



टाटा मूलभूत अनुसंधान संस्थान  
**TATA INSTITUTE OF FUNDAMENTAL RESEARCH**  
भारत सरकार के परमाणु ऊर्जा विभाग की स्वायत्त संस्था एवं समविश्वविद्यालय  
(Autonomous Institution of the Department of Atomic Energy, Government of India)  
सर्वेक्षण संख्या 36 / पी, गोपनपल्ली गांव, सेरिलिंगमपल्ली मंडल, रंगारेड्डी जिला, हैदराबाद - 500 046  
Survey No.36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District,  
Hyderabad-500046, Telangana

दूरभाष / Telephone: +91-40-20203009	दिनांक / Date: 30.08.2024
वेबसाइट / Website : <a href="http://www.tifrh.res.in">www.tifrh.res.in</a>	ईमेल / Email: <a href="mailto:krishnaae@tifrh.res.in">krishnaae@tifrh.res.in</a>

निविदा आमंत्रित करने की सूचना

**NOTICE INVITING TENDER**

(दो भाग निविदा) निम्नलिखित कार्यों के लिए:

**(TWO-PART TENDER) for the following works:**

<b>Supply, Installation, Testing and Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046.</b>	
निविदा सं. / Tender No.	TIFR/PD/ CF24-78/240656
निविदा का प्रकार / Type of Tender	दो भाग की निविदा (भाग-I: तकनीकी बोली और भाग-II: मूल्य बोली)/Two Part Tender (Part-I: Technical Bid and Part- II: Price Bid)
अनुमानित लागत / Estimated Cost	रु. Rs.1,73,23,043/-
अनुमानित लागत / Cost of EMD	रु. Rs.3,46,461/- ("मांग ड्राफ्ट "टीआईएफआर सेंटर फॉर इंटरडिसिप्लिनरी साइंसेज" हैदराबाद में देय (तकनीकी बोली भाग-I के साथ संलग्न होने के लिए) के पक्ष में तैयार किया जाना है।" / Demand Draft to be drawn in favour of "TIFR Center for Interdisciplinary Sciences", Payable at Hyderabad (To be enclosed with the Technical Bid Part – I).
बोली पूर्व बैठक और समय /Pre bidding meeting Date & Time	03.09.2024 at 11:00 Hrs
निविदा प्रस्तुत करने की अंतिम तिथि/ Last Date for Submission of Tender	12.09.2024 by 13:00 Hrs
बोली खोलने की तिथि (केवल भाग-I: तकनीकी बिड) /Date of Opening Bids(Only Part-I: Technical Bid)	12.09.2024 at 15:00 Hrs

- "यदि भाग "I" और भाग "II" बोलियों को अलग-अलग लिफाफों में सील नहीं किया जाता है तो निविदा को अस्वीकार कर दिया जाएगा।"

In case the Part "I" and Part "II" bids are not sealed in separate envelopes the tender will be rejected.



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- तकनीकी बोली में मूल्य का कोई संकेत नहीं होना चाहिए।  
The technical bid should not contain any indication of the price.
- निविदा शुल्क और ईएमडी के भुगतान के बिना प्राप्त तकनीकी बोली को सरसरी तौर पर अस्वीकार कर दिया जाएगा।  
The Technical Bid received without payment of tender fees and EMD shall be summarily rejected.
- संपर्क: श्री कृष्ण, दूरभाष: 040- 20203009 किसी भी तकनीकी या वाणिज्यिक शर्तों के लिए निविदा में उल्लिखित स्पष्टीकरण

Contacts: Mr. Krishna A.E., Engineer (E) Electrical, Tel: 040- 20203009, Email Id: krishnaae@tifrh.res.in for any technical or commercial terms clarifications mentioned in the tender.

Sealed tenders are invited for the aforesaid works from contractors having similar work experience in reputed Research Institutions, Universities, Central Government/Public Sector Undertaking, Private Laboratories, Multinational Companies, etc. Interested contractors who are satisfying prequalification criteria stipulated by TIFR-Hyderabad shall only submit their bids. For further details and any clarification on the tender, you may please contact Head-Technical Services, Survey No.36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District, Hyderabad-500046.

निविदा जमा करने की अंतिम तिथि **12.09.2024** को **13:00** बजे तक है।

**The last date for submission of the tender is 12-09-2024 by 13:00 Hrs.**

(राजशेखर आर/Rajasekhar. R)

प्रमुख - तकनीकी सेवाएं/Head-Technical Services



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Survey No.36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District,  
Hyderabad-500046, Telangana

## TENDER DOCUMENT

**Supply, Installation, Testing & Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046**

**NAME OF THE TENDERER:** .....

**Address:** .....

.....

.....

.....

**Last date of submission of the tender: On or before 12.09.2024 by 13:00 Hrs.**



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## **TECHNICAL BID**

### **PART-I**

**Supply, Installation, Testing & Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046**



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<b>Tender Notice</b>	:	<b>TIFR/PD/CF24-78/240656</b>
<b>Name of Work</b>	:	<b>Supply, Installation, Testing &amp; Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046</b>
<b>Location</b>	:	<b>Tata Institute of Fundamental Research Survey No. 36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District, Hyderabad – 500046.</b>
<b>Estimated Cost</b>	:	<b>Rs.1,73,23,043/-</b>
<b>EMD</b>	:	<b>Rs.3,46,461/- (Demand Draft to be drawn in favour of “TIFR Centre for Interdisciplinary Sciences”, Payable at Hyderabad (To be enclosed with the Technical Bid Part – I).</b>
<b>Delivery Period</b>	:	<b>180 Days (Completion Period)</b>
<b>Validity</b>	:	<b>75 (Seventy Five) days after opening of Part-I, Technical Bid</b>



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**SECTION-I**

**IMPORTANT INFORMATION**

**INTRODUCTION**

The Tata Institute of Fundamental Research is a National Centre of the Government of India, under the umbrella of the Department of Atomic Energy, as well as a deemed University awarding degrees for master's and doctoral programs. Tata Institute of Fundamental Research Centre for Interdisciplinary Sciences, Hyderabad invites bids for the following work:

**Supply, Installation, Testing & Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046**

**1. PARTICULARS**

a)	Location	TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad-500046.
b)	Pre-Bid Meeting Date & Time	<b>03.09.2024 at 11:00 Hrs</b>
c)	Closing date & time of receipt of bids	<b>12.09.2024 by 13:00 Hrs</b>
d)	Date & time of opening of Sealed Cover-I containing Technical Bid	<b>12.09.2024 at 15:00 Hrs</b>
e)	Date of opening of Sealed cover-II containing Financial Bid of eligible bidders	To be intimated to eligible bidders within 7 days from the date of tender open.

**2. GENERAL INSTRUCTIONS**

- 2.1. TIFR shall award the contract for the project through the two Bid systems.
- 2.2. The Contractor is advised to visit and examine the site of work and its surroundings and obtain any information that may be necessary, in addition to those provided in this document. The Contractor shall be deemed to have fully acquainted himself about the site condition, whether he inspects it or not.
- 2.3. The Contractor should adhere to the building bye-laws applicable for the area.



- 2.4. All clarifications shall be sought before the date of pre-bid meeting. The bidders may make suggestions which shall be considered during the Pre Bid Meeting. No further clarifications shall be issued after the issue of noteworthy replies to the pre-bid queries.
- 2.5. The submission of the bid by Contractor would imply that they have carefully read and agreed to the terms and conditions contained in this bid document.
- 2.6. The bid for the work shall remain open for acceptance for a period of **75 (Seventy Five)** days from the date of submission of the bids, which period may be extended by mutual agreement and the Contractor shall not cancel or withdraw the offer during this period.
- 2.7. This bid document shall form a part of the contract agreement.

### 3. SUBMISSION OF BIDS

Bids shall be submitted to Head- Technical Services, **TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist, Hyderabad-500046** in a sealed Master envelope super scribed "Bid for **Supply, Installation, Testing & Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046** with our enquiry no. and due date, containing two separate sealed covers clearly super scribed as "**Technical Bid**" and "**Financial Bid**" before the closing date and time of submission in the following manner:

- a) "**Technical Bid**": This will contain Technical part, Eligibility Documents along with testimonials. Earnest Money Deposit (EMD).
- b) "**Financial Bid**": This will contain the complete bidding document with duly filled in Schedule of Financial Quote of Financial Bid & Tender Drawings.

The Bids without signature of the authorized person of bidder and seal, without EMD, with conditions or conditional rebates shall be summarily rejected.

### 4. EVALUATION OF BID

- 4.1. **EVALUATION OF TECHNICAL BID**: The bids received will first be first opened and will be examined for EMD/ Declaration Letter, Eligibility Criteria, Conditions, etc. Conditional Tenders and Tenders without EMD shall be summarily rejected.
- 4.2. **EVALUATION OF FINANCIAL BID**: The Financial Bid should contain the complete bid document with duly filled in Schedule of Financial Quote of Financial Bid and signed Tender drawings. Financial Bids of Technically qualified Bidders will only be opened. Work will be awarded to lowest bidder (L1) based on their quotes after making necessary arithmetical checks.





## 5. SCOPE & OBJECTIVE

The Objective of the tender is to **Supply, Installation, Testing & Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046** as per the specifications and Bill of quantities mentioned in the Financial Bid.

**Period of Completion of Work: 180** days from the date of issue of work order

**Defect Liability Period:** 12 months from the date of handing over of completed system as per tender.

## 6. PAYMENT SCHEDULE:

The contractor shall submit the bills for payments along with a detailed statement showing the actual works carried out under different heads of items in the format specified by the TIFR. Minimum value of the work for interim payment (**Three Running Bills**) shall be **30% on Work order value**. All interim (Maximum Three Running Bills) and final bills will be settled based on the joint measurements of each item of work and certified by TIFR Engineer. The bills for nonperishable materials on site may also be submitted and the payment by TIFR against the same shall be to the maximum extent of 60% of the value of these materials on production of sufficient documentary evidence ie. Original invoice, Inventory, etc. All interim bills will be paid within **15** days from the date of submission and Final Bill along with all relevant documents will be settled within **30** days from the date of submission with certification of TIFR Engineer.



**SECTION-II**

**ELIGIBILITY CRITERIA FOR TENDER QUALIFICATION**

**Supply, Installation, Testing & Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046**

• **Eligibility criteria:**

1. The Agencies/Contractors shall hold a valid 'A' grade electrical contractor license issued by appropriate authority and must be valid throughout the contractual period
2. The Agencies/Contractors shall hold a valid labour license issued by appropriate authority and must be valid throughout the contractual period.
3. IT Returns for the last three consecutive financial years ended on March 31, 2024.
4. The Agencies/Contractors should have a latest solvency certificate issued by any nationalized bank of value not less than Rs.69.29 Lakhs.
5. The Agencies/Contractors should have an average annual turnover of Rs.69.29 Lakhs during three previous financial years ending March 31, 2024 audited by CA.
6. The Agencies/Contractors shall be in profit for the last three financial years and should have valid PAN from Income Tax Authority, GST registration No. etc. and any other registration applicable/mandatory for contract.
7. The Agencies/Contractors should have executed similar works successfully at least
  - 7.1. One similar work costing Rs.138.58 Lakhs or
  - 7.2. Two similar works costing Rs.103.93 Lakhs or
  - 7.3. Three similar works costing Rs. 69.29 Lakhs during the last 7 financial years ended on the end date of receiving tender for Research Institutes, Universities, Private Laboratories, R & D institutes, etc. in any Government /PSU/Private organizations of repute.

The Agencies/Contractors should furnish copies of work orders and completion certificates from the clients in support of the above.

**Note:**

- ❖ Agencies/Contractors should have a full-fledged in-house project management team to undertake the jobs.
- ❖ The Agencies/Contractors shall **strictly furnish** aforesaid information in the formats/schedules given. **Non adherence to furnishing of information in the given format/schedules given will lead to disqualification of tender.**
- ❖ Instructions to Agencies/Contractors for furnishing the information is given as under:
  - Each page of the application shall be signed by a person having necessary authority to do so.
  - If the space in the proforma is insufficient for furnishing full details, such information may be given in separate sheets.



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- Applicants are required to furnish information against each item of the application. In case a certain item is not applicable, please write NA. Application containing incorrect and or inadequate information is liable to be rejected.

**SCHEDULE – A**  
**BASIC INFORMATION**

1. Name of the firm :
2. a) Address :
- b) Telephone / Fax No. :
- c) Mobile No. Contact Person :
- d) PAN No. :
- e) GST Registration No. :
- f) Labour License Details :
- g) Electrical A grade License Details :
- h) Branch Office if any in Hyderabad :
3. Type of Organization :  
(Proprietorships / Partnership) Ltd. Co. /  
Co-Operative) (Copy of relevant document  
to be enclosed)
4. Date of Incorporation :
5. Nature of Business :
6. Experience as prime Agencies/  
Contractors (in Yrs.) :
7. Name and address of Bankers :



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8. Organization chart of the Company :  
including names and positions of directors  
/ key personnel

Signature of the Applicant (s)



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**SCHEDULE – B**

**Major Electrical works (Copies of the completion certificate to be enclosed)**

A. Similar work of costing Rs.138.58 Lakhs or two similar works of costing Rs.103.93 Lakhs or 3 similar works of costing Rs.69.29 Lakhs during last 7 financial year ending March 31st 2023 for Research Institutes, Universities, Private Laboratories, R & D institutes, etc

Sr.No	Name of the project & Address	Description of work in brief	Name of the Engineer	Name of the client also indicate whether Govt or semi Govt or Pvt body with full postal address	Contract Amount in Rs.	Year of commencement	Date of Completion		Whether work was left /uncompleted or the contract was terminated from either side? Give Details.	Any other relevant information
							Stipulated	Actual		
1.										

B. List of works in progress above Rs.69.29 Lakhs.

Sr No.	Name of the project & Address	Description of work in brief	Name of the Engineer with full postal address.	Name of the Client. Also indicate whether Govt. or semi Govt. or Pvt. Body with full postal address	Contract Amount in (Rs.)	Date of Completion	Present stage of work with reasons if the work is getting delayed	Any other relevant information
1.								

**Signature of the Applicant (s)**



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**SCHEDULE – C**

**TECHNICAL PERSONNEL & SPECIAL EXPERIENCE**

List of technical personnel in your establishment giving details about their technical qualification and experience

Sr No.	Name	Age	Qualifications	Project Experience	Nature of works handled	Name of the project Handled	Date from which employed in your organization	Indicate special experience in Electrical Installation & Testing projects in which were employed
1								
2								

2. Indicate other points if any to show your technical and managerial competency to indicate any important point in your favour.

Signature of the Applicant (s)



**SCHEDULE – D**

**FINANCIAL POSITION AND WORKING RESULTS**

	2021-22	2022-23	2023-24
1 Annual turnover	:	Rs.	
2. Net Profit	:	Rs.	
3. Credit Facilities from the Bank	:	Rs.	
a) Cash Credit	:	Rs.	
b) Overdraft Limit	:	Rs.	
c) Guarantee	:	Rs.	
d) Others	:	Rs.	
4. Certificate from the Bankers regarding financial soundness of the applicant	:	Enclosed (Yes / No)	
5. Solvency Certificate from the Bankers	:	Enclosed (Yes / No)	

Signature of the Application (s)



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**SCHEDULE – E**  
**MISCELLANEOUS INFORMATION**

- 1 Whether it would be possible to process Bank Guarantee for various advances during execution of the work. :
- 2 Details of Civil Suits / Litigations arised during execution of the contracts in the last 5 years. :
- 3 Latest Income Tax Clearance Certificate :
- 4 Name of the two senior official of Organizations preferably Govt./Semi Govt/ Autonomous/ Public Sector Organization for whom you have executed important and major Electrical works, who may be directly contracted by TIFR to gather information about your ability, competence and capacity of your work/organization/etc. :
- 5 Number of Supplementary sheets attached. :

Signature of the Applicant (s)





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**SECTION-III**

**NOTICE & INSTRUCTIONS**

1. **Sealed item rate tenders** in the prescribed form are invited from Head-Technical Services, Tata Institute of Fundamental Research, Centre for Interdisciplinary Services, Hyderabad, for the following:

<b>Tender Notice No.</b>	<b>TIFR/PD/CF24-78/240656</b>
<b>Name of Work</b>	<b>Supply, Installation, Testing &amp; Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046</b>
<b>Estimated Cost</b>	<b>Rs.1,73,23,043/-</b>
<b>Time Limit</b>	<b>180 days (Completion Period)</b>
<b>Earnest Money Deposit</b>	<b>Rs.3,46,461/- (Demand Draft to be drawn in favour of "TIFR Center for Interdisciplinary Sciences", Payable at Hyderabad (To be enclosed with the Technical Bid Part – I)</b>
<b>Last Date &amp; Time of Submission of Tender</b>	<b>12.09.2024 by 13:00 Hrs</b>
<b>Date &amp; Time of Opening of Technical Bid</b>	<b>12.09.2024 at 15:00 Hrs</b>

2. **Submission of Tender & Opening:**

Tenders shall be submitted in a sealed envelope super scribed with Tender enquiry No., Due Date and with heading as **"Supply, Installation, Testing & Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046"** containing two separate sealed covers clearly super scribed as **"TECHNICAL BID"** and **"FINANCIAL BID"** on or before the closing date and time of submission in the following manner:

**"TECHNICAL BID"**: This will contain the following:

- Proof of Tender Cost paid already
- Earnest Money Deposit as stipulated



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c) Schedules giving information on Eligibility Criteria with supporting documents specified for tender qualification.

**“FINANCIAL BID”:** Signed copy of the Financial Bid quoting amount in the stipulated format and signed copies of the tender drawings.

**5. Acceptance of Tender:** The competent authority, on behalf of TIFR, Hyderabad does not bind itself to accept the lowest or any other tender, and reserves to himself the authority to reject any or all the tenders received, without assignment of any reason. All tenders, in which any of the prescribed conditions is not fulfilled or any condition, including that of conditional rebates, is put forth by the tenderer, shall be summarily rejected.

The Competent Authority, on behalf of TIFR, Hyderabad reserves to itself the right of accepting the whole or any part of the tender and the tenderer shall be bound to perform the same at the rates quoted. The officer inviting tenders shall have the right of rejecting all or any of the tenders and will not be bound to accept the lowest tender or any other tender.

**6. Validity of Tender:** The tender for the work shall remain open for acceptance for a period of 75 days from the last date of submission of tenders. If any tenderer withdraws his tender before the said period, or before issue of Letter of Intent, whichever is earlier, or makes any modifications in the terms and conditions of the tender which are not acceptable to the Department, then TIFR, Hyderabad shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money absolutely. Further the tenderer shall not be allowed to participate in the retendering process of the work.

**7. Levy / Taxes payable by contractor:**

i. GST or any other tax on materials and services in respect of this contract shall be payable by the contractor and TIFR shall not entertain any claim whatsoever in this respect.

ii. The contractor shall deposit royalty and obtain necessary permits as required for supply of the sand, aggregate, stone etc. from local authorities.

**8. Deduction of Income Tax :** As per Section 194-C of Income tax Act 1961, as amended by letter No. 275/9/72/9-TJ (Circular No. 86) dated 19.5.72 and No. 275/14/91-IT (B) (Circular No. 593) dated 5.2.91, received from Ministry of Finance, Department of Revenue, Central Board of Direct Taxes, New Delhi, the Income tax @ 2% and Surcharge thereon @12% (or any other amended rate by Ministry of Finance from time to time), of the gross value of the work done will be recovered from the bills. A certificate for the amount so recovered will be issued by the Department.

**9. Site visit by the tenderer before tendering:** Tenderers are advised to inspect and examine the site and its surroundings during working hours and satisfy themselves before submitting their tenders as to the nature of the ground and subsoil (so far as is practicable), the form and nature of the site, the means



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of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their tender. A tenderer shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charges consequent on any misunderstanding or otherwise shall be allowed.

**10. Signing of Tender and receipts for payments:** In the event of the tender being submitted by a firm, it must be signed separately by each partner thereof or in the event of the absence of any partner, it must be signed on his behalf by a person holding a power-of-attorney authorizing him to do so, such power of attorney to be produced with the tender, and it must disclose that the firm is duly registered under the Indian Partnership Act-1952. Receipts for payments made on account of work, when executed by a firm, must also be signed by all the partners, except where contractors are described in their tender as a firm, in which case the receipts must be signed in the name of the firm by one of the partners, or by some other person having due authority to give effectual receipts for the firm.

**11. Tenderer's responsibilities:** The tenderer shall be responsible for arranging and maintaining at his own cost all materials, tools & plants, facilities for workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a tender by a tenderer implies that they have read this notice & all other contract documents, and has made himself aware of the scope & specifications of the work to be done and local conditions and factors having a bearing on the execution of the work.

**12. Signing of contract:** The Notice Inviting Tender shall form a part of the contract document. The successful tenderer / contractor, on acceptance of his tender by the Accepting Authority, shall, within 15 days from the stipulated date of start of the work, sign the contract consisting of: the Notice Inviting Tender, all the documents including all conditions, specifications and drawings, if any, forms the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.

**13. Canvassing,** either directly or indirectly, in connection with the tenders is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable to rejection and may be barred from future participation in TIFR works.

**Head-Technical Services**

*For and on behalf of TIFR, Hyderabad*

**SECTION-IV****GENERAL CONDITIONS OF CONTRACT****1. Definition of Terms:**

- 1.1. In constructing these general conditions and the specifications the following works shall have the meanings herein assigned to them unless there is something in the subject or context inconsistent with such construction.
- 1.2. The 'Purchaser' shall mean Tata Institute of Fundamental Research- -Hyderabad, Tata Institute of Fundamental Research, 36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District, Hyderabad 500046 and shall include the Purchaser's heirs, successors and assigns.
- 1.3. The term 'Engineer In-Charge' and 'Engineer' shall mean Engineer In-Charge, TIFR- Hyderabad or some other person for the time being or from time to time duly appointed in writing by the Purchaser to act as Engineer In-Charge for the purpose of the Contract or in default of such appointment the Purchaser.
- 1.4. The term 'Contractor'/'Supplier'/'Bidder'/'Vender' shall mean the Bidder whose tender has been accepted by the Owner and shall include the Bidder's heirs, successors and assigns approved by the Purchaser:
- 1.5. The term 'Sub-Contractor' shall mean the firm or persons named in the contract for any art of the work or any person to whom any part of the work has been sublet with the consent in writing of the Engineer In-Charge and shall include his heirs, successors and assigns approved by the Purchaser.
- 1.6. The Term 'Inspector' shall mean any person appointed by or on behalf of the Purchaser to inspect supplies, stores or work under the contract or any person deputed by the Inspector for the purpose.
- 1.7. The term 'Particulars' shall mean, the following :
  - 1.7.1. Specifications
  - 1.7.2. Drawing (ANNEXURE-IV)
  - 1.7.3. Sealed Pattern denoting a pattern sealed and signed by the Inspector.
  - 1.7.4. Proprietary make denoting the product of an individual firm.
  - 1.7.5. Any other details governing the construction, manufacture and/or supply as existing for the contract.
- 1.8. The term 'Specification' shall mean the specifications annexed to or issued with these Conditions of Contract.
- 1.9. The term 'Site' shall mean the place or places at which the Equipment is to be delivered or work done by the Contractor; and shall include, where applicable, the lands and buildings upon or in which the works are to be executed and shall also include the place or places at which fabrication and other work is being carried out by the Contractor.
- 1.10. 'Electrical Equipment', 'Stores', 'Work' or 'Works' shall mean and include equipment and materials to be provided and work to be done by the Contractor under the Contract.
- 1.11. The 'Contract' shall mean acceptance of the work order placed on contractor/supplier under section (2) of these conditions and shall include these conditions of Contract, Specifications, Schedule, Drawing, Letter of Intent of the Purchaser and any subsequent amendments mutually agreed upon.



- 1.12. 'Tests on Completion' shall mean such tests which are prescribed by the specifications or have been mutually agreed to between the Contractor/Supplier and the Purchaser to be made before the equipment is taken over by the Purchaser.
- 1.13. Writing' shall include any manuscript, typewritten or printed statement under or over signature or seal as the case may be. Words importing 'person' shall include firms, companies, corporations and association of individuals whether incorporated or not.
- 1.14. Words importing singular shall also include plural and vice versa where context requires.
- 1.15. Bidders are advised to visit and inspect the work-site to make themselves fully conversant with the site conditions and nature of work. Any claim by them after the opening of bids on account of themselves being unaware of any site condition shall not be entertained.

## 2. Contract

Contractor/Supplier/Manufacturer should send their acceptance letter on receipt of 'Letter of Intent' or 'Work Order' or 'Purchase Order' within the stipulated period. On expiry of said period or exorbitant delay in commencing or executing the work, the Purchaser shall not be liable to any claim from the Contractor/ Supplier for work entrusted to and may revoke the contract.

## 3. Work at Site

- 3.1. Access to the works shall be allowed only to the Contractor/Supplier, Sub-Contractors or his duly appointed representatives. The Contractor/ Supplier shall not object to the execution of other works by other contractors or tradesmen and shall afford them every facility for execution of their several works simultaneously with his own.
- 3.2. Work at the Purchaser's premises shall be carried out at such time as the Purchaser may approve but the Purchaser shall give the Contractor/ Supplier all reasonable facilities for the same. The Contractor/Supplier shall provide sufficient fencing, notice boards etc. to guard the works and warn the public.
- 3.3. The Contractor shall obey Central, Local and State regulations and enactments pertaining to workmen and labour and the Engineer In-Charge shall have the right to enquire into and decide all complaints on such matters. The Contractor should comply with the Minimum Wages Act and should also ensure that safe practices are followed by his people at site.

## 4. Delays

The Contractor/Supplier shall not be entitled to any compensation for any loss suffered by him on account of delays in commencing or executing the work, whatever the cause for such delays may be, including delays in procuring Government controlled or other materials and delay in obtaining instructions and decisions from the Engineer In-Charge.

## 5. Taking Over



The equipment when erected at site shall be deemed to have been taken over by the Purchaser when the Engineer In-Charge will have certified in writing that the equipment has fulfilled the contract conditions.

#### **6. Extension of Time**

If the Contractor/Supplier is delayed in the progress of work by changes ordered in the work, or by any cause, which the Engineer In-Charge shall decide to justify the delay, then the time of completion shall be extended by a reasonable time. In this regard, Contractor shall maintain proper hindrance register and record all such events with due signature of E-I-C on occurrence of such instants for seeking extension of time. However, no such extension shall be allowed unless requested for extension is made in writing by the Contractor/Supplier to the Engineer In-Charge within 15 days from the date of occurrence of the delay.

#### **7. Liquidated Damages**

- 7.1. For all delays, which do not merit any extension of time, the Contractor/ Supplier shall attract 1% penalty per week for the first 4 weeks of delay and 2% penalty per week for the next 4 weeks of the total contract value. The amount of liquidated damages shall be recoverable from the payment due to the Contractor/Supplier up to maximum of 10% of value of contract.
- 7.2. The deduction of liquidated damages shall not, however, absolve the Contractor/Supplier of his responsibility and obligations under the contract to complete the work in its entirety and shall also be without prejudice to action by the Purchaser under clause:

'Termination of Contract by the Purchaser'. After that the same shall be completed by the Purchaser at the Contractor's/Supplier's risk and cost.

#### **8. Other Damages:**

- 8.1. The Contractor/Supplier/Manufacturer shall be responsible for all injury to persons, animals or things and for all damage to the works, structure of, and decorative work in the property which may arise from operation or neglect of himself or any of his Subcontractor or of his or Sub-Contractor's employees, whether such injury or damage may arise from carelessness, accident or any other cause whatever in any way connected with the carrying out of this contract. This clause shall be held to include any damage to buildings, whether immediately adjacent or otherwise, any damage to roads, streets, foot paths, as well as all damage caused to the works forming the subject of this contract by frost or other inclemency of weather. The Contractor/Supplier shall indemnify the Purchaser and hold him harmless in respect of all and any expenses on property as aforesaid and also in respect of any claim made in respect of injury or damage under any acts of Government or otherwise and also in respect of any award of compensation or damages consequent upon such claim. Contractor shall furnish necessary insurance documents (Contractor All Risk Policy) taken for the site before commencement of work.
- 8.2. The Contractor/Supplier/Manufacturer shall reinstate all damage of every sort mentioned in this clause, so as to deliver up the whole of the contract works complete and perfect in every respect and so as to make good or otherwise satisfy all claims for damage to the property of the Owner/third parties.



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- 8.3. The Contractor/Supplier/Manufacturer shall indemnify the Purchaser against all claims which may be made against the Purchaser, by any member of the public or other party, in respect of anything which may arise in respect of the works or in consequence thereof and shall, at his own expense, effect and maintain, until the work has been 'Taken Over' under clause 5.
- 8.4. The Contractor/Supplier/Manufacturer shall also indemnify the Purchaser against all claims which may be made upon the Purchaser whether under the Workmen's Compensation Act or any other statute in force during the currency of this contract or at common law in respect of any employee of the Contractor/Supplier or of any of his sub-contractor and shall at his own expense effect and maintain until the work has been 'Taken Over', with an approved office. Contractor shall furnish a copy of the labour license before commencement of work. If the aforesaid are not applicable contractor should furnish declaration to this effect and shall indemnify TIFR-Hyderabad, Hyderabad for violation of any such compliances.
- 8.5. The Purchaser, with the concurrence of the Engineer In-Charge, shall be at liberty and is hereby empowered to deduct the amount of any damages compensation costs, charges and expenses arising or accruing from or in respect of any such claims or damages from any sums due to or become due to the Contractor/Supplier.

**9. Earnest Money Deposit and Performance Guarantee/Security Deposit:**

- 9.1. **Earnest Money Deposit (EMD):** EMD shall be submitted in the form of Demand Draft to be drawn in favour of "TIFR Centre for Interdisciplinary Sciences", Payable at Hyderabad (To be enclosed with the Technical Bid Part-I))
- 9.2. **Performance guarantee:** The tenderer, whose tender is accepted, will be required to furnish a performance guarantee/security deposit of **2.5% of the tendered amount within 7 (seven) working days from the date of intimation** ie (including adjustment of EMD amount submitted). This guarantee shall be in the form Demand Draft / Pay Order / Banker's cheque / Deposit or Government Securities / Fixed Deposit Receipt (FDR) or Guarantee Bonds (BG) of any Scheduled Bank in accordance with the form as Annexure – II hereto. In case a fixed deposit receipt of any Bank is furnished by the contractor to TIFR as part of the performance guarantee and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to TIFR to make good the deficit.
- 9.3. The Performance Guarantee shall be initially valid up to the stipulated date of completion **plus 60 days** beyond that. In case the time for completion of work gets enlarged, the contractor shall get the validity of performance Guarantee extended to cover such enlarged time for completion of work. The performance guarantee/security deposit shall be returned to the contractor, without any interest, after recording of the completion certificate for the work by the competent authority.



- 9.4. The Engineer-in-charge shall make a claim under the Performance guarantee/Security Deposit for amounts to which TIFR entitled under the contract (notwithstanding and / or without prejudice to any other provisions in the contract agreement) in the event of:
- 9.4.1. Failure to attend and rectify the problems in the guarantee period, in which event the Engineer-in-charge may claim the full amount of the Performance guarantee/Security Deposit.
- 9.4.2. Failure by the contractor to pay TIFR, Hyderabad any amount due, either as agreed by the contractor or determined under any of the Clauses / Conditions of the agreement, within 30 days of the service of notice to this effect by Engineer-in-charge.
- 9.5. In the event of the contract being determined under provisions of any of the relevant clauses of the agreement, the performance guarantee/security deposit shall stand forfeited in full and shall be absolutely at the disposal of TIFR, Hyderabad.

### 1. Security Deposit:

The tenderer, whose tender is accepted, will also be required to furnish by way of Security Deposit for fulfillment of his contract, an amount equal to 5% of the tendered value of the work. Earnest Money deposited at the time of tenders will be treated as part of the Security Deposit.

or

The successful tenderer shall permit TIFR, Hyderabad at the time of making any payment to him for work done under the contract to deduct a sum at the rate of 5% of the gross amount of each running bill till the sum along with the sum already deposited as earnest money, will amount to security deposit of 5% of the tendered value of the work. Such deductions will be made and held by TIFR by way of Security Deposit unless he has / they have deposited the amount of Security at the rate mentioned above in cash or in the form of Fixed Deposit Receipts.

In case a fixed deposit receipt of any bank is furnished by the contractor to TIFR, Hyderabad as part of the security deposit and the bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to TIFR, Hyderabad to make good the deficit.

All compensation or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising there from, or from any sums which may be due to or may become due to the contractor by TIFR or any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within 10 days make good in cash or fixed deposit receipt tendered by the State Bank of India or by scheduled banks (if deposited for more than 12 months) endorsed in favour of the TIFR, HYDERABAD, any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof.

Security Deposit shall be initially valid up to one year from the date of completion of work. In case the time for completion of work gets enlarged, the contractor shall get the validity of Security Deposit extended to





cover such enlarged time for completion of work. The Security Deposit shall be returned to the contractor, without any interest, after completion of defect liability period.

Security Deposit as deducted above can be released against Bank Guarantee issued by a Scheduled Bank on its accumulation to a minimum of Rs.5 Lakhs subject to the condition that amount of such Bank Guarantee, except last one, shall not be less than Rs.5 Lakhs. Bank Guarantee should be submitted which will be valid up to the expiry of defect liability period.

#### 10. Guarantee and Defects Liability Period:

- 10.1. The Contractor/Supplier/Manufacturer shall guarantee that all equipment shall be free from any defect due to the defective materials and bad workmanship and that the equipment shall operate satisfactorily and that the performance and efficiencies of the equipment shall be not less than the guaranteed values. The guarantee shall be valid for a period of 12 months after the date of commissioning as certified by the Engineer In-Charge. Any parts found defective shall be replaced free of all costs by the Contractor/Supplier. The services of the Contractor's/Supplier's personnel if requisitioned during this period for such work shall be made available free of any cost to the Purchaser.
- 10.2. If the defects be not remedied within a reasonable time, the Purchaser may proceed to do so at the Contractor's/Supplier's risk and expense without prejudice to any other rights.

#### 11. Terms of Payment

The contractor will be paid only Three Running Account (RA) Bills and Final Bill considering the progress of works based on measurement of works completed. The contractor shall submit the bills for payments along with a detailed statement showing the actual works carried out under different heads of items in the format specified by TIFR-, Hyderabad. Minimum value of the work for interim payment shall be **30% on Work order value.**

##### BILL FORMAT

<u>Tender Item</u>	<u>Description of Item (At least 2 lines)</u>	<u>Unit</u>	<u>Tender Qty</u>	<u>Execute d Qty</u>	<u>Rate</u>	<u>% work done</u>	<u>Amount</u>

NOTE: All quantities in the bill should be cumulative.

All measurements should be in the order of tender sequence and should be recorded in the measurement book. The Measurement should be strictly in the below mentioned format only.



### MEASUREMENT FORMAT

Tender Item No.	Description of Item & Location against each Measurement taken	Nos.	Length	Breadth /width	Height	Qty.	Remarks

The works which have been certified for running bills will also be verified along with the final bill and any defects found need to be replaced / rectified by the contractor at his cost. Till the time, the site is handed over in full, it is the contractor's liability to safeguard the works done and completed at site. The Progress of work should not be affected in any way quoting the reason of non-availability of funds / materials / releasing of Running bill. The liability of the contractor is to complete all works in his scope in the scheduled time as per the terms of contract and will not relieve the contractors from his obligations once the Running bill is paid / kept pending.

#### Final Payment

Payments of Final bill shall be made after deduction of Performance guarantee as specified. The Security Deposit / Performance guarantee, shall be refunded on expiry of the Defects Liability Period after rectifying all defects to the satisfaction of the TIFR-Hyderabad/E.I.C. The acceptance of payment of the final bill by the Contractor would indicate that he would have no further claim in respect of the work executed.

### **12. Special conditions of Contract governing supplies of the Equipment of this Tender:**

#### **12.1. Scope:**

- 12.1.1. This specification covers the supply of material as per the enclosed details and quantities and supervision of erection/installation, testing and commissioning of the material.
- 12.1.2. The Contractor/Manufacturer/Supplier shall quote for all the materials along with accessories as mentioned in the enquiry.
- 12.1.3. All the supply shall be in accordance with relevant I.S. Specifications and recognized standards.

#### **12.2. Inspection & Testing of Material:**

- 12.2.1. Contractor/Manufacturer/Supplier shall submit the lists of Type Tests and Routine Tests to be conducted on the material in the Technical Data Sheet.
- 12.2.2. All the materials shall be tested at factory as per IS Specifications of material by Purchaser's Engineer In-Charge/Engineers before dispatch at the cost of Contractor/Manufacturer/Supplier.



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- 12.2.3. Contractor/Manufacturer/Supplier shall inform the concerned Engineer In-Charge for inspection and testing in accordance and fix up a suitable date for the same.
- 12.3. **Test Certificates:**  
Contractor/Manufacturer/Supplier shall submit the Test Certificates of all materials.
- 12.4. **Delivery of Material:**
- 12.4.1. The Contractor/Manufacturer/Supplier shall arrange for safe transit and shall be held responsible for loading of all equipment and for the stores being sufficiently and properly packed for transport by rail, road, sea or air so as to ensure their being free from any loss or damage on arrival at destination. The packing and marking of packages shall be done by and at the expenses of Manufacturer/Supplier. Each package shall contain a packing note quoting purchase order number and detail of the contents.
- 12.4.2. All the materials must be delivered at site i.e. Hyderabad - TIFR at 36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District, Hyderabad-500046. The unloading and positioning of all equipment at the designated locations specified by the Engineer In-Charge shall be in the scope of the Supplier. The Supplier shall arrange for handling equipment, labour for rigging, etc. as required.
- 12.4.3. Material must be delivered at site in all respects as mentioned in the Purchase Order.
- 12.4.4. **Contractor shall arrange necessary storerooms and security at site to store materials. TIFR shall not be responsible for any missing/theft of materials at site.**
- 12.5. **Guarantee:**  
If during the period of guarantee any fault or defect arises, the material shall be replaced/repared immediately free of cost, as well as any replacement of accessories required shall be done free of cost.
- 12.6. **Mistake in Drawing:** The Contractor/Supplier shall be responsible for and shall pay for any alterations in works due to any discrepancies, errors or omissions the drawings or other particulars supplied by him whether such drawings or particulars have been approved by the Purchaser or not.
- 12.7. **Responsibility for Completeness:**  
Any fittings or accessories which may not be specifically mentioned in the specifications but which are usual or necessary are to be provided by the Contractor/Supplier without extra charge and the equipment must be complete in all details.
- 12.8. **Extra/Deviation items & Variations in quantity**  
**TIFR-Hyderabad has the right to omit/delete any of the items and also increase/decrease the quantities mentioned in the tender. No claim or any compensation in this regard will be**
-



**accepted or paid to the contractor. However, if any new /additional items/deviated items are to be executed, the contractor is bound to execute such items with prior approval from TIFR-Hyderabad after furnishing the proper rate analysis for such extra/deviated items**

**12.9. Rejection of Defective Equipment:**

- 12.9.1. If the equipment after the acceptance thereof is discovered to be defective, notwithstanding that such defects could have been discovered at the time of inspection or found to have failed to fulfill the requirements of the contract or developed defects after the erection within a period of 12 months from the date of erection, even if such erection is done by the Purchaser, he shall be entitled to give a notice on the Contractor/Supplier setting forth details of such defects or failure and the Contractor/Supplier shall, provided such notice is given within a period of 14 months from the date of such erection or acceptance, forthwith make the defective equipment good or alter the same to make it comply with the requirements of the contract at his own cost and further if in the opinion of the Purchaser, the defects are of such a nature that the defects cannot be made good or required without impairing the efficiency or workability of the equipment or if in the opinion of the Purchaser the Equipment cannot be repaired or altered to make it comply with the requirements of the Contract, the Contractor/Supplier shall, provided a notice given by the Purchaser in this behalf within a period of 14 months from the date of erection or acceptance thereof, remove and replace the same with the equipment conforming to the stipulated particulars, in all respects at the Contractor's/Supplier's own cost. Should he fail to do so within a reasonable time, the Purchaser may reject and replace, at the cost of the Contractor/Supplier, with equipment of the same particulars or if equipment conforming to the stipulated particulars are not in the opinion of the Purchaser readily procurable, such opinion being final, then with the nearest substitutes.
- 12.9.2. In the event of such rejection the Purchaser shall be entitled to use the Equipment in a reasonable and proper manner for a time reasonably sufficient to enable him to obtain replacement equipment as herein before provided.

**12.10. Inspection and Final Tests:**

All tests necessary to ensure that the Equipment complies with the particulars and guarantee shall be carried out at such place or places as may be determined by the Inspector. Should, however, it be necessary for the final test as to performance or guarantee to be held over until the Equipment is erected at site they shall be carried out within one month of completion of erection.

**12.11. Intimation about Delivery:**

If the Purchaser shall have notified the Contractor/Supplier in writing that the former is not ready to take delivery, no equipment or materials shall be forwarded until an intimation in writing shall have been given to the Contractor/Supplier by the Purchaser that he is ready to take delivery.



**12.12. Delay in erection:**

Wherever erection of an equipment or machinery is the responsibility of the Contractor/Supplier as a term of the contract and in case the Contractor fails to carry out the erection as and when called upon as to do within the period specified by the Purchaser, the Purchaser shall have right to get the erection done through any source of his choice. In such an event, the Contractor/Supplier shall be liable to bear any additional expenditure that the Purchaser may incur towards erection. The Contractor/Supplier shall, however not be entitled to any gain due to such an action by the Purchaser.

**12.13. Definition of Equipment:**

The work 'Equipment' wherever, it appears in these 'Special Conditions of Contract' governing supplier of Equipment in this Tender shall mean all switchgears, panels, etc. or parts thereof or what the Contractor/Supplier agrees to supply under Contract as specified in the work order.

**12.14. Force Majeure:**

Normally Force Majeure shall cover only acts of God, fire, wars, strike, riots and civil commotion, floods, epidemic, quarantine related strikes, freight embargoes, etc. The contractor shall not be liable for any liquidated damages for delay or any failure to perform the contract arising out of Force Majeure conditions, provided that the contractor shall within ten days from the beginning of such delay notify the department in writing the cause of delay along with convincing supporting evidence. The department once convinced and accepted the reason may extend the supply completion period by a suitable / reasonable margin.

**12.15. Termination of Contract by the Purchaser:**

12.15.1. If the Contractor/Supplier commits any 'Act of Insolvency' or shall be adjudged an Insolvent or shall have an order for compulsory winding up made against him or pass effective resolution for winding up voluntarily, or if the Contractor/Supplier shall suffer any payment under this contract to be attached by or on behalf of any of the creditors of the Contractor/ Supplier, or shall assign the Contract without the prior consent in writing of the Engineer In-Charge, or shall charge or encumber this Contract or any payments due or which may become due to the Contractor/Supplier there under, or if the Engineer In-Charge shall certify in writing to the Purchaser that the Contractor/Supplier –

12.15.1.1. has abandoned the Contract, or

12.15.1.2. has failed to commence the works, or has without any lawful excuse these conditions suspended the progress of the works for seven days after receiving from the Engineer In-Charge written notice to proceed, or



टाटा मूलभूत अनुसंधान संस्थान  
**TATA INSTITUTE OF FUNDAMENTAL RESEARCH**  
भारत सरकार के परमाणु ऊर्जा विभाग की स्वायत्त संस्था एवं समविश्वविद्यालय  
(Autonomous Institution of the Department of Atomic Energy, Government of India)  
सर्वेक्षण संख्या 36 / पी, गोपनपल्ली गांव, सेरिलिंगमपल्ली मंडल, रंगारेड्डी जिला, हैदराबाद - 500 046  
Survey No.36/P, Gopanpally Village, Serilingampally Mandal, Ranga Reddy District,  
Hyderabad-500046, Telangana

- 
- 12.15.1.3. has failed to proceed with the work with such due diligence and failed to make such due progress as would enable the works to be completed in accordance with the approved programme of work,, or
- 12.15.1.4. has failed to remove materials from the site or to pull down and replace work for seven days after receiving from the Engineer In-Charge written notice that the said materials or work were condemned and rejected by the Engineer In-Charge under these conditions, or
- 12.15.1.5. has neglected or failed persistently to observe and perform all or any of the acts matters or things by this contract to be observed and performed by the Contractor for seven days after written notice shall have been given to the Contractor/ Supplier requiring the Contractor/Supplier to observe or perform the same, or
- 12.15.1.6. has to the detriment of good workmanship or in defiance of the Engineer In-Charge's instructions to the contrary sub-let any part of the contract, then and in any of the above said causes, the Purchaser with the written consent of the Engineer In-Charge may, notwithstanding any previous waiver, after giving seven days' notice in writing under the provisions of this clause to the Contractor/Supplier, determine the contract but without prejudice to the powers of the Engineer In-Charge or the obligations and liabilities of the Contract, the whole of which shall continue to be in force as if the contract has not been so determined and as if the work subsequently executed has been executed by and on behalf of the Contractor/ Supplier.
- 12.15.2. After the issue of such notice, the Contractor/Supplier shall not be at liberty to remove from site any equipment, tools and materials belonging to him which shall have been placed thereon for the purpose of the works and the Purchaser shall have lien upon such equipment, tools or materials to subsist from the date of such notice and until the notice shall have been complied with.
- 12.15.3. If the Contractor/Supplier shall fail to comply with the requirements of said notice for seven days after such notice has been given, the Purchaser shall have the power to enter upon and take possession of the works and site and all equipment, tools and materials thereon, and to engage any other person, firm or agency to complete the works, utilizing the equipment, tools and materials to the extent possible. The Purchaser shall not in any way be responsible for damage or loss of the tools, equipment and materials and the Contractor/Supplier shall not have any compensation therefore.
- 12.15.4. Upon completion of the works, the Engineer In-Charge shall certify the amount of expenditure properly incurred consequent on and incidental to the default of the Contractor/Supplier as aforesaid and such amount shall be deducted from the payments due to the Contractor/Supplier, including the Security Deposit. If the said amount exceeds the payment due to the Contractor/Supplier, the Purchaser shall be at liberty to dispose off any of the Contractor's/Supplier's materials, tools or equipment and apply the proceeds for the payments due from the Contractor/Supplier and recover the balance by process of law.
- 12.15.5. After the works have been completed after the amounts due to the Contractor/Supplier, the Engineer In-Charge shall give notice in writing to the Contractor/Supplier to remove the surplus equipment and material from site. If such equipment and materials are not removed within a period



of 14 days after such notice, the Purchaser shall have the power to remove and sell the same holding the proceeds less the cost of removal and sale, to the credit of the Contractor/Supplier. The Purchaser shall not be responsible for any loss sustained by the Contractor/Supplier from the sale of the equipment and material.

**13. Contractor's Representative:**

- 13.1. The Contractor/Supplier shall employ at least one qualified representative (ie. Electrical supervisory License with minimum 3 years of experience of similar works as stipulated by TIFR- Hyderabad in the work order) whose name shall have previously been communicated in writing to the Engineer In-Charge and approved by him to supervise the erection. Any written order or instructions given to the representative shall be deemed to have been given to the Contractor/Supplier. The Engineer In-Charge shall be at liberty to object to any particular representative/or any persons employed by the Contractor/Supplier on the work and the Contractor/Supplier shall remove the person objected to, on the receipt of the Engineer In-Charge, in writing, a request requiring him to do so and shall provide in his place another competent representative acceptable to the Engineer In-Charge.
- 13.2. The Contractor's/Supplier's representative shall be a qualified electrical/ mechanical engineer possessing adequate site experience in similar nature of works.

**14. Completion Time:**

Unless otherwise agreed in writing between the Purchaser and the Contractor/Supplier, the work contract shall be completed within the stipulated period mentioned elsewhere in this tender document from the date of Work/Purchase Order issued to Contractor/Supplier by the Purchaser.

**15. Measurements:**

All joint measurements of quantities shall be done by the Contractor at his own cost in the presence of the Engineer In-Charge or any authorized person deputed by him who will certify the routes, length and quantities etc. for the purpose of determination of the amount payable.

**16. Spare Parts & Manuals:**

Manufacturer/Contractor/Supplier should submit operation, maintenance and spare part list and manuals for all equipment.

**17. Training:**

Manufacturer/Contractor/Supplier should provide training for operation and maintenance free of cost for equipment supplied.

**18. Special Instruction for bidding process**



This tender is a two part tender. The Part-I: Technical Bid and Part-II: Financial Bid. Bidders shall seal each bid separately with a clear label on the envelope about its content. Both the bids should be submitted in a single drop two cover method. Any pricing details must not appear in the Part-I: Technical Bid.

**19. Drawings and Documentation:**

As-built drawings as specified in this technical specifications shall be submitted by the Contractor.

**20. Permissions and Approvals:**

All statutory permissions and approvals from Electricity authority as may be required for commissioning of the entire system shall be carried out by the contractor. All necessary documentation for obtaining such permissions and approvals shall be done by the contractor. Purchaser shall assist in providing required declarations. Statutory fees shall be paid by the purchaser.

**21. Guarantee:**

The equipment shall be guaranteed against all design and manufacturing defects, poor workmanship etc. for a period of 12 months from the date of commissioning or 18 months from the date of supply, whichever is earlier. Any defects discovered during this period shall be rectified by the vendor free of cost to the purchaser.



**SECTION-V****TECHNICAL SPECIFICATIONS****5.1 Scope of Works**

- 5.1.1 Supply, Installation, Testing and Commissioning of 1.1KV grade armoured/unarmoured XLPE/PVC LT cables in ground/wall/false ceiling to draw power from MV panel to DBs and DBs to individual rooms, and circuits for power & lighting.
- 5.1.2 Design, Manufacture, Supply, Installation, Testing and Commissioning of MV Panels
- 5.1.3 Design, Manufacture, Supply, Installation, Testing and Commissioning of DG Sets
- 5.1.4 **Other Works:** All other civil works which might not have been specifically mentioned in the specifications and in the Schedule of quantities but are essential for operational requirements of the entire system shall be in the scope of work. Bidder shall specifically bring out such items in Technical bid and submit quote in separate sheet along with the Financial Bid.

**ELECTRICAL WORKS****Scope:**

This specification is intended to cover the requirements of supply, installation, testing and commissioning of electrical wiring installation and other accessories required for its satisfactory operation. This covers the essential requirements or precautions regarding wiring installations for ensuring satisfactory and reliable service.

**Standards:**

The Electrical wiring installations and other accessories shall comply with latest IS: 732 - 1989 and National Electrical code – 1985 and to the latest amendments from time to time.

**Lamps:**

All Light Fixtures, unless otherwise specified shall be hung at a height of not less than 2.5 m above the finished floor level.

**Recessed PVC conduit wiring system**

a) Making of chase : The chase in the wall shall neatly be made and shall be of suitable dimension to permit the conduit to be fixed in the manner desired by the Engineer-in-charge. In the case of buildings under construction, chases shall be provided in the wall, ceiling, etc. at the time of their construction and shall be filled up neatly after erection of conduit and brought to the original finish of the wall.



b) Fixing of conduit in chase: The conduit shall be fixed by means of staples or by means of saddles not more than 600 mm apart. Fixing of standard bends or elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself with a long radius which will permit easy drawing-in of conductors. All the threaded joints of rigid steel conduits shall be treated with approved preservative compound to ensure protection against rust.

c) Inspection boxes : To permit periodical inspection and to facilitate replacement of wires, suitable inspection boxes shall be provided at convenient locations. They shall be mounted in flush with the wall. The minimum size of inspection boxes shall be 75 x 75 mm. Suitable ventilating holes shall be provided in the inspection box covers.

d) Types of accessories to be used: All outlets, such as switches and sockets, may be either of flush mounting type or of surface mounting type. The switches and other outlets shall be mounted on such boxes. The metal box shall be efficiently earthed with the earth continuity wire run along the conduit. When crossing through expansion joints in buildings, the conduit sections across the joint may be through flexible copper bellows of the same size as PVC conduit. The Number of wires that can be drawn through a conduit shall be strictly as per IS 732 and as mentioned in Drawings.

#### **TESTING OF WIRING:**

The following tests shall be carried out on all types of wiring on completion of the work and before energizing the installation:

- i) Insulation resistance test,
- ii) Electrical continuity test,
- iii) Earth continuity test,
- iv) Earth electrode resistance test,
- v) Switch polarity test.

i) Insulation Resistance test: The insulation resistance shall be measured by using 500 v megger between the following points. Phase and neutral conductor with all fuses in position and all switches in closed condition and main switch in OFF position with lamps and other devices removed. Between earth and the whole system of conductors with all fuses in place, all switches closed and all lamps in position. Between all conductors connected to one phase of the supply of the above tests shall not be less than 50 divided by the number of points on the circuit. Where a whole installation is being tested, a lower value than that given by the above formula is acceptable subject to a minimum of one mega ohm.

The insulation resistance in mega ohm as obtained by each of the above tests shall not be less than 50 divided by the number of points on the circuit. Where a whole installation is being tested, a lower value than that given by the above formula is acceptable subject to a minimum of one mega ohm.



- (ii) Electrical continuity test: Each and every circuit shall be tested for electrical continuity by using a multimeter.
- (iii) Earth continuity test: The earth continuity conductor including metal conduit shall be tested for electrical continuity and the resistance of the same along with the earthing lead measured from the connection with the earth electrode to any point in the earth continuity conductor in the complete installation shall not exceed one ohm.
- iv) Earth electrode resistance test: The earth electrode resistance shall be tested as specified in section (v).
- (v) Switch polarity test: Test shall be made to verify that all switches in every circuit have been fitted in the same conductor throughout and such conductor shall be marked for connection to the phase conductor.

#### **Distribution Boards:**

All the distribution boards shall be with MCCBs/ MCBs as described in the respective schedule. The distribution boards shall be controlled by a switch fuse, miniature circuit breaker or an isolator as described in the respective schedule. Each outgoing circuit shall be provided either with MCB or a fuse on the phase. The neutral shall be connected to a common link and be capable of being disconnected individually for testing purposes. 34 The distribution boards shall be located as indicated in the respective electrical working drawings and as directed by Engineer - in - charge. The distribution boards shall be fixed on wall in the niche provided and marked with the details of circuits, source of supply, size of incoming wires Etc., All marking shall be clear and legible. The total load of the consuming devices shall be evenly distributed between the numbers of ways of distribution board. The consuming devices circuit shall be connected to the distribution board in proper sequence, so as to avoid unnecessary crossing of wires. Cables shall be connected to a terminal only by crimped lugs. Cables shall be rigidly fixed in such a manner that a clearance of at least 2.5cm is maintained between conductors of opposite polarity or phase and between the conductors and any material other than insulating material. The incoming and outgoing cables shall be neatly bunched.

**MOUNTING HEIGHTS:** The Mounting heights of various fixtures shall be as specified in the Drawings. 10. Flexible conduits are strictly not envisaged, only industrial type GI Bind flexible conduit shall be used in a spot where the conduits and bends cannot be possible to run.

#### **L. T. CABLES:**

All power and distribution cables shall be 1100V grade, PVC / XLPE insulated and sheathed, armored/unarmoured, multi strand aluminum conductor/ copper conductor cables unless otherwise specified. All control cables shall be 1100V grade PVC insulated and sheathed unarmoured multi-strand copper conductor cables unless otherwise specified. The cables shall conform to IS 1554-1988 & IS 7098:1988 with up to date amendments. Type test certificates of the cables from manufacturers for the



particular drums shall be provided. Shop inspection shall be offered for routine tests if specifically asked for.

#### **LAYING:**

- The cables shall be thoroughly inspected for transit damage and irregularity in sheath etc.
- Sufficient manpower with necessary equipment like jacks, rollers shall be provided for unwinding and laying the cables and dragging and twisting shall be avoided. Proper unwinding methods shall be used to avoid twists & cable should be meggered before starting laying.
- Cables shall be laid at a depth of at least 750mm from ground level with 50mm sand bedding, brick box with cushion for protection. Bending radius provision of at least 12 D shall be kept while laying. The trenches shall be filled and reinstated layer by layer leaving a crown on top.
- H.T. and L.T. cables shall not be laid in the same trench. When more than one cable is laid in the same trench a gap of at least 150 mm shall be kept between the cables.
- Cables laid on walls; trenches shall be supported at every 600mm for vertical run and every 450mm for horizontal run. Suitable clamps shall be provided for fixing and support. Vertical runs near ground level shall be protected by GI Pipes of suitable size up to the height of at least 1200 mm.
- The length of the cables in schedule will be approximate and actual site measurements shall be taken by contractor prior to cutting any cable.
- Cable identification tags shall be provided at appropriate locations throughout the length of cables and at both ends.

#### **JOINTING:**

Jointing or end termination of cables shall be done by a skilled person only. Straight through joints shall be avoided as far as possible. Heavy-duty compression type brass glands shall be used for all connections. Crimping type lugs with suitable brass/Chrome Plated hardware shall be provided for connections.

The cables on panel side are connected to bus bars Cu or Al, Care should be taken to avoid heating & corrosion at the joints. All LT cable joints in outdoor and humid atmospheres shall be done with double compression glands only / if done by Single compression Gland should be accommodated by PVC HOOD Of Appropriate size.

#### **TESTING:**

Cables shall be meggered as soon as they are brought to site. Insulation resistance shall also be tested.

- a) After cutting.
- b) After laying and preparing the joint.



Following test shall be taken after completing the installation.

- a) Cable continuity.
- b) Earth continuity.
- c) Insulation resistance.

1000V megger shall be used for testing 3 phase 415 Volt systems. All HT cables shall be pressure tested after making the end joints at site. Insulation resistance tests shall be done by 5000V megger for all H.T. Cables.

#### **SURFACE CONDUITING:**

The surface conduits shall be fixed with help of 20 SWG saddles on spacers at every 600mm for vertical run and every 450 mm for horizontal run. The runs shall be straight with pull boxes and inspection type bends as required. Contractors are required to provide suitable sleeves for structural member crossing at the time of casting. No elbows shall be allowed.

In case of false ceilings the conduits shall run on walls/trusses/slabs above false ceiling level as far as possible. The connections between such runs and fixtures shall be made with flexible conduits.

#### **CONCEALED CONDUITING:**

The concealed conduit work shall be carried out along with construction of walls prior to plaster. The work covers chasing walls with wall cutters only if necessary fixing the conduits, boxes, and accessories, redoing the damaged surface using chicken mesh. All horizontal conduit runs shall be straight at wall point light level to necessary junction/pull boxes and then straight vertical drop to switch box if necessary.

The conduits shall be laid such that they are little below the brick level to avoid cracks. Elbow shall not be used and bends shall be avoided as far as possible using offsets. Pull boxes shall be provided at suitable locations. All necessary sleeves shall be provided in beams, columns, and prior to casting. Deep junction boxes only shall be used in slabs.

The pull and junction boxes shall not be clustered at one place and shall be so arranged that they should not be easily seen from heavy movement areas. All cases shall be taken to secure joints and boxes in place. All vertical runs shall be sealed at top, while masonry civil works are going on. Conduit with 25mm dia. minimum shall be used for all concealed work. Generally in areas with false ceiling conduits will not be concealed in slab but will be concealed below the false ceiling area. Conduits above false ceiling in such cases shall run with proper supports / suspenders. Conduits shall not be rested on a false ceiling grid in any case. Flexible conduits shall not be used in concealed work.



## DETAILED TECHNICAL SPECIFICATIONS OF DG SET

### 1.0 INTENT OF SPECIFICATION:

1.1 This specification covers the design, manufacture, assembly, shop testing, packing, dispatch, transportation, supply, erection, testing, commissioning, performance and guarantee testing of Silent type Diesel Generating Sets, complete in all respects with all equipment, fitting and accessories for efficient and trouble-free operation as specified here under including statutory approvals.

### 1.2 SCOPE OF WORK :

General Scope of work shall include design, manufacture, shop testing, packing, dispatch, transportation to site, supply, erection, testing and commissioning of the following:

- a) Diesel engine complete with all accessories, an Alternator directly coupled to the engine through flexible/ rigid coupling complete with all CTs, PTs, etc as required or as per BOQ & specifications, accessories for starting, regulation and control, including base frame, foundation bolts etc, interconnecting piping and accessories, power and control cables, glands and lugs.
- b) AMF/Manual panel including various meters/Annunciation and other control components as per standard practice, BOQ & specifications. Control panel cabling between bidder's & local equipment and special cables if any.
- c) Equipments necessary for fuel storing and distribution, day fuel tank, piping, valves, level controller and indicators etc. Load sharing facility with Synchronization Panel.
- d) Flexible connections and Residential type silencer of exhaust system, including thermal lagging.
- e) Batteries with MS battery stand painted with one coat of Zinc Oxide and two coat of acid proof black paint and battery charging equipment, including their connections as necessary along with tools & accessories for battery maintenance.
- f) Anti Vibration Mountings etc.
- g) Preparing all related shop drawings for approval from client/consultant and statutory bodies. Work shall be as per Final approved drawings
- h) Obtaining approval/licencing of the installation of Diesel Generators by the Electrical Inspectorate and Pollution Control bodies and any other statutory bodies. Any other registrations of Genset (eg. Industry department)
- i) Carrying out performance and guarantee test i.e. full load test for 6 hrs followed by 1 hour 110% over load and again 6 hrs full load. Vendor has to make arrangements for oil lubricants, HSD, other consumables and Electrical loads etc. as required
- j) The DG set shall be mounted on a suitable designed fabricated rigid common base frame with anti vibration pads to provide not less than 99% vibration isolation. First filling of lube oil & 1HSD shall be included in DG - sets cost. The DG Set shall include all standard accessories, fittings, instruments and 3 sets of operating & maintenance manuals, spare parts list etc. complete as per technical



specifications. The DG set shall be inclusive of AMF controller, Fuel day tank, Residential Grade Silencer etc. complete as required.

k) The DG Sets shall be subjected to load tests at factory before dispatch & TIFR site after installation in the presence of TIFR's representative. All consumables required during testing of DG Sets at factory & site testing shall be included in the scope of DG vendor. All consumables required during trial run of DG Sets on load for 13 hours out of which six hours for run up to full load, followed by six hours on full load and concluded by one hour 110% overload capacity to be arranged by DG Vendor. Also, Vendor has to arrange the 110% of rated capacity load availability for testing at factory and at TIFR. The test shall be carried out as per Technical Specification & records to be submitted for approval. (The formats of all tests carried out at factory & at site with details of relevant standards as per latest standards & permissible limits should be submitted by DG vendor for reference along with tender).

l) The design of DG Sets shall conform to the requirement of CPCB IV norms for all parameters including flue gas emission and noise level. DG set should be provided with standard accessories like anti vibration pads, AVR, electronics governor, breaker, MFM, microprocessor-based controller (latest version), control cables, power cables complete as required up to AMF panel. BMS compatible ports & I/Os.

m) RCC foundation as per manufacturer's drawings, minor civil works like chasing, grouting etc, for execution of jobs. All materials must possess high quality.

#### BMS Requirement:

DG Vendor to ensure the BMS system architecture (as indicated in Annexure - 1 for reference only) shall be able to satisfy the client's requirement. Following are some of requirement listed for guidance but not limited to:

- 1) RS 485 / BACnet Output from each DG set for our BMS.
- 2) Analog input along with monitor points for fuel level, generated voltage, current, engine temperature, Battery voltage, charging current, frequency & over speed, RPM, coolant temperature, oil temperature etc.
- 3) Potential free contacts from each DG set breaker for BMS for ON/OFF/Trip status
- 4) BMS Controller with 5 Universal Inputs and 5 Binary Outputs in MS Enclosure with required power supply, connectors, internal wiring etc.
- 5) Converter with 2 inputs and 1 RS 232/485 output, cabling etc

#### GENERATOR STANDARD FEATURES:

- 1) Vendor to provide one-source responsibility for the generating system and accessories.
- 2) The generator set and its components are prototype-tested, factory-built, and production-tested.
- 3) Minimum Two-year warranty covers all systems and components / Manufacturer Warranty
- 4) Industrial diesel engine with 24 Volt battery charging alternator.
- 5) Rated capacity Alternator with insulation class H & IP 23 protection.



- 6) Unit-mounted radiator.
- 7) Subbase fuel tank – Not less than 550 litres. capacity with float type level indicator, seven segment digital fuel level indicator.
- 8) Vibration isolators. 2
- 9) Dry type air filter with restriction indicator.
- 10) Fuel Water separator.
- 11) Main line breaker.
- 12) Starting battery and cables.
- 13) Sound enclosure with 75dB(A), (fully waterproof)
- 14) Conveniently locate fuel level indication.
- 15) Operation and installation literature.

**ADVANCED DIGITAL CONTROL:**

Compact Controller comprising of : LED display for measurement & display of –

- 1) Runtime hours
- 2) Current
- 3) Voltage
- 4) Frequency
- 5) Engine temperature
- 6) Engine Oil Pressure
- 7) Battery Voltage
- 8) LED display faults:
- 9) High engine temperature
- 10) Low oil pressure
- 11) Over crank
- 12) Overspeed
- 13) Over & under voltage
- 14) Over & under frequency
- 15) E-stop
- 16) Auxiliary fault
- 17) Display warning:
- 18) Low battery voltage
- 19) High battery voltage
- 20) Low fuel level

Note: Vendor has to provide latest version of controller for a particular DG

**STANDARD FEATURES & ACCESSORIES :**

- 1) Master switch: Run/Off-Reset/Auto
- 2) Current selector switch





- 3) Remote two-wire start/stop capability
- 4) Event log
- 5) Superior electronics
- 6) Factory-built and production-tested
- 7) Automatic start with programmed cranking cycle
- 8) Field software upgrade possibility
- 9) Environmental specifications: i) Operating temperature- 10°C to 55°C  
ii) Humidity- 0--95% condensing
- 10) Power Requirements: 24 VDC with fuse protection  
250 mA @ 12 VDC  
125 mA @ 24 VDC
- 11) Battery charger 24V :
- 12) Mains sensing relay
- 13) Earth leakage protection

Important Notes:

- 1) DG Set should accept 55% load of rated capacity of DG Set in one step at the time of starting.
- 2) DG Sets panel shall be suitable for Auto operation controlled through AMF Relay / Synchronization Panel as well as manual operation.
- 3) DG Set supplier shall provide microprocessor-based DG Local Control panel mounted on the engine having, all electrical parameters, and fault indication with provision for its remote control.
- 4) DG Supplier should provide for all required hardware (converter to give BACnet compatibility, control wiring, potential free NO/NC, RS ports, A/D & D/A converters etc. as required to operate the BMS system software.) arrangement for remote start/stop and DG fault (LLOP, over speed) etc. along with remote adjustment of voltage & speed of the engine (Motorised/ solid state pot. may be required) & shall be included in the quoted rates as required.
- 5) The neutral CTs as per specification shall be provided on the neutral side of winding and connection brought out to a neutral CT box to be mounted on the alternators (All the six terminals are to be brought out and then shorted).
- 6) Supply, installation, testing & commissioning of residential type silencers as per CPCB norms with 75mm glass/ mineral wool insulation complete with wire chicken mesh and 24-gauge Aluminium cladding from engine up to silencers, including supporting arrangement suitable for the following DG Set complete as required.
- 7) Supply, fabrication, installation, testing & commissioning of M.S. day fuel tank fabricated out of min. 2.5 mm thick M.S. sheet installed on steel frame or masonry pedestal with all associated accessories, filters, valves & fittings including level controller, priming motor complete as required, float switch with contacts for remote interlock should be provided. The tank shall be suitably treated with diesel resistant paint/anticorrosive treatment. The contact of the level controller shall be wired



up to the terminal block. or as per manufacturer's design included in the enclosure. The tank level remote indicator to be provided at some suitable location as advised by the client in the canopy.

### 1.3 CODES AND STANDARDS :

1.3.1 The equipment furnished under this specification shall conform to the following latest standards, except where modified or supplemented by this specification.

BS: 5514	: Specification for reciprocating internal combustion engine.
BS: 5000	: Rotating electrical machines of particular type or for particular applications
IS: 1239 (Part-I & II)	: Mild steel tubes and fittings.
IS: 1651	: Stationary cells and batteries lead acid type (with tubular positive plates).
IS: 9224	: Specification of low voltage fuses, General purpose
IS: 4540	: Mono-crystalline semiconductor rectifier assemblies and equipment.
IS: 5	: Colours for ready mixed paints.
IS: 4722	: Rotating electrical machines.
IS: 1248	: Specification for electrical indicating instruments.
IS: 10000	: Methods of tests for internal combustion engines.
IS: 10002	: Specifications for performance requirements for constant speed compression ignition (Diesel) engine for general purposes (above 20KW)
IS: 2147	: Degree of protection provided by enclosure for low voltage switchgear and control gear.
IS: 1600	: Code for type testing of constant speed IC engines for general purposes.
IS: 1601	: Performance of constant speed IC engines for general purposes.
ASME Power	: Internal combustion engines.
Test Code PTC-17	: Codes of Diesel Engine Manufacturers Association U.S.A.

1.3.2 The installation work shall conform to Indian Electricity act and Indian Electricity Rules as amended up to the date of installation. The fuel oil installation shall meet all statutory requirements of Govt. of India as amended up to the date of installation. Any approval required from statutory authorities shall be obtained by the contractor. Nothing in this specification shall not be the limiting factor to relieve the contractor of their responsibilities.

1.3.3 The equipment furnished under this specification have to operate in a tropical climate and shall be given tropical and fungicidal treatment as per relevant specification.

### 1.4 ENGINE :

Engine Power (kWm)	: 284
Gross engine Power (HP)	: 386.4
No of Cylinders	: 6
Governor type	: Electronic / CRS



#### 1.4.1 Type :

The diesel engine shall be of stationary type four stroke with In Line or (V) Type Cylinder arrangement, Turbo charged, cooled with radiators

#### 1.4.2 Rating :

- a) BHP rating of the engine shall be such that the DG set can continuously deliver the specified net electrical output while supplying power/driving all electrical and mechanical auxiliaries connected to alternator terminals and engine shaft at specified site conditions & ambient temperature of 45 deg C.
- b) It shall also be capable of satisfactorily driving the alternator at 10% overload at the rated speed for one hour in any period of 12 hours of continuous running. The successful bidder shall have to furnish supporting calculations to arrive at the diesel engine rating.

#### 1.4.3 Speed and Vibration Level :

Speed shall be 1500 revolutions per minute. Speed governor/over speed protection shall be provided. At due running conditions, speed shall be stabilized at plus or minus 2% nominal speed, regardless of load. At transient condition, engine speed shall vary not more than 10% plus or minus. Governor class shall be G3 for normal application unless otherwise specified. The Governor of all DG set shall be of similar characteristics to enable synchronization. The engine vibration level shall be within the permissible limits.

#### 1.4.4 Lubrication :

- a) The engine shall have a closed cycle forced & splash lubricating system with positive oil pressure and a crank chamber for collection/storage of the lubricating oil during circulation. No moving part shall require lubrication by hand or any other external source either prior to the starting of the engine or when it is in operation.
- b) A lubricating oil filter shall be provided for operation under normal conditions for a period of 500 hours without the necessity of its replacement or cleaning.
- c) In case lubricating oil coolers are required they shall be of the water cooled type and shall be supplied as an integral part of the Diesel Generator Set.
- d) Necessary temperature and pressure gauges and other instruments shall be supplied and fitted on the lubrication system.
- e) A lubricating oil level dipstick suitably graduated shall be provided and located in the accessible position.

#### 1.4.5 Fuel System :

- a) The engine shall be capable of running on all types of diesel fuel oil normally available in India.



- b) The fuel consumption of the engine at full, three quarters and half of its rated power output shall be indicated by the Contractor in the bid.
- c) A fuel service tank of capacity as specified in BOQ shall be provided on a suitably fabricated steel platform. The tank shall be complete with level indicator marked in liters, filling inlet with removable screen, an outlet, a drain plug, an air vent and necessary piping. The fuel tank shall be painted with oil resistant paint. Service tank level switches (2 Nos. per tank) for alarm & trip shall also be provided by the bidder. All pipe joints should be brazed/ welded. Digital Fuel level indicator recommended with clear 7 segment display.
- d) A hand pump for pumping the fuel into the fuel service tank together with necessary pipes or tubing shall be provided. The inlet of the pump shall be provided with a 10 meters long armoured hose with suitable filter & nozzle.

#### 1.4.6 Air Intake System :

The diesel engine shall be provided with special dry type air filters having low resistance to air passage, high dust retaining efficiency and provision for easy cleaning. Filters shall be suitable for achieving satisfactory engine operation and ensuring the engine life under tropical humid conditions, with sulfur dioxide and trioxide fumes, abrasive dust and coal particles of 5 to 100 microns present in the atmosphere. The minimum efficiency of filters shall be 90% down to 5 micron size.

1.4.7 Cooling : The diesel engine should be liquid/fluid cooled.

#### 1.4.8 Engine Governor :

The governor shall be G3 type as per ISO 8528 part V. It shall have necessary characteristics to maintain the speed substantially constant even with sudden variation in load. However, a tripping shall be provided if speed exceeds maximum permissible limit. The governor shall be suitable for operation without external power supply.

#### 1.4.9 Turbo Charger :

It shall be of a robust construction, suitable for being driven by engine exhaust having a common shaft for the turbine and blower. It shall draw air from a filter of adequate capacity to suit the requirements of the engine.

#### 1.4.10 Quietness of Operation :

- a) The engine shall be designed to achieve maximum quietness of operation.
- b) Efficient residential type silencer shall be provided for the exhaust as well as the air intake.
- c) Noise level of the set shall not exceed 75 dB at 1 meter distance of the DG Set.

#### 1.4.11 Engine Starting :



- a) Engine starting shall be by electric starting motor complete with manual/automatic starting arrangement. The starter motor shall conform to IS-4722 and shall be of adequate power for its duty and be of inertia or pre- engaged type. The pinion shall positively disengage when the engine starts up or when the motor is de-energised. The engine cranking shall be only from the panel and any engine starting devices etc, that are given as original fitment on the engine by engine manufacturers shall be either removed or padlocking arrangement given for this so that all normal start/stop operations could be done only from the panel whether the set is AMF / Synchronization panel or manual.
- b) Time for Run-up to Speed : From the initial operation of the starting device, the engine shall start, run up to normal speed and be capable of accepting 80% of full load within a maximum time of 25 seconds, and full load within a further 5 seconds.
- c) Duty Cycle / Period of Operation : The set is intended to supply power only during an emergency for essential services and may be idle for long periods except for periodic routine run once in a day for a short time. When there is a total failure of mains power supply, the sets shall be required to operate continuously at full load for a period which at times may exceed even 18 hours at a stretch. It shall also be capable of satisfactorily running at 10% overload at the rated speed for 1 hour in any period of 12 hours of continuous running.
- i) Starting Duty : This DG Set shall withstand and shall be able to take care of starting load of largest machine and other running loads (55% of rated capacity).
- ii) Running Duty : This D G Set shall be capable of running continuously on primary duty of about 100% of its nameplate rating.

#### 1.4.12 Engine Instrumentation :

The following instruments mounted on the instrument panel shall be essentially present as minimum, Engine speed tachometer with service hour counter. - Lube oil pressure gauge - Lube oil temperature gauge - Coolant water temperature gauge. The instrument panel shall be mounted on the engine using rubber dampers for vibration isolation. The gauge dials shall have clear red marking to identify the limiting dangerous levels, 'Zone markings' on the scale to indicate the normal healthy & abnormal operating zones for the parameters concerned. The metering could be either normal electromechanical analogue type or electronic digital type, the latter being preferred as manufacturers fitment only.

#### 1.5 ALTERNATOR :

1.5.1 The alternator shall be brushless type with rotating field and static excitation circuit controlled by field control unit suitably compounded for voltage and load current for a self-excited self-regulated system.

1.5.2 The alternator shall be in Screen Protected Drip Proof (SPDP) IP 23 enclosure, foot mounted with ball and roller bearings on end shields.



1.5.3 The alternator shall conform to IS: 4722 / IS/IEC 60034-1/ BS: 2613 and shall be suitable for tropical conditions.

1.5.4 The alternator shall comply with the following specifications:

Rating	: As specified in the B.O.Q
Voltage	: 415 V
Voltage Regulation	: $\pm 1\%$
Speed	: 1500 RPM.
Frequency	: 50 Hz.
P. F	: 0.8 lag
Waveform Distortion	: No Load $< 1.8\%$ , Non-Distorting Balanced Linear Load $< 5\%$
Enclosure	: IP: 23.
Insulation	: 'H' grade

Unbalanced Load Capability – 25 % Excitation Self excited, self-regulated with brushless system and static voltage control unit suitably compounded for voltage and current to maintain terminal voltage constant at  $\pm 5\%$  at all load for p.f. not less than 0.8. Terminal Box shall be a suitable Rating of cable for terminating DG Sets of rating specified in BOQ with Earthing studs.

1.5.5 Alternator meets IS/IEC 60034 and the relevant section of other international standards such as BS5000, VDE 0530, NEMA MG1-32, IEC 60034-1, CSA C22.2-100, AS1359. Superior voltage waveform form a 2/3 pitch wound stator

## **1.6 DIESEL GENERATOR CONTROL PANEL :**

1.6.1 General :

- The control panel shall be sheet steel enclosed and shall be dust, weather and vermin proof providing a degree of protection of IP-52. Sheet steel used shall be cold rolled and at least 2.00 mm thick and properly braced and stiffened.
  - Control panel shall be provided with hidden hinged door(s) with pad locking arrangement and suitable brackets/channels shall be provided for floor mounting.
  - All doors, removable covers and plates shall be gasketed all around with neoprene gaskets. All accessible live connections shall be shrouded and it shall be possible to change individual switches, fuses, ACBs, MCBs without danger of contact with live metal.
  - All live parts shall be provided with at least phase to phase and phase to earth clearances in air of 30 mm and 25 mm respectively.
  - Adequate interior cabling space and suitable removable cable gland plate shall be provided. Necessary number of cable glands shall be supplied and fitted on to this gland plate. Cable glands shall be screwed on type and made of brass.
  - Two numbers of earthing terminals shall be provided.
  - All sheet steel work shall be degreased, pickled, phosphate and then applied with two coats of finishing powder coating both inside and outside.
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1.6.2 Control of Diesel Generating Sets : a) DG Set shall be capable of being controlled independently. Diesel Generator shall be capable of being stopped manually from remote as well as local. However, interlock shall be provided in the DG local control panel to prevent shutting down operations as long as DG Control circuit breaker is closed

Auto Operation:

Necessary control equipments and system incorporating various function etc. shall be provided to ensure following:-

When mains power is available, the healthiness of this power shall be monitored through a mains voltage monitor. If voltage on the 3 phases are within limits, the monitor will send a closing signal to the mains breaker and mains power will be connected to the load.

If the voltage drops on any phase or on all phases, the monitor shall sense this drop, and if this drop persists for more than a pre-adjusted period of time (say 1 to 60 seconds) a signal is sent to start the DG sets. While at the same time opening the mains supply breaker and disconnecting load from mains as voltage is below acceptable limits.

The Command shall be sent for starting the engine through the starting solenoid. When the engine is healthy, it starts up in a few seconds and the generator develops voltage and when the voltage is developed, this gives a signal to the generator breaker/contactors which closes and connects the diesel generator to the load (three DGs get synchronized first). Simultaneously, it sends a signal to de-energise the engine starting circuit and the starter motor is disengaged. The engine protection circuits for high water temperature and low lubricating oil pressure and engine over speed are also energized

b) Resumption of Supply :

If voltage from mains is resumed, the main voltage monitor will sense this voltage for healthiness, i.e. for maintained correct voltage for a period of time (adjustable up to three minutes) and then send a signal to the panel to stop the engine and to change over the breakers from generator to mains and normal supply is resumed to the load. Provision shall also be made for effecting the change over to normal supply through a selector switch.

c) Failure to Start :

A three-attempt starting facility similar to using two impulse timers and a summation timer for engine shall be provided and if voltage fails to develop within 30 seconds from receiving the first start impulse, the set shall lockout automatically and a visual and audible alarm shall be given in the remote panel. The panel shall receive "DG Trouble Alarm" (potential free contacts to be provided).



### **1.7 ENGINE SAFEGUARDS:**

Safeguards shall be provided and arranged when necessary to stop the engine automatically by the following:

- a) Energizing a solenoid coupled to the stop lever on the fuel injection pump rack.
- b) Deenergising "fuel on" solenoid or
- c) Energizing the "fuel - cut off" solenoid.

The operation of the safeguard shall at the same time give individual warning of the failure by illuminating an appropriate local visual indicator and remote alarm at the generator panel.

The contactors, relays and other devices necessary for signal and control, for above purposes shall be provided at the Generator panel.

At the set at an easily accessible place an "EMERGENCY STOP" mushroom head stay put type Push Button (P.B) shall be provided to stop the set in emergency mode.

The safe guards to "STOP THE SET" shall stop the set irrespective of mode selection of the set viz Auto, Manual or test for following cases, with simultaneous isolation of alternator circuit. Emergency stops P.B's operation.

- a) Over speed.
- b) Low lube oil pressure.
- c) Earth fault or restricted earth fault or differential faults of Alternator.

### **1.8 BATTERY & BATTERY CHARGER :**

#### **1.8.1 Starter Battery :**

a) The battery shall conform to the requirement of IS-1651. Starting battery sets of 12 V, heavy duty high performance approved make/quality shall be provided to enable crank & start the engine even in cold/winter morning conditions. Type/ voltage/AH capacity of the same 20 hour rated discharge period shall be indicated in the offer. The battery shall be capable of performing at least eight (8) normal starts without recharging. Necessary battery calculations shall be furnished at the time of bid.

b) The Battery shall be provided with a good quality MS stand painted with one coat of Zinc Oxide & two coats of acid proof black paint with min 3 mm thick rubber mat below the battery.

c) Batteries shall be of lead container type only and not with PVC molded sealed container so that each individual cell is available for individual monitoring during its lifespan. Each cell shall be provided with an electrolyte filling cap with level floats for easy monitoring of electrolytic level.

d) For each battery system following accessories shall be provided.

1. PVC Funnel - 1 No.





2. Small PVC mugs with handle - 2 Nos. (Red & white colour)
  3. Hydrometer syringe type with float calibrated (not with zero markings only) with one spare float.
  4. Center zero voltmeter good quality with 3V-0-3V scale.
  5. PVC jerry-can white colour with tested quality distilled water, with can clearly marked with engraved PVC inscription plate "Distilled Water".
  6. One tin of petroleum jelly (500 gms).
  7. Painter brush 1" wide - 2 nos.
  8. Hand Fuel Pump - 01 No.
- e) The battery shall be provided with 2 nos. cables, min 1.5 m long heavy duty rubber/PVC insulated cabling with brazed tinned lug at one end and with brazed tinned brass terminal lug at battery end - for connecting batteries to cranking system - with 0.25 m long inter battery connecting cable.
- f) The lugs shall be clearly stamped + or - and positive cable also red sleeved for easy identification.
- g) The batteries shall be supplied fully filled and charged ready to use.

#### 1.8.2 Battery Charging System :

- a) Float rate charging and quick rate charging system shall be provided at the generator panel with appropriate bridge charger system, LC network, rate selector switch and generously rated charging transformer and silicon one rectifier bridge, so that the cranking battery system can be kept fully charged at all times from E.B. supply network with quick charging rate limited to 0.8 times rated discharge current with provision in control transformer and Silicon rectifier present to enable boost charging the battery at 2 times rated discharge current in case of emergencies. To this and in the mode selector switch boost charge position shall be present which however shall be kept disconnected at mode selector switch normally.
- b) Two DC ammeters to clearly indicate float charging current and quick/boost charging current shall be provided with 0-250 or 0-500 mA range and 15-0-15 or 30-0-30 A range respectively.
- c) The float charging ammeter circuit logic shall be so as to bring in circuit only on demand through a P.B. the R.S.S. (Rate selector switch) in its float charging mode to prevent damage to the ammeter.
- d) Dropper resistor network on the load side of the battery charger system shall be provided so that higher charger voltages in quick or boost conditions do not get impressed on the I/L and contactor coils, whose voltage shall remain well within +10% of rated voltage.
- e) Battery charging subsystem shall be designed for continuous operation at cubicle ambient of 50 deg C corresponding to 45 deg C ambient outside and should be designed to operate at 1.5 times rated maximum current corresponding to boost charge current which can reach in practice as high as 2.5 times or 3 times rated discharge current.



f) Any charger dynamo and dynamo charging current network present on the set shall either have to be removed or made in operative so that both for AMF and manual application the cranking battery system is kept charged from the charger at the panels at all times during or shut down periods of the set.

### **1.9 ENGINE EXHAUST :**

The exhaust of DG set shall be routed through the residential type silencer. It is desired to insulate the exhaust duct/chimney with insulation & appropriate support arrangement & adequate trap door with feasibility of cleaning.

### **1.10 SPARE PARTS :**

#### **1.10.1 Mandatory Spare Parts :**

The list of mandatory spares which are considered essential by the Supplier shall be indicated in the bid for successful operation of DG Set for 3 years.

### **1.11 TESTS :**

1.11.1 The alternator of each type and rating shall be type tested for all tests as per IS:4722, IEEE 115 & BS:5000. Required type test certificates shall be furnished for information.

1.11.2 The alternators and the starting motors shall be tested for the routine tests as per IS:4722 and test certificates submitted for acceptance.

1.11.3 The control panels shall be tested/checked for following (but not limited to).

- a) Compliance to drawing, data sheet and this specification.
- b) Check for workmanship, wiring, conformity to functional requirements.
- c) Calibration of instruments, meters C.T., P.T. etc.
- d) H.V. Test
- e) I.R. Test before and after HV test.

1.11.4 The acceptance and routine tests of battery shall be done as per relevant standard.

1.11.5 Battery Charger (as per IS: 4540)

- a) All routine tests as per relevant IS.
- b) Test for ripple factor & regulation
- c) Heat run test (as type test)
- d) Operational and functional tests.



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#### **1.12 SPECIFIC EXCLUSIONS :**

The civil works related to DG foundation is included in the scope of works under this specification. DG Vendor has to make sure OEM's approved or referred civil foundation & structure drawings for genset base.

1.13 NEUTRAL POINT : The winding of the alternator for 320 KVA shall be star-connected and neutral side leads shall be brought out to a separate terminal box.

1.14 ERECTION, TESTING, COMMISSIONING, PERFORMANCE & GUARANTEE TESTS / PROCEDURE AT SITE :

Client shall provide space for genset and its equipment. Contractor shall prepare and submit the following drawings in six sets for approval before commencing the erection for construction work at Site –

- i. Equipment Layout drawing.
- ii. Foundation drawing of each equipment and supervise the foundation casting by another agency to ensure its corrections.
- iii. Bus ducting/Power cable, control cable and earth layout drawing.
- iv. Single line diagram.
- v. AMF / Synchronization Panel details.
- vi. Genset and controller wiring diagram
- vii. Canopy design with frame work details.

The entire work of erection, testing and commissioning of equipment supplied under this package shall be carried out by contractor and performance and guarantee tests to be conducted at site are also included under the scope of this specification. For this purpose the contractor shall depute suitable qualified technical supervisor to site on advance intimation to the Owner along with all special testing equipment required for testing and performance and guarantee tests. The supervisor(s) shall be responsible for the installation, testing, commissioning checks and performance & guarantee tests mentioned in relevant clauses of this volume and the checks recommended by the contractor.

The successful contractor shall submit sufficiently in advance the bio-data of the supervisor giving details of his experience for Owner's approval.

The vendor shall ensure that the equipment supplied by him are installed in a neat workmanlike manner such that they are levelled, properly aligned and well oriented. The tolerances shall be established in Contractors drawings and/or as stipulated by the Owner. The canopy of the Genset shall be strong and Waterproof (extra coating of any if required, has to specify while bidding)



All special tools and tackles and spares required for erection, testing and commissioning of equipment shall be supplied by the contractor. The bid shall include a list of these special tools, tackles and spares along with their item wise prices. The total cost for these tools, tackles and spares shall be included in the bid price.

Erection, testing and commissioning manuals and procedures shall be supplied, prior to dispatch of the equipment.

The contractor shall ensure that the drawings, instruction and recommendations are correctly followed while handling, setting, testing and commissioning the equipment.

#### **1.14.1 Commissioning Check Tests/Performance and Guarantee Test :**

In addition to the checks and tests recommended by the manufacturer, the contractor shall supervise the following acceptance tests to be carried out on each set.

##### **Load Test :**

The engine shall be given a test run for a period of at least 13 hours depending upon the actual power factor of the load and set shall be subjected to the maximum achievable load without exceeding the engine or alternator capacity.

This full load test is to be followed immediately by a 10% overload run for one hour. The performance of the engine, alternator and exciter shall be satisfactory at the end of this overload run. All the arrangements of factory visits of TIFR engineers - three engineers including stay-if required, shall be in the scope of DG vendor. At the end of the full load run, and again at the end of the overload run, tests for temperature rise and insulation resistance of the alternator as specified shall be taken.

During the load test half hourly records of the following shall be taken:

- a) Ambient temperature
- b) Exhaust temp. when the exhaust thermometer is fitted.
- c) Lubricating oil temperature when an oil cooler is fitted.
- d) Lubricating oil pressure
- e) Speed
- f) Voltage, wattage and current output.
- g) Oil tank level
- h) Stored diesel oil temperature

##### **Regulation Test :**



The automatic and manual regulation of the alternator load at half and full rated load shall be tested for a nominal voltage of 240 volts, between phase to neutral and at 0.8 p.f. to verify the requirements of voltage and frequency variation as per IS:4722.

Speed and Governing:

The speed of the engine shall be verified to ensure that it conforms to the requirement of BS:5514.

Vibrations :

The vibrations shall be measured during full load test as well as during the overload test and the limit shall be limited to 250 microns.

Check of Fuel Consumption : A check of the fuel consumption shall be made throughout the test run of full load and overload.

Insulation Resistance of Wiring :

On completion of the engine tests, the insulation of each unit of local wiring in the control cubicles and other components of the engine set, shall be tested with a 500 V insulation tester.

The insulation resistance shall not be less than one mega-ohm. between wires in a cable and engine set frame of cable sheath. Test will be done before and after the running of Genset

Functional Tests :

- Protective equipment on the engine against excessive cylinder temperature and low lubrication oil pressure.
- Type of starting provided for the engine.
- Pilot and fault indication lamps.

### **9.0 ACOUSTIC ENCLOSURE :**

The framework shall be made out of suitable sheet steel with anti-corrosive paint. Specially designed acoustic doors shall be provided with glass windows for visibility of the DG sets from outside. These doors shall have a proper sealing arrangement to ensure that there is no sound leakage.

The enclosure shall be provided with suitable ventilating/exhaust fans for fresh air & hot air exhaust with all accessories required. The ventilation system shall be designed so that the temperature rise in the acoustic enclosure shall be less than 15 Deg C above ambient.

The enclosure shall be supplied with necessary anti vibration pads between DG & Enclosure and also between enclosure & foundation.

Noise level – 75dB right around measured at a distance of 1 meter from the enclosure.



#### **10.0 EXECUTION :**

Vendor shall give necessary inputs for designing the foundations & shall be responsible for design, erection shall happen after completion of foundation works (done by other agencies). Vendor shall coordinate with other agencies like electrical contractors, civil contractors etc.

Further to erection, testing and commissioning of the DGs, the termination of cables at DGs, Between DGs and Main LT panel end shall be done by the main electrical contractor. Calibration of CTs, approval from statutory authorities like electrical inspectorate, PCB etc shall be the responsibility of the DG supplier. DG supplier shall coordinate with main electrical contractor for necessary control & power cable termination.

#### **11.0 Auto Synchronizing & Auto Load Sharing Panel for 3 x 320 KVA DG Sets :**

The panel includes Motorized MCCB FP 630A 36 KA with O/C, S/C & E/F as Incomer 1 to 3 from the DG set # 1 to 3. The ACB should be equipped with U/V, O/C, S/C and E/F protection. R-Y-B indication, ON, OFF, Trip indication, and Load Manager for measurement of ampere, voltage, Kw, kwh and frequency, and Max Demand with PC Compatible port. Microprocessor- based Relay with AMF, Auto Synchronizing & Auto Load Sharing and Auto shut off facility. It should have capability to manually synchronize the DG's. Load Manager for measurement of ampere, voltage, Kw, KWh and frequency, and Max Demand with RS 232 / RS 485 port.

The panel should have the following feeders:

3 Nos. 630 Amp FP MCCB 50 kA with ON/OFF/TRIP indication

01 No. 1600 A, 50 kA FP ACB, with ON/OFF/TRIP indication

Busbar 1600 Amp, 50 kA

The panel shall be vermin proof and dustproof, having chemical surface treatment and finishing shall be of 2-coats of synthetic enamel, RAL – 7032

All internal wiring shall be of FRLS 1.1 KV grade, PVC wires. CT shorting links are to be provided for the Ammeter and protection circuit.

A) GENERAL : The switchboard shall be metal clad, totally enclosed, rigid, compartmentalized design, floor mounting, air insulated, extensible cubicle type for use on low voltage power, 415V, 3 phase 4 wire, 50 Hz system. The equipment shall be designed for operation in high ambient temperature and high humidity tropical atmospheric conditions. Means shall be provided to facilitate ease of inspection, cleaning and repairs for use in installations where continuity of operation is of prime importance.

#### **STANDARDS :**

Following equipments shall conform to the requirements as per the latest revisions of



the following standards: -

1. Air Circuit Breaker (ACB) : IS 13937- 1.2 / IEC 947 - 1.2
2. Moulded Case Circuit Breaker (MCCB) : IS 13947 - 1.2/ IEC 947 - 1,2
3. Contactors : IS 13947-1,4
4. Miniature Circuit Breaker (MCB) : IS 8828- /IEC898
5. Residual Current Circuit Breaker (RCCB) : IS 12640 - / IEC 1008
6. HRC fuse link : IS 9224 and BS 8:8
7. Current Transformer : IS 2705 and IEC 185
8. Potential Transformer : IS 3156
9. Relay -(For Static Relays) : IS 3231 and IS 8686
10. Indicating Instrument : IS 1248

#### B) TYPE AND CONSTRUCTION

The switchboard shall be metal clad, totally enclosed, rigid, compartmentalized design, floor mounting, air insulated, extensible cubicle type, CNC fabricated for use on medium voltage power, 3 phase 4 wire 50Hz system. The overall construction shall meet Form-4 constructional requirements.

#### C) GENERAL CONSTRUCTIONAL FEATURES:

The switchboard shall be:

- a) CRCA-Sheet steel enclosed, indoor floor mounted free-standing cubicle type & CNC fabricated.
- b) Made up of the requisite vertical sections which when coupled together shall form continuous switchboards.
- c) Dust, vermin and damp proof and enclosure protection not less than IP 42 for indoor & IP55 for outdoor applications and IP:32 for Battery Chargers or as specified elsewhere.
- d) Each feeder/instrument compartment shall be provided with a hinged door interlocked with ACB/MCCB inside the compartment such that the door can only be opened when ACB/ in off position.
- e) Readily extendable on either side by the addition of vertical sections after removal of the end covers.
- f) Switchboards shall have access to the feeders, bus bars, cable termination, cable alley, etc. as required.
- g) All CTs for metering/protection shall be mounted in respective feeder compartments either in front or on the rear side of the same compartment for easy maintenance without disturbing other feeders.



- h) Mounting of any metering OR instrumentation equipment in the Bus chamber is not envisaged.
- i) All CT wiring shall be done with a CT terminal block with shorting facility mounted in the metering compartment.
- j) Wherever control wiring is done between the shipping sections, terminal blocks shall be provided on both sides of shipping sections with TB diagram pasted near to the TBs.
- k) The total height of the panel shall not be more than 2200mm unless otherwise specified and maximum height of switch operating handle shall not be more than 1800mm from FFL. The maximum shipping section shall be of 2000mm width. The total depth of the panel shall be adequate to cater for proper cabling space.
- l) Sheet thickness shall be as below
- Main frame : 2.5/3mm
  - Doors : 2mm
  - Covers/partitions : 1.6mm
  - Gland plate : 3mm
- Wherever single core cables are used, 3mm thick aluminum gland plate shall be provided. All sheet steel work forming the exterior of switchboards shall be smoothly finished, levelled and free from flaws. The corners should be rounded.
- m) The Components in the switchboards shall be so arranged as to facilitate ease of operation and maintenance and at the same time to ensure necessary degree of safety.
- n) Components forming part of the switchboards shall have the following minimum clearances:
- Between phases - 30mm
  - Between phases and neutral - 25mm
  - Between phases and earth - 20mm
  - Between neutral and earth - 20mm
- Creepage distances shall comply with those specified in relevant standards.
- o) All insulating material used in the construction of the equipment shall be of non-hygroscopic material treated to withstand the effects of high humidity, high temperature and tropical ambient service conditions.





p) Functional units such as circuit breakers, fuse switches, ACBs, etc. shall be arranged in multi tier formation except that not more than two air circuit breakers shall be housed in a single vertical section.

q) Metallic/insulated shrouding shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with Main bus-bars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.

r) Cable terminations of one functional unit, when working on those of adjacent units/units.

s) All covers providing access to live power equipment/circuits shall be provided with tool operated fasteners to prevent unauthorized access.

t) Provision shall be made for permanently earthing the frames and other metal parts of the switchgear by two independent distinct connections.

u) Thickness tolerance for sheets shall be as applicable in relevant IS.

v) All capacitor control panels shall be of compartmentalized design. All capacitors & reactors shall have individual compartments. Exhaust fans shall be provided for ventilation purpose.

w) The complete panel shall be designed such that it's rating is as per SLD without derating considering ambient temperature & temperature rise as per IS/IEC. De-rating of ACBs/ACBs or the whole panel shall not be accepted. Panel shall be provided with necessary ventilation arrangements to meet the above requirement.

(D) EACH VERTICAL SECTION SHALL COMPRISE:

a) A front framed structure of rolled/folded CRCA sheet steel angle section rigidly bolted together. This structure shall house the components contributing to the major weight of the equipment such as circuit breaker cassettes, fuse switch units, main horizontal bus bars, vertical risers and other front mounted accessories.

b) The structure shall be mounted on a rigid base frame of folded CRCA sheet steel of minimum 6 mm thickness and 100 mm height or ISMC100. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.



c) A cable chamber housing the cable end connections and power/control cable terminations.

The design shall ensure generous availability of space for ease of installation and maintenance of cabling and adequate safety for working in one vertical / horizontal section without coming into accidental contact with live parts of the adjacent section.

d) A cover plate at the top of the vertical section, provided with a ventilating hood wherever necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1mm diameter perforations to prevent entry of vermin.

e) Front and rear doors fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors generous overlap shall be ensured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust.

(E) METAL TREATMENT AND FINISH :

a) After fabrication the panel shall undergo 7 tank treatment/sand blasting for removing grease, Rust etc. The panel shall be coated with zinc chromate primer(Applicable for outdoor panels).

b) After coating of primer, the panel shall be coated with Epoxy based paint (powder coating/spray paint). Paint shade shall be as specified by the client/consultant during drawing approval.

(F) BUS BARS :

a) The bus bars shall be made of high conductivity, Electrical grade Aluminum or copper (As specified in SLD), suitable for 415 volts, 3 phase 4 wires 50 Hz,

b) The bus bars shall be suitably supported with non-hygroscopic supports to provide a fault withstand capacity as specified.

c) High tensile (8.8 grade) bolts and spring washers shall be provided at all bus bar joints.

d) Fish plates of equal type and size shall be used at all joints.

e) The bus bars shall have uniform cross section throughout and shall be capable of carrying the rated current at 415V continuously. The bus bars shall be designed to withstand a temperature rise of 40 Deg. C above the ambient temp. of 50 deg. C. A current density (Amp/Sq.mm) shall not exceed 1 A/sq.mm for copper & 0.8 A/Sq.mm for Aluminium.



- f) The neutral bus bars shall have a continuous rating of at least 50% of the phase bus bars unless otherwise mentioned.
- g) Bus bars shall be fully sleeved using heat shrink PVC sleeves appropriately color coded to identify different phases and neutral bars.
- h) All lighting & raw power panels/SMSBs shall be provided with neutral bus rated same as the size of Phase Busbars unless otherwise specified in SLD.
- i) MCCB/ACBs of rating 200A & above rating shall have copper spreaders on terminals & then connected to main busbars.
- j) All panels shall be provided with aluminium earth bus, which shall run throughout the length of switch board at top or bottom as required. Following size of earth bus shall be provided as per the switchboard rating:

PANEL RATING	Al. EARTH BUS SIZE
Up to 100A	- 25x3mm
250A	- 25x6mm
315A	- 25x10mm
400 to 630A	- 30x10mm
800 to 1000A	- 50x6mm
1250 to 2000A	- 50x10mm
2500 to 3200A	- 60x10mm
4000A	- 100x10mm

**(G) POWER/CONTROL WIRING:**

All control wiring shall be carried out with 1100/660 V grade single core PVC-FRLS cable having stranded copper conductors with minimum cross section of 1.5 Sq.mm for potential & control circuits and 2.5 Sq.mm for current transformer circuits. Control wiring for analog, digital inputs/outputs shall be done with 1.5/1 Sq.mm screened copper cables. All power cables shall be a minimum cross section of 4 Sq.mm.

The colour coding of cables shall be as below:

- a) Power up to 25Sq.mm : Red/Yellow/Blue/black  
b) CT & PT : Red/Yellow/Blue/black  
c) Control AC : Black  
d) Control DC : Gray  
e) Analog/digital circuits : Red/black-screened



Wiring shall be neatly bunched, adequately supported and properly routed to allow for easy access and maintenance. Wires shall be identified by numbered ferrules at each end. The ferrules shall be of ring type and of non-deteriorating material. They shall be firmly located on each termination so as to prevent free movement. All control circuit fuses/MCBs shall be mounted in front of the panel and shall be easily accessible. All CT wiring shall be done with CT terminal block with Shorting facility mounted in the metering compartment.

Wherever control wiring is done between the shipping sections, terminal blocks shall be provided on both sides of shipping sections with a TB diagram pasted near the TBs. Control wiring for analog, digital inputs/outputs shall be done with Screened cables & routed separately to avoid EMI.

**(H) TERMINAL BLOCKS :**

Terminal blocks shall be of 500 Volts grade and of stud/screw type. Terminal blocks shall have a minimum current rating of 10 Amps and shall be shrouded. Provisions shall be made for label inscriptions. At least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks. Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities with disconnecting type TBs. Also current transformer secondary leads shall be provided with Terminal block with short circuiting and earthing facilities.

Terminal blocks for power feeders shall be of stud type with bolts & nuts.

There shall be a minimum clearance of 250mm between the first row of terminal blocks and the associated cable gland plate. Also, the clearance between two rows of terminal blocks shall be a minimum of 150mm.

**(I) CABLE TERMINATIONS :**

a) Cable entries and terminals shall be provided in the switch board to suit the number, type and size of aluminium conductor power cables and copper conductor control cable specified in the detailed specifications.

b) Provision shall be made for top or bottom entry of cables as required. Generous size of cabling chambers shall be provided with the position of cable gland and terminals such that cables can be easily and safely terminated.



c) Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit.

e) Cable risers shall be adequately supported to withstand the effects of rated short circuit currents without damage and without causing secondary faults.

f) Sufficient height shall be provided between busbar & gland plate in case higher size cable & more number of runs. Min. cable termination heights from gland plate shall be as below:

Up to 35 Sq.mm	: 200mm
50 to 95 Sq.mm	: 250mm
120 to 185 Sq.mm	: 350mm
240 to 400 Sq.mm	: 550-600mm

## 12.0 INSTRUMENT TRANSFORMERS :

### A) CURRENT TRANSFORMERS :

a) Current transformer shall comply with the requirements of IS 2705. They shall have ratios, outputs and accuracy as specified/required. All CT's shall be of resin cast type unless otherwise specifically called for.

b) All CT's shall be of bar type primary or suitable for the cable given type and size.

c) For all the CT's suitable type and size clamps are to be supplied for mounting in the switchboards.

d) Polarities and terminal markings of primary and secondary shall be clearly marked on all CT's.

e) Specifications for CT's :

1. Current Ratios	:
i. Primary	: As per SLD
ii. Secondary	: 5A
2.Type	: Resin Cast
3.Class	: PS-REF Protection 5P10-O/C & E/F Protection Class 1 for metering
4. System Voltage	: 440 Volts

### B) POTENTIAL TRANSFORMER :

a) All the Potential Transformers shall comply with the requirements of IS 3156 latest edition. All PT's shall be resin cast type and shall have Voltage ratios, output and accuracy class as specified in



SLD/Data Sheet. b) All PT's shall be single phase, dry type suitable for mounting inside the panel/cubicles. Clamps / brackets / supports required for the mounting shall be supplied along with PT.

c) Polarities and Terminal markings shall be clearly marked in all PT's.

d) Name plate indicating, voltage ratio, burden, accuracy class, type, Sr. No. Make and Model etc., shall be provided.

e) A common earth terminal for earthing of core, bolts, clamps (noncurrent carrying metal parts) etc., shall be provided.

### **13.0 BREAKERS :**

#### **13.1 AIR CIRCUIT BREAKERS :**

##### **A) GENERAL:**

The ACBs shall conform to IS 13947-1 / IEC 60947-1 for general rules and IS 13947- 2/IEC 60947 2 for Circuit Breakers. The ACBs shall be suitable for 3 phase 415 Volts.

All the breakers shall have topicalization as a standard feature. ACBs shall meet the following minimum parameters

Rated operational Voltage	: 690V
Rated insulation Voltage	: 1000V
Rated impulse withstand Voltage	: 9kV
No. of mechanical operations	: 25,000(up to 2000A) 15,000(above 2000A, up to 4000A)
No. of electrical operations	: 10,000(up to 2000A) 5,000(above 2000A, up to 4000A)

##### **B) CONSTRUCTION:**

The Breaker shall be suitable for rear and vertical mounting and line load reversibility. All ACBs shall be drawn out type & shall be with service-test-isolated positions.

##### **C) CONTROL UNITS:**

The Control Units shall be housed in a separate enclosure and there shall be total insulation of the control unit with respect to the power unit.

The Control Unit shall be of Microprocessor type & suitable to provide short circuit, overload and earth fault protection.



The setting range of the short circuit protection shall be from 3 to 9 x In and 5 to 15 x In.  
The overload settings shall be adjustable from 0.4 to 1.0 times the rated current.

The breaker shall provide Earth fault protection from 0.2 to 0.7 times rated current.

**D) ACCESSORIES:**

The connection for the auxiliary shall be accessible from the front.

ACB shall be provided with following accessories, in addition to the item specified in Bill of Quantities. Further these devices shall be fittable at site from the front and common for all ratings.

- Under Voltage trip coil.
- Shunt trip coil.
- Closing coil,
- 4NO + 4NC auxiliary switches.
- Fault indicator/Reset unit.
- Pad lock

**E) INTERLOCKING:**

ACBs shall be provided with the following interlocking: -

- Pad lock to prevent unnecessary manipulations of the breaker.
- Electrical interlock shall be done by using breaker aux. contacts only

**F) BREAKING CAPACITY:**

The ACB shall have a minimum service breaking capacity of 50 kA. Preferably Ics shall be equal to ultimate breaking capacity Icu or it shall be rated as specified in SLD. Original test certificate of the ACB as per the IS shall be provided on request.

**13.2 ACB / MOULDED CASE CIRCUIT BREAKER**

The Moulded Case Circuit Breaker shall be incorporated in the switchboard wherever specified and shall be of the current limiting type. ACB shall conform to IS 2516, IS 13947-1/ IEC 947-1 (part I & II / section 1) 1977 for general rules. It should be suitable for Horizontal and Vertical mounting and line load reversibility. ACB shall be suitable either for Single Phase AC 230V Or Three Phase 415V. The MCCB/ACB shall be available in four pole versions for neutral isolation. It shall have tropicalisation as a standard feature. The ACB/MCCB cover and case shall be made of high strength heat-resistant and flame retardant thermosetting insulating material. The operating handle shall be quick make, quick break, trip - free type. The operating handle shall have suitable 'ON' 'OFF' 'TRIPPED' indicators and in order to ensure suitability for isolation complying with IS 13947 2/IEC 947-2, the operating mechanism shall be designed such that the toggle or the handle can only be in 'OFF' position, if the main contacts are actually separated.



**A) ACCESSORIES:**

ACB shall be designed to have following accessories and it shall be fittable at site.

- 1) Under voltage trip
- 2) Shunt trip
- 3) Alarm switch
- 4) Auxiliary switch

**B) INTERLOCKING:**

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

- a) Handle (Pad lock) interlock to prevent unnecessary manipulations of the breaker.
- b) Door interlock to prevent the door being opened when the breaker is in ON position.
- c) The interlocking defeating device to open the door even if the breaker is in ON position, In addition to the above, all other features indicated in the Bill of Quantities/SLD shall also be provided.

**C) BREAKING CAPACITY:**

Short time with-standing capacities & breaking capacities for different ratings of ACBs shall be as specified in the SLD.

Preferably Ics shall be equal to Icu or all breaking capacities shall be considered for Ics.

**D) RELEASES:**

Unless otherwise specified all ACBs up to 250A (including 250A) shall be provided with thermal magnetic releases & all ACBs of rating 315A & above rating shall be provided with Microprocessor releases.

All ACBs with Thermal magnetic releases shall be provided with adjustable overload of 70/80-100% & fixed short circuit releases.

All ACBs with Microprocessor releases shall be provided with adjustable overload of 50- 100% & adjustable short circuit releases.

Wherever earth fault module is required it shall be inbuilt with other releases, i.e. separate module for E/F is not recommended.

**14.0 AMF Relay :**

AMF Relay having numeric digital controller technology, Alphanumeric LCD displays with keypad having supervision of 3 phase mains voltages & DG voltages, remote starting & stopping facilities, 3 operating modes i.e automatic, remote, manual, password protection & able to start the stand by generators in case of main failures. The relay should at least following features:





- 1) Display of voltage, frequency of mains parameters
- 2) Display of generator parameters like V, Hz, Speed, Run hours
- 3) Measurement of load current
- 4) Site name & no. is programmable
- 5) Digital inputs, 6 relay outputs, 11 LEDs
- 6) Last 3 faults & events record
- 7) Internal interlock for EB & DG breaker for fail safe operation
- 8) Wide array of time circuits for start delay, stop delay, mains restoration, recooling etc.
- 9) Full engine safety function like :
  - 9.1) Over / Under frequency, speed indication, shutdown
  - 9.2) DG fault like fail to start, fail to stop & low battery
  - 9.3) Overload protection & selectable overload setting
  - 9.4) Protection against undesired conditions monitored via digital inputs
  - 9.5) Protection against engine faults like LLOP, SCT, Low fuel & over speed, phase reversal etc

#### 15.0 Synchronization Controller Relay for Generators:

The Synchronization Controller relay should have programmable atleast 10 digital inputs, 18 analogue input, 8 output relays, 2 analogue output & communication port like RS 232, RS 485, USB & Bus communication & suitable converter for BACnet bus. It may also be indicated whether Stand Alone SNMP protocol-based communication interface is available for the generator control panel. The controller shall be able to control/monitor

#### **following alarms of engine & alternator:**

- 1) Engine temperature warning (analog sensor)
- 2) High engine temperature alarm (analog sensor)
- 3) Temperature analog sensor fault
- 4) High engine temperature alarm (digital sensor)
- 5) Oil pressure warning (analog sensor)
- 6) Low oil pressure alarm (analog sensor)
- 7) Oil pressure analog sensor fault
- 8) Low oil pressure alarm (digital sensor)
- 9) Temperature digital sensor fault
- 10) Fuel level warning (analog sensor)
- 11) Low fuel level alarm (analog sensor)
- 12) Fuel level analog sensor fault
- 13) Low fuel level alarm (digital sensor)
- 14) High battery voltage
- 15) Low battery voltage
- 16) Faulty battery



- 17) Battery charger alternator fault
- 18) Low engine speed
- 19) High engine speed
- 20) Starting failure
- 21) Emergency button
- 22) Mechanical failure
- 23) Stop failure
- 24) Low generator frequency
- 25) High generator frequency
- 26) Low generator voltage
- 27) High generator voltage
- 28) Generator overload
- 29) External generator protection
- 30) Generator wrong phases sequence
- 31) Mains wrong phases sequence
- 32) Wrong frequency setting
- 33) Generator contactor fault
- 34) Mains contactor fault
- 35) Internal system error
- 36) Expired rental hours
- 37) Low water level in the radiator
- 38) Ambient temperature too high
- 39) Ambient temperature too low

**15.1 Controller shall be able to manage at least following functions:**

- 1) Mains/Generator synchronization
  - 2) Generators synchronization without limits
  - 3) Bus communication
  - 4) TCP/IP static address, for Ethernet/LAN control
  - 5) Insulated analog output for voltage regulator +/-5V
  - 6) Insulated analog output for RPM regulator 0-10V or 10-0V
  - 7) Insulated voltage inputs 500Vac or 100Vac
  - 8) Insulated inputs
  - 9) Current measurements on Dead Bus
  - 10) Active and reactive power sharing
  - 11) Synchronization between sources with different powers
  - 12) Quick control by display of voltage and current parameters
  - 13) Sharing on mains when the mains voltage returns
  - 14) Synchroscope and "zero voltmeter" for manual operation
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- 15) Self-learning function for quick and auto managed synchronizing
- 16) Management of mixed systems with several mains and several generators
- 17) Complete remote-control system,
- 16. Cables

### 1) Codes And Standards

The design, material, construction, manufacture, inspection, testing and performance of LV power cables supplied shall comply with all currently applicable statutes, regulations and safety codes in the locality where the material will be installed. Nothing in this specification shall be construed to relieve the BIDDER of his responsibility. Where no standards are available, the supply items shall be of good quality and workmanship and backed by test results. Any supply items which are bought out by the BIDDER shall be procured from MANUFACTURERS approved by the PURCHASER.

The cables covered by this specification, unless otherwise stated, shall be designed in accordance with the latest editions of the following standards.

- IS 7098 -1988 (Part I) : Specification for XLPE insulated electrical cables
- IS 8130-1984 : Specification for conductors for insulated electric cables and flexible cords
- IS 5831-1984 : Specification for PVC insulation and sheath of electric cables
- IS 3975-1988 : Specification for mild steel wires, strips and tapes for armouring cables
- IS 694 : PVC insulated cables for wiring (1100V)

The cable manufacturing company should have been qualified for ISO-9001/2.

### 2) Design And Manufacturing Requirements Following are the technical particulars for the cables:

- Power supply : 415V, 3 phase, 4 wire,
- Grounded system : Solidly grounded.
- System fault level : 35 MVA (50 KA) symmetrical.
- Type of cable : Aluminum conductor, Cu conductors, XLPE insulated, armoured power cables
- Voltage grade : 1100 Volts
- No. of cores : 3 ½ core; 1 core

The cables supplied under this specification shall be aluminum/copper conductor, XLPE insulated, FRLS PVC sheathed and steel wire armoured cables. Adequate insulation shall be provided for the cables to operate continuously at the specified voltage with a high degree of safety and reliability throughout the life of the cables.

The insulating and sheathing materials shall be high quality XLPE and PVC based compound respectively.



The armoured cables shall conform to the following construction: XLPE insulated stranded & shaped aluminium conductor cable (as the case may be) with cores suitably laid up, extruded with inner sheath of unvulcanised rubber or thermo-plastic material compatible with insulating material, round steel wire armoured and overall extruded with general purpose FRLS PVC outer sheath, black conforming to IS: 7098 (Part- I):1988, 1.1KV grade.

The insulating material for power cables shall be cross linked polyethylene (XLPE) compound as per IS-7098 (Part-I/II)-1988. Gas curing process is desirable for XLPE insulation. The average thickness of insulation shall not be less than the values specified in Table-3 of IS-7098 (Part-I)-1988. The cores shall be identified by the following colour schedule:  
3 & 1/2 core: Red, yellow, blue, black, reduced neutral core being black.

### 3) Inspection And Testing

The BIDDER shall carry out all the shop tests and inspections specified in the following clauses in addition to those normally carried out by him. For Material not covered by any code or specifically mentioned in this specification, the tests are to be agreed with the PURCHASER. All type tests, acceptance tests, routine tests and physical tests for LV power Cables, shall be carried out as per relevant Indian and International standards like IEEE, IEC, ASTM etc, If the MANUFACTURER has already conducted the type tests, then the type test certificates shall be submitted along with his offer.

All the tests specified below shall be carried out in accordance with relevant Indian Standards by the manufacturer in the presence of the purchaser's representative. If the cable fails to pass the test specified, the purchaser shall have the option to reject it.

#### 3.1 Routine Tests

The following routine tests shall be carried out on each and every length of the cable in the presence of the purchaser's representative at the manufacturer's works.

- i) Resistance test for Aluminium/copper
- ii) High voltage test.

#### 3.2 Type tests

The following type tests shall be carried out on samples taken out from the production lot.

- i. Tensile test for conductor
  - ii. Wrapping test for conductor
  - iii. Resistance test for conductor.
  - iv. Test for thickness of insulation and sheath.
  - v. Physical test for insulation and sheath.
  - vi. Fire resistance test.
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- vii. Insulation resistance test.
- viii. High voltage test (water immersion test).
- ix. Tests on armour wires.

### 3.3 Acceptance tests

- i. Tensile test (for aluminum).
- ii. Wrapping test (for aluminum).
- iii. Conductor resistance test.
- iv. Test for thickness of insulation and sheath.
- v. High voltage test.
- vi. Insulation resistance test.

### 3.4 FRLS tests:

- i. Critical Oxygen index as per ASDM-D 2863
- ii. Temperature index as per ASTM-D 2863 & BICC Handbook Chp. No.6
- iii. Smoke Density (Light Transmission) as per ASTM –D 2843
- iv. Acid gas generation as per IEC 754-1
- v. Flammability tests as per IEC 332-1 and IS 694:1990

#### • Optional Tests

- i) Cold bend test for outer sheath.
- ii) Cold impact test for outer sheath.

The purchaser at his option may waive all or any of the type tests, provided type test certificate carried out on essentially identical cable are furnished by the manufacturer.

### 4) Guarantee :

The cable shall be guaranteed against any type of defects and for trouble free operation conforming to this specification for a period of at least 12 months from the date of commissioning or 18 months from the date of despatch from the supplier's works, whichever is earlier. The following performance characteristics of cables shall be guaranteed at the maximum continuous rating, when operating under the specified operating conditions:

- i) Voltage drops.
- ii) Maximum current rating.
- iii) Operating conductor temperature.
- iv) Resistance at 20 deg C.

### 5) Identification Marks



The manufacturer shall be identified throughout the length of the cable by the manufacturer's name or trademark indented or embossed on the outer sheath of the cable. The cable shall be identified as per clause 17 of IS:1554 (Part- I)-1988.

### 17. Earthing System

Maintenance free earthing shall be carried out in accordance with Indian Electricity Rules and Regulations amended till date and also the Earth electrodes shall be provided in conformity with BIS 3043/ BS 7430 of the latest version expecting the specified values detailed herein. The earth electrodes shall be of high tensile low carbon steel circular rods, molecularly bonded copper or clad copper on the outer surface 25 mm dia having at least 250-micron copper plating and not less than 3.0 m length and shall be driven to a depth in the ground below the ground level and 3 meters away from any other earth electrodes or as per latest BIS 3043. The premixed power set carbon based backfill compound shall be poured in the bore with water and re- close the bore (Pre Approval needed from client). Earthing shall be covered with an RCC enclosure of size 400mm (Length) x 400mm (Breadth) x 100 mm (Thick).

### COMMON TECHNICAL SPECIFICATIONS FOR MV PANELS:

Design, Manufacture, Supply, Installation, Testing & Commissioning of floor mounting MV Panel shall be front operated, front access, extensible type, cubicle panel totally enclosed, dust and vermin proof with IP- 42 protection with hinged and lockable doors. The panel shall be fabricated from 2 mm thick CRCA sheets including interconnections, tinned copper strip /Wire crimping lugs, bonding to earth suitable for use at 415 V, 3 phase 4 wire 50 Hz system, and to withstand a fault level of 50kA as specified, symmetrical at 415 V complete as per specifications, as required & as below. All switchboards shall have provision for the entry of cables from the top/bottom as required. All live accessible parts shall be shrouded and all equipment shall be finger-touch proof. The bus bars shall be insulated with heat-shrinkable sleeves. SMC/DMC shrouds and busbar supports shall be used.

### Incomers:-

- a)ACB /MCCBS with all protections & required accessories and adequate size tinned Cu. neutral link. ACBs shall be manual draw-out type with safeties and Electrical & Mechanical interlocks (One is for EB supply & One is for DG Supply)
- b) 1 set of RYB indication lamps with 6A MCBs
- c) 3 nos suitable rating ...../5 A ratio, class-I, 15VA cast resin current transformers
- d) 1 no 3 phase 4 wire, 240 V (L-N) 5 A, Class-I Intelligent Multifunction panel meter to read & record the current, Voltage, PF, KW, KVA, KWH, KVAH, etc & flush mounted, 96 sq. mm, similar to Schneider Energy Meters, EM6400 or equivalent approved.
- e) Light & Space Heater with thermostat with adjustable knob to be provided in Cable Chamber



f) All ACB/MCCB /MCB with microprocessor release and adequate size tinned Cu. neutral link with safeties and Mechanical interlocks

**Outgoing Feeders:-**

a) All ACB/MCCB /MCB with microprocessor release and adequate size tinned Cu. neutral link with safeties and Mechanical interlocks

b) All ACB/MCCB /MCB as per details mentioned in BOQ

**Bus bar:**

Suitable TPN tinned copper bus bar having a maximum current density of 800 A/sq.inch to withstand a symmetrical fault level of 50kA at 415 V. The neutral bus bar shall have 100% capacity

**Note:**

- 1) All G.A. SLD & fabrication drawings shall be approved from the E.I.C.  
Final painting of panel to be done with powder coating. Necessary touch up may be done at site, in case if required. The scope includes all tests as specified in department's specification, relevant I.S. and as required by E.I.C, shall have to be performed at factory & at installation site and shall be included in the quoted rate.
  - 2) The equipment shall be designed to ensure complete safety during operation inspection, connection of cables etc.
  - 3) Control wires shall be of 1.1 KV 1.5 / 2.5 sq.mm FRLS copper wires and neatly bunched separately and adequately supported so as to prevent sagging and strain on termination.
  - 4) A minimum of 10% spare terminals shall be provided on each terminal block.
  - 5) All non- current carrying metallic parts of the equipment shall be earthed with copper flexible wire / strip of adequate size.
  - 6) All concealed hinged doors and covers shall be provided with suitable flexible earthing connections.
  - 7) The size of the earth bus chosen shall be to withstand full fault current of 50kA, as specified at 415V.
  - 8) Earth bus bars shall be supported at suitable intervals.
  - 9) All the current transformers are resin cast type class-I only.
  - 10) Scope includes cable end boxes, reverse entry boxes as per site conditions and extension of bus bars as required for terminating the number of cables as per schematic diagram.
  - 11) G.A. & detailed fabrication drawing and short circuit forces and temp rise calculation for panel including the panel fabricator shall be submitted for dept approval.
  - 12) Bimetallic washers to be used for all aluminum to copper joints wherever required & it shall be of approved make & quality wherever required.
  - 13) Indication lamp shall be cluster heavy duty type LED
-



- 14) All Outgoing feeders shall have 'ON', 'OFF', 'Auto trip'.
- 15) All neutral shall be an isolatable type.
- 16) All Busbars and inter connections for incoming & outgoing should be with copper bus bars only.
- 17) Vertical bus rating shall be based on outgoing feeders.
- 18) All ACB / MCCBs shall have Ics = Icu 100% for all breakers
- 19) Cubicle illumination lamp & space heater in the cable alley should be provided

**Completeness of work:**

Contractor shall include and provide all necessary materials and labour for completing the job in an approved manner following all applicable standards and code of practices.

**Note: Contractor must visit/ inspect the work site, before quoting**

**GENERAL & CODES**

All the supply and work shall be in accordance with the relevant I.S. Specification and recognized standards and modern approved practice and shall meet the requirement of the latest issue of applicable codes, factory rates and regulations, supply codes and all standard accepted practice in locality where the installation is to be made.

All the materials and accessories provided by Contractor under terms of this contract shall conform to the relevant Indian Standard Specifications. Samples of all equipment, materials and accessories to be supplied by the Contractor shall be submitted for the approval of the Engineer before they are supplied and used.

Contractor shall provide all necessary labour, tools, and other requisite work like drilling, cutting, welding etc. at his own cost.

Good workmanship is the essence of this contract and shall be complied with at all time. The Contractor shall have the works supervised by qualified and experienced engineers. All the defects pointed out by the engineer shall be rectified immediately by the Contractor free of cost.

The installation shall generally be carried out strictly in conformity with the requirement of latest edition of the Indian Electricity Act, 1910 as amended and the Indian Electricity Rules, 1956 framed there under and all others statutory regulations that may be relevant to the installation





No alteration which may affect the structures and architecture of building shall be done without the prior approval of the engineer. All work shall be carried out in such a manner that it should not cause any inconvenience to other works which are under progress. The Contractor shall cooperate with other agencies in the area for the smooth execution of all works.

Accidental damage to any property shall be reported immediately to site engineers and letter confirmed in writing.

The equipment shall comply with the requirement of latest revision of following standard issued by BIS (Bureau of Indian Standards), unless otherwise specified.

#### **EARTHING & LIGHTNING PROTECTION**

IS : 3043 – 1987 Code of practice for earthing.

IS : 2309 – 1989 Code of practice for Protection of buildings and allied structures against lightning.

#### **LOW VOLTAGE SWITCHGEAR & PANELS**

IS : 8623 – 1993 Specification for low voltage switchgear and control gear assemblies

IS : 10118-1982 Code of practices for selection, installation and maintenance of switchgear and control gear.

IS : 12063-1987 Classification of degrees of protection provided by enclosures of electrical equipment.

IS : 7752-1975 Guide for improvement of power factor in consumer installation

IS : 12360-1988 Voltage bands for electrical installations including preferred voltages and frequency.

IS : 2147 – 1962 Degrees of Protection provided by enclosures for low voltage switchgear and control gear.

IS : 3070-1993 Metal oxide surge arresters with gaps for AC system.

IS : 13947-1993 L.V. Switchgears and control gears

IS:13032-1991 Miniature circuit breaker boards for voltage up to and including 1000 volts A.C.

IS:13925-1998 Shunt capacitors for ac power systems having a rated voltage above 1000V.

IS:12729-2004 Common specification for high voltage switchgear & controlgear standards.

IS:1293-2005 Plug & socket outlets for household & similar purposes.

IS:4160-2005 Interlocking switch socket outlets –specification

IS:60309-2002 Plug socket –outlets & couplers industrial purposes.



### **CABLE**

IS:12943-1990 Brass glands for PVC cables.

IS:1255-1983 Code practice for installation and maintenance of power cables

Up to and including 33kV rating.

IS:10418-1982 Drums for electric cables.

IS:7098-1988 Cross linked polyethylene insulated PVC sheathed cables.

IS:1554-1988 PVC insulated (heavy duty) electric cables.

IS:694-1990 PVC insulated (heavy duty) electric cables

### **INTERNAL (POINT WIRING, FAN, FIXTURES)**

IS : 4648 – 1968 Guide for electrical layout in Residential buildings.

IS : 732 - 1989 Code of practice for electrical wiring installations.

IS:6665-1972 Code of practice for industrial lighting

IS : 2268 – 1994 Electrical appliances electrical call bells and buzzers for indoor use.

IS : 3646-1992 Code of Practice for interior illumination

IS :11037-1984 Electronic type fan regulators.

IS:9537-1980 Conduits for electrical installation

IS:14768-2000 Conduits fittings for electrical installations general requirements.

IS: 14927-2001 Cable trunking & ducting systems for electrical installations

IS : 1913 - 1978 General and safety requirement for luminaries

IS:3528-1966 Waterproof electric lighting fitting

IS:1944-1970 Code of practice for lighting of public thoroughfare

### **OTHER CODES**

SP30-1985 National Electrical code (Fourth Reprint 1998)

NBC-2008 National Building Code First Reprint 2006

ECBC 2009 Energy Conservation Building Code

### **GENERAL**

SP : 31-1986 Chart and treatment for electrical wiring installations.

IS : 2551 – 1982 Danger notice plates.

IS : 5216 - 1982 Guide for safety procedures and practices in Electrical work

### **Site/Climate Conditions:**

The Equipment shall be suitable for installation and satisfactory continuous operation in a sub-station in a generally hot and humid atmosphere. The equipment shall be designed to operate continuous under site condition as specified below.



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Location	: Hyderabad
Max. ambient air temperature,	: 50 °C
Min. ambient air temperature,	: 10 °C
Max. average daily ambient air temp.,	: 40 °C
Max. yearly weighed average ambient temp,	: 32 °C
Max. relative humidity, %	: 95%
Average Annual rainfall, mm	: 800 mm
Max. altitude above mean level (Meters)	: 540 m



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Technical Data Sheet MV Panels Type Tested Assembly (TTA) and Non- TTA Type			
S.No	Description	Specifications	Compliance Statement (YES/NO)
1	Main MV Panel - Type Tested Assembly Panel (TTA):	<p>Design, Manufacture, Supply, Installation, Testing &amp; Commissioning of floor mounting Main MV Panel shall be front operated, front access, extensible type, cubicle panel totally enclosed, dust and vermin proof with IP- 42 protection with hinged and lockable doors. The panel shall be fabricated from 2 mm thick CRCA sheets including interconnections, tinned copper strip /Wire crimping lugs, bonding to earth suitable for use at 415 V, 3 phase 4 wire 50 Hz system, and to withstand a fault level of 50kA as specified, symmetrical at 415 V complete as per specifications, as required &amp; as below. All switchboards shall have provision for the entry of cables from the top/bottom as required. All live accessible parts shall be shrouded and all equipment shall be finger-touch proof. The bus bars shall be insulated with heat-shrinkable sleeves. SMC/DMC shrouds and busbar supports shall be used. Panels feed from DG power supply -(Emergency) - RAL 9003</p> <p>Incomers:-</p> <p>a) 2 no. 1000 A 50kA FP ACB with all protections &amp; required accessories and adequate size tinned Cu. neutral link. ACBs shall be manual draw-out type with safeties and Electrical &amp; Mechanical interlocks (One is for EB supply &amp; One is for DG Supply)</p> <p>b) 1 set of RYB indication lamps with 6A MCBs</p> <p>c) 3 nos 1000/5 A ratio, class-I, 15VA cast resin current transformer</p> <p>d) 1 no 3 phase 4 wire, 240 V (L-N) 5 A, Class-I Intelligent Multifunction panel meter to read &amp; record the current, Voltage, PF, KW, KVA, KWH, KVAH, etc &amp; flush mounted, 96 sq. mm, similar to Schneider Energy Meters, EM6400 or equivalent approved.</p> <p>e) Light &amp; Space Heater with thermostat with adjustable knob to be provided in Cable Chamber</p> <p>All Incoming / Outgoing Switchgear make Schneider/ABB/Equivalent Approved.</p> <p>Bus bar:</p>	



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	<p>1000 A TPN tinned copper bus bar having a maximum current density of 800 A/sq.inch to withstand a symmetrical fault level of 50kA at 415 V. The neutral bus bar shall have 100% capacity</p> <p>Outgoings:-</p> <ol style="list-style-type: none"><li>1) 1 nos x 630 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for Chiller Panel. MCCB shall be a manual draw-out type with safeties and Mechanical interlocks</li><li>2) 2 nos x 400 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for the AHU Panel and One spare feeder</li><li>3) 2 nos x 250 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for the Laser Hall Panel and Beem Hall Panel</li><li>3) 3 nos x 160 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for Ground Floor EPIC Lab VTPN DB and First Floor VTPN DB for Office &amp; ACs etc and One spare feeder</li><li>4) 1 no x 100 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for General Lighting</li></ol> <p>Note:</p> <ol style="list-style-type: none"><li>1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C.</li><li>2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</li><li>3) LV Switchboards shall be certified by 3rd party Certification body as per IEC 61439-1 &amp; 2. Test reports without certificates shall not be considered admissible proof of compliance. The Certifying Authority shall be qualified under <b>ISO/ IEC 17065 as per IEC 61439-1</b>.</li><li>4) BOM the switchboard shall be form 3b. For forms of separation to be achieved, only metallic covers shall be used. Hylem/ PVC sheets shall not be allowed.</li><li>5) The painting of the sheet metal forming the enclosure shall be through electrostatic spraying of epoxy resin powder to give smooth finish to the equipment. Colour shade used should be RAL 9003.</li><li>6) Panel shall be supplied with a double door arrangement. Global Door/ Front Door shall be fitted with transparent Glass to allow</li></ol>	
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		<p>maintenance staff to visually access device status, meter readings, indicating lamp status without opening the door. IP level &amp; Mechanical impact performance of the panel shall not be compromised in any scenario and shall remain at IP42/54 and IK10 level respectively, in all conditions.</p> <p>7) The panel shall be supplied with a smartphone/web-based maintenance tracking system. A unique identifier(like QR code) shall be employed for each panel to enable quick access to switchboard details including but not limited to switchboard drawings, wiring diagrams, list of spares, Switchboard BOM etc.</p> <p>8) The MCCB shall be current limiting type, corresponding to selectivity category A. It shall be equipped with a double break contact system to ensure low cut off current and let through energy during faults. Manufacturer shall provide cut off current and let through characteristics of the MCCB for the full range of operating current up to the value of Icu. Ics = Icu 100% for all breakers</p> <p>9) Panel shall be tested for Internal arc as per <b>IEC 61641 Class C</b> for 50kA for 0.3seconds. The test should be performed for arc starting place - at Horizontal busbar, Vertical bus bar and in outgoing cable compartments.</p> <p>10) Electrical distribution boards, that are non-forced air ventilated, shall be enabled with DIN rail mounted wireless sensors capable of monitoring the system and generate three-levels of alerts on overheating wire connections or overheating cables depending on the severity of the detected situation.</p>	
2	MV Panel for Ground Floor Labs (Non-TTA):	Design, Manufacture, Supply, Installation, Testing & Commissioning of floor mounting MV Panel shall be front operated, front access, extensible type, cubicle panel totally enclosed, dust and vermin proof with IP- 42 protection with hinged and lockable doors. The panel shall be fabricated from 2 mm thick CRCA sheets including interconnections, tinned copper strip /Wire crimping lugs, bonding to earth suitable for use at 415 V, 3 phase 4 wire 50 Hz system, and to withstand a fault level of 50kA as specified, symmetrical at 415 V complete as per specifications, as required & as below. All switchboards shall have provision for the entry of cables from the top/bottom as required. All live accessible parts shall be shrouded and all equipment shall be finger-touch proof. The bus bars shall be	



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		<p>insulated with heat-shrinkable sleeves. SMC/DMC shrouds and bus bar supports shall be used.</p> <p>Panels feed from DG power supply -(Emergency) - RAL 9003</p> <p>Incomer:-</p> <p>a)1 no. 250 A 50kA FP MCCB with microprocessor release and adequate size tinned Cu. neutral link.</p> <p>b) 1 set of RYB indication lamps with 6A MCBs</p> <p>c) 3 nos 250/5 A ratio, class-I, 15VA cast resin current transformer</p> <p>d) 1 no 3 phase 4 wire, 240 V (L-N) 5 A, Class-I Intelligent Multifunction panel meter to read &amp; record the current, Voltage, PF, KW, KVA, KWH, KVAH, etc &amp; flush mounted, 96 sq. mm, similar to Schneider Energy Meters, EM6400 or equivalent approved.</p> <p>e) Light &amp; Space Heater with thermostat with adjustable knob to be provided in Cable Chamber</p> <p>All Incoming / Outgoing Switchgear make Schneider/ABB/Equivalent Approved.</p> <p>Bus bar:</p> <p>250 A TPN tinned copper bus bar having a maximum current density of 800 A/sq. inch to withstand a symmetrical fault level of 50kA at 415 V. The neutral bus bar shall have 100% capacity</p> <p>Outgoings:-</p> <p>1) 2 nos.160 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link</p> <p>2) 3 nos.100 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link</p> <p>Note:</p> <p>1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C.</p> <p>2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</p>	
3	MV Panel for Ground Floor Beam Hall (Non- TTA):	Design, Manufacture, Supply, Installation, Testing & Commissioning of floor mounting MV Panel shall be front operated, front access, extensible type, cubicle panel totally enclosed, dust and vermin proof with IP- 42 protection with hinged and lockable doors. The panel shall be fabricated from 2 mm thick CRCA sheets including interconnections, tinned copper strip /Wire crimping lugs, bonding to earth suitable for use at 415 V, 3 phase 4	



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		<p>wire 50 Hz system, and to withstand a fault level of 50kA as specified, symmetrical at 415 V complete as per specifications, as required &amp; as below. All switchboards shall have provision for the entry of cables from the top/bottom as required. All live accessible parts shall be shrouded and all equipment shall be finger-touch proof. The bus bars shall be insulated with heat-shrinkable sleeves. SMC/DMC shrouds and bus bar supports shall be used. Panels feed from DG power supply -(Emergency) -RAL 9003</p> <p>Incomer:-</p> <p>a) 1 no. 250 A 50kA FP MCCB with microprocessor release and adequate size tinned Cu. neutral link.</p> <p>b) 1 set of RYB indication lamps with 6A MCBs</p> <p>c) 3 nos 250/5 A ratio, class-I, 15VA cast resin current transformer</p> <p>d) 1 no 3 phase 4 wire, 240 V (L-N) 5 A, Class-I Intelligent Multifunction panel meter to read &amp; record the current, Voltage, PF, KW, KVA, KWH, KVAH, etc &amp; flush mounted, 96 sq. mm, similar to Schneider Energy Meters, EM6400 or equivalent approved.</p> <p>e) Light &amp; Space Heater with thermostat with adjustable knob to be provided in Cable Chamber</p> <p>All Incoming / Outgoing Switchgear make Schneider/ABB/Equivalent Approved.</p> <p>Bus bar: 250 A TPN tinned copper bus bar having a maximum current density of 800 A/sq. inch to withstand a symmetrical fault level of 50kA at 415 V. The neutral bus bar shall have 100% capacity</p> <p>Outgoings:-</p> <p>1) 2 nos.160 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link</p> <p>2) 3 nos.100 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link</p> <p>Note:</p> <p>1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C.</p> <p>2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</p>	
4	Chiller Panel (Non- TTA):	Supply, Installation, Testing and Commissioning of outdoor MCC Chiller panel of 3 phase 415V free standing Floor mounted made	





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		<p>out of 14 G MS sheet after seven tank processes and painted with Epoxy Powder Coated as required for condensing units, hot water generator, pumps, valves, etc.</p> <p>Incomer:- 1 No x 630 A 50kA, FP, MCCB Incomer. MCCB shall be manual draw out type with safeties and interlocks.</p> <p>Outgoings:- 3 Nos x 250 A. 36kA, TP, MCCB out going for air cooled chillers with 112 KW (2 Working+1 Standby) 2 Nos x 32 A 36kA, TP, MCCB outgoing for secondary pump panel with 5.5 kw each (1 working+1 standby) 3 Nos x 32 A 36kA, TP, MCCB outgoing for chilled water primary pump with DOL starter with 3.75 KW each (2 Working+1 standby) 30 Nos x 6 A MCB 10 kA for valves 1 No x 63 A 36kA, TP, MCCB spare feeder 1 No x 250 A 36kA, TP, MCCB out going for air cooled chillers with 112 KW 2 Nos x 32 A 36kA, TP, MCCB spare feeder for Pumps Incomer shall have voltmeter with selector switch, ammeter with selector switch &amp; CTs, back up fuses and indicating lamps. Condensing unit feeders shall have ammeter with CTs and selector switch and single phase preventer. AHU and Fan feeders shall have ammeter with CTs, selector switch, single phase preventer and on/off/trip indicating lamps. Hot water generator feeder shall have an ammeter with CTs and selector switch. Starter below 7.5 HP shall be DOL and 7.5 HP and above shall be Star Delta. Note: 1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C. 2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</p>	
5	AHU Panel (Non- TTA):	Supply, Installation, Testing and Commissioning of outdoor MCC AHU panel of 3 phase 415V free standing Floor mounted made out of 14 G MS sheet after seven tank processes and painted with	



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	<p>Epoxy Powder Coated as required for AHU units, hot water generator, pumps, dampers, etc.</p> <p>Incomer:- 1 No x 400 A 50kA, TP, MCCB Incomer. MCCB shall be manual draw out type with safeties and interlocks</p> <p>Outgoings:- 2 Nos x 160 A 36kA, TP, MCCB outgoing for hot water generator with 75 KW (1 Working+1 Standby) 8 Nos x 63 A 36kA, TP, MCCB outgoing for AHU's (5 Working +3 stand by) 2 Nos x 32 A 36kA, TP, MCCB outgoing for hot water circulating pump with DOL starter with 2.2 KW each (1 Working+1 standby) 20 Nos x 16 A MCB 10kA for fire dampers 1 No x 63 A 36kA, TP, MCCB spare feeder 1 No x 160 A 36kA, TP, MCCB spare feeder for hot water generator with 75 kw Incomer shall have voltmeter with selector switch, ammeter with selector switch &amp; CTs, back up fuses and indicating lamps. Condensing unit feeders shall have ammeter with CTs and selector switch and single phase preventer. AHU and Fan feeders shall have ammeter with CTs, selector switch, single phase preventer and on/off/trip indicating lamps. Hot water generator feeder shall have an ammeter with CTs and selector switch. Starter below 7.5 HP shall be DOL and 7.5 HP and above shall be Star Delta.</p> <p>Note: 1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C. 2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</p>	
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Technical Data Sheet for 320 KVA DG SET and DG Synchronization Panel			
S.N o	Description	Specifications	Compliance Statement (YES/NO)
1	380 KVA DG SET	<p>Design, manufacture, supply, erection, testing and commissioning of CPCB IV, 320 KVA/ 256 KW Silent Diesel Generating Set with acoustic enclosure including assembly, shop testing, packing, dispatch, transportation, performance and guarantee testing, complete in all respects with all equipment, fitting and accessories for efficient and trouble-free operation with ARAI Approved and as per technical specifications mentioned in the tender document. Engine and Alternator mounted on a common Base Frame, complete with:</p> <p><b>Engine Details:</b> Make: Greaves Cotton / Kirloskar/ Cummins/ Mahindra Engine Power (kWm): 284 Gross engine Power (HP): 386.4 No of Cylinders: 6 Governor type: Electronic / CRS with Turbo charged Exhaust , Radiator Cooled</p> <p><b>Alternator Details:</b> Make: Crompton Greaves/LS/Meccalte/Stamford Rating: 320 KVA Voltage: 415 V, 3 Phase with Neutral Voltage Regulation: <math>\pm 1\%</math> Speed: 1500 RPM Frequency: 50 Hz P. F.: 0.8 lag Insulation: 'H' grade Unbalanced Load Capability: at 25 % Excitation: Self excited, self-regulated with brushless system and static voltage control unit suitably compounded for voltage and current to maintain terminal voltage constant at <math>\pm 5\%</math> at all load for p.f. not less than 0.8. Terminal Box shall be suitable Rating of</p>	



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		<p>cable for terminating DG Sets of rating specified in BOQ with Earthing studs</p> <p>Note:</p> <p>A) Suitable In-built Fuel Tank B) Suitable In-built DEF Tank C) Battery &amp; Leads D) Hospital Grade Silencer inside Canopy, tuned to EATS E) Anti-vibration Mounting Pads F) First Fill of Lube G) Acoustic Enclosure H) 3G compatible Remote Monitoring System etc and complete as required.</p>	
2	AUTO LOAD SHARING DG SYNCHRONIZATION PANEL	<p>Design, manufacture, supply, erection, testing and commissioning of DG Synchronization Panel (Indoor Type-IP45) with PLC Programming for Automatic Synchronizing with Auto Load Sharing and Load based Start /Stop should be provided in the Panel and as per technical specifications mentioned in the tender document</p> <p>Incoming:</p> <p>3 Nos x 630A, 4P. EDO ACB of suitable breaking capacity with O/C, S/C, E/F and Micro Processor based Releases with RS485 Communication port (Each consisting of following). Under voltage and Shunt Trip Coil. Generator Control Unit / Relay CL-PS, Tape wound CT's. Generator Differential Protection Relay Multifunction Meter(MFM) With RS485 communication port LED Type R-Y-B Phase Indication Lamps. On, Off &amp; Trip Indication.</p> <p>Outgoing:</p> <p>1 No x 1600A, 4P. EDO ACB of suitable breaking capacity with O/C, S/C, E/F and Micro Processor based Releases with RS485 Communication port (Consisting of following). Under voltage and Shunt Trip Coil</p>	



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		<p>Multifunction Meter (MFM) With RS485 communication port - 1 No. LED Type R-Y-B Phase Indication Lamps. On, Off &amp; Trip Indications.</p> <p>Bus bar: 415V, 1600A,3Ph, 4wire, 50Hz, Aluminum bus bars (91E electrical grade) having withstand ability symmetrical fault level of 50 KA for 1 Sec. - LS</p> <p>Note:-All the accessories required for the satisfactory performance of the DG Synch Panel and the automatic load sharing based on running load and sequential On, Off of the DG sets should be considered by the Bidder.</p>	
--	--	--	--

<b>DATA SHEET FOR 320 KVA D.G. SET (To be filled by the Vendor along with the bid)</b>		
<b>1</b>	<b>ENGINE:</b>	
1.1	Type	
1.2	Make	
1.3	Model Number	
1.4	Engine BHP	
1.5	RPM	
1.6	No. of Cylinder	
1.7	Specific Fuel Consumption at 100% Load Litre/Hr.	
1.8	Type of Cooling	
1.9	Type of Starting	
<b>2</b>	<b>ALTERNATOR:</b>	



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2.1	Make	
2.2	Model Number	
2.3	Type of Enclosure	
2.4	Mounting	
2.5	KW Rating	
2.6	KVA Rating	
2.7	Insulation	
2.8	Excitation	
2.9	Terminal Box Provided (Yes/No)	
2.10	Earthing Studs	
<b>3</b>	<b>Dimensions (LxWxH)</b>	
<b>4</b>	<b>Weight (in Kgs)</b>	
<b>5</b>	<b>Anti-vibration pad provided (Yes/No)</b>	
<b>6</b>	<b>BATTERY CHARGER:</b>	
6.1	Type	
6.2	Make	
6.3	Ampere Hour Rating	
<b>7</b>	<b>CONTROL PANEL :</b>	
7.1	Type	
7.2	Facilities provided (bidder to furnish Details & brief description) covered a)Monitoring b)Startup c)Changeover	



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	d)Operation e)Protection & interlocks & safeguards	
7.3	Cable entry	
7.4	Weight	
7.5	Dimensions	

**(NOTE : The tenderer should fill-in all the data in above format only. If above mentioned data is not filled properly or partially filled tender shall be liable to rejection).**



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**SECTION-VI**

**LIST OF MAKES**

**LIST OF APPROVED MAKES**

S.No	Item Description	Approved Makes
1	Genset(Diesel Generator)	Kirloskar, Cummins, Mahindra, Greaves Cotton /Equivalent Approved
2	LT Breakers (ACB)	Legrand/ABB/ Schneider /Siemens /Equivalent Approved
3	MCCB	Legrand/ABB/ Schneider /Siemens /Equivalent Approved
4	MCB	Legrand/ABB/ Schneider /Siemens /Equivalent Approved
5	Fuel Level Indicator	Honeywell / Jonson/ Siemens /Equivalent Approved
6	Current Transformer	Kappa/ Legrand/Starlite /Equivalent Approved
7	Digital KWH Meters / Energy Meter / MFM with RS 485 Ports	Legrand /ABB/Schneider/Equivalent Approved
8	LED Indicating Lamps	Legrand/ ABB/DSS /Equivalent Approved
9	Fuses & Fuse bases	Legrand/Indo Asian// ABB/Siemens /Equivalent Approved
10	Indicating / Measuring Instruments	Legrand/ Schneider/Equivalent Approved
11	Relays	Areva/ ABB/Schneider /Equivalent Approved
12	LT Cables	Poly Cab/ Universal/Havells /KEI/ Equivalent Approved
13	Brass Cable Gland	Dowell's/Crompton/Bico/Siemens/Comet/ Equivalent Approved
14	PVC Glands	Peeco,/ Comet,/ Dowell's/ Equivalent Approved
15	Cu Lugs	Peeco/, Comet, /Dowell's/ Equivalent Approved
16	Distribution Boards	Legrand/Schneider/Hager/ Equivalent Approved





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17	MS Enclosure	Legrand/Schneider/Hager/ Equivalent Approved
18	Terminals	Elmex/ Connectwell / Equivalent Approved
19	Cu strip	99% Electrolyte Copper
20	LED lights	Phillips/Havells/Wipro/ Equivalent Approved
21	PVC Conduits	Sudhakar/Equivalent Approved
22	DLP Truncking	Legrand/MK/ Equivalent Approved
23	MV Panel	Schneider / ABB / Siemens
24	All other items not covered above	AS PER SAMPLES APPROVED



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**SECTION-VII**

**ANNEXURES**

**ANNEXURE-I**

Form of Performance Security (Guarantee) Bank Guarantee Bond-Format - I In consideration of the President of India (hereinafter called "The Government") having offered to accept the terms and conditions of the proposed agreement between.....and ..... (hereinafter called "the said Contractor(s)") for the work..... (hereinafter called "the said agreement") having agreed to production of an irrevocable Bank Guarantee for Rs. .... (Rupees ..... only) as a security/guarantee from the contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement. 1. We, ..... (hereinafter referred to as "the Bank") hereby undertake to pay to the Government an amount not exceeding Rs. .... (Rupees..... Only) on demand by the Government. 2. We, .....(indicate the name of the Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demure, merely on a demand from the Government stating that the amount claimed as required to meet the recoveries due or likely to be due from the said contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. .... (Rupees .....only) 3. We, the said bank further undertake to pay the Government any money so demanded notwithstanding any dispute or disputes raised by the contractor(s) in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment. 4. We, ..... (indicate the name of the Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Government under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineer-in-Charge on behalf of the Government certified that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee. 5. We, ..... (indicate the name of the Bank) further agree with the Government that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of the Government or any indulgence by the Government to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us. 6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s). 7. We, ..... (indicate the name of the Bank) lastly undertake not to revoke this guarantee except with the previous consent of the Government in writing. 8. This guarantee shall be valid up to .....unless extended on demand by the Government. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs. .... (Rupees .....) and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this 105 guarantee all our liabilities under this guarantee shall stand discharged. Dated the .....day of .....for.....(indicate the name of the Bank).



## **ANNEXURE II**

### **UNDERTAKING BY THE TENDERER**

I / We have read and examined the Tender document including terms & conditions, specifications, Schedule of quantities, drawings and designs, general rules & directions, General Conditions of Contract, Special Conditions of Contract and all relevant other documents, publications and rules referred to in the Conditions of Contract and all other contents in the tender documents for the work.

I / We, hereby tender for execution of the work specified for the TIFR-Hyderabad, Hyderabad within the time specified and in accordance in all respects with the specifications, designs, drawings and instructions in writing.

We agree to keep the tender open for seventy five (75) days from the last date of its submission and not to make any modifications in its terms and conditions. A sum of Rs.....  
.....has been deposited in cash / receipt treasury challan / deposit at call receipt of scheduled bank / fixed deposit receipt of scheduled bank / demand draft of a scheduled bank / Bank Guarantee issued by a Scheduled Bank as earnest money. If I / we, fail to furnish the prescribed performance guarantee within prescribed period, I / we agree that the said TIFR-Hyderabad, Hyderabad or its authorized officer 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 the TIFR-Hyderabad, Hyderabad shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise the said earnest money shall be retained by TIFR- Hyderabad, Hyderabad towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein.

Further, I / We agree that in case of forfeiture of earnest money or both Earnest Money & Performance Guarantee as aforesaid, I / We shall be debarred for participation in the re-tendering process of the work.

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.

Seal & Signature of Contractor Postal Address

Dated

Witness

Address Occupation



**ANNEXURE-III**

**CERTIFICATE OF LOCAL CONTENT**

**\*We [name of manufacturer] hereby confirm in respect of quoted item(s) that local Content is equal to or more than 50% and come under 'Class-I Local Supplier' Category. As being 'Class-I Local Supplier', we are eligible for Purchase Preference under 'Make in India' Policy vide Gol Order No.P-45021/2/2017-PP (B.E.-II) dated 15.06.2017 (subsequently revised vide orders dated 28.05.2018, 29.05.2019 and 04.06.2020)**

**OR**

**\*We [name of manufacturer] hereby confirm in respect of quoted items(s) that Local Content is more than 20% but less than 50% and come under 'Class-II Local Supplier' Category.**

**The details of the location (s) at which the local value addition made is / are under:**

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

**Date:  
Bidder**

**Seal & Signature of the**

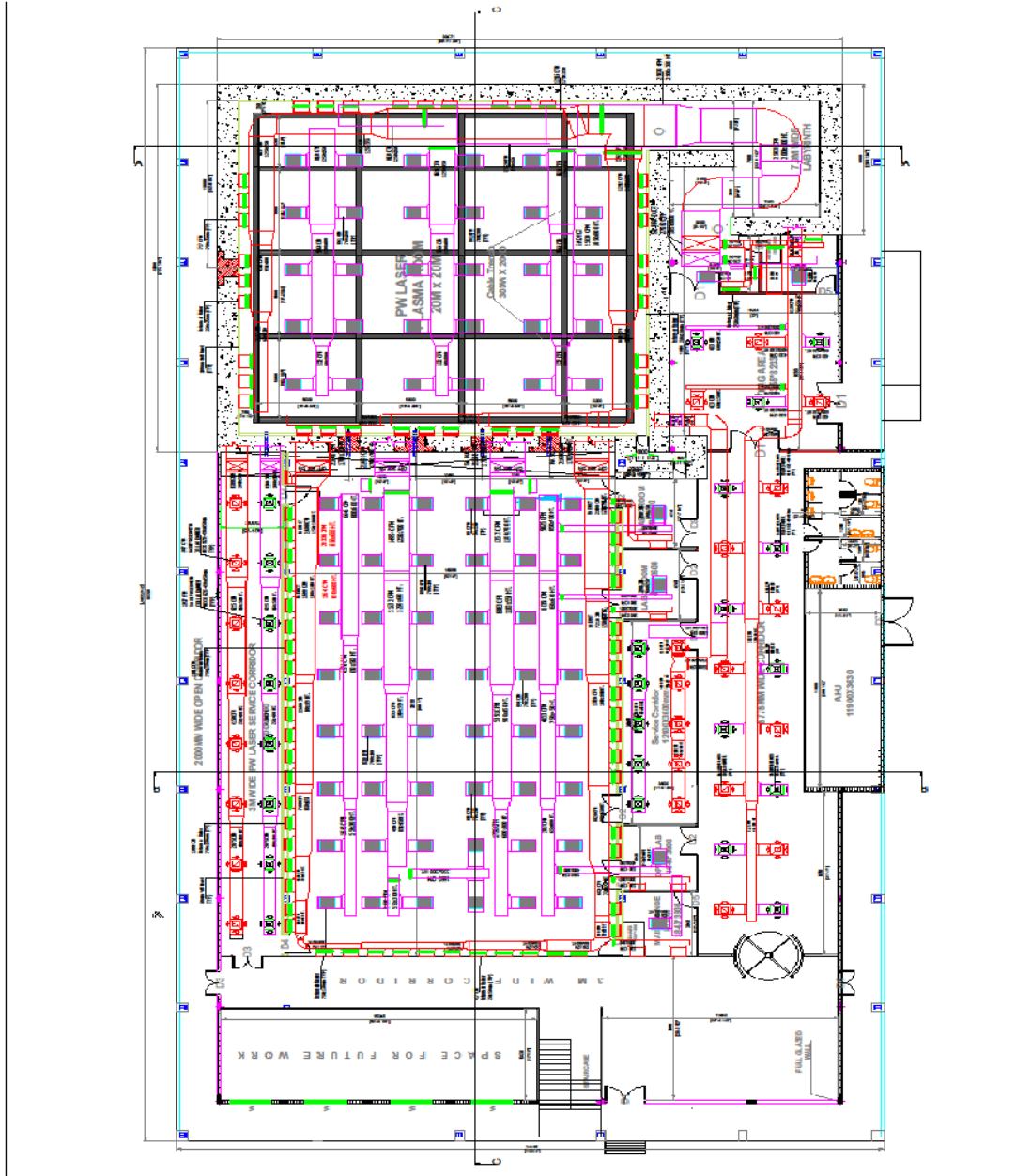
**NOTE:**

**Self-certification that the item offered meets the minimum local content (as above) giving details of the location(s) at which the local value addition is made in case the bidder wishes to avail the benefits under the make in India policy, if applicable.**

**In cases of procurement for a value in excess of Rs.10 crores, the local supplier shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content to avail the benefits under the make in India policy, if applicable.**

**ANNEXURE-IV**

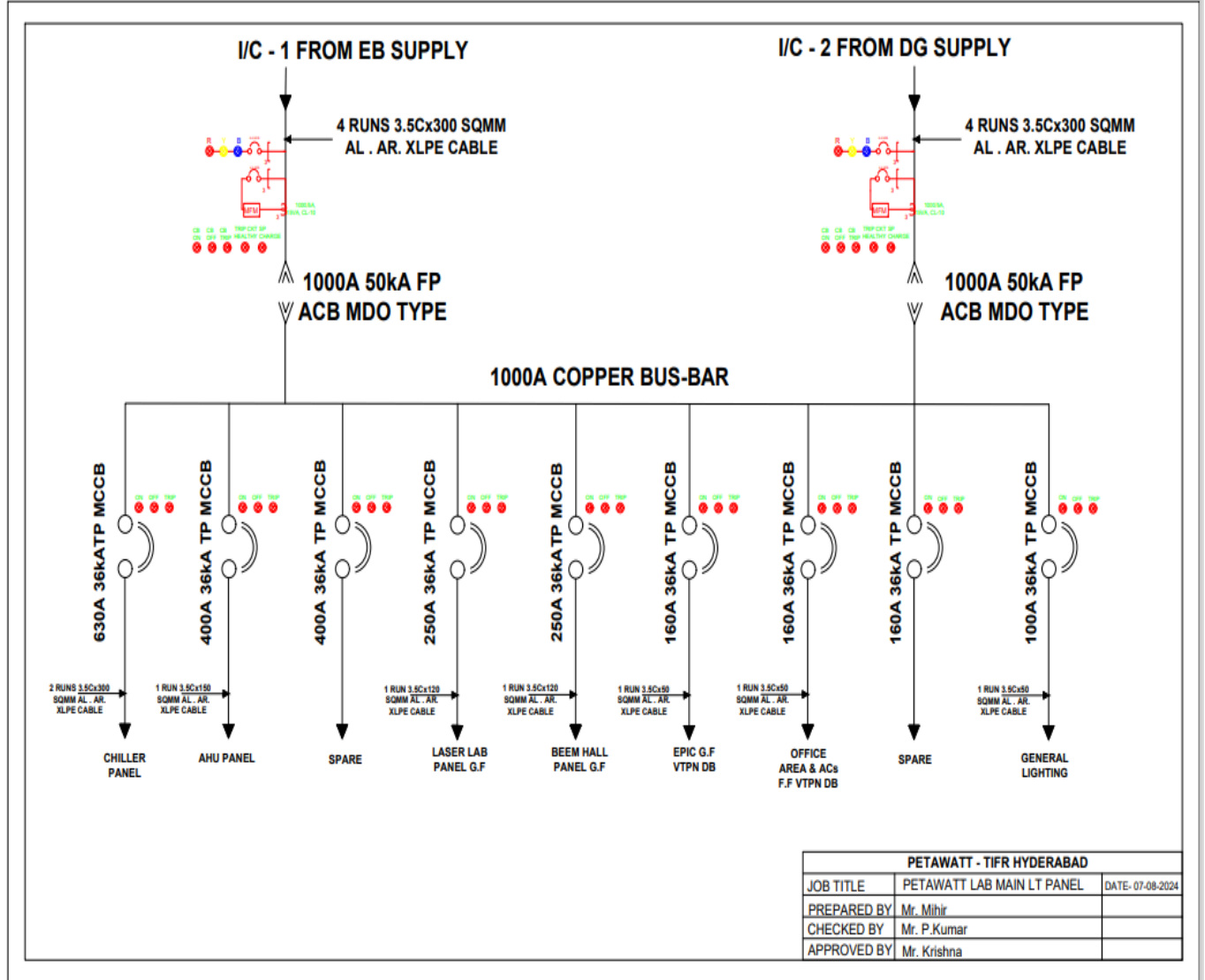
**PETAWATT LASER LAB GROUND FLOOR LAYOUT**





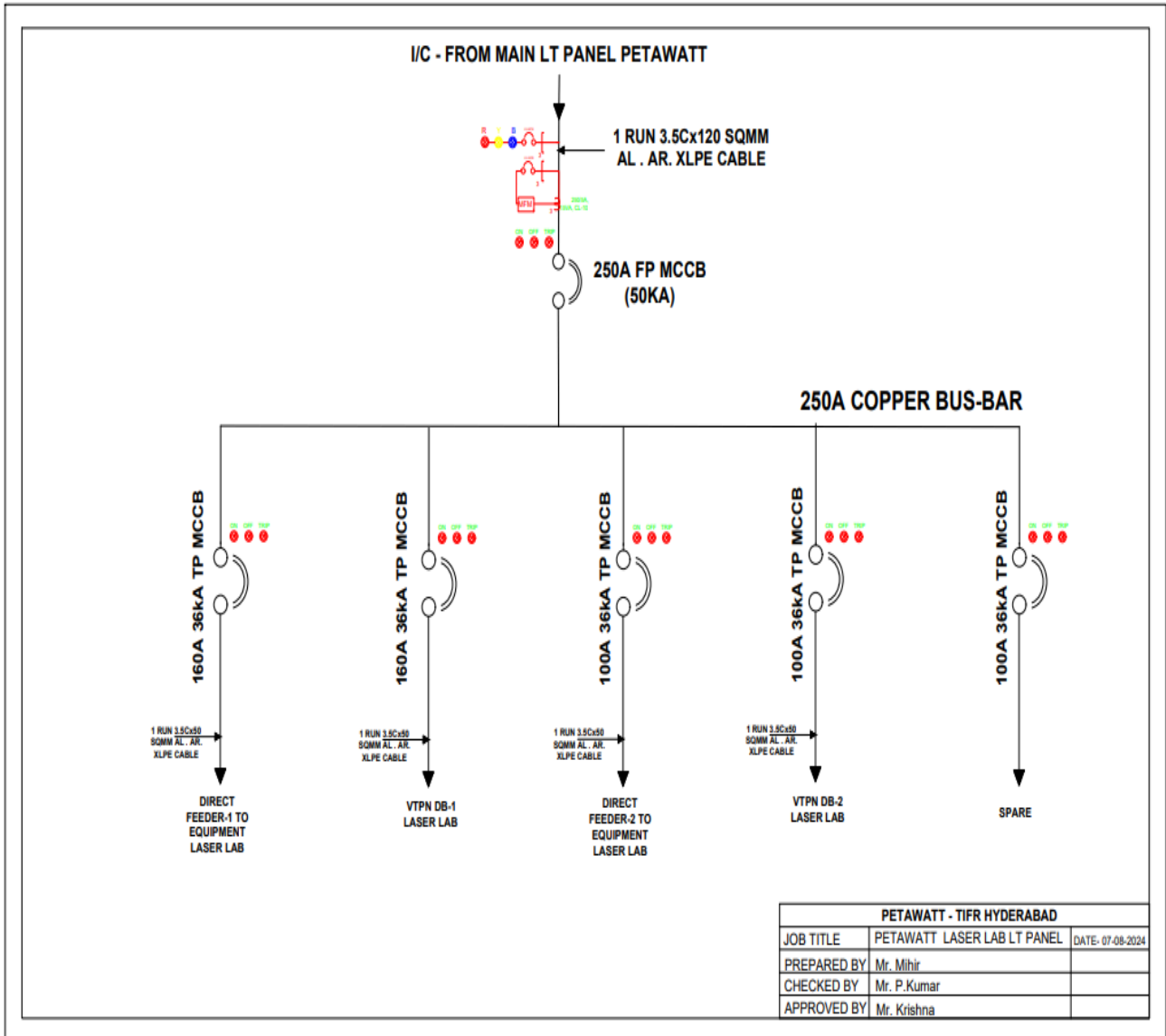
### PETAWATT LASER LAB MAIN PANEL SLD

#### PETAWATT LAB MAIN LT PANEL SLD



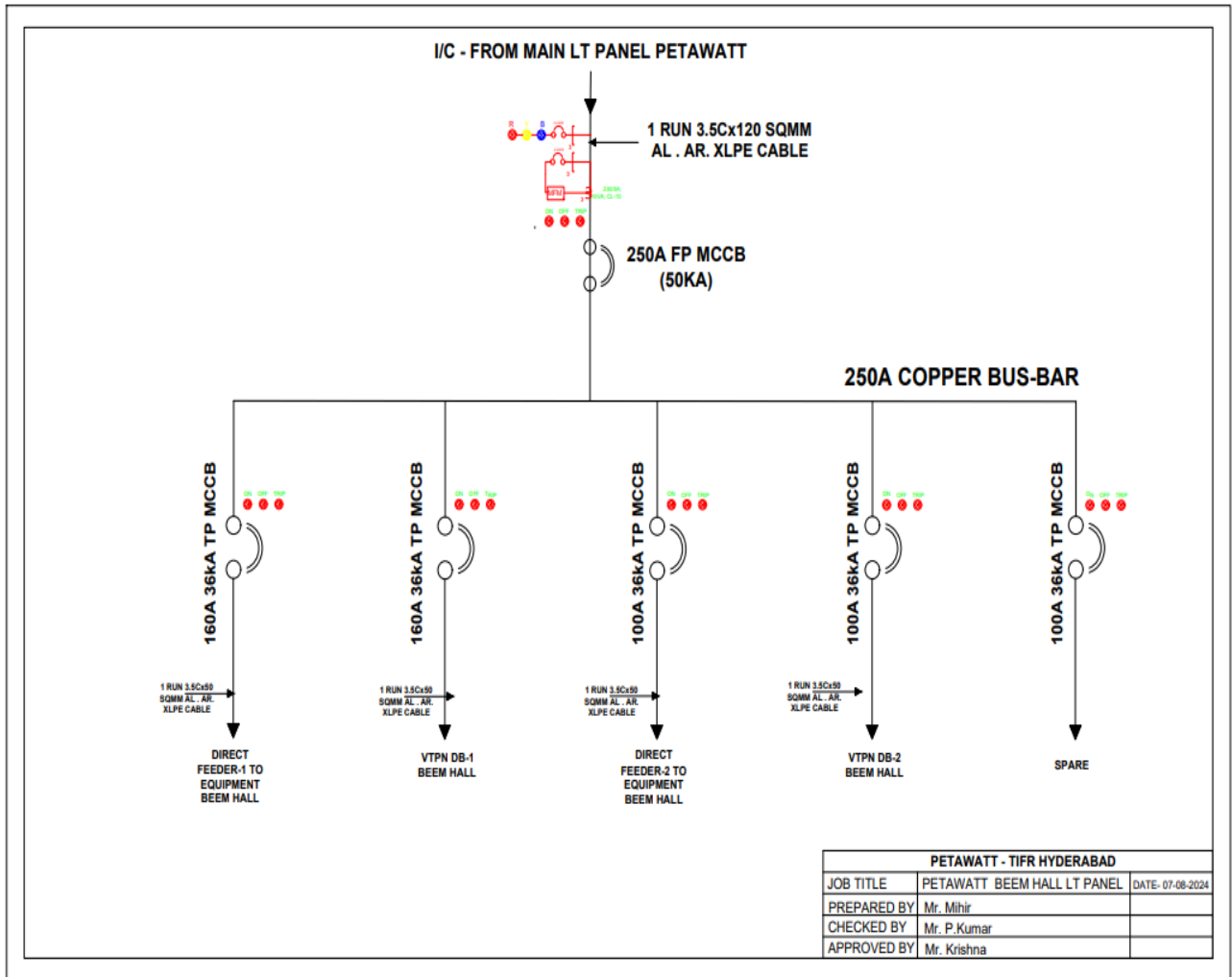
### PETAWATT LASER LAB PANEL SLD

#### PETAWATT LASER LAB LT PANEL SLD



**PETAWATT LASER LAB BEAM HALL PANEL SLD**

**PETAWATT BEEM HALL LT PANEL SLD**



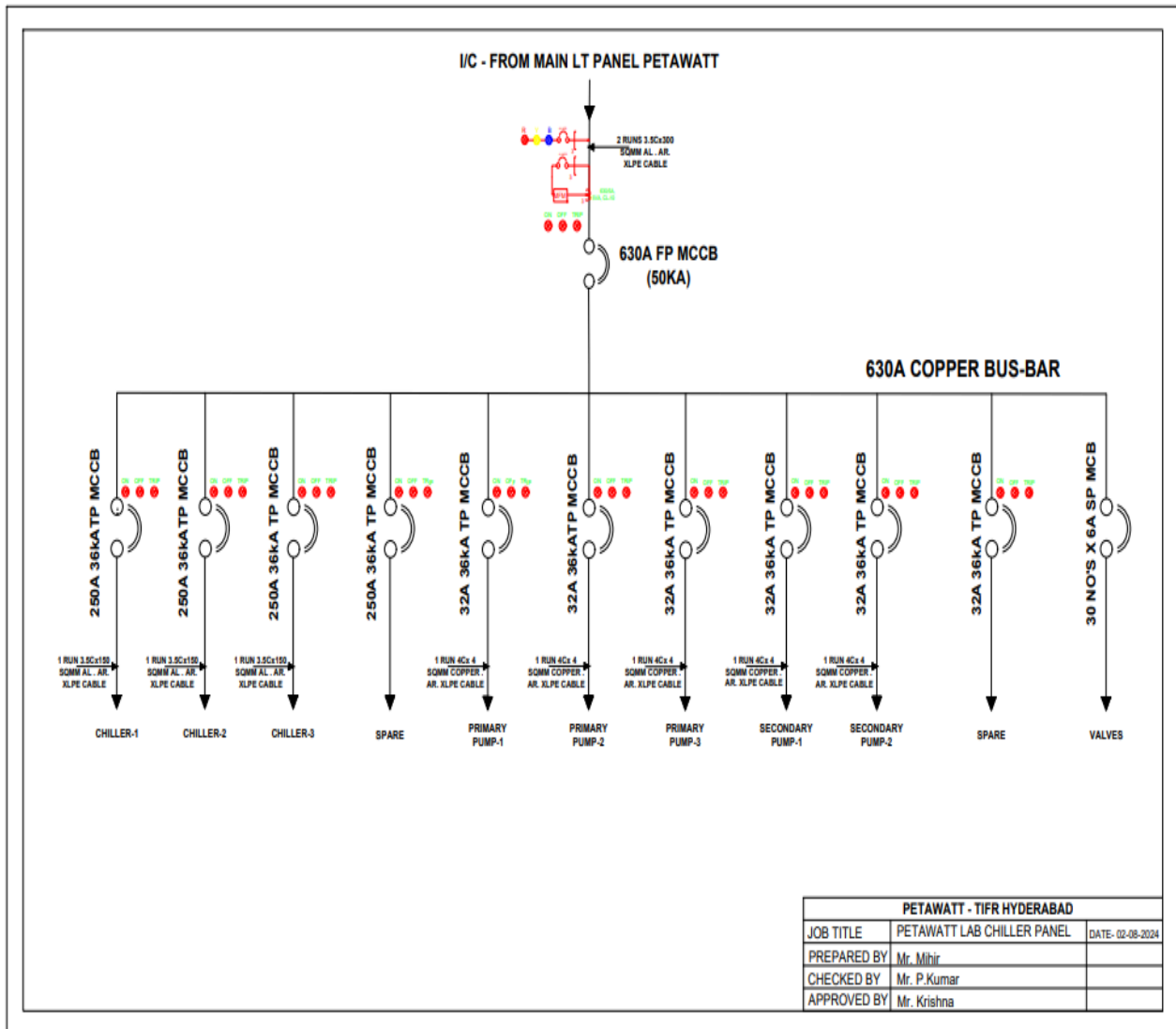




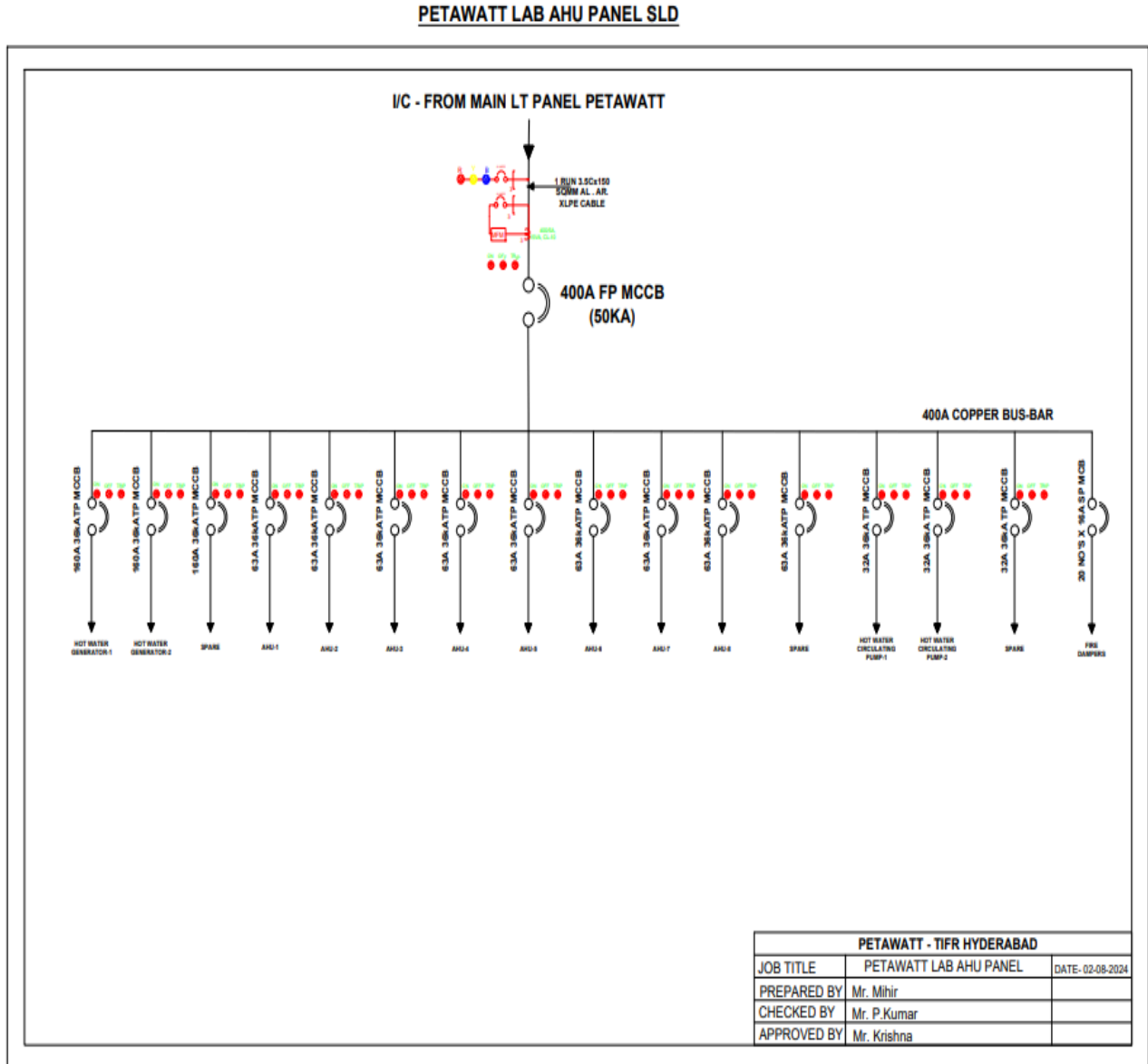
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**PETAWATT LASER LAB CHILLER PANEL SLD**

**PETAWATT LAB CHILLER PANEL SLD**



### PETAWATT LASER LAB AHU PANEL SLD





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**SECTION-VIII**

**FINANCIAL BID**

**INVITATION OF BIDS FOR**

**Supply, Installation, Testing & Commissioning of External Electrical works and other related works for Petawatt Laser Lab, Plot-B, TIFR, Survey No. 36/P, Gopanpally (Village), Serilingampally (Mandal), Ranga Reddy Dist., Hyderabad- 500046**

**PART II**

**FINANCIAL BID**



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**SCHEDULE OF QUANTITIES**

Sl. No.	Item Description	Unit	Qty(A)	Unit Rate (B)	Total (C = A x B)
1	Excavating trenches of required width for pipes, cables etc including excavation for sockets depth up to 1.5M, including getting out the excavated materials, returning the soil as required in layers not exceeding 20 cm in depth, including consolidating each disposed layers by ramming, watering etc stacking serviceable material (Soil) for measurements and disposal of unserviceable material (soil) as directed, within a lead of 50 meter. (all kinds of soil)	CUM	90		
2	Providing and laying Non Pressure NP-3 class (Medium duty) 600mm R.C.C.Hume pipes including collars/spigot jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete	MTR	30		
3	Providing and laying Non Pressure NP-3 class (Medium duty) 300mm R.C.C.Hume pipes including collars/spigot jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete	MTR	10		
4	Supply, Fabrication of MS Flat/ MS Angle for Support of Cables & PVC Conduits and applying of Red oxide & Synthetic Enamel paint and any touchup work if required and as per site condition	KGS	1700		
5	Supply, Laying, Testing and Commissioning of one number of 1100 V grade 3.5C X 300 sq.mm , Aluminium conductor, XLPE insulated, Armored power	MTR	1500		



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	cable as per IS :7098 (Part-I & II). Cable shall be laid on the wall/ceiling/Cable tray and in ground as per the instructions of E.I.C. Make: Polycab/Havells/Finolex/RR Cables				
6	Supply and Installation of suitable Double compression Brass Gland, Lugs and accessories for termination of 3.5Core x 300 sqmm in Panels and as per the instructions of E.I.C.	SET	12		
7	Supply, Laying, Testing and Commissioning of one number of 1100 V grade 3.5C X 240 sq.mm , Aluminium conductor, XLPE insulated, Armored power cable as per IS :7098 (Part-I & II). Cable shall be laid on the wall/ceiling/Cable tray and in ground as per the instructions of E.I.C. (2 Runs for DG Standard / Control Panel to Synchronization Panel) Make: Polycab/Havells/Finolex/RR Cables	MTR	100		
8	Supply and Installation of suitable Double compression Brass Gland, Lugs and accessories for termination of 3.5Core x 240 sqmm in Panels and as per the instructions of E.I.C.	SET	4		
9	Supply, Laying, Testing and Commissioning of one number of 1100 V grade 3.5C X 150sq.mm , Aluminium conductor, XLPE insulated, Armored power cable as per IS :7098 (Part-I & II). Cable shall be laid on the wall/ceiling/Cable tray and in ground as per the instructions of E.I.C. Make: Polycab/Havells/Finolex/RR Cables	MTR	140		
10	Supply and Installation of suitable Double compression Brass Gland, Lugs and accessories for termination of 3.5Core x150 sqmm in Panels and chillers as per the instructions of E.I.C.	SET	8		



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11	Supply, Laying, Testing and Commissioning of one number of 1100 V grade 3.5C X 120sq.mm , Aluminium conductor, XLPE insulated, Armored power cable as per IS :7098 (Part-I & II). Cable shall be laid on the wall/ceiling/Cable tray and in ground as per the instructions of E.I.C. Make: Polycab/Havells/Finolex/RR Cables	MTR	200		
12	Supply and Installation of suitable Double compression Brass Gland, Lugs and accessories for termination of 3.5Core x120 sqmm in Panels and AHUs as per the instructions of E.I.C.	SET	8		
13	Supply, Laying, Testing and Commissioning of one number of 1100 V grade 3.5C X 50 sqmm Aluminium conductor, XLPE insulated, Armored power cable as per IS :7098 (Part-I & II). Cable shall be laid on the wall/ceiling/Cable tray and in ground as per the instructions of E.I.C. Make: Polycab/Havells/Finolex/RR Cables	MTR	200		
14	Supply and Installation of suitable Double compression Brass Gland, Lugs and accessories for termination of 3.5Core x 50 sqmm in Panels and AHUs as per the instructions of E.I.C.	SET	4		
15	Supply, Laying, Testing and Commissioning of one number of 1100 V grade 4C X25sq.mm , Aluminium conductor, XLPE insulated, Armored power cable as per IS :7098 (Part-I & II). Cable shall be laid on the wall/ceiling/Cable tray and in ground as per the instructions of E.I.C. Make: Polycab/Havells/Finolex/RR Cables	MTR	320		
16	Supply and Installation of suitable Double compression Brass Gland, Lugs and accessories for termination of 4 Core x 25 sqmm in Panels and AHUs as per the instructions of E.I.C.	SET	16		



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17	Supply, Laying, Testing and Commissioning of one number of 1100 V grade 4C X 4sq.mm , Copper conductor, XLPE insulated, Armored power cable as per IS :7098 (Part-I & II). Cable shall be laid on the wall/ceiling/Cable tray as per the instructions of E.I.C. Make: Polycab/Havells/Finolex/RR Cables	MTR	270		
18	Supply and Installation of suitable Double compression Brass Gland, Lugs and accessories for termination of 4 Core x 4 sqmm in Panels and Pumps as per the instructions of E.I.C.	SET	4		
19	Supply, Laying, Testing and Commissioning of one number of 1100 V grade 4C X 2.5sq.mm , Copper conductor, XLPE insulated, Armored power cable as per IS :7098 (Part-I & II). Cable shall be laid on the wall/ceiling/Cable tray as per the instructions of E.I.C. Make: Polycab/Havells/Finolex/RR Cables	MTR	620		
20	Supply and Installation of suitable Double compression Brass Gland, Lugs and accessories for termination of 4 Core x 2.5sqmm in Panels and Pumps as per the instructions of E.I.C.	SET	10		
21	Earthing with GI Earth Plate 600 x 600 x 6 mm thick including accessories and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 meters long etc. with charcoal / coke and salt as required	SET	5		
22	Earthing with Cu Earth Plate 600 x 600 x 3 mm thick including accessories and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 meters long etc. with charcoal / coke and salt as required	SET	5		
23	Supply, Laying & Termination of 25 x 5mm GI Strip including all accessories like clamps, nut & Bolts etc.	MTR	20		



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24	Supply, Laying & Termination of 50 x 6mm GI Strip including all accessories like clamps, nut & Bolts etc.	MTR	70		
25	Supply, Laying & Termination of 25 x 5mm Cu Strip including all accessories like clamps, nut & Bolts etc.	MTR	20		
26	Supply, Laying & Termination of 50 x 6mm Cu Strip including all accessories like clamps, nut & Bolts etc.	MTR	70		
27	Supply & installation of 450mm x 50mm x 1.6mm Thick Ladder type GI Cable Tray for Cables laying including necessary hardware material (like Threaded Rods, couplers, nut & bolts, washers, welding works, etc as per site conditions.	MTR	290		
28	Supply & installation of 225mm x 50mm x 1.6mm Thick Perforated GI Cable Tray for Cables laying including necessary hardware material (like Threaded Rods, couplers, nut & bolts, washers, welding works, etc as per site conditions.	MTR	20		
29	Supply & installation of 150mm x 50mm x 1.6mm Thick Perforated GI Cable Tray for Cables laying including necessary hardware material (like Threaded Rods, couplers, nut & bolts, washers, welding works, etc as per site conditions.	MTR	20		
30	Supply & installation of 100mm x 50mm x 1.6mm Thick Perforated GI Cable Tray for Cables laying including necessary hardware material (like Threaded Rods, couplers, nut & bolts, washers, welding works, etc as per site conditions.	MTR	20		
31	Supply and Providing of LT Cable Markers, fabricated with MS Angle   Round plate type marked as "LT Cable"	NOS	50		





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32	Supply of 33KV Rubber Mats.Specification:-Class:C, Category : Category III (Mats resistant to acids, alkali and oil and low temperature) Width (in mm):1000, Length (in mm):2000,Colour : Black, Governing Specification : Conformity to Indian Standard: IS:15652 latest, Thickness:3mm, ISI Marked : Yes,Test reports to be furnished to buyer on demand : Yes, Test report number : RP-1314-014171,Availability of test reports from Central Government/State Government/NABL/ILAC accredited Lab covering all the declared parameters as per IS Specification :Yes. (Make:Jyot/Vardhaman/equivalent approved)	NOS	10		
33	<b>Main MV Panel - Type Tested Assembly Panel (TTA):</b> Design, Manufacture, Supply, Installation, Testing & Commissioning of floor mounting Main MV Panel shall be front operated, front access, extensible type, cubicle panel totally enclosed, dust and vermin proof with IP- 42 protection with hinged and lockable doors. The panel shall be fabricated from 2 mm thick CRCA sheets including interconnections, tinned copper strip /Wire crimping lugs, bonding to earth suitable for use at 415 V, 3 phase 4 wire 50 Hz system, and to withstand a fault level of 50kA as specified, symmetrical at 415 V complete as per specifications, as required & as below. All switchboards shall have provision for the entry of cables from the top/bottom as required. All live accessible parts shall be shrouded and all equipment shall be finger-touch proof. The bus bars shall be insulated with heat-shrinkable sleeves. SMC/DMC shrouds and busbar supports shall be used.and as per technical specifications mentioned in the tender document Panels feed from DG power supply -(Emergency) - RAL 9003	NO	1		



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<p>Incomers:- a) 2 no. 1000 A 50kA FP ACB with all protections &amp; required accessories and adequate size tinned Cu. neutral link. ACBs shall be manual draw-out type with safeties and Electrical &amp; Mechanical interlocks (One is for EB supply &amp; One is for DG Supply) b) 1 set of RYB indication lamps with 6A MCBs c) 3 nos 1000/5 A ratio, class-I, 15VA cast resin current transformer d) 1 no 3 phase 4 wire, 240 V (L-N) 5 A, Class-I Intelligent Multifunction panel meter to read &amp; record the current, Voltage, PF, KW, KVA, KWH, KVAH, etc &amp; flush mounted, 96 sq. mm, similar to Schneider Energy Meters, EM6400 or equivalent approved. e) Light &amp; Space Heater with thermostat with adjustable knob to be provided in Cable Chamber All Incoming / Outgoing Switchgear make Schneider/ABB/Equivalent Approved. Bus bar: 1000 A TPN tinned copper bus bar having a maximum current density of 800 A/sq.inch to withstand a symmetrical fault level of 50kA at 415 V. The neutral bus bar shall have 100% capacity Outgoings:- 1) 1 nos x 630 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for Chiller Panel. MCCB shall be a manual draw-out type with safeties and Mechanical interlocks</p>				
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<p>2) 2 nos x 400 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for the AHU Panel and One spare feeder</p> <p>3) 2 nos x 250 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for the Laser Hall Panel and Beem Hall Panel</p> <p>3) 3 nos x 160 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for Ground Floor EPIC Lab VTPN DB and First Floor VTPN DB for Office &amp; ACs etc and One spare feeder</p> <p>4) 1 no x 100 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link for General Lighting</p> <p>Note:</p> <p>1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C.</p> <p>2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</p> <p>3) LV Switchboards shall be certified by 3rd party Certification body as per IEC 61439-1 &amp; 2. Test reports without certificates shall not be considered admissible proof of compliance. The Certifying Authority shall be qualified under <b>ISO/IEC 17065 as per IEC 61439-1.</b></p> <p>4) BOM the switchboard shall be form 3b. For forms of separation to be achieved, only metallic covers shall be used. Hylem/ PVC sheets shall not be allowed.</p> <p>5) The painting of the sheet metal forming the enclosure shall be through electrostatic spraying of epoxy resin powder to give smooth finish to the equipment. Colour shade used should be RAL 9003.</p> <p>6) Panel shall be supplied with a double door arrangement. Global Door/ Front Door shall be fitted with transparent Glass to allow maintenance staff to</p>				
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	<p>visually access device status, meter readings, indicating lamp status without opening the door. IP level &amp; Mechanical impact performance of the panel shall not be compromised in any scenario and shall remain at IP42/54 and IK10 level respectively, in all conditions.</p> <p>7) The panel shall be supplied with a smartphone/web-based maintenance tracking system. A unique identifier(like QR code) shall be employed for each panel to enable quick access to switchboard details including but not limited to switchboard drawings, wiring diagrams, list of spares, Switchboard BOM etc.</p> <p>8) The MCCB shall be current limiting type, corresponding to selectivity category A. It shall be equipped with a double break contact system to ensure low cut off current and let through energy during faults. Manufacturer shall provide cut off current and let through characteristics of the MCCB for the full range of operating current up to the value of Icu. Ics = Icu 100% for all breakers</p> <p>9) Panel shall be tested for Internal arc <b>as per IEC 61641 Class C</b> for 50kA for 0.3seconds. The test should be performed for arc starting place - at Horizontal busbar, Vertical busbar and in outgoing cable compartments.</p> <p>10) Electrical distribution boards, that are non-forced air ventilated, shall be enabled with DIN rail mounted wireless sensors capable of monitoring the system and generate three-levels of alerts on overheating wire connections or overheating cables depending on the severity of the detected situation.</p>				
34	<b>MV Panel for Ground Floor Labs (Non- TTA):</b>	NO	1		



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<p>Design, Manufacture, Supply, Installation, Testing &amp; Commissioning of floor mounting MV Panel shall be front operated, front access, extensible type, cubicle panel totally enclosed, dust and vermin proof with IP- 42 protection with hinged and lockable doors. The panel shall be fabricated from 2 mm thick CRCA sheets including interconnections, tinned copper strip /Wire crimping lugs, bonding to earth suitable for use at 415 V, 3 phase 4 wire 50 Hz system, and to withstand a fault level of 50kA as specified, symmetrical at 415 V complete as per specifications, as required &amp; as below. All switchboards shall have provision for the entry of cables from the top/bottom as required. All live accessible parts shall be shrouded and all equipment shall be finger-touch proof. The bus bars shall be insulated with heat-shrinkable sleeves. SMC/DMC shrouds and busbar supports shall be used.and as per technical specifications mentioned in the tender document</p> <p>Panels feed from DG power supply -(Emergency) - RAL 9003</p> <p>Incomer:-</p> <p>a)1 no. 250 A 50kA FP MCCB with microprocessor release and adequate size tinned Cu. neutral link.</p> <p>b) 1 set of RYB indication lamps with 6A MCBs</p> <p>c) 3 nos 250/5 A ratio, class-I, 15VA cast resin current transformer</p> <p>d) 1 no 3 phase 4 wire, 240 V (L-N) 5 A, Class-I Intelligent Multifunction panel meter to read &amp; record the current, Voltage, PF, KW, KVA, KWH, KVAH, etc &amp; flush mounted, 96 sq. mm, similar to Schneider Energy Meters, EM6400 or equivalent approved.</p>				
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	<p>e) Light &amp; Space Heater with thermostat with adjustable knob to be provided in Cable Chamber All Incoming / Outgoing Switchgear make Schneider/ABB/Equivalent Approved. Bus bar: 250 A TPN tinned copper bus bar having a maximum current density of 800 A/sq.inch to withstand a symmetrical fault level of 50kA at 415 V. The neutral bus bar shall have 100% capacity Outgoings:- 1) 2 nos.160 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link 2) 3 nos.100 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link Note: 1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C. 2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</p>				
35	<p><b>MV Panel for Ground Floor Beam Hall (Non- TTA):</b> Design, Manufacture, Supply, Installation, Testing &amp; Commissioning of floor mounting MV Panel shall be front operated, front access, extensible type, cubicle panel totally enclosed, dust and vermin proof with IP- 42 protection</p>	NO	1		



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<p>with hinged and lockable doors. The panel shall be fabricated from 2 mm thick CRCA sheets including interconnections, tinned copper strip /Wire crimping lugs, bonding to earth suitable for use at 415 V, 3 phase 4 wire 50 Hz system, and to withstand a fault level of 50kA as specified, symmetrical at 415 V complete as per specifications, as required &amp; as below. All switchboards shall have provision for the entry of cables from the top/bottom as required. All live accessible parts shall be shrouded and all equipment shall be finger-touch proof. The bus bars shall be insulated with heat-shrinkable sleeves. SMC/DMC shrouds and busbar supports shall be used. and as per technical specifications mentioned in the tender document.</p> <p>Panels feed from DG power supply -(Emergency) -RAL 9003</p> <p>Incomer:-</p> <p>a) 1 no. 250 A 50kA FP MCCB with microprocessor release and adequate size tinned Cu. neutral link.</p> <p>b) 1 set of RYB indication lamps with 6A MCBs</p> <p>c) 3 nos 250/5 A ratio, class-I, 15VA cast resin current transformer</p> <p>d) 1 no 3 phase 4 wire, 240 V (L-N) 5 A, Class-I Intelligent Multifunction panel meter to read &amp; record the current, Voltage, PF, KW, KVA, KWH, KVAH, etc &amp; flush mounted, 96 sq. mm, similar to Schneider Energy Meters, EM6400 or equivalent approved.</p> <p>e) Light &amp; Space Heater with thermostat with adjustable knob to be provided in Cable Chamber</p> <p>All Incoming / Outgoing Switchgear make Schneider/ABB/Equivalent Approved.</p>				
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	<p>Bus bar: 250 A TPN tinned copper bus bar having a maximum current density of 800 A/sq.inch to withstand a symmetrical fault level of 50kA at 415 V. The neutral bus bar shall have 100% capacity</p> <p>Outgoings:- 1) 2 nos.160 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link 2) 3 nos.100 A 36kA TP MCCB with microprocessor release and adequate size tinned Cu. neutral link</p> <p>Note: 1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C. 2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</p>				
36	<p><b>Chiller Panel (Non- TTA):</b> Supply, Installation, Testing and Commissioning of outdoor MCC Chiller panel of 3 phase 415V free standing Floor mounted made out of 14 G MS sheet after seven tank processes and painted with Epoxy Powder Coated as required for condensing units, hot water generator, pumps, valves, etc. and as per technical specifications mentioned in the tender document</p> <p>Incomer:- 1 No x 630 A 50kA, FP, MCCB Incomer. MCCB shall be manual draw out type with safeties and interlocks.</p> <p>Outgoings:- 3 Nos x 250 A. 36kA, TP, MCCB out going for air cooled chillers with 112 KW (2 Working+1 Standby)</p>	NO	1		





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	<p>2 Nos x 32 A 36kA, TP, MCCB outgoing for secondary pump panel with 5.5 kw each (1 working+1 standby) 3 Nos x 32 A 36kA, TP, MCCB outgoing for chilled water primary pump with DOL starter with 3.75 KW each (2 Working+1 standby) 30 Nos x 6 A MCB 10 kA for valves 1 No x 63 A 36kA, TP, MCCB spare feeder 1 No x 250 A 36kA, TP, MCCB out going for air cooled chillers with 112 KW 2 Nos x 32 A 36kA, TP, MCCB spare feeder for Pumps Incomer shall have voltmeter with selector switch, ammeter with selector switch &amp; CTs, back up fuses and indicating lamps. Condensing unit feeders shall have ammeter with CTs and selector switch and single phase preventer. AHU and Fan feeders shall have ammeter with CTs, selector switch, single phase preventer and on/off/trip indicating lamps. Hot water generator feeder shall have an ammeter with CTs and selector switch. Starter below 7.5 HP shall be DOL and 7.5 HP and above shall be Star Delta.</p> <p>Note: 1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C. 2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</p>				
37	<p><b>AHU Panel (Non- TTA):</b> Supply, Installation, Testing and Commissioning of outdoor MCC AHU panel of 3 phase 415V free standing Floor mounted made out of 14 G MS sheet after seven tank processes and painted with Epoxy Powder Coated as required for</p>	NO	1		



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<p>AHU units, hot water generator, pumps, dampers, etc. and and as per technical specifications mentioned in the tender document.</p> <p>Incomer:- 1 No x 400 A 50kA, TP, MCCB Incomer. MCCB shall be manual draw out type with safeties and interlocks</p> <p>Outgoings:- 2 Nos x 160 A 36kA, TP,MCCB outgoing for hot water generator with 75 KW (1 Working+1 Standby) 8 Nos x 63 A 36kA, TP, MCCB outgoing for AHU's (5 Working +3 stand by) 2 Nos x 32 A 36kA, TP, MCCB outgoing for hot water circulating pump with DOL starter with 2.2 KW each (1 Working+1 standby) 20 Nos x 16 A MCB 10kA for fire dampers 1 No x 63 A 36kA, TP, MCCB spare feeder 1 No x 160 A 36kA, TP, MCCB spare feeder for hot water generator with 75 kw Incomer shall have voltmeter with selector switch, ammeter with selector switch &amp; CTs, back up fuses and indicating lamps. Condensing unit feeders shall have ammeter with CTs and selector switch and single phase preventer. AHU and Fan feeders shall have ammeter with CTs, selector switch, single phase preventer and on/off/trip indicating lamps. Hot water generator feeder shall have an ammeter with CTs and selector switch.Starter below 7.5 HP shall be DOL and 7.5 HP and above shall be Star Delta.</p> <p>Note: 1) All G.A. SLD &amp; Fabrication drawings shall be approved from the E.I.C. 2) All Incoming &amp; Outgoing feeders shall have 'ON', 'OFF', and 'Auto trip'.</p>				
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38	<p>Design, manufacture, supply, erection, testing and commissioning of <b>CPCB IV, 320 KVA/ 256 KW</b> Silent Diesel Generating Set with acoustic enclosure including assembly, shop testing, packing, dispatch, transportation, performance and guarantee testing, complete in all respects with all equipment, fitting and accessories for efficient and trouble-free operation with ARAI Approved and as per technical specifications mentioned in the tender document. Engine and Alternator mounted on a common Base Frame, complete with:</p> <p><b>Engine Details:</b> Make: Greaves Cotton / Kirloskar/ Cummins/ Mahindra Engine Power (kWm): 284 Gross engine Power (HP): 386.4 No of Cylinders: 6 Governor type: Electronic / CRS with Turbo charged Exhaust , Radiator Cooled and other related accessories</p> <p><b>Alternator Details:</b> Make: Crompton Greaves/LS/Meccalte/Stamford Rating: 320 KVA Voltage: 415 V, 3 Phase with Neutral Voltage Regulation: <math>\pm 1\%</math> Speed: 1500 RPM Frequency: 50 Hz, P. F.: 0.8 lag Insulation: 'H' grade</p>	NO	1		
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	<p>Unbalanced Load Capability: at 25 % Excitation: Self excited, self-regulated with brushless system and static voltage control unit suitably compounded for voltage and current to maintain terminal voltage constant at <math>\pm 5\%</math> at all load for p.f. not less than 0.8. Terminal Box shall be suitable Rating of cable for terminating DG Sets of rating specified in BOQ with Earthing studs</p> <p>Note:</p> <p>A) Suitable In-built Fuel Tank B) Suitable In-built DEF Tank C) Battery &amp; Leads D) Hospital Grade Silencer inside Canopy, tuned to EATS E) Anti-Vibration Mounting Pads F) First Fill of Lube G) Acoustic Enclosure H) Minimum 3G compatible Remote Monitoring System etc complete as required.</p>				
39	<p>Design, manufacture, supply, erection, testing and commissioning of DG Synchronization Panel (Indoor Type-IP45) with PLC Programing for Automatic Synchronizing with Auto Load Sharing and Load based Start /Stop should be provided in the Panel and as per technical specifications mentioned in the tender document</p> <p>Incoming: 3 Nos x 630A, 50kA, 4P. EDO ACB of suitable breaking capacity with O/C, S/C, E/F and Micro Processor based Releases with RS485 Communication port (Each consisting of following).</p>	NO	1		



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<p>Under voltage and Shunt Trip Coil. Generator Control Unit / Relay CL-PS, Tape wound CT's. Generator Differential Protection Relay Multifunction Meter(MFM) With RS485 communication port LED Type R-Y-B Phase Indication Lamps.On, Off &amp; Trip Indication. Outgoing: 1 No x 1600A, 50 kA, 4P. EDO ACB of suitable breaking capacity with O/C, S/C, E/F and Micro Processor based Releases with RS485 Communication port (Consisting of following). Under voltage and Shunt Trip Coil Multifunction Meter (MFM) With RS485 communication port - 1 No. LED Type R-Y-B Phase Indication Lamps. On, Off &amp; Trip Indications. Bus bar: 415V, 1600A,3Ph, 4wire, 50Hz, Aluminum bus bars (91E electrical grade) having withstand ability symmetrical fault level of 50 KA for 1 Sec. - LS Note:-All the accessories required for the satisfactory performance of the DG Synch Panel and the automatic load sharing based on running load and sequential On, Off of the DG sets should be considered by the Bidder.</p>				
				<b>Sub Total</b>
				<b>GST @ 18%</b>
				<b>Grand Total Supply &amp; Installation in Rs.</b>



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Grand Total Amount in words
Rs.....
.....only

Note:	
1	Rates are all inclusive of profit, packing & forwarding, Transport, loading & unloading, labour and Taxes, Etc.
2	TIFR, Hyderabad has right to delete any of above items from scope of work or may increase/reduce quantities as per its requirement during execution of work. No claim or compensation for such deletion/increase/decrease will be accepted/paid to the contractor. Payment will be made as per actual quantities executed at tender rates
3	Manufacturer's warranty of respective supply items to be provided.
4	For any above item quantity exceeding more than 10% of projected qty, contractor shall take prior approval from TIFR Engineer In charge in writing.
5	For any deviating items, the contractor shall take prior approval from TIFR Engineer In charge with proper rate analysis.