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**Name of Work: Annual Repair & Maintenance of Residential and Non-residential Buildings i.e. Administrative block, Academic blocks, sports complex, Hostels, staff Qtrs. at DTU campus, Bawana road, Delhi during the year 2019-20 & 2020-21. SH:-Civil, Electrical & Horticulture Works. (Composite Work).**

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Certified that this NIT Contains 239 pages (Two Hundred and Thirty Nine) marked as 1 to 239.

Executive Engineer/DTU

**CPWD-6, CPWD 7/8 i/c Schedule A to F for the Major Component of the work, standard CPWD,G.C.C. 2014 as amended/modified up to the last date of submission of bid including extension, if any**

<b>DTU</b>
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<b>COMPOSITE NOTICE INVITING TENDER</b>
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<b>N.I.T. No.</b>	DTU/Engg. Cell/2019-20/	
<b>Name of work</b>	Annual Repair & Maintenance of Residential and Non-residential Buildings i.e. administrative block, academic blocks, sports complex, hostels, staff Qtrs. at DTU campus, Bawana road, Delhi during the year 2019-20& 2020-21. SH:-Civil, Electrical & Horticulture Works. (Composite Work)	
<b>Estimated Cost</b>	For Civil Works:	Rs. 7,13,90,680/-
	For Electrical works:	Rs. 4,25,25,763/-
	For Horticulture works:	Rs. 96,35,949/-
	Total:	Rs. 12,35,52,392 /-
<b>Earnest Money</b>	Rs. 22,35,524 /- (In favour of Registrar DTU, Delhi.)	
<b>Performance Guarantee</b>	5% of the tendered amount.	
<b>Security Deposit</b>	2.5% of the Gross work done /tendered value.	
<b>Time Allowed</b>	One Year	

This NIT for work amounting to Rs. 12,35,52,392/- (Rupees Twelve Crore Thirty Five Lakh Fifty Two Thousand Three Hundred and Ninety Two only) contains pages from 1 to 239 (One to Two Hundred and Thirty Nine) only.

J.E. (Civil)/J.E. (Elect.)

A.E. (Civil)

Executive Engineer (DTU)

**INFORMATION AND INSTRUCTIONS FOR BIDDERS FOR E-TENDERING FORMING PART OF BID  
DOCUMENT AND TO BE POSTED ON WEBSITE**

**(Applicable for inviting open bids)**

The Executive Engineer, Delhi Technological University, Bawana Road, Delhi (Email ID: eecivildtu@gmail.com ) on behalf of Delhi Technological University invites online percentage rate bids from eligible contractors of CPWD , DDA enlisted in appropriate category and those of appropriate list of M.E.S., BSNL, Railway and State Govt.'s Departments dealing with building and road works for the following work (s):

S. No.	NIT No.	Name of work & Location	Estimated cost put to tender	Earnest money	Period of completion	Last date & time of submission of bid. EMD, e-tender processing fee and other documents as specified in the Press Notice.	Time & date of opening of bid
1	2	3	4	5	6	7	8
1.	DTU/Engg. Cell/2019-20/	Annual Repair & Maintenance of Residential and Non-residential Buildings i.e. administrative block, academic blocks, sports complex, hostels, staff Qtrs. at DTU campus, Bawana road, Delhi during the year 2019-20 & 2020-21. SH:-Civil, Electrical & Horticulture Works. (Composite Work)	12,35,52,392/-	Rs. 22,35,524/-	01 Year	Up to 03.00 PM On <b>20.01.2020</b>	At 03.30 PM On <b>20.01.2020</b>

- The intending bidder must read the terms and conditions of CPWD-6 carefully. He should only submit his bid if he considers himself eligible and he is in possession of all the documents required.
- Information and Instructions for bidders posted on website shall form part of bid document.
- The bid document consisting of plans, specifications, the schedule of quantities of various types of items to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents can be seen and downloaded from website <http://govtprocurement.delhi.gov.in> free of cost.
- Those contractors not registered on the website mentioned above, are required to get registered beforehand. If needed they can be imparted training on online bidding process as per details available on the website.
- The intending bidder must have valid class and above digital signature to submit the bid.
- On opening date, the contractor can login and see the bid opening process. After opening of bids he will receive the comparative bid sheets.
- Contractor can upload documents in the form of **JPG** format and **PDF** format.

**List of Documents to be scanned and uploaded within the period of bid submission:**

1. Payment of Bid Security (Earnest Money Deposit): The EMD may be submitted through ECS/RTGS/NEFT direct to receipt account of Registrar DTU as detail given below and receipt of proof of ECS/RTGS/NEFT shall be uploaded with documents.

DTU EMD Account No.	30875679275 (Registrar, DTU)
Name of Bank	State Bank of India
Bank Address	DCE Campus, Shahbad Daulatpur, Bawana Road, Delhi- 110042.
IFSC CODE	SBIN0010446
BRANCH CODE	10446
MICR CODE	110002438
SWIFT CODE	SBININBB544

This amount shall be refunded in case of rejection of the bid. Photocopy of proof of ECS/RTGS/NEFT shall be sent to DTU up to Last Date and Time for receipt of tenders through e-procurement solution.

2. Scanned copy of valid CPWD registration certificate of appropriate composite category (Class-I and above).
3. Scanned copy of performance certificate from the client for successfully completed similar works in an Educational university/ Govt./PSU's, semi-govt. for reckoning towards works experience during last seven years ending previous day of last date of submission of bid.
  - a) Three similar work not less than 40% of estimated cost put on tender.  
OR
  - b) Two similar work not less than 60% of estimated cost put on tender.  
OR
  - c) One similar work not less than 80% of estimated cost put on tender.
4. Should have had average annual financial turnover at least of Rs. 6.00 Crores during the immediate last three consecutive financial years ending March 2019 (Scanned copy of Certificate from CA to be uploaded).
5. Should have a solvency of Rs. 6.00 Crore (Scanned copy of original solvency/ Banker's Certificate to be uploaded).
6. Certificate of Registration for G.S.T. and acknowledgement of up to date filed return.
7. Scanned copy of PAN Card issued by Income Tax Department.

**Note:** However, certified copy of all the scanned and uploaded documents duly attested by Gazetted officer/ Notary Public as specified on above shall have to be submitted by the lowest bidder only within a week physically in the office of Executive Engineer, Engineering Cell, DTU, Delhi-110042.

Further details can be seen at <https://dtu.ac.in>

**Executive Engineer**

### **CPWD-6 FOR E-TENDERING**

Percentage rate bids are invited on behalf of Delhi Technological University from eligible contractors of CPWD, DDA enlisted in appropriate category and those in appropriate list of M.E.S., BSNL, Railway and State Govt.'s Departments dealing with building and road works for the work of **Annual Repair & Maintenance of Residential and Non-residential Buildings i.e. administrative block, academic blocks, sports complex, hostels, staff Qtrs. at DTU campus, Bawana road, Delhi during the year 2019-20 & 2020-21. SH:-Civil, Electrical & Horticulture Works. (Composite Work).**

1. The enlistment of the contractors should be valid on the last date of submission of bids. In case the last date of submission of bid is extended, the enlistment of contractor should be valid on the original date of submission of bids.

1.1 The work is estimated to cost **Rs. 12,35,52,392/-**.

1.1.1 Intending bidder is eligible to submit the bid provided he has definite proof from the appropriate authority, which shall be to the satisfaction of the competent authority, of having satisfactorily completed similar works of magnitude specified Below:-.

Criteria of eligibility for submission of bid documents

1.2.1 Three similar works each of value not less than 40% of estimated cost put to tender or two similar works of value not less than 60% of estimated cost put to tender or one similar work of value not less than 80% of estimated cost put to tender in last 7 years ending previous day of last date of submission of bids.

**Similar work shall mean “Construction or Maintenance of Building work”. However the decision of Engineer-in-Charge shall be final in this regard.**

The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum, calculated from the date of completion to the last date of submission of bid.

**To become eligible for bid, the bidders shall have to furnish an affidavit as under:-**

I/We undertake and confirm that eligible similar works(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/we shall be debarred for bidding in DTU in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee. (Scanned copy to be uploaded at the time of submission of bid)

- 2 Agreement shall be drawn with the successful bidders on prescribed Form No. **CPWD 7** (or other Standard Form as Mentioned) which is available as a Govt. of India Publication and also available on website **www.cpwd.gov.in**. Bidders Shall quote his rates as per various terms and conditions of the said form which will form part of the agreement.
3. The time allowed for carrying out the work will be **01 year** from the date of start as defined in schedule 'F' or from the first date of handing over of the site, whichever is later, in accordance with the phasing, if any, indicated in the bid documents.
4. **The site for the work is available.**
5. The bid document consisting of plans, specifications, the schedule of quantities of various types of items to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents except Standard General Conditions of Contract Form can be seen on website <http://govtprocurement.delhi.gov.in> **free of cost.**
6. After submission of the bid the contractor can re-submit revised bid any number of times but before last time and date of submission of bid as notified.
7. While submitting the revised bid, contractor can revise the rate of one or more item(s) any number of times (he need not re-enter rate of all the items) but before last time and date of submission of bid as notified.
8. **Bids are invited in under two bid system i.e. Technical bid and Financial bid.**
9. **Earnest Money shall be deposited through ECS/RTGS/NEFT mode only as mentioned in page no. 6. The original receipt of EMD deposited with all original documents should be deposited in the office of Executive Engineer, DTU by lowest bidder only within the period of submission.**

**Copy of Enlistment Order and certificate of work experience and other documents as specified in the press notice shall be scanned and uploaded to the e-Tendering website within the period of bid submission. However, lowest bidder shall submit certified copy of all the scanned and uploaded documents as specified in press notice in the office of Executive Engineer/ DTU.**

Online bid documents submitted by intending bidders shall be opened only of those bidders, whose documents with receipt of EMD deposited scanned and uploaded are found in order.

The bid submitted shall be opened on **20-01-2020 at 03:30 PM**

10. The bid submitted shall become invalid if:

(i) The bidder is found ineligible.

- (ii) The bidder does not deposit original EMD deposited receipt in office of Executive Engineer, DTU.
- (iii) The bidder does not upload required documents as mentioned above.
- (iv) If any discrepancy is noticed between the documents as uploaded at the time of submission of bid and hard copies as submitted physically by the entire bidder in the office of bid opening authority.
- (v) If a tenderer quotes NIL rates against each items in item rate tender or does not quote any percentage above/below on the total amount of the tender or any section/sub head in percentage rate tender, the tender shall be treated as invalid and will not be considered as lowest tenderer.

11. The contractor whose bid is accepted will be required to furnish **performance guarantee of 5% (Five Percent)** of the tendered and accepted value of the work amount within the period specified in Schedule F. This guarantee shall be in the form of Banker's cheque of any scheduled bank/Demand Draft of any scheduled bank/ Pay order of any Scheduled Bank of any scheduled bank (in case guarantee amount is less than Rs. 1,00,000/-) or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the prescribed form. In case the contractor fails to deposit the said performance guarantee within the period as indicated in Schedule 'F', including the extended period if any, the Earnest Money deposited by the contractor shall be forfeited automatically without any notice to the contractor. **The earnest money deposited along with bid shall be returned after receiving the aforesaid Performance guarantee.** The contractor whose bid is accepted will also be required to furnish either copy of applicable licenses/registrations or proof of applying for obtaining labour licenses, registration with EPFO, ESIC and BOCW welfare board and program chart (Time & progress) with in the period specified in Schedule F.

**12. The description of the work is as follows: Name of Work: - Annual Repair & Maintenance of Residential and Non-residential Buildings i.e. administrative block, academic blocks, sports complex, hostels, staff Qtrs. at DTU campus, Bawana road, Delhi during the year 2019-20, 2020-21. SH:-Civil, Electrical & Horticulture Works. (Composite Work)**

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

- 13. **The competent authority on behalf of the Delhi Technological University does not bind itself to accept the lowest or any other bid and reserves to itself the authority to reject any or all the bids received without the assignment of any reason. All bids in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the bidders shall be summarily rejected.**
- 14. Canvassing whether directly or indirectly, in connection with bidders is strictly prohibited and the bids submitted by the contractors who resort to canvassing will be liable for rejection.
- 15. The competent authority on behalf of the Delhi Technological University reserves to himself the right of accepting the whole or any part of the bid and the bidders shall be bound to perform the same at the rate quoted.
- 16. The contractor shall not be permitted to bid for works in the DTU (Division in case of contractors of Horticulture/Nursery category) responsible for award and execution of contracts, in which his near relative is posted a Divisional Accountant or as an officer in any capacity between the grades of E.E. and Junior Engineer (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any gazetted officer in the Delhi Technological University or in the Govt. of NCT of Delhi. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this Department.
- 17. No Engineer of Gazetted Rank or other Gazetted Officer employed in Engineering or Administrative duties in an Engineering Department of the Government of India is allowed to work as a contractor for a period of one year after his retirement from Government service, without the prior permission of the Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found any time to be such a person who had not obtained the permission of the Government of India as aforesaid before submission of the bid or engagement in the contractor's service.
- 18. **The bid for the works shall remain open for acceptance for a period of Seventy Five (75) days from the date of opening of bids.** If any bidders withdraws his bid before the said period or issue of letter of acceptance, whichever is earlier, or makes any modifications in the terms and conditions of the bid which are not acceptable to the department, then the Government shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money as aforesaid. Further the bidders shall not be allowed to participate in the rebidding process of the work. (Modified vide OM DG/CON/279 Dt. 09.05.2014)

19. This notice inviting Bid shall form a part of the contract document. The successful bidders/contractor, on acceptance of his bid by the Accepting Authority shall within 15 days from the stipulated date of start of the work, sign the contract consisting of:-
- (a) The Notice Inviting Bid, all the documents including additional conditions, specifications and drawings, if any, forming part of the bid as uploaded at the time of invitation of bid and the rates quoted online at the time of submission of bid and acceptance thereof together with any correspondence leading thereto.
  - (b) Standard C.P.W.D. Form 7 or other Standard C.P.W.D. Form as applicable.

## 20. For Bids

20.1.1 The bid document will include following two components:

**Part A:-** CPWD-6, CPWD-7 including schedule A to F for the work, Standard General Conditions of Contract for CPWD 2014 as amended/modified up to the last date of submission of bid, including extension, if any.

**Part B: -** General / specific conditions, specifications and schedule of quantities of the work.

20.1.2 The eligible bidders shall quote rates for all items of work.

20.1.3 After acceptance of the bid by competent authority, the EE of the work shall issue letter of award on behalf of the Delhi Technological University. After the work is awarded, the contractor will have to enter into an agreement with EE.

20.1.4 Security Deposit will be worked out on the basis of estimated cost put to tender for work.

21. **There should be no subletting of work except for any specialized work. In case of any subletting of specialized work, the approval of Engineer-In-Charge shall be obtained.**



**GUIDELINES REGARDING SIGNING OF INTEGRITY PACT BY THE BIDDER AT THE TIME OF  
SUBMISSION Of BID (Vide No. DG/CON/255A dated 10.08.2011)**

**Sub: Clarification regarding Introduction of Integrity Pact introduced vide OM No. CON255 dated 23.05.2011**

A new provision of Integrity Pact (IP) was introduced in GCC-2014 vide OM No. CON/255 dated 23.05.2011. In the OM it is mentioned that at the time of submission of bid, it shall be mandatory to sign the pact by the bidder failing which the bidder will stand disqualified from the tendering process and such bid would be summarily rejected.

Some field Units has raised their doubts regarding submission of duly signed Integrity Pact by the bidder at the time of submission of bid. In this regard it is clarified that:-

1. Submission of duly signed Integrity Pact by the bidder is applicable in case of manual tendering where e-tendering is not followed.
2. In case of manual tendering Executive Engineer should sign the first page addressed to the intending bidder at the time of issue of tender form and before submission of the bid, each bidder shall sign IP at respective places and submit the bid. If duly signed IP is not submitted by the bidder, such bid shall not be considered.
3. In case of e-tendering, Integrity Pact shall be treated in the same manner as other components of the bid document. In e-tendering, the intending bidder does not sign any document physically and entire bid document is submitted through digital signature. Since IP is a part of bid document no separate physical submission is required with other documents to be submitted in the office of tender opening authority. In addition to other component of bid document, the Integrity Pact shall also be signed between Executive Engineer and successful bidder after acceptance of bid.

CPWD -7

DTU

**TENDER**

I/We have read and examined the notice inviting tender, schedule, **A, B, C, D, E & F** Specifications applicable, Drawings & Designs, General Rules and Directions, Conditions of Contract, of **2014** with amendments up to the last date of submission of tenders, clauses of contract, Special conditions, Schedule of Rate & other documents and Rules referred to in the conditions of contract and all other contents in the tender document for the work **Annual Repair & Maintenance of Residential and Non-residential Buildings i.e. administrative block, academic blocks, sports complex, hostels, staff Qtrs. at DTU campus, Bawana road, Delhi during the year 2019-20, 2020-21 SH:-Civil, Electrical & Horticulture Works. (Composite Work).**

I/We hereby tender for the execution of the work specified for the President of India within the time specified in Schedule 'F' viz., schedule of quantities and in accordance in all respect with the specifications, designs, drawing and instructions in writing referred to in Rule-1 of General Rules and Directions and in Clause 11 of the Conditions of contract of **2014** with amendments up to the last date of submission of tender and with such materials as are provided for, by, and in respect of accordance with, such conditions so far as applicable.

We agree to keep the tender open for Seventy Five (75) days from the date of opening of technical bid and not to make any modification in its terms and conditions.

A sum of **Rs. 22,35,524/-** is hereby forwarded in ECS/RTGS/NEFT mode within prescribed period, I/We agree that the said DTU or his successors representatives, in office shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I/We fail to commence work as specified, I/We agree that DTU or the successors representatives in office shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said the performance guarantee absolutely. The said performance Guarantee shall be a guarantee to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to those in excess of that limit at the rates to be determined in accordance with the provision contained in **Clause 12.2 and 12.3** of the tender form. Further, I/We agree that in case of forfeiture of Earnest Money & Performance Guarantee as aforesaid, I/We shall be debarred for participation in the re-tendering process of the work.

I/We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/We shall be debarred for tendering in DTU in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit/ Performance Guarantee.

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

**Dated:** .....\*\*.....

**Signature of Contractor \*\***

**Witness: \*\***

**Address: \*\***

**Postal Address \*\***

**Occupation: \*\***

## ACCEPTANCE

The above tender (as modified by you as provided in the letters mentioned hereunder) is accepted by me for an on behalf of the **Delhi Technological University** for a sum of Rs..... \* .....  
 (Rupee..... \* .....  
 .....).

The letters referred to below shall form part of this contract agreement:-

- (a) \*
- (b) \*
- (c) \*

**For & on behalf of Delhi Technological University**

**Signature** ..... \*

**Dated:** ..... \*

**Designation** ..... \*

**PROFORMA OF SCHEDULES  
(FOR MAJOR COMPONENT)**

**SCHEDULE 'A'**

Schedule of quantities for Civil Works, Electrical works and Horticulture as per Page No.     **to**

**SCHEDULE 'B'**

Schedule of materials to be issued to the contractor.

S. No.	Description of item	Quantity	Rates in figures & words at Which the material will be charged to the contractor	Place of issue
<b>NIL</b>				

**SCHEDULE 'C'**

Tools and plants to be hired to the contractor

S. No.	Description	Hire charges per day	Place of Issue
<b>NIL</b>			

**SCHEDULE 'D'**

Extra schedule for specific requirements /document for the work, if any.

**SCHEDULE 'E'**

Reference to General Conditions of Contract: General Conditions of Contract 2014 read along with correction slips/amendments issued up to the last date of submission of tender including extension, if any.

<b>Name of work</b>	<b>Annual Repair &amp; Maintenance of Residential and Non-residential Buildings i.e. administrative block, academic blocks, sports complex, hostels, staff Qtrs. at DTU campus, Bawana road, Delhi during the year 2019-20 &amp; 2020-21. SH:-Civil, Electrical &amp; Horticulture Works (Composite Work).</b>
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**Estimated cost of work**

I.	Estimated Cost	<b>Rs. 12,35,52,392 /-</b>
II.	Earnest Money	<b>Rs. 22,35,524/-</b>

I.	Performance Guarantee :	5% of the Tendered amount.
II.	Security Deposit	2.5% of Gross work done/Tendered Amount

**SCHEDULE 'F' (GENERAL RULES & DIRECTIONS)**

**Officer inviting tender:** Executive Engineer, DTU, Bawana Road Delhi,  
Email id: eecivildtu@gmail.com

**Definitions:**

<b>1.</b>	<b>Engineer-in-Charge</b>	<b>The Executive Engineer, DTU, Bawana Road, Delhi.</b>
<b>2.</b>	<b>Accepting Authority</b>	<b>Vice Chancellor, DTU, Bawana Road, Delhi.</b>
<b>3.</b>	<b>Percentage on cost of materials and Labour cover all to overheads and profits</b>	<b>15%</b>

4.	Standard Schedule of Rates	1.DSR 2016 (Civil), read along with correction slips/amendments issued up to the last date of submission of tender including extension, if any, plus cost index. 2. DSR-2016 & Prevailing Market rates for Electrical works 3. DSR-2018 for Horticulture works
5.	Department	<b>Delhi Technological University, Shahbad Daulatpur, Bawana Road Delhi</b>
6.	Standard CPWD Contract Form GCC 2014	<b>CPWD Form 7 &amp; GCC 2014</b> read along with correction slips/amendments issued up to the last date of submission of tender including extension, if any.

**Clause 1**

1.	Time allowed for submission of Performance Guarantee from the date of issue of letter of acceptance	<b>07 (Seven) days</b>
2.	Maximum allowable extension beyond the period provided in (i) above	<b>3 (Three) days with late fee @ 0.1% per day of the PG amount.</b>

**Clause 2**

Authority for fixing compensation under clause 2	<b>Vice Chancellor, DTU, Bawana Road, Delhi.</b>
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**Clause 2A**

Whether Clause 2A shall be applicable	<b>N/A</b>
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**Clause 5**

Number of days from the date of issue of letter of acceptance for reckoning date of start	<b>10 (Ten) days or date of handing over of site whichever is later</b>
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Time allowed for execution of work- **01 year**

**Authority to decide:**

(i)	Extension of time :-	<b>Vice Chancellor, DTU, Bawana Road, Delhi.</b>
(ii)	Rescheduling of mile stones :-	<b>Vice Chancellor, DTU, Bawana Road, Delhi.</b>
(iii)	Shifting of date of start in case of delay in handing over of site:	<b>Vice Chancellor, DTU, Bawana Road, Delhi.</b>

**Clause 6, 6A**

Clause applicable - (6 or 6A)	<b>6A ( computerized measurement book to be submitted by agency)</b>
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**Clause 7**

Gross work to be done together with net payment /adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment	<b><u>Rs. 80 lacs for work</u></b>
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**Clause 7A**

<b>No running Account Bill shall be paid for the work till the applicable labour licenses, registration with EPFO, ESIC and BOCW Welfare Board, whatever applicable is submitted by the contractor to the Engineer-in-Charge.</b>	As Applicable.
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**Clause 10A**

List of testing equipment to be provided by the contractor in the lab at each site of work as per [TABLE-1] of Annexure-I attached.

**Clause 10 B (ii)**

Whether Clause 10 B (ii) shall be applicable	N/A
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**Clause 10C.**

Component of labour expressed as percent of value of work	Not Applicable
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**Clause 10CA: - Not-Applicable****Clause 10 CC: - Not-Applicable**

Schedule of component of other materials, Labour, POL etc. for price escalation:-

Component of civil materials (Except materials covered under clause 10CA)

Component of labour expressed as percent of total value of work.

Component of P.O.L. expressed as percent of total value of work.

} **Not Applicable**

**Clause 11**

S. No	Specifications to be followed for execution	
1	Civil work	<b>CPWD Specifications 2009 volume- I &amp; II</b> read along with up to date correction slips/amendments issued up to the last date of submission of tender including extension, if any
2.	Electrical Work	All the works shall be carried out as per <b>CPWD General Specification for E&amp;M Works, Part-I (Internal)-2013 Part-II (External)-1994; Part-IV (Sub-Station)-2013</b> , amended up to date and should also comply with relevant provisions of the Indian Electricity Rules and Acts as applicable, amended up to date
3.	Horticulture	C.P.W.D. Specification - 1999 Vol. - I to VI with upto date correction slips

**Clause 12**

Type of work

It is a maintenance work. Restriction of completion cost up to 1.25 times of tender cost shall be applicable. For the purpose of derivation of rates of extra, substituted, deviations beyond specified limit it shall be treated as maintenance work.

Maximum percentage for quantity of items of work to be executed beyond which rates are to be determined in accordance with Clauses 12.2, 12.3 : Please refer below

12.2. & 12.3	Deviation limit beyond which clauses 12.2 & 12.3 shall apply for building work	<b>50% (Fifty percent only)</b>
12.5	i) Deviation Limit beyond which clauses 12.2 & 12.3 shall apply for foundation work	<b>100% (One Hundred percent only)</b>

**Clause 16**

Competent Authority for deciding reduced rates.	<b>Vice Chancellor, DTU, Bawana Road, Delhi.</b>
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**Clause 18**

List of mandatory machinery, tools & plants to be deployed by the contractor at site:- All plants, equipments and machinery required for smooth and efficient progress of work as per direction of Engineer-in-Charge.

**Clause 25**

**Constitution of Dispute Redressal Committee: - This contract will be subject to Delhi High Court jurisdiction only.**

**Clause 36 (i)**

S. No.	Minimum qualification of Technical Representative	Discipline	Designation (Principal technical / Technical representative)	Minimum experience	Number	Rate at which recovery shall be made from the contractor in the event of not fulfilling provision of Clause 36(I)	
						Figures	Words
1	Graduate Engineer	Civil, Electrical, Horticulture	Principal technical representative	5 Years	3	Rs. 75,000/- (Per month)	Rs. Seventy Five thousand per month
2	Graduate Engineer Or Diploma Engineer	Civil, Electrical, Horticulture	Project/Site Engineer and Project Planning/billing Engineer	2 Years 5 Years	1 1	Rs. 75,000/- (Per month)	Rs. Seventy Five thousand per month

**Assistant Engineer retired from Government services that are holding Diploma will be treated at par with Graduate Engineers.**

Diploma holder with minimum 10 years relevant experience with a reputed construction co. can be treated at par with Graduate Engineers for the purpose of such deployment subject to the condition that such diploma holders should not exceed 50% of requirement of degree engineers.

**Clause 42**

(i)	(a)	Schedule/statement for determining theoretical quantity of cement & bitumen on the basis of Delhi Schedule of Rates	<b>DSR 2016 for civil works will read along with correction slips/amendments issued up to the last date of submission of tender including extension, if any. DSR 2016 for Electrical works will read along with correction slip. DSR 2018 for Horticulture works will read along with correction slip</b>
(ii)		Variations permissible on theoretical quantities:	
	(a)	Cement	
		For works with estimated cost put to tender more than Rs. 5 lakh.	<b>2% (Two percent) plus / minus .</b>
		Bitumen for all works	<b>2.5% (Two point five percent) plus only and nil on minus side.</b>
	(b)	Steel Reinforcement and structural steel sections for each diameter, section and category	<b>2% (Two percent) plus / minus</b>
	(c)	All other materials	<b>Nil</b>

**ANNEXURE –I****(TABLE-1)****Equipment's for Testing of Materials & Concrete at Site Laboratory (on each site of work)**

**Note:** individual school shall be considered as a separate site of work.

All necessary equipment for conducting all necessary tests shall be provided at the site in the well-furnished site laboratory of minimum size 25 feet X 15 feet by the contractor at his own cost The following minimum laboratory equipment shall be set up at site office laboratory:-

<b>Sl. No.</b>	<b>Equipment</b>	<b>Numbers (Minimum)</b>
1.	100 MT compression testing machine, electrical-cum-manually operated)	1
2.	Slump cone, steel plate, tamping rod, steel scale, scoop	3
3.	Vicat's apparatus with Desk pot	1
4.	Weighing scale platform type 100 Kg capacity	1
5.	Graduated glass measuring cylinder	As per requirement
6.	Sets of sieves of 450mm internal dia for coarse aggregate [100mm, 80mm, 40mm; 20mm; 12.5mm, 10mm; 4.75mm complete with lid and pan]	1
7.	Sets of sieves of 200mm internal dia for fine aggregate [4.75mm; 2.36mm; 1.18mm; 600 microns; 300 microns & 150 micron , with lid and pan]	1
8.	Sieve Brushes and sieve shaker capable of 200mm and 300mm dia sieves , manually operated with timing switch assembly	1
9.	Cube moulds size 70mmx70mmx70mm	6
10.	Cube moulds size 150mmx150mmx150mm	30
11.	Hot air oven temp. Range 50°C to 300°C- sensitivity 1 degree	1
12.	Electronic balance 600gx0.1g., 10 kg and 50 kg each	1 Each
13.	Physical balance weight upto 5 kg	1
14.	Air Content of concrete testing machine	1
15.	Measuring jars 100ml, 200ml, 500ml	3 nos each size
16.	Gauging trowels 100mm & 200mm with wooden handle	2
17.	Spatula 100mm & 200mm with long blade wooden handle	2
18.	Vernier calipers 12" & 6" size	1 each
19.	Digital PH meter least count 0.01mm	1each
20.	Digital Micrometer least count. 0.01mm	1 each
21.	Digital paint thickness meter for steel 500 micron range	1
22.	GI tray 600x450x50mm, 450x300x40mm,300x250x40mm	1 no each
23.	Electric Motor mixer 0.25 cum capacity	1
24.	Screw gauge 0.1mm-10mm, least count 0.05	2
25.	Water testing kit	1
26.	Motorized sieve shaker	1
27.	Pruning Rods 2 Kg weight length 40 cm and ramming face 25 mm <sup>2</sup>	1
28.	Extra Bottom plates for 15 cm cube mould	4
29.	Standard Vibration Table for gauging the cubes	1
30.	Pocket concrete pernetrometer 0 to 50kg/ sq.cm	1
31.	Concrete temperature measuring thermometer with Brass protection sheath 0-100 degree centigrade	1



32.	Mortar Cube vibrator	1
33.	Dial type spring balance preferable with zero correction knob capacity 100 kgs reading to ½ kg.	1
34.	Counter scale capacity 1 kg and 10 kg	1
35.	Iron Weight of 5 kg, 2 kg, 1 kg, 500 gm, 200 gm, 100 gm	1 each
36.	Brass Weight of 50 gm, 20 gm, 10 gm, 5 gm, 2 gm, 1 gm	1 each
37.	Measuring cylinder TPX or Poly propylene capacity 100 ml, 500 ml, 250 ml, 100 ml	1 each
38.	Pyrex, corning or Borosil beakers with cover capacity 500 ml, 200 ml, 50 ml	1 each
39.	Wash Bottles capacity 500 ml	1
40.	Thermometers 1-100 degree centigrades/ max. and Min/ Dry and wet with table	1
41.	Set of box spanner ratchet	1
42.	Hammer 1lb& 2lb	2 each
43.	Rubber Hammer	2
44.	Hacksaw with 6 blades	2
45.	Measuring tape 2 mtr	5
46.	Depth gauge 20cm	3
47.	Shovels& Spade	3
48.	Steel plates 5 mm thick 75x75 cm	2
49.	Plastic or G.I. Buckets 15 ltr, 10 ltr, 5 ltr	1 each
50.	Wheel Barrow	1
51.	Floor Brushes, hair dusters, scrappers, wire brush, paint brushes, shutter steel plat oil, kerosene with stove etc.	2 each
52.	Any other equipment for site tests as outlined in BIS codes and as directed by the Engineer-in-charge.	

The contractor for electrical work shall make his own arrangement of tools for maintenance of Sub Station/Electrical Installations equipments & following T&P shall always be available at the site of work by the contractor:-

- a) Tong tester
- b) Gloves- 4 Sets
- c) First Aid Box
- d) Crimping Tool Kit
- e) Meggar (5kV HT and 500 Volts LT)
- f) Spanner Set
- g) Screw Driver set
- h) LN Keys set
- i) Earth Tester
- j) Blower
- k) Hammer, Drill Machine & Spade
- l) Different size of aluminum ladder for maintaining the campus street light of different height and fans & fittings.
- m) Every wireman/operator should have plier, screw driver of different size, tester for day to day maintenance work.

Note :- The rates quoted shall be inclusive of wages of Electrician/ E&M Operator /Wireman/Khallasi etc i/c relievers, cleaning material, uniform and all taxes and duties etc. as applicable. However service tax, ESI/EPF will be reimbursed to the contractor, on production of proof of deposit of the same with respected govt. department.

**MINIMUM REQUIREMENT OF MANPOWER, PLANTS AND EQUIPMENTS**

Sl. No	Description/Type of Plants and Equipments	Minimum Qty. (Nos.)/ requirements	Compensation for not complying with the minimum requirement as specified in column 3. (In Rupees).
1	2	3	4
1.	Maintenance Van	03 Nos.	
2	Diesel running vehicle mounting hydraulic operated high pressure suction cum jetting sewer cleaning machine (Super Sucker machine).	Numbers as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	As decided by the Engineer –In-Charge
3	Pumps for cleaning of water logging	Numbers and capacity as per direction of Engineer-in-Charge as & when required but to be arranged within 2 Hrs.	
4	Pock lane (Long boom / Short boom)	Numbers and type as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	
5	JCB	Numbers and capacity as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	
6	Tankers for Sludge removal :- a. 10,000/- litre capacity fitted with 3HP pumps	Numbers as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	
7	Water tankers 5000 Ltr. Capacity	Numbers and capacity as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	
8	Road rollers.	Numbers and capacity as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	
9	Tippers.	Numbers and capacity as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	
10.	Pot holes/ Patch repair machine	Numbers and capacity as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	
11	Tempo with hydraulically operated system for unloading	Numbers and capacity as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	
12	Concrete Mixer	Numbers and capacity as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	

13	Vibratory roller of more than 0.5 tonne capacity	Numbers and capacity as per direction of Engineer-in-Charge as & when required but to be arranged within 24 Hrs.	As decided by the Engineer –In-Charge
14	Mobile communication system (cell phones 24 Hrs. in active mode)	One number for each key technical personnel prescribed in the list of “Minimum Key Technical Personnel on Project”	
15	Minimum manpower deployment at site to handle the emergency work:-	Plumber-01, Mason-01, Carpenter-01, Electrician- 01, Sewerman – 01, Helpers- 05 nos	

**Note: The agency should quote his rates considering the provision of above minimum requirement of Manpower, Plants, Equipments and Machineries. Nothing extra shall be paid on this account.**

### List of mandatory machinery, tools & plants to be deployed by the contractor at site

**(TABLE -2)**

All plants, equipment's and machinery required for smooth and efficient progress of work as per direction of Engineer-in-Charge.

**(TABLE- 3)**

#### RECOVERY RATES FOR QUANTITIES BEYOND PERMISSIBLE VARIATION

S. No.	Description of Item	Rates in figures and words at which recovery shall be made from the Contractor	
		Excess beyond permissible variation	Less use beyond permissible variation
1.	Cement (OPC)	Nil	<b>Not permitted</b>
2.	Steel Reinforcement TMT Bar of all diameters	Nil	<b>Not permitted</b>
3.	Structural Sections	Nil	<b>Not permitted</b>

#### Items which are to be executed through specialized agency:

##### For Civil:

- a. Water proofing treatment.
- b. Interior works - false ceiling works.
- c. Fabrication & erection of all steel work.
- d. Laying of Kota stone.
- e. Aluminum doors and windows, aluminum partition.
- f. Stainless steel work and stainless steel railing.
- g. Flush Doors
- h. All plumbing work

##### For Electrical

- a) L.T. Panel
- b) HVAC Panel
- c) Telephone system
- d) I.T. Networking/Structured cabling work.
- e) A.V System
- f) UPS
- g) CCTV

The specialized agency for the specialized work as detailed above shall be got approved from the NIT approving authority by the main contractor on the basis of criteria mentioned below: -

- i) One similar completed works of value not less than 80% of quoted amount of that specialized work/sub head.  
Or
- ii) Two similar completed works of value not less than 60% of quoted amount of that specialized work/sub head.  
Or
- iii) Three similar completed works of value not less than 40% of quoted amount of that specialized work/sub head.

# **PART-A**

## **CONDITIONS & SPECIFICATIONS OF CONTRACT AND SCHEDULE OF QUANTITIES OF MAJOR COMPONENT OF CIVIL WORK**

## 1.0 SPECIAL CONDITIONS

### GENERAL

1.1 The Contractors are advised to inspect and examine the site and its surroundings and satisfy themselves with the nature of site, the means of access to the site, the constraints of space for stacking material / machinery, labour etc. constraints put by local regulations, if any, weather conditions at site, general ground / subsoil conditions etc. or any other circumstances which may affect or influence their tenders. The Contractor shall carry out survey of the work area, at his own cost, setting out the layout and fixing of alignment of the building as per architectural and Structural drawings in consultation with the Engineer-in-Charge. Any discrepancy between the architectural drawings and actual layout at site shall be brought to the notice of the Engineer-in-charge. It shall be responsibility of the Contractor to ensure correct setting out of alignment. Nothing extra shall be payable on this account. No claims, whatsoever, shall be entertained at a later date for any errors found, on plea that the information supplied by the Department in the tender is insufficient or is at variance with the actual site conditions.

1.2 The Contractor shall, if required by him, before submission of the tender, inspect the drawings in the Office of The Executive Engineer, DTU, Bawana, road Delhi. Department shall not bear any responsibility for the lack of knowledge and also the consequences, thereof to the Contractor. The information and data shown in the drawings and mentioned in the tender documents have been furnished, in good faith, for general information and guidance only. The Engineer-in-Charge, in no case, shall be held responsible for the accuracy thereof and/or interpretations or conclusions drawn there from by the Contractor and all consequences shall be borne by the Contractor. No claim, whatsoever, shall be entertained from the Contractor, if the data or information furnished in tender document is different or in-correct otherwise or actual working drawings are at variance with the drawings available for inspection or attached to the tender documents. It is presumed that the Contractor shall satisfy himself for all possible contingencies, incidental charges, wastages, bottlenecks etc. likely during execution of work and acts of coordination, which may be required between different agencies. Nothing extra shall be payable on this account.

1.3 The nomenclature of the item given in the schedule of quantities gives in general of the work content but is not exhaustive i.e. does not mention all the incidental works required to be carried out for complete execution of the item of work. The work shall be carried out, all in accordance with true intent and meaning of the specifications and the drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings and/or described in the specifications, provided that the same can be reasonably inferred there from may be several incidental works, which are not mentioned in the nomenclature of each item but will be necessary to complete the item in all respect. All these incidental works / costs which are not mentioned in item nomenclature but are necessary to complete the item shall be deemed to have been included in the rates quoted by the contractor for various items in the schedule of quantities. No adjustment of rates shall be made for any variation in quantum of incidental works due to variation / change in actual working drawings. Also, no adjustment of rates shall be made due to any change in incidental works or any other deviation in such element of work (which is incidental to the items of work and are necessary to complete such items in all respects) on account of the directions of Engineer-in-Charge. Nothing extra shall be payable on this account.

1.4 The contractor(s) shall give to the local body, police and other authorities all necessary notices etc. that may be required by law and obtain all requisite licenses for temporary obstructions, enclosures etc. and pay all fee, taxes and charges which may be available on account of these operations in executing the contract. He shall make good any damage to the adjoining property whether public or private and shall supply and maintain lights either for illumination or for cautioning the public at night.

1.5 The contractor(s) shall execute the work simultaneously at all sites. He has to establish site office along with all necessary arrangements at all sites simultaneously.

1.6 The contractor(s) shall cordon off the area suitably so that the college remains functional during execution of the work.

1.7 Staff/labour shall be deployed for each site of work independently by the contractor.

**1.8 The contractor shall obtain a User's Certificate showing details of work done from HOD of department, Chief Warden/Hostel In-charge or Flat occupant after completion of job where work has been executed. The Payment shall be made to the Agency only after submission of User's Certificate.**

**1.8(A)** All works are time bounded. Agency should complete the work within the time period given by the Engineer-in-charge and if work not completed within given time by the agency, penalty shall be imposed on agency as decided by engineer-in-charge.

**1.8(B)** Contractor shall remove the malba/ dismantle materials from the working site to store or that place which shall be approved by engineer-in-charge on the same day. Nothing shall be paid extra on this account.

**1.8(C)** The contractor shall deposit all the materials brought at site as per the theoretical consumption to the AE/JE incharge. The same shall be issued by the AE/JE in-charge on daily basis as per requirement at site.

## **BY-LAWS AND REGULATIONS.**

All work shall conform to the statutory Bye-laws and Regulations of the concerned authority/Municipality, Delhi Fire Services as applicable to the Project. If the tender specifications and drawings are more stringent than required as per the Local Authorities then the tender specifications and drawings shall be followed. In the other case, if the local authorities more stringent specifications than those specified in the tender specifications, then the set by-laws and regulations shall be followed at no extra cost.

Proper temporary barricading by fencing with G.I. sheets, shall be carried out by the Contractor at the start of work to physically define the boundaries of the plot for restricted entry to only those involved in the work and also to prevent any accidents, at the same time without causing any inconvenience to the traffic and the users of the buildings in the adjacent plots. It shall be done by providing, erecting, maintaining temporary protective barricading of minimum 2.0 metres in height, made in panels, with each panel having MS frames / MS scaffolding pipes of suitable size and stiffness, with 24 gauge thick GI corrugated sheet or suitably stiffened plain GI sheet fixed on frames. Such panels shall be suitably connected to each other for stability with nuts and bolts, hooks, clamps etc. and fixed firmly to the ground at about 2 metres spacing, for the entire duration till completion of the work. He shall also provide and erect temporary protective barricades within the plot, if required, to prevent any accident. Temporary protective roofing near the Entrance to the building, under construction, shall be made to protect the visiting officials from getting hurt by falling debris etc. Also, one or more coat of enamel paint of shade as approved and directed by the Engineer-in-Charge shall be applied on the panels and "DTU" shall be painted over that in suitable sizes, shapes and numbers as directed by the Engineer-in-Charge. It shall be dismantled and taken away by the Contractor after the completion of work at his own cost with the approval of the Engineer-in- Charge. Nothing extra shall be payable on this account.

**1.8(D)** The Contractor(s) shall take all precautions to avoid accidents by exhibiting necessary caution boards day and night. In case of any accident of labours/ contractual staffs the entire responsibility will rest on the part of the contractor and any compensation under such circumstances, if becomes payable, shall be entirely borne by the contractor.

**1.9** The work shall generally be carried out in accordance with the "CPWD Specifications 2009 Vol. I & II" with correction slips issued upto the last date of submission of tender, additional/Particular Specifications, architectural/Structural drawings, mechanical, electrical, plumbing and as per instructions of Engineer-in-Charge. Any additional item of the work, if taken up subsequently, shall also confirm to the relevant CPWD specifications as mentioned above.

**1.10** The several documents forming the tender are to be taken as mutually complementary to one another. Detailed drawings shall be followed in preference to small scale drawings and figured dimensions in preference to scale dimensions.

**1.11** There be any difference or discrepancy between the description of items as given in the schedule of quantities, particular specifications for individual items of work (including special conditions) and I.S. Codes etc., the following order of preference shall be observed.

Description of items as given in Schedule of quantities

Particular specifications

Special conditions

Additional Condition

Tender drawings attached

CPWD Specifications including correction slips issued up to the last date of uploading/submission of tender.

General Conditions of Contract for CPWD works including correction slips issued up to the last date of submission of tender.

Indian Standards Specifications of B.I.S.

ASTM, BS, or other foreign origin code mentioned in tender document.

Manufacturer's specifications and as decided by the Engineer-in-Charge.

Sound Engineering practices or well established local construction practices.

**1.12** The works to be governed by this contract shall cover delivery and transportation up to destination, safe custody at site, insurance, erection, testing and commissioning of the entire works.

The works to be undertaken by the contractor shall inter-alia include the following:

Preparation of detailed SHOP drawings and AS BUILT drawings wherever applicable.

Obtaining of Statutory permissions where-ever applicable and required.

Pre-commissioning tests as per relevant standard specifications, code of practice, Acts and Rules wherever required.

Warranty obligation for the equipments and / or fittings/fixtures supplied by the contractor. Contractor shall provide all the shop drawings or layout drawings for all the coordinated services before starting any work or placing any order of any of the services etc. These shop drawings/layout drawings shall be got approved from Engineer-in-charge before implementation and this shall

be binding on the contractor. The contractor shall submit material submittals along with material sample for approval of Engineer-in-Charge prior to delivery of material at site.

1.13 The work shall be carried out in accordance with the approved architectural drawings, structural drawings, MEP services drawings to be issued from time to time, by the Engineer-in-Charge, and approved shop drawings prepared by the Contractor. Before commencement of any item of work the contractor shall correlate all the relevant architectural and structural drawings, nomenclature of items and specifications etc. issued for the work and satisfy himself that the information available from there is complete and unambiguous. The figure and written dimension of the drawings shall be superseding the measurement by scale. The discrepancy, if any, shall be brought to the notice of the Engineer-in-charge before execution of the work. The contractor alone shall be responsible for any loss or damage occurring by the commencement of work on the basis of any erroneous and or incomplete information and no claim whatsoever shall be entertained by the department on this account.

1.14 Unless otherwise provided in the Schedule of quantities the rates tendered by the contractor shall be all inclusive and shall apply to all heights, lifts, leads and depths of the building and nothing extra shall be payable to him on this account.

1.15 The Contractor(s) shall take instructions from the Engineer-in-Charge regarding collection and stacking of materials at any place. No excavated earth or building rubbish shall be stacked on areas where other buildings, roads, services and compound walls are to be constructed. The stacking shall take place as per stacking plan however, if any change is required, the same shall be done with the approval of Engineer-in-Charge.

1.16 The contractor shall engage specialized agency for carrying out specialized items as listed in para 1.48 below, covered in the schedule of Quantity Immediately after award of work, the contractor shall submit for the approval of NIT approving authority, the name of the agency along with their working experience and credentials, presentation on method statement and materials being used for execution of such items etc. Delay on the part of contractor in submitting the proposal for approval of competent authority shall be his responsibility and no extension of time shall be granted on this account.

1.17 The Contractor shall bear all incidental charges for cartage, storage and safe custody of materials, if any, issued by department as well as to those materials also arranged by the contractor.

1.18 Any cement slurry added over base surface (or) for continuation of concreting for better bond is deemed to have been built in the items and nothing extra shall be payable or extra cement considered in consumption on this account.

1.19 The contractor shall give performance test of the entire installation(s) as per the specifications in the presence of the Engineer-in-charge or his authorized representative before the work is finally accepted and nothing extra what-so-ever shall be payable to the contractor for such test.

1.20 Water tanks, taps, sanitary, water supply & drainage pipes, fittings & accessories should conform to bye-laws of local body/corporation, where CPWD specifications are not available. The Contractor should engage approved, licensed plumbers for the work and get the materials (fixtures/fittings) tested, by the municipal Body/ Corporation authorities wherever required at his own cost. The Contractor shall submit for the approval of the NIT approving authority, the name of the plumbing agency (along with their working experience in recent past) proposed to be engaged by him.

1.21 The contractor shall make his own arrangements for water and for obtaining electric connections if required and make necessary payments directly to the State Govt. departments concerned. Contractor shall get the water tested from laboratory approved by the Engineer-in-charge at regular interval as per the CPWD Specifications 2009. All expenses towards collection of samples, packing, transportation etc. shall be borne by the contractor. Agency shall neither be allowed to use existing bore well, if any. They may have to arrange water through tankers from any outside source after taking due permission from concerned authority.

## **1.22 PREVENTION OF NUISANCE AND POLLUTION CONTROL**

The contractor shall take all necessary precautions to prevent any nuisance or inconvenience to the owners, tenants or occupiers of adjacent properties and to the public in general and to prevent any damage to such properties from pollutants like smoke, dust, noise. The contractor shall use such methodology and equipment so as to cause minimum environmental pollution of any kind during and minimum hindrance to road users and to occupants of the adjacent properties or other services running adjacent/near vicinity. The contractor shall make good at his cost and to the satisfaction of the Engineer-in-Charge, any damage to roads, paths, cross drainage works or public or private property whatsoever caused due to the execution of the work or by traffic brought thereon by the contractor. All waste or superfluous materials shall be carried away by the contractor, without any reservation, entirely to the satisfaction of the Engineer-in-Charge.

Control on Air Pollution of dust from construction and demolition activities: Guidelines of National Green Tribunal Delhi and DPCC, Delhi issued time to time shall be followed by the agency for which nothing extra shall be paid.



1.23 Utmost care shall be taken to keep the noise level to the barest minimum so that no disturbance as far as possible is caused to the nearby occupants/users of building(s), if any.

#### **1.24 SECURITY AND TRAFFIC ARRANGEMENTS**

In the event of any restrictions being imposed by the Security agency, CPWD, Traffic or any other authority having jurisdiction in the area on the working or movement of labour /material, the contractor shall strictly follow such restrictions and nothing extra shall be payable to the contractor on such accounts. The loss of time on these accounts, if any, shall have to be made up by augmenting additional resources whatever required.

1.25 If as per the rules of the local authority, the huts for labour are not to be erected at the site of work by the contractors, the contractors are required to provide such accommodation as is acceptable to local bodies and nothing extra shall be paid on this account. No accommodation is available at the site of work. The labour huts shall not be erected on the plot and the Contractor shall make his own arrangements to provide such accommodation as per the rules of the local bodies. He shall make his own arrangements for stores, field office etc. Before tendering, he shall visit the site and assess the manner in which he is able to arrange the above facilities. The Engineer-in-Charge shall in no way be responsible for any delay on this account and no claim, whatsoever, on this account shall be entertained.

1.26 No payment shall be made for any damage caused by rain, snowfall, flood or any other natural calamity, whatsoever during the execution of the work. The contractor shall be fully responsible for any damage to the govt. property and the work for which payment has been advanced to him under the contract and he shall make good the same at his risk and cost. The contractor shall be fully responsible for safety and security of his material, T&P/Machinery brought to the site by him.

1.27 The contractor shall construct suitable godowns, yard at the site of work for storing all other materials so as to be safe against damage by sun, rain, damages, fire, theft etc. at his own cost and also employ necessary watch and ward establishment for the purpose at his cost.

1.28 All materials obtained from contractor shall be got checked by the representative of Engineer-in-Charge on receipt of the same at site before use.

1.29 Royalty at the prevalent rates shall have to be paid by the contractor on all the boulders, metals, shingle sand and bajri etc. collected by him for the execution of the work, direct to the Revenue authority or authorized agent of the State Government concerned or Central Government.

1.30 The contractor shall be responsible for the watch and ward/guard of the buildings, safety of all fittings and fixtures including all equipments, services provided by him against pilferage and breakage during the period of Installations and thereafter till the building is physically handed over to the Engineering Cell of DTU, New Delhi – the Client Department. No extra payment shall be made on this account and no claim shall be admissible on this account.

1.31 The Contractor shall keep himself fully informed of all acts and laws of the Central & State Governments, all orders, decrees of statutory bodies, tribunals having any jurisdiction or authority, which in any manner may affect those engaged or employed and anything related to carrying out the work. All the rules & regulations and bye-laws laid down by Collector / DDA / MCD and any other statutory bodies shall be adhered to, by the contractor, during the execution of work. The Contractor shall also adhere to all traffic restrictions notified by the local authorities. The extra sewerage charges (one time charges for commencement of work) required to be paid to the Municipal Corporation/ other statutory bodies shall be paid by the department and need not be considered by the contractor. All statutory taxes, levies, charges (including water and sewerage charges, charges for temporary service connections and / or any other charges) payable to such authorities for carrying out the work, shall be borne by the Contractor. The water charges (for municipal water connection as well as tanker water) shall be borne by the contractor. Also, if the contractor obtains water connection for the drinking purposes from the municipal authorities or any other statutory body, the consequent sewerage charges shall be borne by the contractor. The General conditions of contract for CPWD works is not applicable to the tender. The Contractor shall arrange to give all notices as required by any statutory / regulatory authority and shall pay to such authority all the fees that is required to be paid for the execution of work. He shall protect and indemnify the Department and its officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts. The fee payable to statutory authorities for obtaining the various permanent service connections and Occupancy Certificate for the building shall be borne by the Department.

1.32 For works below ground level the contractor shall keep that area free from water. If dewatering or bailing out of water is required the contractor shall do the same at his own cost and nothing extra shall be paid except otherwise provided in the items of Schedule of Quantities.

1.33 The Contractor shall make all necessary arrangements for protecting from rains, fog or likewise extreme weather conditions, the work already executed and for carrying out further work, during monsoon including providing and fixing temporary shelters, protections etc. Nothing extra shall be payable on this account and also no claims for hindrance shall be entertained on this account.

1.34 In case of flooding of site on account of rain or any other cause and any consequent damage, whatsoever, no claim financially or otherwise shall be entertained notwithstanding any other provisions elsewhere in the contract agreement. Also, the Contractor shall make good, at his own cost, the damages caused, if any. Further, no claims for hindrance shall be entertained on this account.

1.35 The contractor will take reasonable precautions to prevent his workman and employees from removing and damaging any flora (plant/vegetation) from the project area.

#### 1.36 SETTING OUT

(i) The Contractor shall carry out survey of the work area, at his own cost, setting out the layout of building in consultation with the Engineer -in-Charge & proceed further. Any discrepancy between the Engineer-in-charge, architectural drawings and actual layout at site shall be brought to the notice of the Engineer -in-charge. It shall be responsibility of the Contractor to ensure correct setting out of alignment. Total station survey instruments only shall be used for layout, fixing boundaries, and centre lines, etc., Nothing extra shall be payable on this account.

(ii). The Contractor shall establish, maintain and assume responsibility for grades, lines, levels and benchmarks. He shall report any errors or inconsistencies regarding grades, lines, levels, dimensions etc. to the Engineer -in-Charge before commencing work. Commencement of work shall be regarded as the Contractor's acceptance of such grades, lines, levels, and dimensions and no claim shall be entertained at a later date for any errors found.

(iii). If at any time, any error appears due to grades, lines, levels and benchmarks during the progress of the work, the Contractor shall, at his own expense rectify such error, if so required, to the satisfaction of the Engineer -in-Charge. Nothing extra shall be payable on this account.

(iv). Though the site levels are indicated in the drawings the Contractor shall ascertain and confirm the site levels with respect to benchmark from the concerned authorities. The Contractor shall protect and maintain temporary/ permanent benchmarks at the site of work throughout the execution of work. These benchmarks shall be got checked by the Engineer-in-Charge or his authorized representatives. The work at different stages shall be checked with reference to bench marks maintained for the said purpose. Nothing extra shall be payable on this account.

(v). The approval by the Engineer-in-Charge, of the setting out by the Contractor, shall not relieve the Contractor of any of his responsibilities and obligation to rectify the errors/ defects, if any, which may be found at any stage during the progress of the work or after the completion of the work.

(vi). The Contractor shall be entirely and exclusively responsible for the horizontal, vertical and other alignments, the level and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectifications shall be carried out by the Contractor at his own cost to the entire satisfaction of the Engineer - in-Charge.

(vii). The rates quoted by the Contractor are deemed to be inclusive of site clearance, setting out work (including marking of reference points, center lines of buildings), construction and maintenance of reference bench mark(s), taking spot levels, construction of all safety and protection devices, barriers, barricading, signage, labour safety, labour welfare and labour training measures, preparatory works, working during monsoon, working at all depths, height and location etc. and any other incidental works required to complete this work. Nothing extra shall be payable on this account.

(viii) The contractor(s) shall study the soil investigation report for the site, available in the office of the Engineer-in-Charge and satisfy himself about complete characteristics of soil and other parameters at site. However, no claim on the alleged inadequacy or incorrectness of the soil data supplied by the department shall be entertained.

1.37 A site laboratory with the minimum equipments as specified in CPWD specifications/in this agreement shall be established, made functional and maintained within a week from the award of work as per without any extra cost to the department. In case of non compliance / delay in compliance in this, a recovery @ Rs. 500/- per day will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.

#### 1.38 COORDINATED DRAWINGS

Before taking up the work, the contractor shall prepare shop drawings for the works listed below for various civil and electrical services showing details of lay out in plan including sections & elevations & large scale details and contractor shall plan and mobilize his resources as per these drawings and as per actual site conditions to facilitate convenient execution, installation as well as maintenance of these items.. Nothing extra shall be payable on this account.

#### SHOP DRAWINGS

The bill of quantities, technical specifications and drawings together shall be considered as a tender requirement and the work shall be carried out as per good for construction (GFC) drawings, issued by Engineer-in-charge. The contractor shall study the

GFC drawings and taking into account actual site conditions and selected material and requirements shall prepare shop drawings for the following works, as fully coordinated drawings, as given above.

- Aluminum work.
- Expansion joint work
- Suspended ceiling work, coordinated with all ceiling related services.
- Marble, granite, vitreous, ceramic, tile work
- All Electrical work
- All Sanitary work
- All steel fabrication work.
- PUF panel ceiling/roofing work.

The shop drawings shall be prepared timely by contractor and submitted for approval to achieve the milestones provided.

Within the time frame agreed with the Engineer-in-charge, the contractor shall prepare shop drawings using latest version of Auto CAD. Shop drawings shall show all layouts, details in plans & sections showing all connections, junctions, bends, supports, clearances. Fixing arrangements with dimensions room, etc shall be prepared by the contractor on AutoCAD based on the architectural drawings and site measurements. All measurable items quantities shall be mentioned on each shop drawing being submitted for approval by the contractor. 3 sets of shop drawings (soft copy also) shall be submitted for approval and Seven sets of final shop drawings after approval by Engineer-in-charge shall be submitted by the contractor along with the soft copy. The shop drawings, shall be prepared as per schedule given in CPM/PERT Chart.

Technical submittals of manufacturer's catalogues and technical data shall be submitted for approval. The contractor shall designate an Engineer responsible for issue and preparation of shop drawings and control of GFC drawings.

### 1.39 TOOLS AND PLANTS

The bidder should have own constructions equipment required for the proper and timely execution of the work. Nothing extra shall be paid on this account.

No tools and plants including any special T&P etc. shall be supplied by the Department and the Contractor shall have to make his own arrangements at his own cost. No claim of hindrance (or any other claim) shall be entertained on this account.

### 1.40 SCAFFOLDING

For the execution of work, all the scaffolding shall be provided and suitably fixed, by the Contractor. It shall be provided strictly with steel double scaffolding system, suitably braced for stability, with all the accessories, gangways, etc. with adjustable suitable working platforms to access the areas with ease for working and inspection. It shall be designed to take all incidental loads. It should cater to the safety features for workmen. Nothing extra shall be payable on this account. It shall be ensured that no damage is caused to any structure due to the scaffolding except for the work of vertical extension where vertical & horizontal scaffolding along with screen to prevent pollution and debris from following along with proper access to be provided for which payment shall be made.

1.41 The Contractor shall do proper sequencing of the various activities by suitably staggering the activities within various pockets in the plot so as to achieve early completion. The agency to deploy adequate equipment, machinery and labour as required for the completion of the entire work within the stipulated period specified. Also ancillary facilities shall be provided by contractor commensurate with requirement to complete the entire work within the stipulated period. Nothing extra shall be payable on this account. Adequate number/sets of equipment in working condition, along with adequate stand-by arrangements, shall be deployed during entire construction period. It shall be ensured by the Contractor that all the equipment, Tools & Plants, machineries etc. provided by him are maintained in proper working conditions at all times during the progress of the work and till the completion of the work. Further, all the constructional tools, plants, equipment and machineries provided by the Contractor, on site of work or his workshop for this work, shall be exclusively intended for use in the construction of this work and they shall not be shifted/ removed from site without the permission of the Engineer-in-Charge.

1.42 The Contractor shall maintain all the work in good condition till the completion of entire work. The Contractor shall be responsible for and shall make good, all damages and repairs, rendered necessary due to fire, rain, traffic, floods or any other causes. The Engineer-in-Charge shall not be responsible for any claims for injuries to person/workmen or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the Contractor or of any other of his representatives, in his employment during the execution of the work. The compensation, if any, shall be paid directly to the Department / authority / persons concerned, by the Contractor at his own cost.

### 1.43 ROYALTY

Royalty at the prevalent rates shall be paid by the Contractor to the RMC supplier as per the terms of supply between them, on all materials such as boulders, metals, all sizes stone aggregates, brick aggregates, coarse and fine sand, moorum, river sand, gravels and bajri etc. collected by him for the execution of the work, directly to the revenue authority of the state government

concerned. Further, contractor needs to submit proof of submission of full royalty to the state government or local authority. Nothing extra shall be payable on this account.

#### **1.44 PRESERVATION AND CONSERVATION MEASURES**

(i) Existing drains, pipes, cables, over-head wires, sewer lines, water lines and similar services, if any, encountered in the course of the execution of work shall be protected against the damage by the contractor at his own expense. In case the same are to be removed and diverted, expenditure incurred in doing so shall be payable to the contractor. The contractor shall work out the cost, get the same approved by Engineer-in-Charge before taking up actual execution. The contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.

(ii) All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on project location during excavation/construction shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precaution to prevent his work men or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer-in-charge of such discovery and carry out the official instructions of Engineer-in-charge for dealing with the same, till then all work shall be carried out in a way so as not to disturb/damage such article or thing.

#### **1.45 RESPONSIBILITY**

(i) He shall protect and indemnify the Department / DTU and its officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts.

(ii) The fee payable to statutory authorities for obtaining the various permanent service connections and Building Use Certificate for the building shall be borne by the DTU.

(iii) The Contractor shall assume all liability, financial or otherwise in connection with this contract and shall protect and indemnify the Department from any and all damages and claims that may arise on any account. The Contractor shall indemnify the Department against all claims in respect of patent rights, royalties, design, trademarks- of name or other protected rights, damages to adjacent buildings, roads or members of public, in course of execution of work or any other reasons whatsoever, and shall himself defend all actions arising from such claims and shall indemnify the Department in all respect from such actions, costs and expenses. Nothing extra shall be payable on this account.

#### **1.46 CO-OPERATION WITH OTHER CONTRACTORS/SPECIALIZED AGENCIES/ SUB-CONTRACTORS**

(i) The Contractor shall take all precautions to abide by the environmental related restrictions imposed by any statutory body having jurisdiction in Delhi as well as prevent any pollution of streams, ravines, river bed and waterways. All waste or superfluous materials shall be transported by the Contractor, entirely to the satisfaction of the Engineer- in-Charge and disposed at designated places only. Utmost care shall be taken to keep the noise level to the barest minimum so that no disturbance as far as possible is caused to the occupants / users of adjoining buildings. No claim what so ever on account of site constraints mentioned above or any other site constraints, lack of public transport, , inadequate availability of skilled, semi-skilled or unskilled workers in the near vicinity, non-availability of construction machinery spare parts and any other constraints not specifically stated here, shall be entertained from the Contractor. Therefore, the Tenderers are advised to visit site and get first-hand information of site constraints. Accordingly, they should quote their tenders. Nothing extra shall be payable on this account.

(ii) The Contractor shall cooperate with and provide the facilities to the sub-Contractors and other agencies working at site for smooth execution of the work. The contractor shall indemnify the Department (DTU) against any claim(s) arising out of such disputes. The Contractor shall:

- (a) Allow use of scaffolding, toilets, sheds etc.
- (b) Properly co-ordinate their work with the work of other Contractors.
- (c) Provide control lines and benchmarks to his Sub-Contractors and the other Contractors.
- (d) Provide electricity and water at mutually agreed rates.
- (e) Provide hoist and crane facilities for lifting material at mutually agreed rates.
- (f) Co-ordinate with other Contractors for leaving inserts, making chases, alignment of services etc. at site.

- (g) Adjust work schedule and site activities in consultation with the Engineer-in- Charge and other Contractors to suit the overall schedule completion.
- (h) Resolve the disputes with other Contractors/ sub-contractors amicably and the Engineer-in-Charge shall not be made intermediary or arbitrator.
- (iii) The work should be planned in a systematic manner so as to ensure proper co-ordination of various disciplines viz. sanitary & water supply, drainage, rain water harvesting, electrical, fire fighting, information technology, communication & electronics and any other services.
- (iv) Other agencies as employed by the contractor, will also simultaneously execute and install the works of sub-station / generating sets, air-conditioning, lifts, etc. for the work and the contractor shall afford necessary facilities for the same. The contractor shall leave such recesses, holes, openings trenches etc. as may be required for such related works and includes provision of inserts and the contractor shall fix the same at time of casting of concrete, stone work and brick work, if required, and nothing extra shall be payable on this account.
- (v) The contractor shall conduct his work, so as not to interfere with or hinder the progress or completion of the work being performed by other contractor(s) or by the Engineer-In-Charge and shall as far as possible arrange his work and shall place and dispose off the materials being used or removed so as not to interfere with the operations of other contractor or he shall arrange his work with that of the others in an acceptable and in a proper co -ordination manner and shall perform it in proper sequence to the complete satisfaction of others.

#### 1.47 SUPERVISION OF WORK

The Contractor shall depute Site Engineer & skilled workers as required for the work. He shall submit organization chart along with details of Engineers and supervisory staff. It shall be ensured that all decision making powers shall be available to the representatives of the Contractor at New Delhi itself to avoid any likely delays on this account. The Contractor shall also furnish list of persons for specialized works to be executed for various items of work. The Contractor shall identify and deploy key persons having qualifications and experience in the similar and other major works, as per the field of their expertise. If during the course of execution of work, the Engineer-in-Charge is of the opinion that the deployed staff is not sufficient or not well experienced; the Contractor shall deploy more staff or better-experienced staff at site to complete the work with quality and in stipulated time limit.

#### 1.48 Specialized Agencies

(i) The tender comprises of two main components: viz. civil works. The list of specialized agencies for civil works is as below:

- Water proofing treatment.
- Interior works - false ceiling works.
- Fabrication & erection of all steel work.
- Laying of granite stone.
- Aluminum doors and windows, aluminum partition.
- Fabrication and erection of PUF sheet roofing.
- Stainless steel work and stainless steel railing.
- PVC Doors
- All plumbing work
- Signage's works

The contractor shall submit the credential of specialized agency well in advance for the approval of NIT Approving Authority as per the direction of Engineer-in-charge. After verification of the same, written approval will be conveyed to main contractor in this regard. The quantum of credentials will be broadly in line with CPWD guidelines. The main contractor shall not change the specialized agency. However, if the change is warranted, he may do so, with permission of NIT approving authority. However before making any such change he has to enter into similar agreement as with previous agency & submit the same to Engineer - in – Charge for approval. This shall however be without any change in the accepted rates of the contract agreement and without any cost implications to the Department.

(ii) It shall be the responsibility of main contractor to sort out any dispute / litigation with the Specialized Agencies without any time & cost overrun to the Department. The main contractor shall be solely responsible for settling any dispute / litigation arising out of his agreement with the Specialized Agencies. The contractor shall ensure that the work shall not suffer on account of litigation/ dispute between him and the specialized agencies / sub- contractor(s). No claim of hindrance in the work shall be entertained from the Contractor on this account. No extension of time shall be granted and no claim what so ever, of any kind, shall be entertained from the Contractor on account of delay attributable to the selection/rejection of the Specialized Agencies or any dispute amongst them.

## 1.49 RATES

The rates quoted by the Contractor are deemed to be inclusive of site clearance, setting out work, profile, setting lay out on ground, establishment of reference bench mark(s), installing various signage, taking spot levels, survey with total station, construction of all safety and protection devices, compulsory use of helmet and safety shoes, and other appropriate safety gadgets by workers, imparting continuous training for all the workers, barriers, preparatory works, construction of clean, hygienic and well ventilated workers housings in sufficient numbers as per drawing supplied by Engineer in charge, working during monsoon or odd season, working beyond normal hours, working at all depths, height, lead, lift, levels and location, implementation of green building norms to achieve desired GRIHA Rating etc. and any other unforeseen but essential incidental works required to complete this work. Nothing extra shall be payable on this account and no extension of time for completion of work shall be granted on these accounts.

The rates quoted by the tenderer, shall be firm and inclusive of all taxes and levies (including GST as applicable).

No foreign exchange shall be made available by the Department for importing (purchase) of equipment, plants, machinery, materials of any kind or any other items required to be carried out during execution of the work. No delay and no claim of any kind shall be entertained from the Contractor, on account of variation in the foreign exchange rate.

Ancillary and incidental facilities required for execution of work like labour camp, stores, fabrication yard, offices for Contractor, watch and ward, temporary ramp required to be made for working at the basement level, temporary structure for plants and machineries, water storage tanks, installation and consumption charges of temporary electricity, telephone, water etc. required for execution of the work, liaison and pursuing for obtaining various No Objection Certificates, completion certificates from local bodies etc., protection works, testing facilities / laboratory at site of work, facilities for all field tests and for taking samples etc. during execution or any other activity which is necessary (for execution of work and as directed by Engineer-in-Charge), shall be deemed to be included in rates quoted by the Contractor, for various items in the schedule of quantities. Nothing extra shall be payable on these accounts. Before start of the work, the Contractor shall submit to the Engineer-in-Charge, a site / construction yard layout, specifying areas for construction, site office, positioning of machinery, material yard, cement and other storage, steel fabrication yard, site laboratory, water tank, etc.

For completing the work in time, the Contractor might be required to work in two or more shifts (including night shifts). No claim whatsoever shall be entertained on this account, not with-standing the fact that the Contractor may have to pay extra amounts for any reason, to the labourers and other staff engaged directly or indirectly on the work according to the provisions of the labour and other statutory bodies regulations and the agreement entered upon by the Contractor with them.

All material shall only be brought at site as per program finalized with the Engineer-in- Charge. Any pre-delivery of the material not required for immediate consumption shall not be accepted and thus not paid for.

## 1.50 SAFETY PRACTICES

i) **WARNING/ CAUTION BOARDS:** All temporary warning / caution boards / glow signage display such as "Construction Work in Progress", "Keep Away", "No Parking", Diversions & protective Barricades etc. shall be provided and displayed during day time by the Contractor, wherever required and as directed by the Engineer-in-Charge. These glow signage and red lights shall be suitably illuminated during night also. The Contractor shall be solely responsible for damage and accident caused, if any, due to negligence on his part. Also he shall ensure that no hindrance, as far as possible, is caused to general traffic during execution of the work. This signage shall be dismantled & taken away by the Contractor after the completion of work, only after approval of the Engineer – in – Charge. Nothing extra shall be payable on this account.

ii) **SIGN BOARDS:** The Contractor shall provide and erect a display board of size and shape as required and paint over it, in a legible and workman like manner, the details about the salient features of the project, as required by the Engineer-in-Charge. The Contractor shall fabricate and put up a sign board in an approved location and to an approved design indicating name of the project, Client/Owner, Engineer-in-charges, Structural Consultants, Department etc. besides providing space for names of other Contractors, Sub-Contractors and specialized agencies within 15 days from issue of award letter. Nothing extra shall be payable on this account. In case of non compliance/delay in compliance in this, a penalty @ Rs. 500/- per day will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.

iii) Necessary protective and safety equipments shall be provided to the Site Engineer, Supervisory staff, labour and technical staff of the contractor by the Contractor at his own cost and to be used at site.

iv) No inflammable materials including P.O.L shall be allowed to be stored in huge quantity at site. Only limited quantity of P.O.L may be allowed to be stored at site subject to the compliance of all rules / instructions issued by the relevant authorities and as per the direction of Engineer -in- Charge in this regard. Also all precautions and safety measures shall be taken by the Contractor for safe handling of the P.O.L products stored at site. All consequences on account of unsafe handling of P.O.L shall be borne by the Contractor.

## 1.51 QUALITY ASSURANCE

The proposed building is a prestigious project and quality of work is of paramount importance. Contractor shall have to engage well-experienced skilled labour and deploy modern T&P and other equipment to execute the work. Many items like specialized flooring work, Polysulphide sealant and backer rod fixing in expansion joints, factory made door- window shutters, proper slope maintaining in toilet units, sanitary- water supply installation, textured finishing, grit plastering with aluminum channel insertions, water proofing treatment with APP Extruded Polystyrene insulation boards, will specially require engagement of skilled workers having experience particularly in execution of such items.

The contractor shall ensure quality construction in a planned and time bound manner. Any sub-standard material / work beyond set out tolerance limit shall be summarily rejected by the Engineer-in-charge & contractor shall be bound to replace / remove such sub-standard / defective work immediately. If any material, even though approved by Engineer-In-Charge is found defective or not conforming to specifications shall be replaced / removed by the contractor at his own risk & cost.

In addition to the supervision of work by DTU engineers, the Consultants deployed by the DTU shall also be carrying out regular and periodic inspection of the ongoing activities in the work and deficiencies, shortcomings, inferior workmanship pointed out by them shall be communicated by DTU engineers to the contractor. Upon receipt of instructions from Engineer in Charge these are also to be made good by necessary improvement, rectification, replacement upto his complete satisfaction. Special attention shall be paid towards line and level of internal and external plastering, exposed smooth surface of RCC members by providing fresh shuttering plates, rubberized linings to all the shuttering joints, accurate joinery work in wooden doors and windows, thinnest joints in stone/ tiling / cladding work, non-hollowness in floor and dado tiles work, protection of scratches over flooring by impounding layer of plaster of Paris, water tight pipe linings, absence of hollow vertical joints in brick masonry, proper compaction of filled up earth etc. to achieve an Institution of International standards and up keeping of quality assurance shall be of paramount importance, as such.

The Contractor shall submit, within 07 (Seven) days after the date of award of work, a detailed and complete method statement for the execution, testing and Quality Assurance, of such items of works, as directed by the Engineer-in-Charge. All the materials to be used in the work, to give the finished work complete in all respects, shall comply with the requirements of the specifications and shall pass all the tests required as per specifications as applicable or such specifications / standards as directed by the Engineer-in- Charge. However, keeping the Quality Assurance in mind, the Contractor shall submit, on request from the Engineer-in- Charge, his own Quality Assurance procedures for basic materials and such items, to be followed during the execution of the work, for approval of the Engineer-in-Charge.

All materials and fittings brought by the contractor to the site for use shall conform to the samples approved by the Engineer-in-charge which shall be preserved till the completion of the work. If a particular brand of material is specified in the item of work in Schedule of Quantity, the same shall be used after getting the same approved from Engineer-In-Charge. Wherever brand / quality of material is not specified in the item of work, the contractor shall submit the samples as per suggested list of brand names given in the tender document / particular specifications for approval of Engineer-In-Charge. For all other items, materials and fittings of ISI Marked shall be used with the prior approval of Engineer-In-Charge. Wherever ISI Marked material / fittings are not available, the contractor shall submit samples of materials / fittings manufactured by firms of repute conforming to relevant specifications or IS codes and use the same only after getting the approval of Engineer-In-Charge.

The Contractor shall procure and provide all the materials from the manufacturers / suppliers as per the list attached with the tender documents, as per the item description and particular specifications for the work. The equivalent brand for any item shall be permitted to be used in the work, only when the specified makes are not available. This is, however, subject to documentary evidence produced by the contractor for non-availability of the brand specified and also subject to independent verification by the Engineer-in-Charge. In exceptional cases, where such approval is required, the decision of Engineer-in-Charge as regards equivalent make of the material shall be final and binding on the Contractor. No claim, whatsoever, of any kind shall be entertained from the Contractor on this account. Nothing extra shall be payable on this account. Also, the material shall be procured only after written approval of the Engineer-in-Charge.

All materials whether obtained from Govt. stores or otherwise shall be got checked by the Engineer-in-Charge or his authorized supervisory staff on receipt of the same at site before use.

The tests, as necessary, shall be conducted in the following laboratory. The samples shall be taken for carrying out all or any of the tests stipulated in the particular specifications and as directed by the Engineer-in-Charge or his authorized representative.

- IIT Delhi.
- CRRI, Delhi.
- National Council for Cement and Building Materials, Ballabh Garh.
- Delhi Technological University (Formerly known as Delhi College of Engineering).
- CPWD Lab, Delhi.
- Shree Ram Testing Laboratories Delhi

- Any other NABL approved lab as approved by the NIT approving authority.

All the registers of tests carried out at Construction Site or in outside laboratories and all material at site (MAS) registers including cement register shall be maintained by the contractor which shall be issued to the contractor by Engineer-in-charge. All the entries in the registers will be made by the designated Engineering Staff of the contractor and same should be regularly reviewed by J.E/Consultant(Civil)/EE. Contractor shall be responsible for safe custody of all the registers.

The Contractor shall at his own risk and cost make all arrangements and shall provide all such facilities including material and labour, the Engineer-in-Charge may require for collecting, preparing, forwarding the required number of samples for testing as per the frequency of test stipulated in the contract specifications or as considered necessary by the Engineer-in-Charge, at such time and to such places, as directed by the Engineer-in-Charge. Nothing extra shall be payable for the above.

The Contractor or his authorized representative shall associate in collection, preparation, forwarding and testing of such samples. In case he or his authorized representative is not present or does not associate him, the result of such tests and consequences thereon shall be binding on the Contractor. The Contractor or his authorized representative shall remain in contact with the Engineer-in-Charge or his authorized representative associated for all such operations. No claim of payment or claim of any other kind, whatsoever, shall be entertained from the Contractor.

All the testing charges shall be borne by the contractor/ department in the manner indicated below:

(a) By the contractor, if the results show that the material does not confirm to relevant specifications and BIS codes or any other relevant code for which confirmatory test is carried out.

(b) By the department, if the results show that the material confirms to relevant specifications and BIS codes or any other relevant code for which confirmatory test is carried out.

If contractor brings the material in smaller lots than specified frequency as per specification, the testing charges shall be born by the contractor in respect of extra numbers of tests required to be carried out on this account irrespective of test result.

(c) The contractor shall get the water tested with regard to its suitability and conforming to the relevant I.S. Code. The contractor shall obtain written approval from the Engineer-in-Charge before proceeds by using the same for execution of work. The testing charges shall be borne by the contractor.

All the hidden items such as water supply lines, drainage pipes, conduits, sewers etc. are to be properly tested as per the design conditions before covering and their measurements in computerized measurement book duly test checked shall be deposited with Engineer in charge or his authorized representative, prior to hiding these items.

Water tanks, taps, sanitary, water supply and drainage pipes, fittings and accessories should confirm to bylaws and municipal body / corporation where DTU Specifications are not available. The contractor should engage licensed plumbers for the work and get the materials (fixtures/fittings) tested by the Municipal Body/Corporation authorities wherever required at his own cost.

The contractor shall give performance test of the entire installation(s) as per the standing specifications before the work is finally accepted and nothing extra whatsoever shall be payable to the contractor for the test.

The contractor shall have to execute guarantee bonds in respect of water proofing works and other specialized works as per Performa enclosed.

The Contractor shall arrange electricity at his own cost for testing of the various electrical installations as directed by Engineer-in-Charge and for the consumption by the contractor for executing the work. Also all the water required for testing various electrical installations, fire pumps, fire fighting/ fire fighting equipments, fire sprinklers etc. and also testing water supply, sanitary and drainage lines, water proofing of underground sump, overhead tanks, water proofing treatment etc. shall be arranged by the contractor at his own cost. Nothing extra shall be payable on this account.

The quality of water in the nearby areas is not fit for construction work, therefore, water treatment plant of suitable capacity shall be installed by the contractor at each site of work. He would also be required to create capacity for storage for a period not less than 3 days for construction and curing purpose, for which nothing extra shall be paid to the contractor.

## 1.52 SUBMISSION AND DOCUMENTATION

(i) The Contractor shall display all permissions, licenses, registration certificates, bar charts, other statements etc under various labour laws and other regulations applicable to the works, at his site office. He should also keep at site at least one set of BIS Codes and other relevant codes at site and produce the same if asked for by Engineer-In-Charge. In case of non compliance, these codes will be purchased from the Market and actual cost of purchase will be recovered from the next RA Bill of the Contractor.



- (ii) The Contractor shall make available four (04) sets of completed Building Drawings, “As Built Drawings” along with literatures, manuals, warranty certificates etc. of various installed fittings, fixtures and equipment for the completed projects. This shall be the prerequisite for payment of final bill.
- (iii) The Contractor shall make available three (03) sets of all services drawings including Electrical & HVAC work internal and external services i.e. Water Supply, Sanitary line and Drainage lines. This shall be the prerequisite for payment of final bill. These drawings shall have the following information:
  - (iv) Run off for all piping and their diameters including soil, waste pipes and vertical stacks.
  - (v) Ground and invert level of all drainage pipes together with locations of all manholes and connections, up to outfall.
  - (vi) Run off for all water supply lines with diameters location of control valves, access panels etc.
- (vii) The contractor shall make available four (04) sets of computerized Standard Measurement Books (SMBs) having measurement of all the permanent standing in a building.
- (viii) The Performance Guarantee shall not be released to the contractor until the aforesaid drawings are submitted to the Engineer-in-Charge.
- (ix) The contractor will submit computerized measurement sheet for the work carried out by him for making payment as per Clause – 6A of the CPWD General Conditions of Contract 2014 (with correction slips up to the last date of submission of tender). For casting of RCC members and other hidden items the corrected and duly test checked measurement sheets of reinforcement or that of other hidden items shall be deposited with Engineer in charge or his authorized representative, before casting of RCC or other hidden items. The delay in submission of corrected and duly checked measurement sheet may, therefore, delay casting of RCC or execution of hidden item for which no hindrance shall be recorded.
- (x) To avoid delay, contractor should submit all samples well in advance so as to give timely orders for procurement.

#### 1.53 Program Chart:

The Contractor shall prepare an integrated program chart within seven days of issue of award letter including civil as well as E & M activities for the execution of work, showing clearly all activities from the start of work to completion, with details of manpower, equipment and machinery required for the fulfillment of the program within the stipulated period and submit the same for approval of the Engineer-In-Charge within seven days of the award of the work. These shall be submitted by the contractor through electronic media besides forwarding hard copies of the same. The integrated program chart so submitted should not have any discrepancy with the physical milestones attached in the contract agreement. The program chart should include the following: -

- (i) Descriptive note explaining sequence of various activities.
- (ii) Construction Program prepared on PRIMAVERA Software or any other equivalent software decided by the Engineer-in-Charge, which will indicate resources in financial terms, manpower and specialized equipment for every important stage.
- (iii) Program for procurement of materials by the contractor.
- (iv) Program for arranging and deployment of manpower both skilled and unskilled so as to achieve targeted progress.
- (v) Program of procurement of machinery/equipment having adequate capacity, commensurate with the quantum of work to be done within the stipulated period, by the contractor.
- (vi) Program for achieving fortnightly micro milestones and periodic milestones.
- (ix) If at any time, it appears to the Engineer-In-Charge that the actual progress of work does not conform to the approved program referred above, the contractor shall produce a revised program showing the modifications to the approved program by additional inputs to ensure completion of the work within the stipulated time.
- (x) The submission for approval by the Engineer-In-Charge of such program or the furnishing of such particulars shall not relieve the contractor of any of his duties or responsibilities under the contract. This is without prejudice to the right of Engineer-In-Charge to take action against the contractor as per terms and conditions of the agreement.

(xi) Apart from the above integrated program chart, the contractor shall be required to submit fortnightly progress report of the work in a computerized form on 1st and 16th of every month. The progress report shall contain the following, apart from whatever else may be required as specified above:

(a) Construction schedule of the various components of the work through a bar chart for the next fortnight (or as may be specified), showing the micro- milestone/milestones, targeted tasks (including material and labour requirement) and up to date progress. At least 10 digital photographs showing all the parts of construction site along with at least 5 minutes video of executions of different items in soft copy has to be submitted in every fortnightly progress report.

(b) Progress chart of the various components of the work that are planned and achieved, for the fortnight as well as cumulative up to the fortnight under reckoning, with reason for deviations, if any in a tabular format.

(c) Plant and machinery statement, indicating those deployed in the work.

(d) Manpower statement indicating:

Individually the names of all the staff deployed on the work, along with their designations.

No. of skilled workers (trade wise) and total no. of unskilled workers deployed on the work and their location of deployment i.e. blocks.

(e) Financial statement, indicating the broad details of all the running account payment received up to date, such as gross value of work done, advances taken, recoveries effected, amount withheld, net payments details of cheque payment received, extra/substituted/deviation items if any, etc.

(xii) In case of non compliance / delay in compliance in submission of fortnightly, a penalty @ Rs. 1000/- per fortnightly report will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.

#### 1.54 **TEMPORARY WATER/ ELECTRICITY/ TELEPHONE CONNECTION**

(i) Arrangement of temporary telephone connection, water and electricity required by Contractor, shall be made by him at his own cost and also necessary permissions shall be obtained by him directly from concerned authorities, under intimation to the Department. Also, all initial cost and running charges, and security deposit, if any, in this regard shall be borne by him. The Contractor shall abide by all the rules/ bye laws applicable in this regard and he shall be solely responsible for any penalty on account of violation of any of the rules/byelaws in this regard. Nothing extra shall be payable on this account.

(ii) The Contractor shall be responsible for maintenance and watch and ward of the complete installation and water / electricity meter and shall also be responsible for any pilferage, theft, damage, penalty etc. in this regard. The Contractor shall indemnify the Department against any claim arising out of pilferage, theft, damage, penalty etc. whatsoever on this account. Security deposit for the work shall be released only after No Dues Certificates are obtained from the local Authorities from whom temporary electric/ water / telephone connection have been obtained by the Contractor. Nothing extra shall be payable on this account.

(iii) The Department shall in no way be responsible for either any delay in getting electric and/or water and/or telephone connections for carrying out the work or not getting connections at all. No claim of delay or any other kind, whatsoever, on this account shall be entertained from the Contractor. Also contingency arrangement of stand-by water & electric supply shall be made by the Contractor for commencement and smooth progress of the work so that work does not suffer on account of power failure or disconnection or not getting connection at all. No claim of any kind whatsoever shall be entertained on this account from the Contractor. Nothing extra shall be payable on this account

#### 1.55 **CLEANLINESS OF SITE**

i) The Contractor shall not stack building material/malba/muck on the land or road of the local development authority or on the land owned by the others, as the case may be. So the muck, rubbish etc. shall be removed periodically as directed by the Engineer-in-Charge, from the site of work to the approved dumping grounds as per the local byelaws and regulations of the concerned authorities and all necessary permissions in this regard from the local bodies shall be obtained by the Contractor. Nothing extra shall be payable on this account. In case, the Contractor is found stacking the building material/malba as stated above, the Contractor shall be liable to pay the stacking charges/penalty as may be levied by the local body or any other authority and also to face penal action as per the rules, regulations and bye-laws of such body or authority. The Engineer –in-Charge shall be at liberty to recover, such sums due but not paid to the concerned authorities on the above counts, from any sums due to the Contractor including amount of the Security Deposit and performance guarantee in respect of this contract agreement.

ii) The contractor shall take instructions from the Engineer-In-Charge regarding collection and stacking of materials at any place. No excavated earth or building rubbish shall be stacked on areas where other buildings, roads, services and compound walls are to be constructed.

iii) The site of work shall be always kept clean due to constraints of space and to avoid any nuisance to the users of buildings in the adjacent plots. The Contractor shall take all care to prevent any water-logging at site. The waste water, slush etc. shall not be allowed to be collected at site. It may be directly pumped into the creek with prior approval of the concerned authorities. For discharge into public drainage system, necessary permission shall be obtained from relevant authorities after paying the necessary charges, if any, directly to the authorities. The work shall be carried out in such a way that the area is kept clean and tidy. All the fees/charges in this regard shall be borne by the Contractor. Nothing extra shall be payable on this account.

#### 1.56 INSPECTION OF WORK

i) In addition to the provisions of relevant clauses of the contract, the work shall also be open to inspection by Senior Officers of DTU & the representative of the Consultants. The contractor shall at times during the usual working hours and at all times at which reasonable notices of the intention of the Engineer-in-charge or other officers as stated above to visit the works shall have been given to the contractor, either himself be present to receive the orders and instructions or have a responsible representative duly accredited in writing, to be present for that purpose.

ii) Inspection of the work by Consultant appointed by the DTU.

The consultant appointed by DTU, shall be inspecting the works including workshops and fabrication factory to ensure that the works are in general being executed according to the design, drawings and specifications laid down in the contract. His observations shall be communicated by DTU engineering staff and compliance is to be reported to DTU.

The consultant appointed by DTU shall certify on completion of particular building that it has been constructed according to the approved drawings design and specifications.

iii) Senior Officers of DTU, Dignitaries from Central Ministry / Department, Client Authorities shall be inspecting the on-going work at site at any time with or without prior intimation. The contractor shall, therefore, keep updated the following requirements and detailing.

Display Board showing detail of work, weekly progress achieved with respect to targets, reason of shortfall, status of manpower, wages being paid for different categories of workers.

Entrance and area surrounding to be kept cleaned.

Display layout plan key plan, Building drawings including plans, elevations and sections.

Upto date displays of Bar chart, CPM and PERT etc.

Keep details of quantities executed, balance quantities, deviations, possible Extra item, substituted Item etc.

Keep plastic / cloth mounted one sets of building drawings.

Set of Helmets and safety shoes for exclusive use for officers/dignitaries visiting at site.

#### 1.57 FINAL TESTING OF THE INSTALLATION

The Contractor shall demonstrate trouble free functioning of all the Civil and E & M installations and services. The Engineer-in-Charge or his authorized representatives shall carry out final inspection of the various Civil and E & M services and installations. Any defect(s) noticed during demonstration shall be rectified by the Contractor at his own cost to the entire satisfaction of the Engineer-in-Charge. Nothing extra shall be payable on this account.

#### 1.58 SUBMISSION OF AS BUILT DRAWINGS AND OBTAINING OCCUPATION CERTIFICATE

The contractor shall coordinate and facilitate consultant for obtaining occupation certificate / completion certificate from local bodies including getting the required site visits conducted by such authorities with a view to obtain the same.

#### 1.59 REFUND OF PERFORMANCE GUARANTEE

The performance guarantee shall be refunded to the contractor soon after the completion of work and recording of the completion certificate by the competent authority.

#### 1.60 DEALING WITH INCONSISTENT RATES

i) The Contractors shall quote same rates for the identical items which may inadvertently appear in more than one place if different rates are quoted by the tenderers for such identical items, the same shall be rationalized by considering the lowest quoted rate for such items, for evaluation and acceptance of tender.

ii) Wherever any reference to any Indian Standards occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued thereto or revisions thereof, if any, up to the date of receipt of tenders.

iii) Unless otherwise specified in the schedule of quantities, the rates for all items of work shall be considered, as inclusive of pumping out or bailing out water, if required throughout the construction period for which no extra payment shall be made.

This shall also include water encountered from any source such as rains, floods, sub soil water table being high and/or due to any other cause whatsoever.

- iv) All stone aggregate and stone ballast shall be of hard stone variety to be obtained from approved quarries.
- v) Coarse sand should be obtained from approved sources. The same shall be clean and sharp angular grit type. The coarse sand shall be screened before using, if required. If the sand brought to site is dirty, it must be washed in clean water to bring the sand to the required specifications. Nothing extra shall be payable on this account.
- vi) The rates for all items of work, shall unless clearly specified otherwise, include cost of all operations and all inputs of labour, material, T & P, scaffolding, wastages, watch and ward, other inputs, all incidental charges, all taxes, cess, VAT, duties, levies etc. required for execution of the work.

#### 1.61 PRODUCT DELIVERY, STORAGE AND HANDLING OF CHEMICALS

The contractor shall construct storage space for Chemicals materials to ensure that the storage conditions are as recommended by the manufactures.

All the materials shall be procured and delivered in sealed containers with labels legible and intact.

All the chemicals {polymers, epoxy, water proofing compound, plasticizer, Polysulphide, SBR based elastomeric, APP (Atactic Polypropylene Polymer), all exterior and interior paints, polish etc.) shall be procured in convenient packs say 20 litres/Kgs.} capacity packing only or as approved by the Engineer-in-Charge, and not in bigger capacity containers, say 200 litres (Kgs.) drums unless otherwise specifically permitted by the Engineer-in-Charge. One sample from each lot of the chemical procured by the contractor shall be tested in a laboratory as approved by the Engineer-in-charge

All material required for the execution of the work shall be got approved, procured and deposited with the Departmental supervisory staff. The materials shall be kept in joint custody of the contractor and the Department. The watch and ward of such material shall, however, remain to be the responsibility of the contractor and no claim, whatsoever, on this account shall be entertained. Different containers of each chemical shall be serially numbered on packing and also consumed in that order. Day-to-Day account of receipt, issue and balance shall be regulated by the Department and proper account shall be maintained at site of work in the prescribed form as per the standard practice.

All the chemicals shall be procured by the contractor directly from the manufacturer. In exceptional circumstances, the contractor may be allowed to procure the materials from the authorized dealers of the manufacturers, if specifically permitted by the Engineer-in-Charge.

The original copies of challan/cash memos and manufacturer's test reports towards the quantity of various chemicals procured shall be made available by the contractor to the Engineer-in- Charge before making payments for work consuming the said material and a copy of the same shall be kept in record.

The Name of manufacturers, manufacturer's product identification, and manufacturer's mixing instructions, warning for handling and toxicity and date of manufacturing and shelf life shall be clearly and legibly mentioned on the labels of the each container.

The contractor shall submit for the chemicals procured, manufacturer's and / or authorized dealer's certificate regarding supplying and verifying conformance to the material specifications, as specified.

All filled containers shall be handled in safe manner and in a way to avoid breaking container seals.

Empty containers of the chemicals should not be removed from site till the completion of work and shall be removed only with the written approval of the Engineer-in-Charge.

All arrangements for measuring, dosing and mixing of material / chemicals at site have to be made by the contractor.

Contractor shall suitably advise his site Engineer and all the workers as regards safe handling of chemicals. Necessary protective and safety equipments in form of hand gloves, goggles etc. shall be provided by the contractor and be also used at site.

All incidental charges of any kind including cartage, storage and wastage and safe custody of material etc. shall be borne by the contractor and no claim, whatsoever, shall be entertained on this account.

The chemicals shall be tested in an independent laboratory as approved by the Engineer-in-charge at the frequency as specified. If required, more samples may have to be tested as per the directions of the Engineer-in-Charge. Nothing extra shall be payable on this account. However testing charges shall be borne by the department for the samples satisfying the requirements specified in the tender.

#### 1.62 De-watering

(i) De-watering required, if any, shall be done conforming to BIS Code IS: 9759 (guide lines for de-watering during construction) and / or as per the specifications approved by the Engineer-in-Charge. Design of an appropriate and suitable dewatering system shall be the Contractor's responsibility. Such scheme shall be modified / augmented as the work proceeds based on fresh information discovered during the progress of work, at no extra cost. At all times during the construction work, efficient drainage of the site shall be carried out by the Contractor and especially during the laying of plain cement concrete, taking levels etc. The Contractor shall also ensure that there is no danger to the nearby properties and installations on account of such lowering of water table. If needed, suitable precautionary measures shall be taken by the Contractor. Also the scheme of dewatering adopted shall have adequate built in arrangement to serve as stand-bye to attend to repair of pumps etc. and disruption of power / fuel supply. Nothing extra shall be payable on this account.

(ii) In trenches where surface water is likely to get into cut / trench during monsoons, a ring bund of puddle clay or by any other means shall be formed outside, to the required height, and maintained by the Contractor. Also, suitable steps shall be taken by the Contractor to prevent back flow of pumped water into the trench. Nothing extra shall be payable on this account.

### 1.63 INSURANCE POLICIES

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

### 1.64 Training of the Personnel

The contractor shall arrange at no extra cost to the Department to train two persons from the department (DTU) one each for civil and electrical works, on how to operate and carryout preventive maintenance of the systems (both civil and electrical) . The contractor shall arrange this training from well qualified and experience personnel for at least seven days.

1.65 The Architectural drawings given in the tender other than those indicated in nomenclature of items are only indicative of the nature of the work and materials/fixings involved unless and otherwise specifically mentioned. However, the work shall be executed in accordance with the drawings duly approved by the Engineer-in-Charge.

### 1.66 Recording of Hindrance & Maintenance of Hindrance Register –

i) Whenever any hindrance whether on part of department or on part of contractor, comes to the notice of the Assistant Engineer, he shall at once make a note of such hindrance in the register kept at site, and immediately make a report to the Executive Engineer within a week.

ii) The following points shall be kept in mind while entering the hindrances in the Hindrance Register:  
The entry of date of start of hindrance and date of removal of hindrance shall be made on the same day as the hindrance takes place or the cause of the hindrance is removed, respectively.

The Executive Engineer shall work out the over lapping period, net if hindrance and of each hindrance within 15 days of removal of the cause of hindrance. For work outside headquarters, this shall be done as and when he visits the site.

The items of work affected due to any hindrance shall be clearly mentioned in the Hindrance Register by the Assistant Engineer, and the weightage shall be allowed on this basis.

Each hindrance shall be entered in the hindrance Register, which shall be authenticated by the Executive Engineer and Contractor.

The hindrance on part of contractor shall also to be entered in the Hindrance Register.

The hindrance shall be recorded carefully in the Hindrance Register after considering its effect on completion of work.

Review of hindrance register shall be compulsory in division office by EE and AAO at the time of payment of each Running Account Bill and final bill and certificate shall be recorded that all up to date hindrances on part of department and contractor have been recorded in the hindrance register.

The net delay on part of department or contractor shall be worked out after considering all the hindrances recorded in the hindrance register.

The Superintending Engineer shall review the hindrance Register whenever he visits site of work.

### 1.67 Safety, Health and Environment

Over and above the provisions made in CPWD Safety Code (part of General Conditions of contract for CPWD works 2014) the following will also be applicable:

In respect of all workmen directly or indirectly employed in the work for the performance of the contractor's part of this agreement, the contractor shall at his expense arrange for the safety provisions as per Indian Standard Safety codes shown below and shall at his own expense provide for all facilities in connection there with. In case the contractor fails to make arrangement and provide necessary facilities, he shall be liable to pay compensations prescribed under Workmen's Compensation Act 1923 as amended from time to time for each default and in addition the Engineer-in-charge shall be at liberty to make arrangement and provide facilities as aforesaid and recover the cost incurred on that behalf from the contractor, and no claims what so ever shall be entertained.

Details regarding some special provisions to be followed by contractor are as follows:

a) Usage of quality Personal Protection Equipments (PPEs) through approved vendors. PPEs would include amongst others the following items:

Safety Helmets.  
Hearing Protection.  
Respiratory Protection.  
Eye Protection.  
Protective Gloves.  
Safety Footwear.  
High Visibility Clothing (Jacket) with approved Logo

All the items should be got approved before issued to the use in the work. Safety Jacket should have DTU Logo as per the size approved.

The contractor shall provide all the PPE (Personnel Protective Equipment) and safety appliances required to carry out the job to all the workmen deployed by the contractor and also ensure that his workmen use those PPE and safety appliances while on the job. The contractor shall not pay any cash amount in lieu of PPE to the workers/sub-contractors and expect them to buy and use during work. If the contractor fails to ensure provision of safety appliances and its workmen do not use the PPE and safety appliances as needed for safe working, the owner may ask the contractor to stop the work and comply with safety requirements first. The contractor shall at all time maintain a minimum of 10% spare PPEs and safety appliances and properly record and show to the Employer during the inspections. Failing to do so shall invite appropriate compensations as per the provisions of under Workmen's Compensation Act 1923 as amended from time to time.

It is always the duty of the contractor to provide required PPEs for all visitors. Towards this required quantity of PPEs shall be kept always at the security post.

#### Colour coding for helmets

Safety Helmet Color Code (Every Helmet should have the LOGO* affixed /painted)	Person to use
White	DTU staffs, All Designers, Architect, Consultants, etc.
Violet	Main Contractors (Engineers / Supervisors)
Blue	All Sub-contractors (Engineers / Supervisors)
Red	Electricians (Both Contractor and Sub-contractor)
Green	Safety Professionals (Both Contractor and Sub-contractor)
Orange	Security Guards / Traffic marshals
Yellow	All workmen
White (with "VISITOR" sticker)	Visitors

Note: LOGO\*

i) Logo shall have its outer dimension 2"X2" and shall be conspicuous.

ii) Logo shall be either painted or affixed.

iii) No words shall come either on Top / Bottom of Logo.

#### b) Working at Heights

Contractor shall ensure that work at height is properly planned for any emergencies and rescue appropriately supervised, and carried out in a manner, which is reasonably practicable safe. Contractor shall ensure that work at height is carried out only when the weather conditions do not jeopardize the health or safety of persons involved in the work. Guardrail, Toe-board, Barrier or similar collective means of protection shall be of sufficient dimensions, of sufficient strength and rigidity for the purposes for which they are being used, and otherwise suitable.

Working Platform shall be of sufficient dimensions to permit the safe passage of persons and the safe use of any plant or materials required to be used and to provide a safe working area-having regard to the work being carried out there. Possess a suitable surface and, in particular, be so constructed that the surface of the working platform has no gap through which a person, material or object could fall and injure a person. A working platform and any supporting structure shall not be loaded so as to give rise to a risk of collapse or to any deformation, which could affect its safe use. Strength and stability calculations for scaffolding shall be carried out by the contractor. The dimensions form and layout of scaffolding decks shall be appropriate to the nature of the work to be performed and suitable for the loads to be carried and permit work and passage in safety.

A personal fall protection system designed for use with an anchor shall be securely attached to at least one anchor, and each anchor and the means of attachment thereto shall be suitable and of sufficient strength and stability for the purpose of supporting any foreseeable loading. Suitable and sufficient steps shall be taken to prevent any person falling or slipping from a personal fall protection system. Any other steps in the opinion of engineer-in-charge suggested will also be taken in Protection system

Only metal ladders shall be allowed. Any surface upon which a ladder rests shall be stable, firm, of sufficient strength and of suitable composition safely to support the ladder so that its rungs or steps remain horizontal, and any loading intended to be placed on it. A ladder shall be so positioned as to ensure its stability during use. A suspended ladder shall be attached in a secure

manner and so that, with the exception of a flexible ladder, it cannot be displaced and swinging is prevented. No interlocking or extension ladder shall be used unless its sections are prevented from moving relative to each other while in use.

c) Lifting appliances and gears.

The contractor shall maintain a register for record of examinations and test details of all lifting appliances. This register should also contain a system of identification of all tools and tackles, its date of purchase, safe working load etc. Contractors can utilize the services of any competent person as defined in Factories Act, 1948 and approved by Chief Inspector of Factories with the permission of the Employer.

d) Automatic safe load indicators

Every lifting appliances and gears like cranes, hydras etc, if so constructed that the safe working load may be varied by raising or lowering of the jib or otherwise shall be attached with an automatic indicator of safe working loads approved by Bureau of Indian standards/ International certifying bodies which gives a warning to the operator and arrests further movements of the lifting parts.

e) Qualification of operator of lifting appliances and of signaler etc.

The contractor shall not employ any person to drive or operate a lifting machine like crane, hydra etc whether driven by mechanical power or otherwise or to give signals to work as a operator of a rigger or derricks unless he is above twenty-one years of age and possesses a valid heavy transport vehicle driving license as per Motor Vehicle Act and Rules, is absolutely competent and reliable, possesses the knowledge of the inherent risks involved in the operation of lifting appliances by undergoing a formal training at any institution of national importance, is medically examined periodically.

1.68 Existing Services:

Existing drains, pipes, electricity cables, overhead wires and telephone cables, sewer lines, water lines and similar services encountered in the course of the execution of the work shall be protected/ maintained against the damage by the contractor. The contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services. In case temporary shifting/supporting of such services is required to facilitate the work, the contractor at no extra cost shall do the same. The decision of the Engineer-in-Charge in this regard shall be final and binding.

1.69 All works pertaining to services including rerouting/diversion of services, routine testing, installation etc., completed in one or more than one process shall be subject to examination and approval to each stage thereof by the Engineer-in-charge or concerned department as would be notified by the Engineer-in-charge or his authorized representative when such stage is ready. In default of such notice the Engineer-in-Charge shall be entitled to appraise the quantity and extent thereof and the decision of Engineer-in-Charge or his authorized representative in this regard shall be final and binding.

1.70 For utilities which are required to be removed or permanently shifted to new position, in the opinion of the Engineer-in-charge, shall be removed / shifted by the contractor in consultation with the service provider agency. Payment for this shall be made as per terms and conditions of the contract. No claim for delay or otherwise due to above reasons shall be entertained on this account.

1.71 The contractor shall make his own arrangement for the disposal of the spoils, waste of bentonite, all dismantled material, slush and foul materials, surplus earth to such place where the same shall not cause nuisance or any environmental problems anywhere and should be acceptable to the authorities concerned. No extra claim whatsoever shall be entertained due to above. The road connected to site should be kept nuisance or environmental problem free.

1.72 The contractor shall make his own arrangement at his own cost for the provision of telephone facilities at the site of works or at any other place.

1.73 The contractor shall make his own arrangements for obtaining electric & water connection(s) if required and make necessary payment directly to department concerned. The department will however make all reasonable recommendations to the authority concerned in this regard.

1.74 The contractor shall bear all incidental charges for cartage, storage and safe custody of materials brought to site.

1.75 The work shall be carried out in accordance with the Architectural drawings, structural and services drawings, to be issued from time to time, by the Engineer-in-Charge. Before commencement of any item of work, the contractor shall correlate all the relevant architectural, structural drawing and services issued for the work, nomenclature of items, specifications etc. and satisfy himself that the information available there from is complete and unambiguous. The figures & the written dimensions of the drawing shall super cede the measurement by scale. The discrepancy, if any, shall be brought to the notice of the Engineer-In-Charge for immediate decision before execution of the work. The contractor alone shall be responsible for any loss or damage occurring by the commencement of work on the basis of any erroneous and or incomplete information and no claim, whatsoever shall be entertained on this account.

1.76 GST on Works Contract as applicable shall be deducted from payment made to the contractor.

No payment shall be made to the contractor for cutting holes in 40 mm thick sand stone slab for electric installations and fixtures such as electric MCB DB's and fire fighting pipes as well as civil plumbing work being the new work unless otherwise provided in schedule of quantity.

The payment for shuttering at the edges of slab at all levels shall be made under schedule item of centering and shuttering 13.7.

## 2.0 SPECIAL CONDITIONS FOR GREEN BUILDING

### 2.1 Pre-construction Stage

#### Construction Vehicles, Equipment and Machinery

All vehicles, equipment and machinery to be procured for construction shall conform to the relevant Bureau of India Standard (BIS) norms.

Emission from the vehicles must conform to environmental norms.

Dust produced from the vehicular movement and other site activities is to be mitigated by sprinkling of water.

Noise limits for construction equipments shall not exceed 75 dB(A), measured at one meter from the edge of the equipment in free area, as specified in the Environment Protection Act, 1986, schedule VI part E, as amended on 9th May, 1993. The maximum noise levels near the construction site should be limited to 65 dB (A) Leq (5 min) in project area.

### 2.2 Construction Stage

#### Construction Wastes Disposal

- (i) The pre-identified dump locations will be a part of solid waste management plan to be prepared by the Contractor in consultation with Engineer -in-charge.
- (ii) Contractor shall get approved the location of disposal site prior to commencement of the excavation on any section of the project location.
- (iii) Contractor shall ensure that any spoils of material will not be disposed off in any municipality solid waste collection bins.

### 2.3 Procurement of Construction Materials

- (i) All vehicles delivering construction materials to the site shall be covered to avoid spillage of materials and maintain cleanliness of the roads.
- (ii) Wheel Tyres of all vehicles used by of the contractor, or any of his sub contractor or materials supplies shall be cleaned and washed clear of all dust/mud before leaving the project premises. This shall be done by routing the vehicles through tyre washing tracks.
- (iii) Contractor shall arrange for regular water sprinkling at least twice a day (i.e. morning and evening) for dust suppression of the construction sites and unpaved roads used by his construction vehicles.

### 2.4 Water Pollution

- (i) The Contractor shall take all precautionary measures to prevent the wastewater during construction to accumulate anywhere.
- (ii) The wastewater arising from the project is to be disposed off in the manner that is acceptable to the Engineer -in-charge.

### 2.5 Air and Noise Pollution

Contractor shall use dust screens and sprinkle water around the construction site to arrest spreading of dust in the air and surrounding areas.

- (i) Contractor shall ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that emission levels comply with environmental emission standards/norms.
- (i) For controlling the noise from Vehicles, Plants and Equipments, the Contractor shall confirm the following:
- (iii) All vehicles and equipment used in construction will be fitted with exhaust silencers.
- (iv) Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.
- (v) Noise emission from compactors (rollers) front loaders, concrete mixers, cranes (movable), vibrators and saws should be less than 75 dB(A).
- (vi) As per the standards/guidelines for control of Noise Pollution from Stationary Diesel Generator (DG) sets, noise emission in dB(A) from DG Set (15-500 KVA) should be less than  $94 + 10 \log_{10} (\text{KVA})$ . The standards also suggest construction of acoustic enclosure around the DG Set and provision of proper exhaust muffler with insertion loss of minimum 25 dB(A) as mandatory.
- (vii) Control of Air Pollution of Dust from construction and demolition activities as per NGT guidelines.

### 2.6 Personal Safety Measures for Labour

Contractor will provide the following items for safety of workers employed by contractor and associate agencies:

Protective footwear and gloves to all workers employed for the work on mixing, cement, lime mortars, concrete etc. and openings in water pipeline/sewer line.



Welder's protective eye-shields to workers who are engaged in welding works.

Safety helmet and Safety harness/ belt .Provide adequate sanitation/safety facilities for construction workers to ensure the health and safety of the workers during construction, with effective provisions for the basic facilities such as sanitation, drinking water and safety equipments or machinery.

All the workers should be wearing helmet and shoes all the time on site.

Masks and gloves should be worn whenever and wherever required.

Adequate drinking water facility should be provided at site, adequate number of decentralized latrines and urinals to be provided for construction workers.

Full time workers residing on site should be provided with clean and adequate temporary hutment.

First aid facility should also be provided.

Overhead lifting of heavy materials should be avoided. Barrow wheel and hand-lift boxes should be used to transport materials onsite.

Tobacco and cigarette smoking should be prohibited onsite.

All dangerous parts of machinery are well guarded and all precautions for working on machinery are taken.

Maintain hoists and lifts, lifting machines, chains, ropes and other lifting tackles in good condition. Provide safety net of adequate strength to arrest falling material down below.

Use of durable and reusable formwork systems to replace timber formwork and ensure that formwork where used is properly maintained.

Ensure that walking surfaces or boards at height are of sound construction and are provided with safety rails and belts. Provide protective equipments such as helmets.

Provide measure to prevent fire. Fire extinguisher and buckets of sand to be provided in fire-prone area and elsewhere.

Provide sufficient and suitable light for working during night.

Ensure that measures to protect workers from materials of construction, transportation, storage and other dangers and health hazards are taken

Ensure that the construction firm/division/company have sound safety policies.

Comply with the safety procedure, norms and guidelines (as applicable) as outlined in NBC 2005 (BIS 2005c).

Adopt additional best practices and prescribed norms as in NBC 2005 (BIS2005).

2.7 Identify roads on-site that would be used for vehicular traffic. Update vehicular roads (if these are unpaved) by increasing the surface strength by improving particle size, shape and mineral type that make up the surface base. Add surface gravel to reduce source of dust emission. Limit amount of fine particles (smaller than 0.075mm) to 10 -20%. Limit vehicular speed on site 10km/h. Nothing extra will be payable for this.

2.8 All material storages should be adequately covered and contained so that they are not exposed to situations where winds on site could lead to dust/particulate emissions.

2.9 Spills of dirt or dusty materials shall be cleaned up promptly so the spilled material does not become a source of fugitive dust and also to prevent of seepage of pollutant laden water into the ground aquifers. When cleaning up the spill, ensure that the clean - up process does not generate additional dust. Similarly, spilled concrete slurries or liquid wastes should be contained/cleaned up immediately before they can infiltrate into the soil/ground or runoff in nearby areas.

2.10 Ensure that water spraying is carried out by wetting the surface by spraying water on:

- (i) Any dusty material.
- (ii) Areas where demolition work is carried out.
- (iii) Any unpaved main-haul road and.
- (iv) Areas where excavation or earth moving activities are to be carried out.

2.11 The contractor shall ensure the following:

- (i) Cover and enclose the site by providing dust screen, sheeting or netting to scaffold along the perimeter of a building.
- (ii) Covering stockpiles of dusty material with impervious sheeting.
- (iii) Covering dusty load on vehicles by impervious sheeting before they leave the site.
- (iv) Transferring, handling/storing dry loose materials like bulk cement and dry pulverized fly ash inside a totally enclosed system.
- (v) Spills of dirt or dusty materials shall be cleaned up promptly so that the spilled material does not become a source of fugitive dust and also to prevent seepage of pollutant laden water into the ground aquifers. When cleaning up the spill, ensure that the clean-up process does not generate additional dust. Similarly, spilled concrete slurries or liquid wastes should be contained / cleaned up immediately before they can infiltrate into the soil/ground or runoff in nearby areas.
- (vi) Clear vegetation only from areas where work will start right away.
- (vii) Vegetate/mulch areas where vehicles do not ply.
- (viii) Apply gravel / landscaping rock to the areas where mulching/paving is impractical.

2.12 Adopt measures to prevent air pollution in the vicinity of the site due to construction activities. There is no standard reference for this. The best practices should be followed (as adopted from international best practice documents and codes)

2.13 Provide sheet covering/barricading of site of not less than 3m height along the site boundary, next to a road or other public area. Nothing extra will be paid for this.

2.14 The contractor shall provide experienced personnel with suitable training to ensure that these methods are implemented. Prior to the commencement of any work, the method of working, plant equipment and air pollution control system

to be used on -site should be made available for the inspection and approval of the Engineer -in-Charge to ensure that these are suitable for the project.

2.15 Employ measures to segregate the waste on-site into inert, chemical or hazardous wastes. Recycle the unused chemical/hazardous wastes such as oil, paint, batteries and asbestos. The inert waste is to be disposed off to Municipal Corporation/local bodies dump yard and landfill sites.

2.16 To preserve the existing landscape and protect it from degradation during the process of construction. Select proper timing for construction activity to minimize the disturbance such as soil pollution due to spilling of the construction material and its mixing with rainwater. The construction management plan including soil erosion control management plan shall be prepared accordingly for each month. The application of erosion control measures includes construction of gravel pits and tier washing bays of approved size and specification for all vehicular site entry/exits, protection of slopes greater than 10%. Sedimentation Collection System and run-off diversion systems shall be in place before the commencement of construction activity. Preserve and protect the existing vegetation by not-disturbing or damaging to specified site areas during construction.

2.17 The Contractor should follow the construction plan as proposed by the Engineer-in-charge / landscape consultant to minimize the site disturbance such as soil pollution due to spilling. Use staging and spill prevention and control plan to restrict the spilling of the contaminating material on site.

2.18 Spill prevention and control plans should clearly state measures to stop the source of the spill. Measures to contain the spill and measures to dispose the contaminated material and hazardous wastes. It should also state the designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners and petroleum products.

2.19 A soil Erosion and Sedimentation Control Plan (ESCP) should be prepared prior to construction and should be applied effectively.

2.20 The contractor shall prepare and submit 'Spill prevention and control plans' before the start of construction, clearly stating measures to stop the source of the spill, to contain the spill, to dispose the contaminated material and hazardous wastes, and stating designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners, and petroleum products.

2.21 The contractor shall ensure that no construction leaches (Ex: cement slurry) is allowed to percolate into the ground. Adequate precautions are to be taken to safeguard against this including reduction of wasteful curing processes, collection, basic filtering and reuse. The contractor shall follow requisite measures for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas. Temporary drainage channels, perimeter dike/swale, etc. shall be constructed to carry the pollutant -laden water directly to the treatment device or facility (municipal sewer line).

2.22 All lighting installed by the contractor around the site and at the labour quarters during construction shall be CFL bulbs of the appropriate illumination levels. This condition is a must, unless specifically prescribed otherwise.

2.23 All paints, adhesives and sealants should comply with the VOC limits prescribed by GRIHA, as follows:

Table 1- VOC limits for paints, adhesives and sealants

Paints	VOC Limit (g/l)	Adhesives	VOC Limit (g/l)
Non-flat paints	150	Wood flooring Adhesive	100
Flat (Mat) paints	50	Tile Adhesive	65
Anti-corrosive/anti-rust paints	250	Indoor Carpet Adhesive	50
Varnish	350	Wood	30
Lacquer	550	Stains Water proofing sealer	250 250

2.24 All the building materials and systems used on site must be as per the specifications and approved makes by the Engineer-In-Charge.

2.25 Nothing extra shall be payable for above provisions unless otherwise specified in Schedule of Quantity

### 3.0 **ADDITIONAL CONDITIONS AND PARTICULAR SPECIFICATION FOR CIVIL COMPONENT**

#### ADDITIONAL CONDITION AND PARTICULAR SPECIFICATION FOR STEEL WORK

##### STRUCTURAL STEEL

3.1 This specification covers the fabrication and transportation to site and erection on prepared foundations and structural steel work consisting of beams, columns, purlins, vertical trusses, bracings, shear connections etc.

3.2 Fabrication, erection and approval of steel structures shall be in compliance with:

General Specifications mentioned in CPWD specifications and IS : 800 – 1984. For the guidance on general fabrication and erection of structural steel work, Chapter 11 of IS: 800 (1984) must be followed. As far as safety is concerned guidance could be obtained from Indian safety code for structural steelwork IS:7205(1974). Before the commencement of the erection, all the erection equipment tools, shackles, ropes etc. should be tested for their load carrying capacity. Such tests if needed may be repeated at intermediate stages also.

Drawings and supplementary drawings to be supplied to the contractors during execution of the work.

3.3 Providing shop primer coat for steel structures. Grouting of holding-down bolt pockets and below base plates where required.

3.4 In case of conflict between the Clauses mentioned here and the Indian Standards, those expressed in this specification shall govern.

3.5 Scope

The fabrication and erection of the steel work consists of accomplishing of all jobs here-in enumerated including providing all labour, tools and plant all materials and consumables such as welding electrodes, bolts and nuts, oxygen and acetylene gases, oils for cleaning etc. of approved quality as per relevant IS. The work shall be executed according to the drawings, specifications, relevant codes etc. in an expeditious and workman like manner, as detailed in the specifications and the relevant Indian Standard Codes and Standard Practice and to the complete satisfaction of the Engineer-in-charge .

3.6 Fabrication Drawings

(i) The contractor shall prepare all fabrication and erection drawings on the basis of design drawings supplied to him and submit the same in triplicate to the Engineer-in-charge for review, Engineer-in-charge shall review and comment, if any, on the same. Such review, if any, by the Engineer-in-charge, does not relieve the contractor of any of his required guarantees and responsibilities. The contractor shall however be responsible to fabricate the structural strictly conforming to specifications and reviewed drawings.

(ii) Fabrication drawings shall include but not limited to the following:

- Member sizes and details
- Types and dimensions of welds and bolts
- Shapes and sizes of edge preparation for welding
- Details of shop and field joints included in assemblies.

(iii) Bill of material

Quality of structural steels, welding electrodes, bolts, nuts and washers etc. to be used.

Erection assemblies, identifying all transportable parts and sub-assemblies, associated with special erection instructions, if required.

Calculations where asked for approval.

(iv) Connections, splices etc. other details not specifically detailed in design drawings shall be suitably given on fabrication drawings considering normal detailing practices and developing full member strengths. Where asked for calculations for the merit shall also be submitted for approval.

(v) Any alternate design or change in section is allowed when approved in writing by the Engineer-in-charge.

However, if any variation in the scheme is found necessary later, the contractor will be supplied with revised drawings. The contractor shall incorporate these changes in his drawings at no extra cost and resubmit for review.

(vii) Engineer-in-charge review shall not absolve the contractor of his responsibility for the correctness of dimensions, adequacy of details and connections. One copy will be returned reviewed with or without comments to the contractor for necessary action. In the former case further three copies of amended drawings shall be submitted by the contractor for final review.

(viii) The contractor shall supply three prints each of the final reviewed drawings to the Engineer-in-charge within a week since final review, at no extra cost for reference and records.

(ix) The Engineer-in-charge will verify the correct interpretation of their requirements.

(x) If any modification is made in the design drawing during the course of execution of the job, revised design drawings will be issued to the contractor. Further changes arising out of these shall be incorporated by the contractor in the fabrication drawings already prepared at no extra cost and the revised fabrication drawings shall be duly got reviewed as per the above Clauses.

### 3.7 Materials

All structural steel shall be procured from primary producers.

#### (i) Rolled Sections

The following grades of steel shall be used for steel structures:

Structural steel will generally be of standard quality conforming to IS: 226/IS:2062. Whenever welded construction is specified plates of more than 20 mm thickness will generally conform to IS: 2062.

#### (ii) Welding Materials

Welding electrodes shall conform to IS: 814.

Approval of welding procedures shall be as per IS: 823.

#### (iii) Bolts, Nuts & Washers

Bolts and nuts shall be as per IS: 1367 and tested as per IS:1608. It shall have a minimum tensile strength of 44 Kg/mm<sup>2</sup> and minimum elongation of 23% on a gauge length of 5.65 (A- Original cross sectional area of the gauge length). Washers shall be as per IS: 2016.

(iv) All materials shall conform to their respective specifications. The use of equivalent or higher grade or alternate materials will be considered only in very special cases subject to the approval of the Engineer-in-charge in writing.

#### (v) Receipt & Storing of Materials

Steel materials supplied by the contractor must be marked for identification and each lot should be accompanied by manufacturer's quality certificate, conforming chemical analysis and mechanical characteristics.

All steel parts furnished by supplier shall be checked, sorted out, straightened, and arranged by grades and qualities in stores.

Structural with surface defects such as pitting, cracks, laminations etc. shall be rejected if the defects exceed the allowable tolerances specified in relevant standards or as directed by the chief Engineer-in-charge.

Welding wire and electrodes shall be stored separately by qualities and lots inside a dry and enclosed room, in compliance with IS: 816 - 1969 and as per instructions given by the Engineer-in-charge. Electrodes shall be perfectly dry and drawn from an electrode even, if required.

(vi) Checking of quality bolts of any kind as well as storage of same shall be made conforming to relevant standards.

Each lot of electrodes, bolts, nuts, etc. shall be accompanied by manufacturer's test certificate.

The contractor may use alternative materials as compared to design specification only with the written approval of the chief Engineer-in-charge.

## (vii) Material Tests

The contractor shall be required to produce manufacturer's quality certificates for the materials supplied by the contractor. Notwithstanding the manufacturer's certificates, the Engineer-in-charge may ask for testing of materials in approved test houses. The test results shall satisfy the requirements of the relevant Indian Standards.

Whenever quality certificates are missing or incomplete or when material quality differs from standard specifications the contractor shall conduct all appropriate tests as directed by the Engineer-in-charge at no extra cost.

Materials for which test certificates are not available or for which test results do not tally with relevant standard specifications, shall not be used.

## 3.8 Fabrication

The Contractor will submit the credential with full particulars about work completed by fabricator to be deployed for this work for approval of Engineer-in-charge. After written approval is communicated in respect of fabricator, then only the jobs should be assigned to him. Fabrication shall be in accordance with IS: 800 Section V in addition to the following:

Fabrication shall be done as per approved fabrication drawings adhering strictly to work points and work lines on the same. The connections shall be welded or bolted as per design drawings. Work shall also include fabricating built up sections.

Any defective material used shall be replaced by the contractor at his own expense, care being taken to prevent any damage to the structure during removal.

All the fabricated and delivered items shall be suitably packed to be protected from any damage during transportation and handling. Any damage caused at any time shall be made good by the Contractor at his own cost.

Any faulty fabrication pointed out at any stage of work shall be made good by the contractor at his own cost.

## (i) Preparation of Materials

Prior to release for fabrication, all rolled sections warped beyond allowable limit shall be pressed or rolled straight and freed from twists, taking care that a uniform pressure is applied.

Minor warping, corrugations etc. in rolled sections shall be rectified by cold working.

The sections shall be straightened by hot working where the Engineer-in-charge so direct and shall be cooled slowly after straightening.

Warped members like plates and flats may be used as such only if wave like deformation does not exceed  $L/1000$  but limited to 10 mm (L-Length).

Surface of members that are to be jointed by lap or fillet welding or bolting shall be even so that there is no gap between overlapping surfaces.

## (ii) Marking

Marking of members shall be made on horizontal pads, of an appropriate racks or supports in order to ensure horizontal and straight placement of such members. Marking accuracy shall be at least  $\pm 1$  mm.

## (iii) Cutting

Members shall be cut mechanically (by saw or shear or by oxyacetylene flame).

All sharp, rough, or broken edges, and all edges of joints which are subjected to tensile or oscillating stresses, shall be ground.

No electric metal arc cutting shall be allowed.

All edges cut by oxyacetylene process shall be cleaned of impurities prior to assembly.

Cutting tolerances shall be as follows:

- a) For members connected at both ends  $\pm 1$  mm.
- b) Elsewhere  $\pm 3$  mm.

The edge preparation for welding of members more than 12 mm thick shall be done by flame cutting and grinding. Cut faces shall not have cracks or be rough.

Edge preparation shall be as per IS : 823 - 1964.

## (iv) Drilling

Bolts holes shall be drilled.

Drilling shall be made to the diameter specified in drawings.

No enlarging of holes filling, by man rolling or oxyacetylene flame shall be allowed.

Allowed variations for holes (out-of-roundness, eccentricity, plumb-line deviation) shall be as per IS:800.

- Maximum deviation for spacing of two holes on the same axis shall be + 1 mm.
- Two perpendicular diameters of any oval hole shall not differ by more than 1 mm.

(v) Drilling faults in holes may be rectified by reaming the holes to the next upper diameter, provided that spacing of new hole centers and distance of hole centers to the edges of members are not less than allowed and that the increase of hole diameter does not impair the structural strength. Hole reaming shall be allowed if the number of faulty holes does not exceed 15% of the total number of holes for one joint.

#### Welding:

##### Preparation of Members for Welding

All welding in mild steel work shall be done with electrodes and / or by methods recommended by the suppliers of the metals being welded in accordance with corresponding Indian Standards. Type, size and spacing of welds, shall be as specified. All welding consumables shall be in accordance with the I.S. standards.

Welds behind finished mild steel surfaces shall be so done as to eliminate distortion and / or discoloration on the finished side.

Weld spatter and welding oxides on finished surfaces shall be removed by descaling and / or grinding. Plug, puddle or spot welding shall not be permitted. If weld beads are visible on exposed finished surfaces, the surfaces shall be ground and polished to match and blend with finish on adjacent parent metal.

Structural welds shall be made by certified welders and shall conform to I.S. code. The welds shall be tested by the Contractor to ensure quality and integrity of the structural welds. However, welding tests shall be carried out as below: and the contractor shall maintain records for Visual testing – 100 % of the welds for size and quality. Fillet weld testing- 30 % of the welds for MPI or Dye penetration test

Dirt grease, lubricant, or other organic material shall be removed by vapor degreasing or suitable solvent.

Joints rejected because of welding defects may be repaired only by re welding. Defective welds shall be removed by chipping or machining. Flame cutting shall not be allowed.

Assembly of structural members shall be made with proper jigs and fixtures to ensure correct positioning of members (angles, axes nodes etc.)

Sharp edges, rust of cut edges, notches, irregularities and fissures due to faulty cutting shall be chipped or ground or filled over the length of the affected area, deep enough to remove faults completely.

Edge preparation for welding shall be carefully and accurately made so as to facilitate a good joint.

Generally no special edge preparation shall be required for members under 8 mm thick.

Edge preparation (beveling) denotes cutting of the same so as to result in V, X K or U seam shapes as per IS: 823.

The members to be assembled shall be clean and dry on the welding edges. Under no circumstances shall wet, greasy, rust or dirt covered parts be assembled. Joints shall be kept free from any foreign matter likely to get in to the gaps between members to be welded.

Before assembly the edges to be welded as well as adjacent areas extending for at least 20 mm shall be cleaned (until metallic polish is achieved).

When assembling members, proper care shall be taken of welding shrinkage and distortions, as the drawing dimensions cover finished dimensions of the structure.

The elements shall be got checked and approved by the Engineer-in-charge or their authorized representative before assembly.

The permissible tolerances for assembly of members preparatory to welding shall be as per IS: 823-1964.

After the assemble has been checked, temporary tack welding in position shall be done by electric welding, keeping in view finished dimensions of the structure.

#### (vii) Welding procedures

Welding shall be carried out only by fully trained and experienced welders as tested and approved by the Engineer-in-charge. Any test carried out either by the Engineer-in-charge or their representative or the inspectors shall constitute a right by them for such tests and the cost involved thereon shall be borne by the contractor himself.

Qualification tests for welders as well as tests for approval of electrodes will be carried out as per IS: 823. The nature of test for performance qualification of welders shall be commensurate with the quality of welding required on this job as judged by the Engineer-in-charge.

The steel structures shall be automatically, semi-automatically or manually welded as per direction of Engineer-in-charge.

Welding shall begin only after the checks mentioned in Clause herein have been carried out.

The welder shall mark with his identification mark on each element welded by him.

When welding is carried out in open air, steps shall be taken to protect the face of welding against wind or rain. The electrodes, wire and parts being welded shall be dry.

Before beginning the welding operation, each joint shall be checked to ensure that the parts to be welded are clean and root gaps provided as per IS: 823.

For continuing the welding of seems discontinued due to some reason, the end of the discontinued seem shall be melted in order to obtain a good continuity. Before resuming the welding operation, the groove as well as the adjacent parts shall be well cleaned for a length of approx. 50 mm.

For single butt welds (in V, 1/2 V or U) and double butt welds (in K, double U etc.) the re-welding of the root is mandatory but only the metal deposit on the root has been cleaned by back gouging or chipping.

The welding seams shall be left to cool slowly. The contractor shall not be allowed to cool the welds quickly by any other method.

For multi-layer welding, before welding the following layer, the formerly welded layer shall be cleaned metal bright by light chipping and wire brushing. Backing strips shall not be allowed.

The order and method of welding shall be so that -

- No unacceptable deformation appears in the welded parts.
- Due margin is provided to compensate for contraction due to welding in order to avoid any high permanent stresses. The defects in welds must be rectified according to IS: 823 and as per instruction of Engineer-in-charge.

#### (viii) Weld Inspection

The weld seams shall satisfy the following :

- Shall correspond to design shapes and dimensions.
- Shall not have any defects such as cracks, incomplete penetration and fusion, under-cuts, rough surfaces, burns, blow holes and porosity etc. beyond permissible limits.

During the welding operation and approval of finished elements, inspections and tests shall be made as shown in annexure-B. The mechanical characteristics of the welded joints shall be as in IS: 823.

#### (ix) Preparation of Members for Bolting

The members shall be assembled for bolting with proper jigs and fixtures to sustain the assemblies without deformation and bending. Before assembly, all sharp edges, shavings, rust dirt, etc. shall be removed. Before assembly, the contacting surfaces of the members shall be cleaned and given a coat of primer as per IS: 2074. The members which are bolt assembled shall be set according to drawings and temporarily fastened with erection bolts (minimum 4 pieces) to check the coaxiality of the holes. The members shall be finally bolted after the deviations have been corrected, after which there shall not be gaps. Before assembly, the members shall be checked and got approved by the Engineer-in-charge. The difference in thickness of the sections that are butt assembled shall not be more than 3% or maximum 0.8 mm whichever is less. If the difference is larger, it shall be corrected by grinding or filling. Reaming of holes to final diameter or cleaning of these shall be done only after the parts have been check assembled. As each hole is finished to final dimensions (reamed if necessary) it shall be set and bolted up. Erection bolts shall not be removed before other bolts are set.

#### (x) Bolting up

Final bolting of the members shall be done after the defects have been rectified and approval of joints obtained. The bolts shall be tightened starting from the centre of joint towards the edge.

#### (xi) Planning of Ends

Planning of ends of members like column ends shall be done by grinding when so specified in the design. Planning of butt welded members shall be done after these have been assembled, the spare edges shall be removed with grinding machines or files. The following tolerances shall be permitted on member that have been planed.

- On the length of the member having both ends planed, maximum + 2 mm with respect to design.
- Level differences of planed surfaces, maximum 0.3 mm.
- Deviation between planed surface and member's axis maximum 1/1500.

#### (xii) Holes for Field Joints

Holes for field joints shall be drilled in the shop to final diameters and tested in the shop, with trial assemblies. When three-dimensional assembly is not possible in the shop, the holes for field joints may be drilled in shop and reamed on site after erection, on approval by the Engineer-in-charge. For bolted steel structures, trial assembly in shop is mandatory. The tolerance for spacing of holes shall be + 1 mm.

#### (xiii) Tolerances

All tolerances regarding dimensions, geometrical shapes and sections of steel structures, shall be as per Annexure B, if not specified in the drawing.

#### (xiv) Marking for Identification

All elements and members prior to despatch for erection shall be shop marked. The members shall be visibly marked with a weather proof light coloured paint. The size and thickness of the numbers shall be chosen as to facilitate the

identification of members. For the small members that are delivered in bundles or crates, the required marking shall be done on small metal tags securely tied to the bundle, while the crates shall be marked directly. Each bundle or crate shall be packed with members for one and the same assembly; in the same bundle or crate, general utility members such as bolts, nuts etc. may be packed. All bill of materials showing weight, quality and dimension of contents shall be placed in the crates.

The members shall be marked with a durable paint, in a visible location, preferably at one end of the member so that these may be easily checked during storage and erection. All members shall be marked in the shop before inspection and acceptance. When the member is being painted, the marking area shall not be painted but bordered with white paint. The marking and job symbol shall be registered in all shop delivery documents (transportation, for erection etc.)

(xv) Shop Test Pre-assembly

For steel structures that have the same type of welding the shop test pre-assembly shall be performed on one out of every 10 members minimum. For bolted steel structures, shop test pre-assembly is mandatory for all elements as well as for the entire structure in conformity with previous Clause .

### 3.9 Shop Inspection and Approval

(i) General

The Engineer-in-charge or their representative shall have free access at all responsible times to the contractors fabrication shop and shall be afforded all reasonable facilities for satisfying himself that the fabrication is being undertaken in accordance with drawings and specifications. Technical approval of the steel structure in the shop by the Engineer-in-charge is mandatory. The contractor shall not limit the number and kinds of tests, final as well as intermediate once, or extra tests required by the Engineer-in-charge. The contractor shall furnish necessary tools, gauges, instruments etc. and technical non-technical personnel for shop tests by the Engineer-in-charge, free of cost.

(ii) Shop Acceptance

The Engineer-in-charge shall inspect and approve at the following stages:

The following approvals may given in shop:

- Intermediate approvals of work that cannot be inspected later.
- Partial approvals
- Final approvals

Intermediate approval of work shall be given when a part of the work is preformed later:

- Cannot be inspected later
- Inspection would be difficult to perform and results would not be satisfactory.

Partial approval in the shop is given on members and assemblies of steel structures before the primer coat is applied and includes:

- Approval of materials
- Approval of field joints
- Approval of parts with planed surfaces
- Test erection
- Approval of members
- Approval of markings
- Inspections and approvals of special features, like Rollers, loading platform mechanism etc.

During the partial approval, intermediate approvals as well as all former approvals, shall be taken in to consideration.

(iii) Final approval in the Shop

The final approval refers to all elements and assemblies of the steel structures, with shop primer coat, ready for delivery from shop to be loaded for transportation, or stored.

The final approval comprises of:

- Partial approvals
- Approval of shop primer coat
- Approval of mode of loading and transport
- Approval of storage (for materials stored)

### 3.10 Painting and Delivery

(i) Preparation of parts for shop painting: Painting shall consist of providing at least one coat of red oxide zinc chromate primer to steel members before despatch from shop. Primer coat shall not be applied unless:



- Surface have been wire brushed, cleaned of dust, oil, rust or sand blasted as per the requirement and direction of Engineer-in-charge etc.
- Erection gaps between members, spots that cannot be painted or where moisture or other aggressive agents may penetrate, have been filled with an approved type of oil and putty.
  - The surface to be painted are completely dry.
- The parts where water of aggressive agents may collect (during transportation, storage, erection and operation) are filled with putty and provided with holes for drainage of water.
  - Members and parts have been inspected and accepted
  - Welds have been accepted.

The following are not to be painted or protected by any other product :

- Surface which are in the vicinity of joints to be welded at site.
- Surfaces bearing markings
- Other surfaces indicated in the design.

The following shall be given a coat of hot oil or any approved resistant lubricant only.

- Planed surfaces
- Holes for links

The surfaces that are to be embedded or in contact with the concrete shall be given a coat of cement wash. The surfaces which are in contact with the ground, gravel or brick work and subject to moisture, shall be given bituminous coat. The other surfaces shall be given a primer coating.

Special attention shall be given to locations not easily accessible, where water can collect and which after assembly and erection cannot be inspected, painted and maintained. Holes shall be provided for water drainage and in accessible box type sections shall be hermetically sealed by welds.

If specified elsewhere, in the schedule of quantities, the contractor shall paint further coats of red-oxide after erection and placing in position of the steel structures.

#### (ii) Packing, transportation, delivery

After final shop acceptance and marking, the item shall be packed and loaded for transportation. Packing must be adequate to protect item against warping during loading and unloading. Proper lifting devices shall be used for loading, in order to protect items against warping. Slender projecting parts shall be braced with additional steel bars, before loading, for protection against warping during transportation. Loading and transportation shall be done in compliance with transportation rules. If certain parts cannot be transported in the lengths stipulated in the design, the position and type of additional splice joints shall be approved by the Engineer-in-charge. Items must be carefully loaded on platforms of transportation means to prevent warping, bending or falling during transportation. The small parts such as fish-plates, quests etc. shall be securely tied with wire to their respective parts. Bolts, nuts and washers shall be packed and transported in crates. The parts shall be delivered in the order stipulated by the Engineer-in-charge and shall be accompanied by document showing:

- Quality and quantity of structure or members
- Position of member in the structure
- Particulars of structure
- Identification number job symbol.

#### 3.11 Field Erection

The erection work shall be permitted only after the foundation or other structure over which the steel work will be erected is approved and is ready for erection.

The contractor shall satisfy himself about the levels, alignment etc. for the foundations well in advance, before starting the erection. Minor chipping etc. shall be carried out by the contractor on his expense.

Any faulty erection done by the contractor shall be made good at his own cost.

Approval by the Engineer-in-charge or their representatives at any stage of work does not relieve the contractor of any of his required guarantees of the contract.

Storage and preparation of parts prior to erection

The storage place for steel parts shall be prepared in advance and got approved by the Engineer-in-charge before the steel structures start arriving from the hop. A platform shall be provided by the Contractor near the erection site for preliminary erection work. The contractor shall make the following verifications upon receipt of material at site.

- For quality certificates regarding materials and workmanship according to these general specifications and drawings.
- Whether parts received are complete without defects due to transportation, loading and unloading and defects, if any, are well within the admissible limit.

For the above work sufficient space must be allotted in the storage area which will be arranged by the contractor without any extra cost to the department. Steps shall be taken to prevent warping of items during unloading. The parts shall be unloaded, stored and stored so as to be easily identified. The parts shall be stored according to construction symbol and markings so that these may be taken out in order or erection. The parts shall be at least 150 mm clear from ground on wooden or steel blocks for protection against direct contact with ground and to permit drainage of water. If rectification of members like straightening etc. are required, these shall be done in a special place allotted which shall be adequately equipped. The parts shall be clean when delivered for erection.

(vi) Erection & Tolerances

Erection in general shall be carried out as required and approved by the Engineer-in-charge. Positioning and levelling of the structure, alignment and plumbing of the stanchion and fixing every member of the structure shall be in accordance with the relevant drawings and to the complete satisfaction of the Engineer-in-charge.

The following checks and inspection shall be carried out before during and after erection.

- damage during transportation
- accuracy of alignment of structures
- erection according to drawings and specifications
- progress and workmanship.

In case there be any deviations regarding positions of foundations or anchor bolts, which would lead to erection deviations, the Engineer-in-charge shall be informed immediately. Minor rectifications in foundations, orientation of bolts holes etc. shall be carried out as part of the work, at no extra cost. The various parts of the steel structure shall be so erected so to ensure stability against inherent weight, wind and erection stresses. The structure shall be anchored and final erection joints completed after plan and elevation positions of the structural members have been verified with corresponding drawings and approved by the Engineer-in-charge. The bolted joints shall be tightened so that the entire surface of the bolt heads and nuts shall rest on the member. For parts with sloping surfaces tapered washers shall be used.

### 3.12 Final acceptance and handing over the structure

(i) At acceptance, the contractor shall submit the following documents:

- Shop and erection drawings – four sets soft copy and hard copies  
4 copies of each of the following:
- Shop acceptance documents quality certificate for structurals, plates, etc. (electrodes, welding wire, bolts, nuts, washers etc.)
- List of certified welders who worked on erection of structures.
  - Acceptance and intermediate control procedure of erection operations.

(ii) Approval by the Engineer-in-charge at any stage of work does not relieve the contractor of any of his required guarantees of the contract.

### 3.13 Method of Payments

Payment for steel work shall be made on basis of admissible weight of the structure accepted, the weight being determined as described below:

The rate for supply, fabrication and erection, shall include cost of all handling and transportation to Owner's store/site of work where supply and fabrication only are involved, trimming, straightening, edge preparation, preparation and getting reviewed of fabrication drawings, and providing one or more coat of Red-oxide zinc chromate primer as specified in the schedule of quantity.

In the case, Owner supplies materials the rate shall include cost of steel materials taking delivery of the materials, from owner's store all handling and rehandling, loading and unloading, transport to site or work, returning of surplus materials to owner's stores etc. complete as well as the cost of all handling and transport, scaffolding, temporary supports, tools and tackles, touching up primer coat, grouting etc.

The actual lengths installed shall be measured and the weight of structural material/plate shall be calculated wherever necessary on the basis of IS handbook. If sections are different from IS section, then manufacturers handbook shall be adopted. No allowance in weights shall be made for rolling tolerance.

Sections built out of plates, structural shall be paid on the actual weight incorporated except for gussets which will be paid on the weight of the smallest rectangle enclosing the shape. No deductions shall be made for skew cuts in rolled steel sections.

Welds, bolts, nuts, washers, etc. shall not be measured. Rate for structural steel work shall be deemed to include the same.

No other payment either for temporary works connected with this contract or for any other item such as welds, shims, pacing plates etc. shall be made. Such item shall be deemed to have been allowed for in the rate quoted for steel work.

### 3.14 Grouting of Pockets

- (i) Grouting of pockets and under base plates will be done only after the steel work has been levelled and plumbed and the bases of stranchions are supported by steel shims. The space below the base plate and pockets shall be thoroughly cleaned.
- (ii) The mortar used for grouting shall not be leaner than 1:2 (1 cement : 2 sand) (grade 300 in case of concrete) or as is specified and shall be mixed to the minimum consistency required. It shall be poured under suitable head and tamped until the space has been completely filled.

### 3.15 Tolerances allowed in the erection of building without cranes

The maximum tolerances for line and level of the steel work shall be + 3.00 mm on any part of the structure. The structure shall not be out of plumb more than 3.5 mm on each 10 M. section of height and not more than 7.0 mm per 30 M. section. These tolerances shall apply to all parts of the structure unless the drawings issued for erection purposes state otherwise.

3.16. Contractor to submit shop drawing for all structural steel work for approval. The work at site should commence only after getting the shop approved.

3.17. Contractor to get erection scheme approved before commencement of erection of trusses.

### B. REINFORCEMENT BARS:

3.1 The contractor shall procure TMT bars of Fe500D grade from primary producers such as SAIL, Tata Steel Ltd., RINL, JSPL & JSW. The TMT bars procured from primary producers shall confirm to manufacture's specifications/ BIS specifications.

3.2 The specifications of TMT bars procured from primary producers shall meet the provisions of IS 1786 : 2008 pertaining Fe 500D grade of steel as specified in the tender.

3.3 The contractor shall have to obtain and furnish factory test certificates to the Engineer - in-charge in respect of all supplies of steel brought by him to the site of work.

3.4 Samples shall also be taken and got tested by the Engineer -in-Charge as per the provisions in this regard in relevant BIS codes. In case the test results indicate that the steel arranged by the contractor does not conform to the specifications as defined, the same shall stand rejected, and it shall be removed from the site of work by the contractor at his cost within a week time or written orders from the Engineer-in-Charge to do so. Else the department shall remove it and recover double the cost of removal from the contractor.

3.5 The steel reinforcement bars shall be brought to the site in bulk supply of 20 tonnes or more, or as decided by the Engineer -in-charge.

3.6 The steel reinforcement bars shall be stored by the contractor at site of work in such a way as to prevent their distortion and corrosion, and nothing extra shall be paid on this account. Bars of different sizes and lengths shall be stored separately to facilitate easy counting and checking.

3.7 Coating of aqueous exhibitor.

3.8 For physical and chemical test, specimens of sufficient length shall be cut from each size of the bar at random, and at frequency not less than that specified below:

Size of Bar	or Consignment below 100 tonnes	For consignments above 100 tonnes
Under 10 mm dia bars	One sample (Three specimen) for each 25 tonnes or part thereof	One sample for each 40 tonnes or part thereof
10 mm to 16 mm dia bars	One sample (Three specimen) for each 35 tonnes or part thereof	One sample for each 45 tonnes or part thereof
Over 16 mm dia bars	One sample (Three specimen) for each 45 tonnes or part thereof	One sample for each 50 tonnes or part thereof

3.8 The contractor shall supply free of charge the steel required for testing including its transportation to testing laboratories. The cost of tests shall be borne by the contractor/ Department in the manner indicated below:

- (i) By the contractor if the results show that steel does not conform to relevant BIS Codes.
- (ii) By the Department if the results show that steel confirms to relevant BIS Codes.

3.9 The actual issue and consumption of steel on work shall be regulated and proper accounts maintained as provided in the contract. The theoretical consumption of steel shall be worked out as per procedure prescribed in clause 42 of the contract and

shall be governed by conditions laid therein. In case the consumption is less than theoretical consumption including permissible variations recovery at the rate so prescribed shall be made. In case of excess consumption no adjustment shall to be made.

3.10 The steel brought to site and the steel remaining unused shall not be removed from site without the written permission of the Engineer-in-charge.

3.11 For the purpose of payment, the actual weight of steel reinforcement / structural steel sections/ plates / bolts and nuts shall be measured as below:

(i) Unit weight for reinforcement bars: The actual weight per meter of the reinforcement of various diameters shall be measured for three random samples collected (for each diameter of steel reinforcement) from each lot of particular diameter of steel reinforcement brought to the site for use in the work. For this, each sample (one sample consisting of three specimens) for each diameter of steel reinforcement shall be cut to require lengths and weighed and average weight calculated and recorded. The average weight for each type of steel section and steel reinforcement of each diameter shall be taken as the actual weight per metre for that steel section and that diameter of steel reinforcement.

(ii) In case actual unit weight is less than standard unit weights mentioned in CPWD Specifications 2009 Volume 1, but within variation, in such cases payment shall be made on the basis of actual unit weight. However, if actual unit weight is more than standard unit weights mentioned in CPWD Specifications 2009 Volume 1, then payment shall be made on the basis of standard unit weight in such cases. In such case nothing extra shall be paid for difference in actual weight and standard weight.

3.12 Contractor to submit Bar Bending Schedule (BBS) for reinforcement steel work for approval. The RCC work should commence only after getting the BBS approved and signing of pour card by Engineer-in-charge.

3.13 The work shall be carried out as per the CPWD specifications.

#### 4.0 ADDITIONAL CONDITIONS AND PARTICULAR SPECIFICATION FOR CEMENT

4.1 The contractor shall procure 43 grade (conforming to IS:8112) ordinary Portland cement as required in the work, from reputed manufacturers of grey cement having a production capacity of one million tonnes or more per annum holding licence to use ISI certification mark for their product. Supply of cement shall be taken in 50 Kg. bags bearing manufacturer's name and ISI marking.

4.2 Every delivery of cement shall be accompanied by producer's certificate confirming that the supplied cement conforms to relevant specifications. These certificates should be endorsed to Engineer-in-charge for his record.

4.3 For each grade, cement bags shall be stored in two separate godowns, one for tested cement and the other for fresh cement (under testing) constructed by the contractor at his own cost as per sketch given in General Conditions of Contract for CPWD 2010 with weather proof roofs and walls. The actual size of godown shall be as per site requirements and as per the direction of the Engineer in charge and nothing extra shall be paid for the same. The decision of the Engineer-in-charge regarding the capacity required/needed will be final. However, the capacity of each godown shall not be less than 100 tonnes or as decided by Engineer-In-Charge.

4.4 Each godown shall be provided with a single door with two locks. The keys of one lock shall remain with CPWD Engineer-in-charge or his authorized person and that of other lock with the authorized agent of the contractor at the site of work so that the cement is issued from godown according to the daily requirement with the knowledge of both the parties. The account of daily receipt and issue of cement shall be maintained in a register in the prescribed Performa and signed daily by the contractor or his authorized agent in token of its correctness. The contractor shall be responsible for the watch & ward and the safety of the cement godown. The contractor shall facilitate the inspection of the cement godown by the Engineer-in-charge any time.

4.5 The contractor shall supply free of charge the cement required for testing including its transportation cost to testing laboratories. Samples of cement arranged by the contractor shall be taken by the Engineer-in-charge and got tested in accordance with provisions of relevant BIS codes. The cement shall be used on the work only after satisfactory test results have been received. In case the test results indicate that the cement arranged by the contractor does not conform to the relevant BIS codes, the same shall stand rejected, and it shall be removed from the site by the contractor at his own cost within a week's time of written order from the Engineer- in-charge to do so.

4.6 The cost of tests shall be borne by the contractor/Department in the manner indicated below:

- (i) By the contractor, if the results show that the cement does not conform to relevant BIS codes.
- (ii) By the Department, if the results show that the cement conforms to relevant BIS codes.

4.7 4.8 The actual issue and consumption of cement on work shall be regulated and proper accounts maintained as provided in clause 10 of the contract. The theoretical consumption of cement shall be worked out as per procedure

prescribed in clause 42 of the contract and shall be governed by conditions therein. No payment for excess consumption of cement will be allowed. However for consumption lesser than permissible theoretical variation, a recovery shall be made in accordance with conditions of contract of schedule A to F without prejudice to action for acceptance of work/item of reduced rate or rejection, as the case may be.

4.9. For non-schedule items, the decision of the Engineer-in-charge or successor thereof regarding theoretical quantity of cement which should have been actually used shall be final and binding on the contractor.

4.10 Cement brought to site and cement remaining unused after completion of work shall not be removed from site without written permission of the Engineer-in-charge.

4.11. Damaged /settled/expired cement shall be removed from site immediately by the contractor on receipt of notice in writing from the Engineer-in-charge. If he does not do so within three days of receipt of such notice, the Engineer-in-charge shall get it removed at the cost of the contractor.

## 5.0 ADDITIONAL conditions and particular specification for R.C.C. WORK (DESIGN MIX CONCRETE )

### GENERAL:-

5.1 The RCC work shall be done with RMC Of Design Mix Concrete, unless otherwise specified in the nomenclature of items, wherever letter M has been indicated, the same shall imply for the Design Mix Concrete. The Ready Mix Concrete shall be as per IS : 4926 and as per CPWD Specification and guide lines. For the nominal mix in RCC, CPWD specification shall be followed. The Design Mix Concrete will be designed based on the principles given in IS : 456, 10262 and SP 23. The contractor shall carry out design mixes for each class of concrete indicating that the concrete ingredients and proportions will result in concrete mix meeting requirements specified. The cement shall be actually weighed as presumption of each bag having 50 kg shall not be allowed. In case of use of admixture, the mix shall be designed with these ingredients as well. The specification mentioned herein below shall be followed for Design Mix Concrete.

### INGREDIENTS

- i) Coarse Aggregate: - As per CPWD Specifications
- ii) Fine Aggregate: - As per CPWD Specifications.
- iii) Water: - As per requirements laid down in IS 456-2000 and CPWD specifications.
- iv) Cement: Cement arranged by the contractor will be OPC (in bags) conforming to IS : 8112.

5.2 Admixture:- Admixtures shall not be used without approval of Engineer-in-Charge. Wherever required, admixtures of approved quality shall be mixed with concrete to achieve the desired workability within specified water cement ratio. The admixture shall conform to IS:9103. The chloride content in the admixture shall satisfy the requirement of BS : 5075. The total amount of chlorides in the admixture mixed concrete shall also satisfy the requirements of IS : 456-2000

5.3 The contractor shall not be paid anything extra for admixture required for achieving desired workability without any change in specified water cement ratio for RCC / CC work.

5.4 Grade of concrete:- The characteristic compressive strength of various grades of concrete shall be given as below :-

Sl. No	Grade Designation	Compressive strength on 15cm cubes min 7 days ( N/mm <sup>2</sup> )	Specified characteristic compressive strength at 28 days (N/mm <sup>2</sup> )	Minimum cement content (Kg per cum)	Maximum *water cement ratio
(i)	M-15	As per Design	15	240	0.5
(ii)	M-25	As per Design	25	330	0.4
(iii)	M-30 M303330NH	As per Design	30	340	0.4

5.5 The Concrete mix will be designed for minimum workability as specified in para 7 of IS-456-2000

## 5.6 WORKABILITY OF CONCRETE (UNLESS OTHERWISE SPECIFIED ELSEWHERE OR AS DECIDED BY ENGINEER IN CHARGE.

Placing Conditions	Degree of Workability	Slump (mm)
(1)	(2)	(3)
Lightly reinforced sections in slabs, beams, walls, columns	Low	25-75
Heavily reinforced section in slabs, beams, walls, columns.	Medium	50-100
Pumped concrete	Medium	75-100

5.7 The recommended values of slump for various members to confirm IS 456

5.8 In the designation of concrete mix letter M refers to the mix and the number to the specified characteristic compressive strength of 15 cm – Cube at 28 days expressed in N/mm<sup>2</sup>. It is specifically highlighted that in addition to above requirement the maximum cement concrete for any grade shall not exceed 430 kg/cum.

5.9 The concrete design mix with or without admixture will be carried out by the contractor through IIT Delhi or NCBM Ballabhgarh and as per direction of Engineer-In-Charge.

5.10 The various ingredients for mix design/laboratory tests shall be sent to the lab / test houses through the Engineer-In-Charge of the project and got it tested in approved laboratories as may be decided by the Engineer-in-charge. Engineer-in-charge immediately after award of work and the samples of such aggregate sent shall be preserved at site by the department. The admixture if used by contractor shall be at his own cost without any extra payment.

5.11 \* Note : The Cement content means OPC Cement.

5.12 The contractor shall submit the mix design report from any of above approved laboratories like IIT Delhi, NCCBM Ballabhgarh PEC Chandigarh, Shree Ram Testing Lab Delhi for approval of Engineer in charge within 30 days from the date of issue of letter of acceptance of the bid. No concreting shall be done until the mix design is approved.

5.13 In case of change of source or characteristic properties of the ingredients used in the concrete mix during the work, a revised laboratory mix design report conducted in approved by Engineer-In-Charge shall be submitted by the contractor as per the direction of the Engineer in charge.

### APPROVAL OF DESIGN MIX

(i) The mix design for a specified grade of concrete shall be done for a target mean compressive strength  $T_{ck} = F_{ck} + 1.65s$

Where  $F_{ck}$  = Characteristic Compressive Strength at 28 days  
 $s$  = Standard deviation which depends on degree of quality control.

(ii) The degree of quality control for this work is “good” for which the standard deviation ( $s$ ) obtained for different grades of concrete shall be as per IS relevant IS Standards/ Codes.

(iii) Out of the six specimen of each set, three shall be tested at seven days and remaining three at 28 days. The preliminary tests at seven days are intended only to indicate the strength to be attained at 28 days.

### 5.15 CHARGES FOR DESIGN MIX

(i) All cost of mix designing and testing connected therewith including charges payable to the laboratory shall be borne by the contractor.

### 5.16 DESIGN MIX CONCRETE FROM FULLY AUTOMATIC COMPUTERISED CONCRETE BATCHING AND MIXING PLANT

(i) Proportioning Concrete

In proportioning cement concrete, the quantity of both cement and aggregates shall be determined by weight. The cement shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. The amount of mixing water shall be adjusted to compensate for moisture content in both coarse and fine aggregates. The moisture content of aggregates shall be determined in

accordance with IS: 2386 (Part III). Suitable adjustments shall also be made in the weights of aggregates to allow for the variation in weight of aggregates due to variation in moisture content.

(ii) Production of Concrete

The concrete shall be RMC produced in a central batching and mixing plant with, computerized printing for contents and admixture dosage. The batching plant shall be fully automatic. Automatic batcher shall be charged by devices which, when actuated by a Single starter switch will automatically start the weighing operation of each material and stop automatically, when the designated weight of each material has been reached. The batching plant shall have automatic arrangement for dispensing the admixture and shall also be capable of discharging water in more than one stage. A print out from the batching plant for every lot shall be submitted. A batching plant essentially shall consist of the following components: Separate storage bins for different sizes of aggregates, silo for cement; and water storage tank.

Batching equipment

Mixers

Control panels

Mechanical material feeding and elevating arrangements

The Contractor shall arrange for inspection of automatic batching plant within seven days of issue of letter of award to facilitate inspection and approval of same by Engineer-In-Charge. Nothing extra will be paid for this.

(iii) The compartments of storage bins for aggregates shall be approximately of equal size. The cement compartment shall be centrally located in the batching plant. It shall be watertight and provided with necessary air vent, aeration fittings for proper flow of cement & emergency cement cut off gate. The aggregate and sand shall be charged by power operated centrally revolving chute. The entire plant from mixer floor upward shall be enclosed and insulated. The batch bins shall be constructed so as to by self-cleansing during drawdown. The batch bins shall in general conform to the requirements of IS :4925.

(iv) The batching equipment shall be capable of determining and controlling the prescribed amounts of various constituent materials for concrete accurately i.e. water, cement, sand, individual size of coarse aggregates etc. The accuracy of the measuring devices shall fall within the following limits.

Measurement of Cement	±2% of the quantity of cement in each batch
Measurement of Water	±3% of the quantity of water in each batch
Measurement of Aggregate	±3% of the quantity of aggregate in each batch
Measurement of Admixture	±3% of the quantity of admixture in each batch

5.17 Mixing Concrete

The mixer in the batching plant shall be so arranged that mixing action in the mixers can be observed from the operator's station. The mixer shall be equipped with a mechanically or electrically operated timing, signaling and metering device which will indicate and assure completion of the required mixing period. The mixer shall have all other components as specified in IS : 4925.

5.18 Transportation, Placing and Compaction of Concrete

(i) Mixed concrete from the batching plant shall be transported to the point of placement by transit mixers or through concrete pumps or steel closed bottom buckets capable of carrying 6 cum concrete. In case the concrete is proposed to be transported by transit mixer, the mixer speed shall not be less than 4 rev/ min. of the drum nor greater than a speed resulting in a peripheral velocity of the drum as 70 m / minute at its largest diameter. The agitating speed of the agitator shall be not less than 2 rev / min. nor more than 6 rev / min. of the drum. The number of revolutions of the mixing drum or blades at mixing speed shall be between 70 to 100 revolutions for a uniform mix, after all ingredients, have been charged into the drum. Unless tempering water is added, all rotation after 100 revolutions shall be at agitating speed of 2 to 6 rev / min. and the number of such rotations shall not exceed 250. The general construction of transit mixer and other requirements shall conform to IS : 5892.

(ii) In case concrete is to be transported by pumping, the conduit shall be primed by pumping a batch of mortar / thick cement slurry through the line to lubricate it. Once the pumping is started, it shall not be interrupted (if at all possible) as concrete standing idle in the line is liable to cause a plug. The operator shall ensure that some concrete is always there in the pump-receiving hopper during operation. The lines shall always be maintained clean and shall be free of dents.

(iii) Materials for pumped concrete shall be batched consistently and uniformly. Maximum size of aggregate shall not exceed one-third of the internal diameter of the pipe. Grading of aggregate shall be continuous and shall have sufficient ultra fine materials (materials finer than 0.25mm). Proportion of fine aggregates passing through 0.25mm shall be between 15 & 30% and that passing through 0.125 mm sieve shall not be less than 5% of the total volume of aggregate. When pumping long distances and through hot weather, set- retarding admixtures may be used. Admixtures to improve workability can be added. Suitability of concrete shall be through pumping shall be verified by trial mixes and by performing pumping tests.

## 5.19 PREPARATION OF MIXES AS PER APPROVED DESIGN MIX AND CONDUCTING CONFIRMATORY TEST AT FIELD LAB.

(i) The contractor shall make the cubes of trial mixes as per approved Mix design at site laboratory for all grades, in presence of Engineer in charge using sample of approved materials proposed to be used in the work prior to commencement of concreting and get them tested in his presence to his entire satisfaction for 7 days and 28 days. Test cubes shall be taken from trial mixes as follows.

For each mix, a set of six cubes shall be made from each of the three consecutive batches. Three cubes from each set of six shall be tested at age of 7 days and remaining three cubes at age of 28 days. The cubes shall be made, cured, transported and tested strictly in accordance with specifications. The average strength of nine cubes at age of 28 days shall exceed the specified target mean strength for which design mix has been approved, the evaluation of test results will be done as per IS : 456-2000.

## 5.20 WORK STRENGTH TEST

### TEST SPECIMEN

Work strength test shall be conducted in accordance with IS: 516 on random sampling. Each test shall be conducted on six specimen, three of which shall be tested at 7 days and remaining three at 28 days. Additional samples shall be prepared, if required, as per direction of Engineer in charge for testing samples cured by accelerated method as described in IS : 9103.

### TEST RESULTS OF SAMPLE

The test results of the sample shall be the average of the strength of three specimen. The individual variation shall not be more than + - 15 percent of the average. If more, the test results of the sample are invalid. 90% of the total tests shall be done at the laboratory established at site by the contractor and remaining 10% in the laboratory of Government Engineering colleges, or in any other approved laboratory as directed by the Engineer-in-charge.

## 5.21 STANDARD FOR ACCEPTANCE

- i) Standard of acceptance shall be same as specified in clause 16 of IS 456-2000.
- ii) In order to keep the floor finish as per direction of Engineer-in-charge and as per Architectural drawings and to provide required thickness of the flooring as per specification, the level of top surface of RCC shall be accordingly adjusted at the time of its centering, shuttering and casting for which nothing extra shall be paid to the contractor.

## 5.22 Ultrasonic Pulse Velocity Method of Test for RCC

- i) The underlying principle of assessing the quality of concrete is that comparatively higher velocities are obtained when the quality of concrete in terms of density, homogeneity and uniformly is good. The consistency of the concrete as regards its general quality gets established. In case of poorer quality lower velocities are obtained. If there are cracks, voids or flaws inside the concrete which come in the way of transmission of pulse, lower velocities are obtained.
- ii) The quality of concrete in terms of uniformity, incidence or absence of internal flaws, cracks and segregation etc. indicative of the level of workmanship employed, can thus be assessed using the guidance given in table below, which have been evolved for characterizing the quality concrete in structure in term of the ultrasonic pulse velocity.

Velocity criterion for Concrete Quality Grading.

Sl. No.	Pulse velocity by Cross Probing (km/sec)	Concrete Quality Grading
1	Above 4.5	Excellent
2	4.5 to 3.5	Good
3	3.5 to 3.0	Medium
4	Below 3.0	Doubtful

Note : In Case of “doubtful” quality it may be necessary to carry further tests.

- iii) Pulse velocity method of test of concrete is to be conducted for DTU works as a routine test. The acceptance criteria as per the above table will be applicable which is as per IS 13311 (part-1): 1992. From the above “Good” and “Excellent” grading are acceptable and below these grading the concrete will not be acceptable.



iv) 5% of the total number of RCC members in each category i.e. beam, column, slab and footing may be tested by UPV test method for establishing quality of concrete. It is suggested that test be conducted on RCC beam near joint with column, on RCC column near joint with beam, on RCC footings and rafts. On RCC rafts a suitable grid can be worked out for determining number of tests. In addition doubtful areas such as honeycombed locations, locations, where continuous seepage is observed, construction joints and visible loose pockets will also be tested.

v) The test results are to be examined in view of the above acceptance criteria “Good” and “Excellent” and wherever concrete is found with less than required quality as per acceptance criteria, repairs to concrete will be made. Honeycombed areas and loose pockets will be repaired by grouting using Portland Cement Mortar/Polymer Modified Cement Mortar/Epoxy Mortar, etc. after chipping loose concrete in appropriate manner. In areas where concrete is found below acceptance criteria and defects are not apparently visible on surface, injecting approved grout in appropriate proportion using epoxy grout /acrylic Polymer modified cements slurry made with shrinkage compensating cement / plain cement slurry etc will be resorted to for repairs.(refer relevant chapters from CPWD Hand Book on Repairs and Rehabilitation of RCC Buildings).Repair to concrete will be done till satisfactory results are obtained as per the acceptance criteria by retesting of the repaired area. If satisfactory results are not obtained dismantling and relaying of concrete will be done.

### 5.23 MEASUREMENT

As per CPWD specifications.

### 5.24 TOLERANCES

As per CPWD specifications

### 5.25 RATE :-

i) The rate includes the cost of materials and labour involved in all the operations described above except for the cost of centering, shuttering and reinforcement, which will be paid separately.

ii) In case of actual average compressive strength being less than specified strength which shall be governed by para ‘Standard of Acceptance’ as above the rate payable shall be worked out accordingly on prorata basis.

iii) In case of rejection of concrete on account of unacceptable compressive strength, governed by para ‘Standard of Acceptance’ as above, the work for which samples have failed shall be redone at the cost of contractors. However, the Engineer in charge may order for additional tests (like cutting cores, ultrasonic pulse velocity test, load test on structure or part of structure etc) to be carried out at the cost of contractor to ascertain if the portion of structure wherein concrete represented by the sample has been used, can be retained on the basis of results of individual or combination of these tests. The contractor shall take remedial measures necessary to retain the structure as approved by the Engineer in charge without any extra cost. However, for payment, the basis of rate payable to contractor shall be governed by the 28 days cube test results and reduced rates shall be regulated in accordance with para 5.4.13 of Revised CPWD specification 2009, Vol.-I.

iv) As per general engineering practice, level of floors in toilet / bath, balconies, shall be kept 12 to 20mm or as required, lower than general floors shuttering should be adjusted accordingly. The landing level of mumti / Staircase cabin shall be Kept one riser level higher than adjoining slab level so as to accommodate water proofing treatment over terrace slab. In case of kitchen slab the portion of floor trap below kitchen platform be kept at lower level as per drawings. Nothing extra is payable on this account.

v) For the execution of centering and shuttering, the contractor shall use propriety “Reebol” chemical mould release agent of FOSROC or equivalent as shuttering oil as approved by Engineer-in-charge and nothing extra shall be paid on this account.

### 5.26 COVER/SPACER BLOCK

The contractor shall provide approved type of support for maintaining the bars in position and ensuring required spacing and correct cover of concrete to reinforcement as called for in the drawings, spacer blocks of required shape and size. Chairs and spacer bars shall be used in order to ensure accurate positioning of reinforcement. Spacer blocks shall be cast well in advance with approved proprietary pre-packed free flowing mortars (Conbextra as manufactured by M/S Fosroc Chemicals India Ltd. or equivalent as approved by the Engineer-in-charge at his discretion) of high early strength and same colour as surrounding concrete. Pre-cast cement mortar/concrete blocks/blocks of polymer shall not be used as spacer blocks unless specially approved by the Engineer-in-charge, rate of RCC items is inclusive of cost of such cover blocks.

### 6.1 FALSE CEILING

#### (i) General

Work shall in general be carried out as per the CPWD specification. Modular and acoustical false ceiling shall be provided and installed in all areas. All ceilings in the office areas, pantry and all service areas shall be openable, where provided in drawing and nothing extra shall be payable for provision for access panels.

The false ceiling material shall be of Gyp board, metal, acoustic modular tiles or calcium silicate mineral fibre ceiling tiles. The technical assistance and guidance is to be taken from the respective approved manufacturers and work shall be done strictly according to the manufacturer's specifications and manuals. Material from original source shall only be used.

The false ceiling shall be got executed through authorized applicator of approved manufacturer only.

A sample of each finish shall be got approved before proceeding for bulk production. GI framing shall be erected as per recommendation of the manufacturer specification and approval of CPWD

No sagging, unlevelled stretch of work or chipped tiles shall be accepted. Contractor shall take full responsibility for its firmness with the structure.

The false ceiling comprises of Gypsum board, Acoustical Ceiling Tiles and Metallic Tiles. The Gypsum board false ceiling is to be in different shapes. Such as Vaults, Coffers, cove's and Plain in unison with Acoustical Ceiling Tiles and Metallic Tiles Ceiling. The technical assistance and guidance is to be taken from manufacturers and work has to be done according to the manufacturer's specifications and manuals. A sample of each finish shall be got approved before proceeding for bulk production. GI

framing shall be erected as per recommendation of the manufacturer specification and approval of the Engineer-in-charge. The main contractor shall engage specialized agency and submit its credentials to Engineer-in-charge for approval. The criteria for setting the terms and conditions shall be broadly in line with CPWD criteria for similar works. The work shall be taken up only when specialized agency is approved in writing by Engineer-in-charge.

False ceiling work shall be carried out in accordance with the actual site conditions at different /split-levels. Any sagging, unlevelled stretch of work shall be redone /replaced and made good, at no extra charge, to the satisfaction of Engineer-in-charge. No compensation shall be paid on account of provision /coverage of openings for lighting fixtures, air-conditioning ducts and the likes as detailed in drawings and /or directed.

## 6.2 GLASS AND GLAZING WORK

### GENERAL

A sensitive use of clear glass and glass with frosted 3M film shall be used in the interiors to admit natural light and give privacy to areas. All glass above 300mm x 300mm should be tempered/ toughened. Frameless glass used should be highly polished edges using CNC machines.

#### a) Glazing

The contractor shall furnish all labour, material and equipment required completing the installation of all glass and related items. A glass shall be of the type, quality, and substance specified in the schedule of quantities. The contractor shall cut glass sizes by field measurements or dimensions of the approved shop drawings. The responsibility for correct glass sizes shall rest with the contractor. No cracked, chipped or disfigured glass shall accepted, and the contractor shall replace all breakages or faulty installation without extra cost.

The glass shall be set in wood or metal glazing straps and metal sash with elastic glazing and compound. The glass shall be beaded first and so installed as to achieve a completely watertight result. The opaque glass, where called for, shall be set with the smooth surface outside. At the completion of the work all glass shall be thoroughly cleaned off paint and other marks removed. No cracked, chipped or disfigured glass shall be accepted, and the contractor shall replace all breakage or faulty installation without extra cost to the owner before acceptance of fit-out.

All vision glasses shall be float glass of specified thickness. The edges shall be beveled as indicated in drawings and shall be done at approved source.

The Etching wherever specified in drawings, shall be done at approved sources as per full-scale drawing approved by Engineer-in-charge / Project Manager. The etched panel shall be chemically washed /treated as per specialist specifications to have a permanent dust free surface.

The Contractor shall be responsible for protecting all mirrors and glasses fixed by him and shall replace at his own expense any broken or damaged mirror / glass caused through lack of adequate protection or care in installation or handling.

#### b) Tempered / Toughened Glass:

Tempered /Toughened glass shall be examined by the glass manufacturer to detect and discard any glass which exceeds the following tolerance: 1.5mm bow in 600mm; 3mm bow in 1500mm; 6mm bow in 3000mm; 9 mm bow in 4500mm. Where the strengthening process results in essentially parallel ripples or waves, the deviation from flatness at any peak shall not exceed 0.13 mm and the difference between adjacent peaks shall not exceed 0.13mm. Where bow tolerance and wave tolerance differ, the stricter requirements shall govern. Direction of ripples shall be consistent and in conformance with architectural design.

Following test shall be also carried out by the contractor at his own cost as per following provisions.

Thickness	Impact Strength	Fragmentation	Surface Compression	Bending Strength
IS-2835-1987	IS-2553-PART-I	IS-2553-PART-I	ASTM C-1048-90	DIN 1249-PART – 12

c) Float Glass

Glass that gives distorted reflections will not be accepted. Reflections due to pressure, paints poor manufacturing process, uneven thickness or poor storage are some of the reasons for distortion. All clear float glass quality should conform to BS – 952 and ASTM C 1036 – 90.

d) Mirrors

Mirrors shall be fabricated from best clear plate or float glass of approved quality in imported variety and shall match the International Standards. All fixed panel mirrors shall be +/- 0.30mm tolerance. The edges of mirrors shall be polished and beveled and mitered as per I.S. specifications wherever, it's indicated in the drawing.

### 6.3 FLOORING:-

All work in general shall be carried out as per CPWD Specification. Only machine cut stone slabs of marble, granite, kota, jaiselmer etc. shall be used for flooring work.

Wherever flooring is to be done in patterns of tiles/stone, the contractor shall get samples of each pattern laid and approved by the Engineer-in-charge before final laying of such flooring for which nothing extra shall be paid.

Different stones/tiles used in pattern flooring shall be measured separately as defined in the nomenclature of the item and nothing extra for laying pattern flooring shall be paid over and above the quoted rate. No additional wastage, if any, shall be accounted for any extra payment.

Nothing extra shall be payable for using combination of marble, granite, kota, sand stone slabs & ceramic tiles in the required pattern at various locations.

Nothing extra will be paid for the additional thickness of bed mortar that will be required to achieve uniform finished surface on account of difference in specified thickness of marble, granite, kota stone, sand stone & ceramic tiles.

Flooring in toilets, verandah, kitchen, courtyard etc. shall be laid to the required slope/gradient as per the directions of the Engineer-in-charge.

Samples of the materials shall be got approved from the Engineer-in-charge well in time and kept in safe custody at the site till completion of work.

The pattern, spacing and locations of joints shall be as per drawings and direction of the Engineer-in-charge. Nothing extra on this account shall be payable.

Projections shall be rounded at the edges or half rounded as per drawings and directions of Engineer-in-charge for which payment shall be made separately if necessary.

The samples of flooring dado & skirting as per approved pattern shall be prepared and got approved from the Engineer-in-charge before execution of work.

Kota/ marble/granite stone used over the treads/risers of the stair cases shall be as per pattern approved by Engineer-in-charge. Nothing extra on this account shall be payable.

Whenever the Kota stone/marble/granite stone flooring are to be provided in treads of staircase. It should be provided in one piece with pre finished nosing and pre polished exposed surfaces and edges.

Whenever Kota stone 25mm thick is used in skirting. It should be executed by making shallow chase in wall to given flush surface.

### 6.4 FINISHING

#### 1 General

a) The work shall be done in accordance with CPWD Specifications -2009 Vol. I to Vol. II with upto date correction slips and the manufacturer's specifications where CPWD specifications are not available.

b) The quantity of paint required as per the theoretical consumption including wastages, if any, shall be procured from the approved manufacturer or his authorized dealers and deposited with the representative of the Engineer-in-Charge at site.

c) The paint shall be obtained in smaller packing (around 20 litre).

d) The paint shall be kept in the joint custody of the Department and the Contractor and day- to-day account of receipt and issue shall be maintained. However, the safe custody and watch and ward shall remain to be the responsibility of the Contractor. Nothing extra shall be payable on this account.

- e) The name of the manufacturer, manufacturer's product identification, manufacturer's mixing instructions, warnings and instructions for handling and application, toxicity and date of manufacturing and shelf life shall be clearly and legibly mentioned on the labels of each container. These details shall be kept in record. The material shall be consumed in the order of material brought to site, first come first consume basis. The Contractor shall obtain and submit to the Department the manufacturer's certificate for compliance of the various characteristics of the materials as per the manufacturer's specifications and also copy of the manufacturer's test report for the record.
- f) Empty containers of the paints shall not be removed from site till the completion of the work unless otherwise permitted and shall be removed only with the permission of the Engineer-in-Charge or his authorized representative at site of work.
- g) All arrangements for measuring, dosing etc. at site shall be made by the Contractor. Nothing extra shall be payable on this account.
- h) The Contractor shall apply samples of each kind of paint for the approval of shade and colour as per the directions of the Engineer-in-Charge before procuring the paint in mass.
- i) All incidental charges of cartage, storage, wastage, safe custody, scaffolding, cost of samples and mock ups etc. shall be borne by the Contractor and no claim, whatsoever, shall be entertained on this account.
- j) For the item of Epoxy paint, it is clarified that the surface for painting shall be prepared by shot blasting. The metal surface shall be cleaned off any rust using sand/ emery paper and also by mechanical brush / power tool cleaning using grinder as required as per the manufacturer's specifications etc. The sand blasting as such is not required to be carried out on the surface. However the epoxy primer shall be applied immediately after the surface preparation.
- k) For the item of melamine polish, the item includes all the sand papering required to be carried out and wiped properly for cleaning all the loose dust particles. Necessary masking tapes are to be provided where different finishing work is to be carried out, so that the melamine polish does not spread to the other surfaces. Care should be taken while removing the masking tape, so that the surface is not damaged. Cost of melamine polish includes the cost of providing and removing the masking tapes wherever required. The surface shall be sand papered using emery paper no. 180, 320 and 400 as required. Any staining required shall be carried out by applying Apcolite Wood Stain or equivalent, to achieve the required colour and shade as directed by the Engineer-in-Charge. The item of melamine polish is deemed to include cost of such staining. Where French spirit polish is to be carried out the rate is inclusive of cost of staining and wood filler (Apcolite wood filler of Asian Paints or Asian NC Clear Wood filler or equivalent of other brands ICI and Pidilite Industries) if required. Nothing extra shall be payable on this account.

#### QUALITY ASSURANCE

For Quality Assurance the Contractor shall ensure that color and texture of finish coats, shall match the approved sample. Also, Color of priming coat shall be lighter than body coat.

Color of body coat shall be lighter than finish coat.

Color prime and body coats as required so as not to show through the finish coat and to mask surface imperfections.

Before starting application of each type of paint, the Contractor shall apply the paint to a specimen area, not to exceed 10 square meter and get finish and texture approved and shall use it as a sample for the remainder of the work.

#### 6.5 STAINLESS STEEL HAND RAIL

The work shall be got executed as per CPWD Specifications and as per the manufacturer's specification through specialized agency as approved by the Engineer-in-Charge.

- i) Providing, fabricating and fixing in position welded built –up section using stainless steel section/pipes and connecting plates, of Grade S.S 304 (SS 316 Grade shall be used for exterior applications) and of required diameter & thickness as per the Engineer-in-charge structural Drawings and details, at the junctions of doors, on walls, other locations as directed etc. including cutting, welding, grinding, bending to required profile and shape, finish, hoisting, buffing and polishing, cutting chase / embedding in RCC / Masonry, fixing using stainless steel screws, nuts, bolts and washers or stainless steel fasteners as required to make it rigidly fixed & stable and making good the plaster/ flooring etc. all complete, at all floors and all levels as directed by the Engineer-in – Charge. Prototype samples to be approved by Engineer-in-charge before mass fabrication.
- ii) Rate includes cost of all inputs of materials, labour, T&P, etc. involved in the work and all incidental charges to execute this item. However, for the purpose of payment only the actual weight of the stainless pipes and stainless steel plates provided and fixed shall be measured in kg.

#### 7 PARTICULAR SPECIFICATION AND ADDITIONAL CONDITIONS FOR WATER PROOFING WORK

7.1. The work shall be got executed as per CPWD Specifications and as per the manufacturer's specification through specialized agency as approved by the Engineer-in-Charge.

The contractor shall furnish the following particulars immediately after the issue of letter of acceptance by the Department.

- The name of the specialized firm.
- The trade names of the product, which would be used.
- List of works where the treatment has been used.
- Quantity of chlorides and sulphides used in the product.

#### 7.2.1 GENERAL

All the water proofing treatment shall be got executed through the specialized agencies. The specialized agencies shall be got approved from the Chief Engineer. The contractor shall furnish the following particulars immediately after the issue of letter of acceptance by the Department.

- The name of the specialized firm.
- The trade names of the product, which would be used.
- List of works where the treatment has been used.
- Quantity of chlorides and sulphides used in the product.

7.2.2 The water proofing treatment for the U.G. sump, terrace tank etc. shall be tested by filling the tanks completely with potable water and observing for leakage for minimum 72 hours. All the arrangements for testing including supplying water, closing all the outlets temporarily and restoring after the test etc. shall be made by the contractor at his own cost. The contractor at his own cost rectify any leakage noticed.

7.2.3 The specialist agency for waterproofing shall also grout the Nothing extra shall be payable on this account.

7.2.4 The water proofing treatment over the terrace slab, in the sunk / depressed slabs shall be tested by ponding water as specified for curing as well as observing for leakage for minimum 2 weeks. All the arrangements for testing including supplying water, making temporary bunds using mortar, removing bunds after testing etc. shall be made by the contractor at his own cost. The contractor at his own cost shall rectify any leakage noticed. Nothing extra shall be payable on this account.

7.3 Water proofing treatment for the basement walls and rafts.

7.3.1 The water proofing items shall be got executed through one of the approved agencies as per the list of approved agencies attached with the tender. The integral cement based water proofing treatment shall be as per the item description and as directed by Engineer-in-Charge.

7.3.2 The specialist agency for water proofing work shall provide necessary sleeves made out of G.I pipes / M.S. puddle flanges (payment for which shall be made under relevant item) in the water proofing treatment at base and the raft for release of uplift pressure till the pressure is taken by the rock anchors and the dead weight of the building. The necessary provisions shall be made for filling these sleeves with cement concrete of same grade and then pressure grouting these holes with polymer modified cement slurry using aluminum nipples etc. at a later date. However, the agency shall ensure complete watertightness of the raft and the water proofing treatment below raft. Junctions of the rock anchors with the concrete of the basement raft. Nothing extra shall be payable on this account and shall not be measured separately for payment.

7.3.3 The specialist agency for water proofing work shall also grout the junctions of the various service lines entering or coming out through the basement wall. Nothing extra shall be payable on this account and shall not be measured separately for payment.

7.3.4 The reinforced cement concrete provided in the base and walls of under ground tanks shall be admixed with water proofing compound conforming to IS 2645. The guarantee for the water proofing treatment shall include dismantling and relaying the Reinforced cement concrete, if required for rectifying any defect in the water proofing treatment. Nothing extra shall be payable on this account and shall not be measured separately for payment.

7.3.5 Layout and Design: The layout and design of raft foundation shall be as per structural design / drawing to be supplied by the Engineer-in-Charge. The structural drawing shall be properly correlated with the architectural drawing of the work before actual execution. The discrepancy if any, thus notice shall be brought to the notice of Engineer-in-Charge for necessary correction.

7.3.6 The work shall be in general carried out in accordance with CPWD specifications with up-to-date correction slips. However if the said specifications differ from those detailed in the specifications of the particular item in the schedule of quantities attached or from the particular specifications given here under the later shall prevail.

7.3.7 The water proofing compound used in integral water proofing treatment shall satisfy all the performance requirements indicated in IS : 2645 and shall be got tested before its use. The compound shall be used @ 2% by weight of cement used or as recommended by the manufacturer.

7.3.8 Total quantity of the water proofing compound required shall be arranged only after obtaining the prior approved of the Engineer-in-Charge in writing. Materials shall be kept under double lock and key and proper account of the water proofing compound used in the work shall be maintained. It shall be ensured that the consumption of the compound is as per specified requirements.

#### GUARANTEE FOR WATER PROOFING TREATMENT

7.4 The contractor shall be fully responsible for and shall guarantee proper performance of the entire waterproofing system for a period of 10 (Ten) years from the final completion of works. In addition, specific 10 years written guarantee (to be

furnished in a non-judicial stamp paper of value not less than Rs.100/-) in approved proforma shall be submitted for the performance of the system, before final payment and shall not in any way limit any other rights the Employer may have under the contract. Guarantee for water proofing shall comprises of all the items described above in particular specification.

7.5 All water-proofing work shall be carried out through approved specialist agency as per method of working approved by the Engineer-in-charge. However the Contractors shall be solely responsible for waterproofing treatment until the expiry of the above guarantee period.

7.6 Ten years guarantee in prescribed proforma attached shall be given by the contractor for the water proofing treatment. In addition 10% (ten percent) of the cost of these items of water proofing under this sub head shall be retained as guarantee to watch the performance of the work executed. However, half of this amount (withheld) would be released after five years from the date of completion of the work, if the performance of the waterproofing works is satisfactory. The remaining withheld amount shall be released after completion of ten years from the date of completion of work, if the performance of the waterproofing work is satisfactory. If any defect is noticed during the guarantee period, it should be rectified by the contractor within seven days of issuing of notice by the Engineer-in-Charge and, if not attended to, the same shall be got done through other agency at the risk and cost of the contractor and recovery shall be effected from the amount retained towards guarantee. In any case, the contractor and the specialist agency, during the guarantee period, shall inspect and examine the treatment once in every year and make good any defect observed and confirm the same in writing. The security deposit can be released in full, if bank guarantee of equivalent amount, valid for the duration of guarantee period, is produced and deposited with the Department.

## **8 PARTICULAR SPECIFICATIONS – ALUMINIUM WORK FOR DOORS, WINDOWS AND PARTITIONS**

8.1 The material for the work shall be procured from the approved manufacturer as per the list attached with the tender documents. The Contractor shall procure and submit samples of various materials to be used in the work for the approval of Engineer-in-Charge and no work shall commence before such samples are approved. Samples of un-anodized as well as anodized aluminium sections, neoprene gaskets, glass, stainless steel screws, anchor fasteners, hardware and any other material or components requiring approval of samples, in opinion of Engineer-in-Charge, shall be submitted for the approval as mentioned above. The above samples shall be retained as standards of materials and workmanship. The cost of the above samples shall be borne by the Contractor.

8.2 The Contractor shall prepare the shop drawings for the aluminium windows giving details of the various aluminium sections, neoprene gaskets, cleats, anchor fasteners, hardware, sealants, glass etc. and submit the same for the approval of Engineer-in-Charge. Nothing extra shall be payable on this account.

8.3 Only after the approval of the samples and the shop drawings by the Engineer-in-Charge, the Contractor shall procure the material for the work. All materials brought to the site by the Contractor, for use in the work, as well as fabricated components shall be subject to inspection and approval by Engineer-in-Charge. The Contractor shall, if required by the Engineer-in-Charge, produce manufacturer's test certificates for any material or particular batch of materials supplied by him.

8.4 The Contractor shall prepare a finished sample of the aluminium window along with glazing panel and fittings etc. for approval of workmanship and material. Nothing extra shall be payable on this account.

8.5 The Contractor shall get the necessary tests carried out in an approved laboratory, as specified. The tests carried out shall be as per relevant specifications / Standard Codes. One test for each lot of anodized aluminium section of each type shall be carried out. However, this is subject to at least one test for every 1,000 Kg or part thereof, for each type of section.

8.6 Aluminium sections to be used for doors, windows, ventilators and fixed glazing, partitions, false ceiling etc. shall be appropriate to meet technical, structural, functional and aesthetic considerations. The anodizing shall be carried out in an approved factory / workshop as specified in the tender documents.

8.7 The aluminium extruded sections shall conform to I.S. Designations HEIWP / HVIWP alloy, with chemical composition and technical properties as per I.S. 733 and I.S. 1285.

For sectional weight tolerance limits shall be (-) 0.5%. However, payment for extruded aluminium sections on weight basis shall be as per paras 10.25 (I) & (II).

## **FABRICATION**

All joints shall be accurately fabricated and be hairline in appearance. The finished surface shall be free from visible defects.

8.11 Taking into consideration varying profiles of aluminium sections being extruded by approved manufacturers, the Contractor shall prepare detailed shop drawings of his proposal using suitable sections based on architectural design / drawings, adequate to meet the requirements / specifications laid down and as proposed by the manufacturer and these detailed shop drawings shall be subject to approval of the Engineer – in – Charge.

8.12 All hardware used shall conform to the relevant specifications and as per samples approved by the Engineer-in-Charge. Design, quality, type, number and fixing of hardware shall be generally in accordance with architectural drawings and as approved by the Engineer-in-Charge before use.

8.13 All doors, windows, ventilators and glazing etc. shall be made water tight with neoprene gaskets and weather silicone sealants to the satisfaction of the Engineer-in-Charge, for which nothing extra shall be payable.

8.14 The frames shall be strictly as per Architectural drawings, the corners of the frame being fabricated to the true right angles. Both the fixed frames and openable shutter frames shall be fabricated out of sections cut to required length, mitered and mechanically jointed for satisfactory performance. All members shall be accurately machine milled and fitted to form hairline joints. The jointing accessories such as aluminium cleats, stainless steel screws etc. shall not to cause any bi-metallic reaction by providing separators, wherever required. Nothing extra shall be payable for jointing accessories.

8.15 Mitered joints of the doors, windows, ventilators shutters and frames shall be either corner crimped or fixed with self tapping stainless steel screws of approved make and quality to heavy duty extruded aluminium cleats and sealed with weather silicone sealant, for which nothing extra shall be payable.

8.16 Vertical members of the aluminium frame work shall be embedded in the floors, wherever required, by cutting and making good of the floor. Nothing extra shall be payable on this account.

#### 8.17 **FIXING OF ALUMINIUM FRAME WORK**

8.18 The screws used for fixing fixed aluminium frames of the aluminium windows to masonry walls / RCC members and aluminium members to other aluminium members shall be of stainless steel of approved make and quality and of stainless steel grade 304. Threads of machine screws used shall conform to requirement of I.S. 4218.

8.19 The aluminium frames of the gypsum board partition and the wooden rafter ceiling shall be fixed to masonry walls / RCC members using stainless steel anchor fasteners of grade 316, of Kundan or Arrow make and aluminium members to other aluminium members shall be fixed using stainless steel screws of approved make and quality and of stainless steel grade 304.

8.20 For the aluminium windows, the gap between the aluminium frames and the R.C.C / Masonry and also any gaps in the various sections shall be filled with weather silicone sealant DC 795 of Dow Corning or equivalent in the required bite size, to ensure water tightness including providing and fixing backer rod, wherever required. The weather silicone sealant shall be of such approved colour and composition that it would not stain or streak the masonry / R.C.C. work. It should not sag or flow and shall not set hard or dry out under any conditions of weather and shall be tooled properly. The weather silicone sealant shall be used as per the manufacturer's specifications and shall be of approved colour and shade. Any excess sealant shall be removed / cleared. Nothing extra shall be payable for the above.

8.21 Fixing of glass panes shall be designed in such a way that replacing damaged / broken glass panes is easily possible without having to remove or damage any members or interior finishing materials.

#### **ANODIZING**

(I) Aluminium sections shall be anodized as per I.S. 7088 – 1973. Anodizing to be as per grade AC 20 and not less than 20 microns thick when measured as per I.S. 6012, in colour and shade as approved by the Engineer-in-charge.

(II) The anodic coating shall be properly sealed by steam or dipping in de-ionized water as per I.S. 1868-1982 and / or I.S. 6057. Sealing quality shall be tested in accordance with the relevant standards. Nothing extra shall be payable on this account.

(III) The Contractor shall satisfy himself by checking in the factory that the thickness of the anodic coating is found to be minimum 20 microns and sealing quality is appropriate everywhere. The testing shall be done in an approved laboratory by EDDY CURRENT METHOD as per I.S. 6012 for thickness. For testing the thickness of anodic coating of the anodized aluminium sections, the calibration shall be done on bare ( un-anodized ) aluminium sections of same type. If any material is found sub-standard, it shall be rejected.

(IV) All anodized aluminium works shall conform to relevant I.S. Codes relating to materials, workmanship, fabrications, finishing, erection, installations etc. In this connection I.S. Codes including I.S. 1868 – 1982, I.S. 733 – 1983, I.S. 1948-1961, I.S. 7088-1973, I.S. 6012-1970, I.S. 1285 – 1975, I.S. 740-1975 are considered relevant and applicable.

The exposed surface of the aluminium sections shall be protected against surface damage, dents, scratches etc. It shall, therefore, be provided with protective tape. After fixing and assuring of proper functioning of doors, windows, frame work for partitions / false ceiling etc. such protective tape shall be cleaned out / removed as per the directions of Engineer-in-Charge. Nothing extra shall be payable for above.

#### 8.23 **Glazing**

(I) All glass panes shall be retained within aluminium framing by use of exterior grade neoprene gaskets. Use of glazing or caulking compounds around the perimeter of glass will not be permitted. There shall be no whistling or rattling. Before installation of glass, Contractor shall ensure the following:

All glazing rebates shall be square, to plumb, true to plane, dry and free from dust.

Glass edge shall be clean and cut to exact size and grounded

Annealed float glass in doors, windows, ventilators and fixed glazing etc. shall be of approved make and standard quality conforming to C.P.W.D. Specifications.

4 mm thick glass panes shall be provided for openings not exceeding 0.5 sqm. For openings exceeding 0.5 sqm in area, 5.0 mm thick glass panes shall be provided unless specified otherwise.

#### 8.24 PROTECTIONS AND CLEANING:

(I) After erection and removal of protective layer, all aluminium works including glass panes shall be moist cleaned with a de-ionized water to clean all marks, stains and blemishes.

#### 8.25 MEASUREMENT AND RATES:

(I) For aluminium framework, the length of each member of the frame shall be measured correct to half a centimeter. The weight shall then be calculated on the basis of unit weight specified in the manufacturer's catalogue.

(II) The actual weight per metre of the respective aluminium sections shall be measured for three random samples collected for each type of aluminium section used in the work, cut to required lengths and weighed and average weight calculated and recorded. The average weight for each type of aluminium section shall be taken as the actual weight per meter for that aluminium section. The decision of the Engineer-in-Charge as regards the random samples and average weight shall be final and binding on the Contractor and no claim of any kind shall be entertained from the Contractor in this regard.

(III) The quantity of the aluminium, to be paid for, shall be the least of the two weights calculated on the basis of above two paras – 11.25 (I) & (II).

(IV) For glazing, the actual area of the glass panels excluding the portion in the beading shall be measured in sqm upto two decimal places, for payment.

(V) Stainless steel adjustable friction hinges and the aluminium handles for the openable side-hung windows shall be of "Earl Bihari", make or equivalent as approved by the Engineer-in-Charge. 2 nos. friction hinges shall be provided per shutter.

(VI) The cost of designing and preparation of shop drawings, all the samples, mock up of window etc. is deemed to be included in the cost of the relevant items. Nothing extra shall be payable on this account.

(VII) The item for aluminium for fixed portions for aluminium windows, frame work for partitions and wooden rafter ceiling shall include cost of all inputs of labour, material (anodized aluminium sections, including cleats, other fixtures, weather silicone sealants, stainless steel screws, nuts, bolts, rawl plugs, backer rods, polyethylene tapes etc. which shall be required for fabrication and erection of aluminium work) T & P, all incidental charges, wastages etc. involved in the work. However, for the purpose of payment, the weight of aluminium sections for the fixed window frame, frame work for partitions and wooden rafter ceiling, shall be measured in Kg. The aluminium cleats, stainless steel screws, nuts, bolts, separators etc. shall not be measured separately for payment and their cost is deemed to be included in the cost of this item. The item for aluminium for frame work for fixed partitions and wooden rafter ceiling shall also include cost of providing and fixing stainless steel anchor fasteners as required.

(IX) The item of aluminium for the openable aluminium shutters for windows and doors etc., shall include cost of all inputs of labour, material (anodized aluminium sections, including such as cleats / angles, other fixtures, stainless steel screws nuts, bolts, stainless steel hinges, weather silicone sealant etc. which shall be required for fabrication of aluminum work) T & P, all incidental charges, wastages etc. involved in the work. However, for the purpose of payment, the weight of aluminium sections for the window shutter (sash frame) shall be measured in Kg. The aluminium cleats, stainless steel anchor fasteners, screws, nuts, bolts, separators, stainless steel hinges, etc. shall not be measured separately for payment and their cost is deemed to be included in the cost of this item. The anodized aluminium snap beading for fixing glass panels in the openable shutters of the windows shall be measured separately ( on weight basis) and paid under this item of aluminium frame work for window shutters.

(X) The glass shall be paid for separately under relevant item. The cost providing and fixing neoprene gasket, felt etc. is included in the cost of this item and shall not be measured separately for payment .

The item for the aluminium frame work includes cost of making provision for fixing fittings, wherever required, as per the item description (The cost for providing fitting (handle and buffer) shall be paid for separately under relevant item).

### 9. PARTICULAR SPECIFICATIONS FOR ROAD WORK

Roadwork shall, in general, be carried out as per the CPWD Specifications.

#### TREMIX FLOORING

The work in general shall be carried out as per the CPWD specifications for CC pavements. The work shall be got executed through specialized applicators having similar experience in executing tremix flooring using vacuum dewatering system. Before taking up the work, the Contractor shall, therefore, submit the credentials of the applicators along with the details of the similar works executed by them for the approval of Engineer-in-Charge.

The Contractor or their applicators shall have adequate machinery for laying and vibrating concrete including vacuum dewatering system etc.

The concrete shall be of specified grade ready mix cement concrete with specified cement content per cubic metre of concrete with slump 70 to 80 mm. The concrete shall not have air-entrainment more than 2%. The concrete shall be levelled to required slope using bull float. The excess water shall be removed using vacuum dewatering process. After the concrete has stiffened to the point of supporting floating operation the surface shall be power floated using IRONITE no. 9.3.

The flooring shall be done in panels of sizes not more than 20 x 4 metre. The construction joints shall, therefore, be formed with square edges using the steel formwork. Each panel shall then be divided into smaller panels of size not more than 3 x 2 metre by providing contraction joints by cutting grooves of size 3 mm x 20 mm deep using mechanical saw. The cutting of the grooves shall be done as soon as the concrete is set.



The top surface of the flooring shall be sprinkled with IRONITE no. 3 (non coloured) @ 3 kg. per sqm. It shall be sprinkled when the concrete is green, before troweling. Two-third quantity of the dry shake (metallic floor hardener) shall be sprinkled in the first pass and floated with power trowel and one third of the dry shakes shall be sprinkled in the 2nd pass and floated with power trowel to smooth finish. The first shake shall be allowed to remain unworked until it has absorbed moisture and then power floated. Similar operation shall be done for the 2nd shake. The surface then shall be textured to brush finish in a workman like manner with uniform grains generally in one direction.

The surface shall then be cured for minimum 10 days.

All precautions shall be taken to avoid any marks, impressions, scratches, stains etc. to the finished surface.

One test for wear resistance (abrasion test) as per IS 1237 shall be carried out on the sample (3 specimen) core cut from the pavement. One core sample shall be tested for every 10,000 sqm or part thereof. The average wear shall not exceed 2 mm and 2.5 mm for individual specimen. Besides, other tests for concrete shall be carried out as per the CPWD specifications. All arrangements for taking out core samples and other samples shall be made by the Contractor. The core holes shall then be filled properly with the concrete of the same mix in a workman like manner and cured properly. Nothing extra shall be paid on this account.

The joints (expansion and contraction) / grooves shall then be filled with joint sealing compound conforming to grade B of IS 1834 or equivalent in workmanlike manner. It shall not be measured separately for payment.

10. The item includes cost of all inputs of material, labour, T & P, all incidental charges, wastages and testing etc. involved in the work.

#### **10.0 PARTICULAR SPECIFICATIONS FOR BACK UP RODS, JOINTS SEALING COMPOUNDS, INSERTS AND EMBEDMENTS**

##### **10.1 BACK UP RODS / WATERBARS**

I. Where water-bars are shown on the drawings, the joints shall incorporate an approved PVC external type water-bar complete with all necessary moulded or prefabricated intersection pieces assembled in accordance with the drawings with bends and butt joints in running lengths made by heat welding in an electrically heated jig.

II. Jointing and fixing of water-bars shall be carried out strictly in accordance with the manufacturer's instructions.

III. The water-bars shall be installed so that they are securely held in their correct position during the placing and compacting of the concrete.

IV. Where reinforcement present adjacent to water-bars, adequate clearance shall be left between the reinforcement and water-bars to facilitate compaction of the concrete.

V. Double headed nails may be used in the edge of the water-bar outside the line of the external grooves for fixing purposes, but no other holes shall be permitted through the water-bar.

##### **10.2 Joint Sealing Compounds**

I. Joint sealing compounds shall seal joints in concrete against the passage of water, prevent the ingress of grit or other foreign material and protect the joint filler. The compound shall have good extensibility and adhesion to concrete surfaces and shall be resistant to flow and weathering.

II. Poly supplied joints where specified on the drawings shall be sealed with polysulphide liquid polymer, stored, mixed, handled applied and cured strictly in accordance with the manufacturer's written instructions, such joints shall be formed to the correct dimensions, thoroughly cleaned and treated with recommended primer strictly in accordance with the manufacturer's written instructions prior to sealing. The Contractor shall use only competent personnel experienced in the application of polysulphide for such work.

III. Where specified in the drawings, rubber/bituminous based sealants shall be of an approved manufacture. The treatment of the joint and the use of sealing compound shall be strictly in accordance with the manufacturer's written instructions. The entire work shall be carried out as per is: 3414, is: 6509, is: 11433.

#### **10.3 INSERTS AND EMBEDMENTSHIP**

Various steel inserts and embedment's are required under the contract to be fabricated, positioned and secured firmly into place inside the formwork prior to concrete being poured. There are also requirements of jointing, threading, bolting and welding inserts and embedment's of different concrete and structural steel elements in order to establish structural continuity and connection. Great care shall be exercised by the contractor in executing all aspects of the work related to inserts and embedment's, including tolerances, so that the final assembly of the concrete elements can meet satisfactorily the continuity and contiguity requirements intended in the structure.

#### **11.0 PARTICULAR SPECIFICATION FOR ACOUSTICS**

##### **11.1 Acoustical Treatment**

Acoustical treatment to ceilings and walls shall be carried out using very low, medium and high frequency absorption materials, as specified in the Schedule of Quantities. The work shall be carried out generally as per CPWD specifications-2009 Vol I & Vol. II with upto date correction slips, with additional recommendations of specialist manufacturers.

11.2 The work of acoustical treatment shall be got executed through authorized applicator of approved manufacturer only.

## 12.0 PLUMBING

The work shall be carried out generally as per CPWD specifications-2009 Vol I & Vol. II with upto date correction slips, with additional recommendations of specialist manufacturers.

13.0 Particular Specifications of PUF panels:-

13.1 The PUF panels should be confirming to PUR (1) material as per IS Code 12436-1988. The n-Pentane blowing agent shall be used to make the panel CFC free. PUF material shall be self-extinguishing. The PUF panel manufacturing company should have in house testing laboratory to test required parameters such as K value, adhesion strength, and compressive strength. The PPGL sheet should be in accordance with Indian standard code for Galvanized steel sheets (plain & corrugated) as per IS 277:2003 or as per Bureau of Indian standards for pre-painted Galvanized steel sheets & coils as per IS 14246 (IOS 77.14050) with up to date and latest amendments.

13.2 Roof Panel: 40/68mm thick PUF insulated Corrugated Panel with 0.5mm PPGL sheet both sides in  $40 \pm 2$  Kg Density. The PU panel shall be CFC free using n-Pentane as a blowing agent. Panel shall have PPGL sheet on both side of Polyurethane Foam confirming to IS 12436:1988. The pre coated sheet shall be of minimum 550 mpa steel grade confirming to IS 14246:1995 and shall have zinc coating of minimum 120 gsm as per IS : 513,5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 micron. The PPGL sheet shall have plastic protective guard film of minimum 25 microns to avoid scratches during transportation. The PU Foam shall be self-extinguishing, fire retardant type having minimum density of 40 Kg/Cu.mt (+, -2 Kgs) Each PUF panel shall be reinforced within with two MS square tubes of size 40x40x1.2mm Hot dip galvanised of thickness 80 microns @ 500mm c/c along the width of panel.

13.3 Ridge :

1. Outer ridge 610 mm (305mmx305mm) should made of 0.5 mm PPGL OF THE SAME COLOR AS THAT OF ROOF PANEL.

2. Inner ridge 450mm (225mm x225mm) should made of 0.5 mm PPGL OF THE SAME COLOR AS THAT OF ROOF PANEL.

13.4 Flashings:

1. Gable end profile flashing will in 610 mm girth

2. End cap as per panel profile in 0.5 mm ppgl will be provided

13.5 TECHNICAL SPECIFICATION OF PUF PANEL

SR.NO.	PARAMETERS	VALUE	STANDARD
1	Density	$40 \pm 2$ kg/m <sup>3</sup>	ASTM-D 1622-98
2	Compressive Strength at 10% Deformation (Perpendicular to Rising)	$\geq 110$ kpa	ASTM-D1621-94
2	Compressive Strength at 10% Deformation (Parallel to Rising)	$\geq 210$ kpa	ASTM-D1621-94
3	Adhesion Strength ( Foam to Steel)	$\geq 100$ kpa	ASTM-D1623-78
4	Dimension Stability	Overall Max. 2 %	ISO 2796 / IS 11239 (part 2)1985
5	Closed Cell Content	Min. 85%	IS 11239(part 5)1985
6	Thermal Conductivity	0.023 W/m.K AT 23 C	ASTM-C518-98 DIN18164
7	( Fire Retarded Foam Chemical ) Not Easily ignitable as per BS : 476 Pt.5 & class -I as per BS: 476 pt. 7 (For Panels)	Self Extinguishing, NO easily ignitable	BS 476,BS 4735 IS 11239
8	Water absorption	Max .2 %	ISO 2896
9	Water Vapor Permeability	5.5 ng/pasm	IS 11239-IV-1985
10	Polyurethane foam	Cfc free	

13.6 Technical Specification of PPGL Sheet

SR.NO.	PARAMETERS	VALUE
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1	YIELD STRENGTH	550-650 Mpa
2	TENSILE STRENGTH	570-700 Mpa
3	HARDNESS	93 ± 5 Hrb
4	PENCIL HARDNESS	2H
5	BEND TEST	4T
6	DFT (TOP SIDE)	24 Micron
7	DFT (BOTTOM SIDE)	10 Micron
8	ELONGATION	2.60%

**GUARANTEE TO BE EXECUTED BY CONTRACTOR FOR REMOVAL OF DEFECTS AFTER COMPLETION OF WORK IN RESPECT OF WATER PROOFING WORKS.**

This agreement made this day of two thousand and between , (Name of the contractor, hereinafter call Guarantor of the one part) and the PRESIDENT OF INDIA (hereinafter called the Government of the other part).

Whereas this agreement is supplementary to a contract (hereinafter called the Contract) dated and made between the GUARANTOR of the one part and the GOVERNMENT of the other part where by the Contractor inter alia, undertook to render the buildings and structures in the said contract recited completely water and leak proof.

And whereas the Guarantor agreed to give a guarantee to the effect that the said structures will remain water / leak proof for ten years from the date of completion of work.

Now the Guarantor hereby guarantees that water proofing treatment given by him will render the structures completely leak proof and the minimum life of such water proofing treatment shall be ten years to be reckoned from the date completion of work.

Provided that the Guarantor will not be responsible for leakage caused by earthquakes or structural defects or misuse of roof or alterations and for such purpose

- a) Misuse of roof shall mean by operation, which will damage roofing treatment, like chopping of firewood and things of the same nature, which might cause damage to the roof.
- b) Alteration shall mean construction of an additional storey or a part of roof or construction adjoining to existing roof, where by roofing treatment is removed in parts.
- c) The decision of the Engineer-in-Charge with regard to cause of leakage shall be final.

During this period of guarantee, the Guarantor shall make good all defects and in case of any defects being found, render the building water proof at his own cost, to the satisfaction of the Engineer-in- Charge and shall commence the work for such rectification within seven days from the date of issue of the notice from the Engineer-in-Charge calling upon him to rectify the defects, failing which the work shall be got done by Department through some other contractor at the GUARANTOR'S cost and risk. The decision of the Engineer-in-Charge as to the cost, payable by the Guarantor shall be final and binding.

That is the Guarantor fails to execute the necessary rectification or commits breach there under then the Guarantor will indemnify the Principal and his successors against all loss, damage, cost expense or otherwise which may be incurred by him by reasons of any default on the part of GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and / or damage and / or cost incurred by the Government, the decision of the Engineer-in-Charge will be final and binding on the parties.

In witness where of these presents has been executed by the Obligator \_\_\_\_\_ and \_\_\_\_\_ by \_\_\_\_\_ and for and on behalf of the PRESIDENT OF INDIA on the day month and year first above written.

Signed, sealed and delivered by (OBLIGOR) in the presence of:

1.  
2.  
Signed for and on behalf of THE PRESIDENT OF INDIA BY \_\_\_\_\_ in the presence of:

1.  
2.

**GUARANTEE BOND**  
**GUARANTEE TO BE EXECUTED BY THE CONTRACTOR**  
**FOR REMOVAL OF DEFECTS AFTER COMPLETION IN RESPECT OF**  
**STONE WORK/GRANITE WORK / TILE WORK.**

The agreement made this..... day of ..... Two Thousand ..... between .....S/o .....(hereinafter called the GUARANTOR on the one part) and the President of India (hereinafter called the Government on the other part)

WHEREAS THIS agreement is supplementary to a contract (Hereinafter called the Contract) dated ..... and made between the GUARANTOR ON THE ONE PART AND the Government on the other part whereby the contractor inter alias undertook to render the work in the said contract structurally stable , workmanship, finishing and use of sound materials.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the affect that the said work will remain structurally stable and guaranteed against faulty workmanship, finishing and materials.

NOW THE GUARANTOR hereby guarantee that work executed by him will remain structurally stable after the expiry of maintenance period prescribed in the contract for the minimum life of five years to be reckoned from the date after the expiry of maintenance period prescribed in the contract.

The decision of the Engineer-in-Charge with regard to nature and cause of defect shall be final.

During this period of guarantee, the guarantor shall make good all defects to the satisfaction of the Engineer-in-Charge calling upon him to rectify the defects failing which the work shall be got done by the Department by some other contractor at the Guarantor's cost and risk. The decision of the Engineer-in-Charge as to the cost payable by the Guarantor shall be final and binding.

That if the guarantor fails to make good all the defects, commits breach there under, then the guarantor will indemnify the principal and his successor against all loss, damage, cost expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and or cost incurred by the Government, the decision of the Engineer-in-Charge will be final and binding on both the parties.

IN WITNESS WHEREOF these presents have been executed by the obligator ..... and ..... by ..... for and on behalf of the President of India on the day, month and year first above written.

SIGNED, sealed and delivered by OBLIGATOR in the presence of :-

1. .... 2. ....

SIGNED FOR AND BEHALF OF THE PRESIDENT OF INDIA BY ..... in the presence of :-

1. .... 2. ....

**GUARANTEE BOND**  
**GUARANTEE TO BE EXECUTED BY THE CONTRACTOR**  
**FOR REMOVAL OF DEFECTS AFTER COMPLETION**  
**IN RESPECT OF SANITARY INSTALLATIONS / WATER SUPPLY / DRAINAGE WORK/PUF**  
**ROOFING/SECTION WINDOWS AND ALUMINIUM WORK**

The agreement made this..... day of ..... Two Thousand ..... between  
 .....S/o .....(hereinafter called the GUARANTOR on the one part) and  
 the PRESIDENT OF INDIA (hereinafter called the Government on the other part)

WHEREAS THIS agreement is supplementary to a contract (Hereinafter called the Contract) dated  
 ..... and made between the GUARANTOR ON THE ONE PART AND the Government on the  
 other part, whereby the contractor inter alia, undertook to render the work in the said contract structurally stable,  
 leak proof and sound material, workmanship, anodizing, coloring, sealing etc.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the affect that the said work will  
 remain structurally stable, leak proof and guaranteed against faulty material and workmanship, defective anodizing  
 /pre-painting/ Powder coating/ coloring and finishing for 5 (Five) years from the date of completion of work.

NOW THE GUARANTOR hereby guarantee that work executed by him will be free from any leakage,  
 seepage, cracks in pipes and guaranteed against faulty material and workmanship, defective galvanizing for five  
 years to be reckoned from the date after the expiry of maintenance period prescribed in the contract.

The decision of the Engineer-in-Charge with regard to nature and cause of defect shall be final.

During this period of guarantee, the guarantor shall make good all defects and in case of any defect to  
 satisfaction of Engineer-in-Charge at his cost and shall commence the work for such rectification within seven days  
 from the date of issue of the notice from the Engineer-in-Charge calling upon him to rectify the defects failing which  
 the work shall be got done by the Department by some other contractor at the guarantor's cost and risk. The decision  
 of the Engineer-in-Charge as to the cost payable by the Guarantor shall be final and binding.

That if the guarantor fails to make good all defects or commits breach thereunder, then the guarantor will  
 indemnify the principal and his successor against all loss, damage, cost expense or otherwise which may be incurred  
 by him by reason of any default on the part of the GUARANTOR in performance and observance of this  
 supplementary agreement. As to the amount of loss and/or damage and or cost incurred by the Government, the  
 decision of the Engineer-in-Charge will be final and binding on both the parties.

IN WITNESS WHEREOF these presents have been executed by the  
 obligator.....  
 .....and ..... by ..... for and on behalf  
 of the PRESIDENT OF INDIA on the day, month and year first above written.

SIGNED, sealed and delivered by OBLIGATOR in the presence of :-

1. .... 2. ....

SIGNED FOR AND ON BEHALF OF THE PRESIDENT OF INDIA BY..... in the presence  
 of:-

1. .... 2. ....

## APPROVED MAKES OF MATERIALS

The Contractor shall obtain prior approval from the Engineer-in-charge before placing order for any specific material or engaging any of the specialized agencies. The Contractor shall make a detailed submission with catalogues and proposed specifications, as well as full details of the works executed by the specialized agency, as specified.

Unless otherwise specified, the brands/makes of the material as specified in the item nomenclature, in the list of approved materials attached in the tender and in the particular specifications shall be used in the work.

In case of non-availability of the brands specified in the contract the Contractor may be allowed to use alternate equivalent brand of the material by Engineer-in-Charge with the prior approval of NIT Approving Authority subject to submission of documentary evidence of non - availability of the specified brands by contractor. The necessary cost adjustments on account of above change shall be made for the same.

The contractor would submit original bills and manufacturer's test certificate for all lots of material procured for the work, payments would be released only for the items for which original bills & manufacturer's test report for the material consumed has been submitted to Engineer-in-Charge. Department shall also get random testing of material from testing Laboratory of its choice.

S.no.	ITEM	APPROVED MAKE/BRANDS
1	CEMENT (OPC 43)	ULTRA TECH/ A.C.C./ J.K. CEMENT/L&T
2	WHITE CEMENT	J.K. WHITE/ BIRLA WHITE
3	READY MIX CONCRETE	UNITECH, ACC, ADITYA BIRLA, TECHNO CONCRETE & AHLCON, LAFARGE, ULTRATECH, L&T, NDCON,
4	SUPERPLASTICIZERS	MC BAUCHEMIE/FOSROC/ SIKA/ MBT
5	WATERPROOFING COMPOUND	PIDILITE / FOSROC/ CICO/ LATICRETE/DOCTOR FIXIT
6	AAC BLOCK	BILTECH/INSTABLOCK/ULTRATECH/J.K. SMART BLOX, FINECREET, MAGICRETE, SHREE, KANAV BUILDER PVT.LTD.,
7	REINFORCEMENT	TATA STEEL LTD./ SAIL/RINL/JSPL/JSW
8	STRUCTURAL STEEL	TATA STEEL LTD./ SAIL/ RINL/JSPL/ JSW
9	CERAMIC GLAZED TILES	JOHNSON/ RAK/ VARMORA/SOMANY/NITCO/SIMPOLO/KAJARIA/ORIENT
10	VITRIFIED TILES/	VARMORA/ SOMANY/ SIMPOLO /KAJARIA/ORIENT BELL/
11	Alkali Resistant Tiles	VARMORA/SIMPOLO/SOMANY/KAJARIA/ORIENT BELL/
12	FLUSH DOORS	DURO/KITPLY/UNI PLY/DURIAN/ MERINO
13	NATURAL WOOD VENEERS/ Block Board	DURO/DURIAN/KITPLY/UNIPLY/ MERINO
14	Prelaminated Particle	MERINO/GREENLAM/DURIAN
15	POLYSULPHIDE SEALANT	FOSROC/PIDILITE/TUFFSEAL/SIKKA
16	DASH FASTENERS	HILTI/FISCHER/BOSCH
17	STAINLESS STEEL SCREWS (UNLESS OTHERWISE SPECIFIED)	KUNDAN/ARROW/NETTLEFOLD/GKW
18	STEEL WINDOWS	METAL WINDOWS/SKS/KALSI/UNITED/PD Industries
19	CLEAR/ FLOAT/	ST. GOBAIN / PILKINGTON/AIS

20	PU ENAMEL METALIC PAINTS ON MS STRUCTURE	SKK/OIKOS/ACRO
21	EPOXY PRIMER AND	ICI/ ASIAN PAINTS/BERGER
22	GYPSUM BOARD	ST. GOBAIN/ GYPROC GYPSUM/ BORAL
23	G I PIPE	TATA/JINDAL HISSAR/SURYA
24	GI FITTINGS	ZOLOTO/UNIK/ICS
25	CPVC PIPES &	SFMC/ FINOLEX/ SUPREME/ PRAYAG
26	SWR PIPE &	SFMC/ FINOLEX/ SUPREME
27	PVC WATER TANK	SFMC/ SINTEX/ SHEETAL
28	CALCIUM SILICATE	AEROLITE/ ULTRALITE
29	FALSE CEILING SYSTEM ALONG WITH SUPPORTING GRID AND METALLIC TILES	Aerolite/Armstrong/Diamond
	ACOUSTICAL WALL	DECOSONIC/ ARMSTRONG/ AEROLITE/
	ACRYLIC	BISON (BERGER)/ TRACTOR (ASIAN)/ MAXILITE (ICI)
	SYNTHETIC ENAMEL PAINT	LUXOL HIGLOSS (BERGER)/ APCOLITE PREMIUM (ASIAN)/ DULUX GLOSS (ICI)
	ACRYLIC EMULSION	SILK LUXURY (BERGER)/ ROYAL (ASIAN)/ VELVET TOUCH (ICI)/ SUPERSATIN(OIKOS)
	CEMENT PRIMER	BP WHITE (BERGER)/ DECOPRIME (ASIAN)/ WHITE PRIMER (ICI)
	CEMENT PAINT	DUROCEM (BERGER)/ SNOWCEM/ ASIAN
	TEXTURED PAINT	WEATHER COAT TEXTURED (BERGER)/ ULTIMA (ASIAN)/
	SILICON BASED WATER REPELLENT COAT	FERROUS CRETE (FERRO 201)/ ARDEX ENDURA (HEAVY DUTY IM[REGNALING & STONE SEALER)/ PIDILITE (ROFF STONE GUARD WB)
	STUD ANCHORS/ ANCHOR FASTENERS	HILTI/FISCHER/BOSCH / AXCEL / CANON
	CLAMP SYSTEM FOR DRY STONE	HILTI/FISCHER/BOSCH/ AXCEL
	WOOD ADHESIVES	FEVICOL/ANCHOR/DUNLOP/3M
	TILE ADHESIVE& EPOXY GROUT	FERROUS CRET (FERRO-1122)/ARDEX ENDURA (GOLD STAR)/ PIDILITE (FEVIMATE XL)
	STONE ADHESIVE	FERROUS CRET (FERRO-1122)/ARDEX ENDURA (GOLD STAR)/ PIDILITE (FEVIMATE XL)/ /MAGICRETE(MAGIC BOND
	GYPSUM PLASTER	FERROUS CRETE (FERRO-500)/GYPROC SAINT GOBAIN (ELITE- 90) / ULTRATECH/ MAGICRETE(MAGIC PLAST)
	AAC BLOCK ADHESIVE	FERROUS CRETE (FERRO-1188)/ARDEX ENDURA(WHITE STAR)/ ULTRATECH (FIXO BLOCK)/ MAGICRETE(MAGIC BOND)
	WALL PUTTY	J.K.WHITE/BIRLA WHITE/FERROUS CRETE
	MIRROR	SAINT GOBAIN/ MODIGUARD/AIS/ ATUL
	WEATHER SILICON SEALANT (NON	WACKER/DOW CORNING/MCCOY SOUDAL/ALSTONE
	STRUCTURAL SEALANT BACKUP	WACKER/DOW CORNING/GE/ALSTONE
	BACKER ROD	SUPREME IND LTD./SYSTRANS POLYMERS

	EPDM	ENVIROSEAL
	EPDM GASKET	HANU/ANAND
	EPOXY MORTAR	FOSROC/SIKA/CICO/LATICRETE/FEROUS
	EUROPEAN WC/ WASHBASIN/ URINAL (CHINA WARE)	JAQUAR/ PARRYWARE/ RAK / CERA
	RCC PIPES	PRAGATI/LAKSHMI/SOOD & SOOD/K.K./JYOTI
	CRYSTALLINE CEMENTIOUS	XYPEX/CONSRUCTION CHEMICALS/ KRYTONE
	STAINLESS STEEL SINKS/WASH BASINS/WC	NEELKANTH/NIRALI/ANUPAM/JAYNA
	SPUN CAST IRON PIPES & FITTINGS (IS:3989)	JAISWAL/ NECO/SKF/HEPCO
	HDPE PIPES &	JAIN/ORIPLAST/KISAN
	C.I. S/S PIPES &	JAISWAL/ NECO/SKF/HEPCO
	G.I. PIPE JOINTING	LOCTITE 55/DR.FIXIT
	RUBBER	ARMAFLEX/VIDEOFLEX/ AFLEX
	SS HINGED GRATING	GMGR/NEER/CHILLY
	STONEWARE PIPES AND GULLY TRAPS	PERFECT/BURN/ANAND/PARRY
	GUNMETAL VALVES (FULL WAY VALVE)	ZOLOTO/CASTLE/KARTAR
	CI DOUBLE FLANGED SLUICE VALVE	KIRLOSKAR/IVC/SONDHI/KEJRIWAL
	CI MANHOLE FRAME & COVERS AND GI	NECO/SKF/HEPCO
	SFRC MANHOLE COVERS & GRATING	K.K./PRAGATI/KJS CONCERT/ DALAL TILES
	SANITARY ACCESSORIES	JAQUAR/KIMBERLY CLARKE/DLINE/ EURONICS/ KOPAL
	CP BATH ROOM FITTINGS	JAQUAR/PARRYWARE/ HINDWARE/ PRAYAG/PARKO
	PTMT FITTINGS	PRAYAG POLYMER PVT. LTD./ SHAKTI ENTERPRISES/ POLYTUF
	RHS, M.S. TUBES,	TISCO/SAIL/RINL/JINDAL
	EPOXY PAINTS ON CONCRETE	TUFF COAT/ASIAN PAINTS/BERGER /PAINTS / FOSROC SHALIMAR
	SOLID ACRYLIC	DU PONT/SAMSUNG/LG HAUSYS/ALSTONE
	FLOOR TRAPS	JAYNA/CHILLY/NIRALI
	ACP FOR	ALUCOBOND/REYNOBOND/ALPOLIC/ALOMAX/ALUDECOR/ALS
	PVDF	RADIANT ANODIZERS/AKZONOBLE/ METAL COATING SOLUTIONS
	SS MESH	GKD/WMW
	LOUVERS/ ROLLER	HUNTER DOUGLAS/MARC/VISTA
	GRASS PAVERS	OVILITE/VICTORIA/VIRENDRA TEXTILES/DALAL TILES/K.K.
	Precast Kerb	UNISTONE/DALAL TILES/SWASTIC TILES/K.K.



	CC/Chequerred tiles	JMD TILES/ DALAL TILES/ SWASTIC TILES/K.K.
	EXPANSION JOINTS	CONSTRUCTION SPECIALITIES/ HERCULES/BIZZAR
	EXTRUDED POLYSTRENE SHEET (XPS)	SUPREME / DOWCORNING/OWENS CORNING
	PVC Doors & Frames	RAJSHRI/ SINTEX/ACCURA/POLYLINE
	SIGNAGE	VISTA SYSTEMS/COSIGN INDIA PVT.LTD./ CLARKE SYSTEMS
	PPGL PUF insulated roofing panel	SHILPKAR/Jindal mectec/Epac/METECNO/LLOYD INSULATION/SUPER DISCO ISPAT PVT.LTD.
	Common Burnt Brick Clay Tile	JINDAL, POINEER, BHARAT
	Blinds	Vista, Mac.

# **Schedule of Quantities of Civil Works**

### Schedule of Quantity

S. NO.	Descriptions	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1	Clearing grass, jungle including uprooting of rank vegetation, brush wood, trees and saplings of girth upto 30 cm measured at a height of 1m above ground level and removal of rubbish upto a distance of 250 m outside the periphery of the area cleared.	10150.00	Sqm	7.20	73080.00
2	Earth work in excavation by mechanical means (Hydraulic excavator) / manual means over areas (exceeding 30cm in depth. 1.5 m in width as well as 10 sqm on plan) including disposal of excavated earth, lead upto 50m and lift upto 1.5m, disposed earth to be levelled and neatly dressed. 2.6.1 All kinds of soil	1995.00	Cum	125.95	251270.25
3	Excavating trenches of required width for pipes, cables, etc including excavation for sockets, and dressing of sides, ramming of bottoms, depth upto 1.5 m, including getting out the excavated soil, and then returning the soil as required, in layers not exceeding 20 cm in depth, including consolidating each deposited layer by ramming, watering, etc. and disposing of surplus excavated soil as directed, within a lead of 50 m : Pipes, cables etc. exceeding 80 mm dia. but not exceeding 300 mm dia	300.00	Mtr	481.60	144480.00
4	Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.	550.00	Cum	125.75	69162.50
5	Extra for every additional lift of 1.5 m or part thereof in excavation / banking excavated or stacked materials. All kinds of soil	255.00	Cum	51.75	13196.25
6	Supplying and filling in plinth with Jamuna sand under floors, including watering, ramming, consolidating and dressing complete.	330.00	Cum	917.75	302857.50
7	Surface dressing of the ground including removing vegetation and inequalities not exceeding 15 cm deep and disposal of rubbish, lead upto 50 m and lift upto 1.5 m. All kinds of soil	5000.00	Sqm	13.95	69750.00
8	Supplying chemical emulsion in sealed containers including delivery as specified. Chlorpyriphos/ Lindane emulsifiable concentrate of 20%	200.00	Ltr	185.95	37190.00

9	Treatment of soil under existing floors using chemical emulsion @ one litre per hole, 300 mm apart including drilling 12 mm diameter holes and plugging with cement mortar 1 :2 (1 cement : 2 Coarse sand) to match the existing floor : With Chlorpyriphos/Lindane E.C. 20% with 1% concentration				
		653.00	Sqm	131.90	86130.70
10	Treatment of existing masonry using chemical emulsion @ one litre per hole at 300 mm interval including drilling holes at 45 degree and plugging them with cement mortar 1:2 (1 cement : 2 coarse sand) to the full depth of the hole : With Chlorpyriphos/Lindane E.C. 20% with 1% concentration	785.00	Mtr	19.05	14954.25
11	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:1½:3 (1 Cement: 1½ coarse sand: 3 graded stone aggregate 20 mm nominal size)	65.00	Cum	5924.65	385102.25
12	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)	55.00	Cum	5481.95	301507.25
13	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size)	85.00	Cum	4478.15	380642.75
14	Providing and fixing up to floor five level precast cement concrete string or lacing courses, copings, bed plates, anchor blocks, plain window sills, shelves, louvers, steps, stair cases, etc., including hoisting and setting in position with cement mortar 1:3 (1 Cement : 3 coarse sand), cost of required centering complete. 1:1.5:3 (1 cement: 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20mm nominal size).	50.00	Cum	6772.45	338622.50
15	Providing and laying damp-proof course 40 mm thick with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm nominal size).	205.00	Sqm	263.10	53935.50
16	Applying a coat of residual petroleum bitumen of grade of VG-10 of approved quality using 1.7 kg per square metre on damp proof course after cleaning the surface with brushes and finally with a piece of cloth lightly soaked in kerosene oil.	205.00	Sqm	91.90	18839.50

17	Making plinth protection 50 mm thick of cement concrete 1:3:6 (1 cement: 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75mm thick bed of dry brick ballast 40 mm nominal size, well rammed and consolidated and grouted with fine sand, including finishing the top smooth.	655.00	Sqm	450.35	294979.25
18	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)	10.00	Cum	7145.80	71458.00
19	Centering and shuttering including strutting, propping etc. and removal of form for : Lintels, beams, plinth beams, girders, bressumers and cantilevers	555.00	Sqm	342.90	190309.50
20	Centering and shuttering including strutting, propping etc. and removal of form for : Columns, Pillars, Piers, Abutments, Posts and Struts	222.00	Sqm	467.85	103862.70
	Total				
21	Centering and shuttering including strutting, propping etc. and removal of form for : Edges of slabs and breaks in floors and walls Under 20 cm wide	340.00	Mtr	122.20	41548.00
22	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete above plinth level. Thermo-Mechanically Treated bars	7800.00	Kg	56.60	441480.00
23	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in foundation and plinth in: Cement mortar 1:6 (1 cement : 6 coarse sand)	165.00	Cum	4751.65	784022.25
24	Brick work with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor V level in all shapes and sizes in : Cement mortar 1:6 (1 cement : 6 coarse sand)	95.00	Cum	5582.85	530370.75
25	Half brick masonry with common burnt clay F.P.S. (non modular) bricks of class designation 7.5 in superstructure above plinth level up to floor V level. Cement mortar 1:4 (1 cement : 4 coarse sand)	365.00	Sqm	593.50	216627.50
26	Extra for providing and placing in position 2 Nos 8mm dia. M.S. bars at every third course of half brick masonry.	365.00	Sqm	56.85	20750.25

27	Providing and fixing 18 mm thick gang saw cut, mirror polished, premoulded and prepolished, machine cut for kitchen platforms, vanity counters, windowsills, facias and similar locations of required size, approved shade, colour and texture laid over 20 mm thick base cement mortar 1:4 (1 cement : 4 coarse sand), joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing, moulding and polishing to edge to give high gloss finish etc. complete at all levels. Granite of any colour and shade Area of slab above 0.50 sqm	165.00	Sqm	3113.30	513694.50
28	Mirror polishing on marble work/Granite work/stone work/Kota work where ever required to give high gloss finish complete.	3500.00	Sqm	231.50	810250.00
29	Providing and fixing stone slab with table rubbed, edges rounded and polished, of size 75x50 cm deep and 1.8 cm thick, fixed in urinal partitions by cutting a chase of appropriate width with chase cutter and embedding the stone in the chase with epoxy grout or with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 6 mm nominal size) as per direction of Engineer-in-charge and finished smooth. Granite Stone of approved shade	28.00	Sqm	2831.95	79294.60
30	Providing and laying Polished Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the building, all complete as per the architectural drawings, with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand), laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade, including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge.	252.00	Sqm	2937.70	740300.40
31	Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought framed and fixed in position with hold fast lugs or with dash fasteners of required dia & length (hold fast lugs or dash fastener shall be paid for separately). Sal wood	4.59	Cum	85386.95	391926.10
32	Providing and fixing ISI marked flush door shutters conforming to IS : 2202 (Part I) decorative type, core of block board construction with frame of 1st class hard wood and well matched teak 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters. 30 mm thick including ISI marked Stainless Steel butt hinges with necessary screws	10.00	Sqm	2372.80	23728.00

33	Providing and fixing ISI marked flush door shutters conforming to IS : 2202 (Part I) non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters: 35 mm thick including ISI marked Stainless Steel butt hinges with necessary screws	558.00	Sqm	1559.75	870340.50
34	Providing and fixing curtain rods of 1.25 mm thick stain less steelwith stailless steel bracket and end knobs fixed with stainless Steel screwsscrews and wooden plugs, etc., wherever necessary complete : 25mm dia	555.00	Mtr	463.85	257436.75
35	Providing and fixing M.S. grills of required pattern in frames of window setc. with M.S. flats, square or round bars etc. including priming coat withapproved steel primer all complete. Fixed to steel windows by welding	5255.00	Kg	104.65	549935.75
36	Providing and fixing ISI marked oxidised M.S. sliding door bolts with nuts and screws etc. complete : 300x16 mm	255.00	Each	154.85	39486.75
37	Providing and fixing ISI marked oxidised M.S. tower bolt black finish, (Barrel type) with necessary screws etc. complete : 200x10 mm	365.00	Each	51.05	18633.25
38	Providing and fixing ISI marked oxidised M.S. tower bolt black finish, (Barrel type) with necessary screws etc. complete : 150x10 mm	245.00	Each	44.10	10804.50
39	Providing and fixing ISI marked oxidised M.S. tower bolt black finish, (Barrel type) with necessary screws etc. complete : 100x10 mm	385.00	Each	31.40	12089.00
40	Providing and fixing ISI marked oxidised M.S. handles conforming to IS:4992 with necessary screws etc. complete : 125 mm	415.00	Each	28.60	11869.00
41	Providing and fixing ISI marked oxidised M.S. handles conforming to IS:4992 with necessary screws etc. complete : 100 mm	365.00	Each	22.65	8267.25
42	Providing and fixing IS : 12817 marked stainless steel butt hinges with stainless steel screws etc. complete : 100X58X1.90 mm	365.00	Each	57.70	21060.50
43	Providing and fixing aluminium extruded section body tubular type universal hydraulic door closer (having brand logo with ISI, IS : 3564, embossed on the body, door weight upto 36 kg to 80 kg and door width from 701 mm to 1000 mm), with double speed adjustment with necessary	365.00	Each	388.40	141766.00

	accessories and screws etc. complete.				
44	Providing and fixing aluminium sliding door bolts, ISI marked anodised anodic coating not less than grade AC 10 as per IS : 1868), transparent or dyed to required colour or shade, with nuts and screws etc. complete : 250x16 mm	256.00	Each	189.20	48435.20
45	Providing and fixing aluminium tower bolts, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868 ) transparent or dyed to required colour or shade, with necessary screws etc. complete : 250x10 mm	269.00	Each	88.10	23698.90
46	Providing and fixing aluminium tower bolts, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868 ) transparent or dyed to required colour or shade, with necessary screws etc. complete : 200x10 mm	365.00	Each	76.15	27794.75
47	Providing and fixing aluminium tower bolts, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868 ) transparent or dyed to required colour or shade, with necessary screws etc. complete : 150x10 mm	285.00	Each	64.30	18325.50
48	Providing and fixing aluminium handles, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour or shade, with necessary screws etc. complete : 125 MM	155.00	Each	51.10	7920.50
49	Providing and fixing aluminium handles, ISI marked, anodised (anodic coating not less than grade AC 10 as per IS : 1868) transparent or dyed to required colour or shade, with necessary screws etc. complete 100 mm	165.00	Each	45.10	7441.50
50	Providing and fixing magnetic catcher of approved quality in cupboard / ward robe shutters, including fixing with necessary screws etc. complete. Triple strip vertical type	365.00	Each	28.45	10384.25
51	Providing & Fixing special quality decorative high pressure laminated sheet of plain / wood grain in gloss / matt / suede finish with high density protective surface layer and reverse side of adhesive bonding quality conforming to IS : 2046 Type S, including cost of adhesive of approved quality. 1 mm thick	355.00	Sqm	518.00	183890.00
52	Providing and fixing fly proof stainless steel grade 304 wire gauge, to windows and clerestory windows using wire gauge with average width of aperture 1.4 mm in both directions with wire of dia. 0.50 mm all complete. With 12 mm mild steel U beading	865.00	Sqm	1094.10	946396.50



53	Providing and fixing plain lining with necessary screws/nuts & bolts/ nails, including a coat of approved primer on one face, and fixed on wooden / steel frame work, complete as per direction of Engineer-incharge (Frame work shall be paid for separately). 18mm thick commercial ply conforming to IS : 1328 BWR type	105.00	Sqm	1074.65	112838.25
54	Structural steel work in single section, fixed with or without connecting plate, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.	6585.00	Kg	58.45	384893.25
55	Providing and fixing factory made ISI marked steel glazed doors, windows and ventilators, side /top /centre hung, with beading and all members such as F7D, F4B, K11 B and K12 B etc. complete of standard rolled steel sections, joints mitred and flash butt welded and sash bars tenoned and riveted, including providing and fixing of hinges, pivots, including priming coat of approved steel primer, but excluding the cost of other fittings, complete all as per approved design, (sectional weight of only steel members shall be measured for payment). Fixing with 15x3 mm lugs 10 cm long embedded in cement concrete block 15x10x10 cm of C.C. 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)	250.00	Kg	113.60	28400.00
56	Steel work in built up tubular ( round, square or rectangular hollow tubes etc.) trusses etc., including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer, including welding and bolted with special shaped washers etc. complete. Hot finished welded type tubes.	12000.00	Kg	90.25	1083000.00
57	Providing and fixing mild steel round holding down bolts with nuts and washer plates complete.	215.00	Kg	68.00	14620.00
58	Welding by gas or electric plant including transportation of plant at site etc. complete	10000.00	Cm	2.85	28500.00
59	Steel work welded in built up sections/ framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structural steel etc. as required. In gratings, frames, guard bar, ladder, railings, brackets, gates and similar works	8500.00	Kg	85.95	730575.00
60	Providing & fixing glass panes with putty and glazing clips in steel doors, windows, clerestory windows, all complete with : 4.0 mm thick glass panes	658.00	Sqm	689.05	453394.90

61	Kota stone slab flooring over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab, including rubbing and polishing complete with base of cement mortar 1 : 4 (1 cement : 4 coarse sand) : 25 mm thick	1200.00	Sqm	1158.10	1389720.00
62	Kota stone slabs 20 mm thick in risers of steps, skirting, dado and pillars laid on 12 mm (average) thick cement mortar 1:3 (1 cement: 3 coarse sand) and jointed with grey cement slurry mixed with pigment to match the shade of the slabs, including rubbing and polishing complete	125.00	Sqm	1238.20	154775.00
63	Providing and fixing 1st quality ceramic glazed wall tiles conforming to IS: 15622 (thickness to be specified by the manufacturer), of approved make, in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge, in skirting, risers of steps and dados, over 12 mm thick bed of cement mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm, including pointing in white cement mixed with pigment of matching shade complete. (Tile of any size or any make as approved by engineer - in charge)	3000.00	Sqm	744.80	2234400.00
64	Providing and laying rectified Glazed Ceramic floor tiles of size 300x300 etc. complete mm or more (thickness to be specified by the manufacturer), of 1st quality conforming to IS : 15622, of approved make, in colours White, Ivory, Grey, Fume Red Brown, laid on 20 mm thick cement mortar 1:4 (1 Cement: 4 Coarse sand), including grouting the joints with white cement and matching pigments etc., complete	2000.00	Sqm	822.45	1644900.00
65	Providing and laying vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption less than 0.08% and conforming to IS : 15622, of approved make, in all colours and shades, laid on 20mm thick cement mortar 1:4 (1 cement : 4 coarse sand), including grouting the joints with white cement and matching pigments etc., complete. Size of Tile 600x600 mm	1100.00	Sqm	1119.40	1231340.00
66	Providing gola 75x75 mm in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 stone aggregate 10 mm and down gauge), including finishing with cement mortar 1:3 (1 cement : 3 fine sand) as per standard design : In 75x75 mm deep chase	525.00	Mtr	153.00	80325.00
67	Providing sand stone slab for roofing and laying them in cement mortar 1 : 4 (1 cement : 4 coarse sand) over wooden karries or R.C.C. battens or	1200.00	Sqm	560.05	672060.00

	structural steel sections (Karries or battens or structural steel sections to be paid separately), including pointing the ceiling joints with cement mortar 1:3 (1 cement : 3 fine sand ) complete : Red sand stone slab 40 to 50 mm thick				
68	Providing and fixing on wall face unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion, (i) Single socketed pipes. 75 mm diameter	700.00	Mtr	148.75	104125.00
69	Providing and fixing on wall face unplasticised - PVC moulded fittings/ accessories for unplasticised Rigid PVC rain water pipes conforming to IS : 13592 Type A, including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion. Bend 87.5° 110 mm bend	350.00	Each	113.10	39585.00
70	Providing and fixing precoated galvanised iron profile sheets (size, shape and pitch of corrugation as approved by Engineer-in-charge) 0.50 mm (+0.05 %) total coated thickness with zinc coating 120 grams per sqm as per IS: 277, in 240 mpa steel grade, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 microns. Sheet should have protective guard film of 25 microns minimum to avoid scratches during transportation and should be supplied in single length upto 12 metre or as desired by Engineer-in-charge. The sheet shall be fixed using self drilling /self tapping screws of size (5.5x 55 mm) with EPDM seal, complete upto any pitch in horizontal/ vertical or curved surfaces, excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required.	500.00	Sqm	550.40	275200.00
71	Providing and fixing precoated galvanised steel sheet roofing accessories 0.50 mm (+ 0.05 %) total coated thickness, Zinc coating 120 grams per sqm as per IS: 277, in 240 mpa steel grade, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 microns using self drilling/ self tapping screws complete : Ridges plain (500 - 600mm)	375.00	Mtr	360.45	135168.75
72	Providing and fixing precoated galvanised steel sheet roofing accessories 0.50 mm (+ 0.05 %) total coated thickness, Zinc coating 120 grams per sqm as per IS: 277, in 240 mpa steel grade, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 microns using self drilling/ self tapping screws complete : Barge board (Upto 300 mm)	255.00	Mtr	321.05	81867.75

73	Providing and fixing precoated galvanised steel sheet roofing accessories 0.50 mm (+ 0.05 %) total coated thickness, Zinc coating 120 grams per sqm as per IS: 277, in 240 mpa steel grade, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 microns using self drilling/ self tapping screws complete : Gutter .(600 mm over all girth)	256.00	Mtr	833.05	213260.80
74	Providing and fixing tiled G.R.G. false ceiling of approved materials of size 595x595 mm in true horizontal level, suspended on inter locking metal grid of hot dipped galvanized steel sections ( galvanized @ 120 grams/ sqm, both side inclusive) consisting of main "T" runner with suitably spaced joints to get required length and of size 24x38 mm made from 0.30 mm thick (minimum) sheet, spaced at 1200 mm center to center and cross "T" of size 24x25 mm made of 0.30 mm thick (minimum) sheet, 1200 mm long spaced between main "T" at 600 mm center to center to form a grid of 1200x600 mm and secondary cross "T" of length 600 mm and size 24x25 mm made of 0.30 mm thick (minimum) sheet to be interlocked at middle of the 1200x600 mm panel to form grids of 600x600 mm and wall angle of size 24x24x0.3 mm and laying false ceiling tiles of approved texture in the grid including, required cutting/making, opening for services like diffusers, grills, light fittings, fixtures, smoke detectors etc. Main "T" runners to be suspended from ceiling using GI slotted cleats of size 27 x 37 x 25 x 1.6 mm fixed to ceiling with 12.5 mm dia and 50 mm long dash fasteners, 4 mm GI djustable rods with galvanised butterfly level clips of size 85 x 30 x 0.8 mm spaced at 1200 mm center to center along main T, bottom exposed width of 24 mm of all T-sections shall be pre-painted with polyester paint, all complete for all heights as per specifications, drawings and as directed by Engineer-in-charge.				
75	12.5 mm thick G.R.G. tile made from plasterboard having glass fibre conforming to IS: 2095 part I, of size 595x595 mm, having perforation of 9.7x9.7 mm at 19.4 mm c/c with center borders of 48 mm and the side borders of 30 mm, backed with non woven tissue on the back side, having an NRC (Noise Reduction Coefficient) of 0.79, with 50 mm resin bonded glass wool backing	300.00	Sqm	1005.35	301605.00
76	12 mm cement plaster of mix : 1:6 (1 cement: 6 fine sand)	2500.00	Sqm	160.35	400875.00
77	15 mm cement plaster on the rough side of single or half brick wall of mix : 1:6 (1 cement: 6 fine sand)	2500.00	Sqm	185.20	463000.00
78	18 mm cement plaster in two coats under layer 12	1900.00	Sqm	272.05	516895.00

	mm thick cement plaster 1:5 (1 cement: 5 coarse sand) and a top layer 6 mm thick cement plaster 1:3 (1 cement : 3 coarse sand) finished rough with sponge.				
79	Distempering with oil bound washable distemper of approved brand and manufacture to give an even shade : New work (two or more coats) over and including water tinnable priming coat with cement primer	9500.00	Sqm	93.70	890150.00
80	Finishing walls with Acrylic Smooth exterior paint of required shade : New work (Two or more coat applied @ 1.67 ltr/10 sqm over and including priming coat of exterior primer applied @ 2.20 kg/ 10 sqm) (Rate including of scaffolding height upto 15.00 mtr.)	5000.00	Sqm	96.05	480250.00
81	Applying priming coat : With ready mixed pink or Grey primer of approved brand and manufacture on wood work (hard and soft wood)	1526.00	Sqm	34.95	53333.70
82	Painting with silicon & acrylic emulsion based water thinnable sealer of approved brand and manufacture on wet or patchy portion of plastered surfaces :Two coats	1256.00	Sqm	90.05	113102.80
83	Painting with synthetic enamel paint of approved brand and manufacture to give an even shade : Two or more coats on new work	4500.00	Sqm	78.40	352800.00
84	French spirit polishing : Two or more coats on new works including a coat of wood filler	1565.00	Sqm	209.75	328258.75
85	Forming groove of uniform size from 12x12 mm and upto 25x15 mm in the top layer of washed stone grit plastered surface as per approved pattern, including providing and fixing aluminum channels of appropriate size and thickness (not less than 2 mm), nailed to the under layer with rust proof screws and nails and finishing the groove complete as per direction of engineer in charge.	255.00	per mtr	71.60	18258.00
86	Providing and applying white cement based putty of average thickness 1 mm, of approved brand and manufacturer, over the plastered wall surface to prepare the surface even and smooth complete.	5000.00	Sqm	87.35	436750.00
87	Repairs to plaster of thickness 12 mm to 20 mm in patches of area 2.5 sq.meters and under, including cutting the patch in proper shape, raking out joints and preparing and plastering the surface of the walls complete, including disposal of rubbish to the dumping ground within 50 metres lead : 14.1.1 With cement mortar 1:4 (1 cement : 4 fine sand)	1540.00	Sqm	264.80	407792.00

88	Fixing chowkhats in existing opening including embedding chowkhats in floors or walls cutting masonry for holdfasts, embedding hold fasts incement concrete blocks of size 15 x 10 x 10 cm with cement concrete1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominalsize), painting two coats of approved wood preservative to sides ofchowkhats and making good the damages to walls and floors as requiredcomplete, including disposal of rubbish to the dumping ground within 50 meters lead : 14.2.1 Door chowkhats	255.00	Each	852.70	217438.50
89	Fixing chowkhats in existing opening including embedding chowkhats in floors or walls cutting masonry for holdfasts, embedding hold fasts incement concrete blocks of size 15 x 10 x 10 cm with cement concrete1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominalsize), painting two coats of approved wood preservative to sides ofchowkhats and making good the damages to walls and floors as requiredcomplete, including disposal of rubbish to the dumping ground within 50 meters lead : 14.2.2 Window chowkhats	255.00	Each	529.50	135022.50
90	Making the opening in brick masonry including dismantling in floor or walls by cutting masonry and making good the damages to walls, flooring and jambs complete, to match existing surface i/c disposal of mulba/rubbish to the nearest municipal dumping ground. For door/ window/ clerestory window	252.00	Sqm	546.25	137655.00
91	Distempering with oil bound washable distemper of approved brand and manufacture to give an even shade : Old work (one or more coats)	10000.00	Sqm	33.35	333500.00
92	Removing dry or oil bound distemper, water proofing cement paint and the like by scrapping, sand papering and preparing the surface smooth including necessary repairs to scratches etc. complete.	15000.00	Sqm	10.80	162000.00
93	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade : One or more coats on old work	5000.00	Sqm	51.30	256500.00
94	Painting with aluminium paint of approved brand and manufacture to give an even shade : One or more coats on old work	1250.00	Sqm	44.40	55500.00
95	Providing and fixing double scaffolding system (cup lock type) on the exterior side, up to seven story height made with 40 mm dia M.S. tube 1.5 m	1525.00	Sqm	160.15	244228.75

	centre to centre, horizontal & vertical tubes joining with cup & lock system with M.S. tubes, M.S. tube challies, M.S. clamps and M.S. staircase system in the scaffolding for working platform etc. and maintaining it in a serviceable condition for the required duration as approved and removing it there after .The scaffolding system shall be stiffened with bracings, runners, connection with the building etc wherever required for inspection of work at required locations with essential safety features for the workmen etc. complete as per directions and approval of ngineerin-charge .The elevational area of the scaffolding shall be measured for payment purpose .The payment will be made once irrespective of duration of scaffolding.				
96	Cleaning of terrace/loft water storage tank (inside surface area) upto 2000 litre capacity at all heights with coconut brushes, duster etc., removal of silt, rubbish from the tank and cleaning the tank with fresh water disinfecting with bleaching powder @ 0.5gm per litre capacity of tank, including marking the date of cleaning on the side of tank body with the help of stencil and paint and disposing of malba, all complete as per direction of Engineer-in-Charge. (The old date already written on tank should be removed with paint remover or black paint and if date is not written with the stencil or old date is not removed deduction will be made @ Rs. 0.10 per litre if during cleaning any GI fittings or ball cock is damaged that is to be repaired by contractor at his own cost and nothing extra will be paid on this account)	1000000.00	Ltr	0.20	200000.00
97	Hacking of CC flooring including cleaning for surface etc. complete as per direction of the Engineer-in-Charge.	500.00	Sqm	1.50	750.00
98	Demolishing cement concrete manually/ by mechanical means including disposal of material within 50 metres lead as per direction of Engineer - in charge. Nominal concrete 1:3:6 or richer mix (i/c equivalent design mix)	150.00	Cum	997.05	149557.50
99	Demolishing cement concrete manually/ by mechanical means including disposal of material within 50 metres lead as per direction of Engineer - in charge Nominal concrete 1:4:8 or leaner mix (i/c equivalent design mix)	200.00	Cum	615.15	123030.00
100	Demolishing brick work manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-harge. In cement mortar	155.00	Cum	842.75	130626.25

101	Taking out doors, windows and clerestory window shutters (steel or wood) including stacking within 800 metres lead : Of area 3 sq. metres and below	300.00	Each	61.25	18375.00
102	Dismantling steel work in built up sections in angles, tees, flats and channels including all gusset plates, bolts, nuts, cutting rivets ,welding etc. including dismembering and stacking within 50metres lead.	1565.00	Kg	2.40	3756.00
103	Dismantling tile work in walls and floor laid in cement mortar including stacking material within 50 metres lead. 15.23.1 For thickness of tiles 10 mm to 25 mm	2500.00	Sqm	31.55	78875.00
104	Dismantling stone slab flooring laid in cement mortar including stackingof serviceable material and disposal of unserviceable material within 50metres lead.	1256.00	Sqm	109.35	137343.60
105	Dismantling manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge : bituminous road.	255.00	Sqm	177.00	45135.00
106	Dismantling G.I. pipes (Internal work) including Cutting and making good the walls etc. 15mm to 40 mm nominal bore	3500.00	Mtr	63.65	222775.00
107	Dismantling C.I. pipes including excavation and refilling trenches after taking out the pipes, manually/ by mechanical means breaking lead caulked joints, melting of lead and making into blocks including stacking of pipes & lead at site within 50 metre lead as per direction of Engineer-in-charge: Up to 150 mm diameter.	1254.00	Mtr	183.05	229544.70
108	Dismantling of flushing cistern of all types (C.I./PVC/Vitrious China) including stacking of useful materials near the site and disposal of unserviceable materials within 50 metres lead	456.00	Each	391.20	178387.20
109	Dismantling old plaster or skirting raking out joints and cleaning the surfacefor plaster including disposal of rubbish to the dumping ground within 50metres lead.	1245.00	Sqm	22.40	27888.00
110	Taking out existing kerb stones of all types from footpath/ central verge, including removal of mortar etc., disposal of unserviceable material to the dumping ground, for which payment shall be made separately and stacking of serviceable material within 50 metre lead as per direction of Engineerin- Charge.	325.00	Mtr	16.05	5216.25



111	Taking out existing CC interlocking paver blocks from footpath/ central verge, including removal of rubbish etc., disposal of unserviceable material to the dumping ground, for which payment shall be made separately and stacking of serviceable material within 50 metre lead as per direction of Engineer-in-Charge.	1564.00	Sqm	53.95	84377.80
112	Laying old cement concrete interlocking paver blocks of any design/ shapelaid in required line, level, curvature, colour and pattern over and including 50 mm thick compacted bed of coarse sand, filling the joints with fine sand etc. all complete as per the direction of Engineer-in-charge. (Old CC paver blocks shall be supplied by the department free of cost).	785.00	Sqm	209.20	164222.00
113	Providing and fixing water closet squatting pan (Indian type W.C. pan ) with 100 mm sand cast Iron P or S trap, 10 litre low level white P.V.C. flushing cistern, including flush pipe, with manually controlled device (handle lever) conforming to IS : 7231, with all fittings and fixtures complete, including cutting and making good the walls and floors wherever required: White Vitreous china Orissa pattern W.C. pan of size 580x440	100.00	Each	3494.20	349420.00
114	Providing and fixing white vitreous china pedestal type water closet (European type W.C. pan) with seat and lid, 10 litre low level white P.V.C. flushing cistern, including flush pipe, with manually controlled device (handle lever), conforming to IS : 7231, with all fittings and fixtures complete, including cutting and making good the walls and floors wherever required : W.C. pan with ISI marked white solid plastic seat and lid	250.00	Each	3418.70	854675.00
115	Providing and fixing white vitreous china flat back or wall corner type lipped front urinal basin of 430x260x350 mm and 340x410x265 mm sizes respectively with automatic flushing cistern with standard flush pipe and C.P. brass spreaders with brass unions and G.I clamps complete, including painting of fittings and brackets, cutting and making good the walls and floors wherever required : One urinal basin with 5 litre white P.V.C. automatic flushing cistern	125.00	Each	3494.15	436768.75
116	Providing and fixing wash basin with C.I. brackets, 15 mm C.P. brass pillar taps, 32 mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever required: White Vitreous China Wash basin size 630x450 mm with a pair of 15 mm C.P. brass pillar tap	125.00	Each	2298.55	287318.75

117	Providing and fixing Stainless Steel A ISI 304 (18/8) kitchen sink as per IS: 13983 with C.I. brackets and stainless steel plug 40 mm, including painting of fittings and brackets, cutting and making good the walls wherever required : Kitchen sink with drain board 510x1040 mm bowl depth 200 mm	155.00	Each	3772.35	584714.25
118	Providing and fixing P.V.C. low level flushing cistern with manually controlled device (handle lever) conforming to IS : 7231, with all fittings and fixtures complete. 10 litre capacity - White	155.00	Each	831.50	128882.50
119	Providing and fixing P.V.C. waste pipe for sink or wash basin including P.V.C. waste fittings complete. Flexible pipe 32 mm dia	1200.00	Each	73.25	87900.00
120	Providing and fixing 600x450 mm beveled edge mirror of superior glass (of approved quality) complete with 6 mm thick hard board ground fixed to wooden cleats with C.P. brass screws and washers complete.	540.00	Each	817.95	441693.00
121	Providing and fixing PTMT towel rail complete with brackets fixed to wooden cleats with CP brass screws with concealed fittings arrangement of approved quality and colour. 600 mm long towel rail with total length of 645 mm, width 78 mm and effective height of 88 mm, weighing not less than 190 gms	855.00	Each	422.70	361408.50
122	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and testing of joints complete as per direction of Engineer in Charge. Internal work - Exposed on wall 20 mm nominal outer dia Pipes	650.00	Mtr	216.20	140530.00
123	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and testing of joints complete as per direction of Engineer in Charge. Internal work - Exposed on wall 25 mm nominal outer dia Pipes	650.00	Mtr	216.20	140530.00
124	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC	650.00	Mtr	385.50	250575.00

	solvent cement and testing of joints complete as per direction of Engineer in Charge. Internal work - Exposed on wall 40 mm nominal outer dia Pipes				
125	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge. Concealed work, including cutting chases and making good the walls etc. 20 mm nominal outer dia Pipes	1000.00	Mtr	284.85	284850.00
126	Providing and fixing G.I. pipes complete with G.I. fittings including trenching and refilling etc. External work 20 mm dia nominal bore metre	655.00	Mtr	186.30	122026.50
127	Providing and fixing G.I. pipes complete with G.I. fittings including trenching and refilling etc. External work 50 mm dia nominal bore	500.00	Mtr	342.70	171350.00
128	Making connection of G.I. distribution branch with G.I. main of following sizes by providing and fixing tee, including cutting and threading the pipe etc. complete : 25 to 40 mm nominal bore.	125.00	Each	394.15	49268.75
129	Providing and fixing uplasticised PVC connection pipe with brass unions : 45 cm length 15 mm nominal bore	365.00	Each	82.90	30258.50
130	Constructing masonry Chamber 60x60x75 cm inside, in brick work in cement mortar 1:4 (1 cement : 4 coarse sand) for sluice valve, with C.I. urface box 100mm top diameter, 160 mm bottom diameter and 180 mm deep ( inside) with chained lid and RCC top slab 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size ) , i/c necessary excavation, foundation concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3 coarse sand) 12 mm thick, finished with a floating coat of neat cement complete as per standard design : With common burnt clay F.P.S.(non modular) bricks of class designation 7.5	55.00	Each	6849.60	376728.00
131	Painting G.I. pipes and fittings with two coats of anti-corrosive bitumastic paint of approved quality : 50 mm diameter pipe	1565.00	Mtr	14.80	23162.00
132	Providing and filling sand of grading zone V or coarser grade, allround the G.I. pipes in external	656.00	Mtr	74.95	49167.20

	work : 50 mm diameter pipe				
133	Providing and fixing G.I. Union in G.I. pipe including cutting and threading the pipe and making long screws etc. complete (New work) : 15 mm nominal bore	1200.00	Each	147.75	177300.00
134	Providing and fixing G.I. Union in G.I. pipe including cutting and threading the pipe and making long screws etc. complete (New work) : 20 mm nominal bore	1155.00	Each	170.95	197447.25
135	Providing and fixing G.I. Union in G.I. pipe including cutting and threading the pipe and making long screws etc. complete (New work) : 50 mm nominal bore	955.00	Each	384.90	367579.50
136	Providing and placing on terrace (at all floor levels) three layered polyethylene water storage tank, ISI : 12701 marked, with cover and suitable locking arrangement and making necessary holes for inlet, outlet and overflow pipes but without fittings and the base support for tank.	75000.00	per litre	7.25	543750.00
137	Providing and fixing C.P. brass bib cock of approved quality conforming to IS:8931 : 15 mm nominal bore	255.00	Each	371.70	94783.50
138	Providing and fixing C.P. brass long body bib cock of approved quality conforming to IS standards and weighing not less than 690 gms. 15 mm nominal bore	255.00	Each	492.55	125600.25
139	Providing and fixing C.P. brass stop cock (concealed) of standard design and of approved make conforming to IS:8931. 15 mm nominal bore	365.00	Each	545.95	199271.75
140	Providing and fixing C.P. brass angle valve for basin mixer and geyser points of approved quality conforming to IS:8931 a) 15 mm nominal bore 15mm nominal bore	255.00	Each	475.70	121303.50
141	Providing and fixing PTMT bib cock of approved quality and colour. 15mm nominal bore, 86 mm long, weighing not less than 88 gms	855.00	Each	103.30	88321.50
142	Providing and fixing PTMT angle valve for basin mixer and geyser points of approved quality conforming to IS:8931 a) 15mm nominal bore	800.00	Each	103.30	82640.00
143	Providing and fixing PTMT pillar cock of approved quality and colour . 15 mm nominal bore, 107 mm long, weighing not less than 110 gms	560.00	Each	168.90	94584.00

144	Providing and fixing PTMT, push cock of approved quality and colour. 15 mm nominal bore, 98 mm long, weighing not less than 75 gms	650.00	Each	91.70	59605.00
145	Providing and fixing PTMT Ball cock of approved quality, colour and make complete with Epoxy coated aluminium rod with L.P./ H.P.H.D. plastic ball. 20 mm nominal bore, 120 mm long, weighing not less than 198 gms	1250.00	Each	216.70	270875.00
146	Providing and fixing PTMT swivelling shower, 15 mm nominal bore, weighing not less than 40 gms	650.00	Each	100.70	65455.00
147	Providing and fixing PTMT extension nipple for water tank pipe, fittings of approved quality and colour. 25mm nominal bore, weighing not less than 62 gms	650.00	Each	53.25	34612.50
148	Cutting holes up to 30x30 cm in walls including making good the same: With common burnt clay F.P.S. (non modular) bricks	500.00	Each	219.20	109600.00
149	Providing and fixing square-mouth S.W. gully trap class SP-1 complete with C.I. grating brick asonry chamber with water tight C.I. cover with frame o f 300 x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design: 100x100 mm size P type With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	450.00	Each	1602.40	721080.00
150	Constructing brick masonry manhole in cement mortar 1:4 ( 1 cement : 4coarse sand ) with R.C.C. top slab with 1:2:4 mix (1 cement : 2 coarsesand : 4 graded stone aggregate 20 mm nominal size), foundation concrete 1:4:8 mix (1 cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size), inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with floating coat of neat cement and making channels in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement complete as per standard design : Inside size 90x80 cm and 45 cm deep including SFRC COVER WITH frame (light duty) 455x610 mm With common burnt clay F.P.S. (non modular) bricks of classdesignation 7.5	50.00	Each	8634.10	431705.00
151	Constructing brick masonry circular type manhole 0.91 m internal dia at bottom and 0.56m dia at top in cement mortar 1:4 (1 cement : 4 coarse sand), in side cement plaster 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement foundation concrete 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size), and making	20.00	Sqm	8683.75	173675.00

	necessary channel in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement, all complete as per standard design :0.91 m deep with S.F.R.C. cover and frame (heavy duty, HD-20 grade designation) 560 mm internal diameter conforming to I.S. 12592, total weight of cover and frame to be not less than 182 kg., fixed in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) including centering, shuttering all complete. (Excavation, foot rests and 12mm thick cement plaster at the external surface shall be paid for separately) : With common burnt clay F.P.S. (non modular) bricks of class designation 7.5				
152	Providing and fixing aluminium work for doors, windows, ventilators and partitions with extruded built up standard tubular sections/ appropriate Z sections and other sections of approved make conforming to IS: 733 and IS: 1285, fixing with dash fasteners of required dia and size, including necessary filling up the gaps at junctions, i.e. at top, bottom and sides with required EPDM rubber/ neoprene gasket etc. Aluminium sections shall be smooth, rust free, straight, mitred and jointed mechanically wherever required including cleat angle, Aluminium snap beading for glazing / paneling, C.P. brass / stainless steel screws, all complete as per architectural drawings and the directions of Engineer-in-charge. (Glazing, paneling and dash fasteners to be paid for separately) : For fixed portion For shutters of doors, windows & ventilators including providing and fixing hinges/ pivots and making provision for fixing of fittings wherever required including the cost of EPDM rubber / neoprene gasket required (Fittings shall be paid for separately) Powder coated aluminium (minimum thickness of powder coating 50 micron)	5500.00	Kg	384.50	2114750.00
153	For shutters of doors, windows & ventilators including providing and fixing hinges/ pivots and making provision for fixing of fittings wherever required including the cost of EPDM rubber / neoprene gasket required (Fittings shall be paid for separately) Powder coated aluminium (minimum thickness of powder coating 50 micron)	1250.00	kg	384.50	480625.00
154	Providing and fixing double action hydraulic floor spring of approved brand and manufacture conforming to IS : 6315, having brand logo embossed on the body / plate with double spring mechanism and door weight upto 125 kg, for doors, including cost of cutting floors, embedding in floors as required and making good the same matching to the existing floor finishing and cover	255.00	each	2054.40	523872.00

	plates with brass pivot and single piece M.S. sheet outer box with slide plate etc. complete as per the direction of Engineer-in-charge. With stainless steel cover plate minimum 1.25 mm thickness				
155	Providing and fixing 12 mm thick prelaminated particle board flat pressed three layer or graded wood particle board conforming to IS: 12823 Grade 1 Type II, in panelling fixed in aluminum doors, windows shutters and partition frames with C.P. brass / stainless steel screws etc. complete as per architectural drawings and directions of engineer-in-charge. Pre-laminated particle board with decorative lamination on both sides	750.00	Sqm	866.60	649950.00
156	Providing and fixing glazing in aluminium door, window, ventilator shutters and partitions etc. with EPDM rubber / neoprene gasket etc. complete as per the architectural drawings and the directions of engineer-in-charge.(Cost of aluminium snap beading shall be paid in basic item): With float glass panes of 5.50 mm thickness	750.00	Sqm	1003.95	752962.50
157	Providing and laying water proofing treatment in sunken portion of WCs, bathroom etc., by applying cement slurry mixed with water proofing cement compound consisting of applying : a) First layer of slurry of cement @ 0.488 kg/sqm mixed with water proofing cement compound @ 0.253 kg/sqm. This layer will be allowed to air cure for 4 hours. b) Second layer of slurry of cement @ 0.242 kg/sqm mixed with water proofing cement compound @ 0.126 kg/sqm. This layer will be allowed to air cure for 4 hours followed with water curing for 48 hours. The rate includes preparation of surface, treatment and sealing of all joints, corners, junctions of pipes and masonry with polymer mixed slurry.	525.00	Sqm	298.30	156607.50
158	Providing and laying integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces etc consisting of following operations: a) Applying a slurry coat of neat cement using 2.75 kg/sqm of cement admixed with water proofing compound conforming to IS. 2645 and approved by Engineer-in-charge over the RCC slab including adjoining walls upto 300 mm height including cleaning the surface before treatment. b) Laying brick bats with mortar using broken bricks/brick bats 25 mm to 115 mm size with 50% of cement mortar 1:5 (1 cement : 5 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge over 20 mm thick layer of cement mortar of mix 1:5 (1 cement :5 coarse sand ) admixed with water proofing compound conforming to IS : 2645 and approved	355.00	Sqm	1034.65	367300.75

	by Engineer-in-charge to required slope and treating similarly the adjoining walls upto 300 mm height including rounding of junctions of walls and slabs c) After two days of proper curing applying a second coat of cement slurry using 2.75 kg/ sqm of cement admixed jointless cement mortar of mix 1:4 (1 cement :4 coarse sand) admixed with water proofing compound conforming to IS : 2645 and approved by Engineer-in-charge including laying glass fibre cloth of approved quality in top layer of plaster and finally finishing the surface with trowel with neat cement slurry and making pattern of 300x300 mm square 3 mm deep. e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above With average thickness of 120 mm and minimum thickness at khurra as 65 mm.				
159	Grading roof for water proofing treatment with Cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)	50.00	cum	5583.80	279190.00
160	Granite work gang saw cut (polished and machine cut) of thickness 18 mm for wall lining (veneer work), backing filled with a grout of 12 mm thick average in cement mortar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 marble dust) with an admixture of pigment to match the marble shade (To be secured to the backing by means of cramps, which shall be paid for separately).	300.00	Sqm	3850.00	1155000.00
161	Providing and fixing of storage almirah made of 19mm thick commercial board, both side laminated with sunmica 1.0mm thick and making cabins, drawers etc. as per the design and drawing including fixing of fixture and fitting all complete as per direction of Engineer-In-charge. (Size of almirah not less than 2.50 sqm.)	110.00	Sqm	7582.00	834020.00
162	Providing and fixing of computer tables made of 19mm thick commercial board both side laminated with sunmica 1mm thick making cabins, drawers, piano hinges, megnatic catcher, handles, etc. with power coated sliding channel as per the design and drawing including fixing of fixture and fitting all complete as per direction of Engineer-In-charge.	50.00	Sqm	11171.60	558580.00
163	Dry cleaning of carpet with all required liquids/chemicals as per the direction of Engineer-In-Charge.	3500.00	Sqm	215.20	753200.00
164	Supply and dosing of liquid chemical chlorine (water based) IS: 11673-1996 having concentration 3% to 6% strenght packed in 20/40 ltr capapcity sealed container at booster pump DTU including labour for dosing of chlorine. (The empty container	30000.00	Ltr	15.00	450000.00



	shall be returned to the contractor).				
165	Spreading the available earth, breacking clods, watering, rolling each layer with half tonne roller for volley ball ground complete as per direction of Engineer in charge	1150.00	Sqm	93.56	107597.45
166	Diluting and injecting chemical emulsion for POSTCONSTRUCTIONAL anti-termite treatment (excluding the cost of chemical emulsion) : on wooden/brick walls complete as per Direction of Engineer in charge	555.00	Sqm	79.35	44039.25
167	Taking out existing wooden door shutter, repair by cutting, painting etc. and refixing of repaired door shutters to existing door frames, including replacement of hinges with screws, etc. as required, all complete as per the direction of the Engineer-in-charge.	500.00	Each	176.40	88200.00
168	Providing and fixing IS marked stainless steel sliding door bolts with nuts and screws etc. complete (heavy type) as approved by the engineer-in-charge. :				
	300x16 mm (Wt. not less than 300 gm)	150.00	Each	465.50	69825.00
	250x16 mm (Wt. not less than 250 gm)	350.00	Each	360.00	126000.00
169	Providing and fixing IS marked stainless steel handle with nuts and screws etc. complete : (heavy type) as approved by the engineer-in-charge.				
	125 mm (Wt. not less than 150 gm)	465.00	Each	195.50	90907.50
170	Providing and fixing IS marked Satainless Steel tower bolt, with necessary screws etc. complete(heavy type) as approved by the engineer-in-charge. :				
	300x10 mm(Wt. not less than 300 gm)	125.00	Each	195.00	24375.00
	250x10 mm(Wt. not less than 200 gm)	155.00	Each	195.00	30225.00
	200x10 mm(Wt. not less than 150 gm)	450.00	Each	195.00	87750.00
171	Providing and fixing IS marked Satainless Steel, with necessary screws etc. complete (heavy type) as approved by the engineer-in-charge. : Single rubber stopper	545.00	Each	70.00	38150.00
172	Taking out resin bonded fiber glass wool of thickness 150 mm including stacking useful material near the site and disposal un servicable material with in 300 metre lead by manual/mechanical means complete as per direction of Engineer in charge	365.00	Sqm	99.15	36189.75
173	Providing and laying resin bonded fiber glass wool of thickness 75 mm with nominal bulk density 48 kg/cum with thermal conductivty 0.0308W/mK at	165.00	Sqm	745.20	122958.00

	25°C, non combustible, nyther nore basic, chamicaly almost neutral, with PH value close to 7 complete as per direction of Engineer in charge				
174	Providing and fixing soil, wsate and vent pipes. UPVC SWR single socket pipe including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion, (i) Single socketed pipes. 63 mm diameter	85.00	Mtr	227.70	19354.50
175	Providing and fixing soil, wsate and vent pipes. UPVC single socket pipe conforming to IS : 13592 Type B 75 mm dia including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion, (i) Single socketed pipes. 75 mm diameter	320.00	Mtr	375.25	120080.00
176	Providing and fixing soil, wsate and vent pipes. UPVC single socket pipe conforming to IS : 13592 Type B 110 mm dia including jointing with seal ring conforming to IS : 5382, leaving 10 mm gap for thermal expansion, (i) Single socketed pipes. 110 mm diameter	320.00	Mtr	510.25	163280.00
177	Providing and fixing unplasticised - PVC moulded fittings/ accessories for unplasticised Rigid PVC pipes Reducing bush 110x90 mm	125.00	Each	185.25	23156.25
178	Providing and fixing unplasticised - PVC moulded fittings/ accessories for unplasticised Rigid PVC pipes coupler 110 mm	125.00	Each	191.10	23887.50
179	Taken out and refixing false ceiling after making necessaory corrections and addition of new members complete as per direction of Engineer in charge	450.00	Sqm	648.83	291973.50
180	Cleaning of 50 mm dia Flag pipe With amry papper to remove the rust, priming with ready mixed red oxide zinc chromate primer and Painting with synthetic enamel paint of approved brand and manufacture Complete as per direction of Engineer in charge	2500.00	Mtr	48.75	121875.00
181	Dismantling of wooden battons of size 2"x3" from including stacking of material with in 800 metre lead and removal of unserviceable material beyond 800 metre initial lead to dumping ground or as approved by Engineers in charge, for all leads includings all lifts involved.	952.00	Mtr	9.83	9358.16
182	Dismantling wood work board/ply in floors including stacking of material with in 800 metre lead and removal of unserviceable material beyond 800 metre initial lead to dumping ground or as approved by Engineers in charge, for all leads	1000.00	Sqm	45.83	45830.00

	including all lifts involved. For thickness of board/ply upto 19 mm thick				
183	Dismantling RCC pipes including excavation and refilling trenches after taking out the pipes, manually/ by mechanical means within 50 metre lead as per direction of Engineer-in-charge: 250 mm diameter	10.00	mtr	407.00	4070.00
184	Dismantling W.C. Pan of all sizes including disposal of dismantled materials i/c malba all complete as per directions of Engineer-in- Charge.	350.00	Each	55.45	19407.50
185	Providing and fixing white vitreous china flat back or wall corner type lipped front urinal basin of 600x400x350 mm sizes respectively with automatic flushing cistern with standard flush pipe and C.P. brass spreaders with brass unions and G.I clamps complete, including painting of fittings and brackets, cutting and making good the walls and floors wherever required : Three urinal basin with 5 litre white P.V.C. automatic flushing cistern.	25.00	Each	10054.05	251351.25
186	Providing and fixing jet spray assembly of approved make for EWC complete as per direction of Engineer - in - charge	25.00	Each	548.55	13713.75
187	Providing and fixing 125 mm CP grating for trap.	25.00	Each	52.73	1318.25
188	Providing and fixing plain elbow (ISI) of UPVC - single socket 63 mm	250.00	Each	90.38	22595.00
189	Providing and fixing door T of required degree with access door complete. UPVC - SWR single socket 110 mm	125.00	Each	292.43	36553.75
190	Providing and fixing plain T of UPVC - SWR single socket 110 mm	25.00	Each	247.65	6191.25
191	Providing and fixing UPVC trap of self cleansing design (Nahani Trap) including cost of cutting and making good the walls and floors : 110 mm inlet and 90 mm outlet without jali	85.00	Each	805.50	68467.50
192	Providing and fixing CPVC Gate valve (ball valve) of approved quality : 20 mm nominal outer dia	155.00	Each	146.40	22692.00
193	Providing and fixing uplasticised PVC connection pipe with brass unions : 60 cm length 15 mm nominal bore	150.00	Each	73.73	11059.50
194	Providing and fixing CPVC Union in CPVC pipe including jointing of pipes and Union with one step CPVC solvent cement and testing of joint complete	150.00	Each	219.30	32895.00

	as per Direction of Engineer in charge : 20 mm nominal outer dia				
195	Providing and fixing CPVC Union in CPVC pipe including jointing of pipes and Union with one step CPVC solvent cement and testing of joint complete as per Direction of Engineer in charge : 25 mm nominal outer dia	150.00	Each	250.28	37542.00
196	Providing and fixing CPVC Union in CPVC pipe including jointing of pipes and Union with one step CPVC solvent cement and testing of joint complete as per Direction of Engineer in charge : 40 mm nominal outer dia	150.00	Each	245.00	36750.00
197	Providing and fixing G.I. elbow in existing G.I. Pipe line cutting and threading including excavation, refilling the earth or cutting of wall and making good the same complete wherever required. 65 mm nominal bore	125.00	Each	365.30	45662.50
198	Providing and fixing G.I. Nipple 100 mm long in existing G.I. Pipe line cutting and threading including excavation, refilling the earth or cutting of wall and making good the same complete wherever required. 65 mm nominal bore	125.00	Each	393.83	49228.75
199	Providing and fixing G.I. Socket in existing G.I. Pipe line cutting and threading including excavation, refilling the earth or cutting of wall and making good the same complete wherever required. 65 mm nominal bore	95.00	Each	340.43	32340.85
200	Providing and fixing PTMT long body bib cock of approved quality and colour. 15mm nominal bore, 86 mm long, weighing not less than 88 gms	165.00	Each	255.00	42075.00
201	Providing and fixing PTMT centre hole basin mixer of approved quality complete as per direction of Engineer-in-charge.	30.00	Each	2000.00	60000.00
202	Providing and fixing C.P. Brass pillar cock of approved quality and colour . 15 mm nominal bore, 107 mm long, weighing not less than 110 gms	45.00	Each	680.63	30628.35
203	Providing and fixing CPVC tank connector for water tank pipe, fittings of approved quality and colour. 40mm nominal bore	175.00	Each	158.25	27693.75
204	Providing and fixing PTMT extension nipple for water tank pipe, fittings of approved quality and colour. 40mm nominal bore	198.00	Each	97.13	19231.74
205	Providing and fixing CP Brass extension nipple for water tank pipe, fittings of approved quality and colour. 20mm nominal bore	180.00	Each	67.28	12110.40

206	Taking out and Refixing 12 mm thick partial board after making necessary corrections to aluminium partitions etc complete as per direction of Engineer in charge	155.00	Sqm	297.98	46186.90
207	Taking out and refixing of glazing 5.5 mm thick in aluminium door / partition complete as per direction of Engineer in charge.	155.00	Sqm	450.25	69788.75
208	Taking out and Refixing after necessary correction and repair double action hydraulic floor spring of approved brand and manufacture conforming to IS : 6315, having brand logo embossed on the body / plate with double spring mechanism and door weight upto 125 kg, for doors, including cost of cutting floors, embedding in floors as required and making good the same matching to the existing floor finishing and cover plates with brass pivot and single piece M.S. sheet outer box with slide plate etc. complete as per the direction of Engineer-in-charge. With stainless steel cover plate minimum 1.25 mm thickness	185.00	Each	499.05	92324.25
209	Taking out and Refixing aluminum grill after making necessary corrections to aluminium partitions etc complete as per direction of Engineer in charge	255.00	Sqm	279.38	71241.90
210	Providing and fixing PTMT health faucet complete as per direction of Engineer-in-Charge.	200.00	Each	656.19	131238.00
211	Extra for cement concrete above plinth level to floor V level.	15.00	Cum	1210.83	18162.45
212	Dismantling terrazo finished dado on walls including plaster under layer complete by manually/ mechanical means including disposal of unserviceable material within 800 metres lead as per direction of Engineer-in-charge	125.00	Sqm	95.70	11962.50
213	Dismantling wood work in Almirah, cup boards, kitchen etc at different floors and stacking with in 800 metres lead as per Direction of Engineer - in - charge	500.00	Sqm	95.18	47590.00
214	Providing and fixing PTMT liquid soap container 109 mm wide, 125 mm high and 112 mm distance from wall of standard shape with bracket of the same materials with snap fittings of approved quality and colour, weighing not less than 105 gms.	500.00	Each	158.55	79275.00
215	Providing and fixing PTMT soap Dish Holder having length of 138mm, breadth 102mm, height of 75mm with concealed fitting arrangements,	500.00	Each	130.50	65250.00

	weighing not less than 106 gms.				
216	Dismantling washed stone grit plaster on extirior walls height upto 20 metres above ground level in two layers under layer 12 mm cement plaster and top layer 15 mm grit plaster including disposal of rubbish to the dumping ground within 800 metres lead. complete as per direction of engineer in charge	298.00	Sqm	186.98	55720.04
217	Dismantling of white vitreous Urinal of all sizes including stacking usefull material near the site and disposal un servicable material with in 800 metre lead by manual/mechanical means complete as per direction of engineer in charge	125.00	Each	423.75	52968.75
218	Dismantling of white vitreous wash basin of all sizes including stacking usefull material near the site and disposal un servicable material with in 800 metre lead by manual/mechanical means complete as per direction of Engineer in charge	125.00	Each	55.00	6875.00
219	Dismantling of white vitreous kitchen sink of all sizes including stacking usefull material near the site and disposal un servicable material with in 800 metre lead by manual/mechanical means complete as per direction of Engineer in charge	125.00	Each	55.00	6875.00
220	Cleaning including scrubbing of washed stone grit plaster on exterior walls height upto 20 metres above ground level with brushes, water and chamical complete as per specification and direction of engineer in charge (Rate including of scaffolding height upto 15.00 mtr.)	200.00	Sqm	106.73	21346.00
221	Removing and refixing by chain puly of black curtain walls in Auditorium after repairing and fixing of M.S. Wheels including removal of old wheels by welding, sticthing etc complete as per direction of Engineer in charge.	450.00	Sqm	151.10	67995.00
222	Shifting of good earth by tractor with in DTU campus including loading and unloading complete as per direction of Engineer in charge	200.00	Trip	517.50	103500.00
223	Providing black pvc sheet of appopreate thickness and covering the chairs of Auditorium hall by and stacking after use in the Enquiry office with in lead of 800 metre complete as per direction of engineer in charge.	570.00	Sqm	60.53	34502.10
224	Taking out and refixing of aluminum door/partition by making necassory corections Of area 3 sq. metres and below complete as per direction of Engineer in charge.	250.00	Sqm	405.45	101362.50

225	Taking out old barriers from different locations within reach of 1 kilometre manually to the work shop area and placing the same to the required locations within reach of 1 kilometre manually after repairing including addition of steel members complete as per direction of Engineer in charge.	200.00	Each	960.30	192060.00
226	Repairing and re-painting of steel almirah of size 1980x990 & 1980x900 from different locations and sending them to the work shop for repairing of handles, supporting feets, replacing of lock etc complete and refixing to the required locations complete as per direction of Engineer in charge	200.00	Each	960.30	192060.00
227	Taking out and Refixing the same wash basin with C.I. brackets, 15 mm C.P. brass pillar taps, 32 mm C.P. brass waste of standard pattern, including painting of fittings and brackets, cutting and making good the walls wherever required: White Vitreous China Wash basin size 630x450 mm with a pair of 15 mm C.P. brass pillar tap	350.00	Each	155.20	54320.00
228	Taking out and Refixing the same white vitreous china flat back or wall corner type lipped front urinal basin of 430x260x350 mm and 340x410x265 mm sizes respectively with automatic flushing cistern with standard flush pipe and C.P. brass spreaders with brass unions and G.I clamps complete, including painting of fittings and brackets, cutting and making good the walls and floors wherever required : One urinal basin with 5 litre white P.V.C. automatic flushing cistern	152.00	Each	250.55	38083.60
229	Supply of 1st quality PVC curing pipe for horticulture	500.00	Kg	104.55	52275.00
230	Providing and fixing white vitreous Urinal channel of size 600x100 mm including cutting and making good the floors wherever required complete as per direction of engineer in charge	25.00	Mtr	950.25	23756.25
231	Providing and fixing of Modular kitchen made of 19mm thick commercial board, both side laminated with sunmica 1.0mm thick, SS tray and making cabins, drawers etc. as per the design and drawing including fixing of fixture and fitting all complete as per direction of Engineer-In-charge.	45.00	Sqm	11798.83	530947.35
232	Providing barrier of size 2430x1550 by using M.S. Pipe of dia 48 mm, M.S. sheet 3 mm thick, M.S. IRC fabric and M.S. wheels including applying a priming coat of approved steel primer, painting with synthetic enamel paint of approved brand to give an even shade: two or more coats over an under coat of suitable shade with ordinary paint of approved brand, writing DTU CAMPUS in hindi & english on both sides of board and placing them	30.00	Each	15000.00	450000.00

	to the required position with in a lead of 1 Kilometre complete as per direction of Engineer in charge				
233	Providing and fixing by rivets circular shape safety sign board of dia 300 mm of approved material and writing matter on road safety barrier complete as per direction of Engineer in charge	150.00	Each	560.18	84027.00
234	Providing and fixing by rivets Triangular shape safety sign board of approved size material and writing matter on road safety barrier complete as per direction of Engineer in charge	150.00	Each	469.50	70425.00
235	Extra for providing and laying glazed ceramic floor tiles of size 400x400 mm instead of size 300x300 mm	1050.00	Sqm	96.00	100800.00
236	Extra for Providing and fixing special quality, size and design of rectified ceramic glazed wall tiles	1050.00	Sqm	160.05	168052.50
237	Providing hydraulic excavator (3D) with driver and fuel for cutting, levelling of surface etc. complete for proper completion of work as per direction of Engineer-in-charge.	55.00	Per Day	8535.53	469454.15
238	Providing and fixing 50/60 mm thick Puf roof pannel with 0.5 mm precoated galvanised iron profile sheets (size, shape and pitch of corrugation as approved by Engineer-in-charge) 0.50 mm (+ 0.05 %) total coated thickness with zinc coating 120 grams per sqm as per IS: 277, in 240 mpa steel grade, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 microns. The sheet shall be fixed using self drilling / self tapping screws of size (5.5x 55 mm) with EPDM seal, complete upto any pitch in horizontal/ vertical or curved surfaces, excluding the cost of purlins, rafters and trusses and including cutting to size and shape wherever required. with Puf density of 40 kg/cum (+2 kg/cum) (make: Llyod equivalent)	300.00	Sqm	2350.00	705000.00
239	Extra for using Electric resistance or induction butt welded tubes instead of Hot finished welded type tubes	10000.00	Kg	18.15	181500.00
240	Providing and fixing Roto road barrier of Neel kamal make of size :1480x1000 mm complete as per direction of engineer-in-charge.	20.00	Each	4534.65	90693.00
241	Providing and fixing pressed steel door frames conforming to IS: 4351, manufactured from commercial mild steel sheet of 1.60 mm thickness, including hinges, jamb, lock jamb, bead and if required angle threshold of mild steel angle of section 50x25 mm, or base ties of 1.60 mm,	20.00	Metre	381.10	7622.00



	pressed mild steel welded or rigidly fixed together by mechanical means, including M.S. pressed butt hinges 2.5 mm thick with mortar guards, lock strikeplate and shock absorbers as specified and applying a coat of approved steel primer after pre-treatment of the surface as directed by Engineer-in-charge: Profile B Fixing with carbon steel galvanised dash fastener of required dia and size (to be paid for separately)				
242	Providing and fixing unplasticised -PVC pipe clips of approved design to unplasticised - PVC rain water pipes by means of 50x50x50 mm hard wood plugs, screwed with M.S. screws of required length, including cutting brick work and fixing in cement mortar 1:4 (1 cement : 4 coarse sand) and making good the wall etc. complete. 110 mm	125.00	Each	195.00	24375.00
243	6 mm cement plaster of mix : 1:3 (1 cement : 3 fine sand)	165.00	Sqm	143.80	23727.00
244	Neat cement punning	135.60	Sqm	42.60	5776.56
245	Finishing with Deluxe Multi surface paint system for interiors and exteriors using Primer as per manufacturers specifications : Two or more coats applied on walls @ 1.25 ltr/10 sqm over and including one coat of Special primer applied @ 0.75 ltr /10 sqm (Rate including of scaffolding height upto 15.00 mtr.)	250.00	Sqm	103.20	25800.00
246	Dismantling C.I. or asbestos rain water pipe with fittings and clamps including stacking the material within 50 metres lead : 100 mm dia pipe	250.00	Mtr	29.50	7375.00
247	Providing and fixing G.I. pipes complete with G.I. fittings and clamps, i/c cutting and making good the walls etc. Internal work - Exposed on wall 50 mm dia nominal bore	165.00	Mtr	543.80	89727.00
248	Providing and fixing G.I. Union in G.I. pipe including cutting and threading the pipe and making long screws etc. complete (New work) : 40 mm nominal bore	255.00	Each	326.20	83181.00
249	Providing and fixing IS marked Stainless Steel tower bolt, with necessary screws etc. complete complete as per direction of engineer in charge. : 150x10 mm	125.00	Each	204.10	25512.50
250	Providing and fixing of G.I. saction 16 Gauge steel door frame including M.S. pressed butt hinges specified and applying a coat of approved steel primer as directed by Engineer in charge.	55.00	Metre	248.70	13678.50

251	Providing and fixing carbon steel galvanised ( minimum coating 5 micron) dash fastener of 10 mm dia double threaded 6.8 grade (yield strength 480 N/mm <sup>2</sup> ), counter sunk head, comprising of 10 m dia polyamide PA 6 grade sleeve, including drilling of hole in frame , concrete/ masonry, etc. as per direction of Engineer-in-charge. 16 x 200 mm	365.00	Each	227.90	83183.50
252	Providing and fixing carbon steel galvanised ( minimum coating 5 micron) dash fastener of 10 mm dia double threaded 6.8 grade (yield strength 480 N/mm <sup>2</sup> ), counter sunk head, comprising of 10 m dia polyamide PA 6 grade sleeve, including drilling of hole in frame , concrete/ masonry, etc. as per direction of Engineer-in-charge. 10 x 120 mm	110.00	Each	89.50	9845.00
253	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, i/c fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and the cost of cutting chases and making good the same including testing of joints complete as per direction of Engineer in Charge. Concealed work, including cutting chases and making good the walls 25 mm nominal outer dia Pipes	450.00	Mtr	362.40	163080.00
254	Providing and fixing ball valve (brass) of approved quality, High or low pressure, with plastic floats complete : 20 mm nominal bore	125.00	Each	422.80	52850.00
255	Providing and fixing CP Brass two in one mixture pillar cock of approved quality conforming to IS standards and weighing not less than 690 gms. 15 mm nominal bore	25.00	Each	3353.00	83825.00
256	Providing and fixing WC seat cover complete as per direction of Engineer-in-Charge.	55.00	Each	924.70	50858.50
257	Providing and fixing UPVC Reducing bush of size 90x63mm complete as per direction of Engineer-in-Charge.	25.00	Each	205.00	5125.00
258	Providing and fixing Head shower with 15 or 20 mm inlet : 85 mm diameter	56.00	Each	671.25	37590.00
259	Providing and fixing G.I. Nipple 100 mm long in existing G.I. Pipe line cutting and threading including excavation, refilling the earth or cutting of wall and making good the same complete wherever required. 20 mm nominal bore	55.00	Each	354.40	19492.00

260	Providing and fixing C.I. Cover with frame for manholes C.I. Cover 300x300 mm (heavy duty)	45.00	Each	772.50	34762.50
261	Taking out and Refixing white vitreous china pedestal type water closet (European type W.C. pan) with seat and lid, 10 litre low level white P.V.C.flushing cistern, including flush pipe, with manually controlled device(handle lever), conforming to IS : 7231, with all fittings and fixturescomplete, including cutting and making good the walls and floors whereverrequired : W.C. pan with ISI marked white solid plastic seat and lid	50.00	Each	1350.25	67512.50
262	Providing and fixing Stainless steel towel rod complete as per direction of Engineer in charge.	100.00	Each	755.00	75500.00
263	Dismantling of fly proof stainless steel grade 304 wire gauge, to windows and clerestory windows using wire gauge with average width of aperture 1.4 mm in both directions with wire of dia. 0.50 mm all complete. With 12 mm mild steel U beading	125.00	Sqm	353.00	44125.00
264	Providing and fixing C.P. waste Jali 32 mm dia complete as per direction of Engineer - in - charge.	56.00	Each	284.50	15932.00
265	Providing and fixing CP Brass extension nipple 15x50 mm complete as per direction of Engineer - in - charge.	154.00	Each	291.60	44906.40
266	Providing M.S. Piano hinges ISI marked IS : 3818 finished with nickel plating and fixing with necessary screws etc., complete. Overall width 35 mm	125.00	Mtr	175.00	21875.00
267	Hiring of super suction machine with with all required equipments and labours for cleaning of existing sewer line by mechanical meanse on daily basis charges all job complete as per dirrection of engineer-in-charge.	10.00	Each	38,500.00	385000.00
268	Providing and fixing wooden showcase (box type) made of 19 mm thick commercial board, both side laminated with sunmica 1 mm thick 5 mm thick glass and making cabins, drawers etc. all complete as per direction of Engineer-In-charge.	15.00	Sqm	12105.00	181575.00
269	Providing and fixing wooden shoe rack (box type) made of 19 mm thick commercial board, both side laminated with sunmica 1 mm thick 5 mm thick glass and making cabins, drawers etc. all complete as per direction of Engineer-In-charge.	10.05	Sqm	9343.00	93897.15
270	Providing and fixing wooden wall cabinet (box type) made of 19 mm thick commercial board, both	50.00	Sqm	9434.00	471700.00

	side laminated with sunmica 1 mm thick 5 mm thick glass and making cabins, drawers etc. all complete as per direction of Engineer-In-charge.				
271	Providing and fixing of roller blinds of 100mm thick stripes in superior quality, approved make & shade at desired locations as per required window size all complete as per direction of Engineer-In-charge.	400.00	Sqm	2035.00	814000.00
272	Disposal of building rubbish / malba / similar unserviceable, dismantled or waste materials by mechanical means, including loading, transporting, unloading to approved municipal dumping ground or as approved by Engineer-in-charge, beyond 50 m initial lead, for all leads including all lifts involved.	1000.00	Cum	127.60	127600.00
273	Providing and fixing S.S. bib cock of approved quality conforming to IS standards and weighing not less than 690 gms. 15 mm nominal bore	125.00	each	645.00	80625.00
274	Providing and fixing S.S. two way shot body bib cock of approved quality conforming to IS standards and weighing not less than 690 gms. 15 mm nominal bore	50.00	each	850.00	42500.00
275	Providing and fixing S.S. two way angle cock of approved quality conforming to IS standards and weighing not less than 690 gms. 15 mm nominal bore	50.00	each	850.00	42500.00
276	Providing and fixing S.S. concealed stop cock of approved quality conforming to IS standards and weighing not less than 690 gms. 15 mm nominal bore	50.00	each	902.00	45100.00
277	Providing and fixing S.S. swan neck angle cock of approved quality conforming to IS standards and weighing not less than 690 gms. 15 mm nominal bore	50.00	each	750.00	37500.00
278	Providing and fixing S.S. shower of approved make and approved quality i.e. C.P pipe etc complete as per direction of Engineer-in-charge. 15mm nominal bore	200.00	each	262.50	52500.00
279	Providing and fixing of solar reflective film or frosted film of superior quality (Garware or equivalent make) on glass panes to protect direct sun rays including scaffolding etc. all complete as per the direction of Engineer-In-Charge.	450.00	sqm	607.00	273150.00
280	Providing and fixing premium range of Laminate Wooden Flooring made up of High Density Fibre Board of E1 Standards of 8.3mm thickness with	250.00	sqm	2544.00	636000.00

	surface finface finish of EIR-Embossed in Registered/Special Synchronised surface-Four side V groove having overlay of Highly resistant surface Impregnated with Melamine Resins and Aluminium Oxide, all complete, as per the direction of Engineer-In-Charge.				
281	Dismantling aluminium/ Gypsum partitions, doors, windows, fixed glazing and false ceiling including disposal of unserviceable surplus material and stacking of serviceable material within 50 meters lead as directed by Engineer-in-charge.	125.00	Sqm	22.00	2750.00
282	Providing and fixing PVC flooring size of 40-50 mm thickness on C:C flooring as directed by Engineer-in-charge.	150.00	Sqm	660.00	99000.00
283	Providing and laying 60mm thick factory made cement concrete interlocking paver block of M -30 grade made by block making machine with strong vibratory compaction, of approved size, design & shape, laid in required colour and pattern over and including 50mm thick compacted bed of coarse sand, filling the joints with line sand etc. all complete as per the direction of Engineer-in-charge	350.00	Sqm	615.70	215495.00
284	Providing and laying at or near ground level factory made kerb stone of M-25 grade cement concrete in position to the required line, level and curvature, jointed with cement mortar 1:3 (1 cement: 3 coarse sand), including making joints with or without grooves (thickness of joints except at sharp curve shall not be more than 5mm), including making drainage opening wherever required complete etc. as per direction of Engineer-in-charge (length of finished kerb edging shall be measured for payment). (Precast C.C. kerb stone shall be approved by Engineer-in-charge).	50.00	cum	5012.65	250632.50
285	Providing and laying APP (Atactic Polypropylene Polymer) modified prefabricated five layer 3 mm thick water proofing membrane, black finished reinforced with non-woven polyester matt consisting of a coat of bitumen primer for bitumen membrane @ 0.40 litre/sqm by the same membrane manufacture of density at 25°C, 0.87-0.89 kg/ litre and viscosity 70-160 cps. Over the primer coat the layer of membrane shall be laid using Butane Torch and sealing all joints etc, and preparing the surface complete. The vital physical and chemical parameters of the membrane shall be as under : Joint strength in longitudinal and transverse direction at 23°C as 650/ 450N/5cm. Tear strength in longitudinal and transverse direction as 300/250N. Softening point of membrane not less than 150°C. Cold flexibility shall be upto -2°C when tested in accordance with	1200.00	sqm	417.10	500520.00

	ASTM, D - 5147. The laying of membrane shall be got done through the authorised applicator of the manufacturer of membrane : 3 mm thick				
286	Aluminium composite panel sheet (ACP) based digital signage including ACP sheet of thickness 3mm . The Face of ACP sheet is duly covered with vinyle Digitally printed. The digital vinyle is also covered with Laminated film (gloss/mat quality) for enhancing the life of the The print. The complete signage is fixed at sites directed by the officer in-charge. It includes completehardware/transportation And labour charges.	55.43	sqm	3820.00	211750.00
287	Providing and fixing SS name plates with itching including SS sheet 304 grade have an elegant seamless finish And are made from top grade ,The SS sheet is duly itched Through a chemical process as per the given text. The itched Part is filled with enamel paint. The SS contains chromium Which made it resistance to tarnishing and rust.It is Capable of with standing adverse weather conditions. The SS plate is fixed at the given site with required hardware.	25.00	sqm	19705.00	492625.00
288	Renovation of sofa set including providing of tat, cotton, jute, marking cloth, niwar dori, spring etc. all Complete and providing and fixing of foam/p.u. cusion of appropriate size and thickness wherever required and change of superior quality cloth /leather foam including lacure polishinh/painting of wooden portion of frame of sofa set/dining chairs.				
	Renovation of cushioned office chairs steel/wooden	125.00	Each	1690.00	211250.00
	Sofa set per seat	125.00	Each	2250.00	281250.00
290	Providing and fixing stainless steel ( Grade 304) railing made of Hollow tubes, channels, plates etc., including welding, grinding, buffing, polishing and making curvature (wherever required) and fitting the same with necessary stainless steel nuts and bolts complete, i/c fixing the railing with necessary accessories & stainless steel dash fasteners , stainless steel bolts etc., of required size, on the top of the floor or the side of waist slab with suitable arrangement as per approval of Engineer- ncharge, (for payment purpose only weight of stainless steel members shall be considered excluding fixing accessories such as nuts, bolts, fasteners etc.).	1200.00	Kg	472.40	566880.00
291	Finishing walls with textured exterior paint of required Shade: New work (Two or more coats applied @ 3.28 ltr/10 sqm) over and including priming coat of exterior primer applied @ 2.20kg/10 sqm	800.00	sqm	150.65	120520.00

	(Rate including of scaffolding height upto 15.00 mtr.)				
292	Reparing of exisitng revolving chairs by changing of hydrulic as approved by engineer in charge all complete i/c labour materials charges as per direction of engineer-in-charge.	350.00	each	1200.00	420000.00
293	Providing and fixing soft Board cum Pin Board including soft board 8mm thickness having Non-woven velvet cloth. Board have backside Covered with laminate sheet , Board frame of Aluminum anodized up to 50 micron with 4 Molded ABS corner made from 100% virgin ABS material. The pin up board is to be provided With necessary fitting clamps, It also includes Hardware & fitting, cartage charges at site.	110.00	sqm	2101.00	231110.00
294	Providing and laying autoclaved aerated cement blocks masonry with 150mm/230mm/300 mm thick AAC blocks in super structure above plinth level up to floor V level with RCC band at sill level and lintel level with approved block laying polymer modified adhesive mortar all complete as per direction of Engineer- in- Charge. (The payment of RCC band and reinforcement shall be made for separately).	300.00	Cum	5687.10	1706130.00
295	Brick work with non modular fly ash bricks conforming to IS:12894, class designation 10 average compressive strength in super structure above plinth level up to floor V level in : Cement mortar 1:6 (1 cement : 6 coarse sand)	195.00	Cum	5269.05	1027464.75
296	Providing and fixing workstation/Computer table made of 19 mm thick block board with 1.00 mm thick sunmica both side with drawers and keyboard tray with channel and egde banding tape all complete and approved by Engineer-in-charge. (Size: 900mmX600mmX750MM)	25.00	Each	13500.00	337500.00
297	Washed stone grit plaster on exterior walls height upto 10 metre above ground level, in two layers, under layer 12 mm cement plaster 1:4 (1 cement : 4 coarse sand ), furrowing the under layer with scratching tool, applying cement slurry on the under layer @ 2 Kg of cement per square metre, top layer 15 mm cement plaster 1:1/ 2:2 (1 cement: 1/2 coarse sand : 2 stone chipping 10 mm nominal size), in panels with groove all around as per approved pattern, including scrubbing and washing the top layer with brushes and water to expose the stone chippings ,complete as per specification and direction of Engineer-in- charge (payment for providing grooves shall be made separately). (Rtae including scaffolding upto height 15.00 mtr.)	400.00	sqm	582.60	233040.00

298	Providing and fixing Glass mosaic tiles on finished plain wall surface of size 20 mm x 20 mm x 4 mm in all colour, design, fixing in customize design as per direction of Engineer-in-Charge. The glass mosaic tiles to be fixed on the wall surface with the help of approved adhesive applied at the rate of 2.5 kg per sqm and grouting of the same. The rate is inclusive of all operation, material and required pattern approved by Engineer-in-Charge:	50	sqm	1603.75	80187.50
299	Providing and fixing white vitreous china pedestal type water closet (European type W.C. pan) conforming to IS : 7231, with all fittings and fixtures complete, including cutting and making good the walls and floors wherever required : Make - Jaquar. W.C. pan with ISI marked white solid plastic seat and lid	18.00	Pcs	13406.30	241313.40
300	Providing and fixing white vitreous china flat back or wall corner type lipped front urinal basin of any size respectively with automatic flushing cistern with standard flush pipe and C.P. brass spreaders with brass unions and G.I clamps complete, including painting of fittings and brackets, cutting and making good the walls and floors wherever required : Make - Jaquar One urinal basin	10.00	Pcs	14425.40	144254.00
301	Providing and fixing wash basin with C.I. brackets including painting of fittings and brackets, cutting and making good the walls wherever required. White Vitreous China Flat back wash basin as per direction of engineer-in-charge.	19.00	Pcs	10423.70	198050.30
302	Providing and fixing health faucet complete as per direction of Engineer-in-Charge. Make- Jaquar	19.00	Pcs	1538.62	29233.78
303	Providing and fixing C.P. spout of approved quality and colour as per direction of engineer-in-charge. 15 mm nominal bore. Make - Jaquar	19.00	Pcs	2062.20	39181.80
304	Providing and fixing C.P. Brass pillar cock of approved quality and colour as per direction of engineer-in-charge. 15 mm nominal bore. Make - Jaquar	19.00	Pcs	3600.80	68415.20
305	Providing and fixing C.P. shower with arm of approved quality and colour as per direction of engineer-in-charge. 15 mm nominal bore. Make - Jaquar	19.00	Pcs	6255.90	118862.10
306	Providing and fixing C.P. cap 15 mm for bib cock and stop cock. Make - Jaquar	110.00	Pcs	95.00	10450.00



307	Providing and fixing C.P.angle cock of approved quality and colour as per direction of engineer-in-charge. 15 mm nominal bore. Make - Jaquar	20.00	Pcs	507.20	10144.00
308	Providing and fixing C.P. waste jali of approved quality as per direction of engineer-in-charge. 150 mm	20.00	Pcs	757.40	15148.00
309	Providing and fixing C.P. bottle trap of approved quality as per direction of engineer-in-charge. Make- Jaquar	20.00	Pcs	1566.80	31336.00
310	Providing and fixing uplasticised PVC connection pipe with brass unions : 45 cm length 15 mm nominal bore. Make- Jaquar	20.00	Pcs	234.40	4688.00
311	Providing and fixing C.P. flush valve of approved quality as per direction of engineer-in-charge. Make: Jaquar	9.00	Pcs	3714.50	33430.50
312	Providing and fixing C.P. angular stop cock regulating valve of approved quality as per direction of engineer-in-charge. Make: Jaquar	18.00	Pcs	856.10	15409.80
313	Providing and fixing Urinal without sensor of approved quality as per direction of engineer-in-charge. Make: Jaquar	2.00	Pcs	13712.80	27425.60
314	Providing and fixing Upvc pipes, having thermal stability for hot & cold water supply including all CPVC plain & brass threaded fittings This includes jointing of pipes & fittings with one step CPVC solvent cement, trenching, refilling & testing of joints complete as per direction of Engineer in Charge. External work				
314.1	100 mm nominal inner dia Pipes	600.00	Mtr.	1250.00	750000.00
314.2	150 mm nominal inner dia Pipes	350.00	Mtr.	1350.00	472500.00
315	Providing and fixing Upvc socket in upvc pipeline all complete as per direction of Engineer-in-charge.				
	150 mm dia	120.00	Each	425.00	51000.00
	100 mm dia	80.00	Each	325.00	26000.00
316	Providing and fixing Upvc elbow in upvc pipeline all complete as per direction of Engineer-in-charge.				
	150 mm dia	100.00	Each	455.00	45500.00
	100 mm dia	80.00	Each	340.00	27200.00
317	Providing and fixing Upvc tee in upvc pipeline all complete as per direction of Engineer-in-charge.				
	150 mm dia	70.00	Each	1125.00	78750.00
	100 mm dia	45.00	Each	985.00	44325.00
318	Making trenchless passage and embedding pipes	827.97	Mtr.	750.00	620973.75

	up to 150 mm diameter in road with rigger machine including labour and machineries all complete as per direction of engineer in charge.				
				Total	69964283.58
				Less 9.50% cost index	-6646606.94
				Total	63317676.64
				Add 12.75% cost index	8073003.77
				Total	71390680.41
				Say	71390680.00

PART-B  
For  
Electrical  
&  
Mechanical Works

**ELIGIBILITY CRITERIA FOR MAIN CONTRACTOR WITH RESPECT TO ASSOCIATED E&M CONTRACTOR TO BE ENGAGED BY MAIN CONTRACTOR FOR EXECUTING THE E&M Works**

1. For the electrical work of Internal electric installation, external lighting and water supply pump sets the composite category contractor of appropriate class and category will only be eligible for doing the work. The eligible main contractor if not registered in CPWD composite category of appropriate class, can associate CPWD registered contractor of appropriate class and category for doing the work mentioned above. The sub-contractor should have valid electrical License.
2. For the E and M of Sub-station , DG sets, Firefighting, fire alarm, lifts, HVAC, UPS, BMS, EPBAX, LAN networking, CCTV and Access control works, High mast lighting, Solar Water Heating Work, shall be executed by the main contractor through association of specialized agencies/firms duly approved by the Engineer-in-Charge for electrical component as per the eligibility criteria as below for the different sub- heads, by executing tripartite agreement between the main contractor, department and specialized agency.
3. For the different E&M , the main contractor will have to engage the associate E&M contractor/specialized Contractor in the field as per following eligibility criteria :

A. For works of List II A and List II B of (Except DG Sets, SubStation works):

Three similar works each of value not less than 40% of the estimated cost put to tender. OR

Two similar works each of value not less than 60% of the estimated cost put to tender. OR

One similar work of value not less than 80% of the estimated cost put to tender. All amounts rounded off to a nearest convenient figure.

B. For works of DG Sets, Sub-Station works:

Three similar works each of value not less than 40% of the estimated cost put to tender with capacity of individual DG Set/transformer being 80% of individual capacity (rounded off to next available higher capacity) of the equipment i.e. DG Set/ transformer proposed in NIT.

OR

Two similar works each of value not less than 60% of the estimated cost put to tender with capacity of individual DG Set/transformer being 80% of individual capacity (rounded off to next available higher capacity) of the equipment i.e. DG Set// transformer proposed in NIT.

OR

One similar work of value not less than 80% of the estimated cost put to tender with capacity of individual DG Set/Chiller/transformer being 80% of individual capacity (rounded off to next available higher capacity) of the equipment i.e. DG Set/ transformer proposed in NIT.

All amounts rounded off to a nearest convenient figure.

4. The Composite category contractor is also be eligible to carry out himself/herself any or all of these works without associating any specialized agency provided:
  - (a) He fulfills the prescribed eligibility criteria respectively for these work(s). OR

- (b) He directly procures the equipment of approved make from manufacturer and gets it installed from authorized agency/service provider of the manufacturer or specialized agency as per criteria mentioned in NIT.
5. After award of work and before the first milestone, the main contractor will have to submit Name /s of the proposed associate contractor (for each of the E&M works), who fulfill set eligibility criteria for the relevant sub-head. The documents will have to be submitted in detail as required, which will be checked as per NIT for approval of the associate contractors. It will be essential that proposed E&M associate agencies qualify for each sub-head as eligibility criteria given in NIT.
  6. The department reserves the right to allow the main firm to submit additional Documents /additional names of the associates in case of the deficiencies in documents or in case of no associate getting qualified in respect of certain subheads. The same will have to be complied with the main contractor within the time allowed. The decision of the department shall be firm & binding on the intending bidders.
  7. The Composite Contractor and the associated specialized agencies is to give required affidavit to confirm their association. The main firm should submit the willingness from eligible E&M contractors to get associated with them for execution of the E&M component of works in wholesome manner and as per the conditions set out in the MOU to be entered into, between the one who is awarded the work and the associated eligible E&M contractor, as per the enclosed proforma.
  8. In support of the eligibility conditions of the proposed associated E&M contractor, copy of their registration documents, E&M Contractor electrical License, GST documents, eligibility documents the eligibility by competent authority. Such associate E&M contractor will certify that they are not debarred as on the day of application for sale of tender.
  9. In event of the concerned E&M Contractor not performing satisfactorily or failure of associate/sub-contractor to complete the E&M work, the main contractor on the written direction of the department, shall remove the Associate/sub-contractor deployed on the work and shall submit name of new associate who fulfills the conditions mentioned in NIT to execute the leftover work without any loss of time or variation in cost to the department in this regard. Such associates shall also enter into Agreement with the main tenderer shall meet all the guarantee for the equipment's already supplied for which payment has been released by the department in part. If any equipment supplied for the work, during the currency of the earlier Associate/sub-contractor and paid partly by the department becomes redundant /not in a position to be installed and commissioned and put to beneficial use due to change in Contractor for execution of E&M work, the main contractor shall be liable for replacement of the equipment(S) at no cost to Department. The tender accepting authority can approve the change of Sub- Agency in case it is required during the currency of the contract.
  10. Executive Engineer (E) shall be the Engineer-in-charge as far as E&M works are concerned.
  11. The main contractor shall be responsible and liable for proper and complete execution of the E&M work and ensure coordination and completion of both civil and E&M work.
  12. The main contractor has to enter into MoU with contractor(s) associated by him for execution of E&M subheads. Copy of such MoU shall be submitted to EE(E) in charge as well as to EE(C) In case of change of associate contractor, the main contractor has to enter into MoU/agreement with the new contractor associated by him.

13. The associate or sub-contractor shall attend the inspection of the work by the Engineer-in-charge of E&M works as and when required. The agencies executing the E&M work should have valid license for LT/HT as applicable and as described in eligibility criteria.
14. The main firm should either himself meet the eligibility conditions for the respective E&M packages or otherwise he will have to associate with other contractor meeting the eligibility requirements given above.
15. Verifiable completion certificates of (individual works separately) (except LV works) duly attested by the applicant shall be submitted. Valid Electrical Contractor license, as the case may be, duly countersigned by the applicant as well as signed by the associate contractors shall also be submitted. Self-attested GST registration documents in respect of the associated agencies as well as signed by associate firms shall be submitted. The main Contractor will submit eligibility documents of Associate Contractor separately for all specialized E&M Sub Heads. In case the completion certificate is issued by private organization the firm has to submit the complete TDS detail to verify the payments made for the respective work.

**FORM – ‘A’****WILLINGNESS CERTIFICATE FROM CONCERNED COMPETENT E & M CONTRACTOR**  
(Separate for each sub head of E&M work)

Name of Work:

I hereby give my willingness to work as E & M contractor for the above mentioned work.

I will execute the work as per specifications and conditions for the agreement and as per direction of the Engineer-in-Charge. Also, I will employ full time technically qualified supervisors for the works. I will attend inspection of officers of the department as and when required.

Dated:

Signature of Main Contractor

Signature of Associate  
E&M Contractor and  
Registration detail

# MEMORANDUM OF UNDERSTANDING [M.O.U] BETWEEN

(Separate for each sub head of E&M work)

- 1] M/S [Name of the firm with full address] [Henceforth called the main contractor]
- And
- 2] M/S [Name of the firm with full address]  
[Henceforth, called Associated E&M Contractor or E&M Contractor]

For the execution of Electrical Work:

We state that M.O.U between us will be treated as an agreement and has legality as per Indian Contract Act [amended upto date] and the department [CPWD] can enforce all the terms and conditions of the agreement for execution of the above work. Both of us shall be responsible for the execution of work as per the agreement to the extent this MOU allows. In case of any dispute, either of us will go for mediation/arbitration by the Pr. Chief Engineer, PWD, Delhi & Chief Engineer (Projects), PWD, Delhi. Any of us may appeal against the mediation/arbitration to the Pr. Chief Engineer, PWD, Delhi his decision shall be final and binding on both of us. We have agreed as under:

- 1 The E&M contractor will execute all E&M works in the wholesome manner as per terms and conditions of the agreement. The E&M contractor shall be paid as per standard procedure followed by the department and the agreement between parties. Any type of internal transaction between the E&M contractor and the main contractor shall be as per their convenience and mutual understanding without involving the department.
- 2 The E&M contractor shall be liable for disciplinary action if he failed to discharge the action[s] and other legal action as per agreement.
- 3 All the machinery and equipment's, tools and tackles required for execution of the E&M works, as per agreement, shall be the responsibility of the E&M contractor.
- 4 The site staff required for the E&M work shall be arranged by the E&M contractor as per terms and conditions of the agreement.
- 5 Site order book maintained for the said work shall be signed by the main contractor as well as by the Engineer of the Associated Contractor and by Associated Contractor himself.
- 6 All the correspondence regarding execution of the E&M work shall be done by the Department with the Associated Contractor with a copy to the main contractor. In case of non-compliance of the provisions of agreement, the main contractor, as well as the associated contractor shall be responsible. The action under clauses 2 and 3 shall be initiated and taken against the main contractor.

\* Name of SH to be indicated by firm.

SIGNATURE OF MAIN CONTRACTOR

Date:

Place:

SIGNATURE OF  
ASSOCIATED E&M  
CONTRACTOR.

Date:

Place:

COUNTERSIGNED  
EXECUTIVE  
ENGINEER



### SCHEDULE OF WORK

**Name of Work:** RMO various Electrical and Mechanical works (Internal and External) at Delhi Technological University, Bawana Road, Delhi, During 2019-20

Sl.No	Description of Work / Items	Qty	Units	Rate	Amount
1.00	Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed medium class steel conduit,with piano type switch, phenolic laminated sheet, suitable size M.S. box and earthing the point with 1.5 sq.mm. FRLS PVC insulated copper conductor single core cable etc as required. Group C	500.0	Point	994	497000
2.00	Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed steel conduit, with modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable etc. as required. Group C	500.0	Point	1037	518500
3.00	Wiring for light/ power plug with 2X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed steel conduit alongwith 1 No. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required	1200.0	mtrs	239	286800
4.00	Wiring for light/ power plug with 4X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed steel conduit alongwith 2 No. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required	1000.0	mtrs	366	366000
5.00	Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed medium class PVC conduit,with piano type switch, phenolic laminated sheet, suitable size M.S. box and earthing the point with 1.5 sq.mm. FRLS PVC insulated copper conductor single core cable etc as required. Group B	200.0	Point	793	158600
6.00	Wiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable in surface / recessed PVC conduit, with modular switch, modular plate, suitable GI box and earthing the point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable etc. as required. Group A	400.0	Point	659	263600
7.00	Wiring for light/ power plug with 2X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed PVC conduit alongwith 1 No. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required	2000.0	mtrs	168	336000
8.00	Wiring for light/ power plug with 4X4 sq. mm FRLS PVC insulated copper conductor single core cable in surface/ recessed PVC conduit alongwith 2 No. 4 sq. mm FRLS PVC insulated copper conductor single core cable for loop earthing as required	800.0	mtrs	281	224800

9.00	Wiring for circuit/ submain wiring alongwith earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed medium class PVC conduit as required.				
a)	2 X 1.5 sq. mm + 1 X 1.5 sq. mm earth wire	1000.0	mtrs	112	112000
b)	2 X 2.5 sq. mm + 1 X 2.5 sq. mm earth wire	500.0	mtrs	137	68500
c)	2 X 4 sq. mm + 1 X 4 sq. mm earth wire	1500.0	mtrs	168	252000
d)	2 X 6 sq. mm + 1 X 6 sq. mm earth wire	1500.0	mtrs	227	340500
e)	2 X 10 sq. mm + 1 X 6 sq. mm earth wire	200.0	mtrs	294	58800
f)	2 X 16 sq. mm + 1 X 6 sq. mm earth wire	200.0	mtrs	408	81600
10.00	Rewiring for light point/ fan point/ exhaust fan point/ call bell point with 1.5 sq.mm FRLS PVC insulated copper conductor single core cable and 1.5 sq.mm FRLS PVC insulatedcopper conductor single core cable as earth wire in existing surface/ recessed steel/PVC conduit including dismantling as required.. Group C	500.0	Point	290	145000
10.01	Group A	500.0	point	323	161500
10.02	Group B	300.0	point	452	135600
11.00	Supplying and drawing following sizes of FRLS PVC insulated copper conductor, single core cable in the existing surface/recessed steel/ PVC conduit as required				
a)	2 X 1.5 sq. mm + 1 X 1.5 sq. mm earth wire	1000.0	mtrs	50	50000
b)	2 X 2.5 sq. mm + 1 X 2.5 sq. mm earth wire	400.0	mtrs	75	30000
c)	2 X 4 sq. mm + 1 X 4 sq. mm earth wire	1000.0	mtrs	111	111000
d)	2 X 6 sq. mm + 1 X 6 sq. mm earth wire	1000.0	mtrs	162	162000
12.00	Supplying and fixing of following sizes of steel conduit along with accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required				
a)	20 mm	200.0	mtrs	126	25200
b)	25 mm	400.0	mtrs	147	58800
c)	32 mm	100.0	mtrs	198	19800
13.00	Supplying and fixing of following sizes of PVC conduit along with accessories in surface/recess including painting in case of surface conduit, or cutting the wall and making good the same in case of recessed conduit as required				
a)	20 mm	250.0	mtrs	57	14250
b)	25 mm	700.0	mtrs	69	48300
c)	32 mm	100.0	mtrs	89	8900
14.00	Supplying and fixing metal box of following sizes (nominal size) on surface or in recess with suitable size of phenolic laminated sheet cover in front including painting etc. as required				
a)	100 mm X 100 mm X 60 mm deep	300.0	Nos	114	34200
b)	180 mm X 100 mm X 60 mm deep	500.0	Nos	133	66500
c)	150 mm X 75 mm X 60 mm deep	200.0	Nos	118	23600
15.00	Supplying and fixing following piano type switch/ socket on the existing switch box/ cover including connections etc. as required				
a)	5/6 A switch	1000.0	Nos	34	34000
b)	15/16 A switch	1000.0	Nos	75	75000
c)	3 pin 5/6 A socket outlet	1000.0	Nos	42	42000
d)	6 pin 15/16 A socket outlet	1000.0	Nos	86	86000
e)	Bell push	50.0	Nos	47	2350
16.00	Supplying and fixing following modular switch/ socket on the existing modular plate & switch box including connections but excluding modular plate etc. as required.				

	a)	5/6 A switch	1000.0	Nos	84	84000
	b)	15/16 A switch	800.0	Nos	114	91200
	c)	3 pin 5/6 A socket outlet	1000.0	Nos	81	81000
	d)	6 pin 15/16 A socket outlet	1200.0	Nos	153	183600
	e)	Bell push	20.0	Nos	114	2280
	f)	Stepped type regulator	300.0	Nos	288	86400
	g)	Blanking plate	500.0	Nos	24	12000
17.00		Supplying and fixing following size/ modules, GI box alongwith modular base & cover plate for modular switches in recess etc. as required.				
	a)	3 Module (100 mmX75 mm)	200.0	Nos	185	37000
	b)	6 Module (200 mmX75 mm)	1200.0	Nos	258	309600
	c)	8 Module (125 mmX125 mm)	1200.0	Nos	297	356400
	d)	12 Module (200 mmX150 mm)	50.0	Nos	344	17200
18.00		Supplying and fixing 3 pin, 5 A ceiling rose on the existing junction box/ wooden block including connections etc. as required	500.0	Nos	46	23000
19.00		Installation, testing and commissioning of ceiling fan, including wiring the down rods of standard length (upto 90 cm) with 1.5 sq. mm FRLS PVC insulated, copper conductor, single core cable, including providing and fixing phenolic laminated sheet cover on the fan box etc. as required.	300.0	Nos	171	51300
20.00		Installation of 450 mm exhaust fan in the existing opening, including making good the damage, connection, testing, commissioning etc. as required	50.0	Nos	363	18150
21.00		Dismantling of ceiling fan and painting the same with with one or more coats of spray painting with synthetic enamel paint of approved brand and manufacture to give an even shade, including cleaning of surface with detergent and replacing the damaged rubber reel, nuts and bolts with washers and safety pins, reinstalling the same as required	400.0	Nos	133	53200
22.00		Providing and fixing following rating and breaking capacity and pole MCCB with thermomagnetic release and terminal spreaders in existing cubicle panel board including drilling holes in cubicle panel, making connections, etc. as required				
	a)	100 A, 16 kA,TPMCCB	25.0	Nos	3218	80450
	b)	125 A, 16 kA,TPMCCB	10.0	Nos	3613	36130
	c)	150 A, 16 kA,TPMCCB	10.0	Nos	4016	40160
	d)	250 A, 25 kA,TPMCCB	10.0	Nos	9397	93970
	e)	400 A, 35 kA,TPMCCB	5.0	Nos	15672	78360
	f)	630 A, 50 kA,TPMCCB	2.0	Nos	20234	40468
	g)	125 A, 36kA, FPMCCB	5.0	Nos	5440	27200
	h)	630 A, 36kA, FPMCCB	1.0	Nos	23710	23710
23.00		Supplying and fixing following way, single pole and neutral, sheet steel, MCB distribution board, 240 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator)				
	a)	8 way, Double door	10.0	Nos	1061	10610
	b)	12 way, Double door	20.0	Nos	1151	23020
	b)	14 way, Double door	10.0	Nos	1364	13640

24.00	Supplying and fixing following way, horizontal type three pole and neutral, sheet steel, MCB distribution board, 415 V, on surface/ recess, complete with tinned copper bus bar, neutral bus bar, earth bar, din bar, interconnections, powder painted including earthing etc. as required. (But without MCB/RCCB/ Isolator)				
a)	6 way (4 + 18), Double door	20.0	Nos	2659	53180
b)	8 way (4 + 24), Double door	15.0	Nos	3171	47565
25.00	Supplying and fixing of following ways surface/ recess mounting, vertical type, 415 V, TPN MCB distribution board of sheet steel, dust protected, duly powder painted, inclusive of 200 A, tinned copper bus bar, common neutral link, earth bar, din bar for mounting MCBs (but without MCBs and incomer) as required. (Note: Vertical type MCB TPDB is normally used where 3 phase outlets are required.)				
a)	6 way (4 + 18), Double door	10.0	Nos	5664	56640
b)	8 way (4 + 24), Double door	10.0	Nos	7189	71890
26.00	Supplying and fixing 10 A to 32 A rating, 40/415 V, 10 kA, "C" curve, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required				
a)	Single pole 16-32	500.0	Nos	173	86500
b)	Double pole 20-32	100.0	Nos	463	46300
c)	Triple pole 25-32	100.0	Nos	700	70000
d)	Triple pole and neutral 25- 32	100.0	Nos	1092	109200
26.01	Supplying and fixing following 40 -63 , curve, rating, 240/415 volts, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required Curve C 10 kA as per IEC 60898				
a)	40-63 A Double pole MCB	200.0	nos.	1256	251200
b)	40-63 A TP pole MCB	60.0	nos.	2198	131880
c)	40-63 A Four pole MCB	50.0	nos.	2552	127600
27.00	Earthing with G.I. earth pipe 4.5 meter long, 40 mm dia including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. with charcoal/ coke and salt as required	20.0	Nos	4033	80660
28.00	Earthing with G.I. earth plate 600 mm X 600 mm X 6 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 meter long etc. with charcoal/ coke and salt as required.	20.0	Nos	3583	71660
29.00	Providing and fixing 25 mm X 5 mm G.I. strip on surface or in recess for connections etc. as required.	400.0	mtrs	129	51600
30.00	Providing and fixing 6 SWG dia G.I. wire on surface or in recess for loop earthing as required.	1500.0	mtrs	37	55500
	<b>Fittings</b>				
31.00	Supplying, installation, testing & Commissioning of Surface/Wall Mounted integrated LED 1 x 4 feet Fitting with Epoxy powder coated white polycarbonate channel housing. Total system Lumen of 18W to 22W with Average life of 50000 Burning hours. Complete with all accessories as required with connections. Similar to Philips Make, Cat No: MAS LEDtube 1200mm 18W865 T8 I-TMC 501 P 1xT-LED 22W P3241 or equivalent preferred make.	200.0	Each	629	125800

32.00	Supplying and fixing 1x1 FT. 15-18 watt Energy Efficient Surface mounted square shaped LED downlighter with durable housing with ABS heat sink with diffuser to give glare free light with removable driver i/c making connection etc as required. (Havells or in equivalent make)	100.0	Each	1655	165500
33.00	Supplying, fixing, testing and commissioning of Surface Mounted 2 x 2 feet (34/38 watt CEILING LED Light fixture) or equivalent to Philips RC380B G2 LED285-6500PSU OD WH	400.0	Each	4472	1788710
34.00	Supplying installation, testing and commissioning of 70 watt LED type street light fitting, road lighting luminaire with high power LED and unique peanut lens with choice of optics to ensure uniform distribution, higher spacing between poles and maintenance free system, Ideal for road width upto 10 mts. (Make : BRP410 LED CW 072 MR FG S1 PSU GR Philips /Crompton/ Havells)	50.0	Each	13220	661000
35.00	Supplying, fixing, testing and commissioning of 10/11W LED Bulkhead fixture with min 850 Lumens suitable for operation on 230V AC supply with minimum LED make shall be Nichia, Cree, Citizen having LM 80 Complied as per LM80 standard tested for min. 10k hours confirming minimum 50000 burning hours of life 6500K LED's only. LED Driver shall withstand 2kV surge protection. Complete fitting similar to philips make CAT NO. WT202W LED6S NW PSU S2 PCor equivalent preferred make.	100.0	Each	1868	186800
36.00	Supplying, installation, testing & Commissioning of 80W Suspended Mounted Round Led highbay. Complete with all accessories as required with connections. (Make : Philips /Crompton/ Havells)	100.0	Each	7680.0	768000
37.00	Supplying and fixing of 34 watt LED 4000 K type fitting complete comprising with Energy efficient Aesthetically designed 4x1 LED flat panel which provides soft light and glare free symmetrical illumination Constant current electronic driver i/c all connections etc. as reqd. (Make Havells model LHEWEBP6PL1W034)	260.0	Each	5550.0	1443000
37.01	Supplying, installation, testing & Commissioning of LED Posttop Fitting of system wattage 35W to 40W of Multiple LED With Lens optics and IP65 Pressure die-cast aluminium housing for effective thermal management. Total system Lumen of 35W to 40W LED should be 3500 or above in Cool day Light(5700K to 6500K), Lumen Efficacy>100 Lm/W, Power factor>0.95, CRI>70, THD(%) < 10, LED Lamp Make- Cree, Nichia, Philips Lumiled, Osram, Edison, Seoul, Bridgelux, LED Lamp Efficacy>120 Lm/W with Average life of 50000 Burning hours. Complete with Mounting Brackets & accessories as required with connections.	70.0	Each	7787.0	545090
37.02	Supplying installation testing and commissioning of 18 watt PLL type energy efficient LED tube in the existing CFL type fittings i/c proper wiring of the fitting alongwith suitable hanging arrangement by providing ceiling hook and chain etc. as reqd. Crompton OR equivalent in Havells / Wipro /	500.0	Each	552.0	276000

37.03	Supplying and fixing 15 watt Energy Efficient Surface mounted round LED panel with powder coated finished in white housing i/c making connection etc as required. (Philips DN170 or in equivalent make)	50.0	Each	2910.0	145500
37.04	Supplying, Installation, testing and commissioning of 150/70 watt LED flood light fitting complete with all accessories. (Make:- Philips Model No:- BVP120 LED 70 CW NB FG S1 PSU GR)	40.0	Each	12743.0	509720
37.05	Supplying and fixing 15 watt Decorative Wall mounted bracket light Energy Efficient Surface mounted round LED panel with powder coated finished in white housing i/c making connection etc as required. (Philips or in equivalent make)	40.0	Each	720.0	28800
37.06	Supplying and fixing 40 watt High Bay Energy Efficient Surface mounted LED panel IP65 with powder coated finished in white housing i/c making connection etc as required. (HPL or in equivalent make)	20.0	Each	3976.0	79520
38.00	Supplying, fixing, testing and commissioning of 5 Star BEE rating 1200mm sweep ceiling fan complete with blades, down rod, shackle insulator, canopy etc. including providing of electronic step regulator with face plate matching the existing modular switches as required similar to Havells make Model: ES-50 Premium 5 star or equivalent preferred make.	400.0	Nos.	935	374000
39.00	Supplying, fixing, testing and commissioning of following size exhaust/ fresh air fan complete with gravity louver and connection with 3 core flexible wire as required. 300mm dia sweep PVC body fresh air fan Havells make model: heavy duty or equivalent preferred makes	100.0	Each	714	71400
39.01	Supplying, fixing, testing and commissioning of following size exhaust/ fresh air fan complete with gravity louver and connection with 3 core flexible wire as required. Havells make model: heavy duty or equivalent preferred makes	100.0	Each	2709	270900
39.02	Supplying, fixing, testing and commissioning of following size exhaust/ fresh air fan complete with gravity louver and connection with 3 core flexible wire as required. 450mm 960 rpm Exhaust Fan fresh air fan Havells make model: heavy duty or equivalent preferred makes	100.0	Each	3748	374800
39.03	Supplying, fixing, testing and commissioning of following size pedestal fan Havells make model: heavy duty or equivalent preferred makes	50.0	Each	3805	190250
40.00	Supply of following sizes XLPE insulated (Heavy duty) Aluminium or Copper conductor armoured cables suitable for working voltage upto and including 1100 Volts complete as required and as per specifications. 2 x 6 sq.mm, Al conductor cable	650.0	RM	150	97500
40.01	3C x 6 sq.mm, Cu conductor cable	650.0	RM	350	227500

42.00	Supply, Receiving and fixing in position, effecting proper connections, testing and commissioning of 70 w .green line v2 (vrp410) philips Luminaire on existing 9 Mtr MS tubular pole as per specifications,complete in all respects including nipple for fixing of Light fixture on pole.	30.0	Nos	13684	410520
43.00	Design, manufacture, supply,including supervision during installation, testing and commissioning of 2 mm thick MS sheet steel fabricated cubicle type Panel dust and vermin proof complete with hinged and lockable doors . The Sheet Steel shall under go minimum eight tank treatment followed by finishing treatment of powder coating with 70 micron minimum thickness. All the panels shall be floor mounted and dead front construction complete with interconnections. (Form IIIB) The panels shall be FRONT operated, with cable entry from the top. Earth bus shall be part of the panel.) (All MCB to be "C" Curve)				
	All MCCB door handle shall be interlocked and lockable in OFF position. Galvanised hardware with zinc passivation shall be used in fabrication of Switchboards. Suitable Aluminium earth bus to be provided throughout the length of Switchboards. All indication lamps / illuminated push buttons shall be LED type.Coil of all motor starters shall be fed from 440 V / 230 V Control Transformer with bus bar chamber suitable for 300 Amp of suitable size of incoming and outgoing bus bar made out of 2 mm thick CRCA sheet duly painted and providing and fixing of MS frame work made by angle iron of size 40 x 40 x 5 mm of suitable dimension with Depth more than 90 cms upto 120 cms etc complete as reqd.				
44.00	2A SP MCBs shall be used as backup protections. All MCCBs shall be variable plug setting type with thermal magnetic up to 630 A rating and with microprocessor based releases above 630 A rating, line load reversibility, Ics = 100% Icu,& rotary handle. All control& power wiring shall be broughtout upto the cable alley in the terminal blocks. An approval shall be taken for each panel before manufacturing. Provision of one 6/16 amp socket & compartment lighting for each vertical section of main panel. Illuminated push button on Starter Panels of Pumps. Interlocking / Auto start command terminals for starter Panels.All breaking Capacity for ACB to be Ics=100%Icu and Icw for 1 sec..All breaking Capacity for MCCB to be Ics=100%Icu. All MCB to be C Curve	15.0	sqmtr	25600	384000
45.00	Supplying of following electrical accessories suitable for existing different type fitting/switch box etc. as required.				
45.01	Tube Starter	800.0	each	11	8800
45.02	40/36 W Electronic Ballast	1000.0	each	146	146000
45.03	2 x 36/40 W El. Choke	100.0	each	702	70200
45.04	28 W Electronic Ballast	500.0	each	193	96500
45.05	18 W Electronic Ballast	500.0	each	136	68000
45.06	14 W El. Choke	50.00	each	131	6550
45.07	2 x 14 W El. Choke	20.00	each	381	7620
45.08	11/13 /14 W Electronic Ballast	500.0	each	122	61000
45.09	14 W T8 Tube	300.0	each	193	57900
45.10	14 W T5 Tube	300.0	each	115	34500
45.11	28 W T5 Tube	300.0	each	125	37500
45.12	36/40 W Fl. Tube	1000.0	each	47	47000

45.13	9 W CFL Lamp	1500.0	each	68	102000
45.14	11W CFL Lamp	1500.0	each	78	117000
45.15	18 W CFL 2 Pin / 4 Pin	500.0	each	125	62500
45.16	36 W CFL 4 Pin LED Crompton	1000.0	each	730	730000
45.17	36 W CFL 4 Pin PLL	1000.0	each	157	157000
45.18	Call Bell	50.00	each	45	2250
45.19	Insulated tape 10 mtr	200.0	Roll	16	3200
45.20	3.15/4 mfd Fan Capacitor	400.0	Roll	21	8400
45.20	2.5 mfd Fan Capacitor	400.0	Roll	21	8400
46.00	Supplying and replacement of following rating 5 A to 32 A rating, 240/415 V, 10 kA, "C" curve, residual current circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required.				
46.01	25 Amp 2 pole RCCB 30mA	20.0	each	1493	29860
46.02	40 Amp 2 pole RCCB 30mA	20.0	each	1556	31120
46.03	63 Amp 2 pole RCCB 30mA	20.0	each	2029	40580
46.04	40 Amp 4 pole RCCB 30mA	20.0	each	1929	38580
46.05	63 Amp 4 pole RCCB 30mA	20.0	each	2083	41660
47.00	Supply and replacement of Following Item/Accessories in the existing Street Light/Compound Light Pole /Fitting/Panel etc as reqd.				
47.01	70 W Copper Ballast Choke	70.0	Nos.	642	44940
47.02	150 W Copper Ballast Choke	70.0	Nos.	936	65520
47.03	250 W Copper Ballast Choke	80.0	Nos.	1321	105680
47.04	400 W Copper Ballast Choke	30.0	Nos.	1963	58890
47.05	70 W HPSV Lamp	100.0	Nos.	366	36600
47.06	150 W HPSV Lamp	50.0	Nos.	491	24550
47.07	250 W HPSV Lamp	150.0	Nos.	554	83100
47.08	400 W HPSV Lamp	50.0	Nos.	606	30300
47.09	70 W MH Lamp	30.0	Nos.	716	21480
47.10	150 W MH Lamp	30.0	Nos.	774	23220
47.11	250 W MH Lamp	30.0	Nos.	889	26670
47.12	400 W MH Lamp	5.0	Nos.	889	4445
47.13	Ignitor 70/150/250/400W MH /HPSV fitting	40.0	Nos.	450	18000
47.14	Diamond Shaped roto mounted acrylic diffuser cover /ruby Clear LED 35 watt	20.0	Nos.	4772	95440
47.15	Rewinding of 1200/1400 mm ceiling fans with super enameled copper wire including inspection of fan suspension arrangement and tightness of nuts and bolts, cotter pin, rubber reel and replacement of the same wherever found defective during inspection for safe running of fan i/c cleaning the fan with detergent i/c less for old dismantle complete etc as required. (Dismantled copper wire should be retained by the firm, rate quoted accordingly)				
		300.0	Nos.	369	110700
47.16	Rewinding of 300/450 mm exhaust fan including inspection of fan fixing arrangement and tightness of nuts and bolts i/c cleaning the fan with detergent i/c less for old dismantle complete etc as required.				
		50.0	Nos.	596	29800
47.17	Providing and fixing of pole mounted box (300x200x105mm) size made out of (SMC) sheet moulded compound dust and weather proof (Sintex make GSJB-3020)				
		50.0	Nos.	808	40400



48.00	Supplying and fixing metal box of 150 mm X 75 mm X 60 mm deep (nominal size) on surface or in recess with suitable size of phenolic laminated sheet cover in front including providing and fixing 3 pin 5/6 A socket outlet and 5/6 A piano type switch, connections, painting etc. as required.	75.0	Each	186	13950
49.00	Supplying and fixing metal box of 180 mm X 100 mm X 60 mm deep (nominal size) on surface or in recess with suitable size of phenolic laminated sheet cover in front including providing and fixing 6 pin 5/6 A & 15/16 A socket outlet and 15/16 A piano type switch, connections, painting etc. as required.	75.0	Each	260	19500
50.00	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess, including providing and fixing 3 pin 5/6 A modular socket outlet and 5/6 A modular switch, connections etc. as required.	25.0	Each	283	7075
51.00	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess, including providing and fixing 6 pin 5/6 A & 15/16 A modular socket outlet and 15/16 A modular switch, connections etc. as required.	25.00	each	367	9175
51.01	Supplying & fixing suitable size GI box with modular plate and cover in front on surface or in recess including providing and fixing 25 A modular socket outlet and 25 A modular SP MCB, "C" curve including connections, painting etc. as required.	20.00	each	482	9640
51.02	Supplying and fixing 3mm thick phenolic laminated sheet suitable for existing switchboards, complete as required.	4.00	sq mtr	1500	6000
52	Supplying and replacement of following parts/items in the existing panel board for Motor/Pump etc as reqd				
52.01	3 Pole Power Contactor ( Type ML 2 )	3.00	each	4651	13953
52.02	3 Pole Power Contactor ( Type MNX ) 80	6.00	each	8697	52182
52.03	Analog Timer Switch	12.00	each	2091	25092
52.04	Single phase preventor	10.0	each	648	6480
52.05	HRC Fuse 20 to 32 Amp.	12.0	each	75.6	907
52.06	HRC Fuse 35 Amp. 63 Amp.	15.00	each	252.2	3783
52.07	HRC Fuse 80 Amp. To 125amp.	15.00	each	485.4	7281
52.08	HRC Fuse 160 Amp. to 200 Amp.	15.00	each	630.5	9458
53	Supplying and replacement of fully automatic Star Delta Staters for 30 HP Motor having relay Range 20 -33 Amp. in the existing panel board for Motor/Pump etc as reqd. MU-G30 Make or L&T Equiuvalent	4.0	Each	31395	125580
54	Supplying and replacement of fully automatic Star Delta Staters for 10 HP Motor having relay Range 15 -20 Amp. in the existing panel board for Motor/Pump etc as reqd.	4.0	Each	12895	51580
55	Taking out of submersible / monoblock-submersible pump set from the existing bore well with the help of chain pulley and tripod stand along with GI pipe i/c replacement of gaskets, nut-bolts and lowering the same after repairing etc. complete as reqd.	8.00	per job	6848	54784

	Rewinding of following capacity 3 phase multi-stage submersible / monoblock-submersible Pump-set with suitable size water proof copper conductor wire i/c turning & polishing of shaft, replacement of GM bearing bush, thrust bush, thrust plate etc. i/c buy back of dismantle to contractor i/c connection, testing etc as reqd.				
56					
56.01	10 HP	2.00	job	14816	29632
56.02	7.5 HP	1.00	job	13516	13516
56.03	5 HP	1.00	job	11542	11542
56.04	2HP to 4 HP	4.00	job	7253	29012
	Rewinding of burnt out 30 HP 3 Phase Motor with super enamelled copper wire i/c varnishing and replacement the gland Dori, ,Bearing ,Oil Seal and making Coupling allinment and re-installation the same i/c cartage of the Motor from site to workshop to site i/c connection testing re-installation etc complete as reqd. i/c buy back of dismantle to contractor				
57		1.00	job	20874	20874
	Supplying and replacement of 3-phase DOL submersible starter in the existing panel / fixing on the wall surface suitable for upto 5 to 10 HP pump-set i/c drilling holes, connections, testing & dismantling the existing one etc. as required.				
58		3.00	job	5989	17967
	S/I/T/C of 1.5 HP Single Phase Mono submersible pump set with Motor for operation complete as required (Make : KOS -216 in Kirlosker/KSB ).( for Priming purpose in Two Nos. of Pump Sets)				
59		4.00	Each	16684	66736
	S/I/T/C of 7.5 HP, 14-stage Borewell submersible pump set capable of delivering 120-160 LPM at a head of 124-108 mtrs directly coupled with submersible electric motor suitable for operation on 415 volts, 3 phase, 50 Hz, AC supply complete as required (Make : Kirlosker KS6B - 0814 /Crompton Model 6W8R7.5 / equivalent make in KSB ).				
60		2.00	each	45450	90900
	S/I/T/C of 10 HP, 16-stage Borewell submersible pump set capable of delivering 120-160 LPM at a head of 146-128 mtrs directly coupled with submersible electric motor suitable for operation on 415 volts, 3 phase, 50 Hz, AC supply complete as required (Make : Kirlosker KS6B - 1016+/- Crompton Model / equivalent make in KSB ).				
61		2.00	each	52450	104900
	Supplying, installation, tesing and commissioning of 35 mtr head, 150 cumtr per hour discharge Kirloskar make split casing pump Cat no. UP100/38 with bronze impeller, suction and discharge 150 x100 mm fitted with 30 HP, 1440 RPM Kirloskar make motor with tyre coupling and MS frame in existing pipe line i/c dismantling old damaged/burnt out pump-motor i/c making connection etc. as reqd. (Make: Kirloskar or equivalent in KSB/Crompton Greaves)				
61.01		2.00	each	186563	373126
	Supplying / Fixing of 8 mm dia steel rope 'D' shackle along with pump motor, G.I. Pipe in the borewell etc. as reqd. ( Usha/ Martin/Mahadev)				
61.02		2.00	each	59	118
	Supplying and fixing of 3 x 4 sq.mm flat submersible cable etc. as reqd. (Finolex, Polycab, Plaza make)				
61.03		200.0	meter	132	26400

61.04	Supplying & fixing of following size Sluice valve in they existing system after cutting the rusted bolts and re-installation the same with new nut-bolt etc. as reqd. (Kirlosker make)				
a	100 mm Dia PN 1.6	2.0	each	13879	27758
b	80 mm Dia PN 1.6	3.0	each	9939	29817
61.05	Supplying, installation, testing and commissioning of 46 mtr head, 16.50 cumtr per hour discharge Kirlosker make DB32/40 with bronze impeller, fitted with 15 HP kirlosker make motor with type coupling and MS frame in existing pipe line i/c dismantling old damaged/brunt out pump-motor i/c making connection etc. as reqd. (Make : kirlosker or equivalent in KSB/ Crompton Greaves)	2.00	each	71285	142570
62.00	Servicig and overhauling of 3 Phase 440 V ACB Air Circuit breaker 800 Amp - 2000 Amp. ,overhauling isolating the ACB from supply line complete cleaning of contact with petrol and cleaning powder , checking of the shunt trip oil ,under voltage coil, NO and NC contacts , Wiring, adjustment of Contact gaps, and tightening of all nut and bolts keys, checking of spring action and its release, Cluster Contact Dismantling, SIC Contact Dismantling, Pole Assembly Dismantling, Repairing, Cleaning & Re-Assembling of all parts of ACB etc.	69.00	each	1974	136206
63.00	Servicig and overhauling of 11 KV HT OCB 630 Amp - 1200 Amp. , overhauling isolating the OCB from supply line complete cleaning of contact with petrol and cleaning powder ,adjustment of Contact gaps, and tightening of all nut and bolts keys, checking of spring action and its release, Repairing, Cleaning & Re-Assembling of all parts of OCB.	15.00	each	3701	55515
64	Calibration of Over Current and Earth fault relay cleaning of wiring system calibration with secondary injection test kit setting of tripping according to the Load complete with testing and commissioning as reqd.	15.00	per job	1850	27750
65	Painting with synthetic enamel paint of approved brand and manufacture of required colour to give an even shade : One or more coats on old work ) ( i.e. Painting of various metallic surface i/c scraping old paint from HT Panel, LT Panel, Transformer ,Feeder Pillar ,DB's, Loose Wire Box etc as reqd.	250.00	sq mtr	10.00	2500
66	Supplying & Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 1.1 KV grade of following size direct in ground including excavation, sand cushioning, protective covering and refilling the trench etc as required.				
66.01	3.5c x 25 Sqmm	2000.0	mtr	398	796820
66.02	3.5c x 70 Sqmm	600.0	mtr	711	426852
66.03	3.5c x 120 Sqmm	800.0	mtr	981	785042
66.04	3.5cx 185 Sqmm	800.0	mtr	1260	1008116
66.05	3.5c x 240 Sqmm	800.0	mtr	1484	1187002
66.06	3.5c x 300 Sqmm	1000.0	mtr	1729	1728742

67.00	Supplying and laying of following size 3 Core ,11 KV (UE) Aluminium Conductor, Conductor screen with Extruded Semi Conducting Compound, XLPE insulated, insulation Screening with Extruded Semi Conducting Compound in combination with Copper Tape, Cores Laid up, Innersheath of PVC, Galvanised Steel Flat Strip Armoured and overall PVC Sheathed Cable Conforming to IS 7098/(part-II) 1985 in the existing masonry duct/ Cable alley/ loops/existing cable tray/angle iron frames etc as required.				
67.01	3.5c x 185 Sqmm	100.0	mtr	1927	192730
67.02	3.5 c x 400 Sqmm	100.0	mtr	2890	288980
68	Supplying and making straight through joint with heat shrinkable kit including ferrules and other jointing materials for following size of PVC insulated and PVC sheathed / XLPE aluminium conductor cable of 1.1 kV grade as required.				
68.01	3.5c x 70 Sqmm	6.00	Each	2298	13788
68.02	3.5c x 120 Sqmm	6.00	Each	2759	16554
68.03	3.5c x 185 Sqmm	6.00	Each	3245	19470
68.04	3.5c x 240 Sqmm	6.00	Each	3711	22266
68.05	3.5c x 300 Sqmm	10.00	Each	4729	47290
68.06	Supply and making end termination with brass double compression gland including providing and crimping of aluminium solderless lugs / ferrules for XLPE armoured power aluminium conductor cable 1.1 KV grade of following sizes:-				
a	3.5c x 300 sq.mm	20	no	814.00	16280.00
b	3.5c x 185 sq.mm	20	no	691.00	13820.00
c	3.5c x 240 sq.mm	20	no	795.00	15900.00
69	Development of tube well in accordance with IS : 2800 (part I) and IS: 11189, to establish maximum rate of usable water yield without sand content (beyond permissible limit), with required capacity air compressor, running the compressor for required time till well is fully developed, measuring yield of well by "V" notch method or any other approved method, measuring static level & draw down etc. by step draw down method, collecting water samples & getting tested in approved laboratory, i/c disinfection of tubewell, all complete, including hire & labour charges of air compressor, tools & accessories etc., all as per requirement and direction of Engineer-in-charge.	300.0	hour	539	161700
70	Supply and Top up of Transformer/ Power Oil duly dehydrated in the existing transformer /HT OCB etc as reqd.	600.0	ltr	130.00	78000
71	Dehydration of transformer oil of using Dehydration machine to reach the dielectric strengths to the desired level (min 50KV/mm) etc as reqd.	6000.00	ltr	10	60000
72	Tracing and locating of underground LT cable fault by means of fault location sensing machine including pointing out the exact place of fault complete etc. as required at site.	15.0	job	12061	180915
73	Tracing and locating of underground HT cable fault by means of fault location sensing machine including pointing out the exact place of fault complete etc. as required at site.	6.0	job	15350	92100

73.01	Hire charges for high potting testing of 11 KV grade cable 3x300 sqmm at sub station no.3 to 5 as required	5.0	Job	7843	39215
74	Supplying and fixing 20mm dia 30 Mtr. Long ISI marked conforming to IS 12585/IS:444 Type II Thermoplastic Hose Pipe in the existing hose reel drum etc as reqs	20.00	each	3416	68320
75	Supplying and fixing 63mm dia stainless steel branch pipe with 20mm (nominal internal diameter) size stainless steel nozzle conforming to IS 903, suitable for instantaneous connection to interconnect hose pipe coupling as required.	25.00	each	4547	113675
76	Supplying and fixing 63mm dia, 15 mtr. Long RRL hose pipe with 63mm dia Male and Female stainless steel couplings duly banded with GI wire, rivets etc. conforming to IS 636 (type-A) as required.	20.00	each	5725	114500
77	Providing laying, testing & commissioning of 'C' class heavy duty MS pipe conforming to IS 1239 i/c fittings like elbows, tees, flanges, tapers, nuts bolts, gaskets etc. in ground including excavation & providing cement concrete blocks as supports, anticorrosive treatment with coaltar and asphalt tape as per IS 10221, refilling the trench etc. of following sizes complete as required. (Underground)				
77.01	150 mm	15.0	mtr	2100	31500
77.02	100 mm	15.0	mtr	1507	22605
77.03	80 mm	20.0	mtr	1098	21960
78	Providing, fixing, testing and commissioning of 15mm size quartzoid bulb type sprinklers, of rating 68 degree C. pendent with required accessories	200.00	each	181	36200
79	Supplying and fixing of following capacity Fire Extinguisher at various location in DTU Campus as per direction of Engineer-in- charge ( Life Guard /Omax /Minimax with ISI Marked )				
79.01	ABC type 6 kgs capacity (ISI Marked)	200.0	each	2474	494800
79.02	ABC type 4 kgs capacity (ISI Marked)	200.0	each	1805	361000
79.03	Water Fire Extinguisher Gas cartridge type 9 Ltr. (ISI Marke)	50.0	each	4071	203550
79.04	CO2 type 4.5 kgs capacity with pipe & Horns (ISI Marked)	150.0	each	6800	1020000
80	Rewinding of burnt out 7.5 HP 3 Phase Motor pump with super enamelled copper wire i/c varnishing and replacement the gland Dori, , Bearing ,Oil Seal and making Coupling allinment and re-installation the same i/c cartage of the Motor from site to workshop to site i/c connection testing re-installation etc complete as reqd. i/c buy back of dismantle to contractor	2.00	job	11027	22053
81	Servicing of 7.5 HP 3 Phase Motor with Pump i/c varnising ,greasing , oiling and making Coupling allinment and re-installation the same.	8.0	Job	1561	12488

82	SH V ( Fire Alarm System ) Comprehensive maintenance and preventive maintenance of conventional/ intelligent fire alarm system and sector indicating panel ( zonal panel) intalled at site of work including providing panel electrician and technician in general shift and replacement of defective zonal card, register, switch, on all days of the week including sundays and holidays in general shift complete as per terms and comditions	12.00	Per Month	20000	240000
82.01	Supplying, replacement, Testing and Commissioning of ionisation type smoke detector with mounting base i/c connection etc. as reqd.	50.00	each	1500	75000
82.02	Supplying, replacement, Testing and Commissioning of ROR type heat detector with mounting base i/c connection etc. as reqd.	80.00	Each	1500	120000
82.03	Supply,Replacement, testing and commissioning of Response Indicator etc as required.	50.00	Each	350	17500
82.04	Supply, Replacement, testing and commissioning of hooters complete with addressable relay output module etc as required.	20.0	Each	600	12000
83	Providing and fixing G.I. pipes complete with G.I. fittings including trenching and refilling etc. external work				
a)	65 mm dia nominal bore	100.0	Meter	348	34800
b)	80 mm dia nominal bore	100.0	Meter	460	46000
c)	100 mm dia nominal bore	100.0	Meter	587	58700
84.00	Providing and fixing Chlorinated Polyvinyl Chloride (CPVC) pipes, having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and testing of joints complete as per direction of Engineer in Charge.				
84.01	40 mm dia nominal bore	100.0	Meter	327	32700
84.02	62.50 mm nominal inner dia Pipes	100.0	Meter	1103	110300
84.03	75 mm nominal inner dia Pipes	100.0	Meter	1225	122500
85.00	Supplying and replacing Kirloskar or equivalent make ISI marked specification 150mm dia sluice valve with flanges ( Class PN 1.0 ) complete with non rising bronze/ss spindle with , hand wheel incuding the cost of dismantling of existing sluice valve and installation of steel sluice valve , providing and fixing rubber insertion, nuts bolts, washers etc. testing commissioning etc all complete as per direction of E-IN-Charge	2.0	each	29681	59362
86.00	Demolishing brick work manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge.	5.0	Cum	754	3770
87.01	Charges for gas cutting machine with LPG and Oxygen gas for cutting the dusted MS nuts and bolts with operator	1.0	shift	550	550
87.02	Charges for chain pully block, fitter/welding grade and tripod for lifting and working of the sluice valve from the chamber along with accessories tools as required by In charge	1.0	shift	1650	1650

87.03	Repairing of sluice valve of size 150 mm dia inculding dismantling of old Sluice Valve 150mm Diax by removing of its nut bolts with gland housing arrangement with the help of puller etc. and taking out complete assembly along with flape of sluice valve to outside from the pump house.	1.0	Job	850	850
87.04	Making of M.S Dead Flange for closing of main body from top to make hole by gas cutter at site and rubber packing, nut bolts to closed the main body of sluice valve to make leak proof arrangement in line so that pumping cannot be disturbed	1.0	Job	1000	1000
87.05	Dismantling of 150mm dia sluice valve flap from the nut & spindle & upper dome each part.	1.0	Job	750	750
87.06	Replacement of Bronze nut as per sample of 150mm dia sluice valve	1.0	No	2500	2500
87.07	Replacement of S.S. Spindle of single collar dia with machining, threading, collar and making square head for hand wheel for 150mm dia sluice valve	1.0	No	2900	2900
87.08	Assembling of 150mm dia sluice valve by fixing of sluice valve flape with the help of rubber packing, nut bolts. greasing etc. and gland dori with gland plate and closing of complete.	1.0	No	2000	2000
87.09	Credit for dismental items Kirloskar or equipment make specification 150mm dia sluice valve with flanges ( Class PN 1.0 )	4.0	Nos	-5000	-20000
88.00	AMF panel of 320 KVA DG set at Substation no. 1 Fabricating, Installaling, Testing & Commissioning of AMF panel (auto main failure control panel) i/c auto bypass panel of 2mm thick CRCA sheets for 320 KVA DG sets with all neccessary accessories as under				
	a) 800 Amp. 4 pole EDO ACB - <b>2 nos</b>				
	b) Selector switch, overvoltage relay, reverse power relay, under voltage relay of required nos.				
	c) C/T,s energy Analyzen				
	d) Battery charger with all neccessary accessories				
	e) all neccessary indicators				
	f) Audio /Video annunciation				
	g) 4 Pole changeover on load switch AC - 23A cat.- 2 nos	2.0	jobs	815000	1630000.0
88.01	Supplying, installation, Testing & Commissioning Air circuit breaker 800 Amp. Capacity 4 pole EDO type having breaking capacity of 50 KA (microprocessor release) inculding provision of cables for connection interconnection i/c making end termination with brass compression gland of requisite Current carring capacity	2.0	nos.	140000	280000.0
88.02	Credit of existing AMF panel i/c dismantling, removing of cables, incoming, outgoing etc complete as required.	2.0	jobs	-40000	-80000.0
89.00	Fest Arrangements				
89.01	Providing lighting arrangements by means LED/ LED par light 100 Nos/ Spot/Sodium lighting 20 nos/Rise bulb Temporary Lighting with Halogen 150 nos of lights on tree and surrounding area of boys hostel for engifest newly developed Making connection for 3 days etc. as required	1.0	Per Job	188000	188000
89.02	Providing of venue wall boundery wall including maksing cloth on Iron pipes arrangment for 450 sqmetre etc. as required	1.0	Per Job	150000	150000



89.03	Providing of tin sheet boundary wall 450 sq meter with masking cloth etc. as required	1.0	Per Job	90000	90000
89.04	Providing of carpetting at venue of size 150ft x 30ft as required	1.0	Per Job	33750	33750
89.05	Hiring of suitable capacity of set silent type for general lighting sound and stage lighting of production occasion for engifest function in concert ground for 3 days including diesel during the function with operation	3.0	Per Job	35000	105000
89.06	Hiring and placing of 1 Nos Urinals proper flush and separate water & waste storage tanks facilities, Making connection, Systematic drainage systems etc. as required	10.0	days	4000	40000
89.07	Supplying and placing of green rooms 6 nos with roof including chair for 3 days etc. as required	1.0	days	13350	13350
89.08	Hiring and placing on P.A. system, Line array speakers 1200 watt with power amplifier (KV2VHD Series ) or JBL equivalent including truss, Bass Speaker 2000 watt (SRX Bass Bins -728 JBL or equivalent), Single speaker 1200 watt (SRX Top 725 JBL or equivalent, big stand microphone, podium Microphones, Digital audio mixer 32 channel, handheld microphone and cordless and lapel microphones, Graphic equalizer/DJ Console etc. as per direction of Engineer -In- Charge.	1.0	days	70000	70000
89.09	Supplying and placing of audio system for Engifest function including 4 top , 2 RCF base, monitor 01, mixer 01, Amplifer, 2 Cordless microphone, JBL speakers for nos 02, Microphones 01 no of set, liner mixer, DJ mixer for Convocation hall , for 3 days as per direction of Engineer -In- Charge.	1.0	days	30000	30000
89.10	Supplying and placing on hire for erecting wooden open stage of suitable made of decorative cloth, wooden stair etc. as per direction of Engineer -In- Charge.	1.0	Per Job	15120	15120
89.11	Providing of 35 round table with 150 chairs i/c round cover and 35 Cover on hire charges for chairs for 3 days in L2 auditorium building etc. as reqd.	1.0	Job	35272	35272
89.12	Providing and fixing of 90 nos. chairs, and 40 nos. 5x4' table with white cover at sport complex at various locations of DTU for 3 days from and providing sound system also on hiring basis system as reqd.	1.0	Job	84500	84500
90.00	Supplying and fabrication aluminium bus bar of 2500 Amp capacity for existing breaker installed at Sub station with proper sleeve and dismantled burnt spare parts of LT panel making proper cable entry and connection in the 3 pole breaker etc. as reqd.	1.0	Job	38000	38000
91.00	Supplying and fixing of 2000 amp ACB Three pole of L&T/ABB make i/c making connection etc. as reqd.	1.0	Job	169287	169287.0
92.00	Supplying and fixing of 2000 amp ACB Four pole of L&T/ABB make i/c making connection etc. as reqd.	1.0	Job	211537	211537.0
93.00	Supply and fixing of 600 mm size heavy duty oscillating type Air circulator fan, suitable for operation on 230 Volt, 50 Hz. AC supply complete with wall mounting bracket, front and rear guard set etc. and required of Usha/Bajaj/Almonard or approved equivalent as reqd.	10.0	nos.	9093	90930



94.00	Supply and fixing of 450 mm size heavy duty oscillating type Air circulator fan, suitable for operation on 230 Volt, 50 Hz. AC supply complete with wall mounting bracket, front and rear guard set etc. and required of Usha/Bajaj/Almonard or approved equivalent as reqd.	20.0	Nos.	7967	159340
95.00	Repairing and overhauling of existing ACB 1000 Amp, M-Pact ACB's Drawout Type installed in the LT Panel of Sub- Station DTU i.e Providing and replacing of following spare parts of ACB's. Including dismantling the existing defective/burnt parts testing, reassembling etc as required.				
95.10	Cluster Contact M-610 (PGA0100269)	6	Nos.	6614	39684
95.20	Isolating Contact (PGA8100051)	6	Nos.	29793	178758
95.30	Top Fix Contact M-610 (PGA0100271)	3	Nos.	10708	32124
95.40	Bottom Fix Contact M-610 (PGA4100020)	3	Nos.	6929	20787
95.50	Inner Mechanism M-610(PGA0100844)	1	Nos.	22676	22676
95.60	Trip Prop M-610 (PGA0100117)	1	Nos.	1260	1260
95.70	Arcing Moving Contact M-610 (PGA0140334)	3	Nos.	6929	20787
95.80	Arcing Fix Contact M-610 (PGA0140335)	3	Nos.	6929	20787
96.00	Repairing and overhauling of existing ACB 2000 Amp, M-Pact ACB's Drawout Type installed in the LT Panel of Sub- Station of DTU i.e providing and replacing of following spare parts of ACB's. Including dismantling the existing defective/burnt parts testing, reassembling etc as required.				
96.10	Cluster Contact M-20 (PGA0100159)	4	Nos.	9007	36028
96.20	Isolating Contact M-20(PGA0100207)	4	Nos.	7244	28976
96.30	Top Fix Contact M-20 (PGA0130374)	2	Nos.	16881	33762
96.40	Bottom Fix Contact M-20 (PGA4100012)	2	Nos.	9763	19526
96.50	Inner Mechanism M-20 (PGA0100844)	1	Nos.	22676	22676
96.60	Trip Prop M-20 (PGA0100117)	1	Nos.	1260	1260
96.70	Arching Moving Contact M-20 (PGA0140334)	2	Nos.	6929	13858
96.80	Arching Fix Contact M-20 (PGA0140335)	2	Nos.	6929	13858
97.00	Dismantling of Enclosure of Bus Duct from Transformer to LT Panel, removal of Dust, Tightening of Nut Bolts of Each Joint replacement of Nut Bolts with HT Nut Bolts wherever required, checking of all insulators and there support, Replacement of Insulators wherever required. Tightening of Enclosure Plate with replacement of Hardware wherever required.	16	Meter	5500	88000
98.00	Taking out of following capacity/type fire extinguishers from the various floors fixed on hanging stand, removing the old gas/other extinguisher material from the cylinder at site hydraulic pressure at work shop and refilling the new gas/cartridge/other extinguishing material reqd. i/c pasting stickers, reinstallation of cylinder at their position etc as reqd.				
98.01	Refilling of CO2 type fire extinguisher 4.5 k.g. capacity	100.0	each	449	44900
98.02	Refilling of CO2 type fire extinguisher 22.5 kg capacity	50.0	each	1719	85950
98.03	Refilling of ABC type fire extinguishers 4 k.g. Capacity	100.0	each	742	74200
98.04	Refilling of ABC type fire extinguishers 6 k.g. Capacity	100.0	each	937	93700

99.00	Supplying, installation, testing and commissioning of Cast resin, Dry Type, 1600 KVA, 11KV/433V, 3 Phase, 50 Hz, Dyn11 vector group, copper wound, class F insulation associated with winding temperature indicator/controller actuated by means of resistance temperature detector embedded in LV windings, Indoor type Transformer IP 23 protection with approximately 5% impedance, Maximum allowable losses as per ECBC compliance, tappings for OFF Load operation on HV side in steps of +5% to -7.5% in the step of 2.5% having cable end boxes on HV side suitable of 3x300 sqmm XLPE cable of 11KV grade, bottom / top entry and 2500Amp. bus trunking arrangement on LV side with neutral brought out separately, Door limit switch, including Supplying & Laying of multicore copper conductor control cable from transformer to HT breaker for safety tripping, door limit switch to trip the HT breaker in case doors of transformer enclosure are opened, suitably mounted on M.S. channel including supplying and routing of suitable M.S. channel with all accessories and confirming to IS 11171:1985 & as per specification attached complete in all respects as required at site. Make Kirloskar or equiplaent (Note: Dismantled Transformer shall be retained by the contractor and rates quoted accordingly)	1.0	each	2166531	2166531
99.01	Providing laying and fixing of insulating mat 1 mtr wide 3mm thick to withstand 15 KV dielectric strength as per IS 15652 -2006	100.0	Sqmtr	760	76000
99.02	Providing and fixing H.T. danger notice plate of 250 mm X 200 mm, made of mild steel, at least 2 mm thick, and vitreous enameled white on both sides, and with inscription in signal red colour on front side as required.	6.0	each	163	978
99.03	Dismantling of old transformer /HT/LT panel etc from the site with the help of chain pully/Crane and heavy labour including opening of all HT & LT connection carrying the defective transformer to the work shop and transporting it back to site after repairing, refixing the transformer at site etc. as required.	2.0	Job	55000	110000
100.00	High pot testing of 11 KV HT bus bar all poles i/c checking connection with cable main & Transformer etc. as reqd.	10	Job	9800.00	98000.00
101.00	AMC of Air conditioner of Compensive running maintenance of Air-conditioners of capacity different makes installed at various places at DTU campus i/c rewinding of blower motor replacement of defective parts, charging of refrigerant gas incase of leakage, rewinding/ replacement of compressor, and cleaning, washing the coil, oiling, greasing including testing and commissioning as reqds Window type 1.5/2.0 ton/Split type 1.5/2.0 ton/Tower /Ductable /Cassette	1,000	Each	587.00	3522000.00
					<b>42525763</b>

## **GENERAL TERMS AND CONDITIONS FOR ALL E & M Works**

1. The work shall be generally carried out in accordance with tender specifications and the following specification rules, unless otherwise specified the latest amended edition of all such codes/specification/manuals on the last date of submission of the tender would be applicable.
  - a) CPWD General Specifications for Electrical Works Part I Internal – 2013 as amended up to date.
  - b) CPWD general specification for electrical work part II External 1994 as amended up to date.
  - c) General Specifications for Electrical Works (Part-III-LITS & Escalators) – 2003 as amended up to date.
  - d) CPWD general specification for electrical work part IV Sub-Station 2013 as amended up to date.
  - e) CPWD General Specifications for Electrical Works Part VII D.G. Sets - 2013 as amended up to date.
  - f) General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) – 2017 as amended up to date.
  - g) Indian Electricity Act 2003 amended up to date.
  - h) National Electrical Code 2008 and NFPA (National Fire Protection Association) 70.
  - i) Indian Electricity Rule 1956 amended up to date.
  - j) National Building Code 2016
  - k) BIS codes as applicable.
  - l) Other standards and codes as applicable in the electrical and mechanical works.
  
2. The contractor is advised to visit the site of work to have an idea of the execution of work; failure to do so shall not absolve their responsibility to do the work as specified in agreement.
  
3. Rates:
  - 3.1 The work shall be treated as on works contract basis and the rates tendered shall before complete items of work (except the materials, if any, stipulated for supply by the department) inclusive of all taxes (including GST, works contract tax, if any), duties, and levies etc. and all charges for items contingent to the work, such as packing, forwarding, insurance, freight and delivery at site for the materials to be supplied by the contractor, watch and ward of all materials (including those supplied by the department, if any) for the work at site etc.
  
4. Taxes and Duties:
  - 4.1 Being an indivisible works contract tax, GST etc. are not payable separately.
  - 4.2 The GST for works contract tax shall be deducted from the bills of the contractor as applicable in the State in which the work is carried out, at the time of payments.
  
- 5.0 Mobilization Advance:
 

No mobilization advance shall be paid for the work, unless otherwise stipulated in tender papers for any individual works/ composite work.
  
- 6.0 Completeness of Tender:

All sundry fittings, assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections as required, and all other sundry items which are useful and necessary for proper assembly and efficient working of the various components of the work shall be deemed to have been included in the tender, whether such items are specifically mentioned in the tender documents or not.

#### 7.0 Works to be arranged by the department:

Unless and otherwise specified in the tender documents, the following works shall be arranged by the Department:

- (i) Supply of materials to the contractor as stipulated in the tender documents.

#### 8.0 Works to be done by the contractor:

Unless and otherwise mentioned in the tender documents, the following works shall be done by the contractor, and therefore their cost shall be deemed to be included in their tendered cost of respective items :-

- (i) Foundations for equipments and components where required, including foundations bolts.
- (ii) Cutting and making good all damages caused during installation and restoring the same to their original finish.
- (iii) Sealing of all floor openings provided by him for pipes and cables, from fire safety point of view, after laying of the same.
- (iv) Painting at site of all exposed metal surfaces of the installation other than pre-Painted, items like fittings, fans, Switchgear / distribution gear items, cubicle Switch board etc. damages to finished surfaces of these items while handling and erection, shall however be rectified to the satisfaction of the Engineer-in-Charge.
- (v) Maintaining the Cleanliness safety and Heigene standards as per per applicable local bylaws and National standards.
- (vi) Testing and commissioning of each of the individual system and Final Integrated System Test (IST) and Handover of complete installation.
- (vii) Reports and Documentation submission post IST which includes Pre-commisisoning, Commisisioning, Test-Reports, IST and SOPs (standard Operating Procedures) for system and Operational manuals.
- (viii) Storage space for all equipments, components and materials for the work

#### 9.0 Storage and Custody of Materials:

The contractor has to make his own arrangement for the storage of the material at site & necessary watch and ward of the electrical installation during the execution of work till the same is handed over to the department. No extra payment will be made on this account. The storage space shall however be arranged by the department at site, if available.

The main contractor shall arrange for proper storage of the electrical fans and fittings at site and that double lock system shall be arranged for the fans and fittings after receipt at site until the time they are taken for installation. The contractor shall however be responsible for proper storage and safe custody of the same till their installation and completion of work to the department.

#### 10.0 Electric Power Supply and Water Supply:

Power and water supply will be arranged by the contractor at the site for installation purpose. However, for testing purpose after complete installation of the electrical items, electricity supply will be made available free of cost to the contractor. Contractor will take due care to ensure safety of electrical installation during execution of work.

#### 11.0 Tools for handling and Erecting:

All tools and tackles required for handling of equipments and materials at site of work as well as for their assembly and erection and also necessary test instruments shall be the arranged by the contractor at his own cost.

**12.0 Co-ordination with other agencies:**

The contractor shall co-ordinate with all other agencies involved in the building work so that the building work is not hampered due to delay in his work. Recessed conduit and other works, which directly affect the progress of building work, should be given priority.

**12.1 Care of buildings:**

Care shall be taken by the contractor to avoid damage to the building during execution of his part of the work. He shall be responsible for repairing all damages and restoring the same to their original finish at his own cost. He shall also remove, at his costs, all unwanted and waste materials arising out of his work, from the site.

**13.0 Structural Alterations to Buildings:**

- (i) No structural member in the building shall be damaged/altered, without prior approval from the competent authority through the Engineer-in-charge.
- (ii) Structural provisions like openings, cutouts, if any, provided by the department for the work, shall be used. Where these required modifications, or fresh provisions are required to be made, such contingent works shall be carried out by the contract at his cost.
- (iii) All such openings in floors provided by the department shall be closed by the contractor after installing the cables/conduits/rising mains etc. as the case may be, by any suitable means as approved by the Engineer-in-charge without any extra payment.
- (iv) All chases required in connection with the Electrical Works shall be provided and filled by the contractor at his own cost to the original architectural finish of the buildings.

**14.0 Addition to an installation:**

Any addition, temporary or permanent, to the existing electrical installation shall not be made without a properly worked out scheme/design by a qualified Electrical Engineer to ensure that such addition does not lead to overloading, safety violation of the existing system.

**15.0 Work in occupied buildings:**

- (i) When work is executed in occupied buildings, there would be minimum of inconvenience to the occupants. The work shall be programmed in consultation with the Engineer-in-charge and the occupying department. If so required, the work may have to be done even before and after the office hours.
- (ii) The contractor shall be responsible to abide by the regulations or restrictions set in regard to entry into, and movement within the premises.
- (iii) The contractor shall not tamper with any of the existing installations including their Switching operations or connections there to without specific approval from the Engineer-in-charge.

**16.0 Drawings:**

- (i) The work shall be carried out in accordance with the drawings and the tender documents and also in accordance with modification thereto from time to time as approved by the Engineer-in-charge.
- (ii) All wiring diagrams shall be deemed to be 'Drawings' within the meaning of the term as used in Clause 11 of the conditions of contract (PWD 7). They shall indicate the main Switch board, the distribution boards (with circuit numbers controlled by them), the runs of various mains and sub mains and the position of all points with their controls.
- (iii) All circuits shall be indicated and numbered in the wiring diagram and the points shall be given the same number as the circuit to which they are electrically connected.

- (iv) After award of the work, the firm will be required to submit the SLD drawings for the proposed work including layout plan, conduit routes etc within the 30 days. Work will be carried out as per the approved drawings.
- 17.0 Conformity to IE act, IE Rules, and standards:
- 17.1 All E&M Works shall be carried out in accordance with the provisions of Indian Electricity Act, 1910 and Indian Electricity Rules, 1956 amended up to date (Date of call of tender unless specified

## **TERMS AND CONDITIONS FOR INTERNAL AND EXTERNAL ELECTRICAL WORKS**

- 1.0** All the works shall be carried out as per CPWD General Specification for E&M Works, Part-I (Internal)-2013 Part-II (External)-1994; Part-IV (Sub-Station)-2013, amended up to date and should also comply with relevant provisions of the Indian Electricity Rules and Acts as applicable, amended up to date.
- 2.0** The contractor is advised to visit the site of work to have an idea of the execution of work; failure to do so shall not absolve their responsibility to do the work as specified in agreement.
- 3.0** Payment Terms:  
The following percentage of contract rates for the EI sub head shall be payable against the stage of work shown herein.
  - a) 60% against supply, as per items of the schedule of work, after delivery at site in good condition against guarantee bond.
  - b) 20% after completion of installations, as per items of the schedule of work at specified locations in all respect.
  - c) Balance 20% will be paid only after testing, commissioning trial run & handing over of the sub-head to the client department for their beneficial use.

### **INTERNAL EI WORKS**

#### **Additional Conditions**

1. The work shall be carried out strictly in accordance with CPWD specifications for E&M Works 2013 (internal) and 1994 (External) as amended upto date and in accordance with Indian Electricity Rules, 1956, Indian Electricity Act, 1910 as amended upto date and as per instructions of the Engineer-in-Charge including as below and nothing will be paid extra.
  2. All materials to be used on this work shall be ISI marked & shall be got approved from the Technical sanctioning authority/Engineer-in-Charge before installation at site unless otherwise not covered under ISI.
  3. PVC insulated class 2 copper conductor wire used shall be multi-standard FRLS grade for which nothing extra shall be paid.
  4. The work shall be carried out according to approved drawings/details which shall be subsequently issued to the successful tenderer for execution of work and as per instructions of Engineer-in-Charge who will have the right to change the layout as per requirement at site and the contractor shall not have any claim due to change in layout. The work shall be executed by skilled person Licensed by the approved authorities.
  5. All damages done to the building during execution of E&M work shall be the responsibility of the contractor and the same will be made good immediately at his own cost to the satisfaction of the Engineer-in-Charge. Any expenditure incurred by the department in this condition shall be recovered from the contractor and decision of the Engineer-in-Charge about recovery shall be final.
  6. The bad workmanship will not be accepted and defects shall be rectified at contractor's cost to the satisfaction of the Engineer-in-Charge. The programme of E&M Works is to be co-ordinated in accordance with the building work and no claim for idle labour shall be entertained.
  7. All the debris of the E&M Works should be removed and the site should be cleared by the contractor immediately after the accruing of debris. Similarly any rejected material should be immediately cleared off from the site by the contractor.
  8. The contractor or his representative is bound to sign the site order book as and when required by the Engineer-in-Charge and to comply with the remarks therein.
  9. The size of conduit and wiring shall be got approved from the Engineer-in-Charge before taking up the execution.
  10. The contractor shall make his own arrangement at his own cost for E&M / general tools and plants required for the work.
- Main Board and Main Distribution Board:**  
The work shall be carried out according to the drawings / details are as approved by the Engineer-in-Charge. The contractor shall have to get the samples approved before the whole lot is brought to site and it shall include all inter connections etc. All termination of electrical cables in panel / feeder pillars DB's, cable-looping box etc. shall have to be done with proper thimbles / lugs using crimping process. Copper

thimbles / reducer shall be used for copper cable and Aluminium cable nothing extra will be paid for the same.

- 11 All materials shall be supplied and used in items of works by the contractor should be of standard and approved quality. They should be got approved from the Engineer-in- Charge or his authorized representative before installation otherwise no payment will be made for an unapproved or rejected material used on the works and the same shall be removed at his cost from site or work.
- 12 The contractor shall have to prove bonafides of the make of materials by producing necessary documentary evidence. They are advised to obtain prior approval of Engineer-in-Charge for proposed make of material, before bringing material to site work.
13. Location of Light fixtures, All Electrical Equipments, cable routes etc. should be got approved from the Engineer-in-Charge before execution.
14. All interconnection in the panel, DB, cable-looping boxes shall be carried out with suitable cable commensurate with the current carrying capacity of incoming and outgoing cables complete with thimbles etc. as required for which nothing extra shall be paid.
15. All panels, DB's, cable-looping boxes will be numbered and marked with paint / name plate and nothing extra will be payable on this amount.
- 16 All MCB, MCCB, MCB, DB's, RCBO's, RCCB with DB's shall be of same make / manufacturer and the MCB's shall be central trip mechanism type.
- 17 Modular Switch / Socket's / Plates / Computer outlet / Telephone outlet and all accessories shall be of the single make only be provided. The contractor shall have to make the edges around the boxes wherever required shall have to be made by the contractor for which nothing extra shall be paid. The galvanized metal box shall be of the standard thickness as the GI boxes besides other requirement.
- 18 All the material should be ISI Marked unless otherwise clarification is not available.
- 19 All concealed works shall have to be done in the presence of Engineer-in-Charge or his authorized representative.
- 20 The contractor shall make his own arrangement for storage and carriage of material at the site.
- 21 The entire installation shall be at the risk and responsibility of the contractor until these are tested and handed over to the department.
- 22 Notwithstanding the schedule of quantities, all items of interrelated works considered necessary to make the installation complete and operative are deemed to be included shall be provided by the contractor at no extra cost.
- 23 The connection, inter connection, earthing and inter earthing shall be done by the contractor wherever required and noting extra shall be paid on this account. All repairs & patch work shall be neatly carried out to match with the original finish & all damages caused to the building installation during the execution of work shall have to be made good by the contractor immediately at his own cost to the entire satisfaction of Engineer-in-charge. In case contractor fails to comply with the instructions of the Engineer-in-charge, Engineer-in-charge shall be at liberty to get the work done by any other Contractor and recover such amount as paid to the other Contractor from the bill(s) of the contractor. Contractor shall have no claim, whatsoever, on the extent of such amount.
- 24 The contractor shall have to provide the fish wire after removing the choking of the conduits. Even if subsequently the conduits are found choked, the choking will be get removed and / or the new conduits shall be provided at the risk and cost of the contractor.
25. The makes of material have been indicated in the list of acceptable makes. No other make will be acceptable. The material to be used in the work shall be got approved from the Engineer-in-Charge before use at site. The Engineer-in-Charge shall reserve the right to instruct the contractor to remove the material which, in his opinion, is not as per specifications.
26. No material shall be brought to site without the approval of Engineer-in-Charge. All fixtures and fittings shall be procured just before the installation or as per direction of Engineer- in- charge.
- 27 Wherever ceiling roses are not required to be provided in the light/fan/exhaust fan points, due to site conditions, the contractor shall use suitable three pin connectors for which nothing extra shall be paid. Wiring shall be carried out with FRLS wires.
- 28 Contractor shall provide polythene/PVC plastic cover for all MDB's/SDB's/DB's, panels, feeder pillars etc to protect them from rust/damages, during execution of work till the work is actually completed and handed over to the department.
- 29 Makes of all items that are not covered in the schedule of work/additional specifications shall be got approved from the Engineer-in-charge and shall conform to relevant Indian Standard as applicable.
- 30 The contractor shall ensure that the staff employed by him for execution of the E&M work, possess the valid electrical license issued by competent authority. Consequences arising due to the default of the contractor in not complying with the above condition shall be the responsibility of the contractor.



- 31 Copper lugs shall be provided for terminating copper/aluminium/GI earth wire to all Switchboards for which nothing extra shall be paid. All multi-stranded/ stranded wires shall be terminated through copper lugs.
- 32 All concealed work and earthing shall be done in the presence of the Engineer-in-charge or his authorized representative.
- 33 The schematic diagram/dimensional drawings of the various electrical cubical panels shall be got approved from the Engineer-in-charge before fabrication and shall comply with CPWD specifications and Indian Electricity Rules. The PTTA panels shall conform to IS: 8623/1993 & TTA panel shall conform to IEC:61439-1/2. All panels shall be powder coated inside out, in shade approved by the Engineer-in-charge.
- 34 All floor-mounted panels shall be mounted on 75mmX75mmX6mm thick M.S. channel on all the sides. It shall have a continuous earth bus of the same size and material as the main phase running continuously along the length of the panel extending on either side for earth connection.
- 35 The doors of all cubicle panels shall be hinged type including those of bus bar chambers and cable alleys. The locking shall be with chrome plated metal key locks. All doors shall be earthed with copper conductor wire as approved by the Engineer-in-charge.
- 36 The work shall be carried out according to drawing approved by the Engineer-in-charge. The layout once approved can only be changed by the Engineer-in-charge as per requirement at site. It shall be the responsibility of the contractor to plan the layout and get the approval from the Engineer-in-charge before laying the conduits etc.
- 37 The MCB should be of the same make as that of MCB DB's and having a minimum breaking capacity of 10 KA. Contractor shall obtain approval of the Engineer-in-charge before procurement of MCB DB's.
- 38 All model of modular accessories required for the work shall be got approved from the Engineer-in-charge from among the approved makes. The base plate shall be preferably in sheet steel or otherwise in unbreakable polycarbonate. The cover plates shall be screw less type in shade approved by the Engineer-in-charge.
- 39 Contractor shall have to check the Site Order Book for any instructions of the Engineer-in-charge or his authorized representative and sign the site order book. He shall be bound to ensure compliance with the instructions recorded therein.
- 40 MCCBs shall be used with terminal spreaders and all terminals shall be shrouded to avoid direct contact.
- 41 All measuring and indicating instruments shall be protected through MCB's and isolating Switches.
- 42 General arrangement drawing of the Switchboard shall be got approved from the Engineer-in-Charge before commencement of manufacturing.
- 43 For the items like LT panels, feeder pillars and accessories, etc, the firm shall arrange for inspection in the factory and provide for all facilities for testing. The cost of the visit of Engineer-in-Charge or his representative shall be borne by department. However, firm will be responsible for arranging the inspections as required.
- 44 Conduit layout, circuiting layout, DB detail with load balance as per Switching arrangement shall be prepared by contractor and got approved from the Engineer-in-Charge before slab casting.
- 45 Conduit and termination to SDB and main board adapter box i/c connection wires to MCB's inter connection between SDB and main board etc shall be included in the tendered rates and nothing extra shall be paid for the same.
- 46 The contractor shall provide junction boxes / looping boxes of required sizes and such boxes shall be measured as part of conduit / batten wiring without any extra payment.
- 47 M.S. dash fastener shall be used for installation of fittings and fixtures in ceiling and for providing suspenders for the angle support, conduiting, cable tray etc. for which nothing extra shall be paid.
- 48 All CI/metal boxes & junction boxes should be cleaned properly and painted from inside before wiring & fixing the accessories.
- 49 Cables:-
- (a) Cables shall be bought from manufacturer only as per approved NIT.
  - (b) The length of the cables required shall be measured w.r.t. site condition and these shall be delivered in section of approved length only, to avoid jointing as far as possible.
  - (c) Cable delivery shall be scheduled in consultation with department only.
  - (d) All cable's shall be offered for inspection by department prior to dispatch, department reserve the right to wave of inspection so required in lien of proper test certificates.
50. Maximum group control of five numbers lights will be made at site by the first/primary light point.

51. The work shall be carried out after approval of the shop drawings & technical data sheet of all equipments / items from the Engineer-in-Charge

**Internal Lighting Fixture and LED:-**

All furniture, fixture, glazing, floors etc. shall be protected by suitable covering. All stains, smears splashing, dropping etc. shall be removed. While painting etc. it shall be ensured that the painting of wall and ceiling etc. is not spoiled in any way.

**SPECIFICATION OF LED LIGHT FIXTURES**

<b>S.No.</b>	<b>Description</b>	<b>Requirement</b>
1	Efficiency of LED light fitting ( Efficacy)	Specified in item nomenclature/ BOQ
2	Life of LED light fitting	Not less than 50000 burning hrs.
3	Approved make for LED	CREE/ NICHIA/OSRAM/PHILLIPS (An undertaking shall be submitted from fitting manufacturer regarding confirmation about use of make of LEDs in their fitting before supply of fittings)
4	CRI	Minimum 80 for Indoor applications and min. 70 for outdoor applications.
5	THD	< 10%
6	Type of housing	Extruded Aluminum / Standard Alloy housing for Indoor applications. High pressure Die Cast Aluminum / Standard Alloy for outdoor applications.
7	IP Category	IP 20 or higher for indoor applications and IP 65 or higher for outdoor applications.
8	Surge protection	Shall be provided conforming to relevant IS standard / IEC 61643-II class-2 & EN 61643-II Type-2 or as specified in SOQ
9	Labeling / identification Mark	Manufactures Name / Logo engraved / Embossed on housing / body or Name / Logo on aluminum plate Labels or Name / Logo printed on housing / body.
10	Warranty period	3 years warranty from actual date of completion of work on complete luminaire including driver / control gear, LED, all accessories etc.
11	Power Factor	Equal or more than 0.95
12	Total Power consumption of fitting.	Not More than 110% of rated capacity of LED Light.
13	CCT	5700K to 6500K or as specified in BOQ
14	Test reports of luminaire	The luminaire should be tested as per IEC 60598:2002 standards and following test reports should be submitted along with the fittings: Heat Resistance Test, Thermal Test, Ingress Protection Test, Drop Test, Electrical / Insulation Resistance Test, Endurance Test, Humidity Test, Photometry Test (LM 79 Report), LM 80 report.

## Term and conditions for AC servicing

- 1 The following work includes in the scope of
  - (i) Replacement of spares as running capacitor, starting capacitor, starting relays, Thermostat, knobs, etc.
  - (ii) Replacement of copper wire of internal connections.
  - (iii) Rewinding blower fan motor and bushes etc.
  - (iv) nut bolt, screw Oil grease, dusters etc.
  - (v) Charging of refrigerant gas in case of leakage etc.
  - (vi) Cleaning the tank of water cooler every fortnightly.
- 2 Rewinding/replacement of compressor is inclusive in the Scope of work.
- 3 Sundays & holidays which can be cheked on any working day during normal duty unskilled labours as & when required.
- 4 The complaint if any shall be attend at once in 24 hours failure of which shall be liable to penalty as E-In- C
- 5 No T&P shall be issued by the department
- 6 The contractor should be maintain a complaint book for day to day maintenance and parts replaced and got signed by JE(E).
- 7 The contractor shall handover the units good working conditions after completion of work.
- 8 The work shall be carried out as per CPWD Specifications and to the entire satisfaction of engineer - in - Charge
- 9 Replacement /rewinding of remote control is not inclusive scope of work.
- 10 The user to provide specified proper Electrical supply desired for the i.e. 230 volts  $\pm$  5% for single phase and 415V olts the unit  $\pm$  5% volts for 3 Phase supply proper load balancing should be ensured .
- 11 The user will provide and maintain the electrical power supply.the wiring to the unit the connection and disconnecting switches/circuit break. These will be attened by the owner/user through his own agency.
- 12 The obigatiions of carrying out the service is subject to force majure conditions mentioned under As scope
 

due to strike ,look outs industrial/ labour disturbance any natural calamities such as fire floods accidental damages,etc.or any act of god ,riots war or restrictions imposed by the govt. and generally any condintions

arising from similar causes for supply of spare parts ,etc and for any reasons beyond our control.
- 13 Any kind of consequential liquidated damaged/losses of any kind whatsoever are not concerned under this service scheme.
- 14 Any break down call made by the user during the normal working hours, will be attened on all working days.
- 15 Supply, free of charge of all spares and materials which are found defective and necessary for the unit. these will be replaced promptly the defects having been caused during service period due to wear and tear only and ot due to maloparation sabotage or any other calamities such as fire or earthquake,etc.
- 16 Replacement of sheet matel parts. Front panel/grill. Outer wrapper /casing and painting of any kind airfilters for VERSATECH models. Replacements to coils. Heating system is not include.voltage stablizers re not included. Missing parts chargeable.
- 16 No cartage shall be paid by the Department if any unit is take to workshop for repairing.

## **PUMPING SYSTEM**

### **1. PUMP**

#### **1.1 Positive Suction (Centrifugal)**

Pump shall be centrifugal installed adjacent to water tank. The MOC shall be as per schedule of quantity.

### **1.2 HYDROPNEUMATIC SYSTEM & PUMPING MAINS**

#### **1.2.1 SCOPE**

This section of the contract involves the design, supply, installation, testing and commissioning of the complete Hydropneumatic pumping system and other pumping systems complete with all controls and electrical work for domestic water supply. It also involves testing and commissioning of the pumping system with the domestic water and flushing water supply & distribution.

This specification described the particulars of the contract, designs and systems chosen, and mode of operation.

All installation work shall comply with the latest rules and regulations.

The work embraced by this specifications covers the design, submission to authorities, supply, delivery on site, installation, testing, commissioning and maintenance of the Hydropneumatic pumping system, other pumping system installation of the building in accordance with this specification and associated drawings.

The scope of work shall include the following (list is indicative and not exhaustive) :

- Variable speed pumping units domestic water supply & distribution.
- Suitably sized food grade quality, non-toxic diaphragm type pressure vessels complete with necessary interconnections and controls.
- Control panel for pump control complete with variable speed drives, circuit breakers, fuses, pressure transmitters etc. complete with all interconnections to pumps and electrical supply panels.
- Pump control units complete with pre-programmed micro-processor chip.
- Pump monitoring units to monitor operation of pumps.
- Each Hydropneumatic Pumping unit shall be supplied as a complete set including variable speed pumps, pressure vessels suction and discharge common manifolds, non-return valves, isolating valves, pressure transmitters on the discharge side and level electrode at the suction tank. Each unit shall be provided with electronic microprocessors for unit control and all necessary electrical work for the unit.
- Submersible drainage pumps for plant room drainage complete with electrical panels and necessary accessories with automation for pump operation.
- The Hydropneumatic system supplier shall provide the pumping units in the designated pump rooms as complete units included all necessary piping within plant such that only discharge connections are required to be connected into the unit's discharge manifolds just inside the plant room, by the Plumbing tenderer. The Hydropneumatic system tenderer shall guarantee specified pump performance at various pump speeds and Hydropneumatic pumps must be able to supply at least 2 bar pressure at the highest/farthest fitting.
- Electrical equipment and installation work including the PLC in Control panel.
- Painting and labelling of pipe work and equipment;

- Provision of all hold down bolts, spigots struts and the like required to be built in during construction;
- Provision of all level Switches, flow Switches and other sensing devices for status indication.
- All interfacing work with other trades.
- Testing and commissioning and balancing of the Hydropneumatic & Pumping system;
- Provisions of operating instructions and maintenance manuals;
- Provision of spare parts;
- Training of the employer's staff for proper operation of the entire systems;
- Liaison with Local Authorities to obtain all necessary certificates and approvals, including the completion of all submission drawings, forms and payment of any fees and charges. All the costs for all the tests required by Local Authorities shall be included. To attend to any Authorities inspection regardless of whether this inspection is carried out after the defect liability period;
- Provisions of the necessary installation which include pumping works, pipe work within the pumping unit up to suction and discharge manifolds, conduit and control wiring, etc. to form a workable system required;
- All other works and systems as specified in the Contract document and or shown on the drawings.
- All cutting, patching, framing up, furring in, chasing and making good associated with the building construction for the passage of pipes, conduits and the like including providing GI pipes sleeves of required size corresponding to pipe dia, wherever pipes crossing fire rated walls and floors and sealing with glass wool in between and fire sealant compound on either end. Details on shop drawings shall also be provided.

## **2 GENERAL**

Equipment offered for supply and installation shall include the following:

All minor items and incidental work, equipment accessories and materials may not be specifically mentioned but are required for the proper completion of the installations in accordance with the true intent and meaning of this Specification.

Readily accessible, dust-proof lubricating facilities on all moving parts and equipment including provision for cleaning all lubricating lines and bearings and charging same with the correct lubricants after installation but prior to testing and commissioning.

Clearly visible and robust manufacturer's name-plates permanently fitted each and every item of equipment and showing the manufacturer's name, type and/or model number, serial number, and all essential operating data such as speed, capacity, voltage, current draw, etc.

The Tenderer also shall allow provision for the inspection of all plant and equipment by the manufacturer or his licensed representative, at least twice during the course of the installation.

## **3. PIPING**

The pipes and fittings in the domestic Water Treatment plant room shall be GI class 'B' (Medium class) conforming to IS: 1239 (Part-I) for pipes and IS: 1879 (Part 1 to 10) for malleable cast iron galvanized fittings or specified in the BOQ.

## **4 PUMPS FOR HYDROPNEUMATIC & DRAINAGE SYSTEM**

#### 4.1 PUMPS

Pumps shall be vertical, centrifugal, multistage directly coupled to motor. Provision of pump with pump head & base of cast iron and other parts in SS 304 shall be made for pumps required in Hydropneumatic System. Impeller shall be hydraulically balanced and keyed to shaft. Pump shall be mounted on a concrete foundation, projecting at least 15 CM above finished floor level. The pumps base shall be set on a vibration elimination pad. The pump shall be lubricated in strict accordance with the manufacturer's instructions and shall be factory aligned prior to shipment. All motors and bases shall be painted with approved finish shop coat of paint. The pump shall be selected for the lowest operating noise level and shall be complete with flexible connections, valves, and pressure gauges. The pumps shall include cost of foundation channel complete.

The Tenderer shall supply and install pumps of the type and performance as shown on the drawings. All duties of pumps given in the Tender Drawings shall be checked and where necessary corrected before ordering. All the parts of the pumps that are in contact with water e.g. shaft, impeller etc. shall be of stainless steel construction.

Pumps shall be so selected that the design duty point is within 5% of the maximum efficiency point. The pump casing so selected shall have ample space to take an impeller one size larger than that capable of performing the design duty.

The pump shall have a speed of not more than 1500 rpm. However pumps of 2900 rpm with high efficiency and low noise motor can be selected and noise data submitted for approval. All pumps and motors shall be of minimum vibration and noise level during operation. Vibration isolators shall be provided for all pump sets.

Facilities shall be provided to prevent starting of pumps when the water tank is at low water level. An indicator for this low water level alarm shall be provided.

Facilities to select which pump to be duty pump and standby pump shall be provided and be interchangeable.

Pump curves for all pumps offered shall be submitted. All curve indicating excessive shut-off head will not be approved.

Each pump shall be provided with a gate valve at suction and discharge, approved check valve at discharge, approved strainer at suction, flexible connections at pump suction and discharge, eccentric reducer at suction, concentric reducer at discharge, pressure gauges at suction and discharge, circulation relief valve and automatic air relief valve.

Appropriate neoprene vibration isolation mountings shall be provided for each pump sets.

##### Vertical/Horizontal Pumps

Multi-stage pumps shall be of centrifugal type and arranged with shafts vertically installed. The impellers shall be of stainless steel mechanically balanced and keyed to shaft. Renewable guide rings are to be provided in the casting, keyed to prevent rotation.

Pumps shall be driven by elevated in-line TEFC squirrel cage motors via extended vertical shafted complete with universal couplings.

The shafts shall be stainless steel. Stainless steel sleeves shall be provided to protect the shaft in the water space and through the sealing glands. The sleeves shall be keyed to prevent rotation and secured against axial movement.

The bearings shall be of ball or roller type protected against ingress of water, dirt and other matter.

Vertical/Horizontal multistage pumps shall have universal flanges. Intermediate bearing, support bearing shall be provided in the pump.

The shaft seal shall be easily serviceable and shall allow for correct adjustment and loading of the seal.. Pump motors above 7.5 kW shall be equipped with a spacer coupling which allows changing of shaft seals without removing the motor. The pump motors shall be of Class “F” insulation and IP55 rating and shall be provided with built-in thermistors for protection against overheating.

## 4.2 VARIABLE SPEED HYDROPNEUMATIC PUMPING SYSTEM

Variable speed Hydropneumatic pumping units shall be provided for supply of domestic water, flushing water supply for the project. The units shall be selected so as to provide at minimum of 1.5 bar pressure at the highest/farthest fitting in each plumbing system, the unit serves. The hdyropnemetic pumping units shall have the following features;

### 4.2.1 System Description

The system shall be supplied as complete sets including suction and discharge common manifolds, non-return valves, isolating valves, pressure transmitter on the discharge side and electrode at the suction tank.

The system operation will be such that the initial small water demand shall be met by the charged diaphragm pressure vessel. Should the water demand continue the system pressure will dip to a preset pump cut-in point when the lead pump starts to operate at reduced speed through the variable speed drive. However, should the system pressure be still below the preset value, the controller continuously increases pump speed to meet the system demand. When the lead pump is not able to meet the system pressure at full speed, the second pump also starts to operate.

At peak demand all the pumps operate, similarly, if there is a drop in water demand the duty pump speed starts to reduce, then standby pumps cuts-off, followed by stopping of the duty pump.

The closed diaphragm pressure vessel shall be of polyethylene material with a pressure gauge and isolating valve. The interior shall be of non-toxic lining suitable for use with potable water. The vessel shall be manufactured to conform to ASME pressure vessel code/standards.

The system shall be under the control of an electronic microprocessor unit (EMU).

A pressure transmitter shall detect the pressure at the delivery manifold and feedback to the microprocessor control panel via control circuit.

The system shall incorporate a frequency converter or frequency converter motors on the pumps and the pressure transmitter shall register the actual pressure on the discharge side.

The variable speed drive pumping system shall maintain a constant pressure regardless of the system demand. If there is a drop in pressure outside the preset point, the Variable Speed Drive (VSD) pump shall start to run until the pressure increases to the preset limit, or it will continue to increase the pump speeds to the upper limit of the frequency. If the water system demand still cannot be met, the second pump shall be called in to run, the VSD will then alter the pump speed to meet the preset pressure point. If the set point is still unable to be met, the third pump is then activated to run (in case of 3 pumps units).

This shall be achieved by continuously varying the motor speed of the duty pump according to the demand up to a maximum designed capacity.

Under decreasing hydraulic demand the reverse sequence to the above description shall apply.

The EMU shall ensure alternation of all the duty and standby pumps for even running hours for all the pumps.

The frequency converter shall be linked to the motor of the duty pump for continuous speed adjustment and ultimately the water delivery shall be maintained at constant pressure at the preset value.

### 4.2.2 Local Motor Control Panel

The motor control panel shall be equipped with all the necessary electrical components including a microprocessor control unit and a frequency drive. The control panel and the microprocessor shall cover the followings functions:

- Flexibility and simplicity in allowing the necessary re-adjustment of the pumping system pre-set delivery pressure to operate the pumps within the specified maximum and minimum delivery ranges.
- Built-in frictional loss compensation factor which will automatically increase the delivery pressure setting, in collaboration with the increase in flow demand. This shall be able to minimize the system pressure differences and provide a more constant pressure along the supply line and also to save the energy consumption of the motor when running at low speed.
- Automatic changeover of the pumps to be controlled by the microprocessor which dictates the duty and standby pumps to run at variable speed.
- Built-in clock functions with weekly programming and with Switch on system to operate at at least 10 different pre-set pressure points as required.
- When the system has not been operated for more than 24 hours, it shall automatically start the pumps for a few seconds/day to ensure the pumps readiness at all times. The standby pumps shall be activated upon failure of duty pump(s). In event of control failure, the pumps shall be able to be start/stopped manually at the local panel by means of pressure Switches.
- The microprocessor control panel shall be able to cut-off the pumping system when excess pressure is registered in the discharge common manifold.
- The system shall have the capability of receiving input signal concerning reduced water level in suction tanks and shall have control mechanisms to prevent the pumps form running dry.
- Automatically starting the pumps when the water level is back to normal.
- In case of pump failure due to motor overload, the standby pump is Switched on automatically. Alarm signal is displayed on the LCD Display unit and alarm lights are activated.
- Functions to limit the no. of start/stop of pumps per hour.
- The system control panel shall incorporate at least the following components:
  - a. LCD Display
  - b. Pumps selections for up to 4 pumps so that system controller can control up to 6 pumps
  - c. Pump status button to display duty pump speed and system capacity
  - d. Zone status button to display operating parameters for different pumping units
  - e. Setting button to input preset pressure, system start/stop time etc.
  - f.  $\pm 1$  button to key in numeric data such as pressure set point, etc.
  - g. Enter button for confirmation of input into the system
  - h. Alarm button to show location of fault - self diagnostic function display
  - i. Hour Run measurement for each supplied pumpset
  - j. Buttons for scrolling to select the actual display reading for system configuration, i.e. up and down scroll concept.
  - k. Necessary devices for programming, supervising and monitoring operation data/system, status shall be incorporating into the control panel.

#### 4.2.3 Operations

Local control panel shall perform as follows:

##### Auto mode



The desired delivery pressure within the range specified shall be set at the duty local control panel. The pressure transmitter shall detect the delivery pressure continuously within 1 second and feedback to the microprocessor which will control the variable speed drive frequency converter for speed control of the duty pump. When demand increases, the subsequent pumps in the system will be activated to boost up the pressure. Ultimately the duty pump set shall be operated fully automatically to maintain the delivery pressure constantly at the desired set value.

#### Manual Mode

The on/off function of the pumps shall be manually adjusted at the microprocessor located at the local control panel.

#### Frequency Control By-pass Mode

All the pump sets shall be started/ stopped automatically with the pump output at fixed maximum rotational speed. All the control and protection functions shall remain active. The cut in/cut out pressure shall be internally calculated by the microprocessor for each pump.

### **4.2.4 System Features**

The required performance features of each Hydropneumatic pumping unit shall be as follows:

#### System Configuration

Variable speed pumps with pressure vessels.

Control panel consisting of the following components:

- Pump Functional Unit (PFU) - control unit c/w pre-programmed microprocessor chip. This unit shall control all pumping unit operations through electronic controller.
- Pumping Monitoring Unit (PMU) - monitor the operation of the pump sets. This unit shall allow for monitoring and setting of all control parameter.
- Variable Speed Drive
- Circuit Breakers
- Fuses
- Pressure Transmitter

#### Set Point

Ten separate pressure “set points” shall be able to be programmed into the PMU, and Switching between set points is timed by a real time clock when a lower pressure is acceptable during certain periods, for instance after hours or weekends, the set point shall be lowered to minimise power consumption.

An external input shall also be used to Switch between set points, or manually adjust a set point at any time.

#### Friction Loss Compensation

It shall be possible to allow for the friction loss component of the system, calculated at full flow and set as a percentage of the set point which will reduce the working pressure of the pump set depending on the actual no. of pumps in operation. A linear approximation of system resistance curve can therefore be allowed for, and pressure will automatically increase as system flow and subsequent frictional losses increase. As such power consumption shall reduce which is required for the pumping system.

#### Displays

Through the PMU keypad all variable parameters shall be adjustable, current status of settings and measured values shall be able to display on the 2 line x 24 character liquid crystal display.

Individual menus shall be available for monitoring individual pumps, zones, settings, alarms and ON/OFF functions.

### Pump Status

Running hours of each pump

Actual pump status (running, not available, standby, allocated to zone, fault)

Maximum head of pump at zero flow.

### Zone Status

This menu shall be the main operating menu where at the setting and operating parameters can be viewed,

- a. Current operating set point
- b. Measured values in the system
- c. Operating capacity in terms of total output
- d. Mode of operation for the zone
- e. Clock programs (relating to set point pressures)
- f. Standby pumps
- g. Pump change over time
- h. Zone configuration
- i. Pressure transducer scaling
- j. Friction loss compensation
- k. Pump priority
- l. Inlet pressure measuring (if required)
- m. System response times
- n. Allowable number of starts per hour for the pumps
- o. Minimum limit (loss of water, burst mains protection)

### Setting Menu (Set)

In this menu all parameters for the operation of the pump set shall be able to be adjusted as required.

- a. Set points (up to 10)
- b. On/Off function (used to prevent unnecessary cycling at low demands)
- c. Displayed pressure units (Bar, PSI, mBar, kPa)
- d. Real time clock programming for any time of the day, week, or weekend
- e. Zone configuration
- f. Friction loss compensation

### Alarm

The alarm menu shall display all faults that occur during operation, logging the time and date of when the fault occurred and when it was corrected, or whether it is still an actual fault, up to 10 faults can be maintained as history in the controller. The following type of faults shall be diagnosed by the controller.

- a. Mains failure
- b. Frequency converter fault
- c. Analogue input (pressure transducer) fault
- d. High discharge pressure fault
- e. Low discharge pressure fault
- f. Motor thermal overload fault

### Variable Frequency Drive

Variable frequency drive shall be of a reputable make acceptable to Project Manager and shall be complete with RFI filter and harmonic dampers.

### Enclosure

An IP 54 powder coated steel enclosure shall house all the electrical components.

The enclosure can be supplied loose for remote mounting, or mounted on a common base with the pumps, it shall be adequately ventilated for use in conditions up to a maximum ambient temperature of 45 degrees Celsius.

#### Electrical Componentry

All circuit breakers, thermal overloads and contactors shall be of reputable make acceptable to the architect. Electrical supply to the pump controller shall be protected using an isolating circuit breaker.

#### Method of Starting

The panel shall be built to start the pumps in suitable starting modes, i.e. D.O.L., Star/Delta, or using Soft Starters.

#### Quality and Testing

Manufacture of the pumps, plus design and assembly of the complete packaged Hydropneumatic pumping system shall be factory assembled and the pump station shall be fully tested hydraulically and electrically prior to dispatch to site. Test reports etc. shall be submitted for review before dispatch.

### 4.2.5 **Pump Pressure Vessel**

Diaphragm type pressure vessels shall be provided as shown on the drawings. They shall be incorporated into the system so that during normal operation the pump shall not need to be start within 30 seconds of it Switching off in order to prevent the pump hunting.

The pressure vessel shall be of adequate capacity to accommodate a considerable fluctuation in water demand by the system with minimum start/ stop cycles of the pumps. The vessel shall be constructed of steel plate built to ASME Standards for Unfired Pressure Vessel. A rubber diaphragm shall be provided in the vessel for separating the water and pre-charge nitrogen. The pre-charge pressure shall be adjustable and charging port with non-return device shall be provided. The adjustable cut-in and cut-off pressure unit for the pumps shall be built-in at the vessel to suit the system.

### 4.3 **FLOATLESS TYPE LEVEL SWITCH IN WATER TANKS**

The Tenderer shall supply and install floatless type Switch probes in the water tanks as indicated below and shown on the drawings.

#### Raw Water Tanks at Basement

- High level alarm (over-flow);
- Low level alarm;
- Low level cut-out for raw water pumps;
- Earthing probe.

#### Cooling Tower Make-up

- High level alarm (over-flow);
- Low level alarm;
- Low level cut-out for supply pumps;
- Earthing probe.

#### Potable Water Tank at Basement Level

- High level alarm (over-flow);
- Low level alarm;
- Low water level cut-out for the domestic hydropneumatic pumps;
- Earthing probe.

#### Soft Water Tank at Basement Level

- High level alarm (over-flow);
- Low level alarm;
- Low water level cut-out for the domestic hydropneumatic pumps;

- Earthing probe.
- Flushing Water Tank at Basement Level
- High level alarm (over-flow);
- Low level alarm;
- Low water level cut-out for the domestic hydropneumatic pumps;
- Earthing probe.

Each probe shall be of the correct length for the particular application and tank location. Electrodes shall be of polished stainless steel 20 mm OD. Electrode holders shall be weatherproof in all respect.

The earthing probes shall be connected and wired to the building earth systems of the building.

Each set of electrodes shall be installed inside a 230 mm diameter PVC pipe acting as a wave barrier.

The level Switch set shall operate with a stepped down voltage at 24V maximum. Stepped down transformers shall be provided for each set of control probes and shall be installed inside centralised control cubicles inside pump room.

Mechanical steel stuffing boxes shall be used.

#### Control of Duty / Standby Pumps

Operation of the duty and standby pumps shall be carried out by the following method:

- a. Automatically by means of pressure sensor (i.e. pressure Switches);
- b. Manually by means of a local start/stop push buttons on pump local motor control panel and emergency stop Switch.

The pressure Switch shall be installed next to the manual release valve. When the pressure drops to the pre-determined level, a signal will be sent to the pump local motor control panel to start the pump.

Automatic controls shall be operated by electronic, float less type level Switches.

#### Pump Indicator

The following audible and visible indication shall be provided at the pump local control panels as applicable:

- a. Red "overflow level" indicator with buzzer for the associated water tanks;
- b. Amber "extra high water level" indicator for the associated water tank;
- c. Amber "high water level" indicator;
- d. Amber "low water level" indicator;
- e. Red "pump trip" indicator for each pump;
- f. Green "pump on" indicator for each pump;
- g. "Pump electrical supply healthy" indicator for each pump;
- h. Amber "remote/local" status indicator.

### 1.2 **Submersible Pumps**

These shall be fully submersible with a fully submersible motor. The pumps shall be provided with an automatic level controller and all interconnecting power and control cabling which shall cause the pumps to operate when the water level in the sump rises to a preset level and stop when the preset low level is reached.

Pumps for drainage shall be single stage, single entry.

Pump shall be with a dynamically balanced impeller connected to a common shaft of the motor. The vane for sewage pump will be open type, while for drainage pump, etc. it will be of semi open type. The MOC of the pump shall be in accordance to schedule of quantity.

Each pump shall be provided with a suitably rated induction motor suitable for 415 volts, 3 phase, 50 Hz A.C. power supply.

Each pump shall be provided with in built liquid level controller for operating the pump between predetermined levels.

The pumping set shall be for stationary application and shall be provided with pump connector unit. The delivery pipe shall be joined to the pump through a rubber diaphragm, and bend and guide pipe for easy installation.

Pump shall be provided with all accessories and devices necessary and required for the pump to make it a complete working system.

Sump pump shall be complete with level controllers, power and control Switch gear, Auto/ off/ Manual Switches, pumps priority selections and control and power cabling upto motor and controller/probes etc. (Including earthing). Level control shall be such that one pump starts on required level, 2<sup>nd</sup> pump cuts in at high level and alarms is given at extra high level. All level controllers shall be provided with remote level indications.

### 1.3 **Motor Design for Submersible Pump**

The pump motor shall be a squirrel cage induction, housed in air filled water-tight enclosure. Oil filled motors are not acceptable. The stator windings shall be Class "F" insulation (155 degree C or 311 degree F) for general usage and class 'H' insulation (180 degree C or 317-8 grade 2) for submersible type.

The stator shall be heat shrunk fitted into the enclosure and shall not use bolts, pins or other fasteners that penetrate through the stator enclosure. The starter shall be equipped with a thermal Switch embedded in series in the coils of the stator windings to protect the stator from wheel.

The motors shall be designed for continuous running duty type at 415 volts, 3 phase, 50 Hz power supply and capable of sustaining a minimum of 20 starts/stops per hour.

Between stator housing and pump, a tandem seal arrangement will be provided with an oil barrier. Both seals run in oil, allowing dry running without seal damage. Both seals shall be of the rubber bellows or metallic bellow type with positive drive between shaft and rotating seal face.

## **TRANSFORMER**

1. 11KV/0.433 KV, 1600KVA, 50Hz Dyn-11 shall be Dry Transformers with on Load Tap Changing on HV Side
 

Scope  
Design, manufacturing, testing at OEM factory and installation, commissioning at site complete with all the accessories and fittings for efficient and trouble free operation.

Codes and Standard  
Transformer design, manufacture and performance shall Conform to Indian Standard IS:2026-Part I to Part IV, IS:1180 IS 6600-1972, IS-10028-1985, IS 8468-1977, IS-11171:1985, ECBC 2017

Rating and Type  
The KVA ratings shall be 1600 KVA/500 KVA based on natural cooling (ONAN). Each transformer shall be capable of supplying its rated power continuously at all tap positions with rated voltage on the low voltage winding. The transformer shall also be capable of delivering rated current at an applied voltage upto 105% of the rated voltage.

Each Transformer shall be suitable for Outdoor application.

Connections and Vector Group  
Delta on High Voltage side and star on low voltage side with neutral terminal brought out for neutral grounding resistor system (NGR) corresponding to the Vector Symbol Dyn - 11.
  2. System of Supply  
3 phase, 50 Hz 11 KV earthed system.
  3. Voltage ratio & Tapings  
Each transformer shall be supplied with an on load tap changer connected to the high voltage winding. The tap changer shall have 16-17 steps and shall be so arranged as to give variations of transformation ratio in equal steps of 1.25% per step on HT side. The total range of the tap-changer shall be from +10.0 percent to -10.0 percent.
- Temperature Rise  
Each transformer shall be capable of supplying its rated power continuously rated for full load, temperature rise not exceeding 45°C by thermometer in oil or 55°C by resistance.  
Transformer may be over loaded during emergency upto 150% of its continuous rating in accordance with IEC publication 354 or IS-6600.
- Flux Density  
Each transformer shall be capable of operating continuously with rated current and with system maximum voltage applied to the low voltage winding at a frequency of 96 per cent of rated frequency without exceeding the temperature rise specified above.  
The limit of flux density at normal voltage and frequency shall be subject to the requirements for losses, harmonics and noise suppression but in any event shall not exceed 1.6 Tesla. The transformer core shall not be saturated at maximum system voltage i.e. 36.3kV
- Radio Influence and Noise Level  
The transformer shall be designed with particular attention to the suppression of maximum harmonic voltage, especially the third and fifth, so as to minimize interference with communication circuit.  
The noise-level when energized at normal voltage and frequency with fans and pumps running shall not be more than 0.5 db above the NEMA standard publication TR-1.
- Harmonic Currents  
The transformers shall be designed with particular attention to the suppression of harmonic voltages, especially the 3rd, 5th and 7th harmonics, so as to eliminate wave form distortion and the possibility of high frequency disturbances, induction effect or of circulating current between neutral points at different transformer stations.
- Cooling  
Cooling Fins/Radiator – in order for the transformer to dissipate the heat it generated in its oil-insulation, cooling fins and radiators are usually attached to the transformer tanks. The capacity of the

transformer is dependent to its temperature that is why it is imperative for it to have a cooling mechanism for better performance and higher efficiency.

Cooling Fans – shall be attached to the cooling fins. Cooling fans shall be either be a timer controlled or a winding/oil temperature controlled. Cooling fans helps raises the transformer capacity during times when the temperature of the transformer rises due to its loading. Cooling fans used on the transformer are actuated by the help of a relaying device which when senses a relatively high temperature enables the fan to automatically run.

#### Insulation Level

The transformers shall be designed and tested to the following insulation levels:

Line terminal Voltage (rms.)	Power Frequency Voltage (peak)	Lightning Impulse
11kV	28kV	75kV (1.2/50 $\mu$ S)

The windings shall be uniformly insulated and the low voltage neutral point shall be insulated for full voltage.

#### Winding

The coils used for winding shall be circular in shape made of paper insulated continuous and smooth tinned or enameled electrolytic copper conductors of high conductivity.

Liberal ducts shall be provided to prevent any hot spot temperature in the winging that may adversely affect the life of the equipment. Adequate supports wedges and spacers of hard insulating material shall be so fitted that they will neither move nor permit relative movement of any part of winding during transit of normal service or under terminal short-circuit, nor damage the winding insulation in any way. All leads and connections shall be robust, adequately insulated, protected and clamped. The winding assembly shall be dried in vacuum with tested insulating oil of approved standard. The windings shall be subjected to a through shrinking and seasoning process so that no further shrinking of windings occurs during service at site. However, adjustable devices shall be provided for taking up any possible shrinkage of coils in service. The assembly shall be held in position under adequate axial compression to withstand the axial thrust likely to occur under terminal short-circuit.

Highly sophisticated design techniques shall be applied to ensure electrical, mechanical and thermal stability. Windings can be Helical and continuous disc type windings to provide maximum strength and short circuit withstand capabilities. The winding coils shall be pressed before core-coil assembly to ensure proper trouble free service. Clamping rings shall be placed on top and bottom of the winding to ensure high axial short circuit withstand capability to the transformer

#### Core

The magnetic circuit shall be built of transformer grade cold rolled grain oriented low loss steel stampings having high permeability and conforming to adopted standards. Stamping shall be insulated from each other with material having high inter-lamination insulation resistance and rust inhibiting property and also capable of withstanding pressure, mechanical vibration and action of heat and oil, thus reducing the possibility of sludge formation to a minimum.

The framework clamping arrangement and general structure of the cores shall be of robust construction and shall be capable of with sustained any shock to which they may be subject during transport, installation and service. The assembled core shall be securely clamped on the limbs and the yoke, to build up a rigid structure. The clamping pressure shall be uniform the whole of the core and so adjusted as to minimize noise and vibration in the core when the transformer is in service. The framework and the core bolts shall be efficiently insulated from the core so as to reduce the circulating currents to a minimum.

The core shall be provided with lugs suitable for lifting the complete core and coil assembly.

The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand a voltage of 2000 V for one minute.

The core clamping frame shall be provided with lifting eyes for the purpose of tanking and untanking the core with winding mounted thereon and shall have ample strength to take the full weight of the core and winding assembly.

### Transformer Oil

The insulation oil shall be mineral oil to the IEC Standard 296 Class 1 or IS 335 whichever is more stringent. The complete first filling shall be of new oil free from inhibitors and additives. Transformers shall be shipped with oil filled at least to cover the core and coil assembly and the balance, with two percent extra quantities to cover spillage during filling to be supplied in non returnable steel drums.

### Bushing CT

This bushing CT is used to measure the current of the primary winding of the transformer. This measured value is monitored at the control room.

### Control Box

This box is used to control the transformer such as tap changing etc.

### Grounding Switch

Grounding switch provides safety during maintenance work. For any maintenance work the safety steps that must be taken are Step 1: Load CB must be open Step 2: Isolator must be open Step 3: Grounding switch must be closed. When maintenance work is done the reverse processes must be done before switching on the transformer.

### Buchholz and Gas Pressure Relays (800 kVA and above)

A double float Buchholz relay shall be provided in the pipe connection from the main tank to the oil conservator. It shall be provided with isolating valves. The upper float of the Buchholz relay shall operate a contact to give an alarm on accumulation of gases caused by a gradual fault. The lower float shall operate a contact to make a circuit to trip associated circuit breakers in the event of further gas accumulation or a sudden flow of oil caused by an explosive development of gases.

The gas release connection from the Buchholz relay shall be brought down to a gas sampling device accessible from the ground to facilitate sampling with the transformer in service.

The test connection from the Buchholz relay may be brought to the gas sampling device if suitable or may be terminated beside it. Isolating valves accessible from ground level shall be provided in both of these connections.

An oil surge relay shall be mounted in the pipe leading from the tap-changer head to the oil conservator. The relay shall be actuated by an oil flow caused by a tap-changer fault and its contact shall make a circuit to trip associated circuit breakers and provide annunciation in the control room.

### Oil temperature Indicator (OTI)

The transformers shall be provided with a mercury contact type thermometer with 150mm dial for top oil temperature indication. The thermometer shall have adjustable, electrically independent potential free alarm and trip contacts. Maximum reading pointer and resetting device shall be mounted in the local control panel. A temperature sensing element suitably located in a pocket on top oil shall be furnished. This shall be connected to the OTI by means of capillary tubing. Accuracy class of OTI shall be  $\pm 1\%$  or better. One number electrical contact capable of operating at 5A at 230 volt AC supply.

### Winding temperature indicator (WTI)

A device for measuring the hot spot temperature of the winding shall be provided. It shall comprise the following.

- i Temperature sensing element
- ii Image Coil.
- iii Mercury contacts
- iv Auxiliary CTS, If required to match the image coil, shall be furnished and mounted in the local control panel.
- v 150mm dial local indicating instrument with maximum reading pointer mounted in local panel and with adjustable electrically independent ungrounded contacts, besides that required for control of cooling equipment, one for high winding temperature alarm and one for trip.
- vi Calibration device.
- vii Two number electrical contact each capable of operating at 5 A ac at 230 Volt supply.

### Marshalling Box



A sheet steel vermin and dust proof, well ventilated and weather -proof marshalling box of a suitable construction shall be provided for the transformer ancillary apparatus. The box shall have domed or slopping. Sheet thickness of the box shall not be less than 3 mm and it shall be provided with lockable doors.

The marshalling box shall accommodate the following

- a) Control and protection equipment for the local electrical control of tap change
- b) Control and protection equipment for the cooling scheme.
- c) Terminal blocks and gland plates with electroplated brass glands for incoming and outgoing cables.
- d) Adequate number of spare contacts to be provided for pick-up of all the measured /inputs (WTI,OTI etc.) for BMS purpose.
- e) Electronic relay winding & oil temperature and various input terminal to receive trip & alarm signals from the transformer and provision to communicate energy center command room through soft communication.

All the above equipment except (c) shall be mounted on panels and back of panelwiring shall be used for interconnection.

The temperature indicators shall be so mounted on the body of the transformer at a height of 1200 mm above rail top level.

A sheet steel, weatherproof, IP55, marshalling box outdoor type shall be provided for transformer. The box shall contain all auxiliary devices except those which must be located directly on the transformer. Sheet steel thickness shall be minimum 3 mm.

All terminal blocks for cable connection shall be located in this box. The terminal blocks shall be ELMEX 10mm<sup>2</sup> or approved equal for control and CT's and suitably sized for fan control.

The marshalling box shall be provided with cubicle lamp with door switch, space heater with Humidistat and removable cable gland plate

#### Tank and Accessories General

The transformer tank shall be skid mounted type.

The transformer tank shall be designed so that the complete transformer with oil and excluding conservator and radiators can be lifted and transported without permanent deformation or oil leakage.

The tank and cover including the stiffeners shall be designed in such a manner as to leave no external pockets in which water can lodge, or internal pockets where gas/air can collect. All fittings shall be designed so as to prevent entry of air or leakage of oil from the tank.

All pipes, shall be externally welded to the tank wall.

The tank and cover shall be of structural quality, weldable mild steel with a minimum thickness of 3 mm. All welding shall be stress relieved. The requirement of post weld heat treatment of tank/stress relieving shall be based on recommendation of BS-5500 table 4.4.3.1.

The tank lid shall not be welded shut, but shall be secured by bolts and provided with suitable oil-tight gasket.

The tank is to withstand vacuum up to 500mm of mercury for transformers and any pressure of oil developed during operation conditions including short circuits.

#### Conservator Tank

The conservator tank shall have adequate capacity between highest and lowest visible levels to meet the requirement of expansion of the total cold oil volume, in the transformer and cooling equipment from minimum ambient temperature to 90 deg.C.

Conservator shall be provided with sump and drain valve so that it can be completely drained by means of the drain valve, when mounted in service position.

The conservator shall be bolted into position so that it can be removed for cleaning purposes.

The conservator shall be fitted with magnetic oil level gauge with low level electrically insulated alarm contacts.

Conservator shall be provided in such a position as not to obstruct the electrical connections to the transformer.

Sealed conservator with atmosphere seal design will be offered as an option.

### Breather

The conservator tank shall be fitted with a breather in which silica gel is the dehydrating agent.

The breather shall be a molded type transparent case of adequate size and so designed that :

- i. the passage of air through the silica gel does not give rise to any excess pressure rise
- ii. silica gel crystal of not less than 5mm. size is used;
- iii. the silica gel is sealed from the external atmosphere by means of an oil seal;
- iv. the moisture absorption indicated by a change in colour of the crystals can be easily observed from a distance;
- v. the breather mounting height facilitates maintenance from ground level without switching out the transformer.

### Explosion Vent or Pressure Relief Device

An explosion vent or pressure relief device shall be provided to release any severe build-up of pressure within the tank. The vent shall be designed such that in the event of an explosion, rain, sand or any other foreign bodies are prevented from getting into the tank. The vent shall be positioned so as to direct the explosion safely into the oil pit.

### Fittings and Accessories

- A. The following accessories and fittings shall be provided for Transformer:
  - Lifting Lugs : The arrangement for lifting the active part out of the transformer tank alongwith the cover by means of lifting lugs without disturbing the connections.
  - Swivel Type Rollers: the transformer to be provided with 4 Nos Bi-Directional rollers fitted on cross channels to facilitate the movement of the transformer in both directions.
  - Air release Valve : An air release valve is to be provided on the top of the tank cover facilitate the release of the entrapped air and filling of oil.
  - Drain-cum-oil Filter Valves : The transformer to be provided with a drain-cum-oil filter valve of 1 1/4" BSF size at the bottom of the tank.
  - Diagram and rating plate : Diagram and rating plate shall be provided indicating the details of transformer, connection diagram, vector group, tap changing diagram etc.
  - MOLG Alarm contact shall be provided till MB
  - Jacking pads with haulage holes.
  - Oil surge relay for OLTC.
  - Shut off valves for OLTC oil surge relay.
  - Access windows for OLTC connections.
  - Extra neutral bushing for NGR earthing.
  - PRV with trip contact.
  - Filter valve of 1 1/4" BSF at top.
  - Explosion vent.
- B. Following items shall be provided for OLTC:
  - High Torque Electric motor suitable for 415 Voltas, 3 phase, 50 Hz AC supply.
  - Motor drive and energy accumulator
  - Motor isolating device with over load protection
  - Contactors for forward and reverse operation of motor
  - 'Raise/Lower' control for local & remote operation.
  - 'Raise/Lower' Limit switch.
  - Interlock between manual & electrical operation.
  - Auxiliary contacts
  - Retainer Switch
  - Tap Position Indicator
  - Tap operation counter
  - Stoppers to prevent over travelling of mechanism
  - Internal illuminating lamp with switch.
  - 'Local/Remote' control selector switch.
  - Auto/Manual selector switch.

- Anti-condensation heater with switch and Humidistat
- Handle for manual operation.
- Driving Mechanism chamber locking arrangement.
- Terminal Strips
- Lubricating Chart
- Undrilled gland plate for cable entry.

C. The following shall be required for remote indicating. :

- Potential meter for remote tap position indicator
- Contacts for Tap change in progress indication.
- Contacts for Upper and Lower limit reached indication.
- Contacts for Tap change stuck / incomplete indication.

#### Terminals

Outdoor bushings shall be provided for the 11 KV and 0.4 KV terminations. The 11 KV terminations shall include a neutral bushing of identical type and rating to the phase bushings. All bushing shall have a minimum creepage distance of 25 mm/ kV. The protected creepage distance shall not be less than 50 % of the total. Bushing shall conform to IEC 137 and IEC 815/ IS 3347 and IS 2099. They shall be sufficiently robust to withstand the normal transport and erection hazards.

For 1600 KVA rated Transformer ,The cable box with glands on 11 kV side shall be suitable for 3 core 300 Sqmm. Aluminium conductor armoured XLPE cable and LT side shall be suitable for 3000 Amp. TPN Bus Duct. All cable glands shall be earthed.

#### Terminal Markings

The terminal markings shall be clearly and permanently shown. Painted markings are not acceptable. The windings shall be labeled as follows:

High Voltage : 3 phases and neutral U V W

Low Voltage : 3 phases and neutral u v w n

Terminals U, V , W and u, v, w shall be connected to phases R, Y, B, respectively.

#### Labels and Rating Plates

Labels, plates, markings, and instructions shall be clear and indelible and in the English language. Cast-in or moulded-in words not in English shall be covered with a permanently fixed non-ferrous label inscribed in English.

A rating plate shall be provided in accordance with IEC Publication 76 / IS 2026 / IS 1180. In addition a plate showing the location of all valves and air release cocks or plugs shall be provided.

#### Painting

All steel surfaces shall be thoroughly cleaned by sand blasting or chemical agents as required insulating varnish which shall not react with and be soluble in the insulating liquid used,

The internal surfaces in contact with insulating oil shall be painted with heat resistant insulating varnish which shall not react re-act with and be soluble in the insulting liquid used.

The external surfaces, after cleaning, shall be given a coat of high quality red oxide or yellow chromate primer followed by filler coats.

The paints shall be carefully selected to withstand tropical heat, rain etc. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling.

Sufficient quantities of touch up paint shall be furnished for application after installation at site.

If it is considered necessary, the transformer may be given a further coating at site by the Supplier. Internal and external steel surface including oil filled chambers and structural steel work to be painted shall be shot blasted / sand blasted to remove all rust, scale and grease. The minimum thickness of outside painting of tank shall be 20 microns per coat and the total thickness shall be minimum 80 microns.

One coat of additional paint shall be given at site to the purchaser. Supplier will also supply requisite quantity of paint. Cubicle and marshaling kiosk sheets shall be phosphate before application of enamel paint.

#### Drawings and Leaflets

Three copies of operation and maintenance manual with complete instructions for the installation, operations, maintenance and repairs, circuit diagram, foundation and trenching details shall be provided with the transformer.

#### Measurement and Reporting of Transformer Losses

##### Testing

The transformers offered should be a type tested product in line with standard and technical specifications. The tenderer shall furnish the following type tests reports for an identical capacity transformer along with General arrangement drawing, rating diagram plate and internal constructional details while submitting the offer:

- Impulse Voltage Withstand Test.
- Temperature rise test.

All routine tests including partial discharge test as per IS 2026 / IS 1180 which is applicable shall be carried out at the factory and copies of test reports shall be submitted for approval and records.

Unless otherwise specified elsewhere Heat Run Test shall be carried out for one transformer in a group at an approved test lab as per IS 2026 / IS 1180 at no extra cost.

Transformers shall be transported with nitrogen filling. Oil (including 10% spare oil) shall be sent in returnable drums for filling at site. Suitable oil filtration machine shall be deployed for filtration/filling of oil.

Transformer yard shall be provided with gravel filling, small gate for man entry as well as big gate for transformer.

Transformers shall be mounted on rails provided as part of foundation/ soak pit construction. The wall of the soak pit below the transformer shall be raised by min 300mm above FGL to prevent water from nearby areas entering the soak pit. Rail top may be at the same height as the top of soak pit wall (FGL +300mm). Cable trenches with pre cast shall be provided in transformer yard for power cables and control cables.

#### On-Load Tap-Changing Mechanism (O.L.T.C.)

Each transformer shall be provided with an on load tap changing mechanism. This shall be suitably designed for

- i) Local manual as well as local and remote electrical operation,
- ii) Remote electrical operation from control room through RTCC panel.

Interlock It shall not be possible to use the electric drive when manual gear is in use and it shall be possible to use only one electrical control at a time. Operation of the local or remote control switches shall cause one tap movement only until the control switch is returned to the off position for the next operation.

The local electrical control switches shall be mounted in the out door cubicle.

The tap change equipment shall be so designed that if the mechanism is stuck in an intermediate position, the transformer shall be capable of delivering full load without any injury.

Limit switches may be connected in the control circuit of the operating motor provided that a mechanical de-clutching mechanism is incorporated. Otherwise it shall be directly connected to the operating motor circuit and mechanical stop.

Thermal devices or other means shall be provided to protect the motor and control circuits. All relay switches, fuses etc. shall be mounted in the marshalling box and shall be clearly marked to indicate their purpose.

The control circuit shall operate at 110 V single phase to be supplied from a transformer having ratio of 230/55-0-55 V with the center point earthed through a removable link mounted in the marshalling box.

The whole of the apparatus shall be of robust design and capable of giving satisfactory service without undue maintenance under the condition to be met in service, including frequent operation by the equipment.

A five-digit counter shall be fitted to the tap changing mechanism to indicate the number of operations completed by the equipment.

A permanently legible lubrication chart shall be fitted within the driving mechanism chamber.

#### On-Load Tap Changer

The ON-LOAD Tap changer shall include the following a) An oil immersed tap selector and arcing switch or arc-suppressing tap selector, provided with resistor for reduction of make and break arcing voltage, overload and short circuits. b) Motor driven mechanism. c) Control and protection devices. d) Local and remote tap-changer position indicator. e) Manual operating device.

The on-load tap changer shall be so designed that the contacts do not interrupt arc within the main tank of the transformer. The tap selector arcing switch or arc suppressing tap selector switch shall be located in one oil filled compartment. The compartment shall be provided with a means of releasing the gas produced by the arcing. It shall be designed so as to prevent the oil in the tap selector compartment from mixing with the oil in the transformer tank.

The oil in those compartments of the main tap-changing apparatus which do not contain contacts used for making or breaking current shall be maintained under conservator head by means of a adequate diameter pipe corresponding data of OLTC oil surge relay connection from the highest point of the chamber to the conservators. This connection shall be controlled by a suitable valve. To operate the gas and oil actuated relay.

The tap changer shall be capable of permitting parallel operation with other transformers for which necessary wiring and accessories, if any, shall be provided.

The center of manual operating device shall be located at a height of 1000 mm from rail top so that it can be operated by a person standing at the ground level. The arrangement shall be strong and robust in construction. The transformer shall give full load output on all tap positions.

The control scheme for the tap changer shall be provided for independent control of the tap changers when the transformers are in independent service. In addition, provision shall be made to enable parallel operation control also at times so that the tap changer will be operated simultaneously when one unit is in parallel with another it will not become out of step and this will eliminate circulating current.

Additional features like Master/ Follower and visual indication during the operation of motor shall also be incorporated.

Necessary interlock, blocking independent control when the units are in parallel, shall be provided. Under abnormal conditions that may occur if the contractor controlling one tap changer sticks, the arrangement must be such as to switch off supply to the motor so that an out of step condition is limited to one tap difference between the units. Details of out of step protection provided for the taps should be furnished in the tender.

The contractor and associated gear for the tap change driving motors shall be housed in a local kiosk mounted adjacent to the transformer. The motors shall be suitable for operation on 230 V, single Phase or 3 Phase 415 V, 50 cycle external power supply. The kiosk shall have space heater, shall be dust and vermin proof and suitably protected against corrosion or deterioration due to condensation, fungi etc.

#### Annunciation

The remote 11 KV Transformer panel indoor cubicle also have the following trip and non trip alarm windows fascias with 5 spare window (for future SCADA purpose) suitable for 110V DC supply. For 11 KV substations, these should be suitable for 110 V DC

- a. Oil temperature alarm & trip
- b. Winding temperature alarm & Trip
- c. Main Buchholz alarm & Trip
- d. Pressure relief valve Trip (Main tank)
- e. Surge relay trip (OLTC gear)
- f. Tap changer out of step alarm
- g. Low oil level alarm
- h. Failure of supply
- i. OLTC Buchholz alarm & trip

Each relay for tripping function shall have two normally open and two normally closed contacts for connection.

The OLTC shall be provided on the conservator side of the Power Transformer and not in front of H.V. Bushings.

OLTC shall be suitable for bidirectional power flow in both of 11/0.433 KV transformers.

#### Remote Tap Changer Control Panel

##### (RTCC) Construction Features

RTCC panel shall be of sheet steel cabinet for indoor installation (IP 52), floor mounting type. The RTCC panel shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors, Neoprene gasket and padlocking arrangement. RTCC panel shall be suitable for the climatic conditions as specified in Special Conditions. Steel sheets used in the construction of RTCC panel shall be 14 SWG CRCA sheet steel 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 rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to IS-8623-1977 (part-I) for factory built assembled switchgear & control gear for voltage upto and including 1100 V AC.

All panels and covers shall be properly fitted and 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 wing nuts. Self-threading screws shall not be used in the construction of RTCC panel. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panel.

The following components shall be provided in the RTCC panel:

- Digital Tap Position Indicating Meter
- Raise/Lower Push Buttons for Remote Control of OLTC
- Tap Change in Progress Signal Lamp.
- Supply on Signal Lamp
- Local / Remote Control Indicating Lamps
- Panel illuminating lamp with door switch.
- Space Heater with Switch and Humidistat
- Automatic Voltage Relay with Time Delay Element.
- Selectors switch for Auto/Manual Operation.
- Undrilled Gland Plate for Cable entry.
- Earthing Terminal
- Lifting Eyes Bolts

#### Packing

The packing shall be in accordance with the bidder's standard practice but he shall give full particulars of packing for the approval of the purchaser. All the parts shall be adequately marked to facilitate field erection. Boxes and crates shall be marked with the contracts number and shall have a packing list enclosed showing the parts contained therein.

#### Labelling

The transformer shall be labeled with the name of the substation where proposed to be installed. The label plate shall be fixed adjoining the name plate and shall be of similar design so as to match with the name plate. The transformer should only be dispatched with the name plate and the labeling plate indicating the name of the substation thereon.

#### Testing General

Tests shall be carried out on transformers in accordance with IEC Publication 76 / IS 2026 / IS 1180, IEC as specified below.

#### Type Test

The following shall be regarded as type tests.

Test of temperature rise. This test shall be carried out on the tap having maximum losses.

- (a) Measurements of open-circuit and short-circuit zero-sequence impedances of the HV and LV Windings.
- (b) Measurement of capacitances.
- (c) Short circuit test.

- (d) Impulse Test
- (e) Noise level measurement, in accordance with IEC Publication 551 using a precision sound level meter conforming to IEC Publication 651. In addition the test shall be repeated with narrow band filters for the harmonic frequencies from 100Hz. up to 350 Hz.
- (f) Vacuum test.

Following routine test shall be performed before Energizing the Transformer at site as per IS 2026 / IS 1180

- (a) Measurement of insulation resistance.
- (b) Measurement of winding resistance
- (c) IR Test Between HV to LV
- (d) IR Test Between HV to Earth
- (e) IR Test Between LV to Earth
- (f) Measurement of voltage ratio and check of phase displacement.
- (g) Measurement of no-load loss and Magnetization current.
- (h) Magnetic Balance test.
- (i) Vector Group relationship test
- (j) Measurement of impedance and load loss - SC Test.
- (k) Dielectric Test.
- (l) Tests on on-load tap-changers, where appropriate.

Following routine test shall be performed before dispatching Transformer at Factory as per IS 2026 / IS 1180

- (a) Measurement of winding resistance
- (b) Measurement of voltage ratio and check of phase displacement.
- (c) Measurement of short-circuit impedance (principal tapping, when applicable) and load loss at 50 percent and 100 percent load.
- (d) Measurement of no-load loss and current.
- (e) Measurement of insulation resistance.
- (f) Induced over-voltage withstand test IS 2026 / IS 1180 (Part 3).
- (g) Separate-source voltage withstand test IS 2026 / IS 1180 (Part 3)
- (h) Dielectric Test
- (i) Tests on on-load tap-changers, where appropriate
- (j) Pressure test
- (k) Oil leakage test

#### Specific Technical Requirement

For all outdoor Transformers, the interconnecting cabling for various instruments on the Transformer shall be routed on perforated cable tray with top cover till the marshalling box. The PRV relay shall be provided with canopy to avoid any ingress of water during rain.

The finish shade for the transformer enclosure and its accessories shall be RAL 7032. The type of paint shall be synthetic enamel air-dried.

Structural support for mounting lightning arrestor on the body above HT bushing shall be provided. The transformer enclosure shall be provided with 50 x 6 mm copper earth bus for neutral and body earthing by connecting to Plant earth grid. The earthing bus shall have minimum two holes at each termination end for fastening to the plant earthing lead.

The winding temperature and Oil temperature scanner shall be numeric type with alarm and trip contacts. The scanner shall also provide rate of rise of temperature feature with separate alarm and trip contacts. This shall also include hot spot temperature and temperature trend displays. The scanner shall have RS 485 communication port.

The enclosure shall be made with cold rolled sheet steel of minimum thickness 2.0 mm with external and internal finished as mentioned in data sheet. The degree of protection shall be IP 32 or better.

The HV and LV side cables shall not be directly terminated on the transformer. An extension busbar with post insulator shall be provided for the purpose.

HV Cable sizes have been mentioned to size the cable termination chamber. Suitable cable clamping arrangement shall be provided in the cable chamber. The minimum height of cable termination from Bottom/top of the gland plate shall be 750 mm.

RCBO of suitable rating shall be used in the control & aux. circuits. All control scheme of Marshaling box shall be designed as fuse less system.

20% spare terminal blocks shall be available in each termination location of TB's for future use.

The transformer shall be provided with neutral bushing terminal suitable for two runs of 50 x 6 mm copper earth bus for connections to earth pit.

## 2. 11/0.433 KV ,50Hz Dyn-11 shall be ONAN Transformers with on Load Tap Changing on HV Side

### 2.1 General

The transformer shall be outdoor type, three phase, 50Hz, Dry /Oil cooled, copper wound, core type, step down, delta/star, DYn- 11, with OFF load tap changer.

The transformer shall be designed and manufactured as per IS 2026 / IS 1180 with up to date amendments.

### 2.2 Standards

The transformers shall conform to the following Indian standard specifications with up-to date amendments: Transformer losses should be as per latest ECBC.

IS	2026 / 1180 part-I to V	- Transformers
IS	335	- Transformer Oil
IS	10028	- Installation & maintenance of Transformers
IS	2099	- Bushings
IS	6600	- Guide for loading of oil immersed transformers
IS	2070	- Method of Impulse Voltage Testing
IS	3637	- Transformer fittings & accessories
IS	1180	- Testing and Inspection

### 2.3. Design

#### 2.3.1. Power supply parameters

The transformer shall be capable of continuous operation at specified rating under the following condition:

- Voltage variation -10% to + 10%
- Frequency variation +/- 5%

#### 2.3.2 Climatic conditions

The reference ambient temperatures assumed for the purpose of this specification are as follows.

- Maximum ambient temperature 45 deg c.
- Maximum daily average ambient air temperature 19.5 deg c.
- Maximum yearly weighted average ambient temperature 35 deg c.
- Minimum ambient air temperature + 3deg c.

The transformer shall conform to the requirements of temperature rise specified in IS 2026 / IS 1180 (Part II) 1977. Continuously rated for full load, temperature rise not to exceed 50 degree C by thermometer in oil (55 degree-C by resistance), over an ambient of 50 degree C.

The transformer shall be free from annoying hum or vibration. The design shall be such as not to cause any undesirable interference with radio or communication circuits.

### 2.4 Construction

The standard constructional features of Manufacturer are acceptable Filter Valve : Filter Valve in the tank. OFF-circuit tap changer Oil

Temperature Indicator Winding temperature indicator Marshalling Box

:OFF- load tap changer to cater to voltage variation range of -10% and +10% in steps of 1.25%.

:Oil temperature indicator with alarm and trip contacts.



: Winding temperature indicator with alarm and trip contacts.

: Suitable size marshalling box to terminate the control cables of thermometer and Bucholtz relay.

Earthing Terminals : Two separate earthing terminals consisting of bolts of not less than 20 mm are to be provided at the sides of the tank on both sides for body earthing.  
Other Standard Accessories

: As per IS

## 2.5 Transformer Oil

The Insulating oil used in Transformer shall comply with the requirement of IS 335 (Specification for insulating oil for transformers and switchgears).

If the transformer is filled up with oil and transported to site, then 10% oil shall be supplied extra in non-returnable containers/drums suitable for outdoor storage. In case, transformer is sent with out oil, then full quantity of transformer oil along with 10% extra shall be supplied in non-returnable containers/drums suitable for outdoor storage

## 2.6 Cooling

The transformer shall be oil immersed natural air-cooled type (ONAN)

## 2.7 Tappings / Tap changing Device

The tapping shall be arranged on the high voltage windings and the tap changer shall be on-circuit type for voltage adjustments in steps of 1.25% for +10% and -10% of rated voltage at constant KVA output.

## 2.8 Other Fittings & Accessories

The followings accessories and fittings shall be provided with the transformer.

Lifting Lugs / Cover lifting eye bolt

2.9: The arrangement of lifting the active part of the transformer without disturbing the connections and also complete transformer lifting lugs shall be provided.

Rollers : 4 Nos. bi-directional rollers of suitable size corresponding to weight of transformer, fitted on cross channels, to facilitate the movement of transformer.

Oil Conservator : A conservator with welded end plates. Dimensions of the conservator shall be such as to allow change in volume due to change in temperature from 10 deg c to 95 deg c. It is to be bolted to the cover and can be dismantled for purposes of transport. It has to be provided with oil level gauge with marking for minimum level and an oil-filling hole with a cap, which can be used for filtering of oil. For draining purposes a plug is to be provided. A connection pipe between the conservator and main tank is to be provided.

Air Release Valve : An Air release valve on top of the tank cover to facilitate the release of the entrapped air while filling of oil.

Breather : An indicating dehydrating silica gel breather of sufficient capacity along with breather pipe of suitable size

Drain Valve with Plug : Oil drain valve of size as per IS with plug at the bottom of the tank.

Diagram and Rating Plate : One diagram and rating plate indicating the details of transformer connection, diagram vector group, tap changing diagram etc

Thermometer : Dial type thermometer (150 mm dia) and electrical contacts for electrical alarm at high temperature

ExplosionVent with diaphragm

: Explosion vent or pressure relief device of sufficient size for rapid release of any pressure that may be generated within the tank and which might result in damage to the equipment. The device shall operate at a static pressure less than the hydraulic test pressure for transformer tank.

## 2.9 Vector Group & Connections

Corresponding to the vector symbols Dyn-11.

The primary windings shall be connected in delta and the secondary windings in star (Vector symbol Dyn-11) so as to produce a positive displacement of 30 degree from primary to the secondary vectors of the same phase. The neutral of the secondary windings shall be brought out to two separate insulated terminals.

## 2.10 Terminal Arrangements

### 2.10.1 Secondary Side

The terminal arrangement at secondary side (0.433 kV side) shall be suitable for terminating as per BOQ, 0.433 kV, XLPE Aluminium armoured cable with sufficient space inside for termination and connections.

Two (2) nos. of neutral bushing shall be provided-one (1) for tapping neutral (4<sup>th</sup> wire) and one (1) for neutral earthing.

### 2.10.2 Primary Side

The terminal arrangement on primary side (11 KV side) shall be suitable for terminating 3 core x 240 Sqmm, 11 KV, XLPE, Aluminium armoured cable. The transformer shall be provided with cable box suitable for XLPE cable. Outdoor heat shrinkable termination kit shall be used for termination of HT Cable. Terminal box shall be provided with removable gland plate.

In general, the arrangement shall be such as to permit removal of the transformer without dismantling the bus duct/cable installation.

## 2.11 Painting

All steel surfaces shall be thoroughly cleaned by sand blasting or chemical agents as required, to produce a smooth surface free of scales, grease and rust.

The steel surfaces after cleaning shall be given a coat of high quality red oxide or yellow chromate primer followed by final coats.

The internal surfaces in contact with insulating oil shall be painted with heat resistant insulating varnish which shall not react with and not soluble in the insulating liquid used.

The transformer shall be finished with two coats of synthetic enamel paint.

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The paints shall be carefully selected to withstand tropical heat, rain etc. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling.

Where the painting is damaged during transit, installation etc., touch up painting shall be done at site.

## 2.12 Name Plates/Labels

This nameplate shall be in addition to the 'rating & diagram plate' mounted on the transformer body. This nameplate shall be fixed near the transformer on the wall / fencing or at a suitable place that attracts immediate attention giving the following details.

- Transformer Number..... Location.....
- KVA rating
- Voltage rating
- Make
- Sl no:
- Date of manufacture.
- Date of commissioning.

## 2.13 Installation

Following shall be the part of the installation works

Shifting of the unit(s) from place of storage to place of installation

Unpacking

Verification for transit damages/ availability of all items including accessories, operating handles, instruction manuals, drawings, test certificates etc and taking necessary action where needed.

Assembling different sections/ units when sent separately. Positioning of the units as per the drawings/site requirements

Alignment checks

Grouting/ securing to the floor/ base channels etc for stable installations.

Taking all necessary safety precautions for the equipment as well as personnel.

Touching up damaged painting portions.

Making earth connection of the unit.

Interconnection with OFTC, Marshalling box etc.

Connecting and ensuring efficient termination of cables/ bus ducts as applicable using proper size cable lugs, glands and appropriate size GI/ zinc passivated hardware with spring washers and plate washers at appropriate locations (smaller size bolts not to be used for bigger holes in cable lugs / switch gears to avoid weak electrical connections).-[scope of cable termination and bus duct connection is covered separately and shall be measured and paid accordingly].

Ensuring proper tightness of all joints, connections.

Providing proper supporting / protection arrangement to the cables/ units etc to avoid undue stress on the termination/ joints.

Providing required instruction/ information/ caution / name plates for easy operation and maintenance.

Provision of interlocks where needed.

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Following proper codes like IS and sound engineering practices.  
 Obtaining requisite statutory approval, (CEA clearance) licences etc where applicable.  
 Performance pre-commissioning checks and ensuring proper functioning of all the systems as required.  
 Satisfactory commissioning the equipment/system  
 Documentation

## 2.14 Tests

### 2.14.1 Factory Tests

The routine/acceptance tests shall be witnessed at the manufacturer's works by AUTHORITY representative. Test shall be carried out as per IS.

### 2.14.2 Type Tests

Transformer manufacturer must possess and produce type test certificate for same rating or higher as per IS and copy of type test shall be made available to the AUTHORITY inspector.

### 2.14.3 Site Tests

In addition to the tests at manufacturer's premises, all relevant pre-commissioning checks and tests shall be done at site before energizing the Transformer.

The following tests are to be particularly done before cable jointing or connecting the bus duct.

- a. Physical inspection for breakages/damages/orderliness.
- b. Insulation test between HV to earth and HV to MV with 5000 volts Megger.
- c. Insulation test between MV to earth with 500 volts Megger.
- d. Di-electric strength of transformer oil.
- e. Buchholtz relay operation by simulation test.
- f. Operational checks on protection system
- g. In case the transformer oil test is not satisfactory, the oil shall be filtered till proper di- electric strength of oil is obtained.

All test results are to be recorded and reports should be submitted to the department.

### 2.14.4 Test Certificates

Following test certificate shall be submitted by the Contractor: -

- a. Test Certificate for the routine/acceptance tests.
- b. Test Certificate for the type tests
- c. Test certificates for the site tests including di-electric strength of transformer oil.

### 2.14.5 Drawings/Documents

The following drawings/documents (3 sets) shall be furnished along with the transformer.

- Foundation details, if any.
- Installation, Operation & Maintenance manuals
- General layout including the dimensions
- Details of after-sales service
- Electrical drawings
- Others, if any, as per site

## **RISING MAINS /BUS TRUNKING SYSTEM / BUSDUCT**

### **SANDWICH TYPE BUS BAR TRUNKING SYSTEM**

#### **Scope**

This specification covers the design, manufacture, tests at works and delivery at site, erecting in proper position, testing and commissioning of the Sandwich type metal enclosed Bus Duct of suitable for 3 phase 415 V, 50 Hz supply. Before fabrication of the Bus-duct the contractor shall have to submit the detailed fabrication shop drawings, three dimensional route drawings and short circuit calculations for the approval of the Engineer-in-Charge.

#### **Codes and Standards**

The design, materials, construction, manufacture and testing for Sandwich Bus Duct shall conform to IEC 60439 Part 1 & 2 standards and Codes for metal enclosed busducts.

#### **Enclosure**

The enclosure shall be fabricated out of 1.5 mm CRCA sheet steel. This enclosure shall be adequately supported by cross-members as required to make the metal enclosure strong and rigid. The enclosure shall be totally dust and vermin proof and degree of protection shall be IP54.

The Bus Duct shall be painted with Granule finished powder coated from inside and outside. The enclosure shall be coated with Siemens grey, RAL 7032. Before powder coating, the enclosure shall undergo the seven tank cleaning process. The enclosure shall have rectangular shape of sections to conform to latest IEC standards. The design of the enclosure to the Bus Duct shall withstand the following:

- a) The enclosure shall be able to operate and withstand the Temperature conditions of 10°C (winter) to 40 °C(summer).
- b) Minimum Short circuit current rating shall be 60 KA for 1Sec.
- c) Mechanical vibration due to earth-quakes.

The Sandwich type Bus Duct system shall be manufactured in convenient section to facilitate easy transportation and installation. Each section shall be provided with suitable brackets at convenient intervals for supporting. The Cost shall include necessary bends, —T, Phase cross over chambers etc. i/c copper flexible. Nothing extra shall be paid on this account.

Expansion joints shall be provided as per the manufacturer's design and Recommendations.

Flexible connections shall be with tinned copper braided flexible at the Transformer and Switchgear end. The size of the flexible shall not be less than the cross section area of the Bus Bars.

MV Danger notice plates shall be provided on the front cover duly fixed by four screws. One danger notice plate shall be fixed at 3 m interval throughout the length of the bus duct. Nothing extra shall be paid on this account.

#### **Terminal Enclosures and Flanges**

Three phase terminal enclosures shall be provided with flanged ends and Adopter box with drilling dimensions to suit the flange at equipment terminals.

The flanges shall be provided with gaskets, nuts, bolts, etc.

#### **Earthing**

Necessary earthing arrangements as applicable shall be provided to connect to the existing earthing bus. All accessories and hardware required for the earthing arrangements shall be provided by the Contractor.

1 No's tinned Copper/aluminium earth strips of suitable size should run along with the entire length of the bus duct either integrally or outside the enclosure. These earthing strips shall be connected to the earthing grid.

#### Gaskets

The gasket material and thickness shall be so selected as to satisfy the operating conditions imposed by temperature, weather durability etc. Over compression of gaskets shall be avoided.

The material of the gasket shall preferably be Neoprene closed-cell sponge rubber or equivalent. Flange gaskets shall be provided at the equipment terminal connection

#### Hardware

The Bus Duct shall not have any through bolts. All nuts, bolts and other hardware shall be High Tensile steel. All spring washers shall be heat treated conical spring washers. SS pressure plates shall be provided at the bolted joints to ensure equal pressure.

#### Bus bar Conductor Material

The material of the Bus-Bars shall be electrolytic grade Copper and should have purity more than 99.95% and Conductivity more than 97 IACS. The Oxygen contents in Copper shall not exceed 10 ppm. The Copper should be cold drawn and annealed up to 30%. All the Bus Bars should be tested as per relevant IS and latest IEC standard. The bus bar manufacturer should submit the certificate from original supplier of copper for purity and oxygen contents in Copper. These shall confirm to IS 613 of 2000 (Rev III) or the latest amendments. The size of the bus bars shall be indicated by the tenderer as part of the Technical Data. The bus bar size calculations shall be based on 1000 Amps. per sq. inch. All Phases and Neutral bus bars shall be 100% rated.

The specification and the system should be suitable to get 100% loading for horizontal and vertical installation at an ambient temperature of 45 deg C and temperature rise of bus bars shall not exceed 55deg C Rating

The material of the conductor shall be designed to carry the rated current and short circuit current for the specified time under normal site operating conditions. Also the temperature of bus shall not exceed 250 degree centigrade while carrying the specified short circuit current for one second when a fault occurs at the operating temperature.

#### Bus bar Coupler

Each Bus Bar of the Bus Duct shall be joined to the adjacent section by single bolt joint clamp without drilling the bus bars. Over the joint inspection window shall be provided. Joint removing shall be a separate assembly so that the two sections shall be electrically isolated without disturbing the sections.

#### Insulating Material for Bus Bars

The insulating material over the Bus Bars shall be Multi layer Class —F insulation with two layers of glass mica sheet and two layers of polyesters. The rated insulation voltage shall be 1000 volts and rated impulse withstand voltage shall be 12KV.

#### Bus Duct Supports

The bus duct shall be supported from ceiling / wall using minimum (or as needed) 12 dia fully threaded GI rods and 50 x 50 x 6 mm GI angles using Anchor fasteners. Nothing extra shall be paid on this account.

Bus duct support design need to be done for withstanding the all the accumulated forces at the time of fault. Support shall withstand the forces at the time of fault. Vendor need to submit the calculations for support design calculations, duly validated by OEM.

#### Markings

All components of the bus duct along with the supporting structure shall be distinctly marked for erection in accordance with the erection drawings to be prepared and furnished by the Contractor

#### Wall/Floor Flanges

Wall/Floor flanges are required to be fitted to both sides of wall or floor while crossing the wall / floor.

#### Tests and Test Reports:

The following tests shall be conducted at manufactures works prior to dispatch of the bus-duct assembly.

- a) One minute power frequency withstand voltage test.
- b) Megger test before and after High Voltage Test.
- c) High Voltage Test
- d) Temp Rise Test (Heat Run Test)

Test Reports shall be submitted for the tests conducted as above

#### BUS DUCT / BUS TRUNKING SYSTEM GENERAL

Bus duct shall be supplied as per BOQ, specification & approved shop drawings. The bus duct shall be of indoor type. Bus duct system shall be air cooled (self-cooled), non-segregated type and shall be suitable for continuous current rating and shall have rupturing capacity of 36MVA at 415 volts. Bus duct shall be suitable for short circuit withstand capacity of 50 kA for 1 second. Manufacturer shall submit type test certificate of similar Bus duct from recognized test lab like CPRI at Bhopal or equivalent.

#### CONSTRUCTION

Bus duct shall consist of three phase and neutral busbars permanently positioned. Bus duct shall conform to degree of enclosure protection IP 54 with upto date amendments Minimum thickness of sheet steel enclosure shall be of 2mm. The busbars shall be of high conductivity electrolytic quality aluminium conforming to relevant Indian Standards and shall be of sufficient cross section. Overall busbar cross section size shall be as per table VI of CPWD General Specification for E&M Works Part – I (Internal) - 2013. The cross section of neutral busbar shall be same as that of phase busbar. Entire length of busbars shall be provided with colour coded PVC sleeves. Bus duct shall be natural cooled with inspections covers at suitable intervals.

Busbars shall be supported with 12mm thick non-hygroscopic insulating material at every 600mm allowing busbar to expand on normal operation but restrict excessive movement under fault conditions. Expansion joints shall be provided in such a way that expansion and contraction does not have undue strain on the bus at the terminals at both ends.

The Bus duct arrangement shall have a 02 runs of common frame GI earth bar of size 32mm x 5mm for entire length suitably loop earthing of various sections. Two number of each terminals shall be provided for earthing connections. Frame earthing of Bus duct system shall be connected to two earthing terminals at Main L.T. Panels/ Transformer ends.

Contractor shall submit the bus bar sizing calculation for short circuit withstand capability and maximum temperature rise indicating the de-rating factors clearly for the approval of Engineer-In-Charge.

## INSTALLATION

All supporting structures required for hanging and/or supporting the complete bus duct shall be provided including related civil works. These include all types of supports, brackets, beams, channels, rods, clamps, hardware, etc to support with wall, roof, truss etc.

Bus ducts running along the wall should be supported at intervals not exceeding 1.5m. In case of branching, there should be a support on all branches at a distance of 30 cms from the point of branching. Support should not be less than 40mm X 40mm X6mm MS angle secured in an approved manner. Supports may also be formed as brackets fixed to walls where runs are along with walls. Supports shall be grouted on the walls.

In case of ceiling suspended bus ducts, supports made of 40mm X 40mm X6mm MS angle iron shall be provided. The horizontal interval between two such supports should not be more than 1200mm. However, additional supports to be given at the bends and termination points. These duct supports shall be suspended from the C.I/MS. boxes or suitable approved suspension device provided in the ceiling by means of 12 mm diameter MS rods.

Where fish plates are available, the same can be used for busduct support works. Where there is no such provision, good quality anchor fasteners of size not less than 8mm shall be used in the ceiling.

Seal-off bushings complete with wall frame and support plates shall be provided where the bus duct penetrates the building wall. The seal is to prevent free exchange of air between two portions of the bus duct part of which is indoor while the other is outdoor.

Silica-gel breather shall be provided on both portions of the bus duct between the seal of bushings.

## CONNECTIONS & TERMINATIONS

All matching flanges, seal-off bushings, gaskets, fittings, hardware and supports required for termination of the bus duct at the switchgears, transformers and other equipment shall be provided.

Flexible connections both for conductor and enclosure shall be provided.

a) At all equipment termination to provide for misalignment upto 25mm(1) in all directions.

b) Between bus duct supported from building steel to prevent transmission of vibration.

The equipment terminal connections shall be readily accessible and shall provide sufficient air gap for safe isolation of equipment during testing.

If the material of bus conductor and that of the equipment terminal connectors are different then suitable bi-metallic connectors shall be furnished.

## PAINTING

Unless otherwise specified, the painting process shall be as follows:-

All steel surfaces shall be thoroughly cleaned by sand blasting or chemical agents, as required, to produce a smooth surface free of scales, grease and rust etc.

The steel surfaces after cleaning shall be given on all sides proper coat of anti- corrosive primer followed by two coats of powder coating painting.

The bus duct shall be finished with two coats of grey (IS 5 shade # 632) powder coated paint. Earth strip shall be painted with green colour enamel paint.



Where the painting is damaged during transit, installation etc., and touch up painting shall be done at site. All metallic parts involved in the installation like supports, beams, channels, brackets, clamps, poles, hardware etc. shall be enamel painted.

## TESTS

### Factory Test

The routine/acceptance tests shall be witnessed at the manufacturer's premises in witness of Engineer-in-Charge. Test shall be carried out as per IS.

### TYPE TESTS

Bus duct shall be got manufactured by only reputed bus duct manufacturers having Government type tested by CPRI or other govt. testing laboratory on similar bus duct (s) with minimum 50KA short circuit current with stand capacity and the type test certificate shall be produced to the AAI inspector at the time of factory test.

### SITE TESTS

In addition to the tests at manufacturer's premises, all relevant pre-commissioning checks and tests shall be done at site before energizing the bus duct. The following tests are to be particularly done before cable jointing or connecting the bus duct.

1. Physical inspection for breakages/damages/orderliness.
2. Physical Inspection for anchorage, alignment, and grounding.
3. Physical Inspection and verification of correct connection in accordance with design SLD
4. Physical Inspection of orientation to verify in accordance with manufacturer's labels
5. Insulation resistance test with 500 V Megger. The insulation resistance shall not be less than 100 mega ohms.
6. Earth continuity test.
7. All test results are to be recorded and reports should be submitted to the department.

## COMMISSIONING

After the satisfactory installation & testing, the Bus duct shall be commissioned.

otherwise). List of rules of particular importance to electrical installations under these General Specifications is given in Appendix C for reference.

### 18.0 General requirements of components:

18.1 Quality of material: All materials and equipments supplied by the contractor shall be new and manufacturing date shall not be prior to six month from date of approval of sample/make. They shall be of such design, size and materials as to satisfactorily function under the rated conditions of operation and to withstand the environmental conditions at site or as specified in the tender.

### 19.0 Inspection of materials and equipments:

19.1 Materials and equipments to be used in the work shall be inspected by the departmental officers. Such inspection will be of following categories:

- (i) Inspection of materials / equipments to be witnessed at the Manufacturer's premises in accordance with relevant BIS /Agreement Inspection Procedure.

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- (ii) To receive materials at site with Manufacturer's Test Certificate(s) for specific part of equipment supplied under the scope.
- (iii) To inspect materials at the authorized dealer's go downs to ensure delivery of genuine materials at site.
- (iv) To receive materials after physical inspection at site.
- 19.2 Adequate care to ensure that only tested and genuine materials of proper quality are used in work shall be ensured by firm. The firm shall ensure that:
  - (i) Material will be ordered & delivered at site only with the prior approval of the department to ensure timely delivery.
  - (ii) As and when the order is placed for the fittings/ fixtures, cables, Switchgears, poles, rising main, other main items etc, its copy shall be endorsed to the Engineer-in-charge.
  - (iii) The firm will be required to procure material like exhaust fans, MCB's & DB's, Switches & sockets, wires & cables, conduits and Switchgears etc directly from the manufacturer/ authorized dealers to ensure genuineness & quality and as per the approved makes only. Proof in this regard shall be submitted by the contractor if required by the department.
  - (iv) Inspection at factory or at go down of the manufacturer, as required, shall be arranged by the firm for a mutually agreed date. Certificate for genuineness of the fittings shall have to provided duly signed by the manufacturer's officer not below the rank of Regional Manager.  
(Note:- Waiver off inspection can be allowed after taking approval from the competent authority).
  - (v) Delivery of material shall be taken up only with the consent of department, after clearance of the material.
  - (vi) Department shall reserve the right to waive inspection in lieu of suitable test certificate, at its discretion.
- 19.3 Similarly, for fabricated equipments, the contractor will first submit dimensional detailed drawings for approval before fabrication is taken up in the factory. Suitable stage inspection at factory also will be made to ensure proper use of materials, workmanship and quality control.
- 20.0 Ratings of components:
- 20.1 All components in a wiring installation shall be of appropriate ratings of voltage, current and frequency, as required at the respective sections of the electrical installations in which they are used.
- 20.2 All conductors, Switches and accessories shall be of such size as to be capable of carrying the maximum current, which will normally flow through them, without their respective ratings being exceeded.
- 21.0 Conformity to standards:
- 21.1 All components shall conform to relevant Indian Standard Specifications wherever existing. Materials with ISI certification mark shall be preferred.
- 21.2 Relevant Indian Standards including amendments or revisions thereof up to the date of tender acceptance shall be applicable in the respective contracts for respective items, firm to ensure its compliance.

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## 22.0 Interchange ability:

Similar parts of all Switches, lamp holders, distribution fuse boards, Switch gears, ceiling roses, brackets, pendants, fans and all other fittings of the same type shall be interchangeable in each installation.

## 23.0 Workmanship:

- 23.1 Good workmanship is an essential requirement to be complied with. The entire work of manufacture/fabrication, assembly and installation shall conform to sound engineering practice.
- 23.2 Proper supervision/skilled workmen: The contractor shall be a licensed electrical contractor of appropriate class suitable for execution of the electrical work. He shall engage suitably skilled/licensed workmen of various categories for execution of work supervised by supervisors / Engineer of appropriate qualification and experience to ensure proper execution of work. They will carry out instruction of Engineer-in-charge and other senior officers of the Department during the progress of work.
- 23.3 Use of quality materials: Only quality materials of reputed make as specified in the tender will be used in work.
- 23.4 Fabrication in reputed workshop: Switch boards and LT panels shall be fabricated in a factory/ workshop having modern facilities like quality fabrication, seven tank process, powder/epoxy paint plant, proper testing facilities, manned by qualified technical personnel. These shall be as per make / item approved.

## 24.0 Testing:

All testes prescribed in this General Specification, to be done before, during and after installation, as part of pre-commissioning stage, shall be carried out, and the test results shall be submitted to the Engineer-in-charge in prescribed Performa, forming part of the Completion Certificate.

## 25.0 Commissioning on completion:

After the work is completed, it shall be ensured that the installation is tested and commissioned Recording of Completion certificate of following Electrical & Mechanical Services as follows:

1. Electrical Sub-station
  2. Fire Fighting System
  3. Fire Alarm System
  4. HVAC / Ventilation)
  5. Lifts will be done after receiving of NOC from the relevant govt. Department
- (Note:- NOC from Delhi Fire Service for item no. 1 to 4 and Lift operation license from lift inspector or eligible govt. department alongwith compliance of local govt. bye-laws.

## 26.0 Completion plan and completion certificate:

- 26.1 For all works completion certificate after completion of work as given in Appendix –E of CPWD Specification shall be submitted to the Engineer-in-charge.
- 26.2 Completion As-built plan drawn to a suitable scale in tracing cloth with ink indicating the

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following, soft copy in storing device (two nos) along with three blue print copies of the same shall also be submitted.

- (i) General layout of the building.
- (ii) Locations of main Switchboard and distribution boards, indicating the circuit numbers controlled by them.
- (iii) Position of all points and their controls.
- (iv) Types of fittings, viz. fluorescent, pendants, brackets, bulk head, fans, exhaust fans etc.
- (v) Location of substation equipments cable route layout etc.
- (vi) Name of work, job number, tender reference, actual date of completion, names of Division/ Sub-division and name of the firm who executed the work with their signature.

#### 27.0 Guarantee

The installation will be handed over to the department after necessary testing and commissioning. The installation will be guaranteed against any defective design/workmanship. Similarly, the materials supplied by the contractor will be guaranteed against any manufacturing defect, inferior quality. The guarantee period will be for a period of 12 months from the date of completion of work. Installation/ equipments or components thereof shall be rectified/ repaired to the satisfaction of the Engineer-in-charge. The firm will be required to submit guarantee of fans and fittings from the manufacturer to the department.

#### 28.0 Supply of fittings, fixtures & other material:

The procurement of material for the works will be programmed as per the progress of work in consultation with Engineer-in-Charge. The firm will be required to submit a detailed programme and prior to the procurement will seek approval of the department. The direction of the department regarding timing & necessity of getting such material will be final & binding on the firm.

29.0 For each E & M services the defect liability period shall be for 12 months after a final certificate of completion of work has been given for entire project (Major and Minor components) by the Engineer-on-Charge or from the actual date of completion of work.

#### 30.0 Interpreting specifications

In interpreting the specifications, the following order of preference shall be followed in case of contradictions:

- a) Nomenclature of item as per Schedule of Quantities
- b) Additional/Special Conditions.
- c) Particular Specifications and List of Makes.
- d) CPWD Specifications.
- e) Architectural Drawings.
- f) National Building code 2016, ECBC 2017, Relevant BIS standards all as modified up to date. (Note: The specification mentioned in relevant code or CPWD specification or NBC 2016 or ECBC 2017 whichever is more stringent will be followed).
- g) OEM specification.

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h)      Sound Engineering Practice

## COMMERCIAL AND ADDITIONAL CONDITIONS

### General

The work is required to be carried out as per CPWD General Specifications, DG Set (Part-VII)-2013 covers manufacture, testing as may be necessary before dispatch, delivery at site, all preparatory work, assembly and installation, commissioning putting into operation of DG Set consisting of synchronization panel.

### Proposed operational scheme

The Scheme includes 2 sets of DG Set installation, each having following:-

1 No. 500 KVA DG set.

Auto main failure cum synchronization cum load sharing panel. Earthing, cabling, Sand witch type Bus duct etc

The work shall be executed as per CPWD General Specifications for E&M Works Part-I, II & IV as amended upto date, relevant I.E. Rules, BIS/ IEC and as per directions of Engineer-in-Charge. These additional specifications/ conditions are to be read in conjunction with above and in case of variations, specifications given in these additional conditions shall apply. However, nothing extra shall be paid on account of these additional specifications and conditions, as the same are to be read along with schedule of quantities for the work.

The tenderer should in his own interest visit the site and get familiarize with the site conditions before tendering.

No T&P shall be issued by the Department and nothing extra shall be paid on account of this.

Tenders shall be valid for acceptance for a period of 90 Days from the date of opening of Technical bid.

### 2.0 Scope

2.1 These specification cover the general specification pertaining to diesel engine generating sets & their installation.

2.2 These general Specification cover the equipment and material for the DG Sets, their testing and/pre inspection as may be necessary before their dispatch from their respective works, their delivery at site, all preparatory works, assembling, installation and adjustment, commissioning, final testing, putting in to operation and handing over of the complete system.

2.3 These General Specification are subject to revision from time to time.

2.4 Each DG Set installation work has its own particular requirements. These General Specifications shall be supplemented with tender specifications as may be required for a particular work. The tender specifications, wherever they differ from these 'General Specifications', shall have over-riding value and shall be followed for that particular work. A specimen NIT for DG Set works is appended at Appendix 'IV' for general guidance.

3.0 The work shall be executed as per CPWD General Specifications for E&M Works (Part VII DG Set- 2013), as per relevant IS and as per directions of Engineer-in-Charge. These additional specification

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are to be read in conjunction with above and in case of variations, specification given in this Additional condition shall apply. However, nothing extra shall be paid on account of these additional specifications & conditions as the same are to be read along with schedule of quantities for the work.

4.0 The tenderer should in his own interest visit the site and familiarizes himself with the site conditions before tendering.

5.0 No T&P shall be issued by the Department and nothing extra shall be paid on account of this.

#### 6.0 Site Information

The tenderer should, in his own interest, visit the site and familiarize himself with the site conditions before tendering. For any clarification, tenderer may discuss with the Engineer-in-Charge.

#### 7.0 Conformity with Statutory Acts, Rules, Standards and Codes

i) All components shall conform to relevant Indian Standard Specifications, wherever existing, amended to date. A list of such standards is appended in Appendix 'V' page No. 94-95 of General Specification for E&M Works Part-VII (DG Set) 2013.

ii) All E&M Works shall be carried out in accordance with the provisions of Indian Electricity Act, 2003 and Indian Electricity Rules, 1956 as amended up to date. They shall also conform to CPWD General Specification for E&M Works, Part-I (Internal) 2013 and Part-II (External) 1994, Part- VII (DG Set) 2013 and Part-IV (Sub-station) 2013 as amended up to date.

#### 8.0 Safety codes and labour regulations

In respect of all labour employed directly or indirectly on the work for the performance of the contractor's part of work, the contractor at his own expense, will arrange for the safety provisions as per the statutory provision, B.I.S recommendations, factory act, workman's compensation act, CPWD code and instructions, issued from time to time. Failure to provide such safety requirements would make the tenderer liable for penalty for Rs. 10,000/- for each violation. In addition the Engineer-in-charge, shall be at liberty to make arrangements and provide facilities as aforesaid and recover the cost from the contractor.

The contractor shall provide necessary barriers, warning signals and other safety measures while executing the work of DG Set installation, cables etc. or wherever necessary so as to avoid accident. He shall also indemnify CPWD against claim for compensation arising out of negligence in this respect. Contractor shall be liable, in accordance with the Indian Law and Regulation for any accident occurring due to any cause. The department shall not be responsible any accident occurred or damage incurred or claims arising there from during the execution of work. The contractor shall also provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the contractor due to the above provision thereof.

#### 9.0 Machinery for erection

All tools and tackles required for unloading/handling of equipments and materials at site, their assembly, erection, testing and commissioning shall be the responsibility of the contractor.

## 10.0 Completeness of the Tender, Submission of Programme, Approval of Drawings and Commencement of Work

### (i) Completeness of the Tender

All sundry equipments, fittings, assemblies, accessories, hardware items, foundation bolts, supports, termination lugs for electrical connections, cable glands, junction boxes and other sundry items for proper assembly and installation of the various equipments and components of the work shall be deemed to have been included in the tender, irrespective of the fact that whether such items are specifically mentioned in tender documents or not.

### (ii) Submission of Programme

Within fifteen days from the date of receipt of the letter of acceptance, the successful tenderer shall submit his programme for submission of drawings, supply of equipment, installation, testing, commissioning and handing over of the installation to the Engineer-in-Charge. This programme shall be framed keeping in view the building progress.

### (iii) Submission of Drawings

The contractor shall submit the drawings to the Engineer-in-Charge as per clause 16 of this specification for approval before start of work.

### (iv) Commencement of Work

The contractor shall commence work as soon as the drawings submitted by him are approved. The drawing are to be submitted by the contractor within 12 days of stipulated date of start, and shall be approved by the Engineer-in-Charge within 3 days of receipt in his office.

## 11.0 Dispatch of materials to site and their safe custody

The contractor shall dispatch materials to site in consultation with the Engineer-in-charge. Suitable lockable storage accommodation shall be made available free of charge temporarily. Watch & ward, however, shall be the responsibility of contractor. Programme of dispatch of material shall be framed keeping in view the building progress. Safe custody of all equipment / items supplied by the contractor shall be the responsibility of the contractor till taking over by the department.

## 12.0 INDEMNITY:

The successful tenderer shall at all times indemnify the department, consequent on this works contract. The successful tenderer shall be liable, in accordance with the Indian Law and Regulations for any accident occurring due to any cause and the contractor shall be responsible for any accident or damage incurred or claims arising there from on the department during the period of erection, construction and putting into operation the equipments and ancillary equipment under the supervision of the successful tenderer is so far as the latter is responsible. The successful tenderer shall also provide all insurance including third party insurance as May by necessary to cover the risk. No extra payment would be made to the successful tenderer on account of the above.

## 13.0 QUALITY OF MATERIAL AND WORKMANSHIP

(i) The components of the installation shall be of such design so as to satisfactorily function under all conditions of operation.

(ii) The entire work of manufacture / fabrication, assembly and installation shall conform to sound engineering practice. The entire installation shall be such as to cause minimum transmission of noise and vibration to the building structure.



(iii) All equipments and materials to be used in work shall be manufactured in factories of good repute having excellent track record of quality manufacturing, performance and proper after sales service.

#### 14.0 INSPECTION AND TESTING:

14.1 The successful tenderer will arrange staff/fuel/POL for test run at his cost.

14.2 Inspection and Testing of DG sets of capacity more than 200 KVA:

i) For DG sets of capacity more than 200 KVA, testing shall necessary be carried out at factory/manufacturing premises in presence of representative of the Department.

ii) For testing, following procedure will be followed: All major items/equipments i.e. engine & alternative in assembled condition, associated electrical control panels etc. shall be offered for inspection and testing at factory/manufacturing works. The successful tenderer shall give a notice of minimum two weeks for carrying out such tests. All expenditure on diesel and lubrication oil for factory test shall be born by the tenderer. The Engineer-in Charge/ or his authorized representative shall witness such inspection & testing at mutually agreed date. The cost of the representative's visit to the factory will be borne by the Department.

iii) The department also reserves the right to inspect the fabrication job at factory and the successful tenderer has to make arrangements for the same.

iv) DG set will be tested on load of unity power factor for the rated KW rating. During testing, each of the D.G sets covered under of work, shall be operated for a period of 12 hours on the rated KW at DG set's KW rating including one hour on 10% overload after continuous run of the 12 Hours. During testing during all controls/operations safeties will be checked and proper record will be maintained. Any defect/abnormality noticed during testing shall be rectified. The testing will be declared successful only when no abnormally/failure is noticed during the testing. The DG set will be cleared for dispatch to site only when the testing is declared successful by authorized representatives/Engineer-in-Charge.

(Note:- Waiver off inspection can be allowed after taking approval from the competent authority).

#### 15.0 Trial Run/Running-in-Period

After successful testing of the DG Set's, a trial run at available load will be carried out for 120 Hours or 15 Days whichever is earlier. The DG Set will be operated and a log of all relevant parameters will be maintained during this period. The arrangement of staff for trial run/running in period will be made by the successful tenderer. However, diesel shall be provided by Department. The contractor will be free to carry out necessary adjustments. The DG Set will be said to have successfully completed the trial run, if no break-down or abnormal/unsatisfactory operation of any component of the entire installation included in the scope of work of the contract, occurs during this period. After this the DG Set will be made available for beneficial use. After the DG Set has operated without any major break-down/trouble, Bidder has to replace lubricant oil/engine oil and then, it shall be taken over by the department subject to guarantee clause of the contract. This date of taking over of the DG Set, after trouble free operation during the trial run/ running-in period shall be the date of acceptance/taking over.

#### 16.0 Safety measures

All equipment shall incorporate suitable safety provision to ensure safety of the operating personal as per manufacturers' standard practice.

#### 17.0 STATUTORY CLEARANCE(S)

Approval/clearance of the complete installation shall be obtained by the contractor from CPCB/state pollution Control Boards/ Local Bodies/ Central Electricity Authority (CEA)/other licensing authorities

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wherever required. However, application shall be made by Department and any statutory fee, as applicable, shall be paid by Department directly to the govt. authorities concerned.

#### 18.0 GUARANTEE

All equipment shall be guaranteed, against unsatisfactory performance and/or break down due to defective design, workmanship or material, for a period of 12 months from the date of completion. The equipments or components, or any part thereof, so found defective during guarantee period shall be forthwith repaired or replaced free of cost, to the satisfaction of the Engineer-in-Charge. In case it is felt by the department that undue delay is being caused by the contractor in attending the defect/fault removed, the same will be got done by the department at the risk and cost of the contractor. The decision of Engineer-in-Charge in this regard shall be final.

#### 19.0 PAYMENT TERMS

i) The following percentage of contract rates shall be payable against the stage of work shown herein:

Stage of work		Engine-alternator Set & Synchronization Panel	All other items
I	After initial inspection(wherever specified) & delivery at site in good condition on pro-rata basis	60%	60%
II	On completion of pro-rata installation	20%	20%
III	On commissioning and completion of successful running in period & taking over of the DG set by the department	20%	20%

ii) Deduction of Security Deposit shall be governed by standard/relevant clauses of CPWD-7.

#### 20.0 Drawings for Approval & Completion Drawings

i) Drawings for approval on award of the work

The contractor shall prepare and submit three sets of following drawings and get them approved from the Engineer –In –Charge before the start of the work. The approval of drawings however does not absolve the contractor not to supply the equipment / materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- Layout drawings of the equipments to be installed including control cables, fuel / lube oil pipes and supports / structure for exhaust piping, chimney and bus ducts/ cable trays.
- Drawings including section, showing the details of erection of entire equipments.
- Any other drawings relevant to the work.
- Dimensioned drawing of Acoustic enclosure/Engine-Alternator set and Electrical control panel.
- Drawings showing details of support for pipes, chimney cable trays, ducts etc.
- Any other drawings relevant to the work.

ii) Drawings / Documents to be furnished on completion of installation.

Three sets of the following laminated drawings shall be submitted by the contractor while handing over the installation to the Department .Out of these three, one set shall be laminated on a hard base for displayed in the DG set room where synchronization panel/auto load sharing panel is installed. One set shall be displayed in Junior Engineer's room. In addition, drawings will be given on Compact Disc (CD): DG set installation drawings giving complete details of all the equipments, including their foundation. Line diagram and layout of all electrical control/AMF panel giving Switchgear ratings and their disposition, cable feeder sizes and their layout.

Control wiring drawings with all control components and sequence of operation to explain the operation of control circuits in Synchronization panel/PCC.

Manufacturer's technical catalogues of all equipments and accessories.

Operation and maintenance manual of all major equipments, detailing all adjustments, operation and maintenance procedure.

#### 21.0 AFTER SALES SERVICES

The contractor shall ensure adequate and prompt after sales service free of cost during guarantee period, and against payment after the guarantee period is over, in the form of maintenance, spares and personnel as and when required during normal life span of the equipments and shall minimize the breakdown period. In case of equipment supplied by other manufactures the firm shall furnish a guarantee from the manufacturer for the same before the DG Set installation is taken over.

#### 22. APPROVAL OF FABRICATION:

Contractor shall submit fabricator drawing as per prepared by the manufacturer for the following items of schedule 'A' and get them approved from the project director/ Architect, before the equipment against these items as fabricated and assembled in the approved factory of the manufacture and brought to site for erection.

#### 23. TEST AT MANUFACTURERS WORKSHOP:

All equipment shall be tested with all routine tests as specified in relevant I.S. The Test Certificates in original as used by the manufacturer shall be submitted by the contractor to the Project Director as soon as the equipment is received at site. Erection of these shall not be commenced till test certificates are received and duly verified.

#### 24. APPROVALS:

Contractor on behalf of the owner shall be responsible to complete all formalities and shall obtain the approvals, sanctions and clearance certificate (NOC) for the installation of DG Sets and for restricted use of DG set from the concerned statutory authorities such as pollution control board of State/ central government state detracted board chief fire officer of state government, chief electrical inspector of state government, tariff advisors committee of regional fire insurance, Local power supply company etc.

## TECHNICAL

### GENERAL

This section deals with unloading procedures, location, standard capacities and climatic conditions for DG set installation.

#### Unloading

##### 2.1 Gensets without Acoustic Enclosure

2.1.1 Gensets should not to be lifted from engine and alternator hooks. These are designed for lifting individual items only. Normally, provision for Gensets lifting is provided on base-rails. The Gensets should be unloaded from base-rail by lifting with proper Gensets lifting tackle or nylon sling/steel rope of suitable capacity and crane so as to ensure no damage to oil sump, air cleaner, radiator pipes etc.

Gensets should be covered with polyethylene or tarpaulin during installation to ensure that water does not enter inside.

Spreader bar/spacer plate of suitable size may be required to avoid damages to Gensets components.

DG set with Acoustic enclosure are provided with lifting hooks.

#### DG Sets With acoustic enclosure

DG Sets upto KVA capacity are required to be supplied with acoustic enclosure as per CPCB norms. Dg set with acoustic enclosure shall preferably be installed outside the building (including terrace subject to structural feasibility) & location should be finalized in consultation with the architect. However, DG set should be as near to the substation as possible i.e. as near to Essential LT Panel as possible. Associated AMF panel/Electrical panel of the DG set can be located inside the acoustic enclosure or outside the acoustic enclosure as per manufacturer standard. In case, AMF/ Electrical panel has to be installed outside the acoustic enclosure, location of room to house AMF/ Electrical panel should be decided in consultation with the Architect so that it shall be as near to the acoustic enclosure as possible. Specially, in case of connection through bus trunking, care should be taken for aesthetics.

#### DG Sets without acoustic enclosure

In case of DG Sets beyond 500KVA capacity i.e. when DG set is supplied without acoustic, room of appropriate size should be provide to house the DG Set. The DG room should be near to the substation as possible (i.e. as near to essential Lt panel as possible). While deciding the room layout, typical 2-metres free space around Gensets is recommended for proper heat dissipation and ease of service. However, to avoid hot air re-circulation, radiator cooled engines should have maximum possible space in the front. Minimum 1.5 meter free space is must.

As far possible, installation of DG Set should be avoided in basement.

##### 2.2.2 Nominal ratings of DG Sets

DG Sets are normally available in flowing standard capacities:

(Ratings in KVA)

7.5	10	12.5	15	17.5	25	30	35	40	50	62.5
75	82.5	110	125	140	200	225	250	320	350	380
415	450	500	550	600	625	700	750	1010	1250	1500

Capacity output of DG Set should be specified in tender in terms of “prime Power rating at 0.85 load factor” as per clause 13.3.2 of ISO-8528 (Part-1) titled ‘Reciprocating internal combustion engine driven alternating current generating sets: Part-1: Application, rating and performance’.(See Appendix ;1;). However, depending upon the particular application & use, ‘Continuous ‘or’ Standby’ rating can be specified.

### 2.3 Climatic Conditions

The output of DG Set shall be specified in tender documents under following climatic conditions to be in conformity with CPCB approved type tests:

- (i) Outside Maximum Ambient Temperatures : 50 Deg.C
- (ii) Height above Mean Sea Level : 1000 Meter
- (iii) RH : 50%

2.4 DG Set upto 1000 KVA capacity should be type tested for Noise and Emission norms/standard as per CPCB as per Appendix ‘II’ and Appendix ‘III’

### DIESEL ENGINE

Scope: This section covers engine rating, standard components of a diesel engine including exhaust piping.

#### Diesel Engine Engine Rating

The engine shall be of standard design of the original manufacturers. It should be 4 stroke cycles, water cooled, naturally aspirated/turbo charged (as per manufacturer standard), diesel engine developing suitable BHP for giving a power rating as per ISO 8528-part-1 in KVA at the load terminals of alternator at 1500 rpm at ambient temperature of 40oC, for height at 1000 meter above MSL and at 50% RH.

The engine shall be capable for delivering specified prime Power rating at variable loads for PF of 0.8 lag with 10% overload 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 (85%) for prime Power output.

The testing procedure shall be as mentioned in Para 1.15.2.4

The engine shall conform to IS; 10000/ISO 3046/BS; 649/BS 5514 amended upto date.

Necessary certificate including the compliance of the above capacity requirement for the engine model so selected along with compliance of Noise and Emission norms as per latest CPCB guidelines for Dg set capacity upto 1000 KVA, should be furnished from the manufacturer’s alongwith the technical bid. (Refer Appendix ‘II’ for noise norms and Appendix ‘III’ for emission norms). However, above 1000 KVA DG set, manufacturers shall furnish certificate that the Engine for the DG set compiles with the CPCB Emission norms.

The engine shall be fitted with following accessories subject to the design of the manufacturer:

Dynamically balanced fly-wheel.

Necessary flexible coupling and guard for alternator and engine (applicable only for double bearing alternator).

Air cleaner (dry/oil bath type) as per manufacturer standard.

A mechanical/electronic governor to maintain engine speed at all conditions of load. (See clause 2.2.1.4).

Daily fuel service tank of minimum capacity as per table 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

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engine with valves, unions, reducers, flexible hose connection and floor mounting pedestals, twin fuel filters and fuel injectors. The location of the tank shall depend on standard manufacturer design.

TABLE I

Recommended minimum capacity of daily fuel service tank

S.No.	Capacity of DG set	Minimum Fuel Tank Capacity
1.	Upto 25 KVA	100 Liters
2.	Above 25 to 62.5 KVA	120 Liters
3.	Above 62.5 to KVA 125 KVA	225 Liters
4.	Above 125 KVA to 200 KVA	285 Liters
5.	Above 200 KVA to 380 KVA	520 Liters
6.	Above 380 KVA to 500 KVA	700 Liters
7.	Above 500 KVA	990 Liters

Dry exhaust manifold with suitable exhaust residential grade silencer to reduce the noise level.

Suitable self-starter for 12 V/24 V DC.

Battery charging alternator unit and voltage regulator, suitable for starting batteries, battery racks with interconnecting leads and terminals.

Necessary gear driven oil pump for lubricating oil, priming of engine bearing as well as fuel systems as per manufacturer recommendations.

Naturally aspirated/turbo charger(as per manufacturer standard)

Lubrication oil cooler.

Lubrication oil filters with replaceable elements.

Crank case heater as per manufacturer recommendations.

Fuel injection: Engine should have suitable fuel injection system in order to achieve low fuel consumption.

Fuel control solenoid.

Fuel pump with engine speed adjustment.

Engine control Panel: fitted and having digital display for following:

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

All moving parts of the engine shall be mechanically guarded in such a manner that a human finger cannot touch any moving part

Radiator/Heat Exchanger System/Remote Radiator ( delete whichever is not applicable).

Any other item not included/specified, but is a standard design of the manufacturer.

#### Governor

Electronic governor of class G2 for less than 100 KVA & class G3 for 100 KVA & above capacity as per IS 8528 Part V with

#### Frequency Variation

The engine speed shall be so maintained that frequency variation at constant load including no load shall remain within a band of 1% of rated frequency.

#### Fuel System

It shall be fed through engine driven fuel pump. A replaceable element of fuel filter shall be suitable located to permit easy servicing. The daily service tank shall be completed with necessary supports, gauges, connecting pipe work etc. In case of top mounted tanks, non return valves are must in fuel supply and return line of specified value. Pipe sealant should be used for sealing all connections. No Teflon tape is to be used. If piping length is more than 10 meters, detail engineering is required in consultation with OEM/Manufacturers.

#### Lubricating oil system

It shall be so designed that when the engine after a long shut down lubrication failure does not occur. Necessary priming pump for the lub. Oil circuit as per recommendation of manufacturer shall be installed, to keep bearings primed. This pump shall be normally automatically operative on AC/DC supply available with the set.

#### Starting system

This shall comprise of necessary set of heavy-duty batteries 12V/24V DC (as per manufacturer standard), and suitable starter motors and axial type gear to match with the toothed ring on the flywheel. A timer in the control panel to protect the starter motor from excessively long cranking runs shall be suitably integrated with the engine protection system and shall be included within the scope of the work. Battery capacity shall be suitable for meeting the needs of starting system ( as three attempt starting), as well as the requirements of control panel, indication and auxiliaries such as priming pump as applicable etc. The scope shall cover all cabling, terminals; including initial charging etc. the system shall be capable of starting the DG set within 20-30 seconds, even in winter condition with an ambient temperature down to 0o C.

#### Battery Charger

The battery charger shall be suitable to charge required numbers of batteries at 12V/24 volts complete with, transformer, rectifier, charge rate selector switch, indicating ammeter & voltmeter etc. Connections between the battery charger & batteries shall be provided with suitable copper leads with lugs etc.

#### 2.2.1.10 Piping Work

All pipe lines, fittings and accessories requirement inside the room/enclosure and outside for exhaust piping shall be provided by the contractor. This shall include necessary flexible pipes in the exhaust, fuel,

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lub. Oil and water lines as are necessary in view of the vibration isolation requirement in the installation. Piping of adequate size shall be used for lub. Oil of the material as per manufacturer standard. However, only M.S. pipes for the exhaust and fuel oil lines shall be used.

The pipe work shall be inclusive of all fittings and accessories required such as bends, reducers, elbows, flanges, flexible connections, necessary hardware etc. The installation shall cover clamps, supports, hangers etc. as are necessary for completing the work. However, the work shall be sectionalized with flanged connections as are necessary for easy isolation for purposes for maintenance of unit as approved by Engineer-in-charge.

#### 2.2.1.11 Common bed plate

Engine and alternator shall be coupled by means of flexo plate/ flexible coupling as per manufacturer standard design and both units shall be mounted on a common bed plate together with all auxiliaries to perfect alignment of engine and alternator with minimum vibration mounting system.

Exhaust system: (wherever Applicable)

Exhaust Piping: All M.S. Pipes for exhaust lines shall be conforming to relevant IS. The runs forming part of factory assembly on the engine flexible connections upto exhaust silencer shall be exclusive of exhaust piping item. The work includes necessary cladding of exhaust pipe work using 50mm thick glass wool /mineral wool/ rockwool, density not less than 46 kg/m<sup>2</sup> and aluminum cladding (0.80mm thick) for the complete portion. The exhaust pipe work includes necessary supports, foundation etc. to avoid any load & stress on turbo charger/exhaust piping. The exhaust pipe support structure shall be got approved by engineer-in-charge before execution.

Exhaust system should create minimum back pressure.

Number of bends should be kept minimum and smooth bends should be used to minimize back pressure.

Pipe sleeve of larger dia should be used while passing the pipe through concrete wall & gap should be filled with 'felt' lining.

Exhaust piping inside the Acoustic Enclosure/Gensets room should be lagged with asbestos rope along with aluminum sheet cladding to avoid heat input to the room.

Exhaust flexible shall have it's free length when it is installed. For bigger engines, two flexible bellows can be used.

For engines upto 500 KVA, only one bellow is required. However, if exhaust pipe length is more than 7 m, then additional bellow/provision for expansion should be provided.

'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 intel/windows etc.

When tail end is horizontal, 50 Degree download cut should be given at the end of the pipe to avoid rain water entry into exhaust piping.

When tail end is vertical, there should be rain trap to avoid rain water entry. If rain cap is used, the distance between exhaust pipe and rain cap should be higher than diameter of pipe. Horizontal run of exhaust piping should slope downwards away from engine to the condensate trap. Silencer should be installed with drain plug at bottom.

Optimum Silencer Location: location of the silencer in exhaust system has very definite influence on both reduction of noise and back pressure imposed on the length of the total exhaust system measured from

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exhaust manifold in meters. Please note that locating the silencer as per optimum silencer location is not mandatory. For high rise buildings, suitable arrangements may have to be provided in consultation with acoustic engineer.

#### Optimum Location of Silencer (In meters)

Exhausts stack height. In order to disperse exhaust above building height, minimum exhaust stack height should be as follows:-

(a) For DG set upto 500 KVA

$$H = + 1.2 \times \sqrt{\text{KVA}}$$

Where H = height of exhaust stacks

(b) For DG set above 500 KVA:

24m high or 3m above the building height, whichever is higher.

Care should be taken to ensure that no carbon practice emitted due to exhaust leakage enters and deposits on alternator windings and on open connections.

#### Support to exhaust Piping

Exhaust piping should be supported in such manner that load of exhaust piping is not exerted to turbocharger.

#### Air system

It is preferable to provide vacuum indicator with all engines to indicate choked filter. Maximum air intake restrictions with clean and choked filters should be within prescribed limits as per OEM/manufacture recommendation for the particular model of the engine. Gensets should be supplied with medium duty/heavy duty air cleaners (specify one only). (Heavy-duty air cleaner should be used for installations in dusty or polluted surroundings.)

#### Cooling System

System should be designed for ambient temperature of 50 Deg. C.

Water softening/dematerializing plants should be used, if raw water quality is not acceptable.

Coolant should be used mixed with additive (in suitable proportion) as per recommendation of OEM/manufacture for various engine models.

Radiator fan flow should be free from any obstruction.

For radiator cooled DG Set and proper room ventilation should be planned at the time of construction of DG room.

Remote radiator can be used in case of case of basement installation where fresh air may not be available. The proper location of remote radiator is very essential for the successful and efficient operation of remote radiator. In this the cooling media is ambient air. So in order to obtain maximum efficiency from remote radiator, it is necessary to get fresh air in its surrounding. The horizontal distance of remote radiator from engine should not exceed 10 meter.

For the dusty or polluted surroundings (as radiator gets clogged) and/or bigger capacity Gensets (say 1000 KVA and above), installation of cooling system with Heat Exchanger system may be used.

Optical items as under may be included as per site requirement at the discretion of technical Sanctioning Authority;

Cooling System

Remote Radiator

Jacket Water Heater

Crankcase Oil Heater

After cooler jacket turbo charger electrical pre-heat systems.

Fuel System

Fuel Water Separator

Auxiliary Fuel pump

Exhaust System

Industrial Grade Muffler

Residential Grade Muffler

Critical Grade Muffler

Super Critical Grade Muffler

Start System

Battery Warmer plate

Battery Charger

Automatic Float Equalizing

Trickle

## ALTERNATOR

Scope: This section covers technical requirement of the alternator.

Synchronous Alternator: self-excited, screen protected, self-regulated, brush less alternator, Horizontal foot mounted in Single/Double bearing construction (specify one only) suitable for the following:

Rated PF.	:	0.8 (lag)
Rated voltage	:	415 volts
Rated frequency	:	50 Hz
No. of phases	:	3
Enclosure	:	SPDP
Degree of protection	:	IP-23
Ventilation	:	Self ventilated air cooled
Ambient Temperature	:	50o C Maximum
Insulation Class	:	F/H
Temperature Rise	:	Within class H limits at rated load
Voltage Regulation	:	+/- 1%
Voltage variation	:	+/- 5%
Overload duration/capacity	:	10 % for one hour in every 12 hours of continuous use.
Frequency variation	:	As defined by
Excitation	:	Self excited up to 1010 KVA
Type of AVR	:	Electronic

A.E. (C)/ J.E(C)

Correction.....  
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Insertion.....

Type of Bearing and : Anti-friction bearings with Grease lubrication  
 Lubrication arrangement Standard : IS -4722 & IEC: 34 as amended up to date.

Alternator should be able to deliver output rating at 50o C. ambient at 1000 Meter altitude at MSL & at 50% RH

The alternator above 750 KVA capacity shall be fitted with suitable nos. Resistance temperature Device (RTD) & Bearing Temperature Device (BTD) along with space heaters. The terminal if space heaters will be wired to terminal box and the temperature scanner shall be provided in control panel for scaling the winding and bearing temperature.

Excitation: The alternator shall be brushless type and shall be self-excited, self-regulated having static excitation. The exciter unit should be mounted on the control panel or on the alternator assembly. The rectifier shall be suitable for operation at high ambient temperature at site.

Automatic Voltage Regulators (AVR): In order to maintain output terminal voltage constant within the regulation limits i.e. +/- 1%, Automatic voltage regulator unit shall be provided as per standard practice of manufacturer.

Fault tripping. In the event of any fault e.g. over voltage /high bearing temperature/high winding temperature or an external fault, the AVR shall remove the excitation voltage to the alternator. An emergency trip shall also be provided.

Standard. The alternator shall be in accordance with the following standards as are applicable.

IS: 4722/BS: 2613/1970. The performance of rotating electrical machine.

IS: 4889/BS: 269 rules for method of declaring efficiency of electrical machine.

Performance: Voltage dip shall not exceed 20% of the rated voltage for any step load or transient load as per ISO: 8528 (Part I). The winding shall not develop hot spots exceeding safe limits due to imbalance of 20% between any two phases any two phases from no load to full load.

The generator shall preferably capable of withstanding a current equal to 1.5 times the rated current for a period of not more than 15 second as required vide clause 14.1. Of IS 4722: 1992.

The performance characteristics of the alternator shall be as below:

(a) Efficiency at full load 0.8 P.F

(i) Upto 25 KVA – not less than 82%

(ii) Above 25 KVA and upto 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 93.5% Less than 3%

(b) Total distortion factor

(c) (i) 10 % overload One hour in every 12 hrs of continuous use.

(ii) 50 % overload 15 seconds.

Terminal Boxes. Terminal boxes shall be suitable for U.G. cables/Bus Trunking. The developed due to any short circuit at the terminals.

Earth Terminals: 2 Nos. Earth terminals on opposite side with vibration proof connections, non-ferrous hardware etc. with galvanized plate and passivated Washers of minimum size 12mm dia. Hole shall be provided.

A.E. (C)/ J.E(C)

Correction.....  
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Space Heaters. Alternators of capacity more than 750 KVA shall be provided with it does not absorb moisture during long idle periods. The heater terminals shall be brought to a separate terminal box suitable for 230 V AC supply and a permanent caution notice shall be displayed.

#### MANUAL/AMF PANEL, BATTERIES AND ELECTRICAL SYSTEM

Scope: This section covers technical and functional requirements of manual/ AMF panel, Battery/ Electrical system

location of panel:

DG Set with acoustic enclosure

Associated AMF panel/manual panel of the DG set can be located inside the acoustic enclosure or outside the acoustic enclosure as per manufacturer's standard. In case, AMF/Manual panel has to be installed outside the acoustic panel, location of room to house AMF/Manual panel should be decided in consultation with the Architects as near to the acoustic enclosure as possible. In case of connection through bus trunking, care should be taken for aesthetics vis-à-vis surrounding.

DG Set without acoustic enclosure

In case of DG Sets is supplied without acoustic enclosure, manual/AMF electrical control panel should be located inside the sub-station building.

Type of Control Panel

Control panel shall be either manual type or AMF as per the requirement of work to be decided by NIT approving authority.

Manual Control Panel

The control panel shall be fabricated out of 1.6 mm sheet, totally enclosed, dust, damp and vermin proof wall mounted / free standing floor mounted type with Ip-53 degree of protection & Front operated.

The Standard control panel shall consist the following instruments:

Composite meter for digital display of:

Voltage

Current

Power factor ( for 15 KVA and above)

Frequency (for 15 KVA & above)

Energy Meter (for 15 KVA & above)

HRC fuses of suitable rating:

One MCB of suitable rating for DG sets up to 45 KVA rating or switch Disconnector Fuse Unit (SDFU) for higher ratings.

Push button-switch or ON-OFF switch for ON and OFF operation

Pilot lamps one No. in case of single phase DG sets and 3 numbers in case of three phases DG sets.

Battery charger complete with voltage regulator, Voltmeter and ammeter for charging the battery from external Mains. This will be in addition to the battery charging alternator or dynamo fitted on the engine.

Instruments Fuses

All the components in the control panel shall be properly mounted, duly wired and labeled. Suitable are to be provided for panel incoming and outgoing connections.

## AMF Control Panel

**General Features:** The control panel shall be fabricated out of 1.6 mm sheet steel, totally enclosed, dust, damp and vermin proof free standing floor mounted type & front operated. It shall be made into sections such that as per feasible, there is no mixing of control, power, DC & AC functions in the same sections and they are sufficiently segregated except where their bunching is necessary. Hinged doors shall be provided preferably double leaf for access for routine inspection from the rear. There is no objection to have single leaf hinged door in the front, all indication lamps, instruments meter etc. shall be flushed in the front. The degree of protection required will be Ip-42 conforming to IS:2147

**Terminal blocks and wiring:** Terminal blocks of robust type and generally not less than 15 Amps capacity, 250/500 volts grade for DC upto 100 volts and 660/1100 volts grade for AC and rest of the junction shall be employed in such a manner so that they are freely accessible for maintenance. All control and small wiring from unit to unit inside the panel shall also be done with not less than 2.5 sq. mm copper conductor PVC insulated and 660/1100 volts grade. Suitable colour coding can be adopted. Wiring system shall be neatly formed and run preferably, function wise and as far as feasible segregated voltage-wise. All ends shall be identified with ferrules at the ends.

**Labeling:** All internal components shall be provided with suitable identification labels suitably engraved. Labels shall be fixed on buttons, indication lamps etc.

**Painting:** The entire panel shall be given primer coat after proper treatment and powder coating with 7 tanks process before assembly of various items.

**Equipment requirements:** The control cubical shall incorporate into assembly general equipment systems as under:

Control system equipment and components such as relays, contactors, timers, etc. both for automatic operation on main failure and as well as for manual operation.

Equipment and components necessary for testing generating set's healthiness with test mode and with load on mains.

Necessary instruments and accessories such as voltmeter, power factor meter, KW meter, KWH meter, Ammeter, Frequency meter etc. in one energy analyzer unit with selector switch to obtain the reading of desired parameters.

Necessary indication lamps, fuses, terminal blocks, push buttons, control switches etc., as required.

Necessary engine/generating set shut down devices due to faults/ abnormalities.

Necessary visual audio alarm indication and annunciation facility, as specified.

Necessary battery charger.

Necessary excitation control and voltage regulating equipment.

Necessary over head bus trunking terminations all internal wiring, connections etc., as required.

Breakers as specified in the schedule of work.

**2.4.2.2.6 System Operation:** The above-mentioned facilities provided shall afford the following operational requirements

**2.4.2.2.6.1 Auto Mode:**

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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 90% 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 initiation.

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 built up voltage after the first or second start as may be, 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 and 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 diesel alternator set reverts to standby for next operation as per (a), (b) and (c) above.

Manual mode:

(a) In a manual mode, it shall be feasible to start-up 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 closure shall be feasible only after alternator has built up full voltage. If the load is already on 'mains', pressure on 'close' button shall be ineffective.

Engine shut down, otherwise due to faults, shall be manual by pressing a 'stop' button.

2.4.2.2.6.3 Test mode:

When under 'test' mode, pressing of 'test' button shall complete the start up sequence simulation and start the engine. The simulation will be that of mains failure. Sequence I (a) and (b) shall be completed.

Engine shall build up voltage but the set shall not take load by closing of alternator circuit breaker. When the load is on the mains, monitoring of 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 to alternator.

Bringing the mode selector to auto position shall shut down the set as per sequence I (d) provided main supply is ON. If the mains supply is not available at that time, y\the alternator shall taken load as in © above.

Engine shut down and alternator protection equipments: Following shut down and protection system shall be integrated in the control panel.

Engine:

Low lubricating oil pressure shut down. This shall be inoperative during start up and acceleration period.

High coolant (water) temperature shut down.

Engine over speed shut down.

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Correction.....  
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Alternator Protection: Following protection arrangement shall be made:

Over load  
Short circuit  
Earth fault  
Over voltage

Monitoring and metering facilities:

Necessary energy analyzer unit for visual monitoring of mains, alternator and load voltage, current, frequency, KWH, power factor, etc.

A set of visual monitoring lamp indication for:

Load on set

Load on mains

Set on test (Alternator on operation duty, Alternator on standby duty).

Set of lamp for engine shut down for over speed, low lub. Oil pressure and high coolant water temperature, overload trip of alternator, earth fault trip of alternator, engine lock out and failure to start etc. All these indications shall have an audio and visual alarm. When operator accepts the alarm, the hooter will be silenced and the fault indication will become steady until reset by operating a reset button.

Operating devices: A set of operation devices shall be incorporated in the front of panel as under:

Master Engine Control Switch: This shall cut off in 'OFF' position DC control to the entire panel, thus preventing start-up of engine due to any cause. However, battery charger and lamp test button for testing the healthiness of indication lamps, DC volt meter/ammeter etc. shall be operative. It shall be feasible to lock the Switch in OFF position for maintenance and shut down purposes.

Operation selector switch OFF/AUTO/MANUAL/TEST position.

Energy analyzer unit for display of various electrical parameters like voltage, current, frequency, KW, power factor, etc.

A set of push button, as, specified.

Relays, contactor, timers, circuit breakers, as required.

Necessary battery charger with boost/trickle selector, DC voltmeter and DC ammeter.

Compatibility with 'Building Management system' (BMS): PLC compatibility and required nos. of Input/output terminals pints should be provided in the AMF control panel.

Battery/Electrical System

Batteries supplied with Gensets are generally dry and uncharged. First charging of uncharged batteries is very important and should be done from authorized battery charging centre. Initial charging should be done for 72-80 hours.

Batteries should be placed on stands and relatively at cool place.

Battery capacity and cable sizes for various engine capacity should be as indicated in the table below. Cable sizes shown are for maximum length of 2m. If length is more, cable size should be selected in such a way that voltage drop does not exceed 2V.

F  
or  
A  
M  
F  
a  
p  
p  
l  
i  
c  
a  
b  
l  
e,

DG Set Capacity	Minimum Battery capacity (AH)	Minimum Cable size (Material: Copper) Sq. mm	Electrical System (Volts)
Above 500 KVA	360	70	24
Above 125 KVA upto 500 KVA	180	70	24
Above 82.5.KVA upto 125 KVA	180	50	24
Above 62.5. KVA upto 82.5. KVA	150	50	12
Above 25 KVA upto 62.5. KVA	120	50	12
upto 25 KVA	88	35	12

a static battery charger working on mains supply is recommended to keep the battery charged at all times.

1.5 Sq.mm copper wire should be used for wiring between junction box and Control panel.

### Cabling

Power cabling between alternator and control panel and control panel and change over switch to mains should be done with recommended cable sizes.

Typical cable size for 415 V application are provided in Appendix-VI

As far as possible, for DG Set of capacity 750 KVA & above, connection between alternator to AMF panel & AMF panel to Essential panel shall be trough bus-trunking. For exposed/outdoor bus trunking protection requirement should be IP-55.

If LT panel is part of tender of the DG Set jobs of 500 KVA & above, LT panel specified, should be one of the reputed brands.

Overheating due to loose tumbling/undersize cables causes most of electrical failures and hence corrects size of cable and thimbles should always be used, If cable is specified.

While terminating cables, avoid any tension on the bolts/ busbars. (if cable is specified)

While terminating R, Y & B phase notation should be maintained in the alternator and control panel for easy maintenance

Crimped cables should be connected to alternator and control panel trough cable glands, if cable is specified.

Multi-core copper cables should be used for inter connecting the engine controls with the switchgear and other equipments.

For AMF application, multicore 1.5 Sq.mm flexible standard copper cable for control cabling should be used.

It is recommended to support output cables on separate structure on ground so that Weight of cables should not fall alternator/base rail.

External Wirings, when provided for remote voltage/excitation monitoring/droop CT etc. shall be screened sheathed type. Maximum length of such wiring shall not exceed 5 meters.

### Alternator termination Links

For proper terminations between links and switchgear terminals, the contact area must be adequate.

The following situation should also be avoided as they lead to creation of heat sources at the point of termination:

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Point contact arising out of improper position of links with switchgear terminals

Gaps between busbars/links and terminals being remedied by connecting bolt/stud. In such cases the bolts will carry the load current. Normally these bolts/studs are made of MS and hence are not designed to carry currents.

Adequate clearance between busbars/links at terminals should be maintained (IS: 4232 may be referred to for guidelines).

Figure 2(iii) indicates the quality of different configurations.

Adequate clearance between busbars/links at terminals should be maintained (IS: 4232 may be referred to for guidelines).

## FOUNDATION

Scope: This section covers details of foundations for DG set with or without acoustic enclosures.

Gensets with acoustic enclosure: A PCC foundation (1:2:4, M-20 grade) of approximate of depth of 300 mm is required so as to provide leveled surface for placement of the acoustic enclosure. About 150 mm foundation height should be above ground level. The length and breadth of foundation should be at least 250 mm more than the size of the enclosure. Gensets should be mounted on AVM's inside the enclosure.

Gensets without acoustic enclosure:

Genset should not be installed on loose sand or clay.

Foundation should be designed considering safe bearing capacity of soil. Vibration isolators (AVMs) should be provided to reduce vibration transmission to the surrounding structure.

Depths of PCC (Plain Cement Concrete) for typical soil condition have been shown in the table below. However structural engineer should be consulted to verify the data depending upon soil condition.

Dg Capacity (KVA)	Typical Depth of PCC Foundation (For soil bearing capacity 5000 kg/sqm)
750-2000	600 mm
625	400 mm
320-500	400 mm
200-320	400 mm
82.5-200	400 mm
upto 82.5	200 mm

Foundation level should be checked diagonally as well as across the length for even flatness. The foundation should be within + 0.5 Degree (angle) of any horizontal plane.

## ACOUSTIC ENCLOSURE

Scope: This section covers technical requirements of the acoustic enclosure.

As per CPCB norms, restriction has been imposed for new DG sets upto 1000 KVA for noise level (see appendix-'II'). Therefore, in terms of these norms, acoustic enclosure should be type tested at the climate conditions specified in Para 2.1.4 through one of the authorized laboratory.

Installation

Acoustic enclosures are supplied with built in anti Vibration Mountings (AVMs). As such Genset can installed directly on the leveled surface.

Exhaust piping outlet should not be turned towards window/ventilator of home or occupied building. Provision of rain cap should be ensured.

The acoustic enclosure placement should be such that there is no restriction in front of air inlet and outlet from canopy.

#### Service Accessibility

Genset/Engine control panel should be visible from outside the enclosure.

Routine/periodical check on engine/alternator (filter replacement and tappet setting etc.) should be possible without dismantling acoustic enclosure.

For major repairs/overhaul, it may be required to dismantle the acoustic enclosure.

Sufficient space should be available around the Genset for inspection and service.

#### General Design Guidelines

To avoid re-circulation of hot air, durable sealing between radiator and canopy is must.

Ventilation fans are must for the Gensets cooled by heat-exchanger/cooling tower system.

Exhaust piping inside the enclosure must be lagged (except bellow).

Temperature rise inside the enclosure should not be more than 5o C for maximum ambient above 40o C and it should be below 10o C for ambient below 40O C.

There should be provision for oil, coolant drain and fill. Fuel tank should have provision for cleaning.

#### Specifications for acoustic Enclosure

The acoustic enclosure shall be designed and manufactured confirming to relevant standards suitable for outdoor installation exposed to weather condition, and to limit overall noise level to 75 dB (A) at a distance of 1 mtr. From the enclosure as per CPCB norms under free field conditions.

The construction should be such that it prevents entry rain water slashing into the enclosure and allows 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 enclosure 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 powder coated CRCA sheet.

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 gasket and heavy duty locks.

All sheet metal parts should be processed trough 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 outside as in automobiles and should be with a lockable cap.

The batteries should be accommodated in the enclosure in battery.

The canopy should be provided with high enclosure temperature safety device.

The acoustic lining should be made up of high quality insulation material i.e. glass/mineral wool of minimum 50mm thickness upto 500 KVA capacity and 100mm above 500 KVA capacity and 75 kg/cubic meter to 100 kg/cubic meter for sound absorption as per standard design of manufacturer's 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 M.S. 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(S). If the acoustic enclosure to be provided with forced Ventilation then suitable size of axial flow fan(with motor and auto-start arrangement) and suitable size 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 /connection through bus-trunking. Such arrangement on acoustic enclosure should be water proof and dust-proof conforming to IP-65 protection.

#### ACOUSTIC INSULATION

High density resin bonded glass wool shall be provided on all five sides including doors and roof to absorb noise. The door shall have acoustic gas proof gaskets all along its periphery. Resin bonded Rockwool of high density (96 Kg/Cu. Mtr.) with minimum 100mm thickness with tissue paper (min 50 gm/sq.m) covered with perforated 1.6 mm painted MS sheet shall be used as sound absorption material on all five sides including doors is provided. The air ducts shall also be covered with mineral wool.

Acoustic hoods with noise splitters provided to block and reduce the sound leakage.

#### PAINTING

The acoustic enclosure shall be painted with good quality Epoxy base powder coated.

#### VIBRATION ISOLATION

To avoid transfer of vibration from Genset to enclosure & surrounding specially designed vibration isolators shall be used.

#### SAFETIES

The enclosure shall have the following safeties;

High Enclosure Temperature

Emergency Stop Push button outside the enclosure.

The enclosure shall also be provide with space heater complete with thermostat and controlling

ELCB working on 230 V A.C. supply and chamber illumination lamp working on 24 V DC supply.

#### 7. FIRST FILL OF ENGINE OIL :

D.G. Set shall be provided complete with first fill of Engine Oil.

#### 8. MS SUPPORT STRUCTURE

Independent Supporting Structure: Providing and fixing of MS Steel structure including RCC foundation for supporting structure with MS Angle/Channel with all accessories painting etc. complete as required along with lightening arrester / aviation light for DG fume pipes as per CPCB approved norms. The steel work shall be welded in built up section/framed work, i/c cutting, hoisting, fixing in position and applying a priming coat of approved steel primer using structure steel etc. including grating frames, guard bar, railings, brackets, gates and similar work complete as required. The design of the support structure shall be done by the contractor and shall get the approval from the Project Director/ Architect.

The design of Independent support structure and RCC foundation shall be got done from the approved structural consultant after considering wind velocity and bearing capacity of soil. Design of supporting

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structure and RCC foundation shall also be get check for proof checking from any independent Contractor as approved in PWD.

## 9. PERFORMANCE TESTING AND TYPE TESTS

### i) Performance Testing

DG sets shall be tested at varying loads at manufacturers works prior to dispatch DG sets to site. The performance tests at the works shall be carried out in presence of authorized representative from the Engineer-in-Charge. Due notice for the programme performance testing at works shall be given to the Engineer-in-Charge to enable to arrange for their representatives for this inspection to be at manufacturers works to inspection and testing. The costs for the arrangement shall be borne by the Contractor.

The performance test on each DG Set shall be of minimum 12 hours duration on rated KW i/c 1hrs. on 10% overloading after continuous run of 12 hrs.

All instruments, materials, consumables (fuel oil, lube oil etc.) load and labour required carrying out of the test shall be provided by the Contractor.

## 10 DESIGN

The design and workmanship shall be in accordance with the best engineering practices, to ensure satisfactory performance and service life. The equipment offered by the contractor shall be complete in all respect. Any material or accessories, which may not have been specifically mentioned, but which are useful and necessary for the satisfactory and trouble free operation and maintenance of the equipment, shall be provided without any extra cost to the purchaser.

## 11. CODES & STANDARDS

The design construction, manufacture, inspection, testing and performance shall comply with all the currently applicable statues, safety codes, relevant Bureau of Indian Standards (BIS) British Standards (BS), International Electro Technical Commission (IEC) Publication, NEMA, VDE and DEMA Standards.

Some of the applicable Standards are listed below:-

IS 1601 : Performance and testing of IC engines for General Purpose.

BS-649 : Performance and testing of diesel engines for General Purpose.

IS-4722 : Rotating electrical machines.

IS-4889 : Method of determination of efficiency of Rotating Electrical machinery.

IS-6491 : Degree of protection provided by enclosures for Rotating Electrical machinery.

IS-4729 : Measurement and evaluation of vibration of Rotating Electrical machines.

AIEE-606 : Recommended specification for speed governing of internal (1959) combustion engine generator units.

IS-2705 : Current transformers.

IS-1248 : Electrical indicating instruments.

ISO-8528 : Reciprocating IC engine driven AC Gensets Section (Part II)

## 12. GENERAL

12.1 The DG set shall be super silent type, water cooled with radiator, manually and automatically operated, designed for continuous operation at 100% load at 100% time duty operation except the time required for periodic maintenance. The DG set shall comprise of diesel engine, coupled to four pole

alternator on a single frame with integrated microprocessor based genset monitoring and control system having self regulated, brushless/static excitation system.

12.2 All equipment shall be of the class most suitable for working under the conditions specified and shall withstand the atmospheric conditions without deterioration.

12.3 The contractor shall also indicate in his offer the time schedule for routine maintenance/overhauling operations necessary for continuous satisfactory operation of DG set.

### 13. PERFORMANCE REQUIREMENT

13.1 The equipment shall be capable of delivering continuously at the generator terminals, 100% output at 100% load at 100% time except for periodical maintenance when operating under the site and ambient conditions described in this specification. Genset should have minimum 50% single step loading capacity and it should be able to take full load within 25 seconds from start.

The design parameters of the generator and excitation system shall be so chosen, that the set is stable while running at any load between no-load and full load. It should have synchronous speed control with load sensing governing system and should be capable of paralleling between sets at synchronous speed.

13.2 Engine should be heavy duty four stroke, turbo charged after cooled, V construction Electrical start. Engine should have minimum lub oil change period of 500 hrs.

13.3 The DG set should be capable of running at 100% load continuously for minimum 500 hours before any change of lube oil or filters.

13.4 Contractor to specify and guarantee maintenance contract cost and to give an undertaking to take a comprehensive maintenance contract at a price with draft scheme papers.

### ANNEXURE – I-A

#### TECHNICAL PARTICULARS OF 500 KVA DIESEL GENERATOR SETS

1. Rating	: 500 KVA Diesel Generator Unit
2. Mode of operation	: Auto start (with provision for manual operation)
3. Alternator	
3.1 Output rating at 0.8 p.f. (lag)	: 500 KVA continuous output at 100% and ambient temperature. of 50°C load at 100% time respectively
except periodic maintenance.	
3.2 Class of insulation for Stator & Rotor	: Class F
3.3 Rated voltage & frequency	: 415 V, 50 Hz
3.4 Maximum permissible time for Building up rated voltage From stand still	: Less than 20 seconds
3.5 Variation of voltage from No load to full load	: + 5% of rated voltage
3.6 Frequency variation	: + 1%
3.7 Capacity of largest rating Motor starting	: To be furnished
3.7.1 Dynamic voltage response & permissible voltage drop Operating condition at 3.6 above. during largest rating motor	: Less than 15% of rated voltage under

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starting	
3.9 Temperature detectors	:8 nos. resistance temperature detectors of type PT-100 for winding temperature and bearing temperature measurements
3.10 Type of excitation system	:Brushless, shunt and booster
3.11 Type of control for voltage	: Local/remote & manual/Automatic regulator.
4.00 Type of fuel for engine	:High speed diesel according to F-DMA or FDMS as per ISO 8217
4.01 Day oil tank capacity	:990 Ltr. for continuous generation
4.02 Lube Oil	:As Per OEM
4.03 Maximum permissible Starting. Starting time for attaining Full speed	: Less than 20 Seconds
4.04 Engine starting	: Electric starting system
4.05 Type of governor	: Electric controlled
4.06 Lubricating system	: Pressure fed type
4.07 Cooling system	: Radiator cooling
4.08 Engine cranking system	: To be included

#### ANNEXURE-IC

##### List of Material for the complete DG set

##### (a) Engine Specification:

- Engine governor and control box for coupled genset
- Speed control switch end of start and over speed
- Fuel and lube oil duplex cartridges filters
- Electric starting system
- Switches on lube oil pressure and temperature, water temperature and pressure, oil sump level, after Cooler air temperature, exhaust gas temperatures.
- DG Controller (Electronic Instrument Panel for indication of Engine Parameter shaftly Controls).
- Electronic control panel with digital governor suitable for synchronization.
- Automatic lube oil filling
- Wiring box
- Electric pre-lubricating lube oil pump

##### (b) Generator 415 V

- According to the standard IEC, VDE, BS, ANSI
- Flanged on engine, connection with elastic coupling
- Double long life re-greasable bearings
- Single and ventilated. Discharge at the drive end.
- Insulation class F
- Enclosure: IP23
- Excitation: Shunt and booster
- 6 stator and 2 bearing = PT 100 sensors
- Preheating resistance
- Overload capacity : 110% for 1 hour every 6 hours at P.F. 0.8

A.E. (C) / J.E(C)

Correction.....  
Deletion.....  
Insertion.....

- Unbalanced load : the unbalanced current between Phases shall NOT exceed the rated Current by 30%
- Radio interference : Within limits of CISPR standard
- Regulation performances : The voltage is kept constant within+ 1%
- Manual voltage adjustment within + 5%
- Dynamic balancing of the complete rotor and shaft
- Short circuit withstanding : 3 in during 10s

(c) Generating Set

- Flywheel housing mounted between engine and generator
- Elastic suspension between generating set and foundations
- Flexible connections on the interface of the circuits for lube oil, water, fuel oil and exhaust gases.
- Standard blue coating
- Maintenance manual
- Factory standard test

(d) Electrical Control Panel

1 x Generator Control panel with Power Command Control which should cover following functions.-  
The system should be integrated into an electric panel

\* Instrumentation

The instrumentation should consist of

\* 1 numerical measure station controlling following parameters:

- Voltage on the 3 phases
- Current on the 3 phases
- Active power
- Reactive power
- Power factor
- Active energy
- Reactive energy
- 1 battery voltmeter
- 1 synchro scope
- 1 speed indicator including 1-hour meter and 1 starting meter
- 1 stop, manual, auto switch
- 1 set of push-buttons for engine start and stop
- 1 set of push buttons for interlocking and release of the genset connection circuit breaker.
- 1 load taking selector (manual mode)
- 1 push button for emergency stop with key
- The whole alarms of the gensets should be reported by light signals connected to the push-buttons sound alarm stop, fault discharge and lamp tests.

\* Automation:

The automation of the genset control must be carried out by D.G. Controller& a load management PLC including starting and stopping sequences of the genset according to the different operating modes as well as the alarm management.

- Speed regulator should control the engine to maintain the genset frequency at present value.

A.E. (C) / J.E(C)

Correction.....  
Deletion.....  
Insertion.....

- A battery charger should be installed inside the M. L. T. Panel (associated to a battery supply for the 24V DC to the common automatism)

\* The following on board protection should be provided:

- max. Current
- Excitation loss
- Unbalancing
- Power return
- Mini/max voltage
- Mini/max frequency
- Earth fault
- Others as specified in the tender elsewhere

## PANELS / SYNCHRONISING CUM PLC PANEL

### 1. MV CUBICAL PANEL

1.1 It shall be as per Section 4 of CPWD General Specifications for E&M Works Part- IV (Sub-station)-2013.

1.2 The LT panel shall be of uniform depth. It shall conform to the standard manufacturing practices and as per directions of the Engineer-in-Charge. It shall conform to IS: 8623-1993. Degree of protection shall be IP-42. Cubical panel sheet steel thickness shall be 2.0 mm for load bearing members and 2.0 mm for doors of L .T. Panels, and shall be stiffened with angle iron frame, formed section etc.

1.3 The Aluminium strips for the horizontal bus bars and vertical / dropper bus bars shall have all arrangements and design as per requirements of C.P.R.I test certification. The neutral bus bars shall not be less than half the size of phase bus bars or of the size in the tested and certified design. The bus bars and supports shall have short circuit withstand capacity of 50 KA RMS for one second. All bus bar joints shall be provided with Nickel cadmium High Tensile Bolts and nuts.

1.4 The successful tenderer will submit detailed dimensional drawings of the L.T. panels for approval. Due care will be taken to provide ample space for ease of maintenance. The fabrication works shall be taken up only after the approval to the detailed dimensional drawings submitted by the successful tenderer.

1.5 The horizontal and vertical bus bars shall be provided with heat shrinkable colour coded PVR sleeves.

1.6 All bus bars joints shall be shrouded with PVC / FRP molded click on or bolted type shrouds.

1.7 All live parts of panel shall be totally shrouded by means of non-hygroscopic & fire retardant material.

1.8 Cable entries will be from the top in cable alleys. Outgoing MCCB's will be provided with suitable extension strips upto the cable alleys with suitable supports and termination arrangements. Removable gland plates shall be provided at the top for proper termination of cables.

1.9 Metal/FRP sheet barriers shall be provided between two adjacent feeders in the cable alley to avoid any spark traveling from one to another feeder.

1.10 Connection from the bus bars to the MCCBs shall be made with solid Aluminium bars / strips in separate bus bars alley. Suitable neutral link shall be provided to break the continuity of neutral as where required.

1.11 Suitable support arrangement shall be provided for the cables in cable alleys.

1.12 Each panel shall be provided with thermo-statically controlled panel space heaters for anti condensation with on/off toggle switch and back up H.R.C. fuses.

1.13 Components/accessories of approved make only shall be used in the manufacturer of panels.



- 1.14 Each door of switch gear cubicle shall be earthed by PVC insulated 2.5mm 2 stranded copper wire/ and separate horizontal & vertical earth bus bar shall be provided in each panel.
- 1.15 LT panel shall be provided with lifting hooks/angle for all shipping sections handling.
- 1.16 Cast resin current transformers shall be provided for metering & protection applications in A.C.B. Feeders.
- 1.17 All control wiring terminations shall be done by means of crimping type cable lugs. Control wiring shall be neatly routed with gourmets to avoid pressure on doors and fouling with other equipment/live links & terminals.
- 1.18 All equipments inside a module shall be properly identified by means of stickers including auxiliary bus bars.
- 1.19 Provision shall be kept for bus duct termination for ACB's. ACB's shall be in single tier formation i.e. one cubicle panel bay shall have only on ACB. Similarly arrangement should also be made for MCCB's which are connected by bus trunking.
- Each incoming and outgoing shall have multifunction digital panel meter of class 1.0 accuracy with communication interface port RS 485 for recording and displaying the various electrical parameter and communicating the same with IBMS System. The firm shall provide necessary hardware and software for communicating all the electrical parameter as specified in BOQ with IBMS System.

## EARTHING

Scope: This section covers the earthing requirement of DG Set installations. Copper plate earthing shall be provided for DG sets of capacity 500 KVA or above, whereas G.I. plate earthing shall be provided for DG sets below 500 KVA capacity.

The generating set and all associated equipments, control and switchgear and switchgear panels must be earthed before the set is put into operation.

Four numbers earth earth sets for each Dg sets are required, as under:

2 earthing sets for Genset/control panel body.

2 earthing sets for neutral.

In case there are more than one DG set in one location, independent two nos. neutral earthlings shall be provided for each DG set. However, two nos. earthing sets shall be common for the body earthing of DG sets, Control panel, AMF panel and Essential LT panel.

Earthing job should be carried out as per General Specifications for E&M Works (part-1-Internal) '2013'. Copper or GI strips of suitable size shall be used for earthing as detailed hereunder for interconnection:

DG set of 50 KVA capacity or above-Copper strip

DG set below 500 KVA capacity-GI strip

For Gensets with AVM's between engine/alternator and base rail, the earthing must be done at the engine/alternator and not at base-rail.

Genset should be earthed at two distinct points through a conductor strip heavy enough to carry the short circuit current without burning out in conformity to General specifications for E&M Works (Part-1-Internal)2013 in vogue.

Earth Bus: For body earthing, an earth-bus shall be provided.

In case, DG set is being installed inside the substation building or near to the sub-. station, for body-earthing of DG set, AMF panel and Essential panel, earth bus provided for sub-station shall be used

Test joints should be provided for testing the earthing as and when required.

For further details of Earthing Work, like size of plate/earth strip, depth of earthing, method etc., please refer "CPWD General Specifications For E&M Works (Part-1-Internal)"2013 in vogue.

**CPCB NORMS FOR NOISE LEVEL**

(This is download from website of CPCB)

**SYSTEM & PROCEDURE FOR COMPLIANCE WITH NOISE LIMITS  
FOR DIESEL GENERATING SETS (UPTO 1000 KVA)****1 SCOPE**

This document lays down the system & procedure for compliance with noise limits for new diesel generator sets (upto 1000 KVA ) vide notification G.S.R.371 (E), dated 17th May, 2002, at serial no.94 (paragraph 1& 3) issued by the Ministry of Environment and Forest, Government of India. The details are covered as under:

Part-I : Noise Limits, Applicability and other requirements

Part-II : Certification System & Procedure

Part-III : Test procedure

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## APPENDIX-III

**CPCB NORMS FOR EMISSION LEVEL**

(This is download from website of CPCB)

**SYSTEM & PROCEDURE FOR COMPLIANCE TO EMISSION LIMITS FOR NEW DIESEL ENGINES (UP TO 800 KW) FOR GENESET APPLICATIONS**

**SCOPE**

This document lays down the requirements, system & procedure fore compliance to the rules vide notification no. G.S.R. 371 (E), dated 17th May, 2002 at serial no. 95, for emission limits for new diesel engines(up to 800 KW) for genset applications, issued by Ministry of Environment and Forest, government of India. The details are covered as under:

- Part I - Emission Limits, Applicability and other Requirements
- Part II - Certification system and procedures
- Part III - Testing Equipments and procedures'

**CONTENETS****PART I: EMISSION LIMITS, APPLICABILITY AND OTHER REQUIREMENTS****PART II: CERTIFICATION SYSTEM AND PROCEDURE**

Model Family

Selection of Certification Contractor

Application for type Approval

Type Approval

Certificate of Type Approval

Modification in the Engine Model

Verification of Conformity of production (COP)

Sample Size and Decision Criteria for verification of COP

Certificate of COP Verification

Consequences of non-Compliance

**PART III: TEST EQUIPEMENT PROCEDURES**

ANNEXURE I: Test Fuel Specifications

ANNEXURE II: Application for Type Approval/Description to be given at the time of COP

ANNEXURE III: Certificate of Type approval (specimen)

ANNEXURE IV: Certificate of Production (specimen)

## INTERNATIONAL STANDARD

## ISO 8528-PART 1

RECIPROCATING INTERNAL COMBUSTION ENGINE DRIVE ALTERNATING CURRENT  
GENERATING SETS

## PART-1

## APPLICATION, RATINGS AND PERFORMANCE

Groupes électro-génératrices à courant alternatif entraînés par moteurs alternatifs à combustion interne-  
Partie 1: Application, caractéristiques et performances

## FOREWORD

ISO (the international Organization for standardization) is a worldwide federation of national standards bodies (ISO member's bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject on which a technical committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft international Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

International standard ISO 8528-1 was prepared by Technical Committee ISO/TC 70, internal combustion engine, Sub-committee SC 2, Performance and tests.

ISO 8528 consists of the following parts, under the general title Reciprocating internal combustion engine driven alternating current generating sets.

Part 1: Application, ratings and performance

Part 2: Engines

Part 3: Alternating current generators for generating sets

Part 4: Controlgear and switchgear

Part 5: Generating sets

Part 6: Test methods

Part 7: Technical declarations for specification and design

Part 8: Low-power general purpose generating sets

Part 9: Measurement and airborne noise-Enveloping surface method

Part 10: Measurement of airborne noise-Enveloping surface method

Part 11: Security generating sets with uninterruptible power systems

Parts 7, 8, 9 and 10 are in course of preparation. Part 11 is at an early stage of preparation and may be split into two parts.

# RECIPROCATING INTERNAL COMBUSTION ENGINE DRIVEN ALTERNATING CURRENT GENERATING SETS

## PART-1

### APPLICATION, RATINGS AND PERFORMANCE

#### 1 SCOPE

This part of ISO 8528 defines various classifications for the applications, ratings and performance which arise out of the combination of generating sets consisting of a reciprocating internal combustion (RIC) engine, alternating current (a.c.) generator, Control gear, switch and auxiliary equipment.

It applies to a.c. generating sets driven by RIC engines for land and marine use, excluding generating sets used on aircraft or to panel land vehicles and locomotives.

For some specific applications (for example, essential hospital supplies, high-rise buildings, etc.) supplementary requirements may be necessary. The provisions of this part of ISO 8528 should be regarded as a basis.

For other reciprocating-type prime movers (e.g. sewage-gas engines, steam engines), the provision of this part of ISO 8528 should be used as a basis.

The generating sets according to this International standard are used to generate electrical power of continuous, Peak-load and standby supplies. The classifications laid down in this part of ISO 8528 are intended to help understanding between manufacturer and customer.

#### 2. NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 8528. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 8528 are encouraged to investigate the possibility of applying the most recent addition of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3046-1:1986, Reciprocating internal combustion engines-Performance-Part 1: Standards reference conditions and declarations of power, fuel consumption and lubricating Oil consumption.

ISO 8528-2:1993, Reciprocating internal combustion engine driven alternating current generating sets-Part 2: Engines.

ISO 8528-3:1993, Reciprocating internal combustion engine driven alternating current generating sets-Part 3: An Alternating current generator for generating sets.

ISO 8528-4:1993, Reciprocating internal combustion engine driven alternating current generating sets-Part 4: Control gear switchgear.

ISO 8528-5:1993, Reciprocating internal combustion engine driven alternating current generating sets-Part 5: Control gear switchgear.

IEC 34-1:1983, Rotating electrical machines-Part 1: rating and performance.

IEC 298:1990, A.C. metal-enclosed switchgear and Control gear for rated voltages above 1 KV and up to and including 52 kV

IEC 439-1:1985, Low-voltage switchgear and Control gear assemblies-Part I: Requirements for type-tested and partially type-tested assemblies.

IEC 439-2:1987, Low-voltage switchgear and Control gear assemblies-Part-2: Particular requirements for busbar trunking system busway:

## SYMBOLS AND ABBREVIATIONS

P	Power in kilowatts
Pr	Total barometric pressure, in kilopascals
Ter	Change air coolant temperature, in kelvins
Tr	Air temperature, in kelvins
t	Time, in seconds
Ør	Relative humidity, as a percentage
a.c.	Alternating current
COP	Continuous power
LPT	Limited-time running power
PRP	Prime power

## OTHER REGULATIONS AND ADDITIONAL REQUIREMENTS

4.1 For a.c. generating sets used on board ships and offshore Installation which have to comply with rules of a classification society, the additional requirements of the classification society shall be observed. The classification society shall be stated by the customer prior to placing of the order.

For a.c. generating sets operating in non-classed equipment, such additional requirements are in each case subject to agreement between the manufacturer and customer.

4.2 If special requirements from regulations of any other authority (e.g. Inspecting and/or legislative authorities) have to be met, the authority shall be started by the customer prior to placing of the order.

Any further additional requirements shall be subject to agreement between the manufacturer and customer.

## GENERAL DESCRIPTION

### 5.1 Generating set

A generating set consists of one or more RIC engines to produce mechanical energy and one or more generators to convert the mechanical energy into electrical energy together with components for

transmitting the mechanical energy (e.g. couplings, gearbox) and, where applicable, bearing and mounting components.

#### Prime movers

These may be of two types:  
compression ignition engines, and  
Spark-ignition engines.

Depending on the application of the generating set the following criteria, among others may be important for the selection of prime mover to be used:

- quality of fuel and fuel consumption;
- exhaust gas and noise emission;
- speed range
- mass and dimensions;
- sudden loading and frequency behavior;
- short-circuit characteristics of the generator;
- cooling systems;
- maintenance;
- waste heat utilization.

#### Generators

These may be of two types:  
-synchronous generators, and  
-asynchronous generators.

Depending on the application of the generating set, the following criteria, among others, may be important for the selection of the generator to be used:

- voltage characteristics during starting, nominal operation and overload operation, as well as, after load changes taking into account the power factor;
- short-circuit behavior (electrical, mechanical);
- efficiency;
- generator design and type of enclosure;
- Parallel-operation behavior
- maintenance.

#### Control gears and switchgears

Equipment for control, switching and monitoring is combined into Controlgear and switchgear systems, for the operation of the generating set.

#### 5.1.4 Auxiliaries

Auxiliaries are items of equipment essential for pre-operation of the generating set, such as

- starting system;
- air intake and exhaust gas systems;
- cooling system;
- lubricating oil system;

A.E. (C)/ J.E(C)

Correction.....  
Deletion.....  
Insertion.....



- fuel system (including fuel treatment where applicable);
- auxiliary electrical power supply.

#### Power station

A power station comprises one or more generating sets and their auxiliary equipment, the associated Control gear and switchgear and, where applicable, the place of installation (e.g. a building, an enclosure or special equipment for protection from the weather).

### APPLICATION CRITERIA

#### 6.1 Modes of operation

The modes of operation of the generating set may affect certain important characteristics (e.g. its economical and reliable operation, the intervals between maintenance and repair), and shall be taken into account by the customer when agreeing the requirements with the manufacturer (see also clause 11).

#### Continuous operation

Continuous operation is operation of a generating set without a time limit, but considering the maintenance period.

#### Limited-time operation

Limited-time operation is operation of the generating set for a limited time.

NOTE 1 : The demand pf electrical power from the connected equipment is supplied from the mains and only in the event of failure of the latter is it supplied by an internal generating set. If there is a failure in the normal power supply, the internal generating set, operating as a back-up or emergency supply, provided as a supply temporarily or for a limited time for:

Safety equipment (e.g. during the evacuation of a building);

Connected equipment which is important for the purpose of operation, to maintain emergency operation;

The entire group of connected equipment or part thereof.

The electrical power generated is used to cover a peak demand (peak-load operation).

There is no mains supply and the generating set is only operated from time to time.

### SITE CRITERIA

#### Land use

Land use covers generating sets, fixed, transportable or mobile, which are used on land.

#### Marine use

Marine use covers generating sets used on board ships and offshore installations.

### SINGLE AND PARALLEL OPERATION

Generating sets may have two type of operation, defined in 6.3.1 and 6.3.2.

#### 6.3.1 Single operation

A.E. (C)/ J.E(C)

Correction.....  
Deletion.....  
Insertion.....

Single operation refers to a generating set, irrespective of its configuration or modes of start –up and control, which will operate as the sole source of electrical power and without the support of other source of electrical supply.

#### Parallel operation

Parallel operation refer to the electrical connection of a generating set to another source of electrical supply with the same voltage, frequency and phase to the share the power supply for the connected network. The characteristics of the main supply, including range and variation of voltage, frequency, impedance of the network, etc., shall be stated by the customer.

#### Parallel operation by generating set

In this type of operation, two or more generating sets are electrically connected (not mechanically connected) after having being brought into synchronism. Generating sets with different outputs and speed can be used.

#### Operation in parallel with mains

In this type of operation, one or more parallel-operating generating sets (as described .in 6.3.2.1) are electricity connected to a mains supply

#### NOTES

In the case of public mains, permission for parallel operation has to be obtained from the public electricity board. Protective equipment has to be harmonized.

This also applies to generating sets which, in order to check the start-up, have to run supplying power into the mains for a time period laid down by the generating set manufacturer.

#### MODES OF START-UP AND CONTROL

The modes of start-up and control involved in the operation of a generating set are normally

- starting,
- monitoring,
- voltage and frequency adjusting and synchronization where applicable,
- switching, and
- stopping.

These can be fully or party manual or automatic (see also ISO 8528-4).

#### Manual operation

Manual operation covers generating sets which are started and controlled manually.

#### Semi-automatic operation

Semi-automatic operation covers generating sets in which some of the functions are started and controlled manually and the remainder automatically.

#### Automatic operation

Automatic operation covers generating sets which are started and controlled automatically.

#### START-UP TIME

The start-up time is the time from the moment when power is first required to the moment when it is first available. It shall meet the demands of the particular application.

#### Generating set with no specified start-up time

This is a generating set where, due to the conditions under which it operates, the start-up time is of no importance. Such generating sets are normally started manually.

#### Generating set with specified start-up time

This is a generating set where the start-up time is specified; starting is normally automatic. Such generating sets may be further classified (see 6.5.2.1 to 6.5.2.3).

#### Long-break set

This is a generating set with a specified start-up time (defined in seconds.) The time a power supply failure and power from the generating set being available is fairly long. In this case the entire set is started from the stationary condition after power is demanded.

#### Short-break set

This is a generating set with running electrical machines where the power supply is interrupted while the necessary switchgear change –over takes place, for a time defined in milliseconds. A source of stored

#### No-break set

This is a generating set with continuous rating electrical machines that ensure an uninterrupted supply of power in the event of mains failure. A source of stored mechanical energy is unable to supply power to the connected equipment for a short period and, where necessary to start and accelerate the RIC engine. As the drive is transferred from one power source to another there may be temporary deviation in frequency.

## 7 PERFORMANCE CLASSES

Four performance classes are specified to the various requirements of the supplied electrical systems see 7.1 to 7.4.

#### performance class G1

This is required for application where the connected loads are such that only basic parameters of voltage and frequency need to be specified.

#### EXAMPLES

General-purpose applications (lighting and other simple electrical loads).

#### Performance class G2

This is required for the application where the demands on voltage characteristics are very much the same as for the commercial power system. When load changes occur, there may be temporary but acceptable deviations of voltage and frequency.

#### EXAMPLES

Lighting systems, pumps, fans and hoists.

A.E. (C) / J.E(C)

Correction.....  
Deletion.....  
Insertion.....

### Performance class G3

This is required for the applications where the connected equipment may make servers demands on frequency. Voltage and waveform characteristics.

### EXAMPLES

Telecommunications and thyristor-controlled loads. It should be especially recognized that both rectifier and thyristor-controlled loads may need special consideration with respect to their effect on generator-voltage waveform.

### Performance class G4

This is required for application where the demands made on the frequency. Voltage and waveform characteristics are exceptionally severe.

### INSTALLATION FEATURE

Requirements to meet local regulation may affect the design of the generating set. They shall be taken into account by the customer and manufacturer in addition to the installation features given in 8.1 to 8.5

### Installation configurations

The installation configuration in 8.1.1 to 8.1.3 may or may not have all necessary auxiliary equipment integrally mounted.

### Fixed

This configuration includes all generating sets which are permanently installed.

### Transportable

This configuration includes all generating sets not permanently installed or mobile.

### Mobile

This configuration includes all generating sets having an integral chassis fitted with wheels whereby the generating set is mobile.

### GENERATING SET CONFIGURATIONS

In order to simplify contractual information for various RIC engine-driven generating set applications, some typical set configurations are given below:

- A: without baseframe;
- B: with baseframe;
- C: with baseframe, integrally mounted Controlgear, switchgear and auxiliaries;
- D: configuration as given in C with enclosure (see also clause 9);
- E: configuration as given in C having an integral set of wheels or mounted on a trailer (see also 8.1.3)

### TYPES OF MOUNTING

The type of mounting (see 8.3.1 to 8.3.3) should be agreed between the customer and the generating set manufacturer.

### Riding mounting

A.E. (C)/ J.E(C)

Correction.....  
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Insertion.....

This is mounting the generating set without the use of resilient mountings, If foundations for mounting generating sets are set up on substrates of low elasticity, for example, cork tiles, with no resilient layers, inserted, the method of mounting is considered to be rigid.

#### Resilient mounting

This is mounting the generating set with the use of resilient mountings. For special applications (e.g. marine or mobile), restrained resilient mountings may be required.

#### Fully resilient mounting

Fully resilient mounting is mounting the RIC engine and the generator resiliently on a baseframe or a foundation with components to provide insulation against vibration.

Semi-resilient mounting the mounting the RIC engine resiliently with the use of components to provide insulation against vibration and mounting the generation rigidly on a baseframe or a foundation.

#### Mounting on resilient foundation

This is mounting the generating set on a resilient foundation (damping mass) which is isolated from the load-bearing foundation by, for example, anti-vibration mounts.

### CONNECTION BETWEEN ENGINE AND GENERATOR

#### Coupling arrangements

Typical coupling arrangements are ridge, torsionally ridge, flexible, torsionally flexible or clutch coupling.

#### Assembly arrangements

The assembly between the RIC engine and the generator may be with or without flange housing.

### ADDITIONAL INSTALLATION FEUTURES-WEATHER EFFECTS

#### Inside Installation

This is installation of the generating set in place where it is not exposed to the direct effects of weather. Consideration shall be given to maximum and minimum room temperatures.

#### Outside Installation with Protection from weather

This may be subdivided into

- installation in a protective enclosure
- installation under a protective roof.

#### Open-air Installation

This is installation in the open, fully exposed to the weather

### EMISSIONS

When a generating set operators, it produces emissions including noise, vibration, heat, waste gases and electromagnetic disturbances. Any applicable legislation relating to the protection of the environment and to the health and safety of personal shall be taken into account by the manufacturer and customer at the time of agreeing a performance specification

### STANDARD REFERENCE CONDITIONS

In determining the rates power of the generating set, it should be noted that different standard reference conditions apply to the engine, a.c. generator and switchgear.

For conditions on site, see clause 11

For the rated power of the RIC engine, the following standard reference conditions apply in accordance with ISO 3046-1:

- total barometric pressure,  $P_r$ : 100 kPa (1 00 mbar)
- air temperature,  $T_r$ : 298 K (25 °C)
- relative humidity,  $\phi_r$ : 30%
- charge air coolant temperature,  $T_{er}$ : 298 K (25 °C)

For the rated power of the a.c. generator, the following reference conditions apply in accordance with IEC 34-1 and ISO 8528-3:

- coolant temperature at cooler inlet: below 298 K (25 °C)
- altitude: up to 1 000 m above sea level.

For the rating of Controlgear and switchgear equipments, the following standard reference conditions apply in accordance with IEC 298 IEC 439-1 and IEC 439-2:

- ambient temperature, temporary maximum 313 K (40 °C)
- relative humidity: 50% at 313 (40 °C)
- altitude: up to 2000 m above sea level

## SITE CONDITIONS

The site conditions under which a generating set is required to operate may affect certain characteristics of the set; they shall be taken into account by the customer and manufacturer.

These conditions shall be clearly defined by the customer and any particular hazardous conditions, such as explosive atmospheres or flammable gases, shall be described. Such characteristics may include but are not limited to those indicated in 11.1 to 11.9.

NOTE 5: In cases where the site conditions are unknown, and if not otherwise specified the following nominal site conditions should be used:

- total barometric pressure: 89,9 kPa (for altitude above sea level 1000 m)
- ambient temperature :313 K(40 °C)
- relative humidity:60%

### Ambient temperature

The customer shall inform the manufacturer of the upper and the lower ambient temperature limits at which the generating set will operate.

### Altitude

The customer shall inform the manufacturer of the altitude above sea level at which the generating set will operate. However, it is preferable to have exact values of the barometric pressure on site.

### Humidity

The customer shall inform the manufacturer of the humidity values related to the temperature and pressure on site (see 11.1 and 11.2)

### Sand and dust

The customer shall inform the manufacturer if a generating set is required to operate in a sandy, dusty or other physically polluted atmosphere, as special requirements may be necessary in order to obtain

satisfactory performance and operation. Any increased maintenance these conditions should be noted by the customer.

#### Marine environment

Special consideration is necessary when generating sets are required to operate in a marine environment. This may also apply to generating sets on land but operated at a coastal site. The environment shall be clearly stated by the customer.

#### Shock and Imposed vibration

If the generating set is required to operate under conditions where shock and/or vibration may occur (for example, earthquake on the land and externally imposed vibration from adjacent reciprocating machinery on the other), this shall be clearly stated by the customer.

#### Chemical pollution

If the generating set is required to operate under conditions where chemical pollution exists, the nature and extent of this shall clearly stated by the customer.

#### Radiation

Various kinds of radiation may affect some of the components of the generating set, and such components may need special protection and/or a special maintenance programme. Any such condition of operating shall be specified by the customer.

#### Cooling water/liquid

If the generating set has water/liquid cooled heat exchangers, the customer shall state the minimum and maximum temperature (and, where necessary, the chemical composition and quantity) of the secondary (external) transferred liquid.

### POWER ADJUSTMENT FOR AMBIENT CONDITIONS

To determine the appropriate generating set ratings, the customer shall specify the operating condition prevailing at the site.

Site barometric pressure (highest and lowest readings available or, if no pressure data are available, the altitude above sea level);

the monthly mean, minimum and maximum air temperature during the hottest and coldest month of the year.

The highest and lowest ambient air temperature around the engine.

the relative humidity (or alternatively the water vapour pressure or the wet and dry bulb temperature) ruling at the maximum temperature conditions;

the maximum and minimum temperature of the cooling water available.

When the operating conditions differ from the standard reference conditions given in clause 10, any necessary adjustment to the RIC engine, a.c. generator or switchgear rating shall be made in order to determine the rated power of the generating set.

For generating sets to be installed on board ships intended for unrestricted service, according to the International Association of classification Societies (IACS), the rated power shall be based on the nominal ambient conditions as specified in ISO 3046-1:1986, 7.4.2.

## 7 WATER RATING DEFINITIONS

### 7.1 General

A.E. (C)/ J.E(C)

Correction.....  
Deletion.....  
Insertion.....

The power of the generating set is the power output available at the generating set terminals excluding the electrical power absorbed by the essential independent auxiliaries. (See also ISO 8528-2:1993, 5.1 and ISO 8528-3:1993, clause 5.)

#### Power ratings

Power ratings of generating sets shall be expressed in kilowatts at rated frequency and a power factor (cos  $\phi$ ) of 0.8 lagging unless otherwise stated.

The power rating classification is necessary set manufacturer's declaration concerning the power which the generating set will deliver under the stated operating conditions.

#### Kinds of power output

The generating set manufacturer shall be responsible for determining the power output according to 13.3.1 to 13.3.3 (see figures 1 to 3) in accordance with the service and maintenance schedule specified by the engine, a.c. generator and Controlgear and switchgear manufacturers.

#### Continuous power (COP)

Continuous power is that which a generating set is capable of delivering continuously for an unlimited number of hours per year between the stated maintenance intervals and under stated ambient conditions, the maintenance being carried out as prescribed by the manufacturers. (See figure 1.)

#### Prime power (PRP)

Prime power is the maximum power available during a variable power sequence, which may be run for an unlimited number of hours per year, between stated maintenance intervals and under the stated ambient conditions, the maintenance being carried out as prescribed by the manufacturers.

The permissible average power output (Ppp) (see figure 2) during a 24 h period shall not exceed some percentage of the prime power to be stated by the RIC engine manufacturer. When determining the actual average power output Pp' powers of less than 30% of the prime power shall be taken as 30% and time at standstill shall not be counted.

The actual average power, Ppa is calculated as follows:

#### NOTES:

The customer should be made aware that if any of these conditions are not fulfilled the RIC engine life will be reduced.

Time periods at standstill do not enter into the formula.

The period of running at prime power is expected to be long enough to enable the generator to reach thermally stable conditions. Limited-time running power (LTP)

The limited-time running power is the maximum power which a generating set is capable of delivering for up to 500 h per year of which a maximum of 300 h is continuous running. Between stated maintenance intervals and under the stated ambient conditions, the maintenance being carried out as prescribed by the RIC engine manufacturers. It is accepted that operation at this rating will affect the life of the set. (See figure 3.)

#### NOTES:

The period of running at limited-time running power is expected to be long enough to enable the generator to reach thermally stable conditions.

The customer should be made aware that If any of these conditions are not fulfilled the RIC engine life will be reduced.

## OPERATING PERFORMANCE

### Starting temperature

A.E. (C) J.E(C)

Correction.....  
Deletion.....  
Insertion.....



The RIC engine manufacturer shall state the minimum temperature at which the generating set will start with the starting system and start aids provided.

#### Load acceptance

When load is suddenly applied to a generating set will be a transient deviation in voltage and frequency. The magnitude of these deviations will depend both on the magnitude of the active power (in kilowatts) and reactive power (in kilovars) changes, relative to the total available capacity and to the dynamic characteristics of the generating sets (See also ISO 8528-2 and ISO 8582-5.)

If load acceptance capability is an important requirement, then it shall be clearly stated by the customer.

#### Cyclic Irregularity

The cyclic irregularity imposed on the generator by the RIC engine combustion process may cause modulation of the voltage. (See ISO 8528-3.)

#### Generator temperature rise

The temperature rise of the generator windings of a generating set may be an important factor limiting the long-term reliability of generating set.

An increase in allowance temperature rise may be possible if the generating set is to be used on a limited time basis.

#### Fuel and lubricating oil consumption

The manufacturer shall state the consumption of fuel and lubricating oil, if verification of fuel consumption is required, the method of measurement shall be agreed between the customer and manufacturer, as outline in ISO 3046-1.

Statement of fuel consumption shall be made with reference to the electrical power available at the terminals, taking into account the electrical power required for the essential independent auxiliaries (see ISO 3046-1) and the power loss in the a.c. generator for a given power and power factor. The lower calorific value of the fuel shall be stated.

#### Minimum running hours

The capacity of fuel and lubricating oil tanks may impose a limit on the generating set running hours. The manufacturer shall state the minimum running hours together with power delivered of the generating set without replenishment, if such tanks are provided.

### Regulation

#### Frequency regulation

The steady-state and transient frequency regulation may be an important requirement when specifying the permanence of a generating set. If this is the case, then it shall be clearly stated by the customer.

#### Voltage regulation

It is necessary to consider both steady-state and transient voltage regulation when specifying a generating set. It must also be noted that the nature of the load current waveforms imposed on the generating set may affect the voltage waveform and the steady-state voltage accuracy. If voltage regulation is an important requirement, then it shall be clearly stated by the customer.

<b>LIST OF APPROVED MAKE FOR E&amp;M WORKS</b>		
S.No.	Description	Makes
1	MS conduit ( ISI Marked)	BEC/Steel Kraft/AKG/NIC
2	MS Conduit accessories (ISI marked)	RAMA/Sharma Sales Corporation / AKG / BEC/NIC
3	Modular Plate ,Modular Switch/ Sockets, TV Socket outlet, Telephone socket outlet, Lan socket outlet, GI Boxes, Fan Regulator, Industrial Socket Outlet(ISI marked)	Legrand(Myrus)/MK (Wrapround) /Schneider (Zendelo)/Northwest (Stylus)/ Crabtree (Athena)/Simon
4	1.1 KV Grade PVC insulated FRLS single core cable/wire ( ISI Marked)	RRKabel/Polycab/Finolex/Skyda/BCH/ L&T/Batra Henlay
5	PVC conduit with accessories(ISI marked)	Precision/AKG/BEC/Batra Henlay
6	TV cable/Telephone cable	Finolex/Polycab /RR Kabel /Havells/ Skyda/BCH/L&T/Delton/Skyton/Plaza/ Beldon
7	Telephone Tag Blocks	Krone Type (German)/Pouyet/D-Link
8	Moulded Case Circuit Breaker (MCCB)	Siemens (3VA)/ Legrand (DPX3)/ Schneider (Compact NSX)/ L&T (D-Sine)
9	MCB / Distribution Boards / Isolator / ELCB /RCCB	Hager / Legrand / Schneider / ABB / L&T
10	Lighting Conductor/Protection & Earthing System	Dehn/APS/Tercel/South Asian/JMV/ABB /Nimbus
11	Cable Tray (Factory Fabricated)	Indiana/Venus/Slotco/Pilco/Recco/Legrand/OBO/ KME
12	Floor Race Ways System	Legrand /OBO/MK /Schneider Electric/Indian
13	UPS system	APC/Emerson/ Numeric/Socomec/Delta
14	LED Light Fixture	Wipro /Osram /Philips /Havells/Panasonic/polycab
15	LED makes in LED fittings	Nishia/Cree/Philips Ltd./Osram/Panasonic
16	LED Solar Street Light	Phillips/Wipro/Havells/Bajaj/Panasonic
17	Ceiling Fan/Wall Fans/Exhaust Fans/ Pedestal Fans	Almonard/ Alstom/Crompton/Usha/Bajaj
18	External Lighting / Lighting Fixtures	Wipro/Osram/Philips/Havells/Crompton/ Panasonic
19	External lighting Pole	Bajaj/Volmount/BPP/Schneider/Caslec/ Philips/GE
20	High Mast Pole	Phillips / Bajaj / BPP /Crompton /Volmount
21	Occupancy Sensor	Phillips /Wipro/GE/Finder
22	RJ-45 Modular Socket with Plate	AMP/ Schneider/ Siemon / Systimax
23	Ploycarbonate Junction Box	Sintex/MK/Legrand/Hensel/Neptune
24	H.T. Panel	ABB/Alstom/Schneider/Siemens/Crompton greaves/Kirloskar
25	Transformer	ABB/Schneider/Crompton/Kirloskar/ Siemens/Alstom (Areva)

A.E. (C)/ J.E(C)

Correction.....  
 Deletion.....  
 Insertion.....

26	Diesel Engine	Cummins/Perkins/ Caterpillar/KOEL/Volvo Penta/Sudhir
27	Alternator	KOEL/Stamford/Leroy Somer/Kohler/ Perkins/Sterling & Wilson/Sudhir
28	Anti-vibration mountings	Dunlop/Resistoflex/Easy Flex/Kanwar
29	SMF Lead Acid Battery	Exide /Okaya /Amron /Amco /Cummins
30	Exhaust MS Pipes	Jindal (Hissar) / TATA / Hindustan
31	Steel Structure	Sail / Tisco/Jindal/ISTM
32	Ball Valve (Fuel)	Audco / Leader / Sant
33	Insulation Mats /Rubber Mats	Jyoti/Maruti/Agni/Howeil/Fire hut
34	GI Pipe	TATA Steel/Jindal (Hissar)/Sail
35	Bus Duct/Rising Main / Tap off Box	Legrand/Schneider/L&T/C&S
36	MV Panel / LT Panel/Feeder Pillar	Adlec/Advance Panels/ Neptune/ Tricolite/C&S/ SPC(Electrotech)/Risha Power Control
37	Rubber Gaskets	CIC/Varuna/Jyoti/Agni
38	Selector Switch's	L&T / Kaycee /AE/Salzer /Siemens
39	ACB's	L&T (Upower)/Siemens (3 WL)/ Schneider (Masterpact-NW)/ Legrand (DMX3)/ ABB (EMAX)
40	VCB's	Siemens / L&T /Schneider /ABB /Crompton
41	LED Indication Lamps/Push button	Schneider Electric/Vaishno Electricals/ Siemens /L&T/Conserve/C&S
42	APFC/Capacitor Panel	Neptune/Schneider/ABB/L&T/Siemens/ Epcos/Ducatti/BCH electric
43	Capacitors	Epcos/L&T/BCH/Neptune
44	CT's /PT's	Automatic Electric/Pragati/Kappa/ L&T/ Neptune
45	Electronic Digital Meters (A/V/PF/Hz/KW/KWH) with LED Display	Schneider Electric/Neptune/L&T/Conserv/ Secure/Ducati/Socomec
46	Automatic Transfer Switch	ASCO/Cummins/L&T/ABB/Socomec
47	SPD (Surge Protector)	Mersen/Eaton/Weidmuller/LPI/ERICO/ Nimbus/ Indelac/ABB
48	Earth Leakage Protection relay /Aux. Relay /APFC Relay/PLC	L&T /Schneider /Legrand /C&S /Neptune/ Siemens
49	Digital Astro Timer	Legrand/L&T/C&S/ABB/Havells
50	Power Contactor / Aux. Contactor (Model to be compelled with System)	L&T/Siemens/Legrand/Schneider/C&S
51	Single Phase Preventer	Minilec/Siemens /Legrand / L&T
52	XLPE Aluminium/copper Conductor Armoured LT cables upto 1100 V Grade ( ISI Marked)	Havells/Polycab/Batra Hanley/Grandley/ Finolex
53	AL. Conductor XLPE HT Cable ( ISI Marked)	Polycab/Havells/National/Finolex/Universal

54	End Termination/ Brass compression gland	Dowell's/Comet/Raychem/Gripwell/Jainson /ABB
55	DWC HDPE Pipe ( ISI Marked)	Rex/ Duraline/Tirupati/GF
56	Jointing Kit /Cable Gland /Lugs /Thimbles /Compression Glands (HT/LT )	Comet /Dowells/Raychem /Gripwell / ABB / Jainson/Denson
57	Water Pumps /Fire Pump/Dewatering Pump/Sewerage Pump / Drainage Pump	Kirloskar/Harrison/Mather & Platt / Grundfoss/Willo / DP Holand/Arm Strong
58	Electrical Motors	Siemens/Kirloskar/NGEF/ABB
59	'C' Class Heavy Duty M.S. Pipe	TATA /Jindal (Hissar) /SAIL
60	Starters	L&T/SiemENS/Schneider
61	Pressure switch	Indfoss/Switzer/System sensor/Plotter
62	Single headed Hydrant( Internal /External) /Fire Brigade inlet/Short branch pipe /shut off nozzle/Suction Collecting Head	Superex/Padmini/Newage/Safefire/Life Guard/Safex/Getech/Omex/Minimex/Suprex
63	Rubber pipe for hose reel	Superex/Maruti/Newage/Safefire/Life Guard/ Suprex/Padmini
64	RRL Hose( ISI Marked) / First Aid Hose Reel/ Hose drum / Hose Cabinet	Superex /Newage /Padmini /Safefire / Life Guard
65	Anti Vibration Mounting/Vibration Eliminator Connectors/ Metallic Expansion Bellows	Resisto Flex/ Easy Flex/ D.Wren/Dunlop/Kanwal
66	Flow Switch	System Sensor/ Plotter/ Johnson Control/Honeywell /Rapid Cool
67	Air Vessel	Padmini/ LG/ Chawla Fire/ Getech/Newage
68	Sluice Valve/Butterfly Valve/Non Return Valves/Check Valve/ Ball Valve/Y Strainer/Air Release Valves/Landing Valve/Orifice Plate	DRP/Cim/AIP/C&R/Emerald/ Advance/Valtree/Kirloskar
69	Sprinklers (UL Listed)	Tyco/HD/G Tech
70	Fire Extinguisher	Life Guard /Ceasefire /Minimax /Safex / Newage/Safe Fire
71	Fire Extinguishing System / Suppression System	Life Guard/Minimax /Safex /Cease fire / Newage /Getech/Supremax/ Foamtech/SVS
72	Synthetic Enamel Paints /Primer	Asian/Berger/Nerolac/ICI
73	Pressure Gauge	Danfoss/ H-Guru/ Fiebig/ Emerald
74	Sprinkler flexible connection pipe	Newage/Youngjin/Flexhead
75	Pipe coat material (Pipe Protection)	Pypkote/ Coalteck/IWL
76	Addressable Fire Alarm / Smoke Detection system and all its components ( UL Listed )	Notifier/ Bosch/Edwards /Siemens

77	Fire Survival Armored Cable	Bonton/Rallison/Ramcro/India-impex/ No burn/Finolex/Tyco/Belden
78	Heat Detector /Response Indicator /Manual Call Point /Fault Isolator /Monitor Module /Hooter /Probe/Monitor Module /Beam Detector/Speaker/Fire Fighter Jack and all other components	Notifier /Bosch /Edwards /Siemens
79	Operator work station (Computer)	Compaq/HP/IBM/Lenovo
80	Laser jet printer	Epson/HP/Canon
81	Software (For fire alarm)	Notifier /Edwards /Bosch /Siemens
82	Desktop PC	HP/Panasonic/Dell/Lenovo
83	Copper/Aluminium conductor control cable	Finolex/Bonton /Polycab /RR Kabel / Batra Hanley /Paramount
84	Communication cable / signal cable	Ramcro/Fusion/Polymer/Beldon/ Cramer/ Batra Hanley
85	Structured cabling and components	Schneider/Siemens/Systemax/Legrand
86	DigitalVoice Equacuation System	Notifier/Bosch/Honeywell/Edwards/ Siemens
87	Wire support	Gripple/Zipclip/Dobygrip
88	Vibration isolator / Rubbed pad/Duct support Arrangement	Dunlop / Resistoflex /Emerald
89	Demand Ventilation Equipment	Conaire / Greenheck/Elt/HK Instruments
90	CO2 Sensor	Danfoss / Honeywell / Siemens
91	Modulating Motor/Valve	Danfoss / Honeywell / Siemens / Oventrop
92	Volume Control Damper, Fresh/ Exhaust air louver	Conaire / Pineair / Caryaire / Dynacraft /System Air
93	Grille / Diffuser / Jet Nozzle	Conaire/ Pineair/ Caryaire /Dynacraft /System Air/ Dynamic /Air Master /Eiena/Trox
94	Fire Damper	Conaire/Pineair/Caryaire/Dynacraft/System Air/Ruskin/Trox /Dynamic /Mapro /Air Master/Eiena
95	Actuator for fire damper	Siemens/ Honeywell / Danfoss
96	Nitrile Rubber Insulation	Armacell / Eurobatex / Vidoflex
97	Acoustic Insulation for Duct	UP Twiga / Owns Conning/K-flex
98	EPS	Beardcell / Styrene Packaging / P.R. Packaging
99	Fastner	Hilti / Wurth / Fisher/Mupro
100	Motor for AHU Fan	Siemens / ABB / Crompton
101	Motor for Ventilation Fan	Siemens / ABB / Crompton
102	Hot water Generator	KEPL/Rapidcool/Emerald

103	Kitchen Scrubber	Edgetech/Rydair/Trion/Espire/Zeco Aircon
104	Air Washer (Pad Type)	Ambcool / Edgetech /Roots Cooling/ System Air
105	UVGI System	Ruks/Trimed/Unicon
106	Aluminium Sheet	Hindalco/ Balco/Jindal
107	Pan Humidifier	KEPL/Rapidcool/Emerald/Danfoss
108	Humidistat/Airstat	Honey well/Danfoss/Johnson/Siemens
109	VRV/VRF system (Indoor/Outdoor)	Daikin/Mitsubishi Electric/Toshiba/ O' General
110	Copper Pipe and Fittings	Rajco / Mandev /Shree Shyam / Mex flow /Jindal
111	Y Joints and fittings	Daikin/Mitsubishi Electric/Toshiba/ O' General
112	Nitrile rubber Insulation	Armacell/ ALP/K-Flex/Aeroflex
113	Drain Pipe /uPVC Pipe	Astral / Supreme / Polypack/Finolex
114	Active Induction Beam	New Climate / Trox / Halton / Swegon
115	Pressure Gauges	H Guru/Fiebig/Emerald/Danfoss
116	Split AC	Daikin/Mitsubishi Electric/Toshiba/ O' General
117	Water Cooler with RO and UV System	Eureka Forbs /Blue Star /Voltas /Ion Exchange/Usha
118	Multigrade sand filter & activated carbon filter/ Water Softener	Aventura/ Pentair/Aqua
119	Variable Frequency Drives	Siemens / Danfoss /ABB/Fuji/Mitsubishi
120	Hydrochloride Dosing System	Pentair/ LMI/Astral
121	Dosing Pumps	LMI / Toschon / Pulser Feeder/Astral / Pentair
122	Coal Tar Treatment for pipes	Pypkote/Coaltek/IWL
123	Welding Rods	Advani/L&T/Superon Schweissttechnik India Ltd.
124	Mechanical Seal	Durametallic/Burgmann/Mseal/Avonsels
125	Fibre Glass	UP Twiga/Owen corning/Kimmco
126	Boom Barrier	Toshi Automatic System /Gandhi Automation Pvt. Ltd./GUNNEBO (E-GSES), Magnetic Auto Control (ACCESS-PRO-L), Automatic Systems (BL-52).
127	Stage Curtain ( Front / Rear / Middle )	Canara /New Age /Leksa
128	Cloth Wings	Deftech /Martin /Naapl
129	LED Parcan Light/Blinder Light /LED PAR/LED Profile Light /LED Moving Head Spot/Splitter/Light Control Panel (Stage	Deftech /Martin /Naapl

A.E. (C)/ J.E(C)

Correction.....  
Deletion.....  
Insertion.....

	lighting equipment)	
130	GI Pipe Fitting	DRP-M/Unik/Zoloto
131	MS forged Pipe Fitting	DRP/VS/Trueforge
132	Fire Sealent	Birla 3M/Hilti
133	Audio Solution System	Accoustic/D&B Audiotechnik/QSC/Music Tribe
134	Desktop hidden connection, HDMI Receiver	Kramer/Extron/Lightwear
135	Ceiling Visualizer	Veddio/Lumens/Sony
136	Intractive Display	Wacom/DTH/Sharp

In case any of makes for any of the material is missed out in the above list for using at site then the contractor shall inform the Engineer-in-charge about the same and obtain the approval. Thereafter, he can proceed with the supply of the material.

Executive Engineer

# **PART-C**

## **Schedule of Quantity for**

### **Horticulture Works**



### Schedule of Quantity

S. NO.	Descriptions	Qty	Unit	Rate (Rs.)	Amount (Rs.)
1	Trenching in ordinary soil up to a depth of 60 cm including removal and stacking of serviceable materials and then disposing of surplus soil, by spreading and neatly leveling within a lead of 50 m and making up the trenched area to proper levels by filling with earth or earth mixed with sludge or / and manure before and after flooding trench with water (excluding cost of imported earth, sludge or manure).	1050.00	cum	45.85	48142.50
2	Supplying and stacking of good earth at site including royalty and carriage upto 5 km complete (earth measured in stacks will be reduced by 20% for payment).	1050.00	Cum	332.55	349177.50
3	Supplying and stacking at site dump manure from approved source, including carriage upto 5 km complete (manure measured in stacks will be reduced by 8% for payment) : Screened through sieve of I.S. designation 4.75 mm	1020.00	cum	209.15	213333.00
4	Rough dressing the trenched ground including breaking clods.	10050.00	sqm	0.90	9045.00
5	Uprooting weeds from the trenched area after 10 to 15 days of its flooding with water including disposal of uprooted vegetation				
	<b>Total</b>	<b>35000.00</b>	sqm	2.90	101500.00
6	Mixing earth and sludge or manure in the required proportion specified or directed by the Officer-in-charge	2000.00	Cum	21.35	42700.00
7	Grassing with selection No. 1 grass including watering and maintenance of the lawn for 60 days or more till the grass forms a thick lawn, free from weeds and fit for mowing including supplying good earth, if needed (the grass and earth shall be paid for separately). In rows 5 cm apart in both directions	5000.00	Sqm	10.40	52000.00
8	Renovating lawns including weeding, cheeling the grass, forking the ground, top dressing with sludge or manure, mixing the same with forked soil, watering and maintaining the lawn for 60 days or more till the grass forms a thick lawn free from weeds and fit for mowing and disposal of rubbish as directed, including supplying good earth if needed but excluding the cost of sludge or manure (The manure/sludge shall be paid for separately).	20000.00	Sqm	20.15	403000.00

A.E. (C)/ J.E(C)

Correction.....  
 Deletion.....  
 Insertion.....

9	Uprooting rank vegetation and weeds by digging the area to a depth of 60 cm, removing all weeds and other growth with roots by forking repeatedly, breaking clods, rough dressing, flooding with water, uprooting fresh growths after 10 to 15 days and then fine dressing for planting new grass, including disposal of all rubbish with all leads and lifts.	<b>10000.00</b>	Sqm	35.75	357500.00
10	Preparation of beds for hedging and shrubbery by excavating 60 cm deep and trenching the excavated base to a further depth of 30 cm, refilling the excavated earth after breaking clods and mixing with sludge or manure in the ratio of 8:1 (8 parts of stacked volume of earth after reduction by 20% : one part of stacked volume of sludge or manure after reduction by 8%), flooding with water, filling with earth if necessary, watering and finally fine dressing, leveling etc. including stacking and disposal of materials declared unserviceable and surplus earth by spreading and leveling as directed, within a lead of 50 m, lift up to 1.5 m complete (cost of sludge, manure or extra earth to be paid for separately)	<b>785.00</b>	cum	130.35	102324.75
11	Digging holes in ordinary soil and refilling the same with the excavated earth mixed with manure or sludge in the ratio of 2:1 by volume (2 parts of stacked volume of earth after reduction by 20% : 1 part of stacked volume of manure after reduction by 8%) flooding with water, dressing including removal of rubbish and surplus earth, if any, with all leads and lifts (cost of manure, sludge or extra good earth if needed to be paid for separately) :				
	Holes 1.2 m dia and 1.2 m deep	<b>68.00</b>	each	236.75	16099.00
	Holes 90 cm dia, and 90 cm deep	<b>105.00</b>	each	101.40	10647.00
	Holes 60 cm dia, and 60 cm deep	<b>500.00</b>	each	31.15	15575.00
	Holes 45 cm dia, and 45 cm deep.	<b>500.00</b>	each	13.40	6700.00

12	Providing and fixing M.S. flat iron tree guard 60 cm dia and 2 m high, above ground consisting 4 nos 25 x 6 mm, 2.25 m long and 8 nos 25 x 3 mm 2 m long verticals M.S. flats, riveted to 3 nos 25 x 6 mm M.S. flat iron rings in two halves, fixing together at site with required six numbers of 8 mm dia and 30 mm long bolts, including painting two coats with synthetic enamel paint of approved brand and manufacture over a coat of primer. One name plate of 1 mm thick M.S. sheet of size 250x100 mm shall be welded to the tree guard near the middle height and lettered DTU or any other approved name. The tree guard shall be suitably fixed to the ground by embedding four legs of tree guard in pits of suitable dia and to a depth of 25 cm, refilling the pits with soil and ramming, complete in all respect as per satisfaction and direction of Officer-in-charge.	<b>650.00</b>	each	3036.15	1973497.50
13	Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:4:8 (1 Cement : 4 coarse sand : 8 graded stone aggregate 40 mm nominal size)	<b>85.00</b>	Cum	4478.15	380642.75
14	Filling mixture of earth and sludge or manure in the desired proportion in trenches, flooding with water and leveling (cost of supplying earth and sludge or manure and mixing excluded).	<b>2000.00</b>	Cum	10.70	21400.00
15	Providing and laying Neelgiri/Mexican grass turf with earth 50mm to 60mm thickness of existing ground prepared with proper level and ramming with tools wooden (Dhurmos) and than rolling the surface with light roller make the surface smoothen and light watering with sprinkler and maintenance for 30 days or more till the grass establish properly, as per direction of officer-in-charge	<b>485.00</b>	Sqm	203.90	98891.50
16	Providing & laying Selection no. 1 grass turf with earth 50mm to 60mm thickness on existing ground prepared with proper level and ramming with required tools wooden and than rolling the surface with light roller make the surface smoothen and light watering the same, as per direction of officer in charge	<b>4580.00</b>	Sqm	77.00	352660.00
17	Supplying & Stacking of Selection No.1 Grass at site fresh & free from weeds having proper roots in green including loading, unloading, carriage and all taxes paid etc.and as per direction of officer in charge.	<b>2560.00</b>	Sqm	50.80	130048.00

18	Cutting of Hedge/Edge including removing of cut material, cleaning, hoeing of hedge/edge bed watering, manureing and applying insecticides and fungicides etc.(excluding the cost of material which shall be supplied by Per Sqm the department) and as per direction of officer in charge.		per sqm per month		
		<b>35000.00</b>		11.00	385000.00
19	Weeding out of lawn by removal of all weeds and other wild growth with roots by forking including disposal of garden rubbish with all loads and lifts complete if top dressing required paid separately (cost of manure, sludge or extra good earth to be paid for separately) as per direction and satisfaction of officer in charge. Where weeds upto 50%	<b>25650.00</b>	Sqm	14.20	364230.00
20	Anti termite treatment by digging pits 30 cm deep and 4 cm dia, 6 to 7 holes around the tree using chemical emulsion at the rate of 1.5 liter per hole in two time or more application to get the trees free from termite infection chemicals used Chlorpyriphos 20% EC in the ratio of 1% concentration and as per direction of officer-in-charge.		each tree		
		<b>10650.00</b>		47.60	506940.00
21	Providing and applying anti termite treatment of infected trees i/c all branches/leaves by spraying chemical emulsion 0.5% (Chlorpyriphos 20% EC) concentration through power spray machine (@ 100 ml Chlorpyriphos per tree i/c cost of chemical) and as per direction of officer-in-charge.and as per direction of officer-in-charge.		each tree		
	<b>Total</b>	<b>10250.00</b>		46.60	477650.00
22	Anti termite treatment of lawn area through premise 30.50% I P. one liter premise diluted in 499 liters water and applying solution @ 1.00 litre solution per sqm lawn or bed area.(two application) i/c cost of chemical)and as per direction of officer-in-charge.and as per direction of officer-in-charge.	<b>10250.00</b>	sqm	7.05	72262.50
23	Providing and fixing Bamboo jaffery/ fencing consisting of superior quality 25 mm dia (Average) half cut bamboo placed vertically and fixed together with three numbers horizontal running members of hollock wood in scantling of section 50X25 mm, fixed with nails and G.I wire on existing support complete as per direction of Engineer-in-charge.	<b>1250.00</b>	Sqm	402.15	502687.50

24	Providing Circular Cement Concrete pots of specified size, cast with cement concrete of nominal mix 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 6 mm nominal size), reinforced with 7 Nos ( 3 nos horizontal & 4 nos vertical “ U “ shape) M.S. wires of 3.5 mm dia as per design, including required form work, finishing with cement punning on exposed surface, curing for specified period and stacking in required rows & height, all complete as per direction of Officer-in-charge.				
24.1	Top inside dia 35 cm, outer bottom dia 25 cm, total height 35 cm with wall thickness of 25.4 mm	<b>710.00</b>	each	173.55	123220.50
24.2	Top inside dia 30 cm, outer bottom dia 20 cm, total height 30 cm with wall thickness of 25.4 mm	<b>725.00</b>	each	126.30	91567.50
25	Providing and fixing of Tuflex Garden fencing Hexagonal net/or equivalent of green colour having contents ( Weight grams/sqm. 510 (+/- 8%)) in width of 60 cm. with bamboo of 90 cm. length. The bamboo should be painted with green colour paint of approved brand and manufacture (two or more coats) and fixed 30 cm. below ground level and 60 cm. above ground level at a distance of 1.50 mtrs. The net and bamboo should be binded with 2 mm. G.I. Wire at three places properly as per direction of Engineer-in-charge	<b>5530.03</b>	Sqm	187.75	1038263.13
25	Providing and fixing of vertical garden on face face including plants, framing and pots all complete as per direction of Engineer-in-charge.	<b>1029.07</b>	Sqm	1350.00	1389244.50
				<b>Total</b>	<b>9635949</b>

## **TERMS AND CONDITIONS FOR HORTICULTURE WORKS**

1. The work shall be carried out as per C.P.W.D. Specification - 1999 Vol. - I to VI with upto date correction slips and as per CPWD Yard stick, in absence of detail specification the standard horticulture practices for healthy growth of plants beautification should be followed as approved by engineer in charge.
2. The contractor shall be responsible for arrangement of all necessary tools and plants required at site of work for which nothing extra shall be paid by the department.
3. The work shall consist of maintenance of tree saplings, plants, shrubs, hedge, lawn area in central verge or other locations within right of way including weeding, hoeing, watering, trimming, manuring, pruning of unwanted branches, spraying insecticides/ pesticides/ fungicide etc. at regular intervals, replacement of dead trees and any other horticulture management including routine activities, involving control of grass, weeds, bush and trees all complete as directed by the Engineer-in-Charge to be maintained over the entire contract period.
4. Maintenance shall not limited to watering, weeding, pruning, trimming, manure, spraying pesticides but following horticulture operation should also be included-
  - (a) Cutting down all branches of the trees up to a height of 2.5 m for footpath from the ground level but in bus lane clearance upto a minimum of 5.5 m height shall be maintain all the times above the carriage for smooth passage of vehicles & the same shall be disposed of and maintained clean. Cut any other branches of trees, which may cause obstruction to minimum sight distance and vision to over head signages and their disposal as directed by the Engineer-in-Charge. Visibility of any signs, signals or any other devices erected for traffic guidance and/or information shall not be obstructed by plantation.
  - (b) Moving of grass in the central verge and both side of roads at regular interval.
  - (c) Uprooting / Cutting all unwanted vegetation, weeds and from entire Right of Way.
  - (d) Cut all branches of hedges extending over the Curb stone along the median/sidewalks/ central verge.
5. The soil testing for texture, nutrient level, water retaining capacity, PH value and other essential test for healthy growth of plants shall be conducted for every 10 km from approved laboratory and at least 25% from ICAR. Necessary recommendation for fertilizer requirement and water consumption requirement shall be made available from the laboratories.
6. Watering should be done in such any way that optimum level of moisture content for healthy growth of plants and trees is maintained, at no time moisture content should fall below the wilting point. Inadequate or excessive watering is to be avoided. During the dry season watering should be carried out at least twice a week in summer & once a week in winter or as per requirement of the tree plant, shrub, water should be sourced from STP (Sewerage Treatment Plants) in case of emergency the source other then STP and be used provided that prior approval of Engineer –in – Charge has been obtained
7. Weeding and Hoeing: The work includes maintaining areas close to the base of the trees and shrubs free from weeds within 300mm radius from the stem of the trees / 150mm radius from the stem of the plants. Weeding has to be carried out once in a month. All weeds are to be disposed off from the site with all leads and lifts.
8. Manure and Fertilizers: Cattle manure/ compost shall be well decayed (should be at least 6 months covered in dump), free from grits and any other unwanted materials. The contractor shall also provide and spread manure (cow dung manure/compost) for healthy growth the plants & trees under

A.E. (C)/ J.E(C)

Correction.....  
Deletion.....  
Insertion.....

- his maintenance. Depending upon requirement to maintained the nutrients level of the soil necessary application of chemical fertilizers (NPK) and other micro nutrients should be done.
9. Pruning and Trimming: All dead or injured twigs, water shoots, unwanted branches are to be removed. Trees, shrubs and ground cover should be pruned to maintain natural shape. The hedges and shrubs shall be given special shapes and sizes to give aesthetic appearance of the greenery at regular intervals.
  10. Pest and Disease control: All trees/plants are to be inspected once in a month to determine any disease or pest infections. Once the infection is identified adequate control measures are to be taken.
  11. The trees and shrubs having height less than 3 metre in the median and planters shall be washed by sprinkler attached with water tankers on monthly basis. The contractor shall take utmost care of the trees and shrubs so that the casualty is brought to a minimum. The dead and fallen tree should be removed immediately from the site of work for smooth traffic movement and it should be brought to the notice of Department so that further survey and auction of the same can be done
  12. The routine maintenance of trees plants, shrubs, hedge , lawn area and ground cover shall be measured in linear kilometer as per category of road length handed over to contractor (irrespective of no. of lanes, width of medians/sidewalks, density of plants/hedges and number of trees within right of way).
  13. The contractor shall make his own arrangements for obtaining electric/water connections, if required, and necessary payment will be made by contractor directly to the Department concerned.
  14. The Department shall not be responsible for any injury partial or permanent or death of any workers at site due to accident or mal functioning of the equipment or by negligence of the staff.
  15. The contractor shall be responsible for removal of garden waste from the site and disposed off at designated dumping area or any other composting yard as approved by Engineer –in-charge.
  16. The contractor shall have to arrange all required tools & plants & other stock items like Bamboo, Sutli, and Hessian cloth. Tokari etc. for the proper development & maintenance of garden feature. Repair cost of tools & plant items shall be borne by the contractor & nothing shall be paid extra on this account.
  17. The Agency should ensure adequate deployed of mali having experience of Horticulture work , In case of any deficiency the Engineer- in- Charge can issue the necessary direction to increase the staff and Agency should abide by order of Engineer –in- Charge.