Water should be sprayed in areas where excavation or earth-moving activities are to be carried out.

5.4.9 Washing bay to be provided for Trucks/ any vehicle carrying loads out of the site.

5.5 EFFICIENT WATER USE DURING CONSTRUCTION

5.5.1 Water should be sprayed on concrete structures after covering them with cloth/gunny bags. To reduce water consumption approved Curing chemicals should be sprayed on concrete structures and free flowing water should not be used for curing.

5.5.2 Ponds should be made using cement and sand mortar to avoid water flowing away from the flat surface while curing. Water ponding should be done on all sunken slabs. makes and manufacturers shall be preferably from the following list. In case the same is not available in the market or in case of a change in trade name, equivalent makes/ re-designated manufacturer shall be used with the approval of EIC. For Items which have

been missed in the current list, vendor shall seek details from owner during execution. Decision of EIC will be final in selection of approved make.

5.0 PREFERABLE MAKES

LIST OF PREFERABLE MAKES/ MANUFACTURERS

1.00 GENERAL

1.01 The makes and manufacturers shall be preferably from the following list. In case the same is not available in the market or in case of a change in trade name, Equivalent makes/ re-designated manufacturer shall be used with the approval of EIC. For Items which have been missed in the current list, vendor shall seek details from owner during execution. Decision of EIC will be final in selection of approved make.

1.02 In case of items not covered in the list, the material shall be best available in the market and each item should have BIS certification mark and should be approved by GRIHA.

1.03 **The list of preferable make/brand is given only for quote their rates**. The preferable makes and brand is not limited. Any other equivalent make, which should be approved by GRIHA/MNRE/CPWD/PWD Maharashtra to achieve GRIHA rating, shall be used. The final selection of make/brand will be discretion of Engineer in charge.

CIVIL

LIST OF PREFERABLE MANUFACTURER		
S. No.	**Description of Item**	**Standard make / brand names**
1.	Chlorpyriphos (For anti-termite treatment)	Sahakar of M/s. Karnataka Co-op. Marketing Fed. Ltd., Termisac of M/s. Bayer India Ltd, Bhagiradha Chemicals Ltd, Hyderabad
	Reticulate Antitermite with Imidaclorpid	Itemsecure – Ivory terrace, Alkapuri Baroda, Gujrat
2.	Water proofing compound	Pidilite Industries, COCO No. 1, SCOTT No. 1, Accoproof, Fosroc chemicals; Sikka
3.	Cement	ACC, Birla cements, L&T, Ultra Tech Cement, Ambuja

4.	Ready Mix Cement Concrete (RMC)	Ultra Tech Concrete, ACC Concrete, L&T Concrete/ approved equivalent
5.	Reinforcement Steel	TISCO, SAIL, RINL
6.	Flush door shutter	Kutty Flush doors, Chennai / KSFIC, Banglore/ Anand Wood Crafts, Hyderabad/ Anchor flush doors
7.	Hydraulic door closers	Dorma, Hafle/ approved equivalent
8.	Structural Steel, MS pipes	TISCO, SAIL, RINL (For Misc requirement like railings, grills etc procurement can be made from local market if the materials are not available with main producers as decided by the Engineer in Charge)
9.	Aluminium sections	Hindalco, Jindal/ approved equivalent
10.	Glazing	Modi glass, AIS glass, Saint Gobain
11.	Floor springs	Dorma, Haflle
12.	Silicon sealants	Dow corning, Other Brand if any shall be as per advice of the consultant.
13.	Wall putty	Birla putty, JK putty, Asian putty
14.	Spider fittings	Dorma, Nexus, Hafle
15.	UPVC Windows	Fenesta, Sintex, Wintech
16.	GI plaster mesh	Arpitha Building products, Banglore, National Wire Products, Pune
17.	Automatic sliding door	Dorma, Gandhi Automation Pvt Ltd, Mumbai
18.	Laminated glass	AIS glass/ saint goban/ approved equivalent. Other Brand if any shall be as per advice of the consultant.
19.	Frosted film	Garware films, 3 M films
20	Epoxy leveling topping	Epoxy.com, Arcoy Industries, MRF
21.	Low VOC paints	Asian Paints, Narolac paints, Alconable (ICI)
22.	Adhesives	Pidilite Industries, Fosroc chemicals , Sika India Ltd

FOR PHE WORKS		
1.	Wash basin	AS PER APPROVED MAKE OF GRIHA

2.	Indian type water closets	
3.	European type water closets	
4.	Flushing cisterns	
5.	Urinals	
6.	Pillar cock, health faucets, angle cocks, bib cocks, Toilet paper holders, Towel rings and other fixtures	
7.	Valves	Leader, HAWA, Globe, Zoloto
8.	Stainless Steel Kitchen Sink	Franke, Futura
9.	Automatic hand dryer	Euronice Industries, Bangalore, Kimberly clark/approved equivalent
10	UPVC Pipes,	Finolex, Supreme, Prince, Kissan
11	CPVC Pipes	Ashirwad Flow Guard, Prince, Astral
12	Cast Iron Manhole covers	Bengal Iron Corpn (BIS), NECO, Zenith
13	Pumps	Kirloskar, Suguna, Texmo
14	Water treatment items like Sand filters, Activated carbon filters, RO System, Water softner, Chlorine dosing system etc.	ION EXCHANGE, DOSI ION
15	Solar Water System	TATA BP Solar, Racold
16	Solar PV Panels	TATA BP Solar, Racold

LIST OF PREFERABLE MAKES OF MATERIALS FOR FIRE FIGHTING

Sl. No.	**ITEM**	**MAKE**
1.	FIRE PUMPS	KIRLOSKAR / MATHER & PLATT
2.	ELECTRICAL MOTORS	KIRLOSKAR/SEIMENS/NGEF/CROMPTON
3.	BOOSTER PUMP	KIRLOSKAR/MATHER & PLATT
4.	GI/MS. PIPES ('C' CLASS)	JINDAL/ (HISSAR)
5.	MS fittings	UNIK
6.	BUTTERFLY VALVES	HAWA/ZOLOTO/AUDCO
7.	BALL VALVE (15-14mm dia)	ZOLOTO/HAWA/VB

8.	SLUCE VALVES	KIRLOSKAR/VB/ZOLOTO
9.	NON- RETURN VALVE-FLAP TYPE CAST IRON	INTERVALVE/ZOLOTO/VB
10.	CANVASS HOSE	JAYSHREE/NEWAGE/MINIMAX
11.	FIRE EXTINGUISHER	SAFEX/MINIMAX/ALERT
12.	PRESSURE GUAGE	H- GURU
13.	PRESSURE SWITCH	DANFOSS/ INDFOSS
14.	PVC INSULATED COPPER WIRES	FINOLEX/UNIVERSAL/CCI
15.	CABLES	FINOLEX/UNIVERSAL/CCI
16.	OVER LOAD RELAYS	EE/ L&T
17.	SINGLE PHASE PREVENTOR	L&T / SEIMENS
18.	INDICATING LAMPS & PUSH BUTTONS	L&T / SEIMENS
19.	SPRINKLER HEAD	TYCO/RELIABLE/SPRAYSALE
20.	SPRINKLER ICV	WORMALD/ RELIABLE
21.	GUN METAL BRANCH PIPE	NEWAGE/ WINCO
22.	GUN METAL NOZZEL	NEWAGE/ WINCO
23.	AIR RELEASE VALVE	RB/TBS/VB
24.	RUBBER HOSE REEL	EVER SAFE/ MINIMAX
25.	FIRE BUCKETS	SAFEX/MINIMAX
26.	SUCTION STRAINER 'Y'	ANIL/ UPADYAYA
27.	FLOW SWITCH	NOTIFIER
28.	SINGLE HEADED HYDRANT VALVE	NEWAGE/ WINCO/ MINIMAX

PREFERABLE VENDORS FOR ELEVATORS

MITSUBHUSHI

SCHINDLER

OTIS

KONE

6.0 GENERAL TERMS AND CONDITIONS (GTC)

GENERAL TERMS AND CONDITIONS OF CONTRACT

1. Definitions

i) The word "Employer" or "Company" or "Owner" wherever occurs in the conditions, means the Central Mine Planning Design Institute Limited, Ranchi represented at Head Quarters of the Company by the CMD or his authorized representatives or any other officer specially deputed for the purpose who will employ the contractor.

ii)The word" Principal Employer" wherever occurs, means the officer nominated by the Company to function on its behalf.

iii)The word "Contractor/ Contractors" wherever occurs means the successful bidder /bidders who has/have deposited the necessary Earnest money and has/have been given written intimation about the acceptance of tender and shall include legal representative of such individual or persons composing a firm or a company or the successors and permitted assignees of such individual, firm or Company, as the case may be and any constitutional, or otherwise change of which shall have prior approval of the employer.

iv) "Site" means the land and places including any building and erection thereon, over, under, in or through which the Permanent works or Temporary works designed by the Engineer-in-Charge are to be executed and any other lands and places provided by the Employer for working space or any other purpose as may be specifically designated in the Contract as forming part of the site.

v) The term "Sub-Contractor" as employed herein, includes those having a direct contract with Contractor either on piece rate, item rate, time rate or any other basis and it includes one who furnishes work to a special design according to the plans or specifications of this work but does not include one who merely supplies materials.

vi) "Accepting Authority" shall mean the management of the company and includes an authorized representative of the company or any other person or body of persons empowered on its behalf by the company.

vii) "Engineer-in-charge" shall mean the officer nominated by the company in the Civil Engineering cadre/ discipline who is competent to direct supervisors and authorised to be in charge of the works for the purpose of this contract. The Engineer-in-Charge /Designated Officer in Charge, who is of an appropriate seniority, will be responsible for

supervising and administering the contract, certifying payments due to the contractor, valuing variations to the contract, awarding extension of time and valuing compensation events. The Engineer-in-Charge /Designated Officer in Charge may further appoint his representatives i.e. another person/Project Manager or any other competent person and notify to the contractor who is directly responsible for supervising the work being executed at the site, on his behalf under their Delegation of Powers of the company. However, overall responsibility, as far as the contract is concerned, will be that of the Engineer-in-Charge/Designated Officer in Charge.

viii) The "Contract" shall mean the notice inviting tender, the tender as accepted by the Company, the work order issued to the contractor, and the formal contract agreement executed between the company and the contractor together with the documents referred to therein including general terms and conditions, special conditions, if any, scope of work, frozen terms & conditions/technical parameters/scope of work and revised offer, if any, specifications, drawings, including those to be submitted during progress of work, schedule of quantities with rates and amounts.

ix) A "Day" shall mean a day of 24 hours from midnight to midnight.

x) The "Work" shall mean the works required to be executed in accordance with the contract/work order or parts thereof as the case may be and shall include all extra or additional, altered or substituted works or any work of emergent nature, which in the opinion of the Engineer-in-charge, become necessary during the progress of the works to obviate any risk or accident or failure or become necessary for security.

xi) "Schedule of Rates" referred to in this conditions shall mean the standard schedule of rates prescribed by the company and the amendments issued from time to time.

xii) "Contract amount" shall mean:

a) in the case of turnkey / lump sum contracts the total sum for which tender is accepted by the company.

b) in the case of other types of contracts the total sum arrived at based on the individual rate(s) / percentage rate(s)quoted by the tenderer for the various items shown in the Schedule of Quantities" of the tender document as accepted by the Company with or without any alteration as the case may be.

xiii) "Written notice" shall mean a notice or communication in writing and shall be

deemed to have been duly served if delivered in person to the individual or to a member of the contractors firm or to an office of the company for whom it is intended, or if delivered at or sent by registered mail / e-mail to the last business address known to him who gives the notice.

xiv) "The constructional plant" means all appliances, tools, plants or machinery of whatsoever nature required in or about the execution, completion or maintenance of the works but does not include materials or other things intended to form part of the permanent work.

xv) "Letter of Acceptance of Tender" means letter giving intimation to the tenderer that his tender has been accepted in accordance with the provisions contained in that letter.

xvi) "Department" means the Civil Engineering Department of Coal India Limited or any of its subsidiary companies/units represented by the appropriate authority.

xvii) "Act of insolvency" means as it is designed by Presidency Town Insolvency Act or Provincial Insolvency Act or any act amending such originals.

xviii) The words indicating the singular only also include the plural and vice-versa where the context so requires.

xix) "Drawings"/"Plans" shall mean all:

a. drawings furnished by the owner with the bid document , if any, as a basis for proposals,

b. working drawings furnished by the Owner after issue of letter of acceptance of the tender to start the work,

c. subsequent working drawings furnished by the owner in phases during progress of the work, and

d. drawings, if any, submitted by the contractor as per provision of the contract and duly approved by the owner.

xx) "Codes" shall mean the following, including the latest amendments, and/or replacements, if any :

a. Bureau of Indian Standards relevant to the works under the contract and their specifications.

b. Indian Electricity Act and Rules and Regulations made there under.

c. Indian Mines Act and Rules and Regulations made there under.

d. Any other Act, rule and regulations applicable for employment of labour, safety provisions, payment of provident fund and compensation, insurance etc.

2. Contract Documents and Miscellaneous Provisions :

The following documents shall constitute the contract documents :

i) Articles of Agreement.

ii) Letter of Acceptance of Bid/ Work Order indicating deviation, if any, from the conditions of contract incorporated in the tender document issued to the bidder.

iii) Notice Inviting Tender and Instructions to Bidders.

iv) Conditions of Contract including General Terms & Conditions of contract, Additional Terms & Conditions, Special Terms & Conditions, and Commercial Terms & Conditions etc.- as applicable.

v) Frozen terms & conditions / technical parameters and revised offer, if any. vi) Specifications/ scope of Work, if any.

vii) Schedule of quantities (or Bill of Quantities)along with accepted rate. viii) Contract drawings and work programme.

ix) Safety Code etc. forming part of the tender,

x) Integrity Pact (If applicable).

2.1The contractor shall enter into and execute contract agreement in the prescribed form. The cost of the stamp papers for the contract agreement shall be borne by the contractor. Two sets of contract document/agreements shall be prepared and signed by both the parties One of the sets shall be stamped "Original" and the other "Duplicate". The duplicate copy will be supplied to the contractor free of cost and the original is to be retained by the company. For additional copy, cost to be charged.

All additional copies should be certified by the Engineer-in-Charge.

The contractor shall keep copy of these documents on the site/place of work in proper manner so that these are available for inspection at all reasonable times by the

Engineer-in-charge, his representatives or any other officials authorized by the company for the purpose.

2.2The contract document shall not be used by the contractor for any purpose other than this contract and the contractor shall ensure that all persons employed for this contract strictly adhere to this and maintain secrecy, as required of such documents.

2.3 The local Court, where the subject work is to be executed shall have exclusive jurisdiction in all matter arising under this contract.

2.4 The Contract Agreement will specify major items of supply or services for which the contractor proposes to engage sub-contractor/sub-vendor. The contractor may from time to time propose any addition or deletion from any such list and will submit proposals in this regard to the Engineer-in-Charge / Designated Officer in charge for approval well in advance so as not to impede the progress of work. Such approval of the Engineer-in-Charge / Designated Officer in Charge will not relieve the contractor from any of his obligations, duties and responsibilities under the contract.

2.5 Acceptance of Offer :

“Letter of Acceptance”- is an acceptance of offer by the company. The tenderer should acknowledge the receipt of the order within 10 days of mailing of LOA and any delay in acknowledging the receipt will be treated as a breach of contract and compensation for the loss caused by such breach will be declared by the company by forfeiting EMD.

3. Discrepancies in contract documents & Adjustments thereof

The documents forming part of the contract are to be treated as mutually explanatory of one another and in case of discrepancy between schedule of quantity, the specifications and/or drawing, the following order of preference shall be observed;

a) Description in Bill of Quantities of work.

b) Particular specification and special conditions, if any

c) Drawings.

d) General specifications.

e) BIS Specifications.

3.1In the event of varying or conflicting provision in any of the document(s) forming part

of the contract, the Accepting Authority's decision/clarification shall hold good with regard to the intention of the document or contract as the case may be.

3.2Any error in description, quantity or rate in Bill of Quantities or any omission there from, shall not vitiate the contract or release the contractor from discharging his obligations under the contract including execution of work according to the Drawings and Specifications forming part of the particular contract document.

4.00 Security Deposit:

4.1 Security Deposit shall consist of two parts;

a) Performance Security to be submitted at award of work and

b) Retention Money to be recovered from running bills. The security deposit shall bear no interest.

4..2 Performance Security should be 5% of contract amount and should be submitted within 28 days of issuance of LOA by the successful bidder in any of the form given below :

a Bank Guarantee in the form given in the bid document from any Scheduled bank. The BG issued by outstation bank shall be operative at its local branch at Ranchi or branch at Ranch iBank Guarantee against Performance Security shall be applicable if the amount of Performance Security exceeds Rs. 5.0 lakhs.

Govt. Securities, FDR or any other form of deposit stipulated by the owner and duly pledged in favour of owner.

Demand Draft drawn in favour of CMPDI Ltd on any Scheduled Bank payable at its Branch at Ranchi

The Earnest Money/ Bid Security deposited shall be discharged when the Bidder has signed the Agreement and furnished the required Performance Security/ 1st part of security deposit.

The bid security deposited may be adjusted against the Performance security (1st part of security deposit) at bidder's option.

If performance security is provided by the successful bidder in the form of bank guarantee it shall be issued either -

(a) at Bidder's option by a Scheduled Bank , or

(b) by a foreign bank located in India and acceptable to the employer.

The validity of the Bank Guarantee shall be for a period of one year or ninety days beyond the period of contract /extended contract period (if any), whichever is more.

Failure of the successful bidder to comply with the requirement as above shall constitute sufficient ground for cancellation of the award of work and forfeiture of the bid security/ earnest money.

In addition to the above penal measures, the bidder will not be allowed to participate in the re-tendering process. The bidder may also be debarred from participating in future tenders in the subsidiary for a minimum period of 12 Months.

4.3 5% Performance Security should be refunded within 14 days of the issue of defect liability certificate (taking over certificate with a list of defects).

4.4 All running on account bills shall be paid at 95% (ninety five percent) of work value. The balance 5% shall be treated as retention money and will be second part of security deposit.

Retention Money may be refunded against equivalent Bank Guarantee, on written request of the contractor, on its accumulation to a minimum amount of Rs 5 lakhs subject to the condition that amount of any Bank Guarantee except last one, shall not be less Rs. 5 lakhs.

However, Bank Guarantee against retention money shall be with suitable validity based on nature of work which shall be 90 days beyond the defect liability period, but in no case less than the period of one year.

Bank Guarantee is to be submitted in the format prescribed by the company. Bank Guarantee shall be irrevocable and will be from Scheduled Banks as elaborated at Cl.4.2.

4.5 Retention Money should be refunded after issue of No Defect Certificate.

4.6 The Company shall be at liberty to deduct/appropriate from the security deposit such sums as are due and payable by the contractor to the company as may be determined in terms of the contract, and the amount appropriated from the security deposit shall have to be restored by further deduction from the contractors subsequent on account

running bills, if any.

4.7 REFUND OF SECURITY DEPOSIT: The refund of security deposit shall be subject to company's right to deduct/ appropriate its due against the contractor under this contract or under any other contract.

On completion of the entire work and issue of defect liability certificate (taking over certificate with a list of defects) by the Engineer-in-charge, one half of the security deposit remaining with the company (Performance Security) shall be refunded as elaborated at Cl. No.4.3.

The other half (Retention Money) shall be refunded to the contractor after issue of No Defect Certificate by the Engineer-in-Charge on the expiry of Defect Liability Period of six months , subject to the following conditions:

a) Any defect/defects in the work, if detected after issue of defect liability certificate (Taking over certificate with list of defects) is/are rectified to the satisfaction of the Engineer-in-Charge within the said defect liability period of six months or on its due extension till completion of the rectification works as required.

b) In the case of building work or other work of similar nature, the refund shall be made on the expiry of the said six months period or at the end of one full monsoon period i.e. June to September, whichever is later in point of time and any defects such as leakages in roof, effloresces in walls, dampness, defects in drainage etc. should be rectified to the satisfaction of Engineer-in-Charge.

NB: In case of Maintenance contracts, that ends with successful completion of work, where question of Defect Liability Period does not arise (e.g. sweeping / cleaning, horticulture, tank cleaning, jungle cutting, grass cutting, surface dressing etc.), the performance security and retention money (second part of bid security) can be released simultaneously after completion of work and taking over by department.

4.8 Additional performance security: (applicable for item rate as well as percentage rate tenders):

Additional performance security shall be applicable if the bid price is below 15% of the justified price, finalized by the owner. The amount of such additional performance security shall be the difference between 85% of the owner's justified price and quoted price.

Justified price shall be finalized by the owner on the basis of prevalent market rate of materials and labour analysed as per standard analysis of rate of CPWD/ NBO, and shall be binding on the bidder.

Additional performance security shall be furnished by bidder along with normal performance security. Failure to submit such additional performance security may result into termination of the contract.

This additional performance security will not carry any interest and shall be released in the following manner:

i) 30% of Additional performance security will be released after 60% of the total work is completed.

ii) 50% of Additional performance security will be released after 80% of the total work is completed.

iii) 100% of Additional performance security will be released after total work is completed.

Additional performance security may be furnished in the shape of BG or any of the forms as applicable for performance security.

4.9 Refund of Security Deposit regarding Specialized Item of Works (shall be applicable only when relevant item exists in the contract and shall be for 10% of value of such items in the contract or for 10% of value of contract with such specialized items only).

a) For some specialized items of work such as anti-termite treatment, waterproofing work, kiln seasoned and chemically treated wooden shutters, or any other item of work deemed as such 'specialized' by Engineer-in-Charge that are entrusted to specialized firms or contractors who associate specialized agencies, the contractor / firm executing the work should be asked to give a specific guarantee that they shall be responsible for removal of any defects cropping up in these works executed by them during the guarantee period. The form of the guarantee to be executed by the contractors shall be as enclosed.

b) 10% of the security (performance security and retention money) deposited / deducted from the bills of the contractors, relevant to the item(s), shall be refunded to him after expiry of Guarantee period. The security amount relevant to the item(s) of work, may be released after 12 months of completion of work against equivalent BG and furnishing Guarantee as at (a) above.

4.10 Refund of security deposit for contracts with supply installation and commissioning of equipment i.e with Mechanical & Electrical Works (shall be applicable only when relevant item exists in the contract)

For some specialized contracts like Pump house, Intake well etc. there may be Civil works as well as Mechanical and Electrical works. For such works 10% as security deposit (performance security and retention money)- deposited / deducted from the bills of the contractors shall be refunded to him after expiry of guarantee period, which will be one year from the date of commissioning of equipment/ completion of work and/or rectification of any defect which may be detected in the individual equipment for the whole system under the contract, whichever is later.

In addition, all types of manufacturers guarantee/warranty wherever applicable are to be issued/ revalidated in the name of the owner by the contractual agency and will be covered with relevant counter guarantee. Bank guarantees furnished against Performance Security and Retention Money shall be validated for a period 90 days beyond the guarantee period.

5. Deviations/Variations in Quantities and Pricing.

The quantities given in the “Schedule of Quantities" are based on estimates and are meant to indicate the extent of the work and to provide a uniform basis for tendering and any variation either by addition or omission shall not vitiate the contract.

5.1 The company through its Engineer-in-Charge or his representative shall, without radically changing the original scope and nature of the work, under contract, have power to make any alterations in or additions to or substitution of the original specifications, drawings, designs and instructions that may appear to be necessary or advisable during the progress of the work.

The contractor shall be bound to carry out the work(s) in accordance with the instructions given to him in writing by the Engineer-in-Charge or his representative on behalf of the

company. Such altered or additional or substituted work, which shall form part of the original contract, shall be carried out by the contractor on the same terms and conditions in all respects on which they agreed to do the main work and at the same rate/rates as are specified in the contract/ work-order.

5.2 The right is reserved to cancel any items of work included in the contract agreement or portion thereof in any stage of execution if found necessary to the work and such omission shall not be a waiver of any condition of the contract nor invalidate any of the provisions thereof.

5.3 If the additional, altered or substituted work includes any class of work for which rate/rates is/are not specified in the contract/work order, rates for such items shall be determined by the Engineer-in-Charge as follows:

a) In the case of percentage tenders, if the rate for the extra item of work executed is available in the company's approved SOR, it will be paid at the schedule rate plus or minus the accepted percentage as per contract.

However, if the extra item is not available in company's approved SOR, then the rate for such extra item(s) shall be dealt as at (c) below.

b) In case of item rate tenders, the rate for extra item shall be derived from the rate for similar item or near similar item / class of work available in the agreement schedule of work or by analysis of rates as at below and the lower rate out of the above two shall be considered.

In case of composite item rate tenders, where two or more schedule of quantities for similar item description may form part of the contract, the applicable rates shall be taken from the Schedule of Quantities of that particular part in which the deviation is involved, failing that at the lowest applicable rate for the similar item of work in the other schedule of quantities.

For derivation of rates based on analysis, the same shall be done by analysis on prevalent market rate of materials and labour based on standard norms of analysis of rate of C.P.W.D/ N.B.O.

c) In the case of extra item(s) that are completely new, and are in addition to the items contained in the contract, the contractor may within 15 days of receipt of order or occurrence of the item(s) claim rates, supported by proper analysis. The Engineer-in-

Charge shall determine the rate(s) by analysis based on prevalent market rate of material and labour and on standard norms of analysis of rate of CPWD / NBO.

d) In case of combined tender with partly item rate for non-schedule items & partly percentage tenders for SOR items, the rate for extra item shall be derived as at (b) & (c) above in case of non-schedule items rates and in case of percentage rates for SOR items the rate for extra item shall be derived as at (a) above.

In case of any difference between the contractor and the Engineer-In Charge as to the fixation of rates, the matter shall be referred to the accepting authority of the company i.e. GM(C) of the company or Staff Officer(C) for the work awarded at Company Hqrs. level and Area level respectively, whose decision shall be final and binding on the contractor.

5.4 Alteration in the quantities shall not be considered as a change in the condition of the contract nor invalidate any of the provision thereof provided that a deviation estimate / revised estimate / supplementary agreement for the item(s) involved is made. Such approval shall be from appropriate authority.

5.5 Payment for such deviated items [additional/ altered / substituted items of work of the agreement schedule] shall be made in the contractors running on account bills, till the revised estimate / deviation estimate regularizing these items are sanctioned by the competent authority of the company, at the provisional rates and shall not exceed :

a) 75% of the rate recommended by the Engineer-in-Charge to the accepting authority of the company i.e. GM(C) of the company or SO(C) of the Area, if the rate is directly available in the SOR of the company/ if the rate is derived from available rate of BOQ.

b) 50% of the rate recommended by the Engineer-in-Charge to the accepting authority of the company, i.e. GM(C) of the company or SO(C) of the Area , if it is analysed item rates based on prevalent market rates of materials and labour following CPWD / NBO norms.

Total payment for such extra items of work shall not exceed 10% of work order / agreement value / approved deviation estimate value. Also total payment including extra items of work shall not exceed the work order / agreement / approved deviation estimate value.

5.6 PROVISIONS FOR DEALING WITH VARIATIONS IN RESPECT OF ABNORMALLY HIGH RATE AND ABNORMALLY LOW RATE ITEMS.

The abnormally high rate items are those whose quoted rates are more than 20% of the justified rates decided by the owner.

The abnormally low rate items are those whose quoted rates are less than 20% of the justified rates decided by the owner.

In case of Item Rate Tenders, the revision of rates for (i) abnormally high rate items and (ii) abnormally low rate items, shall become operative under the following circumstances:-

For increase in quantity of more than 25% in respect of works executed below plinth level and 10% in respect of works executed above plinth level.

Quantity variation beyond the limit mentioned above shall be dealt by arriving at new rate based on prevalent market rate of materials and labour analysed as per standard analysis of rate of CPWD/NBO. Payment of extra quantity over the permitted quantity as explained above would be made on the basis of the new analysed rate.

The variation in quantity of abnormally low rate items for item rate tenders shall not be permitted below 25% for the items below plinth level and below 10% for the items above plinth level of the agreement schedule quantity, but in exceptional cases with written consent of Engineer-in-Charge arising out of technical necessity.

The above provisions shall be applicable for item rate tenders only and not applicable for percentage rate tenders for works based on standard schedule of rates of the company.

For the purpose of operation, the following works shall be treated as works related to foundation, unless otherwise defined in the contract.

a) For Buildings: All works up to 1.2 metres above ground level or up to floor 1 level whichever is lower.

b) For abutments, piers and well steining : All works up to 1.2m above the bed level.

c) For retaining walls, wing walls, compound walls, chimneys, overhead reservoirs / tanks and other elevated structures: all works up to 1.2 metres above the ground level.

d) For reservoirs / tanks (other than overhead reservoirs / tanks): All works up to 1.2 metres above the ground level.

e) For basement : all works up to 1.2m above ground level or up to floor 1 level whichever is lower.

For Roads, all items of excavation and filling including treatment of sub base

5.7 The time of completion of the originally contracted work shall be extended by the company in the event of any deviation resulting in additional cost over the awarded value, if requested by the contractor as follows:-

(i) In the proportion which the additional cost of the altered, additional or substituted work (in value) bears to the original tendered value plus.

(ii) 25% of the time calculated in (i) above or such further additional time as may be consideredreasonable by the Engineer-in-Charge.

5.8 The company through its Engineer-in-Charge or his representative, on behalf of the company, shall have power to omit any part of the work in case of non-availability of a portion of the site or for any other reason and the contractor shall be bound to carry out the rest of the work in accordance with the instructions given by the Engineer-in-Charge. No claim from the Contractor shall be entertained/ accepted on these grounds.

5.9 In the event of any deviation being ordered which in the opinion of the contractor changes radically the original scope/nature of the contract, the contractor shall under no circumstances suspend the work, either original or altered or substituted, and the dispute/disagreement as to the nature of deviation and the rate/rates to be paid for such deviations shall be resolved separately with the company as per the procedures/ norms laid down hereafter.

6. Time for Completion of Contract, Extension thereof, Defaults and Compensation for Delay

Time is the essence of the contract and as such all works shall be completed within the time stipulated in the contract/ work order. The work shall, throughout the stipulated period of contract, be carried out with all due diligence on the part of the contractor. Immediately after the contract is concluded i.e. LOA / Work Order is issued, the Engineer-in-Charge and the contractor shall agree upon a detailed time and progress chart prepared based on BAR CHART/ PERT CPM techniques on the basis of a

construction schedule submitted by the contractor at the time of executing contract showing the order in which the work is proposed to be carried out within the time specified in the LOA /work order.

For the purpose of this detailed time and progress chart, the work shall be deemed to have commenced on the expiry of 10* (ten) days from the issue of Letter of Acceptance of Tender or 7(seven) days after handing over the site of work or handing over reasonable number of working drawings to the contractor or the period of mobilization allowed in the work order for starting the work in special circumstances, whichever is later.

* For Specialized Works/ High Value Works (above Rs. 5 crores), the period shall be 30 days.

6.1 If the contractor, without reasonable cause or valid reasons, commits default in commencing the work within the aforesaid time limit, the company shall, without prejudice to any other right or remedy, be at liberty, by giving 15 day's notice in writing to the contractor to commence the work, failing which to forfeit the Earnest Money deposited by him and to rescind the Letter of Acceptance of Tender/Work Order and also to debar the contractor to take part in the future re-tender.

The Company may debar such defaulting Contractors from participating in future Tenders for a minimum period of 12(twelve) months.

6.2 If the contractor fails to complete the work and clear the site on or before the date of completion or extended date of completion, he shall without prejudice to any other right or remedy available under the law to the company on account of such breach, pay as compensation (Liquidated Damages):

i) @ half percent (½ %) of the contract amount/Revised Contract amount plus GST applicable, whichever is less, per week ofdelay.

OR

ii) ½ % of the contract-value of group of items/ revised completion value of group of items plus GST applicable, whichever is less, per week of delay, for which a separate period of completion is originally given.

The aggregate of such compensation/ compensations shall not exceed:

i)10% (ten) percent of the total amount of the contract/ Revised contract amount plus GST applicable,, whichever is less.

OR

ii) 10% of the contract-value of group of items/ revised completion value of group of items plus GST applicable, whichever is less, for which a separate period of completion is originally given.

The amount of compensation may be adjusted or set off against any sum payable to the contractor under this or any other contract with the company.

6.2.1 The company, if satisfied, that the works can be completed by the contractor within a reasonable time after the specified time of completion, may allow further extension of time at its discretion with or without the levy of L.D. In the event of extension granted being with L.D, the company will be entitled without prejudice to any other right or remedy available in that behalf, to recover from the contractor as agreed damages equivalent to half percent of the contract value of the works for each week or part of the week subject to a ceiling as described at Cl.6.2.

6.2.2 The company, if not satisfied that the works can be completed by the contractor, and in the event of failure on the part of the contractor to complete work within further extension of time allowed as aforesaid, shall be entitled, without prejudice to any other right, or remedy available in that behalf, to rescind the contract.

6.2.3 The company, if not satisfied with the progress of the contract and in the event of failure of the contractor to recoup the delays in the mutually agreed time frame, shall be entitled to terminate the contract.

6.2.4 In the event of such termination of the contract as described in clauses 6.2.2 or 6.2.3 or both, the company, shall be entitled to impose penalty/LD as deliberated at Clause 10. Additionally the contractor shall be debarred from participating in the future tenders for a minimum period of 12 months.

6.3 The company may at its sole discretion, waive the payment of compensation on request received from the contractor indicating valid and acceptable reasons if the entire work is completed within the date as specified in the contract/work order or as validly extended date without stipulating any compensation for delay.

6.4 Extension of date of completion: On occurrences of any events causing delay as stated

here-under, the contractor shall intimate immediately in writing to the Engineer-in-Charge.

a) Force Majeure:

i) Natural phenomena like unprecedented flood and draught, earthquakes & epidemics.

ii) Political upheaval, civil commotion, strikes, lockouts, acts of any Govt. (domestic/foreign) including but not limited to war, proprieties, and quarantine embargoes.

The successful bidder/ contractor will advise in the event of his having to resort to this clause by a registered letter duly certified by the local chamber of commerce or statutory authorities, the beginning and end of the cause of delay, within fifteen days of the occurrence and cessation of such Force Majeure condition.

In the event of delay due to Force Majeure for more than one month the contract may be terminated at the discretion of the company. Termination under such circumstances will be without any liability on either side.

For delays arising out of Force Majeure, the bidder / contractor will not claim extension in completion date for a period exceeding the period of delay attributable to the clauses of Force Majeure and neither company nor bidder / contractor shall be liable to pay extra cost (like increase in rates, remobilization advance, idle charges for labour and materials etc.) provided it is mutually established that Force majeure conditions did actually exists.

b) Serious loss or damage by fire and abnormally bad weather.

c) Non-availability of stores which are the responsibility of the company to supply as per contract.

d) Non-availability of working drawings in time, which are to be made available by the company as per contract during progress of the work.

e) Delay on the part of the contractors or tradesmen engaged by the company not forming part of the contract, holding up further progress of the work.

f) Non-availability or breakdown of tools and plant to be made available or made available by thecompany.

g) The execution of any modified or additional items of work or excess quantity of work.

h) Any other causes which, at the sole discretion of the company, is beyond the control of the contractor.

6.4.1 A HINDRANCE REGISTER shall be maintained by both department and the contractor at site to record the various hindrances, as stated above, encountered during the course of execution.

Hindrance register will be signed by both the parties. The contractor may also record his observations in the Hindrance Register. In case the contractor has a different opinion for hindrance and a dispute arises then the matter would be referred to the EIC and or the next higher authority whose decision would be final & binding on the contractor & the decision to be communicated within 15 days.

6.4.2The contractor shall request the company in writing for extension of time within 15 days of happening of such event causing delay stating also, the period for which extension is required. The company may, considering the genuinity of the request, give a reasonable extension of time for completion of the work. Such extension shall be communicated to the contractor in writing by the company through the Engineer-in-Charge within 1(one) month of the date of receipt of such request.

6.4.3 The opinion of the Engineer-in-charge, whether the grounds shown for the extension of time are or are not reasonable, is final. If the Engineer-in-charge is of the opinion that the grounds shown by the contractor are not reasonable and declines to the grant of extension to time, the contractor cannot challenge the soundness of the opinion.

The opinion of the Engineer-in-charge that the period of extension granted by him is proper or necessary is not, however, final. If the contractor feels that the period of extension granted is inadequate he can appeal to the GM(Civil)/ CM(Civil) of the company for consideration on the question whether the period of extension is or is not proper or necessary.

6.4.4 Provisional extension of time may also be granted by the Engineer-in-Charge during the course of execution, on written request for extension of time within 15(fifteen) days of happening of such events as stated above, reserving the company's right to impose/ waive penalty at the time of granting final extension of time as per contract agreement.

6.4.5 When the period fixed for the completion of the contract is about to expire, the question of extension of the contract may be considered at the instance of the Contractor or the Department or of both. The extension will have to be by party's agreement, express or

implied.

In case the contractor does not apply for grant of extension of time within 15(fifteen) days of the hindrance occurring in execution of the work and the department wants to continue with the work beyond the stipulated date of completion for reason of the work having been unavoidably hindered, the Engineer-in-charge can grant extension of time even in the absence of application from the contractor.

Such extension of time granted by the Engineer-in-Charge is valid provided the contractor accepts the same either expressly or implied by his actions before and subsequent to the date of completion. Such extension of time shall be without prejudice to Company's right to levy compensation under the relevant clause of the contract.

The contractor shall however use his best efforts to prevent or make good the delay by putting his endeavors constantly as may be reasonably required of him to the satisfaction of the Engineer-in-Charge.

7. Material Supply & other facilities :

The contractor shall at his own expense, provide all materials required for the work, unless otherwise specified, and the rates quoted by the contractor shall be for finished work inclusive of all materials required for completion of the work as specified in the contract.

* The company may, of its own or at the request of the contractor, supply such materials as may be specified, if available, at rate/rates to be fixed by the Engineer-in-charge.

7.1 For the materials which the company has agreed to supply for the contract, the contractor shall give in writing of his requirements in accordance with the agreed phased programme to the Engineer-in-charge sufficiently in advance.

The value of materials so supplied shall be set off or deducted from the payment to be made for the items of work in which such materials have been consumed, or from any sum then due or to become due to the contractor thereafter.

7.2* The company will supply steel both reinforcement and structural and cement at the following rates inclusive of all taxes. The contractor shall bear all the cost for transportation; handling and storage from the issuing store of the company to contractor's work site store.

i) Reinforcement Steel *:-

a) M.S. Round : Rs.

b) Tor Steel : Rs.

c) Structural Steel : Rs.

ii) Cement * : Rs.

[* delete whichever is not applicable]

7.3 If the steel is issued by the department, the wastage of steel shall be the barest minimum. The wastage allowed from theoretical quantity will be upto a maximum of 5% to cover the wastage due to cutting into pieces, bending and other factors. No cut pieces or scrap less than 2 mtr. in length will be taken by the department. Efforts should be made to use the cut pieces of 2 mtr. or above length as far as possible.

If the wastage of steel is more than the permissible variation mentioned above the cost of excess wastage made by the contractor shall be recovered at double the issue rates indicated above, or 115% of prevailing market rate along with GST and any other Tax applicable during the period of work, whichever is more.

No allowances shall be entertained on account of Rolling Margin for the steel either issued by the department or procured by the contractor.

7.4 If the cement is issued by the department, the variation of 5% will be permitted over the theoretical consumption of cement for value of work upto Rs.10.00 lakhs and 3% for value of work above Rs.10.00 lakhs. In the event of cement consumed is more/less than specified above, the recovery for the quantity of cement consumed in excess or less than the specified quantity shall be made at double the issue rate or 115% of prevailing market rate along with GST and any other Tax applicable during the period of work, whichever is more

7.5 In case the department is not able to supply cement/steel as per the provisions of the contract, the Engineer-in-Charge may allow, with the approval of GM/HOD(Civil) of the company, the contractor in writing for procurement of cement/ steel from the approved sources and the extra on this account including transport charges, if any, over the issue rate shall be reimbursed to the contractor on production of authentic documents. Transportation of cement/ steel from the place of purchase to the site of work and proper

storage of cement/steel at site shall be contractor's responsibility. He should maintain proper account of cement/steel issued/procured by him and should allow inspection of his godown and his cement/steel account by the concerned Engineer-in-charge or any other authorized officers of the company. Contractor should draw materials from the company on the basis of actual requirement as assessed by the Engineer-in-Charge on "as and when required" basis.

7.6 Recovery of cost of materials issued on sale A/c will be made as per actual consumption basis but the Engineer-in-Charge will have the discretion for making full recovery while processing a particular bill or asking for the return of the balance materials if the work is not progressing satisfactorily.

The contractor shall keep accurate record of materials issued by the company, maintain proper account for the materials received and consumed in the work and shall be open to check by the Engineer-in-Charge or his authorized representative. The contractor shall ensure that such materials are consumed for the contract works only and the Register for the aforesaid account shall be signed both by the representatives of Engineer In Charge and the contractor.

7.7 All materials, tools and plants brought to site by the contractor including the materials supplied by the company shall be deemed to be held in lien by the company and the contractor shall not have the right to remove the same from the site, without the written permission of the Engineer-in-Charge. The company shall not however be liable for any loss, theft or damage due to fire or other cause during this period of lien, the responsibility for which shall lie entirely on the contractor.

7.8 The contractor shall bear the cost of loading, transportation to site, unloading, storing under cover as required etc. as may be necessary for the use and keeping the materials in good condition.

7.9 Any surplus materials issued by the company, remaining after completion or termination of the contract, shall be returned by the contractor at his cost to the place of issue and the Engineer-in-Charge shall accept the same at the rate not exceeding the rate at which these were originally issued taking into consideration the deterioration or damage, if any, that may have been caused during the custody of the contractor. In the event, the contractor fails to return the surplus materials out of those supplied by the company, the Engineer-in-Charge may, in addition to any other liability which the contractor would incur in this regard, by giving notice in writing require the contractor to pay the amount

at double the issue rate for such unreturned surplus materials or 115% of the prevailing market rate along with GST and any other Tax applicable during the period of work, whichever is more

7.10 On completion or on termination of the contract and on complete recovery of secured advance paid by the company, if any, in respect of materials brought to site, the contractor with due permission of the Engineer-in-Charge shall be entitled to remove at his expenses all surplus materials originally supplied by him and upon such removal, the same shall become the property of the contractor.

7.11 All charges on account of GST or any other applicable taxes, duties or levies on materials obtained for the works from any source (excluding materials supplied by the company) shall be borne by the contractor. This clause may be read in conjunction with 13 (ix) of condition of contract

7.12 The contractor shall arrange necessary electricity at his own cost for the work and his own establishment. However, if available and feasible the company may arrange electricity at one point near the work site and necessary recovery of cost of energy consumed will be made at rates prescribed by the company from time to time. Energy meter for this purpose shall be provided by the contractor.

7.13 The contractor shall arrange necessary water for the work and his own establishment and nothing extra will be paid for the same. Such water used by the contractor shall be fit for construction purposes. However, if available and feasible the company may arrange water, at the written request of the contractor, to the extent possible, at one point near the work site for which recovery @ 1% of the contract value of work done will be made from the contractor's bills. The contractor shall make his own arrangement of water connection and laying of pipe lines from main source of supply. Department do not guarantee to maintain uninterrupted supply of water. No claim of damage or refund of water charges will be entertained on account of such break down.

7.14 Explosives, detonators and other inflammable materials shall not be used in the execution of the work at site by the contractor without prior written permission of the Engineer-in-Charge. Transportation and storage of such materials shall be done in specified manner in accordance with the law in force. The contractor shall also obtain license under such laws for, transportation, storage, use and all other operations, connected with the handling of the same.

8. Quality Assurance - Materials and Workmanship

The contractor shall carry out and complete the work in every respect in accordance with the contract and shall ensure that the work conforms strictly to the drawings, specifications, (as enclosed or in absence of enclosed specifications current CPWD/BIS specifications) instructions of the Engineer-in-Charge. The Engineer-in-Charge may issue, from time to time, further drawings, detailed instructions/ directions in writing to the contractor. All such drawings, instructions/directions shall be consistent with the contract documents and should be reasonably inferable there from, along with clarifications/ explanations thereof, if necessary. However, the contractor will be solely responsible for design and erection of all temporary structures required in connection with the work.

8.1 For Quality Assurances of all the Civil Engineering Works the norms/ guidelines laid down by the company herein and elsewhere will form part of the contract for the purpose of quality of works.

8.2 The contractor shall be responsible for correct and complete execution of the work in a workman like manner with the materials as per specification which shall be subject to the approval of the company. All work under execution in pursuance of the contract shall be open to inspection and supervision by the Engineer-in-Charge or by his authorized representative or any other official of higher rank or any other person authorized by the company in his behalf & the contractor shall allow the same.

8.3 All materials to be provided by the contractor shall be in conformity with the specifications/schedule of work as per the contract and the contractor shall furnish proof, if so required by the Engineer-in-Charge to his satisfaction that the materials do so comply.

8.4 The contractor shall immediately after the award of work draw up a schedule giving dates for submission of samples as required or necessary as per the specification for approval of Engineer-in-Charge who shall approve, if found acceptable, promptly so that there is no delay in the progress of the work of the contractor or of the work of any of the sub-contractor.

On receipt of samples as per schedule, the Engineer-in-Charge shall arrange to examine/test with reasonable promptness ensuring conformity of the samples with the required specification and complying with the requirements as per contract documents

keeping in view that the work shall be in accordance with the samples approved by him. The contractor shall be bound to furnish fresh sample, if disapproved by the Engineer-in-Charge, for his approval. The contractor shall not start bringing materials at the site unless the respective samples are approved. Materials conforming to approved samples shall only be brought to site. However, Engineer-in-Charge's approval for any sample, design / drawings (permanent / temporary structures) shall not alter contractor's full responsibility whatsoever for the performance and safety of the executed job.

Samples are to be supplied by the contractor at his own cost. The cost involved in tests shall be borne bythe contractor. If any test is ordered by the Engineer-in-Charge which is to be carried out by any independent person or agency at any place other than the site even then the cost of materials and testing charge etc. shall be borne by the contractor. If the test shows that the materials are not in accordance with the specifications, the said materials shall not be used in the work and removed from the site at contractorscost.

8.5 The company, through the Engineer-in-Charge, shall have full powers to reject any materials or work due to a defect therein for not conforming to the required specification, or for materials not being of the required quality and standard or for reasons of poor workmanship or for not being in accordance with the sample approved by him. The contractor shall forthwith remedy the defect/replace the materials at his expense and no further work shall be done pending such rectification/replacement of materials, if so instructed by the Engineer-in-Charge.

In case of default on the part of the contractor, the Engineer-in-Charge shall be at liberty to procure the proper materials for replacement and/or to carry out the rectifications in any manner considered advisable under the circumstances and the entire cost & delay for such procurement/rectification shall be borne by thecontractor.

8.6 The Engineer-in-Charge shall be entitled to have tests carried out for any materials, according to the standard practice followed for such tests, other than those for which satisfactory proof has already been furnished by the contractor who shall provide at his expense all facilities which the Engineer-in-Charge may require for the purpose. All such expenses born by the contractor are not to be paid separately by the employer and shall be assumed covered in accepted prices.

The cost of any other tests, if so required by the Engineer-in-Charge, shall be borne by the company. However if the test shows the workmanship or materials not to be in

accordance with the provision of the contract or the instruction of Engineer-in-Charge the cost shall be borne by the contractor. .

8.7 Access to the works: The Engineer-in-charge and any person authorized by the company 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 are being obtained for the works and the contractor shall afford every facility for and every assistance in or in obtaining the right to such access.

8.8 Inspection of works:

i) No work shall be covered up or put out of view without the approval of the Engineer-in-charge or the Engineer-in-charge's representative or any other officer nominated by the company for the purpose and the contractor shall afford full opportunity for the EIC or EIC`s representative or any other officer nominated by the company for the purpose to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. the contractor shall give due notice to the Engineer-in-charge's representative whenever any such work or foundations is ready or about to be ready for examination and the Engineer-in-charge's representative shall, without unreasonable delay, unless he considers it unnecessary and advises the contractor accordingly, attend for the purpose of examining and measuring such work or foundations.

ii) The contractor shall uncover any part or parts of the works or making openings in or through the same as the Engineer-in-Charge may from time to time direct and shall reinstate and make good such part or parts to the satisfaction of Engineer-in-charge.

If any such part or parts have been covered up or put out of view after compliance with the requirement of sub-clause above and are found to be executed in accordance with the contract, the expenses of uncovering, making openings in or through and making good the same shall be borne by the Employer, but in any other cases all costs shall be borne by the contractor.

8.9 Removal of Improper Work and Materials:

i) The Engineer-in-charge shall during the progress of the works have power to order in writing from time to time:

a) The removal from the site, of any materials which in the opinion of Engineer-in-charge,

are not in accordance with the contract/ work order/ approved sample.

b) The substitution with proper and suitable materials.

c) The removal and proper re-execution, notwithstanding any previous test thereof or interim payment there from, of any work which in respect of materials or workmanship is not in accordance with the contract.

ii) In case of default on the part of the contractor in carrying out such order, the Engineer-in -charge shall be entitled to employ and pay other agency to carry out the same and all expenses consequent thereon shall be recoverable from the contractor or may be deducted from any amount due or which may become due to the contractor.

8.10 Devaluation of Work : In lieu of rejecting work done or materials supplied not in conformity with the contract/work order/approved samples, the Engineer-in-charge or any other officer nominated by the company for the purpose may allow such work or materials to remain, provided the Engineer-in-Charge/ the officer nominated by the company is satisfied with the quality of any materials, or the strength and structural safety of the work, and in that case shall make such deduction for the difference in value, as in his opinion may be reasonable.

8.11 Final Inspection of Work: The Engineer-in-charge and any other officer nominated by the company for the purpose shall make final inspection of all work included in the contract/work order, or any portion thereof, or any completed structure forming part of the work of the contract, as soon as practicable after notification by the contractor that the work is completed and ready for acceptance. If the work is not acceptable to the Engineer-in-charge at the time of such inspection, he shall inform the contractor in writing as to the particular defects to be remedied before final acceptance can be made.

8.12 Defects appearing after acceptance: Any defects which may appear within the defect liability period and arising, in the opinion of the Engineer-in-charge, from lack of conformance with the drawings and specifications, shall, if so required by the Engineer-in-charge in writing, be remedied by the contractor at his own cost within the time stipulated by the Engineer-in-charge. If the contractor fails to comply, the Engineer-in-charge may employ other persons to remedy the defects and recover the cost thereof from the dues of the contractor.

8.13 Site Order Book : A Site Order Book is a Register duly certified by the Engineer-in-

charge regarding number of pages it contains, each page being numbered, name of work, name of contractor, reference of contract/ work order and the aforesaid certificate should be recorded on its first page.

Site Order Books shall be maintained on the sites of works and should never be removed there from under any circumstances. It shall be the property of the company. The Engineer-in-Charge or his authorized representative shall duly record his observations regarding any work which needs action on the part of the contractor like, improvement in the quality of work, failure to adhere to the scheduled programme etc. as per contract/work order. The contractor shall promptly sign the site order book and note the orders given therein by the EIC or his representative and comply with them. The compliance shall be reported by the contractor in writing to EIC in time so that it can be checked.

The Site Order Book will be consulted by the Engineer-in-Charge at the time of making both running on account and final bills of the contractor. A certificate to this effect should be given in the Measurement books by the Engineer-in-Charge or his representative.

8.14 Samples and Testing of Materials: All the materials to be procured by the contractor and to be used in work shall be approved by the Engineer-in-Charge in advance, and shall pass the tests and analysis required by him, which will be as specified in the specifications of the items concerned and or as specified by BIS or the IRC / MORTH standard specifications acceptable to the Engineer-in-Charge. The method of sampling and testing shall be as per the relevant BIS, IRC/ MORTH and other relevant standards and practices. Minor minerals like sand, stone chips etc. shall be conforming to relevant BIS standards. All bought out items including Cement and Steel shall be procured from such manufacturers who hold valid license conforming to relevant BIS standards for manufacturing of such items.

8.15 Storage of Materials: Materials shall be so stored as to ensure the preservation of the quality and fitness for the work. When considered necessary by the Engineer-in-charge, they shall be placed on wooden platforms or other hard, clean surfaces and not directly on the ground.

Materials shall be placed under cover when so directed and the contractor shall erect and maintain at his own cost temporary weather-proof sheds at the work site for the purpose. Stored materials shall be so located as to facilitate prompt inspection. All stored materials shall be inspected at the time of use in the work, even though they may

have been inspected and approved before being placed in storage or during storage.

8.16 Defective Materials: All materials not conforming to the requirements of the specifications shall be considered as defective, and all such materials, whether in place or not shall be rejected. They shall be removed immediately by the contractor at his expenses and replaced with acceptable material.

No rejected material, the defects of which have been subsequently corrected, shall be used on the work until approval in writing has been given by the Engineer-in-Charge. Upon failure on the part of the contractor to comply with any instruction of the Engineer-in-charge made under the provisions of this article within the time stipulated by the Engineer-in-charge, the Engineer-in-charge shall have authority to remove and replace defective material and recover the cost of removal and replacement from the contractor.

Further all such defective material lying at site not removed and replaced within 30 days after issue of notice by the Engineer-in-charge, if the Engineer-in-charge so decides shall dispose off such material in any manner without any further written notice to the contractor.

9. Measurement and Payments

Except where any general or detailed description of the work in the Bill of Quantities or specifications of the contract/ work order provides otherwise, measurement of work done shall be taken in accordance with the relevant standard method of measurement published by the Bureau of Indian Standards (BIS) and if not covered by the above, other relevant Standards/practices shall be followed as per instructions of the Engineer-in-Charge.

9.1 All items of work carried out by the contractor in accordance with the provision of the contract having a financial value shall be entered in the Measurement Book as prescribed by the company so that a complete record of the measurements is available for all the works executed under the contract and the value of the work executed can be ascertained and determined there from. Measurements of completed work / portion of completed work shall be recorded only in the Measurement Books.

9.2 Measurement shall be taken jointly by the Engineer-in-Charge or his authorized representative and by the contractor or his authorized representative.

9.3 Before taking measurements of any work, the Engineer-in-Charge or the person deputed

by him for the purpose shall intimate the contractor to attend or to send his representative to attend the measurement. Every measurement thus taken shall be signed and dated by both the parties on the site on completion of the measurement. If the contractor objects to any measurements, a note to that effect shall be made in the Measurement Book / Log Book and signed and dated by both the parties.

9.4 The measurement of the portion of work/items of work objected to, shall be re-measured by the Engineer-in-Charge himself or the authority nominated by the company for the purpose in the presence of the contractor or his authorized representative and recorded in the M.B. which shall be signed and dated by both the parties. Measurements so recorded shall be final and binding upon the contractor and no claim whatsoever shall thereafter be entertained.

In case the contractor or his authorized representative does not attend to the joint measurements at the prefixed date and time after due notice, the measurements taken by the Engineer-in-Charge or his representative shall be final and binding on the contractor.

Measurement of the extra items of work or excess quantities of work duly authorized in writing by the Engineer-in-Charge shall also be taken and recorded in the M.B. based on the existing items in the SOR of the company and if such items do not exist in the company's SOR, the description of the work shall be as per actual execution. Payment for such extra items will be based on the rates to be derived as described in the relevant clauses of the contract/ work-order.

9.5 No work shall be covered up or put out of view without the approval by the Engineer-in-Charge and recording of measurements and check measurement thereof duly accepted by the contractor. The contractor shall provide full opportunity to the Engineer-in-Charge or his representative to examine and measure all works to be covered up and to examine the foundations before covering up.

The contractor shall also give notice to Engineer-in-Charge whenever such works or foundations are ready for examination and the Engineer-in-Charge shall without unreasonable delay arrange to inspect and to record the measurements, if the work is acceptable and advise the contractor regarding covering of such works or foundations.

9.6 In case of items which are claimed by the contractor but are not admissible according to the department, measurements of such items, will be taken for record purposes only

and without prejudice so that in case it is subsequently decided by the department to admit the contractor's claims, there should be no difficulty in determining the quantities of such work. A suitable remark should, however, be made against such measurements to guard against payment in the ordinary way.

9.7 Payments: The running on account payments may be made once in a month or at intervals stipulated in the work order/ contract agreement.

9.7.01 Running on account bill/bills for the work executed/ materials supplied in accordance with the work order/ contract shall be prepared on the basis of detailed measurements recorded as described hereinbefore and processed for payments.

9.7.02 Payment of on account bill shall be made on the Engineer-in-Charge's certifying the sum to which the contractor is considered entitled by way of interim payment for the following :

a) The work executed as covered by the bill/bills after deducting the amount already paid, the security deposit and such other amounts as may be deductible or recoverable in terms of the work order/ contract.

b) (i) Payment for excess quantity of work done with the written instructions of the Engineer-in-Charge for items already appearing in the bill of quantities of work with approved rates, will be made along with the on account bills only up to 10% of the quantity provided in the agreement subject to overall value of work not exceeding the agreement value.

(ii) The GM(Civil) of the company and / or the Staff Officer(C) of the Area may authorize interim payment for excess work done up to 20 % of the quantity of work provided in the Bill of Quantity of the work awarded from Company level and Area level respectively subject to overall value of work done does not exceed the contract value. This however, shall not be applicable for High Value Items.

c) Extra items of work executed will be paid on specific written authorization of GM(C) of the company or Staff Officer (Civil) of the Area provided that the value of such extra items of work when added together is not more than 10% of the contract value and the total gross payment including excess quantity does not exceed the contract value.

Balance amount on account of excess quantity and extra items of work executed shall be paid after the deviation estimate / revised estimate regularizing the extra items and

excess quantities of work is sanctioned by the competent authority of the company with the concurrence of the Finance Department of the company.

d) On the Engineer-in-Charge's certificate of completion in respect of the work covered by the contract / final measurements of the work certified by the Engineer In Charge or his representative.

9.7.03 The measurements shall be entered in the M.B for the work done up to the date of completion and evaluated based on the approved rates for the items in the contract agreement/sanctioned revised estimate. In case of extra items of work, the rates shall be derived as stated in the relevant clause of the contract.

The payments shall be released against the final bill subject to all deductions which may be made on account of materials supplied, water supply for construction, supply of electricity and any other dues payable by the contractor to the company, and further subject to the contractor having given to the Engineer-in-Charge a no claim certificate.

The contractor shall indemnify the company against proof of depositing royalty on account of minor minerals used in the work before the final bill is processed for payments. The final payment to be made will also be subject to Clause-4.6 & 4.7 of the General Terms & Conditions of the contract.

9.7.04 Any certificate given by the Engineer-in-Charge for the purpose of payment of interim bill/bills shall not of itself be conclusive evidence that any work/materials to which it relate is/are in accordance with the contract and may be modified or corrected by the Engineer-in-Charge by any subsequent certificate or by the final certificate.

9.7.05 The company reserve the right to recover/enforce recovery of any overpayments detected after the payment as a result of post payment audit or technical examination or by any other means, notwithstanding the fact that the amount of disputed claims, if any, of the contractor exceeds the amount of such overpayment and irrespective of the facts whether such disputed claims of the contractor are the subject matter of arbitration or not.

The amount of such overpayments shall be recovered from subsequent bills under the contract, failing that from contractor's claim under any other contract with the company or form the contractor's security deposit or the contractor shall pay the amount of over payment on demand. In case of contractor's non-payment on such demand, the same should be realised from the contractor's dues, if any, with Coal India Limited or any of

its subsidiaries.

9.7.06 The contractors are required to execute all works satisfactorily and according to the specifications laid down in the contract/ work order. If certain items of work, executed by the contractor, are below specifications, the contractor should re-do them according to the specifications and instructions of EIC and if the contractor fails to rectify the defect within the time and in the manner specified by the EIC, the work shall be got re-done or rectified by the department at the risk and cost of the contractor. Engineer-in-Charge may accept such work of below specifications provided the department is satisfied with the quality of such works and the strength/ structural safety of such works. In that case Engineer-in-Charge shall make such deductions for the difference in value, as in his opinion is reasonable and is approved by the accepting authority of the company i.e. GM/HoD(C) of the company in this case or any other officer nominated by GM/HoD(C) for the purpose.

9.7.07 Payment Stage: The payment stage involved will be as under,

i. Signature of Subordinate Engineer(Civil)/ EA(Civil)/ Sr. Overseer(C) / Overseer(C) in MB's bothin pages recording measurements, abstract of bill & the duly filled in bill form.

ii. Signature of Sr. Officer(C)/ Asstt. Manager(Civil) with appropriate check measurements in theMB's and the bill form.

iii. Signature of Dy. Manager(C)/ Manager(C) with appropriate check measurements in MB's andthe bill form.

iv. Signature of Engineer-in-Charge as per definition as at clause 1(vii) of the General Terms and Conditions, as a token of acceptance for payment of the bill. The EIC may sign in the abstract of the bill in the MB & the bill form. In between stage iii) and iv) accountal checking may be made by the concerned Accounts Officer/ Accountant.

(In case of non-availability of officials as at (i) above, company may authorize suitable executives for the works outlined at (i). Further for check measurement also company may authorize Executives based on availability.

9.7.08 Secured Advance: Secured advance can be paid for items of materials required for execution of the work and covered under categories A & B and supplied by the contractor at work site, supported by necessary vouchers, challans, test certificates etc. after execution of indemnity bond as per prescribed Form of the company on non-

judicial stamp paper of prescribed value.

This advance shall be recovered in four equal installments or as per consumption whichever is higher. Engineer-in-Charge shall recover at his discretion all or any part of secured advance paid, if in his opinion the work is not progressing satisfactorily or the security of these materials at site is not adequately taken care of by the contractor. Secured advance shall be payable for contracts of value above Rs.50.00 lakhs only.

Secured advance for structural steel sections, reinforcement steel and cement, collected at site, will be paid up to 75% of the corresponding stock yard prices of SAIL for the corresponding steel items and Govt. approved/ D.G.S.D. prices for cement, if the same exist.

In case of non-availability of Govt. approved prices of cement & steel and for the materials falling under Category - A and B the secured advance will be paid at the basic rate available in the approved schedule of rates of the company plus or minus the overall percentage on which the work was awarded, provided such rate is not more than 60% of the quoted rate of the contractor for the actual work.

At any point of time the outstanding recoverable secured advance shall not be more than 10% of the contract value.

Items against which secured advance can be granted:

Category-A

Civil:

1. Bricks.
2. Stone and brick aggregate.
3. Stones.
4. Finished products of brass, iron and steel such as doors & windows frames, wire mesh, gate, GI Sheets.
5. Pre-cast R.C.C. products such as pipes, jali, water storage tanks etc.
6. Doors & Window fittings.
7. Pipes and sanitary fittings of CI, SCI & HCI

Electrical :

1. Steel conduits
2. G.I. Pipes
3. I.C. Boards

4. Switchgears (Air circuit breakers and Air break switches)

5. C.I. Boxes.

6. A.C.S.R. Conductors

7. A.C. Plant & Machinery

8. Pumps

9. Generating sets (without oil)

10 any other items as per Engineer incharge

Items against which secured advance can be granted:

Category- B

Civil:

1. Glazed tiles, terrazzo tiles and similar articles.
2. Marble slabs.
3. Asbestos cements products.
4. Finished timber products such as doors, windows, flush doors, particle boards (subject to mandatory test being satisfactory) etc.
5. Bitumen in sealed drums.
6. Bitumen felt.
7. Polythene pipes and fittings and tanks.
8. Sanitary fittings and pipes of S.W., porcelain and chinaware materials
9. Laminated / Safety, one way vision, and bullet proof glasses.
10. Chemical required for anti-termite treatment (in sealed drums).
11. Paints, varnishes, distempers, pigment, spirits etc.

Electrical:

1. Transformers
2. Oil-filled switch gears.
3. L.T. &H.T. Cables
4. Fans
5. Storage and Dry Batteries
6. Insulation tapes.
7. Epoxy cable compounds.
8. Electric light fittings.
9. Wooden battens, casing & capping and wooden boards.
10. Flexible wires.
11. PVC materials.
12. Oil and lubricants.

13.Rubber materials.

14.Glass wool, thermocole & other insulating materials.

15.Porcelain H.T. and L.T. insulators.

In addition to indemnity bond, for materials listed under Category-B, the contractor shall be required to provide necessary insurance cover of equivalent value of materials.

Items against which no secured advance shall be granted:

Civil:

1. Glass products other than those indicated in Category-B.
2. Sand and moorum
3. Chemical compounds other than those indicated in Category-B.

Electrical:

1. Glass gloves and shades
2. Bulbs and tubes
3. Petrol and diesel
4. Freon and other refrigeration gases.

9.8 Income tax deduction @ 2% (Two percent) of the gross value (excluding GST) of each bill or at the rate as amended from time to time, shall be made unless exempted by the competent authority of the Income Tax Department.

Building and Construction Workers Cess (as applicable in States) shall be payable by the contractor. If, however, the company is asked to make deduction from the contractor's bills, the same shall be done and a certificate to this effect shall be issued to the contractor for dealing with the State Govt. and the company does not take any responsibility to do anything further in this regard.

9.9 No interest shall be payable on the amounts withheld, under the terms of the Contract Agreement/Work-order.

10 Termination, Cancellation, Suspension and Foreclosure of Contract

The company shall, in addition to other remedial steps to be taken as provided in the conditions of contract be entitled to cancel the contract in full or in part, and whether the date of completion has or has not elapsed, by notice in writing if the contractor:-

a) makes default in proceeding with the works with due diligence and continues to do so even after a notice in writing from the Engineer-in-Charge, then on the expiry of the period as specified in the notice

Or

b) commits default/breach in complying with any of the terms and conditions of the contract and does not remedy it or fails to take effective steps for the remedy to the satisfaction of the Engineer-in-Charge, then on the expiry of the period as may be specified by the Engineer-in-Charge in a notice in writing.

Or

c) obtains a contract with the company as a result of ring tendering or other non-bonafide methods of competitive tendering

Or

d) shall offer or give or agree to give any person in the service of the company or to any other person on his behalf any gift or consideration of any kind as an inducement or reward for act/acts of favour in relation to the obtaining or execution of this or any other contract for his company.

Or

e) fails to complete the work or items of work with individual dates of completion, on or before the date/dates of completion or as extended by the company, then on the expiry of the period as may be specified by the Engineer-in-Charge in a notice in writing.

Or

f) transfers, sublets, assigns the entire work or any portion thereof without the prior approval in writing from the Engineer-in-Charge. The Engineer-in-Charge may by giving a written notice, cancel the whole contract or portion of it in default.

10.1The contract shall also stand terminated under any of the following circumstances:

a) If the contractor being an individual in the case of proprietary concern or in the case of a partnership firm any of its partners is declared insolvent under the provisions of Insolvency Act for the time being inforce, or makes any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors amounting to proceedings for liquidation or composition under any Insolvency Act.

b) In the case of the contractor being a company, its affairs are under liquidation either

by a resolution passed by the contractors company or by an order of court, not being a voluntary liquidation proceedings for the purpose of amalgamation or reorganization, or a receiver or manager is appointed by the court on the application by the debenture holders of the contractor's company, if any.

c) If the contractor shall suffer an execution being levied on his/their goods, estates and allow it to be continued for a period of 21 (twenty-one) days.

d) On the death of the contractor being a proprietary concern or of any of the partners in the case of a partnership concern and the company is not satisfied that the legal representative of the deceased proprietor or the other surviving partners of the partnership concern are capable of carrying out and completing the contract. The decision of the company in this respect shall be final and binding which is to be intimated in writing to the legal representative or to the partnership concern.

10.2 On cancellation of the contract or on termination of the contract, the Engineer-in-charge shall have powers:

a. To take possession of the site, any materials, constructional plant, equipment, stores etc. thereon and carry out balance work through any means or through any other agency.

b. To give the contractor or his representative of the work 7 (seven) days notice in writing for taking final measurement for the works executed till the date of cancellation or termination of the contract. The Engineer-in-Charge shall fix the time for taking such final measurement and intimate the contractor in writing. The final measurement shall be carried out at the said appointed time notwithstanding whether the contractor is present or not. Any claim as regards measurement which the contractor is to make shall be made in writing within 7 (seven) days of taking final measurement by Engineer-In-charge as aforesaid and if no such claim is received, the contractor shall be deemed to have waived all claims regarding above measurements and any claim made thereafter shall not be entertained.

c. 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 unexecuted out of his hands and to give it to another contractor or take up departmentally, to complete the work. The contractor whose contract is terminated shall not be allowed to participate in future bidding for period of minimum twelve months.

In such an event, the contractor shall be liable for loss/damage suffered by the employer

because of action under this clause and to compensate for this loss or damage, the employer shall be entitled to recover higher of the following:

i) Forfeiture of security deposit comprising of performance guarantee and retention money and additional performance security, if any, at the disposal of the employer.

Or

ii) 20% of value of incomplete work. The value of the incomplete work shall be calculated for the items and quantities remaining incomplete (as per provision of agreement) at the agreement rates including price variation as applicable on the date, when notice in writing for termination of work was issued to the contractor.

The amount to be recovered from the contractor as determined above, shall, without prejudice to any other right or remedy available to the employer as per law or as per agreement, will be recovered from any money due to the contractor on any account or under any other contract and in the event of any shortfall, the contractor shall be liable to pay the same within 30 days. In case of failure to pay the same the amount shall be debt payable.

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 reasons of his having purchased materials, equipment or entered into agreement or made advances on any account or with a view to the execution of work or performance of the contract. And in case action is taken under any of provision aforesaid, the contractor shall not be entitled to recover or to 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 value payable in respect thereof and he shall only be entitled to be paid the value so certified.

The need for determination of the amount of recovery of any extra cost/expenditure or of any loss/damage suffered by the company shall not however arise in the case of termination of the contract for death/demise of the contractor as stated in 10.1(d).

10.3 Suspension of Work:

Suspension of work - The Company shall have power to suspend the work. The contractor shall on receipt of the order in writing of Engineer-in -charge (whose decision shall be final and binding on the contractor), suspend the progress of work or any part

thereof for such time in such manner as the Engineer-in-Charge may consider necessary so as not to cause any damage, 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 ensure the works to the extent necessary and carry out the instruction of the Engineer-in-charge. If the suspension is ordered for reasons (b) & (c), the contractor shall be entitled to an extension of time equal to the period of every such suspension plus 25%. This shall also be applicable for completion of the item or group of items of the work for which a separate period of completion as specified in the contract and of which the suspended work forms a part.

The contractor shall carry out the instructions given in this respect by the Engineer-In Charge & if such suspension exceeds 45 (forty five) days, the contractor will be compensated on mutually agreed terms.

10.4 Foreclosure of contract:

If at any time after acceptance of the tender the company decides to abandon or reduce the scope of work for any reason whatsoever the company, through its Engineer-in-Charge, shall give notice in writing to that effect to the contractor and contractor shall act accordingly in the matter. In the event of abandonment, the contractor shall have no claim to any payment of compensation or otherwise whatsoever, other than those mentioned below:-

a) to pay reasonable amount assessed and certified by the Engineer-in-Charge of the expenditure incurred, if any, by the contractor on preliminary works at site e.g. temporary access roads, temporary construction for labour and staff quarters, office accommodation, storage of materials, water storage tanks and water supply for the work including supply to labour/ staff quarters, office etc.

b) to pay the contractor at the contract rates full amount for works executed and measured at site up to the date of such abandonment.

c) to pay for the materials brought to site or to be delivered at site, which the contractor is legally liable to pay, for the purpose of consumption in works carried out or were to be carried out but for the foreclosure, including the cost of purchase and transportation and cost of delivery of such materials. The materials to be taken over by the company should be in good condition and the company may allow at its discretion the contractor to retain the materials in full or in part if so desired by him and to be transported by the contractor from site to his place at his own cost with due permission of the EIC.

d) to take back the materials issued by the company but remaining unused, if any, in the work on the date of abandonment/reduction in the work, at the original issue price less allowance for any deterioration or damage caused while in custody of the contractor.

e) to pay for the transportation of tools and plants of the contractor from site to contractor's place or to any other destination, whichever is less.

10.4.01 The contractor shall, if required by the Engineer-in-Charge, furnish to him books of accounts, papers, relevant documents as may be necessary to enable the Engineer-in-Charge to assess the amounts payable in terms of clauses10.4(a) (c) & (e) of the contract. The contractor shall not have any claim for compensation for abandonment of the work, other than those as specified above.

11. **Carrying out Part Work at Risk & Cost of Contractor**.

If the progress of the work or of any portion of the work is unsatisfactory, the Engineer-in-Charge, after giving the contractor 15 days' notice in writing, without cancelling or terminating the contract, shall be entitled to employ another Agency for executing the job or to carry out the work departmentally or contractually through tendering / limited tendering process, either wholly or partly, debiting the contractor with cost involved in engaging another Agency or with the cost of labour and the prices of materials, as the case may be. The certificate to be issued by the Engineer-in-Charge for the cost of the work so done shall be final and conclusive and the extra cost, if any, shall be borne by the contractor. However, when this clause is invoked, penalty will not be applicable other than on account of delayed completion.

The value of the work taken away shall be calculated for the items and quantities taken away at the agreement rates including price variation as applicable on the date, when notice in writing for taking away part work was issued to the contractor. The contractor, from whom part work is being taken out, shall not be allowed to participate in the

tendering process if any.

If the expenses incurred by the department is less than the amount payable to the contractor at his agreement rates, the difference shall not be payable to the contractor.

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 reasons 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.

12. Completion Certificate / Defect Liability Certificate

Except in cases where the contract provides for "Performance Test" before issue of Defect Liability certificate, in which case the issue of Defect Liability certificate shall be in accordance with the procedure specified therein, the contractor shall give notice of completion of work, as soon as the work is completed, to the Engineer-in-Charge. The Engineer-in-Charge and or any other Officer, nominated for the purpose by the company, shall within 30 (thirty) days from the receipt thereof, inspect the work and ascertain the defects/deficiencies, if any, to be rectified by the contractor as also the items, if any, for which payment shall be made at reduced rate.

If the defects, according to the Engineer-in-Charge are of a major nature and the rectification of which is necessary for the satisfactory performance of the contract, he shall intimate in writing the defects and instruct the contractor to rectify the defects/remove deficiencies within the period and in the manner to be specified therein. In such cases Defect Liability Certificate will be issued by the EIC after the above rectifications are carried out/ deficiencies are removed by the contractor to the satisfaction of EIC.

In the event there are no defects or the defects/ deficiencies are of a minor nature and the Engineer-in-Charge is satisfied that the contractor has already made arrangements for rectification, or in the event of contractor's failure to rectify the defects for any reason whatsoever, the defects can be rectified by the company departmentally or by other means and the 50% of the security deposit of the contractor shall be sufficient to cover the cost thereof, he shall issue the Defect Liability Certificate (Taking Over Certificate with list of defects)indicating the date of completion of the work, defects to be rectified, if any, and the items, if any, for which payment shall be made at reduced rate indicating

reasons there for and with necessary instructions to the contractor to clear the site/place of work or all debris/ waste materials, scaffoldings, sheds, surplus materials etc. making it clean.

12.1 In cases where separate period of completion for certain items or groups of items are specified in the contract, separate Defect Liability certificate for such items or groups of items may be issued by the Engineer-in-Charge after completion of such items on receipt of notice from the contractor only in the event the work is completed satisfactorily in every respect.

Refund of security deposit and payment of final bill shall, however, be made on completion of the entire contract work, but not on completion of such items of work.

12.2 Before the date fixed for completion of work, the work as well as the site of work are to be made clean after removal of rubbish, scaffolding, surplus materials, temporary structures etc.

12.3 In case of contractor's failure to clear the site, the EIC shall have right to get the work done. The cost thereof shall be recovered from the final bill of the contractor.

13. Additional Responsibilities of the Contractor(s)

The cost on account of the "Additional Responsibilities of the Contractors" under this clause is deemed to be included in the tendered rates.

i) The company reserves the rights to let other contractors also work in connection with the Project and the contractor/contractors shall co-operate in the works for the introduction and stores and materials and execution of his/their works.

ii) The contractor/contractors shall keep on the work site during the progress a competent and experienced Resident Engineer exclusively for the work and necessary assistants who shall represent the contractor(s). The contractor shall employ, on the site in connection with the execution and maintenance of the work, technical and managerial staff as mentioned below.

Sl.No.	Value of Work	Manpower Requirement
1	More than 10 Crores	One Resident Engineer (Degree Holder), One Engineer, Degree Holder), Two Engineers(Diploma Holder)

2	5 Crores to 10 Crores	One Resident Engineer (Degree Holder), TwoEngineers (Diploma Holder)
3	2 Crores to 5 Crores	One Resident Engineer (Diploma Holder), One Engineer (Diploma Holder)
4	50 lakhs to 2 crores	One Resident Engineer (Graduate/ Diploma Holder)

For works below Rs. 50 lakhs, the deployment of manpower shall be as assessed by Engineer.

The contractor shall intimate the Engineer-in-Charge in writing the names, qualifications, experience and full postal address of each and every technical personnel employed at site by him.

The contractor(s) shall not be allowed to execute the work unless he/they engage the required technical staff as assessed by Engineer-in-charge or as specifically mentioned in the bid. The delay on this account, if any, shall be the contractor's responsibility.

Important instructions shall be confirmed to the contractor(s) in writing. If the contractor/contractors in course of the works finds/find any discrepancy between the drawing, forming part of the contract documents and the physical conditions of the locality or any errors or omissions in drawings except those prepared by himself / themselves and not approved by the Engineer-in-Charge. It shall be his/their duty to immediately inform the Engineer-in-Charge in writing and the Engineer-in-Charge shall verify the same. Any work done after such discovery and without intimation as indicated above will be done at the risk of the contractor/contractors.

iii) The contractor / contractors shall employ only competent, skillful and orderly men to do the work. The Engineer-in-Charge shall have the right to ask the contractor/ contractors to remove from the work site any men of the contractor/contractors who in his opinion is undesirable and the contractor/contractors will have to remove him within 3 (three) hours of such orders.

The contractor shall employ apprentices in the execution of the contract work as required under Apprentices Act.

The contractor shall further be responsible for making arrangements at his own cost, or

accommodation and social needs of the staff and workers under his employment.

iv) Precautions shall be exercised at all times by the contractor(s) for the protection of persons (including employees) and property. The safety required or recommended by all applicable laws, codes, statutes and regulations shall be observed by the contractor(s).In case of accidents, the contractor(s) shall beresponsible for compliance with all the requirements imposed by the Workmen's Compensation Act or any other similar laws in force and the contractor shall indemnify the company against any claim on this account.

All scaffoldings, ladders and such other structures which the workmen are likely to use shall be examined by the Engineer-in-Charge or his authorized representative whenever they want and the structure must be strong, durable, and safe and of such design as required by Engineer-in-Charge.

In no case any structure condemned by the Engineer-in-Charge or his authorized representatives shall be kept on the work and such structure must be pulled down within three hours of such condemnation and any certificate or instructions, however, shall in no way absolve the contractor/contractors from his/their responsibility, as an employer, as the company shall in no way be responsible for any claim.

The contractor / contractors shall at all times exercises reasonable precautions for the safety of employees in the performance of his/their contract and shall comply with all applicable provisions of the safety laws drawn up by the State Govt. or Central Govt. or Municipalities and other authorities in India. The contractor/contractors shall comply with the provision of the safety hand book as approved and amended from time to time by the Government of India.

v) The contractor / contractors shall familiarize themselves with and be governed by all laws and rules of India and Local statutes and orders and regulations applicable to his/ their work.

vi) The contractor shall maintain all records as per the provision made in the various statutes including Contract Labour (Regulation & Abolition) Act, 1970 and the Contract Labour (Regulation & Abolition) Central Rules,1971, Minimum Wages Act, Workmen Compensation Act etc. and latest amendment thereof. Such records maintained by the contractor shall be opened for inspection by the Engineer-in-Charge or by the nominated representative of the Principal Employer.

vii) The contractor/ contractors shall provide facilities for the sanitary necessities of all persons employed on the work shall be constructed and maintained in the number, manner and place approved or ordered by the Engineer-in-Charge. The contractor/ contractors shall vigorously prohibit committing of nuisance at any other place. Cost of all works under this item shall be covered by the contractor/contractor's tendered rates.

viii) The contractor/contractors shall furnish to the Engineer-in-Charge or his authorized representative with work reports from time to time regarding the contractor / contractors organization and the progress made by him / them in the execution of the work as per the contract.

ix) All duties, taxes [excluding Goods and Services Tax (GST) and GST Compensation Cess (if applicable) only] and other levies,royalty, building and construction workers cess (as applicable in states), payable by the bidder/Contractor under the Contract, or for any other cause as applicable on the last date of submission of Bid, shall be included in the rates, prices and the total Bid Price submitted by the Bidder. Applicable GST either payable by bidder or by company under reverse charge mechanism shall be computed by system in BOQ sheet as per pre-defined logic. All investments, operating expenses, incidentals, overheads leads, lifts, carriages, tools, and plants etc. as may be attendant upon execution and completion of works shall also be included in the rates, prices and total Bid price submitted by the bidder.

However, such duties, taxes, levies etc. which is notified after the last date of submission of Bid and/ or any increase over the rate existing on the last date of submission of Bid shall be reimbursed by the company on production of documentary evidence in support of payment actually made to the concerned authorities.

Similarly if there is any decrease in such duties, taxes and levies the same shall become recoverable from the contractor. The details of such duties, taxes and other levies along with rates shall be declared by the bidder.

The item wise rate quoted by bidder shall be inclusive of all taxes, duties & levies but excluding GST & GST Compensation Cess, if applicable. The payment of GST and GST Compensation Cess by service availer (i.e. CMPDIL) to bidder/contractor (if GST payable by bidder/contractor) would be made only on the latter submitting a Bill/invoice in accordance with the provision of relevant GST Act and the rules made thereunder and after online filing of valid return on GST portal. Payment of GST & GST Compensation Cess is responsibility of bidder/contractor.

However, in case contractor is GST unregistered bidder in compliance with GST rules, the bidder shall not charge any GST and/or GST Compensation Cess on the bill/invoice. In such case, applicable GST will be deposited by CIL/Subsidiary directly to concerned authorities.

Input tax credit is to be availed by Paying Authority as per rule.

If CMPDIL fails to claim Input Tax Credit (ITC) on eligible Inputs, input services and Capital Goods or the ITC claimed is disallowed due to failure on the part of bidder / vendor of goods and services in incorporating the tax invoice issued to CMPDIL in its relevant returns under GST, payment of CGST & SGST or IGST, GST (Compensation to State) Cess shown in tax invoice to the tax authorities, issue of proper tax invoice or any other reason whatsoever, the applicable taxes &cess paid based on such Tax invoice shall be recovered from the current bills or any other dues of the bidder / vendor along with interest, if any. The rates and prices quoted by the Bidder shall be fixed for the duration of the contract and shall not be subject to variations on any account except to the extent variations allowed as per the conditions of the contract of the bidding document. The Company reserved the right to deduct / withheld any amount towards taxes, levies etc. and to deal with such amount in terms of the provisions of the Statute or in terms of the direction of any statutory authority and the Company shall only provide with certificate towards such deduction and shall not be responsible for any reason whatsoever.

In case of collection of minor minerals in area (both virgin and non-virgin), acquired by the company under the Coal Act, the contractor will have to produce a royalty clearance certificate from the District Authorities before full and final payment.

x) The contractor / contractors shall make his / their own arrangement for all materials, tools, staff and labourer required for the contract, which shall include cost of lead, lift, loading, unloading, railway freight, recruiting expenses and any other charges for the completion of the work to entire satisfaction of the company.

xi) The contractor / contractors shall make their own arrangement for carriage of all materials to the work site at his/their own cost.

xii) The work shall not be sublet to any other party, unless approved by Engineer-in-Charge, in writing. Prior permission is required to be taken from the owner for engagement of sub-contractor in part work/ piece rated work.

xiii) a) No fruit trees or valuable plants or trees with trunk diameter exceeding 150mm shall be pulled, destroyed or damaged by the contractor/contractors or any of his/their employees without the prior permission of the company, failing which the cost of such trees or plants shall be deducted from the contractor/contractors dues at the rate to be decided by the company. The rates quoted are supposed to include clearance of shrubs and jungles and removal of such trees up to 150 mm dia., as will be permitted by the Engineer-in-Charge in writing.

b) Anything of historical or other interest or of significant value unexpectedly discovered on the site isthe property of the employer. The Contractor is to notify the Nodal Officer or his nominee of such discoveries and carry out the Nodal Officer or his nominee's instructions for dealing with him.

xiv) The contractor / contractors shall not pay less than the minimum wages to the labourer engaged by him/them as per Minimum Wages Act or such other legislation or award of the minimum wage fixed by the respective State Govt. or Central Govt. as may be in force. The contractor / contractors shall make necessary payments of the provident fund for the workmen employed by him for the work as per the laws prevailing under provisions of CMPF and allied scheme and Miscellaneous Provisions Act, 1948 or Employees Provident Fund and Miscellaneous Provisions Act 1952 as the case may be.

xv) All accounts shall be maintained properly and the company shall have the right of access and inspection of all such books of accounts etc., relating to payment of labourer including payment of provident fund considered necessary and the company may arrange for witnessing the payment to the labourer by its representatives.

xvi) The contractor shall in additions to any indemnity provided by the relevant clauses of the agreement or by law, indemnify and keep indemnified for the following:

a) The company or any agent or employee of the company against any action, claim or proceeding relating to infringement or use of any patent or design right and shall pay any royalties or other charges which may be payable in respect of any article or material included in the contract.

However, the amount so paid shall be reimbursed by the company in the event such infringement has taken place in complying with the specific directions issued by the company or the use of such article or material was the result of any drawing and/or specifications issued by the company after submission of tender by the contractor. The contractor must notify immediately after any claim being made or any action brought against the company, or any agent or employee of company in respect of any such matter.

b) The company against all claims, damages or compensation under the provisions of payment of Wages Act, 1938, Minimum Wages Act, 1948, Employer's Liability Act, 1938, The Workmen's Act, 1923, Industrial Dispute Act, 1947, Mines Act as applicable, Employees State Insurance Act 1948 and Maternity Benefit Act, 1961, Acts regulating

P.F. or any modification thereof or any other law relating thereto and rules made there under from time to time, as may be applicable to the contract which may arise out of or in consequence of the construction or maintenance or performance of the work under the contract and also against costs, charges and expenses of any suit, action or proceedings arising out of any accident or injury.

c) The company against all losses and claims for injuries or damages to any third party or to any property belonging to any third party which may arise out of or in consequence of the construction or maintenance or performance of the work under the contract and against all claims/demands proceedings/damages, cost charges and expenses whatsoever in respect of or in relation thereto.

xvii) The contractor is under obligation to hand over to the company the vacant possession of the completed building structures failing which the Engineer-in-Charge can impose a levy upon the contractor upto 5% of the total contract value for the delay in handing over the vacant possession of the completed works after giving a 15 (fifteen) days notice to the contractor.

xviii) Insurance - The contractor shall take full responsibility to take all precautions to prevent loss or damage to the works or part thereof for any reasons whatsoever (except for reasons which are beyond control of the contractor or act of God, e.g. flood, riots, war, earthquake, etc.) and shall at his own cost repair and make good the loss/damage to the work so that on completion, the work shall be in good order and condition and in conformity with the requirements of the contract and instructions of the Engineer-in-charge.

The contractor/contractors shall take following insurance policies during the full contract period at his own cost:

a). In the case of construction works, without limiting the obligations and responsibilities under the contract, the contractor shall take insurance policy for the works and for all materials at site so that the value of the works executed and the materials at site up to date are sufficiently covered against risk of loss/damage to the extent as permissible under the law of insurance. The contractor shall arrange insurance in joint names of the company and the contractor. All premiums and other insurance charges of the said insurance policy shall be borne by the contractor.

The terms of the insurance policy shall be such that all insurance claims and

compensations payable by the insurers, shall be paid to the Employer and the same shall be released to the contractor in installments as may be certified by the Engineer-in-charge for the purpose of rebuilding or replacement or repair of the works and/or goods destroyed or damaged for which payment was received from the insurers. Policies and certificates for insurance shall be delivered by the contractor to the EIC for his approval before the starting date. Alterations to the terms of insurance shall not be made without the approval of EIC.

b). Where any company building or part thereof is used, rented or leased by the contractor for the purpose of storing or using materials of combustible nature, the contractor shall take separate insurance policy for the entire building and the policy shall be deposited with the company.

c) The contractor shall at all times during the tenure of the contract indemnify the company against all claims, damages or compensation under the provision of the Workmen's Compensation Act and shall take insurance policy covering all risk, claims, damages, or compensation payable under the Workmen's Compensation Act or under any other law relating thereto.

d) The contractor shall ensure that the insurance policy/ policies is/are kept alive till full expiry of the contract by timely payment of premiums and it/they shall not be cancelled without the approval of the company and a provision is made to this effect in all policies, and similar insurance policies are also taken by his sub-contractors if any. The cost of premium shall be borne by the contractor and it shall be deemed to have been included in the tendered rate.

e) In the event of contractor's failure to effect or to keep in force the insurance referred to above or any other insurance which the contractor is required to effect under the terms of the contract, the company may effect and keep in force any such insurance and pay such premium/premiums as may be necessary for that purpose from time to time and recover the amount thus paid from any moneys due to the contractor.

THE CLAUSE 13(xviii) SHALL BE APPLICABLE FOR WORKS OF ESTIMATED VALUE OF OVER Rs. 50 LAKHS.

xix) Setting Out: The contractor shall be responsible for the contract and proper setting out of the works and correctness of the position, reduced levels, dimensions and alignment of all parts of the work including marking out the correct lay out in reference to the

permanent bench mark and reference points. Only one permanent bench mark and basic reference lines shall be marked and shown to the contractor as basic data.

The contractor shall have all necessary instruments, appliances and labour in connection therewith. If at any time during the progress of work any error is detected in respect of the position, levels, dimensions or alignment of any part of the work, the contractor on being required to do so by the Engineer-in-Charge or his representative shall at the expenses of the contractor rectify such errors to the satisfaction of Engineerin-Charge unless such error is due to incorrect data supplied by the Engineer-in-Charge.

xx) On receipt of Letter of Acceptance of Tender / Work Order the contractor shall forthwith Register and obtain License from the competent authority under the Contract Labour (Regulation & Abolition)Act 1970,the Contract Labour (Regulation & Abolition) Central Rules, 1971 and submit certified copies of the same to the Engineer-in-Charge and the Principal Employer.

xxi) ~~The contractor shall be registered with the concerned State Govt. and the Central Govt. in respect of Sales Tax Act and the certificate having details of Registration No., period of validity etc. should be submitted to the Engineer-in-Charge.~~

xxii) The contractor shall, in connection with works, provide and maintain, at his own cost, all lights, security guards, fencing when and where necessary as required by the Engineer-in-Charge for the purpose of protection of the works, materials at site, safety of workmen and convenience of the public.

xxiii) All materials (e.g. stone, moorum and other materials) obtained in the course of execution of the work during excavation and dismantling etc. shall be the property of the company and the same may be issued to the contractors, if required for use in the works at the rates to be fixed by the Engineer-in-Charge.

xxiv) Unless otherwise specifically provided for, dewatering of excavation pits, working areas etc. shall be the contractor's responsibility and is to be carried out at his own cost as per instructions of EIC. The rates quoted by the contractor shall be deemed to include the dewatering costs.

xxv) Approval by the Nodal Officer/Engineer-in-Charge or his nominee: The contractor shall submit specifications and drawings showing the proposed temporary work to the Nodal Officer/Engineer-in-Charge or his nominee, who is to approve them if they comply with

the specifications and drawings.

The contractor shall be responsible for design of Temporary Works.

The Nodal Officer/Engineer-in-charge or his nominee's approval shall not alter the contractor's responsibility for design of the Temporary Works.

14. Defects Liability Period:

In addition to the defect/s to be rectified by the contractor as per terms of the contract/ work order, the contractor shall be responsible to make good and remedy at his own expense the defect/s mentioned hereunder within such period as may be stipulated by the Engineer-in-Charge in writing:

a) Any defect/defects in the work detected by the Engineer-in-Charge within a period of 6 (six) months from the date of issue of Defect Liability certificate / completion certificate.

b) In the case of building works or other works of similar nature any defect in the work detected by the Engineer-in-Charge within a period of 6 (six) months from the date of issue of Defect Liability certificate/ completion certificate or before the expiry of one full monsoon period i.e. June to September whichever is later in point of time.

14.1 A programme shall be drawn by the contractor and the Engineer-in-Charge for carrying out the defects by the contractor detected within the defect liability period and if the contractor fails to adhere to this programme, the Engineer-in-Charge shall be at liberty to procure proper materials and carry out the rectifications in any manner considered advisable under the circumstances and the cost of such procurement of materials and rectification work shall be chargeable to the contractor and recoverable from any of the pending dues of the contractors.

The defect liability period can be extended by the company on getting request from the contractor only for valid reasons.

There will be no defect liability period for works like Grass Cutting, Jungle Cutting, Surface Dressing & any other work of similar nature to be decided by the Engineer-in-Charge.

15. Operating and Maintenance Manual:

If "as built" drawings and/or Operating and Maintenance Manual are required the contractor shall supply them by the dates as per instruction of the Engineer-in-charge.

If the contractor does not supply the drawings and/or Manual by the dates as stated above, or they do not receive the Nodal Officer or his nominee's approval, the Nodal Officer or his nominee shall withhold the amount as stated in the agreement.

16.Settlement of Disputes.

16.1 Settlement of Disputes with the Contractor

It is incumbent upon the contractor to avoid litigation and disputes during the course of execution. However, if such disputes take place between the contractor and the department, effort shall be made first to settle the disputes at the company level.

The contractor should make request in writing to the Engineer-in-charge for settlement of such disputes/ claims within 30 (thirty) days of arising of the cause of dispute/ claim failing which no disputes/ claims of the contractor shall be entertained by the company.

Effort shall be made to resolve the dispute in two stages

In first stage dispute shall be referred to GM/HOD (Civil). If difference still persist the dispute shall be referred to a committee constituted by the owner. The committee shall have one member of the rank of Director of the company who shall be chairman of the committee.

If differences still persist, the settlement of the dispute shall be resolved in the following manner: Disputes relating to the commercial contracts with Central Public Sector Enterprises / Govt. Departments (except Railways, Income Tax, Customs & excise duties)/ State Public Sector Enterprises shall be referred by either party for Arbitration to the PMA (Permanent Machinery of Arbitration) in the department of Public Enterprises.

In case of parties other than Govt. Agencies, the redressal of the dispute may be sought through Arbitration (The Arbitration and Conciliation Act, 1996 as amended by AMENDMENT ACT of 2015).

16.2 Settlement of Disputes through Arbitration

(i) Normally, there should not be any scope of dispute between the employer department and the contractor after entering into a mutually agreed valid contract. However, due to various unforeseen reasons, disputes may arise during the progress of the contract between the employer (department) and the contractor.
Therefore, the conditions governing the contract shall contain suitable provision for settlement of such disputes / differences binding on both the parties.

(ii) Mode of settlement of such disputes/differences shall be through Arbitration. However, when a dispute/difference arises, then, depending on the position of the case, either the employer (department) or the contractor shall give notice to the other party of its

intention to commence arbitration. The applicable arbitration procedure will be as per the Arbitration and Conciliation Act, 1996 as amended by Amendment Act of 2015.

(iii) Venue of Arbitration: The venue of arbitration shall be the place from where the contract has been issued.

(iv) Applicable Law: The contracts shall be interpreted in accordance with the laws of the Union of lndia.

(v) Legal Advice: While processing a case for arbitration, the purchase organization is to take legal advice, at appropriate stages from competent authorities viz their Legal Department.

(vi) Following clause shall be included in the General Conditions of the Contract (GCC):

Sole Arbitration Clause:

ln the event of any question, dispute or difference arising under these terms & conditions or any condition contained in this contract or interpretation of the terms of, or in connection with this Contract (except as to any matter the decision of which is specially provided for by these conditions), the same shall be referred to the sole arbitration of a person, appointed to be the arbitrator by the Competent Authority of CIL/ CMD of Subsidiary Company (as the case may be). The award of the arbitrator shall be final and binding on the parties of this contract.

(a) ln the event of the Arbitrator dying, neglecting or refusing to act or resigning or being unable to act for any reason, or his/her award being set aside by the court for any reason, it shall be lawful for the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be)to appoint another arbitrator in place of the outgoing arbitrator in the manner aforesaid.

(b) lt is further a term of this contract that no person other than the person. appointed by the competent Authority of CIL I CMD of Subsidiary Company (as the case may be) as aforesaid should act as arbitrator and that, if for any reason that is not possible, the matter is not to be referred to Arbitration at all.

Subject as aforesaid, Arbitration and Conciliation Act, 1996 as amended by Amendment Act of 2015, and the rules thereunder and any statutory modification thereof for the time being in force shall be deemed to apply to the Arbitration proceedings under this clause.

The venue of arbitration shall be the place from which the contract is issued or such other place as the Competent Authority of CIL / CMD of Subsidiary Company (as the case may be) at his discretion may determine.

(vii) Contracts with Partnership firm/ Joint Venture/Consortium :

A partner is the implied authority to bind the firm in a contract coming in the purview of the usual business of the firm. The implied authority of a partner, however, does not extend to enter into arbitration agreement on behalf of the firm. Therefore, while entering into a contract with partnership firm / Joint Venture/ Consortium care should be taken to obtain consent of all the partners to the arbitration agreement.

A suitable clause for obtaining consent of all the partners to the arbitration agreement shall be included in the General Conditions of the Contract (GCC).

ADDITIONAL TERMS AND CONDITIONS

The following additional terms and conditions are also acceptable to the company. The tenderers are requested not to quote any further additional conditions in the tender.

1. Mobilization Advance

i) No mobilization advance is payable for works whose estimated value is less than Rs.100.00 lakhs.

ii) In the case of turnkey work whose estimated value is more than Rs.100 lakhs a maximum of 10 % of the total contract value of work will be paid as mobilization advance subject to submission of Bank Guarantee equal to 110% of the advance amount. The mobilization advance shall be paid in two installments.

iii) In case of other civil works valued more than Rs.100 lakhs mobilization advance will be paid upto 5% of the contract value subject to submission of Bank Guarantee equal to 110% of the advance amount. The mobilization advance shall be paid in two installments.

iv) However, such mobilization advance will carry interest on the basis of CIL's borrowing rate under cash credit arrangement as varying from time to time.

v) The mobilization advance shall be recovered from the bills of the contractor from the 2nd running account bill onwards @ 20% of the advance amount paid and full recovery would be ensured before or with the Final Bill.

vi) The value of Bank Guarantee may be reduced to the extent such advance is recovered by the company subject to the conditions that the value of Bank Guarantee amount at any time is more than the recoverable outstanding advance. Bank Guarantee shall be irrevocable and from a Scheduled- Bank acceptable to the Company.

2. Application of Price Variation Clause.

If the prices of materials (not being the materials supplied at fixed issue rates by the company) and wages of labour required for execution of the work increase or decrease, the contractor shall be compensated for such increase or recoveries will be made from the bills for such decrease as per provisions detailed hereafter:

a) The amount of the contract shall accordingly be varied subject to the condition that such

compensation

for escalation/ de-escalation in price shall be available only for the work done during the stipulated period of the contract including such period for which the contract is validly extended under the provisions of the contract without any penal action. The Price Variation Clause shall not be applicable for works of capital nature, for which stipulated period of completion is six months or less. For regular maintenance/Service contract, price variation shall not be applicable where stipulated period of completion is twelve months or less.

b) The base date for working out such escalation/de-escalation shall be the last date on which the bids (inclusive of price part) or revised price bids (inclusive of revised offer) were stipulated to be received.

c) The compensation for escalation or recoveries to be made shall be worked out at quarterly intervals and shall be with respect to the cost of work done during the previous three months. The first such payment will be made at the end of three months after the month (excluding) in which the tender was accepted and thereafter at three months' interval.

d) Job specific modification in the formulae of price variation given in the following para(s) can be done with the approval of the CMD of the company

2.1 Escalation/ De-escalation for Labour: The amount paid to the contractor for the work done shall be adjusted for increase or decrease in the cost of labour and the cost shall be calculated quarterly in accordance with the following formula :

$$VL = W \times (A/100) \times (L - Lo) / Lo$$

Where :

VL= Variation in labour cost i.e., increase or decrease in the amountin rupees to be paid or recovered.

W = Value of work done during the period under reckoning to which the escalation/de-escalation

relates as indicated in clause-2.4 of the Additional Terms & Conditions of the contract.

A = Component of labour expressed as percentage of the total value of the

work adopted from the Table-1.

Lo = Minimum wages for unskilled workers payable as per the Minimum Wages Act / Rules of the State or Central Govt., whichever is more, applicable to the place of work as on the last date stipulated for receipt of the bids (inclusive of price part) or revised price bids whichever is later.

L = Revised minimum wages of unskilled worker corresponding to Lo during the period to which the escalation/de-escalation relates.

2.2 Escalation /De-escalation on Materials: The amount to be paid to the contractor for the work done will be adjusted for increase or decrease in the cost of materials and the cost shall be calculated quarterly in accordance with the following formula :

$$Vm = W \times (B/100) \times (M - Mo) / Mo$$

Where :

Vm= Variation in the material cost i.e. increase or decrease in the amount in rupees to be paid or recovered.

W = Cost of work done during the period under reckoning to which the escalation / de-escalation relates as indicated in clause-2.4 of the Additional Terms & Conditions of the contract.

B = Component of material expressed as percentage of the total value of the work adopted from the Table -1.

M = Average All India Wholesale Price Index for all commodities for the period to which escalation/de- escalation relates as published by the RBI Bulletin, Ministry of Industry & Commerce, Govt.of India.

Mo = All India Wholesale Price Index for all commodities as published by the RBI Bulletin, Ministry of Industry & Commerce, Govt. of India, relating to the last date on which the bids (inclusive of price part) or revised price bids whichever is later were stipulated to be received.

2.3 Escalation/ De-escalation on POL : The amount to be paid to the contractor for the work done shall be adjusted for the increase or decrease in the cost of POL and the cost shall be calculated quarterly in accordance with the formula given below :

$$Vf = W \times (C/100) \times (F - Fo) / Fo$$

Where :

Vf = Variation in the cost of fuel, oil and lubricants increase or decrease in the rupees to be paid or recovered.

W = Value of work done during the period under reckoning to which the escalation/ de-escalation relates as indicated in clause 2.4 of the Additional terms & Conditions of the contract.

C =Component of POL expressed as percentage of the total cost of the work taken from Table -1.

F = Average Index Number for wholesale price for the group of `Fuel, Power, Light & Lubricants' as published by the Economic Adviser, Ministry of Industry, Govt. of India for the period to which the escalation/de-escalation relates.

Fo = Index number of wholesale price for the group, Fuel, Power, light & lubricants as published by the Economic Adviser, Ministry of Industry, Govt. of India prevalent on the last date of receipt of bids (inclusive of Price Part) or revised price bids whichever is later.

2.4 While calculating the value of "W" the following may be noted : The cost on which the escalation will be payable shall be reckoned as 85 % of the cost of work as per the bills to which escalation relates, and from this amount the value of materials supplied or services rendered at the prescribed charges under the relevant provisions of the contract, and proposed to be recovered in the particular bill, shall be deducted before the amount of compensation for escalation or de-escalation is worked out. In the case of materials brought to site for which any secured advance is included in the bill, the full value of such materials as assessed by the Engineer-in-Charge (and not the reduced amount for which secured advance has been paid) shall be included in the cost of work done for operation of this clause. Similarly, when such materials are incorporated in the work and the secured advance is deducted from the bill, the full assessed value of the materials originally considered for operation of this clause should be deducted from the cost of the work shown in the bill, running or final. Further the cost of work shall not include any work for which payment is made at prevailing market rates.

2.5 In the event the price of materials and/ or wages of labour required for execution of the

work decreases, there shall be downward adjustment of the cost of work so that such price of materials and/or wages of labour shall be deductible from the cost of work under this contract and in this regard the formulae herein before stated under this clause shall mutatis/mutandis apply. No such adjustment for the increase / ecrease in material price and/ or wages of labour before mentioned would be made in case of contracts related to capital works, in which the stipulated period of completion of the work is six (6) months or less. However for Maintenance works any adjustment for the increase or decrease in material price or wages of labour would be made only when the stipulated period of completion of the work is twelve (12) months or less.

2.6 Application of Price Variation Clause during extended period of Contracts.

The Price Variation Clause as stated above will be applied for extended time frame of a contract by following the principle stated as under:

i) Normally, if and when it is understood that a contract is not going to be completed within the scheduled time period, the contract is kept operative by extending the time of completion provisionally. During this provisional extended period the operation of the Price Variation Clause will remain suspended. ii) If and when it is decided at the end of the successful completion of the work that the delay was due to causes not attributable to the contractor, then the Price Variation Clause will be revived and applied as if the scheduled date of completion has been shifted to the approved extended date.

iii) If it is decided at the end of successful completion of the work that the delay was due to the fault of the contractor then the Price Variation Clause will not be revived and no further payment will be made to the contractor on this account. Additionally the Clause related to Compensation for delay will be applied.

No payment will be made by applying “FROZEN INDICES “under any circumstances.

Table - 1

Value of A, B & C in the escalation formula in the additional terms & conditions for Civil Works :

Sl	Particulars	A% (Labour Component)	B% (Material Component)	C% (POL Component)	Remarks
1	For building works	25	75	Nil	
2	For Road works	15	80	05	
3	For external sewerage, External water supply, and external electrification	10	90	Nil	
4	For external water supply, external sanitary and external electrification (through labourrate contract)	75	25	Nil	
5	For steel structural works	15	85	Nil	
6	For steel structural works with Deptt. free supply of rolled steel sections(through labour rate contract)	75	25	Nil	
7	For Coal Handling Plant Civil Works	25	75	Nil	
8	For under-ground civil works such as Incline Drivage, Shaft Sinking etc.	35	65	Nil.	
9	For only labour oriented works of maintenance nature.	100	Nil	Nil	

For all other works not listed above, the component of labour, material and POL of the total cost of work shall be as specifically indicated in the tender document.

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 that ¼ to 1 (¼ horizontal and 1 vertical).

2. Scaffolding of staging more than 3.6 m (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 3.6 m (12ft) above ground 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. Safety 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 9 m (30ft) in length while the width between side rails in rung ladder shall in no case be less than 20 cm (11 ½") for ladder upto and including 3 m (10ft) in length. For longer ladders, this width should be increased at least ¼" for additional 30 cm (1ft.) 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 1.2 m (4ft) or more in depth, shall at all times be supplied with at least one ladder for each 30 m. (100 ft.) 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 1.5 m (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 1.5 m (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 warming signals or boards to prevent accident to the public. In addition, the contractor shall ensure that the following safety measures are adhered to:-

a) Entry for workers into the line shall not be allowed except under supervision of the Engineering Assistant 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 gives 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 condoned of by suitable means to avoid mishaps of any kind. Proper warming 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 meters 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 extents 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 in an individual case will be final.

vi) 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 scrapped.

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.

d) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust
caused by dry rubbing down and scraping.

e) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

f) Overall shall be worn by working painters during the whole of working period.

g) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.

9. When the work is done near any place where there is risk of drowning, all necessary equipments 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.

10. 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 winch 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 each 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 departmental machines, the safe working load shall be notified by the Electrical Engineer-in-Charge. As regards contractor's machines the contractors shall notify the safe working load of the machine to the Engineer-in-Charge whenever he brings any mach8inery 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 department 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.

7.0 DRAWINGS

Attached Separately

LIST OF TENDER DRAWINGS

Tender Drawings

1	**Architectural Drawing**							
	1	Site Plan	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 1**
	2	Ground Floor Plan	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 2**
	3	First Floor Plan	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 3**
	4	Second Floor Plan	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 4**
	5	Third Floor Plan	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 5**
	6	Forth Floor Plan	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 6**
	7	Fifth & Terrace Floor Plan	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 7**
	8	Solar Panel Plan on Terrace	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 8**
	9	**Elevations and sections**						
	9 A	Section - AA	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 9 A**
	9 B	Sections - BB	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 9 B**
	9 C	Sections - CC	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 9 C**
	9 D	Sections - DD	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 9 D**
	9 E	Elevation - West Side	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 9 E**
	9 F	Elevation - East Side	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 9 F**
	9 G	Elevation - North Side	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 9 G**
	9 H	Elevation - South Side	**CMPDI**	**/**	**Arch**	**/**	**TD**	**/ 9 H**
2	**Water supply**							
	1	Site Plan	**CMPDI**	**/**	**WS**	**/**	**TD**	**/ 1**
	2	Ground Floor Plan	**CMPDI**	**/**	**WS**	**/**	**TD**	**/ 2**
	3	First Floor Plan	**CMPDI**	**/**	**WS**	**/**	**TD**	**/ 3**
	4	Second Floor Plan	**CMPDI**	**/**	**WS**	**/**	**TD**	**/ 4**
	5	Third Floor Plan	**CMPDI**	**/**	**WS**	**/**	**TD**	**/ 5**
	6	Forth Floor Plan	**CMPDI**	**/**	**WS**	**/**	**TD**	**/ 6**
	7	Fifth Floor & Terrace floor Plan	**CMPDI**	**/**	**WS**	**/**	**TD**	**/ 7**
	8	Schematic water supply	**CMPDI**	**/**	**WS**	**/**	**TD**	**/ 8**

3 Sanitary & Plumbing

1	Site Plan	**CMPDI**	**/**	**S&P**	**/**	**TD**	**/**	**1**
2	Ground Floor Plan	**CMPDI**	**/**	**S&P**	**/**	**TD**	**/**	**2**
3	First Floor Plan	**CMPDI**	**/**	**S&P**	**/**	**TD**	**/**	**3**
4	Second Floor Plan	**CMPDI**	**/**	**S&P**	**/**	**TD**	**/**	**4**
5	Third Floor Plan	**CMPDI**	**/**	**S&P**	**/**	**TD**	**/**	**5**
6	Forth Floor Plan	**CMPDI**	**/**	**S&P**	**/**	**TD**	**/**	**6**
7	Fifth Floor & Terrace floor Plan	**CMPDI**	**/**	**S&P**	**/**	**TD**	**/**	**7**

4 Structural

1	Foundation Details	**CMPDI**	**/**	**STRUC**	**/**	**TD**	**/**	**1**
2	Plinth Level Plan	**CMPDI**	**/**	**STRUC**	**/**	**TD**	**/**	**2**
3	First Floor Lvl Beam and Slab Plan	**CMPDI**	**/**	**STRUC**	**/**	**TD**	**/**	**3**
4	Snd Floor Lvl Beam and Slab Plan	**CMPDI**	**/**	**STRUC**	**/**	**TD**	**/**	**4**
5	Third Floor Lvl Beam and Slab Plan	**CMPDI**	**/**	**STRUC**	**/**	**TD**	**/**	**5**
6	Forth Floor Lvl Beam and Slab Plan	**CMPDI**	**/**	**STRUC**	**/**	**TD**	**/**	**6**
7	Fifth Floor Lvl Beam and Slab Plan	**CMPDI**	**/**	**STRUC**	**/**	**TD**	**/**	**7**
8	Terrace Floor Lvl Beam and Slab Plan	**CMPDI**	**/**	**STRUC**	**/**	**TD**	**/**	**8**

5 Electrical

1	Site Plan	**CMPDI**	**/**	**ELE**	**/**	**TD**	**/**	**1**
2	Ground Floor Plan	**CMPDI**	**/**	**ELE**	**/**	**TD**	**/**	**2**
3	First Floor Plan	**CMPDI**	**/**	**ELE**	**/**	**TD**	**/**	**3**
4	Second Floor Plan	**CMPDI**	**/**	**ELE**	**/**	**TD**	**/**	**4**
5	Third Floor Plan	**CMPDI**	**/**	**ELE**	**/**	**TD**	**/**	**5**
6	Forth Floor Plan	**CMPDI**	**/**	**ELE**	**/**	**TD**	**/**	**6**
7	Fifth Floor & Terrace Floor Plan	**CMPDI**	**/**	**ELE**	**/**	**TD**	**/**	**7**
8	Single line diagram	**CMPDI**	**/**	**ELE**	**/**	**TD**	**/**	**8**

6 HVAC

1	Site Plan	**CMPDI**	**/**	**HVAC**	**/**	**TD**	**/**	**1**
2	Ground Floor Plan	**CMPDI**	**/**	**HVAC**	**/**	**TD**	**/**	**2**
3	First Floor Plan	**CMPDI**	**/**	**HVAC**	**/**	**TD**	**/**	**3**
4	Second Floor Plan	**CMPDI**	**/**	**HVAC**	**/**	**TD**	**/**	**4**
5	Third Floor Plan	**CMPDI**	**/**	**HVAC**	**/**	**TD**	**/**	**5**
6	Forth Floor Plan	**CMPDI**	**/**	**HVAC**	**/**	**TD**	**/**	**6**

	7	Fifth Floor & Terrace floor Plan	**CMPDI**	**/**	**HVAC**	**/**	**TD**	**/**	**7**
7	**Fire**	**Hydrant & Sprinkler**							
	1	Site Plan & Ground Floor Plan	**CMPDI**	**/**	**FIRE/HY&SPK**	**/**	**TD**	**/**	**1**
	2	First Floor Plan	**CMPDI**	**/**	**FIRE/HY&SPK**	**/**	**TD**	**/**	**2**
	3	Second Floor Plan	**CMPDI**	**/**	**FIRE/HY&SPK**	**/**	**TD**	**/**	**3**
	4	Third Floor Plan	**CMPDI**	**/**	**FIRE/HY&SPK**	**/**	**TD**	**/**	**4**
	5	Forth Floor Plan	**CMPDI**	**/**	**FIRE/HY&SPK**	**/**	**TD**	**/**	**5**
	6	Fifth Floor Plan & Terrace Floor	**CMPDI**	**/**	**FIRE/HY&SPK**	**/**	**TD**	**/**	**6**
	7	Riser details (Section)	**CMPDI**	**/**	**FIRE/HY&SPK**	**/**	**TD**	**/**	**7**
8	**Fire**	**Fire Detection & Alarm System**							
	1	Site Plan & Ground Floor Plan	**CMPDI**	**/**	**FIRE/FD&AS**	**/**	**TD**	**/**	**1**
	2	First Floor Plan	**CMPDI**	**/**	**FIRE/FD&AS**	**/**	**TD**	**/**	**2**
	3	Second Floor Plan	**CMPDI**	**/**	**FIRE/FD&AS**	**/**	**TD**	**/**	**3**
	4	Third Floor Plan	**CMPDI**	**/**	**FIRE/FD&AS**	**/**	**TD**	**/**	**4**
	5	Forth Floor Plan	**CMPDI**	**/**	**FIRE/FD&AS**	**/**	**TD**	**/**	**5**
	6	Fifth Floor Plan	**CMPDI**	**/**	**FIRE/FD&AS**	**/**	**TD**	**/**	**6**

8.0 ENVIRONMENT HEALTH AND SAFETYREQUIREMENTS (EHS POLICY)

ENVIRONMENT, HEALTH& SAFETY POLICY

SPECIFICATION FOR ENVIRONMENT, HEALTH & SAFETY POLICY (EHS) MANAGEMENT

CONTENTS

CLAUSE NO. TITLE

1.0 SCOPE

2.0 REFERENCES

3.0 REQUIREMENT OF ENVIRONMENT, HEALTH &SAFETY(EHS)

3.1 MANAGEMENT RESPONSIBILITY

3.2 HOUSE KEEPING

3.3 ENVIRONMENT, HEALTH & SAFETY

4.0 DETAILS OF EHS MANAGEMENT SYSTEMBY CONTRACTOR

4.1 ON AWARD OF CONTRACT

4.2 DURING JOB EXECUTION

1.0 SCOPE

This specification established theEnvironment, Health and Safety(EHS)management requirement to be complied with by the Contractors during construction.

Requirements stipulated in this specification shall supplement the requirements of EHS Management given in relevant Act (s) / legislations. General Terms and Conditions of Contract (GTC), Special terms and Conditions of Contract (STC) and Job Specifications. Where different documents stipulate different requirements, the most stringent shall be adopted.

2.0 REFERENCES

This document should be read in conjunction with following:

- General Terms and Conditions of Contract (GTC)
- Special Terms and Conditions of Contract (STC)
- Job Specifications

3.0 REQUIREMENTS OFENVIRONMENT, HEALTH& SAFETY (EHS) MANAGEMENT SYSTEM TO BE COMPLIED BY BIDDERS

3.1 MANAGEMENT RESPONSIBILITY

3.1.1 The Contractor should have a documented EHS policy to cover commitment of their organization to ensure health, safety and environment aspects in their line of operations.

3.1.2 The EHS management system of the Contractor shall cover the EHS requirements including but not limited to what is specified under Para 1.0 and para 2.0 above.

3.1.3 Contractor shall be fully responsible for planning and implementing EHSrequirements. Contractor as a minimum requirement shall designate / deploy thefollowing to co-ordinate the above :

No. of workers deployed

Up to 250	- Designate one safety supervisor
Above 250 & up to 500	- Deploy one qualified and experienced safetyEngineer / officer
Above 500	- One additional safety (for every 500 or less) engineer/officer as above.

Contractor shall indemnify & hold harmless Owner / CMPDIL& either representatives free from any and all liabilities arising out of non - fulfillments of EHS requirements.

3.1.4 The Contractor shall ensure that the Environment, Health & Safety(EHS)requirements are clearly understood & faithfully implemented at all levels at site.

3.1.5 The Contractor shall promote and develop consciousness for Safety , Health and Environment among all personnel working for the Contractor. Regular awareness, program site meetings shall be arranged on EHS activities to cover hazards involved in various operations during construction.

3.1.6 Arrange suitable first aid measures such as First Aid Box, trained personnel to give First Aid, Stand by Ambulance or Vehicle and install fire protection measures such as : adequate number of steel buckets with sand and adequate fire extinguishers to the satisfaction of CMPDIL/Owner.

3.1.7 The Contractor shall evolve a comprehensive planned and documented system for implementation and monitoring of the EHS requirements. This shall be submitted to CMPDIL/ Owner for approval. The monitoring for implementation shall be done by regular inspections and compliance to the observations thereof. The Contractor shall get similar EHS requirements implemented at his sub-contractor(s) work site/office. However, compliance of EHS requirements shall be the sole responsibility of the Contractor. Any review / approval by CMPDIL/Owner shall not absolve contractor of his responsibility / liability in relation to all EHSrequirements.

3.1.8 Non-Conformance on EHS by Contractor (including his Sub-contractors) as brought out during review/audit by CMPDIL/Owner representatives shall be resolved forthwith by Contractor. Compliance report shall be provided to CMPDIL/Owner.

3.1.9 The Contractor shall ensure participation of his Resident Engineer / Site-in-Charge in the Safety Committee / EHS Committees meetings arranged by CMPDIL/Owner. The compliance of any observations shall be arranged urgently. He shall assist

CMPDIL/Owner to achieve the targets set by them on EHS during the project implementation.

3.1.10 The Contractor shall adhere consistently to all provisions of EHS requirements. In case of non-compliance or continuous failure in implementation of any of EHS provisions; CMPDIL/Owner may impose stoppage of work without any Cost & Time implication to Owner and/or impose a suitable penalty for non-compliance with a notice of suitable period, **up to a cumulative limit of 1.0% (one percent) of Contract Value with a maximum limit of Rs. 10 lakhs**. This penalty shall be in addition to all other penalties specified else where in the contract. The decision of imposing stoppage work, its extent & monitory penalty shall rest with CMPDIL/Owner & binding on the Contractor.

3.1.11 All fatal accidents and other personnel accidents shall be investigated by a team of Contractor"s senior personnel for root cause & recommend corrective and preventive actions. Findings shall be documented and suitable actions taken to avoid recurrences shall be communicated to CMPDIL/Owner. Owner / CMPDIL shall have the liberty to independently investigate such occurrences and Contractor shall extend all necessary help and co-operation in this regard.

3.2 HOUSE KEEPING

3.2.1 Contractor shall ensure that a high degree of house keeping ismaintained and shall ensure inter alia the followings wherever applicable:

a. All surplus earth and debris are removed/disposed off from the working areas to identified location(s).

b. Unused/Surplus Cables, Steel items and steel scrap lying scattered atdifferent places within the working areas are removed to identifiedlocation(s).

c. All wooden scrap, empty wooden cable drums and other combustiblepacking materials, shall be removed from work place to identifiedlocation(s).

d. Roads shall be kept clear and materials like: pipes, steel, sandboulders, concrete, chips and bricks etc. shall not be allowed on theroads to obstruct free movement of men & machineries.

e. Fabricated steel structural, pipes & piping materials shall be stacked properly for erection.

f. Water logging on roads shall not be allowed.

g. No parking of trucks / trolleys, cranes and trailers etc. shall be allowed on roads which may obstruct the traffic movement.

h. Utmost care shall be taken to ensure over all cleanliness and properupkeep of the working areas.

i. Trucks carrying sand, earth and pulverised materials etc. shall be covered while moving within the premises.

j Only properly designed steel scaffolding materials to be used for workingat heights more than 3.0M . Double scaffolding using wooden ballis maybe allowed for working at height less than 3.0M

3.3 ENVIRONMENT, HEALTH AND SAFETY

3.3.1 The Contractor shall provide safe means of access to any working placeincluding provisions of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen, and, CMPDIL/Owner. Contractor shall ensure deployment of appropriate equipment and appliances for adequate safety and health of the workmen and protection of surrounding areas.

3.3.2 The Contractor shall ensure that all their staff and workers including their sub-contractor(s) shall wear Safety Helmet and Safety shoes. Contractor shall also ensure use of safety belt, protective goggles, gloves etc. by the personnel as per job requirements. All these gadgets shall conform to relevant IS specifications

or equivalent.

3.3.3 Contractor shall ensure that a proper Safety Net System shall be used at appropriate locations. The safety net shall be located not more than 30 feet (9.0 metres) below the working surface at site to arrest or to reduce the consequences of a possible fall of persons working at different heights.

3.3.4 Contractor shall ensure that flash back arrester shall be used while using Gas Cylinders at site. Cylinders shall be mounted on trolleys.

3.3.5 The Contractor shall assign to his workmen, tasks commensurate with their qualification, experience and state of health for driving of vehicles, handling and erection of materials and equipments. All lifting equipments shall be tested certified for its capacity before use. Adequate and suitable lighting at every work place and approach there to, shall be provided by the Contractor before starting the actual operations at night.

3.3.6 Hazardous and/or toxic materials such as solvent coating, or thinners shall be stored in appropriate containers.

3.3.7 All hazardous materials shall be labelled with the name of the materials, the hazards associated with its use and necessary precautions to be taken.

3.3.8 Contractor shall ensure that during the performance of the work, all hazards to be health of personnel, have been identified, assessed andeliminated.

3.3.9 Chemical spills shall be contained & cleaned up immediately to prevent further contamination.

3.3.10 All personnel exposed to physical agents such as ionizing radiation, ultraviolet rays or similar other physical agents shall be provided with adequate shielding or protection commensurate with the type of exposure involved.

3.3.11 Where contact or exposure of hazardous materials could exceed limits or could

otherwise have harmful affects, appropriate personal protective equipments such as gloves, goggles, aprons, chemical resistant clothing andrespirator shall be used.

- A Crèche where 10 or more female workers are having children below the age of 6 years.

- Reasonable Canteen facilities are made available at appropriate location depending upon site conditions.

3.3.13 Suitable facilities for toilet, drinking water, proper lighting shall be provided at site and labour camps, commensurate with applicable Laws / Legislation.

3.3.14 Contractor shall ensure storage and utilization methodology of materials that are not detrimental to the environment. Where required Contractor shall ensure that only the environment friendly materials are selected.

3.3.15 All persons deployed at site shall be knowledgeable of and comply with the environmental laws, rules & regulations relating to the hazardous materials substances and wastes. Contractor shall not dump, release or otherwise discharge or dispose off any such materials without the express authorization of CMPDIL/Owner.

4.0 DETAILS OF EHS MANAGEMENT SYSTEM BY CONTRACTOR

4.1 On Award of Contract

The Contractor shall prior to start of work submit his Safety Health and Environment Manual or procedure and EHS Plans for approval by CMPDIL/Owner.The Contractor shall participate in the pre-start meeting with CMPDIL/Owner tofinalise EHS Plans including the following :

- Job procedure to be followed by Contractor for activities covering.Handling of equipment, Scaffolding, Electric Installation, describing the risks involved, actions to be taken and methodology for monitoring each activity.

- CMPDIL/Owner review / audit requirement.
- Organization structure along with responsibility and authority records / reports etc. on EHS activities.

4.2 During job execution

4.2.1 Implement approved Environment, Health & Safety management procedure including but not limited to as brought out under para 3.0. Contractor shall also ensure to:

- arrange workmen compensation insurance, registration under ESI Act, third party liability insurance etc., as applicable.

- arrange all HSE permits before start of activities (as applicable) like hot work, confined space, work at heights, storage of chemical / explosive materials and its use and implement all precautions mentioned therein.

- submit timely the completed checklist on EHS activities, Monthly EHS report, accident reports, investigation reports etc. as per CMPDIL/Owner requirements. Compliance of instructions on EHS shall be done by Contractor and informed urgently to CMPDIL/Owner.

- ensure that Resident Engineer / Site-in-Charge of the Contractor shall attend all the Safety Committee / EHS meetings arranged by CMPDIL/Owner. Only in case of his absence from site that a second senior most person shall be nominated by him in advance and communicated to CMPDIL/Owner.

- display at site office and work locations caution boards, list of hospitals, emergency services available.

- provide posters, banners for safe working to promote safety consciousness.

- carryout audits / inspection at sub contractor works as per approved EHSdocument and submit the reports for CMPDIL/Owner review.

- assist in EHS audits by CMPDIL/Owner, and submit compliance report.
- generate & submit HSE records / report as per EHS Plan.
- appraise CMPDIL/Owner on EHS activity

****

9.0 ANNEXURES

ANNEXURE- A1

LETTER OF BID

(To be uploaded by the Bidder on his letter head during submission of bid online)

To:

The Tender Committee

Civil Department, CMPDI HQ, Ranchi

Sub: BID for the Work "……."

NIT No:..... ..... Dated.....

Tender Id No: .....

Dear Sir,

This has reference to above referred bid. I/we have read and examined the conditions of contract, Scope of Work, technical specifications, BOQ and other documents carefully.

I /We am/are pleased to submit our bid for the above work. I/We hereby unconditionally accept the bid conditions and bid documents in its entirety for the above work and agree to abide by and fulfill all terms and conditions and specifications as contained in the bid document.

I/we here by confirm to submit all the documents as required to meet the eligibility criteria as per provision of the bid notice/document whenever asked for.

I/We hereby confirm that this bid complies with the Bid validity, Bid security and other documents as required by the Bidding documents.

If any information furnished by me/us towards eligibility criteria of this bid is found to be incorrect at any time, penal action as deemed fit may be taken against me/us for which I/We shall have no claim against CIL/Subsidiary.

Until a formal agreement is prepared and executed, this bid and your subsequent Letter of Acceptance/Work Order shall constitute a binding contract between us and CMPDI Ltd.

Should this bid be accepted, we agree to furnish Performance Security within 28 days of issue of letter

of acceptance and commence the work within 10 days of issue of letter of acceptance. In case of our failure to abide by the said provision CMPDI Ltd. shall, without prejudice to any other right or remedy, be at liberty to cancel the letter of acceptance/ award and to forfeit the Earnest Money and also debar us from participating in future tenders for a minimum period 12 months.

Yours faithfully,

Signature of Bidder

Name: Address…….. E-mail address……..

Mobile no…… Fax No…… Telephone No……

In case of JV, signature and other particulars listed above of all partners are mandatory

ANNEXURE- A2

PROFORMA FOR UNDERTAKING TO BE SUBMITTED BY THE L-1 Bidder (For genuineness of the information furnished by bidder on-line and authenticity of the documents submitted online in support of eligibility)

I / We, ...,Proprietor/Partner/Legal Attorney/Director/ Accredited Representative of M/S. ....., solemnly declare that:

1. I/We am/are submitting Bid for the work “Balance work for Construction of Office Building at CMPDI, RI-V, Bilaspur” against Bid Notice No. ..... Dated..... and I/we offer to execute the work in accordance with all the terms, conditions and provisions of the bid.

2. Myself / Our Partners/ Directors don’t has/have any relative as employee of CMPDI Ltd. / Coal India Ltd. /Any subsidiary of Coal India Ltd.

3. All information furnished by us in respect of fulfillment of eligibility criteria and qualification information of this Bid is complete, correct and true.

4. All copy of documents, credentials and documents submitted along with this Bid/to be submitted are genuine, authentic, true and valid.

5. I/ We hereby authorize department to seek references / clarifications from our Bankers.

6. I/We hereby undertake that we shall register and obtain license from the competent authority under the contract labour (Regulation & Abolition Act) as relevant, if applicable.

7. *I/We hereby confirm that we have registration with CMPF / EPF Authorities. We shall make necessary payments as required under law. **Or,**

*I/We hereby undertake that we shall take appropriate steps for registration as relevant under CMPF / EPF authorities, if applicable. We shall make necessary payments as required under law.

* Delete whichever is not applicable.

8. ** I/We have not been banned or delisted by any Govt., or Quasi Govt. Agencies or PSUs.

(In case of JV, all partners are covered)

Or

**I / We.....have been banned by the organization named "_____" for a period of..... year/s, effective from ..... to.....

[In case of JV, name(s) of the JV Partner(s)]

** Delete whichever is not applicable.

10. If any information and document submitted is found to be false/ incorrect at any time, department

may cancel my /our Bid and action as deemed fit may be taken against me/us, including termination of the contract, forfeiture of all dues including Earnest Money and banning/ delisting of our firm and all partners of the firm etc.

Signature of the Bidder

Name: Address…….. e- Mail address…….

Mobile no…… Fax No…… Telephone No……

In case of JV, signature and other particulars listed above of all partners are mandatory.

Dated.....

ANNEXURE –A3

MANDATE FORM FOR ELECTRONIC FUND TRANSFER/INTERNET BANKING PAYMENT.

M/s Central Mine and Planning Institute,

Gondwana Place, Kanke Road, Ranchi,

Jharkhand-834031.

Dear Sir,

Sub: Authorization for release of payment due from M/s Central Mine and Planning Institute, Gondwana Place, Kanke Road, Ranchi, through Electronic Fund transfer/Internet Banking. (SBI_NET).

Ref: Order No._____ Date _____ and/or Tender/Enquiry/Letter No. _____ Date _____

(Please fill in the information in CAPITAL LETTERS, Please TICK wherever it is applicable).

1. Name of the Party : _____

2. Address of the Party : _____

_____

City _____PINCODE-----

E- Mail Id

Permanent Account Number _____

3. Particulars of Bank

Bank Name Branch Name
Branch Place Branch City
PIN Code Branch Code
MICR No.

(9 Digits code number appearing on the MICR Band of the cheque supplied by the Bank. Please attach Xerox copy of a cheque of your bank for ensuring accuracy of the bank name, branch name and code number)

RTGS CODE

Account Type Savings Current Cash Credit

Account Number (as appearing in the Cheque Book)

Date from which the mandate should be effective.

I hereby declare that the particulars given above are correct and complete. If any transaction is delayed or not effected for reasons of incomplete or incorrect information. I shall not hold Central Mine Planning and Design Institute responsible. I also undertake to advise any change in the particulars of my account to facilitate up-dating of records for purpose of credit of amount through SBI Net.

Place:

Date:

Signature of the party/Authorized Signatory.

Certified that the particulars furnished above are correct as per our records.

Banker's Stamp: Date :

(Signature of the Authorized official from the Banks)

Annexure–A4

NON-BANNING OR DELISTING CERTIFICATE

M/s Central Mine and Planning Institute,

Gondwana Place, Kanke Road, Ranchi,

Jharkhand-834031.

This is to certify that our firm has not been suspended, banned or de-listed by any Government or Quasi-Government agencies or any PSU.

Date: Signature of the Bidder with seal of the firm

ANNEXURE – A5

PROFORMA OF BANK GURANTEE FOR PERFORMANCE SECURITY OF THE CONTRACT

To

Tender Inviting
Authority,

CMPDIL.

Re: Bank Guarantee in respect of Contract No…….. Dated……. Between Central Mine Planning & Design Institute, Ranchi and ……..…….. (Name of the Contractor)

WHEREAS,

…….. (Name and address of the Contractor) (herein after called "the Contractor") has entered into a contract made as per letter of acceptance ……. Dated ……..(hereinafter called the said contract) with M/s CMPDI LTD having its Registered Office at Gondwana Place, Kanke Road, Ranchi, Jharkhand (hereinafter called "the Company") to execute ……. (Name of the contract and brief description of work) on the terms and conditions contained in the said contract.

It has been agreed that the Contractor shall furnish a Performance Security in the shape of Bank Guarantee from a Schedule Bank for a sum of Rs…….. as security for due compliance and performance of the terms and conditions of the said contract.

We …… (Name of the Bank) having its branch/office at ……..… have at the request of the Contractor, agreed to furnish this Bank Guarantee by way of Performance Security.

NOW, THEREFORE, we, the …….. Bank ((hereinafter called "the Bank") hereby unconditionally and irrevocably, guarantees and affirms as follows :

The Bank do hereby irrevocably guarantees and unconditionally agree with the Company that if the contractor shall in any way fail to observe or perform the terms and conditions of the said contract

or shall commit any breach of its obligation thereunder, the Bank shall on its mere first written demand, and without any objection, demur and without any reference to the contractor, pay to the company the said sum of Rs…… or such portion as shall then remain due with interest without requiring the Company to have recourse to any legal remedy that may be available to it to compel the Bank to pay the sum, or failing on the company to compel such payment by the contractor.

Any such demand shall be conclusive as regards the liability of the Contractor to the company and as regards the amount payable by the Bank under this Guarantee. The Bank shall not be entitled to withhold payment on the ground that the Contractor has disputed its liability to pay or has disputed the quantum of the amount or that any arbitration proceeding or legal proceeding is pending between the company and the Contractor regarding the claim.

The Bank further agree that the Guarantee shall come into force from the date hereof and shall remain in force and effect till the period that will be taken for the performance of the said Contract which is likely to be ……. day of …….. but if the period of Contract is extended either pursuant to the provisions in the said contract or by mutual agreement between the contractor and the company, the Bank shall renew the period of the Bank Guarantee failing which it shall pay to the company the said sum of Rs…… or such lesser amount of the said sum of Rs…… as may be due to the company and as the company may demand.

This Guarantee shall remain in force until the dues of the company in respect of the said sum of Rs……. and interest are fully satisfied and the Company certifies that the Contract has been fully carried out by the Contractor and discharged the guarantee.

The Bank further agrees with the company that the company shall have the fullest liberty without consent of the Bank and without affecting in any way the obligations hereunder to vary any of the terms and conditions of the said contract or to extend time for performance of the said contract from time to time or to postpone for any time or from time to time any of the powers exercisable by the Company against the contractor and to forebear to enforce any of the terms and conditions relating to the said Contract and the Bank shall not be relieved from its liability by reason of such failure or extension being granted to the Contractor or to any forbearance, act or omissions on the part of the company or any indulgence by the Company to the Contractor or any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect or relieving or discharging the Guarantor.

The Bank further agrees that in case this Guarantee is required for a longer period and it is not extended by the Bank beyond the period specified, above the Bank shall pay to the company the said sum of Rs…….. or such lesser sum as may then be deemed to the Company and as the Company may require.

Notwithstanding anything contained herein the liability of the Bank under this Guarantee is restricted to Rs……..…… the guarantee shall remain in force till the day ……..* of *……..……. and unless the guarantee is renewed or claim is preferred against the bank on or before the said date all rights of the Company under this guarantee shall cease and the Bank shall be relieved and discharged from all liabilities hereunder except as provided in the preceding Clause.

*The date shall cover a period of minimum one year or ninety days beyond the date of completion

whichever is more.

Any Notice by way of request, demand or otherwise herein under may be sent by Post/email/fax addressed to the Bank branch/operative branch, which shall be deemed to be a sufficient demand notice. Bank shall effect payment thereof forthwith.

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

The Bank has under its constitution power to give this Guarantee and

Sri……. who has signed it on behalf of the Bank has authority to do

so. Signed and sealed this …….. day of …… at ……

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by

Signature …….

Name …….

Designation …….

Code No. …….

Address …….

ANNEXURE – A6

PROFORMA FOR EXECUTION OF AGREEMENT.

(TO BE STAMPED IN ACCORDANCE WITH STAMP ACT)

This agreement is made on …….. day of …….. between M/s CMPDI LTD having its Registered Office at Gondwana Place, Kanke Road, Ranchi, Jharkhand (hereinafter called "the Company") which expression shall, unless repugnant to the subject or context, include its successors and assignees) of the one part and……..

(Name of the Contractor) carrying on business as a (partnership/proprietorship/ Ltd. Co. etc.) firm under the name and style …… (here-in-after called the "said Contractor" which expression shall, unless the context requires otherwise include them and their respective heirs, executors, administrators and legal representatives) of the other part.

Whereas the Company invited tenders for the work of "Balance work for Construction of Office Building at CMPDI, RI-V, Bilaspur" and whereas the said Contractor/Firm submitted tender for the said work and deposited a sum of Rs…….. as Earnest Money and whereas the tender of the said contract has been accepted by the Company for execution of the said work.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this agreement words and expressions shall have the same meaning as are respectively assigned to them in the tender papers hereinafter referred to.

2. The following documents which are annexures to this agreement should be deemed to form and be read and construed as part of this agreement viz.

i) Annexure – A : Tender Notice (Page …….. to ……..)

ii) Schedule-A : General terms and Conditions, Special Conditions and General Technical Specification (Page …. To……) and

Safety Code.

iii) Schedule – B : The probable Quantities and Amount (Page ….. to ……)

iv) Schedule - C : Negotiation letters (Page ….. to ……)

v) Schedule –D : Letter of Acceptance / Work Order (Page ….. to ……)

vi) Schedule –E : Drawings (Page ….. to ……)

3. In consideration for the payment of the sum of Rs……(W/O Value; both in words and figures) or such other sum as may be arrived at under the clause of the specification relating to Payment by items measurements at unit prices by the Company, the said Contractor shall, subject to the terms & condition contained herein execute and complete the work as described and to the extent of probable quantities as indicated in Schedule B with such variations by way of alteration, addition to or reduction from the said works.

4. The Company has received a sum of Rs……. Towards Performance Security Deposit (1st part of Security Deposit) in the form of Demand Draft/Certified Cheque/B.G/Other Form (details to be furnished).

5. The said Contractor hereby covenants with the Company that the Company shall deduct at 5% of R/A bills as Retention money (2nd part of Security deposit) to make the total Security as 10% (ten percent) of contract value as per the terms & conditions of the tender/contract.

IN WITNESS WHEREOF THE parties herein have set their hands and seals the date and year above written.

1 Partner. Signature

2 Partner Signature

On behalf of M/S……..

The Contractor, as one of the constituted attorney,

In the presence of –

1. Name _____ Signature

Address :

Occupation:

Signed by Sri …….on behalf of Signature

(Name of Company) in presence of -

1. Name : Signature
2. Address:

Note: In case of Joint Venture signature of all partners of Joint Venture is mandatory.

ANNEXURE-A7

[Instructions: Successful Bidder shall be required to upload/ submit the Integrity Pact document duly signed, stamped and accepted on each page mentioning the Tender No. and date.]

INTEGRITY PACT

Between

Central Mine Planning and Design Institute Limited (CMPDIL) hereinafter referred to as "The Principal",

And

…… , hereinafter referred to as "The Bidder/ Contractor"

Preamble

The principal intends to award, under laid down organizational procedures, contracts for ……. The Principal values full compliance with all relevant laws and regulations, and the principles of economic use of resources and of fairness and transparency in its relations with its Bidder(s) and Contractor(s).

In order to achieve these goals, the Principal cooperates with the international Non-Governmental Organization "Transparency International" (TI). Following TI's national and international experience, the Principal will appoint external independent Monitors 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) The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

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 or accept, for him/herself or third person, any material or immaterial benefit which he/she is not legally entitled to.
2. The Principal will, during the tender process treat all Bidders with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidders the same information and will not provide to any Bidder confidential/ additional information through which the Bidders could obtain an advantage in relation to the tender process or the contract execution.

3. The Principal will exclude from the process all known prejudiced persons.

(2) If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the relevant Anti-Corruption Laws of India, or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder/ Contractor

(1) The Bidder/ Contractor commits itself 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.

1. The Bidder/ Contractor will not, directly or through any other person or firm, offer, promise or give 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 or immaterial benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind what-so-ever during the tender process or during the execution of the contract.
2 The Bidder/ Contractor will not enter with other Bidders into any 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.
3. The Bidder/ Contractor will not commit any offence under the relevant Anti-Corruption Laws of India, further the Bidder/ Contractor 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.
4. The Bidder/ Contractor will, when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

(2) The Bidder/ Contractor 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/ Contractor, before contract award has committed a transgression through a violation of Section 2 or in any other form such as to put his reliability or credibility as Bidder into question, the Principal is entitled to disqualify the Bidder/ Contractor from the tender process or to terminate the contract if already signed for such reason.
(1) If the Bidder/Contractor has committed a transgression through a violation of section-2 such as to put his reliability or credibility into question, the principal is entitled also to exclude the Bidder/Contractor from future contract award processes. The imposition and duration of exclusion will be determined by the severity of the transgression. The severity will be determined by circumstances of the case, in particular the number of transgressions, the position of the transgressors within the company hierarchy of the Bidder and the amount of damage. The exclusion will be imposed for a minimum of six months and maximum of 3 years.

(2) The Bidder accepts and undertakes to respect and uphold the Principal's absolute right to resort to and impose such exclusion and further accepts and undertakes not to challenge or question such exclusion on any ground, including the lack of any hearing before the decision to resort to such exclusion is taken. This undertaking is given freshly and after obtaining independent legal advice.

(3) If the Bidder/Contractor can prove that he has restored/ recouped the damage caused by him and has installed a suitable corruption prevention system, the Principal may revoke the exclusion prematurely.

(4) A transgression is considered to have occurred if in light of available evidence no reasonable doubt is possible.

Section4 – Compensation for Damages

(1) If the Principal has disqualified the Bidder from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover from the Bidder liquidated damages equivalent to 3% of the value of the offer or the amount equivalent to Earnest Money Deposit/ Bid Security, whichever is higher.
(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 5% of the contract value or the amount equivalent to Security Deposit/ Performance Bank Guarantee, whichever is higher.
(3) The Bidder agrees and undertakes to pay the said amounts without protest or demur subject only to condition that if the Bidder/Contractor can prove and establish that the exclusion of the Bidder from the tender process or the terminate of the contract after the contract award has caused no damage or less damage that the amount of the liquidated damages, the Bidder/ Contractor shall compensate the Principal only to the extent of the damage in the amount proved.

Section 5 – Previous transgression

(1) The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the TI approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.
(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/ Subcontractors.

(1) The Bidder / Contractor undertakes to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.
(2) The Principal will enter into agreement with identical conditions as this one with all Bidders, Contractors and subcontractors.
(3) The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

Section7–Criminal charges against violating Bidders / Contractors /Subcontractors

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 – External Independent Monitor/ Monitors (Two in number depending on the size of the contract) (to be decided by the Chairperson of the Principal)

(1) The Principal appoints competent and credible External Independent 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.
(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 Chairperson of the Board of the Principal.
(3) The Contractor accepts that the Monitor has the right to access without restriction to all Project documentation of the Principal including that provided by the Contractor. The Contractor will also grant the monitor, upon his request and demonstration of a valid Interest, Unrestricted and unconditional access to his project documentation. The same is applicable to subcontractors. The Monitor is under contractual obligation to treat the information and documents of the Bidder, Contractor /Subcontractor with confidentiality.
(4) The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the project 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.

(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 heal the violation 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.
(6) The monitor will submit a written report to the Chairperson of the Board of the principal within 8 to10 weeks from the date of reference or intimation to him by the "Principal" and, should the occasion arise, submit proposals for correcting problematic situations.
(7) Monitor shall be entitled to compensation on the same terms as being extended to / provided to outside expert committee members/ Chairman as prevailing with Principal.
(8) If the Monitor has reported to the Chairperson of the Board, a substantiated suspicion of an offence under relevant ant corruption loss of India, and the Chairperson has not within reasonable time, taken visible action to proceed against such offences or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.
(9) The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

This Pact begins when both parties have legally signed it. 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.
If any claim is made/ agreed during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged / determined by Chairperson of the Principal..

Section 10 – Other provisions

(1) This agreement is subject to Indian Law, Place of performance and jurisdiction is the Registered Office of the Principal, i.e. Ranchi.
(2) Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
(3) If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
(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.

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(For & on behalf of the Principal)	(For & on behalf of Bidder/ Contractor)
(Office Seal)	(Office Seal)

Place: ……..
Date: …….

Witness 1: ……..
(Name & Address) ……..
……..
……..

Witness 2: ……..
(Name & Address) ……..
……..
……..

Names and addresses of the Independent External Monitors for operation of the Integrity Pact with CMPDI

Name	Address	Contact Number
Prof(Dr)L.C.SINGHI, IAS(Retd)	L-31, Third floor, Kailash colony, New Delhi .	Ph. No: 91-11-29237274. Mob. No: +919968073976 e-mail: lcsinghi@yahoo.com & lcsinghi@gmail.com
Dr S. M. Jharwal, IES (Retd).	Flat No: 69, IES Apartment, Plot No: 9, Sector: 4, Dwarka, New Delhi	e-mail: jharwal@nic.in

ANNEXURE- A- 8

SPECIMEN OF LETTER OF CONTRACTOR'S ACCEPTANCE OF PROVISIONAL REDUCTION OF RATE FOR SUBSTANDARD WORK

No. Dated

To

General
Manager/HoD(Civil)

Tender Inviting Authority

Address of TIA.

Sir,

Subject: Name of work:

Reference: Your letter No……..

I/We have carefully read the terms and conditions offered in your letter dated…… and they are acceptable to me/us.

Pending the decision of the Engineer in Charge of the final rates of payment against the items of work specified in the statement attached to your above letter, which will be final and binding. I/We agree to the same being paid at the provisional rates indicated against each of the said item of work for the above work as mentioned in your statement.

Yours faithfully,

Contractor(s)

ANNEXURE- A- 9

PROFORMA OF BANK GUARANTEE IN LIEU OF BID SECURITY/EARNEST MONEY

To
Tender Inviting authority,
M/s CENTRAL MINE PLANNING & DESIGN INSTITUTE Ltd.
Address of TIA.
Dear Sir,

1. In consideration of the Notice issued by M/s CMPDI LTD having its Registered Office at Gondwana Place, Kanke Road, Ranchi, Jharkhand (hereinafter called "the Company" which expression shall unless repugnant to the subject or context includes its successors and assigns) having agreed to accept from M/s. ……. Having its registered office at …….. (hereinafter called "the said bidder" which expression shall unless repugnant to the subject or context includes its successors and assigns) a Bank Guarantee from a Nationalized/Scheduled Bank in lieu of deposit of Bid Security/Earnest Money in Bank Draft amounting to Rs…….. for the due fulfilment of the terms and conditions contained in the Bid No. …… Dated ……., We ……. Bank (hereinafter referred to as the Bank) having its Office/Branch at …… do hereby undertake to pay to the Company an amount not exceeding Rs…… on demand by the Company for the reason of any breach by the bidder of any of the Terms and conditions contained in the said bid. The decision of the Company as to whether any such breach having been committed by the bidder shall be final and binding on us.

2. We ……. Bank, do hereby undertake to pay an amount due and payable under this Guarantee without any demur merely on a demand from the Company stating that the amount claimed is due from the bidder for the reason of breach by the said bidder of any Terms and conditions contained in the said bid or for the reason of the bidder failing to keep the bid valid. Any such demand made on the Bank shall be conclusive. As regards the amount due and payable by the bank under this guarantee shall be restricted to an amount not exceeding ……

3. We, the said Bank further agree that the Guarantee herein contained shall come into force from the date hereof and shall remain in full force and effect till a demand or claim under this Guarantee is made on us in writing on or before the ……. **…… We shall be discharged from all liability under this guarantee thereafter.

** The bidder shall allow guarantee up to bid validity period plus ninety days considering date of submission/revised submission, if any, or up to …… as fixed by the notice inviting authority.

4. We the said Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the company in writing and agree that any change in the constitution of the said bidder or the bank shall not discharge our liability hereunder.

5. The Bank has under its constitution power to give this Guarantee and Sri ……. Who has signed it on behalf of he Bank, has authority to do so. Signed and sealed this …….. day of …… at ……

SIGNED, SEALED AND DELIVERED
For and on behalf of the Bank by
Signature ……..
Name ……..
Designation ……..
Code No. ……..
Address ……..

"The Bank Guarantee as referred above shall be operative/payable at our branch at Ranchi.

Signature of the authorized person for and on behalf of the Bank

ANNEXURE – A 10

PROFORMA OF BANK GUARANTEE FOR MOBILISATION/ LUMP SUM ADVANCE.

(If applicable as per tender conditions)

To

Tender Inviting Authority,

CMPDI,

Address of TIA

Dear Sir,

In consideration of M/S. Central Mine Planning & Design Institute, having its Registered Office at Gondwana Place, Kanke Road, Ranchi.(hereinafter called "the Company" which expression shall unless repugnant to the subject or context includes its successors and assigns) having agreed under the terms and conditions of the contract no…… dated…….. entered into between Coal India Limited/Subsidiary Company and M/s…….. having its Registered Office at …….. (hereinafter called "the Contractor" to make mobilization advance lump-sum advance to the tune of Rs…… subject to submission of the Bank Guarantee for equal amount from any Nationalized Bank/ Scheduled Bank(referred to as the said Bank)having its registered Office at ……. do hereby undertake and agree to pay the company to the extent of Rs……. on demand stating that the amount claimed by the Company is due and payable by the contractor for the reasons of non-refund and or non-recovery of the amount with interest thereon and to unconditionally pay the amount claimed by the company on such demand without any demur to the extent aforesaid.

2. We…… Bank agree that the company shall be the sole judge as to whether the said contractor has failed/neglected in refunding the amount advanced by the Company and/or extent of loss and damages caused to or suffered by the Company on account of the amount advanced not being recovered in full and non-utilization of the said advanced amount or part thereof for the purpose of performance of the contract and interest payable thereon and the decision of the company in this behalf shall be final and binding on us.

3.We the said Bank further agree that the Guarantee herein contained shall remain in full force and effect up to ……..and any claim received after the said date shall in no case bind the Bank.

4.The Company shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee or indemnity from time to time vary any of the terms and conditions of the said contract or to extend the time of performance by the said contractor or to postpone any time and from time to time any of the powers exercisable by it against the said contractor and either to enforce or to forbear from enforcing any of the terms and conditions governing the said contract or securities available to the company and the said Bank shall not be released from its liability under these presents.

Notwithstanding anything contained herein the liability of the said Bank under this guarantee is restricted to Rs……. and this Guarantee shall come into force from the date hereof and shall remain in full force and effect till ……. unless the written demand or claim under this Guarantee is made by the Company with us on or before ..... all rights of the Company under this Guarantee shall cease to have any effect and we shall be discharged from our liabilities hereunder.

We the said Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the company in writing and agree that any change in the constitution of the said contractor or the said bank shall not discharge our liability hereunder.

This guarantee issued by Sri …… who is authorized by the Bank.

Under jurisdiction of …… Court only.

ANNEXURE
– A11

PROFORMA OF BANK GURANTEE FOR RELEASE OF RETENTION MONEY/BID SECURITY DEDUCTED @ 5% FROM RUNNING BILL (IN LIEU OF RECEIVING PAYMENT AGAINST THE SECURITY DEPOSIT ACCRUED ANNUALLY BY PAYING THE RUNNING BILL AT 95% i.e. THE RETENTION MONEY DEDUCTED @5% FROM RUNNING BILL)

To

TIA

Address of the TIA.

Re: Bank guarantee in respect of contract no ……..Dated…… between M/s CMPDI LTD having its Registered Office at Gondwana Place, Kanke Road, Ranchi, Jharkhand and ……..(Name of the contractor)

WHEREAS

……..(name and address of the Contractor) (herein after called 'the Contractor') has entered into a contract dated ……..(hereinafter called the said contract) with M/s CMPDI LTD (hereinafter called "the Company") to execute Balance work for Construction of Office Building at CMPDI, RI-V, Bilaspur on the Terms and conditions contained in the said contract.

It has been agreed that the contractor shall furnish a Bank Guarantee from a Schedule Bank for a sum of Rs…….. As Security for release of equivalent amount of retention money /bid security as per terms and conditions of the said contract.

We, …….. (Name of the Bank) having its branch/office at Bilaspur have, at the request of the contractor, agreed to furnish this bank guarantee by way of bid security.

NOW, THEREFORE, we the ……Bank (hereinafter called the Bank) hereby, unconditionally and irrevocably, guarantees and affirms as follows:

The Bank do hereby irrevocably guarantees and unconditionally agree with the Company that if the contractor shall in any way fail to observe or perform the terms and conditions of the said contract or shall commit any breach of its obligation thereunder, the bank shall on its mere first written demand, and without any objection, demur and without any reference to the contractor, pay to the company the said sum of …… or such portion as shall then remain due with interest without requiring the Company to have recourse to any legal remedy that may be available to it to compel the bank to pay the sum, or failing on the Company to compel such payment by the contractor.

Any such demand, shall be conclusive as regards the liability of the contractor to the company and as regards the amount payable by the bank under this guarantee. The bank shall not be entitled to withhold payment on the ground that the contractor has disputed its liability to pay or has disputed the quantum of the amount or that any arbitration proceeding or legal proceeding is pending between the company and the contractor regarding the claim.

The Bank further agree that the guarantee shall come into force from the date hereof and shall remain in force and effect till the period that will be taken for the performance of the said contract which is likely to be ……. Day of …… but if the period of contract is extended either pursuant to the provisions in the said contract or by mutual agreement between the contractor and the Company , the bank shall renew the period of the Bank Guarantee failing which it shall pay to the Company the said sum of Rs……. Or such lesser amount of the said sum of Rs…… as may be due to the Company and as the Company may demand.

The guarantee shall remain in force until the dues of the Company in respect of the said sum of Rs……. and interest are fully satisfied and the Company certifies that the contract has been fully carried out by the contractor and he has discharged the guarantee.

The bank further agrees with the Company that the company shall have the fullest liberty without consent of the Bank and without affecting in any way the obligations hereunder to vary any of the items and conditions of the said contract or to extend time for performance of the said contract from time to time or to postpone for any time or from time to time any of the powers exercisable by the Company against the contractor and to forebear to enforce any of the terms and conditions relating to the said contract and the bank shall not be relieved from its liability by reason of such failure or extension being granted to the contractor or to any forbearance, act or omissions on the part of the company or any indulgence by the company to the contractor or any other matter or thing whatsoever which under the law relating to sureties would but for this provision have the effect or relieving or discharging the guarantor.

The Bank further agrees that in case this guarantee is required for a longer period and it is not extended by the Bank beyond the period specified above the Bank shall pay to the company the said sum of Rs……. Or such lesser sum as may then be deemed to the Company and as the Company may require.

Notwithstanding anything contained herein the liability of the Bank under this Guarantee is restricted to Rs…….. The Guarantee shall remain in force till the day……..*……. of …….*……. And unless the Guarantee is renewed or claim is preferred against the Bank on or before the said date all rights of the Company under this Guarantee shall cease and the Bank shall be relieved and discharged from all liabilities hereunder except as provided in the preceding clause.

*The date of Guarantee shall cover a period of minimum period of one year or suitable period i.e. ninety days beyond the defect liability period whichever is more. Defect Liability Period shall be derived based on provisions of contract.

Any notice by way of request, demand or otherwise hereunder may be sent by Post/e-mail/fax addressed to the branch/operative branch, which shall be deemed to be a sufficient demand notice. Bank shall effect payment thereof forthwith.

The guarantee will not be discharged due to the change in the constitution of the Bank or the contractor. The Bank has under its constitution power to give this Guarantee and

Sri……. who has signed it on behalf of the Bank has authority to do so.

Signed and sealed this ……..day of …… at ……

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by

Signature …….

Name …….

Designation …….

Code No. …….

Address …….

“The Bank Guarantee as referred above shall be operative/payable at our branch at Bilaspur

ANNEXURE – A-12

PROFORMA OF JOINT VENTURE AGREEMENT

(On Non-Judicial Stamp paper of appropriate value as per provision of Stamp Act applicable in the concerned State)

This Joint Venture agreement is made on this ……day of ……..

AMONGST/BETWEEN

M/s ……, having its registered office at …….. represented by Shri…… (Name and Designation) of M/s …….. who has power of Attorney to enter into Joint Venture with …… and sign all documents/agreements on behalf of M/s ……. (herein after referred to as "…….")

AND

M/s ……, having its registered office at …….. represented by Shri…… (Name and Designation) of M/s …….. who has power of Attorney to enter into Joint Venture with …… and sign all documents/agreements on behalf of M/s ……. (herein after referred to as "…….")

AND

M/s ……, having its registered office at …….. represented by Shri…… (Name and Designation) of M/s …….. who has power of Attorney to enter into Joint Venture with …… and sign all documents/agreements on behalf of M/s ……. (herein after referred to as "…….")

The expressions M/s …….. and M/s …….. and M/s ……. Shall, wherever the context admits, mean and include their respective legal representatives, successors-in-interests and assigns and shall collectively be referred to as "Joint Venture/Parties" and individually as "Joint Venture Partner/Party".

WHEREAS M/s …… and M/s ……. agreed to form a joint venture in order to join their forces to obtain best results from the combinations of their individual resources of technical and management skill, finance and equipment for the benefit of the project and in order to submit the bid for the work of Balance work for Construction of Office Building at CMPDI, RI-V, Bilaspur (hereinafter referred to as "Project") under M/s CMPDI LTD having its Registered Office at Gondwana Place, Kanke Road, Ranchi, Jharkhand (herein referred to as the "principal employer").

The parties hereby enter into this Joint Venture agreement (hereinafter referred to as "Joint Venture Agreement") to jointly prepare and submit and submit the bid for the project and in the event of securing the Project from the Employer, to execute the Project in accordance with the contract terms and conditions, to the satisfaction of the principal employer.

NOW, THEREFORE, the parties, in consideration of the mutual premises contained herein agree as follows:

1) **FORMATION AND TERMINATION OF THE JOINT VENTURE**

The parties under this agreement have decided to form a joint venture to submit the Bid for the above Project and execute the Contract with the Principal Employer for the Project, if qualified and awarded.

a) The name and style of the Joint Venture shall be "……" (herein after called the "Joint Venture")

b) The Head office of the Joint Venture shall be located at ……and the site office will be located at the site of the Project. All communication regarding the Project will be made to …… Telephone nos……

c) Neither of the parties of the Joint Venture shall be allowed to sign, pledge, sell or otherwise dispose all or part of its respective interests in the Joint Venture to any party including the existing partner of the Joint Venture.

d) The terms of Joint Venture shall begin as on the date first set forth above and shall terminate on the earliest of the following dates.

i) The Joint Venture fails to obtain qualification from the Employer.

ii) The contract for the project is not awarded to the Joint Venture.

iii) The Employer cancels the Project

iii) The Project is completed including defect liability period to the satisfaction of the Employer and all the parties complete any and all duties, liabilities and responsibilities under or in connection with the Contract and the Joint Venture agreement.

2) **LEAD PARTNER**

M/s ……shall be the Lead Partner of the Joint Venture and is in-charge for performing the contract management. M/s…….. shall be attorney of the parties duly authorized to incur liabilities and receive instructions for and on behalf of any and all partners in the Joint Venture and also all the partners of the Joint Venture shall be jointly and severally liable during the bidding process and for the execution of the contract as per contract terms with the employer in accordance with the power of attorney annexed. All Joint Venture partners M/s ……., M/s……. and M/s …….. nominate and authorize Sri …….. (Name and designation) of M/s …… to sign all letters, correspondence, papers and certificates and to submit the bid document for and on behalf of the Joint Venture.

3) REPRESENTATIVE OF THE PARTNERS OF THE JOINT VENTURE

Each constituent party of the Joint Venture appoint the following personnel as the representative of

the relevant party with full power of attorney from the Board of Directors of the concerned company, or from the partners of the entity, or from the proprietor.

JV Partner	Name	Position in the respective company
M/s …….		
M/s …….		
M/s …….		

4) PARTICIPATION SHARE AND WORK RESPONSIBILITIES

Each constituent party of the Joint Venture appoint the following personnel as the representative of the relevant party with full power of attorney from the Board of Directors of the concerned company, or from the partners of the entity, or from the proprietor.

4.1 The parties agree that their respective participation share (hereinafter called “Participation Share”) in the Joint Venture shall be as follows:

M/s …….	……. % (……. Per cent)
M/s …….	……. % (……. Per cent)
M/s …….	……. % (……. Per cent)

4.2 The parties shall share the rights and obligations, risk, cost and expenses, working capitals, profit or losses or others arising out of or in relation to execution of the project in proportion to

their share of participation in the Joint Venture except as otherwise agreed.

4.3 The parties shall jointly execute the works under the project as an integrated entity and allocate responsibilities as regards division of work between themselves by organizing the adequate resources for successful completion of the project. However, all parties shall remain jointly and severally responsible for the satisfactory execution of the project in accordance with the contract terms and conditions.

5) JOINT AND SEVERAL LIABILITIES

All partners of Joint Venture shall be liable jointly and severally during the bidding process; and in the event the contract is awarded, during the execution of the contract, in accordance with contract terms.

6) WORKING CAPITAL

Each party shall contribute working capital for equipment, labour and material or any expenses incurred for execution of the project or any other investment required in connection with the execution of the project proportionate to the participation ratio.

7) BID SECURITY

Bid security, performance security and other securities shall be paid by the Joint Venture as otherwise agreed.

8) PERSONNEL AND EQUIPMENT

Team of managers/engineers of all the partners of the Joint Venture will form part of the core management structure and assist in execution of the project. The list of personnel and equipment proposed to be engaged for the project by each party will be decided by the management committee.

9) NON-PERFORMANCE OF RESPONSIBILITY BY ANY PARTY OF JOINT VENTURE

a. As between themselves, each party shall be full responsible for the fulfilment of all obligations arising out of its scope of the work for the project to be clarified subject to the agreement between the parties and shall hold harmless and indemnified against any damage arising from its default or non-fulfilment of such obligations.

b. if any party fails to perform its obligations described in this agreement during the execution of the project and to cure such breach within the period designated by the non-defaulting party, then the other party shall have the right to take up work, the interest and responsibilities of the defaulting party at the cost of the defaulting party.

c. Stepping into the shoes of the existing partner of Joint Venture with all liabilities of the existing partner from the beginning of the contract with the prior approval of the Company.

d. Notwithstanding demarcation or allotment of work of between/amongst Joint Venture partners, Joint Venture shall be liable for non-performance of the whole contract irrespective of their demarcation or share of work.

e. In case bid being accepted by Company, the payments under the contract shall only be made to the Joint Venture and not to the individual partners.

10) BANK ACCOUNT

Separate Bank A/c. shall be opened in the name of the Joint Venture in a scheduled or Nationalized Bank in India as per mutual agreement and all payments due to the Joint Venture shall be received only in that account, which shall be operated jointly by the representative of the Parties hereto. The financial obligations of the Joint Venture shall be discharged through the said Joint Venture Bank account only and also all the payments received or paid by the Company to the Joint Venture shall be through that account only.

11) LIMIT OF JOINT VENTURE ACTIVITIES

The Joint Venture activities are limited to the bidding and in case of award, to the performance of the Contract for the Project according to the conditions of the Contract with the Employer.

12) TAXES

Each Party shall be responsible for its own taxes, duties and other levies to be imposed on each party in connection with the Project. The taxes, duties and other levies imposed on the Joint Venture in connection with the Project shall be paid from the account of the Joint Venture.

13) EXCLUSIVITY

The parties hereto agree and undertake that they shall not directly or indirectly either individually or with other party or parties take part in the bid for the said project. Each party further guarantee to the other party hereto that this undertaking shall also apply to its subsidiaries and companies under its direct or indirect control.

14) MISCELLANEOUS

a. Neither party of the Joint Venture shall assign, pledge, sell or otherwise dispose all or part its respective interests in the Joint Venture to all third party without the agreement of the other party in writing.

b. subject to the above clause, the terms and conditions of this agreement shall be binding upon the parties, the Directors, Officers, Employees, Successors, Assigns and Representatives.

15) APPLICABLE LAW

This agreement shall be interpreted under laws and regulations of India.

IN WITNESS whereof the parties hereto have hereunder set their respective hands and seals the day, month, year first above written

For……	For ……..	For……..
Signature ……..	Signature ……..	Signature ……..
(Name and address)	(Name and address)	(Name and address)
(Official Seal)	(Official Seal)	(Official Seal)
Place ……	Place ……	Place ……
Date ……..	Date ……..	Date ……..
Witness signature ……	Witness signature ……	Witness signature ……
(Name and address)	(Name and address)	(Name and address)

Annexure-13

FORMAT FOR CONTRACTORS BILL FOR CIVIL ENGG WORKS

UNIT: **COMPANY'S NAME:**

1. On a/c or Final Bill:

2. Name of work

3. Estimate No. Of the work

4. Agreement value/work order value & date

5. Name of contractor

6. Date of commencement of the work

7. Date of completion as per wok order

8. Extension of time granted if any

9. Actual date of completion

10. Claims for work done from…….to……..

	Quantities of Work			**Rate & unit**	**Amount**			
Description of work	Paid as per bill	Since last bill	Upto date		Paid as per last bill	Since last bill	Total upto date	Remarks
1	2	3	4	5	6	7	8	9
				Total				

Deduct amount of previous Bill:

Gross amount of this Bill:

Dated signature of Contractor

Certified that the foregoing claims are correct and have been ascertained by actual measurement by Sri…….on……..and recorded at page……..of MB No….and that no contractors measurement has been accepted and that the work has satisfactorily performed.

MEASUREMENT ACCEPTED

Signatures:

Contractor Dy Manager/Manager Asstt. Manager/Sr. officer(Civil) Sub ordinate Engr

Recording Measurement

Received the sum of Rs……..as per foregoing details:-

Rupees……Witness stamp

Contractor

Certified that there is no claim outstanding against the contractor for the work of……..on a/c of material supply, House rent, water charges, electricity-supply etc.

Dy Manager/Manager(C) Asst. Manager/Sr. Officer(C) Sub ordinate Engr/Sr overseer.

Certified that I have no claims outstanding against the department for this work and the claim preferred through this bill is in full and final settlement of my claim(to be filled in case of final bills).

Contractor

Head of accounts	Amount in Rupees
Debit	
Total debit	
Credit	
Security deposit	
Value of stores(Details enclosed)	
Other recoveries(details enclosed)	
Total credit	
Net Amount of the bill	

Certified for payment of Rs…… (Rupees……..)

Chief Manager/Sr. Manager(C).

Bill duly checked, audited and passed for payment of Rs…….(Rupees…….) only and necessary deductions have been made.

Designated Accounts Officer

PERSPECTIVE VIEW OF PROPOSED BUILDINGS

FOR REFERENCE

PWD
CSR (ELECTRICAL)
SPECIFICATION

CURRENT SCHEDULE OF RATES 2008-2009

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Chapter 1

WIRING

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1.14	Networking Accessories	WG-COC/NAS

Chapter 1 WIRING (WG)

General:

All material shall be conforming to relevant standard as per BIS and shall carry ISI mark. If any particular category of material for which ISI mark is not available in market, it shall either carry valid 'Quality Control' certificate issued by the Chief Engineer (Elect), P.W. Dept. Maharashtra State Govt. as included in approved list.
Work shall be carried out as per the Method of Construction specified by BIS. If there is no reference for particular Method of Construction in IS, such work shall be carried out as per the approved Method of Construction specified in chapter 16 of P.W. Dept. Handbook.
Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of the Engineer in Charge.
Material shall be tested in approved Testing Laboratory and shall qualify the relevant tests as and when directed by Engineer In-Charge.

Recommended Standards:

The following list is showing Indian Standards, which are acceptable as good practice, and accepted standards.

IS 732: 1989	Code of Practice for Electrical Wiring Installations?
IS 4648: 1968	Guide for Electrical Layout in residential buildings
IS 9537 (Part 1): 1980	Conduits for Electrical Installations: General requirements
IS 9537 (Part 2): 1981	Rigid Steel Conduits
IS 9537 (Part 3): 1983	Rigid Plain Conduits of insulating material
IS 3419: 1989	Specifications for fittings for rigid non metallic conduits
IS 694:	PVC insulated cables for working voltages up to and including 1100V
IS 1554 (Part 1): 1988	PVC insulated (heavy-duty) electric cables for working voltages up to and including 1100V
IS 3961 (Part 5): 1968	Recommended current ratings for cables: PVC insulated light duty cables.
IS 4288: 1988	PVC insulated (heavy duty) electric cables with solid aluminium conductors for voltages up to and including 1100V
IS 14772: 2000	Specifications for Accessories for household and similar fixed Electrical Installations
IS 3043: 1987	Code of practice for Earthing
SP 30: 1984	National Electrical Code
SP 7 (Group 4): 2005	National Building Code
IS 14927(Part 1): 2001	Cable Trunking and Ducting systems for electrical installations.

1.1 Conduits / Trunking (Casing Capping) (Surface type)

1.1.1 PVC Conduits

Specification No **(WG-MA/CON)**

Scope:
PVC Conduits: Surface
Providing specified PVC Conduits and erecting as per approved Method of Construction; on surface of wall / ceiling, etc. including entries through walls / slabs / flooring as per requirement, and with all necessary hardware, accessories such as Spacers, Saddles, Bends, Tees, Junction boxes, Check-nuts, etc.; making conduits erection work rigid and duly finishing, removing debris from site.
Material:
PVC Conduit:
PVC pipe minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No**.** 1/2) ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

Hardware:
Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Method of Construction:
Erection PVC Conduits for Surface type wiring:

General:
Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm, round headed screws for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers. Distance between 2 spacers shall not be more than 600mm. Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/2 for PVC conduits). Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm. or ant electrostatic partition/separate pipe should be used. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface and with colour coding conduit (For visual identification) as per Table No. 1/4. Flexible conduits shall be used at expansion joints.

Especially for PVC Conduits of surface type wiring:
In addition to general instructions above, all joints shall be made rigid with resin / adhesive. Wherever offsets are necessary, it shall be done with bending spring. Size of conduit shall be as per Table No. ½ for number of wires to be drawn through the conduit.

1.1.2 PVC Trunking (Casing capping)

Specification No **(WG-MA/CON)**

Scope:

PVC Trunking:
Providing specified PVC Trunking (Casing capping) and erecting as per approved Method of Construction, on surface of wall / ceiling, etc. including entries made with PVC conduit through walls / slabs / flooring as per requirement with all necessary hardware, accessories such as inner / outer Elbows, Tees, Junction boxes, etc. and duly finishing, removing debris from site.

Material:
PVC Trunking (casing capping):
PVC Trunking (casing capping) ISI mark, 1.2 mm thick, minimum 20 mm width and above depending on No. of wires to be drawn (Refer Table No 1/3 for the size of trunking and number of wires to be drawn); with double locking arrangement, 1.8mm thick push-fit joints/ accessories for PVC trunking such as couplers, elbows, internal / external angles, junction boxes of required ways of the same make.
Hardware:
Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Method of Construction:
Erection of PVC Trunking for surface type wiring:
Erection shall be done as per the final approved layout. The Trunking shall be in perfect level and plumb. Screws of minimum 35x8 mm and suitable plugs shall be used for fixing. In case of stonewalls wooden gutties shall be grouted in wall for fixing of screws of Trunking. Distance between 2 screws shall not be more than 600 mm. Size of Trunking shall be correct depending on number of wires to be drawn as per Table No 1/3 but not less than 20mm. Separate Trunking shall be used for each phase in single phase distribution and for power and light distribution and also for wiring of other utilities like data, telephone, TV cabling and distance of 300 mm shall be maintained between the Trunking or anti electrostatic partition to be provided. Double locking shall be checked while fixing capping. Adequate use of accessories shall be made at joints and at required locations.

1.1.3 Rigid Steel Conduits

Specification No (WG-MA/CON)

Scope:

Rigid Steel Conduits: Surface

Providing specified Rigid Steel Conduits and erecting as per approved Method of Construction; on surface of wall / ceiling, etc including entries through walls / slabs / flooring as per requirement along with continuous earth wire, earth-clips and all necessary hardware, accessories; such as; spacers, saddles, Bends, Tees, Junction boxes, Check-nuts, etc. and duly finishing, removing debris from site.

Material:

Rigid Steel conduit:

Rigid steel conduit minimum 20mm dia and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ISI mark, ERW grade duly processed for anti-rust treatment and painted with black enamel paint including inspection type or normal accessories such as, 5mm thick 20mm width spacers and G.I. saddles for individual pipe or GI strip for bunch of pipe, sockets, open bends, junction boxes of required ways all of the same make.

Earth continuity wire:

GI wire of 2.5 Sqmm; GI earth clips 22g, 10mm width, for fixing earth wire along the conduits.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, PVC/ rubber bushings etc.

Method of Construction:

Erection of Rigid steel Conduits:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be duly screwed and firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm round headed for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers and saddles. Distance between 2 spacers shall not be more than 600mm. Separate pipe shall be used for each phase in single phase distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm or anti electrostatic partition to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No 1/4. Flexible conduits shall be used at expansion joints. Bushing shall be provided at open ends.

Erection of Rigid steel Conduits:

Especially for Rigid Steel Conduit of surface type wiring

In addition to general conditions above, Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/1 for steel conduits). All exposed threaded portion of Rigid Steel Conduits shall be painted with anti corrosive paint. Sharp edges at cut ends shall be made smooth by removing burr. Inspection type conduits accessories shall be used as per requirement in accessible position to facilitate drawing or withdrawing of wires. All conduits piping work shall be properly Earthed with 2.5 sq. mm G.I Earth wire fixed to conduit and made continuous with Earth clips at every 1m and at ends and joints viz. bends, junction boxes.

Testing:

Earth continuity:

Earth continuity shall be ensured at termination points of Earth wire, and between the ends of Rigid steel conduit.

Polarity:

Polarity test and should be done including confirmation of phase entry in switch only.

Mode of Measurement:

Measurement shall be carried out on the basis per running meter length of conduit / Trunking.

1.2 Conduits (Concealed type)

Specification No (WG-MA/CC)

1.2.1 Concealing PVC Conduits in RCC work

Scope:

Providing specified PVC conduit and laying / erecting in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with of all required material including hardware, binding wire, fish wire; accessories such as deep / long neck PVC junction boxes, PVC / MS junction / draw-in boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages.

Material:

PVC Conduit:

PVC pipe of minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No.1/2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, deep Junction boxes of required ways and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire, steel fish wire etc.

Method of Construction:

Concealing of PVC conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in single phase distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All PVC conduit bending shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC conduits:

In RCC work:

Work shall be commenced after fixing of steel re-enforcement on centering material. Conduits shall be firmly fixed on steel of RCC work by binding wire. Fixing of conduits shall be such that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through in the conduits for drawing of wires later on.

1.2.2 Concealing PVC Conduits in walls / flooring

Scope:

Providing specified PVC conduit and erecting / laying in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with of all required material including hardware such as 'U' nails, binding wire, fish wire; accessories such as PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, glands, drawing fish-wires

and making all piping rigid, refinishing the surface with cement mortar, removing debris from site.

Material:

PVC Conduit:

PVC pipe minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No.1/2), ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, Junction boxes of required ways, type and resin / adhesive to make all joints rigid.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plate on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, etc.

Other material for Surface finishing: Cement, sand, putty, and water.

Method of Construction:

Concealing of PVC conduits: (General)

Work shall be done in co-ordination with civil work to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. for which the distance between pipes shall not be less than 300 mm or anti electrostatic partition is be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No.1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC Conduits In walls / flooring:

Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCC work, Conduits of adequate size shall be erected with use of appropriate accessories, and 'U' nails. All joints shall be made rigid with resin. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

1.2.3 Rigid Steel Conduits in RCC work

Specification No **(WG-MA/CC)**

Scope:

Concealing of Rigid Steel Conduits:

In RCC work:

Providing specified Rigid Steel conduit and laying / erecting in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with continuous earth wire and all required material including earth clips, hardware, binding wire, fish wire; accessories such as deep junction boxes, MS draw-in / junction / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages.

Material:

Rigid Steel conduit:

Rigid HG steel screwed conduit, minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as check nuts, long bends, deep junction boxes for slab, regular junction boxes for walls; of required ways, all of the same make.

Earth continuity wire:

GI wire of 2.5 sq. mm; GI earth clips 22g, 10mm width, for fixing earth wire along the conduits.

Junction boxes / Draw-in boxes:
Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plate on it.
Hardware:
U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, fish wire, etc.

Method of Construction:
Concealing of Rigid steel Conduits:
General:
Work shall be done in co-ordination with civil work to suite final approved layout. Conduit shall be duly screwed and size of conduit shall be correct depending on number of wires to be drawn. (Table No.1/1, for Steel conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. for which distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For visual identification). Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done approved manner without changing the cross-section.

In RCC work:
Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed with steel in slab by binding wire. Fixing of conduits shall be possibly done with welding tags so that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through the conduits for drawing of wires later on.

1.2.4 Rigid steel Conduits in walls / flooring

Specification No **(WG-MA/CC)**

Scope:
Concealing of Rigid steel Conduits:
In walls / flooring:
Providing specified Rigid Steel Conduits and erecting in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with continuous earth wire and all required material including earth clips hardware such as 'U' nails, binding wire, fish wire; accessories such as MS junction / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, refinishing the surface with cement mortar, removing debris from site.

Material:
Rigid Steel conduit:
Rigid steel HG conduit minimum 20mm dia. and 16 gauge, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as check nuts, long bends, deep junction boxes for flooring, regular junction boxes for walls; of required ways all of the same make.
Earth continuity wire:
GI wire of 2.5 sq. mm, GI earth clips 22g, 10mm width, for fixing earth wire along the conduits.
Junction boxes / Draw-in boxes:
Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; fabricated from 16 SWG CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be

knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, GI fish wire, etc.

Other material for Surface finishing: Cement, sand, putty and water.

Method of Construction:

Concealing of Rigid Steel Conduits:

General:

Work shall be done in co-ordination with civil work to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No.1/1, for Steel conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc; for which the distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25 metre, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done approved manner without changing the cross-section.

Concealing of Rigid Steel Conduits in walls/ flooring:

Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCC work, Conduits of adequate size shall be erected with use of appropriate accessories, and hardware like 'U' nails, etc. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

Testing:

Earth continuity:

Earth continuity shall be ensured at termination point of Earth wire, between the ends of metal conduit.

Mode of Measurement:

Measurement shall be carried out on the basis per running meter length of conduit.

1.3 Bunch of wires:

Specification No **(WG-MA/BW)**

Scope:

Bunch of wires:

Providing specified wires and drawing them through provided conduits / trunking and / or as directed; with coded ferrules, harnessing the bunch of wires with necessary material when used in panel boards, duly connecting / terminating with lugs, and testing for safety and beneficial use.

Material:

Wires: in conduits / trunking / panel boards

Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5.

Wires: open

PVC insulated and PVC sheathed wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5.

Earth Continuity Wire:

PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5.

Lugs: Copper lugs of appropriate size & type

Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Bunch of wires:

Drawing of wires: General

Specified wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5, shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Wires shall be terminated in the terminals of accessories only, with appropriate type and size of lugs.

Drawing of wires: through PVC conduits

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2.

Drawing of wires: through Rigid Steel conduits

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1.

Open Wire bunch: Open wires shall be erected with due care so as to avoid chances of any mechanical injury. Harnessing shall be done with required material in an approved manner in panel boards or where ever necessary. For covering lead wires flexible conduit shall be used with gland as per necessity.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured between termination points of Earth wire.

Polarity Test:

Test shall be carried out for ensuring the correct polarity in switch and plug.

Mode of Measurement:

Measurement shall be carried out on the basis per running meter length of single wire or bunch as specified.

1.4 Mains (surface type)

1.4.1 Mains in surface PVC conduit

Specification No (WG-MA/PC)

Scope:

Mains in surface PVC conduit:

Providing specified PVC Conduits, Wires and erecting the conduits as per approved Method of Construction; on surface of wall / ceiling, etc. including entries through walls / slabs / flooring as per requirement, and with all necessary hardware, accessories such as Spacers, Saddles, Bends, Tees, Junction boxes, Check-nuts / glands, etc.; making conduits erection work rigid; and drawing the specified wires through these conduits and duly connecting / terminating with lugs, complete finishing, removing debris from site; testing for safety and beneficial use.

Material:

PVC Conduit:

PVC pipe of minimum 20mm dia and above depending on No. of wires to be drawn (refer Table No 1/2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires)

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of appropriate colour coding as per Table No 1/5

Earth Continuity Wire:

PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green or green yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of appropriate type and size.

Other material: Rubber grommet, bush, flexible PVC conduit, gland etc.

Method of Construction:

Erection PVC Conduits for Surface type wiring:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm, round headed screws for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers. Distance between 2 spacers shall not be more than 600 mm. Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. ½ for PVC conduits). Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No. 1/4. Flexible conduits shall be used at expansion joints.

Especially for PVC Conduits of surface type wiring:

In addition to general instructions above, all joints shall be made rigid with resin / adhesive. Wherever offsets are necessary, it shall be done with bending spring. Size of conduit shall be as per Table No. 1/2 for number of wires to be drawn through the conduit.

Drawing of wires: General

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5, shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with appropriate type and size of lugs.

Drawing of wires: through PVC conduits for surface type wiring

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be drawn through conduit. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2. At the termination end flexible PVC conduit shall be used with gland as per required.

1.4.2 Mains in PVC Trunking (casing capping)

Specification No (WG-MA/PC)

Scope:

Surface type Mains in PVC Trunking (casing capping)

Providing specified PVC Trunking, Wires and erecting the Trunking as per approved Method of Construction; on surface of wall / ceiling, etc. including entries made with PVC conduit through walls / slabs / flooring as per requirement with all necessary hardware, accessories such as inner / outer Elbows, Tees, Junction boxes, etc; including erection of specified wires in PVC trunking, with coded ferrules and duly connecting with lugs, and finishing, removing debris from site; testing for safety and beneficial use.

Material:

PVC Trunking:

PVC Trunking (casing capping) ISI mark, 1.2 mm thick, minimum 20 mm width and above depending on No. of wires to be drawn (Refer Table No 1/2 for the size of trunking and number of wires to be drawn); with double locking arrangement, 1.8mm thick push-fit joints/

accessories for PVC trunking such as couplers, elbows, internal / external angles, junction boxes of required ways of the same make.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, etc.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires)

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green colour, ISI marked, of specified size but not less than 1.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of appropriate type and size.

Other material: Flexible PVC conduit, gland coded ferrules, etc.

Method of Construction:

Erection of PVC Trunking for surface type wiring

Erection shall be done as per the final approved layout. The Trunking shall be in perfect level and plumb. Screws of minimum 35x8 mm and suitable plugs shall be used for fixing. In case of unleveled surface number and size of screws shall be changed to higher size as per requirement and in case of stonewalls wooden gutties shall be grouted in wall for fixing of screws of Trunking. Distance between 2 screws shall not be more than 600 mm. Size of Trunking shall be correct depending on number of wires to be drawn as per Table No 1/3 but not less than 20mm. Separate Trunking shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring of other utilities like data, telephone, TV cabling and distance of 300 mm shall be maintained between the Trunking or anti electrostatic partition is to be provided. Double locking shall be checked while fixing capping. Adequate use of accessories shall be made at joints and required locations.

Erecting wires in Trunking:

Wires shall be erected within Trunking with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be erected in single Trunking. Wires shall be terminated in the terminals of accessories only, with appropriate type and size of lugs. Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be erected through Trunking. Number of wires shall not exceed with respect to size of Trunking as per Table No. 1/3. After erection of wires double locking shall be checked while fixing capping. At the termination end flexible PVC conduit shall be used with gland as per required.

1.4.3 Mains in Rigid steel conduit (Surface type)

Specification No **(WG-MA/MC)**

Scope:

Surface type Mains in Rigid steel conduit:

Providing specified Rigid Steel Conduits and erecting as per approved Method of Construction; on surface of wall / ceiling, etc including entries through walls / slabs / flooring as per requirement along with continuous earth wire, earth-clips and all necessary hardware, accessories; such as; spacers, saddles, Bends, Tees, Junction boxes, Check-nuts, etc; and drawing the specified wires through these conduits in approved manner; with coded ferrules and duly connecting with lugs, and duly finishing, removing debris from site; testing the installation for safety and beneficial use.

Material:

Rigid Steel conduit:

Rigid steel HG screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ISI mark, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as 5 mm thick 20mm width spacers and G.I. saddles, sockets, open bends, junction boxes of required ways all of the same make.

Earth continuity wire:

GI wire of 2.5 sq. mm GI earth clips 22g, 10mm width, for fixing earth wire along the conduits.

Hardware:
Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, PVC/ rubber bushings etc.
Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires): PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pit (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5
Earth Continuity Wire:
PVC insulated wire minimum FR grade insulation copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5
Lugs: Copper lugs of appropriate size & type
Other material: Rubber Bush, Flexible metal conduit, gland etc.

Method of Construction:
Erection of Rigid Steel Conduits:
General:
Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be duly screwed and firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm round headed for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers and saddles. Distance between 2 spacers shall not be more than 600mm. Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/1 for steel conduits). Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No 1/4. Flexible conduits shall be used at expansion joints. Bushing shall be provided at open ends.

Erection of rigid steel Conduits:
Specially for Rigid Steel Conduit of surface type wiring:
In addition to general conditions above, Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/1 for steel conduits). All exposed threaded portion of Rigid Steel Conduits shall be painted with anti corrosive paint. Sharp edges and burr at cut ends shall be made smooth. Inspection type conduits accessories shall be used as per requirement in accessible position to facilitate drawing or withdrawing of wires. All conduits, piping work shall be properly earthed with 2.5 Sqmm G.I Earth wire duly fixed to conduit and made continuous with Earth clips at every 1m and at ends and joints viz. bends, junction boxes.

Drawing of wires:
General:
Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with correct type of and correct size of lugs.

Drawing of wires:
Through Rigid Steel conduits for surface type wiring:
Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1. At the termination end flexible metal conduit shall be used with gland.

Testing:
Insulation resistance test:
All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.
Earth continuity:
Earth continuity shall be ensured at all earth terminals and at earth terminals of metal enclosures.

Polarity test:
Polarity test shall be carried out for ensuring polarity in switch and plug.

Mode of Measurement:
Measurement shall be carried out on the basis per running meter of pipe length.

1.5 Mains (Concealed type)

1.5.1 Mains in PVC Conduits in RCC work

Specification No (WG-MA/CC, WG-MA/BW)

Scope:
Concealed Mains in PVC Conduits in RCC work:
Providing specified PVC conduit, wires and laying / erecting Conduits in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with of all required material including hardware, binding wire, fish wire; accessories such as deep PVC junction boxes, PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages and as and when directed drawing of specified wires through these conduits with fish wire, tagging with coded ferrules and duly connecting with lugs, complete testing the installation for safety and beneficial use.

Material:
PVC Conduit:
PVC pipe of minimum 20mm dia and above, depending on number of wires to be drawn (refer Table No 1/2, ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, deep Junction boxes of required ways and resin / adhesive to make all joints rigid.
Junction boxes / Draw-in boxes:
Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16 SWG CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.
Hardware:
'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, GI fish wire, etc.
Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):
PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5
Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 1.5 Sqmm as per Table No 1/5
Lugs: Copper lugs of required size & type
Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:
Concealing of PVC conduits:
General:
Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No. 1/1 for Steel conduits & Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All PVC conduit bending shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC conduits:
In RCC work:
Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed on steel of RCC work by binding wire. Fixing of conduits shall be such that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and at located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through in the conduits for drawing of wires later on.
Drawing of wires:
General:
Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with appropriate type and size of lugs.

Drawing of wires:
Through PVC conduits:
Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be drawn through pipe. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2.

1.5.2 Concealed Mains in PVC Conduits in walls / flooring:

Specification No (WG-MA/CC)

Scope:
Concealed Mains in PVC Conduits in walls / flooring:
Providing specified PVC conduit, Wires and laying / erecting the conduits in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with of all required material including hardware such as 'U' nails, binding wire, fish wire; accessories such as PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, refinishing the surface with cement mortar, removing debris from site and as and when directed drawing of specified wires through these conduits with fish help of wire, tagging by coded ferrules and duly connecting / terminating with lugs, complete testing the installation for safety and beneficial use.

Material:
PVC Conduit:
PVC pipe minimum 20mm dia and above depending No. of wires to be drawn (refer Table No1/2, ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; Couplers, long Bends, Junction boxes of required ways and resin / adhesive to make all joints rigid.
Junction boxes / Draw-in boxes:
Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; PVC or fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plate on it.
Hardware:
'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, etc.
Other material for Surface finishing: Cement, sand, putty and water.
Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):
PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic tough pitch (ETP) grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5
Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5

Lugs: Copper lugs of appropriate size & type
Other material for wire drawing: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Concealing of PVC conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No. 1/1 for Steel conduits & Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No**.** 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done with Bending Spring. All joints shall be made rigid with resin.

Concealing of PVC Conduits In walls / flooring:

Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCC work, Conduits of adequate size shall be erected with use of appropriate accessories, and 'U' nails. All joints shall be made rigid with resin. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

Drawing of wires:

General:

Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with correct type of and correct size of lugs.

Drawing of wires:

Through PVC conduits:

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be drawn through pipe. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2. At the termination end flexible PVC conduit shall be used with gland as per necessity.

1.5.3 Concealed Mains in Rigid Steel Conduits in RCC work

Specification No **(WG-MA/CC, WG-MA/BW)**

Scope:

Concealed Mains in Rigid Steel Conduits in RCC work:

Providing specified PVC conduit, Wires and laying / erecting the conduits in RCC work, such as slab, beam, column before casting as per approved Method of Construction along with continuous earth wire and all required material including earth clips, hardware, binding wire, fish wire; accessories such as deep PVC junction boxes, PVC / MS junction boxes / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, removing debris from site and supervising the work during casting to confirm rigidity, continuity and avoid damages and as and when directed drawing of wires through these conduits with fish wire, ferruling by coding tags and duly connecting with lugs, complete testing the installation for safety and beneficial use.

Material:

Rigid Steel conduit:

Rigid HG steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as check nuts, long bends, deep junction boxes for slab, regular junction boxes for walls; of required ways all of the same make.

Earth Continuity wire:
GI wire of 2.5 sq. mm 22g 10mm width, GI earth clips for fixing earth wire along with the conduits.
Junction boxes / Draw-in boxes:
Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; fabricated from 16 SWG CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.
Hardware:
'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, rubber / PVC bushes etc.
Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):
PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5
Earth Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per Table No 1/5
Lugs: Copper lugs of required size & type.
Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:
Concealed Mains in Rigid Steel Conduits in RCC work:

Concealing of conduits:
General:
Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No1/1, for Steel conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the final approved layout, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25 m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done approved manner without changing the cross-section.

Concealing of conduits:
In RCC work:
Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed with steel in slab by binding wire. Fixing of conduits shall be possibly done with welding tags so that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through the conduits for drawing of wires later on.

Drawing of wires:
General:
Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with correct type of and correct size of lugs.

Drawing of wires:
Through Rigid Steel conduits:

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1

1.5.4 Mains in Rigid steel Conduits in walls / flooring

Specification No **(WG-MA/CC, WG-MA/BW)**

Scope:

Concealed Mains in Rigid Steel Conduits in walls / flooring:

Providing specified Metal conduit, Wires and erecting in wall, flooring by making chases / grooves / entries as per approved Method of Construction along with continuous earth wire and all required material including earth clips hardware such as 'U' nails, binding wire, fish wire; accessories such as MS junction / inspection boxes, check-nuts, flexible PVC pipe, drawing fish-wires and making all piping rigid, refinishing the surface with cement mortar, removing debris from site and as and when directed drawing of wires through these conduits with fish wire, ferruling by coding tags and duly connecting with lugs, complete testing the installation for safety and beneficial use.

Material:

Rigid Steel conduit:

Rigid HG steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as check nuts, long bends, deep junction boxes for flooring, regular junction boxes for walls; of required ways all of the same make.

Earth continuity wire: GI wire of 2.5 sq. mm 22g 10mm width, GI earth clips for fixing earth wire along with the conduits.

Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate and of suitable size to accommodate No. of entries; fabricated from 16 SWG CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix cover plates on it.

Hardware:

'U' nails, plumbing and general use nails of required sizes, washers, check-nuts, steel binding wire 20g, steel fish wire, rubber, PVC bushes etc.

Other material for Surface finishing; Cement, sand, putty and water.

Wires: Mains / Sub-mains / Circuit mains (comprising phase and neutral wires):

PVC insulated wire of specified size, minimum FR grade insulation, copper conductor of electrolytic grade, having insulation of 1.1 kV grade, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire: PVC insulated wire minimum FR grade insulation copper conductor of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, of specified size but not less than 2.5 Sqmm as per **Table No 1/5**.

Lugs: Copper lugs of appropriate size & type

Other material: Rubber grommet, bush, harnessing material, flexible conduit etc.

Method of Construction:

Concealed Mains in Metal Conduits in walls / flooring Concealing of conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No 1/1, for Steel conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm or anti electrostatic partition is to be provided. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All bending of conduits shall be done approved manner without changing the cross-section.

Concealing of Conduits in walls/ flooring:
Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the wall surface shall be done. Work in flooring shall not disturb RCC work, Conduits of adequate size shall be erected with use of appropriate accessories and hardware like 'U' nails, etc. Draw-in / inspection boxes shall be fixed with check-nut, flush with surrounding surface and earthed.

Drawing of wires:
General:
Wires shall be drawn with adequate care. Correct colour coding as per Table No. 1/5, shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped only within circuit. For lighting load or single-phase distribution wires of two different phases shall not be drawn in single pipe. Lead wires of sufficient extra length shall be provided and shall be terminated in the terminals of accessories only, with correct type of and correct size of lugs.

Drawing of wires:
Through Rigid Steel conduits:
Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1. At the termination end flexible metal conduit shall be used with glands as per necessity.

Testing:
Insulation resistance test:
All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.
Earth continuity:
Earth continuity shall be ensured at all earth terminals and at earth terminals of metal enclosures.
Polarity Test:
Polarity test shall be carried out for ensuring correct polarity in plug and switch.

Mode of Measurement:
Measurement shall be carried out on the basis per running meter of pipe length.

1.6 Point wiring (Surface type)

Specification No (WG-PW/SW)

Scope:
Point wiring (Surface type):
Providing all required approved specified material including hardware and erecting wiring on surface of wall, ceiling from switch board to outlet for light / fan / bell / independent plug point, in rigid steel / PVC conduit or PVC trunking as specified; fixing one board with a 1 way switch for one way point or two boards with a 2 way switch on each board, in case of 2 way point; for controlling power supply and one board / block with accessory for outlet of light / fan / plug and terminating wires within as per approved Method of Construction; removing all debris and testing the installation for safety and beneficial use.

Material:
Point wiring (Surface)
PVC conduit:
PVC pipe of minimum 20mm dia and above depending No. of wires to be drawn (refer Table No 1/2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.
PVC Trunking:
PVC Trunking (casing capping) ISI mark, 1.2 mm thick, minimum 20 mm width and above depending on No. of wires to be drawn (Refer Table No 1/2 for the size of trunking and number of wires to be drawn); with double locking arrangement, 1.8 mm thick push-fit joints

/ accessories for PVC trunking such as couplers, elbows, internal / external angles, junction boxes of required ways of the same make.

Rigid Steel conduit:

Rigid steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No. 1/1, 16 gauge, ISI mark, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as 5mm thick 20mm width spacers and G.I. saddles for individual pipe or GI strip for bunch of pipes, sockets, inspection type or normal; open bends, junction boxes of required ways all of the same make.

Wires: Phase and Neutral

PVC insulated wires of specified size, 1.1 kV, & minimum FR grade insulation, electrolytic tough pitch (ETP) copper conductor, ISI marked, of required colour coding as per Table No 1/5

Earth Wire:

PVC insulated minimum FR grade copper wires of electrolytic grade, having insulation of 1.1 kV grade, of green / green-yellow colour, ISI marked, 2.5 Sqmm or bare copper wire of 14g

Accessories:

Switch: 1 or 2 way Piano type 6/10 A, 1 or 2 way Modular type switch 6/10A.

Outlet: 6A angle / batten lamp holder or 3 plate ceiling-rose or Bakelite / porcelain three way connector or if plug point, 6A, 3-pin plug socket.

Boards:

Switchboards shall be double walled (back and front) of suitable size, to accommodate independent slot for each switch, socket, fan regulator. Boards shall be made up of 4mm thick marine grade plywood for back and front fixed on wooden frame with 0.8mm thick laminate pasted on exposed portion of front ply, totally varnished and with either brass hinged door or screwed top.

Or

As above with 3mm thick Bakelite/Hylam top instead of laminated front ply.

Or

Board made from Filled polypropylene.

Round/Square double wooden block or PVC board for mounting light / fan outlet accessory.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs, wooden gutties, PVC/ rubber bushings etc.

Method of Construction:

Point wiring (Surface)

Erection of conduits:

General:

Erection shall be done as per the final approved layout, in perfect level and plumb. Conduits shall be duly screwed and firmly fixed on spacers with saddles. Fixing of spacers shall be equidistant and at ends, bends, elbows, junction boxes, couplings, boards. CSK screws of minimum 35x8 mm and suitable plugs shall be used for fixing spacers and 12x5 mm round headed for fixing saddles on spacers. In case of stonewalls wooden gutties shall be grouted in wall for fixing of spacers and saddles. Distance between 2 spacers shall not be more than 600mm. Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution. Also for wiring for other utilities like data, telephone, TV cabling distance between pipes shall not be less than 300 mm. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of surface conduit with colour coding (For Visual identification) as per Table No 1/4. Flexible conduits shall be used at expansion joints. Bushing shall be provided at open ends.

Erection of conduits:

PVC pipes for surface type wiring:

In addition to General conditions above, all joints shall be made rigid with resin / adhesive. Wherever offsets are necessary, same shall be done with bending spring. Size of conduit shall be correct depending on number of wires to be drawn as per Table No. 1/2.

Or

Specially for Rigid Steel Conduit of surface type wiring:

In addition to general conditions above, Size of conduit shall be correct depending on number of wires to be drawn (as per Table No. 1/1 for steel conduits). All exposed threaded portion of Rigid Steel Conduits shall be painted with anti corrosive paint. Sharp edges and burr at cut ends shall be made smooth. Inspection type conduits accessories shall be used as per requirement in accessible position to facilitate drawing or withdrawing of wires. All

conduits piping work shall be properly earthed with 2.5 sq. mm G.I Earth wire fixed to conduit and made continuous with Earth clips at every 1m and at ends and joints viz. bends, junction boxes.

Or

Erection of PVC Trunking for surface type wiring:

Erection shall be done as per the final approved layout. The Trunking shall be in perfect level and plumb. Screws of minimum 35x8 mm and suitable plugs shall be used for fixing. In case of unleveled surface number and size of screws shall be changed to higher size as per requirement and in case of stonewalls wooden gutties shall be grouted in wall for fixing of screws of Trunking. Distance between 2 screws shall not be more than 600 mm. Size of Trunking shall be correct depending on number of wires to be drawn as per Table No 1/3 but not less than 20mm. Separate Trunking shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring of other utilities like data, telephone, TV cabling and distance of 300 mm shall be maintained between the Trunking. Double locking shall be checked while fixing capping. Adequate use of accessories shall be made at joints and required locations.

Drawing of wires: General

Wires shall be drawn with adequate care. Correct colour coding as per Table No 1/5 shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped within circuit. For lighting load distribution wires of two different phases shall not be drawn in single pipe. Wires shall be terminated in the terminals of accessories only. Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm or as per specified shall be erected wherever necessary. In case of 2-way point wiring additional wires of phase conductor shall be provided between the 2-way switches.

Drawing of wires: through PVC conduits for surface type wiring

Insulated Earth wire of green or green-yellow colour of minimum 2.5 sq mm shall be drawn through pipe. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/2.

Or

Drawing of wires: through Rigid Steel conduits for surface type wiring

Bush shall be used at pipe opening to protect wire insulation from getting damaged due to burrs / sharp edges. Number of wires shall not exceed with respect to size of pipe as per Table No. 1/1.

Or

Erecting wires in Trunking:

Wires shall be erected within Trunking with adequate care. Number of wires shall not exceed with respect to size of Trunking as per Table No. 1/3. After erection of wires double locking shall be checked while fixing capping.

Fixing Switchboards and accessories:

Control switchboards shall generally be erected at 1.35m height or as specified and fixed with minimum 2 Nos. (and more as per size of board) of screws of length not less than 50mm, termination of wires shall be done with lugs on switch and other accessories only by carefully inserting all strands in lugs, terminals and proper tightening. Switches shall be provided on phase wire only. Bare wire shall not be used for looping incoming supply to switches and for earthing inside switchboards. For plug socket phase wire shall be connected in right side terminal when seen from front. Proper termination of earth wire in Earth terminal shall be ensured.

Testing:

Insulation resistance test:

All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.

Earth continuity:

Earth continuity shall be ensured at all earth terminals of plug outlets and at earth terminals of metal enclosures.

Polarity test:

Polarity test shall be carried out for ensuing the correct polarity in switch and plug.

Mode of Measurement:

Measurement shall be carried out on the basis per number of points, **for the point length up to 6 metre between switch and outlet**. For the length exceeding 6 metre 10% of overall rate shall be added for every 1m.

1.7 Point wiring (Concealed type)

Specification No (WG-PW/CW)

Scope:

Point wiring (Concealed type):

Providing all required approved specified material including hardware and erecting rigid steel / PVC conduits, junction boxes, provided fan boxes, along with required accessories in RCC slabs before casting and in walls, flooring by making chases, and refilling the same after erection of conduits, fixing concealed type boxes for switch boards in walls, drawing wires through conduits, from switch board to outlet for light / fan / bell / independent plug point fixing modular type switch for controlling power supply and an accessory for outlet of light / fan / bell / plug at other end, with mounting plate, and terminating wires within at both ends, as per approved Method of Construction, closing all junction boxes with plates; removing all debris and testing the installation for safety and beneficial use.

Material:

Point wiring (Concealed):

PVC conduit:

PVC pipe of minimum 20mm dia and above depending No. of wires to be drawn (refer Table No 1 / 2); ISI mark, HMS grade (2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, deep / normal Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.

Rigid Steel conduit:

Rigid steel screwed conduit minimum 20mm dia. and higher depending on No. of wires to be drawn as per Table No.1/1, 16 gauge, ISI mark, ERW grade duly processed for anti-rust treatment and painted with black enamel paint, accessories for rigid steel conduits such as sockets, bends, deep / normal junction boxes of required ways all of the same make.

Sheet metal Junction boxes / Draw-in boxes:

Junction box shall be 5 sided with removable top plate, fabricated from 16g CRCA sheet steel with earth terminal duly treated with antirust treatment and painted with two coats of red oxide paint. There shall be knockout holes in required numbers and dia. for entry of conduit pipes and arrangement to fix surface cover plate on it. Cover plate shall be made up of fire resistant PVC material / 3mm thick laminate / Bakelite / Hylam / transparent acrylic sheet painted from inside to match colour of wall with duly tapered edges.

Wires: phase and neutral wires

PVC insulated wires of specified size, 1.1 kV, & minimum FR grade insulation, electrolytic tough pitch (ETP) copper conductor, ISI marked, of required colour coding as per Table No 1/5

Earth Continuity Wire:

PVC insulated minimum FR grade copper wires of electrolytic grade, having insulation of 1.1 kV grade, of green colour, ISI marked, 2.5 Sqmm or bare copper wire of 14g

Lugs: Pin type Copper lugs.

Accessories:

Switch: 1 or 2 way Modular type switch 6/10A.

Outlet:

Modular type 6A angle / batten lamp holder or 3 plate ceiling-rose or Bakelite / porcelain 3 way connector or if plug point, 6A, 3-pin plug shuttered socket.

Boards:

Switchboards shall comprise of; concealed type box of required modules made of sheet metal or Polypropylene material, mounting plate and cover plate. The required modules shall be worked out on the basis of points, plug socket/sockets, step type fan regulator, etc are to be fixed. For every blank module, 1 way blank plate shall be fixed. All the above accessories shall be of same make, as that of switch.

Hardware:

Sheet Metal (SM) screws of sizes specified in Method of Construction, washers, rawl / PVC / fill type plugs / wooden gutties, 'U' nails, plumbing nails, steel binding wire, fish wire 20g, rubber / PVC bushes etc.

Other material for Surface finishing: Sand, Cement, water etc.

Method of Construction:

Point wiring (Concealed):

Concealing of conduits:

General:

Work shall be done in co-ordination with civil work and to suite final approved layout. Size of conduit shall be correct depending on number of wires to be drawn. (Table No. 1/1 for

Steel conduits & Table No 1/2 for PVC conduits) Separate pipe shall be used for each phase in 1-ph distribution and for power and light distribution and also for wiring for other utilities like data, telephone, TV cabling, etc. The distance between pipes shall not be less than 300 mm. Adequate use of conduit accessories shall be made at required locations. Entries in wall shall be at level of corresponding conduit with colour coding as per Table No. 1/4. (For Visual identification) Flexible conduits shall be used at expansion joints. Erection shall be done as per the layout finalized, with minimum sharp bends, with junction boxes at angular junctions and for straight runs at every 4.25m, in such manner so as to facilitate drawing of wires. All the bends shall be done with Bending Spring.

Concealing of conduits: In RCC work
Work shall be commenced after fixing of steel (re-enforcement) on centering material. Conduits shall be firmly fixed on steel of RCC work by binding wire. Fixing of conduits shall be such that it will remain rigid during casting of slab, beam, and column even after use of vibrator. Deep junction boxes and other draw-in boxes shall be such that their open end and centering material will not have gap in between so as to avoid concrete entering inside even after fixing covers to steel re-enforcement; and be filled with dry sand. Open ends of conduits; to be concealed in walls, shall be provided with couplers / sockets at ends and be flush with bottom of beam, and at located at the center of the beam. As far as possible bunching / grouping of conduits shall be avoided so that it will not affect strength of RCC work especially in beams. Suitable steel fish wire shall be drawn through in the conduits for drawing of wires later on.

Concealing of Conduits: In walls
Chases shall be made in walls of adequate width, with cutter and chiseling through it. Necessary finishing of the surface shall be done. Conduits of adequate size shall be erected with use of appropriate accessories and 'U' nails.

Drawing of wires:
Use of Steel fish wire shall be made for drawing of wires. Wires shall be drawn with adequate care. Correct colour coding shall be used for phase, neutral and earth. Wires shall not have intermediate joint in between terminals of the accessories. Earth-wire and Return wire (neutral) may be looped within circuit only. For lighting load distribution, wires of two different phases shall not be drawn in single pipe. Wires shall be terminated in the terminals of accessories only. Adequate extra length shall be left at termination points. In case of 2-way point wiring additional wires of phase conductor shall be provided between the 2-way switches.

Fixing Switchboards and accessories:
Control switchboards shall generally be erected at 1.35m height or as specified and fixed with minimum 2 Nos. of screws of length not less than 50 x 8mm, Boards shall be in line and plum and shall be in level with wall surface so as to fix mounting plate flush with wall, Termination of wires shall be done in switch and other accessories only by carefully inserting all strands in terminals and proper tightening. Switches shall be provided on phase wire only. Bare wire shall not be used for looping incoming supply to switches. Phase wire shall be routed through switch only. For plug socket phase wire shall be connected in right side terminal when seen from front. Proper termination of earth wire in Earth terminal shall be ensured. All blank modules shall be plugged with blanking plates.

Testing:
Insulation resistance test:
All wiring shall be tested with 500V Meggar between phases, phase – neutral and to Earth. IR value shall not be less than 1M-ohm.
Earth continuity:
Earth continuity shall be ensured at all earth terminals of plug outlets and at earth terminals of metal enclosures.
Polarity test:
Polarity test shall be carried out for ensuring the correct polarity in the plug.

Mode of Measurement:
Measurement shall be carried out on the basis per number of points, **for the point length up to 6 metre between switch and outlet.** For the length exceeding 6 metre 10% of overall rate shall be added for every 1metre.

2. DISMANTLING POINT WIRING: (WG-PW/DM)

Electrical installation of point wiring along with circuit mains from DBs shall be dismantled with adequate care without damaging surface of wall, ceiling, and flooring. The holes shall be refinished to match with the surrounding surface. Site shall be made clean by removing debris. Dismantled material shall be retained by the agency.

3. Mode of Measurement:

Executed quantity will be counted on the basis of number of points. (i.e. per Point)

Table No. 1/1

Maximum Number Of Single Core 1.1 kV Cables That Can Be Drawn In Rigid Steel Conduits

Size of cable mm²		***Size of conduit mm***													
Nominal Cross sectional area	No. and dia. of wires	16		20		25		32		40		50		63	
		S	B	S	B	S	B	S	B	S	B	S	B	S	B
1.0	1 / 1.12 Cu	5	4	7	5	13	10	20	14						
1.5	1 / 1.4	4	3	7	5	12	10	20	14						
2.5	1 / 1.8 3 / 1.06 Cu	3	2	0	5	10	8	18	12						
4.0	1 / 2.24 7 / 0.85 Cu	3	2	4	3	7	8	12	10						
6	1 / 2.80 7 / 1.06 Cu	2		3	2	6	5	10	8						
10	11 / 3.55 Al 7 / 1.40 Cu			2 2		5 4	4 3	8 6	7 5						
16	7 / 1.70					2		4	3	7	6				
25	7 / 2.24							3	2	5	4	8	6	9	7
35	7 / 2.50							2		4	3	7	5	8	6
50	7 / 3.0 Al 19 / 1.80									2		5	4	6	5

Note 1: Cu- applicable to only copper cable; Al- applicable to only Aluminium cable

Note 2: The table shows maximum capacity of conduits for the simultaneous drawing of cables. The columns headed 'S' apply to straight runs of conduits which have distance not exceeding 4.25m between draw in boxes and which do not deflect from straight by an angle more than 15^0. The columns headed 'B' apply to bent runs of conduit, which deflect from the straight by an angle of more than 15^0.

Note 3: In case of inspection type draw in box has been provided and if the cable is first drawn through one straight conduit, then through the draw in box and then through the second straight conduit such system may be considered as that of straight conduit even if the conduit deflects through the straight by more than 15^0.

Table No. 1/2
Maximum Number of Single Core 1.1 kV Cables That Can Be Drawn In Rigid Non-Metallic Conduits

Size of cable mm²		***Size of conduit mm***					
Nominal Cross sectional area	No. and dia. of wires	16	20	25	32	40	50
1.0	1 / 1.12 Cu	5	7	13	20		
1.5	1 / 1.4	4	6	10	14		
2.5	1 / 1.8 3 / 1.06 Cu	3	5	10	14		
4.0	1 / 2.24 7 / 0.85 Cu	2	3	6	10	14	
6	1 / 2.80 7 / 1.06 Cu		2	5	9	11	
10	11 / 3.55 Al 7 / 1.40 Cu			4	7	9	
16	7 / 1.70			2	4	5	12
25	7 / 2.24				2	2	6
35	7 / 2.50					2	5
50	7 / 3.0 Al 19 / 1.80					2 2	5 3

Note 1: Cu- applicable to only copper cable; Al- applicable to only Aluminium cable

Table No. 1/3
Maximum Number of Single Core 1.1 kV Cables in Cable Trunking (Casing and Capping)

Size of cable mm²		***Size of Trunking mm***				
Nominal Cross sectional area	12/16 x 12 mm	20 x 12 mm	25 x12 mm	32 x 12 mm	40 x 20 mm	50 x 20 mm
1.0						
1.5	3	5	6	8	12	18
2.5	2	4	5	6	9	15
4.0	2	3	4	5	8	12
6		2	3	4	6	9
10		1	2	3	5	8
16			1	2	4	6
25				1	3	5
35					2	4
50					1	3

Note 1: Cu- applicable to only copper cable; Al- applicable to only Aluminium cable

Table No. 1/4
Colour Coding For Conduits in Wall Entry

Conduit for	*Colour*
Light / Power circuit	Black
Security wiring	Blue
Fire Alarm wiring	Red
Low voltage circuits	Brown
UPS circuits	Green

Table No 1/5
Colour Code for Wires

Type	*Colour*
Phase	Red, Yellow, Blue
Neutral	Black
Earth	Green

1.11 Telephone wiring (TW)

1. General

All material shall conform to relevant standard as per BIS and shall carry ISI mark. If any particular category of material for which PSI mark is not available in market, it shall be approved either by ITD ***/*** DOT of Govt. of India.

Work shall be carried out as per the Method of Construction specified by BIS and as specified by DOT (Department of Telephone), Govt. of India. Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of Engineer in Charge.

2. Scope:

Specification No (WG-TW)

To provide wiring for telephone on surface of wall or ceiling concealed in slab, wall, under flooring, etc, through existing metallic conduits, rigid PVC conduits, PVC trunking, with all necessary hardware, material, etc. as specified.

To provide, install, test & commission the instruments / equipments and accessories used in telephone system, such as; Main Distribution Frames (MDF), Krone Modules, Over Voltage Magazine, PBX / EPABX, CO-axial cable, Rosette box, Jumper wire, etc.

3. **Material:**
PVC Telephone cable*:* PVC insulated Tinned copper solid conductor with minimum 0.5 mm dia. (Single & Multi pair) properly paired and colour coded, shall be terminated on KRONE module with suitable tool.
Jelly filled Armoured Telephone cable: PVC insulated, PVC sheathed with steel armouring, Tinned copper solid conductor with minimum 0.5 mm dia multi pair, with Jelly, properly paired and colour coded.
Saddles: Saddles fabricated from G I sheet of required gauge (16/18 gauge) either galvanized finish or painted with superior quality enamel black paint, with necessary shearing for mechanical strength, semi circular shaped with extended piece having suitable holes for fixing on spacer.
Hardware: Sheet Metal (SM) screws of required sizes, plugs, wooden gutties, etc.
MDF: Manufactured by reputed manufacturer of specified capacity, facility for wall mounting, with door & lock, aluminium frame for fixing of KRONE, duly enclosed in cabinet made from 18 SWG CRCA sheet with powder coating of required colour.

Junction box: Manufactured by reputed manufacturer of specified capacity, facility for + wall mounting, with door & lock, aluminium frame for fixing of Krone, duly enclosed in cabinet made from 18 SWG CRCA sheet with powder coating of required colour. The depth of the box should consider the height of KRONE module plus protection magazine.
Over Voltage protection Magazine: Manufactured by reputed manufacturer of 10 pair capacity, with 3 pole gas discharge tube should be properly fitted on KRONE module in MDF / Junction box.
Rosette box: PVC / Bakelite box with LED indicator, RJ 11 jack, facility for fixing on wall.
Jumper wire: Twin twisted PVC insulated with Tinned copper solid conductor minimum 0.5 mm dia.
KRONE Module: Disconnection type KRONE module having capacity to connect 10 pairs with silver-plated terminal contacts.
RG-11 Co-axial low voltage grade cable: PVC insulated with Tinned copper solid conductor minimum 0.5 mm dia, with connector at both ends suitable for termination in RJ type socket.
PBX (Analogue type): Manufactured by reputed manufacturer and approved by Telephone Engineering Certificate (TEC) of specified extensions, having following features:

- Direct Inward dialling (DID) with voice guidance facility.
- Caller line Identification (CLI) on Analog as well as digital extension.
- Call Billing software (CB)
- Dynamic STD locking
- Conferencing facility for specified extensions.

EPABX (Digital type): Manufactured by reputed manufacturer and approved by Telephone Engineering Certificate (TEC) of specified extensions, having following features:

- Direct Inward dialling (DID) with voice guidance facility.
- Caller line Identification (CLI) on Analog as well as digital extension.
- Call Billing software (CB)
- Dynamic STD locking
- Conferencing facility for specified extensions.
- Provision of battery back-up and power failure line transfer.

4. <u>Method of Construction:</u>

4.1 Drawing of telephone wire through Steel conduit / PVC conduit / PVC Trunking: As specified in Chapter for Point Wiring.

4.2 Erection of Jelly filled armoured Telephone cable:
Erection shall be done as per the layout finalized, in perfect level and plum. Before fixing the cable shall be straightened as far as possible for good aesthetics look. Cable shall be fixed with saddles firmly clipped on cable. Saddles shall be fixed to wall with minimum 50x8 mm SM screws with plugs/wooden gutties (Distance between two saddles shall be minimum 600 mm). Wooden gutties shall be used wherever required (Especially for stone wall). The entries made in wall, floor slab, etc for laying the cable shall be made good by filling and finishing with plastering the same.

4.3 Erection of MDF Junction box / Rosette box / PBX / EPABX, etc: Specified equipment shall be fixed to wall with minimum 50x8 mm SM screws, with necessary plugs, wooden gutties, etc. or may be fixed on Table Top if required.

5. <u>Mode of Measurement</u>:

Work done for telephone in Steel / PVC conduit / PVC Trunking will be measured on running meter basis, (i.e. per running meter) for each single run. For the other accessories / equipments shall be done as per unit specified. (I.e. Job / each)

1.12 Computer Cabling (COC)

A) UTP *Networking Cable*

General:

All material shall conform to relevant standard as per ISO/IEC11801, CENELEC EN50173 & TIA/EIA 568-B2-1; CUL listed & ETL verified.

Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of Engineer in Charge.

Scope:

Specification No (WG-COC/NC)

To lay the cables for Computers on surface of wall or ceiling concealed in slab, wall, under flooring etc, through existing metallic conduits, rigid PVC conduits, PVC trunking, with all necessary hardware, material, etc. as specified. The cable shall be used only for connections between Information Outlet & Patch/ Multimax Panel. (Exception: For making MDIX patch cord)

Material:

UTP cable:

4 pairs,100 ohms, unshielded twisted pair (UTP), each pair separated by a PE former (Star shaped) solid 23AWG tinned copper conductor rated for temperature of 75^0 C, PVC insulated grey colour with following types as in the table 1.12/1

Table 1.12/1

Sr. No.	Type	Class	Tested frequency
1	Cat 6	E	350MHz
2	Cat 6+	E	500MHz

1 The Category 6 cable and Category 6 channel components shall be manufactured by a single manufacturer. The manufacturer shall warrant the Category 6 channel cable, components, and applications for a period of 20 years.
2 The Delay Skew on the 100 meter channel shall not exceed 30 ns
3 The 20 year warranty shall be a transferable warranty and has component replacement policy in case of manufacturing defect
4 Category 6, 100mtr channel, **4-connection** model should guarantee 400% margin over standard NEXT specification across swept frequency
5 Category 6, 100mtr channel, **6-connection** model should guarantee +4dB margin over standard NEXT Specification across swept frequency (1~250MHZ)
6 The high performance Category 6 UTP cable 23AWG shall be of the traditional round design with Mylar bisector tape Non-Plenum rated.
7 The cable shall support Voice, Analog Baseband Video/Audio, Fax, Modem,Switched-56, T-1, ISDN,RS-232, RS422, RS-485, 10BASE – T Ethernet, Token Ring, 100Mbps TP-PMD, 100BASE-T Ethernet, 155 Mbps ATM, AES/EBU Digital Audio, 270 Mbps Digital Video, 622 Mbps 64-CAP ATM and emerging high-bandwidth applications, including 1 Gbps Ethernet, gigabit ATM, IEEE 1394B S100 and S400, as well as all 77 channels (550 MHz) of analog broadband video.
8 The cable jacket shall comply with Article 800 NEC for use as a non-plenum cable. The 4 pair UTP cable shall be UL® and c (UL®) Listed Type CM.
9 Performance shall be characterized to 550 MHz to support high-bandwidth video applications

Non Plenum CAT6 UTP Cable

1 Weight=25.3 lb (1000 ft)
2 Jacket Thickness=.022 in
3 Outside Diameter=0.232 in
4 Conductor Diameter=.022 in
5 Insulation Type=High density Polyethylene
6 Jacket Material=PVC
7 Maximum Pulling Tension=25 lbs
8 Nom. Velocity of Propagation=0.69
9 Max DC Resistance=9.83 Ohms/100m

10 Mutual Capacitance @ 1 kHz = 4.95 nF/100m
11 Operating Temperature= -20 to 60° C
12 The high performance Category 6 UTP cable shall be of the **traditional round design with Mylar bisector tape.**
13 The 4 pair UTP cable shall be UL Type CM (non-plenum)
14 Performance shall be characterized to 550 MHz to support high-bandwidth video applications

Method of Construction:
The cable shall be laid in provided separate casing n capping/ PVC conduit/ trunking 400mm away from electrical cables wherever required without sharp bends. The cable shall be spliced at both the ends for punching/ crimping at keystone jacks/ UTP connectors.

Mode of measurement: Executed quantity shall be measured on running metre basis.

B) UTP Patch cord

Scope:

Specification No (WG-COC/PC)

Structured cabling, to make connections from switch to patch panel or information outlet to computer

Material:
UTP Patch Cord:
Assembly (conforming to EIA/TIA 568B-2-1) of Cat 6 type 4 unshielded twisted pair 24-26AWG (0.51mm-0.40mm), each pair separated by a PE former (Star shaped) 100 ohms stranded wire PVC insulated cables with modular RJ-45 polycarbonate UL94V housing 15milliohms gold over nickel contacts (superior three piece connector) crimped on both ends with T568A & T568B wiring schemes with 8P8C connection. The cord shall be branded. The cords shall be used in structured cabling in accordance with following table 1.12/2.

Table 1.12/2

Sr. No.	Length	Use in
1	1m	from switch to patch panel
2	3m	from computer to information outlet

1 All patch cords shall exceed TIA/EIA and ISO/IEC Category 6/Classs E specifications.
2 All patch cords shall be backward compatible with Category 5 and Category 5E systems.
3 The patch cords shall incorporate an anti-snag feature that provides maximum protection from snagging during moves and re-arrangements.
4 Patch cords shall be UL listed, UL-C certified and AUSTEL approved.
5 Patch cords shall support network line speeds in excess of 1 gigabit per second.

Physical Specifications:

Contact Material:	Phosphor Bronze
Contact Plating:	Gold 50 micro-inch (1.27 microns) Nickel 100 micro –inch (2.54 microns)
Insertion Life:	750 minimum
Plug Material:	Polycarbonate UL-rated 94 V-O
Operating Temperature:	14°F to 140°F (-10°C to 60°C)

Method of construction:
The patch cord shall be erected for making connections from switch to patch panel or from computer to information outlet.

Mode of measurement: Executed quantity shall be counted on number basis

BACKBONE (Fibre Network)

C) PVC Armoured Optical Fibre Cable (OFC)

General:

All material shall conform to relevant standard as per IEEE, EIA/TIA 568-B.3

Scope:

Specification No (WG-COC/OFC)

Optical fibre cable is used for connecting remote places networks by means of fibre switch or fibre module without much loss of signal.

Material:

Optical Fibre Cable:

Dielectric & metallic sheath armoured multimode optical fibre cable for underground/ aerial applications, fibres separated into binder groups inside a Industry standard 3mm gel filled buffer tubes standard around a central strength member; water blocked with dry water blocking material, making access & handling individual tubes easier & craft-friendly cable core; operating temperature of 40 - 70^0 C, crush resistance of 44N/m, as per table 1.12/3.

Table 1.12/3

Physical Specifications:

Fiber Count	Subunits	Outer Diameter in. (mm)	Weight lbs/kit kg/km	Minimum Bend Radius In. (cm)		Max. Tensile Load lbs. (Newtons)		Max. Vertical Rise Feet (Meter)
				Loaded	Unloaded	Short Term	Long Term	
4 - 48	5	0.46 (11.7)	63 (94)	9.2 (23.4)	4.6 (11.7)	607 (2700)	180 (800)	2856 (871)
72	6	0.50 (12.7)	72 (107)	10.0 (25.4)	5.0 (12.7)	607 (2700)	180 (800)	2509 765)
96	8	0.58 (14.7)	95 (141)	11.5 (29.4)	5.8 (14.7)	607 (2700)	180 (800)	1904 (580)
144	12	0.74 (18.9)	146 (217)	14.8 (37.8)	7.4 (18.9)	607 (2700)	180 (800)	1237 (377)
288	24	0.86 (21.9)	211 (315)	17.2 (43.8)	8.6 (21.9)	607 (2700)	180 (800)	852 (260)

Note* There are 12 fibres per tube

04/ 06/ 12/ 24 fibres				
Sr. No.	Grade	Core dia.	1Gbps Distance at wavelength	
			850nm	1300nm
1	FR	62.5 µm	3000m	550m
2	FR	50 µm	1100m	600m
3	FRLS	62.5 µm	3000m	550m
4	FRLS	50 µm	1100m	600m

1. The cable shall support Gigabit Ethernet and legacy applications including Ethernet, Fast Ethernet, Token Ring, ATM and FDDI.
2. The loose tube dielectric OSP cable shall be armored with a corrugated polymer
3. coated steel tape and constructed with industry standard 3mm buffer tubes, stranded around a central strength member.
4. The armor layer shall provide crush protection meeting the Telcordia requirements for Superior Armored cable.
5. The buffer tubes shall compatible with standard hardware, cable routing and fan-out kits.

6. The cable core shall be water blocked with dry water-blocking materials, making access and handling of individual tubes easier and craft-friendly.
7. The cables shall be designed for point-to point applications as well as mid-span access, and provide a high-level of protection for fiber installed in the outside plant environment.

S. No	Features
1	Support 10 Gbps up to 300 meters
2	Meets and exceeds the next generation multimode fiber (OM3) specifications in standards
3	Gigabit Ethernet is supported up to over 1.0 kilometre for 1000BASE-SX.
4	Supports very high speed data transmission by controlling DMD
5	Differential Mode Delay Exceeds TIA-492AAAC-A (IEC-60793-2-10ed2) @ 850nm
6	> 2,000 MHz-km laser bandwidth at 850 nm
7	Core Diameter should be 50.0 ± 3.0 µm
8	Cladding Diameter should be 125.0 ± 1.0 µm
9	Max. Attenuation, Loose Tube Cable 3.0 dB/km
10	Coating/Cladding Concentricity Error should be =< 6 µm
11	Clad Non-Circularity ≤ 1%
12	Zero Dispersion Wavelength 1297-1316 nm
13	Water Immersion, 73.4°F (23°C) should be ≤ 0.20 dB

Environmental and Mechanical

	Specification	Test Method
Operating Temperature	-40°to +70°C	FOTP - 3
Installation Temperature	20°to +70°C	N/A
Storage Temperature	-40°to +70°C	N/A
Crush Resistance	44 N/mm	FOTP - 41
Impact Resistance	Exceeds	FOTP - 25
Flexing	Exceeds	FOTP - 104
Twist Bend	Exceeds	FOTP - 85

Cable Identification:

Buffer Tubes and Fibres are identified with standard color coding:

1 - Blue	5 - Slate	9 - Yellow
2 - Orange	6 - White	10 - Violet
3 - Green	7 - Red	11 - Rose
4 - Brown	8 - Black	12 - Aqua

Hardware:

Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, clips etc.

Method of Construction:

As per the method of construction of PVC armoured cable. But these cables shall be tagged as “OFC” every metre length & can be laid in trench side by side. For underground cable laying cable indicator mentioning “Optical Fibre Cable” is a must.

Mode of measurement: Executed quantity shall be measured on running meter basis.

D) Fibre Patch Cord (FPC)

General:
All material shall conform to relevant standard as per IEEE, EIA/TIA, CENELEC

Scope:

Specification No (WG-COC/FPC)

The cord is to be used to connect fibre optic equipment to fibre optic cross-connects, interconnects & information outlets. (e.g. Remote Ethernet switch with fibre optic module can be connected to another same type of switch or Fibre Optic Switch.)

Material:
FRLS duplex fibre patch cord/ pigtails 1mtr in length with LC/ SC/ ST termination consisting of 1.6mm/ 3.0mm dia. 62.5um fibre with minimum bandwidth of 200MHz-km at 850nm & 500MHz at 1300nm with following specifications, as per table 1.12/4.

Table 1.12/4

Sr. No.	Outside dia.	Cable retention strength	Minimum Bend Radius	Maximum Cordage Tensile Load
1	1.6mm: 1.6mm x 3.3mm	50 Newton	Loaded: 5.1cm Unloaded: 3.5cm	Short Term : 3111 Newton Long Term: 93 Newton
2	3.0mm: 3.0mm x 5.9mm	50 Newton	Loaded: 5.8cm Unloaded: 3.5cm	Short Term : 400 Newton Long Term: 120 Newton

1. The fiber-optic patch cord shall be configurable with standard LC, SC, and ST terminations, and shall be available in either 1.6 mm or 3.0 mm duplex zip cord.
2. The 1.6 mm cordage shall exceed the requirements for larger diameter cordage and allows at least twice as many fibers to be installed in a cabinet.
3. The duplex cordage shall be 1.6 mm by 3.5 mm and have two single fiber cords joined together with a web.
4. The connector shall have a pull-proof design that helps prevent accidental disconnects and helps to assure optimal performance of equipment.
5. Custom hybrid patch cords shall also be available, to simplify migration to industry-leading connectors.
6. All fibers shall be Differential Mode Delay (DMD) tested by using a high-resolution test bench that exceeds the FOTP-220 standards and shall be independently certified by UL®.
7. All patch cords shall be a distinctive aqua color for positive identification.

Physical Specifications:

Minimum Bandwidth	@ 850 nm: 4700 MHz-km (laser), 3500 MHz-km (OFL) @ 1300 nm: 500 MHz-km (laser), 500 MHz-km (OFL)
Attenuation:	3.0 dB/Km @ 850 nm, 1.0dB/Km @ 1300 nm
Cable Outside Diameter:	Duplex: 1.6 x 3.7 mm
Min. Bend Radius:	2.5 cm
Operating Temperature Range:	-20 to 70 ºC
Average Connection Loss:	LC = 0.1 dB
Return Loss Minimum:	-20 dB
Tip Material:	Ceramic
Mating Durability for:	500 Reconnects
Insertion Loss Change:	<0.2 dB
Temperature Stability:	-40 to + 75 ºC
Insertion Loss Change:	<0.3 dB

Method of Construction:
Supplying & plugging FRLS duplex fibre patch cord/ pigtails into the LC/ SC/ ST termination of LIU & fibre module/ fibre switch port complete.

Mode of Measurement: Executed quantity shall be counted on number basis

1.13 Networking Components (NWC)

Switches/ Routers

A) Web Smart Power Over Ethernet Switch (ENS)

General:

All material shall conform to relevant standard as per IEEE802.3af PoE

Scope:

Specification No (WG-NWC/ENS)

Preferred in Wireless LAN obviating the use of external power supply for Access Points

Material:
Ethernet Switch:
Ethernet Switch with PoE: 24 ports PoE (Power Over Ethernet) with IEEE 802.3af PoE protocol, each PoE to supply up to 15.4 Watts for connecting devices such as Access Point needing additional power, 10/100Base-Tx 24 Fast Ethernet ports, 1000 Base-T 4 ports, 2 combo ports for flexible copper/fibre Gigabit connections, VLAN web manageable switch with rack mountable clips, screws, console utility software, mechanisms to detect an attack against the central processing unit of the switch and to take corrective action on attacking interface.

1. Feature-rich solution with functionality enabling by Secure Always On access to mission critical applications
2. High performance switch architecture and stacking performance delivering 320Gbps
3. High-density 10/100 ports for edge connectivity
4. Two combo 10/100/1000/SFP uplinks ports per switch for high speed gigabit or low speed connections such as 100FX
5. Simplified converged network deployments through support for Power over Ethernet (PoE), advanced Quality of Service (Quos), and auto-configuration of ports with IP Handsets & Wireless Access Points

Technical Specifications:

- 10/100 Power over Ethernet ports: 24 per switch
- 10/100/1000/SFP Gigabit ports: 2 per switch
- SFP support: SX, LX, XD, ZX, CWDM, 100FX,& T1
- Resilient Stacking: up to 8 units / 192 ports per stack
- Stacking ports: 2 built-in stacking ports per switch
- Total stacking capacity: 320 Gbps
- Individual switch packet throughput: 6.6 Mpps
- Individual switch capacity: 48.8Gbps
- Concurrent VLANs: 256
- Jumbo Frame Support on Gigabit ports
- Maximum MAC addresses: 8,000

Standards Compliance:

- IEEE 802.3 10BASE-T Ethernet
- IEEE 802.3u 100BASE-TX Fast Ethernet
- IEEE (ANSI) 802.3 Auto-negotiation
- IEEE 802.3z Gigabit Ethernet
- IEEE 802.3x Flow Control
- IEEE 802.1Q VLANs

- IEEE 802.1p Priority Queues
- IEEE 802.1D Spanning Tree
- IEEE 802.1w Rapid Spanning Tree
- IEEE 802.1s Multiple Spanning Tree Groups
- IEEE 802.3ad Link Aggregation
- IEEE 802.1X Ethernet Authentication Protocol
- IEEE 802.3AB Link Layer Discovery Protocol
- RFC 783 Trivial File Transfer Protocol (TFTP)
- RFC 791/950 Internet Protocol (IP)
- RFC 792 Internet Control Message Protocol (ICMP)
- RFC 826 Address Resolution Protocol (ARP)
- RFC 854 Telnet Server and Client
- RFC 951 / 1542 BOOTP
- RFC 1112 Internet Group Management Protocol v1
- RFC 1215 SNMP Traps Definition
- RFC 1271 / 1757 / 2819 RMON
- RFC 1361 / 1769 Simple Network Time Protocol (SNTP)
- RFC 1493 Bridge MIB
- RFC 1573 / 2863 Interface MIB
- RFC 1643 / 2665 Ethernet MIB
- RFC 1905 / 3416 SNMP
- RFC 1906 / 3417 SNMP Transport Mappings
- RFC 1907 / 3418 SNMP MIB
- RFC 1945 HTTP v1.0
- RFC 2011 SNMP v2 MIB for IP
- RFC 2012 SNMP v2 MIB for TCP
- RFC 2013 SNMP v2 MIB for UDP
- RFC 2138 RADIUS
- RFC 2236 Internet Group Management Protocol v2
- RFC 2474 Differentiated Services Support
- RFC 2570 / 3410 SNMPv3
- RFC 2571 / 3411 SNMP Frameworks
- RFC 2572 / 3412 SNMP Message Processing
- RFC 2573 / 3413 SNMPv3 Applications
- RFC 2574 / 3414 SNMPv3 USM
- RFC 2575 / 3415 SNMPv3 VACM
- RFC 2576 / 3584 Co-existence of SNMP v1/v2/v3
- RFC 2660 HTTPS (Secure Web Server)
- RFC 2665 Ethernet MIB
- RFC 2863 Interfaces Group MIB
- RFC 2674 Q-Bridge MIB
- RFC 2737 Entity MIBv2
- RFC 2819 RMON MIB

Additional features:

- Customizable Auto-negotiation Advertisements (CANA)
- Distributed Link Aggregation Groups
- Virtual Link Aggregation Control Protocol (VLACP)
- Single IP address for stack management
- Resilient fail-safe stacking
- Automatic Unit Replacement (Configuration and Software)
- Automatic Detection Automatic Configuration (ADAC)
- 802.1X Single Host Single Authentication
- 802.1X Single Host Multiple Authentication
- 802.1X Multiple Host Multiple Authentication
- 802.1X Guest VLAN
- 802.1X Non-EAP (NEAP) access
- DSCP-based Recognition, Marking and Recolouring
- Ingress and Egress Port Mirroring
- Broadcast and Multicast Rate limiting per port
- ASCII Configuration File
- Web, NNCLI, JDM

- SSHv2 and SNMPv3 secure management support
- Secure Network Access (NSNA) support
- BPDU Filter
- Stack Monitor
- USB software and ASCII configure upload
- New unit quick to configure

Resiliency Features:
- Should support a technology which will allow multiple physical network links between two network switches and another device (which could be another switch or a network device such as a server) to be treated as a single logical link and load balance the traffic across all available links
- Generally all the physical ports in the link aggregation group must reside on the same switch. It should also support protocols remove this limitation by allowing the physical ports to be split between two switches.
- Load balancing mechanism should not be round robin or dynamic which may not work with applications like Voice & Video, where session persistence is must.

Main Objective of above features is to achieve Active-Active Cluster Switching. And achieve sub second fail over in case of Link failure & Device Failure, which will result in 99.999% uptime.

Power over Ethernet specifications:
- 802.3af compliant with Power classification support
- Signal pair power delivery
- Maximum 15.4 watts per port
- Maximum DTE Power AC 320 watts
- Maximum DTE Power AC + RPS 740 watts

Electrical specifications:
- Power supply: AC 100-240V, 50-60Hz
- Input current at 110v: 7.1A
- Input current at 220v: 3.6A
- Max power consumption: 470W

Dimensions:
- Width: 438.2mm (17.25 in)
- Height: 1RU 43.7mm (1.72 in)
- Depth: 368.3mm (14.5 in)

Environmental specifications:
- Operating temperature: 0 to 50 degrees C
- Storage temperature: -25 to 55 degrees C
- Relative humidity: 10% - 90%vnon-condensing
- Peak noise level: 42.3 dB
- Thermal rating: 375 BTU/hr
- Calculated MTBF: 242,552 hrs

Safety Agency Approvals:
- IEC 60950 International CB Certification
- EN 60950 European Certification
- UL60950 US certification
- CSA22.2, #60950 Canadian Certification
- NOM Mexican Certification

Electromagnetic Emissions and Immunity:
- CISPR22, Class A/CISPR24 International
- EN55022, Class A/EN55024 European
- FCC, Past 15, Class A US Certification
- ICES-003, Class A Canadian Certification
- AN/NZS 3548 Australian/NZ Certification
- BSMI - Taiwan - CNS 13438, Class A

- MIC - Korea - MIC, No. 2001-116
- VCCI Class A Japanese Certification

Hardware: Chromium plated brass nuts & bolts with special type of U shaped square washers of required sizes.

Method of construction:
The Ethernet switch fitted with rack mountable clips shall be fixed in U Rack (Networking Cabinet) with 4 nos. of chromium plated brass nuts & bolts. The switch shall be configured for TCP/IP addresses for switch IP & Gateway.

Mode of measurement: Executed quantity shall be counted on number basis

B) 24 Port Gigabit Switch (GBS)

Scope:

Specification No (WG-NWC/GBS)

To be used in wired LAN connections.

Material:
Gigabit Ethernet Switch:
24 nos. of 10/100/1000 Base-T Gigabit ports, 2 or 4 combo SFP slots for flexible fibre backbone, VLAN, manageable, 19"standard rack mountable, auto detection of MDI/MDIX, Layer 2, Safeguard Engine to protect against traffic flooding caused by virus/worm outbreaks with rack mountable clips, screws, console utility software.

1. Feature-rich solution with functionality enabling by Secure Always On access to mission critical applications
2. High performance switch architecture and stacking performance delivering 320Gbps
3. High-density 10/100/1000 ports for edge connectivity
4. Shared SFP uplinks ports per switch for gigabit fibre connectivity

Technical Specifications:
- 10/100/1000 Ethernet ports: 24 per switch
- SFP Gigabit ports: 4 per switch
- SFP support: SX, LX, XD, ZX, CWDM, 100FX & T1
- Resilient Stacking: up to 8 units
- Stacking ports: 2 built-in ports per switch
- Total stacking capacity: 320 Gbps
- Individual switch packet throughput: 36 Mpps
- Individual switch capacity: 88 Gbps
- Concurrent VLANs: 256
- Jumbo Frame Support on Gigabit ports
- Maximum MAC addresses: 8,000

Standards compliance:
- IEEE 802.3 10BASE-T Ethernet
- IEEE 802.3u 100BASE-TX Fast Ethernet
- IEEE (ANSI) 802.3 Auto-negotiation
- IEEE 802.3z Gigabit Ethernet
- IEEE 802.3x Flow Control
- IEEE 802.1Q VLANs
- IEEE 802.1p Priority Queues
- IEEE 802.1D Spanning Tree
- IEEE 802.1w Rapid Spanning Tree
- IEEE 802.1s Multiple Spanning Tree Groups
- IEEE 802.3ad Link Aggregation
- IEEE 802.1X Ethernet Authentication Protocol
- IEEE 802.3AB Link Layer Discovery Protocol
- RFC 783 Trivial File Transfer Protocol (TFTP)

- RFC 791/950 Internet Protocol (IP)
- RFC 792 Internet Control Message Protocol (ICMP)
- RFC 826 Address Resolution Protocol (ARP)
- RFC 854 Telnet Server and Client
- RFC 951 / 1542 BOOTP
- RFC 1112 Internet Group Management Protocol v1
- RFC 1215 SNMP Traps Definition
- RFC 1271 / 1757 / 2819 RMON
- RFC 1361 / 1769 Simple Network Time Protocol (SNTP)
- RFC 1493 Bridge MIB
- RFC 1573 / 2863 Interface MIB
- RFC 1643 / 2665 Ethernet MIB
- RFC 1905 / 3416 SNMP
- RFC 1906 / 3417 SNMP Transport Mappings
- RFC 1907 / 3418 SNMP MIB
- RFC 1945 HTTP v1.0
- RFC 2011 SNMP v2 MIB for IP
- RFC 2012 SNMP v2 MIB for TCP
- RFC 2013 SNMP v2 MIB for UDP
- RFC 2138 RADIUS
- RFC 2236 Internet Group Management Protocol v2
- RFC 2474 Differentiated Services Support
- RFC 2570 / 3410 SNMPv3
- RFC 2571 / 3411 SNMP Frameworks
- RFC 2572 / 3412 SNMP Message Processing
- RFC 2573 / 3413 SNMPv3 Applications
- RFC 2574 / 3414 SNMPv3 USM
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- RFC 2660 HTTPS (Secure Web Server)
- RFC 2665 Ethernet MIB
- RFC 2863 Interfaces Group MIB
- RFC 2674 Q-Bridge MIB
- RFC 2737 Entity MIBv2
- RFC 2819 RMON MIB

Additional features:

- Customizable Auto-negotiation Advertisements (CANA)
- Distributed Link Aggregation Groups
- Virtual Link Aggregation Control Protocol (VLACP)
- Nortel Multiple Spanning Tree groups
- Single IP address for stack management
- Resilient fail-safe stacking
- Automatic Unit Replacement (Configuration and Software)
- Automatic Detection Automatic Configuration (ADAC)
- 802.1X Single Host Single Authentication
- 802.1X Single Host Multiple Authentication
- 802.1X Multiple Host Multiple Authentication
- 802.1X Guest VLAN
- 802.1X Non-EAP (NEAP) access
- DSCP-based Recognition, Marking and Recolouring
- Ingress and Egress Port Mirroring
- Broadcast and Multicast Rate limiting per port
- ASCII Configuration File
- Web, NNCLI, JDM
- SSHv2 and SNMPv3 secure management support
- Nortel Secure Network Access (NSNA) support
- BPDU Filter
- Stack Monitor
- USB software and ASCII configure upload
- New unit quick to configure

Resiliency Features:

- Should support a technology which will allow multiple physical network links between two network switches and another device (which could be another switch or a network device such as a server) to be treated as a single logical link and load balance the traffic across all available links
- Generally all the physical ports in the link aggregation group must reside on the same switch. It should also support protocols remove this limitation by allowing the physical ports to be split between two switches.
- Load balancing mechanism should not be round robin or dynamic which may not work with applications like Voice & Video, where session persistence is must.
- Main Objective of above features is to achieve Active-Active Cluster Switching .And achieve sub second failover in case of Link failure & Device Failure which will result in 99.999% uptime

Electrical specifications:

- Power supply: AC 100-240V, 50-60Hz
- Input current at 110v: 1.3A
- Input current at 220v: 0.7A
- Max power consumption: 150W

Dimensions:

- Width: 438.2mm (17.25 in)
- Height: 1RU 43.7mm (1.72 in)
- Depth: 368.3mm (14.5 in)
-

Environmental specifications:

- Operating temperature: 0 to 50 degrees C
- Storage temperature: -25 to 55 degrees C
- Relative humidity10% - 90% non-condensing
- Peak noise level: 42.4 dB
- Thermal rating: 290 BTU/hr
- Calculated MTBF: 312,001 hrs

Safety Agency Approvals:

- IEC 60950 International CB Certification
- EN 60950 European Certification
- UL60950 US certification
- CSA22.2, #60950 Canadian Certification
- NOM Mexican Certification

Electromagnetic Emissions and Immunity:

- CISPR22, Class A/CISPR24 International
- EN55022, Class A/EN55024 European
- FCC, Past 15, Class A US Certification
- ICES-003, Class A Canadian Certification
- AN/NZS 3548 Australian/NZ Certification
- BSMI - Taiwan - CNS 13438, Class A
- MIC - Korea - MIC, No. 2001-116
- VCCI Class A Japanese Certification

Hardware:

Chromium plated brass nuts & bolts with special type of U shaped square washers of required sizes.

Method of construction:

The Ethernet switch fitted with rack mountable clips shall be fixed in U Rack (Networking Cabinet) with 4 nos. of chromium plated brass nuts & bolts. The switch shall be configured for TCP/IP addresses for switch IP & Gateway.

Mode of measurement: Executed quantity shall be counted on number basis

C) Broadband ADSL Router (ADSL)

General:

All material shall conform to relevant standard as per ITU G.992.2 & RFC

Scope:

Specification No (WG-NWC/ADSL)

For broadband internet connections to individual computer or Wired LAN/ Wireless LAN.

Material:

Broadband ADSL Router:

ADSL2+ broadband router with PPP(Point-to-Point Protocol), DHCP support, TCP/IP, downstream up to 24Mbps, upstream up to 1Mbps, RJ-11 for ADSL line, RJ-11 for phone line with Patch cord 3 metre in length, 10/100 Base-T port, USB 1.1 & 9V adaptor with UTP(Ethernet) Patch Cord, USB 2.0 patch cord, USB driver software

- **Designed for the small to medium business** - Simpler than enterprise class routers but more robust than consumer grade routers
- **Secure** - Good security and heavy encryption, but easy to implement; simple yet statefull firewall with simple filters
- **Simplified architecture** - Has a smaller processor that does not require a noisy fan, making it small and attractive for in-office or desk top installation

Note: Provision of Network Interface Card (NIC) shall be made for computer without built in NIC.

Input/Output Requirements:

- WAN 1- 10/100 Base-T Auto-sensing - RJ-45
- LAN -4 Port Ethernet 10/100 Base-T Auto-sensing switch – RJ- 45 (fifth port for internal connection)

VPN Services:

- Minimum 10 IPSec tunnels
- IKEv1 Main Mode
- IKEv1 Aggressive Mode
- Up to 3 IP pools for Client
- 16 Split networks configured
- 64 Subnets specified for Split (inverse) network
- Diffie-Hellman Group 1, 2
- IPSec Tunnel Mode
- ESP
- Support for Dynamically addressed peers – ABOT
- NAT Traversal
- IPSec Transport Mode
- Keep Alive – For branch office and client tunnels
- VPN Router Client termination

Cryptographic Services:

- DES
- 3DES
- Data authentication SHA-1
- Data authentication MD-5
- AES -128
- AES – 192, 256 – Branch Office

Authentication Services:

- Pre-shared secrets
- External RADIUS support
- 802.1x/EAP support

Firewall:
- Statefull Packet Inspection
- IP application Inspection (FTP, SMTP, HTTP, Telnet, SSL, DNS, etc.)
- Denial of Service (DoS) detection and prevention
- URL Filtering
- Content filtering

ALG's:
- CU-SeeME
- FTP
- SIP
- H.323
- IPSEC
- VDiLive
- RealAudio

IP Services: NAT:
- NAT, Many to One, Static, Many to Many, Many One-to-One
- Port Forwarding
- IPSec pass-through
- SIP and H.323 ALG's
- Cone NAT
- NAT support for tunnel Mode IPSec tunnels

IP Services: Routing:
- Clear text routing
- Static
- RIP v1
- RIP v2

IP Services: DHCP:
- Client
- Server
- Relay
- Static mapping – 8 IP address lease mapping

IP Services: DNS:
- DNS Proxy
- Dynamic DNS

IP Services: NTP:
- RFC-867, 868, 1305

Layer Two Protocols:
- PPPoE
- IP masquerade/ alias – Configurable MAC address

Performance and Scaling:
- 20 Mbps 3DES throughput w/ 1500 byte packets
- 10 IPSec tunnels

Management:
- TFTP/FTP firmware upload
- RS232 console port
- Built-in Diagnostic tool
- SNMP
- Web GUI
- CLI (Command Line Interpreter)
- Remote management (FTP, Telnet, Web)

- Backup and restore configuration via FTP and Web

WAN and LAN Ports:

- The WAN and LAN ports are 10/100-base T Ethernet ports, without PoE

Two-Port Router:

- The router is based on the Intel IXP-425 network processor, running at 266 MHz. It will have 64 Mbytes of FLASH, and 32 Mbytes of RAM.

5-Port Switch:

- The 5-port layer-2 switch uses the Infineon 6996i chip

Serial Port:

- The serial port provides a DCE connection that can be used for either WAN back-up or for installing software into a router that has a corrupted software load

Power Supply:

- The router will be powered by 19 volts DC. The power supply circuit block will convert this supply to the supply voltages needed by the rest of the circuitry. The Business Secure Router 222 uses a universal wall-mount power supply.

Method of construction:

The ADSL Router shall be connected directly to the incoming phone line without any parallel telephone, then to telephone to avoid breaks in Internet connection, 9V DC adaptor connected to provide power supply, UTP patch cord for connections between router Ethernet port to computer/ switch. The router shall be configured as per the requirements of Broadband Internet Service Provider. As far as possible use of USB port shall be avoided.

Mode of measurement: Executed quantity shall be counted on number basis

Wireless LAN

D) Indoor LAN Dipole Antenna (DPA)

General:

All material shall conform to relevant standard as per IEEE.

Scope:

Specification No (WG-NWC/DPA)

To enhance the signal strength of Access Point & Wireless PCI adaptor/ Router up to 500 metres.

Material:

Indoor LAN Dipole Antenna:

2.4 GHz, 5dBi gain, 50 ohms Omni-Directional Indoor Antenna outer covering made from polyurethane, polycarbonate swivel mechanism with built-in connector (RP-SMA & Reverse SMA/ TNC) for 802.11b/g wireless network

Method of Construction:

Supplying & erecting 2.4 GHz, 5dBi Omni-Directional Antenna to be screwed to Access point/ wireless PCI adaptor complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

E) Omni Directional Antenna (ODA)

Scope:

Specification No (WG-NWC/ODA)

To enhance the signal strength of Access Point & Wireless PCI adaptor/ Router at difficult to reach or far places.

Material:

Omni Directional Antenna:

2.4 GHz, 4dBi gain, Collinear, 50 ohms Omni-Directional Indoor Antenna covering horizontal 360 deg. vertical 36 deg. with 1.5m ULA-316 fixed cable, connectors (RP-SMA & Reverse SMA/ TNC), sturdy magnetic base stand to place it on flat surfaces & can be mounted on wall for 802.11b/g wireless network

Method of Construction:

Supplying & erecting 2.4 GHz, 4dBi Omni-Directional Antenna on wall or on the desktop or suitable place which shall be at least 150mm away from electronic devices such as computers, TV, video equipment & audio/video tapes.

Mode of Measurement: Executed quantity shall be counted on number basis.

F) Aesthetic Omni Directional Antenna (AODA)

Scope:

Specification No (WG-NWC/AODA)

To enhance the signal strength of Access Point & Wireless PCI adaptor/ Router at difficult to reach or far places.

Material:

Aesthetic Omni Directional Antenna:

2.4 GHz, 20W (cw) power handling, 40 deg down tilt, 50 ohms Omni-Directional Aesthetic Indoor Ceiling Antenna with ULA-316 fixed cable, connectors (RP-SMA & Reverse SMA/ TNC) for 802.11b/g wireless network.

S No.	Type	Colour	Gain (dBi)	Coverage (deg)		Cable (mtr)	Use
				Horizontal	Vertical		
1	Globe	White	4	360	63	2.0	Places with false ceiling
2	Rod	Gray-White	5	360	32	3.0	Any other place

Hardware: Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, etc.

Method of Construction

Supplying & erecting 2.4 GHz, Omni-Directional Indoor Aesthetic Ceiling Antenna on ceiling at suitable place fixed with required size of SM screws, plugs/ gitties etc. complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

1.13 Networking Accessories (NAS)

LAN Accessories

A) UTP connector (RJ-45) (UTPC)

General:

All material shall conform to relevant standard as per TIA/EIA 568-B2-1.

Scope:

Specification No (WG-NAS/UTPC)

To make MDIX (Cross) patch cord required for cascade connections of switches & routers.

Material:
UTP connector:
Assembly of Gold over nickel contacts with 1.5A current carrying capacity, 30V with 15milli ohms contact resistance, 8P8C connection easy to crimp with crimping tool in polycarbonate UL94V housing.

Method of construction:
The UTP cable shall be spliced, untwisted not more than 12mm, inserted into the connector with sequence as shown in the diagram ____ as per EIA/TIA 568 B.2-1 & crimped firmly with crimping tool.

Mode of Measurement: Executed quantity shall be counted on number basis.

B) Information Outlet (Ethernet) (IO)

General:

All material shall conform to relevant standard as per TIA/EIA 568-B2-1.

Scope:

Specification No (WG-NAS/IO)

For connecting computers to wired LAN or external wireless Ethernet interface in Wireless LAN.

Material:
Information Outlet Flush/ Surface type:
Spring shuttered front access, high impact plastic body FR grade with high performance unshielded RJ-45 keystone jack (conforming to EIA/TIA 568-B.2-1 Cat 6), 15 milliohms contact resistance, gold over nickel spring contact, 1.5A current carrying capacity, with T568A/T568B wiring option, insulation displacement connector for cable crimping to accept 22-26AWG solid wire for connections up to Gigabit Ethernet.

1. All Category 6 outlets shall meet or exceed Category 6 transmission requirements for connecting hardware, as specified in TIA/EIA 568-B.2-1 Commercial Building Telecommunications Cabling Standard and ISO/IEC 11801:2002 Second Edition.
2. The Category 6 outlets shall be backward compatible with Category 5E, 5 and 3 cords and cables.
3. The Category 6 outlets shall be of a universal design supporting T568 A & B wiring.
4. The Category 6 outlets shall be capable of being in a modular patching situation or as a modular telecommunication outlet (TO) supporting current 10BASE-T, Token Ring, 100 Mbps TP-PMD, 155 Mbps ATM, 622 Mbps ATM using parallel transmission schemes and evolving high-speed, high-bandwidth applications, including Ethernet, 1000BASE-T and 1.2 Gbps ATM.
5. The Category 6 outlets shall be capable of being installed at either a 45° or a 90°

angle in any M-series modular faceplate, frame, or surface-mounted box avoiding the need for special faceplates.

6. The Category 6 outlets shall have improved pair splitters and wider channel for enhanced conductor placement. The outlet shall also have a low-profile wire cap, which protects against contamination and secures the connection. Multicolored identification labels shall be available to assure accurate installation.

Hardware:
Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, etc.

Method of construction:
The Information outlet shall be fixed on the wall with sheet metal (SM) screws, rawl plugs/wooden gitties and making due connections as per EIA/TIA 568 B.2-1 by splicing the UTP cable, untwisted up to 12mm & punching the 4 pairs in the keystone jack with the help of punching tool. Not a single wire shall be left without connections.

Mode of Measurement: Executed quantity shall be counted on number basis.

C) Keystone jack (RJ-45) (KJ)

Scope:

Specification No (WG-NAS/KJ)

Structured cabling, to provide connections to switch/ server from desktop computers/ Wireless devices in the patch panel.

Material:
Keystone jack:
High impact plastic body FR grade with high performance unshielded RJ-45 keystone jack (conforming to EIA/TIA 568-B.2-1 Cat 6) , 20milli ohms contact resistance, gold over nickel spring contact ,1.5A current carrying capacity, with T568A/T568B wiring option, insulation displacement connector for cable crimping to accept 22-26AWG solid wire for connections up to Gigabit Ethernet

Method of construction:
The keystone jack shall be fixed with the help of its self-locking arrangement in provided patch panel before making due connection as per EIA/TIA 568 B.2-1 by splicing UTP cable, untwisted up to 12mm & punching the 4 pairs in the keystone jack with the help of punching tool. Not a single wire shall be left without connections.

Mode of Measurement: Executed quantity shall be counted on number basis.

D) Patch Panel (PP)

Scope:

Specification No (WG-NAS/PP)

Structured cabling for the installation of keystone jacks.

Material:
Patch Panel:
Three piece structure including front panel, cable management plate with pre-fitted B-clip to help in routing cables & metal case of 1.6mm thick Mild Steel powder coated panel of size 442.6mm X 44.5mm with the provision for 1 to 24 high density keystone jacks

1. 24 and 48 port patch panels with 110 IDC connector terminations on rear
2. The patch shall have electrical performance guaranteed to meet or exceed TIA/EIA 568-B.2-1 Category 6 and ISO/IEC Category 6/Class E specifications.
3. The panel shall have vertical and horizontal cord organizers available as to improve patch cord management.

4. The panel shall be available in 24-port and 48-port configurations with universal A/B labeling and 110 connector terminations on rear of panel allowing for quick and easy installation of 22 to 24 AWG cable.
5. The patch panel shall have a black powder finish over high-strength steel.
6. The panel shall be equipped with a removable rear mounted cable management bar and front and rear labels.
7. The panel shall be UL listed, UL-C certified and ACA approved.
8. The panel shall support network line speeds in excess of 1 gigabit per second and be backward compatible with Category 5e, 5 and 3 cords and cables.
9. The Category 6 modular jack panels shall meet or exceed the Category 6/Class E standards requirements in ISO/IEC 11801, CENLEC EN 50173 and TIA/EIA and shall be UL Listed.
10. The panels shall be either wall or 19-inch rack mountable.
11. The panels shall meet the following specifications:

Performance Specifications:

	Category 6 Patch Panel	High Performance Solution	Premium Performance Solution
		Category 6 Channel (4 Connectors)	
	Typical Worst Pair Margin*	**Guaranteed Margin****	**Guaranteed Margin****
Insertion Loss	64.3%	5.0%	7.5%
NEXT	6.6 dB	6.0 dB	7.0 dB
PSNEXT	7.3 dB	7.5 dB	8.5 dB
ELFEXT	6.4 dB	6.0 dB	8.0 dB
PSELFEXT	6.1 dB	8.0 dB	10.0 dB
Return Loss	6.6 dB	4.0 dB	4.0 dB
Frequency Range	1-250 MHz	1-250 MHz	1-250 MHz

Operational Specifications:

Operating Temperature Range:	14°F to 140°F (-10°C to 60°C)
Storage Temperature Range:	-40°F to 158°F (-40°C to 70°C)
Humidity:	95% (non-condensing)
Nominal Solid Conductor Diameter:	0.025 to 0.020 in (0.64 to 0.51 mm) (22 to 24 AWG)
Nominal Stranded Conductor Diameter:	0.025 to 0.020 in (0.64 to 0.51 mm (22 to 24 AWG)
Insulation Size:	0.042 in (1.08 mm) (22 to 24 AWG) Maximum DOD
Insulation Types:	All plastic insulates (including PVC, irradiated PVC, Polyethylene, Polypropylene, PTF Polyurethane, Nylon, and FEP)
Insertion Life:	750 minimum insertions of an FCC 8-Position Telecommunications Plug
Front Panel:	Black powder painted steel.
Plastic:	High-impact, flame retardant, UL-rated 94V-0 thermoplastic

Hardware:
Chromium plated brass nuts & bolts with special type of U shaped square washers of required sizes.

Method of construction

The Patch Panel shall be firmly secured in U Rack (Networking Cabinet) with 4 nos. of chromium plated brass nuts & bolts.

Mode of Measurement: Executed quantity shall be counted on number basis.

E) Lightguide Interconnect Unit (LIU)

General:

All material shall conform to relevant standard as per IEEE, EIA/TIA, CENELEC

Scope:

Specification No (WG-NAS/LIU)

To terminate the fibre backbone cables & the equipment cables.

Material:

Lightguide Interconnect Unit:

Wall mount type Lightguide Interconnect Unit with dimensions shown in the table, an interfacing unit for fibre cables coming in from field & those originating from the equipments. consisting of fibre spools to provide minimum bending radius & splice trays as splice cover for pigtail splicing, two compartment design with adaptor panel in the centre, compartmentalizing the box, complete aluminium housing, fully powder coated, two doors enclosure with lock & key, rubber grommets at the cable entry points for tight sealing; Splice trays of 140 x125 x 10mm complete aluminium body fully powder coated with provision for fibre splices fully cushioned splice holder containing grooves for fixing splice protective sleeves; FR grade high impact resistance plastic two halves design stackable sufficient room for excess cable.

Sr. No.	Ports	Dimensions	Fibre splices
1	12	300 x 300 x 80mm	6
2	24	370 x 350 x 80mm	12

Hardware:

Sheet Metal (SM) screws of required sizes, plugs, wooden gitties, etc.

Method of Construction:

Supplying & erecting Lightguide Interconnect Unit (LIU) on wall with cable termination complete with sheet metal screws of required size, plugs/ wooden gitties.

Mode of Measurement: Executed quantity shall be counted on number basis.

Fibre Accessories

F) ST “D" type Multimode Adaptor (MMA)

General:

All material shall conform to relevant standard as per IEEE, EIA/TIA 568-B.3

Scope:

Specification No (WG-NAS/MMA)

To couple two connectors together i.e. to provide optical connectivity between fibre cable & fibre switch/ fibre module.

Material:

ST "D" type multimode adaptor consists of Die cast zinc alloy housing Nickel plated, thread type mounting, washer, nut, 2 nos. of rubber plugs, high precision mechanical design Zirconium/ Phosphor Bronze sleeve having insertion loss < 0.3dB max, return loss < -40dB.

Method of Construction:

Supplying & fixing ST " D" type with threads in provided Lightguide Interconnect Unit on adaptor panel with nut & washer. The adaptor which is not in use shall be plugged with rubber plugs on both the sides to avoid dust accumulation in the adaptor.

Mode of Measurement: Executed quantity shall be counted on number basis.

G) ST "D" type Multimode Connector for LIU (MMA-LIU1)

General

All material shall conform to relevant standard as per IEEE, EIA/TIA 568-B.3

Scope:

Specification No (WG-NAS/MMA-LIU1)

To terminate the optical fibre cables in Lightguide Interconnect Unit (LIU)

Material:

1. ***ST "D" type Multimode connector*** consists of bayonet coupling, 2.5mm Zirconium Ferrule, wide range of Ferrule selection, pre-radiused ferrule to provide fast physical contact polishing, insertion loss < 0.5dB.
2. Distilled water (as lubricant & flushing agent between each polishing process).
3. Epoxy or Anaerobic adhesive (to bond the fibre inside the ferrule).

Tools to be used:

- Carbide cleaving tool with 30 deg tip (to cut off the fibre to the desired height above the ferrule)
- Portable Microscope (200X minimum)
- Polishing kit (includes a polishing puck, pads & an assortment of diamond, aluminium oxide & silica films)

Method of Construction:

The fibre shall be stripped & cleaved. Epoxy and polish connectors field-installed to terminate backbone and distribution cables. Epoxy and polish fibre termination include the following steps: injecting the connector ferrule with epoxy, curing, scribing the protruding fibre(s) from the ferrule, and polishing the ferrule end-face. The correct amount of epoxy must be injected into the ferrule and cured for the specified time and temperature before the ferrule end-face is scribed and polished. Air bubbles shall be avoided in the epoxy to avoid micro-bending and increased loss. The cured epoxy securely bonds the fibre to the ferrule over the operating temperature minimizing relative fibre movement. The connectors with fibre cable shall be tested for loss test with Optical Time Domain Reflectometer (OTDR) & recording the results.

Mode of Measurement: Executed quantity shall be counted on number basis.

H) No Epoxy No polish ST "D" type Multimode Connector (MMA-LIU2)

Scope:

Specification No (WG-NAS/MMA-LIU2)

To terminate the optical fibre cables in Lightguide Interconnect Unit (LIU)

Material:
ST "D" type Multimode connector with Factory pre-polished fibre stub end face consists of bayonet coupling, 2.5mm Zirconium Ferrule, insertion loss < 0.5dB

Tools to be used:
Carbide cleaving tool with 30 deg tip (to cut off the fibre to the desired height above the ferrule)

Method of Construction:
The no Epoxy no polish connectors field-installed to terminate backbone and distribution cables. The fibre shall be striped, cleaved, inserted into the connector & mechanically secured. The connectors with fibre cable shall be tested for loss test with Optical Time Domain Reflectometer (OTDR) & recording the results.

Mode of Measurement: Executed quantity shall be counted on number basis.

I) Power over Ethernet Adaptor (PoEA)

General:

All material shall conform to relevant standard as per IEEE, TIA/EIA.

Scope:

Specification No (WG-NAS/PoEA)

To provide DC power supply to Ethernet devices, which do not have external/ built-in power supply.

Material:
Power over Ethernet Adaptor with output voltage of 5V DC or 12V DC (selectable) with input of 48V DC consists of Power over Ethernet base unit, Power over terminal unit, AC to DC power adaptor, DC power cable & Ethernet cable.

Method of Construction:
Supplying & connecting Power over Ethernet Adaptor with all its connections of base unit, terminal unit & AC to DC power adaptor for supplying power to Access Point, Router or Wireless Ethernet Transceiver complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

J) Tri-Mode Dual band Wireless PCI LAN Card (LANC1)

General:

All material shall conform to relevant standard as per IEEE 802.11 xs.

Scope:

Specification No (WG-NAS/LANC1)

Making provision of Wireless LAN connectivity for desktop PCs in difficult places where signal strength is low.

Material:
Wireless PCI 32 bit interface LAN card covering 100 metres (indoor) transmission speed of 108Mbps to connect 802.11b, 802.11g & 802.11a networks operating in two non-interfering bands 2.4 GHz & 5GHz with 4dBi to 5dBi gain Omni directional dipole antenna & driver.

Method of Construction:
Supplying & fixing Tri-mode dual band wireless PCI LAN card in desktop computer with installation of driver & configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

K) Wireless PCI LAN Card (LANC2)

General:

All material shall conform to relevant standard as per IEEE 802.11g.

Scope:

Specification No (WG-NAS/LANC2)

Making provision of Wireless LAN connectivity for desktop PCs.

Material:
Wireless PCI 32 bit interface LAN card to connect 802.11g networks operating in 2.4 GHz band covering 100 metres range (indoor), transmission speed of 54Mbps with external dipole antenna, detachable reverse SMA connector & driver.

Method of Construction:
Supplying & fixing Wireless PCI LAN card in desktop computer with installation of driver & configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

L) Manageable Wireless LAN Access Point (LAP1)

General:

All material shall conform to relevant standard as per IEEE 802.11b/g & IEEE802.3/u

Scope:

Specification No (WG-NAS/LAP1)

To provide wireless access to the WLAN network.

Material:
Wireless Access Point consists of 108Mbps turbo mode handling heavy data payloads, 2dBi gain detachable dipole antenna with reverse SMA connector, external AC to DC 5V adaptor.

Method of Construction:
Supplying & connecting Wireless Access Point with AC to DC adaptor to Ethernet switch with due configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

M) High Performance Manageable Wireless LAN Access Point with PoE (Power over Ethernet) (LAP2)
General:

All material shall conform to relevant standard as per IEEE 802.11b/g, IEEE 802.3/u & IEEE 802.3af

Scope:

Specification No (WG-NAS/LAP2)

To provide high performance wireless access to the WLAN network.

Material:

Wireless Access Point consists of 108Mbps turbo mode handling heavy data payloads, dual 5dBi gain detachable dipole antenna with reverse SMA connectors, Power over Ethernet 10/100 Base-Tx port.

Note: To connect the Access Point, availability of PoE Ethernet Switch or PoE adaptor is essential.

Method of Construction:

Supplying & connecting Wireless Access Point to PoE Ethernet switch or Ethernet Switch through PoE Adaptor with due configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

N) Dual Band High Performance Manageable Wireless LAN Access Point with PoE (Power over Ethernet) (LAN3)

Scope:

Specification No (WG-NAS/LAP3)

To provide high performance wireless access to the WLAN network.

Material:

Wireless Access Point consists of 108Mbps turbo mode handling heavy data payloads operating in 2.4 GHz & 5 GHz bands, dual 5dBi gain detachable dipole antenna with reverse SMA connectors, Power over Ethernet 10/100 Base- Tx port.

Note: To connect the Access Point, availability of PoE Ethernet Switch or PoE adaptor is essential.

Method of Construction:

Supplying & connecting Wireless Access Point to PoE Ethernet switch or Ethernet Switch through PoE Adaptor with due configuration for TCP/IP address complete.

Mode of Measurement: Executed quantity shall be counted on number basis.

Chapter 2

FITTINGS

2.1	**Lamps**	**FG-LP**
2.2	**Indoor fittings**	**FG-IF**
2.3	**Outdoor fittings**	**FG-OF**
2.4	**Accessories for fittings**	**FG-AS**
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Chapter 2 **Fittings** **(FG)**

2.1 Lamps (FG-LP)

A) GLS/MF Lamps (GLS)

Specification No **(FG-LP/GLS)**

Scope:

Supplying and fixing of GLS/MF lamps suitable for 230 volts, and of specified wattage, conforming to IS: 418-1978. The lamp shall meet with the requirements mentioned in Table No. 2.1/1

Material:

Lamp: Made of blown molten glass, and shall comply with IS: 418-1978.
Filament: Made from Tungsten.
Cap: Made from high grade Aluminium sheet either Bi pin/Edison screwed.

Method of Construction:

The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e each)

Table No. 2.1/1

Lamp Data for GLS lamps

Watts (W)	Filling	Filament	Finish	Luminous flux (lm) at 230 V
25	Vacuum	Single Coil	Clear	220
40				425
60				700
100	Gas filled	Coiled coil		1380
150				2080
200				2920
300				4700
500				8300
1000				18600
1500				29500

B) Fluorescent tubes (FT)

Specification No **(FG-LP/FT)**

Scope:

Supplying and fixing of fluorescent tube suitable for 230 volts, and of specified wattage, conforming to IS: 2418 (Part 1 to 4) - 1977. The lamp shall meet with the requirements mentioned in Table No. 2.1/2

Material:

Lamp: Based on Tri-phosphor fluorescent powder, with triple coil electrode & anode ring.
Cap: Bipin cap made from high grade Aluminium sheet.

Method of Construction:

The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/2

Lamp Data for Fluorescent tubes

Lamp Type	Colour Rendering Index	Colour Temp. (^{0}K)	Lamp watt (W)	Lamp volt (V)	Operating lamp current (A)	Nominal luminous flux (lm)	Life (hrs)
Tri-band phosphor 36 W	82 % 84 % 86 %	6500 4000 2700	36 36 36	103 103 103	0.44 0.44 0.44	3250 3250 3250	15000 15000 15000
24 W	85 % 85 %	3000 3400	24 24	- -	- -	1350 1350	- -
Normal 18 W	54 %	6500	18	58	0.37	1015	-
Normal 36 W	54 %	6500	36	103	0.44	2450	-

C) <u>High Pressure Mercury Vapour Lamps</u> (MV)

Specification No (FG-LP/MV)
<u>Scope:</u>
Supplying and fixing of High pressure Mercury vapour lamps suitable for 230 volts, and of specified wattage, conforming to IS: 9900 (Part 1 to 4) - 1981. The lamp shall meet with the requirements mentioned in Table No. 2.1/3

<u>Material:</u>
Lamp: Hard glass lamp made from high pressure mercury vapour with quartz discharge tube in an ovoid shaped, internally phosphor coated outer shell, with average colour temperature 3800 ^{0}K
Cap: 3 Pin BC/Screwed cap made from high grade Aluminium sheet.

<u>Method of Construction:</u>
The lamp shall be fixed at specified location as directed by site engineer.

<u>Mode of Measurement:</u> Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/3

Lamp Data for High Pressure Mercury Vapour lamps

Lamp Type	Colour Temp. (^{0}K)	Lamp watt (W)	Lamp volt (V)	Operating lamp current (A)	Nominal luminous flux (lm)	Starting Time (min.)
HPL-N	3800	80	115	0.80	3500	3.5
HPL-N	3800	125	125	1.15	6250	3.5
HPL-N	3800	250	135	2.0	13500	4.0
HPL-N	3800	400	140	3.2	23000	4.0

D) <u>ML Blended Lamp/Self Ballasted Lamp</u> (MLL)

Specification No (FG-LP/MLL)
<u>Scope:</u>
Supplying and fixing of ML Blended lamps suitable for 230 volts, and of specified wattage, conforming to IS: 9900 (Part 1 to 4) - 1981. The lamp shall meet with the requirements mentioned in Table No. 2.1/4

<u>Material:</u>
Lamp: Hard glass lamp made from high pressure mercury vapour self ballasted with quartz discharge tube in an ovoid shaped, with average colour temperature 3600 ^{0}K

Cap: 3 Pin BC cap made from high grade Aluminium sheet.

Method of Construction:
The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/4

Lamp Data for High Pressure Mercury Vapour lamps

Lamp Type	Colour Temp. (^{0}K)	Lamp watt (W)	Min. mains Voltage (V)	Lamp current (A)	Nominal luminous flux (lm)	Average life (hrs)
MLL	3600	160	190	0.72	2900	5000

E) High Pressure Sodium Vapour Lamps (SV)

Specification No **(FG-LP/SV)**

Scope:
Supplying and fixing of High pressure Sodium vapour lamps suitable for 230 volts, and of specified wattage, conforming to IS: 9974 (Part 1 & 2) - 1981. The lamp shall meet with the requirements mentioned in Table No. 2.1/5

Material:
Lamp: High pressure sodium vapour lamps with a polycrystalline translucent Aluminium discharge tube enclosed in an ovoid or tubular outer glass envelope. The ovoid shell shall have internally coated with uniform layer of diffusing powder applied electro statically. The discharge tube shall contain an amalgam of mercury and sodium along with Xenon gas as starting aid.
Cap: Screwed cap made from high grade Aluminium sheet.

Method of Construction:
The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/5

Lamp Data for High Pressure Sodium Vapour lamps

Lamp Type	Lamp watt (W)	Average Lamp volt (V)	Average lamp current (A)	Nominal luminous flux (lm)
SON	70	90	1.0	5800
SON	150	100	1.8	13500
SON-T	150	100	1.8	14000
SON	250	100	3.0	25000
SON-T	250	100	3.0	27000
SON	400	105	4.4	47000
SON-T	400	105	4.4	47500

F) Metal Halide Lamps (MHL)

Specification No **(FG-LP/MHL)**

Scope:
Supplying and fixing of Metal Halide lamps single/Double ended, suitable for 230 volts, and of specified wattage. The lamp shall meet with the requirements mentioned in Table No. 2.1/6

Material:
Lamp: High pressure metal halide gas discharged lamps with iodide additives indium, thallium and sodium in the mercury discharge. The discharge tube shall be enclosed in an

ovoid, hard glass outer bulb with fluorescent coating (HPI-BU) or clear tubular outer hard glass envelope, (HPI-T).

- Colour Temperature : HPI-BU - -> 4300 ^{0}K
  : HPI-T - -> 4300 ^{0}K to 4900 ^{0}K

Cap: Pin type/Screwed cap made from high grade Aluminium sheet.

Method of Construction:
The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/6
Lamp Data for Metal Halide lamps

Lamp Type	Lamp watt (W)	Minimum Voltage for Ignition (V)	Average lamp voltage after 100 burning hours (V)	Average lamp current after 100 burning hours (A)	Lamp starting current (A)	CRI (Ra)	Average luminous flux after 100 burning hours (lm)
HPI-BU	250	200	128	2.2	3.2	69	17000
HPI-BU	400	200	125	3.4	6.0	69	30600
HPI-T	70	200	90	1.0	1.4	80	5500
HPI-T	150	200	98	1.8	2.4	85	12100
HPI-T	250	200	128	2.2	3.9	65	17000
HPI-T	400	200	125	3.4	6.0	65	30500

G) Compact Fluorescent Lamps (CFL)

Specification No (FG-LP/CFL)
Scope:
Supplying and fixing of Compact Fluorescent lamps either with adapter (Retrofit – Instant Start type) or without (Pin type-PL tube to be used with ballast), suitable for 230 volts, and of specified wattage. The lamp shall have life of 10000 burning hours and shall meet with the requirements mentioned in Table No. 2.1/7. All lamps shall have pf above 0.9.

Material:
Lamp: Based on fluorescent powder, with electrode.
Cap: Pin type/Screwed cap made from high grade Aluminium sheet.

Method of Construction:
The lamp shall be fixed at specified location as directed by site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

Table No. 2.1/7

Lamp Data for Compact Fluorescent lamps

Mounting type	Lamp watt (W)	Colour Temp. (^{0}K)	Luminous flux (lm)	Efficacy (lm/W)	Average life in (hrs)
Retrofit	13	5000	575	44	10000
Retrofit	13	6000	575	44	10000
Retrofit	13	2700	550	42	10000
Retrofit	18	5000	850	47	10000
Retrofit	18	6000	850	47	10000
Retrofit	18	2700	800	45	10000
Retrofit	25	5000	1100	44	10000
Retrofit	25	6000	1100	44	10000
Retrofit	25	2700	1050	42	10000
PL	9	2700	400	44	10000
PL	11	2700	600	55	10000
PL	15	2700	900	60	10000
PL	15	5000	800	53	10000
PL	20	2700	1200	60	10000
PL	20	5000	1100	55	10000
PL	23	2700	1500	65	10000
PL	23	5000	1350	59	10000
PL	5	2700	250	50	8000
PL	5	4000	250	50	8000
PL	7	2700	400	57	8000
PL	7	4000	400	57	8000
PL	11	4000	900	91	8000

2.2 Indoor fittings (FG/IDF)

A) Bulkhead Fitting

Scope:

Specification No (FG-IDF/BHF)

Supplying and erecting bulkhead fitting with fine finished cast Aluminium enamel painted body with 20 mm conduit entry and clear glass / prismatic glass with guard and complete water tight hinged with locking screw porcelain holder to house CFL up to 5/9/11 Watt erected in position on polished double wooden block.

Material:

Bulkhead fitting:

Bulk Head Fitting shall be made from pressure dia-cast aluminium LM6 body in stove enamel finish and fitted with a heat resistant elegant glass cover through a gasket. A two pin BC porcelain holder for GLS or a CFL holder shall be fitted inside the housing. An electro-galvanized MS wire guard for protection against pilferage. Glass and wire guard assembly shall be hinged to the body for ease of maintenance. The bulkhead shall be suitable for Integral type CFL, with cable entry through one no.3/4" B.S. threaded inlet. Incoming wires shall be terminated on the lamp holder terminals in case of GLS and in the terminal block in case of CFL. Two lugs with slots for facilitating wall/ceiling mounting. The fitting shall be I.P. 54 protected.

Wooden board: As per **(WG-PW/PW)** 1.6 specified in chapter for Point wiring.

Hardware*:* Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Method of Construction:

The Bulkhead shall be mounted on polish double wooden block with required size of SM screws, duly wired.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) **Mirror Light Fitting Suitable for CFL 9/13/18 watts (ML1)**

Scope:

Specification No (FG-IDF/ML1)

Supplying and erecting luminaries suitable for 9/13/18 watt CFL lamp made of engineering Plastic in approved colour finish and an elegantly designed milky white acrylic front diffuser, and bright anodized Aluminium reflector, with VPIT ballast, lamp holder, and connector.

Material:

Fitting:

The Luminaries Comprises housing made of engineering plastic in approved colour finish and an elegantly designed mike white acrylic front diffuser enclosing a bright anodized Aluminium reflector. Pre-wired with vacuum pressure impregnated copper ballast, lamp holder and mains connector with two holes on rear side facilitates wall/ceiling mountings, the grommet should be provided at rear side.

Wooden board: As per 1.6 specified in chapter for Point wiring. **(WG-PW/PW)**

Hardware*:* Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Terminal connector: **As per (FG-FG/AS10) specified in chapter 2.4.**

Connection Wire: Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Method of Construction:

The fitting shall be mounted on polished Wooden / Laminated 4mm plywood top / block by required size of screws with necessary flexible wire for connection.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

C) **Mirror Light Fitting Suitable for CFL 9 watts (ML2)**

Scope:

Specification No (FG-IDF/ML2)

Supplying and erecting Mirror light fitting with 1 x 9 Watts CFL, with necessary Choke & accessories complete erected on polished wooden / sunmica block.

Material:

Fitting:

Channel fabricated from CRCA MS sheet and finished in reflector white inside and outside. Pre-wired with vacuum pressure impregnated copper ballast, lamp holder and mains connector, and an aesthetically appealing serrated / reeded opal diffuser held in position by decorative end covers white (W) / deep blue (B) / orange (O) / H.C. grey (G), post office red (R)/ Black (BK) or approved colour, 12mm dia grommet. Two 6.5 mm dia holes on the rear side of the channel to facilitate wall / ceiling mounting.

Wooden board: As per 1.6 specified in chapter for Point wiring. **(WG-PW/PW)**

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Connection wire: Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Terminal connector: **As per (FG-FG/AS10) specified in chapter 2.4.**

Method of Construction:

The fitting shall be mounted on polished Wooden / Laminated 4mm plywood top / block by required size of screws with necessary flexible wire for connection.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

D) **Mirror Optic Recessed down Lighter suitable for 2 x 18 watts CFL (DL1)**

Scope:

Specification No (FG-IDF/DL1)

Supplying and erecting circular type recessed down lighter suitable for 2x18 watts CFL, including gear box. The luminaire comprises a ceiling ring spun from Aluminium attached to mounting unit made of mild steel. The mounting unit has a pair of sliding brackets for fixing the luminaire to the ceiling.

Material:

Fitting:

Scientifically designed highly polished & anodized Aluminum reflector ensures precise light control with optimum light utilization, leading to substantial savings in energy cost and excellent ambient conditions. Reflector is fitted into the frame with decorative screw

arrangement. Frame is fabricated from CRCA MS sheet and epoxy powder coated white. Precoated frame ensure corrosion free life. Fitting shall have a prismatic acrylic diffuser resting on upper part of reflector to reduce glare. Retaining clips facilitate mounting in false ceilings.
Ballast: As per **(FG-FG/AS1)** specified in chapter 2.4.
Bi-pin lamp holder: Conforming to IS: 3323/80 with amendment No.1 to the extent possible /applicable.
Capacitor / Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4.
Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.
Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:
The fitting shall be fixed firmly in the designated place (False ceiling / unspecified ceiling) with the help of swinging bracket, and making the connection.
In case where fittings are to be installed flush with /on false ceiling; layout shall be given to civil wing and work shall be done in co-ordination with civil wing e.g. making recesses in false ceiling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

E) Mirror Optic CFL fitting (MOF)

Scope:
Specification No (FG-IDF/MOF)
Supplying & erecting recessed / surface down lighter with mirror optics suitable for specified wattage of CFL.

Material:
Fitting:
Housing fabricated from CRCA sheet, epoxy powder coated, white enamelled, with mirror assembly comprising of significantly designed high purity aluminium reflector for high optical performance back wing light and with improved vertical illumination.
Ballast: As per **(FG-FG/AS1)** specified in chapter 2.4.
***Bi-pin lamp holder*:** Conforming to IS: 3323/80 with amendment No.1 to the extent possible /applicable.
Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.
Hardware*:* Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.
Chain: Heavy duty lacquered MS chain with hooks.
Block: As per 1.6 specified in chapter for Point wiring. **(WG-PW/PW)**
Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:
Mirror optic fitting suitable for specified wattage of CFL complete erected on wooden block/PVC block /on ceiling directly in case of surface mounting fitting, as directed by site engineer, with necessary screws of suitable size, with rawl plugs, gutties, etc. In case of recesses mounting, the fitting shall be secured and erected by fixing the hook at ceiling, and the chain shall be fixed to the fitting, in such a manner that the fitting shall be in level with the designated place (false / unspecified ceiling)

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

F) Box type Fluorescent fitting (BFF)

Scope:
Specification No (FG-IDF/BFF)
Supplying & erecting white stove enamelled / powder coated box type fluorescent fitting suitable for T 8 tube/ tubes, with specified ballast, and necessary accessories, duly wired up for use on 250 V AC, supply and erected if required on varnished wooden / PVC block with flexible wire, twin core 24/0.20 mm. and with necessary materials complete and marking Sr. No. and date of erection.

Material:

Fitting:

White stove enameled / powder coated box type fluorescent fitting suitable for T 8 tube, made of CRCA sheet not less than 0.5 mm thick, painted white on the reflector side and gray/any other colour (specified by the Engineer in-charge) on other surface. Wire ways shall be smooth & free from sharp edges, burrs, flashes & like which might cause abrasion of the insulation of the wiring. Parts such as metal set screws shall not protrude into wire ways. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.IDF-1 (Fig.1))

Ballast: As per **(FG-FG/AS2) / (FG-FG/AS3) / (FG-FG/AS4)** specified in chapter 2.4.

Tube holders: As per **(FG-FG/AS8)** specified in chapter 2.4

Starter: As per **(FG-FG/AS11)** specified in chapter 2.4

Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4

Starter holder: As per **(FG-FG/AS9)** specified in chapter 2.4

Terminal connector*:* As per **(FG-FG/AS10)** specified in chapter 2.4.

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Paint: Superior quality enamel paint of specified colour.

Hardware*:* Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Chain: Heavy duty lacquered MS chain with hooks.

Down Rod: Steel conduit as per **(WG-MA/CON)** specified in chapter for Point wiring.

Block: As per 1.6 specified in chapter for Point wiring. **(WG-PW/PW)**

Method of Construction:

The complete fitting with all the above accessories shall be fixed on wooden / PVC block with SM screws (minimum size shall be 25x8 mm). The wooden/PVC block shall be fixed on wall/ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. S. No and date of erection shall be painted/marked by enamel paint. The fitting shall be connected with PVC insulated copper wire leads, to the point and testing shall be carried out.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

G) Chalk Board type Fluorescent fitting (CBF)

Scope:

Specification No (FG-IDF/CBF)

Supplying & erecting white stove enameled / powder coated Chalk board type fluorescent fitting with enameled reflector of 0.8 mm thick, white on the reflector side and gray on other surface suitable for T 8 tube/ tubes, with specified ballast, and necessary accessories, duly wired up for use on 250 V AC, supply including material required for erection and erecting as per requirement complete and marking Sr. No. and date of erection.

Material:

Fitting:

White stove enameled / powder coated Chalk board type fluorescent fitting suitable for T 8 tube, made of CRCA sheet not less than 0.5 mm thick, with enameled reflector of 0.8 mm thick, painted white on the reflector side and gray on other surface. Wire ways shall be smooth & free from sharp edges, burrs, flashes & like which might cause abrasion of the insulation of the wiring. Parts such as metal set screws shall not protrude into wire ways. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.IDF-1 (Fig.2))

Ballast: As per **(FG-FG/AS2) / (FG-FG/AS3) / (FG-FG/AS4)** specified in chapter 2.4.

Tube holders: As per **(FG-FG/AS8)** specified in chapter 2.4

Starter: As per **(FG-FG/AS11)** specified in chapter 2.4

Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4

Starter holder: As per **(FG-FG/AS9)** specified in chapter 2.4

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Paint: Superior quality enamel paint of specified colour.

Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Block/ Board: As per 1.6 specified in chapter for Point wiring. **(WG-PW/PW)**

Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:
The complete fitting with all the above accessories shall be fixed on wooden / PVC block with SM screws (minimum size shall be 25x8 mm). The wooden/PVC block shall be fixed on wall/ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. S. No and date of erection shall be marked/painted by enamel paint. The fitting shall be connected PVC copper wire leads, to the point and testing shall be carried out.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

H) Industrial type Fluorescent fitting (INF)

Scope:
Specification No (FG-IDF/INF)
Supplying & erecting white stove enameled / powder coated Industrial type fluorescent fitting with enameled reflector of 0.8 mm thick, white on the reflector side and gray on other surface suitable for T 8 tube/ tubes, with specified ballast, and necessary accessories, duly wired up for use on 250 V AC, supply including material required for erection and erecting as per requirement complete and marking Sr. No. and date of erection.

Material:
Fitting:
White stove enameled / powder coated Industrial type fluorescent fitting suitable for T-8 tube, made of CRCA sheet not less than 0.5 mm thick, with enameled reflector of 0.8 mm thick, painted white on the reflector side and gray on other surface. Wire ways shall be smooth & free from sharp edges, burrs, flashes & like which might cause abrasion of the insulation of the wiring. Parts such as metal set screws shall not protrude into wire ways. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.IDF-1 (Fig.3))
Ballast: As per **(FG-FG/AS2) / (FG-FG/AS3) / (FG-FG/AS4)** specified in chapter 2.4.
Tube holders: As per **(FG-FG/AS8)** specified in chapter 2.4
Starter: As per **(FG-FG/AS11)** specified in chapter 2.4
Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4
Starter holder: As per **(FG-FG/AS9)** specified in chapter 2.4
Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.
Paint: Superior quality enamel paint of specified colour for marking.
Hardware: Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.
Block: As per 1.6 specified in chapter for Point wiring. **(WG-PW/PW)**
Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:
The complete fitting with all the above accessories duly wired up shall be fixed on block with SM screws (minimum size shall be 25x8 mm). The block shall be fixed on wall/ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. The fitting if, to be ceiling suspended, it shall be fixed to the provided 16 SWG 20 mm dia., HG conduit duly threaded in ball suspension plate. The provided ball suspension plate shall be fixed on block with SM screws (minimum size shall be 25x8 mm) and the block shall be fixed at ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. S. No and date of erection shall be marked/painted by enamel paint. The fitting shall be connected with PVC insulated copper wire leads, to the point and testing shall be carried out.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

I) Recess /Surface mounting Mirror Optic Fluorescent Fitting (MOP)

Scope:
Specification No (FG-IDF/MOP)
Supplying & erecting white stove enameled / powder coated Mirror Optic type fluorescent fitting with enameled reflector of 0.8 mm thick, white on the reflector side and gray on other

surface suitable for T 8 tube/ tubes, with specified ballast, and necessary accessories, duly wired up for use on 250 V AC, supply including material required for erection and erecting as per requirement complete and marking Sr. No. and date of erection.

Material:

Fitting:

White stove enameled / powder coated recess /surface mounting mirror optic type fluorescent fitting suitable for T 8 tube, made of CRCA sheet not less than 0.5 mm thick, painted white on the reflector side and gray on other surface, and with Mirror assembly comprising of significantly designed high purity aluminium reflector for high optical performance. Wire ways shall be smooth & free from sharp edges, burrs, flashes & like which might cause abrasion of the insulation of the wiring. Parts such as metal set screws shall not protrude into wire ways. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.IDF-2 (Fig.4 & Fig.5))

Ballast: As per **(FG-FG/AS2) / (FG-FG/AS3) / (FG-FG/AS4)** specified in chapter 2.4.

Tube holders: As per **(FG-FG/AS8)** specified in chapter 2.4

Starter: As per **(FG-FG/AS11)** specified in chapter 2.4

Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4

Starter holder: As per **(FG-FG/AS9)** specified in chapter 2.4

Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.

Paint: Superior quality enamel paint of specified colour.

Hardware*:* Sheet Metal (SM) screws, washers, plugs / wooden gutties, etc.

Chain: Heavy duty lacquered MS chain with hooks.

Down Rod: As per **(WG-MA/CON)** specified in chapter for Point wiring.

Block: As per 1.6 specified in chapter for Point wiring. **(WG-PW/PW)**

Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:

The complete fitting with all the above accessories shall be fixed on wooden / PVC block / on provided chain / down rod with ball suspension plate with SM screws (minimum size shall be 25x8 mm). The wooden/PVC block shall be fixed on wall/ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. The fitting if, to be ceiling suspended, it shall be fixed to the provided 16 SWG 20 mm dia., HG conduit duly threaded in ball suspension plate. The provided ball suspension plate shall be fixed in wooden /PVC block with SM screws (minimum size shall be 25x8 mm).The wooden/PVC block shall be fixed at ceiling with SM screws (minimum size shall be 75x8mm) with necessary plugs, gutties, etc. In case of recesses mounting, the fitting shall be secured and erected by fixing the hook at ceiling, and the chain shall be fixed to the fitting, in such a manner that the fitting shall be in level with the false / unspecified ceiling. Sr. No and date of erection shall be marked or painted by enamel paint. The fitting shall be connected PVC copper wire leads, to the point and testing shall be carried out.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

2.3 Outdoor fittings (FG/ODF)

A) Street Light fitting suitable for CFL (CSL)

Scope:

Specification No (FG-ODF/CSL)

Supplying & erecting Street Light suitable for specified wattage of CFL complete with serrated acrylic diffuser & gasket, with necessary control gear and erected on provided bracket.

Material:

Fitting:

The fitting canopy shall be made of deep drawn of CRCA Sheet, powder coated / epoxy powder coated CRCA sheet housing with epoxy white powder coated CRCA sheet steel gray tray covered with anodized Aluminium reflector wired with a provision for housing open construction ballast required for specified wattage of CFL with clear acrylic cover with rubber gasket fixed by 4 Nos. toggles of suitable OD entry for direct mounting pipe bracket. Fitting shall be with degree of protection IP 54 electrical Safety Class-I. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.ODF-1 (Fig.1 & Fig.2)

Ballast: As per **(FG-FG/AS1)** specified in chapter 2.4.
Bi-pin lamp holder: Conforming to IS: 3323/80 with amendment No.1 to the extent possible /applicable.
Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.
Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:
The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Street Light fitting suitable for HPMV/HPSV/MH Lamps (GSL)

Scope:
Specification No (FG-ODF/GSL)
Supplying & erecting Street Light fitting suitable for specified wattage of HPSV/HPMV/MH lamps, with all accessories, erected with provided bracket onwall/street light pole or at any place as directed by Site engineer with necessary materials.

Material:
Fitting:
The fitting comprises deep drawn one piece Aluminium body. Lamp compartment has stove enamel white finish from inside & gray finish from outside. nickel chrome plated reflector / Aluminium reflector is mounted inside the lamp compartment for high optical efficiency control gear compartment houses a detachable gear tray & is wired with provided copper wound ballast, power factor improvement capacitor, electronic ignitor & with mains connector. The cable entry is through mounting pipe & terminated on mains connector inside the control gear housing with felt gasket which ensures weather proofness & also prevents entry of insects inside the housing. The fittings lamp compartment shall have IP 43 protection & IP 23 protection for control gear compartment. The fitting shall be ISI marked to IS: 10322 part -5: 1987 with Amendment No.1&2 and comply with requirements of IS: 10322: part-5/Sec-1:1985 with Amendment No.1&2 IS: 13383: part 2: 1992 with Amendment No.1. Fitting shall be duly wired up internally with appropriate size of wire. (Refer drawing no.ODF-2 (Fig.3))
Ballast: As per **(FG-FG/AS5)** specified in chapter 2.4
Ignitor: As per **(FG-FG/AS6)** specified in chapter 2.4
Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4
Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:
The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

C) Street Light fitting suitable for T 8 Fluorescent tubes (FSL1)

Scope:
Specification No (FG-ODF/FSL1)
Supplying & erecting Street Light suitable for specified wattage complete with serrated acrylic diffuser & gasket, with necessary control gear and erected on provided bracket.

Material:
Fitting:
ISI marked Fluorescent Street light fittings complete with electronic ballast, transparent cover made out of 3mm thick acrylic sheet, gear cum reflector tray, canopy and lamp holder duly wired for use on 240 volt AC single phase 50 Hz without fluorescent lamp. Canopy shall be made of Aluminium sheet 1.25 mm thick minimum. Gear cum reflector tray (GCRT) shall be made of either CRCA sheet of 0.8 mm thick or Aluminium sheet of 1.25 mm thick.

Fitting shall be suitable for mounting up to a height of 15 meters and shall be able to withstand wind load test. It shall conform to class-1 of IS: 10322 (part 5/sec 3)/87 with amendment 1 and IP-53 protection with photometric test requirement with luminous efficiency not less than 65%.
i) Various components of fittings shall conform to IS specification as noted below.
a) Electronic ballast (EB) to IS: 13021: Part-1:1991 with Amendment No.1, IS: 13021: Part-2:1991 with Amendment Nos.1 and 2 and additional requirement as per the

b) Bi-pin lamp holders to IS: 3323/80 with amendment No.1/
c) PVC cables to IS: 694/90 with amdt.No.1 & 2.
ii) Surface of CRCA Steel and Aluminium sheets used shall be properly phosphatized and stove enamelled white on the reflector side, tray side and other surface stove enamelled grey.
iii) The street light fittings shall be required with socket bore of 30mm or 40 mm or 50mm for side entry/top entry type fittings. The socket bore, however, will be specified by the indenters at the time of placement of supply order.
iv) All wire leads to be adequately covered with sleeves for protection against accidental contracts.
v) All hardware parts used should be zinc coated or nickel/chromium plated so as to be corrosion resistant.
vi) Fitting shall be wired with multi-stranded copper wire terminating on suitable connectors. The wiring shall be properly clamped.
Ballast: As per **(FG-FG/AS1)** specified in chapter 2.4.
Bi-pin lamp holder: Conforming to IS: 3323/80 with amendment No.1 to the extent possible /applicable.
Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.
Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:
The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

D) Energy efficient T-5 2X14 & 2X24 Street Light fitting (FSL2)

Scope:
Specification No (FG-ODF/FSL2)
Supplying & erecting Energy efficient T-5 2X14 & 2X24 Street Light fitting suitable for specified wattage of T-5 lamp complete with serrated acrylic diffuser & gasket, with necessary control gear and erected on provided bracket.

Material:
Fitting:
ISI marked Energy efficient T-5 2X14 & 2X24 Street Light fitting complete with electronic ballast, transparent cover made out of 3mm thick acrylic sheet, gear cum reflector tray, canopy and lamp holder duly wired for use on 240 volt AC single phase 50 Hz without T-5 lamp. Canopy shall be made of Aluminium sheet of width 3" minimum per lamp. Gear cum reflector tray (GCRT) shall be made of either CRCA sheet of 0.8 mm thick or Aluminium sheet of 1.25 mm thick. Fitting shall be suitable for mounting up to a height of 15 meters and shall be able to withstand wind load test. It shall conform to class-1 of IS: 10322 (part 5/sec 3)/87 with amendment 1 and IP-65 protection
i) Various components of fittings shall conform to IS specification as noted below.
a) Electronic ballast (EB) to IS: 13021: Part-1:1991 with Amendment No.1, IS: 13021: Part-2:1991 with Amendment Nos.1 and 2 and additional requirement as per the
b) Bi-pin lamp holders to IS: 3323/80 with amendment No.1/
c) PVC cables to IS: 694/90 with amdt.No.1 & 2.
ii) Surface of CRCA Steel and Aluminium sheets used shall be properly phosphatized and stove enamelled white on the reflector side, tray side and other surface stove enamelled grey.

iii) The street light fittings shall be required with socket bore of 30mm or 40 mm or 50mm for side entry/top entry type fittings. The socket bore, however, will be specified by the indenters at the time of placement of supply order.
iv) All wire leads to be adequately covered with sleeves for protection against accidental contracts.
v) All hardware parts used should be zinc coated or nickel/chromium plated so as to be corrosion resistant.
vi) Fitting shall be wired with multi-stranded copper wire terminating on suitable connectors. The wiring shall be properly clamped.

Method of Construction:
The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

E) Flood Light fitting suitable for HPMV/HPSV/MH Lamps (GFL)

Scope:
Specification No (FG-ODF/GFL)
Supplying & erecting Flood Light fitting suitable for specified wattage of HPSV/HPMV/MH lamps, with all accessories, erected with provided bracket on wall/street light pole or at any place as directed by Site engineer with necessary materials.

Material:
Fitting:
Luminaries comprising of a die cast aluminium housing with store enamel finish. A flat toughened heat resistance glass is firmly fixed with a synthetic rubber gasket to the housing by stainless steel toggles. Control gear comprises of provided copper wound ballast, power factor improvement capacitor, and electronic ignitor & with mains connector. Luminaire shall be mounted on a MS cradle for rotating in horizontal & vertical planes for facilitating positioning of the luminaire to effectively illuminate the target area. Brightened & anodized aluminium reflector for high optical efficiency. Cable entry shall be through suitable cable glands/ nipple provided for cable entry.
(Refer drawing no.ODF-2 (Fig.4))
Ballast: As per **(FG-FG/AS5)** specified in chapter 2.4
Ignitor: As per **(FG-FG/AS6)** specified in chapter 2.4
Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4
Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:
The complete fitting with all the above accessories shall be erected with provided bracket, on wall/street light pole or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

F) Gate Light fitting (PTL) suitable for HPMV/HPSV/MH Lamps (PTL)

Scope:
Specification No (FG-ODF/PTL)
Supplying and erecting Gate light fitting suitable for specified wattage of HPMV/SV/MH lamp/lamps, complete with control gear, duly wire and erected on provided pipe/pole or at any other place, as directed by site engineer.

Material:
Fitting:
The fitting comprising of a control gear capsule made of die cast aluminium alloy and shall have provision for fixing of control gear. Fitting shall have acrylic bowl with ushroom/round shape bowl of specified diameter, and shall be fixed on the top of the capsule. The bowl shall be adequately gasketed for weather proofness. The inner diameter of control gear capsule base shall be suitable for pipe of 50 mm to 77 mm O.D. Fitting shall have entry for

termination of cable. The control gear capsule shall have IP 43 protection class. (Refer drawing no.ODF-2 (Fig.5))
Ballast: As per **(FG-FG/AS5)** specified in chapter 2.4
Ignitor: As per **(FG-FG/AS6)** specified in chapter 2.4
Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4
Terminal connector: As per (FG-FG/AS10) specified in chapter 2.4.

Method of Construction:
The complete fitting with all the above accessories shall be erected with provided pole/pipe or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

G) Gate / Garden Light fitting suitable for CFL (GLT)

Scope:
Specification No (FG-ODF/GLT)
Supplying and erecting Gate / Garden light fitting suitable for specified wattage of CFL (One or Two), complete with control gear, duly wire and erected on provided pipe/pole or at any other place, as directed by site engineer.

Material:
Fitting:
The fitting comprising of a control gear capsule made of die cast aluminium alloy and shall have provision for fixing of control gear. Fitting shall have acrylic bowl with mushroom/round shape bowl of specified diameter, and shall be fixed on the top of the capsule. The bowl shall be adequately gasketed for weather proofness. The inner diameter of control gear capsule base shall be suitable for pipe of 50 mm to 77 mm O.D. Fitting shall have entry for termination of cable. The control gear capsule shall have IP 43 protection class.
Ballast: As per **(FG-FG/AS5)** specified in chapter 2.4
Ignitor: As per **(FG-FG/AS6)** specified in chapter 2.4
Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4
Terminal connector: As per **(FG-FG/AS10)** specified in chapter 2.4.

Method of Construction:
The complete fitting with all the above accessories shall be erected with provided pole/pipe or at any place as directed by Site engineer, duly connected and giving necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

2.4 Accessories for fittings (FG/AS)

Specifications for Ballasts / Ignitor / Condenser

Scope:
This chapter deals with supply, erection and connecting the accessories required in arious types of fittings suitable for fluorescent tubes, HPMV/SV/MH lamps, etc., and giving necessary testing of the fittings after erecting the accessory.

Specification No (FG-FG/AS1)

1. **CFL Ballast:**
Ballast shall be copper wire wound, polyester filled or vacuum impregnated type suitable for Compact fluorescent lamp (CFL) conforming to I.S. 1534 with amendment No. 1 to 4 suitable for use on 230 V, 50 Hz, Single phase AC Supply, Temperature rise for ballast shall be 50 degree C, above the ambient temperature under normal conditions, minimum preheating current shall be 153 milliamp at 90 % of rated voltage and maximum 240 milliamp at 110 % of the rated voltage.

Specification No (FG-FG/AS2)

2. **Electromagnetic Ballast for T 8 fluorescent tubes:**
The ballast shall be of self Inductive coil of super enamelled copper low loss silicon steel lamination inductive coil with or without as additional resistor, designed to give operational characteristics for 40 W, at rated voltage of 220 V to 240V with calibration current 0.43 A., conforming to IS: 1534. Air temperature of the ballast winding shall not exceed 25^0 C above ambient, with appropriate IP protection class.

Specification No (FG-FG/AS3)

3. **Electronic Ballast for T 8 fluorescent tubes:**
The High frequency electronic ballast suitable for T 8 tube shall have circuit P.F of 0.95 / protected against mains disturbances, automatic cut off protection for a deactivated tube, glass fuse in main input circuitry, short circuit protection for a limited duration for both PCB terminals and components. Should withstand 1.5 KV AC high voltage for insulation as per IS 1302/ Part I. Terminal block should be provided for mains and lamp connections, separate earthing terminal & tamper proof warrantee seal, the losses should not be more than 4 watts & without humming noise.

Specification No (FG-FG/AS4)

4. **VPIT Ballast T 8 fluorescent tubes:**
Vacuum impregnated low loss copper ballast made of low loss silicon steel lamination with super enamelled copper wire, vacuum impregnated with white resin, two way terminal block and winding temperature limited to 120^0C, conforming to IS 1534 (Part -1 of 1977) and suitable for 240 Volt 50 Hz, AC supply.

Specification No (FG-FG/AS5)

5. **Ballast for HPMV/SV and Metal Halide Lamps:**
Ballast shall confirm to IS: 6616/82 with the following variations. The ballast shall be marked with watt loss and at rated voltage power delivered shall be between 92.5% and 107.5% of the power delivered by the reference ballast.
Ballast used in the fittings shall be energy efficient where watt loss will not exceed the following limits:-

Ballast for 70 Watts Lamp : 15 Watts max.
Ballast for 150 Watts Lamp : 19 Watts max.
Ballast for 250 Watts Lamp : 26 Watts max.
Ballast for 400 Watts Lamp : 38 Watts max.

Winding Resistance shall be within a Tolerance of +5% & 10 % on values declared by the manufacturer.

Specification No **(FG-FG/AS6)**

6. **Ignitor:**
Ignitor shall be suitable for HPSV/MV and Metal Halide lamps. It shall not pulsate after the lamp has been fully ignited. Ignitor improper connection shall not cause any deleterious effects on the luminaries. The components shall be fitted inside the polypropylene, insulating container. Necessary wires with standard colour coding (Red, yellow & Black), shall be drawn outside the container for facilitating the connections.

Specification No **(FG-FG/AS7)**

7. **Condenser / Capacitor:**
Made of Metallized Polypropylene (MPP) housed in a polypropylene container, hermetically sealed designed for tropical conditions, of appropriate capacity conforming to IS: 1569 of 1976 used for P.F improvement not less than 0.9 for all types of luminaries or other appliances. Condenser shall be connected across the mains or in series with one ballast for lead / lag circuit.

Specification No **(FG-FG/AS8)**

8. **Tube holders:**
Lamp holder should be designed for tubular fluorescent T 8 lamps for all wattages, for end to end mounting, rotary locking type. The holder shall conform to IS: 3323 of 1980.

Specification No **(FG-FG/AS9)**

9. **Starter holder:**
Starter holder made from PVC with copper contacts, and groove for securely holding the starter. The starter holder shall conform to IS: 2215/1984.

Specification No **(FG-FG/AS10)**

10. **Terminal connector:**
Connector shall be made of Porcelain / Bakelite / PVC, with necessary brass / copper contacts, screws for connections. The nominal cross sectional area of the connector shall be suitable for leads of 2.5 mm^2.

Specification No **(FG-FG/AS11)**

11. **Starter:**
Starter made of bi-metallic glow switch housed in polypropylene can with plastic cover and brass pins, with radio interference suppression capacitors and heavy gauge nickel plated brass contact, conforming to IS 2215 of 1983. Starter shall be suitable for fixing in all types of starter holders.

Method of Construction:
The above accessories shall be fixed in the fitting, duly wired and necessary testing shall be carried out in presence of site engineer.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

2.5 Brackets for Outdoor fittings (BKT)

A) Bracket welded to Pole Cap (BKT/BPC)

Scope:

Specification No **(FG-BKT/BPC)**

Fabrication of Street light bracket of specified diameter 'B' class G.I. Pipe, of specified length welded to pole cap erected on top of the pole for erection of either single /

double, side entry WP fluorescent/CFL/MV/MH/SV fitting(s), duly painted with one coat of red oxide & one coat of Aluminium paint, and erecting the same with provided leads.

Material:
GI Pipe: GI Pipe of specified diameter as per **(CW-PLB/GP)** mentioned in chapter 17.5
Pole Cap: Pole cap fabricated from 4 mm thick MS Sheet, of 30 cm in length.
Corner support: 3 mm thick MS flat / sheet
Set screws: MS bolts, nuts of 6 mm dia.
Paint: Red oxide & Aluminium paint.

Method of Construction:
The bracket shall be fabricated as per drawing No(s) BKT-1 (Fig.1 Fig.3), BKT-2 (Fig.4, Fig.5) and shall be placed on the pole cap. Inner diameter of pole cap shall be as per the outer diameter of pole with sufficient clearance, so as to facilitate easy placing of the cap on top of pole. Two holes of minimum 6 mm diameter shall be drilled to pole cap. The nuts shall be placed on the pole cap duly aligned with the hole, and shall be butt welded. Bolts shall then be tightened through the nut so as to hold the bracket in vertical position.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Wall Bracket (BKT/WB)

Scope:
Specification No (FG-BKT/WB)
Fabrication of Street light bracket of specified diameter 'B' class G.I. Pipe, 1.2 m in length erected on wall for erection of side entry WP fluorescent/CFL/MV/MH/SV fitting(s), duly painted with one coat of red oxide & one coat of Aluminium paint, and duly connected to supply with PVC wire leads.

Material:
GI Pipe: GI Pipe of specified diameter as per **(CW-PLB/GP)** mentioned in chapter 17.5
Hardware: Grouting MS bolts, nuts of 10 mm dia. & 100 mm length. "U" shaped clamps of suitable diameter made of GI.
MS Flat: MS flat 3 mm thick 50 mm wide
Paint: Red oxide & Aluminium paint.
Wire leads: 1.5 mm^2, as per **(WG-MA/BW)** mentioned in chapter 1.3
Miscellaneous: Cement, Sand, Water, etc.

Method of Construction:
The bracket fabricated as per drawing No BKT- 1 (Fig.2) shall be erected on wall as explained below:

- MS flat of length 15 cm with 10 mm diameter hole shall be welded to the pipe as shown in drawing.
- Grouting bolts shall be grouted in wall and finished with cement plaster.
- Bracket shall be placed on the grouted bolts with clamps and nut shall be tightened.
- Fitting shall then be inserted onto the bracket and connections shall be made.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

C) Street Light Bracket (BKT/SLB)

Scope:
Specification No (FG-BKT/WB)
Fabrication of Street light bracket of specified diameter 'B' class G.I. Pipe, of required length erected on pole for erection of side entry WP fluorescent/CFL/MV/MH/SV fitting(s), duly painted with one coat of red oxide & one coat of Aluminium paint, and duly connected to supply with PVC wire leads.

Material:
GI Pipe: GI Pipe of specified diameter as per **(CW-PLB/GP)** mentioned in chapter 17.5
Hardware: MS nuts & bolts, Rubber Grommet.
MS Flat: MS sheet 5 mm thick 40 mm wide.
Paint: Red oxide & Aluminium paint.
Wire leads: 1.5 mm^2, as per **(WG-MA/BW)** mentioned in chapter 1.3

Method of Construction:

The bracket fabricated as per drawing no BKT-2 (Fig.6) , shall be erected on pole as explained below:

- Clamps of required length shall be fabricated as per outer diameter of pole and the pipe used for bracket.
- Bracket shall be clamped with the pole and the nuts bolts shall be tightened so as to keep bracket in plum.
- Hole for drawing the mains wire shall be drilled just below the bracket. The grommet shall be placed and the wires shall then be drawn.
- Fitting shall then be inserted onto the bracket and connections shall be made.

Mode of Measurement: Executed quantity shall be measured on running metre basis of the pipe used. (i.e. each)

2.6 Fans (FG/FN)

A) Ceiling Fans

Scope:
Specification No (FG-FN/CF)
Supplying and erecting Ceiling fan of specified sweep with all accessories and necessary materials, erected in provided hook/clamp.

Material:
Ceiling Fan:
Electric Ceiling fan capacitor type with double ball bearing complete with capacitor, 300 mm down rod, canopies, shackles, reel insulator, half threaded bolts of 9.53 mm (3/8") dia 62.5 mm (2-1/2") to 88 mm (3-1/2") long and 7.94 mm (5/16") dia 44.5 mm (1-3/4") to 57 mm (2-1/4") long with nuts, with lock type split pin, spring & plate washers, etc.; three number blade made of Aluminium alloy, suitable for single phase, AC 210 volts, 50 Hz supply and conforming to class I of IS : 374/1979 with amendment no 1 to 6 except for performance parameters to the extent modified as details in general requirements. The down rod shall be capable to withstand a tensile load of 1000 kg without breakdown and a torsion load of 500 kg.cm without breakage as per Clause 10.14.1 of IS: 374/1979 with amendment no.1 to 6. Electrical motor should be single phase permanent capacitor type with no. of poles 12/14/16/18 (As per sweep), Class-I with basic insulation. Class of insulation shall be B class. The winding wire used for fan should be synthetic enamelled of 30 to 38 SWG.
Connection wire: Flat / round Two core flexible stranded copper wire cord 24/0.2mm ISI marked.
Paint: Superior quality enamel paint of specified colour for marking Sr. No and date of rection.

Table 2.6/1

Performance Parameters for Fans suitable for Rated Voltage

S.No.	Sweep	Maximum Input Power in watts	Air delivery in m^3/minute	Minimum Service Value
			at Rated Voltage	at 180 V
1	900 mm	42	140	3.4
2	1200 mm	50	215	4.3
3	1400 mm	60	270	4.5

Method of Construction:
Blades of ceiling fan shall be properly fixed. Down rod, clamp shall be carefully fixed with nut bolt and split pin. Canopies shall be tightened on down rod keeping sufficient clearance. Wiring connections shall be made with required wire leads. Regulator of fan shall be erected on provided switchboard with required wire leads.

Testing:
After erection fan shall be tested by connecting to supply at all positions of regulator. Also steadiness of fan shall be checked at full speed, so that there is no wobbling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Exhaust Fans

Scope:
Specification No (FG-FN/EXF)

Supplying and erecting Exhaust fan of specified sweep and speed, with all accessories and necessary materials, suitable to work on 230 V / 415 V, AC Supply 50 Hz, erected in position.

Material:
Exhaust Fan:
ISI marked Exhaust fan suitable for Single/Three phase AC 230/415 Volts 50 Hz, capacitor run with mounting ring, four numbers of fixing hole without regulator and louvers. The weep and speed shall be as per table below. Fan motor with moisture proof treatment and E class insulation, ISI marked, conforming to IS: 2312/67 with amendments 1 to 8. The fan mounting rings shall be proper pre-treatment followed with at least two coats of primer; final finish shall be with two coats of grey colour paint duly baked. The connecting leads shall be brought out for making connections.
Paint: Superior quality enamel paint of specified colour.

Table 2.6/2

Corresponding Speed with Sweep

S.No.	Sweep	Speed in RPM	Voltage level	CFM in m^3/hr
1	375 mm	900	230 V	2460
2	375 mm	1400	230 V	4000
3	450 mm	1400	230 V	6800
4	450 mm	900	230 V	4350
5	375 mm	900	415 V	2460

Method of Construction:
The Exhaust fan complete with all above accessories and duly wired shall be erected at specified position, connected to the supply and tested.

Testing:
After erection fan shall be tested by connecting to supply. Also steadiness and vibrations if any, of fan shall be checked at full speed, so that there is no wobbling.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e each)

2.7 Accessories for Fans (FG-FAS)

Metal Sheet Cawl (MSC)

A) Metal Sheet Cawl

Scope:

Specification No (FG-FAS/MSC)

Supplying & erecting metal sheet cawl made from GI sheet of specified shape and with radius more than the size of exhaust fan. The cawl mounted on angle iron frame to be fixed to wall with grouting nut & bolts, duly painted.

Material:
GI Sheet: 20/22 SWG
Angle iron: 25x5x3 mm, 40x40x4 mm
MS Flat: 25 x 3 mm
Metal mesh: Expanded metal mesh
GI Wire: 8 SWG
Paint: Red Oxide, Superior quality enamel paint
Grouting bolts: 6 x 100 mm, 10 x 100 mm MS nut, bolts.
Finishing material: Cement, Sand, Putty, and Water.

Method of Construction:
Sector shaped Cawl:
Fabrication of Cawl shall be made from 22 SWG GI Sheet. The cawl shall be of round with sector shape, having radius more than the radius of exhaust fan. Cawl shall be fixed to the angle iron frame made from 40x40x4 mm angle, duly welded and the edges made smooth by removing burrs, etc. At the open end expanded metal mesh shall be fixed with 25x3 mm MS flat. Spray painting shall be done by applying 1 coat of red oxide and 2 coats of superior quality enamel paint of colour directed by site engineer. Cawl than shall be fixed on wall by grouting the foundation bolts. The damaged portion of wall shall be finished properly with cement mortar, with necessary colour washing. (Refer drawing no FG-FAS-3 (Fig. 5) for fabrication details.)

Rectangular/Round shaped Cawl:
Fabrication of Cawl shall be made from 20 SWG GI Sheet with slanting flaps at 45 degree. The cawl shall be of rectangular/round shape, having 10 cms radius more than the radius of exhaust fan. Cawl shall be fixed to the angle iron frame made from 25x25x3 mm angle, duly welded and the edges made smooth by removing burrs, etc. At the fan end expanded metal mesh shall be fixed. The flaps shall be rigidly fixed by GI wire of 8 SWG on the width wise. Spray painting shall be done by applying 1 coat of red oxide and 2 coats of superior quality enamel paint of colour directed by site engineer. Cawl than shall be fixed on wall by grouting the foundation bolts. The damaged portion of wall shall be finished properly with cement mortar, with necessary colour washing. (Refer drawing no FG-FAS-3 (Fig. 6 & Fig.7) for fabrication details.)

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

DRAWINGS

Fan clamp for round pipe with hook (Refer drawing no. FG-FAS-1 (Fig.1)
Fan clamp for I-beam with hook (Refer drawing no. FG-FAS-1 (Fig.2)
Fan box with hook (Refer drawing no. FG-FAS-2 (Fig.3)
Fan hook grouted in RCC slab (Refer drawing no. FG-FAS-2 (Fig.4)

Chapter 3

APPLIANCES

3.1	**Water-heaters**	**AP-WH**
3.2	**Air-conditioners**	**AP-AC**
3.3	**Water-coolers, Refrigerators**	**AP-WC**
3.4	**Air Cooler**	**AP-ACR**
3.5	**Water Purifier**	**AP-WPF**
3.6	**Inverter,**	**AP-INV**
3.7	**On line UPS**	**AP-UPS**
3.8	**Batteries for Inverter & UPS**	**No Specs**
3.9	**Voltage Stabilizers**	**AP-VS**

Chapter 3 Appliances (AP)

3.1 Water Heaters (AP-WH)

A) Storage / Pressure type Water Heaters (STWH)

Scope:
Specification No (AP-WH/STWH)

Supplying, erecting and testing of horizontal/ vertical, stove enameled, storage/pressure type water heater, suitable for wall / floor mounting, of specified capacity, one inlet with non return valve, one outlet with dead weight, pressure reducing valve, stop cock; suitable to work on 230/250-V single phase AC Supply, heating element of specified wattage, thermostat, control fusible plug, pilot lamp etc. ISI mark only and marking of S No. and date of erection. (IS 2082)

Material:
Outer Casing: Corrosion proof stove enameled/ powder coated, mild steel / engineering plastic body. Colour of the casing shall be as directed by Engineer in-charge.
Inner tank: It should be of electrolytic copper (99% pure) properly fabricated so as to be leak proof and of specified capacity.
Heating Element: Mineral filled / tubular / copper cord & nickel plated, and conforming to IS: 4159, of specified wattage.
Pilot Lamp*:* A neon gas field indicating lamp shows functioning of heating elements along with thermostat & thermal cut-out.
Thermal Insulation: Resin bonded glass wool slab insulation & should be filled between two casings of storage water heater.
Thermostat*:* A Stem type snap action thermostat, which should cut off the electric supply automatically as per setting of temperature & should be ISI mark.
Thermal Cut-out: In case of thermostat failure this cutout should cut off the electric supply automatically and should restart only on pressing the reset knob.
Pressure Release Valve: If pressure exceeds above 50 psi, it should release the pressure & should be fitted on the inlet pipe.
Dead weight: It will operate when pressure in inside tank increase beyond specified limit.
Fusible plug: Cast aluminium body with threading, and hole for plug with fusible metal. The metal shall be fused, only all the other safeties fails & at high pressure
Hardware: 100x10 mm grouting bolts, MS washers, nuts, etc.
Wall Fasteners: 100x10 mm with vertical cuts, and pin at the centre, washer and nut, etc., made of MS. (Similar to Anchor bolt fastener)
Grouting material: Cement, Sand, water, etc.
Paint: Superior quality enamel paint of specified colour.

Method of Construction:
The water heater shall be erected in required position with necessary hardware's and base is grouted, as per the site situation. The water heater is to be connected to water supply on inlet side by valve, mountings and connected to outlet tap.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

3.2 Air Conditioners (AC)

A) Window Model Air Conditioners (WAC)

Scope:
Specification No (AP-AC/WAC)

Supplying, erecting, and testing Window model room air conditioner of specified tonnage, conforming to I.S.1391 suitable for operation on single phase, AC supply, 230/250 Volts 50 Hz, using best quality compressor, dehumidifier in provided air circulating, ventilators and

fitting in position in recess or in window to required size, and connected to supply, and marking of S No. and date of erection.
The AC unit shall be capable of performing following functions:

- Cooling
- Dehumidifying
- Air Circulating
- Air Filtering
- Ventilation

The Window AC should be of minimum 3 Star rating as directed by B.E.E.

Material:

Compressor:

The room air conditioners shall be fitted with hermetically sealed type suction cooled (Reciprocating) or discharge cooled (Rotary) compressor with suitable rated capacitor start electric motor. It should start unloaded and shall be equipped with overload protection. The compressor shall be mounted on resilient mountings for quiet operation. The compressor shall conform to IS.10617 (part-1): 1983 with amendment 1 & 2.
Cooling capacity for Compressors shall be as under:

For 1.5 Ton - Minimum 4750 kcal/hour
For 2.0 Ton - Minimum 6250 kcal/hour

Energy efficiency ratio for Compressor shall be minimum 2.625 kcal/hour/watt.

Cabinet:

The cabinet of the air conditioner be made from either galvanized MS sheet of 1mm thickness or aluminium alloy sheet of 1.2mm thickness. The sheets shall be suitably stiffened by embossing the fabrication work and shall be of suitable workmanship. The sheets shall be suitably phosphate and protected by powder coated paint. The galvanized steel sheets shall conform to IS: 277:2003 and have a coating grade of 120 gm/m^2.

Air Filter: The air filters provided shall be of cleanable type and made of synthetic material.

Thermostat:

The air-conditioner shall be fitted with thermostat suitable for a working range from 16 degree Centigrade to 35 degree Centigrade with a differential of +/-1 degree Centigrade, with operational voltage as 240V and current rating not exceeding 25 amps. The thermostat shall conform to IS: 11338:1985.

Condenser: As per (FG-FG/AS7) specified in chapter 2.4

Paint: Superior quality enamel paint of specified colour.

Method of Construction:

The AC unit shall be fixed in the recess/window with necessary materials. The outer frame shall be fitted to recess or cutout made in window making the recess/window air tight, duly connecting the unit to power supply by means of metal clad switch & plug and giving satisfactory trials.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Split type Air Conditioners (SAC)

Scope:

Specification No (AP-AC/SAC)

Supplying, erecting, and testing Split type room air- conditioner of specified tonnage, conforming to I.S.1391, having one/two air handling units Hi-wall / ceiling (suitable for false ceiling) mounting type having cooling unit and the outdoor condensing unit connected with 12/9 mm copper piping up to 6 meter duly insulated and 3 core copper flexible cord of required length etc. with stand for condensing unit, complete with testing etc. (Conforming to IS: 1391 Part-I & Part-II with all amendments & as per BEE) suitable for operation on single phase, AC supply, 230/250 Volts 50 Hz, using best quality compressor, and fitting in position as per site situation and as directed by site engineer, duly connected to supply, and marking of S No. and date of erection.
The AC unit shall be capable of performing following functions:

- Cooling

- Dehumidifying
- Air Circulating
- Air Filtering
- Ventilation

The Split type AC should be minimum 3 Star rating as directed by B.E.E.

Material:

Compressor:

The air conditioners shall be fitted with hermetically sealed type suction cooled reciprocation or discharge cooled rotary compressor (as applicable), compressor unit operating on Refrigerant R-22 with suitable rated capacitor start electric motor. It shall be equipped with overload protection. These shall be mounted on resilient mountings for quiet operation. The compressor shall conform to IS: 10617 part (1) -1983 (amendment 1 & 2)

The air conditioners shall be complete with automatic temperature control and cut-in and cut-out etc. for temperature range 16 degrees to 35 deg. C. The differential of the thermostat for cut-in and cut-out shall not be greater than +/- 1 degree Centigrade.

Outdoor Cabinet:

The cabinet of the evaporator unit and condensing unit shall be made from galvanized steel sheet of 1.0mm thick with stiffness for robust construction and shall have rounded corners, steel parts/front panel etc. shall have stove-enameled finish preceded by undercoat of anti corrosive primer paint phosphate and through cleaning of the surface. Alternate method of corrosion protection like plastic powder coating, electrostatic paintings are also acceptable in lieu of stove enameled finish. Galvanized sheet shall conform to IS: 277/ 2003.

Indoor Unit:

The indoor units made of ABS/HIPS shall be of flame retardant and impact resistant life. ABS/HIPS indoor unit cabinet shall pass in flammability test requirement for Grade V-O as per UL -94. For impact resistance the unit duly packed, when dropped from a height of 1 metre shall show no damage.

Air Filter: The air filters provided shall be of cleanable type and made of synthetic material.

Thermostat: Thermostat or electronic thermostat as per IS 11338: 1985.

Condenser: As per **(FG-FG/AS7)** specified in chapter 2.4

Piping:

Suction line -Copper pipe of min 0.70mm thickness and of suitable diameter as per manufacturers design.

Liquid line -Copper pipe of min 0.70mm thickness and of suitable diameter as per manufacturers design.

Drain pipe -15mm dia flexible PVC pipe.

Connection Cable: Suitable capacity 3 Core PVC insulated FRLS copper wire to be electrically connected to both the units.

Paint: Superior quality enamel paint of specified colour.

Remote Control: Remote control (Cordless) shall be provided with one On/Off timer, selecting Fan speed(Three speeds) and setting up of temperature.

Drain Pipe: Drain pipe (15mm dia flexible PVC pipe).

Method of Construction:

The installation shall comprise the following work:

- Mounting/Fitting indoor & outdoor units at the respective locations on provided MS stands with necessary hardware's.
- Laying refrigerant piping of 6m length and connecting both the units after drilling hole/holes in the wall, if required. The thickness of the copper tubing shall not be less than 0.70mm and diameter of required size by flaring, threading, etc.
- Insulating the suction pipe with expanded polyethylene of foam 5mm tubing.
- Laying 15mm drain pipe to throw out the condensate water formed in the Indoor unit.
- Leak testing of the entire system.
- Charging Refrigerant gas in the unit.
- Suitable electric wiring between indoor and outdoor units up to 6 m length & up to switch within 3 metre of location of indoor unit.
- Testing and giving satisfactory trials.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

3.3 Water Coolers, Refrigerators (WCR)

A) Water Coolers (WC)

Scope:
Specification No (AP-WCR/WC)

Supplying, erecting, testing and commissioning self contained water cooler with specified storage capacity & cooling capacity, and marking S No and date of erection.

Material:

Water Cooler:
The water cooler shall be suitable for operation on 230 V +/- 10% , 50 Hz, single phase AC supply with hermetically sealed type suction cooled compressor with overload protection conforming to IS :-10617(part I) : 1983 with amendment no 1&2.

Tank:
Tank shall be fabricated from SS sheet of 0.8 mm min. thickness as per ISI 304 and shall be made by electrically seam welded lap joints or alternatively from 0.63 mm thickness stainless steel sheet with PUF insulation, with required number of Taps. However tank fabricated by double seam jointing is also acceptable if the same is reinforced and sealed by lead free solder material. Use of lead soldering material for sealing the joints of water tank is not permitted. Water tank cover and lid bottom shall be made of 1.25 mm aluminum sheet duly anodized / epoxy painted / high impact polystyrene (HIP) of 1.5 mm thickness. Positive locking of the lead is to be provided (lock with two keys). A drain valve at the bottom of the storage tank to be provided to draw out water while cleaning.

Cabinet (Body):
The cabinet of the water cooler shall be made of GS or SS sheet of 1.0 mm. The front panel, below the water outlets in the storage type water coolers shall be made of stainless steel of 0.8 mm. The drain pan for storage type water coolers shall be made of stainless steel sheet of 0.63 mm upto size 40 liters/hour and beyond 40 liters/hour of 0.8 mm thickness. The bottom pedestal shall be made of 2.65 mm minimum thick stainless steel sheet. Pedestal shall have a minimum ground clearance of 100 mm for ease of cleaning. Pedestal shall be strong enough to withstand weight with storage tank full and shall be reinforced to prevent skewing. The body shall be held securely with the pedestal with stainless steel nuts and bolts. The drain size should be 25 mm or above. In case water outlets are provided on three sides then all the three lower panels should be made of aluminium sheet or stainless steel sheet.
The mild steel components used in the manufacture of the cabinet shall be individually degreased, pickled, scrubbed and rinsed to remove grease, rust, scale or any other foreign elements. Immediately after pickling the MS parts shall be given phosphate treatment. The components along with the front panels shall then be given a primer coat with a finish coat of stove with a finish coat of stove enamel paint. The finish shall be smooth and uniform with hard tough film of the enamel adhering to the surface. The finish shall be free from all the visible defects and shall not chip when tapped lightly with a dull pointed instrument. Alternatively method of corrosion protection like plastic powder coating, electrostatic painting shall be permitted
Refrigeration coils to be fully soldered to the outside of the tank for good thermal contact and not merely tack welded.
There shall not be any gap between water tank cover (mask) and water tank to prevent rodent/ insect/ dust entry.
Water tank overflow should be adequately covered with strainer such as wire mesh etc to avoid rodent/ insect/ dust entry.
Condenser Fan Motor: The condenser fan motor shall be capacitor start and capacitor run (CSR) or permanently split capacitor (PSC) or alternatively permanently lubricated motor may be provided.
Thermostat: The thermostat shall conform to IS: 11338-1985. The position of the thermostat shall be adjustable through a rotary switch mounted on the front or side panels. Min and max of the thermostat setting shall be from 0 degree Celsius and 25 degree Celsius which shall be marked.

Method of Construction:
The water cooler shall be fixed at designated place or as directed by the site engineer, duly connected with inlet and drain by leak proof joints. The water cooler is to be erected on stand and tested.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

3.4 Air Coolers (ACR)

A) Desert type Air Coolers (DAC)

Scope:
Specification No (AP-ACR/DAC)

Supplying and erecting and testing evaporative air cooler (desert Cooler) with fibre body, 230/250 Volts, 50 cycles, comprising of fan, pump,, drip proof motor , filter pads, confirming to IS: 3315 and having specified cooling capacity, complete with 5 metre long 3 core cable and 5A hand shield type three pin top and marking S No. and date of erection.

Material:

Exhaust fan for Inlet air:

Exhaust fan shall be complete with motor and ISI marked to IS: 2312:1967 with amendment No 1 to 8. Fan shall be complete with motor and fan, motor shall be ISI marked to IS: 996:1979 with amendment No 1, 2 &3. Cooler pump shall be ISI marked, and confirming to IS: 11951:1987 with amendment No 1 to 4. Exhaust fan shall be of 900mm (6 pole motor) and shall have single speed

Cooler:

Cooler shall be suitable for operation on 230 volts +/- 10%, single phase, 50 Hz AC supply. Pump set shall conform to IS: 11951-1987 with amendment no.1 to 4. The coolers shall be omplete with fan, motor, filter pads, water pump, etc. Fan motor will be of 1400 rpm (4 poles) and shall have three speeds. Filter panel, front grill, and top of the cooler body shall be made of 0.8 mm galvanized steel sheet. The sump tank and rest of the body shall be made of 1.2 mm thick galvanized steel sheet. The galvanized steel sheet shall be ISI marked and shall have zinc coating not less than 120 gm/m^2 and shall conform to IS: 277-2003. All internal surfaces including inside of the tank, fan blades, motor body, pump, pump body and frame shall be painted with water resistant paint conforming to IS: 9862-1981 with amendment No 1.

Water pump shall be provided with proper clamping arrangement. The shaft of the pump shall be stainless steel. Impeller, housing, and fan shall be of polypropylene. The pump shall conform to IS: 11951-1987 with amendment No 1 to 4 and shall be ISI marked.

Suitable nylon bushes shall be provided in the grill for easy and smooth movement of louvers.

The filter pads shall contain wood wool. The filter pads shall be fixed over the panel and secured by clamping guard of galvanized wire of 2 mm dia approx and net size 50 to 75 mm approx, square/ rectangular. The wire guard shall be fixed in the clamps to avoid any sagging.

15 mm size punched hole shall be provided to fix the float valve where required.

The drain plug of brass shall be fitted in such a way so as to be able to completely drain the water from the tank.

The inside wiring connection shall be through suitable non- ferrous thimbles and the live contacts of rotary switch shall be protected by suitable enclosure of insulating material.

Rotary switches:

The cooler shall be provided rotary/ piano type On-Off and speed selection switch for three speed cooler fan motor.

Method of Construction:

The air cooler shall be fixed at designated place or as directed by the site engineer, duly connected to electric supply by means of 3 core copper wire and tested.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

3.6 Inverter (AP-INV)

General

This part of the specifications covers the technical aspects of the Digital pure Sine wave Inverter.

Scope:
Supplying, erecting, testing & commissioning of Digital pure sine wave Inverter with necessary safeties, etc.
Specification No (AP-INV)

Material:
Equipment manufactured as per standard manufacturer's specification. The unit housed in powder coated CRCA sheet enclosure with following fault protection on mains / inverter mode:

- Under voltage on mains mode
- Over voltage on mains mode
- Charger protection on mains mode
- Overload on inverter mode
- Short circuit on inverter mode
- Low battery on inverter mode
- Battery reverse on inverter mode
- Under voltage on inverter mode
- Over voltage on inverter mode
- LED display for above fault protection
- Alarm for above fault protection
- Arrangement to cut of neutral of supplier when supply from invertors is on.

In addition to above the inverter shall comply with the specifications mentioned in Table No. 3.6/1

Table No. 3.6/1

Additional Specifications for Inverter

S.No.	Specifications / Features		Standard Parameters
1	**Input AC range**	Under Voltage Under Voltage restoration Over Voltage Over Voltage restoration	180 +/- 5 V 185 +/- 5 V 260 +/- 5 V 255 +/- 5 V
2	**Output on Inverter Mode**	Maximum power Minimum Efficiency Voltage (Inverter mode) Frequency (Inverter mode) Overload Transfer time	As specified 85 % (As per Clause 7.9.3 of ISS) 230 V Nominal +/- 12% 50 Hz +/- 2% > 110% for 10 minutes 30 ms
3	**Conversion**	Switching device Harmonic distortion	MOSFET or IGBT. < 5 %
4	**Inverter mode protection**	Low battery Battery reverse Over load Short Circuit	Electronic trip Through fuse Electronic trip Electronic trip
5	**Mains mode protection**	Over load / Short Circuit Charger	Through MCB Through MCB
6	**Battery**	Charging time	10 – 12 hours
7	**Battery charger**	Constant voltage with current limit	10 amp with boost voltage & float voltage as per manufacturer's specification High power factor boost charger
8	**LED Display**	Switch On, Inverter ON, Low battery Pre-alarm, Battery low, Mains ON, Smart charge, Overload, Short Circuit, Battery fuse fail, Battery reverse, MCB Trip.	As per manufacturer's standard specification
9	**Alarms**	Low battery Pre-Alarm Overload Pre-alarm Short Circuit MCB Trip	Continuous beeping Continuous beeping Continuous beeping Continuous beeping

10	**Environmental**	Operating temperature Storage temperature Humidity	0 - 40^0 C 0 - 40^0 C 0 -95 % RH non-condensing
11	**Enclosure**	CRCA/MS sheet minimum 1.2 mm thick	Aesthetically finished, duly pre treated and powder coated.

Mode of Measurement:
Executed quantity will be measured on number basis. (i.e. each)

3.7 On Line UPS (UPS)

General

This part of the specifications covers the technical aspects of the Online UPS system for 1 to 10 kVA capacity.

Scope:
Specification No (AP-UPS)

Supplying, erecting, testing & commissioning of Online UPS with necessary safeties, etc.

Material:
Equipment manufactured as per standard manufacturer's specification and as tabulated in Table No. 3.7/2. The unit housed in powder coated CRCA sheet enclosure with following fault protection on mains / UPS mode:

- Under voltage on mains mode
- Over voltage on mains mode
- Charger protection on mains mode
- Overload on UPS mode
- Short circuit on UPS mode
- Low battery on UPS mode
- Battery reverse on UPS mode
- Under voltage on UPS mode
- Over voltage on UPS mode
- LED & LCD display for above fault protection
- Alarm for above fault protection
- Batteries shall be of Sealed Maintenance Free type (Tubular). The selection of number of batteries required shall be as per Table No 3.7/1

Table No. 3.7/1

Details of Batteries required for the UPS in respect to the Backup Period.

kVA rating	DC Voltage	Output pf	No of SMF Batteries	Back Up Period				
				15 mins.	30 mins.	1Hr	2Hrs	3Hrs
1kVA	36V	0.7	3	17AH	2 X 17AH	42AH	65AH	100AH
2kVA	96V	0.7	8	17AH	26AH	42AH	65AH	100AH
3kVA	192V	0.8	16	17AH	17AH	26AH	42AH	65AH
5/6 kVA	192V	0.8	16	17AH	26AH	42AH	65AH	100AH
8kVA	240V	0.8	20	17AH	26AH	42AH	100AH	2X 65AH
10kVA	240V	0.8	20	26AH	42AH	65AH	2X 65AH	2X 100AH
A)	The Batteries considered are Sealed Maintenance Free Batteries (SMF)							
B)	The Batteries need to be placed in Ambient Temperature of 20Deg C - 25Deg C							
C)	The UPS is considered to be working @ 90% Load of its capacity							

Table No. 3.7/2

Specifications & Standard Parameters of On Line UPS

The UPS shall comply with specifications as indicated in the following table:

S.No.	Specifications / Features	Standard Parameters
1	**Technology**	True online Double Conversion design (DSP / Microprocessor based)
2	**Input voltage range**	160 V to 270 V for **1 Phase Input** 335 V to 477 V for **3 Phase Input**
3	**Input power factor**	Near unity Power factor > 0.93 for **1 Phase input**
4	**Generator compatibility**	Yes (**1.2 times the UPS rating**)
5	**Nominal input frequency**	50 Hz +/- 6 %
6	**Rectifier type**	Advance Rectifier with inbuilt APFC (Advance Power Factor Compensated) for **1 Phase.** IGBT charger Advance Rectifier with inbuilt APFC (Advance Power Factor Compensated) for **3 Phase.**
7	**Output Voltage**	230 V AC +/- 1 % for **1 Phase Output**. 400 V AC (380/415 selectable) for **3 Phase & Neutral.**
8	**Total Harmonic distortion**	**1 Phase Output** < 3 % for Linear load < 5 % for Non-linear load **3 Phase Output** < 2 % for Linear load < 5 % for Non-linear load
9	**Overload Capacity**	110 % for 10 Seconds & 130 % for 2 Seconds for **1 & 2 kVA UPS.** 125 % for 10 Minutes & 150 % for 60 Seconds for **3 to 10 kVA UPS.**
10	**Inverter**	IGBT based PWM with Digital control (Microprocessor based)
11	**Crest Factor**	3: 1 for **1 & 2 kVA UPS.** 5: 1 for **3 to 10 kVA UPS.**
12	**Static Bypass**	Automatic bypass switch facility
13	**Display**	Should be User friendly with LED & LCD display with showing important parameters.
14	**Output Power factor**	0.7 lag to Unity within kVA & kW rating.
15	**Load in terms of PC per kVA. (PC with 15" CRT Monitor)**	3 PC's per kVA (for **1 & 2 kVA UPS)** 5 PC's per kVA (for **3 to 10 kVA UPS)**
16	**Battery type**	SMF / Thick plate / Tubular
17	**DC Voltage**	1 kVA – 36 V, 2 kVA – 96 V, 3 & 5 kVA – 192 V, 8 to 10 kVA – 240 V
18	**Battery charger current limit**	1 & 2 kVA – 6 A, 3 & 5 kVA – 4 & 6 A, 8 & 10 kVA – 8 & 15 A.
19	**Ambient temperature**	45^0 C
20	**Noise level**	< 50 db @ 3 metres
21	**Testing standards**	IEC 62040 Part III
22	**Isolation Galvanic**	Isolation transformer from 3 to 10 kVA

Mode of Measurement: Executed quantity will be measured on number basis. (i.e. each.

3.9 Voltage Stabilizer (VS)

A) Servo Motor controlled Voltage Stabilizer (SVS)

Scope:

Specification No (AP-VS/SVS)

Providing single phase auto/manual line voltage servo motor operated voltage stabilizer confirming to IS 9815-1981 of specified KVA capacity duly tested with guarantee for one year marking S. No. & date of erection.

Material:

- Single Phase auto/manual line voltage stabilizer confirming to IS 9815-1981 with following components:
- Motorized variable voltage auto transformer.
- Double wound Buck boost/series transformer
- Servo control sensing card (PCB)
- Suitable for input 160 to 250 volts & output voltage 230 ± 1%
- Zero wave distortion losses should be negligible with 95% efficiency
- No phase shift.
- No effect of load power factor.
- Natural air-cooled.
- Correction rate 20 to 30 volts per second.
- Audio alarm for over voltage & under voltage.
- Volt meter 0-300 volts with selectors switch to monitor input & output voltage, overload & short circuit protection.

Method of Construction:

The stabilizer shall be installed at designated place as directed by engineer in- charge, with both input & output connected, with necessary testing.

Mode of Measurement: Executed quantity will be measured on number basis. (i.e. Each)

Chapter 4

ENERGY SAVING DEVICES

4.1	**Solar Hot water system**	**ESD-SHWS**
4.2	**Pipes for Solar Hot Water System**	**ESD-HWP**
4.3	**Solar Lighting**	**ESD-SOL**
4.4	**Energy Devices (Harmonic Active Filter, APFC Panel with Harmonic filters)**	**ESD-ESD/DAHF** **ESD-ESD/APFC**
4.5	**Miscellaneous**	**No Specs**
4.6	**Drawings**	

Chapter 4 Energy Saving Devices (ESD)

4.1 Solar Hot Water Systems (SHWS)

Scope:

Specification No (ESD-SHWS)

Supplying, erecting, testing and commissioning of Solar Water Heating System with & without heat exchanger for cold & warm regions respectively with Solar flat plate collector conforming to IS: 12933 (part 1) with amdt.no.1 and IS: 12933 (Part 2)/2003 suitable for inlet water with chlorine and fluorine content up to 100 ppm and supply hot water at the outlet. (Refer drawing no.ESD-SHWS-1)

Material:

1. ***Solar water heating system***:
   Comprising of solar flat plate collector, collectors stand assembly, stainless steel insulated hot water storage tank with heat exchanger and various other components.
   Solar flat plate collector component shall have:
   - Solar flat plate collector cover plate made of toughened glass
   - Sheet for absorber made of copper
   - Absorber made of copper sheet and copper tube.

2. ***Solar Flat Plate Collector:***
   Solar flat plate collector shall conforming to IS: 12933 (Part 1) with amdt.no.1 and IS: 12933 (Part 2)/2003 and various components shall be as under:
   Cover plate: Cover plate shall be toughened glass and thickness of 4.0 mm (min.) conforming to section-1 of IS: 12933(Part-2)/2003. The solar transmittance of the cover plate shall be minimum 82 percent at near normal incidence.
   Collector Box: Collector box shall be made of Aluminium sections only. Type, grade, size, workmanship and finish of the material used shall be as per section-2 of IS: 12933 (pt2/2003. The minimum thickness of Aluminium shall be as under:
   a) Channel section for sides 1.6 mm
   b) Sheet for bottom 0.7 mm
   c) Support for glass retaining 1.2 mm
   d) Sheet for entire body 1.0 mm

3. ***Absorber:***
   Absorber shall consist of riser, header, and sheet for absorber. The Diameter of header shall be 25.4 +/-0.5mm and thickness 0.71mm. The Diameter of riser shall be 12.7 +/- 0.5mm and thickness 0.56mm and made of copper only. The distance between the risers from center to center shall be 120mm. Type grade, size, workmanship and finish of the material used shall be as per section-3 of IS:12933 (Part 2)/2003.
   Riser and header assembly designed for working pressure up to 24.5 K Pa (2.5 kg/cm^2 shall be tested for leakage at a minimum hydraulic pressure of 490 K Pa (5 kg/cm^2).
   Sheet for absorber:
   Sheet for absorber shall be made of copper only. Type, grade, size, workmanship and finis of the material used shall be as per sectiob-3 of IS: 12933 (pt2)/2003. A sample piece of the absorber for having minimum area of 400 square cm. shall be heated in an oven at temperature of 175 degree C for 2 hours. After heating, the sample shall be taken out from the oven and cooled at room temperature. The cooled sample shall be inspected visually for damages, if any. There shall not be any appearance of blistering/rupture/peeling off of the coated/painted surface and of weakening of the bonding between absorber sheet and risers/headers.
   Collector box insulation: Insulation shall be provided at back and sides. Thermal Resistance ® of insulation material shall be minimum 0.96 m square degree C/W for back insulation and minimum 0.48 m square degree C/W for side insulation. This shall be derived after determining thermal conductivity (K) value at 100 degree C mean temperature in accordance with IS:3346.Collector box insulation shall conform to sec.4 of IS: 12933(Part-2)/2003
   Gaskets and Grommets: Gaskets and Grommets shall conform to sec.5 of IS: 12933 (Part-2)/2003.

4. ***Insulated hot water storage tank:*** The thickness of the water storage tank shall be uniform.

Material: Insulated hot water storage tank shall be non-pressure type and made of stainless steel grade (X04Cr19Ni9 or X07Cr18Ni9 of IS: 1570(part 5) /1985), TIG welded.

Insulation: Solar water heating system (SWHS) up to and including 500 LPD shall be insulated with 40mm thermal grade PUF insulation of 32 Kg/ meter cube or higher density. PUF insulation could be pre extruded type fitted with FRP exterior cladding or alternatively injection moulded in a twin walled steel tank and PPE end cap. Other systems shall be insulated with 100 mm thick Rock wool of 48Kg/m3 density with 22swg Aluminium cladding. Systems up to 500 LPD may also alternatively be installed with 100 mm thick Rock wool of same specifications with aluminium or GI powder coated cladding.

Tank stand*:* Tank stand assembly shall be made of MS angle of size (min) 38x38x4 mm duly pre-treated and stove enamelled with black Colour paint. Alternatively tubular structure with Powder coating could also be provided.

5. ***Heat Exchanger****:* Heat Exchanger shall be cage type and made of copper/stainless steel tubes of grade X04Cr19Ni9 or X07Cr18Ni9 of IS: 1570(part 5)/1985 .Heat exchangers shall have a minimum of 0.24 sq. meters heat transfer area per 100 LPD capacities.
6. ***System inter connecting piping:*** ISI marked G.I. pipes, medium class of IS: 1239 duly insulated with 50mm thick rock wool of 48 Kg/m3 density and 26swg Al cladding. EPDM hose pipes can also be used for systems up to and including 500LPD.
7. ***Collector stand:*** Collector stand assembly shall be made of MS angle of size 38x38x4 mm duly pre-treated and stove enamelled with black Colour paint. Alternatively tubular structure with Powder coating could also be provided.
8. ***Make up water tank:*** The capacity of make up tank shall be 5 litres up to 500 LPD and 10 litres for 1000 LPD and above.
9. ***Electrical heaters:*** Electrical heater shall be ISI marked. Electrical heater backup shall be two nos. each of rating 3 KW for 500 LPD, 3 nos. each of rating 3 KW for 1000 LPD, 4 nos. each of rating 3 KW for 2000 LPD and 2 nos. of 3 KW rating in each of the three phase for 3000 LPD.
10. ***Temperature Gauge:*** Dial type, duly calibrated and suitable for temperature range from 0 degree C to 120 degree C and shall be provided for capacity above 500 LPD.
11. ***Valves:*** 3 valves, one for inlet, outlet, and make up tank each.

Method of Construction:
The entire Solar Hot water system with all accessories shall be installed at designated place, with necessary plumbing, wiring and testing.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

4.2 Pipes for Solar Hot Water System (ESD-HWP)

A) Thermal insulated GI pipes: (TIP)

Scope:
Specification No (ESD-HWP/TGP)

Supplying and erecting ISI mark GI Pipe with accessories, as piping for solar hot water system of specified diameter with resin bonded flap rock wool/glass wool insulation with aluminium cladding to withstand the temperature of 100 degree C maximum, complete as directed by the site engineer.

Material:
GI Pipe: As per **(CW-PLB/GP)** specified in chapter 17.5 for Plumbing
Glass Wool: Superior quality with thermal conductivity value 1.67 per cm^2 per watt.
Rock wool: Superior quality with density of 30 – 32 kg/ cm^2
Bonding material: Resin or adhesive.
Cladding material: Aluminum sheet of 26 SWG or Plastic sheet, Chicken mesh.
MS Clamps: Clamps fabricated of required length and shape, of 3 mm thick mild steel having 25 mm width.
Hardware: Sheet Metal (SM) screws of required sizes, plugs/wooden gutties, etc.

Method of Construction:

Before preparing the piping, exact measurements shall be taken. The pipes shall be insulated either by rock wool or with glass wool as explained below:

Glass wool insulation: Firstly the outer surface shall be cleaned so as to make it free from oily substance, if any. Then the glass wool shall be pasted with resin or adhesive uniformly for a thickness of 50 mm. The glass wool shall then be covered with plastic sheet so as to hold it in position, this will form the insulation. Then the aluminium sheet shall be fixed to the insulation and the ends shall be securely fixed with SM screws. The insulation at fixing ends of pipe (i.e. at coupling, bend, elbows, Tee's, valves, etc) shall be done after the piping is fixed to the system. The entire insulated piping shall be tested for leakages, temperature.

Rock wool insulation: As mentioned above, but with rock wool bonded to the pipe and covered with chicken mesh to hold in its place.

The insulated piping shall be fixed on wall or at any other location directed by the site engineer, with MS clamps fixed with SM screws, with plugs, wooden gutties (for erection on stone wall) complete. In addition to above the erection shall meet the requirements mentioned in para 4.2.1 of chapter 17.5 for Plumbing.

Mode of Measurement:

Executed quantity shall be measured on running meter basis, including the entire accessory. The lengths shall be measured net on the straight and bends along the center line of the pipes and fittings correct up to a cm. (i.e. per meter)

B) Polyethylene Composite Pipes: (PCP)

Scope:

Specification No (ESD-HWP/PCP)

Supplying and erecting Polyethylene Composite Pipe with accessories, as piping for solar hot water system of specified diameter, suitable for continuous operating temp. of 95 degree C. and rated pressure of 6.9 Kg / sq. cm at 82 degree C complete as directed by the site engineer. The pipe shall have chemical composition prepared as per ASTMF1282-02 specifications (pressure rating of 13.8 kg per sq cm and 11 kg per sq. cm at 60 degree, short term excursions to 95 degree C) and shall not affect the overall performance

Material:

Composite Pipes & accessories:

Pipes shall be made from aluminum and polyethylene composite by combining the two materials along with adhesive layers. The pipe shall have the following properties:

Properties of Pipe:

a) No thermal expansion and deformation.
b) High flexibility, frost resistant, ready to use with plastic.
c) Malleable. Easy to form curves, bends.
d) Corrosion free.
e) No scaling build up, to avoid reduction in flow of water.
f) Non-toxic, rust free and shall not allow growth of micro-organisms to make it contamination free.
g) Fire retardant with Low smoke.
h) UV resistant and shall be Opaque.
i) Pipe walls shall not allow Permeation. (No entry of foreign material inside the pipe through the pipe walls)
j) Low coefficient of linear expansion.
k) Thermal expansion of $25x10^{-6}$ degree Kelvin (Expansion/Contraction rate shall be less than 10% of Plastic pipe). Anti-freezing, with thermal conductivity of 0.43 watt /m degree Kelvin.

MS Clamps: Clamps fabricated of required length and shape, of 3 mm thick mild steel having 25 mm width.

Hardware: Sheet Metal (SM) screws of required sizes, plugs/wooden gutties, etc.

Method of Construction:

Before preparing the piping, exact measurements shall be taken. The pipe shall be joined by compression/crimp fitted with internal as well as external end with necessary sealing arrangement, to make it leak proof.

The piping shall be fixed on wall or at any other location directed by the site engineer, with MS clamps fixed with SM screws, with plugs, wooden gutties (for erection on stone wall) complete. In addition to above the erection shall meet the requirements mentioned in para 4.2.1 of chapter 17.5 for Plumbing.

Mode of Measurement:
Executed quantity shall be measured on running meter basis, including the entire accessory. The lengths shall be measured net on the straight and bends along the center line of the pipes and fittings correct up to a cm. (i.e. per meter)

4.3 Solar Lighting (ESD-SOL)

A) Solar Street Light (SOL)

Scope:
Specification No (ESD-SOL/STL)

Supplying & erecting Solar Street Light Fittings suitable for specified wattage of CFL, along with GI/MS Pipe Pole. The system should be designed to automatically switch ON at dusk, operate throughout the night, and automatically switch OFF at the dawn, under average daily, solar radiation conditions of 5 kWh/m^2 on a horizontal surface. (Refer drawing no.ESD-SOL-1 (Fig.1))

Material:

1. PV Module(s):

- The PV module(s) shall contain crystalline silicon solar cells.
- The power output of the module(s) under STC should be a minimum of 74 W, either two modules of minimum 37W output each or one module of 74W output should be used.
- The operating voltage corresponding to the power output mentioned above should be 16.4 V.
- The open circuit voltage of the PV modules under STC should be at least 21.0 Volts.
- The terminal box on the module should have a provision of opening for replacing the cable, if required.

2. *Inverter:*

- The inverter should be of quasi sine wave or full sine wave type with frequency in the range of 20-35 KHz.
- The total electronic efficiency should be at least 80%.
- No blackening or reduction in the lumen output by more than 10% should be observed after 1000 ON/OFF cycles (two minutes ON followed by four minutes OFF is one cycle).
- The idle current consumption should not be more than 10 mA.
- Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery through out the year.
- Necessary length of wires, cables, and fuses should be provided.
- The PV module will be used to sense the ambient light level for switching ON and OFF the lamp.

3. *Electronic Protections:*

- Adequate protection is to be incorporated under no load conditions e.g. when the lamp is removed and the system is switched ON.
- The system should have protection against battery overcharge and deep discharge conditions.
- Fuses should be provided to protect against battery overcharge and deep discharge conditions.
- A blocking diode should be provided as a part of the electronics to prevent reverse flow of current throughout the PV module(s), in case such diode is not provided with the solar module(s).
- Full protection against open circuit accidental short circuit and reverse polarity should be provided.

4. *Mechanical Hardware:*

- A metallic frame structure (with corrosion resistance paint) to be fixed on the pole to hold the SPV module(s). The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45 degrees so that the module(s) can be oriented at the specified tilt angle.

- The pole should be made of mild steel pipe with a height of 4 meters above the ground level, after grouting and final installation. The pole should have the provision to hold the weather proof lamp housing. It should be painted with a corrosion resistant paint.
- A vented acid proof and corrosion resistant painted metallic box for outdoor use should be provided for housing the battery.

Method of Construction:
The entire solar light with all accessories shall be installed at designated place, duly wired and giving necessary testing.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

B) Solar Home Lighting System (SHL)

General:
A solar home system aims at providing solar electricity for operating lights and/or fan or energizing a DC operated portable TV set for specified hours of operation per day.

Scope:
Specification No (ESD-SOL/SHL)

Supplying & erecting Solar Home Light Fittings suitable for specified wattage of CFL/DC Fan, along with required accessories.

Material:
1. *Models:*
The model shall be as mentioned in the Table No. 4.3/1 given below:

Table No. 4.3/1

Model wise details of Solar Home Lights

S.No.	Model Configuration	Details of PV Module	No. of 9/11 Watts CFL	No. of DC Fan (Wattage < 20 Watts)	Battery
1	Model 1 (1 Light)	1x18 Wp under STC	1	0	1x12 V, 20 AH, Tubular/Plate, low maintenance
2	Model 2 (2 Lights)	1x37Wp under STC	2	0	1x12 V, 40 AH, Tubular/Plate, low maintenance
3	Model 3 (1 Light and 1 Fan)	1x37Wp under STC	1	1	1x12 V, 40 AH, Tubular/Plate, low maintenance

2. *Lamps:*
- The lamps shall be of compact fluorescent (CFL) type, either 4-Pin or 2 Pin types, with rating of 9/11W. For the 4-Pin type CFL a suitable preheating circuit must be provided.
- (b) The light output from the lamps should be around 600 +/- 5% lumens (9W CFL) and 900 +/- 5% lumens (11W CFL).
- (c)The lamps should be housed in an assembly suitable for indoor use, with a reflector on its back. While fixing the assembly, the lamp should be held in a base up configuration.

3. *Battery:*
- The battery will be of flooded electrolyte type, positive tubular plate, low, maintenance lead acid battery.
- (b) The battery will have a minimum rating of 12V, 20 or 40 or 75 Ah, the discharge rate of $1/10^{th}$ of the AH capacity of the battery.

- 75% of the rated capacity of the battery should be between fully charged & load cut off conditions.

4. *Electronics:*

- The inverter should be of quasi sine or full sine wave type with frequency in the range of 20-35 KHz. Half wave operation is not acceptable.
- (b) The total electronic efficiency should be at least 80%.
- © No blackening or reduction in the lumen output by more than 10% should be observed after 1000 ON/OFF cycles (two minutes ON followed by four minutes OFF is one cycle.)
- (d) The idle current consumption should not be more than 10 mA.
- (e) Electronics should operate at 12 V and should have temperature compensation for proper charging of the battery though out the year.
- Necessary lengths of wires/cables, switches suitable for DC use and fuses should be provided.

5. *PV Module(s):*

- The PV module(s) shall contain crystalline silicon solar cells.
- The power output of the module(s) under STC should be a minimum of 18W or 37W or 74W. In case of Model 4 & 5 either two modules of 37 W each or one module of 74W should be used.
- The operating voltage corresponding to the power output mentioned above should be 16.4 V
- The open circuit voltage of the PV modules under STC should be at least 21.0 Volts
- The terminal box on the module should have a provision for opening for replacing the cable, if required.
- A strip containing the following details should be laminated inside the module so as to be clearly visible from the front side:

6. *DC Fan:*

- The wattage of the fan should not be more than 20 Watts and it should operate at 12V DC.

7. *Electronic Protections:*

- Adequate protection is to be incorporated under no load conditions e.g. when the lamps are removed and the system is switched ON.
- The system should have protection against battery overcharge and deep discharge conditions.
- Fuses should be provided to protect against short circuit conditions.

8. *Mechanical Components:*

- Metallic frame structure (with corrosion resistance paint) to be fixed on the roof of the house to hold the SPV module(s). The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45, so that it can be installed at the specified tilt angle.
- A vented metallic box with acid proof and corrosion resistance paint, for housing the storage battery indoors should be provided. The box can be of injection Moulded plastic or wooden for home lighting models 1, 2 and 3 only.

Method of Construction:

The entire Solar Home light with all accessories shall be installed at designated place, duly wired and giving necessary testing.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

4.4 Energy Devices (ESD-ED)

A) Digital Active Harmonic Filter (DAHF)

Scope:

Specification No (ESD-ED/DAHF)

Designing, supplying, erecting, testing, and commissioning of Digital Active Harmonic filter cum Power conditioner, with high speed IGBT device for specified filtering current.

Material:

The unit shall comprise of following features and meet the following parameters:

Topology	4 wire (3Ph + N) Active Power Filter			
Technology	Digital Closed Loop Active Filter with Source Current Sensing 32 bit, Digital Signal processing, High speed IGBT's in power circuit with necessary CT for current sensing.			
Working Principle	Synchronous rotating reference frame.			
Application	Selectable for Harmonic Filtration & or PF Correction.			
Compensation Filter current	30 AMP	60 AMP		
Heat dissipation	< 1500 W	< 1700 W		
Input Voltage	Nominal 400 Volt Phase to Phase Accepted Phase to Phase voltage range: +10%, -15%			
Input Frequency	Nominal: 50Hz +/-10%, (60Hz Optional)			
Interrupting capacity	100 KA, Fused	100 KA, Fused		
Over load capacity	Limiting to nominal current continuous limiting operation possible			
Harmonics Filtering	3rd to 31st Harmonic compensation attenuation ratio up to 96%. Programmable for Selective Harmonic Elimination.			
Power Factor correction	Adjustable up to unity from 0.6 lag or 0.6 lead without Over compensation **OR** Under compensation			
Audible noise level	< 65 db (A)	< 65 db (A)		
Operating temperature range	-5°C To 40°C			
Storage temperature range	-25°C To + 55°C			
Relative Humidity	Max. 90%, Non-condensing			
Standards	IEEE 519 for compensated harmonics IEC / EN62040-2: 2006- Category C3. EN 50178: 1997. CE approved.			
Protection degree	IP32			
Electrostatic discharge immunity	4 KV contact / 8 KVA air discharge			
Cooling	Forced air cooling with axial flow fan			
Color	Havells grey or as specified by Engineer in-charge			
Access	Front access			
External cable connections	Bottom / Top Entry (Front Side)			
Configuration	Standalone/ with facility of Paralleling up to 8 Machines.			
Switches for →	1. ON 2. OFF 3. Reset 4. Up		5. Down 6. Acknowledge 7. Soft Key 1 8. Soft Key 2	
Remote Signals for →	1. Filter Running – 1 Amp – 125 V AC 2. Fault			
Indications for →	1. OK (Filter Running) 2. Alarm 3. Warning			
Display Faults for →	1. Wrong Phase sequence 2. External Inhibit 3. Fast DCOV 4. Rph CTFB Wrong 5. Yph CTFB Wrong 6. Bph CTFB Wrong 7. DC Over voltage		8. Over Load 9. Over Temp. 10. Over current 11. No Sync 12. Mains Abnormal 13. DC Under Volt 14. Filter Trip	
Display Parameters for →	1. Status 2. ID 3. Input Voltage 4. Input Voltage Waveform 5. Input Voltage FFT 6. Input Current 7. Input Current Waveform 8. Input Current FFT 9. Input Current (KW) 10. Input Power (KVA)		11. No. of mains failures 12. Total Filter ON Time 13. Alarm Log 14. Power Factor 15. DC BUS Voltage 16. Filter Load % 17. Mains Frequency 18. Heat Sink Temp. 19. Date & Time	

Method of Construction:
The entire equipment shall be installed at designated place, duly wired with provided cable/leads and giving necessary testing.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

B) APFC Panel with Harmonic suppressor (APFC)

Scope:
Specification No (ESD-ED/APFC)
Supplying, Installing Testing & commissioning manual / Auto power load correction panel of required capacity in kVAR, 440 Volts, 3 phase 50 Hz, Thyristor switch consisting of minimum 4 steps suitably design to take care of 5% of load variation at any time. Steps configuration shall be by the Engineer in charge as per site conditions.

Material:
Capacitors: App Type IS: 13585 part-I 1994 any type gas filled 525 Volts.
Thyristor switches: Thyristor switches should be designed for zero crossing with snubber circuit forced cooling & min 1600 PIV rating.
Series reactor: Copper wound dry type, iron core suitable as per requirement.
Harmonic filter circuit: Circuit suitable to filter Harmonics up to 17th Harmonics.
CRCA sheet: CRCA sheet 14/16 SWG with 7 tank process & powder coating suitable to site condition of required colour shade.
MS angles & channels: Size as per site condition.
Bus bar: Electrolytic copper bus bar of suitable capacity.
Exhaust fan: Tube axial exhaust fan of adequate capacity.
Fabrication materials: MS Jali, Hinges, nut bolts washers, screws etc. of suitable size.
Switchgear: SFU, MCB, MCCB, HRC Din type fuse base as specified in chapter switchgear.
Power factor Controller Relay: Minimum four steps, microprocessor based programmable intelligent relay / dynamic correction Intelligent relay with switches time from selected 1sec.to 1200 sec. having display of system v/s, current, frequency, target PF, THD, short fall KVAR, active power KW, KVAR, Harmonic display up to 17th order.
Accessories: Digital ammeter, digital Voltmeter, Bar primary CTS Class 1, 15VA and of require ratio, selector switch indicating pilot Lamps all Bakelite with colour glass, push buttons.

Method of construction:
APFC panel shall be designed to cater required KVAR capacity with 20% expandable additional load requirement.
Fabrication of panel shall be in such away to accommodate additional extra capacitors.
Panel shall be delivered after testing in presence of the engineer in charge.

Method of Construction:
The entire equipment shall be installed at designated place, duly wired with provided cable/leads and giving necessary testing.

Mode of Measurement: Executed quantity will be measured according to the sum of capacitor banks installed on kVAR basis. (i.e. per kVAR)

Chapter 5

SWITCHGEARS

5.1	LT --I/C M/C Switches, ATS, Bus Bar, Feeder Pillar	SW-SWR
5.2	I/C M/C Distribution boards	SW-DB
5.3	LT -- MCB	SW-MCB
5.4	LT -- MCBDB	SW-MCBDB
5.5	LT -- MCCB	SW-MCCB
5.6	LT -- RCCB	SW-RCCB
5.7	LT – Oil Circuit Breakers	SW-OCB
5.8	LT – Air Circuit Breakers	SW-ACB
5.9	HT – SFU, LBS	SW-HTS
5.10	HT – Breakers (VCB)	SW-VCB
5.11	Drawings	

Chapter 5 Switchgears (SW)

5.1 LT—I/C M/C Switches, ATS, Feeder Pillar (SWR)

General
All material shall confirm to relevant standard as per BIS and shall carry ISI mark.

Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W. Dept. Handbook/NEC.

Refer IS; 13947/1993, For Switch gears, IS: 13703/1993 for HRC fuses.

Incoming contacts for all switchgears shall be shrouded for avoiding accidental contact.

A) Indicator DP (BDP)

Scope:
Specification No (SW-SWR/BDP)

Supplying surface/flush mounting Bakelite D.P switch and erecting on filled polypropylene ISI marked board or on screwed board with top of plywood pasted with laminate.

Material:
DP Switch: Bakelite double pole switch 32A 250V, with copper contacts for make & break, and fuse, indicator lamp with shrouded incoming contacts.
Boards: As per **(WG-PW/SW)** in chapter of Wiring para No. 1.6
Hardware: SM screws, rawl plug, wooden gutties etc.

Method of Construction:
The DP switch shall be erected on specified board or flush in provided enclosure.

Mode of Measurement:
Executed quantity will be counted on number basis. (i.e. Each)

B) IC/Metal clad DP (MDP)

Scope:
Specification No (SW-SWR/MDP)

Supplying and erecting IC/Metal clad DP switches of specified rating on angle iron frame of suitable size.

Material:
DP Switch: Single phase Double pole metal / iron clad weatherproof air break switch fuse unit, confirming to IS: 13947 (part- 1 &3)/ 1993 with facility to de-link neutral, suitable for single phase 240 volts, 50 Hz AC supply, having positive make break arrangement with shrouded incoming contacts, cable entry holes, sealing arrangement and mounting arrangements.
Fabrication: Required size of angle iron / MS Flat.
Paint: Superior quality enamel paint of specified shade & colour, Red Oxide paint.
Hardware: SM screws, MS Nuts & bolts, rawl plug, wooden gutties etc.
Grouting Material: Cement, Sand, Putty, water, etc.

Method of Construction:
The switch shall be erected at designated place duly mounted on suitable size of angle iron frame as per Table no. 5.1/1 with the help of required nut bolt washer etc. The angle frame to be erected on wall with the help of screws, or to be grouted in wall with the help of cement concrete etc. Frame shall be painted prior to erection.

Mode of Measurement:
Executed quantity will be counted on number basis. (i.e. Each)

C) IC/Metal clad TP/TPN switches (MTP)

Scope:
Specification No (SW-SWR/MTP)

Supplying and erecting IC/Metal clad TP/TPN /on load/off load changeover switches of specified rating on angle iron frame of suitable size.

Material:
TP/TPN Switches: Three phase Triple pole / Three phase Triple pole with neutral link weatherproof metal clad air break switch fuse unit of specified rating, confirming to IS: 13947 (part- 1 &3)/ 1993 with positive make and break arrangement with shrouded incoming contacts, facility suitable for Three phase 415 volts, 50 Hz AC supply, It shall be fitted with interlock-able cover and re-wire able type porcelain fuse and having cable entry holes, sealing arrangement and mounting arrangements.

Fabrication: Required size of angle iron / MS Flat.
Paint: Superior quality enamel paint of specified shade & colour, Red Oxide paint.
Hardware: SM screws, MS Nuts & bolts, rawl plug, wooden gutties etc.
Grouting Material: Cement, Sand, Putty, water, etc.

Method of Construction:
The switch shall be erected at designated place duly mounted on suitable size of angle iron frame as per Table No. 5.1/1 with the help of required nut bolt, washer, etc; on frame/wall. The angle frame to be erected on wall with the help of screws, or to be grouted in wall with the help of cement plaster, and finished as original. The Frame shall be painted prior to erection.

Mode of Measurement:
Executed quantity will be counted on number basis. (i.e. Each)

D) Metal clad TP/TPN Switches with HRC fuse (TPHRC)

Scope

Specification No.: (SW-SWR/TPHRC)

Supplying and erecting Metal clad TP/TPN switches with HRC Fuses of specified rating on angle iron frame of suitable size.

Material:
TP/TPN Switches: Combination fuse switch unit, Metal clad, Triple pole with Neutral link, Degree of Protection IP-2L3 as per IS: 13947 (pt.3) 1993.Quick make and break, Inter-lockable cover, uninterrupted duty, Utilization category AC-23A and confirming to IS: 13947 (Part.3) 1993. It shall be suitable for three high rupturing capacity equal to 80 KA (HRC) cartridge fuses confirming to IS: 13703 (Part.1) 1993 and IS: 13703 (Part.2/Section & 2) 1993 having rupturing capacity 80 KA minimum, with rated voltage 415 Volts, 50 Hz. AC with shrouded incoming contacts.

Enclosure: Made of CRCA sheet of thickness not less than 1.2mm.
Fuses: 80 kA High rupturing capacity fuses with ISI mark.
Mounting: Required size of angle iron / MS Flat.
Paint: Superior quality enamel paint of specified shade & colour, Red Oxide paint.
Hardware: SM screws, MS Nuts & bolts, rawl plug, wooden gutties etc.
Grouting material: Cement, Sand, Putty, Water, etc.

Method of Construction
The switch shall be erected at designated place duly mounted on suitable size of angle iron frame as per table no. 5.1/1 with the help of required nut bolt, washer, etc on frame/wall. The angle frame to be erected on wall with the help of screws, or to be grouted in wall with the help of cement plaster, and finished as original. The Frame shall be painted prior to erection.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

Table No.5.1/1
Minimum size of angle to be used for Mounting frames of Switchgear

S No.	Capacity	Minimum Size of angle iron
1	16A,32 A, DP/TP/TPN/ changeover switch	25x25x3 mm
2	63A to 200 A DP/TP/TPN/ changeover switch	40x40x5 mm
3	300 A and above TPN/changeover switch	50x50x6 mm

E) Mini Feeder Pillar (MFP)

Scope:
Specification No (SW-SWR/MFP)

Fabrication of feeder pillar with CRCA sheet, fixing of aluminium strips/bars, with necessary painting and complete erection on provided cement concrete foundation.

Material:
Incoming Isolator: 200 A Four Pole MCCB with 35 kA SC rating
CRCA Sheet: 14 gauge
Fabrication: Angle iron of required size.
Bus bar strip: Aluminium strips with colour coding heat shrinkable sleeves
Insulators: Bus bar insulators (Porcelain/Epoxy)
Gasket: Rubber / Neoprene gasket
Red Oxide: Red oxide paint /Primer
Paint: Superior quality Enamel paint
Hardware: MS nut bolts of required size and length. MS Hinges, Self locks for door.
Danger Board: Danger notice in Marathi & English
Foundation material: Cement, Sand, water.

Method of Construction
The mini feeder pillar shall be fabricated from 14 SWG CRCA sheet. The size of the chamber shall be 75 cm in height, 50 cm in width and 35 cm in depth. The top cover (50 cm in width and 30 cm in depth) shall be fabricated in such a manner so as to have slope on all four sides. The slope shall start at the centre of the chamber. Front door of the feeder pillar shall have self locking arrangement (minimum two) and shall be fixed as directed by the site engineer. The door shall be made water proof by fixing the rubber / neoprene gasket on the inner side. Necessary provision for ventilation shall be made on both side of feeder pillar chamber. These shall be complete with welded non ferrous metallic mesh so as to make it vermin proof. The entire fabricated chamber shall be fixed frame made from 50x50x5 mm angle iron. Dimensions of the frame shall be as per the size of the frame and the depth of the legs shall be 50 cm. The extended portion of the leg of frame shall be covered on all four sides with 14 SWG CRCA sheet duly fixed with suitable size of MS bolts & nuts. The chamber shall have removable bottom plate at the end of the frame, with holes of suitable diameter for incoming and outgoing cables.
Four numbers of aluminium bars of 40 x 5 mm cross section with 35 cm in length for three phases & neutral duly covered with colour coded PVC heat shrunk sleeves or covered with PVC insulation tapes with colour coding, shall be fixed inside the chamber on porcelain / epoxy insulators in staggered manner so as to facilitate the connections of cable leads. (Minimum two insulators shall be provided), with main cable socket to each bar. The provided Four Pole MCCB of 500 V 200 A rating, shall be fixed on mounting made from CRCA sheet at the bottom for terminating the incoming cable.
The feeder pillar chamber door shall be fixed with enamel iron G.I. Sheet 18 gauge caution board of size 200 mm x150 mm or have sticker pasted, as per I.S.2551 of 1982.
The entire feeder pillar thus fabricated shall be erected in cement concrete foundation (with excavation of soil) with 4 numbers of suitable size foundation bolts. The minimum dimensions of the cement concrete foundation shall be 60 cm in width, 50 cm in depth and 30 cm height.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.2 I/C M/C Distribution boards (MDB)

Metal clad DB (MDB)

Scope:
Specification No (SW-SWR/MDB)

Supplying, erecting Metal clad distribution board of specified ways and rating, suitable 250 V/440 V 50 Hz, AC supply, erected on iron frame/board.

Material:
Distribution board: Fabricated from 18 gauge C.R.C.A. sheet steel of required ways, 250/440 V having kitkat pattern H.C. type fuse bridges 16 A/32 A and Neutral bar connector with earth terminal.

Mounting: Required size of angle iron / MS Flat.
Paint: Superior quality enamel paint of specified shade & colour, Red Oxide paint.
Hardware: SM screws, MS Nuts & bolts, rawl plug, wooden gutties etc.
Boards: As per **(WG-PW/SW)** in chapter of Wiring Para. No. 1.6

Method of Construction:
The switch shall be erected at designated place duly mounted on suitable size of angle iron frame as per Table no. 5.2/3 with the help of required nut bolt, washer, etc on frame/wall. The angle frame to be erected on wall with the help of screws, or to be grouted in wall with the help of cement plaster, and finished as original. The Frame shall be painted prior to erection.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

Table No. 5.2/3
Minimum size of angle to be used for fabrication of frames for DB's

Sr. No	Rating of Distribution Boxes	Minimum size of angle iron in mm
1	DB 16 A, 250 V.	25x25x3
2	DB 16 A, 415 V	40x40x3
3	DB 32 A, 415 V	40x40x5

5.3 Miniature Circuit Breakers (MCB) (MCB)

SP/SPN/DP/TP/FP MCB'S

Scope:
Specification No (SW-SWR/MCB)

Supplying MCB of specified poles, current rating, and either of B or C series with required wiring connections & lugs etc. and erecting in provided enclosure / distribution board.

General Specifications for MCB's

- MCB's shall be of current limiting type, ISI marked confirms to IS 8828 – 1996.
- The power loss per pole shall be low and shall be in accordance with IS 8828 – 1996.
- All cable entries shall be either from bottom or top.
- MCB's shall be of C- curve characteristic & shall have quick make & break non-welding self wiping silver alloy contacts for 10 kA short circuit both on the manual & automatic operation.
- All the active, live parts of MCB's should be out of human reach, ensuring safety & confirms to IP: 55 degree of protection.
- The MCB's must house transparent label holder to ensure circuit identification.
- The MCB's must have fully insulated safety shutters.

- The MCB's shall have lockable switching lever.
- The Minimum electrical endurance shall be 20,000 operations.
- The housing of the MCB shall be mounted self-extinguishing DMC (Dough Moulding Compound).
- The short circuit Current shall be brought to zero within 4 to 5 milliseconds from the time they are established.
- All MCB's shall have a minimum short circuit Capacity of 10kA RMS.

Material:
***Single Pole / Single pole with Neutral / Double Pole / Triple pole / Four pole*:**
MCB, ISI marked as per IS 8828 : 1996 (IEC 60898) with hammer trip and watch mechanism15 arc plates,10 KA capacity with nominal rating of 240/415V.
Lugs: Copper lugs of suitable size as per **(CB-CL/CU)** in chapter 7.10 for Cable

Method of Construction:
MCB shall be erected in provided enclosure / distribution board and terminating the provided wires by copper lugs (crimping type) and connecting the same.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.4 Distribution Board suitable for MCB's (MCBDB)

Horizontal / Vertical type DB's

Scope:
Specification No (SW-SWR/MCBDB)

Supplying of MCBDB suitable for 230 V / 415 V, horizontal/vertical, with/without door of specified ways (poles), surface / flush mounting to house incoming and outgoing MCB's, and erected on iron frame.

General Specifications for MCBDB's
- DB's shall be prewired and shall be fabricated as per IS: 8623.
- Suitable for flush mounting & surface mounting, with 100 A copper bus bar (For Horizontal type DB), neutral bar, earth bar & cable ties for cable management.
- In case of Vertical DB the bus bar shall be of 200 A rating.
- DB's shall be of IP – 43 degree of protection.
- All the MCB distribution boards shall be fabricated out of 18 SWG thick sheet steel duly rust inhibited through a process of degreasing, pickling, phosphating & powder coating to an approved colour over primer & shall be of the totally enclosed dust proof type suitable for wall mounting.
- All components shall be mounted on DIN rails & covered totally with a sheet steel cover rendering it finger-safe. Access to the internal connections shall be only through removing the cover sheet.
- All DB's shall be internally prewired using copper insulated high temperature PVC wires.
- Bus bars & neutral bar shall be fully insulated with standard colour code.
- Bus bar withstanding capacity shall be 10kA.
- DB's must have facility of reversing door without modification, pan assembly for ease of installation & convertible locking.

Material:
Horizontal/Vertical type MCBDB: ISI marked as per IS 8623, of specified ways (poles), surface/flush mounting, with/without door, suitable for 230 V / 415 V.

Lugs – Copper lugs of suitable size as per **(CB-CL/CU)** in chapter 7.10 for Cable
Iron work: Suitable size of angle/flat.
Hardware: SM screws, rawl plug, gutties, etc.

Method of Construction:
MCBDB shall be erected at designated location and directed by site engineer and terminating the provided wires by copper lugs (crimping type) and connecting the same.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.5 Moulded Case Circuit Breaker (MCCB) (MCCB)

Scope:
Specification No **(SW-SWR/MCCB)**

Providing & erecting 3 Pole/4 Pole MCCB of specified rating and with specified short circuit rupturing capacity in KA, complete erecting in provided enclosure & connected with provided leads on incoming and out going side, complete.

General Specifications for MCCB's

- MCCB's should comply with IS 13947 part -2, IEC (6094) and IEC 60947-3 & IEC 60947 part – 2.
- The MCCB shall be suitable for universal mounting i.e. the load/line shall be interchangeable with shrouded incoming contacts.
- The MCCB shall be suitable for minimum operating voltage of 415V.
- The thermal setting shall be adjustable from 64 % to 100% of its normal current.
- The magnetic setting shall be adjustable from 3.5 to 10 In (normal current).
- Trip reset should be available Manual / Automatic.
- Isolator switches for electronic circuits to open the MCCB automatically.
- The MCCB's must house transparent label holder to ensure circuit identification.
- The MCCB's must have fully insulated safety shutters.
- Overload Zone adjustable from 0.4 to 1 in with line (For 630 amp & above MCCB)
- Short circuit Zone adjustable from 1.5 to 10 In with time.

Material:
3 pole or 4 Pole MCCB Moulded case circuit breaker. Fixed version– front Terminals with current rating & breaking capacity as below:

i.	63 A to 125 A	-	15 KA
ii.	160 A to 250 A	-	35 KA
iii.	300/400 A	-	35 KA
iv.	630 A	-	70 KA

Method of Construction:
3 pole /4 pole MCCB shall be erected in provided enclosure & connected with provided leads/strip on incoming & out going site complete

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.6 Residual Current Circuit Breaker (RCCB)

A) Residual Current Circuit Breaker (RCCB)

Scope:
Specification No (SW-RCCB/RCCB)

Supplying, erecting, and commissioning of 2/4 Pole RCCB of specified rating, conforming to IS: 12640, duly connected with copper leads, copper lugs, etc., in provided enclosure.

General Specifications for RCCB

- RCCBs shall be ISI marked as per IS 12640 (part 1) – 2000 and Confirming to IEC 61008-1.
- It shall work on residual current energy, having 30 milliamp sensitivity and shall protect against earth leakage.
- Tripping time shall be maximum 30 milliseconds.
- Breaking capacity shall be 20 kA.
- RCCB shall operate for rated leakage at nominal Ten volts AC, and also in both, Neutral Open & Snapping condition.
- RCCBs shall have trip free mechanism with quick make & break non-welding self wiping silver alloy contacts for 20 KA short circuit current both on the manual & automatic operation. Test knob facility shall be provided.
- All the active, live parts of RCCBs should be out of human reach, ensuring safety & confirms to IP20 degree of protection.
- The RCCBs must house transparent label holder to ensure circuit identification.
- The RCCBs must have fully insulated safety shutters.
- The Minimum electrical endurance shall be 20,000 operations.

Material:
2 Pole / 4 pole, RCCB, ISI marked as per IS: 12640-2000 (IEC 61008-1) with hammer trip and watch mechanism 15 arc plates, 20 KA breaking capacity of specified rating suitable for 240/415V.

Lugs – Copper lugs of suitable size as per **(CB-CL/CU)** in chapter 7.10 for Cable
PVC Copper leads: As per **WG-MA/BW** specified in chapter of Wiring in para. no. 1.3

Method of Construction:
2 / 4 Pole RCCB shall be erected in provided enclosure & connected with leads, with necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Residual Current Circuit Breaker with over voltage cut Off (RCBO)

Scope:
Specification No (SW-RCCB/RCBO)

Supplying, erecting, and commissioning of 2 Pole RCBO (RCCB+MCB) of specified rating, conforming to IS: 12640 duly connected with copper leads, copper lugs, etc., in provided enclosure.

General Specifications for RCBO

- RCBO's with integral combination of RCCB+MCB, shall be ISI marked as per IS 12640 (part 1) – 2000 and Confirming to IEC 61008-1.
- It shall work on residual current energy, having 30 milliamp sensitivity with protection against earth leakage and over voltage upto 290 Volts.
- Tripping time shall be maximum 30 milliseconds.

- Breaking capacity shall be 10 kA.
- RCCB shall operate for rated leakage at nominal Ten volts AC, and also in both, Neutral Open & Snapping condition.
- RCBO's shall have trip free mechanism with quick make & break non-welding self wiping silver alloy contacts for 10 kA short circuit both on the manual & automatic operation. Test knob facility shall be provided.
- All the active, live parts of RCBO's should be out of human reach, ensuring safety & confirms to IP20 degree of protection.
- The RCBO's must house transparent label holder to ensure circuit identification.
- The RCBO's must have fully insulated safety shutters.
- The Minimum electrical endurance shall be 20,000 operations.

Material:
2 Pole / 4 pole, RCBO with integral combination of RCCB+MCB, ISI marked as per IS: 12640-2000 (IEC 61008-1) with hammer trip and watch mechanism 15 arc plates, 10 kA breaking capacity of specified rating suitable for 240/415V.
Lugs – Copper lugs of suitable size as per **(CB-CL/CU)** in chapter 7.10 for Cable
PVC Copper leads: Copper leads of suitable size, as per **(WG-MA/BW)** specified in chapter of Wiring in para. No. 1.3

Method of Construction:
2 /4 Pole RCBO shall be erected in provided enclosure & connected with leads, with necessary testing.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.7 LT – Oil Circuit Breakers (OCB)

Scope:
Specification No **(SW-SWR/OCB)**

Supply, erection of panel mounting, non-draw out type Oil Circuit Breaker of specified rating and rupturing capacity, triple pole 440 V, 50 Hz, neural link, oil filled, totally enclosed. (Conforming to BSS 936/1960 & IS 2516/1965)

Material:
Enclosure:
Compact, all-welded robustly constructed steel enclosure, suitable for wall mounting/pedestal mounting with standard finish of dark admiral grey paint, making perfect for industrial use under the most severe operating conditions. The unit should also be suitable to mount on the switchboard directly.

Protection:
Overload protection:
Overload protection is through a triple pole series, operated upto 200 Amps and above CT operated electromagnetic overload coils suitably time lagged with oil dash pots operated directly on the mechanism tripping the breaker on sustained overloads. These overload devices are instantaneous self resetting type with an inverse time-lag characteristic protecting the circuitry faster than any other type of protection. Suitable range of calibration is also provided for, thus ensuring more accurate fool proof overload protection.

Under Voltage protection:
Electro-magnetic under voltage protection by an under voltage coil fitted separately and acts directly on the mechanism Normal coil voltage is 415 Volts 50 cycles AC, A special arrangement shall be made to make it impossible to close the breaker as long as there is no supply.

Short Circuit Protection:
Short Circuit Protection is ensured through Electromagnetic series/CT operated overload devices.
Contacts:

Contacts should be substantial size cross section made of Electrolytic 99.9% purely copper contacts that have durable silver plating on contacts. The fixed contacts are spring finger type, fitted with easily removable arcing, Contacts. The moving contacts for lower range are made of flat copper bars made into specific shapes and for higher ranges are made from copper 'V' bars. Moving arcing contacts are made of hard bronze Metal and are self-aligning type fitted to 'V' bars. Rupturing capacity shall be 15MVA up to 400A and 25 MVA for capacity above 400A up to 800A.

Oil:

First filling of oil shall be done in the oil tank & in dashpot with specific gravity 0.96, and dielectric strength 30kV at 2.5mm gap.

Termination:

Cable end box & glands on incoming side & out going sides should be provided.

Method of Construction:

The O.C.B. should be erected on provided panel board complete with first filling of oil in oil tank & in dash pot with connecting to bus bar by means of provided insulated copper strip of suitable rating as per the rating, complete.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.8 LT – Air Circuit Breakers (ACB)

Scope:

Specification No (SW-SWR/ACB)

Supplying, erecting, and commissioning of Air Circuit breaker of specified rating, confirming to IS 2516/IES157 manually operated non draw out type/draw out type erected at position in provided panel board in approved manner.

Material:

Air Circuit Breaker:

Draw out type/non draw out type manually quick make quick break type front operated mechanical indication for ON/OFF position with 50 kA short circuit rating. Trip free mechanism with high performance characteristic based on modular construction and should be compact.

The breaker shall have following accessories:

- ***Auxiliary Switch:*** Auxiliary switch shall consist of 2 NO & 2 NC contacts. The total Auxiliary switch block shall have minimum six auxiliary. In case of draw out breakers two sliding contacts should be provided.
- ***Alarm Switch:*** For breaker with thermal and magnetic trip units the indication should be direct from trip unit through micro switch with necessary wiring.
- ***Shunt Release:*** Shunt trips are used for remote control. Shunt trip coil should operate though an auxiliary switch. The operating ranges should be normally 50-110 % of the rated voltage.
- ***Under voltage Release:*** Under voltage release must be energized before closing breaker. This should be provided for remote control.
- ***Over current release:*** Over current release shall consist of Current Transformer with slides on each current carrying path of a bi-metal relay common to all transformers. The transformer shall have a fix ratio suited to particular setting range. Overload releases shall be thermal time lagged. Overload relay range shall be 50 % to 100 % of CT ratio. Frame shall facilitate site adjustment from 25-100% of ACB rating to match the load requirement.
- ***RA unit -*** given for 0-110% operating range of SHT-ensures supply available to shunt trip from same AC source in short circuit condition.
- ***RC unit*** – for up to 3secs. Time delay with U/V trip. Ideal for protection against transient voltage dips and nuisance tripping continuously adjustable time delay range of 40-500 ms with S/c trip ideal for selective interruption co- ordination of ACB's.
- Contacts made of electrolytic copper of 99.9 % purity, of ACB shall be totally shrouded, for eliminating access to live parts.
- Short Circuit release pick up shall be adjustable for closer protection.

- Breaker shall be compact in size, for saving space in the cubicle and as far as possible shall be lightweight for easy handling.
- Thermal over load and magnetic short circuit protection shall be provided.

Method of Construction:

The breaker should be erected on provided panel board or cubicle as the case may be, complete with connecting to bus bar by means of provided insulated copper strip of suitable cross section as per the rating, complete.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

5.9 HT -- SFU's, Load Break Switch (HTS)

A) HT Switch Fuse Unit/ Load Break Switch (LBS)

Scope:

Specification No (SW-HTS/LBS)

Supplying and erecting extendable/ non extendable type load break switch with fuses of required rating and with IP 55 protection class, on provided MS channels/ trench/ foundation in an approved manner.

Recommended Standards:

IS 9920 (Latest Revision):- Rating, performance, testing of load break switch
IS 9921 :- Standards for temperature of electrical parts exposed to air

Load Break Switch should normally comply with the following parameters:

S. No	Specifications	11 KV	22 KV
1	Rated Voltage	12 KV	24 KV
2	Rated Current	630A	630A
3	Rated short time current	25 KA	25 KA
4	Rated making current	62.5 KA	62.5 KA
5	Rated breaking current	630A	630A
6	Impulse withstand voltage		
	Earth and between poles	75 KV	125 KV
	Across the isolation distance	85 KV	145 KV
7	Power frequency test voltage		
	Earth and between poles	28 KV	50KV
	Across the isolation distance	32 KV	60KV

Material:

- ***Steel Sheet***
- ***Electrolytic Aluminium Bus bar of 400A***
- ***Arc Chutes***
- ***Epoxy Resin Cast Type Insulators***
- ***H.T. Fuses of adequate capacity***
- ***Shunt Trip Coil***
- ***Manual trip push button***
- ***Auxiliary contacts***
- ***Earth switch***
- ***Earth Bus bar copper (25x3)***

Method of Construction:

Load break switch should be erected on provided MS channels/ trench/ foundation as per approved drawing by site in charge.
Manufacturer's certificate for type test should be obtained.
Routine Type test should be carried out at site.
An earth switch having separate operating handle should be interlocked with main switch should be checked.
An operating handle with correct sequence device having ON and OFF position and arrangement for pad locking provided should be checked.

Application:

Load break switch is suitable mainly for underground H.T. distribution system. It can be used for switching of transformers, overhead lines, capacitors, ring mains and cables.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

B) Ring Main Unit: (RMU)

Scope:

Specification No (SW-HTS/RMU)

Supplying and erecting Indoor type ring main unit with 2 incoming and 1 outgoing with HRC fuses and with IP 55 protection class, complete erected on provided CC foundation/ MS channels/ trench in an approved manner. (Refer drawing no. SW-HTS-1)

Recommended Standards:

IS 9920 (Latest Revision):- Rating, performance, testing of Ring Main Unit
IS 9921 :- Standards for temperature of electrical parts exposed to air

Material:

- ***Steel Sheet***
- ***Electrolytic copper Bus bar of 400 A***
- ***Arc Chutes***
- ***Epoxy Resin Cast Type Insulators***
- ***H.T. Fuses of adequate capacity***
- ***Shunt Trip Coil***
- ***Manual trip push button***
- ***Auxiliary contacts***
- ***Earth switch***
- ***Earth Bus bar copper (25x3)***

Method of Construction:
Ring main unit should be erected on provided MS channels/ trench/foundation as per approved drawing by site in charge.
Manufacturer's certificate for type test should be obtained.
Routine Type test should be carried out at site.
An earth switch having separate operating handle should be interlocked with main switch should be checked.
An operating handle with correct sequence device having ON and OFF position and arrangement for pad locking provided should be checked.

Application:
Ring Main Unit is suitable mainly for underground distribution system. It can be used for switching of transformers, overhead lines, capacitors, ring mains and cables
Mode of Measurement: - Per RMU

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

Chapter 6

CONTROL PANEL

6.1	**Sheets**	**No Specs**
6.2	**Bus-bars**	**CP-BB/**
6.3	**Measuring Instruments**	**No Specs**
6.4	**Accessories**	**No Specs**

Chapter 6 **Control Panel (CP)**

6.2 Bus bar (BB)

Scope:

Specification No (CP-BB)

Fabrication of bus bar chamber, fixing of bus bar of specified metal, complete erection of the bus bar chamber on provided angle iron or as instructed.

Material:

Sheet: 16 gauge CRCA sheet

Fabrication material: Angle iron of required size, Hinges made from MS.

Bus bar strip: Aluminum/Copper strips covered with colour coded PVC heat shrunk sleeves or wrapped with PVC insulation tape with colour coding.

Bus bar support: Bus bar insulators (Porcelain/Epoxy)

Earth stud: MS Nut & Bolt minimum 10 mm diameter.

Packing material: Rubber / Neoprene gasket

Paint: Red oxide paint /Primer, Enamel paint

Hardware: Nuts, bolts, washers, etc of required size & length.

Danger Board: GI Sheet danger board in Marathi & English or Screen printed sticker.

Method of Construction:

The bus bar chamber shall be fabricated from 16 SWG CRCA sheet with necessary clearance on all side as mentioned in Table No 5/1 duly painted with one coat of red oxide/primer and with 2 coats of Superior quality enamel paint of required shade. The earth stud shall be welded to the chamber. The bus bar shall be fixed on fabricated bracket (to be fixed on inner rear surface of the box), with minimum three porcelain / epoxy bus bar insulator minimum at both ends & at the centre of the bar (with distance of 45cms.between insulators), with minimum 40x8 mm MS nut bolt, spring washers, etc. The above method shall be adopted for all the 4 bars. The bar shall be vertically fixed in staggered manner so as to maintain clearance in between the bars as per Table No. 6.2/2. All the bars shall either be covered with colour coded PVC heat shrunk sleeves or wrapped with PVC insulation tape with colour coding. (i.e. R, Y, B, N). The chamber shall be fixed on 25x25x4 mm angle iron frame to make it sturdy. The chamber shall have minimum one hole per bus bar for fixing incoming cable, and required holes for the out going cables. The size of the bar either aluminium / copper for the required rating shall be as per Table No 6.2/1

Mode of Measurement:

Measurement will be on running metre basis of the length of the bus bar provided in the chamber. (i.e. per meter length of bus bar)

Table No 6.2/1

Dimensions of Bus bar chamber & Size & Number of Strips required for the corresponding current rating.

S.No.	Dimensions of Bus bar chamber Length, Height, Depth in mm	Aluminum/ Copper bus bar length per phase in mm	Current rating in amperes	No. of Insulators (Epoxy /Porcelain) per bus	Recommended rectangular cross section			
					Aluminium		Copper	
					No. of strips per phase	Size in mm	No. of strip per phase	Size in mm
1	1150x400x150	1000	100	3	1	25x5	1	20x5
2	1150x400x150	1000	200	3	1	40x5	1	30x5
3	1150x400x150	1000	300	3	1	50x5	1	40x5
4	1150x500x300	1000	400	3	1	50x10	1	50x5
5	1150x500x300	1000	630	3	2	40x10	-	-
6	1150x500x300	1000	800	3	2	50x10	-	-

Table No 6.2/2

Minimum Clearance between Bus Bars in Bus Bar Chamber / Control Panel

(IS: 4237-1967)

S.No.	Voltage level (kV)	Clearance in mm	
		Between Phases	Between Phase & Earth
1.	0.416	19	16
2.	0.6	25	19
3.	3.3	51	35
4.	11	127	77
5.	22	242	140
6.	33	356	223

Chapter 7

CABLES

7.1	**LT Cables (Aluminium)**	**CB-LT/AL/**
7.2	**LT Cables (Copper)**	**CB-LT/CU**
7.3	**HT Cables**	**CB-HT/**
7.4	**Cable Joints, Termination Kit (LT)**	**CB-JT/LT**
7.5	**Cable Joints, Termination Kit (HT)**	**CB-JT/HT**
7.6	**Cable Enclosure (Pipes)**	**CB-CE/**
7.7	**Cable Glands**	**CB-GL/**
7.8	**Street Light Boxes & Cable Indicators**	**CB-SB/ CB-CIP**
7.9	**Cable Lugs (Copper)**	**CB-CL/CU**
7.10	**Cable Lugs (Aluminium)**	**CB-CL/AL**
7.11	**Drawings**	

7.1, 7.2, & 7.3 Armoured Cables (HT & LT)

1. General

All material shall conform to relevant standard as per BIS and shall carry ISI mark. If any particular category of material for which ISI mark is not available in market, it shall be as included in approved list.

Work shall be carried out as per the method of construction specified by BIS. If there is no reference for particular method of construction in IS, such work shall be carried out as per the approved method of construction specified in chapter 16 of P.W. Dept. Handbook.

Material and Work not qualifying to any provision mentioned above shall be to the satisfaction of the Engineer in Charge.

2. Cables: (Armoured)

The following list records those Indian Standards in force, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code
IS 1255: 1983		Code of practice of Installation & Maintenance of armoured cables up to 33 kV.
IS 3961: Part 2: 1967	:	Recommended current ratings of PVC cables.
IS 1554: Part 1; 1988	:	PVC Insulated (Heavy duty) Electric Cables; Part 1 for working voltages up to and including 1100 Volts.
IS 1554: Part 2; 1988	:	PVC Insulated (Heavy duty) Electric Cables; Part 1 for working voltages up to and including 3.3 kV to 11 kV.
IS 10810: Part 63; 1993	:	Method for Test of cables, Part 63 Smoke density of electric cables under fire condition.

3. Scope: (Armoured cables)

Specification No. **(CB-LT/AL, CB-LT/CU, CB-HT)**

Providing armoured cable of specified voltage level, size & specified conducting material (Aluminum / Copper) as per **Table no. 7/3** including required material, hardware's for erection and erecting on wall, ceiling, RCC slab or drawing the same through pole, pipe, laying in provided conduit, trench, ducts, trays as per approved method of construction including glands, lugs, etc.

4. Material:

Cables:

Cables shall be PVC for LT/MP and XLPE for HT as per Table no. 7/3 and of required construction, colour, shall carry ISI mark, IS No, manufacturer's name, size, duly embossed / screen printed at every metre and having the total count of progressive length in meter at each mark.

Earth wire: Galvanized Iron (G I) wire of appropriate gauge as per Table No 7/1.

Glands: As per specification **(CB-GL)**

Lugs: As per specification **(CB-CL/AL, CB-CL/CU)**

Saddles: Saddles fabricated from GI sheet of required gauge and size depending on dia of cable either galvanized or painted with superior quality enamel black paint with necessary shearing mechanical strength, semi circular shaped with extended piece having suitable holes for fixing.

G I Strip: 22 g x 25 mm width G I Strip.

Clamps: MS Clamps fabricated of required length and shape, having the size of 3/6 mm thick mild steel having 25/50 mm width (as per size of cable), rounded ends with wooden / resin cast grip for holding the cable.

Identification tags: For identifying root, connection position GI strip with identification mark / name embossed / painted with arrangement to tie should be fix on cable or arrangement of ferrules to be done.

Hardware: Sheet Metal (SM) screws of required sizes, plugs / wooden gutties, etc.

4. Method of Construction:

General:

a) Irrespective of method of construction the cable ends shall be terminated with appropriate size & type of glands with lugs duly crimped, as directed by Site engineer.

b) Wherever the cable has to be bent, the turning radius shall be as mentioned in Table No 7/2. Grouping of cables shall be done with adequate distance between cables as mentioned in IS so as to minimize de-rating. Cables shall be tagged/ferruled with identification name / mark at the point from where distribution starts and at ends. Bare earth wire of appropriate size as per Table no. 7/1 shall run along with the cable. Earth wire running with the cable shall be terminated at the earth terminal nearest to cable termination.

5.1 Erection of Cable on Surface:

Erection shall be done as per the routes and layout finalized, in perfect level and in plumb. Before fixing the cable shall be straightened as far as possible for good aesthetics look, continuous bare GI earth wire of required gauge as per Table No 7/1 shall be run. Cable with G I wire shall be fixed by saddles firmly clipped on cable and shall be fixed to wall with minimum 50 x 8 mm SM screws with plugs/wooden gutties, etc. (Distance between two supports / saddles shall be maximum 450 mm). Wooden gutties shall be used wherever required (Especially for stone wall). The entries made in wall, floor slab, etc for laying the cable shall be made good by filling and finishing with plastering the same.

5.2 Erection of Cable on Trusses:

Cable along with bare GI earth wire, while erecting on trusses, shall be firmly clamped by wrapping GI strip of 22 g, 25 mm width of required length fixed to truss with nuts and bolts.

5.3 Erection of Cable on Pole:

Cable along with bare GI earth wire, while erecting on pole, shall be firmly clipped by suitable wooden / epoxy resin cast grips, clamped with 25 x 3 mm or50x6 mm MS strip of required length and fixed to pole with nuts and bolts.

5.4 Laying of Cable in provided Trench/Pole:

While laying Cable along with bare GI earth wire, utmost care shall be taken to prevent damage to the insulation of the cable and to the open end. Cable shall be brought out from trench vertically straight (minimum 1.0 metre above G L). Care shall be taken to inspect the trench so that depth of cable shall not be less than as shown in Table No 7/4. Suitable size of cable loops shall be provided near termination point at adequate depth.

5.5 Erecting cable in constructed Trench / duct:

Erection of cable/s in constructed trench / duct, shall be as per guide lines of IS 1255.

5.6 Erection of cable/s on trays:

Cable/s shall be tied with PVC tags on GI trays. At bending point care shall be taken so that sharp edges of sheet will not damage insulation of cable.

5.7 Mode of Measurement: Executed quantity shall be measured on the basis of running metre per run of cable.

6. Dismantling

Cable laid underground, or fixed on any surface shall be dismantled carefully without damaging complete with all its accessories, making coil and stored as directed. The surface of the dismantled cable shall be made clear by removing of unwanted material, cement mortar, etc. When cable is dismantled from trench refill back the trench and making the surface proper.

7. Mode of Measurement: Executed quantity shall be measured on the basis of running metre per run of cable.

Table No 7/1

Size of Bare GI Earth wire to be used with LT Cables upto 1.1 kV

S.No.	Size of cable	Size of bare GI Earth wire to be used with cable
1	2.5 Sqmm to 50 Sqmm of all cores.	12 SWG
2	70 Sqmm to 95 Sqmm of all cores.	10 SWG
3	120 Sqmm and above of all cores.	8 SWG

Table No 7/2

Minimum bending Radius for Cables

S.No.	Voltage level of cables	Single core	Multi core Unarmoured	Multi core Armoured
1	Up to 11 kV	20 D	15 D	12 D
2	Up to 22 kV	25 D	20 D	15 D
3	Up to 33 kV	30 D	25 D	20 D

Note: D diameter of cable.
Wherever possible, 25 percent larger radii than the specified above should be used.

Table No 7/3

Current Rating (In Ground) for PVC/ XLPE Insulated 1.1 kV Grade Cables

Nominal area of conductor	***Aluminum Conductor***				***Copper Conductor***			
	Single Core		***Multi Core***		***Single Core***		***Multi Core***	
Sqmm	**PVC**	**XLPE**	**PVC**	**XLPE**	**PVC**	**XLPE**	**PVC**	**XLPE**
10	51	55	46	50	65	71	60	65
16	66	74	60	68	85	95	77	87
25	86	98	76	90	110	125	99	115
35	100	118	92	108	130	150	120	138
50	120	137	110	126	155	175	145	161
70	140	172	135	158	190	220	175	202
95	175	204	165	187	220	260	210	239
120	195	234	185	215	250	301	240	276
150	220	262	210	240	280	336	270	308
185	240	298	235	273	305	381	300	350
240	270	344	275	316	345	441	345	405
300	295	387	305	355	375	496	385	455
400	325	458	335	420	400	586	425	538
500	345	495	-	-	425	635	-	-
630	390	555	-		470	710	-	-
800	440	625	-	-	-	-	-	-
1000	490	685	-	-	-	-	-	-

Rating Factors for Variation in Ambient Air Temperature			
Air Temperature (^{o}C)	40	45	50
Rating Factor (XLPE)	1.00	0.94	0.88
Rating Factor (PVC)	1.00	0.90	0.81

Table No 7/4

Minimum laying Depth of cables (IS: 1255)

S.No.	Voltage level of cables	Minimum depth from top of the cable
1	Up to 1.1 kV	750 mm
2	3.3 kV to 11 kV	900 mm
3	22 kV to 33 kV	1050 mm
4	At road crossing	1000 mm
5	At railway crossing (from Bottom of sleepers to Top of pipe)	1000 mm

Notes below Table No 7/4:

1.	PVC Insulated electrical cable for voltage grade up to 1.1 kV is based on 8 volts drop.			
2.	The distances are given in meters and after rounding.			
3.	The distances are given in meters and after rounding.			
For Temperature Correction please see as detailed below:				
Ground temp.	**20 degree C**	**25 degree C**	**30 degree C**	**35 degree C**
Rating factors:	0.95	0.90	0.85	0.80

Table No 7/5

Distance up to which different sizes of UG Aluminum Conductor Cables 1.1 kV grade, can be used for different current ratings of 8 Volts drop. (PVC insulated, PVC Sheathed, 3 cores or 4 cores)

Maximum Conductor temperature – 70 degree C														
S. No	***Current***	***Distance in meters for the following cable sizes in Sqmm***												
	Amp	***6***	***10***	***16***	***25***	***35***	***50***	***70***	***95***	***120***	***150***	***185***	***240***	***300***
1	**5**	165	260	415	725	895	1300	1925	2360	3065	3555	4300	5770	6460
2	**10**	80	130	205	360	450	650	960	1180	1530	1775	2150	2885	3230
3	**15**	55	85	140	240	300	430	640	785	1020	1185	1430	1920	2155
4	**20**	40	65	100	180	225	325	480	590	765	890	1075	1440	1615
5	**25**	30	50	80	145	180	260	385	470	610	710	860	1150	1290
6	**30**	25	40	70	120	150	215	320	390	570	590	715	960	1075
7	**40**	20	30	50	90	110	160	240	295	380	445	535	720	805
8	**50**	-	25	40	70	90	130	190	235	305	355	430	575	645
9	**60**	-	-	35	60	75	110	160	195	255	295	355	480	535
10	**70**	-	-	30	50	65	90	135	165	215	255	305	410	460
11	**80**	-	-	-	45	55	80	120	145	190	220	265	360	405
12	**90**	-	-	-	40	50	70	105	130	170	195	235	320	360
13	**100**	-	-	-	35	45	65	95	115	150	175	215	290	320
14	**110**	-	-	-	-	40	60	85	105	140	160	195	260	290
15	**120**	-	-	-	-	35	55	80	95	125	145	180	240	270
16	**130**	-	-	-	-	-	50	75	90	115	135	165	220	250
17	**140**	-	-	-	-	-	45	70	80	110	125	150	205	230
18	**150**	-	-	-	-	-	-	65	75	100	115	140	190	215
19	**160**	-	-	-	-	-	-	60	70	95	110	130	180	200
20	**170**	-	-	-	-	-	-	55	70	90	105	125	170	190
21	**180**	-	-	-	-	-	-	50	65	85	100	120	160	180
22	**190**	-	-	-	-	-	-	-	60	80	90	110	150	170
23	**200**	-	-	-	-	-	-	-	60	75	90	105	145	160
24	**225**	-	-	-	-	-	-	-	-	65	80	95	125	145
25	**250**	-	-	-	-	-	-	-	-	-	70	85	115	130
26	**275**	-	-	-	-	-	-	-	-	-	-	80	105	115
27	**300**	-	-	-	-	-	-	-	-	-	-	70	95	105

7.4 & 7.5 Cable Joints & End Termination Kits

(LT/HT Cables) (JT/LT/HT)

1. Scope:

Specification No (CB-JT/LT/HT)

Providing straight through cable jointing kit of approved make and jointing cable as per the manufacturer's instructions and duly marking name of jointer and date.

2. Material:

Joint kit: Kit manufactured by reputed manufacturer with PVC moulds made in two parts, with epoxy compound, earth continuity lead of appropriate cross section having lugs at both ends, aluminum ferrules of the size of the cable, cross shaped epoxy spacer, MS clips for holding the moulds, adhesive for pasting the moulds.

3. Method of Construction:

3.1 Straight through joint Kit: LT/HT Cables

Before providing joint to the cable, the cable ends of the equivalent length of the joint moulds, shall be prepared by removing the outer PVC insulation along with the steel armouring. The ferrule shall then be inserted over the bare core of the cable, and shall be crimped with hydraulic / mechanical type heavy duty crimping tool. The crimped portion shall be wrapped first with the PVC insulation tape and then with the insulation tape used for wrapping HT conductor. The above method shall be carried out for all the cores strictly following the colour code. The leads of the both the cables now shall be placed into the mould by using the epoxy spacer, for having sufficient gap in-between the leads. The earth continuity lead shall be clamped to the both ends of the cable. After covering the cable leads with the PVC moulds, the edges shall be clipped after applying the adhesive on the inside face of the moulds. The pasting of moulds shall be rigid and as far as possible leak proof, so that the epoxy compound shall not spill out. Now the duly stirred epoxy compound shall be poured and fill till the compound rises through the risers provided on the moulds.

After completing the above procedure, the joint shall be allowed to dry out for at least 8 to 10 hours (for epoxy compound to get hardened) depending upon the size of cable. Before connecting to supply, the dry and hardened joint shall be tested for its insulation level with 1000 V/ 5000 V Meggar.

The cable should be fixed or laid in such manner that there should not be pressure on end of moulds or on jointing position of cables. (Refer drawing No. CB-JT-1)

3.2 Outdoor/Indoor end termination Kit: LT/HT Cables

Before providing end termination kit to the cable, the cable end of the equivalent length of the moulds, shall be prepared by removing the outer PVC insulation along with the steel armouring. The ferrule shall then be inserted over the bare core of the cable, and shall be crimped with hydraulic / mechanical type heavy duty crimping tool. The crimping shall be done in such a manner that there shall be no air gap. Then the crimped portion shall be wrapped first with the PVC insulation tape and then with the insulation tape used for wrapping HT conductor. The above method shall be carried out for all the cores strictly following the colour code. The leads of the cable now shall be placed into the mould by using the epoxy spacer, for having sufficient gap in-between the leads. The earth continuity lead shall be clamped to theends of the cable. After covering the cable leads with the PVC moulds, the edges shall be clipped after applying the adhesive on the inside face of the moulds. The pasting of moulds shall be rigid and as far as possible leak proof, so that the epoxy compound shall not spill out. Now the duly stirred epoxy compound shall be poured and fill till the compound rises through the risers provided on the moulds. (Refer drawing No. CB-JT-2)

After completing the above procedure, the joint shall be allowed to dry out for at least 8 to 10 hours (for epoxy compound to get hardened) depending upon the size of cable. Before connecting to supply, the dry and hardened joint shall be tested for its insulation level with 1000 V/ 5000 V Meggar.

4 Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each).

7.7 Cable Glands (GL)

Scope:

Specification Nos (CB-GL)

Termination of cable ends with cable glands for preparing and fixing the cable leads for connection. Cable glands shall be of Flange type.

Material:
Cable glands: Flange type heavy duty. Made of high purity brass metal, with brass washers, rubber rings, threaded stud with washers and nuts.

Method of Construction
Before erection of gland, the cable end shall be prepared by removing the outer PVC insulation up to the point where gland to be fixed, by assessing the length of leads required. Bottom portion of gland shall be inserted over the steel armouring, and then armour strips shall be bent for the length of collar of gland, remaining length of armoring shall be cut. The cable end shall then be, inserted through the entry of plate where the cable is to be terminated. The top portion of gland with washer shall be then inserted in such a manner that the bent armour strip should be touching the surface of the entry. The nuts shall be tightened with spring washers over the projected stud portion. Fixing of gland shall be at right angle to the gland plate. Tightening shall assure continuity of earth. Hole to the gland plate shall be punched / knocked out, of correct diameter with respect to gland size.

Mode of Measurement:
Executed quantity will be measured on number basis. (i.e. each).

7.8 Street Light Boxes & Cable Indicators

A) Cable Indicator Plate (CIP)

Scope:
Specification No (CB-CIP)

Providing and fixing of cable indicator plate along the route of under ground cable.

Material:
Cable indicator plate: Circular plate made of cast iron having 100 mm dia. and 6 mm thick.
Iron rod for fixing of cable indicator plate: 700 mm long galvanized iron rod of 12 mm dia., and 150 mm long cross bar welded at bottom or hook to be made with same continuous bar.

Method of Construction:
Cable indicator plate fixed/welded to the 700 mm long iron rod or angle, with 150 mm cross bars welded at bottom as fasteners or bent in 'J' shape to hook the cable in the bent portion, shall be buried along the route of cable in the trench made for laying the cable. For clear visibility, the Cable indicator plate shall be buried in such a manner that the plate should be minimum 200 mm above the ground level and shall be provided at every 15-25 metre in straight run, at both ends of road crossing and immediate before and after turning point of cable.

Mode of Measurement:
Executed quantity will be measured on number basis. (I.e. each).

B) Street Light Boxes (SB)

Scope:

Specification No (CB-SB)

Providing and fixing of CRCA sheet metal / FRP boxes on pole with MS Clamps fixing to poles and terminating the cable.

Material:

CRCA sheet metal box: 16 gauge CRCA sheet with mounting arrangement for kitkat / MCB

Bakelite connectors: Bakelite connector of 2/4 ways, 32A, 250 V.

MS Clamps: Clamps fabricated of required length and shape, of 3 mm thick mild steel having 40 mm width.

Hardware: 10 mm mild steel nuts and bolts.

Paint for CRCA box: Superior quality aluminum / silver paint or required shade enameled paint as per the requirement of site engineer.

Primer / Red oxide: Superior quality primer / red oxide for use on sheet metal.

Method of Construction:

CRCA Sheet metal boxes:

Box shall be fabricated from 16 gauge CRCA sheet as per dimensions specified in item, with minimum 3 mm fold on front side of the box so as to make it water proof (Rubber beading / gasket shall be pasted on the edges / asbestos rope beading). Edges of front cover shall be folded in such a manner so that it shall cover the front opening of the box. The front cover shall be fixed either by screws or be hinged (as per requirement), with self-locking arrangement. There shall be provision of fixing connector / porcelain kitkat fuse / single pole MCB, inside the box. Provision of two holes of minimum 10 mm dia. for fixing bolt of clamp and one hole of required dia. for PVC wire leads, shall be made at the rear side of the box and provision for holes of required dia. at bottom for fixing the cable gland of incoming and outgoing cables. Box shall have earth terminal. Box shall have anti rust treatment and be painted with two coats of red oxide and finally two coats aluminum / silver paint. Rubber gasket shall be provided for making the box watertight. Unless and otherwise specified, the mounting height of the box shall be minimum 1750 mm from the finished ground level for facilitating easy maintenance.

FRP boxes:

FRP boxes manufactured with minimum wall thickness of 2.7 mm either gray or blue in colour, having provision for fixing either porcelain kitkat fuse or Single pole MCB, 4 way bakelite connector, and with provision of two holes of minimum 10 mm dia. for fixing bolt of clamp and one hole of required dia. for PVC wire leads, shall be made at the rear side of the box and one hole of required dia. at bottom to for fixing the cable gland of incoming and outgoing cables. The front cover shall be hinged, with locking arrangement and lock and key. The mounting height of the box shall be minimum 1750 mm from the finished ground level for facilitating easy maintenance. Wherever required fixing of box shall be done with MS clamps of required length, so as to hold pipe pole / RSJ pole and shall be duly painted in approved manner.

Mode of Measurement:

Executed quantity will be measured on number basis. (I.e. each).

7.9 & 7.10 Cable Lugs (Aluminum & Copper)

2. Scope:

Specification Nos (CB-CL/AL, CB-CL/CU)

Crimping of lugs, and fixing to the terminals with nuts and bolts, etc.

3. Material:

Lug: Lug shall be of high purity aluminum / copper / bimetallic of required type, with required size of hole and smooth finished both from inside and outside.
Hardware: Brass or Cadmium plated mild steel nuts and bolts, bimetallic washers.
Anti-Oxide paste: Paste of superior quality manufactured by reputed manufacturer.

4. Method of Construction:

Before fixing of lugs to the cable end, the cable end to the equivalent length of the lug shall be prepared by removing the outer PVC insulation along with the steel armouring and then, the inner PVC insulation. The paste shall be applied to the cable lead and inside the lug prior to the inserting of lug on the cable lead. The lug shall then be crimped with hydraulic / mechanical type heavy duty crimping tool. The crimping shall be done in such a manner that there shall be no air gap. Then the crimped portion shall be wrapped with the PVC insulation tape. (Colour of tape shall be of that of cable lead) The above method shall be carried out for all the cores. The cable end with lug shall then be terminated into the terminal and then be tightened with either brass nuts or Cadmium plated nuts as directed by Engineer in-charge.

5. Mode of Measurement:

Executed quantity will be measured on number basis. (i.e. each).

Chapter 8

OVERHEAD SYSTEMS

8.1	**Steel Poles**	**OH-PL**
8.2	**Spun Poles**	**OH-SPP**
8.3	**Hot dipped Galvanized Poles & High Mast**	**OH-HM**
8.4	**Brackets**	**OH-BKT**
8.5	**Conductors**	**OH-CON**
8.6	**Insulators**	**OH-INS**
8.7	**Accessories**	**No Specs**
8.8	**Drawings**	

Chapter 8 **Overhead Systems** **(OH)**

8.1 Steel Poles (OH-PL)

A) Steel Tubular Poles (OH-PL/STP)

Scope:
Specification No **(OH-PL/STP)**

Supply of steel tubular swaged pole (Swan type or other wise) as per IS 2713: Part 2 1980, fabricated with earthing stud, pole base plate with required numbers of holes as per drawing and erecting the pole, including painting in provided foundation as per method of construction.

Material:
Pole: Steel tubular swaged pole (Swan type or other wise) as per Table No 8/1
Base plate: MS Base plate of 30x30x0.6 cms.
Pole Cap: Pole cap 4 mm thick with inside diameter equal to outside Dia. of the pole and minimum height shall be 100 mm and welded or fixed with set screws.
Earth Stud: Earth stud 5/8"mm Dia. bolt welded to pole with required size nut and double G.I. /M.S. washers
Paint: Red oxide paint as primer, bituminous paint, Aluminium paint/ any other paint as per the instructions of engineer-in-charge.

Method of construction:
Before erection of pole base plate of size 30x30x0.6 cm shall be full length welded or fixed with 4 set screws at the bottom of the pole, a suitable hole of required diameter and at specified height shall be drilled and welded with knock out nipple for laying wires for street light poles at required height. The pole shall be then painted by 2 coats of red oxide paint and one coat of bituminous paint before erection for min 1/6 length which is to be buried in ground & after erection remaining portion to be painted by two coats of aluminium paint. The pole shall be erected in provided pit with cement Concrete foundation and muffing in perfect plumb.

Mode of Measurement:
Executed quantity will be measured on number basis. (I.e. each)

Table 8.1/1
Swaged Poles Made From Steel of Ultimate as per IS: 2713 (Part-II) 1980

Designation	Overall Length in mtr	Planting Depth in mtr	Height above Ground in mtr	Length of Sections in mtr			Outside Diameter / Thickness of Sections			Approx Weight of Pole. Kg
				Bottom h3	*Middle* h2	*Top* h1	*Bottom*	*Middle*	*Top*	
410 SP-28	9.00	1.50	7.50	5.00	2.00	2.00	139.7 x 4.50	114.3 x 3.65	88.9 x 3.25	113
410 SP-31	9.00	1.50	7.50	5.00	2.00	2.00	165.1 x 4.50	139.7 x 4.50	114.3 x 3.65	147
410 SP-52	11.00	1.80	9.20	5.60	2.70	2.70	165.1 x 4.50	139.7 x 4.50	114.3 x 3.65	175
410 SP-60	12.00	2.00	0.60	5.80	3.10	3.10	165.1 x 5.40	139.7 x 4.50	114.3 x 3.65	208

B) Rolled Steel Joist (RSJ) Poles (OH-PL/RSJ)

Scope:
Specification No **(OH-PL/RSJ)**

Supply and erection of Rolled Steel Joist (Girder) pole as per IS 2713, including painting in provided foundation as per method of construction.

Material:
Pole: Rolled Steel Joist (Girder) As per Table No 8.1/2
Base plate: MS Base plate of 30x30x0.6 cms.
Hardware: Nut and bolts for fixing earth wire
Paint: Bituminous paint, Aluminium paint, Red oxide paint.

Method of construction:
Before erection of pole base plate of size 30x30x0.6 cm shall be full length welded at the bottom of pole, a suitable hole of required diameter and at specified height shall be drilled for earth stud. The pole shall be then painted by 2 coats of red oxide paint as primer for full length and then by one coat of bituminous paint before erection for min.1/6 length which is to be buried in ground & after erection remaining portion to be painted by two coats of aluminium paint. The pole shall be erected in provided pit with cement concrete foundation and muffing in perfect plumb.

Mode of Measurement:
Executed quantity will be measured on number basis. (i.e. each)

Table No. 8.1/2
Weight of various sizes of RSJ Poles with 8.5 meter length

RSJ POLE	Size	Weight per Meter
Rolled steel Joist	150x80 / 150x75mm	14.9 Kg/meter
Rolled steel Joist	200x100 mm	25.4 Kg/meter
Rolled steel Joist	175x90 mm	19.3 Kg/meter
Rolled steel Joist	100x116 mm	23.0 Kg/meter
Rolled steel Joist	125x75 mm	12.42 Kg/meter
Rolled steel Joist	152x152 mm	37.0 Kg/meter

C) Rail Poles (OH-PL/RLP)
Scope:
Specification No (OH-PL/RLP)

Supply and erection of Rail Pole including painting in provided foundation as per method of construction.

Material:
Pole: Rail Pole 29.76 Kg/ metre, as per IS 2713 (Part II)
Base plate: MS Base plate of 30x30x0.6 cms.
Hardware: Nut and bolts for fixing earth wire
Paint: Bituminous paint, Aluminium paint, Red oxide paint.

Method of construction:
Before erection of pole, base plate of size 30x30x0.6 cm shall be full length welded or fixed with 4 set screws at the bottom of pole, a suitable hole of required diameter and at `specified height shall be drilled for earth stud. The pole shall be then painted by 2 coats of red oxide paint as primer for full length and then by one coat of bituminous paint before erection for 1/6 length which is to be buried in ground & after erection remaining portion is to be painted by two coats of aluminium paint. The pole shall be erected in provided pit with cement concrete foundation and muffing in perfect plumb.

Mode of Measurement:
Executed quantity will be measured on number basis. (i.e. each)

D) G I Pipe Pole (OH-PL/GIP)

Scope:
Specification No (OH-PL/GIP)

Supply and erection of ISI mark G.I. Pipe Pole 'B' Grade 75/80 mm dia. 6 m long including painting in provided foundation as per method of construction.

Material:
Pole: ISI mark G.I. Pipe Pole 'B' Grade 75/80mm dia. of total length 6 meter
Base plate: CI/MS Base plate of 30x30x0.6 cms.
Pole Cap: Pole cap 4 mm thick with inside diameter equal to outside Dia. of the pole and minimum height shall be 75 mm shall be welded or fixed with set screws.
Earth Stud: Earth stud 5/8"mm Dia. size bolt welded to pole with required size nut and double G.I. /M.S. washers
Paint: Bituminous paint, Aluminium paint/ any other paint as per the instructions of engineer-in-charge, Red oxide paint.

Method of construction:
Before erection of pole base plate of size 30x30x0.6 cm shall be full length welded or fixed with 4 set screws at the bottom of pole, a suitable hole of required diameter and at specified height shall be drilled and welded with knock out nipple for laying wires of street light. The pole shall be then painted by 2 coats of red oxide paint as primer and one coat of bituminous paint before erection for 1/6 length which is to be buried in ground & after erection remaining portion to be painted by two coats of aluminium paint. The pole shall be erected in provided pit with cement concrete foundation and muffing in perfect plum.

Mode of Measurement:
Executed quantity will be measured on number basis. (i.e. each)

8.2 PSC Poles (PSC)

PSC Poles (OH-PL/PSC)

Scope:
Specification No (OH-PL/PSC)

Supply and erection of PSC Rectangular pole in provided foundation as per IS 13158 1991, and as per method of construction mentioned below.

Material:
PSC Rectangular Poles as per Specifications in Table 8/3 and as per satisfactory tests minimum required as per IS.

Table 8.2/3

Specifications for PSC Poles

Top Cross section in mm	Bottom Cross section in mm	Length in metre	Weight in kg
90x102	90x275	8	140
105x115	105x315	9	200

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Method of construction:
The pole shall be erected in provided pit with cement concrete foundation and muffing or as instructed by site-in-charge in perfect plum. $1/6^{th}$ of the total length of pole shall be buried in ground. The poles shall not to be used for end pole, large angle **pole (angle more than 30^0), cut point or span length more than 65 mtr length, where heavy vehicular traffic exists and to be used for straight poles or small angle pole.**

Mode of Measurement:
Executed quantity will be measured on number basis. (i.e. each)

8.3 Hot dipped Galvanized poles & High Mast (HM)

A) High Mast (OH-PL/HM)

Scope:

Specification No (OH-PL/HM)

Supplying and erecting 12.5 m /16 m / 24 m high-mast and its accessories as specified below.

Material:

Hot dipped galvanised pole with details as given in the Table below;
(Refer drawing no. OH-PL-1 & OH-PL-2)
The design life of high mast shall be minimum 25 years.

Height	12.5 m without Power Tool	12.5 m with Power Tool	16 m Power Tool	20 m Power Tool	Remarks
1. Material	Hot dipped galvanised as per specification BSEN ISO 1461	Hot dipped galvanised as per specification BSEN ISO 1461	Hot dipped galvanised as per specification BSEN ISO 1461	Hot dipped galvanised as per specification BSEN ISO 1461	Each section shall be fabricated out of individual plates duly folded and welded. There shall be only one longitudinal seam weld per section. Hot deep internally and externally having uniform thickness of 85 microns for bottom section and 65 microns for top and middle section
Top and bottom Dia. Thickness	110 mm and 242 mm thickness 3 / 3 mm	150 mm and 360 mm thickness 3/3 mm	150 mm (thickness 3mm) and 460 mm (thickness 4mm)	150 mm (thickness 3mm) and 460 mm (thickness 4mm)	
Overlap	1.5 times the Dia	1.5 times the Dia	1.5 times the Dia	1.5 times the Dia	At site sections shall be joined together by slip-stressed- fit method. No site welding or bolted joints shall be done to the mast.
Max. Dynamic loading to withstand Max. Wind pressure	As per IS 875 part 3	As per IS 875 part 3	As per IS 875 part 3	As per IS 875 part 3	Max. Dynamic loading to withstand Max. wind pressure
Opening of base door	175 X 500 mm	225x1050 mm	1200 X 250 mm	1200 X 250 mm	
Double internal lock	Yes	Yes	Yes	Yes	
Base plate	20 mm thick 320 X 320 mm	25 mm thick 520 mm Dia	25mm thick 670mm Dia	30 mm thick 670mm Dia	The welding connection of the base flange shall be fully developed to the strength of the entire section. The base flange shall be provided with supplementary gussets between the bolt- holes to ensure elimination of helical stress concentration.
Anchor plate	3 mm	5 mm	8 mm	8 mm	

2. Accessories	12.5 m	12.5 m	16 m	20 m	Remarks
Lantern Carriage arrangement	Hexagonal Lantern Carriage for 6 fittings symmetrically	Lantern carriage of 50 NB ERW Class-B M.S pipe covered with PVC sleeve suitable to carry 250 Kg load upto 6 fittings	Lantern carriage of 50 NB ERW Class-BM.S pipe covered with PVC sleeve suitable to carry 250 Kg load upto 8 fittings	Lantern carriage of 50 NB ERW Class-BM.S pipe covered with PVC sleeve suitable to carry 250 Kg load upto 8 fittings	Hot deep, in two halves with stainless steel bolts and lock type stainless steel nuts to ensure easy installation, lining with protective PVC arrangement. junction box of cast aluminium-weather proof
Raising and lowering mechanism	----	Yes	Yes	Yes	Completely self sustaining Winch fixed at the base without the need of brake shoe, spring or clutches. Gravity activated pawls. Gear ratio 53:1, with self lubricating oil bath
Head frame	Yes	Yes	Yes	Yes	Galvanised
MCB erected on PVC board	Yes	Yes	Yes	Yes	OF suitable rating.

3. Lighting protection - By G.I. single spike 1200mm at top
4. Trailing - PVC sheathed 5 X 2.5 Sq. mm copper cable
5. Winch - Double drum, oil bath (SAE 90/140) with lubrication arrangement
6. Wire rope - 2 Nos stainless steel wire rope 7/19, 6mm dia. Breaking load capacity 2400 Kgx2
7. Integral power tool - 3 Ph 1 HP 2m/ min single speed,
8. Torque limiter - Upto 500Kg adjustable
9. Aviation obstruction light - Twin dome with 2 Nos 100W GLS/LED lamp

Standards applicable:

a) I.S. 875 (part- III) 1987 - **Code and practice for design for structures**
b) BSEN10-025/DIN17100 - **Grades of M.S plates**
c) B.S 5135/AWS - **Welding**
d) B.S. ISO1461 - **Galvanising**
e) TR. No.7 2000 of ILE UK - **Specification for Mast and foundation**

Manufacturer of the Mast must have conducted wind tunnel test on their Mast sample.

Mode of Measurement:
Executed quantity will be measured on number basis (i.e. each)

B) Octagonal Poles (OPL)

Scope:
Specification No (OH-PL/OPL)

Supplying and erecting 9 m high galvanised octagonal pole details are as specified below.

Material:
9 m high galvanised Octagonal pole with details of given below.

Particulars	CSR Item No 8-3-3	CSR Item No 8-3-4
Material	Galvanised as per specification	Hot dipped galvanised as per specification BSEN ISO 1461
Top and bottom Dia. Thickness	100 mm A/F and 200 mm A/F thickness 3mm HT plate	70 mm A/F and 155 mm A/F thickness 3mm HT plate
Bracket	1500 mm long decorative sword type single arm bracket	1500 mm long decorative sword type double arm bracket

Method of construction:
The pole shall be erected in provided cement concrete foundation specially designed. Erection shall be in plum.

Mode of Measurement:
Executed quantity will be measured on number basis (i.e. each)

8.4 Brackets (BKT)

A) Pole Bracket (Cross arm) (OH-PL/BKT)

Scope:
Specification No (OH-PL/BKT)
Supply and erection of MS Pole Bracket for erection of L T insulators on provided pole.

Material:
Pole Bracket: MS pole bracket fabricated as per specifications in Table 8.4/1. Thickness and size of channel is to be checked from the steel table.

Table No 8.4/1
Details of Pole Brackets

Item No	Material of bracket	Length	No of insulator	No of insulator	Guarding Extension piece	Remark
8-4-1	**Angle iron 50x50x6 mm**	550 mm	2	2		**For LT guarding for vertical formation**
8-4-2	**Angle iron 50x50x6 mm**	750 mm	2	2		**For LT guarding for horizontal formation**
8-4-3	**ISMC Channel 75x40x 6.8 mm**	550 mm	4	4		**For LT 3 phase 4 wire vertical formation**

8-4-4	**ISMC Channel 75x40x 6.8 mm**	750 mm	5	5		**For LT 3 phase 5 wire vertical formation**
8-4-5	**ISMC Channel 75x40x 6.8 mm**	550 mm	2	2		
8-4-6	**ISMC Channel 75x40x 6.8 mm**	1100 mm	4	4		
8-4-7	**ISMC Channel 75 x40x 6.8 mm**	550 mm	2	2	300mm of same channel	
8-4-8	**ISMC Channel 75 x40x 6.8 mm**	1100 mm	4	4	300mm of same channel	

D' type Clamps: MS Flat of 50x6mm, 15 mm MS nut bolts
Paint: Silver paint, Red oxide paint

Method of construction:
The cross arm shall be made up of size of channel mentioned in above table. The length shall be as stated above table. The cross arm shall be complete with pole clamp of size 50X6 mm MS flat and holes required for pin / shackle insulator. For MS pole bracket with guarding extension, an extension piece of same size of length 300 mm shall be welded to bracket as per drawing attached herewith. The cross arm and pole clamp shall be painted with one coat of red oxide and two coat silver enamel paint any other colour paint (as per the instructions of engineer in-charge).
Cross arm shall be fabricated as per drawing no. OH-PL/BKT-1 (Fig.2 & Fig.3)

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Mode of Measurement: Executed quantity will be measured on number basis. (i.e. Each)

B) Vee Cross Arm (OH-PL/VCA)

Scope:
Specification No (OH-PL/VCA1)
Supplying Vee cross arm, suitable for 11 kV and necessary ancillary materials complete erection on provided pole with necessary painting as per specification and as per instructions from the site engineer.

Material:
Cross arm: Channel Iron cross arm
Hardware: G.I. nut bolts
Flat: MS flat 80 x 10 mm thick
Clamp: Two clamps made from MS flat of size 80 x 10 mm.
Paint: Red oxide, Silver paint.

Method of construction:
Fabricating the Vee cross arm for erecting Insulators with channel 75 x 40 mm with 4.4 mm thick web and 7.3 mm thick flange, length of 45 mm for base of insulator, vertical member of suitable length to maintain the clearance of 1220 mm, with angle of 60 degrees to horizontal and M.S. flat of 80 x 10 mm at centre of cross arm fixed to the pole by means of two M.S. clamps of 80 x 10 mm. M.S. flat with 15mm. dia bolts and nuts duly painted with one coat of red oxide paint and two coats of aluminium paint. Cross arm shall be fabricated as per drawing no. OH-PL/BKT-1 (Fig.1)

Detailed specifications of material of the items included in CSR are given in Table No 8.4/2.

Mode of Measurement: Executed quantity will be measured on number basis (i.e. each)

C) Vee Cross Arm (OH-PL/VCA)

Scope:
Specification No (OH-PL/VCA2)
Supplying Vee cross arm, suitable for 22 kV and necessary ancillary materials complete erection on provided pole with necessary painting as per specification and as per instructions from the site engineer.

Material:
Cross arm: Channel Iron cross arm
Hardware: G.I. nut bolts
Flat: MS flat 80 x 10 mm thick
Clamp: Two clamps made from MS flat of size 80 x 10 mm.
Paint: Red oxide, Silver paint.

Method of construction:
Fabricating the Vee cross arm for erecting Insulators with channel 75 x 40 mm with 4.4 mm thick web and 7.3 mm thick flange, length of 45 mm for base of insulator, vertical member of suitable length to maintain the clearance of 1530 mm, with angle of 60 degrees to horizontal and M.S. flat of 80 x 10 mm at centre of cross arm fixed to the pole by means of two M.S. clamps of 80 x 10 mm. M.S. flat with 15mm. dia bolts and nuts duly painted with one coat of red oxide paint and two coats of aluminium paint. Cross arm shall be fabricated as per drawing no. OH-PL/BKT-1 (Fig.1)

Detailed specifications of material of the items included in CSR are given in Table No 8.4/2.

Mode of Measurement: Executed quantity will be measured on number basis (i.e. each)

Table No 8.4/2
Details of Iron Cross Arm / Bracket as Per Item in CSR

Item No.	Item description	Size of channel	Clamps	Nut bolts
8-4-11	100X50 channel cross arm	100 x 50 mm. with 4.7 mm thick web and 7.5 mm thick flange channel X 2.7 m length	Two clamps of 50x6mm. M.S. flat	15mm. nuts and bolts
8-4-12	Vee-cross arm	made out of channel 75 x 40 mm with 4.4 mm thick web and 7.3 mm thick flange with clearance of 1220 mm. between the insulators as per drawing attached here with	Clamps of 75x10 mm of MS Flat	15mm. dia bolts and nuts
8-4-13	Vee-cross arm	100x50 mm with 4.7 mm thick web and 7.5 mm thick flange size suitable with clearance of 1530 mm. between the insulators	Clamps of 75x10 mm of MS Flat	15mm. dia. bolts and nuts
8-4-14	Channel with clamp for erection of 11/22 KV pin insulators	75x40 mm with 4.4 mm thick web and 7.3 mm thick flange channel	Clamps of 80x10 mm of MS Flat	with 3 sets screws
8-4-15	Channel bracket for guarding	channel iron 1600 mm. in length and 75x40 mm. with 4.4 mm. thick web and 7.3 mm thick flange	Clamps of 50x6 mm of MS Flat	15mm. dia nuts and bolts with 2 earthing clips, made from 25x3 mm
8-4-16	Angle iron bracket for guarding	Angle iron bracket 65 x 65 x 6mm. Angle 1600 mm. in length and 75x40 mm. with 4.4 mm. thick web and 7.3 mm thick flange	Clamps of 50x6 mm of MS Flat	15mm. dia nuts and bolts with 2 earthing clips, made from 25x3 mm

8.5 Conductors (CON)

A) All Aluminium Conductors (AAC) (OH-CON/AAC)

Scope:
Specification No (OH-CON/AAC)
Supply and erection of All Aluminium Conductors for overhead line.

Material:
Conductor: All aluminium stranded conductor (As per table 8.5/1)
Binding wire: 12 SWG aluminium binding wire
Clamps: PG clamps as per requirement

Method of construction:
At first the conductor is removed from bundle/drum straighten without knots, bends, etc.
Stringing of conductor shall be done with draw vice. Conductor shall not be twisted while stringing. Shackle insulators shall be used if the line deviates by 30 degrees or more, at terminal pole and at junction/ cut pole.
Parallel double groove clamp having two nut bolts designated to carry full line current shall be used for making Jumper wire connections.
On straight line the conductor shall be bounded on top groove of insulator and at angular position binding shall be done in side groove. Binding wire of 12 SWG shall be of the same metal as that of conductor.

Mode of Measurement:
For measurement purpose, sum of the total conductor including jumper connections shall be considered. (i.e. per km)

B) Aluminium Conductor Steel Reinforced (ACSR) (OH-CON/ACSR)

Scope:
Specification No (OH-CON/ACSR)
Supply and erection of aluminium conductor steel reinforced for overhead line.

Material:
Conductor: All aluminium conductor steel reinforced (As per table 8.5/1)
Binding wire: 12 SWG aluminium binding wire
Clamps: PG clamps as per requirement

Method of construction:
At first the conductor is removed from bundle/drum straighten without knots, bends, etc.
Stringing of conductor shall be done with drawing vice. Conductor shall not be twisted while stringing. Disc insulators shall be used if the line deviates by 30 degrees or more, terminal pole and tri-pole or four pole structure at terminal pole and at junction/ cut pole.
Parallel double groove clamp having two nut bolts designated to carry full line current shall be used for making Jumper wire connections. Universal parallel double groove clamp having two nut bolts shall be used for Tap Off point.
On straight line the conductor shall be bounded on top groove of insulator and at angular position binding shall be done in side groove. Binding wire of 12 SWG shall be of the same metal as that of conductor.

Mode of Measurement:
For measurement purpose, sum of the total conductor including jumper connections shall be considered. (i.e. per km)

Table No. 8.5/1
Conductor Specifications As Per I.S. 398/1961

Code Name of Conductor	Resistance at 20^0 ohm /km.	Approx. Current Carrying Capacity in Amperes.		Number of Strands / Diameter of each Strand in mm	Overall Diameter of Conductor in mm	Weight of Conductor (kg/km)
		At 40^0 C	At 45^0 C			
All Aluminium Conductor						
Rose	1.361	116	108	7/1.96	5.88	58
Gnat	1.071	133	123	7/2.21	6.63	73
Irish	0.850	150	138	7/2.48	7.44	92
Pansy	0.677	178	165	7/2.78	8.34	116
Ant	0.544	204	189	7/3.10	9.30	144
ACSR Conductor						
Squirrel	1.374	115	107	6+1/2.11	6.33	85
Weasel	0.911	150	139	6+1/2.59	7.77	128
Ferret 4.04	0.679	181	618	6+1/3.0	9.00	171
Mink 0.06	0.456	234	217	6+3.66	10.98	255
Raccoon	0.365	270	250	6+1/4.09	12.27	318
Dog 0.1	1.137	520	482	30+7/3.0	21.00	976

Table No 8.5/2

Minimum Clearance between Conductors
(IS: 4237-1967)

S.No.	Voltage level (kV)	Clearance in mm	
		Between Phases	Between Phase & Earth
7.	11	460	305
8.	22	610	460
9.	33	915	610
10.	110	1675	1000
11.	230	3350	1675
12.	400	4000	3500

8.6 Insulators (INS)

A) Porcelain Disc Type Insulator 11/22/33 kV (OH-INS/DI)

Scope:
Specification No (OH-INS/DI)

Supplying porcelain disc type insulator, suitable for 11/22/33KV and necessary ancillary materials and complete erection on provided cross arm / bracket and connected to the over-head line as per instructions from the site engineer

Material:
***Insulator*:** Distribution class Disc type insulator made from porcelain, suitable for specified voltage level, having ISI mark, with necessary hardware.
Hardware: Nuts, washers, etc.
Binding wire: Bare Copper wire or conductor.
***Clamps*:** *MS clamps.*

Method of construction:
Distribution class porcelain disc type insulator, suitable for specified voltage level, erected on provided cross arm or bracket with clamps, ancillary materials, and connected to the over-head line. Connection shall be made with bare copper wire of specified gauge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e. each)

B) Pin Type Insulator 11/22/33 kV (OH-INS/PN)

Scope:
Specification No (OH-INS/PN)

Supplying porcelain Pin type insulator, suitable for 11/22/33KV and necessary ancillary materials and complete erection on provided cross arm / bracket and connected to the over-head line as per instructions from the site engineer

Material:
Insulator: Distribution class Pin type insulator made from porcelain, suitable for specified voltage level, having ISI mark, with necessary hardware.
***Hardware*:** Nuts, washers, etc.
Binding wire: Bare Copper wire or conductor.
***Clamps*:** MS clamps.

Method of construction:
Distribution class porcelain pin type insulator, suitable for specified voltage level, erected on provided cross arm or bracket with clamps, ancillary materials, and connected to the over-head line. Connection shall be made with bare copper wire of specified gauge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e. each)

C) Post Type Insulator 11/22/33 kV (OH-INS/PST)

Scope:
Specification No (OH-INS/PST)

Supplying porcelain Post type insulator, suitable for 11/22/33KV and necessary ancillary materials and complete erection on provided cross arm / bracket and connected to the over-head line as per instructions from the site engineer

Material:
Insulator: Distribution class Post type insulator made from porcelain, suitable for specified voltage level, having ISI mark, with necessary hardware.
***Hardware*:** Nuts, washers, etc.
Binding wire: Bare Copper wire or conductor.
***Clamps*:** MS clamps.

Method of construction:
Distribution class porcelain post type insulator, suitable for specified voltage level, erected on provided cross arm or bracket with clamps, ancillary materials, and connected to the over-head line. Connection shall be made with bare copper wire of specified gauge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e. each)

D) Thyrite type Lightening Arrestor 11/22 kV (OH-INS/LA)

Scope:
Specification No (OH-INS/LA)

Supplying porcelain Thyrite type lightening arrestor, suitable for specified voltage level and necessary ancillary materials and complete erection on provided cross arm / bracket and connected to the over-head line as per instructions from the site engineer.

Material:

***Arrestor*:** Distribution class Thyrite type lightening arrestor made from porcelain, suitable for specified voltage level, having ISI mark.

***Hardware*:** Nuts, washers, etc.

Binding wire: Bare Copper wire or conductor.

***Clamps*:** MS clamps.

Method of construction:

Distribution class porcelain Thyrite type lightening arrestor, suitable for specified voltage level, erected on provided cross arm or bracket with clamps, ancillary materials, and connected to the over-head line. Connection shall be made with bare copper wire of specified gauge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e. each)

DRAWINGS

OH-1 : Overhead Line Distribution System
OH-2 : Overhead Line Distribution System

Chapter 9

EARTHING

9.1	**Plate, Pipe**	**EA-EP/**
9.2	**Accessories**	**No Specs**
9.3	**Drawings**	

9.1 Plate / Pipe type Earthing

A) Plate type Earthing (With or Without CI Cover, Funnel, etc) (EA-EP)

Scope:
Specification No **(EA-EP)**

Supplying and erecting galvanised cast iron / copper earth plate type / G.I. pipe type earthing **with / without C.I. cover** as per instructions from the site engineer.

Material:
Earth Plate: Galvanised cast iron / Copper earth plate or G.I. pipe as per specifications given in Table No 9.1/1.
CI Cover: As per specifications given in Table No 9.1/1.
Earthing Conductor: Copper/G.I strip/Annealed bare copper wire/G.I. earth wire of size as per specifications given in Table No 9.1/1.
GI Pipe: As per specification **(CW-PLB/GP)** mentioned chapter no. 17.5 for watering, and as enclosure for Earth wire, refer specifications given in Table No 9.1/1.
Hardware: Screw / nut bolts with required washer of dimensions, Rawl plug / clip/ 'U' nails and material as per specifications given in Table No 9.1/1.
Filling material: Coal /Charcoal/ salt as per specifications given in Table No 9.1/1.
as per specifications given in Table No 9.1/1.
Lugs: As per specification **(CB-LG/AL, CB-LG/CU)** mentioned chapter 7.9 & 7.10 Copper/ Aluminium lugs as per specifications given in Table No 9.1/1.

Method of construction:
Pit is to be dug of required dimension and depth for the earthing at site, and laying of Galvanised cast iron / Copper earth plate or G.I. pipe shall be as per Table No 9.1/1. The earth connection to equipment/ switch gear and earthing electrode shall be connected as shown in the diagram and as per IS 3043 amended up to-date. The connections shall be made either by strip or double run of earth wire with drilling, welding, riveting, brazing and nut bolting to plate or pipe, where ever required in an approved manner. As far as possible continuous strip shall be used, but where ever jointing of strip is unavoidable, the overlap portion must not be less than $2^{1/2}$ times the width of the strip either welded/ brazed/soldered by all sides or 6 inches overlap with two nut bolts/ riveting of adequate size with required washer and covered by anti-corrosive paint as per approved jointing practice in the industry and as per directives from site engineer in charge.
Pit shall then be filled with screened soil with alternate layer of coal and salt, and if, necessary brick masonry work (Where ever applicable) shall be done as specified in IS: 3043, with laying wires in PVC/ G.I. pipe and watering arrangement as per drawing no EA-1 and covered with C.I. Cover (Where ever applicable).
Where ever requires or as specified by Site Engineer, a Test link shall be provided for facilitating the testing of resistance of earth electrode.

Testing:
The value of each earth electrode shall be measured by earth tester in presence of site Engineer and record to be submitted.

Mode of Measurement: Executed quantity will be measured on number basis (i.e. each)

Table No 9.1/1
Detailed Specifications of various types of Earthing

Type of earthing ---------->		Galvanised cast iron earth plate type without C.I cover	Copper earth plate type with C.I cover	Galvanised cast iron earth plate type with C.I cover	Pipe type earthing with out C.I cover
S.No.	**Particulars**				
1)	**Depth from top of plate Up to Ground level**	1.5 m	1.5 m	1.5 m	1.5 m
2)	**Size & type of material for pipe / Plate type earthing.**	Cast iron earth plate size 60x60x0.6 cms	Copper earth plate size 60x60x0.6 cms	cast iron earth plate size 60x60x0.6 cms	'B' grade G.I. pipe 40mm. dia. 2.5 mtr. Long or 20 mm dia. G.I. Rod
3)	**Salt/charcoal**	30 Kg. charcoal and salt each	30 Kg. charcoal and salt each	40 Kg. charcoal and salt each	N A
4)	**Type of Wire**	Double G.I. wire 8 SWG	Double G.I. 8 SWG	Double G.I. 6 SWG	double G.I. 8 SWG
5)	**Wire enclosure**	12mm. dia. G. I. pipe 2 mtr. Long	12mm. dia. G. I. pipe 2 mtr. Long	12mm. dia. G. I. pipe 2.5 mtr. Long	N A
6)	**Nut bolts**	12 mm dia. Cadmium / GI	12 mm dia. Cadmium / GI	12 mm dia. Cadmium / GI	N A
7)	**Washers**	GI	GI	GI	N A
8)	**Watering pipe**	19mm. dia. G.I. pipe	19mm. dia. G.I. pipe	19mm. dia. G.I. pipe	N A
9)	**Lugs**	Yes	Yes	Yes	Yes
10)	**funnel**	No	yes	yes	N A
11)	**Brick Masonry**	No	yes	yes	N A

B) **Low Impedance Earthing (Pipe in pipe technology) (EA-EPP)**

Scope:
Specification No (EA-EPP)

Supplying and erecting approved type earthing system with **Pipe in pipe technology** with necessary ancillary materials and complete erection as per instructions from the site engineer

Material:
GI Pipe: As per specification no. **(CW-PLB/GP)** mentioned chapter 17.5;
1. 50 mm dia x 3 meter long (In place of traditional GI pipe Earthing), for LV / MV applications.

Or

2. 80 mm x 3 meter long (In place of traditional copper plate Earthing), for HV/EHV applications.

Earthing Conductor: G.I strip/GI earth wire of size as per specifications given in Table No 9.1/1.
GI Pipe: As per specification no. **(CW-PLB/GP)** mentioned chapter 17.5 for watering and as enclosure for Earth wire, as per specifications given in Table No 9.1/1.
Hardware: Screw / nut bolts with required washer of dimensions, Rawl plug / clip/ 'U' Nails and material as per specifications given in Table No 9.1/1.
Filling material: Coal /Charcoal/ salt as per specifications given in Table No 9.1/1. as per specifications given in Table No 9.1/1.
Lugs: As per specification no. **(CB-LG/AL, CB-LG/CU)** mentioned in chapter 7.9 & 7.10 for Copper/ Aluminium lugs and as per specifications given in Table No 9.1/1.

Method of construction:
Earthing Pipe in pipe technology with ancillary materials shall be done by digging an 8" / 10" dia hand bore 10.5' deep sufficient to install the electrode in normal soil conditions. The space between the soil and the electrode is filled up with electrolyte material mixed with the dug out mother soil, along with water and tightly packed up to the base of the terminal. In rocky areas and under hard soil and sandy soil conditions the method of installation will be as specified by manufacturer. Installation shall include drilling, welding, reverting, brazing and nut bolting pipe when ever required in an approved manner with required material such as nut bolts and washer etc. and with necessary brick masonry work as per the specification. (As per IS 3043 amended up to-date). As far as possible continuous GI strip shall be used but when ever jointing of strip is un avoidable, the jointing over lap portion must not be less than $\mathbf{2^{1/2}}$ times the width of the strip either welded/ brazed/soldered by all sides or overlap of 6 inch with two nut bolts/ riveting of adequate size with required washer and covered by anti corrosive paint as per approved jointing practice in the industry and as per directives from site engineer in-charge.

Testing:
The value of each earth electrode shall be measured by earth tester and record to be submitted. (Also refer drawing No. EA-2)

Mode of Measurement: Executed quantity will be measured on number basis i.e. each

Chapter 10

SUB STATION

10.1	**Transformer**	**SS-TR**
10.2	**Accessories**	**No Specs**
10.3	**Drawings**	

Chapter 10 **Sub Station** **(SS)**

10.1 Transformer (TR)

Scope:
Specification No (SS-TR)

Supplying and erecting AC three phase 11or 22 kV/0.44 kV, 50 Hz, oil immersed and naturally cooled indoor/outdoor type copper wound distribution transformer of specified capacity, connected delta on HV side and star on LV side with additional neutral brought out on load side.

Recommended standards:
The following list shows Indian Standards which are acceptable as good practice and accepted standards.

IS 335: 1963	Dielectric Strength
IS 2026 part I 1977	Specification for Transformer
IS 2026 part II 1977	Specification for type of cooling and permissible temp. rise of transformer
IS 2026 part III 1981	Specification for insulation level and dielectric strength of transformer
IS 2026 part IV 1977	Specification for terminal marking tapping and connections
IS 1180 part I 1989	Specification for outdoor type three phase distribution transformer
IS 10028 Part I 1985	Code of practice for selection installation and maintenance of transformers
CBIP/TAC Manuals	

Material:
1. Copper wound Transformer with Delta connection on HV side and star connection on LV side complete with Manufacturer's test certificates
2. Standard mountings required for transformer are shown below. The mountings are to be selected from them and any additional if required.

- Off load tap changing
- Oil conservator with fitting holes and cap and plain oil level gauge
- Silica gel dehydrating breather
- Oil drain valve
- Thermometer pockets
- Oil filter valve
- Lifting arrangement
- Two earthing terminals
- Diagram and rating plate
- Four bi directional plain rollers
- Air vent
- Explosion vent
- Terminal arrangement
- Bushing with lugs and/or cable end box on LV side
- HV cable end box and/or HV bushing

The transformer losses shall be as mentioned in Table No 10.1/1

Method of Construction:
The contractor should intimate name of manufacturer and make of the Transformer and location of the manufacturer factory to engineer in charge prior to delivery of the transformer. After manufacturing of the transformer, the agency/contractor shall intimate the engineer-in-charge for carrying out the inspection.
After receipt of intimation engineer-in-charge or his representative should inspect the Transformer at manufacturer factory and shall carry out the following tests jointly in presence of concern contractor.
1) Open Circuit test
2) Short Circuit test
3) Specific Resistance Test
4) Insulation Resistance of HV, LV, in between HV and LV, Winding and Body.
5) Dielectric Strength and acidity test of Transformer oil.

The test results of joint inspection shall be recorded on the test report of Transformer with its Sr. No. prior to delivery of the Transformer to site.
Necessary work of plinth and or for D.P. structure with D.O. set, L.A., A.B. switch should be completed before dispatch of the transformer. The channel arrangement on plinth is to be done. Earthing arrangement should be completed. The Transformer should be installed on plinths / double pole structure/floor by arranging chains pulley block, crane etc as per IS Norms.
After installation of Transformer the stopper/lock should be provided to rollers of the Transformer.
The connection of H.T/L.T. side should be completed by provided Copper wire/ cable with necessary lugs to avoid loose connection. The earthing (2 Nos for Neutral & 2 Nos for Body) should be connected from distinct electrodes. The earthing should be connected by lugs/proper size of strip.
The Engineer in charge or his representative should check all connections on H.T. side, L.T. side and earths and insulation and earth résistance test should be carried out and results obtained shall be recorded. .

Statutory Permissions to be obtained by the Agency/Contractor:
Before commencement of work, the drawings of installation shall be got approved from the Electrical Inspector, I E & L Department.
The installation should be got inspected from Electrical Inspector and obtain written permission to charge the Transformers.

Commissioning:
After above formalities the Transformer, should be charged/commissioned in presence of Engineer in charge or his representative along with load trials and shall be handed over to the department for beneficial use
After charging the Transformer, line, phase voltages and line current shall be measured, and the same shall be submitted.
Following test certificates shall be submitted:

1. Manufacturer's original certificate of Transformer as stipulated in IS.
2. Test certificate for dielectric strength of oil as per IS.
3. Test results of IR values.
4. Test results of all earth electrodes.
5. Readings of Voltages & currents at the time of commissioning.

Table No 10.1/1

Capacity wise maximum losses of Transformers

Sr. No.	Transformer Rating kVA	Voltage Ratio in kV	Winding	(At 75°C) Losses at No Load (Watts)	(At 75°C) Losses at 50 % Load (Watts)	(At 75°C) Losses at 100 % Load (Watts)	Short Circuit Current Amp
1	63	11/0.433	Cu	155	380	1250	
2	63	22/0.433	Cu		362	1193	
3	63	11/0.433	Al	180		1235	84
4	63	22/0.433	Al				
5	100	11/0.433	Cu	220	520	1800	
6	100	22/0.433	Cu		495	1717	
7	100	11/0.433	Al	260		1765	133.34
8	100	22/0.433	Al				
9	160	11/0.433	Cu	400		2400	
10	160	22/0.433	Cu				
11	160	11/0.433	Al				
12	160	22/0.433	Al				
13	200	11/0.433	Cu	500		3000	
14	200	22/0.433	Cu				
15	200	11/0.433	Al	500		3000	266.67
16	200	22/0.433	Al				
17	250	11/0.433	Cu	550		3600	
18	250	22/0.433	Cu				
19	315	11/0.433	Cu	580		4200	420.02
20	315	22/0.433	Cu				
21	500	11/0.433	Cu				
22	500	22/0.433	Cu				
23	630	11/0.433	Cu	1000		7000	840.04
24	630	22/0.433	Cu				

10.2 Accessories (AS)

A) Fencing for Sub Station (FSG)

Scope:

Specification No (SS-AS/FSG)

Supplying and erecting fencing of section having size **2450 mm** in height from ground level and **1200 mm** width with angle iron frame work, erected in foundation, and painted.

Material:

Fabrication material: ISI mark 50x50x6 mm angle iron, Iron studs/Spikes 10 mm thick with arrow head, 25x6 mm MS flat iron.
Chain link Jali: Jali made from hard GI wire 10 SWG/3.26 mm dia.
Foundation material: Cement, Sand, Water.
Paint: Aluminium paint, Red oxide.

Method of Construction:
The fencing shall be fabricated as per drawing no. ….. The fencing section shall be **2450 mm in height from finished ground level and 1200 mm** in width. The square jali shall be welded from inside of the angle iron frame measuring 2200mm (1800 mm for fencing frame + 400 mm for embedding in cement concrete foundation) in height and 1200 mm in width. On top the frame iron studs of minimum 150 mm in height with arrow head shall be welded with spacing of minimum 300 mm. Supports made from MS flat iron shall be welded width wise on the top the jali from inside the frame at top, middle and at the bottom. The entire structure shall be erected in plumb. After the entire fabrication, fencing shall be painted with one coat of red oxide and two coats of aluminium paint. (Overall size of doors shall be 1800 mm height x 3000 mm wide)

Mode of Measurement: Executed quantity will be measured on number basis. (i.e each)

B) Double leaf door for Sub Station (DLD)

Scope:

Specification No (SS-AS/DLD)

Supplying and erecting double leaf hinged door each 1500 mm in width x 1800 mm in height using B Class GI pipe with angle iron supports, chain link jali, complete supported on channel iron, erected in foundation, and painted.

Material:
GI Pipe: ISI mark, 25 mm diameter as per **(CW-PLB/GP)** for chapter 17.5
Fabrication material: ISI mark 45x45x5 mm angle iron, Iron studs/Spikes 10 mm thick with arrow head.
Channel iron: ISI mark 100x 50mmx 5mm.
Chain link Jali: Jali made from hard GI wire 10 SWG/3.26 mm dia.
Foundation material: Cement, Sand, Water.
Paint: Aluminium paint, Red oxide.

Method of Construction:

The door shall be fabricated as per drawing no. ….. The door section shall be **1800 mm in height from finished ground level and 1500 mm** in width. The door frame shall be fabricated from B class GI pipe 25 mm in diameter, with chain link jali welded into the frame. The jali shall be supported with cross bracing the 45x45x5 mm angle. The door shall be supported to the channel with hinges welded to door frame and the channel. On top the frame iron studs of minimum 150 mm in height with arrow head shall be welded with spacing of minimum 300 mm. The total length of the channel shall be minimum 2200 mm. The channel shall be embedded in cement concrete foundation. The doors shall have locking arrangement for restricting unauthorized entry and the lock shall be with minimum 6 levers with duplicate keys. The entire structure shall be erected in plumb. After the entire

fabrication, fencing shall be painted with one coat of red oxide and two coats of aluminium paint.

Mode of Measurement: Executed quantity will be measured on number basis. (i.e each)

DRAWINGS

SS-1 : 22kv Plinth mounted substation
SS-2 : 22kV Pole mounted susbstation
SS-3 : Layout of Plinth mounted substation with feeder pillar
SS-4 : Layout of Plinth mounted substation with LT panel room
SS-5 : Layout of Plinth mounted substation with 4 pole structure for 2 transformers
SS-6 : Layout of Partial outdoor substation
SS-7 : Layout of Indoor substation for one transformer
SS-8 : Layout of Indoor substation for two transformers
SS-9 : 22kV Metering cum isolator panel
SS-10 : 11kV Earth pits & connections

Chapter 11

GENERATORS

11.1	**Generators**	**GEN-GEN**
11.2	**AMF Panel**	**GEN-AMF**
11.3	**Acoustic Enclosure**	**GEN-ACS**
11.3	**Drawings**	

Chapter 11 **Generators (GEN)**

11.1 Generators

A) Portable Generator (PG)

Scope:
Specification No (GEN-PG)

The work includes supplying, erecting, final testing, putting in to operation and handing over of the complete system of portable generator set with petrol start & Kerosene run suitable to give specified output at 220 V +/-13 volts A. C. with accessories like tool kit and comprehensive maintenance of the installation up to 1 year from date of commissioning.

Material:
Portable generator suitable to give output 1400 VA/ 2000 VA output Generator with built in voltmeter, non fuse circuit breaker, along with one set of tool kit comprising of one spanner, screw driver spark plug opener & Oil, fuel etc.
Portable Generator shall be of standard design and of original manufacturer with petrol start and kerosene run engine of 4 stroke, single cylinder, TCI ignition system, centrifugal governor, air cooled, semi dry type air cleaner and recoil starter, noise suppressor, oil alert system, with blushless, self exciting, two pole, rotating field type and with "E" class insulation alternator suitable to give specified output, duly tested at full load for continuous 2 hours with first filling of oil and fuel.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

B) Diesel Generator (DG)

Scope:
Specification No (GEN-DG)

Providing D.G. Set at site, carrying out all preparatory works, assembling, installing, making adjustments, confirming all pre-commissioning requirement as per manufacturer's instructions, commissioning, final testing, putting in to operation and handing over of the complete system of D.G. set including inspection from inspectorate office. The work include necessary minor Civil works including opening on wall/Slab/floor and making good as it was etc. & comprehensive maintenance of the DG set for 1 year from date of commissioning.

Material:
Diesel Generator set with continuous rating, 3 Phase, 415 V., 50 Cycles A.C. supply of specified capacity, comprising of totally enclosed air/water cooled diesel engine with standard control panel & tool kit. (Refer drawing no. GEN-DG-1 & GEN-DG-2)

Diesel Engine:

The engine shall be of standard design of original manufacturers. It should be a totally enclosed air/water cooled Diesel engine with 4 stroke multi cylinders developing suitable BHP (As per Table 11/3) for giving power rating of (As per table 11/3) at the load terminals of alternator at 1500 R.P.M., at armature temperature of 40^0 C for height at 1000 Meter above M.S.L. at 50% R.H. The engine shall be capable of delivering specified power at variable loads for P.F. of 0.8 (lag) with 10% over load available in excess of specified output for one hour in every 12 hours. The average load factor of the engine over period of 24 hours shall be 0.85 for power output. The engine shall confirm to IS: 10000 and Amended up to date.
The engine shall be fitted with following accessories:-

1) Dynamically balanced fly wheel.
2) Necessary flexible coupling and guard for alternator and engine applicable
3) Lubricating oil cooler
4) Air cleaner Dry/Bath type
5) Lubricating oil pressure gauge
6) Lubricating oil filter with replicable element

7) Dry exhaust manifold with suitable exhausts heavy duty residential type exhaust silencer and vertical hot air duct both logged with asbestos rope exhaust piping of required length to reduce noise level.

8) 12/24 V. Electric starting equipment complete with standard batteries, dynamo, cut-out, ammeter, necessary wiring, self starter etc. The system shall be capable of starting D.G. set within 20 to 30 second even in winter condition with an ambient temperature down to 0^0 C.

9) Mechanical Governor of Class A2 for up to and including 200 KVA capacity and electronic governor of Class A1 for capacity above 200 KVA shall be provided as per standard design of manufacturer. Governor shall be a self contained unit capable of monitoring speed.

10) Radiator

11) Daily fuel Tank

Daily fuel service tank of minimum capacity as per Table 11/1, below, fabricated from M.S. sheet with inlet, outlet connections air vent tap, drain plug and level indicator (gauge) M.S. fuel piping from tank to engine with valves, unions, reducers, flexible hose connection and floor mounting pedestals, twin fuel filter. The location of the tank shall depend on standard manufactures design.

Table 11/1

Minimum capacity of Daily fuel tank for Generators

Sr. No	Capacity of D.G. set	Minimum Fuel Tank Capacity
1.	Up to 25 KVA	100 Liters
2.	Above 25 KVA to 62.5 kVA	120 Liters
3.	Above 62.5 KVA to 125 KVA	225 Liters
4.	Above 125 KVA to 200 KVA	285 Liters
5.	Above 200 KVA to 380 KVA	520 Liters

Engine Control Panel:

Engine control panel should be fitted with following accessories/indicators and shall have display:-

- Start/stop key switch
- Lube oil pressure indication
- Water temperature indication
- RPM indication
- Engine Hours indications
- Battery charging indication
- Low lube oil trip indication
- High water temperature indication
- Over speed indication

Battery Charger:

The battery charger shall be of Trickle & Boost type, and suitable to charge required numbers of batteries at 12V/ 24 Volts complete with, transformer, rectifier, charge rate selector switch, indicating ammeter, voltmeter, battery over charging protection with audible alarm. Connections between the battery charger & batteries shall be provided with suitable copper leads with lugs.

Battery:

Battery capacity and copper cable sizes for various engine capacities shall be as per the details given in Table No 11/2. Cable sizes shown are for maximum length of 2m length, if higher size of cable is required, it shall be selected in such a way that voltage drop does not exceed 2 V.

Table 11/2
Battery Capacity and Copper Cable Sizes for Various Engine Capacities

S.No.	D G Set Capacity	Battery Capacity (AH)	Copper Cable size in mm^2	Electrical System (Voltage)
1.	Upto 25 kVA	88	35	12
2.	Above 25 kVA upto 62.5 kVA	120	50	12
3.	Above 62.5 kVA upto 82.5 kVA	150	50	12
4.	Above 82.5 kVA upto 125 kVA	180	50	24
5.	Above 125 kVA upto 500 kVA	180	70	24

For AMF applications, a static battery charger working on mains supply recommended to keep the batteries charged at all times.

Alternator:

Alternator of specified rating, 415 Volts, 1500 RPM, 3 Ph, 50 HZ, A/c Supply with P.F 0.8 lagging at 40^0 C armature temperature for height 1000 mtr. Above MSL at 50 % R.H. alternator shall be brush less type self regulated having static excitation system having capacity of desired output confirming to IS: 4722-1968 with automatic voltage Regulation + 5% operated voltage from no load to full load, two numbers of earth terminal on opposite sides. Terminal box shall be suitable for underground cables and same shall be with stand mechanical and thermal stresses developed due to any short circuit at the terminals. The alternator shall be in accordance with following standards:-

IS: 4722 The performance of rotating electrical machines
IS: 4889 Rules for method of declaring efficiency of electrical machines
IS: 13364 Part I 1992 Alternator-voltage Regulation up to 20 KVA
IS: 13364 Part II 1992 Alternator Voltage regulation above 20 KVA to 80 KVA

Performance:

Voltage dip shall not exceed 20 % of the rated voltage for any step load or transient load as per IS: 8528 (Part I). The winding shall not develop hot spots exceeding safe limits due to unbalance of 20% between any two phases from no load to full load.
The performance characteristics of the alternator shall be as below:-

(a) Efficiency at full load o.8 P.F.
(i) Up to 25 KVA- not less than 82 %
(ii) Above 25 KVA and up to 62.5 KVA- not less than 86 %
(iii) Above 62.5 KVA/upto 250 KVA- not less than 90 %
(iv) Above 250 KVA- not less than 93 %
(b) Total Distortion factor Less than 3 %
(i) 10 % Overload One Hour in every 12 hrs of continuous operation
(ii) 50% overload 15 seconds.

Common Base Plate:

Engine and alternator shall be coupled by means of flex plate/flexible coupling as per manufacturer standard design and both units shall be mounted on a common base plate together with all auxiliaries to ensure perfect alignment of engine and alternator with minimum vibrations. The base plate shall be suitable for installation on suitable anti-vibration mounting system comprising of 6 anti-vibration pads duly provided.

Control Panel:

Floor/wall mounted control panel Box comprising of voltmeter, ammeter, selector switches MCCB/MCB of adequate capacity, indicator lamp duly wired with HRC fuses. Alternator &

control panel shall be connected with provided suitable capacity armored cable with necessary cable glands & lugs etc.

Exhaust system:

It shall comprise of following parameters:-
Exhaust system should create minimum back Pressure.
Smooth bends shall be used for minimizing the back pressure.
Minimum number of bends shall be used for minimizing the back pressure.
Pipe sleeve of larger diameter should be used while passing the pipe through concrete wall & gap shall be filled with felt lining.
Exhaust piping inside the Acoustic enclosure / Generating set room should be lagged with asbestos rope and covered with aluminum sheet cladding to avoid heating of the area.
Class 'B' MS pipes and long bend/elbows should be used.
The exhaust outlet should be in the direction of prevailing winds and should not allow exhaust gases to enter air inlet / windows, etc.

Factory Testing:

DG set shall be tested in presence of Engineer in charge or his authorized representative in the factory for following before dispatch;

- Full load trial for 12 hour. Fuel, lubricating oil, etc shall be arranged by the agency.
- 10% overload trial for one hour within 12 hrs test.

Certificates:

- Manufacturer's test certificates for Engine, Alternator and of the set.
- Necessary certificate for the engine model so selected along with compliance of noise and emission norms as per latest CPCB guidelines for D.G. set should be furnished from the manufacturer along with manufacturer's technical details.
- Permission from Electrical Inspector.

Method of Construction:

The DG Set with canopy shall be erected with due care and ensuring the perfect level with the help of Sprit level, on provided cement concrete foundation and connecting the provided earthing connections. The exhaust system shall be connected to the exhaust manifold. After ensuring the filling of fuel, lubricating oil and medium of coolant, the set shall be commissioned, with giving necessary full load trials or with the available load at site. The set shall then be handed over to the department along with the installation report given by the manufacturer and with all the necessary certificates and permissions obtained.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

Table No 11/3

Rating of Alternator and minimum BHP of Engine

S No.	KVA Capacity of Alternator	Minimum BHP of Diesel Engine	Average Fuel consumption litre per hour at 100 % Load
1	10	12	3.0
2	15	19	4.1
3	20	26	6.0
4	25	32	6.4
5	30	42	8.3
6	40	50.5	10.3
7	50	65.8	13.0
8	62.5	76	15.6
9	75	91	16.0
10	82.5	102	18.6
11	100	127	22.8
12	125	154	28.0
13	140	166	30.0
14	160	198	34.3
15	180	235	40.0
16	200	254	44.0
17	250	313	54.0

11.2 Automatic Mains Failure Panel (AMF)

Scope:

Specification No (GEN-AMF)

The work includes supplying, installing, Testing & commissioning of automatic mains failure control panel including auto by-pass, suitable for specified rating of DG Set complete with accessories **and comprehensive maintenance of the panel up to 1 year from date of commissioning.**

AMF Panel shall comply following IS specification:

IS: 2147 1962	Degree of protection.
IS: 4722	H.V. testing for panel

Material:

Panel shall consist of following:

Power module a pair of electromechanically interlocked contactors for all the phase / phases & neutral. (For mains & generator)

Overload relay for generator contactor, neutral contactor for mains and generator.

Control and Metering module: Line voltage monitor. Generator voltage monitor, Ammeter, 3 times attempt to start facility.

MCB/MCCB of suitable rating for auto/manual operation. Auto/manual switch.

Emergency stop push buttons.

Manual start push button.
Frequency meter.
Engine hour and RPM meter. (Taco meter)
Two earthing studs.
Protection module: The engine shutdown in the unlikely event of low lube oil pressure, high cylinder head temperature, high water temperature (For water cooled engine)
Indicators with alarm for Full/ Maximum Load on generator.
Indicators for Load on mains, Load on D.G. set, Engine fails to start, Emergency stop.
Battery charger complete with transformer/ rectifier, D.C Voltmeter and Ammeter, selector switch for trickle, off, and boost charging and current adjustment.
Main supply failure monitor.
Timers.
Fault reset push button.

Method of Construction:

AMF Panel complete with relays, timers, set of CT's for metering & protection and energy analyzer to indicate currents, phase and line voltages, frequency, power factor, KWH, KVARH & provision for overload, short circuit, fault, under frequency, control cabling from AMF panel to diesel engine and elsewhere if required, complete with metering as per material list.

System Operation:

The above-mentioned facilities provided shall be functional for following operational requirements:

1. Auto Mode

- A line voltage monitor shall monitor supply voltage on each phase when the mains supply voltage fails completely or falls below set value (variable between 80 to 95 % of the normal value) on any phase, the monitor module shall initiate start-up of diesel engine. To avoid initiation due to momentary disturbance, a time delay adjustment between 0 to 5 second shall be incorporated in start-up intimation.
- A three attempt starting facility shall be provided 6 seconds ON, 5 seconds OFF, 6 seconds ON, 5 Seconds OFF, 6 seconds ON. If at the end of the third attempt, the engine does not start it shall be locked out of start and a master timer shall be provided for this function, suitable adjustment timers are to be incorporated which will make it feasible to vary independently ON-OFF setting periods from 1-10 seconds, if alternator does not build up voltage after the first or second start as may be the case, further starting attempt will not be made until the starting facility is reset.
- Once the alternator has built up voltage, the alternator circuit breaker shall close connecting the load to the alternator. The load is now supplied by the alternator.
  When the main supply is restored and is healthy as sensed by the line voltage monitor setting, both for under voltage or unbalance, the system shall be monitored by a suitable timer which can be set between 1 minute to 10 minutes for the load to be transferred automatically to main supply.
- The panel shall start the set in the event of fault condition of under voltage, over voltage, phase reversal, high frequency, neutral snapping, short circuit, etc., on the mains side. If the above fault condition arises if the load is being fed from the DG Set, then the panel start cut off the load from the set with an audible alarm, and the set shall run on no load.

2. Manual Mode:

- In a manual mode, it shall be feasible to start-up the generator set by the operator on pressing the start push button.
- Three attempts starting facility shall be operative for the start-up function.
- Alternator circuit breakers closing and trip operations shall also be through operator only by pressing the appropriate button on the panel and closed shall be feasible only after alternator has built up full voltage.

3. Test Mode:

- When under test mode, pressing of test button should complete the start up sequence simulation, and engine shall be started.
- Engine shall build up voltage but the set shall not take load by closing alternator circuit breaker when the load is on the mains, monitoring performance for voltage/ frequency etc. shall be feasible without supply to load
- If during test mode, the power supply has failed, the load shall automatically get transferred on DG Set.
- Bringing the mode selector to auto position shall shut down the set provided main supply is ON if the mains supply is not available at that time, the alternator shall take load.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

11.3 Acoustic Enclosure (AEC)

Scope:

Specification No (GEN-AEC)

The Work includes supplying & erecting the Acoustic Enclosure (Canopy) fabricated from CRCA sheet of specified gauge, suitable for indoor / outdoor installation exposed to weather conditions & to limit overall noise level to 75 dB at distance 1 meter from the enclosure as per CPCB / MPCB norms under free field condition.

Material:
Acoustic enclosure (canopy) shall be fabricated out of the CRCA sheet of thickness not less than 1.6 mm on the outside cover with inside cover having not less than 0.6 mm thick perforated power coated CRCA sheet.

Method of Construction:
The construction of Acoustic enclosure (canopy) should be such that, it shall prevent entry of rain water splashing into the enclosure, and shall allow free & quick flow of rain water to the ground in the event of heavy rain.
The detailed construction shall confirm to the details as under:-
The hinged doors shall be made from not less than 16 SWG (1.6 mm) thick CRCA sheet and will be made air tight with neoprene rubber gasket and heavy duty locks.
All sheet metal parts should be processed through 7-tank process.
The enclosure should be powder coated.
The enclosure should accommodate the daily service fuel tank of the D.G. set to make the system compact.
There should be provision of fuel gauge, which should show the level of the fuel even when the DG set is not running. The gauge should be calibrated. The fuel tank should be filled from the out side as in automobiles and should be with a lockable cap.
The batteries should be accommodated in the enclosure in battery rack.
The canopy should be provided with high enclosure temperature safety device.
The acoustics lining should be made up of high quality insulation material/ glass / mineral or rock wool of minimum 50 mm thickness and shall be of 75 kg/m^3 to 100 kg/m^3 density for sound absorption as per standard design of manufacturers to reduce the sound level as per CPCB norms. The insulation material shall be covered with fine glass fiber cloth and would be supported by perforated MS sheet duly powder coated.
The enclosure shall be provided with suitable size and No. of hinged type doors along the length of the enclosure on each side for easy access inside the acoustic enclosure for inspection, operation, and maintenance purpose. Sufficient space will be provided inside the enclosure on all sides of the D.G. set for inspection, easy maintenance, and repairs.
The canopy should be as compact as possible with good aesthetic look
The complete enclosure shall be of modular construction.
The forced ventilation shall be as per manufacturer design using either engine radiator fan or additional blower fans. If the acoustic enclosure is to be provided with forced ventilation then suitable size of axial flow fan with motor (Auto-start arrangement) and suitable size of axial flow exhaust fan to take the hot air from the enclosure complete with necessary motors and auto start arrangement should be provided. The forced ventilation arrangement should be provided with auto stop arrangement to stop after 5 minutes of the stopping of D.G. sets.
The acoustic enclosure should be suitable for cable connection through bus-trucking. Such arrangements on acoustic enclosure should be water proof and dust-proof conforming to IP-65 protection.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each)

Chapter 12

WATER PUMPS

12.1	**Centrifugal**	**WP-CGP/**
12.2	**Ejecto type Water Pump**	**WP-EJP/**
12.3	**Submersible Pumps for Bore wells**	**WP-SMP/**
12.4	**Submersible pumps for Open well**	**WP-OSP**
12.5	**Accessories**	**No Specs**
12.6	**Drawings**	

12.1 Centrifugal Pump (CGP)

General:
This part of the specifications deals with providing, installing, testing & commissioning of Centrifugal pump.
All material shall conform to relevant standard as per BIS and shall carry ISI mark.
Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W. Dept. Handbook/NEC.

Scope:
Specification No (WP-CGP)

Providing, installing, testing & commissioning of ISI mark Centrifugal water pump (Monobloc), of required HP with specified discharge and head with required size of suction & delivery, foundation bolts grouted in provided cement concrete. (As Per IS: 9079 specifications)

The following list records those Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code

Material:
Pump Body: Cast iron Grade FG 200 of IS 210 -1978
Impeller: Cast iron Grade FG 200 of IS 210 -1978
Shaft: High grade carbon steel Grade C-40 of IS 2073
Bearings: Stainless Steel
Motor: Squirrel cage induction.
Protection class: IP 55 TEFC with Class "F" insulation, with copper windings operated on Single phase, 250 V / Three phase 415 V, 50 Hz, AC, Supply, with 2900 RPM. IS: 325
Base plate: Mild steel
Foundation Nut Bolts: Mild steel
Shaft seal: Fitted with high quality mechanical seal ensuring zero leakage

Method of Construction:
Pump mounted with motor on base plate, shall be placed on provided foundation with perfect alignment, proper leveling. The pump should be connected to suction & delivery in an approved manner, with provided MS / CI flange. (Refer drawing no.WP-1 (Fig.1))
After the completing the erection of pump ,it shall be run continuously for minimum 2 hours, and following tests shall be carried out for its performance:
a) Alignment, b) Bearing noise, c) Discharge, d) Current

Mode of Measurement: Executed quantity will be counted on number basis. (Each)

Dismantling:
Dismantling of pump along with/without pipeline shall be done with utmost care with required tools / shackles, machinery, if any. The dismantled pump and the pipeline shall be store in a safe place or shall be transported to the place as per the direction of Engineer-in-charge.

Mode of Measurement: Executed quantity will be counted on number basis. (Each)

12.2 Ejecto Type Jet Water Pump (EJP)

General:
This part of the specifications deals with providing, installing, testing & commissioning of Ejecto type Jet pump.
All material shall conform to relevant standard as per BIS and shall carry ISI mark.
Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W. Dept. Handbook/NEC.

Scope:
Specification No (WP-EJP)
Providing, installing, testing & commissioning of ISI mark Ejecto type Jet water pump of required HP with specified discharge and head with required size of suction, delivery & pressure pipe, with "H" type MS clamps to hold the suction & pressure pipe and duly grouted with foundation nuts & bolts on provided cement concrete, spring washers of requisite size or on provided angle iron frame. (As Per IS 9079 specifications)

The following list records those Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code

Material:
Pump Body: Cast iron Grade FG 200 of IS 210 -1978
Impeller: Cast iron Grade FG 200 of IS 210 -1978
Shaft: High grade carbon steel Grade C-40 of IS 2073
Bearings: Stainless Steel
Motor: Squirrel cage induction. TEFC fan cooled with Class "F" insulation, with copper windings operated on Single phase, 250 V / Three phase 415 V, 50 Hz, AC Supply, with 2900 RPM. IS: 325
Venturi & nozzle: High tensile bronze.
H type clamps with nut bolts: Made from Mild steel.
Foundation Nut Bolts: Mild steel.

Method of Construction:
First inspect the jet pump for any foreign particles in nozzle as well as in venturi with the help of screw for freeness of plunger of foot valve to ensure no damage has taken place in transit. Plunger should be free for up & down movements. While connecting Suction & pressure pipe to jet pump, do not over tighten as this may damage the threads on jet pump and also do not move away the two pipes. A good practice is to hold two pipes together by tying with steel wire keeping the pipes in vertical position & filling the same with water & checking the leakage of venturi, as well as of joints. Ensure that the pipes are ndependently supported so as to avoid the transmitting of load of pump.
After the completing the erection of pump ,it shall run continuously for minimum 2 hours, and following tests shall be carried out for its performance:
a) Alignment, b) Bearing noise, c) Discharge, d) Current

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each).

Dismantling:
Dismantling of pump along with the pipeline shall be done with utmost care with required tools / shackles, machinery, if any. The dismantled pump and the pipeline shall be store in a safe place or shall be transported to the place as per the direction of Engineer-in-charge.
Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each).

12.3 Submersible Pump for Bore Well (SMP)

General:
This part of the specifications deals with providing, installing, testing & commissioning of Submersible pump.
All material shall conform to relevant standard as per BIS and shall carry ISI mark.
Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W. Dept. Handbook/NEC.

Scope:
Specification No (WP-SMP)

Supplying and erecting ISI mark submersible pump set suitable for bore well, with high quality wear resistance and dynamically balanced bronze impeller with stainless steel shaft sleeves, pump-coupling and pivot with squirrel cage induction motor of 415 V/230 V, 50 cycles A.C. supply winding with waterproof PVC insulated copper wire of high precision strength, not to be affected by chemically aggressive water and suitable bronze

bearings with nut & bolts etc. of required stage, specified H.P, discharge, head and delivery pipe with necessary H. type clamp of suitable size and strength.

The following list records those Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code
IS 8034	:	Submersible Pumps

Material:
Pump Body: Cast iron Grade FG 200 of IS 210 -1978.
Impeller: Made of Gun metal.
Shaft: High carbon steel Grade C-40 of IS 2073.
Bearings: Mitchell type thrust bearing unit with tilting pad assembly.
Motor & Pump: Windings with weather proof class, PVC insulated copper wire, Rotor with stainless steel shaft & spine coupling, Stage casing high grade engineering polymer & intermediate plate with stainless steel protection ring, Re-woundable stator with stainless steel casing, Diffuser with stainless steel protection ring, etc.
H type clamps with nut, bolts: Made from Mild steel.
Foundation Nut Bolts: Mild steel.

Method of Construction:
Before installing the pump, the bore shall be checked thoroughly for its trueness and presence of any protruding material (stones, tree roots, etc). After ascertaining the trueness, the pump along with pipe line shall be lowered in to the bore with the help of Tripod. While connecting delivery pipe to Submersible pump do not over tighten as this may damage the threads on Submersible pump, Keep the pipes in vertical position & fill the same with water & check the leakage at joints. The delivery pipes shall be clamped with 2 Nos of 'H' type clamps and shall be rested on the top of the bore casing. (Refer drawing no.WP-1 (Fig.2))
After the completing the erection of pump ,it shall be run continuously for minimum 2 hours, and following tests shall be carried out for its performance:
a) Alignment, b) Bearing noise, c) Discharge, d) Current

Mode of measurement: - Executed quantity will be counted on number basis. (i.e. each).

Dismantling:
Dismantling of pump along with the pipeline shall be done with utmost care with required tools / shackles, machinery, if any. The dismantled pump and the pipeline shall be store in a safe place or shall be transported to the place as per the direction of Engineer-in-charge.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each).

12.4 Submersible Pumps for Open well (OSP)

General:
This part of the specifications deals with providing, installing, testing & commissioning of Submersible pump.
All material shall conform to relevant standard as per BIS and shall carry ISI mark.
Work shall be carried out as per the method of construction as specified by BIS/Chapter 16 of P.W. Dept. Handbook/NEC.

Scope:
Specification No (WP-OSP)

Supplying and erecting ISI mark submersible pump set suitable for bore well, with high quality wear resistance and dynamically balanced bronze impeller with stainless steel shaft sleeves, pump-coupling and pivot with squirrel cage induction motor of 415 V/230 V, 50 cycles A.C. supply winding with waterproof PVC insulated copper wire of high precision strength, not to be affected by chemically aggressive water and suitable bronze bearings with nut & bolts etc. of required stage, specified H.P, discharge, head and delivery pipe with necessary H. type clamp of suitable size and strength.

The following list records those Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code

Material:
Pump Body: Cast iron Grade FG 200 of IS 210 -1978.
Impeller: Made of high quality and purity Bronze metal.
Shaft: High grade carbon steel Grade C-40 of IS 2073.
Bearings: Stainless steel.
Motor & Pump: Windings with weather proof class, PVC insulated copper wire, Rotor with stainless steel shaft & spine coupling, Stage casing high grade engineering polymer & intermediate plate with stainless steel protection ring, Re-woundable stator with stainless steel casing, Diffuser with stainless steel protection ring, etc.
H type clamps with nut bolts: Made from Mild steel.
Foundation Nut Bolts: Mild steel.

Method of Construction
While connecting delivery pipe to Submersible pump do not over tighten as this may damage the threads on Submersible pump, Keep the pipes in vertical position & fill the same with water & check the leakage at joints. The delivery pipe shall be clamped with 2 Nos of 'H' type clamps and shall be rested on the top of the well.
After the completing the erection of pump ,it shall be run continuously for minimum 2 hours, and following tests shall be carried out for its performance:
a) Alignment, b) Bearing noise, c) Discharge, d) Current

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each).

Dismantling:
Dismantling of pump along with the pipeline shall be done with utmost care with required tools / shackles, machinery, if any. The dismantled pump and the pipeline shall be store in a safe place or shall be transported to the place as per the direction of Engineer-in-charge.

Mode of Measurement: Executed quantity will be counted on number basis. (i.e. each).

Chapter 13

FIRE FIGHTING & FIRE ALARM

13.1	**Main Fire Pumps (Single Stage Centrifugal)**	**FF-MFP/SSC**
13.2	**Main Fire Pumps (Multi Stage Centrifugal)**	**FF-MFP/MSC**
13.3	**Main Fire Pumps (Submersible)**	**FF-MFP/SBM**
13.4	**Jockey Pumps**	**FF- MFP/JP**
13.5	**Booster Pump**	**FF- MFP/BP**
13.6	**Pipes**	**FF-PP**
13.7	**Valves**	**FF-VL**
13.8	**Fire Fighting Accessories**	**FF-FFA**
13.9	**Fire Alarm System**	**FF-FAS**
13.1	**Fire Alarm accessories**	**FF-FAAS**
13.1	**P. A. System**	**FF-PAS**
13.1	**Sprinklers**	**FF-SPR**

13.1 Main Fire Pumps (Single Stage Centrifugal) (FF-MFP/SSC)
13.2 Main Fire Pumps (Multi Stage Centrifugal) (FF-MFP/MSC)
13.4 Jockey Pumps (FF-MFP/JP)
13.5 Booster Pumps (FF-MFP/BP)

General:

Fire safety in building has become very important consideration in construction and maintenance. A normal office building has fire load in the form of large quantity of papers and furnishing. Buildings like Hospitals, Laboratories, Auditorium, Libraries, and Museum etc. require fire safety provisions by virtue of their type of occupancy and importance irrespective of their height.

The design and installation of a fire fighting system is of utmost importance. The fire fighting installation on completion will have to be got cleared from the local fire fighting authorities (Fire Service) for its efficacy, suitability and usability by the Fire Service in the event of a fire.

Following types of water based fixed fire fighting installations are normally provided in buildings:

Wet Riser.
Down Comer.
Automatic Sprinkler.

The design of fire fighting system for a building shall base as per the provisions in National Building Code of India (Part IV) (Amended up to date) and also considering the provisions in the Development Control Rules of local body/authority.

The operating pressure of individual hydrant shall be between 5.5 kg/cm^2 to 3.5 kg/cm^2 and the operating pressure of the furthest level hydrant from main pump shall be minimum 3.5 kg/cm^2.

The pipeline will be designed in such a way that it should be possible to get discharge at any location.

Specifications:

This part deals with the specifications of following pumps:

Specification No(s)

1. Main Fire Pumps (Single Stage)	**(FF-MFP/SSC)**
2. Main Fire Pumps (Multi Stage)	**(FF-MFP/MSC)**
3. Jockey Pumps	**(FF- MFP/JP)**
4. Booster Pumps	**(FF-MFP/BP)**

Scope:

Supplying, installing, testing, perfect aligning, proper levelling and commissioning of Fire service main/jockey/booster pump single/multi stage having specified discharge and head with required HP or similar to with minimum parameters, confirming to IS: 1520 with specified size of suction and delivery pipes, coupled with squirrel cage A.C. induction motor. The pump set shall be erected in alignment on cement concrete foundation.

The Main Fire pumps should be able to deliver minimum operating pressure of 3.5 kg/cm2 at highest and farthest hydrant.

Selection of Main Fire Pumps (Single & Multi Stage Centrifugal type) shall be as per Table No. 13.1/1, & 13.1/2 and, whereas the selection of Jockey Pump (Centrifugal type) & Booster Pump (Centrifugal type) shall be as per Table No. 13.1/3 & 13.1/4 respectively.

Material:

Pump Body:

The centrifugal pumps shall conform to IS 1520. The pump casing shall be of heavy section close grained cast iron and designed to withstand 1.5 times the working pressure. The casing shall be provided with shaft seal arrangement as well as flanges for suction and delivery pipe connections as required.

Impeller:
The impeller shall be bronze. This shall be shrouded type with machined collars. Wear rings, where fitted to the impeller, shall be of the same material as the impeller. The impeller surface shall be smooth finished for minimum frictional loss. The impeller shall be secured to the shaft by a key.
Shaft:
The shaft shall be of stainless steel EN-8/ C – 40 and shall be accurately machined. The shaft shall be balanced to avoid vibration at any speed within the operating range of the pump.
Shaft Sleeve:
The shaft sleeve shall be of bronze.
Bearing:
The bearing shall be of stainless steel and of ball or roller type suitable for duty involved. These shall be grease lubricated and shall be provided with grease nipples /cups. The bearings shall be effectively sealed against leakage of lubricant or entry of dust or water.
Shaft seal:
The shaft seal shall be mechanical type so as to allow minimum leakage. A drip well shall be provided beneath the seal.
Motor:
Suitable HP squirrel cage induction motor, TEFC (totally enclosed fan cooled) synchronous speed 2900 RPM, suitable for operation on 415 volts, 3 phase 50 Hz. AC with IP 55 protection for enclosure, horizontal foot mounted type with Class-'F' insulation, conforming to IS-325.
Body: Cast iron
Rotor Shaft: Stainless steel
Bearing: Refer specification for bearing under Pump above.
Winding: Class 'F' insulated copper winding.
Base plate: Fabricated from Mild Steel, foundation bolts etc.
Cement Concrete Foundation: Cement, Sand, and Water, in 1:2:4 ratio.
Anti Vibrating Pads: Made from high quality rubber of specified grade and strength.
Hardware: Mild Steel

Method of Construction:
The surface of the pump foundation should be chipped with pneumatic hammer or sharp pointed chisel. The teak wood box of appropriate size shall be placed and filled with cement concrete in 1:2:4 ratio with 20 to 25 mm stone metal and required size and strength of foundation nut & bolts. The necessary curing & finishing shall be done in approved manner. The M.S. fabricated base plate of suitable size & strength should be fixed with anti-vibration rubber pads. Proper levelling and alignment shall be observed before tightening of foundation bolts. Both the pump and motor shall be placed on common base plate frame with perfect alignment, proper levelling. The pump should be connected to pipe line with M.S. flanges, gaskets, nut bolt etc and shall be checked for the leakages. The coupling guard shall be provided with nut bolts of required size. The pump shall be tested for 3.5 kg/cm^2 pressure at highest and farthest point of the building for minimum 2 hours. The necessary test certificate from manufacturer of pump and motor shall be produced. The motor should have efficiency more than 90% and power factor above 0.80.

Mode of Measurement:
Executed quantity shall be measured on number basis**.**

Table No. 13.1/1
Fire Fighting pump (Single Stage Centrifugal)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
30	2900	1400	56	80/65
50	2900	1800	76	80/65
75	2900	2400	76	100/80

Table No. 13.1/2
Fire Fighting pump (Multi Stage Centrifugal)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
30	1450	1400	56	80/65
50	1450	1800	76	100/80
75	1450	2400	88	125/100
75	1450	2800	76	125/100
120	1450	2800	105	150/125

Table No. 13.1/3
Jockey Pump (Centrifugal type)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
15	2900	240	56	50/32
20	2900	240	105	50/32

Table No13.1/4
Booster Pump (Centrifugal type)

Capacity in HP	Speed in RPM	Discharge in LPM	Head in metre	Suction/Delivery Size in mm
7.5	2900	450	35	50/32
10	2900	468	40	50/32

13.3 Main Fire Pumps (Submersible) (FF- MFP/SBM)
13.4 Jockey Pumps (FF-MPF/JP)

Specification No
1. Main Fire Pumps (FF- MFP/SBM)
2. Jockey Pumps (FF- MFP/JP)

Scope:
Supply, installation, testing & commissioning of fire pump (submersible) of required stages having specified discharge and head with min. HP or equivalent for design parameters. Submersible pump sets shall be manufactured in accordance with IS: 8034 specifications.
Selection of Main Fire Pumps (Submersible type) shall be as per Table No. 13.1/5

Material:
Pump bowls & casings: Closed grained C.I. coated with special Epoxy resin paint or high corrosion resistance.
Impeller: Made form Gun metal & dynamically balanced for smooth and silent operations.
Strainer: Stainless steel
Bearing Bushes: Lead bronze
Bearing sleeves: **High quality stainless steel**
Pump shaft: High quality stainless steel & dynamically balanced for smooth and silent operations.
Motor body: Cast iron
Rotor shaft: High quality stainless steel & dynamically balanced for smooth and silent operations.

Stator Housing: MS Seamless tube.
Thrust bearing: Bronze
Thrust bearing plate: High quality fiber sheet
Windings: PVC insulated copper

Method of Construction:
The provided M.S. frame shall be erected at inclined level at bottom of sump in rigid manner. The submersible pump shall be erected on this frame & shall be clamped properly & shall be connected to delivery pipe line with M.S. flanges, gaskets, nut-bolts, water level guard connections, etc. The pump shall be checked for the leakages. The proper electrical connection shall be made. The pump shall be tested for 3.5 Kg/ cm^2. Pressure at highest & furthest point building for minimum 2 hours. The test certificate from manufacturer of pump and motor shall be submitted. The motor should have efficiency more than 90% and power factor above 0.80.

Mode of Measurement: Executed quantity shall be measured on number basis.

Table No-13.1/5
Fire Fighting pump (Submersible pump)

Capacity in HP/ No. Of stages	Speed in RPM	Discharge in LPM	Head in metre	Delivery/Size in mm
30/2	2900	1400	56	130
45/3	2900	1800	76	130
75/5	2900	2400	88	
30/2	2900	1800	56	
105/7	2900	2800	105	
60/4	2900	2800	76	

13.6 Pipes (FF-PP)

Pipes

Specification No (FF-PP)

Scope:
Supplying erecting C class (Heavy Duty) galvanized iron pipe, ISI mark of specified diameter with screwed sockets, Joints & necessary G.I. fittings such as sockets, check nuts, elbows, bends, tees, reducers, enlarger, plugs, etc. including electric resistance welding (ERW), fixing with clamps & all connected works such as excavation, drilling holes in wall, slabs, backfilling & making good the damages.

Material:
The galvanized iron pipes shall be of type and diameter as specified and shall comply with I.S. 1239--1973 and 1969 for the specified type. The specified diameter of the pipes shall refer to the inside diameter of the bore pipes. The fittings of which the galvanizing has been damaged shall not be used. For the firefighting works, the C Class pipes and accessories shall be used.
Anti-Corrosive Protection On Under Ground Pipe:
Corrosion protection tape shall be wrapped on M.S. Pipes to be buried in ground. This corrosion protection tape shall comprise of coat tar/asphalt component supported on fabric of organic or inorganic fiber and minimum 4 mm. thick and conform to requirement of IS: 10221-Code of practice for coating and wrapping of under ground mild steel pipe line. Before application of corrosion protection tape all foreign matter on pipe shall be removed with the help of wire brush and suitable primer shall be applied over the pipe thereafter. The primer shall be allowed to dry until the solvent evaporates and the surface becomes tacky. Both primer and tape shall be furnished by the same manufacturer. Corrosion protection tape shall then be wound around the pipe in spiral fashion and bounded completely to the pipe. There shall be

no air pocket or bubble beneath the tape. The overlaps shall be 15 mm. and 250 mm. shall be left uncoated on either end of pipe to permit installation and welding. This area shall be coated and wrapped after the pipe line is installed.
The tapes shall be wrapped in accordance with the manufacturer's recommendations. If application is done in cold weather, the surface of the pipe shall be pre-heated until it is worm to touch and traces of moisture are removed and then primer shall be applied and allowed to dry.
No joint shall be located in the thickness of the walls.
If the pipe is required to be cut and the end threaded, the burns of the cut end shall be filled smooth and any obstruction in the bore shall be entirely eliminated. The rate includes wastage in cutting etc.
When the pipe is to be fixed to walls it shall be fixed with standard bracket, clips or holder bates keeping the pipe about 12mm clear of the wall. The pipe shall be fixed to the wall horizontally and vertically and parallel to one another when more than one pipe is laid unless unavoidable. The supporting clips, etc., for the pipe shall be spaced at about two meters or so as necessary.
When holes are not left during construction they shall be cut into the walls or slabs, etc., to pass the pipe through or to fix clamps. etc., after fixing of the pipes, clamps etc., these shall be neatly made good.

Pressure Testing:
All piping shall be tested to hydrostatic test pressure of at least one and a half times the maximum operating pressure, but not less than 10 kg/cm^2 for a period not less than 24 hours. All leaks and defects in joints revealed during the testing shall be rectified to the satisfaction of the Engineer-in-Charge.
Piping repaired subsequent to the above pressure test shall be re-tested in the same manner.
System may be tested in sections and such sections shall be securely capped.
Pressure gauges may be capped off during pressure testing of the installation.

Method of Construction:
Galvanized iron pipes of specified diameter and type and galvanized iron fittings with ERW shall be erected on MS angle support with one coat of red oxide primer and two coats of Post Office fire red enamel paint duly tested to 1.5 times of working pressure.
Excavating and back filling trenches including dewatering, cutting through walls, floor, etc., and making site good.
Laying, jointing, and fixing the pipe with the fittings including cutting pipes, wastage and threading the ends.
At all the road crossings the pipes shall be laid lower than the crust of the road.
During excavation if, any other service pipes (Water, electric, telephone, etc) come across, these shall be carefully protected and supported. Any damages done shall be made good.
The pipe shall be laid on a well compacted bed in the trench. The trench after laying the pipe shall be refilled except at the joints in layers and manually rammed. Care shall be taken to see that no earth, etc., gets inside the pipes.
The filling shall be kept raised by about 5 cm. for subsequent settlement.
Bedding and cushioning of murum, good earth, or sand shall be provided for the pipe in case of trench through rock. The trench at the joints shall be filled similarly after satisfactory testing of the pipe. Any surplus excavated stuff shall be disposed of satisfactorily without causing nuisance.

Mode of Measurement:
Measurement shall be for one metre of each type and diameter of pipe laid complete with fittings, clamps etc., as specified.
The lengths shall be measured net on the straight and bends along the center line of the pipes and fittings correct up to a cm.

13.7 Valves (FF-VL)

A) Foot Valve with Strainer (-ve suction)

Scope:
Specification No (FF- VL/FV)

Supplying and installing cast iron foot valve of specified diameter with strainer conforming to IS: 4038 with Gun metal seat (flapper), nut bolts, gasket, washers etc. for negative suction.

Material:
Housing, seat discs and disc plates: Grey cast iron
Hinge pins and disc guide: High tensile Stainless Steel bars
Strainers: a) Grey cast iron, b) Galvanized steel
Disc faces: a) Vegetable tanned leather (Min. 3 mm. thick), b) Leaded tin bronze, c) Natural rubber (with reinforcement of cotton canvas), d) Synthetic rubber (with reinforcement of cotton canvas)
Flange jointing nature: a) Compressed fibre board or rubber minimum 1.5 mm thick. The fibre board shall be impregnated with chemically neutral oil and shall have a smooth and hard surface. b) Compressed asbestos fibre.

Method of Construction:
The footwall with strainer shall be fitted with provided flange, gaskets, nut bolts to be erected at required position and fitted firmly to pipe with proper alignment so as the joints should be leak proof with shellac and other material required including necessary labour and required tools and plants

Mode of Measurement:
Executed quantity shall be measured on number basis.

B) End line strainer (+ ve suction)

Specification No (FF- VL/ELS)
Scope:
Supplying and installing end liner strainer of specified diameter as per IS: 907, fabricated out of brass perforated sheet of 14 SWG (2.0 mm. thick) duly with brazing to flange or pipe with nut bolts, gaskets, washers etc, in position for only suction in an approved manner.

Material:
Body: Cast Iron
Strainer screen: Stainless steel/Brass screen of 1mm thick perforated sheet with 3 mm diameter holes.
Flange: Cast iron / M.S. sheet

Method of Construction:
End line strainer with strainer shall be fitted with provided flange, gaskets, nut bolts etc, and to be erected at the end of suction pipe, including labour and required tools and plants.
Mode of Measurement:
Executed quantity shall be measured on number basis.

C) Sluice valve

Specification No (FF- VL/SV)
Scope:
Supplying and installing cast iron double flange sluice valve of specified diameter conforming to IS: 780, ISI mark, having cast iron body and gun metal working parts with nut bolts, gaskets etc. and tested to 1.5 times of working pressure, in an approved manner.

Material:
Body: a) Brass, b) Leaded tin bronze
Bonnet or cover: a) Leaded tin bronze, b) Forged brass, c) Brass
Stuffing box, disc hinge, check nut, stem nut, disc retaining nut, gland, gland *nut, gland flange, body seat rings and disc or wedge facing rings (where renewable):* a) Leaded tin bronze, b) Extruded brass rod, c) Forged brass, d) Brass
Stem, hinge pin and plug: a) Extruded brass rod, b) High-tensile brass, c) Forged Brass
Ball (for ball type check valves): Chromium steel
Nut bolts: Mild steel
Hand wheel: Cast iron
Gasket: Compressed asbestos fibre
Gland packing: a) Hemp and jute, b) Asbestos
Spring: Phosphor bronze wire
Seating ring: Synthetic rubber

Method of Construction:
The double flange sluice valve shall be fitted with provided flange, gaskets, Nut bolts, etc. to be fitted to pipe, accessories with washers, spring washers, check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:
Executed quantity shall be measured on number basis.

D) Butterfly valves

Specification No (FF- VL/BFV)
Scope:
Supplying & installing cast iron double flange butterfly valve of size 75/80mm.dia confirming to IS: 13095 having cast iron body, FG 220 Nitrite rubber replaceable seat with Moulded 'O' ring, C.I. powder coated disc flow control complete & tested to 1.5 times of working pressure in an approved manner.
Material:
Body: Cast iron Spheroid graphite iron Carbon steel
Disc: a) Cast iron Spheroid graphite iron carbon steel, b) Stainless steel Gun metal
c) Aluminum bronze
Shaft: a) Stainless steel, b) Carbon steel Aluminum bronze Nickel copper alloy
Seating ring/Seal retaining ring: a) Stainless steel, b) Gun metal aluminum bronze deposited metal suitable for duty or resilient material
Seat: Elastomers
Shaft bearing seals: Manufacturer's standards suitable for duty
Internal fastenings: Stainless steel
External bolting: Carbon steel: tensile strength 390 n/mm or MPa

Method of Construction:
The double flange butterfly valve shall be fitted with provided flange, gaskets, Nut bolts etc. to be fitted to pipe, accessories with washers, spring washers, check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.
Mode of Measurement:
Executed quantity shall be measured on number basis.

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E) Non Return Valves

Specification No (FF- VL/NRV)
Scope:
Supplying and installing double flange NRV of specified diameter conforming to IS: 5312 (Part-I), ISI mark, having cast iron body and gun metal working parts with nut bolts, gaskets, etc. and tested to 1.5 times of working pressure in an approved manner.
Material:
Body, cover, door, bearing holder: Grey cast iron
Hinge pin, door pin and door suspension pin: Stainless steel

Body seat rings: Leaded tin bronze
Door face ring: Leaded tin bronze
Bearing bushes/ Bearing block: Leaded tin bronze
Plugs for hinged pin/Air release plug: Leaded tin bronze
Bolts: Carbon steel
Nuts: Carbon steel
Gaskets: Rubber
Hinges: Grey cast iron

P N Rating and Test Pressure:

S No.	PN Rating	Test for	Test Pressure (Gauge) MPa	Test Duration in minutes
1	PN 1.0	Body Seat	1.5 1.0	5 2
2	PN 1.6	Body Seat	2.4 1.6	5 2

Method of Construction:
The double flange NRV shall be fitted to pipe with provided flange, gaskets, and Nut bolts etc, accessories with washers, spring washers, and check nuts as required with roper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:
Executed quantity shall be measured on number basis.

F) Gate Valves

Specification No (FF- VL/GV)
Scope:
Supplying & installing gun metal gate valve of specified diameter having threaded ends, conforming to IS: 778, ISI mark, along with G.I. threaded nipple.

Material:
Body: a) Brass, b) Leaded tin bronze
Bonnet or cover: a) Leaded tin bronze, b) Forged brass, c) Brass
Stuffing box, disc hinge, check nut, stem nut, disc retaining nut, gland, gland nut, gland flange, body seat rings and disc or wedge facing rings (where renewable): a) Leaded tin bronze, b) Extruded brass rod, c) Forged brass, d) Brass
Stem, hinge pin and plug: a) Extruded brass rod, b) High-tensile brass, c) Forged Brass
Ball (for ball type check valves): Chromium steel
Nut bolts: Mild steel
Hand wheel: Cast iron
Gasket: Compressed asbestos fibre
Gland packing: a) Hemp and jute, b) Asbestos
Spring: Phosphor bronze wire
Seating ring: Synthetic rubber

Method of Construction:
The Gate Valve shall be fitted to pipe with provided flange, gaskets, and Nut bolts etc, accessories with washers, spring washers, and check nuts as required with proper alignment so as to be leak proof including necessary labour and required tools and plants.

Mode of Measurement:
Executed quantity shall be measured on number basis.

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G) Hydrant Valves (Landing Valves)

Specification No (FF- VL/HV)

Scope:
Supplying and installing gun metal single outlet hydrant valve Morris pattern, oblique type, conforming to IS:5290, ISI mark, with G.M. blanks cap and M.S. or G.I. chain in an approved manner.

Material:
Valve Body, bonnet, stop valve, Check nut, female outlet: Bronze/ Aluminium alloy or Stainless Steel
Valve spindle: Bronze/ Aluminum alloy or Stainless Steel
Hand Wheel: M.S. or C.I. (Black painted)
Spring: Made of phosphor wire.
Washer, Gasket: Rubber
Blank Cap: ABS plastic.

Method of Construction:
The hydrant valve shall be connected with provided flange, gaskets, Nut bolts etc. with use of required tools and plants.
The water discharge shall be not less than 900 lpm for single head and 1800 lpm for double head valves at 7 kg / cm^2

Mode of Measurement:
Executed quantity shall be measured on number basis.

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13.8 Fire Fighting Accessories (FF-FFA)

A) Priming Tank

Specification No (FF- FFA/PT)
Scope:
Supplying & Installing One piece Moulded HDP / Fibre water tank of required capacity with necessary plumbing material on provided M.S. structural supports in an approved manner.

Material:
Priming Tank: HDPE/ Fiber of good quality material
Gate Valves: **As per (FF- VL/GV) above.**

Method of Construction:
The Priming tank shall be installed on provided M.S. structural supports with 20/25 mm dia. inlet valve and 50 mm dia. outlet valve with provided necessary G.I. piping up to delivery of main fire pump before non-return valve.

Mode of Measurement:
Tank capacity will be measured on litre basis. (i.e. per litre)

B) Hose Reel

Specification No (FF-FFA/HRD)
Scope:
Supplying and installing wall mounting swinging Hose reel drum as per IS: 884 and fitted with 19 mm dia 22.5 meter long high pressure polypropylene (Polyhose) pipe as per IS: 444 (type III) G.M. chrome plated nozzle and 19 mm dia and G.M. gate valve on the inlet pipe with necessary M.S. Bracket for holding Hose reel drum fitted in position with wall fasteners, in an approved manner.

Material:
Hub and sides: Aluminum Alloy/Mild steel/ Aluminum sheet
Wall Bracket: Cast iron / Mild steel.
Hose tube (20 mm): Thermoplastic (Textile Reinforced) Type-2, (Nominal internal dia) as per IS- 12585
Nozzle with branch Pipe: Brass as per IS 8090
Stop Valve (Ball Valve): Gun metal.

Method of Construction:
The Wall Mounting swinging Hose reel drum with Gun Metal Nozzle, gate valve, shall be connected on M.S. bracket with provided flange, gaskets, Nut bolts etc. with use of required tools and plants. The water flow rate shall be not less than 24 LPM and the range of jet shall be not less than 6 metre.

Mode of Measurement:
Executed quantity shall be measured on number basis.

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C) Hose pipe for Hose reel

Specification No (FF-FFA/HOP)
Scope:
Supplying & erecting high pressure polypropylene hose pipe 20 mm. dia as per IS 444- type III & IS 446-1980 type I fabricated from polyester core braided with high tensile textile yarn suitable for erection of 19 mm Gun Metal Crome plated nozzle.

Material:
Hose pipe material: Polypropylene, the lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity and splits. The tensile strength shall be minimum 5.00 MPa and shall withstand for 10.2 kg/cm2
Nozzle: Crome plated gun metal

Method of Construction:
The hose pipe shall be connected with provided couplings.

Mode of Measurement:
Executed quantity shall be measured on per meter basis.

D) Rubber Hose Pipe

Specification No (FF-FFA/RHP)
Scope:
Supplying & erecting high pressure rubber hose pipe 20 mm. Dia as per IS 446- 1978 (type I) &IS 444- 1978 (type II) fabricated lead moulded with high tensile yarn braided rubber hose pipe suitable for erection of 19 mm gun metal Crome plated nozzle.

Material:
Hose pipe material: Rubber. The lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity, and splits. The tensile shall be minimum 5.00 MPa and shall withstand pressure of 10.2 kg/cm^2
Nozzle: Crome plated gun metal

Method of Construction:
The hose pipe shall be connected with provided couplings.

Mode of Measurement:
Executed quantity shall be measured on per meter basis.

E) Controlled Percolation Hose Pipe

Specification No (FF-FFA/CPH)
Scope:
Supplying fire fighting C P (Controlled Percolation) Hose pipe of 63 mm in diameter, conforming to IS: 8423, and 15 metre in length, fitted with male and female G.M. coupling confirming to IS: 903, ISI mark.

Material:
Hose pipe material: Synthetic cotton yarn confirming to IS 8423 and shall be made of jacket or cotton or synthetic material or their combination. It shall be tested as specified in IS and shall withstand for pressure 10.2 kgf/cm^2 and should not burst before a pressure of 35.7 kg/ cm^2 is reached.
***Coupling*:** Gun metal confirming to IS 903

Method of Construction:
Hose pipe of 15 metre length with male and female Gun metal coupling shall be connected as per direction.
Mode of Measurement:
Executed quantity shall be measured on number basis.

F) R.R.L Hose Pipe

Specification No (FF-FFA/RRL)
Scope:
Supplying fire fighting R.R.L. Hose pipe, conforming to IS: 636 (Type-A) 15 metre length, fitted with male and female G.M. coupling confirming to IS: 903, with ISI mark.

Material:
Hose pipe material: Rubber lined woven jacketed & 63mm in dia., the lining and the cover shall be of uniform thickness, reasonably concentric and free from air blisters, porosity and splits. The tensile shall be minimum 5.00 MPa and shall withstand pressure of 10.2 kg/ cm^2
Coupling: Gun metal

Method of Construction:
Hose pipe of 15 metre length with male and female Gun metal coupling shall be connected as per direction.
Mode of Measurement:
Executed quantity shall be measured on number basis

G) Canvas Hose Pipe

Specification No (FF-FFA/CHP)
Scope:
Supplying fire fighting canvas Hose pipe, conforming to IS: 4927 and 15 metre length, fitted with male and female G.M. coupling confirming to IS: 903, with ISI mark.

Material:
Hose pipe material: Canvas
Coupling: Gun metal

Method of Construction:
Canvas hose pipe 15 metre in length with male and female Gun metal coupling including necessary labour, material and use of required tools and plants.

Mode of Measurement:
Executed quantity shall be measured on number basis

H) Nozzles

Specification No (FF-FFA/NZ)
Scope:
Supplying G.M. branch pipe of 63 mm diameter with specified length fitted with 20 mm diameter detachable hexagonal nozzle confirming to Is: 903, ISI mark.

Material:
Nozzle: Chrome plated Gun metal

Method of Construction:
Gun metal hexagonal nozzle fitted with required tools and plants including necessary labour, material, etc.

Mode of Measurement:
Executed quantity shall be measured on number basis.

I) Fire Brigade connection

Specification No **(FF-FFA/FBC)**

Scope:

Supplying and installing fire brigade Header of 150 mm Ø, G.I. 'C' class pipe having 2 Nos. of 100 mm 'T' outlet with 100 mm Ø flange, fitted with 2 Nos. of G.M. fire branching inlet connection, each consisting of 2 Nos. 63 mm dia. G.M. male inlet for supplying water in fire tank.

Material:

Pipe material: G.I. 'C' class (Heavy duty)
Branching Inlet: Gun metal
Male Inlet: Gun metal

Method of Construction:

In case under ground storage tank is not approachable by fire tenders, a 4 way 63 mm diameter instantaneous male inlet connection is provided at street level and connected to UG tank with 1 meter length of 150mm. diameter under ground pipe.
The whole unit shall be placed in provided MS box made of 2 mm thick MS sheet with openable glass cover.

Mode of Measurement:

Executed quantity shall be measured on number basis

J) Siamese connection (Fire service Inlet)

Specification No **(FF-FFA/SMC)**

Scope:

Supplying and installing fire brigade Header (Siamese Connection) of 150 mm Ø, G.I. 'C' class pipe having 2 Nos. of 100 mm 'T' outlet with 100 mm Ø flange, fitted with 2 Nos. of G.M. male inlets with spring type NRV for supplying water to Wet riser.

Material:

Pipe material: G.I. 'C' class
Branching Inlet: Gun metal
Male Inlet: Gun metal
Non Return Valve: As per **(FF- VL/NRV)** above.

Method of Construction:

In order to facilitate feeding of water in the system by fire service, a 4 way 63 mm diameter collecting head shall be provided and connected with each riser/down comer and the ring main with non return valve and with provided butterfly/sluice valve. This should be located at a place where fire brigade tender can reach.

The whole unit is placed in provided MS box made of 2 mm thick MS sheet with open-able glass cover.

Mode of Measurement:

Executed quantity shall be measured on number basis

K) Air Cushion Tank (Air Vessel)

Specification No **(FF-FFA/ACT)**

Scope:

Supplying and installing Air Vessel of 300 mm Ø 1.5 mtr. in height M.S. Tank fabricated from M.S. black ERW pipe, conforming to I.S.: 3589, having 6mm thickness, dish end at both ends, duly welded with 300 mm Ø pipe, having inlet of 100 mm Ø, duly fitted with 100 mm Ø sluice valve and 20/25 mm Ø draw in with G.M. gate valve, to be installed inside pump house along with provided M.S. angle tripod.

Material:

Air Vessel: MS ERW pipe confirming to IS 3589
Tripod: MS angle of size 75 x 75 x 5mm

Method of Construction:

300mm dia, 1.5 metre height air vessel, Gate Valve, flanges, MS angle Tripod including necessary labour, material and use of required tools and plants.

Mode of Measurement:
Executed quantity shall be measured on number basis

L) Air Release Valve

Specification No (FF-FFA/ARV)
Scope:
Supplying and erecting Air release cock of 20/25 mm Ø made from G.M. with necessary G.I. coupling for fixing on top of Air vessel or on wet riser.

Material:
Air release Valve: Gun metal
Coupling: G.I.

Method of Construction:
Air release Valve with necessary GI Coupling shall be fixed on top of wet riser with required labour, tools, etc.

Mode of Measurement:
Executed quantity shall be measured on number basis

M) Pressure Gauge

Specification No (FF-FFA/PG)
Scope:
Supplying and installing pressure gauge of 100 mm Ø. 0-300 PSI or 0-21 kg/cm^2 square fitted with 12/15 mm Ø. pad cock valve, and G.I. pipe, elbow etc. as per requirement in an approved manner.

Material:
Pressure Gauge: 100 mm diameter made from Brass metal.
***Cock valve, elbow, and pipe*:** G.I

Method of Construction:
The 100 mm dia pressure gauge with G I cock valve, erected with GI Pipe including accessories, with required labour, tools, etc, as directed by the Engineer-in-charge.

Mode of Measurement:
Executed quantity shall be measured on number basis

N) Pressure Switch

Specification No (FF-FFA/PS)
Scope:
Supplying and installing pressure switch with 12/15 mm Ø isolation valve, G.I. nipple, elbow etc. in an approved manner.

Material:
Pressure switch: Brass metal
Isolation valve, elbow, Nipple: G.I

Method of Construction:
The Pressure switch with G I isolation valve, and necessary GI fittings (elbow, Nipple) fitted with required labour, tools, etc.

Mode of Measurement:
Executed quantity shall be measured on number basis

O) Orifice plate

Specification No (FF-FFA/OP)

Scope:
Supplying and erecting one no. Brass orifice plate having 6 mm. thick with specified outer diameter and suitable inner diameter to reduce the pressure between 3.2 kg/cm^2 to 5.5 kg/cm^2

Material:
Body: Stainless steel 6 mm thick

Method of Construction:
The Orifice plate shall be placed before the hydrant valve.

Mode of Measurement:
Executed quantity shall be measured on number basis

13.9 Fire Alarm System (FF-FAS)

A) Heat detector

Specification No (FF-FAS-HD)
Scope:
Supplying, erecting, and testing heat detector with base erected on 16 gauges M.S. sheet box of 100 x 100 x75 mm size duly painted.

Material:
Heat detector: UL listed / LPCB marked with 360^0 blinking LED & having 68^0 C/78^0 C fixed temperature.
***Box*:** CRCA/MS sheet of 16 gauges
Red oxide paint: Superior quality
Enamel paint: Superior quality of specified colour
Hardware: Sheet metal screws
Plugs: Plastic

Method of Construction:
The Heat Detector shall be fixed on the CRCA/MS sheet box duly painted with one coat of red oxide & 2 coats of enamel paint of specified shade with necessary SM screws, plugs, etc on ceiling, duly terminating the provided cable with provided glands and making the connection.

Mode of measurement:
Executed quantity shall be measured on number basis

B) Optical type Photo electric smoke detector

Specification No (FF-FAS/SD)
Scope:
Supplying, erecting and testing optical type smoke detector complete with base erected on 16 gauge CRCA/MS sheet box of 100 x 100 x 75 mm duly painted.

Material:
Smoke detector: UL listed / LPCB marked
Box: CRCA/MS sheet of 16 gauge
Red oxide paint: Superior quality
Enamel paint: Superior quality of specified colour
Hardware: Sheet metal screws
Plugs: Plastic

Method of Construction:
The Smoke Detector shall be fixed on the CRCA/MS sheet box duly painted with one coat of red oxide & 2 coats of enamel paint of specified shade with necessary SM screws, plugs, etc on ceiling, duly terminating the provided cable with provided glands and making the connection.

Mode of Measurement:
Executed quantity shall be measured on number basis.

C) Beam type Photo-Thermal/Thermal Smoke detector (Optical Beam Detector)

Specification No (FF-FAS/OBSD)

Scope:

Supplying, erecting and testing Optical Beam Detector (Beam type Photo-Thermal Smoke detector) complete with Transmitter and receiver unit erected on wall/ceiling with base.

Material:

Detector: Comprising Transmitter & Receiver unit, UL listed / LPCB marked, with BS 5839 part 1 2002, compliance and duly tested & certified as per EN54-12: 2002.
The detector shall have following features:

- Automatic drift compensation
- Dust tolerance chamber to provide optimum detection performance and minimal nuisance alarms to minimize maintenance
- Digital addressing capability
- Photoelectric and Photo-thermal multi criteria
- Operating voltage range 8 to 30 V DC
- Operating temperature range -30 to $+70^0$ C
- Multi-function Alarm- Normal bi-colour LED indicator.

Hardware: Sheet metal screws
Plugs: Plastic

Applications:

- Photo-Thermal detector to be used in General purpose halls, auditoriums, and at spaces where the ceiling **height is more than** 4.0 metre.
- Thermal detector with combination of fixed and rate of rise heat shall be used in kitchens, pantry and bars and at similar spaces where the ceiling **height is more than** 4.0 metre.

Method of Construction:

The Detector consisting of Transmitter (Detector) and receiver shall be mounted / fixed at designated place duly connected with provided cable/wires and tested.

Mode of Measurement:

Executed quantity shall be measured on number basis.

13.10 Fire Alarm Accessories (FF-FAAS)

A) Pill Box (Manual Call Point [MCP])

Specification No (FF-FAAS/MCP)

Scope:

Supplying, erecting, testing, and commissioning pill box with break glass, push button. MCP is manually operated device used to initiate an alarm signal

Material:

Push Button: Plastic
Enclosure: CRCA/MS with 100/150 mm round/square with Glass cover
Hammer with chain: *Brass*
Enamel paint: Superior quality Post Office red colour
Hardware: S.M. Screw
Plugs: Plastic

Method of Construction:

The pill box with break glass cover, push button in circular/ square enclosure with push button kept inside per set with a glass outside marked “IN CASE OF FIRE BREAK GLASS” provided with a small hammer and chain fixed to the pill box shall be mounted on wall or any other place as directed and provided with cable entry with suitable terminal inside and painted with two coats of red oxide and two coats of post office red enamel paint.

Mode of Measurement:
Executed quantity shall be measured on number basis

B) Hooter

Specification No (FF-FAAS/HTR)
Scope:
Supply and erecting hooters with CRCA enclosure duly connected to main amplifier to radiate two tone sounds for public.

Material:
Hooter: Electronic type with 6W output, Line matching transformer
Enclosure: CRCA sheet of 14 SWG with perforation
Enamel paint: Superior quality Post Office red colour
Hardware: S.M. Screw
Plugs: Plastic
Gitties: Wooden

Method of Construction:
The electronics hooter with Line matching transformer shall be enclosed in suitable size perforated CRCA enclosure and installed as per instructions and shall be connected and fixed at suitable site to ensure that the alarm is heard anywhere in the protected area. The minimum sound level shall be 80 dB.

Mode of Measurement:
Executed quantity shall be measured on number basis

C) Remote Response Indicators

Specification No (FF-FAAS/RRI)
Scope:
Supplying, erecting, and testing of remote response indicators.

Application: ***Remote Response Indicators shall be fixed for closed rooms, cabins, or for inaccessible rooms, etc.***

Material:
Indicator: 5 mm LED (2 Nos) / 10 mm LED (1 No) in Red colour
Enclosure: CRCA sheet of 14 SWG with perforation
Enamel paint: Superior quality of specified colour
Hardware: S.M. Screws
Plugs: Plastic
Gitties: Wooden

Method of Construction:
Remote response indicator housed in enclosure shall be fitted out side the rooms, cabins at accessible height and shall be clearly visible.

Mode of Measurement:
Executed quantity shall be measured on number basis

D) Fire Alarm Control Panel
Local Control Panel

Specification Nos
Fire Alarm Control Panel (FF-FAAS/FACP)
Local Control Panel (FF-FAS/LCP)

Scope:
Supplying, erecting, testing, & commissioning of Fire Alarm Control Panel with all accessories.

Material:

Panel: Microprocessor based Conventional Main Fire Alarm Control Panel (FACP) with necessary Test Certificate from ERTL as per IS 2189-1999 provided with SMPS (Switch Mode Power Supply) of suitable battery (2x12V) 24V, 24 AH capacity maintenance free battery as standby supply to switch over automatically for a period of 8 hours in case of A.C. supply failure to panel with 7 AH capacity battery charger, panel shall have following features.

a) Visual zone indication in which fire has emerged.
b) Audio alarm devices.
c) Acknowledge reset and test devices.
d) Visual indication (2x20 character LCD display) incorporating following indications:

(i) Fire condition
(ii) Fault condition
(iii) A.C. Pilot indication
(iv) Low battery indication
(v) Blown fuse indication A.C. as well as D.C.
(vi) Built in electronic hooters of 2 tone round for fire condition and single tone for fault condition.
(vii) Open and short circuit fault.
(viii) Push button switch for checking each zone.
(ix) Push button to disable audio alarm.
(x) Reset push button.

e) Fire protection and alarm circuit shall have modular design using electronic plug in type printed circuit boards (PCB) with spare cards.

Method of installation:

The microprocessor based main fire Alarm control panel designed as per IS 2189-1999 with ERTL Test certificate shall be fixed at accessible place so that security or fire personal can attend to the fault immediately.

Testing:

The control shall be tested for following features:

1) Alarm cancel Test
2) Reset 1 lamp
3) Fire Test
4) Open Test (for detector & hooter)
5) Short circuit Test (for detector & hooter)
6) Walk Test(one man test)
7) Sounder Test

Mode of Measurement:

Executed quantity shall be measured on number basis

13.11 P.A. System (FF-PA/AFR)

A) Amplifier for P A System

Specification No (FF-PA/AFR)

Scope:

Supplying, erecting, testing, and commissioning amplifier 120 W / 250W for Public address system.

Material:

Amplifier: Amplifier unit with wall mounted closed cabinet having rated output wattage 120 W / 250W with 4 Nos input channels (2 Nos for Microphone & 2 Nos Auxiliary), 4/8/16 Output lines, suitable to work on 230 V AC supply / 12 V DC supply, and necessary protection circuit.

Method of Construction:

Amplifier unit shall be installed as per guide lines of manufacture and shall be tested for rated output.

Mode of Measurement:
Executed quantity shall be measured on number basis

B) Sound Column

Specification No (FF-PA/SOC)
Scope:
Supplying, erecting, testing, and commissioning 15 watts Sound Column.

Material:
Sound Column: Wall mounted Sound column shall give 15 watts output, with necessary fixing arrangement.

Method of Construction:
Sound column shall be installed as per guide lines of and connected to the amplifier duly tested.

Mode of Measurement:
Executed quantity shall be measured on number basis

C) Microphone

Specification No (FF-PA/MIC)
Scope:
Supplying, erecting, testing, and commissioning hand shield microphone

Material:
Microphone: Microphone unit as per manufacturer's standard specifications.

Method of Construction:
Microphone unit shall be connected with cord to amplifier unit as per guide lines of manufacture and shall be tested.

Mode of Measurement:
Executed quantity shall be measured on number basis

D) Microphone Cable

Specification No (FF-PA/MCC)
Scope:
Supplying erecting, testing to 2 core shielded Microphone cable.

Material:
Microphone cable: 2 core microphone cable, PVC insulated with copper conductor.

Method of Construction:
Microphone cable shall be connected to microphone and tested.

Mode of Measurement:
Executed quantity shall be measured on meter basis

13.12 Sprinklers (FF-SPR)

A) Sprinklers

Specification No (FF-SPR)

Scope:

Supplying and erecting 15 mm (1/2") dia. NBCM Body chrome finished, pendent type quartzoid bulb sprinkler.

Material:

Chrome plated sprinkler bulb having 68^0 / 78^0C fixed temperature rating UL listed.

Method of Construction:

The sprinklers bulb shall be fitted to sprinklers pipe line and tested for required pressure.

Mode of Measurement:

Executed quantity shall be measured on number basis.

Chapter 14

LIFTS

14.1 Lifts **LFT-LFT**

14.2 Drawings

14.1 Lifts

Scope:

Specification No (LFT)

Supplying erecting and commissioning passenger lift, hospital lifts and goods lift with technical requirements of lift installation, its components, safety devices various type of controls and methods of operation. The selection of a particular type of control and method of operation will be guided by the requirements in individual case such as nature of building, usage, occupancy, traffic pattern, etc. and has to be decided in individual case considering quality and quantity analysis of service.

(Refer drawing no. LFT-1)

Recommended Standards:

The following list is for Indian Standards which are acceptable as good practice and accepted standards;

IS 14665 part I	:	Guidelines for outline dimensions of passenger, goods, service and hospital lifts.
IS 14665 part II	:	Code of practice for installation, operation and maintenance of lifts.
IS 14665 part III	:	Safety rules
IS 14665 part IV	:	Components
Development Control Rules	:	Of concerned Corporation or Local Authority
National Building Code 2005		
Bombay Lift Act 1939		
Bombay Lift Rules 1958		
I. E. Rules 1956	:	Reprint as per 2005

Material:

- ***Electric Supply:***
  Three phase, 50 c/s, 415 V electric supply shall be made available by owner. The entire lift equipments should be suitable for operation at +10% to - 20% of the rated supply voltage.
- ***Gearless machine:***
  The gearless machine shall consist of a motor, traction sheave and break-drum or brake disc completely aligned on a single shaft. Gearless machine shall be AC. gearless with VVVF drive.
- ***Geared machine;***
  The lift machine shall be of worm gear reduction type with motor, brake, worm gearing and driving sheave and suitable for type of control specified.
- ***Electric motor:***
  Energy efficient Electric motor of suitable HP with class F insulation and S-4 duty cycle
- ***Car:***
  As per IS 14665 part IV with MS Girders, bracings of adequate size and strength at the bottom and top with angle iron frame and side panels of CRCA/MS of 16 gauge duly powder coated paint or SS sheet of 18 gauge with mirror or hairline finish with safety factor more than 5.
- ***Signals:***
  FPI in car and CPI at all landings are to be provided with up / down direction indicators with call registration facility.
- ***Variable Voltage Variable Frequency:***
  Incoming mains AC power is first rectified to DC and then inverted to provide controlled AC current to the elevator drive. Precision monitoring is required for motor speed, car direction, position and load to enable the pulse width of the AC power supplied to the motor and to be adjusted to ensure that elevator speed is maintained very accurately to an ideal profile. Energy saving through reduced power consumption should be achieved.
- ***Controls:***

Microprocessor based Control panel duly wired with proper size and strength of copper wire.

- ***Control panel box****:*
  Control panel box of MS sheet of 16 gauge with duly power coated of MS sheet of 16 gauge.
- ***Driving / traction pulley:***
  Sheaves and pulleys shall be of hard alloy, cast iron, SG iron or steel and free from cracks, sand holes and others defects. They shall have machined rope grooves. The traction sheave shall be grooved to produce proper traction and shall be of sufficient dimension to provide for wear in the groove. The deflector sheave shall be grooved so as to provide a smooth bed for the rope.
- ***Over speed governor:***
  The car safety shall be operated by speed governor located overhead and driven by governor rope suitably connected to the car and mounted on its own pulleys. Governor shall be provided for lifts with a travel of more than 5.5 meters. The governor rope shall be not less than 6mm in dia and shall be made of steel or phosphor bronze. These shall be in accordance with IS 14665 (part 4lsec-4): 2001.
- ***Electromagnetic breaks:***
  The lift drive machinery shall be provided with an electro-magnetic brake or motor operated brake normally applied by means of springs in compression when the operating device is in off position. The brake shall be suitably curved over the brake drum or brake disc and provided with fire proof friction lining. The operation of brake shall be smooth, gradual and noiseless. The brake shall be designed to be of sufficient size and strength to stop and hold the car at rest with rated load. The brake should be capable of operation automatically by the various safety devices.
- ***Suspension wire rope:***
  Round strand steel wires ropes made from steel wire ropes having a tensile strength not less than 12.5 tones / cm2 and of good flexibility shall be used for lift. Lubrications between the strands shall be achieved by providing impregnated hemp core.
- ***Guide rails:***
  The guide rails shall be continuous throughout the entire travel and shall withstand without any deformation by the action of safety gear with a fully loaded car. Generally the guide rails shall be supported by brackets secured to the hoist way frame at each floor. The rails shall be securely fastened to the brackets or other supports by approved heavy rail clamps. Guide rails shall extend from pit floor to the underside of concrete slabs or grafting at top of the lift well. They shall be erected in plumb and parallel with a maximum deviation of 3mm.
- ***Buffers:***
  Buffers shall be suitable for installation in the space available. Buffer anchorage at pit floors shall be installed avoiding puncturing of water proofing. Oil buffers of the car and counter weight shall be of the spring return type or of gravity type. The contractor must indicate the name of buffer manufacturers, buffer stroke & certified maximum loads.

Method of Construction:

- Bar chart shall be prepared as per tender condition and requirement.
  Lift hoist way measurement shall be done before finalizing the material quantity.
- Drawing should be prepared according to tender specification considering hoist way size and permission from Lift Inspector for erection of lift should be taken prior to commencement of erection.
- White wash in lift well shall be carried out by the client.

- Site in full readiness shall be handed over to the agency.
- Minor civil work pertaining to front wall architraves internal / external plastering etc. shall be done by the lift agency.
- Prepare and install scaffolding and template by adjustment required.
- List of components / finished items those are not manufactured by lift manufacturer shall be informed by the agency.
- Brackets are to be erected and fixed in to plum line.
- Put the fasteners (16 mm dia x 100 mm) if the brackets are to be fixed on RCC wall / beam / lintel or fix rig bolts if brick work found in RCC.
- After fixing brackets and guides with adjustment fix the car and counterweight
- Fix the landing door frame / door bottom with sill and suitable brackets to with stand the load of passenger / freight as per specification
- Fix metal trunking / PVC pipe as per IS requirement

- Complete civil work such as fixing up hoist way, push button, buffers, machine room I beams for resting machine, foundation for control panel, minor civil work, making holes in bottom slab of machine room to pass traction rope, speed governor rope / wiring and complete finishing according to sizes and specification.
- Electrical wiring in lift shaft and supply cable shall be carried out from electrical agency as per requirement of lift rules.
- Fix machine with complete gear box unit, suitable rubber pad / anti vibrating pad, diverter if required with alignment as per norms.
- Fix the control panel at accessible height from floor level to inspect, connect, and operate easily.
- Put wires in accordance with the control panel connection diagram according to colour code in metal trunking with insulating paper on all bends, corners. Metal trunking shall be duly earthed from top to bottom according to IS specifications.
- Mid way junction boxes are to be fixed according to size but it should be marked by every wire with nos. (Ferrules) Traveling cables should be fixed with suitable hanger to take load of travelling cable and put extra wire of 20 % approximately
- Fix the car and counterweight frame according to sizes, adjustment of safety block wedges shoes as per requirement.
- ***Toe Guard Aprons:***
- The toe guard apron of gauge not less than 1.6mm sheet steel may be provided extending at least 15mm beyond entrance jams at each side. The guards shall have a straight vertical face extending below the level of the finished car floor and not less than the depth of the levelling zone plus 7.5mm. It shall be seamed to car platform construction and be reinforced and braced.
- ***Car Apron, Landing Thresholds and Sills:***
  An apron shall be fitted to the car platform such that no dangerous gap exist at any time when the landing door is opened, Thresholds and sill plates shall be provided at the landings also. The distance between landing sill and the sill on car platform shall not be more than 30mm.
- ***Emergency Power Supply for lift car, fan and intercom system:***
  This shall include suitable secondary battery with trickle/Boost charge arrangement and inverter power pack with necessary contactors for supply to light fixtures in the lift car, fresh air fan in lift car. The same battery shall also feed the alarm bell and communication equipment.
- ***Inter-communication system:***
  Intercom system shall be provided in car to have communication in case of an emergency and shall be connected to re-chargeable battery supply.
- ***Ratings and Instructions:***
  Inside the lift car, the lift supplier shall also provide a stainless steel metallic plate indicating the rated load and detailed instructions for the passengers. This shall be mounted at a suitable place.

- ***General:***

a) Put main traction ropes from car to counterweight with rope tension adjustment.
b) Put counterweight i.e. of CI blocks in counter weight frame for suitable equilibrium.
c) Put car platform and car with adjustment.
d) Fix car door and panels / car push button/ fall ceiling light, fan.
e) Fix landing panels and put in lock in circuit.
f) Fix hoist way accessories like drum reels terminators, final limits, levelling
g) Removing the scaffolding.
h) Connect three phase supply from main switch along with earthing to controllers as per instruction given.
i) Wiring from controller to motor along with earth wire is to be completed.
j) Check motor / gear oil.
k) Start lift in maintenance mode.
l) Check adjustment of hoist way switch/ safety doors and check all parameters of shaft.
m) Put controller on normal mode.
n) Test run to be taken and & service inspection of lift with all safeties shall be done in presence of site in charge.
o) Pre commissioning work such as cleaning of shaft, pit etc shall be done.
p) After completion of work, NOC shall be obtained from lift inspector

q) by the agency before putting LIFT in to operational use.

Testing of Lift Installation:
Tests at site:

(a) Levelling Test:
Accuracy of the floor levelling shall be tested with the lift empty, fully loaded. The lift shall be run to each floor while travelling both in upward and downward directions and the actual distance of car floor above, below landing floor shall be measured. In each case there shall not be any appreciable difference in these measurements for levelling at the floors when the car is empty and when it is fully loaded. The tolerances for levelling shall be as specified in para 8 of chapter IV, section I.

(b) Safety Gear Tests:
Instantaneous safety gear controlled by a governor should be tested with contract load and a contract speed, the governor being operated by hand. Two tests should be made, however, with wedge clamp or flexible clamp safeties, one with contract load in the car and the other with 68 kg (equivalent to one person) in the car. The stopping distance obtained should be compared with the specified figures and the guides, car platform, and safety gear should be carefully examined afterwards for signs of permanent distortion.
Counterweight safety gear should be tripped by the counter weight governor and the stopping distance noted. In this case, however the governor tripping speed may exceed that of the car safety governor but by not more than 10 percent.
During the safety gear tests, car speed (from the governor or the main sheave) should be determined at the instant or tripping speed with that stated in IS. The governor jaws and rope should be examined for any undue wear.

(c) Contract speed:
This should be measured with contract load in the car, with half load, with no load, and should not vary from the contract speed by more than 10 percent. The convenient method is by counting the number of revolutions, made by the sheave or drum in a known time, Chalk mark on the sheave or drum and a stop switch will facilitate timing but care must be exercised to ensure that no acceleration or retardation periods are included. If the roping is 2 to 1 the sheave speed is twice the car speed. Alternatively, the speed can be measured by a tachometer applied directly to shaft immediately below the sheave.

(d) Lift balance:
After the above test, some of the weight shall be removed until the remaining weights represent the figures specified. With this condition at half way travel the effort required to move the lift car in either direction with the help of winding wheel shall be as nearly as can be judged by the same.

(e) Car and landing doors interlock:
The lift shall not move with any door open. The car door relay contact and the retiring release cam must be tested. The workings of the door operation and the safety edges and light equipment if any provided shall also be examined.

(f) Controllers:
The operation of the contactors and interlocks shall be examined and it shall be ascertained whether all the requirements laid down in the specifications have been met.

(g) Normal terminal stopping switches:
These shall be tested by letting the car run to each terminal landing in turn, first with no load and then with contract load and by taking measurements, top and bottom over travels can be ascertained.

(h) Final terminal stopping switches:
The normal terminal stopping switches shall be disconnected for this test. It shall be ensured that these switches operate before the buffers are engaged.

(i) Insulation Resistance:
This shall be measured (after removing the electronic PCB's and their connection) between power and control lines and earth and shall not be less than 5 mega-ohms when measured with D.C. voltage of 500 volts. The test shall be carried out with contactors so connected together as to ensure that all parts of every circuit are simultaneously tested.

(j) Earthing:
Earthing continuity of all conduits, switches, casing and similar metal work shall be tested.

(k) Ropes:
The size, number construction and fastenings of the ropes should be carefully examined and recorded.

(l) Buffers:
The car should be run on to its buffers at contract speed and with contract load in the car to test whether there is any permanent distortion of the car or buffers. The counter weight buffers should be tested similarly. Test report shall be intimated after testing at works.

Service Temperature Test:
A continuous run of one hour should be made with number of starts and stops to reproduce as nearly as practical the anticipate duty in service. (The standard duty cycle is for 180 starts per hour). It is very difficult in practice to carry out this test with alternate starts at full load and no load and it is necessary therefore to simulate these cycles. A suitable test for all motors except squirrel cage motors is to run the car up from the bottom landing with contract load and stop at each floor. From the top floor a non stop run is made to the lowest floor and the upward journey with stop is then repeated. The time intervals between stops and starts at the floors should be uniform and such as to give about 150 starts in one hour. At the end of this run the temperatures of the armatures and fields of the motor and generator are recorded. The temperature rise should, not exceed 55 deg C or 75 deg C for class A or B insulation respectively.

Method of Construction: Executed quantity will be counted on number basis. (i.e. each)

Chapter 15

TEMPORARY ILLUMINATION

15.1	**Temporary Illumination**	**TE-IL**
15.2	**Hiring of DG Set**	**TE-DG**

Chapter 15 Temporary Illumination (TE)

15.1 Temporary Illumination (TE/IL)

Scope:
Specification No (TE/IL)

This work is to be carried out within municipal premises or as instructed by Engineer- in-charge.

Method of Construction:
Wires shall be used of copper conductor with one continuous length and with minimum joints and of good insulation quality.
All switchgears and panels must be checked, tested with earth test, IR test Polarity, continuity prior to commencement or charging of installation. The results for the same shall be maintained in the logbook at site.
Termination shall be done with copper lugs at an important place such as in main switchgears and in panel.
Necessary ancillary works such as making holes in brick wall or concrete wall, scaffolding or wood work, mechanical work, civil work etc. to be done and again have to make good as original with no extra cost if required.
Maintenance personnel shall be made available for the entire period of function.

Safety Code:
All the safety codes under different statutory authorities shall be observed strictly while doing the work.
Full load testing shall be given prior to trial day with all necessary latest testing equipment.

15.2 Hiring of DG Sets (TE/HDG)

Scope:
Specification No (TE/HDG)

This work is to be carried out within municipal premises or as instructed by Engineer- in-charge and for temporary functional programs.

Method of Construction:
The DG Set on hire basis shall be fully equipped with all accessories, four pole changeover, etc and shall be filled with fuel. The connections of the changeover shall be made in presence of site engineer. Necessary testing on full load or on available load shall be taken in presence of site engineer. As far as possible load balancing shall be done. In case of switches with interlocking neutral isolation should be confirmed.
The set shall be properly earthed and earth connection are to be connected to body & neutral as per IE rules.
Termination shall be done with copper lugs at an important place such as in main switchgears and in panel.
Agency must have sufficient quantity of fuel and oil to be stored at site with tools for necessary maintenance, arrangement of first aid and fire extinguishing system.
Maintenance personnel along with Operator of DG Set shall be made available for the entire period of function.

Safety Code:
All the safety codes under different statutory authority shall be observed strictly while doing the work.
Full load testing shall be given prior to function day with all necessary latest testing equipment.

Certificate:
Commencement certificate shall be obtained by the agency from concerned Electrical Inspector of I.E. & L. Department.

Chapter 16

SIREN

16.1 Siren & Accessories SRN-SRN

Chapter 16 Siren (SRN)

16.1 Siren & Accessories (SRN-AS)

A) Weather Shade (WS)

Scope:
Specification No (SRN-AS/WS)

Supplying and erecting weather shade for protection of Siren motor, with louvers from all sides for ventilation and clear sounding of siren, duly painted with one coat of red oxide paint and two coat of approved enamel paint.

Material:
MS Sheet: 18 SWG.
Fabrication: MS angle iron
Paint: Primer & Enamel paint
Anti vibrating Pads: High density, heavy duty class rubber pads, with nut, bolts.

Method of Construction:
Weather shade for covering Siren motor shall be fabricated from 18 SWG MS sheet with necessary cutting, bending & welding. Shade shall have louvers from all sides for ventilation & clear sounding of Siren. Shade of size 91 cm height x 91 cm length x 60 cm width, top having hollow trapezium of size 91 cm x 35 cm x 35c m with angle iron frame work of size 25 x 25 x 3 mm shall be fabricated and painted with one coat of red oxide & two coats of approved enamel paint from both sides i.e., from inside & outside. The weather shade shall be firmly erected on anti vibrating pads.

Mode of Measurement: Executed quantity will be measured on number basis (i.e., each)

B) Scrapping & Painting of Shade (PTG)

Scope:
Specification No (SRN-AS/PTG)

Scrapping the existing paint and repainting the weather shade of Siren motor to withstand all weather conditions.

Material:
Surface cleaning material: Iron brush and emery paper.
Paint & Red Oxide: Epoxy red oxide, Epoxy Enamel paint, and Special thinner for painting.

Method of Construction:
Scrapping the existing paint of outer and inner surface of the weather shade with cleaning powder (Shade having an area of 3.5 Sq. mtr approx. on one side) and applying one coat of special primer red oxide mixed in special type thinner (844)in 1:3 proportion. After curing time of 6 hours, apply two coats of epoxy air dry paint (anticorrosive) of approved colour mixed in special type thinner complete (the job is to be carried out on site).

Mode of Measurement: Executed quantity will be measured on number basis (i.e., each)

C) Siren Motor (SM)

Scope:
Specification No (SRN-AS/SM)

Supplying & erecting Siren Motor of specified HP 1 ph / 3 ph AC, 50 Hz. 230/415 Volt type and as per IS 1941 (Part I) 1976, at the rated speed of 2800 RPM within 10 seconds of start for the range up to 3.25/8 Km.

Material:

Motor:

The stator & rotor shall be of aluminium alloy or similar material. The siren motor shall be compact in design and reliable in operation and stable for installation in open as well as in exposed position any where in the country. The electric motor with Class 'F' insulation shall be totally enclosed with greased sealed ball bearing and shall conform to IS 325 of 1970. If housing is provided for protection against rains, it shall not affect the sound output at the specified distance. The siren motor shall be fitted with two blowers (double mounted) horizontally properly balanced and mounted on opposite side of motor shaft and having unequal numbers of slots on the stators capable of producing a basic note from 400 to 1000 Hz.

Anti vibrating Pads: High density, heavy duty class rubber pads, with nut, bolts.

Method of Construction:

The Siren motor complete assembly shall be erected on designated plate on provided cement concrete foundation with anti-vibration pads nut-bolts etc. as directed by the engineer in-charge.

Mode of Measurement: Executed quantity will be measured on number basis (i.e., each)

Chapter 17

CIVIL WORK

17.1	**Excavation**	**CW-EXN**
17.2	**Masonry work**	**No Specs**
17.3	**C.C. Foundation**	**No Specs**
17.4	**Painting**	**CW-PTG**
17.5	**Plumbing**	**CW-PLB**
17.6	**Plumbing Accessories**	**No Specs**

17.1 Excavation (EXN)

A) Cable Trench (CTR)

1. General

This part of specification deals with the preparation of trenches in soft soil, hard murum, BT road, and laying of cables inside the trench, etc as per IS: 1255.

2. Scope:

Specification No (CW-EXN/CTR)

Excavating in all types of soil strata and making trench for laying cable/cables, providing sand bed for laying the cable, covering cable with specified material as per requirement, and finishing the same by making the surface proper with crown on top of the trench.

The following list shows Indian Standards, which are acceptable as good practice, and accepted standards.

SP 30: 1984	:	National Electrical Code
SP 7 (Group 4): 2005	:	National Building Code
IS 1255: 1967	:	Code of practice of Installation & Maintenance of armoured cables up to 33 kV.

3. Material:

Bricks: Solid Clay bricks of minimum size 225x110x62.5 mm (L x B x H), burnt in the kiln, of good quality.
Sand: Screened sand of good quality.

4. Method of Construction:

Trench in Soft soil / Hard Murum / Tar road: Single run of cable

Before excavating the soil for preparing trench, route of cable laying shall be got finalized from the site in-charge. Trench of minimum 300 mm width shall be excavated up to minimum depth below the ground surface as per Table No 17.1/1 Bottom of the trench should be carefully levelled and freed from stones. Cable duly straightened shall be laid flat and embedded in the 200 mm layer of screened sand at the bottom of the trench. Bricks shall be laid all over the run of cable as specified below:

Lengthwise for cable up to and including 10 Sqmm of all cores.

Width wise for cable above 10 Sqmm of all cores.

Remaining portion of the trench shall be back filled with the excavated material after removing stones and sharp / hard material, and making the surface proper. Crown of 150 mm shall be provided over the trench. The remaining excavated material shall be removed from site and dumped in scrap yard of Local authorities or at suitable place.

Trench in Soft soil / Hard Murum / Tar road: Two or more cables run of cable

Before excavating the soil for preparing trench, route of cable laying shall be got finalized from the site in-charge. Trench of minimum required width more than 300mm. shall be excavated up to minimum depth as per Table No 5, below the ground surface. Bottom of the trench should be carefully levelled and freed from stones. Cables duly straightened shall be laid flat and embedded in the 200 mm layer of screened sand. The inter-axial distance between two cables shall be between 230 and 400 mm. at the bottom of the trench. Bricks shall be laid all over the run of cable as specified below:

Lengthwise for cable up to and including 10 Sqmm of all cores.

Width wise for cable above 10 Sqmm of all cores.

Remaining portion of the trench shall be back filled with the excavated material after removing stones and sharp / hard material, and making the surface proper. Crown of 150

mm shall be provided over the trench. The remaining excavated material shall be removed from site and dumped in scrap yard of Local authorities or at suitable place.

Trench in Soft soil/Hard Murum/Tar road with half round Hume pipe:

(For cables of size 25 Sqmm. and above shall be covered by min. 150 mm. dia. of RCC Hume pipe)

Before excavating the soil for preparing trench, route of cable laying shall be got finalized from the site in-charge. Trench of minimum required width more than 300mm. shall be excavated up to minimum depth as per Table No 5, below the ground surface. Bottom of the trench should be carefully levelled and freed from stones. Cables duly straightened shall be laid flat and embedded in the 200 mm layer of screened sand. The inter-axial distance between two cables shall be between 230 and 400 mm. at the bottom of the trench. Inverted 150mm. dia. Half round RCC Hume pipe shall be laid above full length of cable. For more than one cable higher size or more number of Hume pipes are to be provided.

Remaining portion of the trench shall be back filled with the excavated material after removing stones and sharp / hard material, and making the surface proper. Crown of 150 mm shall be provided over the trench. The remaining excavated material shall be removed from site and dumped in scrap yard of Local authorities or at suitable place.

As per 3.1 above, in place of bricks, the cable of size 25 sq.mm and above shall be covered with 150 mm dia. half round Hume pipe.

4.4 Mode of Measurement:

Executed quantity shall be measured on the basis of running meter per run of cable.

Table No 17.1/1

Minimum laying Depth of cables (IS: 1255)

S.No	Voltage level of cables	Minimum depth from top of the cable
1	Up to 1.1 kV	750 mm
2	3.3 kV to 11 kV	900 mm
3	22 kV to 33 kV	1050 mm
4	At road crossing	1000 mm
5	At railway crossing (from Bottom of sleepers to Top of pipe)	1000 mm

17.4 Painting (PTG)

General:

This part of specification deals with the painting of all types of Fans, Poles, Fluorescent fittings, Panel type lift doors, Collapsible gates of lift, Transformer, Fencing & Gate of transformer sub station, Feeder pillar, etc.

A) Painting of Fans (PTF)

Specification No (CW-PTG/PTF)

Scope:

Spray painting of table fan / pedestal fan / cabin fan / ceiling fan / exhaust fan including guards etc., shall be carried out in the workshop by adopting following method:

Method of construction:

a) Existing paint on the surface of the fan body and its accessories shall first be scrapped off with the help of Emery paper of required grade or by heating the surface with blowlamp. One coat of primer shall then be uniformly applied with spraying gun and same shall be allowed to dry out. The body of fan then shall be spray painted with 2 coats of enamel paint of specified colour. When the colour is completely dried, rubbing Wax compound shall be applied. With a smooth cloth, the surface shall then be vigorously rubbed, until the painted parts starts shining. Same method shall be adopted for fan blades, base & stand of pedestal fan, mounting frame of exhaust fan. After complete drying, fan shall be covered in paper, to avoid abrasion.
b) Grills of the fan shall be soaked and then cleaned with solvent and pressure dried. Paint shall be applied either by brush or with by spraying. After complete drying, it shall be covered in paper, to avoid abrasion.
c) The agency shall have to make arrangement of transportation of fans from site to workshop & back to site, after completion of painting job.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

B) Painting of Poles/Channels (PTP)

Specification No (CW-PTG/PTP)

Scope:

Painting of channel / steel tubular / Rail / RSJ / pipe pole along with street light / pole brackets / clamps completely & providing one coat of red oxide paint and two coats of aluminum paint (Black paint up to 1.5 m from plinth is recommended)

Method of construction:

a) Existing paint of the pole/channel shall be scrapped completely by emery paper/wire brush. Then one coat of red oxide shall be applied on cleaned surface. After drying out of the red oxide two coats of aluminium paint shall be uniformly applied to the pole/channel. In case of pole, it is recommended to apply black paint for the portion, which shall get embedded in soil/foundation. Remaining portion of the pole shall then be painted with two coats of aluminium paint as per instruction.
b) The agency shall make arrangement of ladders, tools, spares, etc. required for carrying out painting at site.

Mode of Measurement: Executed quantity shall be measured on running meter basis. (i.e per meter)

C) Painting of Fluorescent fittings (PFT)

Specification No (CW-PTG/PFT)

Scope:

Spray painting of fluorescent fitting with flat reflector for ½ - 4' FTL completely from inside and outside after dismantling inside wiring / accessories and providing one coat of red oxide and two coats of best quality enamel paint of required colour and duly wired with accessories complete with re-erection as original.

Method of construction:

a) Fitting shall be dismantled from its location. All wiring shall then be dismantled and stored in safe place, so as to reuse it after the painting.
b) Existing paint of the metal surface of both the surfaces (inside & outside) shall be scrapped completely by using emery paper. After cleaning the scrapped surface, one coat of red oxide shall be applied by spraying gun. When the red oxide is completely dried out, two coats of white or any other specified colour shall be uniformly applied with spraying gun.
c) The fitting duly painted then shall be erected at its location with necessary required hardware.
d) The agency shall make necessary arrangements of tools/ladders required for executing the above job.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

D) Painting of Panel type doors of Lift (PLD1)

Specification No (CW-PTG/PLD1)

Scope:
Spray Painting of Panel type lift doors of MS, complete with scrapping the existing paint preparing the surface, painting the door with one coat of red oxide paint, white primer and finally with two coats of best quality paint of colour specified by engineer in-charge & polishing with rubbing compound & final polish of surface painting of doors etc.

Method of construction:

a) Existing paint on the surface of the door and its accessories shall first be scrapped off with the help of Emery paper of required grade or by heating the surface with blowlamp.
b) One coat of primer shall then be uniformly applied with spraying gun and same shall be allowed to dry out. Then all parts shall be spray painted with 2 coats of enamel paint of specified colour. When the colour is completely dried, rubbing Wax compound shall be applied. With a smooth cloth, the surface shall then be vigorously rubbed, until the painted parts starts shining.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

E) Painting of lift door of Collapsible type (PLD2)

Specification No (CW-PTG/PLD2)

Scope:
Painting lift door of collapsible type complete by scrapping the existing paint & preparing the surface, applying one coat of red oxide, white primer & two coats of approved quality enamel paint of required colour.

Method of construction:
Existing paint collapsible door of lift shall be scrapped completely by emery paper/wire brush. Then one coat of red oxide shall be applied on cleaned surface. After drying out of the red oxide, two coats of best quality paint of colour specified by engineer in-charge shall be uniformly applied to the door.

Mode of Measurement: Executed quantity shall be counted on number basis. (i.e. each)

F) Spray painting of Distribution Transformer (PDT)

Specification No (CW-PTG/PDT)

Scope:
Spray painting of distribution transformer of specified capacity with one coat of red oxide & two coats of approved quality enamel paint after scrapping the existing paint without any damages, in an approved manner as per direction.

Method of construction:
Existing paint of the transformer body, radiator fins, conservator tank, along with cable end boxes if any, shall be scrapped with emery paper of required grade. Sufficient care shall be taken while scrapping the paint at joints, so as to avoid leakage of oil. All the oil stains shall be removed. After preparing the surface, one coat of red oxide shall be applied with spray gun. After drying out of red oxide two coats of superior quality paint shall then be uniformly applied as instructed by site in charge.

Mode of Measurement: Executed quantity shall be measured on job basis. (i.e. job)

17.5 Plumbing (PLB)

A) Galvanized Iron Pipes (GP)

1. General

This part of specification deals with the Galvanized Iron pipes of different Class (Heavy, Medium & Light) used for water supply, or for any other purpose.
The guidelines for the use of pipes are as under:

- Heavy gauge pipes shall be used for delivery line of Submersible pumps/Ejecto Jet pumps/Open well submersible pumps.
- Medium gauge shall be used for suction pipe of Centrifugal pumps, (Except for Centrifugal pumps meant for Fire fighting purpose.) and shall be used enclosure for cables while meant for laying underground at road crossing, or any other location as directed by engineer in-charge, etc.
- Light gauge shall be used as enclosure for cables on wall, pole, or for other purpose wherever specified.

2. Scope:

Specification No (CW-PLB/GP)
Supplying and erecting GI Pipes of specified class, with necessary accessories, (such as: bends, tees, couplings, unions, sockets, enlargers, reducers, check nuts, plugs, etc.) at designated place, having relevant ISI mark, complete to the satisfaction of the department.

3. Material:

Pipe: The galvanized iron pipes shall comply with IS: 1239--1973 and 1969 for the specified class. The specified diameter of the pipes shall refer to inside diameter.
Fittings & Accessories: Bends, Tees, Couplings, Unions, sockets, bends, tees, enlargers, reducers, back nuts, plugs, unions, etc shall made of galvanized iron and shall comply IS: 1239-1973 and 1969.
Plumbing material: Hemp, Linseed oil.
MS Clamps: Clamps fabricated of required length and shape, of 3/6 mm thick mild steel having 25/50 mm width.
Hardware: MS nuts & bolts of required size and strength, Sheet Metal (SM) screws of required sizes, plugs/wooden gitties, etc.

4. Method of Construction:

4.1 Pipes to be used as Enclosure:

4.1.1 Erection of Pipe on wall:

The required length of pipe shall be machine cut, without any sharp edges, burrs, etc. The pipe duly enclosing the specified material, shall be erected on wall in plum, and fixed with required size of MS clamps on wall with plugs, gitties, etc.
When the pipe is to be fixed to walls it shall be fixed with standard bracket, clips or holder by keeping the pipe about 12mm clear of the wall. The pipe shall be fixed to the wall horizontally and vertically and parallel to one another, when more than one pipe is to be laid, unless unavoidable. The supporting clips, etc. for the pipe shall be spaced at about two meters or so as necessary. Holes cut during construction shall not be left out; they shall be filled and finished after passing of the pipe through it.

4.1.2 Erection of Pipe on pole:

The required length of pipe shall be machine cut, without any sharp edges, burrs, etc. The pipe duly enclosing the specified material, shall be erected on pole in plum, and fixed with required size of MS clamps with MS nuts & bolts of required size and strength. When the pipe is to be used as cable enclosure and is to be terminated on street light pole(s), the pipe at the trench level should be placed at least 30 cm above the cable level for avoiding damage to the insulation of cable.

4.1.3 Laying the Pipe underground:

The excavation for laying the pipe underground shall be done as required, and in advance of laying, so as to cause least damage to the trench and least inconvenience to traffic and in other respects. The trench for laying the pipe shall be excavated to the lines and levels as directed by the site engineer. The bed shall be made even. Unless otherwise

specified in the special provisions, the excavation shall be about 30 cm. wide and not less than 45 cm. deep. The trench shall be excavated through all strata met with. Where necessary, sides may be shored or sloped. In case rock is met with the section of the trench, the depth may be slightly reduced but shall be sufficient to receive the pipe and the cushioning with a safe margin. Dewatering shall be done where necessary.

During excavation, if any, pipes, water mains, cables. etc. are met, these shall be carefully protected and supported; any damage done shall be made good by the contractor at his own cost.

4.3 Pipe used for Plumbing purpose:

The required length of pipe shall be machine cut and threaded (threading shall be done by machine only), without any sharp edges, burrs, etc. The pipe shall then be properly aligned with the accessory and tightening by applying hemp, linseed oil, so as to make it leak proof. During the erection, wherever required, correct accessory shall be used. When holes are not left during construction they shall be cut into the walls or slabs, etc., to pass the pipe through. The necessary clamps, supports shall be provided wherever required.

5. <u>Mode of Measurement:</u>

Executed quantity shall be measured on running meter basis, including the entire accessory. The lengths shall be measured net including the straight and bends along the center line of the pipes and fittings correct up to a cm. (i.e. per meter)