



భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

NOTICE INVITING TENDER (NIT)

Name of the Project: Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).




27.07.2026
Executive Engineer - Electrical
IIT Hyderabad

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INDIAN INSTITUTE OF TECHNOLOGY(IIT) HYDERABAD

NOTICE INVITING TENDER

NIT No. IITH/CMD/ELE/NIT/2026-27/12

The Indian Institute of Technology (IIT) Hyderabad, an Autonomous Institute under Department of Higher Education, Government of India invites on behalf of President of India, **an online bids (e-tenders) in Two Bid (Technical + Financial) system on Engineering, Procurement and Construction (EPC) Mode I basis from the well-established, experienced and innovative eligible companies/bidders for the Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).**

Copy of valid Registration of Firm (ROF) certificate, PAN card, GST Registration certificate & GSTIN should accompany the Bid and those certificates should be valid on the last date of submission of bid.

1.1	NIT No.:	IITH/CMD/ELE/NIT/2026-27/12	
1.2	Name of Project:	Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineer (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).	
1.3	Location of work:	Indian Institute of Technology (IIT) Hyderabad campus, Kandi-502284, Sangareddy, Telangana, India.	
1.4	Estimated Cost: (given merely as a rough guide)	Rs. 6,41,95,792.00/- only	
1.5	Earnest Money Deposit (EMD)	Rs. 12,84,000.00/- only	
1.6	Period of Completion:	07 Months	
1.7	Date of Online Publication/Download of Tender document.	28/07/2026 @ 09:00hrs	
1.8	Last Date & Time for receiving of Pre-Bid Queries and to email ID	Date & Time	03/08/2026 @ 17:00hrs
		email ID	ee.electrical@iith.ac.in
1.9	Date and Time of Pre-bid meeting at Conference Hall/Online, CMD, IIT Hyderabad	04/08/2026 @ 11:00hrs	
1.10	Last Date for Submission of bids	18/08/2026 @ 17:00hrs	
1.11	Date and time for Opening of Technical bids	19/08/2026 @ 17:30hrs	
1.12	Date and Time for Technical Presentation	21/08/2026 @ 11:00hrs	
1.13	Date and Time for Opening of Financial bids	To be Decided	
1.14	Website Link:	https://eprocure.gov.in/eprocure/app	

Sd/-
Executive Engineer - Electrical
IIT Hyderabad

INSTRUCTIONS TO THE BIDDERS FOR ONLINE BID SUBMISSION

The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, preparing their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

More information useful for submitting online bids on the CPP Portal may be obtained at: <https://eprocure.gov.in/eprocure/app>.

REGISTRATION

1. Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL: <https://eprocure.gov.in/eprocure/app>) by clicking on the link “Online bidder Enrolment” on the CPP Portal which is free of charge.
2. As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.
3. Bidders are advised to register their valid email addresses and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.
4. Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile.
5. Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.
6. Bidder then logs in to the site through the secured log-in by entering their user ID/password and the password of the DSC / e-Token.

SEARCHING FOR TENDER DOCUMENTS

- 1) There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.
- 2) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective ‘My Tenders’ folder. This would enable the CPP Portal to intimate the bidders through SMS / e- mail in case there is any corrigendum issued to the tender document.
- 3) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

PREPARATION OF BIDS

- 1) Bidder should take into account any corrigendum published on the tender document before submitting their bids.
- 2) Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.
- 3) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document/schedule and generally, they can be in PDF / XLS / RAR / DWF/JPG formats. Bid documents may be scanned with 100 dpi with black-and white option which helps in reducing the size of the scanned document.
- 4) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates, etc.) has been provided to the bidders. Bidders can use the “My Space” or “Other Important Documents” are available to them to upload such documents. These documents may be directly submitted from the “My Space” area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

Note: My Documents space is only a repository given to the Bidders to ease the uploading process. If Bidder has uploaded his Documents in My Documents space, this does not automatically ensure these Documents being part of Technical Bid.

SUBMISSION OF BIDS

- 5) Bidder should log into the site well in advance for bid submission.
- 6) Bidder should ensure that they can upload the bid in time i.e., on or before the bid submission time. Bidder will be responsible for any delay due to other issues.
- 7) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.
- 8) The bidder has to select the payment option as “offline” to pay the tender fee/ EMD as applicable and enter details of the instrument.
- 9) The bidder should prepare the EMD (if any) as per the instructions specified in the tender document. The original should be posted/couriered/given in person to the concerned official, latest by the last date and time of bid submission or as specified in the tender documents. The details of the DD/any other accepted instrument, physically sent, should tally with the details available in the scanned copy and the data entered during bid submission time. Otherwise, the uploaded bid will be rejected.

- 10) Bidders are requested to note that they should necessarily submit their financial bids(if any) in the format provided and no other format is acceptable. If the price bid has been given as a standard BoQ format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BoQ file, open it and complete the white coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BoQ file is found to be modified by the bidder, the bid will be rejected.
- 11) The server time (which is displayed on the bidders' dashboard) will be considered as the standard time for referencing the deadlines for submission of the bids by the bidders, opening of bids etc., The bidders should follow this time during bid submission.
- 12) All the documents being submitted by the bidders would be encrypted using PKI encryption techniques to ensure the secrecy of the data. The data entered cannot be viewed by unauthorized persons until the time of bid opening. The confidentiality of the bids is maintained using the secured Socket Layer 128-bit encryption technology. Data storage encryption of sensitive fields is done. Any bid document that is uploaded to the server is subjected to symmetric encryption using a system generated symmetric key. Further this key is subjected to asymmetric encryption using buyers/bid opener's public keys. Overall, the uploaded tender documents become readable only after the tender opening by the authorized bid openers.
- 13) The uploaded tender documents become readable only after the tender opening by the authorized bid openers.
- 14) Upon the successful and timely submission of bids (i.e., after Clicking "Freeze Bid Submission" in the portal), the portal will give a successful bid submission message & a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.
- 15) The bid summary has to be printed and kept as an acknowledgment of the submission of the bid. This acknowledgment may be used as an entry pass for any bid opening meetings.

ASSISTANCE TO BIDDERS

- 16) Any queries relating to the tender document and the terms and conditions contained therein should be addressed to the Tender Inviting Authority for a tender or the relevant contact person indicated in the tender.
- 17) Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24x7 CPP Portal Helpdesk. The contact details of the helpdesk are 0120-4711508, 0120-6277787, 0120-4001002, 0120- 4001005 and support-eproc@nic.in.

SECTION-01

1. ELIGIBILITY CRITERIA

The interested firms should have the credentials to meet all of the following criteria to become eligible bidders for the selection process of contractor for the **Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).**

A. BASIC ELIGIBILITY CRITERIA related to Technical and Financial Credentials

1. Bidders shall produce definite proof from the appropriate authority, in the form of a completion certificate which shall be to the satisfaction of the Competent Authority, of having satisfactorily completed similar works of magnitude specified below:

Experience of having successfully completed similar works during the last 07 years ending last day of the month previous to the one in which tenders are invited.

(i) Three similar completed works each costing not less Rs.2,56,78,317.00/- only

OR

(ii) Two similar completed works each costing not less than Rs.3,85,17,476.00/- only

OR

(iii) One similar completed work costing not less than Rs. 5,13,56,634.00/- only.

“Similar Work” shall mean the work of Planning, Design, Supply, Installation, Testing and Commissioning of Data Center (excluding civil works) in any Research laboratories/Educational Institutions/Universities/Hospitals/Commercial complexes/Municipal corporations/Power Discoms/Banks/PSUs/IT companies/Pharma companies/Any other organizations.

Note: The reference similar Data Centre needs to be successfully commissioned and shall be fully functional for a minimum period of 01year (after commissioning), as on previous day of due date of submission of this bid.

2. Turnover: The Average annual financial turnover of the bidder should be at least **Rs.1,92,58,738.00/- only** during the immediate last three (03) consecutive financial years **ending 31st March 2025 or ending 31st March 2026**. The value of annual turnover figures shall be brought to current value by enhancing the actual turnover figures at simple rate of 7% per annum. The signed and stamped certificate from the Chartered Accountant (CA) shall be attached with the bid.

3. Banker's Certificate or Net worth Certificate (as per the prescribed format given in NIT): The bidder shall submit the Banker's certificate or Net-worth certificate as per the below:

Banker's Certificate of the amount equal to **Rs.2,56,78,317.00/-only** issued by any scheduled bank,

or

Net worth certificate of minimum amount **Rs.64,19,579.00/-only**, issued by certified Chartered Accountant with UDIN.

5. **Bidding Capacity** : The bidder should have bidding capacity equal to or more than **Rs.6,41,95,792.00/- only**.
The bidding capacity shall be worked out by the following formula:

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

Where,

A = Maximum turnover in any one year during the last seven years taking into account the completed as well as works in progress. The value of completed works shall be brought to the current costing level by enhancing at a simple rate of 7% per annum.

N = Number of years prescribed for completion of work for which bids have been invited.

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

6. To become eligible, the tenderer shall have to furnish an affidavit as per **Form 'J'** of the NIT.
7. The bidder shall have **Employees Provident Fund (EPF) enlistment** and proof of the same shall be attached along with the Technical Bid clearly showing the Provident Fund Code number.
8. The bidder shall have the **Employee State Insurance Corporation (ESIC) enlistment** and proof of the same shall be attached with the Technical bid.
9. The bidder shall submit the **Indemnity bond** as per format provided in Annexure-II.
10. The bidder shall submit a valid and applicable **Electrical contractor license of 11 kV or above voltage level** along with its bid.
11. The bidder shall submit the **Manufacturer Authorization Certificate** from the approved Original Equipment Manufacturers (OEM's) of each **Compact Secondary Sub-station (CSS), DG set, UPS, PAC, Inrow Cooling system and VRV AC System** as per the format enclosed as Annexure-IV.
12. The bidder shall submit the details of **eligible similar nature of works** completed during the last seven years ending previous day of last date of submission of tender as per the format enclosed as **Form-D**.
13. The bidder shall submit the **Performance report of works** as per the format enclosed as **Form-E**.
14. The bidder shall submit the **Acceptance of tender terms & conditions** as per the format enclosed as **Annexure-III**.
15. The bidder shall submit the **Litigation Impact Statement** as per the format enclosed as **Appendix-II**.

A. Basic Eligibility Criteria related to Incorporation of the Firm:

- a) The bidder/ entity should have been operational in India at least for the last three financial years ending with 31.03.2025
- b) The bidder must not be a Joint Venture (JV) or Consortium of firms.

Note: The bidder shall submit all the necessary documentation in support of the above eligibility criteria.

B. Basic Eligibility Criteria related to Project Technical details:

- a) The bidder shall submit the Project Report including Key proposed features of Data Centre, detailed technical specifications, including proposed makes of each and every component proposed to be installed in the Project.
- b) The bidder shall submit the detailed Electrical Plan i.e., Single Line Diagram etc. mentioning the technical details of each Electrical component proposed for the intended Project.
- c) Potential bidder may please note that this is a live site and the campus is fully operational. The selected agency shall ensure the safety of the existing structures, services, its occupants against disturbances and/or harm, without hampering operations of the organization while planning and execution of the work.

Note: The bidder shall submit all the necessary documentation in support of the above eligibility criteria. Also, the Technical presentation shall be given by the bidder (in Physical Mode) to the IITH explaining the above submitted details, on the specified date and time.

11 The description of the work is as follows:

**Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy
(Sub Head: Electro-Mechanical works).**

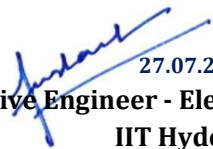
Tenderer are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their tenders as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require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

12. Tenders with any condition including that of conditional rebates shall be rejected forthwith.

13. Cost of EMD may also be remitted to Institute's account number as per bank particulars given below:

Name of the Account Holder	:	Indian Institute of Technology Hyderabad
Account Number	:	30412797764 (Current Account)
Name of the Bank	:	State Bank of India
Address of the Bank	:	IIT Kandi, IIT Hyderabad Campus,
Kandi, Sangareddy, Telangana -		502284
Branch code	:	14182
IFSC code	:	SBIN0014182
MICR code	:	502002528
SHIFT code	:	SBININBB762

14. The competent authority on behalf of the President of India does not bind itself to accept the lowest or any other tender and reserves to itself the authority to reject any or all the tenders received without the assignment of any reason. All tenders in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the tenderer shall be summarily rejected.
15. Canvassing whether directly or indirectly, in connection with tenderers is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable to rejection.
16. The contractor shall not be permitted to tender for works if his near relative is posted a Divisional Accountant or as an officer in any capacity between the grades of Superintending ENGINEER IN CHARGE and Junior ENGINEER IN CHARGE (both inclusive). Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this Institute.
17. No ENGINEER IN CHARGE of gazette rank or other Gazetted Officer employed in ENGINEER IN CHARGE or Administrative duties in an ENGINEER IN CHARGE Department of the Government of India is allowed to work as a contractor for a period of one year after his retirement from Government service, without the previous permission of the Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found any time to be such a person who had not obtained the permission of the Government of India as aforesaid before submission of the tender or engagement in the contractor's service.
18. The Tender for the works shall remain open for acceptance for a period of Ninety (90) days from the date of opening of NIT bid. If any tenderer withdraws his tender before the said period, or makes any modifications in the terms and conditions of the tender which are not acceptable to the department, then the Government shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money as aforesaid. Further the tenderer shall not be allowed to participate in the re-tendering process of the work.
19. This Notice inviting Tender (NIT) shall form a part of the contract agreement. 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 :-
 - a) The Notice Inviting Tender (NIT), all the documents including Terms and conditions, Special conditions of contract, additional conditions, Technical specifications and drawings, if any, forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.
 - b) Standard Contract form (General Conditions of Contract) as posted in the website of the Institute. The bidder is deemed to have gone through and understood the Standard Contract Form and the General Conditions of Contract.


27.07.2026
Executive Engineer - Electrical
IIT Hyderabad

(Signature of bidder)

SECTION-02
PROJECT DETAILS

2.0 Objective of this NIT:

The IIT Hyderabad is in the process of selecting a well-established, experienced and innovative company/contractor for the **Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works)** through an online competitive bidding process.

The objective of this document is to Invite tender from the interested parties, who satisfy the eligibility criteria set out in this document and who can offer, Plan, Design, Supply, Install, Test and Commission, the new Institute Data Centre (IDC) at IIT Hyderabad campus.

Based on the evaluation of bids received, interested parties found acceptable by IIT Hyderabad as per the selection criteria set out, will be short-listed for further evaluation process to award the work to the eligible bidder.

It is expected that only the System Integrators /Original Equipment Manufacturers (OEMs)/ EPC contractors/Specialized agencies having proven experience in Planning, Design, Supply, installation, Testing and Commissioning (SITC) of Data Center projects will respond to this Notice Inviting Tender.

2.1 Project Details

The Indian Institute of Technology Hyderabad (IITH) is a premier Institute of Science and Technology established in 2008. IITH has been consistently ranked in the top 10 institutes in India for Engineering according to NIRF making it one of the most coveted schools for science and technology in the country. The IIT Hyderabad campus is spread across 600 acres of campus in the Kandi Village of Sangareddy District, Telangana, India.

2.2 History of IITH Data Centre:

The current Data Center facility of IITH namely Institute Data Center (IDC)-01 is operational at Chemical Engineering Dept (erstwhile A- Block) building and has reached almost its full limit for hosting new servers, storage, and network infrastructure, leaving zero remaining capacity for any growth.

To meet the growing research, academic, and administrative computing demands of IITH, **a new Energy-Efficient Data Centre (IDC-02) currently TIER-01 and scalable to TIER-03 category** is proposed in the EE-CSE Building (AD-02 Building) located with the IIT Hyderabad campus.

The proposed new DC will encompass all critical infrastructure components necessary for a modern, reliable, and secure facility. This includes Power conditioning (UPS), Precision cooling (PAC), fire detection/Fire suppression system, DG Backup, dedicated power line from the nearby substation and structured cabling.

A Brief about TIERS of Data Centre;

Tier 1: A Tier 1 data center has a single path for power and cooling and few, if any, redundant and backup components. It has an expected uptime of 99.671% (28.8 hours of downtime annually).

Tier 2: A Tier 2 data center has a single path for power and cooling and some redundant and backup components. It has an expected uptime of 99.741% (22 hours of downtime annually).

Tier 3: A Tier 3 data center has multiple paths for power and cooling and systems in place to update and maintain it without taking it offline. It has an expected uptime of 99.982% (1.6 hours of downtime annually).

2.3 SCOPE OF THE REQUIREMENT:

The Scope of the work includes, but not limited to the following:

- a) Site survey, Technical feasibility, regulatory & policy assessment.
- b) Securing all necessary permits and approvals from all local authorities and IITH authorities as applicable.
- c) The Data Center project shall be Designed, supplied, install and commission strictly as per any applicable Govt. of India Guidelines.
- d) Providing all necessary labour, material, services, tools, plant and equipment for the works;
- e) Offer a range of viable project delivery options and extensive proposals, including but not limited to:
 - i. Planning, design, construct/Establish the Data Center to the best of its performance during the Liability Period.
 - ii. Any other value addition feature to the proposed Data Center as necessary.

2.4 Mode of Project Execution-Engineering, Procurement and Construction (EPC) Mode I;

The IIT Hyderabad intends to award and execute the said project of ***Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works)*** in the EPC Mode-I of contract.

The EPC Mode-I involves the preparation of detailed architectural, structural, MEP design & drawings and shop drawings, procurement & construction by the EPC contractor based on basic architectural/ MEP technical drawings prepared after considering statutory requirements by Construction and Maintenance Division (CMD), IITH.

The responsibility of investigations, planning and design, procurement, construction, safety, quality, and engineering risk lies with the contractor only for EPC Mode I projects.

The Engineering, Procurement and Construction (EPC) (also called 'Design & Build' Contracts) approach relies on assigning the responsibility for investigations, design and construction to the contractor for a lump sum price determined through competitive bidding. The objective is to ensure implementation of the project to specified standards with a fair degree of certainty relating to costs and time while transferring the construction risks to the contractor.

SECTION-03
EVALUATION METHODOLOGY:

3.1 The Procurement Process:

The activities leading to the procurement of the services of the well-established, experienced and innovative company/contractor for the **Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works)** will consist of the following key activities:

Invitation for Tender : The IIT Hyderabad invites intending bidders to submit the bids for consideration in the subsequent tendering process for selection of well-established, experienced and innovative company for the **Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works)**. A Notice inviting Tender will be published in the Central Public Procurement Portal (CPP Portal) of Govt. of India (www.eprocure.gov.in) and also will be uploaded on the IIT Hyderabad website (www.iith.ac.in), as per the standard procedure of IITH. This document with key details of the project and response formats is available for all potential and interested bidders through aforesaid websites.

3.1.1 Receipt of bids: The bids from the potential bidders who are interested in participating in the selection process will be received in online mode, on a designated date and time as specified in this document.

3.1.2 Evaluation of bids: The information provided by the potential bidders in their bids, as part of the response to this tender will be evaluated against the eligibility criteria specified in the tender to qualify for the subsequent processes of selection. Based on this evaluation, the potential bidders who meet the qualifying (eligibility) criteria will be short-listed. The eligibility conditions have been formulated to assess the competence and capability of the potential bidding firms to meet the requirements of IIT Hyderabad for providing the required services. **For a bidder to be shortlisted for next stage of the evaluation, he must secure at least fifty percent (50%) marks in each attribute (given in the technical evaluation criteria) and sixty percent marks (60%) in aggregate.**

The financial bids of the above-shortlisted cum technically qualified bidders as per the above criteria will be opened at the designated date and time and accordingly evaluated further for award of work to the successful eligible bidder.

3.2 RIGHT TO TERMINATE THE PROCESS:

- IIT Hyderabad makes no commitments, explicit or implicit, that this process will result in a business transaction with anyone.
- This NIT does not constitute any offer by IIT Hyderabad. The bidder's participation in this process may result in IIT Hyderabad selecting the bidders to engage in further responses, discussions and negotiations towards execution of a final contract. The commencement of any subsequent procurement activity resulting out of this NIT does not signify a commitment by IIT Hyderabad either to continue the activities or to culminate such activities with a definitive contract.
- IIT Hyderabad reserves the right to withdraw this tender if it determines that such action is in the best interest of the organization without assigning any reason whatsoever.

3.3 Authenticity of the Information and Right for Verification:

- IITH reserves the right to verify all statements, information and documents submitted by the potential bidder in response to the NIT. Any such verification or lack of such verification by the IIT Hyderabad shall not relieve the bidder of its obligations or liabilities hereunder nor will it affect any rights of the IITH thereunder.
- In case it is found during the evaluation of the responses or at any time during the subsequent procurement process or before signing of the contract or after its execution and during the period of project execution resulting out of the contract thereof, that one or more of the pre-qualification conditions have not been met by the bidder, or the bidder has made material misrepresentation or has given any materially incorrect or false information, the bidder shall be disqualified forthwith if not yet awarded the contract either by issue of the letter of intent or entering into a contract.

3.4 Additional Conditions:

- Timing and sequence of events resulting from this tender shall be as determined by IITH.
- Responses are subject to rejection if they limit or modify any of the terms and conditions or specifications of this tender.
- Neither the bidder nor any of bidder's representatives shall have any claims whatsoever against IITH or any of its respective officials, agents, or employees arising out of or relating to this NIT or these procedures (other than those arising under a definitive service agreement with the bidder in accordance with the terms thereof).
- The Bidder shall not bid under any Consortium or Joint Ventures. Bids from a Consortium/Joint venture shall be summarily rejected.
- The bidder should not be under a declaration of ineligibility for corrupt and fraudulent practices issued by Government of India or any State Governments in the country of India. (To be furnished under Notarized Affidavit).
- The bidder must not have any history of defaulting in execution of work orders issued by Government of India or any State Government in the country of India. A self-declaration certificate to this effect should be enclosed. (To be furnished under Notarized Affidavit).
- The bidder hasn't been blacklisted by any Central/State Government institution and there has been no pending litigation with any government department on account of similar services. (To be furnished under Notarized Affidavit).
- No Criminal Proceedings in any Court of Law should pending against the bidding Firm Or its Promoters Or its Directors Or its Executives. (To be furnished under Notarized Affidavit).

SECTION-04
SCOPE OF WORK

4.1 General:

The scope of work (SOW) for **Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works)** is described as under. The SOW shall consist of Planning, Designing, Supply, Installation, Testing and Commissioning of following Electrical and Electro-mechanical works and Services, but not limited to the following:

- Wiring and Internal Lighting
- DBs, MCBs, RCCBs, MCCBs, Industrial Sockets, Earth Pits, Cable Trays & Cable glands
- Hume Pipes, Cable Chambers
- MV Power Cables
- Compact Secondary Substation (CSS)
- UPS
- MV Electrical Panels
- DG Set along with AMF Panel and Control cables
- Fire alarm system (FAS)
- Gas Based Fire Suppression System (FK-5-1-12)
- Racks
- SITC of Inrow Cooling System
- PAC for IT Servers Ambient area
- Variable Refrigerant Volume (VRV) System
- VESDA system
- Access Control System
- CCTV
- Building Management System (BMS) /Datacenter Infrastructure management (DCIM)
- Rodent Repellent System
- Water Leak Detection System
- IT Racks Bus bar Power distribution System

Electrical works Indicative Scheme:

The Electrical work being one of the very critical aspects of the project, hence it is advised that the Contractor shall carry out detailed site survey to understand the site conditions before starting the execution of work. The Main incoming power supply for the proposed Data Centre shall be tapped from the nearby IITH Substation which is at distance of approximately 650meter from the Data center. The power supply to the Proposed Data Center is to be tapped at 11kV voltage level by augmentation of the Existing 11kV HT Panel board installed at IITH downstream 11kV substation. Further, this 11kV HT Power supply will be feed to the Compact Secondary Substation (CSS) of voltage level 11/0.433kV and minimum rating of 630kVA (to be supplied by the contractor) and to be installed at nearby location of proposed Data center. Finally, the 3Phase LT power supply at 433V will be feed from the Secondary side of CSS to the main Incomer LT Panel of Data Center. An indicative and Schematic SLD of the power scheme of the Data Centre is provided along with this NIT Document for better understanding of Intending bidders.

A 500 KVA rating (01 Nos) DG Set along with an AMF panel and Auto changeover mechanism shall also be installed near the aforesaid CSS and nearby Data center location. The contractor need to submit the Standard analysis for DG foundation and structures prior to execution. From IITH existing substation till CSS and DG Set and further extending till the proposed Data Centre in the CSE building, all the cables shall be laid in the Hume pipes as per the CPWD General Specifications for Electrical works.

For IT Load a minimum of 300kVA UPS (with initial load of 100kVA) is proposed. However, for other specific Non IT loads a minimum of 30KVA UPS is proposed to be installed by the contractor. The contractor may provide the UPS of higher ratings as well as per its design and Engineering calculations.

All the services in data Centre such as power and data network media shall run overhead and above the racks. All the Electrical cables in the Data Centre shall be FRLS type. The cables shall be laid in the Cable trays with separate trays for each source.

The lighting shall be done in the entire area with LED light fixtures of different types as per drawings. The contractor shall prepare and submit a DIALUX report to this effect.

Earthing and grounding shall be done as per drawing and specifications provided; all earth pits shall be shorted to provide an equipotential grid.

HVAC works Indicative scheme:

The Precision air-conditioning (PAC) units of suitable capacity shall be installed in the Data Centre server room area for providing ambient cooling.

For Electrical rooms, UPS rooms, BMS room, Staging room and other rooms the VRV air-conditioning system of suitable capacity shall be designed and provided by the contractor.

For IT server racks, an Inrow cooling system as specified in the detailed technical specifications shall be provided by the contractor.

Safety, Security, surveillance and monitoring work

An Addressable fire alarm system with all necessary smoke detectors or multifunction detectors along with fire panel must be installed in all areas of the proposed Data Centre. A proper cross zoning has to be done. The fire alarm system must be integrated with the building Main fire alarm panel as well, as per the technical feasibility.

A Gas based fire suppression system is required for the Data Centre server room area, UPS & battery room, Main Electrical rooms. For other areas, a portable type Fire extinguishers need to be provided by the contractor.

Aspiration smoke detection system or very early smoke detection system (VESDA) also to be provided by the contractor for Data Centre as per the design.

All the critical Areas / rooms entry & Exit are restricted with Access Control System. Biometric plus Smart Card Reader, Card reader with PIN & Card Readers shall be installed at the doors.

Surveillance for the entire Data Centre area by means of IP based CCTV system must be made. It should cover all the area i/c DG set and CSS and AC outdoor units as well.

Water leak detection is required for the Server farm area and other area covered with PAC Units for cooling.

Rodent repellent system is required for all the voids.

A centralized Building Management System (BMS) system /Datacenter Infrastructure management (DCIM) for monitoring all Operations of Data Centre shall be designed and provided by the contractor.

All the system under this scope shall be integrated with Datacenter Infrastructure management (DCIM)/BMS. In addition to this all the monitoring controls of all the field devices as per I/O summary must be integrated with the DCIM/BMS.

SECTION-05

SPECIAL CONDITIONS FOR SITC WORK

General

The special conditions of contract must be read carefully as this is specific in nature pertaining to this project. All the conditions mentioned in this document are mandatorily to be adhered and complied.

About the site:

The Site is on Ground floor, Computer Science Engineering (CSE) Building, AD-02, IIT Hyderabad.

Bidding Stage:

At any time prior to the last date of submission of proposal, IIT Hyderabad may for any reason be able to modify the Request for Proposal (RFP).

Any modifications in RFP or reply to queries shall be hosted – <https://eprocure.gov.in/eprocure/app> and <https://iith.ac.in/tenders/#Civil%20Works>. IIT Hyderabad at its discretion may extend the last date for the receipt of proposals.

Site Survey

The bidder may send their technical representative to the site for detail survey on a specified date as per the department. It is highly advised that a thorough site survey must be done by the bidder to ascertain the quantum of work, present issues at the sites in terms of execution. Once the bid submission date is passed, no site survey will be allowed.

Execution Stage:

General

The successful bidder hence called Contractor has to submit a detail project plan after award of work. The timeline clock will be calculated from the date of start as per agreement.

The Contractor must schedule a kick-off meeting of the project with all the stakeholders within 3 days from award of work. The Contractor has to submit the details of the persons to be engaged in the project time to time for issuance of entry passes.

Any kind of ladder, scaffolding, tools and tackles required has to be arranged by the Contractor only. Wherever any reference to any Indian Standard Specifications occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued there-to or revisions thereof, if any, up to the date of receipt of tenders.

The contractor shall take instructions from the ENGINEER IN CHARGE for stacking of materials at site. No excavated earth or building materials shall be stacked on areas where the buildings, roads, services or compound walls or any other structure are to be constructed.

If as per municipal rules, or due to any other restrictions, the huts for laborers are not to be erected at the site of work by the contractors, then the contractors shall provide such accommodation at such locations as are acceptable to local bodies, or contractor shall make his own alternative arrangement for stay of laborers outside the site of work, for which nothing extra shall be payable.

If ISI marked products are available, the contractor shall use only ISI marked products. In other cases, the materials shall conform to IITH specifications. In case a material /product is neither covered by ISI nor by CPWD specification, the work shall be carried out as per sound ENGINEER IN CHARGE practice, in such case,

the decisions of the ENGINEER IN CHARGE shall be final & binding. In such cases ENGINEER IN CHARGE shall satisfy himself about the quality of such materials and give his approval in writing. Only articles classified as first quality by the manufacturers shall be used, unless otherwise specified. All materials not bearing ISI mark shall be tested as per relevant ISI specifications. The ENGINEER IN CHARGE may relax the condition regarding testing if the quantity of the materials required for the work is small. In all cases of use of ISI marked materials, proper proof of procurement of materials from authentic manufacturers shall be provided by the contractor to the entire satisfaction of ENGINEER IN CHARGE.

The contractor shall give a performance test of the entire installation(s), as per standing specifications, before the work is finally accepted and nothing extra whatsoever shall be payable to the contractor for the test. Any damage to work resulting from weathering conditions, defacing or from any other cause such as negligent act on the part of contractor, until the work is taken over by the Department after completion of work, shall be made good by the contractor at his own cost.

Factory Inspection of Products

The client / department if so desires at the discretion of Engineer-in-Charge; the bidder must arrange for a factory inspection of material before dispatch. However not all the products require factory inspection. The following product but not limited to, may be included in factory inspection.

- a) Compact Secondary Substation (CSS)
- b) Precision Air conditioning (PAC) system
- c) UPS System
- d) DG Set
- e) Electrical Panels
- f) Bus Trunking
- g) Inrow Cooling system
- h) VRV AC system
- i) LT, HT Cables

In case of extraordinary circumstances OR the ENGINEER IN CHARGE at his discretion, Factory inspections can be waived Off. In such a case, the contractor may produce the type test certificates and all routine certificates of the products as it may require. For inspection the agency/contractor shall give minimum 7 days advance notice to the department for FAT Invitation.

Sample testing at site

The bidder has to submit sample of the items as directed by ENGINEER IN CHARGE from specified list in the bill of material as on when asked. Only after the approval of the ENGINEER IN CHARGE the product may be used at the site.

Preparation and Submission of Drawings

The bidder has to submit all the drawings during the course of the execution of project. The drawings essentially are shop drawings, coordinated drawings, good for construction drawings and as built drawings. The list of drawing may be as follows but not limited to

- a) Electrical Panel GA drawing
- b) PAC GA drawing
- c) Equipment placement drawing
- d) PAC outdoor layout
- e) Reflected ceiling plan
- f) Cable tray, raceway, cable pathway plan
- g) Sectional drawings as ordered by ENGINEER IN CHARGE time to time.
- h) Lighting drawing

SECTION-06

TECHNICAL SPECIFICATIONS

6.0 General

6.1 Data Centre Build Project

A Complete Turnkey implementation including Planning, Design, Supply, Installation, Testing, Commissioning (DSITC) works with 03(Three) years of Defect Liability Period (DLP) by the contractor i/c 03years onsite warranty by OEM for all equipments supplied & installed for setting up of Data Center at IIT Hyderabad as per the approved design and to meet the desired functional objectives of IITH.

The broad scope of work under of the project will include, but is not limited to:

6.1.1 Supply / Create

The contractor prior of ordering of any equipment shall submit the technical documentation compliant to tender specification for formal approval by Engineer-in-Charge. The contractor shall deploy trained & skilled manpower with good workmanship qualities to provide the Data Centre facility which is easily maintainable.

6.1.2 Installation, Integration and Commissioning

The scope of installation, configuration, integration and commissioning shall mean to install and configure all components and subsystems integrating the Building Management System(BMS)/Data Centre Infrastructure Management (DCIM) with the required components, integrating the entire facility and make the system operational as per scope of work.

6.1.3 Acceptance Tests

The acceptance test shall cover the following scope:

6.1.3.1 Factory Test Reports

The contractor shall provide factory test report for all supplied items after testing each parameter of products as per their standard test procedure. Below are the major items, but not limited to them only-

6.1.3.1.1 Compact Secondary Substation (CSS)

6.1.3.1.2 Electrical panels

6.1.3.1.3 DG Set

6.1.3.1.4 UPS

6.1.3.1.5 PAC

6.1.3.1.6 Inrow Cooling system

6.1.3.1.7 VRV AC system

6.1.3.1.8 VESDA system

6.1.3.1.9 CCTV

6.1.3.1.10 Fire Alarm system

6.1.3.1.11 Fire Suppression system.

6.1.3.1.12 BMS/DCIM

6.1.3.1.13 Busbar Trunking system

6.1.3.1.14 Other systems.

6.1.3.2 Integrated Site Acceptance Test (ISAT)

On completion of the commissioning, full load test of DC infrastructure by populating Rack Mountable Server Simulator Load Banks shall be arranged by the bidder. This test should be done for 48 hours to evaluate the Computer Room Air Conditioning, Aisle Containment and air flow, BMS configuration. Heating elements like Industrial Space heaters, Infrared Heaters and Hair Dryers are not to be used in place of Server Simulator Load banks. The load banks shall be dual power.

Rack-mount server-simulating dual power load banks discharge heat while consuming power to accurately mimic the load of a Server processing a workload thereby giving a real time performance benchmark for the installed infrastructure. Final acceptance of the DC infrastructure by IITH will be based on this ISAT report.

Integrated Site Acceptance Test (ISAT)
The scope of ISAT involves the following activities:
a.) Analysis of system design, review of actual design and script writing of integrated system test condition, expected result, method and impact.
b.) Development of system test simulation methodology for all the systems i.e., electrical, mechanical, fire & safety, monitoring and control system.
c.) Coordination with all the vendors to explain the test procedure, simulation methodology and requirements to be provided by vendors.
d.) Mock drill of ISAT once complete system is ready.
e.) Actual ISAT completion with detail of compliance, deviation found during test and correction required.
f.) Follow up and review with vendors / Customer to correct the gap identified during SIAT.

6.1.3.3 Prerequisite for carrying out User Acceptance Test (UAT):

Detailed test plan and procedure shall be defined by the Bidder in consultation with respective OEMs. This plan shall be submitted to IITH for review and approval. IITH reserves the right to modify the type and / or number of parameters being tested. Approved test plan will be the basis for final acceptance of system. All documentation (as built drawings, equipment labeling details, cable routes, manuals, data sheets, software, maintenance schedule, communication and escalation details etc.) related to the Data Centre and workspace shall be completed and submitted to IITH in hardcopy, before the final acceptance test.

6.1.3.4 The UAT shall include the following:

- All hardware and software items must be installed at Data Centre and workspace as per the scope of work and related layout drawings and technical specifications.
- Availability of all systems shall be verified. The Bidder shall be required to demonstrate all the features / facilities / functionalities as mentioned in the RFP (contract document).
- The Contractor shall arrange the test equipment including dual power rack-based heat load, simulation facility required for performance verification and shall provide documented test results.

6.1.3.5 Training

The Bidder shall conduct training for IITH designated Data Center executives. Training will be provided for a batch of at least 05 people at IIT Hyderabad premises.

IITH in consultation with the Bidder shall decide the detailed scope and schedule of training program. Furthermore, IITH may request any other training during O&M phase to familiarize its technical team with the operations & maintenance procedures for Data Centre and Workspace. The Bidder shall provide all the

training material (user/operation/maintenance manual). The training shall cover all the systems involved in the build of the Data Centre and Workspace. Training should be provided during data Center implementation or as part of technical support for minimum 5 working days

6.1.3.6 Documentation & Reports

Bidder shall provide documentation, which follows the ITIL/ISO20000 and other such similar standards and best practices (e.g.: FIDIC Conditions). This documentation and reports shall be submitted as the **project undergoes various stages of implementation Indicative list of documents includes but is not limited to:**

- **Project Commencement:** Project plan in MS Project or any other equivalent project management tool giving out micro level activities with milestones and deadlines.
- **Delivery of Material:** Factory Test Certificate from OEMs.
- **Training:** Training material shall be provided (hard copy), which shall include the presentations used for training and also the required relevant documents for the topics being covered.
- **Process Documentation:** The Bidder shall be responsible for preparing process documentation related to the operation and maintenance of each component of the DC. The prepared process document shall be formally approved and signed off by IITH before commencement of UAT.
- **Installation and Commissioning Report:** The Bidder shall document all the installation and commissioning procedures and provide detailed report on the same to Infocom at least one week before the UAT.
- **Layout Drawings/ SLD's:** The Bidder shall submit 4 set of floor layout drawings, BMS components, SLD's, and complete cabling system layouts (as installed), including cable routing, labeling designations etc. The layouts, SLD's shall detail all components, systems and equipment locations for easy understanding.
- **Configuration Manual:** Manuals for configuring control panels shall be provided by Bidder. The Bidder shall be responsible for documenting configuration of all panels /devices and keeping back up of all configuration files to enable quick recovery in case of failure of device.
- The training should be minimum of 5 days at the IITH Data Centre

Note:

The Bidder shall be responsible for preparing documentation required for certification/approvals wherever applicable or as required by IITH.

6.1.3.7 Delivery and Completion Schedule:

The contractor shall provide project key dates (milestones) of different activities for implementation of the project within given completion schedule.

The timeline for completion of this Project is **Seven (07) months** only.

6.2 Technical Specifications for Electrical Works

6.2.1 Scope

This specification covers the requirement of design, manufacture, supply, installation, testing and commissioning, handing over in approved working order of Data Centre at CSE Department, IIT Hyderabad. For LT Electrical Installation Work as per Single Line Diagrams, Specifications, covering the following:

- LT panels
- Lighting & Power Distribution
- Busbar trunking system
- Data Centre Power Distribution
- Earthing & Grounding system
- Augmentation panel to be provided for tapping the Power from Main HT panel through modification in existing Bus-duct & provisioning the power to new LT panels for New DC.

All the Electrical and Electro-Mechanical works of the Project shall be fully complied to the below CPWD specifications;

- 1. CPWD General Specifications for Electrical Works- Part I Internal 2023 (with upto date amendments)**
- 2. CPWD General Specifications for Electrical works- Part II External 2023(with upto date amendments)**
- 3. CPWD General Specifications for Electrical works- Part IV Substation 2013 (with upto date amendments)**
- 4. CPWD General Specifications for Electrical Works- Part VI Fire Detection and Alarm System 2018 (with upto date amendments)**
- 5. CPWD General Specifications for Electrical Works- Part VII DG Sets 2013 (with upto date amendments)**
- 6. CPWD General Specifications for Electrical works - Part VIII Gas Based Fire Extinguishing System 2013 (with upto date amendments)**
- 7. CPWD General Specifications for Electrical Works- Heating, Ventilation & Air-Conditioning (HVAC) 2024 (with upto date amendments)**

NOTE; In addition to the above CPWD Specifications, the Particular specifications of the items/equipments/components shall also be complied to by the contractor.

All equipment supplied shall meet all applicable IS codes, and other approved applicable standards.

6.2.2 General Notes

- 1) The Electrical work to be carried out shall be in accordance with the specifications covering the supply, installation, testing and commissioning various equipment / system, project layout drawings, typical installation drawings, notes and details enclosed in the tender documents.
- 2) The Electrical work to be carried shall meet the requirement of local codes, standards, local inspection / approval authority's requirements / regulations, safety codes, National / International standard practice, etc. Nothing in this specification shall be construed to relieve the responsibility of the CONTRACTOR.
- 3) The CONTRACTOR shall furnish all tools, ladders, scaffolding, welding equipment, rigging materials, testing equipment, test kits etc., required for complete installation, testing and commissioning of the items included in the contract work.

- 4) The CONTRACTOR shall co-operate through the MAIN CONTRACTOR with OTHER CONTRACTORS at site, in all matters of common interest, so as not to obstruct operation of others and to ensure the safety of all personnel and works at the site. In case of any conflict EMPLOYER/ PMC/ ARCHITECTS, / SERVICE CONSULTANTS decision will be final and binding. We would like to stress the importance of coordination with building electrical systems and agencies for timely and professional execution of Electrical works for this Data center. Tap Offs, Cable & containment routing, earthing and other such areas would need close interaction with IIT Hyderabad.
- 5) It will be the CONTRACTOR's responsibility to obtain approval from local statutory authorities including Electrical Inspector, wherever applicable, for carrying out any work or for installation carried out which comes under the purview of such authorities.
- 6) Sample of any quantity & any type of LED fitting at random selected from the material supplied at site as per discretion of ENGINEER IN CHARGE may be sent to any NABL/UL accredited lab for the checking and verification of its performance parameter as per LM-79/ 80 report. This expenditure cost shall be borne by the department. However, in case of failure of sample or the sample not found as per specification, the expenditure on this A/C shall be recovered from the bill of the contractor and the material shall required to be removed from the site.
- 7) The contractor shall arrange to submit LM -79 & LM -80 reports from LED manufacturer for each and every type of LED fittings, as per the directions and discretion of Engineer-in-Charge.

6.2.3 Installation and Inspection at Site

- 1) All work at site is to be carried out in such a manner as not to obstruct the operations of other CONTRACTORS and shall be co-ordinate with MAIN CONTRACTOR.
- 2) The execution of all works included in this Contract is to be supervised by a sufficient number of qualified representatives of the CONTRACTOR and full facilities and assistance are to be accorded by the CONTRACTOR for the ENGINEER IN CHARGE to inspect the works.
- 3) The CONTRACTOR is to obtain from the ENGINEER IN CHARGE details of the parts which he wishes to inspect, but such inspection shall in no way exonerate the CONTRACTOR from any of his obligations. The CONTRACTOR, if so, requested by the ENGINEER IN CHARGE, is to open for inspection before erection of any equipment which has been delivered to site partly assembled.
- 4) On completion of the works, the site is to be left neat and tidy to the satisfaction of the ENGINEER IN CHARGE. Any damage done to the building, structure, plant or property belonging to the EMPLOYER is to be made good at the CONTRACTOR'S expense.

6.2.4 Tender Drawings

The Drawings issued with this Specification are for guidance of the TENDERER and show the approximate positions of all items of equipment, etc. The actual and final position of all items of equipment shall be determined at site and approved by the ENGINEER IN CHARGE. TENDERER is to ensure that their proposal will meet with all the current rules and regulations of the relevant authorities in India.

6.2.5 Shop Drawings

- 1) All shop drawings shall be on standard and approved sizes.
- 2) Before any work is implemented, the CONTRACTOR shall submit 3 sets of dimensioned drawings, duly reviewed by himself, showing all details of the equipment, wiring, ductwork and materials etc., to be used to the ENGINEER IN CHARGE for review. The CONTRACTOR shall not commence final connection works until

the shop drawings are reviewed and approved by the ENGINEER IN CHARGE.

- 3) Review and approval of drawings by the ENGINEER IN CHARGE does not exonerate the CONTRACTOR from any responsibility under the Contract terms and conditions.
- 4) The CONTRACTOR shall co-ordinate / assist with CIVIL CONTRACTOR for the preparation of co-coordinated composite drawing covering all Civil, Mechanical and Electrical CONTRACTORS' details such as wall, doors, opening, civil, plumbing work, A/c & ventilation system duct layout, firefighting system piping / sprinklers layout, electrical equipment layout, cable trays & conduit layout, lighting layout, earthing layout etc., to avoid interference with each other system layout. CONTRACTOR shall submit the coordinated drawing for ENGINEER IN CHARGE for his approval.

6.2.6 Working Drawings

The CONTRACTOR shall always maintain on site, in good order and condition, a complete set of all drawings and documents necessary for the proper execution and checking of the works. The drawings and documents shall be made available on request to the ENGINEER IN CHARGE or other authorized persons on site. Any amendment shall be indicated on the drawing, dated and signed by the Authorized person in charge, with reasons stated thereon.

6.3 As-Installed Drawings

- 1) The CONTRACTOR shall prepare six (6) sets of paper prints of the As-Installed drawings, diagrams and schedules as in the opinion of the ENGINEER IN CHARGE, shown as an accurate record of the work as installed by the CONTRACTOR and submit to the ENGINEER IN CHARGE for approval. When approved, the CONTRACTOR shall submit three (3) sets of paper prints, two (2) set of reproducible and two (2) set of soft copies in compact disk of the approved "As-Installed" drawings for reference and record by the ENGINEER IN CHARGE.
- 2) Such records shall include the preparation of properly dimensioned drawings showing the following:
 - General arrangement of all services.
 - Cable routes, types of fixings, layout, support and other particulars.
 - The detailed layout of all equipment's
 - Conduit runs, pipe runs, duct work, etc.
 - A system diagram giving means of identification, circuit labeling and mounting level of equipment, etc.,
 - Schedule of all equipment's installed.
- 3) All drawings submitted by the CONTRACTOR shall have in the bottom right-hand corner in addition to the CONTRACTOR's name, title, scale, date and drawing number, the title of the project and subject of the drawings.
- 4) The retention sum of final payment will not be made until all such drawings and records have been received and approved by the ENGINEER IN CHARGE in charge.
- 5) One copy of the schematic drawing, isometric or layout drawing showing all equipment, controls connections, etc., shall be framed and hung in the relevant plant room at location as directed by the ENGINEER IN CHARGE.

6.4 Identification and Labeling

- 1) All parts of the works shall be properly labeled and identified. The CONTRACTOR shall carry out the following work:
 - a. Machine engraved trifoliate nameplates shall be provided to identify each major item of equipment. Similar labels will indicate the function of ancillary equipment such as switches, indicating lights, push-buttons, relays and other indicating devices.

- b. Lettering shall be black on white background. Nameplates for major items of equipment shall be engraved in lettering of at least 6 mm. Labels identifying ancillary equipment shall be engraved in lettering of at least 3 mm.

Identification lettering shall be applied to all conduit at the following spacing:

- (i) For all concealed runs in walls or ceiling spaces, every 5 meters but at least once.
- (ii) For exposed runs, every 10 meters but at least once for each exposed section.

The identification shall consist of stenciled painted black lettering 25 mm high naming the services.

6.5 TESTING AND COMMISSIONING

6.5.6 General

- (a) Factory Acceptance Testing of LT Panels, FM PDUs & Bus bar trunking will be witnessed by the client's representative/Engineer-in-Charge. Testing shall mean that all the systems efficiently meet the performance specified in operation. The systems shall be tested in the presence of the ENGINEER IN CHARGE or his authorized representative who requires at least two-week prior notice to enable him to attend.
- (b) The CONTRACTOR shall arrange for the representatives of any of his own specialties to be in attendance.
- (c) It shall be the responsibility of the CONTRACTOR to arrange all necessary testing equipment, instruments newly calibrated, etc. Provision of all testing equipment and the appropriately skilled labor shall have been included in the Tender Price.
- (d) Should anyone of the tests reveal a fault, the ENGINEER IN CHARGE will order that the fault be corrected and re-tested prior to acceptance. All fees connected with testing of equipment payable by the CONTRACTOR to any of the relevant Government Authority shall be borne by the CONTRACTOR.

6.5.7 Commissioning Test

- (i) The complete installation or any part thereof shall be tested, both before and after being commissioned to check the performance in operation. All fees connected with testing of equipment payable by the CONTRACTOR to any of the relevant Government Authority or expert from the supplier shall have been included in the Tender Sum.
- (ii) The CONTRACTOR shall be represented by a competent person approved by the ENGINEER IN CHARGE during the whole of the period required for the tests.
- (iii) All materials and equipment supplied or erected under this Contract which failed in the tests shall be replaced or rectified at once by the CONTRACTOR without cost to the IITH.
- (iv) The spares required during start-up and commissioning and during defect liability period of the system shall form a part of the scope of CONTRACTOR.
- (v) The CONTRACTOR shall supply all necessary instruments, apparatus, connections, skilled and unskilled labor required for the tests to be conducted in the presence of the ENGINEER IN CHARGE, make accurate records of all tests carried out and furnish the ENGINEER IN CHARGE with six (6) copies of the Test certificates and Schedule of Tests Results in approved form.

6.6 LT SWITCHBOARDS (PANELS)

A) GENERAL

The Switchboards shall be metal clad, totally enclosed, rigid, compartmentalized design, floor mounting, air insulated, extensible cubicle type for use on medium voltage power. 3- Phase, 4 wire 50 HZ system.

The equipment's shall be designed for operations 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:

The following equipment's shall confirm to the requirements as per the latest revision or the following standards:

1	Air Circuit Breaker (ACB)	IS-13947-1.2 /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	IS-8828/ IEC -898
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 Switchboards 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 50 HZ 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 enclosed protection not less than IP 42 for indoor & IP 55 for outdoor applications and IP:32 for battery charger.
- d) Each feeder/ instrument compartment shall be provided with a hinged door interlocked with MCCB/LBS inside the compartment such that door can only be opened when MCCB/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 of the feeders, busbars, cable termination, cable alley etc. as required.
- g) All CT's 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) wherever control wiring is done between the shipping sections, terminal blocks shall be provided on both sides of the shipping sections with TB diagram pasted near to the TBs.
- i) The total height of the panel shall not be more than 2200mm unless otherwise specified and maximum height of the switch operating handle shall not be more than 1800mm from FFL. The maximum shipping section shall be 2000mm width. The total depth of the panel shall be adequate to cater for proper cabling space.

j) Sheet thickness shall be as below :

- Main Frame : 3 mm
- Doors : 2 mm
- Covers/ partition : 1.6 mm
- Gland plate : 3 mm

Wherever single core cables are used, 3 mm thick aluminium 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.

- k) Components forming part of the switchboards shall have the following minimum clearances:

Between Phases – 32mm

Between Phases and neutral – 26mm

Between Phases and earth – 26mm

Between Neutral and Earth – 26mm

Creepage distances shall comply to those specified in relevant standards.

- l) 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 condition.
- m) Functional units such as circuit breakers, fuse switches, MCCBs, 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.
- n) Metallic/ insulated shrouding shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with.
- o) Main bus bars and vertical risers during operation, inspection or maintenance of functional units and front mounting accessories.
- p) All covers providing access to live power equipment's /circuits shall be provided with tool operated fasteners to prevent unauthorized access.
- q) Provision shall be made for permanently earthing the frames and other metal parts of the switchgear by two independent distinct connections.
- r) The complete panel shall be designed such that its rating is as per SLD without de-rating considering ambient temperature and temperature rise as per IS/IEC. De-rating of MCCBs/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..
- b) The panel shall be coated with zinc chromate primer (Applicable for outdoor panels).
- c) 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 Aluminium or copper (As specified in SLD), suitable for 415 volts, 3phase 4 wires 50 Hz, with minimum STC of 16KA for 1 Sec. unless otherwise specified or as specified in SLD for 1 Sec,
- 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 1.5A/sq.mm for copper & 0.8A/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 shrunk PVC sleeves appropriately color coded to identify different phases and neutral bar.

- h) All UPS output panels/SMSBs shall be provided with neutral bus rated double the size of Phase Busbars unless otherwise specified in SLD.
- i) 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.
- j) MCCBs of rating 200A & above rating shall have copper spreaders on terminals & then connected to main busbars.
- k) 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 (tentative & indicative only)
Up to 100A	25x3mm
250A	25x6mm
315A	25x10mm
400 to 630A	30x10mm
800 to 1000A	50x6mm
1250 to 2000A	50x10mm
2500 to 3200A	50x10mm
4000A	60x10mm

G) POWER/CONTROL WIRING:

All control wiring shall be carried out with 1100/660 V grade single core P VC- FRLS cable having stranded copper conductors with minimum cross section of 1.5 Sq.mm for potential & control circuits and/15 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 minimum cross section of 4 Sq. The color coding of cables shall be as below:

- a) Power up to 25Sq. : Red/ Yellow/Blue/ black**
- b) CT & PT : Red/ Yellow/Blue/ black**
- c) Control AC : Black**
- d) Control DC : Grey**
- 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 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 minimum clearance of 250 mm between the first row of the terminal blocks and the associated cable gland plate. Also, the clearance between two rows shall be a minimum of 150 mm.

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.
- f) Cable risers shall be adequately supported to withstand the effects of rated short circuit currents without damage and without causing secondary faults.
- g) 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.	: 250mm
120 to 185 Sq.	: 350mm
240 to 400 Sq.	: 550-600mm

(J) 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 switch boards.

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

e) Specifications for CT's:

i) Current Ratios:

ii) Primary: : As per SLD

iii) Secondary : 5A

1. Type : Resin Cast

2. Class : PS-REF Protection 5P10-O/C & E/F Protection Class 1 for metering.

B) POTENTIAL TRANSFORMER:

a) All the Potential Transformers shall comply with the requirements of IS 315 6 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, Sl.No. Make and model etc., shall be provided.

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

6.6.6 BREAKERS:

6.6.6.1 AIR CIRCUIT BREAKERS :

A) GENERAL:

The ACBs shall conform to IS 13947 -1 / IEC 60947-1 for general rules and I S 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 draw 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 9x 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.

- a) Under Voltage trip coil.
- b) Shunt trip coil.
- c) Closing coil,
- e) 4NO + 4NC auxiliary switches.
- f) Fault indicator/Reset unit.
- g) Pad lock

E) INTERLOCKING:

ACBs shall be provided with the following interlocking: -

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

F) BREAKING CAPACITY:

The ACB shall have minimum service breaking capacity of 35k A. 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.

6.6.6.2 MCCB - MOULDED CASE CIRCUIT BREAKER

The Moulded Case Circuit Breaker shall be incorporated in the switchboard where specified and shall be of the current limiting type. MCCB 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. MCCB shall be suitable either for Single Phase AC 230V Or Three Phase 415V. The MCCB shall be available in four pole versions for neutral isolation. It shall have tropicalisation as standard feature.

The 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/ IEC947-2, 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:

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

- 1) Undervoltage Trip
- 2) Shunt Trip
- 3) Alarm switch
- 4) Auxiliary Switch

B) INTERLOCKING:

MCCB shall be provided with following interlocking devices for interlocking the door of switchboard.

- a) Handle (Padlock) inter lock to prevent unnecessary manipulation of the breaker.
- b) Door Interlock to prevent door being opened when breaker is ON position.
- c) The Interlocking defeating device to open the door even if the breaker is in ON position

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

Irrespective of ratings, all MCCBs used in UPS , UPS Input & Output panel shall be with thermal magnetic release. All the MCCBs with thermal magnetic release shall be provided with adjustable overload of 70/80- 100% & fixed short circuit releases.

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

MULTI DATA METERS / ENERGY METERS

Multi data meters & kWh meters shall be of Electronic & 3 phase 4 wire type suitable for measurement of unbalanced loads. They shall be 96Sq.mm in size & suitable for flush mounting with back connecting terminals.

The Energy Meter shall be connected to the secondaries of potential transformers and current transformers rated for LT supply. These meters shall conform to IS : 13010 and have an accuracy of class 0.5 or better for kWh meter..

The current coil of the meters shall have a continuous overload capacity of 200% for both accuracy and thermal limits. Also the current coils shall withstand at least 10 times the rated current for 1 second without loss of accuracy.

Multi data meters shall read the following minimum parameters

- a) Current
- b) Voltage
- c) KW
- d) KVA
- e) KWH
- f) Power factor
- g) KVA Max. demand
- h) Total Harmonic Distortion (THD)

Multi data meters shall be provided with communication capability through RS485 port (Wherever specified in the SLD). All necessary hardware & software items shall be considered for integration with BMS, the preferred protocol is MODBUS.

6.6.6.3 RELAYS

All relays shall conform to applicable approved standard. Relays shall be suitable for flush mounting & connections from the rear.

All Protective Relays shall be of draw out or plug in type/Modular cases with proper built in test facilities. Test blocks and switches shall be located immediately below each relay for testing. The auxiliary relays shall be self reset type.

All protection relays shall be numerical & draw out type with 24V DC auxiliary supply

All other relays like master trip relays, aux. relays shall be Electro-Mechanical type.

All the relays shall be suitable for operation at 50Hz. AC Voltage operated relays shall be suitable for 110/v3 Volts PT secondaries and Current operated relays for 5Amp. CT. secondaries as specified in this specification. Voltage operated relays shall have adequate thermal capacity for continuous operation.

Auxiliary Relays and Timers shall have pairs of contacts as required to complete the scheme i.e. separate set of aux. contacts for tripping & alarm. Contacts shall be silver faced with spring action.

All Protective Relays, Auxiliary Relays and Timers except the lockout relays and Interlocking relays specified shall be provided with self reset type contacts. All Trip Relays and Timers shall be provided with externally hand reset positive action provided with description subject to Client/Consultant approval. Timers shall be of the electromagnetic or solid state type. Wherever solid state relays are used the following requirement shall be met with:

All Relays shall be designed for operating under an ambient temperature 50° C and 100% relative humidity.

All accessories required for correct operation of each relay shall be supported by the Contractor without any extra cost.

The solid state relays shall be stable and suitably protected against transient/induced over voltages. The Bidder shall state clearly in his list special requirements, if any, for DC input arrangement or cabling considered necessary for satisfactory operation of solid state relays quoted by him.

6.6.6.4 CONTROL COMPONENTS

A) INDICATING LAMPS:

All indicating lamps shall be of LED type & 22.5mm dia in size. Indicating lamps shall be suitable for panel mounting with screw connections on backside.

B) PUSH BUTTONS/ILLUMINATED PUSH BUTTONS:

All push buttons shall be of spring return & flush type. All push buttons shall be with minimum 1NO+1NC contacts. Emergency stop PB shall be mushroom head, stay put type with turn to release feature. All Mushroom PB shall be with minimum 2NO+2NC contacts of minimum 6A rating.

All illuminated PBs shall be with LED type lamps & 22.5mm dia in size with minimum 1 NO.+1NC contacts.

Rating of all Push Button contacts shall be 10A AC 230V OR 3 A 110V DC.

C) SELECTOR SWITCHES:

All selector switches shall be rotary type & shall be of 10A for AC circuit & 16A for DC circuits. Selector switches shall be with at least two poles.

Breaker control switches shall be of 25A rating & with minimum two poles. It shall be with sequence locking device, pistol grip handle and spring return to neutral position from both close and trip positions.

6.6.6.5 Factory Testing

The following tests shall be conducted on all typical panels . these tests shall form part of this package and necessary items , cost of travel etc. shall be included:

- a) Routine tests as per IS (Meggar, HV test etc.)
- b) Functional tests
- c) Paint thickness test, scratch test etc.
- d) Heat run test for all typical feeders/ incomers of rating 400A & above.

6.6.6.6 Tests for Battery Chargers

The following routine tests shall be conducted at works:

6.6.7 Visual Checks for dimensions and general arrangement.

6.6.8 Wiring Checks

6.6.9 Functional checks

6.6.10 Voltage regulation for rated input supply for loads from 0-100%.

6.6.11 Load test to show the charger can deliver the rated duty without the current limiter device operating.

6.6.12 Calibration of potentiometer vis-a-vis the DC output for float and boost chargers.

6.6.13 Ripple measurement by oscilloscope at different loads.

6.6.14 Demonstration of guaranteed efficiency and power factor.

6.6.15 Insulation test (with 500 V megger)

6.6.16 HI pot test, excluding electronic controller, at 2 kV AC for one min. EMPLOYER / ENGINEER IN CHARGE will have option to witness the tests on batteries and chargers before dispatch.

6.7 START-UP & ESSENTIAL SPARES

The CONTRACTOR shall maintain essential spares to meet the condition of SLA at their own cost.

6.30 PROGRAMMABLE LOGIC CONTROLLER (PLC)

6.3.1 GENERAL

All PLCs shall be suitable for communication interface with suitable interface port, to communicate/ collect data from digital meters or other equipment's.

PLC's shall be of expandable type to add I/O modules as required. PLCs shall have slave Modbus modules for third party integration. (BMS)

Preferable PLC shall communicate with MODBUS protocol.

PLC shall be complete with rack/base for I/O's, CPU & power supply. Control wiring for input & output shall be done with different color coding.

All digital output points shall be multiplied through suitable plug in relays/aux. contractors & PLC DO shall not be used directly. Suitable terminal block shall be provided all input & output terminals. Each PLC panel shall be provided with dedicated UPS of minimum 800VA & this shall be a part of PLC panel. Supplier shall consider programming of PLCs at works & then at site for at least two times.

General parameters (Minimum but not be limited to):

Operating temp. : 0 to +50° C

Degree of protection : IP20

Certification : VDE 0631/ IEC 1131/UL

6.3.2 CPU

CPU shall have minimum main memory of 32KB & load memory of 64KB to 2MB.

Processing times Bit operation	: 0.1 micro secs
Word operation	: 0.2 micro secs
Bit memory	: 128MB
I/O address area	: 1024/1024byte
Digital channels	: 200
Analog channels	: 25

6.3.3 I/O MODULES

6.3.4 DIGITAL INPUTS

Voltage : 24V DC

No. of channels : as required.

Galvanic isolation : max. 8 channels in 1 group

6.3.5 DIGITAL OUTPUTS

Voltage : 24V DC

Output current : 0.5Amps

No. of channels : as required.

Galvanic isolation : max. 8 channels in 1 group

C) ANALOG INPUTS

Current	:	4-20mA DC
Operating error	:	+ 0.5%
Conversion time/channel	:	<3 ms
No. of channels	:	as required.
Galvanic isolation	:	max. 8 channels in 1 group

6.4 Specifications for Electrical Cabling

Fire retardant cables of rated capacity exceeding the power requirement of fully blown configuration of the existing and proposed component must be used for expansion needs suitable redundant power points to be provided at suitable locations. All materials used shall conform to IS standards as per industry practice.

- 6.4.2 **Bunching of Wires** – Wires carrying current shall be so bunched in the conduit that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit.
- 6.4.3 **Drawing of Conductors** – The drawing Aluminium / Copper conductor wires shall be executed with due regards to the following precautions while drawing insulated wires in to conduits. Care shall be taken to avoid scratches and kinks, which cause breakages.
- 6.4.4 **Joints** – All joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joints shall be made inside conduits and junction's boxes. Conductors shall be continuous from outlet to outlet.
- 6.4.5 **Mains & Sub-Mains** – Mains & sub-mains wires where called for shall be of the rated capacity and approved make. Every main and sub-main shall be drawn into an independent adequate size conduit. Adequate size draw boxes shall be provided at Convenient locations to facilitate easy drawing of the mains and sub-mains. An independent earth wire of proper rating shall be provided. The earth wires shall run along the entire length of the mains and sub-mains.
- 6.4.6 **Load Balancing** – Balancing of circuits in three-phase installation shall be planned before the commencement of wiring.
- 6.4.7 **Colour Code of the Conductors** – Colour code shall be maintained for the entire wiring installation, Red, Yellow, Blue for three phases and "OFF" circuit black for neutral and green for earth (or bare earth).
- 6.4.8 **Fixing of the Conduits** – Conduits junction boxes shall be kept in position and proper Hold fasts shall be provided. Conduits shall be so arranged as to facilitate easy drawing of the wires through them. Adequate junction boxes of approved shape & size shall be provided. All conduits shall be installed to avoid stream and hot water pipes. After conduits, junction boxes, outlet boxes & switch boxes are installed in position their outlets shall be properly plugged so that water, mortar, insects or any other foreign matter does not enter into conduit system. Conduits shall be laid in a neat and organize manner as directed and approved by the Information Technology Department Personnel or person on their behalf. Conductors shall be planned so as not to conflict with any other service pipe lines / ducts.
- 6.4.9 **Protection** – To minimize condensation or sweating inside the conductors all outlets of conduit system shall be adequately ventilated and approved by the proper competent authority. All screwed and socketed connections shall be adequately made fully water tight by use of proper jointing materials.
- 6.4.10 **Switch-Outlet Boxes and Junction Boxes** – All Switch sockets should be modular type with necessary face plates, back box & required accessories. Boxes shall conform to all prevailing Indian Standards. Proper support shall be provided to the outer boxes to fix the cover plates of switches as required.

Sockets used for raw power & UPS power shall have different colour coding.

6.4.11 **Inspection Boxes** – Rust proof inspection boxes of required size having smooth external and internal Finish shall be provided to permit periodical inspection and to facilitate removal and replacement of wires when required.

- **Industrial Type Sockets:** All sockets shall meet IEC-309 requirements. Industrial type sockets shall be provided wherever specifically called for on the drawings. Industrial sockets shall be rated as specified.

Plugs and sockets shall have 3 pins for single phase applications and 5 pins for 3 phase applications. The sockets shall be provided with suitable plug top and cable entry device and shall be controlled by a suitably rated rotary switch. Where ever called, the sockets shall be housed in suitable metal or PVC enclosure as specified. Protection class shall be as per SLD.

- **Labelling:** The labelling should be provided for all light control switches, industrial-type sockets, socket outlets, permanently connected devices, etc, identifying the distribution board and circuit breaker number, in an approved manner, acceptable to IITH, to provide ready identification.
- Hand painted labels are not acceptable.

6.5 CABLE TRAYS, RACEWAYS & ACCESSORIES CABLE TRAYS AND ACCESSORIES

The cable trays shall be complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories and hardware. All hardware (i.e. bolts, nuts, screws, washers, etc.) shall be hot dip galvanized/ MS powder Coated as per BOQ.

6.6 GI PERFORATED CABLE TRAYS - CONSTRUCTION NOTES

- A) The perforated type cable trays shall be fabricated out of GI sheet, the associated accessories such as coupler plates, tees, elbows etc., shall be fabricated from 2mm thick for trays above 300mm, up to 300mm shall be with 1.6mm mild steel/GI sheets. Cable tray covers with 1.6mm thick GI perforated sheet shall be provided if specified in the BOQ.
- B) The cable trays shall be supplied in standard lengths of 2500 mm and clear inside widths x height of trays shall be as follows:
- C) Ladder type trays: 300x 50mm, 450x 50mm, 600x 75mm, 750x 75mm and 1000x 75mm.
- D) Cable trays, accessories and covers shall be galvanized.
- E) All finished cable trays and accessories shall be free from sharp edges, corners, burrs and unevenness.
- F) The thickness of galvanizing shall be 60 Microns in line with IS: 4759.

Ladder type trays: 300x 50mm, 450x 50mm, 600x 75mm, 750x 75mm and 1000x 75 mm

- G) Cable trays, accessories and covers shall be galvanized.
- H) All finished cable trays and accessories shall be free from sharp edges, corners, burrs and unevenness.
- I) The thickness of galvanizing shall be 60 Microns in line with IS: 4759.

6.7 CABLE TRAYS - INSTALLATION NOTES

Cable trays shall be installed generally at the elevations shown in respective cable tray layout drawings. If any major modifications in the drawings are envisaged in the field, these should be carried out after getting approval from design office. Before laying the trays, contractor shall submit the shop drawing & take the approval from client/consultant.

- A) It shall be the responsibility of the electrical contractor to mark up all the field modifications on the latest

issues of the drawings and return two copies of all such “ as constructed ” drawings to client/ consultant’s design office.

- B) The type and size of tray to be used shall be as mentioned in the individual layout drawings.
- C) The maximum size of cable tray when used in trenchess shall be of 750 mm width.
- D) Cable trays shall be welded to the mounting/carrier structures. Trays shall be supported with suitable angle/hitech rod supports.
- E) Each continuous laid out length of cable tray shall be earthed at minimum two places by M.S. flats of minimum size 25x 6 mm (unless otherwise noted) to the purchaser’s earthing system. The distance between earthing points shall not exceed 10 meters.
- F) The following shall be checked before laying the cables on trays.
 - a) Check for proper painting and identification nos. of the trays.
 - b) Check for continuity of cable trays over the entire route.
 - c) Check that all sharp corners, burrs and waste materials have been removed from the tray.
 - d) Obtain clearances from the ENGINEER IN CHARGE that no piping will be taken in the way of cable trays.
 - e) Check for earth continuity & earth connection of cable trays.
- G) Cable tray installation work shall comply with all currently applicable statutes, regulations and safety codes in the locality/country where the installation is to be carried out.

Installation of Cable trays should be as per Approved Shop Drawings.

S.No.	Equipment Specification
1	Cable trays should be of such dimension that the cables laid in it do not touch one another. If found necessary, the cable shall be fixed with clamps on the cable trays. Cables shall be laid on the walls/on the trays as required using suitable clamping/ fixing arrangement as required. Cables shall be neatly arranged on the trays in such manner that a crisis crossing is avoided, and final take off to switch gear is easily facilitated.
2	All cables will be identified close to their termination point by cable number as per circuit schedule. Cable numbers will be punched on 2mm thick aluminium strips and securely fastened to the. In case of control cables all covers shall be identified by their wire numbers by means of PVC ferrules. For trip circuit identification additional red ferrules are to be used only in the switch gear / control panels, cables shall be supported to prevent appreciable sagging. In general distance between supports shall not be greater than 600mm for horizontal run and 750mm for vertical run.
3	Whenever the rising Cable trays/ Raceways pass through the floor they shall be provided with a built- in fire proof barrier so that this barrier restricts the spread of fire through the rising mains from one section to the other adjacent section.
4	Neoprene rubber gaskets shall be provided between the covers and channel to satisfy the operating conditions imposed by temperature weathering, durability etc.
5	Necessary earthing arrangement shall be made alongside the cable trays.
6	The space between data and power cabling should be as per standards and there should not be any crisscross wiring of the two, in order to avoid any interference, or corruption of data.

6.4. LOW TENSION (LT) CABLES

6.40 GENERAL

Low voltage power cables shall be 1100V grade, XLPE insulated, extruded PVC inner sheathed, armoured / unarmoured extruded PVC outer sheathed. The cables shall conform to IS 1554 Part I in all respects.

Instrumentation cables spec:

Conductor : shall be/15 sq mm of electrolytic copper wire tinned stranded conductors.
Inner sheath : 85deg C Grade PVC.
Overall Screen : copper wire braid.
Aarmor : Galvanized steel wire.
Outer sheath : FRLS-PVC.

The FRLS outer sheath (if specified in BOQ) material shall meet the following requirements

- 1) The oxygen index value shall be minimum 29 when tested at 27 ± 2 C as per ASTM- D-2863-77 and temperature index value shall be minimum 250 C when tested as per NES 715.
- 2) The maximum total acid gas generation as determined by titration shall be less than 20 % by weight. The test shall be conducted as per IEC-754-1 (1994).
- 3) The smoke density shall be 60 % maximum, when tested as per ASTM-D-2843-77 (1988).
- 4) The finished cable shall pass the flammability test as per IEC-332-1 (1993), In addition, it shall also pass flammability test as per Class F3 of Swedish Standard SS-424-1475 (1978).

a) Core identifications

Cores shall be provided with the following colour scheme of PVC insulation:

1 core : **Red/Black/Yellow/Blue**
2 core : **Red and Black**
3 core : **Red, Yellow and Blue**
3 ½ / 4 core : **Red, Yellow, Blue & Black**

6.4.1 STORING, LAYING, JOINTING AND TERMINATIONS.

6.4.1.1 STORING

On receipt of cables at site, the cables shall be inspected and stored in a safe place.

6.4.1.2 LAYING

All cables which are laid indoor shall be of armoured/ unarmoured and outdoors shall be armoured only. Cables shall be laid as per the specifications given below:

6.4.1.3 CABLES IN OUTDOOR & INDOOR TRENCHES

Cables shall be laid in outdoor & indoor trenches as per CPWD Specifications .

CABLE ON TRAYS/RACKS

Cables shall be laid on cable trays/racks wherever specified. Cable racks/trays shall be of perforated steel

section slotted angles for suitable purpose. The trays/racks shall be complete with plates, tees, elbows, risers and all necessary hardware. The steel trays and supports shall be galvanized. Cable trays shall be erected properly to present a neat and clean appearance. Suitable cleats or saddles shall be used for securing the cables to the cable trays. All single core cables shall be laid in trefoil form with suitable clamps/ties.

6.4.1.4 JOINTING

Cable jointing shall be done as per the recommendations of the cable manufacturer. Jointing shall be done by qualified cable jointers.

Each termination shall be carried out using brass double compression glands and cable sockets. crimping tool shall be used for making the end terminations. Cable gland shall be bonded to the earth by using suitable size G.I. wire/tape. Suitable identification tags with the feeder designation inscribed on an aluminium/G. I. sheet shall be tied to either ends of each cable.

6.4.1.5 TESTING

Cables shall be tested at factory as per the requirements of IS 1554 Part I. The tests shall incorporate routine tests and acceptance tests. Copy of such test certificates shall be furnished to the department prior to dispatch.

6.4.2 ALUMINIUM CABLE TERMINATION METHODS

A. The general requirements for terminations of aluminium cables shall be:

- a) To remove oxide from the conductor and prevent the oxide re-forming.
- b) To prevent corrosion resulting from contact between dissimilar metals.
- c) To retain contact pressure under cyclic loading conditions.

For all aluminium cables, the oxide shall be removed by thoroughly wire- brushing the bare end of the cable. After brushing, a liberal coating of an approved oxide-inhibiting, moisture-excluding thermally stable grease shall be applied, and the cable shall be wire- brushed again through the grease. Cable strands shall not be separated before brushing.

Bare aluminium lugs, ferrules and other connectors, unless factory-tinned or factory pre-filled with inhibiting grease, shall be wire-brushed and contact grease coated in the same way as cables. Before making any joints or terminations in aluminium cables, the Contractor shall submit the proposed method to the client/consultants for approval.

Notice shall be given before making any joints or terminations, to enable the client/ consultants to witness the work.

B) ACCEPTABLE JOINT/TERMINATION METHODS

Aluminium to aluminium connections shall be made by one of the following methods:

- a) Aluminium crimp lugs or tinned copper lugs.
- b) Fusion welding with aluminium lugs.

Tinned copper lugs shall be terminated using the compression method. For compression connections on stranded cables, a hexagonal die shall be used. On solid conductor cables, indent type dies shall be used, with at least two indentations per cable connection.

Lugs shall be selected to suit the size and shape of the conductor. Compression dies shall be selected to suit the particular lug or ferrule. Aluminium crimp lugs shall be filled with oxide inhibiting contact grease.

Joints by the fusion welding method shall be made by jointers experienced in this method. Particular care

shall be taken to protect the cable insulation from heat by fixing substantial heat sinks to the cable near the joint. After completion of the weld the joint shall be wire brushed and all sharp projections filed smooth.

Aluminium to copper connections shall be made by one of the following methods:

- Bi-metal connectors, or
- Tinned copper lugs or
- Electro-tinned cast aluminium lugs.

Bi-metal connections shall consist of lugs or pin type connectors having a cast copper palm or pin, friction-welded to an aluminium barrel section which is subsequently factory filled with oxide-inhibiting grease. The aluminium cable shall be inserted in the barrel section and fixed using the compression method as detailed above. The copper pin or palm section shall be fixed to copper or brass connectors or bus-bars in the conventional manner.

Tinned copper lugs shall be terminated using the compression method.

Where electro-tinned aluminium lugs are used, they shall be fixed to the cable using the compression method. The palm of the lug shall be bolted to the copper bus-bar or terminal using a stainless steel bolt and nut, with one large diameter stainless steel flat washer and two "Belleville" spring cup washers.

All nuts shall be adequately torque tightened to manufacturer's recommended levels. Identification tags for feeder designation shall be by using 'Phoenix' plastic cable markers, tied to either end of each cable.

All cable glands & cable armour shall be earthed properly with earthing clamps & braided copper wires. All cable glands shall be of double compression type & lugs shall be aluminium for aluminium cables & copper for copper cables.

C) ROAD CROSSINGS

All pipelines laid up to 1Mt below roads (FGL) or shall be taken through suitable underground trenches. The size of trenches shall be as per the drawings.

D) CONSTRUCTION ACROSS ROADS

All works across roads shall be carried out as per the directions of the client/consultants. Necessary safety measures shall be taken to divert traffic. Care shall be taken not to disturb electrical and communication cables.

E) PROTECTION OF EXISTING SERVICES

All pipes, water mains, cables, etc. met with during the course of excavation shall be carefully protected and supported. In any case damage is caused, the same shall be made good at no extra cost, failing which necessary rectification will be done by the client/consultants, at the risk and cost of the Contractor.

F) REFILLING:

The filling shall be done in layers not exceeding 15mm in depth. Each layer shall be watered, rammed and compacted. Ramming shall be done with iron rammers where possible and with blunt end of the crow bars where rammers cannot be used. Special care shall be taken to ensure that no damage is caused to the pipes, drains, masonry or concrete in the trenches.

Filling in trenches shall be commenced soon after the joints of pipes, cables, conduits etc. have been tested and approved by the client/consultants. The space around the pipes shall be cleared of all debris where the trenches are excavated in hard/soft soil. The filling shall be done with earth on the sides and top of pipes in layers not exceeding 15mm in depth. Each layer shall be watered rammed and compacted.

G) SETTLEMENT AND DAMAGES:

The Contractor shall at his own cost make good promptly during the whole period the works are in hand, any settlements that may occur in the surfaces or roads, beams, footpaths, gardens, open spaces etc. Whether public or private caused by his trenches or by his other excavations due to not using the method of compaction and he shall be liable for any accidents caused thereby.

He shall also at his own expense and charges, repair and make good any damage done to the building and other properties.

4 LT Cables; All the Aluminium/ Copper cables/ wires should be FRLS type.

S.No.	Equipment Specification
1	Cables: The Bidder shall install, terminate and connect all cable as per drawings.
1.01	All Cables shall be FRLS (Fire Retardant Low Smoke) type.
1.02	The drawings shall be strictly followed except where obvious interference occurs. In such cases, the routing shall be changed as directed and / or approved by Consultant.
1.03	Approximate lengths of cable runs are given in the cable schedule for guidance & evaluation purposes only. Before commencement of work, the Bidder shall take actual measurements and prepare his own cable schedule to reduce wastage to a minimum.
2	Cable Laying: Cable shall generally be installed in pre-fabricated trays except for some short run in rigid / flexible conduit for protection or crossing.
2.01	Cables on trays and risers shall be neatly dressed and clamped at an interval of 1000 mm and 600 mm for horizontal and vertical cable runs.
2.02	All power cables shall be clamped individually, and control cables shall be clamped in groups of three or four cables.
2.03	Also, the cable runs both before and after the fire seals shall be suitably sprayed with anti-fire propagation liquid at least for 1M length.
3	Cable Tag & Marker: Each cable shall be tagged with numbers that appear in the cable schedule.
3.01	Cables shall be tagged at entrance and exit from any equipment and junction box.
3.02	The location of cable joints, if any, shall be clearly indicated with cable marker with an inscription 'cable-joint'.
4	Cable Termination: The termination and connection of cables shall be done using double compression glands, strictly in accordance with manufacturer's instruction, drawings and /or as directed by the consultant
4.01	The work shall include all clamping, fitting, fixing, cable jointing, crimping, shorting etc. as required for heat / cold shrinking technology for the complete job.
4.02	All equipment required for all such operations and furnishing of all consumable materials, such as soldering material, electrical tape, sealing material as well as cable jointing kits shall be included in the offer.

5.0 Light Fixtures

Power efficient and aesthetically good-looking fixtures shall be provided to provide lighting thus ensuring a comfortable working environment.

6.0 EARTHING SYSTEM

All electrical components are to be earthed is to be by connecting two earth tapes, cables or as specified, from the frame of the component ring will be connected via several earth electrodes. The cable arm will be earthed through the cable glands. Earthing shall be in conformity with provision of rules 32, 61, 62, 67 & 68 of Indian Electricity rules 1956 and as per IS- 3043, TIA -942, TIA/EIA J-STD-607- A and IEEE 1100. The entire applicable IT infrastructure in the Data Center shall be earthed.

PLEASE READ THIS ALONG WITH THE EARTHING & GROUNDING SLD

S.NO	Earthing Specifications
1	Earthing & Grounding should be done inside the Data Centre for the entire power system and provisioning should be there to earth UPS systems, Power distribution units, AC units etc. so as to avoid a ground differential. IITH shall provide the necessary space required to prepare the maintenance free earthing pits.
2	All metallic objects on the premises that are likely to be energized by electric currents should be effectively grounded.
3	The connection to the earth or the electrode system should have sufficient low resistance in the range of 0 to 25 ohm to ensure prompt operation of respective protective devices in event of a ground fault, to provide the required safety from an electric shock to personnel & protect the equipment from voltage gradients, which are likely to damage the equipment.
4	Recommended levels for equipment grounding conductors should have very low impedance level less than 0.25 ohm.
5	There should be enough space between data and power cabling and there should not be any cross wiring of the two, in order to avoid any interference, or corruption of data.
6	The earth connections shall be properly made. A small copper loop to bridge the top cover of the transformer and the tank shall be provided to avoid earth fault current passing through fastened bolts, when there is a lighting surge, high voltage surge or failure of bushings.
7	Common Bonding Network: A CBN must be created inside the Data Centre for creating a proper Grounding & Bonding. Components include: AC Plumbing, Racks, All Structural members, Cable Trays and raceways, Panels, etc. The CBN must have a mesh topology and connected to the earthing network. PLEASE SEE THE SLD
8	The Contractor would be responsible for providing separate or Equipotential Earthing System for Servers & UPS as per the standards and as per SLD and as per approved drawings.

6.5 Technical Specifications of Bus ducts

6.5.1 General

This specification details the electrical characteristics and general requirements for a continuous open channel, low voltage bus bar system.

- The system shall be designed primarily for overhead distribution of electrical power.
- The bus bar must be an open channel system with continuous access to the power. Tap off boxes must be able to be inserted and removed anywhere along the length of the busbar.
- The bus bar system must be hot swappable i.e., tap off boxes can be added or removed without shutting down the bus bar.
- The Quantities in BOQ are tentative. Contractor to order the Quantity as per site requirements and shall be paid accordingly.

Standards

The busbar system, components and accessories shall be designed and manufactured to the following standards and guidelines:

- Low Voltage Directive 73/23/EEC including amendment 93/68/EEC
- Low Voltage Switchgear and Control Gear Assemblies, Part 1: Type Tested and Partially Type Tested Assemblies, IEC 61439-1:2011
- Low Voltage switchgear and Control Gear Assemblies, Part 6: Busbar Trunking Systems, IEC 61439-2:2012
- Seismic qualification: UBC-1997, IBC-2015, CBC 2013, ASCE7-10 and IEEE693
- Impact Resistance: BS EN 62262:2002, Rating of IK10
- Arc flash protection: IEC/TR 61641:2014

Certificates from an independent testing agency shall be made available on request.

6.5.2 System Description

6.5.2.1 Environmental Conditions

The busbar should be capable of operating in the following environmental conditions without mechanical or electrical damage, degradation, or derating of operating capability:

- Ambient Temperature for Electronic Components: 0°C to 50°C
- Relative Humidity: 0 – 95%, noncondensing

6.5.2.2 Electrical Specification

The busbar system shall perform as stated in this specification while supplying rated full-load currents as shown on the project drawings.

The busbar system must comply with the following electrical specification:

Available Current Ratings	250A
Earthing	100% isolated earth
System Voltage	600V
Insulation Voltage	1000V
Frequency	50Hz or 60 Hz
Short Circuit Rating	Icw = Rated short-time withstand current (rms) – Minimum 25 KA per second RMS

6.5.2.3 Busbar Assembly

The manufacturer should recommend appropriate busbar lengths to meet the project requirements as indicated on the electrical drawings.

- 6.5.2.3.1 The busbar should be available in lengths up to 4m with options of colours (full chassis or only identification strip) to help differentiate/identification of power source from different power sources.
- 6.5.2.3.2 The busbar housing shall be constructed of an extruded aluminium shell and provide a 100% rated earth path. Steel housings shall not be permitted.
- 6.5.2.3.3 The extruded aluminium housing shall be directly connected to the busbar hangers. The hangers shall not in any way interfere with the tap off installation.
- 6.5.2.3.4 The manufacturer must supply appropriate hangers as per the project drawings.
- 6.5.2.3.5 The busbar housing shall have an integral channel to accommodate monitoring/communication cables.
- 6.5.2.3.6 The busbar conductors shall be continuous copper. Busbars shall be fabricated from high strength electrical grade Copper (C101 BS 1432/1433) 99.99% Purity to ETP 99.9
- 6.5.2.3.7 The busbar conductors shall be sized to handle 100% of the busbar rating under continuous operation up to 50°C.
- 6.5.2.3.8 The conductors shall be electrically isolated from the housing using IEC certified, halogen free, non-flammable thermoplastic material. The insulation must have excellent dielectric strength and impact resistance.
- 6.5.2.3.9 The bottom of the busbar shall be a continuous open channel system with an Ingress Protection rating of IP2X.
- 6.5.2.3.10 An end cap shall be installed at the end of a busbar run.
- 6.5.2.3.11 A joint pack shall be used to make electrical and mechanical connections between the busbar sections and end feeds. The fitting of this joint pack shall be via a bolted means. No special tooling shall be required. The joint packs should be such that tap off units can be installed very close to the joints.
- 6.5.2.3.12 Isolated earth to be provided.
- 6.5.2.3.13 The Vendor shall include 100% oversized neutral.

6.5.3 Tap Off Units

A system of tap off units will be provided. The tap offs shall be made by the same manufacturer as the busbar with same country of origin in case of imported into India.

- Tap offs units shall be capable of being inserted safely while the busbar is energised. The manufacturer shall provide a statement to confirm tap offs can be engaged whilst the busbar is live.

- Tap off units shall be polarized to avoid incorrect installation.
- All tap off units shall use a mechanical/electrical interlock. Tap offs shall make earth contact prior to any contact with live conductors. Earth contact will break last during removal.
- The tap off unit will not become live during insertion into the busbar. An independent mechanism shall be operated to engage the tap off conductors into the busbar conductors. This mechanism shall only be operable when the tap off has been correctly inserted to the busbar.
- Tap off units shall have integral shutters.
- Tap off units that make a simultaneous mechanical and electrical connection when attached to the busbar shall not be permitted.
- Tap off units shall be compatible for vertical and horizontal mounting on the busbar.
- The tap off units shall be compatible with all ratings of the busbar system.
- The required protection device shall be as indicated on the drawings.
- The required outlet device shall be as indicated on the drawings.
- Tap off units shall be configured by the manufacturer to balance the load based on the quantity of tap off units provided.
- Tap off units shall use either a circuit breaker or a fuse for branch circuit protection as indicated on the project drawings.
- An MCB interlock shall be added to ensure that the tap off unit cannot be fitted/ removed while the circuit breaker is in the on position.

6.5.4 End Feed

- The end feed shall provide the connections from the incoming power sandwich type busbar to the data Centre busbar system.
- The end feed shall be an IP2X enclosure with various access panels for incoming cabling.
- The end feed shall have an internal connection to a section of busbar conductors.
- The end feed shall also be available as a Centre feed box to accommodate existing or future site conditions.
- The end point unit should have the capability of metering along with integration with BMS/DCIM over SNMP or Modbus.
- Standard factory tests shall be performed on the equipment provided under this section.
- All test shall be in accordance with the latest version of ISO, ANSI and NEMA standards.
- The manufacturer shall provide three certified copies of factory test reports upon request.

6.5.5 Examination

- Examine areas and conditions, with installer present, for compliance with requirements for conditions affecting performance of the busbar.
- Proceed with installation only after unsatisfactory conditions have been corrected.

6.5.6 Installation

- The contractor shall install the busbar in accordance with manufacturer's instructions.
- The busbar runs shall consist of lengths as shown on the drawings.
- The tap off units' orientation shall be as indicated on the drawings.
- Hanging of the busbar shall be done using the busbar hangers from a secure structure above the busbar.

- The hangers shall connect to the busbar, and to an all thread rod provided by the installing contractor.
- The spacing of the hangers along the busbar is 1.5m or less as recommended by the manufacturer.
- The end feed shall have connection provisions for the contractor supplied feeder cabling.
- The end feed shall be connected to the busbar section using a joint kit.
- Connection of sections of the busbar shall be done using a joint kit. The connection shall be made per the manufacturer's instructions.
- An end cap shall be installed at the end of the busbar run.
- As shown on the drawings elbow or tee connections may also be required.
- Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions.
- Contractor shall make connections to supply circuits according to manufacturer's instructions and project drawings.
- An installation and operational manual shall be provided by the manufacturer.

6.5.7 Miscellaneous

- The manufacturer shall provide submittal drawings for the busbar system and for tap off units.
- The manufacturer shall guarantee the entire system against defective material and workmanship for a period of one year from date of shipment.

6.6 Power Distribution Unit with K-13 Isolation Transformer

Data Center will have 2 PDU, powering to IT Rack.

Parameter	Details
Type / Technology	Floor Mountable
Size and Number	kVA/ KW as per final design
Regulation	2 – 4 % for 100 % change in current at Unity P.F.
Input Voltage	400 / 415 V AC 3 phase 3 wires
Input Frequency	50 Hz
Input Breakers	MCCB at Input of Transformer rated to withstand inrush current of transformer
Surge suppression	Surge Protection Device with local indicator and remote monitor option. Rated for 20 kA, with disconnect
Operating Power Factor	0.75 lagging to 0.9 leading
Neutral Size	200% of the phase conductor size
AC – AC Efficiency	97.5 % or more at all loads from 50% upwards
Output Voltage	400 V 3ph + N
Input Metering	Multifunction Digital Meters – for input voltage, input current, Frequency, kW, kohl, pF
Output Metering	Multifunction Digital Meters – for input voltage, input current, Frequency, kW, kWH, pF
Duty	Continuous at 45 Deg Centigrade
Cooling	Forced Air Cooling Ventilation
Ambient Temp Range	0 – 45 Deg Centigrade
Painting	Anti-corrosive Powder Coating

Incoming Switchgear	AS PER SLD
Outgoing Switchgear	AS PER SLD
R, Y, B Phase Indication Breaker	For Input MCCB
ON/OFF& TRIP Indication	For Input MCCB

UPS output should be through external isolation transformer part of floor mounted PDU having MODBUS based card.

PDU Display should have following parameters to monitor:

- Input and Output Voltages;
- Output Current;
- Output Voltage THD; Output Current THD;
- kVA; kW; kWH;
- Power Factor and Frequency.

Following alarms should be possible to configure

- Output over – voltage and under - Voltage;
- Output Overload;
- Output Voltage THD high;

TECHNICAL DATA SHEET FOR K-13 RATED ISOLATION TRANSFORMER

Item	ISO. TRANSFORMER CUBICLE –K13 RATED	
Application	Computer / Server loads (Nonlinear loads)	
Input Range – Config.	415 V 3 PH 3 W	
Output Voltage	415 V 3 Ph 4 W	
Transformer	As per IS-2026-Part II-1977	
Capacity Rating	As per SLD	
Winding material	Copper	
Class of Insulation	H – Class	
Input frequency	50 Hz.	
Configuration	Delta – Star zigzag	
Vector Group	Dyzss	
Input (Primary) voltage	415 V AC, 3 PH., 3 wires.	
Off load tap changer	+/- 5% in steps of/15%	
Input voltage tolerance	10 %/-10%	
Frequency tolerance	+5 %, -5 %	
K -Rating	K-13 with built in derating as per UL1561 ANSI/C 57.110	
Output (Seco.)voltage	415 VAC, 3 Ph, 4 WIRES	

Efficiency	98.2 % @ 40 % loading	
% Impedance	< 3 %	
Transformer Neutral	Effectively earthed.	
Enclosure Panel		
Overall size		
Total Weight of Panel	_KG	
Cable Entry	Top cable entry from front side	
Protection	IP 31	
Cooling	AF F o r c e d Air cooled	
Paint shade	As per required.	
Base Frame	to be included	
Load bearing members	2.5 mm thick	
All other items	2 mm thick	

6.6 TECHNICAL SPECIFICATIONS – UPS

6.6.0 General

This specification describes the electrical, mechanical characteristics and requirements of three phases, on-line, double conversion, solid-state Modular Uninterruptible Power Supply (UPS). The UPS should be having VFI (Voltage Frequency Independent) technology, fully DSP controlled power factor corrected rectifier and IGBT inverter capable of providing high quality AC power for sensitive electronic equipment loads. It should also supply clean power without any break in the supply in the absence of raw power. Under no conditions will the protected system get direct supply from the raw mains unless there is fault in the protected system. The description of the specification includes aspects related to design, manufacturing, fabrication and putting UPS Systems together with all necessary accessories and auxiliaries to make an operational UPS system in a condition acceptable to the end user.

6.7.0 Scope of Work

6. The scope covers supply, installation, testing and commissioning of **01 nos. of 300 kVA/300 kW modular, Hot Swappable UPS systems connected in Stand Alone Configuration. Each power module shall be of minimum 50kW capacity.**

6.7.1 Supply of remote monitoring interface through SNMP or Modbus protocol to interface with BMS/DCIM.

6.7.1.1 Supply of SMF VRLA Battery bank suitable for 30 min back up on Each UPS.

6.7.1.2 Battery Management System.

6.7.1.3 BMS must be integrated with LCD Screen / through MODBUS for better interface.

6.7.1.4 Switch Gear: Racks containing modules connected in Series, switch gear and SMPS assembly to power the Rack BMS. BMS shall be integral part of Battery module as well as rack.

6.7.2 Supply of cables and inter connection between battery banks and UPS system

6.8.0 Submittals

9.3.1 Vendor to provide UPS rating, configuration along with distribution scheme.

9.3.2 UPS footprints including weights, dimensions, service access, and airflow requirements of each unit (GA drawings required).

6.9.0 Foot prints of battery racks, type of battery including overall weight of battery proposed for installation (typical layout diagram to be provided)

6.10.0 Reference and codes

The UPS shall be designed in accordance with the applicable sections of the current revision of the following documents. Where a conflict arises between these documents and statements made herein, the statements in this specification shall govern.

6.10.1 Low Voltage Directive: 2006/95/EC with the Amendment Directive 93/68/EEC Directive for electromagnetic compatibility 2004/108/EC

6.10.2 General and safety requirements for UPS used in operator access area: IEC/EN 62040-1-1 incorporating requirements of IEC/EN 60950-1

6.10.3 Electromagnetic compatibility (EMC) requirements for UPS: IEC/EN 62040-2: Immunity category C2, Emission category C2

The UPS shall be CE marked in accordance with EEC directives 73/23 “ low voltage” and 89/336 “electromagnetic compatibility”.

6.11.0 System Configuration

- A) Modular frame of 300kVA comprising of total 300 kVA/ 300 kW hot swappable UPS Modules (each of minimum 50kW rating)
- B) Each UPS shall have individual back up with SMF-VRLA Battery suitable to meet backup of 30 min @ 300 kW load
- C) Module shall be of minimum rating of 50kW capacity with a Hot interchangeability feature.

6.12.0 Environmental Requirements

9.7.1 Temperature: UPS system normal operations: 0° to 40°C (32°F to 104°F)

9.7.2 Batteries : 25°C (77°F)

9.7.3 Storage : -20°C to +40°C (-4°F to 104°F)

9.7.4 Relative humidity (operating and storage): 95 % non-condensing.

9.7.5 Altitude: Up to 1000 meters above sea level.

9.7.6 Audible Noise: Up to 75 dBA at 1 meter.

6.13.0 Basic requirements

6.13.1 Nominal Voltage

6.13.1.1 Input: 380/ 400/ 415 VAC - Three Phase four wires + ground

6.13.1.2 Output: 220/380, 230/ 400, 240/415 VAC (Selectable) - Three Phase four wires + ground

6.13.2 Nominal Frequency

6.13.2.1 Input: 50/ 60 Hz (Auto selectable)

6.13.2.2 Output: 50/ 60 Hz (Selectable)

6.13.3 Power factor

- UPS Rated power factor: Unity
- Input power factor: > 0.99

6.13.4 Battery

- SMF-VRLA Battery : 3.2 V/Cell to 3.8 V/ Cell
- No. of battery banks in parallel: Appropriate Nos. to meet the battery backup requirement. (Vendor to submit the battery sizing calculation)

6.13.5 System Efficiency

- 6.13.5.1 Online AC to AC efficiency without Iso Txr. : > 97 %
- 6.13.5.2 Eco mode efficiency :> 98%

6.13.6 Total Harmonic Distortion

- 6.13.6.1 Input iTHD: < 3 % (considering input THDv < 1%)
- 6.13.6.2 Output uTHD: < 1% for linear load
< 5% for non-linear load

6.14.0 System Description/Configuration

- 6.14.1 The UPS technology should be True Online, Double conversion (VFI).
- 6.14.2 Each UPS Rack shall be Modular, Hot swappable of 300 kVA capacity. Each module shall be rated for minimum 50kW with rated power factor of Unity at 40 Deg C.
- 6.14.3 The module should be independent with complete topology of rectifier and inverter inbuilt.
- 6.14.4 The module should be hot swappable which means it can be inserted or removed from the UPS system without disconnecting or disturbing the critical load connected at the output of the UPS.
- 6.14.5 The UPS frame for the module should be floor mounted with minimum foot print as per OEM design.
- 6.14.6 The UPS frame for the modules can be used as stand-alone or in parallel up to minimum of two units (horizontal expansion) Or Load Bus Synchronisation.
- 6.14.7 The UPS frame for the modules shall have provision of connecting input/ output/ battery connection cables (from TOP and BOTTOM side) suitable for the maximum 300 kVA/ 300 kW as per the maximum number of the module which can be engaged in the frame.
- 6.14.8 Each UPS frame shall have provision for independent monitoring the power modules placed in it for electrical parameters and operating status.
- 6.14.9 Each hot swappable module shall have its own DSP controller , and contain a Full rated rectifier ,full rated inverter & battery charging circuit.
- 6.14.10 The UPS frame shall be provided with automatic static bypass & maintenance bypass suitable for the maximum kVA/kW as per the maximum number of the module which can be engaged in the rack.
- 6.14.11 Each power module shall have inbuilt provision to isolate itself from the input/ output/ DC bus under fault condition or when being disengaged from UPS.
- 6.14.12 UPS comprises a user replaceable continuous duty bypass static switch module
- 6.14.13 Each power module rectifier shall be capable of providing continuous power to the load as well as for battery charging.
- 6.14.14 Each UPS system shall be sized to maintain a kVA as per Bill of Material, and be equipped with an individual battery bank capable to supply this load for the time as indicated in Bill of Materials and Data Sheet.
- 6.14.15 Each power module in each UPS shall have its own intelligent control logic to avoid single point of

failure (i.e peer to peer control) . There shall not be any common controller that controls all power modules in connected in parallel. That means instead of having main Or Redundant controller , system shall be having independent controller for each Power module

6.14.16 Each UPS shall be comprising of Inbuilt Input , Output ,Static and internal / external maintenance Bypass switches rated for 100% capacity.

6.14.17 UPS shall have a feature called “Dormancy Mode “ which means , if load is lesser , all extra modules will go in sleep mode , thereby optimising the load% and enhancing the efficiency of a UPS . These modules should then turn ON immediately , if the load increases . This Dormancy mode will be applicable when Batteries are fully charged , Rectifier Inverter & Bypass is normal.

6.14.18 Within each UPS ,Module to Module power connections shall be with flexible PVC insulated copper flexible cable instead of busbars so as to eliminate the risk of short circuiting between busbars due to any foreign object.

6.14.19 The cooling fans shall be multi-speed DC Fans with speed control based on the loading conditions on the UPS, thereby saving energy and enhancing the life of the cooling fans.

6.14.20 UPS shall have a arrangement for TOP and Bottom Cable Entry .

6.15.0 Modes of operations

The UPS system shall be designed to operate as a double conversion, on-line system in the following modes.

6.15.1 **Normal:** The rectifier and battery charger shall draw power from the utility AC source and shall supply DC power to the inverter while simultaneously charging the battery. The inverter shall convert DC to AC and continuously supply clean power to the critical load.

6.15.2 **Backup mode:** Upon failure of the utility AC power source, the critical load shall be supplied by the inverter without any interruption and shall obtain its power from the battery.

6.15.3 **Recharge:** Upon restoration of the utility AC power source (prior to complete battery discharge), the rectifier/battery charger shall power the inverter and simultaneously recharge the battery.

6.15.4 **Bypass Mode:** The static bypass transfer switch shall be used to transfer the load to the bypass without interruption to the critical power load in synchronise condition and with 10 ms break in un synchronised condition.

6.15.5 **Maintenance Mode:** During failure of a redundant UPS power module, UPS should have a provision of removing the faulty power module & adding new power module in online mode (hot swappable) without effecting the load. In case of maintenance of the entire UPS system, a manual internal maintenance bypass switch shall be provided to isolate the UPS inverter output and static bypass transfer switch for maintenance. This shall allow the UPS to be tested or repaired without affecting load operation. UPS should have an electronic interlocking between maintenance bypass switch & UPS module inverters to ensure inverter output is off during maintenance bypass operation to avoid any fault.

6.15.6 **Load Bus Synchronisation Mode :** This mode is applicable in Dual Bus configuration suitable for Server Load with Dual Input arrangement as well as single Input Switch load (powered through Static switch) In this scheme , 2 X 300 kVA/kW UPS are made to work in synchronisation , so that external Static Switch connected for single Input Load will work satisfactorily and transfer the Power from source 1 to source 2 with no break . This operational requirement is most important for no break

transfer during the condition of mains and Source 1 failure together.

- 6.15.7 **Rectifier & charger:** Rectifier & charger denotes the solid-state equipment and controls necessary to convert incoming AC power to DC power for input to the inverter and for battery charging. The rectifier cum PFC shall be three phase fully DSP controlled & have low input THDi & PF close to Unity . Charger section should be CVCC type (Constant Voltage Constant Current) for efficient battery charging & supplying regulated DC voltage. The charger section should have an electronic switch in battery path to isolate battery bank from UPS in case of fault.
- 6.15.8 **Input Current Limiting:** The UPS shall be equipped with a system designed to limit the battery recharge current up to 0.1 C10.
- 6.15.9 **Modular design:** The rectifier, charger & inverter shall be constructed in a power module and be a building block of UPS. The power modules should be capable of plug in / out in UPS online mode without affecting the load.
- 6.15.10 **Inverter:** Inverter denotes a solid state device which is capable of converting DC to AC. Inverter should be constructed of IGBT by means of PWM design to ensure low component stress & high efficiency with switching frequency > 20 kHz and using DSP controlled PWM technology. The inverter output power to the loads in terms of Voltage / Frequency should be regulated to close tolerance and a pure Sine waveform.
- 6.15.11 **Static bypass:** A bypass static transfer switch shall be provided as an integral part of the UPS to provide high speed load transfer from inverter to bypass and vice versa. The Static switch shall be a Bi-directional using naturally commutated high-speed static (SCR type) device rated to carry full load current continuously.
- 6.15.12 **Uninterrupted Transfer:** The static bypass transfer switch shall automatically cause the bypass source to supply power to the critical load without interruption after the logic senses one of the following conditions:
- 6.15.12.1 Inverter overload exceeds unit's rating
 - 6.15.12.2 Battery protection period expired and bypass source is available
 - 6.15.12.3 Inverter failure
 - 6.15.12.4 Interrupted Transfer: If the bypass source is beyond the conditions stated below, the UPS will make an interrupted transfer (less than 10 msec. in duration).
- 6.15.13 **Manual maintenance bypass:** Manual maintenance bypass switch should be inbuilt in the UPS to bypass the complete UPS in event of failure of any of its components, so that repairs can be undertaken without interrupting the load.
- 6.15.14 **DPS Digital Control:** The UPS system should have digital control through fully DSP controlled microprocessor circuitry to enhance reliability and provide excellent control dynamics.
- 6.15.15 **Intelligent cooling:** The UPS system should be forced cooled through cooling fans that use the air from the ambient to intelligently cool the control electronics, device heat sinks and magnetics provided in the system. The cooling fans should be multi-speed with speed control based on the loading conditions on the UPS, thereby saving energy and enhancing the life of the cooling fans.
- 6.15.16 **Emergency Power Off (EPO):** The UPS should have built in facility through which it can be switched off immediately through local switch or remote Emergency Power Off switch wherein the load is disconnected from the UPS under emergency condition. Restarts are possible after manual inspection and removing the conditions of emergency and resetting the Emergency Power Off switch.
- 6.15.17 **Multi-language and user friendly console:** Each UPS module shall be equipped with a 320 x 240 dot graphic LCD display (Dimension [L x H] = 160x109 mm). This shall automatically provide all information relating to the current status of the UPS as well as being capable of displaying metered values. The display shall be menu-driven, permitting the user to easily navigate through operator

screens. The LCD shall be able to store minimum 500 historical event records that can be retrieved and reference and diagnosis.

6.15.18Event Monitoring: UPS should have built-in SRAM to stores up to minimum 500 events with date and time stamping of the historical records and event logs. It should be possible to monitor these events from the front LCD panel of the UPS or on a PC if the UPS is connected through a SNMP card on a LAN.

6.15.19Communication Interface: UPS should have a wide choice of communication interface through SNMP / Modbus protocol using the RS232 / RS485 / Ethernet port.

- RS 232: The UPS should have RS232 port for serial communication with the computer for monitoring purpose.
- RS 485: The UPS should have RS 485 port for communication/ broadcast information about its status to the Building Management System. There should a provision of cascading up to 30 UPS system for communication through RS 485 port.
- SNMP: UPS should have an Ethernet port to broadcast information about its status to Network Management software on servers in a LAN through SNMP protocol.
- This connectivity should also provides control of the UPS and shall offer complete UPS management solutions.

6.15.20Metering: An MCU or DSP shall control the display functions of the monitoring system. All three-phase parameters shall be displayed simultaneously. All voltage and current parameters shall be monitored using true RMS measurements for accurate ($\pm 1\%$) representation of non-sinusoidal waveforms typical of computers and other sensitive loads.

The following parameters shall be displayed:

- Main input
- Three-phase main input line-to-neutral voltage
- Three-phase main input line-to-line voltage
- Three-phase main input current
- Main input frequency
- Three-phase input power factor
- Bypass
- Each phase bypass input line-to-neutral voltage
- Bypass input line-to-line voltage
- Bypass input frequency
- UPS output
- Each phase output voltage of UPS
- Each phase output current of UPS
- Output line-to-line voltage of UPS
- Power factor of each phase
- UPS output frequency
- Local load
- Load of each phase (% of total load)
- Active power, apparent and reactive power of each phase (output)

- Load crest factor
- Battery
- Battery bus voltage
- Battery current
- Forecasted Battery backup time (remaining time)
- Battery temperature (in degree centigrade)
- Parallel load
- Apparent power of each output phase (for parallel operation system)
- Active power of each output phase (for parallel operation system)
- Inactive power (Reactive power) of each output phase (for parallel operation system)

Power Flow Mimic: Each UPS module shall be equipped with a mimic to indicate power flow to the critical load along with an indication of the availability of the rectifier/charger, battery, automatic bypass, inverter, load. The mimic shall provide a quick and easy indication of the load level (displayed on LCD), including for overload conditions (displayed on LCD). This power flow is also shown in the LCD menu.

Alarms and Status Information: Alarm and status conditions shall be reported via the display and control panel shall report the alarms and status information. Each alarm shall be visually displayed in text form and an audible alarm will sound for each alarm displayed

Inverter ON/OFF: Each UPS module shall be equipped with an inverter ON/OFF buttons which will transfer the load from all UPS modules to the bypass mains supply, if it is available. The inverter ON/OFF control shall be protected under menu confirm protect if the bypass mains is not available.

6.16.0 System Protection

The UPS shall have built-in protection against: surges, sags, and over-current from the AC rectifier input source, over-voltage and voltage surges from output terminals of paralleled sources, and load switching and circuit breaker operation in the distribution system.

The UPS rack system shall be protected against sudden changes in output load and short circuits at the output terminals. The UPS shall have built-in protection against permanent damage to itself and the connected load for all predictable types of malfunctions. Fast-acting current limiting devices shall be used to protect against cascading failure of solid-state devices. Internal UPS malfunctions shall cause the module to trip off-line with minimum damage to the module and provide maximum information to maintenance personnel regarding the reason for tripping off line. The load shall be automatically transferred to the bypass line uninterrupted, should the connected critical load exceed the capacity of the available on-line modules. The status of protective devices shall be indicated on a graphic display screen on the front of the unit.

6.17.0 Factory Inspection:

The Units will be dispatched after factory inspection witnessed by department's representative. All the factory test reports will be submitted along with handover documentation. Vendor need to give Inspection call before two weeks.

6.18.0 Fabrication

Materials: Vendor to certify that all materials of the UPS is new, of current manufacture, high grade and free from all defects and will not have been in prior service except as required during factory testing.

6.19.0 Construction and Mounting: The UPS unit should comprised of rectifier/charger, inverter, static transfer switch, maintenance bypass switch, and static bypass input switch housed in a free-standing steel enclosure with key-lockable doors. Also, switch gears to be provided at input, output, static bypass & maintenance bypass of UPS. Front access only is required for servicing, adjustments, and installation. Also,

switch gears to be provided at input, output, static bypass & maintenance bypass of UPS. Front access only is required for servicing, adjustments, and installation. The enclosure should be built to comply with IP20. The UPS cabinet should be cleaned, primed, and painted with the manufacturer's standard colour.

6.20.0 Technical Specification:

1. 1 No 300 KVA/ 300 KW UPS with 30 Minute Battery Back up

UPS Technical Specifications for each 300kVA / 300kW UPS			
Sr. No.	Specifications	Requirement	Vendor's Offer
1	Capacity (in kVA / kW)	300kVA/300 kW 3-Phase Input / 3-Phase	
2	Technology and Capability	a) True Online configuration double conversion UPS. b) Modular & Scalable UPS with hot swappable Power Module of 50kVA/50kW c) Hot swappable Power module shall have its own DSP controller (centralized control systems not recommended) , and Contains a Full rated rectifier, full rated inverter & battery charging circuit d) UPS comprises a user replaceable continuous duty bypass static switch module e) DSP (Digital Signal Processor) / Microprocessor based control , using IGBT devices and high switching frequency PWM. f) PFC controlled IGBT rectifier with Active power factor Correction (APFC). g) Capability to operate in N+1 / N+X and N+N PRS -Parallel Redundant Configuration. h) Capability of independent or common battery bank operation of the UPS when operated in PRS. i) UPS should be with Inbuilt switches for Input , Output , Static Bypass and Maint. Bypass. j) UPS should have Sleep Mode feature so that in case of less load , extra no's modules should go in OFF (sleep) mode . k) Shall have advance cooling system using DC fans whose speed is dependent on load. l) Shall have inter-module Power connection with PVC insulated copper flexible Cables.	

3	Model Name & Number		
	300kVA / 300 kW	Make / Model / Part No must be specified	
4	Input		
4.1	Input facility -Phases / Wires	3-Phase / 4-Wire & Gnd (R, Y, B -Phases & Neutral + Ground)	
4.2	Nominal Input Voltage	380 / 400 / 415V AC	
4.3	Input Voltage Range	331 - 477 V AC (On Full Load) 235 - 477 V AC (On 70% Load)	
4.4	Nominal Input Frequency	50 / 60 Hz (Auto selectable)	
4.5	Input Frequency Range	45 to 55 Hz	
4.6	Input Power Factor	> 0.99 on Full resistive load	
4.7	Input Current Harmonic Distortion (THDi)	@ 50 % load	<=5 %
		@ 75% load	<=3 %
		@ 100 % load	<=3 %
4.8	Generator Compatibility	Compatibility to genset supply required	
4.9	Input Protection (Thru In-built Switch Gear	Input to Rectifier / Output / Static Bypass/ Manual Bypass (In-built)	
5	Output		
5.1	Nominal Output Voltage	380 / 400 / 415V AC (Selectable)	
5.2	Output Voltage Regulation	+/- 1%	
5.3	Nominal Output Frequency	50 / 60 Hz (Selectable)	
5.4	Output Frequency Regulation	+/- 0.05 Hz (Free Running / Self Clocked Mode) + / - 5 % (Synchronized to Mains Mode, Selectable)	
5.5	Output Frequency Slew Rate	1 Hz / s	
5.6	Output Wave Form	Pure sine wave	
5.7	Output Voltage Distortion (THDu)	<= 1% (For 100% Linear / Resistive Load) <= 4% (For 100% Non-Linear / RCD Load)	
5.8	Crest Factor	3 : 1 On Full Load	
5.9	Unbalanced load on Phases	100% unbalanced load should be allowed	
5.10	Voltage symmetry with 100% Unbalanced Load	+/- 1%	
5.11	Displacement angle for 100% balanced Load	120 deg +/- 2 deg	
5.12	Output Protection	Through In-built 3P switch / Isolator	
6	Transient Response / Recovery		

6.1	Transient response: Dynamic regulation for 0% to 90 % step load	+/- 5%	
7	Transfer Time		
7.1	Transfer Time (Mode of operation)	Nil from Mains mode to Battery Mode Nil from Battery Mode to Mains mode	
7.2	Transfer Time (Inverter to Bypass / Bypass to Inverter)	< 1 ms (Synchronized Mode) < 10 ms (Asynchronized Mode)	
7.3	Automatic & Bi- directional static by- pass (In-built)	Should be provided to take care of uninterrupted transfer of load from Inverter to bypass (under overload / fault conditions) & automatic retransfer from bypass to inverter (on removal of overload / fault conditions). And should be user replaceable.	
8	Efficiency (At Nominal Voltage & Resistive Load up to kW rating of UPS)		
8.1	Overall Efficiency (AC to AC) - Online (Double Conversion)	@ 50 % load	≈ 97%(Plz Specify)
		@ 75% load	≈ 97%(Plz Specify)
		@ 100 % load	≈ 96%(Plz Specify)
8.2	Inverter Efficiency (DC to AC) - Battery Mode of operation	> 96% (On Full Load)	
8.3	Eco mode efficiency	>98%	
9	Overload		
9.1	Inverter Overload capacity (Mains Mode & Battery Mode)	110% for 10 minutes 125% for 30 seconds 150% for 10 seconds	
10	Display Panel (In-built LC Display & LED)		
10.1	Measurements (On LCD)	Input: Voltage (L-L & L-N)/ Current/ Frequency/Power factor Bypass: Voltage (L-L & L-N)/ Frequency Output: Voltage (L-L & L-N)/ Current/Frequency/Power factor Battery: Voltage / Capacity/Backup time Load: In kVA / kW / Percentage/Crest factor	
10.2	Event Logging & Statistical Data (On LCD): UPS should capture and display up to 512 events	Events like: Over temperature / DC Bus Fail / Fan Fail / Fuse Fail / Overload / Short- circuit / Device Fail / Inverter Fail / Rectifier Fail / Bypass Fail, etc Statistical Data: No. of power failures / Transfers to Bypass / Total Running time, etc	

10,3	User Programmable Parameters & Settings (On LCD)	Bypass: Voltage / Frequency Range Inverter: Voltage / Frequency / Eco Mode / Frequency converter / Redundancy selection Battery: Type / Banks / Chargers Current / Manual & Automatic Testing Alarms: Buzzer & LED Test / Buzzer Mute Date & Time Setting Password: User / Administrator Setting Information: UPS Serial No. / Firmware Log & Statistical Data Reset & Firmware upgrade	
10.4	Indications (LED)	Rectifier Indicator / Battery Indicator / Bypass Indicator / Inverter Indicator / Load Indicator / and Status Indicator	
11	Alarms		
	Audible Alarms	Mains Failure / Battery Low Alarm / UPS Overload / Fault / Shutdown	
12	Battery Backup / Battery Bank & Charger		
12.1	Backup Required	SMF VRLA Battery for 30 min	
12.2	Battery Bank Voltage	Vendor to specify	
12.3	Battery Bank V Ah (Vendor to include battery sizing calculations with tender)	Vendor to specify	
12.4	Batteries Type	SMF VRLA	
12.5	Battery Makes	Vendor to specify from approved list of Makes	
12.6	Minimum Charger Rating (Including internal / external)	10% of Battery Ah rating offered	
12.7	Charger type / Charging Method & Charging Voltages	Constant Voltage Constant Current Solid state SMPS charger designed for at least 10% of Battery Ah offered Float Voltage: 2.25 VPC Boost Voltage:/132 VPC	
12.9	Battery recharge time (After complete discharge) to 90% capacity	8 to 10 hours to 90% capacity	
12.10	Battery Protection (Vendor to specify the rating)	Inbuilt BMS and Battery Circuit Breaker	
12.11	Battery Housing (Vendor to provide the GA drawings of the offered Battery Rack)	Cabinet complete with interconnectors & breaker	

12.12	Battery End Cell Voltage	Volt/cell shall be as per OEM design	
13	Interfaces		
13.1	Interface to NMS (Network Management System) - To be quoted as option	SNMP Card for connecting the UPS to LAN thru Ethernet port & monitoring thru NMS.	
13.2	Interface to BMS/DCIM (Building Management System)	Modbus card for connecting to UPS to BMS/DCIM thru RS485/TCP IP & monitoring thru BMS/DCIM	
13.3	Potential Free Contact – Relay Card	Required	Potential Free Contact – Relay Card
14	Restart / Testing Capability		
14.1	Automatic Restart	UPS should start up automatically on mains resumption after battery low shutdown	
14.2	Battery Self Test	Manual / Scheduled battery test to ensure healthiness of batteries. However in event of weak batteries, test should be aborted and fault reported to the user thru replace battery warning	
15	Configuration Flexibility		
15.1	Parallel	UPS should be capable of paralleling minimum four numbers of similar rating UPS	
15.2	Load Bus Synchronisation for N+N	For a N+N system , UPS should have a provision for LBS connection , so that even during condition when Mains / Bypass is not available . Both the UPS (with 10 meter distance apart in N+N config.) are in synch with each other .	
16	Physical		
16.1	Operating Temperature	Regular as : 0 to 40 deg C and also mention deration above 40 Deg C.	
16.2	Storage Temperature	-20 to 40 deg C	
16.3	Operating Humidity	0 to 95% RH (Non-condensing)	
16.4	Operating Altitude	< 1000 m above sea level	
16.5	Protection Class	IP – 20	
16.6	Type of Cooling	Forced Air	
16.7	Noise Level	< 70 dbA at 1 meter distance	
16.8	Form Factor	Free Standing Floor Mounted UPS	

16.9	Dimension (w x d x h) in Mm	To be furnished by the vendor	
16.10	Weight - in kg	To be furnished by the vendor	
16.11	Reliability	MTBF greater than 100000 hours	
16.12	Packaging Material	Recyclable (No CFC)	
16.13	Connections - Rectifier Input / Output / Bypass Input / Battery	Hardwired	
17	Conformity and Standards		
17.1	General and safety requirements for UPS used in operator access Areas	EN50091-1-1/IEC62040-1-1/AS 62040-1-1	
17.2	Electromagnetic compatibility (EMC) requirements for UPS	EN50091-2/IEC62040-2/AS 62040-2 (C3)	
17.3	Method of specifying the performance and test requirements of UPS	EN50091-3/IEC62040-3/AS 62040-3 (VFI SS 111)	

GENERAL TECH SPEC FOR SMF-VRLA SOLUTION (UPS APPLICATION)

Sr. No.	Technical Particulars	Client Requirement * Data to be filled by Manufacturer	Manufacturer's Data
A	CELL DETAILS		
1	Make of SMF-VRLA Cell Battery	Vendor to specify from approved list of makes	
2	Model of Cell proposed	As per as Vendor	
3	Cell Material / Chemistry	NCM, LMO	
4	Cell type	Pouch, Prismatic , Wing folded	
5	Cell Capacity in AH	As per OEM	
6	Cell Nominal Voltage (Volts)	As per OEM	
7	Cell Operating Voltage range (Volts)	As per OEM	
8	Standard charge voltage	As per OEM	
9	Internal resistance	As per as Vendor	
10	Energy Density	>150	
11	Cell Operating temp during charging	under 60 °C	
12	Cell Operating temp during Discharging	under 60 °C	
13	Temp. rise allowed above ambient inside Cell Cabinet	under 60 °C	
14	State of charge (SOC)	>95%	

15	State of Health (SOH)	>55%	
16	Depth of discharge (DOD)	>80%	
B	MODULE DETAILS		
1	Model of Module	As per as Vendor	
2	No of cells in series and in parallel	As per as Vendor	
3	No of Cells required to form Module	As per as Vendor	
4	Module Capacity in AH	>60Ah	
5	Module Nominal Voltage (Volts)	As per OEM	
6	Module Operating Voltage range (Volts)	As per OEM	
7	Standard charge voltage	As per OEM	
8	Module Energy in KWh	As per OEM	
9	Module Nominal power	As per as Vendor	
10	Weight of Module Cabinet with cells	As per as Vendor	
11	Module Dimensions (L X W X H) in Mm	As per as Vendor	
12	Module & Cabinet Material. Module & Cabinets tested as per UL9540A test script	AI 6063 & UL9540A	
13	Module Cabinet cooling method	As per OEM	
14	Module Operating temp during Charging	under 60 °C	
15	Module Operating temp during Discharging	under 60 °C	
16	Temp. rise allowed above ambient inside Module Cabinet	under 60 °C	
C	RACK DETAILS		
1	No of Modules in series per Rack	As per as Vendor	
	Series / Parallel combination of Modules	As per as Vendor	
2	Rack AH capacity	As per as Vendor	
3	Rack Nominal Voltage (Volts)	As per as Vendor	
4	Rack Operating Voltage range (Volts)	As per as Vendor	
5	Standard charge voltage	As per as Vendor	
6	Standard charge current	As per as Vendor	
7	Standard discharge current	As per as Vendor	
8	Rack Nominal Energy in KWh	As per as Vendor	
9	Rack Nominal power	As per as Vendor	
10	Rack contents		
a	System BMS with display	Required	
b	Rack BMS Monitoring system	Required	
c	Rack DC Circuit breaker with rating	Required	
d	Rack Fuse protections	Cell Level	

e	Rack level power Contactor	As per as Vendor	
f	SMPS for control power supply	As per as Vendor	
g	Common Battery Circuit breaker with EPO	As per as Vendor	
11	Rack Fresh air suction & hot air Discharge	Rear	
12	Cabling from Rack to rack / Rack to BCB	TOP / BOTTOM	
13	Weight of Rack Cabinet with Modules, Rack BMS, Rack BCB and any other component	As per as Vendor	
14	Rack Dimensions (W X D X H) in Mm	As per as Vendor	

BMS Spec sheet

Sr. No.	Technical Particulars	Client Requirement * means Vendor to specify	Manufacturer's Data
	BMS -Cell Level		
A	Monitoring / Measurement		
1	Cell Voltage	As per as Vendor	
2	Cell Amp	As per as Vendor	
3	Cell Temperature	As per as Vendor	
B	Protections / Control		
1	Electrical Protection for cell	Fuse	
2	Pressure, Temp. rise protection for cell	Pressure vent	
D	Communication		
1	Communication protocol from Cells to Modules	As per as Vendor	
	BMS -Module Level		
A	Monitoring / Measurement		
1	Module voltage	As per as Vendor	
2	Module Amp	As per as Vendor	
3	Module temperature	As per as Vendor	
4	Fan running status	As per as Vendor	
B	Protections / Control		
1	Cell balancing management and alarm	As per as Vendor	
2	Overvoltage detection of cell with sr no and alarm generation	As per as Vendor	

3	Over temp detection of cell with sr no and alarm generation	As per as Vendor	
C	Diagnosis / Calculation		
1	Average cell temp	As per as Vendor	
2	Average cell voltage	As per as Vendor	
D	Communication		
1	Communication protocol from Modules to Modules and to Rack	As per as Vendor	
	BMS -Rack Level		
A	Monitoring / Measurement		
1	Rack Voltage	As per as Vendor	
2	Rack Amp	As per as Vendor	
4	Charging Current / Discharging current	As per as Vendor	
5	Charging Voltage / Discharging Voltage	As per as Vendor	
B	Protections / Control		
1	Cell / Modules balancing management and alarm	As per as Vendor	
2	Switching Control of Contactor / Breaker based on Voltage, current parameters and based in input from System BMS	As per as Vendor	
5	Highest & lowest voltage recorded	As per as Vendor	
6	Highest & lowest Current recorded	As per as Vendor	
C	Diagnosis / Calculation		
1	State of Charge (SOC) Calculation	As per as Vendor	
2	State of Health (SOH) Calculation	As per as Vendor	
3	Battery voltage, Current, Temp. historical graphs report generation	As per as Vendor	
4	Historical report of alarms occurred and analysis report generation	As per as Vendor	
5	Average Module voltage	As per as Vendor	
6	Average Module temperature	As per as Vendor	
7	Life expectancy of Battery Rack based on charge/discharge cycles, temp, voltage, current analysis	As per as Vendor	
8	Analysis of Battery racks when Battery rack went out of circuit while other Racks connected (during normal / charging / discharging mode)	As per as Vendor	

D	Communication		
1	Communication protocol from Racks to Racks and Racks to Modules	As per as Vendor	
2	Status & Control list available on PFC / dry contacts	As per as Vendor	
	BMS -System Level		
B	Protections / Control		
1	Switching Control of Contactor / Breaker (Common and Individual racks) based on Voltage, current parameters and based in input from UPS / External Client BMS / EPO	As per as Vendor	
2	Highest & lowest voltage recorded	As per as Vendor	
3	Highest & lowest Current recorded	As per as Vendor	
4	SMPS / control supply fail alarm	As per as Vendor	
5	No of Charge / Discharge Cycles	As per as Vendor	
6	No of Incidents when Rack disconnected from circuit during normal / charging / discharging mode	As per as Vendor	
7	Setting charging, discharging current from display	As per as Vendor	
C	Diagnosis / Calculation		
1	State of Charge (SOC) Calculation	As per as Vendor	
2	State of Health (SOH) Calculation	As per as Vendor	
3	Battery voltage, Current, Temp. historical graphs report generation	As per as Vendor	
4	Historical report of alarms occurred and analysis report generation	As per as Vendor	
5	Average Rack voltage	As per as Vendor	
6	Average Rack temperature	As per as Vendor	
7	Life expectancy of Battery Set based on charge/discharge cycles, temp, voltage, current analysis	As per as Vendor	
8	Analysis of Battery racks when Battery rack went out of circuit while other Racks connected (during normal / charging / discharging mode)	As per as Vendor	

2. 1 No 30KVA/ 30 KW UPS with 30 Minute battery back up

	Rating	30KVA/30kW 3phase in -3 phase out
System parameter	Technology	IGBT based Double conversion PWM based online UPS
	Parallel mode	4 (N+1)
	Installation mode	Rack/Tower
Input	Rated voltage	400VAC 3-phase,4-wire
	Voltage Range	331 - 477 V AC (On Full Load) 235 - 477 V AC (On 70% Load)
	Rated Frequency	50Hz/60Hz
	Frequency Range	40Hz ~ 70Hz
	Power factor	0.95 for Three Phase
OUTPUT	Rated power	25KVA/25kw
	Voltage	Three phase 415VAC
	Frequency synchronization range	Rated frequency $\pm$ 3Hz. Configurable range: $\pm$ 0.5Hz ~ $\pm$ 5Hz
	Rated Power Factor	Unity
	Crest Factor	3:1'
	Voltage harmonic distortion	< 2% (linear load)
	Voltage Regulation	1%
	Dynamic response recovery time	60ms
	Inverter Overload Capability on utility mode	At 25°C: 105% ~ 125%- 5min; 125% ~ 150%- 1min; 150%- more than 200ms
	Programmable Outlet	Available
	Inverter Overload Capability on battery mode	At 25°C :105% ~125%-60~ 30 s; >125%- more than 200ms
Bypass	Separate bypass	Yes
	Static bypass	Inbuilt
Efficiency	ECO Mode	96%
	Online mode (AC-AC)	> 96%
	Inverter Efficiency(DC-AC)	>92%
BATTERY	Type	SMF-VRLA
	Battery charging capacity	As per 10 % of battery AH capacity .
Transfer Time	Mains - Battery	0ms
	Inverter-Bypass	Synchronous transfer: $\leq$ 0ms
		Asynchronous transfer (default): $\leq$ 20ms
Noise		<65db
Panel display mode	Display type	Graphical LCD display
	No of events stored	Max 256
	Orientation	Gravity sense
Environmental parameter	Operating temperature	0°C ~ 50°C
	Storage temperature	-40°C ~ +70°C (battery excluded); -25°C ~ +55°C (battery included)
	Relative humidity	5%RH ~ 95%RH, non-condensing

	Altitude	≤1000m; derating when higher than 1000m
Mechanical parameter	W*D*H (mm)	As per OEM
	Weight (Kg)	As per OEM
	Ventilation	Forced -air cooled
	Ingress protection level	IP20
	Colour	As per OEM
	Cable entry	Rear
Network Management	Smart RS232/USB	Supports Windows 2000/2003/XP/Vista/2008, Windows 7, Linux, unix and MAC
	SNMP	Inbuilt for web monitoring
	MODBUS	Inbuilt for BMS/ DCIM connectivity
	Optional SNMP	Power management from SNMP manager and web browser
	Management software	Site monitor
	Modbus	Inbuilt via multifunction port
Certifications	Safety (CE)	IEC/EN62040-1-1
	Electromagnetic Compatibility(EMC)	IEC/EN62040-2, IEC/EN61000-3-11, IEC/EN61000-3-12, YD/T1095-2008
	Surge Protection	IEC/EN62040-2, meeting IEC/EN61000-4-5
	Energy star	As per UL approved
	ROHS	Yes
	Govt approved NABL lab test report	Available
	Top 5 company in terms of revenue	Yes
	Quality standard	IS 9001-2015
	Environment standard	ISO 14001
	OSHAS	ISO 45001
Test report	IT security management	ISO 27001
	NABL Approved Government lab test report	YES

6.7 TECHNICAL SPECIFICATIONS FOR HVAC WORKS

6.8 Precision Air Conditioning Units

6.8.2 SCOPE OF WORK

The Scope of Work covers the supply, installation, commissioning, and warranty of Precision Air conditioner (herein referred to as “product”) and services provided for the same.

6.8.3 GENERAL

The AC Units should have high sensible heat ratios, to match high sensible loads of Computer/Server Rooms/Switch room/UPS. A Microprocessor controlled Precision package AC system with **R-407C/R- 410a refrigerant shall be suitable to take thermal and air qty. inputs from the server and adjust its operation accordingly so as to achieve highest levels of performance and efficiency.**

The Indoor unit shall comprise of Variable capacity **Digital/inverter Scroll** Compressor in independent or Tandem circuit, corrosion resistant EC fans, Evaporator DX Cooling Coil with hydrophilic coating, Microprocessor controllers, Expansion valves, Driers, G4 Filter, Suction and Discharge piping, Internal power and Control wiring, Crankcase heaters, Humidifier, Heaters, HP/LP Cutouts, Power and Control contactors, water leak detectors and Other Electrical accessories.

Fixed capacity compressor technology like multiple scrolls or Fixed capacity Tandem scrolls are strictly not allowed. Systems should mandatorily be having variable capacity compressors and performance as per above specifications.

THE AIR-COOLED PRECISION UNIT SHALL BE DESIGNED AS PER FOLLOWING CONDITIONS

6.8.3.2 Unit return air temperature : As per Boq

6.8.3.3 Ambient air design temperature : 48.3 DegC (bidder/contractor shall verify this data)

6.8.3.4 Cooling Capacity : 20°C ± 1°C

6.8.3.5 Air Flow Direction : Bottom discharge-top return for Server room & Staging Room/ Front discharge –
top return for UPS Rooms.

6.8.3.6 Air inlet Temp & RH : Set point ± 1°C (DB) & Set point ± 5% (Return Air)

6.8.3.7 Air Quantity : Modulating as per server (160 cfm/kW (min)

6.8.3.8 Units should be able to provide 1 SHR at part load

6.8.3.9 Units should be able to work for fixed supply air logic instead of return air control logic. Units should be also connected to cold aisle remote sensors for taking the temperature feedback from the top of the racks at multiple places. This would help to regulate the fan for required airflow in the cold aisles.

6.8.3.10 The Units shall be designed for 70 DBA at 1.5 meter from the unit outlet quiet operation with all moving parts mounted on anti-vibration mounting and carefully balanced to ensure minimum vibration.

6.8.3.11 If required, the unit shall be tested at site for performance rating before acceptance. Performance test shall be a heat load test using heater supplied by the Precision unit supplier.

6.8.3.12 Its mandatory to submit software selection output of the proposed unit. The specific power consumption and other performance details shall be as mentioned in Boq.

6.8.4 TECHNICAL SPECIFICATIONS:

6.8.4.1 Design Requirements

The environmental control system shall be Factory assembled unit. It shall be floor mounted, optimized for maximum cooling capacity in a minimum footprint. It shall be specifically designed for service from the front of the unit. The system shall be designed for draw-through air arrangement to insure even air distribution to the entire face area of the coil. The unit shall modulate cooling capacity and airflow based on requirements. The unit shall be ready to allow the installation of shackles for top handling. Forklift handling should be possible as well.

6.8.4.2 Quality Assurance

The specified system shall be factory end of line tested (functionality test) before shipment and designed to meet CE requirements. The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

6.8.4.3 Cabinet

The cabinet is manufactured from CRCA externally painted with epoxy-polyester powder paint and assembled. Double skinned fan section and side panel and insulation material shall be as per OEM design, but the insulation material shall be fire resistant.

The frontal panel(s) are assembled on hinges to make the access easier; this can be opened by the fast closing lock. The rear and side panels are screwed to the supports. The rear panel(s) are screwed directly to the frame.

6.8.4.4 Cooling circuits

One /Two refrigeration circuit(s), (each) incorporating one / two high efficiency, fully hermetic Digital Scroll/Inverter Scroll compressor/s with crankcase heater, air-cooled condenser, liquid receiver with outlet service valve, safety valve, filter drier, moisture indicating sight glass, liquid line solenoid valve and an electronic expansion valve directly controlled by the unit microprocessor to allow the highest energy saving.

Each circuit is equipped with pre-set high pressure switch and low pressure transducer for protection against high condensing and low evaporating temperatures. The low pressure transducer is managed by microprocessor controller, whilst to avoid compressor cycling at high discharge pressures, the high pressure switch is equipped with a manual reset.

The inclined evaporator coil is manufactured from copper tubes, mechanically bonded to hydrophilic painted aluminium fins, with a stainless steel condensate drain pan. The large face area/low velocity coil allows precise control of temperature and humidity during cooling and dehumidification, and is designed to optimize fluid velocity and minimize pressure drop. The evaporator shall be staged coil to allow a maximum efficiency on partial loads.

The moisture indicating sight glass and liquid line solenoid valve for each circuit are mounted visible from a service window, immediately accessible once open the frontal door/s, to allow checking and adjustment while the unit is in operation.

6.8.4.5 Fan section

The unit is fitted with one /two/ three direct-driven, high efficiency, single inlet, backward curved, centrifugal 'plug' type innovating EC fan(s). The fan(s) have an impeller with curved blades corrosion resistant made of fiberglass plastic. This new technology allows keeping the current high strength of aluminium alloy adding the benefits of light weight and full flexibility on blade design of the new material. The good dampening behavior of the plastic also helps to reduce noiseemissions.

The fan motors are Electronically Commutated, IP54, with internal protections, continuous speed regulation via controller signal. The motor is three-phase with IP54 protection; provided with internal thermal protection. The fan wheel is statically and dynamically balanced; the bearings are self-lubricating.

Between the fans shall be installed an "S" shape separator design to eliminate turbulence effects of one fan to the others; it shall be also designed to increase efficiency compared to simple plate separator.

Fan(s) removal(s) shall be made faster thanks to the use of buttonhole specifically designed and tested to allow 10 cm increasing height during theoperation.

6.8.4.6 Humidifier

The humidification system is provided by an electronic control humidifier. The dehumidification function, which is supplied as standard when the humidifier option is installed, acts by reducing the fan speed with consequent reduction of the air flow and at the same time operating the variable capacity compressors at full capacity

Humidification control may be of the proportional or of the on-off type, according to the requirements of the installation: on/off is set as standard.

The unit Shall be fitted with an humidifier suitable for use with water of varying degrees of hardness. The humidifier is complete with a water inlet valve, and a maximum water level sensor. The Humidifier Shall generate instantaneous moisture (preferably using non heating technology) and shall be independent of Water Quality and shall be easily cleanable.

6.8.4.7 Heating / reheating

The heating resistors are of a rigid design for extended operational life and are normally utilized to maintain room dry-bulb conditions during a system call for dehumidification. Each stage of heaters shall be made of as per OEM design. Ionization effects are eliminated owing to the low heater surface temperature.

Heating control is of the ON-OFF type. The heaters are phase balanced and are provided with a manual reset safety thermostat to disable them in the event of a high temperature.

The heating system also incorporates Miniature Circuit Breaker(s) which protect the heater(s) from short circuits, should the harness be damaged accidentally.

6.8.4.8 Air filtration

The standard filtration grade is G4 (95% down to 5 microns). The filter pleated structure gives high filtration efficiency, low pressure drop and permit to use the filter without metallic or cardboard frame. They are easily accessed/replaced by opening the front panels.The unit is fitted with a filter differential pressure switch, connected to the microprocessor controller to provide 'Filter Clogged' warning indication.

6.8.4.9 Monitoring

The unit shall be supplied with suitable card for both SNMP & Modbus connectivity.

6.8.4.10 Electrical panel

The electrical panel, located at the front of the unit in a compartment isolated from the airflow, contains the

MCB's, contactors, transformers, controller PCB, overload relays etc. Each high voltage system component is provided with an MCB over-current protective device. All high voltage components are touch protected by means of a plastic cover. The electrical panel complies with the IEC norm en60204-1.

Electrical power supply is 400V ($\pm 10\%$) / 3Ph / 50Hz ($\pm 2\text{Hz}$) +N +E and are fitted with a mains isolator, mechanically interlocked with the electrical panel cover.

Unit Shall be equipped with a highly efficient dual power sources with minimum electrical losses. The unit shall have In-Built /External two power modules as a back up to each other to ensure the seamless operation, thereby providing reliability and stability to the system.

6.8.4.11 Microprocessor controller

The Control System is microprocessor based, 32 bit RISC. It can be programmed to control the function of every device within the unit via I/O.

The controller allows setting and monitoring of the following room parameters via a 3 button keypad:

- 6.8.4.11.1 Air Temperature
- 6.8.4.11.2 Temperature set-point
- 6.8.4.11.3 Temperature band
- 6.8.4.11.4 Humidity
- 6.8.4.11.5 Humidity set-point
- 6.8.4.11.6 Humidity band

The parameters are indicated using symbols and text on a back-lit, 3 digits Liquid Crystal Display. Cooling and heating modes are also indicated on the LCD screen. Alarm conditions activate a visual indicator. Three LED's indicate the unit status – 'Power on' (Yellow), 'Unit on' (Green) and 'Warning/Alarm activated' (Red)

The controller shall provide Unit to Unit Ethernet connection to operate with multiple units, run/stand-by rotation, automatic changeover and parameter sharing functions, external communications through BMS, sequential auto restart timer, with adjustable time delays to be applied to unit restart after a power loss.

The following warnings / alarms are included:

- High temperature
- Low temperature
- High relativehumidity
- Low relativehumidity
- Humidifier failure
- Fan failure
- Electrical heater high temperature (Whenapplicable)
- Sensor failure
- Controller errors

Terminals are provided for remote start/stop control plus Volt-free 'Common Alarm' and 'Unit Run' indication

The display shall provide with track recorded of temperature and humidity with graphically display on the screen. A buzzer provides audible indication of a 'Warning' or 'Alarm' condition

Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarm

Unit memory shall hold the 400 most recent events with id number, time and date stamp for each event

Menu shall display accumulative component operating hours for major components including compressors, fan motor, humidifier and reheate.

6.8.4.12 Safety interlocks:

Operation of heaters & humidifiers shall be possible only when blower fan is in operation. Fire detection signal from fire detector system shall be able to switch off the package unit operation in event of fire in conditioned space.

6.8.4.13 Refrigerant piping:

Each refrigerant circuit shall be suitable for operation on R-407C/R410a and shall include the following items:

- a) Expansion valve with pressure equalization.
- b) Removable liquid line drier / filter.
- c) Liquid line sight glass with moisture indicator.
- d) Hand shut off valves.

6.8.4 FACTORY INSPECTION

The Units will be dispatched after factory inspection witnessed by department's representative. All the factory test reports will be submitted along with handover documentation. Vendor shall give minimum two weeks prior notice for Inspection.

6.8.5 WARRANTY

Warranty will be 03 Years from the date of complete Handover. The warranty coverage shall start after successful installation and integration of all the systems of both the Data Centre and Workspace and the bidder shall submit the OEM warranty coverage documents.

The Quantities in BOQ are tentative. Contractor to order the Quantity as per site requirements and shall be paid accordingly.

6.9 VARIABLE REFRIGERANT FLOW SYSTEM

6.9.4 The specifications under this section covers the supply, installation, testing and commissioning of the VARIABLE REFRIGERANT FLOW SYSTEM conforming to these specifications and in accordance with the requirements of the Schedule of Equipment and detailed Bill of Quantities.

6.9.5 General:

Each VRF Unit shall consist of air cooled outdoor unit, multi-split system air conditioner indoor unit, each having capability to cool and heat for the requirements of the individual area to be air- conditioned. The VRF unit should be capable of connecting different type indoor units to one refrigerant circuit and controlled individually.

Each VRF unit shall have minimum two number scroll compressors and in each module there shall be at least one inverter\Digital Compressor (With controller) and capable of changing the rotating speed to follow variations in cooling loads. Each indoor units shall have the capability to cool or heat for the requirement of the rooms.

Compressor installed in each module unit shall be equipped with at least one Inverter\ Digital Compressor. The system shall be capable of changing the rotating speed of Inverter compressor by Inverter controller to follow variations in cooling and heating load. The vendor should supply imported factory assembled, wired and tested outdoor unit instead of being shipped in modular section and later being sub-assembled at site. The Outdoor units shall be suitable for mix-match connection of all type of Indoor units.

The Unit shall be capable of extending refrigerant piping up to maximum 150m in length with 50 mtrs.

height difference between outdoor and indoor units.

The unit shall be suitable for non CFC refrigerant R-410A .

6.9.6 OUTDOOR UNIT:

The outdoor unit shall be factory assembled, weather proof casing, constructed from heavy gauge mild steel panels and coated with baked enamel finish. The unit should be completely factory wired, tested with all necessary controls tested prior to dispatch conforming to the following specifications.

- a) All outdoor units module shall consist of minimum two scroll compressors above 8.0 HP Machine with one Inverter/Digital drive compressor capable to operate even when one compressor is unserviceable.
- b) The outdoor unit shall be such in design that it facilitates installation one after another close to each other. Preference would be given to compact units having smaller footprint.
- c) Outdoor units should be rugged of anti-corrosion design and should have strong base plate for easy mounting of unit.
- d) The outdoor unit shall comprise of sub cooling feature to effectively use the entire coil surface through proper circuit/bridge in order to prevent flushing of refrigerant owing to large length of piping.
- e) The condensing unit shall be provided with microprocessor based control panel.
- f) The outdoor unit shall be provided with Aero spiral design fan exhibiting low noise level characteristics complete with aero fitting grille to facilitate spiral discharge of airflow to effect reduction in pressure losses. The fan should be capable to respond to external static pressure of 5mm.
- g) The outdoor unit shall be factory gas charged with high efficiency refrigerant R-410A.
- h) Motor shall be speed controlled to ensure a stable operation for varying ambient, by a factory fitted direct acting head pressure activated variable speed drive to give precise discharge pressure and minimum power consumption of condenser fan motor.
- i) The condenser shall be complete with provisions for refrigerant piping connections, shut off valves and any other standard accessories necessary with the equipment supplied.

The condensing unit shall be designed to facilitate fail safe operation when connected to multiple indoor units.

6.9.7 Scroll Compressor:

The scroll compressor shall be an industrial quality rugged, cast iron, direct hermetic compressor with scroll plates, suction & discharge service valves. The compressor shall be completely enclosed in a chamber with no leakage path and providing the capability for scroll plates to separate. The compressor shall be provided with industrial solid motor mounts internal motor protection and vibration isolation pads. Each compressor shall be independently wired and piped to its own circuit for efficient operation & ease of maintenance. The compressor speed shall not exceed 3000 RPM.

The compressor shall be highly efficient scroll type. One of the compressors should be of Inverter/Digital control. The inverter/Digital compressor shall change the speed in accordance to the variation in cooling or heating load requirement through signals analyzed through the microprocessor of the unit.

- a) All outdoor units shall have **to operate through inverter/Digital drive to give accurate cooling with minimum required power** meet load fluctuation and indoor unit individual control. All parts of compressor shall be sufficiently lubricated stock. Forced lubrication may also be employed.
- b) Oil heater shall be provided in the compressor casing.
- c) The Inverter compressor shall be efficient & reliable.

6.9.8 HEAT EXCHANGER:

The heat exchanger shall be constructed with copper tubes mechanically bonded to aluminum fins to form a cross fin coil.

- a) The aluminum fins shall be covered by anti-corrosion resin film.
- b) The unit should have optimized path of heat exchanger for better efficiency of condenser.
- c) The unit shall be provided with necessary number of direct driven low noise level propeller type fans arranged for vertical discharge. Each fan shall have a safety guard.

6.9.9 REFRIGERANT CIRCUIT:

The refrigerant circuit shall include liquid & gas shut-off valves and a solenoid valves at condenser end. The equipment must have inbuilt refrigerant stabilization control for proper refrigerant distribution.

6.9.10 SAFETY DEVICES:

All necessary safety devices shall be provided to ensure safe operation of the system.

Following safety devices shall be integral part of the outdoor unit :

- a) High pressure switch
- b) Fan drive overload protection switch
- c) Fusible plug
- d) Overload relay including overload protection for inverter driven compressor.

6.9.11 Oil Recovery System

Unit shall be equipped an oil recovery system to ensure stable operation with long refrigeration piping lengths. The system must be provided with oil balancing circuit to avoid poor lubrication in any unit.

6.9.12 INDOOR UNIT:

This section deals with supply, erection, testing and commissioning of VARIOUS TYPE OF INDOOR UNITS confirming to general specification and suitable for the duty selected. The type, capacity and size of indoor units shall be as specified in Detailed Bill of Quantities.

6.9.13 GENERAL:

The unit shall be as specified in BOQ, each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the room. Indoor units shall be of following types.

6.9.13.4.1 Wall mounted type

- a) The address of the indoor unit shall be set automatically in case of individual and group control
- b) In case of centralized control, it shall be set by liquid crystal remote controller

The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having supported from housing.

The cooling coil shall be made out of seamless copper tubes having mechanically bonded aluminum fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of

airflow. The tubes shall be hydraulically/ mechanically expanded for minimum thermal contact resistance with fins. Each coils shall be factory tested at 21kg/sqm air pressure under water.

Unit shall have cleanable type filter fixed to an integrally molded plastic frame. The filter shall be slide away type and neatly inserted.

Each indoor unit shall have microprocessor-based control for maintaining design room temperature. Each unit shall be provided with microprocessor-based thermostat for cooling or cooling and heating.

Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.

6.9.13.5 CENTRALIZED TYPE REMOTE CONTROLLER:

A multifunctional compact centralized controller shall be provided with the system.

The controller should be LCD remote controller to act as an advanced air-conditioning management system to give complete control of VRF air-conditioning Equipment, It should have ease of use for the user and must have a user friendly panel and LCD display.

It shall be able to control up to more than 10 indoor units in selected no. of groups with the following functions:-

- a) Starting/stopping of Air-conditioners as a zone or group or individual unit.
- b) Temperature settling for each indoor unit or zone.
- c) Switching between temperature control modes, switching of fan speed and direction of airflow, enabling/disabling of individual remote controller operation.
- d) Monitoring of operation status such as operation mode & temperature setting of individual indoor units, maintenance information, troubleshooting information.
- e) OPTIONAL-Display of air conditioner operation history.

6.9.13.6 COLOUR OF UNIT:

The color of indoor units should be off white or to suit interiors as designed by the architects / clients.

6.9.13.7 SCHEDULE TIMER

- a) The timer shall be able to set operation schedule for all indoor units.
- b) The timer shall be able to set 8 pattern of schedule combined with centralized controller.

11. TECHNICAL SPECIFICATIONS FOR LOW VOLTAGE SYSTEM

11.0 FIRE ALARM SYSTEM

The Fire Alarm System supplier shall furnish and install a fully integrated Fire Detection & alarm system for the area. Wherein all the sensors, modules, devices are too installed in all areas and voids to cover the entire premises.

This section of the specification includes the furnishing, installation, and connection of a microprocessor controlled, analog addressable, intelligent fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein.

The Panel shall be interface with a Public Address System to relay evacuation messages in case of a fire emergency.

Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Central Monitoring Stations and designated personnel in other buildings at the site via a multiplex communication network.

The system shall also support independent gas release circuits for activation of Fire Suppression system. The system shall include hardware, modules to facilitate cross zoning of specific sensors, abort release functions, time delay and inputs for pressure switch and 24V output for solenoid operation.

The panel shall be capable to further extend fire and fault output to the BMS/DCIM for critical alarm monitoring, and it shall be possible to connect an interface card for open Protocol based (Commonly BACnet, Modbus or eqv.) output to enable a software level integration with the BMS/DCIM System. Panel shall be with required graphical software for integration with DCIM.

The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.

11.0.1 GENERAL

11.0.1.1 Scope:

The control panel, to be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.

The system shall be in full compliance with National and Local Codes.

The system shall include all required hardware, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein.

All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of intelligent fire detection devices for over ten years.

The system as specified shall be supplied, installed, tested and approved by the local Authority Having Jurisdiction, and turned over to the owner in an operational condition.

Standards & Codes:

The publications listed below form a part of this publication to the extent referenced. The publications are

referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

- Factory Mutual (FM) FM AG Approval Guide.
- Underwriters' Laboratories, Inc. (UL) Appropriate "UL" equipment standards. "UL" 864 Control Panels.
- "UL" 268 Smoke Detectors.
- "UL" 268A Smoke Detectors (HVAC). "UL" 1076 Security.
- "UL" 1971, Standard for Visual Signaling Appliances.

Building Codes

- BOCA National Building Code and the BOCA Fire Code.
- Standard Building Code and the Standard Fire Code.
- Uniform Building Code and the Uniform Fire Code.
- International Building Code and the International Fire Code.
- State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction. ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.

Manufacturer's Representative:

Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation, maintenance and service of the type of system provided. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation, maintenance and programming.

Submittal:

The contractor shall include the following information in the equipment submittal: Power calculations. Battery capacity calculations. NAC circuit design shall incorporate a 15% spare capacity for future expansion.

Complete manufacturers catalog data including supervisory power usage, alarm power usage, physical dimensions, and finish and mounting requirements.

Incomplete submittals shall be returned without review, unless with prior approval of the ENGINEER IN CHARGE.

System Requirements:

The system shall be a complete, electrically supervised fire detection and notification system, microprocessor based operating system having the following: capabilities, features and capacities:

Communication between network nodes, each supporting an interactive, self-standing, intelligent local control panel, with system wide displays.

The local system shall provide status indicators and control switches for all of the following functions: Audible and visual notification alarm circuit zone control. Status indicators for sprinkling system water-flow and valve supervisory devices. Any additional status or control functions as indicated on the drawings, including but not limited to; emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.

Each intelligent addressable device or conventional zone on the system shall be displayed at fire alarm control panel by a unique alphanumeric label identifying its location.

System Operation:

Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indication to display in the panel.

Fire Alarm Condition:

Sound an audible alarm and display a custom screen/message defining the building in alarm and the specific alarm point initiating the alarm in a graphic display. The display shall provide standard NFPA graphical symbols indicating hazardous materials and personnel situations critical to situation management. Hazmat ICONs must conform to NFPA standard 170 format. The system shall supply a simple building floor plan and icons representing alarm devices in off normal or alarm condition.

Log to the system history archives all activity pertaining to the alarm condition. Print to system printer (where required) alarm condition information. Sound the ANSI 117-1 signal with synchronized audibles and synchronized strobes throughout the facility. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.

Supervisory Condition:

Display the origin of the supervisory condition report at the local fire alarm control panel LCD display.

Activate supervisory audible and dedicated visual signal.

Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.

Record within system history the initiating device and time of occurrence of the event.

Print to the system printer (where required) the supervisory condition.

Trouble Condition:

Display at the local fire alarm control panel LCD display, the origin of the trouble condition report.

Activate trouble audible and visual signals at the control panel and as indicated on the drawings.

Audible signals shall be silenced from the fire alarm control panel by a trouble acknowledge switch.

Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

Print to the system printer (where required) the trouble condition.

11.0.1.2 PRODUCT**Control Panel:**

The fire alarm control panel shall be microprocessor based using the multiple microprocessors throughout the system providing rapid processing of smoke detector and other initiation device information to control system output functions. Either operating interface unit provides multi-use capability for each end-user to efficiently 'Acknowledge' events; to quickly control the NACs of the FACP, and to permit a manual reset of the respective system. Detailed information about the nature and location of the events can also be displayed, via a backlit, 2" —x— 4-3/4" (5.1 cm. —x— 12.1 cm.) LCD screen and the four-way navigation push button at the top of the FACP.

The basic system shall have capabilities for 252 intelligent initiation devices in loop. The system shall employ a flexible number of detection input loops to reach maximum system capacity. Systems which, have a fixed number of device addresses per node based on a fixed number of device circuits (loops) shall provide 20% of loop maximum spare capacity on all loops to meet this requirement. The programming software for the 252 / 504-point fire systems is held in flash electrically erasable programmable read-only memory (EEPROM).

The Device Loop Card shall be capable of maximum 252 intelligent devices distributed between two SLC circuits. Any trouble on one circuit shall not affect the other circuit. This module controls the signaling from

the initiation devices reporting alarms and troubles to the control panel. This module shall also provide the signaling to the field devices for controlling the output of specific initiation devices. The circuit shall be capable of being connected with polarity insensitive intelligent initiation devices. The circuits shall have the ability to be wired, Style 4 or Style 6. Any of all of the 252 devices on the loop card shall be capable of activating up to two devices (relay base, audible base or remote lamps). These accessories shall not take away from the 252 addresses available in loop. Systems which, require unique addresses for SLC circuit accessories (remote relays, relay bases, audible bases and remote lamps) shall provide 20% spare capacity for each loop to provide for system expansion. The on board microprocessor provides the loop card with the ability to function even if the main microprocessor fails.

The Signal Line Circuits shall be tested for opens, shorts, ground faults, device status and multiple device response (2 devices at same address) and communications with all addressable devices installed before connection to the control panel. Systems without this capability shall have a test panel installed for initial testing to eliminate any possible damage short term or long term to the control panel. After initial testing replace the test panel and proceed with complete testing.

The Network Interface Card shall provide communication between enclosures. The network card supervises the network to insure proper operation. Any faults that are detected shall be reported to the DISPLAY for annunciation. The network card shall isolate short circuits to each individual segment of the network. If a short occurs only the segment between the network card will be affected. The card shall have the ability to provide Style 4 or 7 network wiring configurations. The card shall have as the minimum the following diagnostic LED; Reset, Power, Card Fail, CAN Fail, HNET Fail, ZNET Fail, GND Fault, Loop A Fail, Loop B fail, Networks - Style 7, Style 4, Gnd Fault Enabled, GND Fault Disabled.

The Controllable Relay Card shall provide 6 programmable relays. Each relay shall have SPDT contacts rated at 4 amps at 30VDC/120VAC resistive and 3.5 amps, 120VAC inductive. The card shall have as a minimum the following diagnostic LED's; Reset, Power, Card Fail, 24V Fail, Relay 1, Relay2, Relay3, Relay 4, Relay5, Relay6.

Where required to monitor a large amount of relays, such as monitoring subsystems or normally open contact devices, provide a Supervised Input Module, which will monitor up to 16 inputs. Each input shall be individually programmed for supervised or non-supervised circuits. This module shall be connected to a system network. The module shall contain 2 programmable form "C" relays for control of the monitored subsystem.

Where required for control of relays or LED's the Output control Module shall provide 16 open collector outputs to operate LED's, incandescent lamps or relays as needed. The module shall contain a local audible output, Lamp Test and local audible silence. All circuits shall be power limited.

The system card cage shall provide the mounting of all system cards, field wiring, and panel's inter-card wiring. The terminal strips for the cards shall be color-coded to eliminate the possibility of making the wrong connection. The terminal blocks maybe disconnected and reconnected while the system is powered up without causing any difficulties. All power limited field wiring shall connect to the top of the card cage. All non-power limited internal wiring shall be connected to the bottom of the card cage. The card cage shall hold the systems cards and have capability of connecting multiple card cages to meet system demands.

System response time from alarm to output shall not exceed four (4) seconds.

To expedite system troubleshooting, the system cards shall have ground fault detection, and diagnostic LED's by card.

All system cards and modules shall have Flash memory for downloading the latest module firmware. Power

Supply:

All functions are supported by the 170W or 300W power supplies, which therefore eliminate the need for external power supplies. Additionally power module provide primary, 24VDC nominal power for normal operation to FAS panel. Power supplies are filtered and regulated, is rated at 6.5 Amp/ 11.5A. The 170-Watt

power supply incorporates a 4.0A, non resettable slow-blow fuse on the primary input, and includes a built-in AC-line filter for surge and noise suppression. Power supply module mounts in the panel's enclosure, and there are no serviceable Fire Safety parts to be maintained. The 300-Watt power supply incorporates two (2) 6.3A replaceable, non-resettable slow-blow fuses on the primary input and includes a built-in AC line filter for surge and noise suppression. Power module mounts in the panel's enclosure, and there are no serviceable Fire Safety parts to be maintained. All enclosures come with ground straps for the inner and outer doors, shield termination lugs, grounding lugs, and tie wrap lances for securing wire. All FAP two height-unit (2HU) enclosures can also mount system back-up batteries up to 33AH in capacity.

System Enclosures:

Provide the enclosure needed to hold all the cards and modules as specified. The enclosures shall be either black or red. The outer doors shall be capable of being a left hand open or a right hand open. The inner door shall have a left hand opening. System enclosure doors shall provide where required ventilation for the modules or cards in the enclosure.

Intelligent Initiation Devices:

All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/ minus voltage connections on either Style 4 or Style 6 circuits.

The smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and duct sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. Detectors shall be programmable as application specific, selected in software for a minimum of eleven environmental fire profiles unique to the installed location. These fire profiles shall eliminate the possibility of false indications caused by dust, moisture, RFI/EMI, chemical fumes and air movement while factoring in conditions of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition report. The intelligent smoke detector shall be capable of providing three distinct outputs from the control panel. The system controlled output functions shall be from an individual or unique input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions. The detector shall be designed to eliminate calibration errors associated with field cleaning of the chamber. The detector shall support the use of a relay and LED remote indicator at the same time. Low profile, white case shall not exceed 15 inches of extension below the finish ceiling. Detector wiring shall not require any special shielded cable.

Thermal Detectors shall be rated at 135 degrees fixed temperature and 15 degrees per minute rate of rise. Detectors shall be constructed to compensate for the thermal lag inherent in conventional type detectors due to the thermal mass, and alarm at the set point of 135 degrees Fahrenheit. The choice of alarm reporting as a fixed temperature detector or a combination of fixed and rate of rise shall be made in system software and be changeable at any time without the necessity of hardware replacement. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet and shall be installed according to the requirements of NFPA 72 for open area coverage.

The smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. The detector shall be mounted in a duct detector housing listed for that purpose. The duct detector shall support the use of a remote test switch, relay or LED remote indicator. The duct detector shall be supplied with the appropriate sampling tubes to fit the installation. Where duct detectors are exposed to the weather provide a weatherproof enclosure.

Detector bases shall be low profile twist lock type with screw clamp terminals and self-wiping contacts. Bases shall be installed on an industry standard, 4" square or octagonal electrical outlet box.

Where selective localized control of electrical devices is required for system operation, furnish and install detector base with software programmed addressable relay integral to the base. The relay shall switch

electrical loads within relay ratings, as indicated on the drawings. Operation of the addressable control circuit shall be independent of the number of detectors and relays on the circuit or the number in an alarm state. Relay bases shall be rated for resistive or inductive load (120VAC or 30VDC) 3 amps.

Where indicated on the drawings, furnish detector base with integral approved audible evacuation alarm signal having an output of 85db. The audible signal shall be individually addressable and software programmed for operation.

Provide single action addressable manual stations where shown on the drawings, to be flush or surface mounted as required. Manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel. The manual station communications shall allow the station to provide alarm input to the system and alarm output from the system within less than four (4) seconds. The manual station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Surface mounted stations where indicated on the drawings shall be mounted using a manufacturer's prescribed matching red enamel outlet box.

Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each device and all physical devices shall require only one address on a signaling line circuit regardless of the number of circuits on an individual module. Where remote supervised relay is required the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive.

Notification Appliances:

The Horn or horn/strobe appliance as indicated on the drawings shall be a synchronized temporal horn with a synchronized strobe light with multiple candela taps to meet the intended application. The appliance shall be red or white as indicated on the drawings. The strobe light taps shall be adjustable for 15/75, 30/75, 75, and 110 candela. The appliance shall be red for wall mounted and white for ceiling mounted. Ceiling mounted appliances shall be rated for that application.

The electronic chime or chime/strobe as indicated on the drawings shall be a speaker with a tone card and have an adjustable range of 700 to 1300 Hz. The chime or chime/strobe shall be adjustable for either single stroke or continuous operation. The chime/strobe shall be available with adjustable strobe intensities of 15, 30, 75, and 110 candela. The appliance shall be red for wall mounted and white for ceiling mounted. Ceiling mounted appliances shall be rated for that application.

The strobe only appliance as indicated on the drawings shall be a synchronized strobe light with multiple candela taps to meet the intended application. The strobe light taps shall be adjustable for 15, 30, 75, and 110 candela. The appliance shall be red for wall mounting and white for ceiling mounted. Ceiling mounted appliances shall be rated for that application.

Where required provide a 10" bell where indicated on drawings to be connected to a non-silenceable circuit for activation of the sprinkler system.

An alarm extender panel shall be provided where needed. The power supply shall be a minimum of 6 amps. The power supply shall contain four supervised notification circuits maximum of 3 amps each circuit. The power supply shall contain built-in synchronizing modules for strobes and audibles. There shall be a 3 amp filtered auxiliary power limited output. There shall be a minimum of 8 options as to the operations of the inputs and outputs.

11.0.1.3 EXECUTION

Installation: Perform work in accordance with the requirements of NFPA 70 and NFPA 72.

Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.

Limited energy cable installation is allowed under Div. 16, all cable runs shall be run at right angles to building walls, supported from structure at intervals not exceeding 3 feet and where installed in environmental air

plenums, be rated for such use and tied/supported by components listed for environmental air plenums installation.

Boxes, Enclosures And Wiring Devices:

Boxes shall be installed plumb and firmly in position.

Extension rings with blank covers shall be installed on junction boxes where required.

Junction boxes served by concealed conduit shall be flush mounted.

Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed.

Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

"Fire Alarm System" decal or silk-screened label shall be applied to all junction box covers.

Conductors:

Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.

Wiring for strobe and audible circuits shall be a minimum 14 AWG, signal line circuits shall be minimum 18 AWG.

All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer recommendations.

Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers. A consistent color code for fire alarm system conductors throughout the installation.

The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.

Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

Devices:

Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

Wiring within sub-panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

All devices and appliances shall be mounted to or in an approved electrical box.

Certificate of Compliance:

Complete and submit to the Project ENGINEER IN CHARGE in accordance with NFPA 72, 1999 edition section 1-6.2.

FIELD QUALITY CONTROL:

Testing, general

All Alarm Initiating Devices shall be observed and logged for correct zone and sensitivity. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the initials of the installing technician and date.

Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.

A systematic record shall be maintained of all readings using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.

The acceptance inspector shall be notified before the start of the required tests. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.

Test reports shall be delivered to the acceptance inspector as completed.

The installing contractor shall make instruments, tools and labor required to conduct the system tests available.

The following equipment shall be a minimum for conducting the tests:

Ladders and scaffolds as required to access all installed equipment.

Multimeter for reading voltage, current and resistance.

Two way radios and flashlights.

A manufacturer recommended device for measuring airflow through air duct smoke detector sampling assemblies.

Decibel meter.

In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the ENGINEER IN CHARGE of Record and the AHJ.

Acceptance Testing:

A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the ENGINEER IN CHARGE in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.

The installing contractor prior to the ATP shall prepare a complete listing of all device labels for alphanumeric annunciator displays.

The acceptance inspector shall use the system record drawings in combination with the documents during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions.

The items tested shall include but not be limited to the following:

- System wiring shall be tested to show the following results and the system subsequence operation: Open, Shorted or Grounded Circuits. Primary and Battery power disconnected.
- System notification circuits and appliances operate as programmed. Audibility and Visual levels meet required standards.
- System shall demonstrate the correct messages at the FACP and Remote Annunciator. System off site reporting shall be verified for alarm, supervisory and trouble.
- System shall be tested for stand-by battery back up as outline in this specification.

Documentation:

System documentation shall be supplied to the owner and shall include but not be limited to the following:

- System record drawings and wiring details including one set of reproducible drawings, and a CD ROM with copies of the record drawings in DXF format for use in a CAD drafting program.
- System Operating, Installation and Maintenance Manuals. System matrix showing input signals to output commands. Provide a Soft copy of the system program.

Warranty and Services:

The contractor shall warranty the entire system for electrical and mechanical failures for a period five year. The warranty shall begin with the completion of the acceptance testing or when beneficial use to the owner is determined.

The fire alarm system subcontractor or manufacturer shall offer for the owner's consideration at the time of system submittal a priced inspection, maintenance, testing and repair contract in full compliance with the requirements of NFPA 72.

The contractor performing the contract services shall be qualified, factory trained and certified in the service and the maintenance of the system provided and listed to maintain ongoing certification of the completed system to the "UL" installed system listing.

The installation contractor shall furnish training as follows:

- Training in the receipt, handling and acknowledgment of alarms.
- Training in the system operation including manual control of output functions from the system control panel.
- The total training requirement shall be a minimum of 2 hours, but shall be sufficient to cover all items specified. The contractor shall provide two such training sessions.

11.2 Public Address & Voice evacuation System.

11.2.1 General description

The contractor shall supply, install, test, connect and commission a high quality fast-acting Public Address and Voice Alarm System. The Public Address and Voice Evacuation System shall comprise of Audio Matrix Units, High quality speakers, Audio rack all mounted on a 19" Rack and fully connected and integrated on the fire alarm loop. The system shall be used for Professional Sound Reproduction for all the areas where possible special events take place.

To ensure whole site integration capability, the fire and voice alarm system will be awarded to a single specialist local supplier who will be responsible for the design, global operation, management and interfacing of the system. The contractor shall make sure that all power tapping of the speakers must be carried out as specified, even if the acoustic calculations indicates less power tapings. The contractor must endure minimum of 10dB above the ambient noise levels are achieved. The system shall be fully programmed to accommodate fire alarm and voice communication zones as indicated on the drawings and schematics

11.2.2 Scope of Work

The scope of work under this head shall include designing supplying and installing of Public Address System. The work under this system shall consist of furnishing all materials, equipment's and appliances and labor necessary to install the said system, complete with Speakers, Amplifiers, Microphone, Zone Selection Panel for interfacing with other systems.

The PA system is designed to serve the dual purpose of making general announcement and Voice Evacuation at the time of Fire alarm activation.

System Design

The PAVA system shall be connected on the same Fire Alarm loop. The system shall be de-centralized in nature, each distributed rack DAU (Distributed Amplifier Unit) shall have all the DSP (Digital Signal Processing), messages, amplifiers in such a way that can work in a stand-alone mode or Centralized mode.

The Man Machine Interface (MMI) shall be connected back to the control room, to monitor and control the entire PAVA system. The DAU shall play background / Foreground music and in case of Fire Alarm / Paging announcement, the system shall go to full power as programmed to provide the enough SPL (Sound Pressure Level) levels to comply with BS5839 part8, with minimum of 10dB above the noise levels.

The PAVA system shall be properly integrated with the fire alarm system. The integrated PAVA system shall cover all normally accessible areas including the car parks.

In addition, a FIRE DRILL, BOMB ALERT, EARTHQUAKE ALERT and an ALL CLEAR message shall be incorporated into the operation. A fire alarm broadcast signal shall cancel any public-address operation and shall override it. When a fireman's microphone is operated, this shall override any automatic voice alarm signal being transmitted to the zone selected.

The PAVA Rack shall be in the Control/Security Room enabling the operator to select music from the CD player, FM tuner or the double cassette deck to transmit music to selected zones or all the zones in the

building from the Keypad paging microphone. A public-address announcement shall override the music transmission to selected zones or all zones. The Speakers shall be distributed in the entire floor and shall be configured in different zones. The announcement can have made in zone wise or to all the speakers simultaneously in ALL CALL mode. Fire Alarm shall be announced immediately on receipt of Fire signal from the panel to all zones or group of Zones.

11.2.3 System shall have following functions:

Voice Evacuation and Public Address system integration includes paging system and background music system.

Monitoring of microphone, controller, amplifier, fireman microphone, and source modular, AC&DC power Supply, and Volume Control.

11.2.4 Amplifiers

All amplifiers shall be power amplifier with High quality speech and Music broadcast. The power amplifiers shall have adequate continuous (RMS) power output to meet the requirement of the configuration. The unit shall can deliver the rated output power with less than 0.1% harmonic distortion in the design bandwidth. The amplifier shall have a broad band frequency response of 60 Hz to 15 KHz. The output voltage and impedance shall meet with the system requirements. Amplifiers shall be protected against over loads and output shorts and a special thermal overload on the heat sink.

The Amplifier shall be one channel or Two Channel and each channel have rated power 120/240or 480W.

Amplifier shall have AC 110V or 230V power supply, having separate fuse for each channel. The Amplifier shall be connected through balanced audio input and shall work on 100V Speaker Line.

Technical Specifications

Rated Output Voltage(RMS) 120W/240W/480W/2x120W/2x240W/2x480W

Frequency Response 60Hz to 15KHz

S/N Ratio >70 dB

Total Harmonic Distortion <0.1% @ 1kHz

Power Efficiency >70%

Power Consumption < 670W for 480W Amplifier

Input 10k Ohm < 1V

Output 10k Ohm 0.775V (0dB)

11.2.5 Speakers

Speakers shall be especially designed for broadcasting high quality, integrated emergency fire alarm signals and voice communications and approved by an appropriate authority for use in such situations.

Speakers shall be ceiling, wall mounted or Horn Speaker as shown in the schedule of work and shall be completed with mounting brackets accessories etc. Speakers shall be in metal enclosures only.

Speakers shall be interconnected in the zone configuration.

6W Ceiling/wall Mounted Speaker

The ceiling mounted 6 W speakers shall be installed as depicted in the drawing. The speakers support EASE,

CATT or ULYSSES models for acoustic studies. This mean the acoustic model can be designed to simulate the sound quality and distortion prior to installation. The Speaker should be in compliance BS/EN 60065, 2003 and EMC (BS EN 61000-6-Part 1/2/3/4). The Ceiling speaker shall work on 100V line so that it can reduce line losses over long distance and allow easy parallel connection of multiple loudspeakers. The Speaker shall have multiple tapping for different application according to room size and ambient noise environment. The Speaker shall have aluminum grille and metal baffle and shall have spring clip clamp for easy installation.

Technical Specifications

Rated power	6 W
Tapings 100V line	6/3/1.5W
Operation Voltage	100V or 70V
Effective frequency range	110 ~ 15kHz
SPL @ 1W/m	>91 dB
S.P.L., @Full power/ 1m, dB	>97 dB
10W Ceiling/wall Mounted Speaker	
Rated power	10 W
Effective frequency range	150 ~ 15kHz
Sensitivity	98dB
Power Handling	10W

11.2.6 Remote Paging Microphone

The Remote Paging Microphone should be fully digital connected via CAT6 Cable with Controller. The Microphone should have capability to make announcement in 6 Zones and have all call facility. The Microphone shall have ability to control music and should be able to route the music in zones. The Microphone should have LED indication for the different Status, the unit shall have 12 Selection buttons with colored indicators. The Microphone have reset/channel, All call & Call buttons. The Unit shall have RJ45 ports for connection.

The Microphone shall have following features:

6 Zone Control button and indicators LED for Zones indication

Connect up to 5 Microphone.

Compress function through microphone input to avoid distortion. Auxiliary input for supply background Music

Auxiliary input -22dBV, 47K Communication up to 400 meter Voice Alarm Controller (VCA)

The Controller shall be a 19" Rack Node, which shall operate on 230V mains, it can be installed next to the Fire Alarm Control Panel

The System shall comprise of Master Control Modules, Amplifiers, Link Audio Processor, Power Supply and all the connectors, wires to complete a standalone PAVA Rack with in-built messages.

The use of these units shall be primarily for broadcast fire messages and other optional auxiliary messages as well the back-ground music which is site and application specific, as well live evacuation messages and instructions from the operator or the fire brigade to direct the people to the safety points of the building.

The all components installed for small and medium scale installations. It comprises the latest technology in

Voice Evacuation, Voice messages can be customized.

It shall be possible to define Siren Tone for each message and define the length of it without depending on the message recording.

Controller shall have one audio input (0dB symmetric)

Each controller unit can support up to 12 or 8 speaker circuits of up to 480W per circuit speaker.

All communication must be digital between the entire system components, except the output to the 100V line of the speaker circuit and the 100V output of the amplifier units.

When amplifier, manual switching over of amplifier is option available.

Inbuilt fire evacuation messages, it can be customized based on project/client requirement. Individual digital control for each input and output level from the Microphone.

Controller having individual volume controller for music, announcement and fire message

All messages shall be of WAV files directly can be downloaded to the system through a PC. 0dB input / outputs

Audio input impedance: 10K Ohms Input sensitivity: 0dB

Audio output impedance: 50Ohms Output levels 0dB

Max input/output level +14 dBv Pass-band 10 Hz to 22KHz

Sampling 48 kHz 24bit Distortion 0.02% to 1 KHz

Output noise<84 dBu Lin, <88 dBu A-weighted Output dynamic >98dBu Lin, >102dBu A-weighted 100V Inputs/Outputs

Max power per Channel 500W, and 12 channel per VOICER-G2 Amplifier gain measurement 1 kHz, 18 kHz

Line impedance measurement 100V 1kHz, 18kHz Ground fault measurement

11.2.7 Digital AM/FM Tuner

The digital AM/FM tabletop and rack mount design with aluminum alloy panel. It shall have clearly visible LDC display, microcomputer control and touch-button operation. FM/AM two band receive option, FM receiving frequency 76MHz – 108MHz, AM receiving frequency 520Hz – 1708 KHz. Radio frequency automatic search and memory function, memory up to 99 bands and a power off memory functions. Using vehicle dedicated digital radio module, integrated radio tuner module, with a small size good performance and strong anti – interference etc.

Built in High fidelity wideband monitor Speaker, Sound full and clear, and a monitor with adjustable volume knob

Technical Specifications:

Power Supply 220V/50Hz Power Consumption 8W

1 Channel audio signal left and right channel output

11.2.8 19" Rack

The equipment shall be housed in a standard rack of suitable height, with Plexiglas door or metal mesh and lock. Ventilation panels of 1U height shall be provided between each item of equipment.

Details of the proposed equipment shall be forwarded to the Consultant with performance specifications, dimensions, construction and finish for approval.

Rack should comply with ANSI/EIA RS-310-D; DIN41491; DIN41494; IEC297-2; and GB/T3047.2-92.

The Rack should have DIN Rail Mounted Terminal Blocks for termination of Speaker Zone cables on the rear. All cables coming from Speaker zones, Call Stations, Power supply should enter from Bottom.

Rack should be installed at location which has minimum 600mm space from front & back for accessing it easily. Rack should be installed in well ventilated room preferable Air conditioned. The unit should have Fans from top.

The unit should have Lockable Glass door at front Dimensions

Height as per the Quantity of PA Processor & Amplifiers

Depth 600mm Deep

Width 19"

11.2.9 Speaker Cables

All cables associated with PA System shall be of following specifications:

The 2-core speaker cable will be connected to the speakers by screw terminals before which it shall be crimped using 1.5 sq. mm. bootlace lugs. Care must be taken for avoiding any single strand of wire shall not come out of Lug & screw terminals to avoid noise & leakage.

Speaker cables used should be Multi-Conductor Stranded type

Flexible Copper Conductor of cross section 1.5 Sq. mm //15 Sq. mm insulated, PVCFRLS sheathed control Cable as per IS 694.

These Cables shall be laid in G.I. Conduits concealed/surface. Call Station Cables

Call station cables should be 4pair CAT6 STP (Shielded Twisted Pair) type,

It should be crimped by RJ45 Shielded Male Connectors. Testing PAVA System

Sr. No.	Description	Visual	Test Readings	Documentation
1	All cables are tested for continuity, insulation, resistance etc.			√
2	System installation proper as per drawing	√		
3	Carry out visual checks on all speakers & Processors are free from any mechanical damage, cables, inter phase modules etc.to ensure they are properly installed.	√		
4	Check for proper termination of bootlace lugs & feruling	√		
5	Check Input A/C Supply Voltage		√	
6	Check location / spacing of loudspeakers as in drawing.	√		√
7	Check Distribution of Zones as per Drawing.	√		√

8	Check full load speaker sound quality & measure Sound pressure level (SPL) in dB.	√	√	
9	Check if local loudspeakers overrides by voice messages in case of emergency evacuation.	√		√
10	If power fails, whether Voice evacuation system is working on battery supply if yes for what time		√	
11	Check if recorder messages are CLEAR, free from any noise distortion & easy to understand with Room acoustic speech transmission Index (RaSTI) value >0.5.	√	√	
12	Processor LED's and all keys are working Properly	√		
13	Check for Microphone locations & the sensitivity by paging	√		√
14	Play a soft music & check sound quality	√		

11.3 Very Early Smoke Detection System (VESDA)

11.3.1 SCOPE OF WORK

These specifications cover the requirements of design, supply of materials, installation, testing and commissioning of Aspirating Smoke Detection System. The system shall include all equipment's, appliances and labour necessary to install the system, complete with highly sensitive LASER / LED- based Smoke Detectors with aspirators connected to network of sampling pipes.

11.3.2 CODES AND STANDARDS

The entire installation shall be installed to comply one or more of the following codes and standards:

NFPA Standards, US

British Standards, BS 5839 part :1 and BS 6266

(UK) - FIA Code of Practice for Design, Installation, Commissioning & Maintenance of Aspirating Smoke Detector (ASD) Systems – Issue 3 February 2012.

11.3.3 APPROVALS

All the equipment's shall be designed, tested, approved, and listed by any one:

LPCB (Loss Prevention Certification Board), UK

UL (Underwriters Laboratories Inc.), US

ULC (Underwriters Laboratories Canada), Canada Vds (Verband der Sachversicherere.V), Germany EN 54-20 (European standards)

11.3.4 DESIGN REQUIREMENTS

The System shall consist of a highly sensitive LASER/LED-based smoke detector, aspirator, and filter.

It shall have a display featuring LCD & LEDs and Reset/Isolate button. The system shall be configured by a programmer that is either integral to the system, portable or PC based.

The system shall allow programming of:

- a) Multiple Smoke Threshold Alarm Levels.

- b) Time Delays.
- c) Faults including airflow of each pipe, detector, power, filter block and network as well as an indication of the urgency of the fault.
- d) At least 5 Configurable relay outputs for remote indication of alarm and fault Conditions.

It shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modelling tool. Maximum transport time shall not exceed 90 seconds, and designed within the certification requirements of relevant approvals as per Clause 3.0.0.

Optional equipment may include feature like live camera stream upto 6 IP cameras; ENGINEER IN CHARGE's fault finding assistant; detector tour tutorials.

11.3.5 Performance Requirements

- a) Shall provide very early smoke detection though four smoke threshold alarm levels per pipe provide multiple output levels. These levels shall be programmable and shall be able to set sensitivities ranging from 0.002 % obscuration / meter.
- b) Shall report any fault on the unit by using configurable fault output relays or via the graphics Software.
- c) Shall notify for filter contamination / blockage in holes.
- d) Shall incorporate a flow sensor in each pipe and provide staged airflow faults.
- e) Shall have a clean air supply to maintain Laser chamber clean all the time. or have a failsafe technology to verify true fire/smoke alarm conditions.

MATERIALS AND EQUIPMENT'S

A particle counting method shall be employed for the purposes of

- a) Preventing large particles from affecting the true smoke reading.
- b) Monitoring contamination of the filter (dust & dirt etc.) to notify automatically when maintenance is required.
- c) Should have dual / special detection technology to distinguish between false alarm conditions resulting from ordinary dust, moisture / condensation, air currents or ambient thermal conditions.

The detector shall not use adaptive algorithms to adjust the sensitivity from the set during commissioning. An appropriate algorithm should be incorporated to avoid any false alarms

11.3.6 DETECTOR ASSEMBLY

11.3.6.1 The Detector, Filter, Aspirator and Relay Outputs shall be housed in a mounting box and shall be arranged in such a way that air is drawn continuously from the fire risk area by the Aspirator and a sample passed through the Filter and then to the detector.

11.3.6.2 6.2.0 The detector shall be LASER/LED-based and shall have an obscuration sensitivity range of 0.002 – 10% obscuration per meter.

11.3.6.3 The detector shall have four independent field programmable smoke alarm thresholds across its sensitivity range

11.3.6.4 The Detector shall also incorporate facilities to transmit the following faults

- a) Detector
- b) Airflow per pipe

- c) Filter
- d) System
- e) Zone
- f) Network
- g) Power faults

11.3.6.5 The detector shall have single/multiple pipe inlets which must contain a flow sensor. Both Minor and Urgent flow faults shall be reported. All channels should be capable of giving pipe wise alarms.

11.3.6.6 The filter must be a disposable type filter cartridge.

11.3.6.7 The aspirator shall be a purpose-designed rotary air pump. It shall be capable of allowing/ supporting for a single pipe run / multiple sampling pipe runs with a transport time of less than 120 seconds.

11.3.6.8 The Assembly must contain at least 5 relays for fire alarm and fault conditions. The relays shall be software programmable (latching or non-latching). The relays must be rated at 2 A at 30V DC.

11.3.6.9 The Assembly shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each event shall be recorded. Each detector (Zone) shall be capable of storing up to minimum 9000 events.

11.3.7 DISPLAYS ON THE DETECTOR ASSEMBLY

The detector shall have a LED and LCD for the multiple alarm threshold levels indicated and faults such as detector fault, airflow fault and indication for Isolate and Reset.

11.3.8 PROGRAMMERS

11.3.8.1 When required, a Programmer module may be located within the detector, a remote mounting box, or in a portable hand-held unit.

11.3.8.2 Each Programmer at a minimum shall support the following features:

- a) Programming of any device on the system.
- b) Viewing of the status of any device in the system.
- c) Adjustment of the alarm thresholds of a nominated detector.
- d) Setting of Day/night, weekend and holiday sensitivity threshold settings.
- e) Multi-level password control.
- f) To Program latching or non-latching relay operation.
- g) To Program energizing or de-energizing relays.
- h) To Program high and low flow settings for airflow supervision.
- i) To Program aspirator speed control.
- j) To Program maintenance intervals.
- k) Testing of relays assigned to a specific zone to aid commissioning.

11.3.9 NETWORK

11.3.9.1 The devices in the smoke detection system shall be capable of communicating with each other via twisted pair RS485 cable and have in built / IP network interface. The network shall be able to support up to 250 devices (detectors, displays units and programmers), of which at least 100 detectors can be supported.

11.3.9.2 The network shall be capable of being configured in a fault tolerant loop for both short circuit and

open circuit. Any communication faults shall be reported unambiguously and shall be clearly attributable to an individual device or wire link in the fault messages.

11.3.9.3 PC based configuration tools shall be available to configure and manage the network of detectors.

11.3.9.4 Digital Communication Port shall comply with EIA RS485 Protocol and integrated into the local network for centralized monitoring, Real time alerts and integration with BMS.

11.3.10 POWER SUPPLY

The power supply should be EN approved unit with 110/230VAC input and 18 to 29VDC output with battery backup of 24 hours.

11.3.11 SAMPLING PIPE

- 1 The sampling pipe shall be smooth bore with an internal diameter between 15-25 mm. normally; pipe with an outside diameter of 25mm and internal diameter of 21mm should be used.
- 2 The pipe material should be suitable for the environment in which it is installed, or should be the material as required by the specifying body.
- 3 All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
- 4 The pipe shall be identified as Aspirating Smoke Detector Pipe along its entire length at regular intervals not exceeding the manufacturer's recommendation or that of local codes and standards.
- 5 All pipes should be supported at not less than 1.5m centres, or that of the local codes or standards.
- 6 The far end of each trunk or branch pipe shall be fitted an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.

SAMPLING HOLES

1. Sampling Holes of 2mm, or otherwise appropriately sized holes, shall not be separated by more than the maximum distance allowable for conventional detectors as specified in the local codes & standards. Intervals may vary according to calculations.
2. Each sampling point shall be identified in accordance with Codes or Standards.
3. Consideration shall be given to the manufacturer's recommendations and standards in relation to the number of Sampling Points and the distance of the Sampling Points from the ceiling and roof structure and forced ventilation systems.

11.3.12 INSTALLATION

- 1 The Contractor shall install the system in accordance with the manufacturer's recommendation.
- 2 Where false ceilings are available, the sampling pipe shall be installed above the ceiling, and Capillary Sampling Points shall be installed on the ceiling and connected by means of a capillary tube.
- 3 The minimum internal diameter of the Capillary tube shall be 5mm, the maximum length of the capillary tube shall be 2m unless the manufacturer in consultation with the ENGINEER IN CHARGE have specified otherwise.
- 4 The Capillary tube shall terminate at a ceiling Sampling Point specifically approved by the Client. The performance characteristics of the sampling points shall be taken into account during the system design.

5 Air Sampling Piping network shall be laid as per the approved pipe layout. Pipe work calculations shall be submitted with the proposed pipe layout design for approval.

TESTING

11.3.12.1 Commissioning of the entire installation shall be done in the presence of the owner and/or its representative.

11.3.12.2 All necessary instrumentation, equipment, materials and labour shall be provided by the Contractor.

11.3.12.3 13.1.3 The Contractor shall record all tests and system calibrations and a copy of these results shall be retained on the device at site in the systems Log Book.

11.3.13 FUNCTIONAL TEST

- Introduce Smoke into the Detector Assembly to provide a basic functional test.
- Introduce smoke to the least favourable Sampling Point in each Sampling Pipe. Transport time is not to exceed 120 Sec's.

11.3.14 Documentation

The bidder shall be authorized and trained by the manufacturer to design, install, test and maintain the Aspiration Smoke Detection system and shall be able to produce a certificate issued by the manufacturer along with the offer.

The bidder shall submit computer generated software calculations for design of aspirating pipe network, on award of the contract.

Product data and performance criteria shall be submitted by the bidder.

The bidder should provide, as part of handing over, the as-built drawing, operation manual and maintenance manual. The as-built drawing shall exactly match the Sampling pipe layout with the aspire pipe software calculation.

11.4 Gas Suppression System – NOVEC 1230

11.4.1 General

Specification outlines the requirements for a "Total Flood" Clean Agent Fire Suppression System with automatic detection and control. The work described in this specification includes all ENGINEER IN CHARGE, labor, materials, equipment and service necessary, and required, to complete and test the suppression system.

11.4.2 Applicable Standards and Publications

- A. The design, equipment, installation, testing and maintenance of the Clean Agent Suppression System shall be in accordance with the applicable requirements set forth in the latest edition of the following codes and standards:
1. National Fire Protection Association (NFPA) Standards: NFPA 2001 Clean Agent Fire Extinguishing Systems NFPA 70 National Electric Code NFPA 72 National Fire Alarm Code
 2. Factory Mutual Systems (FM) Publications Factory Mutual Approval Guide
 3. Underwriters Laboratories, Inc. (UL) Publication Fire Protection Equipment Directory with quarterly supplements
 4. National Electrical Manufacturers Association (NEMA) Publication Enclosures for Industrial Controls

and Systems

5. U.S. Environmental Protection Agency, Protection of Stratospheric Ozone 59 FR 13044 (SNAP)
 6. Requirements of the Authority Having Jurisdiction (AHJ), State and Local codes in force at time of award of contract
- B. The standards listed, as well as all other applicable codes, standards, and good ENGINEER IN CHARGE practices, shall be used as "minimum" design standards.

11.4.3 REQUIREMENTS

The Suppression System installation shall be made in accordance with the drawings, specifications, and applicable standards. Should a conflict occur between the drawings and specifications, the specifications shall prevail.

11.4.4 EXCLUSIONS

The work listed below shall be provided by others, or under other sections of this specification:

- A. 120 VAC or 220 VAC power supply to the system control panel
- B. Interlock wiring and conduit for shutdown of HVAC, dampers and/or electric power supplies, relays or shunt trip breakers

11.4.5 QUALITY ASSURANCE

A. MANUFACTURER

1. The manufacturer of the suppression system hardware and detection components shall be ISO 9001 registered.
2. The name of the manufacturer shall appear on all major components.
3. All devices, components, and equipment shall be the products of the same manufacturer or supplied by the same manufacturer.
4. All devices, components, and equipment shall be new, standard products of the manufacturer's latest design and suitable to perform the functions intended.
5. All devices and equipment shall be UL listed and/or FM approved.
6. Locks for all cabinets shall be keyed alike.

B. SUBMITTALS

1. -The installing contractor shall submit the following design information and drawings for approval prior to starting work on this project:
 - a) -Field installation layout drawings having a scale of not less than 1/8 in. = 1 ft.- 0 in. or 1:100 detailing the location of all agent storage tanks, nozzles, pipe runs, including pipe sizes and lengths, control panel(s), detectors, manual pull stations, abort stations, audible and visual alarms, etc.
 - b) -Auxiliary details and information such as maintenance panels, door holders, special sealing requirements, and equipment shutdown.
 - c) -Separate layouts, or drawings, shall be provided for each level, (i.e.; room, sub floor, and above ceiling) and for mechanical and electrical work.
 - d) -Electrical layout drawings shall show the location of all devices and include point-to-point conduit runs and a description of the method(s) used for detector mounting.
 - e) -Provide an internal control panel wiring diagram which shall include power supply requirements and field wiring termination points.
 - f) -Separate drawing providing symbol legend and identifying all symbols used.
 - g) -Annunciator wiring schematics and dimensioned display panel illustration shall be provided. (Optional

device.)

- h) -Complete hydraulic flow calculations, from a UL listed computer program, shall be provided for all ENGINEER IN CHARGE clean agent systems. Calculation sheet(s) must include the manufacturer's name and UL listing number for verification. The individual sections of pipe and each fitting to be used, as shown on the isometrics, must be identified and included in the calculation. Total agent discharge time must be shown and detailed by zone.
 - i) -Provide calculations for the battery stand-by power supply, taking into consideration the power requirements of all alarms, initiating devices, and auxiliary components under full load conditions.
 - j) -A complete sequence of operation shall be submitted detailing all alarm devices, shutdown functions, remote signaling, damper operation, time delay, and agent discharge for each zone or system.
2. Submit drawings, calculations and system component sheets for approval to the local fire prevention agency, owner's insurance underwriter, and all other authorities having jurisdiction before starting installation. Submit approved plans to the architect/ENGINEER IN CHARGE for record.

11.4.6 SYSTEM REQUIREMENTS

11.4.6.1 System Description and Operation

- A. -The system shall be a Total Flood Novec 1230 Fire Suppression System supplied.
- B. -The system shall provide a Novec 1230 minimum design concentration of 4.2% by volume for Class A hazards and a minimum of 5.85% by volume for Class B hazards in all areas and/or protected spaces, at the minimum anticipated temperature within the protected area. System design shall not exceed 10% for normally occupied spaces, adjusted for maximum space temperature anticipated, with provisions for room evacuation before agent release.
- C. -The system shall be complete in all ways. It shall include a mechanical and electrical installation, all detection and control equipment, agent storage containers, Novec 1230 agent, discharge nozzles, pipe and fittings, manual release and abort stations, audible and visual alarm devices, auxiliary devices and controls, shutdowns, alarm interface, advisory signs, functional checkout and testing, training and any other operations necessary for a functional UL listed Clean Agent suppression system.
- D. -Provide two (2) inspections during the first year of service: Inspections shall be made at 6-month intervals commencing when the system is first placed into normal service.
- E. -The general contractor shall be responsible for sealing and securing the protected spaces against agent loss and/or leakage during the 10-minute "hold" period.
- F. -The system(s) shall be actuated by a combination of ionization and photoelectric detectors installed for maximum area coverage of 250 sq. ft. (23.2 m) per detector, in both the room, under floor and above ceiling protected spaces. If the airflow is one air change per minute, photoelectric detectors only shall be installed for maximum area coverage of 125 sq. ft. (11.6 m) per detector. (Ref. NFPA No. 72.)
- G. -Detectors shall be Cross-Zoned detection requiring two detectors to be in alarm before release.
- H. Automatic operation of each protected area shall be as follows:
 - 1. Actuation of one (1) detector, within the system, shall:
 - a) Illuminate the "ALARM" lamp on the control panel face.
 - b) Energize an alarm bell.
 - c) -Transfer auxiliary contacts, which can perform auxiliary system functions such as: Operate door holder/closures on access doors; Transmit a signal to a fire alarm system; Shutdown HVAC equipment.
 - d) Light an individual lamp on an optional annunciator.
 - 2. Actuation of a 2nd detector, within the system, shall:
 - a) Illuminate the "PRE-DISCHARGE" lamp on the control panel face.
 - b) Energize a pre-discharge horn/strobe device.
 - c) Shut down the HVAC system and/or close dampers.
 - d) Start time-delay sequence (not to exceed 60 seconds).
 - e) System abort sequence is enabled at this time.

- f) Light an individual lamp on an optional annunciator.
- 3. After completion of the time-delay sequence, the NOVEC 1230 Clean Agent system shall discharge, and the following shall occur:
 - a) Illuminate a "SYSTEM FIRED" lamp on the control panel face.
 - b) Shutdown of all power to high-voltage equipment.
 - c) Energize a visual indicator(s) outside the hazard in which the discharge occurred.
 - d) Energize a "System Fired" audible device. (Optional)
- 4. -The system shall be capable of being actuated by manual discharge devices located at each hazard exit. Operation of a manual device shall duplicate the sequence description above except that the time delay and abort functions shall be bypassed. The manual discharge station shall be of the electrical actuation type and shall be supervised at the main control panel.
- 5. The cylinders must have digital pressure gauge which must be Capable of integration with DCIM tool for remote monitoring.

11.4.6.2 Material and Equipment

A. GENERAL REQUIREMENTS

1. The NOVEC 1230 Clean Agent system materials and equipment shall be standard products of the supplier's latest design and suitable to perform all functions intended. When one or more pieces of equipment must perform the same function(s), they shall be duplicates produced by one manufacturer.
2. All devices and equipment shall be U.L. Listed and/or FM approved.
3. Each system shall have its own supply of clean agent.
4. The system design can be modular, central storage, or a combination of both design criteria.
5. Systems shall be designed in accordance with the manufacturer's guidelines.
6. Each supply shall be located within the hazard area, or as near as possible, to reduce the amount of pipe and fittings required to install the system.
7. The clean agent shall be stored in NOVEC 1230 Clean Agent storage tanks. Tanks shall be super- pressurized with dry nitrogen to an operating pressure of 360 psi @ 70 °F (24.8 bar at 21 °C). Tanks shall be of high-strength low alloy steel construction and conforming to NFPA 2001.
8. Tanks (master) shall be actuated by either a resettable electric actuator or by pneumatic means from a nitrogen cartridge located in the releasing device. Explosive devices shall not be permitted.
9. Each tank shall have a pressure gauge and low-pressure switch (optional) to provide visual and electrical supervision of the container pressure. The low-pressure switch shall be wired to the control panel to provide audible and visual "Trouble" alarms in the event the container pressure drops below 290 psi (20 bar). The pressure gauge shall be color coded to provide an easy, visual indication of container pressure.
10. Tanks shall have a pressure relief provision that automatically operates before the internal nominal pressure exceeds 730 psi (50 bar).
11. ENGINEER IN CHARGE discharge nozzles shall be provided within the manufacturer's guidelines to distribute the Noves 1230 agent throughout the protected spaces. The nozzles shall be designed to provide proper agent quantity and distribution. Nozzles shall be available in 1/2 in. through 2 in. pipe sizes. Each size shall be available in 180° and 360° distribution patterns.
12. Distribution piping and fittings shall be installed in accordance with the manufacturer's requirements, NFPA 2001, and approved piping standards and guidelines. All distribution piping shall be installed by qualified individuals using accepted practices and quality procedures. All piping shall be adequately supported and anchored at all directional changes and nozzle locations.
 - a). All piping shall be reamed, blown clear and swabbed with suitable solvents to remove burrs, mill varnish and cutting oils before assembly.
 - b). All pipe threads shall be sealed with Teflon tape pipe sealant applied to the male thread only.
13. The system shall have an environmental warranty of a minimum of twenty years. If the agent is banned by governmental agencies due to excess atmospheric life time, global warming potential or ozone depletion potential the manufacturing company must replace the entire system free of charge without causing any inconvenience to the end-user. This must be in accordance with the manufacturing company and the end-user's mutual agreement.

14. The Fluro ketone fire suppression system shall be supplied with Cylinders, Discharge valves, Discharge hose, check valves, Nozzles, Orifices etc. from the same manufacturer and approved by Department of Transportation (DOT, USA) The certificate of origin for the entire system must be from a single source.
15. The system must be environmentally friendly and must be and in strict accordance with Kyoto Protocol, for which India is a signatory.
16. The manufacturer/vendor must have a filling station for Fluro ketone chemical during/ after the execution of the project. This is important to ensure that the refilling of the extinguishing agent can be done within 48 hours of release of the agent due to either fire or by accidental discharge. The filling station and the technical staff must be certified by the manufacturer to ensure that the refill procedures are followed to the original manufacturer's standard.
17. The Fire Extinguishing agent storage Cylinder must have CCOE, Nagpur, India approval for the range of cylinders provided. The cylinder approval must be with Fluro ketone (Noves 1230) agent for use in Indian conditions.
18. The Fluro ketone agent design calculations must be done by UL Listed software by manufacturer certified ENGINEER IN CHARGE. This is to be submitted during detailed ENGINEER IN CHARGE.

11.4.6.3 AGENT

- 1.-The fire suppression agent shall be 3M™ Noves™ 1230 Fire Protection Fluid manufactured by 3M Company, St. Paul, MN or their approved supplier.
- 2.Agent shall not contain any Hydrofluorocarbons (HFC).

11.4.6.4 CONTROL PANEL

- 1.-The control panel shall be an AUTOPULSE releasing panel supplied by APPROVED INCORPORATED.
- 2.-The detection control system and its components shall be UL listed and FM approved for use as a local fire alarm system with releasing device service.
- 3.-The control system shall perform all functions necessary to operate the system detection, actuation, and auxiliary functions.
- 4.-The control system shall include battery standby power to support 24 hours in standby and 5 minutes in alarm.
- 5.-The control system shall be microprocessor based, utilizing a distributed processing concept. A single microprocessor failure shall not impact operation of additional modules in the system.
- 6.-The control system shall be capable of supporting Cross Zoned Detection.
- 7.-The control system shall supply integrated/10-amp (minimum) power supply circuitry. 8.-Each control system shall contain four (4) initiating circuits:
 - a)-Each circuit shall be capable of Class A (Style D) or Class B (Style A) operation.
 - b)-Each circuit shall be capable of operating up to fifteen (15) approved detectors or thirty (30) detectors per system.
 - c)-Each circuit shall be capable of monitoring contact devices configured for manual release, manual alarm, system abort, trouble input or auxiliary (non-fire) input.
- 9.-Each control system shall contain release circuits for activation of a fire suppression system(s):
 - a)Each circuit shall be capable of Class B (Style Y) operation.
 - b)Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.
- 10.-Each control system shall contain two (2) indicating appliance circuits for annunciation:
 - a)Each circuit shall be capable of Class A (Style B) or Class B (Style Y) operation.
 - b)Each circuit shall be rated for a minimum of 1.5 amp @ 24 VDC.
- 11.Each control system shall provide an auxiliary power supply rated for 2 amps @ 24 VDC.

- 12.-Each control system shall provide two (2) SPST relays: one for common alarm and one for common trouble. Four (4) additional programmable relays can be added to each control system by adding a relay module.

11.4.6.5 DETECTORS

- 1.-The detectors shall be spaced and installed in accordance with the manufacturer's specifications and the guidelines of NFPA 72.
2.The ionization detector shall be an approved model. 3.The photoelectric detector shall be an Approved model.

11.4.6.6 MANUAL RELEASE (Electric)

- 1.-The electric manual release shall be a dual action device which provides a means of manually discharging the suppression system when used in conjunction with the detection system.
2.-The manual release shall be an Approved model.
3.-The manual release or manual pull station shall be a dual action device requiring two distinct operations to initiate a system actuation.
4.-Manual actuation shall bypass the time delay and abort functions and shall cause all release and shutdown devices to operate in the same manner as if the system had operated automatically.
5.Manual release shall be located at each exit from the protected hazard.

11.4.6.7 ABORT STATION (Optional)

- 1.-The optional abort station shall be the "Dead Man" type and shall be located next to each manual release./1The abort station shall be an Approved model.
3.-The abort station shall be supervised and shall indicate a trouble condition at the control panel, if depressed, and no alarm condition exists.
4."Locking" or "Keyed" abort stations shall not be permitted.

11.4.6.8 AUDIBLE and VISUAL ALARMS

- 1.Alarm audible and visual signal devices shall operate from the control panel.
2.-The alarm bell, alarm horn, and horn strobe devices shall be an Approved model. 3.-The visual alarm unit shall be an Approved strobe device.
4.-A strobe device shall be placed outside, and above, each exit door from the protected space. Provide an advisory sign at each light location.

11.4.6.9 CAUTION and ADVISORY SIGNS

- Signs shall be provided to comply with NFPA 2001 and the recommendations of the NOVEC 1230 equipment provider.
1.Entrance sign: (1) required at each entrance to a protected space./1Manual discharge sign: (1) required at each manual release station.
3.Flashlight sign: (1) required at each flashing light over each exit from a protected space.

11.4.6.10 SYSTEM and CONTROL WIRING

- 1.All system wiring shall be furnished and installed by the contractor.
2.All wiring shall be installed in electrical metallic tubing (EMT), or conduit, and must be installed and kept separate from all other building wiring.
3.All system components shall be securely supported independent of the wiring. Runs of conduit and wiring shall be straight, neatly arranged, properly supported, and installed parallel and perpendicular to walls and partitions.
4.The sizes of the conductors shall be those specified by the manufacturer. Color-coded wire shall be used. All

wires shall be tagged at all junction points and shall be free from shorts, earth connections (unless so noted on the system drawings), and crosses between conductors. Final terminations between the control panel and the system field wiring shall be made under the direct supervision of a factory-trained - representative.

5.All wiring shall be installed by qualified individuals, in a neat and workmanlike manner, to conform to the National Electrical Code, Article 725 and Article 760, except as otherwise permitted for limited energy circuits, as described in NFPA 72. Wiring installation shall meet all local, state, province, and/or country codes.

6.The complete system electrical installation and all auxiliary components shall be connected to earth ground in accordance with the National Electrical Code.

11.4.7 TESTING AND DOCUMENTATION

A. SYSTEM INSPECTION and CHECKOUT

After the system installation has been completed, the entire system shall be checked out, inspected, and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures and NFPA standards.

A. All containers and distribution piping shall be checked for proper mounting and installation.

B. All electrical wiring shall be tested for proper connection, continuity and resistance to earth.

C. The complete system shall be functionally tested, in the presence of the owner or his representative, and all functions, including system and equipment interlocks, must be operational at least five (5) days prior to the final acceptance tests.

D. Each detector shall be tested in accordance with the manufacturer's recommended procedures and test values recorded.

E. All system and equipment interlocks, such as door release devices, audible and visual devices, equipment shutdowns, local and remote alarms, etc. shall function as required and designed.

F. Each control panel circuit shall be tested for trouble by inducing a trouble condition into the system.

B. TRAINING REQUIREMENTS

Prior to final acceptance, the installing contractor shall provide operational training to each shift of the owner's personnel. Each training session shall include control panel operation, manual and (optional) abort functions, trouble procedures, supervisory procedures, auxiliary functions and emergency procedures.

C. OPERATION and MAINTENANCE

Prior to final acceptance, the installing contractor shall provide four (4) complete operation and maintenance instruction manuals to the owner. All aspects of system operation and maintenance shall be detailed, including piping isometrics, wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s) illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, troubleshooting techniques, maintenance operations and procedures shall be included in the manual.

D. AS-BUILT DRAWINGS

Upon completion of each system, the installing contractor shall provide five (5) copies of system "As-Built" drawings to the owner. The drawings shall show actual installation details including all equipment locations (i.e., control panel(s), agent container(s), detectors, alarms, manual pull station(s) and abort switch(s), etc.), as well as piping and conduit routing details. Show all room or facilities modifications, including door and/or damper installations completed. One (1) copy of reproducible ENGINEER IN CHARGE drawings shall be provided reflecting all actual installation details.

E. ACCEPTANCE TEST

- A. At the time "As-Built" drawings and maintenance/operations manuals are submitted; the installing contractor shall submit a "Test Plan" describing procedures to be used to test the control system(s). The Test Plan shall include a step-by-step description of all tests to be performed and shall indicate the type and location of test apparatus to be employed. The tests shall demonstrate that the operational and installation requirements of this specification have been met. All tests shall be conducted in the presence of the owner and shall not be conducted until the Test Plan has been approved.
- B. The tests shall demonstrate that the entire control system functions as designed and intended. All circuits shall be tested: automatic actuation and manual actuation, HVAC and power shutdowns, audible and visual alarm devices, and manual override of abort functions. Supervision of all panel circuits, including AC power and battery power supplies, shall be tested and qualified.
- C. A room pressurization test shall be conducted in each protected space to determine the presence of openings, which would affect the agent concentration levels. The test(s) shall be conducted using the Retro-Tec Corp. Door Fan system, or equivalent, with integrated computer program. All testing shall be in accordance with NFPA 2001.
- D. If room pressurization testing indicates that openings exist which would result in leaks and/or loss of the extinguishing agent, the installing contractor shall be responsible for coordinating the proper sealing of the protected space(s) by the general contractor or his sub-contractor or agent. The general contractor shall be responsible for adequately sealing all protected space(s) against agent loss or leakage. The installing contractor shall inspect all work to ascertain that the protected space(s) have been adequately and properly sealed. THE SUPPRESSION SYSTEM INSTALLING CONTRACTOR SHALL BE RESPONSIBLE FOR THE SUCCESS OF THE ROOM PRESSURIZATION TESTS. If the first room pressurization test is not successful, in accordance with these specifications, the installing contractor shall direct the general contractor to determine, and correct, the cause of the test failure. The installing contractor shall conduct additional room pressurization tests, at no additional cost to the owner, until a successful test is obtained. Copies of successful test results shall be submitted to the owner for his record. Upon acceptance by the owner, the completed system(s) shall be placed into service.

11.5 ACCESS CONTROL SYSTEM (ACS)

11.5.1 SYSTEM DESCRIPTION

The Integrated Access Control System's (ACS) primary function shall be to regulate access through specific doors, gates or barriers to secured areas of the facility. It shall also have the provision of capturing cardholder images and producing access cards used to provide this access.

The system shall use a single seamlessly integrated database for both its access control and badging functionality. This integration shall be provided under one operating environment.

The system shall provide a multi-tasking environment that allows the user to run several applications simultaneously. The ACS software shall run on a Windows 11 64 bit operating system or Compatible with Linux/Unix. The ACS shall be able to run in conjunction with other Windows applications such as MS Word and Excel while concurrently annunciating on-line access and security alarms and monitoring information.

The system shall operate on a Windows 11/LINUX/UNIX multi-tasking, multi-threading 64-bit operating system. The System software shall be a true native 64-bit application built 'from the ground up' for Windows 11.

All system application modules, features, and functions shall be generated from a single source code set. In addition, the source code must be designed using object-oriented software development techniques and

compiled into native 64-bit applications. There shall not be separate source code bases for access control and ID badging. All system features and functionality listed in the proceeding pages shall ship with each system.

Features and functionality available to the "Owner" shall be determined through licensing and shall be controlled by a software license key. The "Security Contractor" shall work with the Owner to develop and configure the system.

GLOSSARY OF TERMS & ABBREVIATIONS

ACS Access Control System, incorporates the entire access control and security network, including the Server, Workstations and Intelligent field or system controllers.

ISC (Intelligent System Controller). The hardware components of the system to which the physical components (input devices, entry devices, and output devices) of the access control system connect. The ISC communicates with the ASC Server.

11.5.2 INSTALLATION

The ACS shall be designed, installed, commissioned and serviced by manufacturer employed, factory trained personnel.

All materials supplied by the Security Contractor shall be new and shall comply with the latest published specifications and recommendations of the manufacturer in all respects unless otherwise indicated. The Security Contractor shall supply the latest model available for all equipment items. Unless otherwise indicated in the specification, all electronic equipment shall be a standard, unmodified production model.

Equivalent products may not be substituted for previously approved products unless the Architect has approved a written request from the Security Contractor. All requests for substitute equipment must reflect a complete description of the proposed substitute equipment, including manufacturer's technical descriptions, drawings and technical performance.

The Security Contractor shall be responsible for providing complete and operational subsystems, including but not limited to all hardware, software, wire, cable, conduit and boxes, power circuit connections, terminal blocks, labor, management, ENGINEER IN CHARGE, training, testing, relocation adjusting and connection to IITH work and devices.

11.5.3 System Requirements

11.5.4 System Architecture

The system shall be of a Server / Client architecture with the option to configure the Server and client ACS software on different PCs residing on the same computer network. Full network functionality shall be available over remote links between the Server and any workstation, using the following protocols:

- NetBEUI, IPX/SPX, TCP/IP

Dial-in capability from remote workstation to the Server using a remote access service shall also be available.

Encryption between the Server and each Client is configurable and safeguarded using IPSec, to ensure the integrity and security of the data transferred.

11.5.4.1 Workstation

Workstations shall be capable of operating on an IBM compatible computer with the following minimum system requirements:

Operating System :Windows 10/11 Pro (64-bit)
Processor : Intel Core i7 or equivalent
RAM : 32 GB
Hard Drive :1TB SSD
Graphics : Dedicated GPU with 4GB VRAM
Network : 1 GbE RJ45 Ethernet port

11.5.4.2 Intelligent System Controllers

The system shall be configured with the ACS software connected via an Ethernet link to any configurable number of Intelligent System Controllers.

Distributed intelligence

The system shall employ a distributed architecture so that all access decisions are made locally at the Intelligent System Controller (ISC). All decisions to grant access shall be made by the local ISC. An Intelligent System Controller (ISC) shall link the ACS software to all other field hardware. It shall provide full distributed processing for access control and alarm monitoring operations. Access levels, hardware configurations and programmed alarm outputs assigned at the administrative workstation shall be downloaded immediately to the ACS software. All access granted/denied decisions shall be made at the ISC to provide fast responses to card reader transactions. The IP controller is connected to an Internet/Intranet network which allows for communication with the Access Software system, and can be configured through the Components dialog in ACS integrated Configuration Client.

Single Door/ Two reader IP controller:-

2 OSDP Readers: Controller for one or 2 doors (depending on configuration) Linux O/S
4 Monitored or Unmonitored Inputs: Connect for up to 2 x OSDP card readers 2 Relay Outputs
4 Open-collector Outputs
1 general-purpose FLN bus to connect to IPM, OPM and 8IO devices Capacity for 500,000 users (configurable)
4 inputs and 6 outputs, of which 2 are relay outputs

Anti-passback

11.5.4.3 Housings & equipment tamper switches

All access control hardware components shall be housed in a lockable metal cabinet that is fitted with equipment tamper switches and meets the appropriate environmental requirements.

There are two types of tamper switches:

Opening the lid

Removing unit from the wall

The wall tamper requires that the unit is properly fixed to wall with a screw. If the unit is removed, the plastic plug (which presses on the tamper switch) breaks, and the tamper alarm becomes active.

11.5.4.4 COMMUNICATIONS

- The system shall use TCP/IP communications techniques over Ethernet, whilst employing proprietary communications protocols. The encryption between the ACS host and each ISC shall use implementation of the Advanced Encryption Standard (AES) to encrypt all messages and ensure data security.

ACS communications

- The connection between the ACS Server and each MMI workstation shall use standard Ethernet communications.

- The communications protocol to transfer messages to or from the ACS Server to any MMI workstation in the system shall be of a proprietary nature to the manufacturer providing the highest level of security.
- In addition, the communications protocol shall allow an encryption mechanism to be configured, that ensures the transfer of data cannot be interpreted.
- ACS / ISC communications
- The connection between the ACS Host and the ISCs shall use standard Ethernet communications.
- All communications between the ISCs and sub-devices shall be based upon the standard RS485 transmission techniques using a proprietary protocol.
- The communications protocol to transfer messages to or from the ACS Host to any ISC in the system shall be of a proprietary nature to the manufacturer providing the highest level of security.
- In addition, the communications protocol shall incorporate an error checking routine that checks the integrity of the messages that are transferred on this line.

ISC communications

- The connection between an ISC and a series of entry devices using Reader Interface Modules (RIMs), or system extension boards shall use standard RS485 communications techniques. The communications protocol to transfer messages to or from the ISC to any connected device shall be of a proprietary nature to the manufacturer providing the highest level of security possible.
- In addition, the communications protocol shall incorporate an error checking routine that checks the integrity of the messages that are transferred on this line.
- Each ISC shall be capable of communicating with at least 96 of these devices at any one time, using four separate channels to co-ordinate the communications process and share the load across different channels.

11.5.4.5 MAN MACHINE INTERFACE (MMI)

As a minimum the ACS shall provide the ability to connect up to 20 workstations to the server. Each workstation shall have the capability of displaying an easy to use MMI, from which all system operation, including programming, control and operation can be accomplished. The MMI shall employ a standard Windows look and feel and provide both an intuitive menu and button driven navigation system.

On-line help

The MMI shall provide a comprehensive on-line help system, which shall be available at anytime and from any screen. The help system shall describe the use of all system functions and provide a comprehensive glossary of terms. In addition, the help system shall provide the standard windows help contents listing, index listing and key word or phrase search functionality.

Navigation

The MMI shall use standard Windows controls, including:

- Mouse control
- Menu functionality
- Button navigation
- Keyboard equivalent mouse shortcuts
- Toolbar Customization

The MMI shall use allow for the customization of an operator specific toolbar. This shall provide the ability to create a custom toolbar that only includes those buttons (links to parts of the ACS) that are most commonly used or required for the operation of the system.

In addition, the operator shall be able to display the look and feel of the toolbar buttons that allow them to perform tasks quickly and efficiently including the text size and placement and size and position of icons displayed.

In addition, the MMI shall also provide the ability for custom toolbar buttons to be programmed. This customization will permit the selection of a personalized icon and the ability to include a command to be performed when the button is clicked by an operator.

Windows look and feel

The MMI shall support a user friendly, Windows Graphical User Interface (GUI) that shall be intuitive. All messages and interface text shall be in English prose unless another language has been specified and installed. All functions shall be either keyboard or mouse driven to allow the System Operators to choose the method of navigating through the screens. In the alarm-monitoring module of the system software, all major functions (opening a door, acknowledging alarms, etc.) shall be accomplished using a minimum number of mouse clicks.

The operator workstation interface software shall minimize operator training through the use of language prompting, on-line help, and industry standard PC application software.

Languages

The system shall support the installation of multiple language versions.

In addition, the manufacturer shall be able to provide the tools to translate the ACS into other languages as may be required.

Installation:

The MMI and ACS shall use standard Windows installation processes and employ a software installation that is similar in look and feel to other Windows Vista applications.

The installation licensing shall allow for the selection of software installations that cater for the size and functionality of the facility at which the system is being installed. As a minimum the following package types should be available as default:

Basic

Intermediate Advanced System

Operators

The system will only permit authorized operators, who have been given permissions to log on to the ACS at a workstation, to administer aspects of the system. The functionality available to these operators shall be fully configurable via the comprehensive partitioning architecture.

Authentication

The system shall request an operator's user name and password before entry to the MMI is granted. The password must be fully encrypted on-screen to prevent it from being easily copied. The MMI will not be displayed until the identification of the operator has been verified and access to the ACS is granted. Authentication may be based on a pre-defined time schedule for certain groups of operators.

Authentication Rules

It shall be possible for the following configurable logon rules to apply to each account:

Password age

Password Length

Logon retries

Complexity

Finally, it may be possible for the operator to change their own password or for authentication to be performed using the standard Windows logon identification. Therefore the currently logged in Windows User's details can be used to verify their permission to log into the ACS.

Partitioning

Operator specific password access protection shall be provided to allow the user/manager to limit workstation control, display and database manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (an unlimited number of operator accounts shall be supported).

The System shall employ an application partitioning design so that applications are broken into separate distinct programs capable of running independently to other System applications. Applications shall include, but not be limited to, alarm monitoring, system administration & configuration, cardholder management, graphics, ID card printing, and cardholder forms designing modules. Each client workstation shall have the ability to be installed with any combination of the above listed modular applications.

The system shall allow partitioning to be assigned on the basis of the following conditions (as a minimum):

- Cardholders
- System Functions (minimum of 60 feature levels)
- Holidays/SCs
- Field Devices
- Custom Pages
- Time Schedules
- Site Plans
- Reports

The system shall prevent the currently logged in operator from viewing the details, regarding any alarms triggered by a system component to which they have not been assigned privileges, including:

- Audit trail alarm entries
- Audit trail reports, which include alarm details
- Audible and visual alarm annunciation

The alarm information associated with any system component to which an operator has been assigned privileges will be displayed.

The system shall allow partitioning to be assigned on the basis of audit trail reports. The currently logged on operator shall only be able to create or run those reports to which they have been assigned privileges.

The system shall also prevent the currently logged in operator from printing reports that include those system components to which they have not been provided privileges.

Privilege levels

When assigning a function to an operator, the system shall allow the level of assignment to be specified. These levels include:

- Read only. This type of privilege level does not allow the operator to create or modify components in the specified area of the system. However, they are allowed to view those records.
- Modify. This type of privilege level does not allow the operator to create components in the specified area of the system. However, they are allowed to view and make modifications to existing records.

- Full. This type of privilege level allows the operator to create, modify and view components in the specified area of the system.

Operator profiles

The ACS shall support multiple operator profiles such that preferences are retained for individual operators, irrespective of the workstation that they log onto. The display colors and data layout shall be configurable (and be saved) per operator.

Operator journal

A system operator journal shall be available to log important daily events. The operator is required to select a journal subject from a pre-defined list. The ACS shall allow an administrator to set the names to comprise this list of subjects. The system shall also allow all journal entries relating to a particular subject to be recalled and viewed on-screen, printed or both.

Workstation auto-lock

All ACS workstations shall automatically lock if left idle for a configurable period of time - requiring the operator to identify him or herself by re-entering their password. The operator shall also have the capability of manually locking a workstation at any time. Any system initiated or manual workstation locks shall be logged in the ACS audit trail.

Default Accounts

At installation the ISC shall be automatically configured with default operator accounts. These accounts shall be defined in such away that they reflect the standard duties of different operators that can be expected to use the system.

CARDHOLDERS

The system shall include a cardholder management component that is integrated with the access control system. The system must support at least 500,000 cards – all of which are downloaded and retained in the memory of each ISC. This cardholder management functionality must allow the enrolment of cardholders into the database, capturing of images and import/export of employee data. This functionality shall also allow a system operator to assign or modify the access rights of any cardholder.

Cardholder data

As a minimum, the ACS shall allow up to 196 configurable fields to be customized by the system administrator to suit the needs of the facility owner. The system shall provide a Graphics Editing Module (GEM) that gives operators the ability to modify any standard field to customize the cardholder screens as desired. Once these fields have been defined, the

ACS shall not permit these (database) fields to be changed.

In addition it shall be possible to add cardholders to the database without assigning a card to that cardholder. Searching

The system shall allow the search of all programmed cardholders, based on the criteria supplied by an operator. Operators shall only be able to search and retrieve cardholder records to which they have assigned privileges.

The search criteria shall include any information that can be recorded against the cardholder and as a minimum include:

- Card number
- Name (first and / or last)

- Work Group
- Title
- Address
- Contact Numbers (phone, mobile, and pager)
- Payroll Number
- Vehicle Details (registration, color, model)
- Custom Cardholder Data

Searching shall not only be limited to entire word matches. An operator may also search for cardholders by entering data that appears in the beginning of a word or string.

If more than one cardholder in the system meets the specified criteria, the operator shall be displayed a list of all matching records, from which they can select a particular record.

When search results are returned, the operator shall be able to dynamically re-sort the information displayed so that appears in a useful order (for example, by last name). When selecting an individual record to expand, it shall be possible to keep the search dialog active so that other cardholder records can be opened at a later time if required.

Cardholder images

The ACS shall support the capturing of a high quality image of a cardholder from any workstation. The system operator shall have the option of capturing images in real-time or alternatively by importing an existing image. If capturing images in real-time, the operator shall be able to use an appropriate capture card or use a USB digital video camera. If cardholder images already exist, the operator shall be able to import images of all standard formats including jpg, bmp, gif, and if The cardholder image shall be able to be recalled at any time from any workstation to verify the identity of any cardholder on the facility.

Cardholder Fingerprints

The ACS shall support the capturing of high quality finger prints and encoding the finger print into the card during enrolment process that is native of ACS.

Also the ACS shall allow operators to capture and store the fingerprint to the ACS database. The fingerprints shall be captured using a biometric reader and an enrolment reader shall be used for fingerprint encoding.

Cardholder Signatures

The ACS shall support the capturing of cardholder signatures from any workstation. The system operator shall have the option of capturing signatures in real-time or alternatively by importing an existing signature. If capturing signature in real-time, the operator shall be able to use a USB signature capture pad. If cardholder signature already exists, the operator shall be able to import images of all standard formats including jpg, bmp, gif, and if.

Card Trace

The ACS shall record the last visited access point (with date and time) for every cardholder. A special trace function shall be available for operators to track activity of specific cardholders. When the trace has been applied, all card activity relating to that cardholder will be highlighted in the audit trail. A report may also be generated that details the locations visited by the traced cardholder.

Grouping cardholders

The ACS shall allow the grouping of cardholders into specific configurable entities. This shall facilitate voiding of a large number of cards with a single action and also assist with operator partitioning.

Cardholder violations

The system shall monitor every card presented at each reader in the system and prevent access at the reader (door) if any of the following access violation conditions exist:

- The card has not been assigned access permission at the current time.
- The card has not been assigned permission at the reader.
- The cardholder has been voided in the system.
- The cardholder belongs to a group of cardholders that has been voided.
- Entry to or exit from an area governed by anti-pass back control has been violated.
- A card belongs to a group of cards that has been disabled.
- A card was presented at a reader that has been disabled or taken out of service.
- The card has been presented before its allocated start date, or after the card's designated end date.
- The card presented does not belong to the site, which includes an invalid card number, an invalid site number or a card containing an invalid facility code.

In addition, a message will be logged in the audit trail indicating the card use violation, and if configured, a visual and audible alarm will also be displayed.

Cardholder Data Import / Export

The system shall provide an external software tool that can be used to import or export cardholder data from another application via text file.

This manipulation of data shall be governed by the same login rules applied to a standard operator of the system and shall also be capable of synchronizing data over a period of time.

The system shall also provide an automatic synchronization tool that allows changes to be automatically bought in the ACS.

Cardholder Record Changes

It shall be possible to display all changes made to a cardholder record within a specified date range so that record can be reversed to a previous status from any point in time.

Multiple Cards per Cardholder

It shall be possible to define up to 5 cards for each cardholder in the system and have an independent void or active status for each card and the overall cardholder.

In addition, it shall be possible for each card assigned to the same cardholder to be of a different card technology and for each card to have separate access permissions.

Inactive Cardholders

It shall be possible to effectively park cardholders by removing a card from their current identity profile. Whilst this data will still remain in the ACS the cardholder will still be considered inactive and not count toward any overall licensing structure or otherwise.

Custom Cardholder Information

The ACS shall provide an integrated tool for creating custom cardholder information. This shall provide the ability to add the following information types to a cardholder custom page:

- Textbox
- Dropdown List Box
- Date Calendar
- Group Box

- Dialog Labels
- Custom Button
- Attachments Box
- In addition, design of custom pages shall be simple drag and drop functionality with automatic page guides for aligning already placed components and the ability to individually change the parameters of each component selected.
- Finally, it shall be possible to import or export custom pages using an xml format.
- Cardholder Watchlists
- The ACS shall provide the ability to import information regarding any cardholder on a watchlist from a government agency or otherwise
- When an operator attempts to enroll a cardholder into the ACS that matches the information already contained in a watchlist, the ACS shall generate an alarm that alerts the operator that a match has been recognized and further action may be required.
- This match shall include general cardholder information or may even include custom cardholder information.

ASSIGNMENT OF ACCESS

- The system shall allow an infinite number of combinations of access permissions to be assigned to any cardholder programmed in the system. The system shall allow access permissions to be assigned to access points, areas, elevator floors and groups of any of these.
- In addition, the system shall provide the ability to schedule the times during which cardholder access to each separately allocated resource is permitted.
- Access shall also be extended to output points, whereby a cardholder presenting their access badge not only unlocks a door, but can also easily change the state of any output in the system.
- Upon changing or assigning access to any cardholder, the details shall be immediately propagated to all on-line ISCs.

Access privileges shall be assignable on the following basis:

Access based upon group privileges Access based upon individual privileges Access based upon a temporary privilege Access based upon offline doors Any combination of the above Time Schedules & Holidays

- The ACS shall allow up to 65,000 configurable time schedules to be defined. Each time schedule can consist of up to 20 independent time periods including up to 2 holidays. For ease of configuration, the operator shall be able to select from week days, weekends, or specify a particular day or time. The ACS shall have the intelligence to check whether the time periods are valid and not conflicting with existing credentials.
- A time schedule can be configured to include or exclude holidays. Upon changing a time schedule record, the ACS shall immediately propagate the appropriate changes to all affected ISCs.

CARD READERS AND CARDS

Card Readers shall read encoded data from the access card and transmit that data back to the ISC. The card reader or entry device should give an audible and visual indication of each read.

Supported cards and technologies

- The system shall be compatible with all major card and access entry technologies, including (but not limited to):
 - Proximity cards and readers
 - Biometric readers
 - Bar code cards and readers
 - Magstripe cards and readers
 - Wiegand cards and readers

- Smart cards and readers
- class cards and readers (HADP range)
- Optical cards and readers
- Transmitter and infra-red cards and readers
- Keypads and PIN pads
- In addition, the ACS manufacturer shall be able to provide a number of different encoded card technologies, which use sophisticated algorithms. These algorithms shall be proprietary in nature to the manufacturer, and should be sophisticated enough that they increase the security of the installation. The support for these formats will be in addition to any format perceived to be an industry standard. These shall include at least one proprietary format in each of the following:
 - Bar code
 - Magstripe
 - Wiegand (output protocol)
 - Smart Card
 - RS-485
 - Clock & Data

Ability to produce cards with bar codes, magnetic stripes, smart cards

The system shall be able to create and print either magstripe, bar code, or smart cards using an integrated printing function.

When creating bar code cards the user must have the option to choose the type of barcode that suits their facility. The user should be able to specify the bar code ratios, character length and position on the card.

Ability to support multiple cards

The ACS system shall support the use of 60 different card technologies. As such, each tenant within an allotted environment may bring their own card technologies with them.

Ability to support MIFARE smart cards

The ACS system shall support the use of MIFARE smart card technology. As such the system shall provide the ability to encode smart cards including the ability to program the following:

Specify a custom format including length, facility, company, card number and parity.

Program each sector / block on a MIFARE (1K and 4K byte) smart card for access control and non-access control applications

Specify sector keys and the way in which these keys interact with the sector for the reading and writing of information

Specify the output type and data type of the information stored on the card Program database information for each block / sector

The ACS system shall also support the ability to read an entire smart (1Kb and 4Kb) card based upon a pre-configured profile. This card reading shall provide a dedicated viewing screen from which the current contents of all blocks and sectors can be viewed on-screen.

Ability to support DESFire smart cards

The ACS system shall support the use of DESFire smart card encoding technology. This option shall support a wide range of smart cards. The ACS shall provide the ability to encode DESFire smart cards including the ability to program the following:

Specify a custom format including length, facility, company, card number and parity.

Program each Application / File on a DESFire (2K, 4K and 8K) smart card for access control and non- access control applications

Encryption Key for the smart card

Length of data written on the card, Output format, Access Control, and the Data Type to be encoded on to the smart card.

Ability to support Custom Wiegand cards

The ACS system shall support the use of proximity card technology with a custom Wiegand format including the ability to program the following:

Specify a custom format including;

Length

Facility Code

Company Code

Card number

Revision

Parity

Provide a graphical means of specifying the format details Enrollment

It shall be possible to connect standard card readers to the ISC workstation directly using a free USB port for the purpose of automatically capturing the card details during the cardholder enrollment process.

Ability to support iClass cards and readers

The ACS system shall support the use of iClass technology natively (e.g.; not just via a wiegand connection) including the ability to perform the following:

Support for HADP iClass readers

Support for access control via CSN or iClass ID

Ability to display appropriate status messages on those readers with an LCD screen Host Event Processing

The ACS shall be capable of processing events in the system as they occur, and distributing this information throughout the entire access control and security network.

Immediate propagation

- Changes made using the ACS software shall be automatically recorded to the ODBC compliant database and downloaded to the correct ISC(s) using the appropriate communications channel. In addition, the ACS software shall also provide the tools to manually download all appropriate database information, allowing the full initialization of each ISC.

All database changes shall be performed while the workstation is on-line without disrupting other system operations.

- Changes made at the ISC equipment shall be automatically uploaded to the ACS server, to ensure system continuity. Each ISC shall be capable of reporting all changes in status, system events, and actions performed, to the ACS in real-time. These messages shall be displayed immediately in the ACS audit trail. The affect of each message must be reflected throughout the system as they occur, such as, the immediate changing of the colour of a symbol located on a site plan to indicate a change in point status.

Local event buffer

The ISCs shall maintain a buffer of all events that occur locally. This buffer shall store all messages until they are uploaded to the ACS server. If the communications between the ISC and the ACS server are lost, the buffer will be retained until communications is restored, at which point all logged events shall be uploaded to the ACS server.

Database accessibility

All System data must reside on a single database on the network and must be accessible in real-time to every / any system workstation. This shall allow for automatic change propagation to all workstations on the system as well as a common database to consolidate all information and allow for better disaster recovery.

Real time Audit Trail

The system shall log all events that occur to both an on-screen audit trail window and a retrievable database record. These events must be logged on-screen as they occur (in real-time). All system changes, alarm events, entry / exit conditions, point state changes, exception messages, miscellaneous system messages, or any information relating to the access control system in general shall be logged to this audit trail.

Partitioned display data

The system shall be capable of filtering all displayed audit trail messages based upon the currently 'logged in' operator's assigned privileges. Only those events to which the operator has been assigned privileges will appear on-screen or any audit trail report printed whilst that operator is logged on.

Operator audit trail profile

- The system shall allow the operator to select which information columns are displayed and which information columns are not displayed on-screen in the audit trail window. The system shall also allow the operator to change the width of any displayed audit trail column by simply using the mouse to drag the column wider.
- The system shall allow the operator to select the colors in which certain events are displayed in the on- screen audit trail window. The operator shall also be able to select the background colors displayed behind these entries. As a minimum, the system shall allow the following audit trail component colors to be configured:
 - Alarm message text color
 - Normal message text color
 - Alarm message background color
 - Normal message background color

In addition, it shall be possible to display each alarm with an individual alarm color, this will allow alarms of a similar to type to be instantly recognized.

History View

The system shall provide the ability to switch to an audit trail history mode that allows history events to be easily searched. This view shall allow events to be searched based upon any text contained in the audit trail messages that have been recorded.

Event short-cuts

The system shall facilitate a quick link (short-cut) from any event appearing in the audit trail. As a minimum, there shall be a link to the cardholders and the point location relating to the audit trail event. This will enable easy access to the respective record, allowing the operator to change the details of that record, if necessary.

Dual window

- The ACS shall allow any operator to scroll through past events without losing the ability to monitor new events. This shall be easily achieved via a split-pane audit trail window. Both viewers shall display all events as they occur. The upper viewer shall allow the operator to scroll-back and view previous events that have occurred at the facility, but have scrolled off screen as other events are logged. The lower viewer shall display the latest logged events at all times.

- The two viewers shall be separated by a movable partition that allows the operator to change the viewable area by simply using the PC mouse. In addition, the system shall allow the operator to select the number of entries that are retained in each on-screen viewer at any time.
- Any older events that cause the viewer to exceed the configured entry limit, will be removed and must be logged to a permanently stored log-file that can be recovered by creating an audit trail report.
- The currently logged in operator shall also be allowed to determine the order in which events are displayed (i.e.: latest event appearing at the top or the bottom of the audit trail).

Real-time audit trail printing

The ACS shall allow the system administrator to configure the type of events to print to a dedicated printer in real-time. The administrator shall have the option of selecting to print all events or only alarm events. This can be in addition to displaying the events on-screen.

Filtering and Search

The MMI workstation shall allow the audit trail messages displayed on-screen (in history mode) to be searched using a full text search field. In addition, should be possible to filter the displayed records.. The filter options will include, but will not be limited to:

Date and Time

Type and Category of event

Point Information

Group

Name

Employee ID

Change Tracking

The Audit Trail shall detail each database change made within the system, including the data that was changed and a record of the operator who made that change.

Custom Audit Trails Views

The ACS shall provide the ability for an operator to create a custom Audit Trail view that includes the following features:

The customized view should update in real time as transactions occur in the system Multiple custom views shall be permitted at any point in time.

Ability to filter information displayed (for example may only display messages from a select group of doors) An operator shall be permitted to share views (configuration of) with other ACS operators.

Ability to configure a view with special trace conditions such that any important event in the system is displayed with identifying colors. For example, whenever a specific door is unlocked a message should appear in green

Any view shall support the configuration of multiple trace conditions at any time It shall be possible to print the custom view at any system printer.

Advanced Alarm Management

The ACS shall provide an advanced alarm management system. This system shall allow the visual and audible annunciation of alarm events as they occur, in real-time. The annunciation of an alarm shall take priority over all other system functionality to ensure the alarm is registered immediately upon occurring.

Alarm annunciation

- The system shall provide an audible and visual annunciation of all appropriate alarm situations as they occur. Each alarm annunciation shall be configurable, so that it requires positive action to be taken by the System Operator when acknowledging it, and always appears in the foreground of the MMI.

Immediately following the visual and audible annunciation of an alarm, a field shall become available where the

system operator can enter comments regarding the alarm situation, and shall prevent the alarm from being cleared until an entry in this field has been made. Once entered the System Operator shall be allowed to acknowledge the alarm.

In addition, pre-defined alarm responses shall be available. These responses are specific to the facility and can be selected from a drop-down list to ensure quick and efficient acknowledgement of an alarm situation, in lieu of typing a message.

- After an alarm has been announced, the system shall allow the operator to silence the alarm for a selected period of time. After this time period has elapsed the alarm annunciation will be regenerated.
- Upon an alarm being announced, the System Operator shall be provided with the facility to view an alarm queue before taking further action. Alarms with the highest priority shall be placed at the head of the queue. As a minimum the alarm queue will display the following alarm attributes:
 - Priority of the alarm
 - Date and Time at which the alarm occurred
 - Name of the system component that caused or initiated the alarm
 - Current status of the system component that caused or initiated the alarm
- The system shall provide the ability to outline unique emergency instructions to be specified for each type of alarm. These instructions should be displayed on request before the alarm is actioned, in order to help the Operator understand the requirements and necessary routines for clearing the alarm. These alarm instructions should be able to contain any combination text or graphics and if appropriate contain a windows video (*.avi) that can be played on request of the system operator.

In addition, these instructions should appear in a dialog that allows the system operator to enter a log in relation to the alarm and acknowledge the alarm, whilst simultaneously viewing the instructions.

Visual alarm graphics

The system shall be configured so that the activation of any alarm provides text and audio instructions outlining the procedures to follow in responding to the alarm, at the Alarm Monitoring Workstation and automatically calls up associated maps upon grabbing the alarm.

The alarm-handling portion of the system shall provide dynamic color alarm graphic maps. These maps shall allow the operator to respond to and clear alarms from the alarms graphics screen.

The system shall allow the creation of color graphic floor plan displays and system schematics for each piece of equipment, including card readers, inputs (monitor points), and outputs (control points) to optimize system performance, analysis and speed alarm recognition.

The MMI shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.

The system shall allow the equipment state to be changed by clicking on the point block or graphic symbol and selecting the new state. In addition symbol colors shall be used to indicate status and change as the status of the equipment changes.

Real-time, dynamic graphical maps will mean that the map screen will not have to re-paint or refresh each time a new alarm or event condition occurs.

Multimedia alarming

The system shall extensively integrate and use multimedia throughout the ACS. The system shall provide owner customizable voice alarm annunciation and a flashing colored system icon for each alarm in the System. In addition, the System shall provide customizable voice instructions so that each alarm or event in the System can have both sets of text instructions and/or pre-recorded audio voice instructions.

Alarm re-activation

The ACS shall allow each alarm to be configured with an internal timer that re-activates the alarm annunciation if the change in status that initially caused the alarm to be announced has not been rectified. This timer shall only accompany those alarms where the status of the system component can be restored to a normal state.

Alarm Queue

The ACS shall place each outstanding alarm in a queue with the highest priority alarm at the top of the queue. The alarm queue shall be able display different alarms with unique colors to allow for easy and quick identification of any outstanding alarm.

In addition, each entry in the queue as a minimum, will display the alarm location, its current status, and the date and time at which the alarm first occurred. The alarm queue will also provide the ability to clear alarms when necessary.

Alarm configuration

▪ The ACS shall allow each alarm to be fully configurable. As a minimum the System Operator shall be able to configure alarms in response to changes in state or messages received from the following system components:

- Access Points
- Areas or zones
- Communications
- Elevator floors
- Input points
- Output points
- Intelligent System Controller (ISC)
- Interlocked Door Groups
- External System Points

▪ As a minimum, each alarm created shall allow the operator to define the following attributes:

- Whether or not the alarm is required to be acknowledged when announced
- Alarm priority, with up to 1,000 priority alarm levels
- The color of each alarm priority level
- Instructions to be associated with the alarm
- Sound to be played when the alarm is visually announced
- Alarm re-activation time
- State change or event that will trigger the alarm or return the system component to normal
- Description of each status
- Symbols to represent the alarm and normal status of the component on a graphical map
- The system shall also allow alarms to be forwarded to an alternative alarm handling solution. The methods in which alarms can be forwarded include:
 - To a mobile phone using SMS
 - To a pager
 - Via email
 - From one ACS server to another (in the same security network and communications structure) via OPC
 - To an OPC (Alarm and Events) compliant system

Printers

All printers can reside on the same network as the access control and security system.

Dedicate printers by function

The system shall be capable of configuring dedicated printers for each specific task that requires the use of printed results. As a minimum the system shall allow the following printer types to be specified:

- Audit Trail printing
- Card printing
- Plan printing
- Report printing

Reports

The system shall be capable of configuring a dedicated printer specifically for the task of printing audit trail, database, or operator journal reports. This facility shall provide the selection of a default printer for this task and the ability to change the printer characteristics to suit the printing requirements.

Real time printing

The system shall be capable of printing all audit trail entries as they occur, using a dedicated printer specifically for this task. This facility shall allow the filtering of audit trail messages that are printed, including alarm messages only or all messages. In addition, the system shall allow the printer type used to be selected, be it 132 column, 80 column, or other printer types.

ID card printing

The system shall support any card printer with industry standard Windows drivers. It shall support double-sided full color printing, edge to edge printing with the additional ability to encode magnetic stripes or bar codes on cards.

Plan printing

- The system shall be capable of configuring a dedicated printer specifically for the task of printing graphical site plans. This facility shall provide the selection of a default printer for this task including the ability to select the following type of printers:
 - pen plotters
 - inkjet printers
 - bubblejet printers
 - laser printers
 - electrostatic printers
- The ability to change the printer characteristics to suit the operator's requirements shall also be available.

ARCHIVING SYSTEM

The system shall be capable of archiving the programmed database information, the logged audit trail data, operator journal entries, graphics, alarm sound files, alarm instructions and custom designed reports. Once archived, the system shall provide the tools required to restore this data at a later time if necessary.

Archiving medium

The system shall provide the ability to select the location of the archived data, be it using a local hard drive, another hard drive located on a machine in the same computer network, a floppy drive or any other mass storage device as deemed acceptable.

User-definable archiving parameters

- The archiving facility shall allow the operator to select what information is to be stored. When archiving database information, the operator should be able to independently or collectively select the following information for storage:
 - All programmed database records
 - All system graphics, including site plans, symbols, alarm instructions and drawings
 - System parameters
 - Operator profiles
 - Cardholder images
 - Reports
- Upon restoring the archived data, the system operator shall have the same flexibility in choosing which

components are to be restored if more than one component was part of the archived file.

- When archiving audit trail information, the operator should be able to independently or collectively select specific dates for storage. Upon restoring the archived data, the system operator shall have the same flexibility in choosing the dates for which audit trail entries are to be restored.

In addition, the operator shall be able to choose whether to encrypt the backed audit trail data. Automatic Archive

The system shall provide the mechanisms to create an automated backup. This will allow a backup schedule to be implemented for the ACS data and will include scheduling for one off date and time, day of the week, or monthly. In addition it shall be possible to specify the type of data to be automatically archived.

REPORTING

The system shall be capable of providing detailed reports regarding the information contained in the database, audit trail, or operator journals, without the need for programming skills.

The system shall provide the capability for the configuration and set-up of a specific system printer for printing reports, and allow the use of network printers. The system shall also exclude those records from any report to which the currently logged in System Operator has not been assigned privileges to view.

Available Reports

The list of reports shall be available in a tree view sorted by functional area of the system, whereby individual report views can be easily selected and displayed within the MMI. As a minimum the system shall supply at least 50 pre-defined reports in the following functional areas:

Alarm Information

Hardware Components

Time Schedules

Groups (hardware / cardholders) Access Definitions

Site Plans Cardholders

Audit Trail Messages Event

Routines

External Devices (e.g.: CCTV)

Holidays

Elevators

Operators

Mustering

Credential Profiles

Advanced Security Programming

Synchronization

The report view MMI shall be displayed within an independent window to the ACS main operation window so that the reporting function never takes away focus from the audit trail view or other important access control information being displayed on screen,

In addition, it shall be possible to hide the tree view navigation pane to maximize the area on screen in which to view the data associated with the report selected.

Report sort and filtering

Once displayed, each report can be filtered and information ordered as required. The main functions that shall be available to customize the current view of a displayed report shall include as a minimum:

- Customized column view (order columns, add new columns, remove columns)
- Column order (alphabetical sort order – ascending / descending)
- Information Grouping (Group information based upon data in a column, including hierarchical grouping)
- Key word filter (filter any information in a column based on a key word including wild card characters etc.)
- Automatically size columns for the information displayed Design custom report views

The system shall provide the tools necessary for the operator to create custom reports regarding information in either the audit trail or database. This customization shall allow the following selection criteria as a minimum:

- Customized report creation wizard
- Custom report name
- Report type selection (for example: cardholders)
- Selection of column information to be displayed (for example: first name, last name)
- Filtered criteria (for example: first name = John) with more than 15 different filter types (equal to, greater than, etc.)
- Ability to add additional filtered criteria including logical operators (and / or / and not / or not)
- Addition of the new custom report to the tree view for easy and permanent selection Print to reports printer

The system shall provide the functionality to configure and setup individual printers for each different system task that may require printed results. This includes the ability to configure a printer specifically for the purpose of creating printed reports. In addition, the printer configuration shall allow for the setup of local or network printers for these tasks.

Print reports automatically

The system shall provide the tools to automatically generate reports, based upon a defined schedule without operator intervention. These automatically generated reports shall be saved to disk and can be viewed at any later time while still saved.

Print Preview

It shall be possible to provide a print preview on screen with the option to change the printer settings so that the view can be customized by the operator before printing.

Report Export

It shall be possible to export the data contained within a report to the following data formats:

- Microsoft Excel (.xls)
- XML (.xml)
- Tab delimited (.txt)
- Comma delimited (.csv)

Report Layout

Where applicable it shall be possible to dynamically change the report layout on screen by selecting an appropriate current view. For example, when creating a report based upon cardholders it shall be possible to view layouts based upon a list, by card status, alphabetical order, grouping, or with photograph. Once selected the screen will reflect the layout chosen.

Interactive Reporting

The ACS shall provide a report with an interactive functionality. As a minimum, interactive reports shall permit the following:

- Ability to create a complex report based on any information contained within the ACS
- Alternatively, it will be possible to import reports from an external source
- Each interactive report will provide the facility for a set of conditions to configured for the report information (e.g.: date > mm/dd/yyyy)
- Perform functions on any information that meets the criteria selected. These functions shall include voiding a cardholder.
- Functions shall be activated manually by right clicking or automatically upon report analysis by the ACS. Unused Cards

The ACS shall provide a mechanism to remove unused cards from an active state in the system. The length of time

which defines an unused card shall be configurable.

- The ACS shall allow a report to be generated that lists all cards that at the time the report was generated the cards listed were considered unused.

It shall be possible to directly from right clicking on entries in the report to void any or all unused cards as seen applicable by the operator who produced the report.

- The ACS shall also provide the ability for unused cards to be automatically voided in the system at a regular interval (for example, on a weekly basis), without the need for operator intervention.

Scheduling

The system must provide the capability for an operator to define specific times, during which certain events and system control will occur. The system must be capable of handling at least 65,000 distinct time schedules. These schedules must be operator customizable, so that, they can schedule events across an entire week, with up to twenty distinct time periods during that week. Primarily, the time schedules must be able to handle holidays, provide access at certain times, and schedule or permit events during the specified times.

Holidays

The system must be capable of defining over 100 holiday dates in advance of them occurring. A defined holiday will override the normal timed schedules where configured and allow other system functions to behave as normal.

Public floor access

The system must be capable of scheduling specific times when access to floors in an elevator system are taken 'off' security and are accessible to the general public. At all other times the system shall secure those floors and provide access only to valid cardholders.

Access per door

The system must be capable of scheduling specific times when a cardholder is permitted to access a specified door, barrier or gate. At all other times the cardholder will be prevented from gaining access at that door.

By specific date & time

The system shall be capable of scheduling certain programmable events to occur on specific dates or during specific times of the day.

By certain event

The system shall be capable of scheduling certain programmable events to occur in response to the activation of another event or system status change. The event or status changes that trigger this response shall be configurable.

ANTI-PASSBACK

The system shall be capable of providing anti-pass back control, whereby, a cardholder that uses their card at an entry reader must not be able to re-enter until they have first exited using the specified exit reader. The system must also be capable of operating in either a soft or hard anti-pass back mode

The anti-pass back control should also be flexible so that cardholder's that have violated anti-pass back rules or have lost their access card can be forgiven by a system operator.

Soft Anti-pass back

The system shall provide the selection of a soft anti-pass back mode, which permits entry at a door or barrier (to a valid cardholder) when the anti-pass back rules have breached. However, the system will still generate an alarm in response to this anti-pass back violation.

Hard Anti-pass back

The system shall provide the selection of a hard anti-pass back mode, which does not permit entry at a door or barrier (to a valid cardholder) when anti-pass back rules have been breached. In addition this type of breach will also generate an alarm.

Peer-to-Peer Anti-pass back

The system shall provide full anti-pass back capabilities across multiple ISCs without the need to consult the ACS host. This will allow full anti-pass back capability even when communications with the host has been lost.

In addition, peer-to-peer anti-pass back operation shall provide a fail-safe mode, whereby entry or exit to a secure area will be permitted when communications between controllers has been lost.

Mustering Area

The system shall provide the facility via the anti-pass back functionality to designate specific mustering areas. These areas shall allow reports to be generated that display all those cardholders currently logged into that area.

Area Limits

The system shall allow each area to be defined with a maximum cardholder count. Once this limit has been reached the area will be considered as being "Full". Once the full capacity has been reached, the system shall allow:

- The prevention of further cardholders from entering the area
- The triggering of an output device, for example a "Max entry " sign

Cascading Anti-pass back

The system shall allow single reader doors to be created within an area. These doors will not fall under normal anti-pass back control, however, entry will not be permitted unless the anti-pass back conditions assigned to the surrounding area have been previously observed.

Four Eyes Access

The system shall allow an area to be nominated as a "Four Eyes" location. An alarm in a four eyes location shall be raised when a single cardholder has entered that location and resided within the location for a specified amount of time without a second or subsequent cardholder entering. A four eyes area will also allow an alarm to be raised when no cardholders reside within the location.

Timed Re-entry

The system shall allow an entry point(s) to be nominated as a timed re-entry point. Once a cardholder has used their card at a timed re-entry access point, that cardholder will not be permitted to re-use their card again to gain access to that location within a specified time period.

Door Interlocking

The system shall allow the configuration of a set of interlocked doors, such that opening any single door within the defined set prevents any other door from being opened at the same time, even if a valid cardholder attempts to gain entry at that door.

In addition, it shall be possible to define a time period once the first door has been closed, before another door in the set can be opened.

Dual Custody

The system shall allow the configuration of a door such that it can only be opened if two valid cardholders present their access badge at the door within a defined time period. This mode shall also allow for supervisory access (e.g.: visitor escort) and an override function based upon cardholder so that cardholders of an authorized level do not require a subsequent cardholder before entry is permitted.

Clustering

Finally, the system shall allow the configuration of a set of controllers in a single group for the purpose of Antipas back configuration. Whilst both local anti-pass back and global anti-passback operation shall be available, this subset allows a group of controllers to monitor anti-pass back within their own cluster.

This type of clustering shall also allow cardholders to maintain a current count in separate anti-pass back locations. For example, when a cardholder leaves their car in the carpark the increased count because of that card remains raised, even if the cardholder enters another anti-pass back area that is managed across multiple controllers.

- The system shall allow cardholders to indicate whether they are requesting access under a forced or duress situation and thus communicate a potential emergency to the ACS. When such a duress action has been registered, the cardholder will be permitted access and a duress alarm will be announced on the system, without arousing suspicion.
- In addition, the system shall allow the configuration of a duress button, which, when triggered shall raise a visual and audible alarm at each ACS workstation.

SECURITY PROGRAMMING

The ISC or the system controller shall have a Programmable logic engine allowing security programming and control.

The security control shall be presented to the operator through a user-friendly graphical designer.

The programmable security control shall operate like a programming logic engine running in a controller.

This feature shall give the ACS operators an ability to construct logical activities using the graphical designer. The logical activities shall then be executed by the controller.

The programmable security control shall allow the operator to visually design activity programs in the system and download them to the controller. The operators shall be able to customize activities for multiple triggers, and resulting effects via the graphical designers.

As a minimum, the ACS's security programming shall make the following features available:

Enabling users to create and design customized, site-specific activity programs for their site, without having to contact vendors for related firmware modifications

A Single ISC or controller shall execute multiple programmable activities simultaneously. A single programmed activity shall be executed from multiple ISC's.

The programmable activities shall be controlled and executed by Time Schedules. A variety of entities like Access, Input and Output point, Access Events, Intrusion Areas, Anti-Pass back areas, Workgroups, and Floors shall be supported.

Virtual Components like flags, timers, counters shall be incorporated as triggers and effects. Time and Attendance Recording

The system shall be capable of recording the entry and exit of cardholders at designated card readers or groups of card readers.

Once recorded the system shall allow for the export of the time and attendance information to a third party T&A or HR application. This export shall be available in a ".CSV" or "tab delimited" format to a pre- defined file location and file name.

In addition, the exact information contained within the export file shall be selectable and extend to at least the following required information:

- First Name
- Last Name
- Date of record
- Time of record
- Location that the record was logged

The system shall provide the ability for a report to be generated that counts the hours a cardholder is estimated

to have been on-site.

- The hour counting function shall allow a count of hours from a specified date at specified readers within the ACS
- The hour counting function shall allow a count of hours from within a given time frame (for example, within the last week)
- It shall be possible to automate such a report and send this via email to a specified recipient.
- It shall be possible to export the report so that the information contained can be used in another third-party system.

Graphical Maps

- The system shall allow the design, import, and construction of site plans, which can be used to visually handle alarms, control access, and generally monitor the facility. Each site plan shall be updated dynamically as the status of system components change. The symbol representing each component will automatically update in color, alerting the operator of its change in status.
- The system shall provide a pre-defined library of symbols that represent the most common access control and security components. In addition, the system shall allow the operator to create their own library of symbols that represent the devices installed at the facility.
- The system shall provide a built-in suite of graphics tools that can be used to create or modify a site plan. As a minimum, these tools shall include:
 - Import of existing site plans, including AutoCAD, bmp, jpg, wife, tif, and most other raster type images.
 - Common Windows text tools, such as alignment, font, and style.
 - Color tools to change the fill and border color of components in a plan.
 - Drawing tools, so that lines, boxes, circles, arcs, and free-hand lines can be drawn.
 - Alignment tools, to align separate components in a site plan.
 - Shortcuts that add a button to a site plan that, when clicked automatically open a new site plan or trigger a system action, such as opening a door.
 - Grid or crosshairs that aid in the alignment and scale when creating a site plan.
- Each site plan shall have the ability to unlock a door to allow entry, control points at the click of a button, retrieve point information at the click of a button, and create shortcut buttons to other plans in the system or frequently used system commands.
- In addition, the ACS shall allow partitioning for each graphical map. This partitioning shall allow only those System Operators that have been assigned the appropriate privileges to the graphical map, to view it and control points located on that map.

11.6IP CCTV SYSTEM

11.6.1 SYSTEM REQUIREMENT

The CCTV System shall be a Network Video Recorder based system.

11.6.2 SYSTEM OBJECTIVE

- a. To enable the important areas of the premises to be remotely monitored.
- b. To enable sensitive areas to be scanned from pre-selected position.
- c. To enable automatic recording by Network Multiplex Recorder on hard disk and to play back the recorded events on selected monitors.
- d. All CCTV Equipment shall be UL/CE/FCC approved only.

A. INDOOR VARIFOCA LENS DOME SYSTEM.

1. The IP based domes cameras shall support power over Ethernet (IEEE802.3af) and 24V AC
2. The IP cameras shall support open architecture and shall support the following protocols TCP / IP , UDP / IP (Unicast , multicast IGMP) UPnP , DNS , DHCP , RTP , NTP .
3. The cameras shall have a minimum resolution 1920 X 1080
4. The camera shall support multilevel password protection.
5. The camera shall provide minimum 2 simultaneous video streams – Dual H.264 both at 800 X 600 resolution @ 25 fps
6. The varifocal lens shall be available in following options 3.2 to 10 mm.
7. The dome camera shall have wide dynamic range of 120db or better.
8. The network dome camera shall provide a removable, local storage medium (Micro SD) to capture video clips of varying lengths upon camera sabotage, motion, or relay alarm. Video can be retrieved from the card through the FTP protocol.
9. The network dome camera shall be conformant to the ONVIF Profile S supporting open architecture best practices with a published API available to third-party network video recording and management systems
10. The network dome camera shall offer local storage capture of 10-second video clips on camera from alarms created by sabotage, motion detection, or alarm inputs.
11. The network dome camera shall offer the ability to record continuous video in the case of network outage, where the camera is powered by 24 VAC. It will be accessible through FTP protocol.
12. The network dome camera shall provide the ability to backup and restore camera settings through an embedded Web browser.
13. The network dome camera shall provide motorized zoom capabilities with a Web browser interface for remote configuration and administration
14. The network dome camera shall provide autofocus capabilities with a Web browser interface for remote configuration and administration. The automatic autofocus shall be triggered when the camera detects an environmental temperature change and when the camera changes from color to monochrome or vice versa. User-selectable options for full-range auto-focus and quick auto-focus shall be available.
15. The network dome camera shall provide camera sabotage analytics to detect changes in the camera's field of view, including obstruction of the lens and unauthorized movement of the camera. Such behaviors shall

trigger an alarm

16.The cameras shall use 1/3 or 1/4 inch interline color CCD/CMOS imaging device.

17.The sensitivity of the cameras shall be a minimum of 0.03 lux/F=1.2

18.Cameras shall be FCC and UL listed

B OUTDOOR PTZ DOME SYSTEM.

1. The outdoor CCTV camera dome system shall include a built-in 100Base-TX network interface for live streaming to a standard Web browser.
2. The indoor/outdoor CCTV camera dome system shall be a discreet camera dome system consisting of a dome drive with a variable speed/high speed pan/tilt drive unit with continuous 360° rotation; 1/4-inch-high resolution color, monochrome, or color/black-white CCD camera; motorized zoom lens with optical and digital zoom; auto focus; and an enclosure consisting of a back box, lower dome, and a quick-install mounting.
3. The outdoor fixed dome system shall meet or exceed the following design and performance specifications.
4. The Proposed outdoor PTZ dome cameras shall be suitable for Day / night operation. The Day sensitivity of the Camera shall be minimum 0.05 Lux (ICR ON) (colour)
5. The cameras shall have a minimum resolution of not less than 540 TV lines
6. The cameras shall have inbuilt electronic image stabilization feature along with inbuilt motion detection
7. The cameras shall have a wide dynamic range feature so as to provide clean and clear picture at all times irrespective of the changing light conditions and heavy back light or low light conditions.
8. The PTZ camera shall have at least 256 presets
9. The PTZ camera shall have 7 alarm inputs and 1 Auxiliary (Form C) Relay Output and 1 Open Collector Auxiliary Output
10. The PTZ camera shall have 400°/sec Pan Preset Speed and 200°/sec Tilt Preset Speed
11. The cameras shall have a wide dynamic range feature so as to provide clean and clear picture at all times irrespective of the changing light conditions and heavy back light or low light conditions.
12. The outdoor PTZ camera shall have at least 120 presets
13. The camera shall have a optical zoom of 30X , 4.4mm to 142.6 mm and a digital zoom of 12 X.
14. The cameras when used for outdoor application shall have IP 66 protection
15. The cameras proposed shall be FCC and UL Listed
16. 256 positions with a 20-character label available for each position; programmable camera settings, including selectable auto focus modes, iris level, Lowlight limit, and backlight compensation for each preset; command to copy camera settings from one preset to another; and preset programming through control keyboard or through dome system on-screen menu
17. User-defined shapes, each side with different lengths; window blanking setting to turn off at user-defined zoom ratio; window blanking set to opaque gray or translucent smear; blank all video above user-defined tilt angle; blank all video below user-defined tilt angle user-defined programmable patterns including pan/tilt/zoom

and preset functions, and pattern programming through control keyboard or through dome system on - screen menu

DATABASE SERVER / VIDEO MANAGEMENT SERVER

- A. The system shall be an integrated hardware and software platform that serves as the system management component and provides gateway functionality when accessing the security platform from external networks.
- B. The system shall utilize reliable SSD drives for the operating system drive to protect against hard disk drive failures from interrupting system functionality
- C. The system shall be capable of serving as an NTP Server for the entire system. The IP video security system shall be synchronized to an NTP server so that all system components function on the same time basis. The NTP server shall reside within the system, and it shall be capable of being synchronized to a more accurate external time source if required. All time-zone corrections shall automatically be provided in the system.
- D. The system shall be capable of performing as a DHCP server for the entire system and components. The system manager shall assign IP addresses and manage leases for automatic provisioning.
- E. The system manager shall act as a web server for web browser based access to video cameras and recorders on the network.
- F. The system shall manage system security, functioning as a key server for user and device authentication. The system manager shall store and administer secure keys and shall have multi-level and user permission management.
- G. The system shall incorporate built-in transcoding of video to send video across low bandwidth network connections to remote browsers accessing cameras and recorders. The transcoder shall be capable of delivering MPEG4 and H.264 video streams into lower resolution, lower frame rate streams to fit the bandwidth limit established by the IT administrator or available on the network connection. The system manager shall be capable of supporting up to 16 transcoded streams.
- H. The system shall offer local storage of 30 days recording backup for exported video. Hard disk drives used shall be enterprise- class drivers specifically designed for operation in RAID environments. Where more than three data drives are used, the drives shall be configured in a RAID5 array.
- I. The system shall manage rights and permissions for all devices, persons, and any system video or other data.
- J. The system shall maintain a system log of all user activity on the system including time and date of user log-in, log-off, configuration changes made, video exported.
- K. The system shall store the database of device errors, alarms, and other system events, and the comprehensive database shall be accessed and searched through the system log window in an interface.
- L. The system shall allow for connection to an intelligent uninterruptible power supply (UPS), and it shall allow for the initiation of a graceful shutdown should the UPS deplete its stored charge.
- M. The system shall meet or exceed the following design and performance specifications.
 - 1. System Specifications
 - a. Processor 2nd Generation Intel® Core™ i7
 - b. Internal Memory 8 GB or better

- c. Operating System Windows/ Linux
 - d. System Storage 3 TB in RAID5
- 2. Network Specifications
 - a. Interface Gigabit Ethernet RJ-45 port (1000BaseT)
 - b. Security Two modes: secure mode and unsecure mode
- 3. Auxiliary Specifications
 - a. USB/10 Three USB/10 ports or more
- 4. Front Panel Specifications
 - a. DVD/CD-RW Drive
- 5. Power Specifications
 - a. Power Input 100-240 VAC, 50/60 Hz, autoranging
 - b. Power Supply Internal
- 6. Environmental Specifications
 - a. Operating Temperature 50°F to 95°F (10°C to 35°C)
 - b. Operating Humidity 20% to 80% non-condensing
 - c. Maximum Humidity 10% per hour
 - d. Operating Altitude -50 ft to 10,000 ft (-16 m to 3,048 m)
- 7. Physical Specifications
 - a. Construction Steel cabinet Rack mountable
- 8. Certifications and Regulations
 - a. CE, Class A
 - b. UL/cUL Listed
 - c. FCC, Class A
 - d. C-Tick

NETWORK ATTACHED STORAGE / NETWORK STORAGE MANAGER

- A. The network storage shall record video and audio streams from IP cameras and video encoders on the network.
- B. The network storage shall incorporate the server functions and storage elements into a purpose-built chassis.
- C. The network storage shall use RAID 6 parity across the storage drives to protect recorded data against a hard disk drive failure.
- D. The network storage manager shall only use enterprise-level hard disk drives specifically rated for operation in RAID systems.
- E. The network storage manager chassis shall be designed for video surveillance recording applications and encompass redundancy at all vital points:
 - 1. Redundant, hot swappable power supply modules
 - 2. Redundant, hot swappable system fans
 - 3. Hot swappable O/S drive
 - 4. Hot swappable CPU fans
- F. The network storage manager chassis shall be designed for online service and maintenance and cannot be

removed from the rack when hard disk drives, fans, power supplies, or operating system drives must be replaced.

- G. The network storage manager shall be built upon a reliable and robust Windows/ Linux operating system.
- H. The network storage manager shall support a guaranteed recording throughput of 250 Mbps per storage device with a minimum of 64 Mbps of read throughput. This throughput shall be guaranteed under normal and error (RAID rebuild) conditions.
- I. The network storage manager shall support any number of cameras so long as the maximum throughput required is less than 250 Mbps.
- J. The network storage manager shall support the recording of MPEG-4 and H.264 baseline, and high profile streams from standard resolution and megapixel cameras.
- K. The network storage manager shall support continuous, scheduled, alarm/event (including analytics alarms), motion, and manual recording. Pre- and post-alarm periods shall be configurable up to the total capacity of the system.
- L. The network storage manager shall support bookmarking and locking/unlocking of video content on the drives.
- M. The network storage manager should have Active-Active Failover Within a Storage Pool to Ensure Continued Recording if Catastrophic Failure Occurs
- N. The network storage manager should support redundant recording to ensures duplication of vital data for mission-critical applications
- O. The network storage manager shall support privacy tools that allow administrators to establish maximum retention times for normal, alarm, and locked video.
- P. The system should have video pruning to increase storage efficiency by grooming recorded streams based on age and priority
- Q. The network storage manager shall support an intelligent video grooming protocol that can reduce the frame rate of recorded video as the video ages. Administrators shall have the flexibility to determine whether to groom alarm video or leave it at its real-time level.
- R. The network storage manager shall have the ability to report all diagnostic events, including software status diagnostics to a centralized user interface. In addition, Simple Network Management Protocol (SNMP) traps and polling shall be available for monitoring through a third-party SNMP management console.
- S. The network storage manager shall be fully managed from a remote workstation, including the ability to configure settings and update firmware and software.
- T. The network storage manager shall meet or exceed the following design and performance specifications.
 - 1. Power Specifications
 - a. Power Input 100 to 240 VAC, 50/60 Hz, auto ranging
 - b. Power Supply Internal, dual-redundant, hot-swappable
 - 2. Environmental Specifications
 - a. Operating Temperature 50°F to 95°F (10°C to 35°C) at unit intake

- b. Operating Humidity 20% to 80%, noncondensing
 - c. Maximum Humidity 10% per hour
 - d. Operating Altitude -50 to 10,000 ft (-16 to 3,048 m)
 - e. Operating Vibration 0.25 G at 3 to 200 Hz at a sweep rate of 0.5 octave/minute

- 3. Physical Specifications
 - a. Construction Steel cabinet
 - 1. Mounting Rack Mountable
(Rack rails and hardware provided)

- 4. System Specifications
 - a. RAID Level RAID 6 for storage drives
 - b. Effective Capacity Up to 27.2 TB or better
 - c. Drive Interface SAS/SATA II
 - d. Network
 - 1. Interface 2, 1 Gigabit Ethernet RJ-45 ports (1000Base-T)
 - e. Security 2 modes: secure mode (device authentication) and unsecured mode
 - f. Auxiliary Interfaces
 - 1. USB/10 3 USB/10 Ports or more

- 5. Certifications
 - a. CE, Class A
 - b. FCC, Class A
 - c. UL/cUL Listed
 - d. C-Tick

CLIENT SOFTWARE ON WORKSTATION

- A. The workstation shall be a high end personal computer with two DVI-I monitor outputs, USB keyboard, and mouse.
- B. The workstation shall use a graphical user interface and keyboard/mouse that runs on 64-bit Microsoft Windows 7 Ultimate for monitoring live and recorded video, and virtual matrix functionality that shall allow operators to see and respond to any alarm from any device on the network as well as direct any camera to any monitor on the network.
- C. The client software shall allow administrators to configure devices, set up users, adjust network settings, and create recording schedules. Permission to access these functions and all other system services shall be configured to a fine level of detail including the ability to restrict cameras from viewers, restrict PTZ operation, allow or restrict digital zoom, Zone of Interest operations, or the ability to configure maps. In addition, user permissions shall allow for designated users to receive and respond to alarm and system diagnostic messages. Administrators shall have the ability to prioritize user access to PTZ cameras.
- D. The client software shall have advanced search capabilities, event logging, and alarm interface displays. The workstation shall export video and still images in multiple formats, including AVI, BMP, and JPG. The unit shall provide a front panel USB port and DVD/CD-RW drive to make it capable of exporting video clips and still images to external media.
- E. The client software XX shall allow users with authority to monitor content from standard resolution and megapixel resolution cameras and encoders throughout the network. The workstation shall display content encoded in MPEG-4 and H.264 baseline, main, and high profiles. The workstation shall support cameras from multiple manufacturers.
- F. The client software shall be capable of decoding up to 16 simultaneous 4CIF resolution, 30 images per second (ips) video streams encoded in MPEG-4; or 12 simultaneous 4CIF resolution, 30ips video streams encoded in H.264 baseline profile; or 2 simultaneous 1080p video streams encoded in H.264 baseline profile.
- G. The client software shall be capable of minimizing the CPU processing load and network bandwidth , a scheme that shall automatically seek out and subscribe to a secondary stream from the cameras or encoders at a lower resolution when the display is changed to a multichannel display.
- H. The client software shall provide users with single, 2 x 2, 3 x 3, 4 x 4, 1 + 5, 1 + 12, 2 + 8 displays for 4:3 aspect ratio monitors, and provide 3 x 2 and 4 x 3 displays for 16:9 aspect ratio monitors or better
- I. The client software shall retain the camera's aspect ratio and allow mixing standard resolution and megapixel resolution cameras on the same display.
- J. The client software shall allow any combination of live or playback video on the same monitor at the same time. The workstation shall provide time-synchronized playback of up to 16 cameras simultaneously.
- K. The client software shall provide digital zoom capability for any camera in live or playback mode.
- L. The client software shall provide a Zone of Interest feature that can generate up to six independently controlled and zoomed images from a single image and allow operators to maintain a panoramic view of the scene while closely monitoring selected areas. This shall be accomplished without requiring additional network throughput.
- M. The system shall be capable of customizing the display area to suit user preferences. All aspects of the graphical user interface shall be capable of being resized, torn-off and moved to other monitors, or simply

hidden. The system shall allow up to 6 customizable workspaces to be created and loaded with camera groups to facilitate easy and efficient monitoring. The system shall allow for up to two detachable video display windows to accommodate up to a 32-camera display.

- N. The client software shall notify designated operators of all alarms on the system in an alarm tab. Video thumbnails shall be available for visual verification within the alarm monitoring workspace. The system shall allow alarms to be acknowledged or snoozed by the operator. The workstation application shall support the functionality to view procedures and instructions for given alarms triggered to appear during alarm events, while generating detailed written or verbal instructions to the operator as to the actions to be taken. An operator shall have the capability of entering his or her own feedback to the given alarm. All user alarms and user actions shall be kept in the system log for audit purposes.
- O. The client software application shall provide the ability to control and program any camera equipped with PTZ. The workstation shall be capable of the following operations
 1. Manually control the PTZ
 2. Set the pan/tilt home positions for manual or alarm activation
 3. Automatically control the cameras through an alarm trigger
 4. Ability to set multiple preset positions
 5. Ability to set multiple tours
 6. Remotely set and clear the movement limits of the pan/tilt mechanism from the control room, through a telemetry unit at an outdoor camera site
 7. Adjust the zoom lens
 8. Ability to control the camera menu and set up the camera through the IP video security system

The Workstation configuration selected shall be as per the manufacturer specification for smooth operation of the system. The server selection shall be in the scope of the vendor. The below mentioned specifications are the bare minimum specifications required for the workstation

Processor	Intel Core i7 or i9 (12th Gen+)
Internal memory	32 G DDR5
Operating System	Windows 10/11 Pro (64-bit)
Graphics (GPU)	NVIDIA RTX 3060 / A2000 (4GB+ VRAM)
Network Interface	Dual 1 GbE RJ45
Auxiliary Interfaces	USB2.0 (minimum 3 to be offered)
Storage Derives	Combi Drive read / write
Power Input	100 – 240 VAC , 50 / 60 Hz auto ranging
Internal storage	2 TB Enterprise HDD/SSD

Network Managed Switches

All switches provided shall be managed switches and shall support 10 base 1000 RJ45 ports except for single channel encoders and single channel decoders

The switches shall be recommended by the manufactures to avoid any malfunction of the system. Numbers of ports shall be applicable as mentioned in the Bill of quantity.

All switched shall be managed switches so as to manage the bandwidth of the systems and avoid any flooding of data in either unicast for multicast mode of operations

2 NOs of 50 inch display Units for CCTV Monitoring suitable for 24X7 duty.

11.7 WATER LEAK DETECTION SYSTEM

Overview

This section of the specification covers the design, supply, installation, testing, commissioning and thereafter maintaining water leak Detection System (WLD) during the 5 years period.

Installation of a liquid leak detection system is recommended for continuous protection from the risk of water and other liquids leaking within critical areas of the building.

This complete LLDS shall include electronic leakage detection panel, zonal modules, conductive sensing cable, monitoring leakage at any zone along the run and all required auxiliary accessories (such as jumper cables, connectors, hold down clips and tag/labels).

The WLD System shall be installed at the various rooms as per specified in the tender drawing. This specification shall be the guideline for Supply, installation, testing and commissioning of Water Leak Detection System installed in the designated Sub-floor / Floor Areas as per the following:

1. Data Center
2. UPS Room 's
3. Staging Room

The layout of the water leak detection equipment and circuits as shown on the Drawings is given for guidance to the Contractor for preparing his estimation during tendering and indication of the design intent only. The Contractor shall be responsible to determine the most effective arrangement of the detection system and circuits basing on the manufacturer's recommendations, quantity of liquid leak detection panels required, the additional of the accessories, individual features and operating coverage characteristics of the selected products.

CODES AND STANDARDS: Original Equipment Manufacturer Standard System performance

General

The liquid leak detection system (LLDS) shall identify any abnormal presence of liquid on any point of The water leak detector shall be installed to detect any seepage of water into the critical area and alert the Security Control Room for such leakage. It shall consist of water leak detection cable and an alarm module.

Water Leak Detection system should be for the Server and Network room Areas to detect and water flooding below the floor of the DC.

Water Leak Detection System should be wire based solution with alarm; the wire needs to lay in DC surrounding the PAC units, which is the probable source of water leakage.

The water leak detector shall be installed to detect any seepage ingress or leakage of water into the critical area and alert the Security Control Room for such leakage. It shall consist of water leak detection cable and an alarm module. The cable shall be installed in the ceiling & floor areas around the periphery.

SITC of Water Leak Cable with end Connections.

- Flame retardant polymer with greenish color for high visibility, Non flame propagating and self-extinguishing,
- 2 wired sensing cable
- Sensing Cable should be able to detect Water & slightly corrosive liquids. SITC of 4 Zone Water Leak Detection Panel

- LED/LCD Panel for Zonal indication.
- Module to be powered with 230 V AC
- Upon removal of Water or slightly corrosive liquid the Module should reset automatically without any human intervention
- Each Zonal should be able to detect Leak in 50 meters of Sensing Cable
- 80 db Buzzer inbuilt in the module with Silencing button
- Leak Sensitivity to be adjustable

Water leak detection system must have capabilities to integrate with monitoring tools like DCIM.

Installation

The system shall be installed by well-trained staffs, with the procedure recommended by the manufacturer.

TESTING :

Testing the cable by placing a wet cloth or wire gauge over the cable to simulate an water leak , displayed and the alarm relay operates. Extension of alarm to the BMS system to be verified.

DOCUMENTATION:

The Contractor, upon completion of the commissioning activity, shall hand over the system to the customer. At the time of hand over, the contractor shall provide the customer with the following documentation:

1. Copy of detailed report
2. Component and equipment list
3. Product description sheets
4. System design drawing(s)
5. System schematic diagram(s)
6. System operating manuals

HANDOVER :

Prior to final acceptance, the installing contractor shall provide complete operation and maintenance instruction manuals to the owner. All aspects of system operation and maintenance shall be detailed, including wiring diagrams of all circuits, a written description of the system design, sequence of operation and drawing(s), illustrating control logic and equipment used in the system. Checklists and procedures for emergency situations, maintenance operations and procedures shall be included in the manual.

TRAINING :

General The contractor shall provide the customer with details of the training required by personnel to operate and maintain the Water leak detection system.

The Contractor and the customer shall jointly agree the number of staff to attend the training courses.

MAINTANANCE :

Routine maintenance should be carried out in accordance with relevant IS and TAC requirements. All performance checks undertaken should be recorded in the system log book.

As a minimum, the following performance checks must be undertaken on each maintenance visit. The standard handling procedures must be adhered to and extreme caution must be exercised when working under the floor or with Sensor Interface Modules due to the presence of main voltage 240 V AC.

Carry out verification checks as detailed in the commissioning instructions.

Remove dust and dirt from the panel exterior using a soft brush or a lint cloth. A solvent which is harmless to the finishes of metal and plastic may be applied to more stubborn stains.

Examine the exterior of the enclosure for any signs of damage or loose cable glands and rectify any faults found.

Remove any dust or dirt from the interior of the control panel using a soft brush or a vacuum cleaner.

Examine the printed circuit boards for signs of over-heating, dry joints and/or damaged tracks. Sensing cable to be cleaned with a damp cloth preferably every six-months.

11.8 RODENT REPELLENT

SPECIFICATIONS FOR RODENT REPELLENT SYSTEM

11.8.1 General

Rodent Repellent System shall be designed by using Electronic transmitters of high frequency sound waves, which will emit sound at very high decibel levels painful to pests, as described in the specification given hereunder.

11.8.2 System

The system shall consist of a Master Console, satellites and its cable circuits.

11.8.2.1 MASTER CONSOLE

These will be Electronic transmitters of high frequency sound waves (well above the 20 KHZ frequency which is the upper limit of the hearing range of the human ear.) emitting sound at high decibel levels (sound pressure) that is audible and painful to pests, but inaudible and harmless to humans. The system will consist of one Master Console and 20 satellites in dedicated circuit & 24 Satellites in Looping. The Console will be installed in the control room, or as directed and the satellites in the problem areas as required. The powerful sound waves generated by the satellites shall be within the hearing range of many pests, and cause them pain and discomfort. Satellites should be quiet and inaudible to humans. **The RRS must capable of integration with DCIM tool for monitoring the health of satellites & Transducers.**

11.8.2.2 SATELLITE

Each satellite will cover an open floor area of approximately 500 sq. ft for an average height of the ceiling is 10 ft. As regards area of false ceilings or false floorings, it should cover an approximate area of 500sq. ft. The satellites should

1. Be able to mount in any angle to match the décor.
2. Possible to install in sensitive areas.
3. Should withstand high temperatures in false ceilings, and low temperatures in cold storages and air locks.
4. Should not require a power connection.
5. Should be able to test on an audible range with the help of a self-testing facility or any other suitable means.

The RRS must capable of integration with DCIM tool for monitoring the health of satellites & Transducers

11.9 Technical Specifications of Transducers & Sensors for DCIM

11.9.1 Field Devices

11.9.1.1 Electric and Electronic Controls Related Equipment

General Requirements

All controls shall be capable of operating in ambient conditions varying between 0-55 deg. C and 90% R.H. non-condensing.

All Control devices shall have a 20 mm conduit knockout. Alternatively, they shall be supplied with adaptors for 20 mm conduit.

Ancillary Items

When items of equipment are installed in the situations listed below, the BAS contractor shall include the

following ancillary items:

(i) Weather Protection

All devices required to be weatherproofed are detailed in the Schedule of Quantities. IP ratings for the equipment is mentioned in the respective section.

(ii) Pipework Immersion

Corrosion resisting pockets of a length suitable for the complete active length of the device, screwed ½" (13 mm) or ¾" (20 mm) NPT suitable for the temperature, pressure and medium.

(iii) Duct Mounting (Metal or Builders Work)

Mounting flanges, clamping bushes, couplings, locknuts, gaskets, brackets, sealing glands and any special fittings necessitated by the device.

Additional features

- (i) Concealed Adjustment: All two position switching devices shall have concealed adjustment unless detailed otherwise in the Schedule of Quantities.
- (ii) Operating Voltage: All two position switching devices shall operate on 230 v a.c and all accessible live parts shall be shrouded. An earth terminal shall be provided.

11.9.1.2 Temperature Sensor

Temperature sensors for space, pipes and ducts, shall be of the Resistance Temperature detector (RTD) type or thermistor. These shall be two wire type and shall conform to the following specifications:

- 1) Immersion sensors shall be high accuracy type with a high resistance versus temperature change. The accuracy shall be at least ± 0.33 degrees F and sensitivity of at least 2 ohm/F.
- 2) Immersion sensors shall be provided with separate stainless steel thermo well. These shall be manufactured from bar stock with hydrostatic pressure rating of at least 10 kg./cm².
- 3) The connection to the pipe shall be screwed ¾ inch NPT (M). An aluminum sleeve shall be provided to ensure proper heat transfer from the well to the sensor. Terminations to be provided on the head. Flying leads shall not be acceptable.
- 4) The sensor housing shall plug into the base so that the same can be easily removed without disturbing the wiring connections.
- 5) Duct temperature sensors shall be with rigid stem and of averaging type. These shall be suitable for duct installation.
- 6) Outdoor air temperature sensor shall be provided with a sun shield.
- 7) The sensors shall not be mounted near any heat source such as windows, electrical appliances etc.

The temperature sensors may be of any of the following types:

- 1) PT 100, PT 1000, PT 3000
- 2) NI 100, NI 1000
- 3) Balco 500.
- 4) Thermistor

11.9.1.3 Humidity Sensor

Space and duct humidity sensors shall be of capacitance type with an effective sensing range of 10% to 90% RH. Accuracy shall be + 3% or better. Duct mounted humidity sensors shall be provided with a sampling chamber. Wall mounted sensors shall be provided with a housing. The sensor housing shall plug into the base so that the same can be easily removed without disturbing the wiring connections. The sensors shall not be mounted near any heat source such as windows, electrical appliances etc.

11.9.1.4 Transducers for Electrical Services

Electrical transducers shall be integrated electronic type and rack mounted on the field. These shall work on 230 V supply with the output being standard type i.e. 4-20 mA, 0- 10 Volts etc.

Power factor, Voltage, Current, Frequency and Kilowatt transducers shall have standard output signal for measurement for the specified variable.

Kilowatt-Hour metering (if any) shall be poly-phase; three- element with current transformer (CT) operated type. The metering shall feature high accuracy with no more than +/- 1% error over the expected load range. The coils shall be totally encapsulated against high impulse levels.

11.9.2 Execution

11.9.2.1 Installation

- a) All work described in this section shall be performed by system integrators or contractors that have a successful history in the design and installation of integrated control systems.
- b) Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
- c) Drawings of the BMS network are diagrammatic only and any apparatus not shown but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.
- d) Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by this contractor in accordance with these specifications.
- e) Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field shall be furnished and installed by this contractor.

11.9.2.2 Wiring

- a) All electrical control wiring and power wiring to the control panels, NAC, computers and network components shall be the responsibility of this contractor.
- b) The electrical contractor shall furnish all power wiring to electrical starters and motors.
- c) All wiring shall be in accordance with the Project Electrical Specifications, the National Electrical Code and any applicable local codes. All BMS wiring shall be installed in the conduit types specified in the Electrical Specifications unless otherwise allowed by the National Electrical Code or applicable local codes. Where BMS plenum rated cable, wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

11.9.2.3 Warranty

- a) Equipment, materials and workmanship incorporated into the work shall be warranted for a period of five years from the time of system acceptance.
- b) Within this period, upon notice by the IITH, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this contractor at no expense to the IITH.

11.9.2.4 Warranty Access

- a) The IITH shall grant to this contractor, reasonable access to the BMS during the warranty period.
- b) The IITH shall allow the contractor to access the BMS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

11.9.2.5 Software License

- A. IITH shall be the named license holder of all software associated with any and all incremental work on the project(s). The owner, or his appointed agent, shall determine which organizations to be named in the “**org id**” of all software licenses.
- B. IITH, or his appointed agent, shall be free to direct the modification of the “**org id**” in any software license, regardless of supplier.
- C. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within based controllers and/or servers and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required Ids and passwords for access to any component or software program shall be provided to the owner.

11.9.2.6 Acceptance Testing

- A. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.
- B. This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
- C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of IITH Representative, as required. Properly schedule these tests so testing is complete at a time directed by the IITH Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
- D. System Acceptance: Satisfactory completion is when BMS contractor have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of IITH Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

11.9.2.7 Operator Instruction, Training

- A. During system commissioning and at such time acceptable performance of the BMS hardware and software has been established this contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.
- B. This contractor shall provide 40 hours of instruction to the IITH designated personnel on the operation of the BMS/ DCIM and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.
- C. The training shall be in three sessions as follows:
 - 1. Initial Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize themselves with the system before classroom instruction begins.
 - 2. First Follow-Up Training: Two days (16 hours total) approximately two weeks after initial training, and before Formal Acceptance. These sessions shall deal with more advanced topics and answer questions.
 - 3. Warranty Follow Up: Two days (16 hours total) in no less than 4-hour increments, to be scheduled at the request of the owner during the five-year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

11.10 Technical Specifications for Data centre Infrastructure monitoring (DCIM)

DCIM should be installed to enable centralised Monitoring for Utility equipment performance, functional status and alarms.

DCIM should be integrated with following equipment

- UPS System
- Cooling System (PAC)
- Electrical Panels (for Data Centre) – Digital Contact and Energy Meter
- Floor PDU (with Each Branch Monitoring) – Rack Power Consumption
- Water leak detection System
- Fire Alarm System
- VESDA System through FACP
- Rodent Repellent system
- Gas suppression system-digital pressure gauge for remote monitoring.
- Temp & RH Sensors
- External Temperature and Humidity Sensor.
- DG sets

The DG set shall be installed & commissioned approximately 250 meters away from the BMS Room at the IITH substation Building. The bidder needs to lay the Fibre optic cable from BMS room to the Substation building along with required hardware at substation building.

CMS should be web based to monitor the Data Centre equipment remotely. Electrical Parameters like (PUE, rack wise Power monitoring should be monitored through CMS. All the equipment connected should be configured for providing alarm message on CMS to take corrective action.

The contractor shall provide a Work Station of Suitable specifications(minimum 34" size) along with the Color Printer, UPS and Remote Login and Monitoring facility for the exclusive monitoring of Engineer-in-Charge of all Data Centre Operations using DCIM/BMS Software.

DATA CENTRE MONITORING SOFTWARE

S.N.	Specification	Compliance (Yes/No)	Remarks
1	System Overview		
1.1	The vendor shall provide system software based on Web-based architecture, designed around the open standards of Web technology. The server shall be accessed using a Web browser over the owner's intranet.		
1.2	Minimum software solution shall provide: • Unlimited simultaneous users • Historical database • Built-in alarming, trending and analytics/reporting capabilities • Support for third-party device integration • Open Restful API		

2	Web architecture		
2.1	The intent of the Web architecture is to provide the operator(s) complete access to the system via a Web browser.		
3	Operating system support		
3.1	The server software must support Microsoft Windows 11/Linux operating environment on physical or on virtual environment.		
4	Graphical user interface and functionality		
4.1	The client Web browser GUI shall provide a comprehensive user interface. It shall be constructed to function as an application and provide a complete and intuitive mouse- or menu-driven interface. It shall be possible to navigate through the system using a Web browser. The Web browser GUI shall (as a minimum) provide a navigation menu for navigation, and a pane for display of graphics, alarms/events, active graphic setpoint controls, configuration menus for operator access, analytics and reporting actions for events. All system graphics are to be HTML 5 compatible. It should support minimum 5 locale languages, English is a must.		
4.2	Supported Browsers: The GUI shall support the following browsers: • Microsoft Edge • Google Chrome • Mozilla Firefox		
4.3	Color Graphics: The Web browser GUI shall make extensive use of color in the user interface to communicate status information about the equipment being monitored. Both light and dark user interfaces will be supported and able to be toggled within seconds.		
4.4	Display Size: The GUI workstation software shall graphically display in 1920 x 1080 pixels and 32-bit true color.		
4.5	General Graphics: General area maps shall show the locations of controlled buildings in relation to local landmarks, if desired.		
4.6	Integrated Devices: system graphics shall show the system components via a graphical representation (points, status color(s), labels, and trends). Points being controlled or monitored for each piece of equipment shall be displayed with the appropriate ENGINEER IN CHARGE units. SNMP (v1, v2 & v3), Modbus TCP and BacNet over IP devices can be integrated via the Web UI by the end user. • The equipment view shall show the status of equipment such as rack PDU, UPS and so on. • The view must allow users to drill down into equipment pages to view alarms and equipment information in full detail, including individual status of all associated device points.		
4.7	Minimum System Color Graphics: Color graphics (32 bit) shall be selected and displayed via a Web browser.		
4.8	Intuitive Interface: Visualizations of boards/sites are to be customized by the user. The main view will comprise the side navigation menu, including boards, analytics, equipment and system admin. The main view can be used for navigation and to drill down into all boards, sites, devices and other features within the system.		
4.9	System Navigation		

4.9.1	At a minimum, the user must be able to navigate the system through a side navigation menu.		
4.9.2	The system must provide the capability of using links to navigate through the user interface.		
4.9.3	Floorplan views must provide geographical navigation and are flexible to show global, regional, local and data center specific views of site/location hierarchy. Components of the floorplan view must include: • Ability to import image to match level of hierarchy being viewed (map, data center, etc.) • Add groups, devices, racks, points, labels, or IP cameras to the floorplan view • Ability to add a heatmap view, capable of showing hot spots and cold spots for environmental or power data • Visualization of alarms • When racks are added, a dropdown view selector will allow for: alarm status, free front/rear rack U space, max contiguous front/rear rack U space, max rack temp, max rack kW load percent, total rack kW, heatmap view		
4.9.4	The user must be able to create, edit and add boards, dashboards and floorplan views		
4.10	Graphics shall show each piece of equipment monitored or controlled for: • Each building • Each floor • Each room • Each rack • Each device		
4.11	Events and Alarms: Events and alarms associated with a specific system, area or equipment shall be displayed on the main site view and/or within an embedded alarm console. The solution must have native capability to alarm on all connected devices. The alarm system shall have multiple alarm types depending on the severity level. Users must be able to drill down through views to locate alarm sources. The alarm should be accessible from the device level. Events, alarms and reporting actions shall have the following capabilities:		
4.11.1	Alarm Console: Capable of displaying the following information for each alarm that has occurred in the system: Alarm State (with associated status color), Site, Device, Circuit, Tenant, Point, Point Type, Point Unit, Source, Last Alarm, Acknowledge Requested, Acknowledge State, Last Acknowledgment, Last Acknowledged By, Last Return to Normal, Last Update, Alarm Class, Warning Class, Message and Notes. The Alarm Console must also provide a link to the Site, Device and Point.		
4.11.2	User Definitions: Users must be able to choose the thresholds (high and low) for when an alarm and/or warning will activate, along with the points for the severity level. Users must be able to acknowledge and filter alarms. Alarms should have a way to prioritize more important alarms. The solution shall include an alarm history page where all system alarms are stored. Users should be able to search for previous alarms by site, device, or point.		

4.11.3	Nuisance Alarms: Alarm settings should also contain time delay and deadband settings to help reduce the number of nuisance alarms that occur within the data center.		
4.12	Alarm / Event Notification: The solution must be able to notify different users based on the type of alarm. Users should be able to acknowledge alarms remotely. The alarm system should be able to notify users until a person acknowledges the alarm via escalating alarm levels. The alarm system should be able to alert users via email. The solution must allow users to customize		
	alarm messages by escalation level. Multiple escalation level 1, 2 & 3 must be supported. Unique alarm instructions must be available within the system. Users must be able to edit messaging for alarms and return-to-normal status. The user shall be able to:		
4.12.1	View events throughout the system.		
4.12.2	Dependent on access level, manage the event through acknowledgements, deletions, sorting rules and viewing alarm notes.		
4.12.3	Configure Alarm / Event notifications: • Alarm console and alarm pop up window • E-mail • Audible system sound alert for alarm condition		
4.13	Configuration of operators		
4.13.1	User names and passwords: • Permissions: The Permissions field allows administrators to set access level for different users. Permissions include the following options: • Read/Write: Full read access and full write access to the entire system. • Read Only: Full read access but no writes or changes may be done. • Read/Acknowledge: Full read but no write or changes may be done, except to alarm database for acknowledging alarms. System owner shall have the ability to assign combinations of roles and privileges to users that define access levels. • User password expiration • Auto-log off period • Audible Alerts		
4.14	Audit History: A log shall record operator activities and some system activities, such as opening and closing the database or automatic deletions.		
4.15	Histories/Trending: Histories shall be user-configurable and displayed via the GUI. Trends shall comprise native points, along with calculated points (collections of point data). A trend log's properties shall be editable within the GUI.		
4.15.1	Viewing Trends: The operator shall have the ability to view trends with a time series line chart by using the history database or by selecting a specific point within the GUI. The line chart must be exportable within the pop-up window to Microsoft Excel and able to be saved as a visualization to be used within the Analytics tool.		

4.15.2	Historical Data Records: Trend data shall be collected locally and retained within the local hard drive.		
4.15.3	History Intervals: Historical records shall be saved to match the user-defined polling interval. Each trended point shall have the ability to be trended at a unique interval as specified by the user.		
4.15.4	Tolerance: The user shall be able to enter a value for tolerance (change of value) – if point data changes by the specified amount in between historical reading, a separate record will be created.		
15.15.5	Numeric Value Display: It shall be possible to mouse over any value on a history chart and have the numerical value and time of data capture displayed.		
4.15.6	Systemwide Trends: Any trend point in the system can be evaluated alongside any other trend point in the system. Unit or location shall not define trends.		
4.15.7	Graph Appearance: Trend values can be presented in line chart graphical format.		
4.15.8	Global Parameter Change: The system shall have the ability to execute a global parameter change (for example, bulk config of all points or a filtered subset of points for historical trending and/or alarm setpoints).		
4.15.9	Analytics and Reports: The software solution shall allow users to view previously created reports as well as to create new, user-defined reports using drag-and-drop functionality.		
4.15.10	Reports shall contain visualizations utilizing the following graphic types: • Bar Chart • Gauge • Pie Chart • Scatter Plot • Simple Value • Table • Time Series • User Image • User Text		
4.15.11	User-defined reports shall include but not be limited to: • Alarms • Historical device data • Trend data based on user-defined timeframe		
4.15.12	Each report can be run ad-hoc within the Analytics feature.		
4.15.13	Each report shall have the ability to be saved electronically. Standard and user-defined reports can be saved in the following file formats: • XLS • PDF		
4.15.14	Each report shall have the ability to be delivered via email or saved to a specified file path, using a daily/weekly/monthly schedule.		

4.15.15	IT Racks: The solution provides IT rack management tools and contain the following capabilities: • IT rack view where the user can search IT racks by name, make, model, serial number, asset tag and so on. • The user should be able to associate power and environmental data to each rack. • Other important rack information such as rack location, RU used and RU free (front and rear), contact details, etcetera – along with the ability to select/deselect columns from the view. • The user must also be able to create custom columns for inputting custom data. • Allow users to add new racks to the system and export/import rack data using spreadsheet format, to include install IT assets within the rack. • The user must be able to link to the individual rack view from the main rack database.		
.15.16	IT Assets: The solution includes an asset database. IT Assets are representations of a physical rack assets that will be associated to IT Racks		
	within the software. These assets are created within a dedicated assets feature. The assets feature contains a detailed list view of assets. The asset feature shall provide the following capabilities: • Asset database which is sortable, filterable and searchable by key asset data • Add assets – manually or via CSV import • Edit assets individually or by group • Support of assets within assets (blade server enclosures, as an example) • Export & import of existing asset database • Ability to assign IT assets to IT racks • Asset tab within the Rack View to visually display IT assets within each IT rack		
4.15.16	Control Groups: The solution shall provide the ability to control points, along with providing the ability for the user to create control groups. Control groups will consist of identical points across equipment (single or multiple) that can be sent a control command for the entire group.		
4.15.17	Maintenance: The solution must provide users with a feature to manage device maintenance events. The maintenance feature will silence all alarms and trending on specific equipment or multiple pieces of equipment for the duration of the maintenance event. • Users must be able to place a device into maintenance mode instantly or schedule maintenance within the interface, for single or multiple grouped devices at a time. • Users have the option to receive email notification for the start and end of maintenance events. • Maintenance events must include start and end dates, devices and task descriptions. • Users must be able to view maintenance history. • The solution shall allow users to add, edit and delete maintenance tasks. Events that have completed cannot be deleted.		
5.1	Device Integration		

5.1.1	The software solution shall support any vendor agnostic facility device to be integrated under monitoring using standard SNMP, Modbus TCP/IP & BacNet over IP.		
6.1	Security		
6.1.1	The software solution shall also be subject to owner's policies for security without effect on the Server or Client operation. • System must support https • System must support import of certificate, use self-sign certificate or upload a certificate • File type supported must be PEM • The system shall not deploy protocols inherently susceptible to intrusion. • The system shall strip all unnecessary files and services from the Web service to protect the owner from intrusions. • Must support the ability to add security certificates via the user interface.		
7.1	Database Support		
	The DCIM solution shall support industry-standard relational database management systems (RDBMS) and Open Source Database. Supported databases shall include, but are not limited to: Microsoft SQL Server (Current supported versions) PostgreSQL (Latest stable release) Oracle Database (Enterprise editions) MySQL (Enterprise or Community editions)		
8.1	Software Components		
8.1.1	All components of the software solution shall be installed and completed in accordance with the specification. Components shall include: • Server software, database and Web browser Graphical User Interface • System configuration utilities for future modifications to the system		
9.1	Backup and Restore		
9.1.1	Software solution must support one click backup and restore option, thus enabling user to revert to last known good configuration of application, this feature will help operation team to bring system online as quickly as possible during any breakdown or revert to known configuration in case of any manual changes to be revert to last good working application config.		
9.1.2	This option of Backup and restore must be available inside the application itself must have multiple backup and restore option.		
10.1	Redundancy & High Availability		
10.1.1	Software solution proposed should support user to deploy HA or DC/DR (high availability or redundancy) architecture, with 100% guaranteed uptime.		
11.1	Integration with physical asset management		
11.1.1	The proposed solution should have well established integration support with a physical asset management solution to detect physical assets at rack level & precise u level location.		
12.1	Rest API Support		
12.1.1	Proposed solution must have Rest API support to facilitate information sharing with 3 rd party application.		

13.1	Authentication		
13.1.1	Proposed solution must support active directory or LDAP integration.		
14.1	Tenancy		
14.1.1	Proposed solution must have an inbuilt feature to support multiple internal departments by mapping them against tenant ID, thus it should provide information regarding power used, capacity used by a tenant.		

12.0 TECHNICAL SPECIFICATION FOR FIBER DUCTS FOR CONTROL/ INSTRUMENTATION AND DATA CENTRES

This document defines the cabling system and subsystem components to include cable, termination hardware, supporting hardware, and miscellany required to furnish, and to install a complete cabling infrastructure supporting data and video. The intent of this section is to provide pertinent information to allow the vendor to bid the labour, supervision, tooling, materials, and miscellaneous mounting hardware and consumables to install a complete system. However, it is the responsibility of the vendor to propose any, and, all items required for a complete system whether or not it is identified in the specification, drawings and bill of materials attached to this specification. All the items must be used from an ISO 9001 and ISO 14001 certified manufacturer. The compliance statement for all the technical specification listed herewith must be provided on the OEM's letter head.

Fiber Guide / Tray should be as per latest TIA 568C standard maintaining all stringent requirements of the same standard. Fiber raceway system shall provide routing for both fibre optic patch cords (jumpers) 3 mm in diameter and multi-fibre cables. The fibre raceways system shall be available in 2x2, 2x6, 4x4, 4x6, 4x12 and 4x24 inch etc dimensions. Should be available in Yellow Color. All components shall be UL94V-0 flame resistant, shall not contain any PVC material. Shall be UL listed, proof of the same shall be submitted. The solution shall maintain a 2-inch bend radius through the system. Shall use snap fit junctions when connecting two components together.

Fiber Pathway System

S. No.	Description of Parameter	Acceptable range for parameters	Bidder's compliance
1	Make	Bidder to Specify	
2	Model	Bidder to Specify	
3	General specification	The 12x4 & 6 x 4 routing system shall be a system of channel, fittings, and brackets designed to segregate, route, and protect fiber optic. Channel and fittings shall be assembled using pre-assembled couplers. A selection of spill out options shall be available that can be easily attached. Fittings maintain a minimum 2" bend radius to protect against signal loss due to excessive cable bends. Hinged channel cover and split fitting covers protect cabling and provide fast and easy access for future cabling moves, addition, and changes.	
4	Regulatory Certifications	a) The Fiber pathway should be UL listed b) All components shall be UL94V-0 flame resistant	

5	Material and color	a) Rigid PVC (Channel), ABS (Fittings) b) Should be available in Yellow color	
6	Component	a) Basic components shall include horizontal and vertical straight sections, horizontal and vertical elbows, express exits, junctions and numerous support hardware and flextube kits.	
		b) The fiber raceways system shall be available in 4x6 and 4x12 inch dimensions.	
7	Connection or installation	No bolts need to be tightened and no tools are required when installing the Couplers and Brackets take minimum time to make a mechanically secure connection. Shall use hinged fit junctions when connecting two components together	

13.0 RACK

13.1 TECHNICAL SPECIFICATION FOR 42U SERVER

Rack Technical specifications for IT RACKS

Sr.No.	Specifications	Compliance (Yes/No)	Remarks
Server Racks			
1	42U Server rack with dimension (HWD) 2000mmX800mmX1200mm respectively.		
	Horizontal Cable Management: 1U with PVC loops ; 2 units per rack.		
	Vertical Cable Management: Vertical Cable Router, 150mm (W) x 1700mm (H), Powder Coated; 2 units per rack.		
2	RAL7021 Black powder coat on all sheet metal components of the rack.		
3	No wire connection among or to the frame except the doors & side panel. All components should be self-grounded.		
4	Single front and split rear doors should be min 75% hexagonal perforated. Both the front and rear doors should be designed with quick release hinges allowing for quick and easy detachment with/without the use of tools. The front door of unit should be reversible so that it may open from either side.		
5	The front and rear doors should open a minimum of 130 degrees to allow easy access to the interior.		
6	EIA rails two sets should be fully depth adjustable within 980mm use space area. 19" Rails should accept tool less Cable Management Accessories.		
7	Two full height, multiple standard hole pattern for tool less accessories mounting should be part of the rack, which should have capability to hold two Rack PDUs each. Horizontal cable manager is to be considered for sorting out cables.		
8	Rack frame shall support 1500kg static weight load, 1000kg dynamic (non- transit) weight load.		

9	Single / split lockable side panels with Slam Latch should be removable in nature.		
10	The roof of the racks should be removable from the interior of the enclosure with/without tools and should have cable entry holes to allow up to 1800 cables or 60A PDU plug.		
11	The racks should be comply to EIA-310, CE/UL and RoHS. The racks should have a minimum of IP 20 rating for protection against touch, ingress of foreign bodies, and ingress of water		
12	Minimum 20 nos. of tool-less blanking panels to avoid air recirculation		
Network Racks			
13	42U Server rack with dimension (HDW) 2000mmX800mmX1200mm respectively.		
14	RAL7021 Black powder coat on all sheet metal components of the rack.		
15	No wire connection among or to the frame except the doors & side panel. All components should be self grounded.		
16	Single front and split rear doors should be min 75% hexagonal perforated. Both the front and rear doors should be designed with quick release hinges allowing for quick and easy detachment with/without the use of tools. The front door of unit should be reversible so that it may open from either side.		
17	The front and rear doors should open a minimum of 130 degrees to allow easy access to the interior.		
18	EIA rails two sets should be fully depth adjustable within 980mm use space area. 19" Rails should accept tool less Cable Management Accessories.		
19	Two full height, multiple standard hole pattern for tool less accessories mounting should be part of the rack, which should have capability to hold two Rack PDUs each. Horizontal cable manager & vertical cable manager is to be considered for sorting out cables.		
20	Rack frame shall support 1500kg static weight load, 1000kg dynamic (non- transit) weight load.		
21	Single / split lockable side panels with Slam Latch should be removable in nature.		
22	The roof of the racks should be removable from the interior of the enclosure with/without tools and should have cable entry holes to allow up to 1800 cables or 60A PDU plug.		
23	The racks should be comply to EIA-310, CE/UL and RoHS. The racks should have a minimum of IP 20 rating for protection against touch, ingress of foreign bodies, and ingress of water.		
24	Minimum 2U 10 nos. per pack		

13.2 In Rack centralized monitoring and management of Power and Environment

Sr.No.	Specifications	Compliance (Yes/No)	Remarks
IPDU			
1	Each rack should have 2 IPDUs. The IPDUs should be connected to the two different UPS sources A and B individually. The 2 IPDUs in each rack should have different chassis color for identification of UPS source.		
2	All the iPDU should have vertical form factor having input rating of 15 Racks with minimum 30kW and 15 Racks with 15kW PDU Capacity 230V for single phase & 400V for three phase. Input cable of the PDU's must be minimum 3-meter-long, and the input industrial plug should be IEC60309, Splash proof IP44.		
3	iPDU should have min. 24 numbers of hybrid outlets should be of hybrid nature which can be utilized as either C13 or C19 outlet. All outlets should provide high retention to avoid accidental dislodging of power cords. The IPDU hybrid outlets should meet electrical compliance and should be UL certified.		
4	Monitoring parameters – The IPDU should have monitoring capability at the iPDU/Socket level metering Following monitoring parameter should be available at total and phase wise. a. Voltage (V) b. Current (A) c. Power factor d. Active power (W) e. Apparent power (VA) f. Energy consumption (kwh) The metering accuracy should be +/- 1% compliant to ANSI C12.1 and IEC 62053-21 at 1% Accuracy Class Requirements for strip level.		
6	IPDU should have 2 numbers 16A magnetic circuit breakers for overcurrent protection in single phase PDU and 6 numbers 16A magnetic circuit breakers for overcurrent protection in three phase PDU.		
7	The IPDU should have color coded outlets based on circuit color for easy identification of circuits for quick troubleshooting and ease in maintenance.		
8	All the three phase PDU should have color coded alternate phase outlets for simplified circuit/phase balancing and cable management.		
9	IPDU should support High Operating temperature upto 60°C to take care of high operating temperature at back of Rack.		
10	Network communication – PDU should have two Network Ports. IPDU should support communication protocols including DHCP, HTTP, HTTPS, Ipv4, Ipv6, LDAP, NTP, RADIUS, RSTP, SSH, SMTP, SSL, SNMP (v1, v2, v3), Syslog and TACACS+. Communication module should be hot-swappable, so that it can be replaced without powering off the PDU.		
11	IPDU should support encryption via TLS1.3 for additional security.		

12	The IPDU should support the daisy chain of minimum 16 units to reduce network port requirement and ensure continuous flow of data on network to monitoring tool/BMS/DCIM even a break in daisy chain occurs.		
13	The IPDU shall have rotatable display, to easily read the displayed values when PDU is mounted upside down, based on the site requirement.		
14	IPDU should have USB support for firmware upgrade, backup, restored device configuration or expand logging capacity via USB storage device.		
15	The IPDU should support an android or iOS app to read power data securely. Some mode of communication should be provided using which IPDU data can be accessed while user is inside the datacenter and IOS/Android app should not use Bluetooth or Wi-Fi connectivity to prevent breach.		
16	Each IPDUs should be supplied with a combo sensor (Temp. and humidity & dew point).		
17	The IPDU should support grouping of minimum 16 rPDU and rPDU sensor in the interconnected array to create the aggregated measurements like total rack power, total row power, average power, max and min power, maximum temperature, maximum humidity, minimum temperature, minimum humidity, average temperature, average humidity in the row without use of any additional software.		
18	IPDU should have separate reset buttons for reset to factory defaults and separate button to reset IP only, if other configurations are not to be altered.		
19	IPDU should support configuration of user defined thresholds, reports and email alerts and send it automatically to the configured users automatically on the scheduled time intervals		
20	The IPDU should support “circuit breaker loss load alarm”. A sudden loss of circuit load when operating under full circuit load will result in a rack IPDU device state alarm.		
21	IPDU should support strong password enforcement, where the user can select the minimum number of password characters, uppercase characters, digits, symbols. Additionally, the user can restrict the use of more than 2 repeat characters and restrict the inclusion of the username in the password.		
22	IPDU should support cryptographically signed firmware upgrades and must comply with FIPS 140-2 and CSNA requirements.		
23	The IPDU should have approvals form RoHS, CE/UL, EN, IEC		
24	IPDU should support configuration of user defined thresholds, reports and email alerts and send it automatically to the configured users automatically on the scheduled time intervals.		
25	IPDU must support integration with third party DCIM and telemetry software (Like NetBox, Zabbix), either via SNMP polling or REST APIs for providing periodical data of power consumption		

14.0 Cold Aisle Containment

Sr.No.	Specifications	Compliance (Yes/No)	Remarks
1. General			
1.1	The Containment uses a series of panels, door frames and doors, and air blocks to enclose a cold aisle zone which contains cooling unit supply air		
1.2	The cold aisle zone is the space between two rows of IT equipment racks with cold air being supplied between the two rows of racks (or one row of racks and an architectural wall) and the IT equipment exhausts hot air away		
1.3	from the aisle. In this enclosed space cooling unit supply air is collected inside of the Containment. The cool air is supplied to the IT equipment while the IT equipment exhaust air is pushed outside the Containment and returned to the cooling unit.		
1.4	By preventing mixing of cool supply air and hot exhaust air, this self-contained configuration is capable of supporting a complete range of low, medium and high power/heat density loads, and can be deployed in multiple environments without affecting the surrounding area.		
1.5	The Cold Aisle Containment Glass has to withstand temperature of 80°C		
2. <u>Ceiling Panel</u>			
2.1	Ceiling panels shall be minimum 5.0 mm or more thick Lexan clear-ribbed panels or/136 mm thick V0 clear panels with aluminium framing.		
2.2	Flame spread rates: Smoke development index "0-65" and flame spread index "0" in accordance with UL723 or ASTM84. Nominal thickness:/136 mm (V0 clear) --or-- Smoke development index "20" and flame spread index "0" in accordance with UL723 or ASTM84. Nominal thickness: 6.0 mm (Lexan)		
2.3	Minimum Light Transmission per ASTM D1003 equal to 82% or greater.		
2.4	Ceiling panels shall be designed to be supported by the frames of the IT Equipment racks. Ceiling Panel frames sizes shall be suitable to match up with various rack widths, row width, and aisle widths.		
2.5	The ceiling system shall be designed to permit removal of the ceiling panel from within the contained zone without the use of tools for service access to the space above the Aisle		
3. <u>Door Frames and Door</u>			
3.1	Metal door frames and doors shall be provided to establish air containment at the end of two rows of racks. The door frame system shall match the height of the rack based equipment, and match the design width of the contained aisle		
3.2	Doors shall be Sliding, to permit access into the contained aisle for maintenance or servicing		
3.3	Doors shall be provided with a window and handles		

3.4	Automatic door closure system for sliding door		
3.5	Frames and Component Seal		
3.6	Foam Rubber gaskets or metal/composite, brush, or plastic air blocks shall be installed at Aisle joints to minimize open gaps between containment system components, such as door frames, ceiling and duct panels, and IT Equipment racks and rack based equipment. Gasketing and/or air blocks may include, but not be limited to, the following.		
3.7	Joints between adjacent ceiling/duct panels		
3.8	Joints between ceiling/duct panels and top of racks, if not metal to metal		
3.9	Joints between door frames and ceiling/duct panels, if not metal to metal		
3.10	Joints between door frames and racks at the end of the row(s)		
3.11	Joints between rack bottom rear frame and floor		
3.12	Joints between duct panel and ceiling/roof of room		
4.	<u>Blanking Panels, Height Adapters, and Depth Extenders</u>		
4.1	Can be used to provide an aesthetic alternative for varying dimension enclosures		
4.2	Blanking Panels shall be placed where gaps between racks exist to seal contained aisle. The panel shall match the height of the enclosures and match the width of the gap. It shall not be mounted to any adjacent blanking panels nor shall it support any adjustable height supports.		
4.3	Depth Extenders shall mount to front or back of enclosures to align aisle. The extender shall match the depth of the adjacent racks and match the width and height of the enclosure (including any height adapters) of which it is being mounted		
4.4	Height Adapters shall mount to the top of enclosures to align the enclosure height. The height adapter matches the height of the adjacent racks and shall match the width and depth of the rack (including any depth adapters) of which it is being mounted		
5.	<u>Installation</u>		
5.1	Installation, Testing and Commissioning has to be done by a Certified ENGINEER IN CHARGE.		

Note: Racks & cold aisle containment shall be from Single OEM.

Additional Instructions to the bidders

- i. Factory Acceptance Tests (FAT): FAT for all the major and critical components like Electrical Panels, UPS, Precision air conditioning & DG sets to be arranged by executing agency, it would be witnessed by IITH before dispatch.
- ii. The Quantities in BOQ are tentative. Contractor to order the Quantity as per site requirements and shall be paid accordingly.
- iii. On completion of the commissioning, full load test of DC infrastructure by populating Rack Mountable dual power Server Simulator. Load Banks shall be arranged by the bidder. This test should be done for 48 hours to evaluate the Computer Room Air Conditioning, Aisle Containment, and air flow, BMS/ DCIM configuration. Heating elements like Industrial Space heaters, Infrared Heaters and Hair Dryers are not to be used in place of Server Simulator Load banks.

- iv. SI Needs to submit 5 Sets of Handing over documents in Hard & soft copy (In CD) at the Time Handover. Handover document to include Warranty Certificate, Installation & Commissioning Reports, catalogues, Manuals, Escalation chart & As built drawings.
- v. SI need to give Training to IITH Team for each system prior Handover during Acceptance testing. This also is prerequisite for the final acceptance of site.
- vi. The warranty of the components and entire DC will only start from the date of Final Handover after successful completion of SIAT. Warranty will be 03 Years from the date of sign -off of acceptance by customer.

2.1. CABLES AND ACCESSORIES

- a. **LT cable:** All LT power and control cables shall be flame retardant low smoke type. Power cables shall be with multi stranded aluminum conductor for above 6 sq. mm, XLPE insulated, (ST-2) PVC inner sheathed, armoured & FRLS (C2 category type FRLS) (ST-2) PVC outer sheathed. Copper conductor (multi strand) shall be used for sizes up to and including 6 sq. mm. All control cable shall be with the same specification with copper conductor and size of the control cable should not be less than 1.5 sq mm. All LT power and control cable should be suitable for voltage level 1.1 KV.
- b. **HT cable :** All HT power cable shall be flame retardant low smoke type. XLPE insulated, HRPVC inner sheathed, armoured & outer sheath HRPVC with FRLS (C2 FRLS) properties as per relevant Indian Standard. The HT cable should be suitable for 11 KV rating.
- c. While sizing of HT cables derating of 0.65 should be considered. Other cables also to be de-rated in view of 50 deg ambient, grouping, underground, harmonics etc. The voltage drop should not be more than specified limit as per standards.
- d. All wires (panel and building wiring) should have FRLS properties.
- e. The cables shall be suitably colour coded for the required services.
- f. The cables shall be tested in presence of representative of IITH for routine & acceptance test as per relevant standards.
- g. Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted.
- h. The suitable size of Hume pipe to be used for cable laying where ever road crossing is required.
- i. The outdoor cable should be UV resistant.
- j. Solar cables as applicable as per relevant international standards shall be used for solar PV system.
- k. The minimum depth from finished earth to be 900 mm (HT cable) and 750 mm (LT power and control cable) for underground cabling in the outdoor area. Proper brick boxing and sand cushioning to be done. The cable route marker also to be provided at proper interval (every 25 M and all turnings).

2.3. TRANSFORMER:

The AC output of the inverter to be connected to the step up transformer of suitable rating to raise the voltage level to 11 KV. The transformer may be either dry type transformer (with class H insulation but temperature rise to class F) or oil filled but should be suitable for inverter operation (with suitable K factor). The transformer may be a dual primary (ddY11 or ddY1) type to connect the AC O/P of both the inverter of a zone. Proper grounding to be done either solid or resistive, the SLD of east S/S is also enclosed.

The transformers shall be preferably natural air-cooled (ONAN in case of Oil filled transformer). HV off-circuit tap changing links shall be provided and shall have a range +/- 5 % in five equal steps. Under conditions of external short circuit, the tap changing device shall be capable of carrying the same current as the windings. However, at discretion of ENGINEER IN CHARGE in charge the contractor has to supply either Dry Type Transformer in a compact secondary substation (CSS) or Oil type transformer with suitable switchgears and protection.

2.3.1 Accessories

The Dry type transformers must be provided with at least the following:

- Rating and terminal marking plate
- Marshaling box
- Lifting hooks and jacking pads, towing holes
- Earthing terminals
- Neutral CT
- Off-circuit tap changer
- Temperature monitoring system /temperature scanner
- Winding temperature indication (WTI) relay

Temperature monitoring system shall be supplied with temperature sensors fitted in each limb. Temperature monitoring system shall initiate alarm and trip for winding over temperature. Alarm and trip temperatures shall be site settable. The monitoring system shall also have an indicating device.

The Dry type transformer shall be provided suitable mechanical ventilation as well as per the site condition if required.

2.4 EARTHING

2.4.1 Earthing System

The LT & HT equipment and parts shall be earthed as required as per provisions of IS.

2.4.2 Earthing System for Array Yard

- a. The earthing for array and LT power system shall be made with GI pipe including accessories, and providing masonry enclosure with cast iron cover plate having locking arrangement, watering pipe using charcoal or coke and salt as required as per provisions of IS: 3043. Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- b. Each Array structure of the Solar PV Yard shall be grounded properly. The array structures are to be connected to earth pits as per IS standards.
- c. The earthing for the power plant equipment shall be made as per provisions of IS. Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- d. The complete earthing system shall be mechanically & electrically connected to provide independent return to earth. All equipments shall have two distinct earth connections.

2.5 PROTECTION CLASS OF CABINET / PANELS, ENCLOSURES etc.

The degree of protection for following equipment shall be,

TABLE 2 CLASS OF INGRESS PROTECTION

1	Indoor Inverter panel	IP 42
2	LT switch board	IP 52
3	HT switch gear	IP 4X
4	All outdoor Junction Box	IP 65
5	String combiner	IP 65
6	Dry type main transformer(if applicable)	IP 34

The Switchboard shall be designed and manufactured in accordance with the relevant International and Indian standards suitable for the site conditions, and the specific code number and validity should be mentioned. Separate control and power panels shall be provided with separate power circuit for isolated operation of control circuit. The design of panels, cabinet enclosures and packaging density of components mounted therein shall be such that the temperature rises does not exceed 10 deg C above the ambient under the worst conditions.

2.6 LIGHTNING PROTECTION

- The Solar PV Power plant should be provided with Lightning and over voltage protection. The “Lightning Protection System” must be completed prior to start-up of commissioning activities of the project. The main aim of overvoltage protection is to reduce the over voltage to a tolerable level before it reaches the PV or other sub-system components. The source of over voltage can be lightning or other atmospheric disturbance.
- The Lightning Conductors shall be made as per Indian Standards in order to protect the entire Array Yard from Lightning stroke. BS – 4752 – Circuit breakers of rated voltage upto and including 1000 volts and 1200 volts dc.

2.7 TECHNICAL SPECIFICATIONS FOR COMPACT SECONDARY SUBSTATION (CSS):

2.7.1 CODE & STANDARDS:

All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standards. The 11KV Package Substation design must be as per IEC 61330/62271-202.

The Package Sub-station offered shall in general comply with the latest issues including amendments of the following standards.

Title	Standards
High Voltage Low Voltage Pre-Fabricated Substation	IEC:61330/ 62271-202
High Voltage Switches	IEC 60265
Metal Enclosed High Voltage Switchgear	IEC 60298/IEC62271-200
High Voltage Switchgear	IEC 60694
Low Voltage Switchgear and Control gear	IEC 60439
Power Transformers	IEC 60076

2.7.2 Service Conditions:

The Package substation shall be suitable for continuous operation under the basic service conditions indicated below:

Ambient Temperature: 50 Deg C
Relative Humidity up to 95%
Altitude of Installation up to 1000m

The Enclosure of High Voltage switchgear-control gear, Low Voltage switchgear-control gear and transformer of

the package substation shall be designed to be used under **normal outdoor service conditions** as mentioned. The enclosure should take minimum space for the installation including the space required for approaching various doors & equipment inside.

2.7.3 SPECIFIC REQUIREMENT

The main components of a prefabricated- package substation are Transformer, High-voltage switchgear-control gear, Low-voltage switchgear-control gear and corresponding interconnections (cable, flexible, bus bars) & auxiliary equipment. The components shall be enclosed, by either common enclosure or by an assembly of enclosure. All the components shall comply with their relevant IEC standards.

17.4 OUTDOOR ENCLOSURE

a. **Outdoor enclosure:**

The outdoor enclosure shall be made up of Galvanized Iron sheet instead of CRCA tropicalized to local weather conditions. Painting with Powder coating 7 tank process.

The enclosure shall be of partially modular design of GI sheets fastened by riveting. Enclosure construction is with Steel Rivets instead of Nut-Bolt/welding.

The thickness of enclosure shall be 1.5 mm for non-load bearing members & 2mm for load bearing members.

The enclosure shall be painted with Powder Coating/polyurethane paint.

The metal base shall ensure rigidity for easy transport & installation. Baseframe made up of 4mm HRCA Material with HOT DIP GALVANIZATION Process to enhance the life of the product and avoid rusting.

Substation will be used in outdoor application hence to prevent enclosure from rusting/corrosion, welding should be avoided.

The protection degree of the Enclosure shall be **IP54 for LT & HT switchgear compartment & IP23 for Transformer compartment**. Proper / adequate ventilation aperture shall be provided for natural ventilation by way of Louvers etc.

Considering the outdoor application of the substation the doors shall be provided with proper interlocking arrangement for safety of operator and to avoid corrosion door should have stainless steel hinges. Door should be provided with stoppers.

Interconnection between HT switchgear and transformer shall be using 1Cx3x95 sq.mm al. unarmored XLPE cable and between transformer and LT switchgear shall be using busbar.

b. Internal Fault: Failure within the package substation due either to a defect, an exceptional service condition or mal-operation may initiate an internal arc. Such an event may lead to the risk of injury, if persons are present. It is desirable that the highest practicable degree of protection to persons shall be provided. The Design shall be tested as per IEC61330/62271-202. **Type test report of arcing due to internal fault should submitted with offer. The Compact substation shall be tested for internal arc test –AB for 21KA for 1 sec (A-operator, B-pedestrian) (Test done with RMU inside CSS Enclosure)**

c. Covers & Doors: Covers & doors are part of the enclosure. When they are closed, they shall provide the degree of protection specified for the enclosure. Ventilation openings shall be so arranged or shielded that same degree of protection as specified for enclosure is obtained. Additional wire mesh may be used with proper Danger board for safety of the operator. All covers, doors or roof shall be provided with locking facility or it shall not be possible to open or remove them before doors used for normal operation have been opened. The doors shall open outward at an angle of at least 90° & be equipped with a device able to maintain them in an open position. **The doors shall**

be lockable type with cylindrical shooting bolt and the locking arrangement shall be covered by magnetic flap pad Lock arrangement instead of Al-Drop (Normal Kundi tala). Roof is 6 Degree Inclined to avoid Water coggng during rainy season. The roof of the transformer compartment shall be detachable type to access the transformer for maintenance purpose.

d. Earthing: All metallic components shall be earthed to a common earthing point. It shall be terminated by an adequate terminal intended for connection to the earth system of the installation, by way of flexible jumpers/strips & Lug arrangement. The continuity of the earth system shall be ensured taking into account the thermal & mechanical stresses caused by the current it may have to carry. The components to be connected to the earth system shall include:

- a) The enclosure of Package substation,
- b) The enclosure of High voltage switchgear & control gear from the terminal provided for the purpose,
- c) The metal screen & the high voltage cable earth conductor,
- d) The transformer tank or metal frame of transformer,
- e) The frame &/or enclosure of low voltage switchgear,

There shall be an arrangement for internal lighting activated by associated switch for HV , Transformer & LV compartments separately.

e. Labels: Labels for warning, manufacturer's operating instructions etc. shall be durable & clearly legible.

f. Cleaning & Painting :

The paints shall be carefully selected to withstand tropical heat and rain. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling. **The enclosure shall be painted with Powder Coating.**

g. Current Transformers

All current transformers should be complying with IEC 60185. Current transformers should be of dry type, with ratings and ratios as required. Cable current transformers used in circuit breaker modules should be maximum 100mm wide. Current transformers used in metering cubicles should be having dimensions according to DIN 42600, Narrow type. Current transformer shall be placed in the cable covers so that it can be easily replaced at site without removing the bushings.

h. Auxiliaries.

The switchgear should be prepared for options like motor operation, auxiliary contacts and short-circuit indicators. Necessary terminal blocks and wiring etc. should be placed behind the front cover of each module.

i. Fault Passage Indicators.

These shall facilitate quick detection of faulty section of line. The fault indication may be on the basis of monitoring fault current flow through the device. The unit should be self-contained requiring no auxiliary power supply. The FPI shall be integral part of RMU to avoid thefts. The FPI shall have clear display, automatic reset facility and shall be SCADA compatible.

17.5 TESTING AND CERTIFICATION.

A) TYPE TESTS.

Units should be type tested in accordance with IEC standards 60056, 60129, 60265, 60298, 60420, 60529 and 60694. The following type tests should perform on the HT Switchgear and report should submit with offer.

- Short time and peak withstand current test

- Temperature rise tests
 - Dielectric tests
 - Test of apparatus i.e. circuit breaker and earthing switch
 - Arc fault test
 - Measurement of resistance of main circuit.
 - Mechanical endurance test.
 - Duty cycle test.
 - Internal arc test for HT chamber.
- Type test reports for above type shall be submitted with the offer.

B) ROUTINE TESTS.

Routine tests should be carried out in accordance with IEC 60298 standards. These tests should ensure the reliability of the unit.

Below listed test should be performed as routine tests before the delivery of units;

- Withstand voltage at power frequency
- Measurement of the resistance of the main circuit
- Withstand voltage on the auxiliary circuits
- Operation of functional locks, interlocks, signaling devices and auxiliary devices
- Suitability and correct operation of protections, control instruments and electrical connections of the circuit breaker operating mechanism
- Verification of wiring
- Visual inspection
- Time travel characteristics measurement facility for Breaker should be available with the manufacturer to assess the quality of RMU.

C) DISTRIBUTION TRANSFORMER:

i) Cast Resin Dry Type Transformer

This specification covers the requirements of design, manufacture, testing and supply of cast resin dry type transformers complete with all the accessories and fittings for efficient and trouble-free operation.

ii) CODES & STANDARDS

The equipment covered by this specification shall, unless Otherwise stated to be designed, constructed and tested in accordance with latest revisions of relevant Indian standards / IEC publications.

IS 1271	-	Classification of Insulating Materials.
IS 2026	-	Power transformers (part I - V)
IS 2099	-	Bushing for alternating voltages above 1000 V
IS 2705	-	Current transformers
IS 3202	-	Code of practice for climate proofing
IS 3639	-	Power transformer fittings and accessories
IS 4257	-	Porcelain bushings for transformers
IS 11171	-	Dry type Transformer
IS 8478	-	Application guide for tap-changers
IS 10028	-	Code of practice for selection, installation and maintenance of transformers.

D) GENERAL DESIGN FEATURES:

1. All transformers shall be of the latest design, dry type Cast Resin only.
2. The type of cooling shall be Natural Air cooled (AN) and the corresponding ratings for each transformer shall be as indicated in the specific requirements.
3. Each transformer shall be suitable for operation at full rated power on all tapings without exceeding the applicable temperature rise.
4. It shall be possible to operate the transformer satisfactorily, with the loading guide specified in IS-6600. There shall be no limitations imposed by bushings, tap changers, auxiliary equipment to meet this requirement.
5. The transformers shall be designed to be capable of with-standing, without injury, the thermal and mechanical effects of short-circuits between phases or between phase and earth at the terminals of any winding with full voltage applied across the other winding for periods given in relevant standards. There shall be no limitations imposed by any part/component of the transformer/off load tap links to meet the short circuit level Specified.
6. Each transformer shall be designed for minimum no-load and load losses within the economic limit and shall be able to have minimum loss at the rated load condition.
7. All electrical connections and contacts shall be of ample cross sections for carrying the rated current without excessive heating.

The transformer shall be capable of continuous operation at full load rating under the following conditions.

- a) Voltage variation = $\pm 10\%$
- b) Frequency variation = $\pm 5\%$
- c) Combined voltage and frequency variation (Absolute sum) = 10%

E) CONSTRUCTION

The transformer shall be dry type, AN cooled suitable for Compact substation application.

The core-clamping frame shall be provided with lifting eyes having ample strength to lift the complete core and winding assembly.

- i. Off circuit tapings shall be provided on the HV windings. Tap changing is done by means of off-circuit links accessible through openings provided.
- ii. The lifting lugs and rollers shall be provided. A winding temp. Scanner shall be provided and is actuated by means of resistance temperature detectors embedded in LV windings of all three phases. It should have alarm and trip contacts at a specified temperature.
- iii. The transformer shall be of IP00 protection class and will be installed in the transformer compartment of compact substation having IP23 protection class.

F) WINDINGS

- I. The winding insulation shall be of Class "F/H" and temperature rise limit i.e. 90 deg. C/ 115 Deg C over ambient of 50 Deg C. Windings shall be of electrolytic copper conductors (circular in shape) of high conductivity and 99.9% purity.
- II. Windings shall be designed to withstand the specified thermal and dynamic short circuit stresses.
 - a. The windings shall be duly sectionalized. Accessible joints brazed or welded and finished smooth shall connect similar sections. No corona discharge shall result on the winding upon testing the transformer for induced voltage test as specified in IS.
 - b. The end turns of the high voltage windings shall have reinforced insulation to take care of the voltage surges likely to occur during switching or any other abnormal condition.

The high voltage and low voltage winding are shall be made of copper Conductors. HV winding will be always be resin casted under vacuum while LV winding can either be casted or pre-impregnated with resin.

G) CORE

The double wound Core shall be constructed from non-ageing cold rolled Grain oriented steel sheets. The built core shall be painted with high temperature resistant paint to prevent corrosion at the edges of core plates and to withstand high temperatures. By using different core material optimization of core losses shall be achieved. The yokes shall be firmly clamped between yoke channels or plates. The top & bottom yoke frames shall be secured to each other by means of tie-rods, which help in securing the winding in place.

The design of the magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and the production of flux component at right angles to the planes of laminations which may cause local heating.

H) OFF-CIRCUIT TAP CHANGING LINKS

Off circuit tapings are provided on HV windings. Tap changing is done by means off circuit links. Use of tap changing links eliminates any moving parts as against a manually operated tap changer.

Terminal Arrangement

HV side and LV side of transformer will have the top busbar arrangement for connection of HT side by means of cable and LT side by means of busbar.

I) PAINTING

All steel surfaces shall be thoroughly cleaned by sand blasting or chemical agents as required to produce a smooth surface free of scale, grease and rust

The external surface, after cleaning, shall be given a coat of high quality red oxide or yellow quoted primer, followed by filler coats.

J) ROUTINE TEST

All Routine Tests in accordance with IEC 60076 / IS 2026 shall be carried out on each transformer.

K) CSS EARTHING:

Earthing arrangement shall be provided for earthing each cable, PVC cable gland, neutral busbar, chassis and frame work of the cubicle with separate earthing terminals at two ends. The main earthing terminals shall be suitably marked .The earthing terminals shall be of adequate size, protected against corrosion, and readily accessible. These shall be identified by means of sign marked in a legible manner on or adjacent to terminals.

Neutral bus bar strip shall be connected to Earthing terminal with help of GI strip of suitable capacity & nut-bolt arrangement.

L) TYPE TESTS FOR THE PACKAGE SUBSTATION:

The Package Substations offered must be type-tested as per IEC 61330/62271-202. The copy of type test summary should be submitted along with the tender. CSS manufactured at in JV consortium/ System Houses/ System Integrator shall not be accepted. Only Original Equipment Manufacturers are accepted.

Routine Tests: The routine tests shall be made on each complete prefabricated substation.

- a) Voltage tests on auxiliary circuit.
- b) Functional test.
- c) Verification of complete wiring.

Test Witness: Routine test shall be performed in presence of Owner's representative if so desired by the Owner. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

M) TEST CERTIFICATES:

Certified reports of all the tests carried out at the works shall be furnished in three (3) copies for approval of the Owner.

N) PACKAGED SUBSTATION ENCLOSURE:

- Tests to verify the degree of protection.
- Arcing due to internal fault
- Test to prove enclosure class - Temperature rise of the transformer inside the enclosure.
- Short circuit test to prove the capability of the earthing circuits to be subjected to the rated peak and the rated short-time withstand currents.
- Tests to verify the withstand of the enclosure of the prefabricated substation against mechanical stress.

SERVER BUSWAY SYSTEM

1. SCOPE

This section covers manufacture, supply, testing and commissioning of Server Busway system with Hot Swappable Tap off Units for overhead power distribution inside the data hall for supplying power to the server racks with plug in and plug out of tap off units during live condition to attain less downtime in Data Centre.

2. SUPPLY VOLTAGE

For 3 phase, 4 wire/5 wire/6 wire, 50 cycles AC supply, operating voltage 1000 volts.

3. STANDARD FOR COMPLIANCE

IEC 61439- 1 & 6- Particular requirement of bus trunking system IS: 8623(I & II) / BS: 5486(II) CPRI certified
IEC- 60529 – Degree of protection

4. CONSTRUCTION

The enclosure shall be made from 2 mm thickness of aluminium duly powder coated RAL 7032 with IP 54 protection. Bus bars would be in 'Air Insulated' and busbar insulator shall be Glass Filled Polyester overall providing Class F insulation. No drilling of Bus bars is permitted. Tin plated Copper Conductors Half hard, ETP grade, 99.9% Pure and shall comply to JIS H 3140 & IS 613. Length of section will be limited to max 3 Mtrs. Bus bars of one section will be connected to Bus bars of adjacent section by uniblock joint system removable as separate subassembly, so that it can be inserted or removed without disturbing the adjacent sections. The Uni-block joint must have uniform torque irrespective of the ratings with double headed nut

for proper torque tightening indication.

5. Technical Parameter:

S.no Description Parameters

- 1 Compliance Standard IEC 61436(1&6)
- 2 Bus Bar Rating 250A-1250A
- 3 Short Circuit Rating (KA) 10KA - 50KA
- 4 Configuration 4P: 3P+100%N+Integral Earth
5P: 3P+200%N+Integral Earth
6P: 3P+100%N+Isolated Earth 100% +Integral Earth
- 5 Bus Bar Material (Phase/ Neutral) Copper Tin Plated (ETP grade), 99.9% Pure
- 6 Bus Bar Material (Internal Earth) Copper Tin Plated (ETP grade), 99.9% Pure
- 7 Housing Integral (Earth) Aluminium (2.00mm)
- 8 Bus Bar Insulator Glass Filled Polyster (Class F)
- 9 Rated Frequency 50/60Hz
- 10 Rated Operational Voltage 1000V
- 11 Rated Insulation Voltage 1000V
- 12 Rated Withstand Voltage 12KV
- 13 Jointing Uni Block Joint
- 14 Plug in Box 16A-125A

Server Busway Features

- Server Busway comes up with the provision of tap off points at every 250mm i.e. 10 Nos of
- plug in units are accessible in 3-meter length.
- Server Busway offers Class F insulation.
- Server Busway with IP protection of IP54 this excludes the requirement of finger probe test
- and easily insertion of plug in points during live condition at site.
- Server Busway is accessible during live condition i.e. plug in and plug out of tap off boxes during live condition.
- Server Busway comes with power monitoring in end feed unit & tap off boxes. Server Busway have Uni Block Joints that ensures the proper jointing of two straight length i.e. the nut will sheer off when force of 80-90-N/m is applied ensuring the proper tightening of joints Which reduces the risk of loose connections at site
- Server Busway offers proper covered and enclosed solution so that no safety gets hampered.

6. Straight Length:

Straight Length comes in standard length of 1m & 3m PIP (Plug in Points) are designed to tap power at every 250mm interval (total 10-11 PIP in 3 meter length). Server Busway straight length consists of Tin platted copper busbar fitted inside Aluminium housing on insulator.

Uni Block joint is used to join two sections of track busway for perfect mechanical & electrical connection.

7.End Feed Unit:

End feed unit made out of GI duly powder coated, with provision of power monitoring with RS 485/ TCP IP protocol.

8. Plug in Box

Plug in Box comes with customization as per customer requirement. PIB enclosure is made up of GI duty power coated RAL 7032.

Plug in contacts are made of silver-plated copper with spring steel back up pressure clips for ensuring uniform pressure & low contact resistance.

Earth Contact makes first & last break during Plug in Plug out operations.

Plug in automatically ensures matching of polarity with track busway.

Comes with provision of power monitoring, 1 or 2 Industrial Plug & Socket or Gland with Cable.

9. Uni Block Joint

Uniblock Joint facilitates joining of two elements of busway route.

Heavy duty disc spring used on both sides for uniform distribution of pressure and to achieve perfect mechanical & electrical joint.

Joint can be tightened easily with the help of spanner on nut side only.

Shear off nut ensures tightness of joint at desired torque and eliminate the need of torque wrench during installation.

Tamper proof cap over shear off nut prevents opening of nut after achieving desired torque. Nut can only be opened after breaking the cap.

Uni block joint can be inserted and removed in installed condition without removing any element of the busway run.

11. End Cover:

End Cover is used to close the end of busway run.

End cover can be removed easily for extension of busway.

11. Mounting Bracket

Mounting brackets are used at approximate interval of 1.2 meter to install the track busway from ceiling.

12. List of Test to be carried out

Type Tests: Copies of the following certificates should be submitted.

- (i) Verification of Temperature Rise Limits.
- (ii) Verification of dielectric properties.
- (iii) Verification of short circuit strength.
- (iv) Verification of degree of protection.
- (v) Verification to mechanical Impact -IK10
- (vi) Verification to Seismic Zone IV Integrity

13. Factory Acceptance Test

- (i) Verification of insulation resistance (Megger)
- (ii) Inspection of assembly, interlocks, locks etc.
- (iii) Dielectric test – 2.5kV for 5 seconds
- (iv) Other Visual Inspection

All the test needs to be carried out in presence of client / customer as per Quality assurance plan (QAP).

14. Site Testing:

Before connecting main supply after installation, pre-commissioning check comprising Megger test, checking the tightness of connections, body earth connection etc. shall be carried out and recorded in presence of manufacturer is a must. Only trained persons from manufacturer need to carry out the pre-commissioning audit in presence of user.

If Installation is not carried out by manufacturer than one day training need to be given compulsorily to the Installation team on methodology, DO s & DON'T s, Storage and Minutes of meeting should be registered.

PAC Specifications

Technical Specification INROW COOLING DX Unit

Server room,

Classification	:	INROW COOLING UNITS – Critical Areas SERVER ROOM
Inside design conditions	:	Temperature: 20 Deg C $\pm$ 1 Deg C Relative humidity: 50+/5% RH Noise level 60+/-5 dB A
Outside conditions	:	Summer -35.6°C DBT 25.6°C WBT
Operation	:	24/7

EQUIPMENT SELECTION

Server room : DX type In-row cooling units with inverter compressor, front discharge type incorporating R410A refrigerant.

Cooling version

The unit will feature a cooling circuit with one compressor. **The compressor will be a high efficiency scroll unit installed on the outdoor condensing unit so as to limit maintenance requirements inside the data center.** This is equipped with an electronic controller for managing cooling capacity. An electronic board fitted with microprocessor will control effective compressor capacity using a PID algorithm (proportional – integral – derivative) so as to ensure continuous and precise modulation of compressor rotation speed, R410A ecological refrigerant will be used; no alternatives are permitted. The cooling circuit will include: electronic thermostatic valve, solenoid valve, high and low pressure switches, liquid sight glass and filter-drier. The low pressure switch features automatic reset and activation can be delayed when restarting in winter. The high pressure switch requires manual reset.

The circuit will also include an oil separator to guarantee oil return to the compressor and reduce the risk of shutdown, plus a liquid separator.

The evaporator coil will be made from copper pipes mechanically fixed to aluminium fins with hydrophilic treatment.

Air flow configuration

In the InRow versions, the air to be cooled is taken in at the rear of the unit, directly from the hot aisle of the data center (35°C), with considerable benefits both in terms of energy efficiency and cooling capacity; it is then cooled and delivered into the cold aisle (18-20°C), that is, the front of the same racks where the air is taken in from.

The surface of the evaporator coil must be designed to deliver a high level of sensible cooling capacity, i.e. the SHR (Sensible Heat Ratio, ratio between sensible and total heat load) must be > 0.9, measured at an air inlet temperature of 35°C and 30% relative humidity. A steel condensate collection pan must be installed on the coil.

Energy Efficiency

In order to provide best advantages in terms of energy saving, the CRAC efficiency shall increase when heat load reduces (partial load) or any time the cooling capacity exceeds the required capacity (for instance when outdoor temperature drops).

Control of the condensation stage

The condensation stage must be controlled by measuring the compressor discharge pressure i.e. on the condensing unit, so as to be able to manage the effective pressure difference across the compressor and allow simultaneous control of the evaporator-condenser system.

The condensation stage must be controlled by modulating the power supply voltage to the fans on the outside condenser.

Active redundancy and shared mode

The cooling units will be capable of providing active redundancy. To ensure this, all the units installed, including the redundant unit, must be able to operate at the same time and at part loads.

This feature must also be able to increase system efficiency by reducing energy consumption at part loads.

Protection function for long refrigerant lines

The unit will have a function that at regular intervals increases gas flow speed, so as to allow better oil return to the compressor even on very long refrigerant lines.

Fans

The air-conditioning unit will have fans with backward-curved blades made from reinforced ultra-light and highly resistant polymer material. The motors are coupled directly to the fans (plug-fan), and are **EC (Electronically Commuted)** brushless motors: this technology allows continuous modulation of air flow-rate by continuously controlling fan speed via a 0-10V signal. Fan rotation speed can also be controlled directly on the user terminal, so as to allow adjustment of the flow-rate or external static pressure (ESP)

The motor can be powered at either 50 or 60Hz, and will have **IP54** ingress protection. All the fans are statically and dynamically balanced, have self-lubricating bearings and are mounted on vibration-damping supports.

The unit controller will be able to modulate fan speed at part loads, together with the compressor inverter. This further reduces power consumption during part-load operation.

The fans are designed to allow **“hot replacement”** in the event of faults, i.e. an individual faulty fan can be replaced without having to stop the entire unit, thus reducing system down time.

Power supply

The electrical panel is located at the front of the unit, and will be easily accessible and away from the air flow. This will be constructed and wired in compliance with standards IEC 204-1/EN60204-1 and will include: contactors and overload protectors for compressors and fans, PCB, and safety devices.

Power supply will be

230 volts, single-phase, 50Hz.

or

400 volts, three-phase + neutral, 50Hz

Controller with microprocessor

The control system will include a microprocessor that will be programmed to manage all the functions of the air-conditioner. The system will include

- An electronic board housing the microprocessor, fitted inside the electrical panel.
- A user terminal as the interface.

The electronic board complies with EEC directive 89/336.

The user terminal is a backlit LCD with 132x64 pixel resolution and 6 buttons.

All the messages will be displayed using icons; no specific language needs to be known.

The main functions of the control system are to:

- control room temperature
- manage the compressor inverter;
- manage fan speed;
- monitor supply air temperature;
- manage alarms and warnings for correct maintenance;
- log up to 100 events;
- manage the unit in standby;
- control room humidity (if a humidity probe is connected)
- manage the humidifier (if featured)
- manage from 1 to 3 electric heater stages for reheating (if featured);
- automatically manage the free cooling system (if featured);
- allow remote monitoring and control of the unit via LAN, network or BMS (Lon Works, BACnet, Modbus.....).

The controller requires **3 password levels** and can manage the following parameters:

- readings of sensors and probes and corresponding settings;
- activation of alarms, event log, digital output settings;
- LAN management;
- BM communication parameter settings;

When connected via LAN to other units - up to 10 - the controller can:

- manage, based on set times or events, automatic rotation of the unit/units in standby (1 or 2) ;
- manage the average temperature and humidity between the units;
- access all the control boards from just one remote user terminal,

In order to protect the software against incorrect settings, some parameters are protected by **2 password levels**: User level and Authorised service level.

Filters

Regenerable polyester fibre filtering media treated with synthetic resins, supported by a frame with protective metal mesh. Efficiency grade G2/G4 in accordance with standard CEN-EN 779, and average efficiency G4 to ASHRAE 90.1. The filter is non-flammable.

Noise

The units must be designed to reduce noise emissions. Specifically, in normal operation the compressor must not generate any type of impulse noise, not being measurable.

Reheating

The unit will be equipped with electric heaters, to allow temperature control during dehumidification cycles.

The electric heaters include stainless steel fins, and are fitted with safety thermostat to cut-off power supply and activate an alarm in the event of overheating. The heaters feature modulating operation, in 3 stages.

Humidifier

The unit will read the relative humidity (RH) and control the level by activating humidification cycles only when the return air humidity is too low (<40%, settable).

The humidifier is an immersed electrode model with modulation of steam production. It also features automatic control of dissolved salt concentration so as to allow untreated water to be used

Communication boards

The unit will be fitted with RS485 communication board for ModBus protocol.

Alarm sensors :

Dirty filter sensor: this sensor is needed to optimise filter operation, so they can be replaced only when necessary

Flood sensor: this sensor is needed if there is condensate water spillage outside unit.

SECTION 07

LIST OF APPROVED MAKES FOR VITAL ITEMS

Following is the approved list of acceptable makes.

The contactor should supply only the following make items as specified.

S.NO	ITEM	APPROVED MAKE
	ELECTRICAL	
1	ACB	SCHNEIDER ELECTRIC/ABB / SIEMENS/LEGRAND/LAURITZ KNUDSEN (L&T)/MITSUBISHI ELECTRIC
2	MPCB / MCCB	SCHNEIDER ELECTRIC/ABB / SIEMENS/LEGRAND/LAURITZ KNUDSEN (L&T)/MITSUBISHI ELECTRIC
3	MCB / ELCB	SCHNEIDER ELECTRIC/ABB / SIEMENS/LEGRAND/LAURITZ KNUDSEN (L&T)/MITSUBISHI ELECTRIC
4	MCB DB	SCHNEIDER ELECTRIC/ABB / SIEMENS/LEGRAND/LAURITZ KNUDSEN (L&T)/MITSUBISHI ELECTRIC
5	INSTRUMENT TRANSFORMER	KAPPA / INSTRANS / AE
6	PROTECTION RELAY	SCHNEIDER ELECTRIC/ABB / SIEMENS/LEGRAND/LAURITZ KNUDSEN (L&T)/MITSUBISHI ELECTRIC
7	DIGITAL METER	ABB / SCHNEIDER ELECTRIC/CONZERV/ SIEMENS/L&T/ELMEASURE/SECURE/MITSUBISHI ELECTRIC
8	LED INDICATING LAMPS / PBS	TECHNIC / SIEMENS/L&T/SCHNEIDER ELECTRIC
9	PLC	ABB/SIEMENS/ALLEN BRADLEY/SCHNEIDER ELECTRIC/MITSUBISHI ELECTRIC
10	MODULAR TYPE SOCKETS & SWITCHES	LEGRAND (Arteor)/HONEYWELL (Blanze Pro)/ABB/Schneider Electric
11	INDUSTRIAL PLUG & SOCKET	SCHNEIDER ELECTRIC/ABB / SIEMENS/LEGRAND/LAURITZ KNUDSEN (L&T)/MITSUBISHI ELECTRIC
12	PVC - INSULATED COPPER WIRES	POLYCAB/FINOLEX / HAVELLS / LAPP/BONTON
13	LT SINGLE CORE / MULTI CORE COPPER CABLES	POLYCAB/FINOLEX / HAVELLS / LAPP/KEC
14	LT CABLES	POLYCAB / HAVELLS / FINOLEX /KEC/LAPP
15	CONTROL CABLES	POLYCAB/FINOLEX / HAVELLS /BONTON
16	END TERMINATION MATERIAL	COMET / DOWELL (DOUBLE COMPRESSION)/PHOENIX
17	PVC CONDUIT	AKG / BEC / PRECISION/POLYCAB
18	HT/ LT PANEL FABRICATOR	TRICOLITE / AMBIT/ ADLECS/SIEMENS/C&S ELECTRIC / LAURITZ KNUDSEN (L&T)
19	BUS BAR TRUNKING	LEGRAND/C&S ELECTRIC/LAURITZ KNUDSEN (L&T)/SIEMENS/SCHNEIDER ELECTRIC
20	PERFORATED GI CABLETRAY	STEELWAYS/ INDIANA / LEGRAND/OBO/PROFAB
21	GI RACEWAYS	STEELWAYS/ INDIANA / LEGRAND/OBO/PROFAB
22	HOT DIP GALAVANISED WIRE MESH CABLE TRAY	LEGRAND/OBO/ STEELWAYS/ INDIANA/PROFAB

23	LIGHT FIXTURES	PHILIPS / WIPRO / HAVELLS/HALONIX
24	TVSS	SCHNIEDER / ASCO / LEGRAND
25	ATS - (UPTO 1000 AMPS)	SOCOMEK/ ASCO / SCHNEIDER ELECTRIC/LAURITZ KNUDSEN (L&T)
26	MAINTENANCE FREE EARTHING SYSTEMS	ERICO / LIGHTNING PROTECTION INTERNATIONAL/ASHLOK
27	K - RATED ISOLATION TRANSFORMER BASED PDU'S	SCHNIEDER/VERTIV/DATSUN/ADLEC
28	UPS	SCHNEIDER ELECTRIC (APC)/ VERTIV/ SOCOMEK/DELTA/RIELLO/EATON
30	BATTERY BREAKER	ABB/SCHNEIDER/HAGER/LEGRAND
31	DG SET	CUMMINS / CATER PILLAR/ GREAVES COTTON/KIRLOSKAR
32	ENGINE	CUMMINS/CATERPILLAR/MTU
33	ALTERNATOR	STAMFORD/ LEROYSOMER/CATERPILLAR
34	COMPACT SECONDARY SUBSTATION (with Dry Type Transformer)	ABB/VOLTAMP/SCHNEIDER ELECTRIC/SIEMENS
	LOW VOLTAGE SYSTEM	
1	FIRE ALARM PANEL	HONEYWELL(Notifier)/SCHNIEDER ELECTRIC/SIEMENS/BOSCH
2	ADDRESSABLE DETECTORS	HONEYWELL(Notifier)/SCHNIEDER ELECTRIC/SIEMENS/BOSCH
3	MODULES/ MCP	HONEYWELL(Notifier)/SCHNIEDER ELECTRIC/SIEMENS/BOSCH
4	TRANSPONDER/MODULES	HONEYWELL(Notifier)/SCHNIEDER ELECTRIC/SIEMENS/BOSCH
5	RESPONSE INDICATOR	HONEYWELL(Notifier)/SCHNIEDER ELECTRIC/SIEMENS/BOSCH
6	CABLE	FINOLEX/POLYCAB/HAVELLS/KEC/LAPP/SCHNEIDER ELECTRIC
7	CONDUIT	AKG/BEC/POLYCAB/PRECISION
8	GAS SUPPRESSION SYSTEM	NOVEC 1230 /SIEMENS/ HONEYWELL/UTC-KIDDE
9	SMOKE ASPIRATION SYSTEM	HONEYWELL/ SIEMENS/ XTRALIS
10	ACCESS CONTROL SYSTEM	HONEYWELL /CARDKEY/SIEMENS/SCHNIEDER
11	CARDS & TAGS	HID / HONEYWELL/ SCHNIEDER/SIEMENS/ LENEL/ TYCO SOFTWARE HOUSE
12	DOOR CONTROLLER	HONEYWELL / CARDAX /SIEMENS/ CARDKEY/ SCHNIEDER/ LENEL/TYCO SOFTWARE HOUSE
13	MAIN ACCESS CONTROLLER	HONEYWELL / LENEL / CARDAX /CARDKEY/ HID/ SCHNIEDER/ TYCO SOFTWARE HOUSE
14	CARD READER	HID / HONEYWELL/SCHNIEDER/SIEMENS
15	RODENT PANEL	MASER/R SCAT /C-SYSTEM
16	SENSORS / SATELLITES	MASER/R SCAT /C-SYSTEM
17	CCTV Camera	PELCO/AXIS/HONEYWELL/SONY
18	NVR	AXIS/HONEYWELL/PELCO/SONY/ SIEMENS
19	VMS	AXIS/HONEYWELL/PELCO/SONY/ SIEMENS
20	JOYSTICK	AXIS/HONEYWELL/PELCO/SONY/ SIEMENS
21	WORKSTATION & SERVER MACHINES	DELL / IBM / HP
22	WATER LEAK DETECTION PANEL	HONEYWELL /TTK/TRACETEK/C SYSTEM
23	SENSORS & MODULES	HONEYWELL /TTK/TRACETEK/C SYSTEM

24	PUBLIC ADDRESSABLE SYSTEM	HONEYWELL / BOSCH
25	DCIM SOFTWARE WITH UNLIMITED USER LICENSE AS REQUIRED	SCHNIEDER/ VERTIV/NLYTE/SIEMENS/SUNBIRD/JOHNSON CONTROLS/HONEYWELL
26	OUTSIDE AIR TEMPERATURE PLUS HUMIDITY SENSOR	HONEYWELL/SCHNEIDER/SIEMENS/OMNICROM
27	ROOM TEMPERATURE PLUS HUMIDITY SENSOR	HONEYWELL/SCHNEIDER/SIEMENS/OMNICROM
28	COMPUTER/ SERVERS	HP / DELL / IBM
29	PRINTER	HP / EPSON / CANON
30	COPPER CONDUCTOR CONTROL CABLE	FINOLEX / SKYTONE / DELTON / FUSION POLYMERS / POLYCAB / EXCEL
31	COMMUNICATION CABLES / SIGNAL CABLE	FINOLEX / SKYTONE / DELTON / FUSION POLYMERS / POLYCAB / EXCEL
32	LAN CABLES FOR BMS NETWORK	SCHNIEDER/AMP TYCO / BELDEN /LEVITON/LEGRAND
33	PVC FRLS CONDUITS	BEC / AKG/CHIRAG
24	BMS SYSTEM	HONEYWELL/SCHNEIDER ELECTRIC/SIEMENS/JOHNSON CONTROLS/MITSUBISHI ELECTRIC
	NETWORK	
1	IT 42 RU RACKS 600 X 1200 MM	APC/VERTIV/NETRACK
2	IT 42 RU RACKS 800 X 1200 MM	APC/VERTIV/NETRACK
3	IP PDU'S	SCHNIEDER(APC)/VERTIV/(RARITAN)/
4	COLD AISLE CONTAINEMENT	APC/VERTIV/NETRACK
5	CAT 6A	SCHNIEDER/AMP TYCO / BELDEN /LEVITON
6	STS	SOCOMEK/SCHNIEDER/VERTIV
7	L3 Switch	CISCO/JUNIPER/HP/ARISTA
8	FIBER DUCT	PANDUIT/ COMSCOPE/CORNING
	HVAC	
1	PRECISION AIR CONDITIONING UNITS	VERTIV /SCHNIEDER ELECTRIC/SWEGON BLUE BOX/STULZ
2	VRV UNITS	DAIKIN / HITACHI/ BLUE STAR/ MITSUBISHI/LG
3	REFRIGERANT FITTINGS	IMPORTED AS PER MANUFACTURER
4	REFRIGERANT PIPING	DYNA FLOW / KOTHARI/ MODERN/ RAJCO
5	FIRE SEALANTS	ROXTEC/ HILTI / OBO
	VIDEO WALL	
1	SCREEN	DELTA/BARCO/CHRISTIE
2	VIDEO WALL CONTROLLER	DELTA/BARCO/CHRISTIE
3	50" DISPLAY UNIT	BARCO/ PANASONIC/ LG SAMSUNG/SONY

SECTION-08

PAYMENT TERMS AND PAYMENT SCHEDULE

4.0 THE DETAILED PAYMENT TERMS AND PAYMENT SCHEDULE ARE GIVEN UNDER:

4.1 PAYMENT TERMS

- (i) All the payments against the Schedules specified under shall be made through Running Account Bills in specified format.
- (ii) From all Running Account Bill payments of Part-A cited below, **2.5% of gross amount** of payment shall be withheld as security deposit for the satisfactory performance of the plant. The security deposit so withheld shall be released at the end of **Three (03) years** from date of completion of work as per the completion certificate issued by Engineer-in-Charge subject to adjustments of all amounts towards unattended claims, if any.
- (iii) The contractor is allowed to submit the bank guarantee (BG) in lieu of liquid retention of money from the RA Bills.
- (iv) During the Part- B period of operation and maintenance of Institute Data Centre (IDC), monthly Running Account bills shall be raised by the contractor by 7th of every month in prescribed proforma (CPWA 27A). IITH shall endeavour to make payment of monthly Running Bills within ten working days from the date of receipt of bills with all required documents in the office of Engineer-in-Charge, IITH.
- (v) The tendered amount for works shall be inclusive of applicable Works Contract Tax under GST.
- (vi) Other Taxes: Income tax/surcharge/cess or any other tax as applicable on the amounts paid by IIT Hyderabad shall be recovered at source at applicable rates as notified by Government of India and a certificate to this extent shall be issued to the contractor.

Table: SCHEDULE OF PAYMENTS

Component	Stage of work	Payment
Part-A Electrical- Mechanical Works (Original Agreement)	Stage 1: Planning and Designing – Submission and approval of all design calculations, drawings, Design Basis Reports (DBRs), Feasibility Reports, Electrical Load calculations, heat Load calculations, Electrical SLDs, Services Routing plans, BMS Architecture, DG Set, UPS System, Fire suppression system design, VESDA, WLD, Inrow cooling solutions, PAC Design, VRV System Design, Busbar power distribution system design and other essential services and systems design and allied drawings good for construction, Technical Data Sheets(TDS) Approval of all above components from the Engineer In Charge (EiC) of project. <i>[This schedule can be operated in a maximum of Four(04) segments].</i>	On submission of Tax invoice by the contractor towards the running bill subject to a maximum of 5.0% of contract amount of Part A
	Stage 2: Delivery of Electro-Mechanical equipment and Systems including Wiring & Internal Lighting, DB'S, MCB's, Cable trays, switch, Sockets, MV Power Cables, Hume pipes, MV Electrical Panels, Earthing & fire alarm system (FAS), Gas Based Fire Suppression System, Variable Refrigerant Volume (VRV) System, DG Set along with AMF Panel, UPS, Batteries, Compact Secondary Substation (CSS), IT Racks Bus bar Power distribution System, BMS, CCTV, Access control system, Inrow Cooling system, PAC units, WLD System, Rodent Repellant system, and other allied components and Systems and upon submission of their Delivery Chalan/Tax Invoice copies. <i>[This schedule can be operated in a maximum of Six (06) segments].</i>	On submission of tax invoice by the contractor towards the running bill subject to a maximum of 60% of contract amount of Part A
	Stage 3: Installation of Electro-Mechanical equipment and Systems including Wiring & Internal Lighting, DB'S, MCB's, Cable trays, switch, Sockets, MV Power Cables, Hume pipes, MV Electrical Panels, Earthing & fire alarm system (FAS), Gas Based Fire Suppression System, Variable Refrigerant Volume (VRV) System, DG Set along with AMF Panel, UPS, Batteries, Compact Secondary Substation (CSS), IT Racks Bus bar	On submission of tax invoice by the contractor towards the running bill subject to a maximum of 15.0% of contract amount of Part A

	Power distribution System, BMS, CCTV, Access control system, Inrow Cooling system, PAC units, WLD System, Rodent Repellant system, and other allied components and Systems and upon submission of their Delivery Chalan/Tax Invoice copies. <i>[This schedule can be operated in a maximum of Four (04) segments].</i>	
	Stage 4: Testing and Commissioning- Completion of Testing, Commissioning of all electrical, mechanical components, systems and works including load testing with `DG Set, UPS, CSS, VRV Air Conditioning systems, PAC System, Inrow cooling system, including USAT with all BMS, and Fire Suppression system, Fire Alarm System, VESDA System, WLD, CCTV and other allied systems and components etc., up to the satisfactory of EiC. <i>[This schedule can be operated in a maximum of Four (04) segments].</i>	On submission of tax invoice by the contractor towards the running bill subject to a maximum of 10% of contract amount of Part A
	Stage 5: Final Trial Run- Completion of Performance testing, Fifteen (15) Days Trial run and commissioning of Data Centre including all allied works related to mechanical/ electrical / instrumentation/ Automation works and declaration of provisional completion of Part-A by EiC. <i>[This schedule can be operated in a maximum of One (01) segment].</i>	On submission of tax invoice by the contractor towards the running bill subject to a maximum of 10% of contract amount of Part A
Part-B (Supplementary Agreement for Operation and Maintenance)	Stage 1: The relevant tendered rate shall be paid for Operation and Maintenance of Institute Data centre (IDC) for 03 Years based on Quarterly (03 months) RA bills for O&M of Data Centre.	Quarterly (03 months) contract amount rate for relevant period of Part B
	Stage 2 (Original Agreement and Supplementary Agreement): On Satisfactory completion of DLP and O&M period of Three years after commissioning of the Data Center, Final Bill shall be settled under this schedule.	All dues to be settled on submission of Final bill by Contractor.

SECTION-09
RESPONSE REQUIREMENTS

5.0 Potential bidders may furnish their bids by submitting the following documents in English language as per the indicated formats.

- a) Covering Letter as per the format provided in **Appendix I**.
- b) Supporting documents as per formats provided in **Appendix II** against each of the above-mentioned qualifying criteria as proof of having the capabilities to support the requirements of IIT Hyderabad.
- c) Litigation Impact Statement as per format in **Appendix III**.

APPENDIXES

APPENDIX - I

Cover Letter from the Bidder (On Company letter head)

Date :

To
The Executive Engineer-Electrical,
Construction and Maintenance Division,
IIT Hyderabad, Kandi, Sangareddy,
Telangana-502284.

Reference: Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).

Dear Sir,

This is to notify you that our company intends to submit a response to this NIT for **Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).**

Primary and Secondary contacts for our company are:

Primary Contact Secondary Contact

Name:

Designation:

Address:

Mobile No.

e-mail ID

We confirm that the information contained in this response or any part thereof, including its exhibits, and other documents and instruments delivered or to be delivered to IITH is true, accurate, verifiable and complete. This response includes all information necessary to ensure that the statements therein do not in whole or in part mislead the IITH in its short listing process.

We fully understand and agree to comply that on verification, if any of the information provided here is found to be misleading the short listing process or offering or accepting unduly favors from our company in the short listing process, we are liable to be dismissed from the selection process or termination of the contract during the project, if selected to do so, for undertaking the installation of said Project at IITH.

It is hereby confirmed that I/We are entitled to act on behalf of our corporation/company/firm/organization and empowered to sign this document as well as such other documents, which may be required in this connection.

Dated this Day of 2026

(Signature) (In the capacity of)

Duly authorized to sign the NIT Response for and on behalf of:

Sincerely,

[SYSTEM INTEGRATOR'S NAME]

Name

Title

Signature

Date

(Name and Address of Company) Seal/Stamp of System Integrator

CERTIFICATE AS TO AUTHORISED SIGNATORIES

I, certify that I am of the, and that
..... who signed the above response is authorized to bind the
corporation by authority of its governing body.

Date:

(Seal Here)

APPENDIX – II

RESPONSE FORMATS & SUPPORTING DOCUMENTS

The respondent must use the following formats to provide the information against each of the qualifying criteria specified in Section 5.

Form 1

Criterion I: Details of the Organization	
Name	
Nature of the legal status in India	
Nature of business in India	
Date of Incorporation	
Date of Commencement of Business	
Address of the Headquarters	
Address of the Registered Office in India	
Supporting Documents Certificate of Incorporation from Registrar of Companies (ROC), PAN, Service tax Certificate,	

FORM-02 :

Criterion II: Financial Information			
	FY 2025-26	FY 2024-25	FY 2023-24
Revenue (in INR Crores)			
Profit Before Tax (in INR Crores)			
Revenue from IT Services (in INR Crores)			

Form 3:

Criterion III: Support office in Telangana Information

Date of Commencement of Business:

Address of the Headquarters:

Address of the Registered Office in Telangana

Supporting Documents

Rent Agreement / Labours License / Bank Statements / Undertaking by the competent authority of the company to open the office within 1 month of Work commencement

APPENDIX- III
LITIGATION IMPACT STATEMENT
On Company letterhead

[Date]

To
The Executive Engineer-Electrical,
Construction and Maintenance Division,
IIT Hyderabad, Kandi, Sangareddy,
Telangana-502284.

Reference: Notice Inviting Tender for Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).

Dear Sir,

We have read and understood the contents of the Notice Inviting Tender and pursuant to this hereby confirm that we satisfy the eligibility criteria laid out therein. We hereby confirm that save as may be set out in the schedule attached to this statement, there is no litigation (including court, arbitration and other proceedings), inquiry or order from any regulatory authority, current or pending against us, which if adversely determined might have material adverse impact on our ability to carry on our business or pay our debts as they fall due or on our ability to enter into any of the transactions contained in or contemplated in respect of the *Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).*

(Signature) (In the capacity of)
Duly authorized to sign the NIT Response for and on behalf of:

Sincerely,
[BIDDER NAME]

Name

Title

Signature

Date

(Name and Address of Company) Seal/Stamp of System Integrator

TABLE-XX
BROAD CHECKLIST OF DOCUMENTS TO BE SUBMITTED ALONG WITH TENDER:

Sl. No.	Doc Ref	Description of the Document	Enclosed Yes/No	Remarks
1	Registration of Firm (ROF)	Copy of valid Registration of Firm (ROF)		
2	PAN details	Copy of PAN card		
3	GST registration details	Copy of GST Registration certificate & GSTIN should accompany the Technical Bid		
4	Details of similar works executed (Detailed Completion certificates & statements to be enclosed)	Three similar completed works each costing not less Rs.2,56,78,317.00/- only		
		Two similar completed works each costing not less Rs.3,85,17,476.00/- only		
		Three similar completed works each costing not less Rs.5,13,56,634.00/- only		
5	As per Para No. 1.4 of NIT	Cost of EMD (Rs.12,83,916/- only)		
6	As per Sl. No.2 of NIT	The Average annual financial turnover of the bidder should be at least Rs.1,92,58,738.00/- only during the immediate last three (03) consecutive financial years ending 31st March 2025 . The value of annual turnover figures shall be brought to current value by enhancing the actual turnover figures at simple rate of 7% per annum. The certificate from CA shall be attached with the bid.		
7	As per Sl. No. 3 of NIT	The bidder should not have incurred any loss (profit after tax should be positive) in more than two years during available last five consecutive balance sheets (balance sheet in case of private/public limited company means its standalone financial statement and consolidated financial statement both), duly audited and certified by the Chartered Accountant.		

8	As per Sl. No. 4 of NIT	Banker's Certificate or Net worth Certificate (as per the prescribed format given in NIT): The bidder shall submit the Banker's certificate or Net-worth certificate as per the below: Banker's Certificate of the amount equal to Rs. 2,56,78,317/-only issued by any scheduled bank, Or Net worth certificate of minimum amount Rs.64,19,579/-only, issued by certified Chartered Accountant with UDIN .		
9	As per Sl. No. 5 of NIT	The bidder should have bidding capacity equal to or more than Rs.6,41,95,793/-only.		
10	As per Sl. No. 6 of NIT	The tenderer shall have to furnish an affidavit as per Form 'J' of the NIT		
11	As per Sl. No. 7 of NIT	The bidder shall have Employees Provident Fund (EPF) enlistment and proof of the same shall be attached along with the Technical Bid clearly showing the Provident Fund Code number		
12	As per Sl. No. 8 of NIT	The bidder shall have the Employee State Insurance Corporation (ESIC) enlistment and proof of the same shall be attached with the Technical bid.		
13	As per Sl. No. 09 of NIT	The bidder shall submit the Indemnity bond as per format provided in Annexure-II.		
14	As per Sl. No. 10 of NIT	The bidder shall submit a valid and applicable Electrical contractor license of 11 kV or above voltage level along with its bid.		
15	As per Sl. No. 11 of NIT	The bidder shall submit the Manufacturer Authorization Certificate from the approved Original Equipment Manufacturer (OEM) of Compact secondary sub-station (CSS), DG Set, UPS, PAC, Inrow Cooling system and VRV AC System as per the format enclosed as Annexure-IV.		
16	As per Sl. No. 12 of NIT	The bidder shall submit the details of eligible similar nature of works completed during the last seven years ending previous day of last date of submission of tender as per the format enclosed as Form-D .		

17	As per Sl. No. 13 of NIT	The bidder shall submit the Performance report of works as per the format enclosed as Form-E .		
18	As per Sl. No. 14 of NIT	The bidder shall submit the Acceptance of tender terms & conditions as per the format enclosed as Annexure-III .		
19	As per Appendix -I	The bidder shall submit the Cover letter as per Appendix-I		
20	As per Appendix -II	The bidder shall submit the Response Formats & Supporting documents as per Appendix-II		
21	As per Sl. No. 15 of NIT	The bidder shall submit the Litigation Impact Statement as per the format enclosed as Appendix-III .		

Note: The above check-list is broad and indicative only. Apart from the above, the bidder shall ensure to submit all the documents along with his technical bid, which are specified in this Notice inviting Tender document and also which are otherwise appropriately required in support of its bid.

SECTION-11

EVALUATION CRITERIA:

The details submitted by the bidders shall be evaluated in the following manner:

- (i) The basic eligibility criteria as prescribed in Section 1.0 of this NIT in respect of experience of similar works completed, bidding capacity and financial turnover etc., shall first be scrutinized and the bidders basic eligibility for this work be determined.
- (ii) The bidders qualifying the basic eligibility criteria as set out in Section 1.0 of this NIT shall be evaluated for following criteria by scoring method on the basis of details furnished by them.
- (iii) The scoring for evaluation shall be done as per Table 1. The IITH reserves the right to restrict the list of such qualified bidders to any number deemed suitable by it.
- (iv) IIT Hyderabad may independently verify the credentials submitted by the bidder and may obtain the client feedback directly. In case of adverse feedback of the clients, those bids will be disqualified. The bidders shall give complete contact information of clients of eligible projects while submitting their credentials. Bids with incomplete submissions in this context shall be rejected.

5.5 EVALUATION BREAK-UP

The bidders qualifying the initial criteria for eligibility as set out in above paras, will be evaluated by the scoring method detailed below on the basis of details furnished by them:

(a) Financial strength (Form A, B & C)		Maximum 15 marks
1. Annual Turnover		10 marks
2. Bankers Certificate/Networth Certificate		5 marks
(b) Experience in eligible similar nature of work during last Seven years (Form "D")		Maximum 20 marks
<i>A site visit to the project(s) specified in NIT bid may be undertaken by the IITH nominee/committee to assess the quality of the work.</i>		
(c) Fulfilment of basic eligibility criteria related to Project as mentioned in Section-D i.e., submission of Detailed Project report including Technical feasibility; Technical Presentation etc.		
		Maximum 25 marks
1. Project report		15 marks
2. Technical Presentation by Bidder		10 marks
(d) Performance on work (Form "F")- Time over run		Maximum 20 Marks
(e) Performance on work (Form "F")- Quality		Maximum 20 Marks
		Total 100 Marks

Notes:

- 1. Criteria for evaluation of performance of the contractor is given in Form "K".*
- 2. To become eligible for qualification in technical bid evaluation, the bidder must secure at least fifty percent marks in each attribute (Section a, b, c, d & e) and sixty percent marks in aggregate.*
- 3. The department, however, reserves the right to restrict the list of bidders in NIT bid evaluation to any number, as deemed suitable by it.*
- 4. The average value of performance of works for time overrun and quality shall be taken on the basis of performance report of the eligible similar works.*

5.6 DISQUALIFICATION

Even though any bidder may satisfy the above requirements, he would be liable to disqualification if he has:

- made misleading or false representation or deliberately suppressed the information in the forms, statements and enclosures required in the eligibility criteria document.
- record of poor performance such as abandoning work, not properly completing the contract, or financial failures / weaknesses etc.,

TABLE-08**FORM-K****CRITERIA FOR EVALUATION OF THE PERFORMANCE OF BIDDERS FOR TECHNICAL ELIGIBILITY**

Sl.	Attributes	Marks	Evaluation	
(a)	<u>Financial Strength</u> (Maximum 15 Marks)		(i) 60% marks for minimum eligibility Criteria	
	(i) Average annual Turnover	10 Marks	(ii)100% marks for twice the minimum eligibility criteria or more.	
	(ii) Bankers Certificate/ Networth Certificate	05 Marks	(iii) In between (i) & (ii)- on pro-rata Basis	
(b)	Experience in similar class of work (Maximum 20 Marks)	20 marks	(i) 60% marks for minimum eligibility criteria (ii) 100% marks for twice the minimum eligibility criteria or more. (iii) In between (i) & (ii) – on pro-rata basis	
(c)	Submission of Project report with, Technical Presentation. (i) Project report (ii) Technical Presentation	25 marks	# Marks will be given based on the quality of documentation provided by the bidder and as per the assessment of Bid evaluation committee.	
		15marks		
		10marks		
(d)	Performance on works [Time Over Run (TOR)]: Maximum 20 marks			
	Parameter	Calculation for points	Score	Maximum Marks
	If TOR =		1.00 3.0 >3.50	20
	(i) Without levy of compensation		$\frac{20}{15} \times 10$	
	(ii) With levy of compensation		20 5 0 -5	
	(iii) Levy of compensation not decided		20 10 0 0	
	TOR = AT/ST, where AT =Actual Time; ST= Stipulated Time. Time in the Agreement plus (+) justified period of extension of time. Note: Marks for value in between the stages indicated above is to be determined by straight line variation basis.			
(e)	Performance of works (Quality): Maximum 20 Marks			

(i) Outstanding	20
(ii) Very Good	15
(iii) Good	10
(iv) Poor	0

Note:

Performance of work (Quality) certified as “satisfactory” will be treated as good.

- 1. *Criteria for evaluation of performance of the contractor is given in Form “K”.***
- 2. *To become eligible for qualification in technical bid evaluation, the bidder must secure at least fifty percent marks in each attribute (Sections a, b, c, d & e) and sixty percent marks in aggregate.***
- 3. *The department, however, reserves the right to restrict the list of bidders in NIT bid evaluation to any number, as deemed suitable by it.***
- 4. *The average value of performance of works for time overrun and quality shall be taken on the basis of performance report of the eligible similar works.***

SECTION-12

ANNEXURES

ANNEXURE-I

On non-judicial stamp paper of minimum Rs. 100

Guarantee offered by Bank to IITH in connection with the execution of contracts) Form of Bank Guarantee for Earnest Money Deposit /Performance Guarantee/Security Deposit/Mobilization Advance/Refund of milestone with held amount

1. Whereas the Executive Engineer (name of division), IITH on behalf of the President of India (hereinafter called "The Government") has invited bids under (NIT number)..... dated for (name of work)..... The Government has further agreed to accept irrevocable Bank Guarantee for Rs. (Rupees only) valid up to (date)*...as Earnest Money Deposit from (Name and address of contractor) (hereinafter called "the contractor") for compliance of his obligations in accordance with the terms and conditions of the said NIT.

OR**

Whereas the Executive Engineer (name of division), IITH on behalf of the President of India (hereinafter called "The Government") has entered into an agreement bearing number..... with (name and address of the contractor) (hereinafter called "the Contractor") for execution of work (name of work) The Government has further agreed to accept an irrevocable Bank Guarantee for Rs. (Rupees only) valid upto (date)..... as Performance Guarantee/Security Deposit/Mobilization Advance/Refund of mile stone withheld amount from the said Contractor for compliance of his obligations in accordance with the terms and conditions of the agreement.

2. We, (indicate the name of the bank) (herein after referred to as "the Bank"), hereby undertake to pay to the Government an amount not exceeding Rs. (Rupees only) on demand by the Government within 10 days of the demand.
3. We, (indicate the name of the Bank), do here by undertake to pay the amount due and payable under this guarantee without any demur, merely on a demand from the Government stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Contractor. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. (Rupees only).
4. We, (indicate the name of the Bank), further undertake to pay the Government any money so demanded notwithstanding any dispute or disputes raised by the contractor in any suit or proceeding pending On non-judicial stamp paper of minimum Rs. 100 before any Court or Tribunal, our liability under this Bank Guarantee being absolute and unequivocal. The payment so made by us under this Bank Guarantee shall be a valid discharge of our liability for payment there under and the Contractor shall have no claim against us for making such payment.

5. We, (indicate the name of the Bank)..... , further agree that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligation here under to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said contractor 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 or for any forbearance, act of omission on the part of the Government or any indulgence by the Government to the said Contractor or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.
6. We, (indicate the name of the Bank), further agree that the Government at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor at the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee the Government may have in relation to the Contractor's liabilities.
7. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor.
8. We, (indicate the name of the Bank)..... , undertake not to revoke this guarantee except with the consent of the Government in writing.
9. This Bank 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..... only) and unless a claim in writing is lodged with us within the date of expiry or extended date of expiry of this guarantee, all our liabilities under this guarantee shall stand discharged.

Date

Witnesses:

1. Signature.....

Authorized signatory

Name and address

Name

Designation Staff code no.

2. Signature

Bank seal

Name and address

* Date to be worked out on the basis of validity period of 90 days where only financial bids are invited and 180 days for two/three bid system from the date of submission of tender.

**In paragraph 1, strike out the portion not applicable. Bank Guarantee will be made either for earnest money or for performance guarantee/security deposit/mobilization advance/Refund of mile stone withheld amount, as the case may be.

ANNEXURE-II

INDEMNITY BOND (VIOLATION OF LAWS, NORMS, ACCIDENTS, DAMAGES ETC)

(On Non-Judicial Stamp Paper of Rs.100/-only)

Name of Project: Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).

KNOW all men by these presents that I/We _____ (Name of Contractor with address) do hereby execute Indemnity Bond in favour of Indian Institute of Technology (IIT) Hyderabad having their office at Kandi, Sangareddy-502284, Telangana, India and for the project IIT Hyderabad under consideration.

On this day of2026

THIS DEED WITNESSETH AS FOLLOWS:

I/We, (Name of Contractor) hereby do indemnify and save harmless IITH having their office at Kandi-502284, Sangareddy, Telangana, India from the following: -

1. Any third party claims, civil or criminal complaints/liabilities/material/life loss during site mishaps and other accidents such as snake bites etc or disputes and/or damages occurring or arising out of any mishaps at the site due to faulty work, negligence, faulty construction and/or for violating any law, rules and regulations in force, for the time being while executing/executed civil works by me/us.
2. Any damages, loss or expenses due to or resulting from any negligence or breach of duty on the part of me/us or any sub-Contractor/s if any, servants or agents.
3. Any claims by an employee of mine/ours or of sub-Contractors if any, under the workman compensation act and employers' Liability act, 1939 or any other law rules and regulations in force for the time being and any acts replacing and/or amending the same or any of the same as may be in force at the time and under any law in respect of injuries to persons or property arising out of and in the course of execution of the Contract work and/or arising out of and in the course of employment of any workman/employee.
4. Any act or omission of mine/ours or sub-Contractor/s if any, our/their servants or agent which may involve any loss, damage, liability, civil or criminal action.

IN WITNESS WHEREOF THE HAS SET HIS/THEIR HANDS ON THIS DAY OF SIGNED AND DELIVERED BY THE AFORESAID IN THE PRESENCE OF WITNESSES:

- 1.
- 2.

ANNEXURE-III
ACCEPTANCE OF TENDER TERMS & CONDITIONS
(To be given on Company Letter Head)

Date:

To
The Executive Engineer-Electrical,
Indian Institute of Technology Hyderabad,
Kandi – 502 284,
Telangana, India.

Sub: Acceptance of Terms & Conditions of Tender.

Tender Reference No: _____

Name of work: - **Construction/Establishment of New Institute Data Center (IDC) at Computer Science Engineering (CSE) Department in AD2 Building at IIT Hyderabad Campus, Kandi, Sangareddy (Sub Head: Electro-Mechanical works).**

Dear Sir,

1. I/ We have downloaded / obtained the NIT/ tender document(s) for the above mentioned 'NIT' from the web site(s) namely _____ as per your advertisement, given in the above-mentioned website(s).
2. I / We hereby certify that I / we have read the entire terms and conditions of the tender documents (including all documents like annexure(s), schedule(s), etc.), which form part of the contract agreement and I / we shall abide hereby by the terms / conditions / clauses contained therein.
3. The corrigendum(s) issued from time to time by your IITH too have also been taken into consideration, while submitting this acceptance letter.
4. I / We hereby unconditionally accept the tender conditions of above-mentioned tender document(s) / corrigendum(s) in its totality / entirety.
5. I / We certify that all information furnished by the our Firm is true & correct and in the event that the information is found to be incorrect/untrue or found violated, then IIT Hyderabad shall without giving any notice or reason therefore or summarily reject the bid or terminate the contract, without prejudice to any other rights or remedy including the forfeiture of the full said earnest money deposit absolutely.

Yours Faithfully,

(Signature of the Bidder, with Official Seal)

SECTION-13

FORMS

FORM-A

FINANCIAL INFORMATION

Name of Bidder:

- I. Financial Analysis Details to be furnished duly supported by figures in balance sheet/ profit loss account for the last five years duly certified by the Chartered Accountant, as submitted by the applicant to the Income Tax Department (Copies to be attached).

Fig in Lakhs Rs.

Sl. No.	Particulars	Financial Years				
		2022-23	2022-23	2023-24	2024-25	2025-26
i)	Turnover of construction Works					
ii)	Profit /Loss					

II. Financial arrangements for carrying out the proposed work.

III. Net worth Certificate from Bankers of the bidder in the prescribed Form B.

Signature of Chartered Accountant with Seal

Signature of Bidder(s)

FORM – B

FORM OF BANKERS' CERTIFICATE' FROM A SCHEDULED BANK

To
The Executive Engineer -Electrical
Construction and Maintenance Division,
IIT Hyderabad.

This is to certify that to the best of our knowledge and information that Ms./Shri.....
.....having marginally noted address, a customer of our bank are/is respectable and can be treated as good
for any engagement up to a limit of Rs.....(Rupees.....).

This certificate is issued without any guarantee or responsibility on the bank or any of the officers.

(Signature with seal of Branch Manager)

For the Bank NOTE: (1) In case of partnership firm, certificate should include names of all partners as recorded with the Bank.

2. The bankers certificate should be on letter head of the bank

FORM - C

FORM FOR CERTIFICATE OF NET WORTH FROM CHARTERED ACCOUNTANT

It is to certify that as per the audited balance sheet and profit & loss account during the **financial year 2024-25**), the Net Worth of M/s _____(Name & Registered Address of contractor/ Individual/firm/company), as on _____(the relevant date) is Rs._____after considering all liabilities. It is further certified that the Networth of the company has not eroded by more than 30% in the last three years ending on **31st March 2025 or March 2026**.

Signature of Chartered Accountant

Name of Chartered Accountant

Membership No. of ICAI

Date and Seal

NOTE: The Turnover Certificate and Networth certificate shall be submitted by the Intending bidder for the same set of consecutive 03 financial years only.

DETAILS OF ELIGIBLE SIMILAR NATURE OF WORKS COMPLETED DURING THE LAST SEVEN YEARS ENDING PREVIOUS DAY OF LAST DATE OF SUBMISSION OF TENDER

Sl. No.	Name of work/ project and Location	IITH or sponsoring Organization	Cost of work (in Crores)	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Litigation /arbitration pending / in progress with details*	Name and address (Postal & email)/ contact no of officer	Whether the work was done on back to back basis. Yes / No
1	2	3	4	5	6	7	8	9	10

***Indicate gross Amount Claimed and Amount Awarded by the Arbitrator.**

NATURE (S) OF BIDDER (S) (WITH STAMP)

FORM "E"**LIST OF THE PROJECTS UNDER EXECUTION OR AWARDED**

Sl. No.	Name of work/ project and Location	IITH or sponsoring Organization	Cost of work (in Crores)	Date of commenc- ement as per contract	Stipulated date of completion	Present Progress (Financial & Physical)	Litigation / arbitratio n pending / in progress	Name and address (Postal & email)/ contact no of officer	Whether the work being done on back to back basis. /No

***Indicate gross Amount Claimed and Amount Awarded by the Arbitrator.**

SIGNATURE (S) OF BIDDER (S) (WITH STAMP)

FORM 'F'**PERFORMANCE REPORT OF WORKS REFERRED IN FORM -B& C:**

(Bidder may suggested to submit the Performance Report with the details covering in this Form-F)

1.	Name of work / Project & Location	
2.	Agreement No.	
3.	Estimated Cost	
4.	Tendered Cost	
5.	Actual Value of work done.	
6.	Date of Start	
7.	Date of completion	Yes / No.
	i) Stipulated Date of Completion (as mentioned in work order)	
8.	ii) Actual Date of Completion	
	i) Whether case of levy of compensation for delay has been decided or not	
9.	ii) If decided, amount of compensation levied for delayed completion, if any.	
	1) Quality of Work	Outstanding / Very Good / Good / Poor
	2) Financial Soundness	Outstanding / Very Good / Good / Poor
	3) Technical Proficiency	Outstanding / Very Good / Good / Poor
	4) Resourcefulness	Outstanding / Very Good / Good / Poor
	5) General Behaviour	Outstanding / Very Good / Good / Poor
Dated:		Executive Engineer or Equivalent with office stamp

FORM "G"

STRUCTURE ORGANISATION

1. Name address of the bidder:
2. Telephone no./Telex no./Fax no.:
3. Legal status of the bidder (attach copies of original document defining the legal status):
 - (a) An Individual
 - (b) A proprietary firm
 - (c) A firm in partnership
 - (d) A limited company or Corporation
4. Particulars of registration with various Government Bodies (attach attested photocopy):

Organization/Place of registration

Registration No.

- i.**
- ii.**
- iii.**

5. Names and titles of Directors Officers with designation to be concerned with this work:
6. Designation of individuals authorized to act for the organization:
7. Was the bidder ever required to suspend construction for a period of more than six months continuously after he commenced the construction? If so, give the name of the project and reasons of suspension of work:
8. Has the bidder, or any constituent partner in case of partnership firm, ever abandoned the awarded work before its completion? If so, give name of the project and reasons for abandonment:
9. Has the bidder, or any constituent partner in case of partnership firm, ever been debarred/black listed for tendering in any organization at any time? If so, give details:
10. Has the bidder, or any constituent partner in case of partnership firm, ever been convicted by the court of law? If so, give details:
11. In which field of Civil Engineering construction the bidder has specialization and interest?:
12. Any other information considered necessary but not included above.:

Signature of Bidder(s)

FORM "H"**DETAILS OF TECHNICAL & ADMINISTRATIVE PERSONNEL TO BE
EMPLOYED FOR THE WORK**

S.No.	Designation	Total Number	Number available for this work	Name	Qualifications	Professional experience and details of work carried out	How these would be involved in this work	Remarks

Signature of Bidder(s)

LIST OF CONSTRUCTION PLANT AND EQUIPMENT LIKELY TO BE USED IN CARRYING OUT THE WORK

Sl. No.	Name of equipment	No.	Capacity or Type	Age	Condition	How is it used			Current location	Remarks
						Presently owned	Leased	To be Purchased		

Signature of Bidder(s)

AFFIDAVIT

I/we undertake and confirm that our firm/partnership firm has not been blacklisted by any state/Central Departments/PSUs/Autonomous bodies during the last 7 years of its operations. Further that, if such information comes to the notice of the department then I/we shall be debarred for bidding in IIT Hyderabad in future forever. Also, if such information comes to the notice of IIT Hyderabad on any day before date of start of work, the Engineer-in-charge shall be free to cancel the agreement and to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee (Scanned copy of this notarized affidavit to be uploaded at the time of submission of bid)

NOTE: Affidavit to be furnished on a 'Non-Judicial' stamp paper worth Rs.100/-

Signature of Bidder(s) or an authorized Officer of the firm with stamp

Signature of Notary with seal

FORM-L

**WLLINGNESS CERTIFICATE FROM CONCERNED COMPETENT
ASSOCIATE CONTRACTOR**

(Separate for each sub head of E&M work)

Name of Work:

I hereby give my willingness to work as E&M Contractor for Sub Head of the above mentioned work. I will execute the work as per specifications and conditions for the agreement and as per direction of the Engineer-in-charge. Also I will employ full time technically qualified supervisor for the works.

I will attend inspection of officers of the department as and when required.

Signature of Main Contractor

Address Telephone: FAX:

Email:

Signature of Associate Electrical
Contractor

and Registration Detail Address:

Telephone:

FAX:

Email:

AFFIDAVIT OF MEMORANDUM OF UNDERSTANDING (MOU)

(to be submitted for each and every E&M component on Non-Judicial stamp paper of Rs.100/- only)

1. M/s. (Name of the firm with full address) Enlistment Status

Valid Up to:

(Henceforth called the main Contractor)

2. M/s. (Name of the firm with full address) Enlistment Status

Valid Up to:

(Henceforth called Associate Contractor or Electrical contractor) For the execution of E & M Work)

Name of Project:

We state that M.O.U between us will be treated as an agreement and has legality as per Indian Contract Act (amended up to date) and the IITH can enforce all the terms and conditions of the agreement for execution of the above work. Both of us shall be responsible for the execution of work as per the agreement to the extent this MOU allows. Both the parties shall be paid consequent to the execution as per agreement to the extent this MOU permits. In case of any dispute, either of us will go for mediation/arbitration by the Superintending Engineer (SE) or above, IITH In charge. His decision shall be final and binding on both of us.

We have agreed as under:

1. The Associated Contractor will execute all E & M works in the wholesome manner as per terms and conditions of the agreement. The associate contractor shall be paid as per standard procedure followed by the department and the agreement between parties. Any type of internal transaction between the associate contractor and the main contractor shall be as per their convenience and mutual understanding without involving the department.
2. The Main contractor will execute E & M works by associated electrical contractor as per contract.
3. All the machinery and equipment, tools and tackles required for execution of the E & M works, as per agreement, shall be the responsibility of the Associated Contractor.
4. The site staff required for the E & M work shall be arranged by the Associated Contractor as per terms and conditions of the agreement.
5. Site order book maintained for the said work shall be signed by the main contractor as well as by the Engineer of the Associated Contractor and by Associated Contractor himself.

6. All the correspondence regarding execution of the E & M work shall be done by the department with the Associated Contractor with a copy to the main contractor. In case of non-compliance of the provisions of agreement, the main contractor, as well as the associated contractor shall be responsible. The action under relevant clause of contract will be taken.
7. The main contractor will make payment to associate contractor as and when bill paid by department, failure to which department shall make payment to associate contractor as per contract condition.

Name of the Sub Head to be indicated:

SIGNATURE OF MAIN CONTRACTOR with Address, telephone No., FAX, email

DATE:

PLACE:

SIGNATURE OF ASSOCIATED CONTRACTOR with Address, telephone No., FAX, email

Date:

Place:

1. Witness with address

2. Witness with address

(From major component contractor side) (From minor component contractor side)

Countersigned Executive Engineer(E)

List of Minimum number of Testing Equipment's for Electrical & Mechanical works

- 1) Megger(LT/HT)- 2 nos.
- 2) Earth Resistance Tester 2 nos.
- 3) Wire Gauge 2 nos.
- 4) Multi meter 2 nos.
- 5) Vernier Calipers 2 nos.
- 6) Tong Tester 2 nos.
- 7) 3-Phase Power Analyzer

SECTION-14

PROFORMA OF SCHEDULES: A TO F

SCHEDULE “A” : Volume 2 (Price Bid)

SCHEDULE “B” : - : Nil-

Schedule of material to be issued to the agency

SCHEDULE “C” : -Nil-

Tools and Plants to be hired to the agency.

SCHEDULE “D” : Nil

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

SCHEDULE “E” : **For Original works component:**

Reference to General Conditions of Contract

1. General Conditions of Contract of CPWD for EPC Works; GCC for EPC Projects 2024(with upto date amendments)
2. CPWD Works Manual 2024(with upto date amendments)
3. Standard Operating Procedures 2024 for CPWD Works Manual 2024 (with upto date amendments)
4. **For Operation and Maintenance O&M Component (if applicable):** CPWD GCC for Maintenance works 2023 and CPWD Maintenance Manual 2023 as amended/ modified up to the last date of submission of Bid.

Estimated Cost of Work	: Rs.6,41,95,792.00 /- only. [Part A (Electrical and Mechanical works): Rs. 6,41,95,793/- only Part B (Operation & Maintenance): If Applicable
Earnest Money Deposit	: Rs.12,84,000.00/-
Performance Guarantee	: 5% of accepted tender value for Part-A (Original works component) or ECPT (whichever is Higher), Prior to the commencement of work and 5% of the accepted tender value for Part-B (O&M Component), Prior to the commencement of supplementary agreement(if any) .
Security Deposit	: 2.50% of bid amount + 50% of the PG amount shall be retained as Security Deposit for the Defect Liability Period (DLP).

SCHEDULE "F" (GENERAL RULES & DIRECTIONS)

- | | |
|--|--|
| a) Officer inviting Tender
Construction and Maintenance Division (CMD),
IIT Hyderabad. | : Executive Engineer (Electrical), |
| b) Applicable mode of EPC Contract | : Engineering, Procurement & Construction (EPC) Mode – I |
| c) Mode of Technology to be adopted | : Broadly as per NIT Specifications |
| d) Maximum % of quantity of items of works to be executed of | : (i) Electrical -Mechanical and associated works.....100%
(ii) Civil and associated works.....0% |

Definitions:

- | | |
|--|--|
| (i) Engineer-in-charge of Project | : Executive Engineer (Electrical), IITH or successor thereof. |
| (ii) Accepting Authority | : Director, IIT Hyderabad or successor thereof. |
| (iii) Percentage on cost of materials and Labour to cover all overheads and profits: 15% (Fifteen Percentage) | |
| (iv) Standard Schedule of Rates | : CPWD Plinth Area Rates 2025, CPWD DSR (E&M) 2025 with modifications and correction slips up to date of submission of bids + Cost Index applicable. |
| (v) Department | : Construction and Maintenance Division |
| (vi) Standard Contract Form | : CPWD Form 8 & GCC 2024 for Works on EPC mode enclosed with this tender document |

Clause 1:

Time allowed for submission of Performance Guarantee, programme chart (Time and Progress) and applicable labour licenses, registration with GST, EPFO, ESIC and BOCW Welfare Board or proof of applying thereof from the date of issue of letter of acceptance, as applicable for this project.

: 15 days

Maximum allowable extension with late fee (non-refundable) @ 0.1% per day of Performance Guarantee amount beyond the period provided in (i) above

: 7 days with late fee @ 0.1% per day of PG amount

Clause 2:

Authority for fixing compensation under clause 2

: Superintending Engineer, Construction and Maintenance Division, IIT Hyderabad or successor thereof.

Clause 5:

Number of days from the date of issue of letter of acceptance for reckoning date of start

: 15 days from Letter of Acceptance or handing over of site, whichever is later.

5.1.1 (a) Schedule of Handing over of site:

: 15 days from Letter of Acceptance (LoA)

5.1.1.(b) Schedule of issue of Designs:

: Not Applicable

Clause 5.7:

Recording of hindrances

: Applicable

Table of Milestones for Project Completion
Time Period Allowed:07 Months

Sl. No.	Milestone Programme	Time Allowed (from date of start)	Amount to be withheld in case of non- achievement of milestone
1	Planning and Designing – Submission and approval of all design calculations, drawings, Design Basis Reports (DBRs), Feasibility Reports, Electrical Load calculations, heat Load calculations, Electrical SLDs, Services Routing plans, BMS Architecture, DG Set, UPS System, Fire suppression system design, VESDA, WLD, Inrow cooling solutions, PAC Design, VRV System Design, Busbar power distribution system design and other essential services and systems design and allied drawings good for construction, Technical Data Sheets(TDS) Approval of all above components from the Engineer In Charge (EiC) of project.	01 Month	1 % of total contract amount of Part-A
2	Delivery of Electro-Mechanical equipment and Systems including Wiring & Internal Lighting, DB'S, MCB's, Cable trays, switch, Sockets, MV Power Cables, Hume pipes, MV Electrical Panels, Earthing & fire alarm system (FAS), Gas Based Fire Suppression System, Variable Refrigerant Volume (VRV) System, DG Set along with AMF Panel, UPS, Batteries, Compact Secondary Substation (CSS), IT Racks Bus bar Power distribution System, BMS, CCTV, Access control system, Inrow Cooling system, PAC units, WLD System, Rodent Repellant system, and other allied components and Systems and upon submission of their Delivery Chalan/Tax Invoice copies.	04 Months	1.5 % of total contract amount of Part-A

3	Installation of Electro-Mechanical equipment and Systems including Wiring & Internal Lighting, DB'S, MCB's, Cable trays, switch, Sockets, MV Power Cables, Hume pipes, MV Electrical Panels, Earthing & fire alarm system (FAS), Gas Based Fire Suppression System, Variable Refrigerant Volume (VRV) System, DG Set along with AMF Panel, UPS, Batteries, Compact Secondary Substation (CSS), IT Racks Bus bar Power distribution System, BMS, CCTV, Access control system, Inrow Cooling system, PAC units, WLD System, Rodent Repellant system, and other allied components and Systems and upon submission of their Delivery Chalan/Tax Invoice copies.	6.0 Months	1.5 % of total contract amount of Part-A
4	Testing and Commissioning- Completion of Testing, Commissioning of all electrical, mechanical components, systems and works including load testing with `DG Set, UPS, CSS, VRV Air Conditioning systems, PAC System, Inrow cooling system, including USAT with all BMS, and Fire Suppression system, Fire Alarm System, VESDA System, WLD, CCTV and other allied systems and components etc., up to the satisfactory of EiC.	6.5 Months	0.5 % of total contract amount of Part- A
5	Final Trial Run- Completion of Performance testing, Fifteen (15) Days Trial run and commissioning of Data Centre including all allied works related to mechanical/ electrical / instrumentation/ Automation works and declaration of provisional completion of Part-A by EiC.	07 months	0.5 % of total contract amount of Part-A

NOTE:

1. Withheld amount shall be released if and when subsequent milestone is achieved within respective time specified. However, in case milestones are not achieved by the Contractor for the work, the amount shown against milestone shall be withheld without prior notice.
2. Intending bidder may submit phasing of activities/milestones based on their resources and methodology at the time of bidding corresponding to physical milestones/stages indicated in the above table. These shall be formed part of the agreement after approval of the accepting authority, otherwise it would be assumed that agency agrees with the above mentioned physical milestones.

Time allowed for execution of this work**: 07 Months**

Authority to decide:			
(i)	Extension of time	:	Superintending Engineer, IIT Hyderabad or successor thereof.
(ii)	Rescheduling of mile stones	:	Superintending Engineer, IIT Hyderabad or successor thereof.
(iii)	Shifting of date of start in Case of delay in handing over of site	:	Superintending Engineer, IIT Hyderabad or successor thereof.
Clause 6:		:	Applicable
Clause 7:			
	Gross work to be done together with net payment /adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment.	:	(i)As per Schedule of Stage Payment of Original works (Part-A), the minimum amount eligible for interim payment is Rs. 20 Lacs for first three RA bills. This value includes admissible amount of Secured Advance. However, Engineer in charge at his discretion may release monthly payment even at a lesser amount but the contractor cannot claim as a matter of right and no interest is permitted.
Clause 7A:		:	Yes, Applicable No Running Account Bill shall be paid for the work till the applicable labour licenses, registration with GST, EPFO, ESIC and BOCW Welfare Board, whatever applicable as submitted by the Bidder to the Engineer-in Charge.
Clause 8A:			
	Authority to decide compensation on account if contractor fails to submit completion plans	:	Superintending Engineer, IIT Hyderabad
	This shall not apply for maintenance or upgradation contracts not involving any services For other works, the limit shall be as	:	

	below:		
Clause 10A:			Applicable
	List of testing equipment to be provided by the agency at site lab	:	As per applicable CPWD Specifications and NIT Particular Specifications or as Instructed by the Engineer In Charge (EiC)
Clause 10 B (i):		:	Applicable
Clause 10 B (ii):		:	Applicable as per GCC
Clause 10 B (iii):		:	Not Applicable
Clause 10 B (iv) & (v):		:	Applicable
Clause 10CC:		:	Applicable
Clause 10CC for Maintenance Period:		:	Not applicable
Clause 11:			
	Specifications to be followed for execution of work	:	Civil work: (1) CPWD Specifications 2019 Volume- I & II with corrections slips up to last date of submission of bid. Electrical work: 1. CPWD General Specifications for Electrical Works- Part I Internal 2023 (with upto date amendments) 2. CPWD General Specifications for Electrical works- Part II External 2023(with upto date amendments) 3.CPWD General Specifications for Electrical works- Part IV Substation 2013 (with upto date amendments) 4.CPWD General Specifications for Electrical Works-Part VI Fire Detection and Alarm System 2018 (with upto date amendments) 5.CPWD General Specifications for Gas Based Fire Extinguishing System 2013 6. CPWD General Specifications for Electrical Works- Part VII DG Sets 2013 (with upto date amendments) 7. CPWD General Specifications for Heating, Ventilation & Air-Conditioning (HVAC) 2024 8.Particular Specifications provided in the NIT document.
Note:			
	i) All above specifications shall be applicable along with all correction slips up to the last date of submission/uploading of Bid. ii) In case of discrepancy in mentioned items / description among any of the following two or more		

		documents, the following order of preference shall be followed. If any item required for completing the work in any of the following documents but not in the order of preference below, shall be applicable and nothing extra shall be paid on this account. However, percentages mentioned in “Schedule of Building wise Sub-Heads” shall have precedence among all the following documents for payment purpose. - Description under Scope of work & Nomenclature of BOQ. - Architectural Drawings and Schedule of finishes. - Schedule of Quantities. - Technical Specifications, Particular Specification and Special Condition, if any - CPWD Specifications, Electrical & Mechanical and Civil with up to date corrections as on last date of submission of Bid. - GCC for EPC Projects enclosed with the Bid - Indian Standard Specifications of B.I.S. - National Building Code 2016 - Manufacturers specifications. - Sound Engineering practices. - Decision of Engineer-in-charge. Note: A reference made to any Indian Standard Specifications in these documents, shall imply to the latest version of that standard, including such revisions/ amendments as issued by the Bureau of India Standards up to last date of submission of tenders. The Contractor shall keep at his own cost all such publications of relevant Indian Standard applicable to the work at site, with correction slips up to last date of submission of bids.
Clause 12:	:	Applicable only for the original construction work. Type of work: Project and original work
Clause 12.1: Deviation/variation limit:	: :	Applicable 5%
Clause 12.2: Payment of deviations/variations beyond 0.25% of the accepted tendered amount.	:	In case there is any change in scope as defined in the contract, the contractor shall carry out the changes as per direction of Engineer- in Charge and nothing extra shall be payable to the contractor on account of same if the additional cost of such work is up to 0.25% (zero-point two five percent) of the accepted tendered amount and worked out as per sub-clause 12.3 of GCC 2022. Variations/ deviations up to 0.25% (zero-point two five percent) of the accepted tendered amount shall be deducted from overall variations/ deviations for making payment.
Clause 12.3 & Clause 12.4:	:	Applicable
Clause 16:		
Action in case Work not done as per Specifications	:	Superintending Engineer (Civil), IIT Hyderabad.

Clause 17:	:	Defects liability period shall be Five (05) years after declaring the completion of work by the Executive Engineer (Electrical) IIT Hyderabad. However, the final completion certificate of the project shall be issued by Superintending Engineer, IIT Hyderabad.
Clause -19,19A,19B,19C,19D,19E,19F, 19G,19H,19I,19J,19K,19L	:	Applicable
Authority to decide penalty for each default under 19C, 19D, 19G & 19K	:	Executive Engineer (Electrical)
Clause 25: Settlement of disputes by Conciliation and Arbitration:		
Conciliator	:	Dean (Planning)
Authority to appoint arbitrator	:	Director, IIT Hyderabad
Seat of Arbitration	:	Hyderabad
Venue of Arbitration	:	IIT Hyderabad
Type of Arbitration Tribunal	:	Sole Arbitrator
<i>Note: Provisions of Arbitration and Conciliation Act 1996 with latest amendments in force shall be applicable.</i>		
Clause 31:	:	Not Applicable

Clause 32:

A. The Requirement of Technical / Architectural Personnel required to be deployed for planning stage (Till all the Architectural & structural drawings are prepared & got approved) and their recovery rates at which recovery shall be made from the Contractor in the event of not fulfilling the provision of clause 32(i) are as below:

Sl. No.	Qualification	Discipline	Number	Minimum Experience (Years)	Designation	Rate of recovery
1	Graduate Engineer – IT/CS Engineer	IT/CS Engineering	1	10	Lead Planner-Data Center	Rs. 70,000/- per month
2	Graduate Engineer - Electrical Engineer	Electrical Engineering	1	10	Lead Planner - E&M	Rs. 70,000/- per Month per person

B. The Requirement of Technical Representative(s) at Site execution and Recovery Rates at which recovery shall be made from the Contractor in the event of not fulfilling the provision of clause 32(i) are as below:

S. No.	Minimum Qualification of Technical Representative	Number	Minimum experience (years)	Designation Technical Staff	Rate at which recovery shall be made from the contractor in the event of not fulfilling provision of clause 32 (i)	
					Figures	Words
1	Graduate Engineer	1	10 (and having experience of one similar nature of work)	Project Manager	Rs. 100000/- per month	(Rupees Sixty Thousand per month)
3	Graduate Engineer Or Diploma Engineer – Electrical/Electrical and Electronics	1	5 respectively	Project / Site Engineer-Electrical	Rs. 50000/- per month	(Rupees Twenty Five Thousand per month)
4.	Graduate Engineer Or Diploma Engineer-Mechanical	1	5 respectively	Project Planning / billing Engineer-Mechanical	Rs. 50000/- per month	(Rupees Fifteen Thousand per month)

5	Safety Engineer/ Graduate	1	5	Ensuring Quality & Safety measure	Rs. 30,000/- per month per person	(Rupees Thirty Thousand per month)
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Note:

1. The requirement shown above is the peak requirement. Deployment of personnel as per actual need shall be made by the Contractor as directed by Engineer- in- Charge.
2. The specialized technical staff for execution for components such as Electrical, Mechanical and Civil structures etc. shall be deployed as per the requirement of work.
3. Assistant Engineers retired from Government services who are holding Diploma will be treated at par with Graduate Engineers. Diploma holder with minimum 10-years relevant experience with a reputed construction company can be treated at par with Graduate Engineers for the purpose of such deployment subject to that such diploma holder should not exceed 50% of requirement of degree engineers.
4. The bidder shall submit a certificate of employment of the technical representative(s) (in the form of copy of Form – 16 or CPF deduction issued to the Engineers employed by him) along with every account bill / final bill and shall produce evidence of regular physical availability of such engineers on the above project whenever required by the Engineer – in – charge.

Clause 38 Applicable as given below

1	Schedule/statement for determining theoretical quantity of cement & bitumen based on Delhi Schedule of Rates.	Delhi Schedule of Rates 2023 with amendments up to the date of submission of bid.
	Variations permissible on theoretical quantities.	
	Cement	
	Cement for works with estimated cost put to tender more than Rs. 5 Lakh.	2% Plus/Minus
	Bitumen for all works.	2.5% Plus only and nil on minus side.
	Steel reinforcement and structural steel	2% Plus/minus side sections for each diameter, section and category.
	All other materials	Nil

RECOVERY RATES FOR QUANTITIES BEYOND PERMISSIBLE VARIATION

S. No	Description of item	Rates in figure and word at which recovery shall be made from th	
		Excess beyond permissible variation	Less use beyond the permissible variation
1	Cement (PPC)	NIL	Not Permitted
2	Reinforcement bars(TMT) (a)Primary Producer	NIL	Not Permitted
3	Structural steel	NIL	Not Permitted

SECTION- 15

SPECIAL CONDITIONS OF CONTRACT

9.0 GENERAL:

- 9.1 Special Conditions of Contract shall be read in conjunction with the General Conditions of Contract, Schedule of Quantities, specifications of work, approved drawings and any other documents forming part of this contract wherever the context so requires. The order of precedence of the above documents shall be interpreted as per General Conditions of Contract.
- 9.2 Notwithstanding the sub-division of the document into these separate sections and volumes, every part of each shall be deemed to be supplementary of every other part and shall be read with and into the contract so far as it may be practicable to do so.
- 9.3 The materials, design and workmanship shall satisfy the relevant Indian Standards (Latest), the job specifications contained herein and other national / international codes (Latest) referred to. Where the job specifications, stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied. In the absence of any Standards/Specifications/Codes of practices for detailed specifications covering any part of the work covered in this tender, Contractor shall ensure that the work is executed as per the best and sound engineering practices and/or as per the instructions/ directions of Engineer- in-Charge. The decision of EIC as regards the specification to be adopted and their interpretation and the mode of execution of work shall be final and binding on the Contractor and no claim whatsoever shall be entertained on this account.
- 9.4 The Contractor shall execute the whole and every part of the Works in the most professional and workman-like manner and both as regards materials and in other respects in strict accordance with specifications and latest Indian and international codes.
- 9.5 The Contractor shall put in place a Vehicle Wash area to ensure that the vehicles exiting the construction work site are free from sediment to avoid dirtying the public roads.
- 9.6 The Contractor shall carefully protect and preserve all bench marks, site details, pegs and other things used in the setting out of the building for Construction. All preliminary works such as establishment of a set of bench marks, permanent DGPS, Total Station/theodolite stations, for the commencement and during the progress of the work and till physical completion of the work shall be carried out by the Contractor at his own cost. It shall be Contractor's responsibility to shift the existing benchmark to his work site to set out the necessary control points and alignment of the various works. The Contractor shall also provide DGPS instrument with other required precision Survey Instruments as per site requirement and/or as directed by EIC. The work of setting out shall be deemed to be a part of general works preparatory to the execution of the work and no separate payment shall be made for the same.
- 9.7 The work will be carried out in accordance with the architectural drawings and structural drawings as approved by the Engineer-in- Charge. The structural and architectural drawings shall have to be properly correlated before executing the work. Working drawings will be submitted by the contractor timely for progressive work and enable EIC to approve the drawings.
- 9.8 Shop drawings giving complete information for the fabrication of the component parts including the location, type, size, length and details of connections shall be prepared well in advance by the contractor before the actual fabrication and got approved from the respective consultants, who are appointed and subsequent approvals of Engineer-in-Charge. Delay in submission of the drawings by the contractor causing consequent delay in approval by the respective consultant shall not absolve the contractor of his responsibilities.

- 9.9 As the Contract is in EPC Mode-1, the Contractor have to supply designs and shop drawings and which got to be approved by respective consultants or Indian Institute of Technology or any other Institute of repute for the particular items as specified and approved subsequently by Engineer-in-charge, and all costs towards the same, including charges for approvals by third party shall be deemed to have been included in the quoted rates.
- 9.10 Architectural drawings shall take precedence over other services drawings in respect of overall dimensions unless and otherwise directed by EIC.
- 9.11 All temporary works, ancillary works, enabling works, including dewatering of surface and subsoil water, preparation and maintenance of temporary drains at the work site, preparation and maintenance of approaches to working areas, wherever required, for execution of the work, shall be the responsibility of the Contractor and all costs towards the same shall be deemed to have been included in the quoted prices.
- 9.12 The Contractor shall, at his own expense and without extra charges, make provision for all pumping, de-watering, dredging or bailing out water, if necessary, irrespective of the source of water. The water so pumped out shall be discharged as per local byelaws and as approved by the Engineer-in-charge. The Contractor shall also take all necessary precautions in diverting channels and in discharging the drained water as not to cause damage to the works, crops or any other property within/outside the plot. Excavated area for the basement/ foundation trenches shall be kept free from water while all the works below Ground level are in progress. Nothing extra shall be paid on this account in terms of time and cost.
- 9.13 The Contractor shall at his own expense and without extra charges, take all precautions such as shoring for all depths or any other arrangement as approved by Engineer-in-Charge for ensuring that there shall be no sliding / collapsing of the excavated earth. The measurement for excavation shall be regulated as per the provisions of the MOHTH specification and Nothing extra shall be payable on account of shoring / other arrangements.
- 9.14 Earth work in excavation and filling for, building works shall be governed under provisions of CPWD Specifications and Delhi Analysis of Rates (DAR).
- 9.15 Further contractor shall take all necessary precautions to protect and safe guard the foundation of the adjacent building / Structure / Overhead/Underground utilities. Nothing extra shall be payable on this account.
- 9.16 For the building items covered by CPWD Specifications shall be executed accordingly. Where it is felt that the CPWD Specifications concerned does not reflect the full scope of work under any item, those items shall be executed as per the Indian Standards or any other relevant Specifications.
- 9.17 Should work be suspended by reason of rain, strike, lockouts or any other cause, Contractor shall take all precautionary measures for the protection of works and at his own cost and shall make good any damage arising from any of these causes to satisfaction of EIC.
- 9.18 Work shall normally be done in a single shift/day. However, if the work is required to be executed in more than one shift in a day for meeting the time lines, the Contractor with prior approval of the Engineer - in -charge, shall have to make necessary arrangements for the same and all costs towards the same shall be deemed to have been included in the quoted rates.
- 9.19 Defect liability period shall start from the date of taking over of sectional completion of building after its completion in all respects as mentioned in Schedule-F@clause-5 and as per the scope of the contract by the Engineer – in - charge.
- 9.20 After completion of Project as mentioned in Schedule-F of the contract, the Solar Plant shall be taken over by the Institute and put to use. To ensure safety of the occupants and prevent from dust & debris, the contractor has to hard barricade the on-going solar plazas being constructed by them nearby, as per the directions of Engineer in Charge.

9.21 LABOUR CAMP:

IITH shall not permit the contractor to set up labour camp within its boundary. Contractor shall make his own arrangements to set up labour camps. The facilities like dwelling units, water supply, lighting arrangement, drainage and sanitation as stipulated in Clause- 19H of the contract shall be arranged by the Contractor and all costs towards the same shall be deemed to have been included in the quoted rates.

9.27 The Contractor shall put in place an arrangement for controlled entry and exit of labourers / workers / technicians with Gate Passes or Identification Badges with Colour photographs individually authorized by the Contractor or through Bio-metric system at entry & exit gates as required and all costs towards the same shall be deemed to have been included in the quoted prices.

9.28 MAINTENANCE OF REGISTER OF TESTS: -

All the registers of tests carried out at Construction Site or in outside laboratories shall be maintained by the contractor which shall be issued to the contractor by Engineer-in-charge. Contractor shall be responsible for safe custody of all the test registers.

9.29 METHOD STATEMENT:

The contractor shall submit a 'Methods statement' for the approval of the EIC soon after the award of work to him. The 'Methods statement' is a statement by which the construction procedures for important activities of construction are stated, checked, and approved. The 'Methods statement', should have a description of the item with elaborate procedures in steps to implement the same, the specifications of the materials involved, their testing and acceptance criteria, equipment to be used, precautions to be taken, mode of measurement, etc.

9.30 AMENDMENT OF TENDER DOCUMENT

Before the deadline for submission of tenders, the Tender Document may be modified by Indian Institute of Technology Hyderabad by issue of addendum/ corrigendum. Issue of addendum/ corrigendum will however be stopped 03 days prior to the deadline for submission of tenders as finally stipulated.

Addendum/ corrigendum, if any, will be hosted on e-procurement portal of Ministry of Education, Govt. of India (<https://eprocure.gov.in/eprocure/app;>) and IITH Website (<https://www.iith.ac.in/tenders>) only and shall become a part of the tender document. All Tenderers are advised to see the website for addendum/ corrigendum to the tender document which may be uploaded up to 03 days prior to the deadline for submission of Tender as finally stipulated.

To give prospective tenderer reasonable time in which to take the addendum/ corrigendum into account in preparing their tenders, extension of the deadline for submission of tenders may be given as considered necessary by IITH.

9.4 WORK PROGRAMME:

9.4.1 The Contractor shall, within 15 days after the date of award of the work, submit his detailed work programme preferably in Microsoft Project (Level-3), detailed Project quality plan for works executable at site and also at manufacturer's place, safety plan, for the approval of the Engineer in - charge, which shall clearly set out his proposed schedule for the whole of the Works, the time for completing the major sections of the Works and his schedule for mobilizing the materials and equipment necessary for implementing the Works in a timely cohesive and efficient manner. The Contractor shall submit the above Resource Mobilization Plan on the basis of site /region prevalent labour constants/ productivity factors and separately a Project Material Procurement Plan

clearly mentioning the procurement strategy for long lead items.

9.4.2 PROJECT REVIEW MEETINGS:

The contractor, immediately on award of work shall submit details of his key personnel to be engaged for the work at site. In addition, he shall furnish the Engineer-in-Charge detailed organogram involved with the work. The Contractor shall present the programme and status at various review meetings as required.

6.9.13.7.1 Weekly Review Meetings: Shall be attended by Local Team headed by Project -in-Charge.

6.9.13.7.2 Agenda:

- a) Weekly programme v/ s actual achieved in the past week and programme for next week.
- b) Remedial Actions and hold up analysis.
- c) Client query approval.

iii) Monthly Review meetings: Shall be attended by Project -in- Charge and the Management Representative who can take independent decisions.

iv) Agenda

- a) Progress Status/ Statistics.
- b) Completion Outlook.
- c) Major hold ups / slippages.
- d) Assistance required.
- e) Critical issues.
- f) Client query/ approval.
- g) Anticipated cash flow requirement for next two months

9.5.0 WATER AND POWER

9.5.1 Water: Contractor shall make his own arrangement for water, required and suitable for construction.

9.5.2 Power: Contractor shall make his own arrangements for power required for construction of the Project. Alternately, he may apply for and arrange power at the project site. All associated activities for obtaining necessary approvals and sanctions for construction power shall be coordinated by the contractor, the cost of which shall be deemed to be included in the quoted rates under various items of work (i.e. Schedule of Items)". However, the EIC shall provide all necessary documents / drawings for submission to the TGSPDCL/ TGTRANSCO. All installations / fixtures & fittings / cabling for construction power shall be in the scope of the contractor without any additional cost to the Institute. The delay on part of the Contractor in timely getting the statutory clearances and establishing required installation for adequate power supply shall not be accounted for extension of time and also shall not absolve him of Contractual responsibilities.

9.5.3 If the IITH provides water and electricity, the cost for such facility will be recovered from the bills of the contractor at the prevailing rates of local Government bodies as per actuals.

9.6 MEASUREMENTS, BILLING & TERMS OF PAYMENT:

9.6.1 All works shall be measured as per the Solar Zonewise schedules and Sub-Head wise payment % Breakup provided on actual works done as per the terms and conditions of the tender document.

9.6.2 Contractor shall submit computerized bills as per Clause 6A of GCC.

9.6.3 Terms of Payment: Following shall be the terms of payments for the subject works: -

The above progressive payments are subject to deduction towards income tax and other recoveries as applicable as per the terms of the contract.

Note: The contractor shall prepare and submit a consolidated Bill for the Project. However, separate abstract shall be submitted for each subhead.

9.7 CONTRACT DRAWINGS

The contractor shall keep mandatorily one copy each of approved drawings, conditions of contract, specifications, instructions and schedule of quantities at the site of works available for reference by any authorized representative of IITH/ Engineer- in-charge, at all times during the progress of the works. The drawings shall be displayed and arranged as directed by the Engineer- in- Charge.

9.8 WORK TO BE CARRIED OUT BY SPECIALISED AGENCIES (if any):

9.8.1 The contractor shall submit the following details of the specialized agency (if any) before execution of work as per the Terms and conditions of the Contract for approval of EIC:

List of similar works carried out by the agency during the last five years along with the name of work, name and address of clients, year of execution, value of work done and brief specification of the work. The credentials for such completed works shall be obtained from the Project Manager / Executive Engineer concerned along with contact address.

9.8.2 Notwithstanding the approval of the Engineer-in-Charge for the specialized agencies, the services of the specialized agencies shall be removed wherever the Engineer-in-Charge is not satisfied with the performance of the specialized agency. Thereupon, the Contractor shall immediately arrange for an alternate specialized agency conforming to prescribed eligibility criteria. Nothing extra shall be payable on this account. Further, no extension of time shall be permissible on this account.

9.9 MOCK-UP

9.9.1 The concept of Mock Ups is to assess the performance parameters / quality standards specified for specified item/unit in the project. The main objective of the section is to address issues prior to construction to minimize disruption to the critical path of construction program and is as follows;

- Determine whether the contractor possesses required skill level necessary to construct the activity, assemblies or systems such that the as-built construction will satisfy specified requirement.
- To understand the sequence of operation and discuss alternative sequencing options if any.
- To assess the standard of workmanship and aesthetics to be replicated throughout the project.
- To recognize and resolve potential areas of conflict prior to the commencement of construction.

9.6.7 The Contractor shall establish the acceptable quality of workmanship as desired by the EIC for each of the items of the Works and their elements by preparing specimens and mock ups as directed by the EIC.

9.6.8 Nothing extra shall be payable for preparing the specimens and the mock ups. No claims of any kind whatsoever including the claim of extension of time will be entertained due to the incorporation of the requirement.

9.6.9 In case of non-approval of the mock-ups by EIC on account of quality issues or other reasons attributable to the Contractor, the mock ups shall be rebuilt up by the Contractor at no extra cost and time to EIC.

9.10 MATERIALS AND SAMPLES:

The Contractor shall arrange a sample room for displaying approved samples which shall be maintained till the completion of the work. No payment will be made to the contractor for the samples procured.

The sample approval shall be given in writing by EIC within 15 days after submission of the sample with supporting catalogues and other documents as required by EIC.

The delay in submittal of the samples by the Contractor and further cascading delay in subsequent approvals and procurement shall not attract any extra cost and time to the Contract.

9.11. RECOMMENDED MAKE OF MATERIALS:

9.11.1 A list of recommended makes of materials is placed as Approved Makes list.

9.11.2 The order of preference amongst the various products/materials shall be as follows:

The products/materials shall be as per the Brand specified in the Approved Makes list. If the Brand is not specified, then the products/material shall be ISI marked and the same shall be got approved by the Engineer- in-Charge before execution.

If ISI marked product/material is not available, the same shall be as approved by the Engineer-in-Charge before execution.

9.12. MEDIA RELEASES

The Contractor shall not issue any information, publication, document or article for publication concerning the project to the media without the express approval of Indian Institute of Technology Hyderabad.

9.13 COMPLETION CERTIFICATES/NOC FROM LOCAL STATUTORY BODIES

Contractor has to arrange at his own cost work completion certificates or NOCs if required to be obtained, from the local statutory bodies of central and state govt. such as electrical, safety, Fire authority, CEA, TGSPDCL, TGTRANSCO etc. Any fees required for obtaining such NOCs shall be paid by IITH on production of relevant depository challans/ receipts from such Govt. authorities.

The application on behalf of IITH for submission to relevant authorities along with copies of required certificates complete in all respects shall be prepared and submitted by the Contractor well ahead of time so that the actual construction / commissioning of the work is not delayed for want of the approval / inspection by concerned authorities.

The inspection of the works by the authorities shall be arranged by the Contractor and necessary co-ordination and liaison work in this respect shall be the responsibility of the Contractor.

9.14 COMPLETION DRAWINGS & STANDARD MEASUREMENT BOOK (SMB)

9.14.1 During the execution of the Works a set of drawings shall be retained in the Contractor's Site Offices for the exclusive purpose of recording changes made to the Work as the construction proceeds. On completion of the Work, the Contractor shall submit required details and "Mark- up" of changes if any in all drawings of the project to the EIC. The Contractor shall render all required assistance in getting the "AS BUILT" drawings prepared by the Engineer-in-Charge. These drawings shall include and show all the changes / deviations made from the working drawings during the course of construction and also the other details as called for by the Engineer-in-Charge.

9.14.2 Along with the completion drawings the Contractor shall also prepare and submit to the Engineer-in-Charge the Standard Measurement Book (SMB) in the form of a bound book in two sets and a soft copy of the same in Excel. SMB shall incorporate the standard measurements of the all types of Painting works as per the completion / as built drawings in modules finalized in consultation with the Engineer-in-Charge. All the above to be done at no extra cost.

9.15 TOOLS, PLANTS AND MACHINERY

The Contractor shall provide and install at site, T &P as stipulated in Clause of the Contract. The deployment of T&P shall be planned as per work requirement to suit the nature, quantum and speed of the work for lifting/ hoisting construction materials/equipment etc. The T&P shall be maintained in good working condition throughout the progress of work. All adequate precaution regarding formal upkeep of valid Statutory/ Safety credentials of major construction equipment as directed by EIC, their installation, operation, maintenance, materials etc., shall be taken care of. The operating staff to be deployed shall be properly qualified and adequately trained and experienced. All safety precautions shall be taken during the project duration, against possible accident. The Contractor shall deploy his representative to effectively enforce the safety rules and regulations in this regard. Nothing extra shall be payable on this account for the above.

9.15.1 Construction equipment & Mechanization of construction activities:

The contractor shall deploy all necessary tools and plants as per the requirement of the work.

The Contractor shall without prejudice to his overall responsibility to execute and complete the work as per specifications and Time Schedule, progressively deploy adequate equipment, and tools & tackles and augment the same as decided by Engineer-in-Charge depending on the exigencies of the work so as to suit the construction schedule.

The Contractor shall mechanize the construction activities to the maximum extent by deploying all necessary construction equipment/ machinery in adequate numbers and capacities.

9.16 REPORTS TO BE SUBMITTED

The contractor shall prepare and submit monthly progress report (including progress photographs) for the month to the EIC in three copies within 7 days of the following/next month. Reporting shall continue until the contractor has completed all works including the outstanding work as on the completion date as stated in the taking over certificate for the works. Each report shall include but shall not be limited to the following:

- The status of supply and delivery of major materials and Plant to be incorporated in the Works, and the supply of major items of the Contractor's construction plant;
- Records of personnel and Contractor's equipment on site;
- Activities executed/ achievements during the month.
- copies of quality assurance documents, test results and certificates of materials;
- Safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and
- Comparisons of actual and planned progress, with details of any aspects which may jeopardize the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome such aspects.
- Areas of concern/ problems/hold ups & its impact and action plans. And any other reports sought by the EIC.

9.17 QUARRY MATERIALS

The Contractor shall be wholly responsible to identify the suitable sources for quarry materials required for the Works, such as earth, sand, stone, gravel, murrum, etc., and to make his own arrangements (within the contract

price) for collection and transportation of the materials irrespective of the leads and lifts required. The party managing the quarry identified by the Contractor should have proper license from the Government of Telangana. All materials supplied by the Contractor shall satisfy the requirements set forth in the Specifications contained in this Bid and shall be subject to the approval of the EIC. The Contractor shall take this into account while offering his rates and no claims whatsoever shall be entertained for extra costs on this account. All the seignorage (royalty) charges, levies etc., payable to Government shall be paid by the Contractor and are deemed to be included in the quoted rates.

19.18 INTERFERENCE WITH TRAFFIC AND ADJOINING PROPERTIES/BUILDINGS:

- 19.19.1 The Contractor shall prepare General Maintenance of Traffic Plan which will be subject to the approval of the EIC. In case any operation connected with the Works requires temporary diversion of the traffic, or obstruction or closure of any road, or any other 'right of way', the approval of the EIC and the respective competent authorities shall be obtained at least one week in advance.
- 19.19.2 The Contractor shall at all times during execution of the Works, ensure an uninterrupted flow of traffic/ students/ faculty/ Staff/occupants of completed buildings on the work locations.
- 19.19.3 The Contractor shall at all times during execution of the Works, provide convenient access to parts, steps, bridges or drives for all entrances to property abutting the work sites and maintain them clear, tidy and free from mud or objectionable matter.
- 19.19.4 If in order to avoid undue interference with the traffic and adjoining properties, the EIC instructs the Contractor to take special precautions or work within restricted time periods; the Contractor shall carry out the Works during such time and in such manner as directed by the EIC.
- 19.19.5 The Contractor shall not claim any extra cost or payment on account of all or any of the works specified in the above clauses 19.1 to 19.4.

19.20.0 CONTRACTOR TO CO-ORDINATE HIS WORK WITH OTHER CONTRACTORS:

Various other works may be progressing simultaneously in the project site. The Contractor shall co-ordinate with the other concerned Contractors and take into account the inter-relation with other works while planning his daily construction activities, so as to eliminate any hindrance to any work(s) and/or to avoid any damages to the work(s) already carried out by other Contractors. The Contractor shall co-ordinate with the other concerned Contractors for all such works as per the Engineer's directions at no extra cost and he shall provide unhindered access to the T&P and machinery of the other contractors as per the directions of EIC.

19.21 SHIFTING OF UTILITY LINES:

During the course of execution of the works under this contract, the contractor is bound to undertake shifting of any Utility line(s) that are required to complete the Works satisfactorily. However, the Institute reserves the option to get such work carried out by other agency, but this shall not relieve the Contractor of any of his responsibilities and obligations under this Contract implying that this shall not be treated as compensation event for extension of time unless otherwise consented by EIC.

19.22 MOBILISATION OF MEN, MATERIALS AND EQUIPMENTS:

All expenses towards mobilization at site and demobilization including bringing the equipment, work force, materials, dismantling the equipment, clearing the site etc. shall be deemed to be included in prices quoted and no separate payments on account of such expenses shall be entertained. the EIC shall have exclusive rights to accept or reject any material or equipment and also the manpower engaged by the Contractor during complete tenure of the Project. This can also lead to demobilization of the supervisory manpower including key persons of

the Contractor/Specialized agency in case of their non-satisfactory performance.

19.23 LIGHTING & WATCH AND WARD:

19.23.1 The contractor shall at his own cost take all precautions to ensure safety of life and property by providing necessary barriers, area lighting, CCTV cameras with live feeding at the construction site and approaches, barrications, watchmen, necessary watch towers etc. during progress of work at all hours including night hours, if required, as directed by the Engineer-in-charge.

19.23.2 The Contractor shall be responsible for the watch and ward of the all construction premises and buildings, safety of all fittings and fixtures including sanitary and water supply fittings and fixtures provided by him against pilferage and breakage during the period of installation till handing over of all the works to IITH. Nothing extra shall be payable on this account.

19.24 DRAWINGS & DESIGN BASIS REPORTS(DBR):

Since the contract is on EPC mode, only concept drawings for the work are attached in the tender document. All other drawings shall be prepared by the contractor and got approved by the Engineer-in-Charge before execution. All drawings shall be made in Latest Version of AutoCAD and the Soft Copies on CDs and Six Hard Copies of Prints (A0 size) of all “Approved Drawings” and “As Built” Drawings shall be supplied by the Contractor to the Engineer – in – charge at Free of cost as per the Approved Program.

Also, Contractor has to submit the Soft/Hard copies of Design Basis Reports(DBR) of the all Structural, Electrical and Mechanical services etc., like as submitted by concerned consultants and which are approved by authorized certifiers.

9.25 APPLICABLE PERMITS:

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

9.25.2 The Contractor shall ensure that applicable permits mandated by the local bodies are obtained as required under the Applicable Laws. An indicative but not exhaustive list of some of the applicable permits are mentioned below for the guidance of the Contractor.

9.25.3 Consequences on account of failure to obtain the mandatory permits shall be the sole responsibility of the contractor and no claim what so ever shall be entertained by the EIC. Any liability incurred by EIC on account of such failure shall be recovered from the amounts/ payments due to the Contractor.

9.26 ADDITIONAL/EXTRA WORKS:

IITH reserves the right to execute any additional works/extra works, during the execution of work, either by themselves or by appointing any other agency, even though such works are incidental to and necessary for the completion of works awarded to the Contractor.

9.27 QUALITY ASSURANCE:

Detailed quality assurance programme to be followed for the execution of Contract under various divisions of works will be mutually discussed and agreed to. The Contractor shall establish document and maintain an effective quality assurance systems in line with CPWD Quality Assurance Manual for Building Works 2022 and Quality Assurance Policy & Check List for E& M services vide CPWD CSQ(E) Lr.No. 51(4)/CE(E) CSQ/2018/252, dtd 30.01.2018 and also as outlined in other recognized codes.

Quality Assurance System plans/procedures of the Contractor shall be furnished in the form of a QA manual. This document should cover details of the personnel responsible for the quality assurance, plans or procedures to be followed for quality control in respect of all the activities envisaged in the construction works. The quality assurance system should indicate organizational approach for quality control and quality assurance of the construction activities, at all stages of work at site.

IITH or their representative or any 3rd party for QA & QC approved by IITH shall reserve the right to inspect/witness, review any or all stages of work at site as deemed necessary for quality assurance and / or timely completion of the work.

The Contractor has to ensure the deployment of quality Assurance and Quality Control Engineer(s) depending upon the quantum of work. This QA/QC group shall be fully responsible to carry out the work as per standards and all codes' requirements. In case EIC feels that Contractor's QA/ QC Engineer(s) are insufficient, Contractor has to deploy other experienced Engineer(s) as per site requirement and to the full satisfaction of EIC.

9.28 INSURANCE:

Without limiting the Contractor's obligations and responsibilities stated elsewhere in the Contract, the Contractor shall at his own cost arrange, secure and maintain insurance in the joint names of IITH and the contractor with any of the subsidiary of the General Insurance Corporation of India in such a manner that IITH and the contractor are covered for all time during the period of contract i.e. the time period allowed for completion of work, extended period and the defect liability period. The insurance shall be effected in accordance with terms approved by IITH and the contractor shall submit the insurance policies to the Engineer-In-Charge within 15 (Fifteen) days of signing of the agreement along with the receipt of premium. The contractor shall timely pay and submit the receipts of payment of premiums for extensions of policies, if any. The insurance shall cover the following: -

9.29 CONTRACTOR'S ALL RISKS INSURANCE:

The contractor shall insure the work for a sum equivalent to the Contract value or such additional sums as specified and the interests of Indian Institute of Technology Hyderabad against ALL RISKS claims, proceedings, loss or damages, costs, charges and expenses from whatsoever cause arising out of OP in consequence of the execution and maintenance of the work for which the contractor is responsible under the contract.

9.30 WORKMAN COMPENSATION & EMPLOYERS LIABILITY INSURANCE:

This insurance shall be effected for all the contractor's employees engaged in the performance of the contract. IITH shall not be liable in respect of any damages or compensation payable at law in respect of or in consequence of any accident or injury to any workman or any other person in the employment of the contractor and the contractor shall indemnify and keep indemnified the Indian Institute of Technology Hyderabad against all such damages and compensation and against all claims, demands, proceedings, costs, charges and expenses, whatsoever in respect or in relation thereof.

9.30.1 Third Party Insurance The contractor shall be responsible for making good to the satisfaction of the Engineer-in-Charge any loss or any damage to all structures and properties belonging to IITH or being executed or procured or being procured by IITH or of the other agencies within the premises of all work of IITH if such loss or damage is due to fault and or the negligence or willful acts or omissions of the contractor, his employees, agents, representatives.

The contractor shall take sufficient care in moving his plants, equipment and materials from one place to another so that they do not cause any damage to any person or to the property of IITH or any third party including overhead and underground cables and in the event of any damage resulting to the property of the IITH or to a third party during the movement of the aforesaid plant, equipment or materials, the cost of such damages

including eventual loss of production, operation or services in any plant or establishment as estimated by the IITH or ascertained or demanded by the third party, shall be borne by the contractor.

- 9.30.2 Before commencing the execution of the work, the contractor, shall insure and indemnify and keep IITH harmless of all claims, against the contractor's liability for any materials or physical damage, loss or injury which may occur to any property, including that of IITH or to any person including any employee of IITH, or arising out of the execution of the work or in the carrying out of the contract, otherwise than due to the matters referred to in the provision to (a) above. Such insurance shall be effected for an amount sufficient to cover such risks. The terms shall include a provision whereby, in the event of any claim being brought or made against IITH the insurer shall indemnify IITH against such claims and any costs, charges and expenses in respect thereof.
- 9.30.3 The contractor shall also at times indemnify IITH against all claims, damages or compensation under the provisions of Payment or Wages Act, 1936, Minimum Wages Act, 1948, Employer's Liability Act, 1938, the Workman's Compensation Act, 1947, Industrial Disputes Act, 1947 and Maternity Benefit Act, 1961, or any modification thereof or any other law relating thereof and rules made there under from time to time.
- 9.30.4 Contractor shall also at his own cost carry and maintain any and all other insurance(s) which he may be required to take out under any laws or regulation from time to time. He shall also carry and maintain any other insurance, which may be required by the Engineer-in-Charge.
- 9.30.5 The Contractor shall prove to the Engineer-in-charge from time to time he has taken out all the insurance policies referred to above and has paid the necessary premiums for keeping the policies alive till expiry of the Defects Liability Period.
- 9.30.6 The aforesaid insurance policies shall provide that they shall not be cancelled till the Engineer-in-charge has agreed for cancellation.
- 9.30.7 Remedy on the contractor's Failure to insure If the contractor shall fail to effect and keep in force the insurance referred to above or any other insurance which he /they may be required to effect under the terms of the contract then and in any such case Engineer-in-charge may without being bound to, effect and keep in force any such insurance and pay such premium or premiums, as may be necessary for that purpose and from time to time deduct the amount so paid by the Engineer-in-charge from any moneys due or which may become due to the contractor or recover the same as a debt due from the contractor.

9.31.0 INDEMNITIES:

The Contractor shall indemnify and hold harmless the IITH, the IITH's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

- a) bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying any defects, unless attributable to any negligence, willful act or breach of the Contract by the IITH, the IITH's Personnel, or any of their respective agents, and damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless and to the extent that any such damage or loss is attributable to any negligence, willful act or breach of the Contract by the IITH, the IITH's Personnel, their respective agents, or anyone directly or indirectly employed by any of them.

9.32. FACTORY ACCEPTANCE TESTING (FAT):

The Contractor shall facilitate and organise Factory Acceptance Testing (FAT) inspections for IIT Hyderabad personnel who are nominated for the items which are mandatorily required FAT inspections as per the directions

of Engineer-in-charge and at the discretion of Engineer-in-Charge. The FAT inspections are mandatory for CSS, LT Panels, PAC, Inrow Cooling systems, LT/HT Cables, Bus Trunking, UPS, DG sets etc.

9.33. PRO-RATA BASIS PAYMENTS:

The Data Centre Sub-Head wise Percentage weightages of payment schedule of items mentioned at NIT are indicative and the payment may be released on Pro-rata basis against progressive quantum of work executed/procured materials as the case applicable as per the directions of Engineer-in-Charge.

9.34 SPECIAL CONDITIONS OF CONTRACT FOR EXECUTION OF ALL SPECIALIZED ELECTRICAL & MECHANICAL (E & M) WORKS:

Association of Other Agencies for Execution of Specialized E&M Works by Main Contractor:

9.33.1 The bidder should either himself meet the eligibility conditions for the respective E&M components or otherwise he will have to associate with specialized agencies, fulfilling the eligibility requirements and hence consent letter from at least one eligible associate agency of the respective components of E&M work shall also be submitted as per attached Proforma as per Form "P".

In case the main contractor is himself eligible (as per eligibility criteria) for executing any specific minor component and intends doing the job himself, he may not be required to associate with another agency for that minor component of work. In such cases the main contractor also has to submit the documents as per eligibility criteria mentioned for associated agency of individual E&M component.

However, the Composite category contractor shall also be eligible to carry out himself any or all of these works without associating any specialized agency provided:

He fulfil the prescribed eligibility criteria respectively for these work(s) If the main contractor does not fulfil the minimum eligibility criteria, the main contractor has to enter into MoU with agencies contractor(s) associated by him who is found eligible as per the eligibility criteria. Copy of such MoU shall be submitted to Engineer -in- charge of minor component .In case of change of associate contractor, the main contractor has to enter into agreement with the new contractor associated by him.

In case the main contractor intends to change any of the above agency/agencies during the operation of the contract, he shall obtain prior approval of Engineer-in-charge of relevant specialized component(s). The new agency/agencies shall also have to satisfy the laid down eligibility criteria. In case Engineer-in-charge is not satisfied with the performance of any agency, he can direct the contractor to change the agency executing such items of work and this shall be binding on the contractor.

The department (CMD, IITH) reserves the right to allow the main firm to submit additional Documents/additional names of the associates in case of the deficiencies in documents or in case of no associate getting qualified in respect of certain subheads. The same will have to be complied with the main contractor within the time allowed. The decision of the department shall be firm & binding on the intending bidders.

The main contractor should submit the willingness from eligible electrical/specialized contractors to get associated with him/her for execution of the specialized E & M component of works in wholesome manner and as per the conditions set out in the MOU to be entered into, between the one who is awarded the work and the associated eligible electrical contractor.

9.33.2 The main contractor has to submit the following documents for association of specialized agencies /associated

contractor within one month of award of work:

- (i) In support of the eligibility conditions of the proposed associated Contractor, copy of their registration documents, Electrical License, GST Documents duly attested by the applicants (Main Contractor) shall be submitted to the Engineer-In- Charge for deciding the eligibility. Each such Associated Contractor will certify that they are not debarred from any Central Govt./State Govt., Central/State Govt. PSU/Autonomous bodies as on the day of application of tender. Proposal for associating agency for minor components of work shall be submitted in Form- "N" of this tender document from each associate independently for all electrical and mechanical components.
- (ii) The main contractor will submit the true copy of MOU signed with eligible associated agency. The MOU in the enclosed Form Q shall be signed by both the parties" main contractor i.e., as 1st party and associated contractor as 2nd party. Independently for all electrical and mechanical components.

9.33.3 In the event of the concerned E&M agency not performing satisfactorily or failure of associate contractor to complete the E&M work, the main contractor on written directions of the Engineer in Charge of minor component, shall remove the associate contractor deployed on the work and shall submit name of new associate who fulfil the conditions mentioned in IITH to execute the left-over work without any loss of time or variation in cost to the department. Such associates shall also give an undertaking along with the main tenderer but both of them together will stand guarantee for the equipment already supplied for which payment has been released by the department in part. If any equipment supplied for the work, during the currency of the earlier Associate contractor and paid partly by the Dept., becomes redundant /not in a position to be installed and commissioned and put to beneficial use due to change in agency for execution of E&M work, the main contractor shall be liable for replacement of the equipment(s) at no cost to Department. No change of Associated Contractor will be allowed without prior approval of the Engineer-in-charge of minor component of the work.

9.33.4 In respect of all works i.e., Internal wiring, Lighting, HT/LT Switchgears, Transformers, HT/LT Cables, Compact Secondary substation (CSS), SCADA, PLC, DG Set along with AMF Panel and Control cables, FIRE ALARM SYSTEM (FAS), Gas Based Fire Suppression System, Racks, Inrow System, Variable Refrigerant Volume (VRV) System, Building Management System (BMS) and allied components, the materials shall be procured only from the original equipment manufacturers/ authorized dealers of OEM. The contractor shall submit all documentary details in fulfilment of this conditions regarding procurement of materials including relevant test certificates.

9.33.5 Special Conditions for E&M Work are appended with this tender. It will be obligatory on the part of the contractor/tenderer to sign the tender documents for all the component parts.

9.33.6 The main contractor shall be responsible and liable for proper and complete execution of the E & M works.

The associate contractor shall attend the inspection of the work by the Engineer-in-Charge of E&M works as and when required. The agencies executing the electrical work should have valid license for LT/HT as applicable and as described in eligibility criteria. Verifiable completion certificates of the work eligibility documents as the case may be, duly attested by the applicant shall be submitted. Valid Electrical Contractor' license, as the case may be, duly countersigned by the applicant as well as signed by the associate contractors shall also be submitted. Self-attested GST documents in respect of the associated agencies as well as signed by associate firms shall be submitted after the award of work.

The agencies executing the electrical work should have valid license for LT/HT as applicable and as described in eligibility criteria.

Class 1 category Electrical license issued by respective state department is required to execute any HT work. Class 2 category Electrical license issued by respective state department is required to execute any LT work. Main contractor/associate contractor shall submit the eligibility documents accordingly.

9.34 GENERAL CONDITIONS FOR ALL E&M WORKS:

- The agency must study various CPWD specifications; get themselves acquainted with site and site conditions, provision for firefighting system for various buildings in local byelaws and additional conditions carefully. The work shall be executed in close co-ordination with the progress of building work.
- All the equipment shall be delivered with
 - Manufacturer's test certificate,
 - Manufacturer's technical catalogues and Installation / Instruction (O&M) manuals.
- Scaffoldings & any other T & P required for execution, testing and commissioning of work shall be arranged by the contractor and is included in the cost of work tendered by the contractor.
- The design layout plans / drawings / other documents pertaining to E & M services shall have to be submitted by the consultant engaged by the contractor for approval from the Engineer in Charge of minor component within the time period as specified in the approved milestone chart.
- The main contractor shall submit the milestone/per chart for completion of each activity as per the scope of work including details design and engineering, drawings, submissions and the same shall be got approved from the Engineer in Charge of minor component for further necessary execution.
- Inspection before Dispatch: All routine tests shall be conducted before dispatch of equipment's. No equipment shall be dispatched out from the manufactures premises before such tests are conducted and test result recorded. These test certificates shall be given along the supply of equipment. The Engineer- in-charge shall, if he so desires inspect and witness the pre-delivery tests. For this purpose, the agency shall give 15-day advance notice. Agency shall arrange for inspection of the department (FAT). The main contractor has to organize the FAT inspections with IITH personnel by intimating them in advance. However, the inspection shall be done at the discretion of the Engineer-In-charge without any additional cost implication by the contractor to IITH for FAT but ROUTINE TEST & TYPE TEST Certificates shall have to be submitted for equipment.
- Prior to dispatch, all equipment's shall be adequately protected & insured for the whole period of transit, storage and erection against corrosion and incidental damages etc. from the effect of vermin, sunlight, rain, heat, humid climate and accidents etc.

9.35 PROCEDURE FOR APPROVAL OF MATERIALS, SHOP FLOOR DRAWINGS AND COMMENCEMENT OF WORK

Within the time specified in the approved table of milestone, the contractor shall submit the following documents for approval.

- (i) List of makes & Model numbers of all items of equipment and accessories each sub Head of work.
- (ii) Catalogues of the equipment to be supplied.
- (iii) Shop floor drawings of each packages/ Sub work separately for approval.

It is the responsibility of the tenderer to get the makes, models and shop floor drawings approved by the Engineer-In-charge before placing of order.

9.36 Quality of material and workmanship: All parts of the equipment shall be of such design, size and material so as to function satisfactorily under all rated conditions of operation. All components of the equipment shall have adequate factor of safety. The work of fabrication and assembly shall conform to sound engineering practice and on the basis of "Fail Safe Design". The mechanical parts subject to wear and tear shall be easily replaceable type.

The construction of the equipment shall be such as to facilitate easy operation, inspection, maintenance and repairs. All connections and contacts shall be designed to minimize risk of accidental short circuits caused by animals, birds and vermin etc. All identical items and their component parts should be completely interchangeable including spare parts.

9.37 Inspection and testing at site:

- (i) The installation shall be subject to necessary inspection during every stage of erection, by the Engineer In-charge or his authorized representative. The Contractor shall provide all facilities and assistance for the purpose.
- (ii) The completed installation shall be inspected and tested by the Engineer-in charge in the manner as will be laid down by department.
- (iii) All instruments and facilities necessary for the tests at site shall be provided by the agency.
- iv) Some of the mandatory test to be complied by the contractor are as follows:
 - a) Insulation resistance test of cables
 - b) Insulation resistance test of ACBs/MCCB
 - c) Earth Resistance Testing
 - d) Functional Testing of LT Panel
 - e) Power supply quality testing

INSPECTION VEHICLE:

For the site Inspections & Field visits related to this Project, the Contractor shall, at his own cost, deploy for the exclusive use of the EIC and his team, a minimum of 01 (One) no. SEDAN inspection vehicle, Four (4) Passenger capacity, Model not older than year 2025 with driver and fuel with average monthly ceiling of 2500Km within 01month of issue of award letter. The operation and maintenance cost of the vehicle has to borne by the contractor and the vehicle is to be at the exclusive disposal of EIC till the completion of the whole Project. In the event contractor fails to arrange the vehicle in satisfactory condition, the Engineer-in- charge shall make alternate arrangement at the cost of the contractor.

PROJECT OFFICE:

The contractor shall provide, erect and maintain at his own cost separate temporary water tight, Puf insulated air-conditioned office accommodation in the form of one (1) No. Porta Cabin of size 20' X 10' at designated location for their Project Staff with the following minimum facilities in the cabin. These shall be available till handing over of the project.

Toilet facility: 1 No.portable for cabin
Modular Work Station : 3 Nos. in the cabin

Visitors Chairs : 6 Nos.
Overhead Storage Racks : 'All along the walls Adequate number of Power plugs
White Board with Markers : 1 No. in each cabin Pin-Up Display board of size as required
Free Drinking water, stabilized power and lighting as required for the duration of the Project.
Janitorial and Housekeeping services

The contractor has to relocate the Porta Cabins if required as per the exigencies of the work and as directed by EIC without any extra cost. After completion of the Project the Contractor shall take away this material and the site shall be cleaned free from all construction debris.

9.38 Completeness of work:

- (i) The installations shall be completed in all respects and put in to operation even where certain details have not been mentioned / left out in these specifications. Any discrepancy may be brought out in pre-bid meeting.
- (ii) All E&M services such as electrical installations, substation MV panels, cables, Transformers etc. shall be declared as completed after completion of trial run of 15 days or completion of whole work whichever is later. However, maintenance of these installations during the maintenance period of 36 months shall be carried out by the agency at his own cost.
- (iii) DLP / Warranty period of all works / machine / equipment shall commence from date of completion of complete work and it shall be minimum 03 years from the date of completion declared by the Engineer-in-Charge of the project.
- (iv) All electrical & mechanical fittings / fixture / appliances, to be provided for the work, where BEE certification is available should have 5-star rating (of BEE).

The CPWD specifications are available at CPWD website “cpwd.gov.in”. The department shall not be responsible for the lack of knowledge and also the consequences thereof to the Contractor. The information and data mentioned in the tender document have been furnished in good faith and for general information and guidance only. The Engineer-in-Charge in no case shall be held responsible for the accuracy thereof and / or interpretations or conclusions drawn there from by the Contractor and all consequences shall be borne by the Contractor and no claim, whatsoever, shall be entertained from the Contractor, if the data or information furnished in tender document is different from data / drawing after Preparation of architectural drawings, design and approved for construction. It is presumed that the Contractor has satisfied himself for all possible contingencies, situations, bottlenecks and acts of coordination, which may be required between different agencies.

9.39 QUALITY ASSURANCE: The Contractor shall make available, on request from the Department, for record, copies of challans, Purchase order copy, receipts and other certificates, if any, vouchers towards the quantity and quality of various materials procured and the same shall be kept in record. These shall also provide information on the name of the manufacturer, manufacturer’s product identification, manufacturer’s instructions, warning, date of manufacturing and test certificates from manufacturers for the product for each consignment delivered at site, shelf life, if any, for the department to ensure that the material have been procured from the approved source and of the approved quality, as directed by the Engineer-in-Charge. Day to day account of receipt of such material shall be maintained at site of work and shall be regulated by the department. Nothing extra shall be payable on this account. The contractor shall prepare a Quality Assurance Plan (QAP) in line with the CPWD Quality Assurance Policy and Checklist for E and M services and get it approved from the Executive Engineer-Electrical, IITH for further implementation during execution of Project.

9.40 STORAGE OF MATERIALS: Storage and safe custody of all materials shall be the sole responsibility of the Contractor. Nothing extra shall be payable on this account.

9.41 QUALITY CONTROL AND TESTING OF MATERIALS:

- (i) All the material to be used on works shall bear ISI certification mark unless otherwise the make is specified in the item or special conditions appended this tender document. In case ISI mark material or the materials mentioned in the tender documents are not available, as per opinion of Engineer-in-charge, which shall be final and binding, the material to be used shall conform to CPWD specifications applicable in this tender or IS Code. In such cases Engineer-in-charge shall satisfy himself about the quality of such material and give his approval in writing. Only articles classified as first quality by the manufacturers shall be used unless otherwise specified. All material not having ISI mark shall be tested as per relevant ISI specification. The Engineer in charge may relax the condition regarding testing if the quantity of the materials required for the work is small. In all cases of use of ISI marked materials proper proof of procurement of materials from

authentic manufacturers shall be provided by the contractor to the entire satisfaction of Engineer-in-charge. All materials equivalent to the one specified should be got approved by the Engineer-in-charge before using the said materials in the work.

- (ii) If the department desires to send any samples of materials for testing in an accredited laboratory, the Contractor at his own expense shall supply all materials, labour for preparing and testing samples as required by the Engineer-in-Charge. The testing shall be carried out in the presence of the representative of the Engineer-in-Charge. The transportation and testing charges shall also be borne by the contractor. The major samples which can be tested are wires, cables, PEX pipes, Chiller MS Pipes, PVC/MS Conduit Pipes.
 - (iii) Main contractor/ Associate Agency shall submit the required quantity of material as sample for testing from Govt./ Approved Private Laboratory.
 - (iv) Department shall send the samples to the testing laboratory & the test results shall directly come to department however, the cost of all testing shall be borne by the contractor.
- 9.42** No foreign exchange shall be made available by the department for importing (purchase) of equipment, plants, machinery, materials of any kind. No delay and no claim of any kind shall be entertained from the Contractor on account of variation in the foreign exchange rate and/or any Custom duties / charges or any other levies.
- 9.43** The tenderers shall take into account the element of wastage(s) those are likely to be there in all elements of the work and quote his price, taking that into account. The tenderers shall study all the items from the point of view of wastage(s), which are likely to take place.
- 9.44** Power supply required for construction, testing & commissioning shall have to be arranged by the Contractor at his own costs. Water required for testing of equipment is also in the scope of agency.
- 9.45** The description of E & M service & specification are given in general but they are not exhaustive i.e.; does not mention all the incidental works required to be carried out for complete execution of the item of work. The work shall be carried out, all in accordance with true intent and meaning of the specifications and the drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings and/ or described in the specifications, provided that the same can be reasonably inferred there from. There may be several incidental works which are not mentioned in the contract document/specifications but will be necessary to complete the item in all respects. All these incidental works/ costs which are not mentioned, but are necessary to complete the work shall be deemed to have been included in the overall amount quoted by the contractor for various components of work. No adjustment of rates shall be made for any variation in quantum of incidental works due to variation/change in actual working drawings. Also, no adjustment of rates shall be made due to any change in incidental works or any other deviation in such element of work (which is incidental to the items of work and are necessary to complete such items in all respects) on account of the directions of Engineer-in-charge. Nothing extra shall be payable on this account.
- 9.46** The scope of works also covers the preparation of layout plans, drawings for E & M schemes and approval of the same from the respective local bodies viz. Fire Officer/Lift Inspector/ CFO/ Electrical Inspector etc. before the commencement of work. During execution, if the local bodies etc. require a modification, the same shall be executed without any extra cost. Finally, after execution, approvals / NOCs / clearances from local bodies etc. shall be the responsibility of successful bidder for which nothing extra is payable. In case any modification / extra work is required by the local bodies necessary for approvals / NOCs / clearances, the same shall be get executed and nothing extra shall be paid on this account. All statutory fees / charges required for obtaining clearances from Fire Officer/Lift Inspector/CEA / Local Bodies etc. shall be paid by the department.

9.47 The Make in India Policy of Govt. of India is invariably applicable to this NIT.

9.48 CONSULTANCY SERVICES FOR PROJECT:

9.48.1 SCOPE OF SERVICES:

- I. The contractor himself or the consultant appointed by the contractor shall provide consultancy services in the following areas:
- i. All Electrical Engineering services
 - ii. All Mechanical Engineering services
 - v All works including electrical Installation, External Electrification, MV Panels, Transformers, Compact Secondary substation(CSS), routes for service connection, substation works, power distribution, HVAC Load calculations, HVAC system design, Inrow Cooling system.
 - iii. Electrical load details and Electrical Single line diagrams at substation level including complete Internal/External Power distribution scheme.
 - vii. Any other services specified in this NIT document which are required but not specifically indicated.
- The consultant shall provide comprehensive consultancy services broadly described hereinafter. However, it should be clearly understand that the description of services is only indicative, and the consultant shall be required to perform any other services which may be required whether or not expressly mentioned hereinafter in this contract document of this work up to the entire project requirement and satisfaction of the Institute.

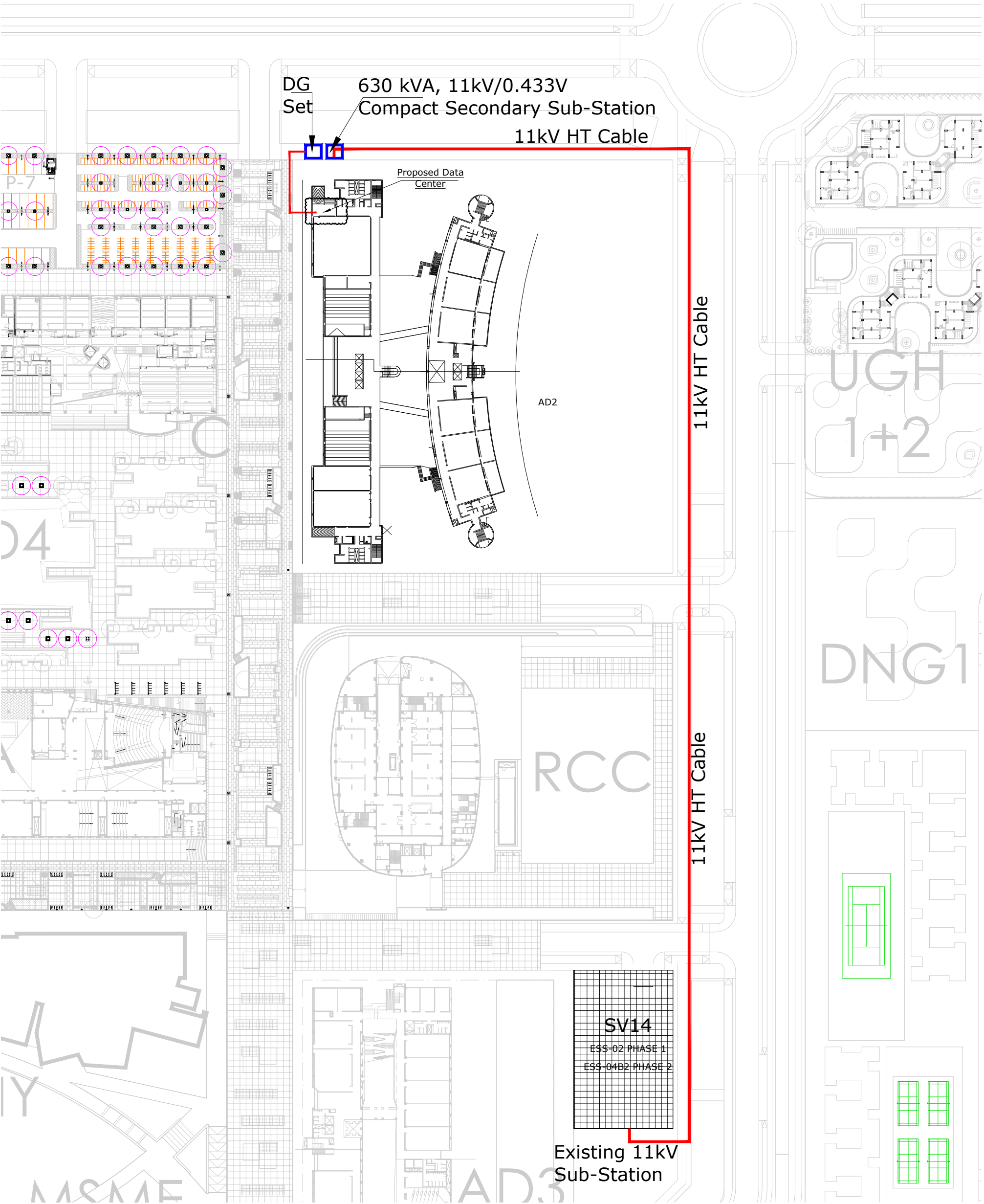
The consultant shall perform all the Architectural, design of Data Centre E&M services etc. by utilizing the most economical, effective and widely accepted engineering concepts/practices and shall at all times show a high degree of professionalism in his work.

The consultant shall be fully responsible for the design of all the Electrical & Mechanical engineering works.

9.49 Defect-liability period(DLP)/Warranty Period:

The DLP/Warranty period shall be 36 (Thirty six) months from the date of Handing over of the works after successful commissioning. If the contractor or his working people or servants shall break, deface, injure or destroy any part of equipment in which they may be working, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within twenty four six months after a certificate final or otherwise of its completion shall have been given by the Engineer In Charge as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense or in default the Engineer In charge cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof. The security deposit of the contractor shall not be refunded before the expiry of thirty- six months after the issue of the certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later.

HT Cable Routing Indicative Plan



Data Centre Indicative Layout Plan

