

Tender No. CDAC/DCIS/TIERIII/30(05)/19-20

# SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF TIER III – UPTIME DESIGN AND FACILITY CERTIFIED DATA CENTER AT CDAC, SECTOR-62, NOIDA

#### Volume-I

Centre for Development of Advanced Computing,

(An Autonomous Scientific Society of Ministry of Electronics and Information Technology, Govt. of India),

Anusandhan Bhawan, C-56/1, Institutional Area Sector-62,

Noida 201309



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# 1. Notice Inviting E-Tender (NIT)

Tender No: CDAC/DCIS/TIERIII/30(05)/19-20DT 21.11.2019

Centre for Development of Advanced Computing (C-DAC), Noida, Ministry of Electronics and Information Technology, Govt. of India, invites electronic bids in two bid system (1) Technical Bid, (2) Financial Bid from well-established, experienced agencies for "Supply, Installation, Testing and Commissioning of Tier III – Uptime Design and Facility Certified Data Center at Plot No. B-30, Sector-62, Noida". Tender document can be downloaded from the link: https://eprocure.gov.in/cppp/ or https://www.cdac.in.



# 2. Important Tender details

Date of commencement of downloading Tender document	21.11.2019
Last date and time for downloading of Tender Document	19.12.2019 at 10:00 HRS IST
Date and time and address for Pre – Bid Meeting	at Centre for Development of Advanced Computing (C-DAC), C-56/1, Anusandhan Bhawan, Sector-62, Noida-201309
Earnest Money Deposit (EMD)	The bidders need to deposit EMD amount Rs. 13,00,000/- through online payment in C-DAC bank account before the last of bid receipt i.e 19.12.2019 at 15:00 HRS IST as per the details given below. In case of non receipt of EMD within the stipulated time, the bid will be rejected. If the bidder is exempted from submitting the EMD, in that case the bidder should upload the relevant supporting document such as MSME,NSIC. Start-ups etc., along with the technical bid, without which the bid will be considered invalid and rejected.  ACCOUNT DETAILS:  BENEFICIARY NAME: CENTRE FOR DEVELOPMENT OF ADVACNCE COMPUTING  ACCOUNT NUMBER:09312191029526  BANK NAME: ORIENTAL BANK OF COMMERCE  ADDRESS: B-31, INSTITUTIONAL AREA, SECTOR-62 NOIDA.  IFSC CODE: ORBC0100931
Last date and time for online Tender submission	19.12.2019 at 15:00 HRS IST
Mode of Tender Submission	Tender documents shall be submitted in electronic form using the e-procurement system at <a href="https://www.eprocure.gov.in">www.eprocure.gov.in</a>
Opening of Technical Bids	Technical Bids shall be opened online at 20.12.2019 at 15:00 HRS IST
Date & Time for opening of Financial Bid	Shall be conveyed separately.
Validity of Bid	180 days from the specified date of closing of bid.



Contact to Bidders and the authority to whom	Head MMG
the bids are to be addressed	CDAC, Anusandhan Bhawan, C-56/1, Sector-62,
	Noida-201309, Tel. 0120-3063334/3063347,
	Fax-0120-3063317,
	Email: headmmg-noida@cdac.in

Note: In case the specified date for the submission of offers happens to be Saturday/Sunday or Holiday, the bid-closing deadline shall stand extended to the next working day up to the same time.



It is optional for the bidders to be present at C-DAC office on the scheduled date and time for the opening of the technical/Financial bid. Bidders can view the status and tender opening statement by logging on to e-procurement site.

#### 3. About CDAC

Centre for Development of Advanced Computing (CDAC) - is a premier research organization under the administrative control of Ministry of Electronics & Information Technology, Government of India.

The following are the major thematic thrust areas of CDAC:

**High Performance Computing** – development of the PARAM series of supercomputers, Garuda national grid initiative, development of scientific computing applications and cloud computing.

**Multi-lingual Computing** spanning the entire range from fonts and encoding to speech and language translation, which includes fonts for Indian languages, encoding standards, information extraction and retrieval, machine aided translation, speech recognition and synthesis, etc.

**Professional Electronics** covering electronic devices and embedded systems. This area covers work such as underwater electronics, software radio, ubiquitous computing.

**Information and Cyber Security** including intrusion detection and prevention, malware analysis, cyber forensics, network security, etc.

**Software Technologies** including e-governance solutions, e-learning technologies, geometrics, open source software, accessibility, etc.

**Health Informatics** including hospital information systems, electronic medical records, telemedicine, and cancer networks.

**Data Center Services** CDAC also provides commercial Data Center Services to various Government Departments and industry from the year 2005 from its existing facility at Noida.

# 4. Objective of Tender

CDAC proposes to enhance its Data Center services by setting up a Tier-III Certified Data Center, initially with a capacity of 30 IT racks, scalable up to 95 racks in its campus at Plot No. B-30, Sector-62, Noida.

In the initial phase, the Data Center with 23 racks currently operational at the R&D Block of CDAC at C-56/1, Sector-62 shall be migrated to the new location. The tender is for selection of a qualified and experienced agency meeting the eligibility criteria prescribed in this document for undertaking the project elaborated in detail in the scope of work herein below, on turnkey basis.

# 5. Pre-qualification Criteria

The bidder must satisfy/comply with the eligibility criteria as stipulated below and submit the relevant documents as shown in ePacket-2 and ePacket-3 respectively. The details of documents to be enclosed in each e-packet along with details of Annexure to be submitted are provided separately in Check List (Annexure – F).



S. No.	Qualifying Criteria	Mandatory Documentary Proof to be uploaded
a)	The bidder should be a Govt. Organization /PSU/ PSE/ Proprietary/ Partnership firm, or a Limited Company registered in India with an established and running setup in India, preferably in Delhi/NCR.	Attested copies of documents relating to the Registration of the firm like; Partnership deed, Articles of Association, Certificate of Incorporation etc. (ePacket-2).
b)	The bidder should have minimum five years experience in providing data center design and build services.	Relevant Purchase Orders, completion certificates, testimonials received in previous 5 years (ePacket-3).
c)	The bidder should have built at least one Data Center Facility which is Uptime Certified for Tier III (design & built) or higher / TIA 942 certified Rated 3 or higher by EPI, for in-house requirement or as a turnkey project for other clients.  In case the project was undertaken in a consortium mode, the entity should have been the Primary bidder.	Relevant Purchase Orders*, completion certificates, uptime/TIA design & build certificate, testimonials along with the taking over certificate issued by users/clients (in case of projects executed on turnkey basis). (ePacket-3).  * In case of in-house projects the purchase order placed to one or more implementation partners may be provided.
d)	The bidder should have designed & built at least 3 Data Center in last five years, each costing at least INR 2.60 Crores.  or  The bidder should have designed & built at least 2 Data Center in last five years, each costing at least INR 3.25 Crores.  or  The bidder should have designed & built at least 1 Data Center in the last five years, costing at least INR 5.20 Crores.  Note: The Data Center built shall cover complete turn-key solution including SITC of Electrical Panels, Cabling, HVAC, UPS, DG Set, Server & Network Racks and BMS / DCIM.	Relevant Purchase Orders, completion certificates, testimonials along with the taking over certificate issued by users/clients. (ePacket-3).
e)	The bidder should have at least two qualified and experienced Data Center professionals like CDCP/ CDCS/CDCE/ ATD in its payroll with a minimum experience of 3 years in Data Center design and installation for deployment on the project.	Bio-data of the qualified personnel to be deployed on the project along with copies of the certifications. Appointment Order & last drawn pay slip for proof of association. (ePacket-3).
f)	The bidder should have an average annual turnover of INR 1.95 Crores from the business of supply, installation, testing, and	The Audited Financial statements (Profit and loss statement, Balance sheet) for the last three years. (ePacket-2).



S. No.	Qualifying Criteria	Mandatory Documentary Proof to be uploaded
	commissioning of Tier-III data Center during last three financial years, 2016-17, 2017-18 and 2018-19.	Note: If the financial statements are combined for different activities undertaken by the bidder, a certificate from the CA on the value of business from supply, installation, testing and commissioning of Tier-III data Center should be uploaded.
g)	If the bidder is not a principal manufacturer of Data Center approved components, the undertaking(s) (in original) from the respective principal manufacturers (on their letter-head).	Undertaking as per format given in Annexure – C must be submitted for the components as DG set, UPS and battery, LT panels and associated component, HVAC, BMS Software etc. (ePacket-3).
h)	The principal manufacturers/ original equipment manufacturer (OEM) of Data Center components viz. UPS, HVAC, DG Set, should have preferably service centre in NCR.	Documentary evidence for the same to be provided. (ePacket-3).
i)	The bidder shall have their local/ Branch Office in Delhi/ NCR with technical infrastructure/technical personnel.	Relevant address proof of office in Delhi/NCR. (ePacket-3)
j)	The Bidder should have all necessary licenses, permissions, consents, no objection certificates, approvals as required under the law for carrying out its/their business including those envisaged under the scope of this document.	Relevant documentary proofs. (ePacket-3).
k)	The Bidder should have valid GST Registration Certificate and PAN.	GST Registration Certificate, PAN and ITR for the year 2015-16, 2016 -17 & 2017-18. (ePacket-3)
I)	The bidder should have Solvency of minimum INR 65.00 Lacs only.	Solvency certificate issued by PSU/scheduled banks not older than six months from the last date of submission of bid. (ePacket-3)
m)	In case the bidder(s) is/are bidding this tender in a consortium mode, then any one member (including the Lead Partner) of the consortium shall qualify this criteria (sl. No. c), while the Primary bidder has to mandatorily qualify all the other qualifying criteria's. The Primary bidder shall be responsible for discharging all the obligations as per the tender in case they emerge to be the successful bidder and awarded the contract.	Copy of the Consortium agreement & Power of Attorney to the Primary Bidder have to be uploaded (ePacket-2).  The following documents of all the consortium members has to be uploaded (ePacket-2):  A. EPF Code No.  B. ESI Code No.  C. Goods and Service Tax Registration No.  D. PAN No.  E. TIN No.



S. No.	Qualifying Criteria	Mandatory Documentary Proof to be uploaded	
		F. Registration Number of the Sole	
		Proprietor/Firm/Organization.	
		G. Self attested copy of challan for the	
		month of August 2019 (EPF,ESI & GST)	

## 6. Preparation of Bids and on-line Bid Submission

Before submission of the bid, the bidders must verify the eligibility criteria and also ensure fulfilling all the terms and conditions. The bids without EMD or with late receipt of EMD shall be summarily rejected. It is the prerogative of C-DAC to ask for any additional documents/records/data from the bidders even after tender submission. The bidders are required to submit soft copies of their bids electronically on the CPP Portal (<a href="https://eprocure.gov.in/eprocure/app">https://eprocure.gov.in/eprocure/app</a>), using valid Digital Signature Certificates. More information for submitting online bids on the CPP Portal may be obtained at: <a href="https://eprocure.gov.in/eprocure/app">https://eprocure.gov.in/eprocure/app</a>

- 6.1 Bidder should take into account any corrigendum published on the tender document before submitting their bids for which no separate advertisements shall be issued.
- 6.2 Bidder should 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.
- 6.3 Bidder, in advance, should get the bid documents ready to be submitted as indicated in the tender document / schedule and they should be in PDF format.
- 6.4 Bidder should log in to the site well in advance for bid submission so that the bid can be uploaded in time i.e. on or before the last date and time for bid submission. Bidder will be responsible for any delay due to any technical issues.
- 6.5 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.
- 6.6 The uploaded tender documents become readable only after the tender opening by the authorized bid openers.
- 6.7 Upon the successful and timely submission of bids, the portal will give a successful bid submission message and a bid summary will be displayed with the bid no. and the date & time of submission of the bid with all other relevant details.
- 6.8 The CPP Portal is maintained by National Informatics Centre (NIC). Any queries relating to the process of online bid submission or queries relating to CPP Portal in general may be directed to the 24\*7 CPP Portal Helpdesk. The contact number for the helpdesk is 0120-4200462, 0120-4001002, 0120-4001005, and 0120-6277787. C-DAC shall not be responsible for any technical issues/errors relating to the portal.



- 6.9 The Technical bids must be uploaded on-line (pdf format) in packets-1 to 3 and price bid in excel sheet format in e-packet- 4 through https://eprocure.gov.in/eprocure/app, as explained below:
- 6.10 The details of documents to be submitted in each e-packet are provided in Check List Annexure F.

#### Note

- All the documents listed in e-packet-1 to e-packet-3 must be signed in ink by the authorized signatory of the bidder.
- The bid documents must be properly arranged in sequence.
- C-DAC reserves the right to reject the bid, if any of the above listed documents are not submitted.

# 7. Part No. 1 (Technical Bid)

a) Technical Bid uploaded shall contains: e-packets-1, e-packets-2 and e-packets-3 as per Annexure-F.

## 8. Part -II (Financial Bid)

- a) The financial bid should be uploaded online only in the prescribed BOQ format. **FINANCIAL BID SHOULD NOT BE SUBMITTED IN PHYSICAL FORM**.
- b) The financial bid shall contain only schedule of all the rates duly filled in. No stipulation, deviation, terms & conditions, presumptions etc. is permissible in financial bid. CDAC shall not take any cognizance of any such conditions and may at its discretion reject such bids.
- c) The Bidders are advised strictly not to alter or change the BOQ format /contents. Bidders are also advised not to paste any image file with BOQ.
- d) All Prices should be given in Indian Rupees (INR) only.
- e) Price offered by the bidder shall not appear anywhere in any manner in the technical bid
- f) The GST rate to be filled in the BOQ without fail in case of receipt of BOQ without GST rate, it shall be construed that the rate quoted in the BOQ is inclusive of GST for further process.

# 9. Pre-Bid Meeting

The pre-bid meeting will be held at C-DAC, Noida as given in schedule to clarify the queries, if any, of the prospective bidders. All the bidders are advised to study the tender document before attending the Pre bid meet. The bidders should furnish their queries to the tender calling authority in writing in hard form or through email at least 3 days before the pre-bid meeting. The clarifications/replies to the queries raised and discussed in the pre-bid meeting shall be uploaded on https://eprocure.gov.in/eprocure/app.



#### 10. Other Documents to be submitted with tender

- a) The bidder should upload the Resolution of the Board of Directors/Power of Attorney/Authorization Letter signed by one of the Directors in respect of the officer singing and submitting the bid on behalf of the bidder
- b) The Bidders are advised to carefully go through the Bid documents and furnish the necessary information/documents etc., as required. The checklist (Annexure F) shall be attached to the bid.

# 11. Instructions to Bidders (General)

- a) The Bid prepared by the Bidder and all correspondence and documents relating to the bid exchanged by the Bidder and the CDAC shall be written in English language only.
- b) The bidder is advised to study all terms and conditions of the tender including technical specifications for submitting complete and comprehensive tender. Failure to comply with any of the terms and conditions or instructions of the offer with insufficient particulars which are likely to render fair comparison of tender as a whole impossible may lead to rejection even if otherwise it is a competitive offer/ tender.
- c) All signatures in the tender documents shall be dated.
- d) The documents to be submitted shall be signed, stamped and sent to reach the tender inviting authority on or before the specified time and date. The bidder shall ensure uploading of the scanned documents only after signing and stamping.
- e) It will be incumbent upon each bidder to fully acquaint himself with the local conditions and other relevant factors at the proposed Data Center site, which would have any effect on the performance of the contract and / or the cost. The Bidder is expected to make a site visit to the proposed Data Center facility and obtain all information that may be necessary for preparing the bid and entering into contract at least 3 days before the pre-bid meeting. Failure to obtain the information necessary for preparing the bid and / or failure to perform activities that may be necessary for the providing services before entering into contract, will in no way relieve the successful bidder from the responsibility of performing any work in accordance with the tender documents. It will be imperative for each bidder to diligently be informed of all legal conditions and factors, which may have any effect on the execution of the contract as described in the bidding documents. The C-DAC shall not entertain any request for clarifications from the bidder regarding such conditions. It is the responsibility of the bidder that such factors have properly been investigated, considered while submitting the bid proposals and that no claim whatsoever including those for financial adjustment to the contract awarded under the bidding documents will be entertained by C-DAC. Neither any change in the time schedule of the contract nor any financial adjustments arising thereof shall be permitted by the C-DAC because of failure of the bidder to appraise himself of local laws and site conditions or otherwise.
- f) The Bidder is required to carefully examine the specifications and documents and fully inform himself as to all the conditions of matters, which may in any way affect the works or the cost thereof. If any Bidder finds discrepancies or the omissions in the specifications and



documents or is in doubt as to the true meaning of any part, he shall at once request in writing for an interpretation/ clarification, to C-DAC. Such clarifications shall be submitted before pre-bid meeting. The clarifications found necessary will be furnished in the form of corrigendum/ Addendum to all the Bidders, which will form part of the Bid documents.

- g) Verbal clarifications and information, if any, given by C-DAC or his employee(s) or his representative(s) shall not in any way be binding on C-DAC.
- h) Bidder should avoid, as far as possible, corrections, overwriting, erasures or postscripts in the bid documents. In case however, any corrections, overwriting, erasures or postscripts have to be made in the bids, they should be supported by dated signatures of the same authorized person signing the bid documents. In case of discrepancies and/ or calculation errors, if any, the lower unit prices and amounts shall only be considered for comparison of bids.
- i) The overall project is a turnkey solution and the price quoted for the line items shall include any other components required for completing the project. No separate price for any additional item / service shall be allowed after the award of contract.
- j) The prices must be quoted for all the items as per format given in financial Bid.
- k) Timely completion is the essence of the Contract. The offers not complying with the completion schedule shall be considered non-responsive and shall not be evaluated.
- I) The bidders may please note that this is a contract on 'Turnkey' basis. Notwithstanding the scope of work, engineering, supply and services stated in bid document, any equipment or material, engineering or technical services which are not specifically mentioned under the scope of supply of the bidder, which are not expressly excluded there from but which in view of the bidder are necessary for the required completion & Tier III certification of the Data Center Facility in accordance with the tender specifications are treated to be included in the bid and has to be implicitly performed by bidder. In no case, the bidder will be permitted to increase the prices quoted.

#### 11.1 Removal of Rejected Goods and Replacement

If upon delivery / execution, the material / equipment / execution of any unsound or imperfect work / has supplied any materials inferior quality or quantity to these specified and is found not in conformity with the specifications stipulated in the contract, whether inspected and approved earlier or otherwise, those shall be rejected forthwith. The contractor shall arrange suitable replacement supplies and remove the rejected goods within 7 days from the date of notification.

# 11.2 Regulation of Local Authorities and Status

The bidder shall, to the extent relevant and applicable, comply with all the rules and regulations of local authorities, during the performance of the works. Bidder shall also comply with the Minimum Wage Act: 1948, the Payment of Bonus Act, Workmen Compensation Act and the rules made there under, including amendments thereof from time to time in respect of employees or workmen employed or engaged by him on the project.



#### 11.3 Bidder's Site Office Establishment

The successful bidder shall establish a site office at the site and keep posted an authorized representative for the purpose of Contact. Any written order or instructions of CDAC shall be communicated to the bidder's representative and such communication shall be treated as a communication to the bidder's legal address.

#### 11.4 Discipline of Workmen

The bidder shall adhere to the disciplinary procedure set by CDAC in respect of his employees and workmen, if any, at site. The CDAC shall be at liberty to object to the presence of any representative or employee of the Bidder at the site, if in the opinion of CDAC, such employee has misconduct, or is incompetent or negligent or otherwise undesirable, and then the bidder, after mutual agreement, shall replace such a person objected to.

#### 11.5 Cleanliness

The areas within the premises of the C-DAC or those allotted by the C-DAC to bidder, shall be kept neat and clean to the entire satisfaction of C-DAC.

#### 11.6 Comprehensive Warranty

The Supplier warrants that all the Goods are new, unused, and of the most recent or current models, and that they incorporate all recent improvements in design and materials, unless provided otherwise in the Contract. The supplier further warrants that all Goods supplied under this contract shall have no defect arising from design, materials or workmanship (except when the design and/or material is required by the Purchaser's specifications) or from any act or omission of the supplier. The warranty should be comprehensive on site, repair/replacement basis free of cost. Bidder has to enter into agreement / MoU with C-DAC on award of contract, which shall be in-line with this tender document.

- a) Bidder shall ensure that the electrical equipment quoted against the tender shall not reach end of life (declared by OEM) at least for next **Ten Years** and for other equipment, it shall not reach end of life (declared by OEM) at least for next **Seven Years**.
- b) All the equipment and components supplied must have minimum two years or default warranty period from the OEM, whichever is HIGHER from the date of Provisional Acceptance Certificate. The warranty for all the equipment shall be onsite comprehensive, including parts, labor and service.
- c) All the equipment shall carry predictive support pricing policy and bidder shall ensure with an undertaking from the OEM that the Annual Comprehensive Onsite Maintenance Cost shall be less than 10% of the quoted price of the equipment.
- d) The bidder shall carry out necessary preventive maintenance activities for all the products supplied for the Data Center in a timely manner. Necessary approval shall be taken from CDAC in two weeks advance prior to the Preventive Maintenance. Preventive Maintenance Schedule shall be provided for each equipment and the same shall be adhered by the successful bidder.



- e) C-DAC reserves the right to invoke the Performance Bank Guarantee submitted by bidder, in case of the following:
  - i. The system fails to achieve the performance as stipulated in this document or
  - ii. The bidder fails to provide the warranty and other services in scheduled time frame, as stipulated in this document or
  - iii. The bidder fails to meet the Preventive Maintenance Schedule on time and any failure of component during preventive maintenance, which results in the downtime of the Data Center.
  - iv. The bidder fails to replace the faulty equipment/defective module/part in the stipulated time during the warranty

#### 11.7 Right to Amend / Cancel

- a) At any time prior to the last date of submission of bids, C-DAC reserves the right to modify the bid document by release of Corrigendum, for any reason, whether on its own initiative or in response to the clarification request by a prospective bidder.
- b) CDAC may, at his discretion, extend the due date & time for submission of bids.
- c) C-DAC reserves the right to cancel the entire tender without assigning any reasons thereof.

#### 11.8 Return/forfeiture of EMD

- a) The EMD will be returned to the bidder(s) whose offer is not accepted, within 30 days after the award of the contract to the successful bidder. In case of the bidder whose offer is accepted, the EMD will be returned on submission of Security Deposit (Refer Para 13). However, if the return of EMD is delayed for any reason, no interest / penalty shall be payable to the bidder.
- b) The successful bidder, on award of contract / order, must send the contract / order acceptance in writing, within 7 days of award of contract / order, failing which the EMD will be forfeited and the order will be cancelled.
- c) C-DAC reserves the right to forfeit the EMD,
  - If the bidder withdraws the bid during the period of bid validity specified in the tender.
  - ii. If the successful bidder fails to furnish the acceptance in writing, within 7 days of award of contract/ order.
  - iii. If the successful bidder, fails to furnish the Security Deposit.
  - iv. The offer is disqualified for the reasons stated in the bid documents, for example, where the EMD is super-scribed on the tender cover as if it was furnished, but not found within or found insufficient, etc.



#### 11.9 Financial Bid to be free of Escalation

The bidder should quote his lowest firm prices valid for the duration and completion of the contract i.e. supply, erection, testing, commissioning, Integrated System Acceptance Testing (ISAT) of the Data Center and migration of IT Infrastructure in the existing DC Facility. No enhancement / escalation of prices for what so ever reason will be allowed once the offer is accepted.

#### 11.10 Taxes and levies

- a) Bidder must indicate applicable GST separately. The bidder should exercise utmost care to quote the correct percentage of applicable GST on each item.
- b) The bids will be reckoned as L1, L2, L3 and so on based on the price including taxes.
- c) In case due to any error/ oversight, the GST rate quoted by the bidder is different from the actual GST rate as per the notified tariff, the bidder will not be permitted to rectify the error/oversight. The orders/ contract will be placed with the GST rate quoted by the bidder or actual tariff rate (as on placement of order), whichever is LOWER. The difference amount payable, if any, between the quoted GST rate and actual tariff rate shall be borne by the bidder.
- d) Notwithstanding the para 11.26.2 and 11.26.3 mentioned above, if the GST is not quoted separately and the bid is silent whether GST is included or excluded in price, for the purpose of evaluation of bids, the prices shall be taken as quoted with GST. The GST applicable, if any will be borne by the bidder/bidder.
- e) Any upward revision in statutory levies or new levy is introduced after opening of the bids/placement of order shall be to the account of the C-DAC, provided that the delivery is completed within the contractual delivery schedule. In cases where delivery schedule is not adhered to by the supplier and there is upward revision after the agreed delivery date, the bidder/supplier shall bear the impact of such increased levies. In case of any downward revision of taxes after placing the order and till the completion of the project, the same shall be paid as applicable.
- f) The prices quoted must be inclusive of packing & forwarding, freight, insurance, loading, unloading charges /entry tax/ e-Way bill, whatsoever until destination and any other charges during the warranty period.
- g) GST at applicable rates shall be shown separately in the invoice. GST deposit should be reflected on GST portal

#### 11.11 Validity of bids

- a) Bids shall be valid for minimum 180 days from the date of closing of bid. A bid valid for a shorter period shall stand rejected.
- b) During this period the bidder shall not be permitted to withdraw or vary their offers, once made and if they do so, the EMD shall be forfeited.
- c) C-DAC may ask for the bidder's consent to extend the period of validity. Such request and the response shall be made in writing only. A bidder agreeing to the request for extension will not be permitted to modify their bid.



#### 12. Evaluation of Bids

The Criteria for Technical Evaluation is as follows:

- a) The bids will be evaluated in two steps. First, the bids will be examined based on prequalification criteria. Second, the technical bids of only the prequalified bidders will be evaluated based on the criteria stipulated in the tender. As part of the technical evaluation, C-DAC may invite the Bidders for technical presentation on their capability and the concept plan for completion of project as per the specifications, within the time frame.
- b) During the technical evaluation of the bids, C-DAC at its discretion may ask the Bidder for clarification of its Bid. The request for clarification and the response shall be in writing. During the process of evaluation of bids, if any discrepancies are observed in the bid submitted, the bidders may be given an opportunity to clarify the same. If in the view of bidder, any change in quantity, make or model is required or any additional items are required, for clearing the said discrepancy, the bidder has to arrange for said change and / or addition of material without any increase in the prices quoted.
- c) If the information provided by the bidder is found to be incorrect / misleading at any stage / time during the tendering Process, C-DAC reserves the right to reject all such incomplete bids.
- d) Only the bidders, whose technical bid is found to meet the requirements as specified will qualify for opening of the financial bid and will be informed about the date and time of the opening of the bid.
- e) The decision of the TEC with respect to complete technical evaluation is final and binding on all the bidders.

#### 13. Award of Contract

- a) C-DAC shall award the contract to the pre/technically qualified bidder whose financial bid has been accepted and determined as the lowest.
- b) Notification of Award of contract will be made in writing to the successful Bidder by C-DAC.
- c) However, C-DAC reserves the right and has sole discretion to reject the lowest evaluated bid.
- d) If more than one bidder happen to be determined as L1, C-DAC reserves the right to place the order on the bidder who has set up the maximum no. of Tier-III Uptime /TIA certified Data Center. The decision of C-DAC shall be final.

# 14. Completion Period

- a) The project work for Supply, Installation, Testing and Commissioning of Data Center shall be completed within 180 days reckoned from the 7<sup>th</sup> day of placement of order.
- b) In case, the supply of all the material/services required for the project are not completed within the scheduled milestones, the CDAC may resort to procurement of the materials/equipment/services from elsewhere at the risk and cost of the contractor and shall



- recover the full cost of such materials from them. If the cost of procurement is more than the quoted value for those items, the difference shall also be borne by the contractor.
- c) Alternatively, the CDAC may cancel the purchase Order completely or partly without prejudice to its right as mentioned above.

#### 15. Payments

The payment would be on basis of the actual value of work done by taking joint measurements, duly certified by the site Engineer in-charge/authorized representative of C-DAC, Noida and the Consultant. Billing is to be done in the name of Centre for Development of Advanced Computing (C-DAC), C-56/1, Institutional Area, Sector-62, Noida, UP - 201309.

S. No.	Particulars	% of Payment	Milestone
a)	Completion of Civil Works – Supply of Deliverables and completion of work	60% of total order value of Civil Works	14 weeks from the date of release of Purchase Order
b)	Delivery of equipment at site & verification by C-DAC or its authorized agency.	60% of the total order value of goods delivered/inspected (excluding civil works)	16 weeks from the date of release of Purchase Order
c)	Completion of Installation, Testing, Commissioning and submission ISAT report to C- DAC and submission of all respective documents for Uptime Facility Certification.	70% of total order value of the Project (difference of payment already made at S. No. a & b)	20 weeks from the date of release of Purchase Order
d)	Completion of Tier III uptime certification and physical migration of IT infrastructure from existing facility.	90 % of actual project value (as per actual measurements)	24 weeks from the date of release of Purchase Order
e)	Successful award of project completion certificate and submission of PBG for the warranty period of 2 years from date of commissioning of the Data Center	Balance amount as per actual final bill.	26 weeks from the date of release of Purchase Order

- i. The applicable TDS as per income tax and as per GST will be deducted.
- ii. The payments shall be remitted through NEFT/RTGS only.
- iii. All the payments are subject to submission of the valid and complete tax invoices.



## 16. Security Deposit

- a) The successful bidder who is determined as L1 and awarded the project will be required to furnish the Security Deposit in INR equivalent to 10% of the Contract / Order value (excluding taxes) in the form of Demand Draft drawn in favor of C-DAC payable at Noida within 15 days of award of Contract / receipt of Order(s).
- b) The amount of Security Deposit will be forfeited to the extent of financial loss suffered by CDAC, if supplier fails to execute the order and fulfill its terms and conditions.
- c) Within 30 days of the completion of the project, the contractor shall submit a PBG of 10% of the actual value of the works, in favor of CDAC, Noida, issued by scheduled Nationalized Bank, valid till the expiry of the defect liability of the warranty period. On receipt of the PBG, the Security Deposit of the 10% shall be returned to the contractor.
- d) All payments shall be subject to certification by the Engineer in-charge of CDAC and the Consultant.
- e) The final payment shall be subject to Engineer in-charge of CDAC and the Consultant certifying the following:
  - The contractor has fulfilled all contractual obligations and successfully completed Supply, Installation, Testing and Commissioning of Data Center, obtain the Uptime Certification for design and build and migrated the existing Data Center to new location.
  - ii. The contractor has proven the satisfactory performance of the Data Center as per the terms and conditions set out in the contract.

# 17. Performance Bank Guarantee (PBG)

- a) The successful bidder will be required to furnish the Performance Bank Guarantee towards the Data Center Solutions supplied, in the form of a Bank Guarantee in INR equivalent to 10% of the project value, as per the format attached to this document (Annexure E).
- b) The Performance Bank Guarantee shall be submitted along with the invoice after issuing Provisional Acceptance Certificate by CDAC. The PBG shall be from a nationalized bank and shall remain valid for the period of 27 months and a claim period of one month from the date of Provision Acceptance Certificate. The PBG must be negotiable at a branch of issuing bank in Noida. The PBG shall be extended from time to time as per requirement.
- c) Performance Bank Guarantee shall be returned to the bidder after completion of warranty period subject to satisfactory performance of the equipment as per the defined SLA parameters in the Annexure G.
- d) The bidder has proven the satisfactory performance of the equipment in the Data Center as per the terms and conditions set out in the contract and there is nothing outstanding either against the contract or any other purchase orders / contracts placed by the C-DAC on the bidder.



#### 18. Penalties

- a) Penalty for delayed deliveries (supply), Installation, Commissioning and Certification with reference to the project milestones C-DAC shall recover from the contractor a sum equivalent to 0.5 (half) percent of the prices of any portion of equipment, subsystems/stores/services delivered delayed for each week or part thereof. The total penalty so recovered shall not exceed 10 (Ten) percent of the value of the delayed supplies /services.
- b) Notwithstanding para (a) above, in case the total project till the issue of Completion Certificate is delayed beyond the mentioned timelines due to the delay in the bidders part, then C-DAC shall recover 0.5 (half) percent of the total final project value for each week or part thereof from the final (inclusive of the penalty already recovered in any of the preceding milestones). The total penalty so recovered shall not exceed 10 (Ten) percent of the value of the project.
- c) In case the bidder fails to satisfy the Tier III Data Center facility certification requirements in the first or subsequent attempt(s) from Uptime Institute, the bidder shall be liable for getting the facility re-certified at his own risk and cost. This shall be in addition to the penalty mentioned for the delay as mentioned in para (a) above.
- d) Notwithstanding para (b) above, if the delay is more than 10 weeks, C-DAC reserves the right to cancel the Contract/ Order. In case of such delay on the part of the bidder in completing the work and obtaining the Uptime Certification, CDAC, at its discretion may cancel the Purchase order and arrange to complete unfinished work through other suitable contactor(s) at the risk and cost of the bidder.

# 19. Force Majeure

- a) Force Majeure is defined as an event of effect that cannot reasonably be anticipated such as earthquakes, floods, storms etc., acts of states / state agencies, the direct and indirect consequences of wars (declared or undeclared), hostilities, national emergencies, civil commotion and strikes at successful Bidder's premises or any other act beyond control of the bidder. Only those causes or its after effects, which have duration of more than 7 days, shall be considered for force majeure.
- b) The contractor shall within 10 days from the beginning of such delay notify to the C-DAC in writing the cause of delay. C-DAC shall verify the facts and grant such extension of time as facts justify.
- c) No price variation shall be allowed during the period of force majeure and liquidated damages would not be levied for this period. C-DAC may consider relaxing the penalty and delivery requirements, as specified in this document, if and to the extent that, the delay in performance or other failure to perform its obligations under the contract is the result of a Force Majeure.
- d) If the performance in whole or part by the bidder or any obligation under the Contract is prevented or delayed by "Force Majeure' conditions for a period exceeding 60 days, the CDAC may at its discretion terminate the contract by notice in writing.



#### 20. Arbitration

In case any dispute arises between the C-DAC and the successful bidder/contractor with respect to this tender, including its interpretation, implementation or alleged material breach of any of its provisions, both the Parties hereto shall endeavor to settle such dispute amicably. If the Parties fail to bring about an amicable settlement within a period of 30 (thirty) days, such disputes shall be referred to the sole arbitrator mutually appointed by both parties. Arbitration proceedings shall be conducted in accordance with the provisions of the Arbitration and Conciliation Act, 1996 and Rules made there under, or any amendment or modification thereto. The venue of the arbitration shall be Noida/Delhi. The award given by the arbitrator shall be final and binding on the Parties. The language of arbitration shall be English. The common cost of the arbitration proceedings shall initially be borne equally by the Parties and finally by the Party against whom the award is passed. Any other costs or expenses incurred by a Party in relation to the arbitration proceedings shall ultimately be borne by the Party as the arbitrator may decide.

#### 21. Jurisdiction

Courts in Noida/Delhi only shall have the exclusive jurisdiction to try, entertain and decide the matters, which are not covered under the Arbitration and conciliation Act.

# 22. Risk and Owner ship of the materials/equipments/subsystems brought at site

All risks, responsibilities and liabilities in respect of goods delivered at site shall remain with selected bidder/contractor until they are handed over to C-DAC after successful commissioning, Tier III facility Certification by Uptime and issuing of Provisional Acceptance Certificate by CDAC

In case of loss, theft or damage of any components at site the responsibility of the same shall lies with the bidder.

# 23. Liability for Accidents and Damage

- a) The contractor shall be responsible for all loss, damage or deterioration to the equipment's/sub-systems until the Data Center is taken over by CDAC intact and hence they need to take a comprehensive insurance policy covering all risks associated with this subject project viz., transit, temporary storage in C-DAC premises, Project Erection Process etc at their cost.
- b) The bidder shall, during the progress of the work, properly cover up and protect the equipment's/sub-systems from exposure to the weather, and shall take every reasonable, proper, timely precaution against accidental damage to the same.
- c) In case of an accident which results in the death of any of the workmen employed by the contractor or which is so serious as to be likely to result in the death of any such workmen, the bidder shall within 24 hours of the happening of such accident, intimate in writing to the CDAC, the fact of such accident. At the same time, it is the responsibility of the contractor to ensure that the employees deployed for the subject project are necessarily covered under



Insurance, ESI, EPF etc., to make sure that such workmen get all reliefs/benefits as per the existing government rules & regulations.

- d) The successful bidder/contractor shall indemnify and hold CDAC, Noida harmless from and against all claims, damages, losses and expenses arising out of, or resulting from the works/services under the contract provided by them or their personnel, including any claims under the Workmen Compensation Act.
- e) In the event of an accident in respect of which compensation may become payable under workmen's Compensation Act, whether by the successful bidder/contractor or by CDAC, it shall be lawful for CDAC to retain out of moneys due and payable to the bidder/contractor such sums of money as may in its opinion be sufficient to meet such liability. The decision of CDAC shall be final in regard to all matters arising under this clause.

# 24. Indemnification against infringement of intellectual IPR etc.

The successful bidder/contractor shall indemnify, protect and save C-DAC against all claims, losses, costs, damages, expenses, action suits and other proceeding, resulting from / arising out of:

- a) Infringement of any law pertaining to intellectual property, patent, trademarks, copyrights etc. by the bidder or
- b) Such other statutory infringements in respect of all the equipment supplied by successful bidder, or
- c) 22.1.3 Caused due to any act / omission / performance / under or non or part performance / failure of the bidder.

# 25. Assignment

Selected bidder/contractor shall not assign, delegate any of its rights or obligation under this Contract to other parties, without prior approval of C-DAC.

# 26. Severability

If any provision of this Contract is determined to be invalid or unenforceable, it will be deemed to be modified to the minimum extent necessary to be valid and enforceable. If it cannot be so modified, it will be deleted and the deletion will not affect the validity or enforceability of any other provision of the contract.

# 27. Validity of Contract

The contract shall be valid until fulfillment of all obligations including but not limited to providing comprehensive warranty and the AMC services (if opted by CDAC) by the successful bidder/contractor.



#### 28. Termination of Contract

- a) In case of the delays in providing the stipulated services, and / or defect / delay / under or non- Performance pertaining to the services / products supplied by the bidder, C-DAC shall give written notice to the bidder directing to set the things right within 30 days of notice. If bidder fails to comply with the requirements, C-DAC shall have the right to terminate the contract and / or cancel the order/s.
- b) C-DAC also reserves the right to terminate the contract / cancel order by giving 90 days' notice to the successful bidder, if
  - i. The bidder fails to comply with any of the terms of the contract.
  - ii. The bidder becomes bankrupt or goes into liquidation.
  - iii. The bidder make general assignment for the benefit of the creditors and
  - iv. Any Receiver is appointed for the property owned by the bidder.
- c) C-DAC will release the due amount payable to successful bidder towards the material and / or services provided until the date of termination and accepted by C-DAC. However, the amount towards penalty, if any will be deducted from the payable amounts.
- d) The successful bidder agrees and accepts that they shall be liable to pay damages claimed by C-DAC, in the event of termination of contract / cancellation of order, as detailed in this tender.
- e) The successful bidder may terminate the contract by at least 30 days' written notice, only in the event of non-payment of undisputed invoices for 90 days from the due date. Except this situation, the successful bidder shall have no right of termination.

# 29. Limitation of Liability

The liability of the Bidder / Bidder arising out of breach of any terms / conditions of the tender / contract / work order and addendums / amendments thereto, misconduct, willful default will be limited to the total contract value. However, liability of the bidder in case of death / injury / damage caused to the personnel / property due to / arising out of / incidental to any act / omission / default / deficiency of bidder / bidder will be at actuals.

In no event shall either Party, its officers, directors, or employees be liable for any form of incidental, consequential, indirect, special or punitive damages of any kind.

#### 30. Disclaimer

The purpose of this tender is to provide the bidder (s) with information to assist the formulation of their proposals. This tender does not claim to contain all the information each bidder may require. Each bidder should conduct his own investigations and analysis and should check the accuracy, reliability and completeness of the information in this tender and where necessary obtain independent advice. C-DAC makes no representation or warranty and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of this tender. This tender is not an offer by C-DAC Noida, but an invitation for bidder's response.



# 31. Corrupt or Fraudulent Practices

- a) It is expected that the bidders who wish to bid for this project have highest standards of ethics.
- b) C-DAC will reject the bid if it determines that the bidder recommended for award has engaged in corrupt or fraudulent practices while competing for this contract.
- c) C-DAC may declare a bidder ineligible, either indefinitely or for a stated duration, for award of a contract if it at any time determines that the bidder has engaged in corrupt and fraudulent practices during the award / execution of contract.

# 32. Interpretation of the clauses in the Tender Document / Contract Document

In case of any ambiguity/ dispute in the interpretation of any of the clauses in this tender Document, the interpretation of the clauses by Director General, C-DAC shall be final and binding on all parties.

#### 33. Non-Disclosure of Information

The bidder shall not communicate or use in advertising, publicity, sales releases or in any other medium any information/materials like description of the site, dimensions, photographs or any other information concerning the work under this contract which may come to its possession, without the prior written permission of the CDAC.

# 34. Completeness of Contract

Equipment/ sub-systems supplied should be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment needed for erection, completion and safe operation of the equipment by applicable codes, though they may not have been specifically detailed in the respective specifications, unless covered in the list of exclusions. All similar standard equipment, provided, shall be interchangeable with one another.

#### 35. General

- a) The Bidder shall be responsible for provision of health and sanitary arrangement more particularly described in Contract Labour (Regulation and Abolition Act), safety precautions, etc. as may be required for safe and satisfactory execution of the contract.
- b) The Bidder shall fulfil all his obligations in respect of accommodation including proper facilities for the personnel employed by them, outside CDAC Campus.
- c) The bidder shall be responsible for the proper behaviour at site and observance of all regulations by the staff employed by them.
- d) Insurance for the labour engaged shall be the responsibility of the bidder until completion of works covering all risks as per industry practice.



# 36. Annexure A - Covering Letter

nissioning of Tier III – Uptime
he cited works including the Conditions therein, I/we er bid in the required Bid
rate sealed cover.
only) in the form _issued by in
his bid are true and we accept
ntion activities towards supply
der document, including any s as stipulated in the tender
in the capacity of t the bid. Necessary evidence, to me/us on behalf of d is attached herewith.
ithout assigning any reason.
ure of Bidder with Seal
:
ation :
& Mobile :



# 37. Annexure B – Authority Letter

	Date:
То	
HoD (MMG),	
CDAC, Anus	andhan Bhawan,
C-56/1, Secto	r-62,
Noida-201307	(UP)
	norization Letter for Submission of bid for Supply, Installation, Testing and g of Tier III – Uptime Design and Facility Certified Data Center at CDAC, Sector-62,
Reference: Te	nder document no
Dear Sir,	
	(Name of the bidder) having registered office at
tender docum	(address of the bidder) herewith submit our bid against the said
Mr./Ms	(Name and designation of the signatory), whose ppended below, is authorized to sign and submit the bid documents on our behalf
Specimen Sign	nature:
The undersign	ed is authorized to issue such authorization on behalf of us.
For M/s	(Name of the bidder)
Signature and	company seal
Name	:
Designation	:
Email	:
Mobile No.	:



# 38. Annexure C – Undertaking by Principal Manufacturer

(To be submitted in OEM on Letterhead)

	Date:
То	
HoD (MMG),	
CDAC, Anusar	ndhan Bhawan,
C-56/1, Secto	r-62,
Subject: Unde	ertaking by Principal Manufacturer against tender no for Supply,
	esting and Commissioning of Tier III – Uptime Design and Facility Certified Data Center
at CDAC, Secto	or-62, Noida
Dear Sir,	
We, M/s	(Name of the manufacturer) having registered office at
	(address of the manufacturer) by virtue of being manufacturer for
	(Name of the product/s), hereby authorize M/s (Name of the bidder)
	ffice at (Address of bidder) to submit quote, supply, install and provide
after sales sup	oport for our range of products quoted by them to meet the above mentioned tender
requirements	
M/s	(Name of the manufacturer) within the scope of requirement as per the tender
mentioned ab	ove undertake to provide technical & other support towards fulfilling the requirements
of installation	, commissioning, acceptance criteria and product warranty services of the Data Center
Solutions to I	be supplied and installed at site(s) by our authorized representative M/s (Name of
bidder) agains	t said tender.
All the equipn	nent quoted against the tender are not end of life as on date of commission and spare
	upport shall be provided for at least for <b>Ten Years</b> from date of commissioning and
	All the quoted equipment shall carry predictive support pricing and the Annual
-	/e Maintenance Charges shall not exceed% (as per the standard support pricing
policy of OEM	1 in % of the equipment value quoted in the bid or maximum capping of 10% of the
	lue quoted in the bid, whichever is lower) of the quoted value in the bid during the life
time of the pr	oduct.
The undersign	ned is authorized to issue such authorization on behalf of M/s(Name
of the manufa	
For M/s	(Name of the manufacturer)
Signature and	company seal
Name	:
Designation	:
Email	:
Mobile No.	:



## 39. Annexure D – Tender Acceptance Letter

(To be submitted on Company Letter Head).

Date:
То
HoD (MMG),
CDAC, Anusandhan Bhawan,
C-56/1, Sector-62,
Noida-201307 (UP)
Subject: Tender Acceptance Letter for Supply, Installation, Testing and Commissioning of Tier III – Uptime Design and Facility Certified Data Center at CDAC, Sector-62, Noida
Reference: Tender document no
Dear Sir,
1 I / Wa have downloaded / obtained the tender document(s) for the above mentioned

- I / We have downloaded / obtained the tender document(s) for the above mentioned `Tender/Work' from the web site(s) namely: <a href="https://www.cdac.in/">https://www.cdac.in/</a> / https://eprocure.gov.in/cppp/ etc.; as per your NIT / 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 document, (including all documents like annexure(s), schedules(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 department / organization too has 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 do hereby declare that our Firm has not been blacklisted / debarred by any Govt. Department/Public sector undertaking.
- 6. 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 your department/ organization 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 fully said earnest money deposit absolutely.

including the fortestare of the fully said	earriest money deposit absolutely.
Yours Faithfully,	
(Signature of the Bidder, with Official Seal)	
Email id for correspondence	:



# 40. Annexure E – Performance Bank Guarantee Format

(on non-judicial paper of appropriate value)

10,		
Executive director		
Centre for Development of Advanced Com	nputing	
Noida		
BANK GUARANTEE NO:	DATE:	
Dear Sir(S)		
This has reference to the Contract/ Ord Centre for Development of Advanced Co Address of vendor) for supply, installatio items)	mputing(C-DAC), Noida on M/s	(Name 8
The conditions of this order provide that t	he vendor shall,	
Arrange to deliver the items listed in the s said order, and	aid Contract /order to the consignee	, as per details given ir
Arrange to install and commission the iter satisfaction of C-DAC and	ns listed in said Contract/order at cli	ent's site, to the entire
Arrange for the comprehensive warranty order.	service support towards the items	specified in Contract ,
M/s (Name of Vendor) has accepted to stipulated therein and have agreed to issupromises and assurance of their contract M/s (name of vendor) holds request and in consideration of the prohereinafter.	ue the performance bank guarantee tual obligations vide the Contract / ( an account with us and has appro	on their part, towards Order No pached us and at their
C-DAC shall be at liberty without reference Bank hereunder to take any other undertory or liabilities under or in connection wis supplier or the said contract or to grant increase or otherwise vary the prices or the all or any of the obligations of the suppliander any security (ies) now, or hereafter release or forbearance whatsoever shall here.	aking of security in respect of the supith the said contract or to vary the time and or indulgence to the suppine total contract value or to forebeatier under the said contract and/or the held by C-DAC and no such dealing	pplier's obligations and terms vis-a – vis the olier or to reduce or to refuce or to the from enforcement of the remedies of C-DAC (s) with the supplier or

C-DAC hereunder or of prejudicing right of C-DAC against the bank.



This undertaking guarantee shall be a continuing undertaking guarantee and shall remain valid and irrevocable for all claims of C-DAC and liabilities of the supplier arising up to and until \_\_\_\_\_ (date) This undertaking guarantee shall be in addition to any other undertaking or guarantee or security whatsoever the that C-DAC may now or at any time have in relation to its claims or the supplier's obligations/liabilities under and / or in connection with the said contract and C-DAC shall have the full authority to take recourse to or enforce this undertaking guarantee in preference to the other undertaking or security (ies) at its sole discretion and no failure on the part of C-DAC in enforcing or requiring enforcement of any other undertaking or security shall have the effect of releasing the bank from its full liability hereunder. (Name of Bank) hereby agree and irrevocably undertake and promise that if in your (C-DAC's) opinion any default is made by M/s (Name of Vendor) in performing any of the terms and /or conditions of the agreement or if in your opinion they commit any breach of the contract or there is any demand by you against M/s (Name of Vendor), then on notice to us by you, we shall on demand and without demur and without reference to M/s (Name of Vendor), pay you, in any manner in which you may direct, the amount of Rs. \_\_\_/- (Rupees \_\_\_\_\_\_ Only) or such portion thereof as may be demanded by you not exceeding the said sum and as you may from time to time require. Our liability to pay is not dependent or conditional on your proceeding against M/s (Name of Vendor) and we shall be liable & obligated to pay the aforesaid amount as and when demanded by you merely on an intimation being given by you and even before any legal proceedings, if any, are taken against M/s (Name of Vendor) The Bank hereby waives all rights at any time inconsistent with the terms of this undertaking guarantee and the obligations of the bank in terms hereof shall not be anywise affected or suspended by reason of any dispute or disputes having been raised by the supplier (whether or not pending before any arbitrator, Tribunal or Court) or any denial of liability by the supplier or any order or any order or communication whatsoever by the supplier stopping or preventing or purporting to stop or prevent payment by the Bank to C-DAC hereunder. The amount stated in any notice of demand addressed by C-DAC to the Bank as claimed by C-DAC from the supplier or as suffered or incurred by C-DAC on the account of any losses or damages or costs, charges and/or expenses shall as between the Bank and C-DAC be conclusive of the amount so claimed or liable to be paid to C-DAC or suffered or incurred by C-DAC, as the case may be and payable by the Bank to C-DAC in terms hereof. You (C-DAC's) shall full liberty without reference to us and without affecting this guarantee, postpone for any time or from time to time the exercise of any of the powers and rights conferred on you under the contact with the said M/s \_\_\_\_\_ (Name of Vendor) and to enforce or to forbear from endorsing any power or rights or by reason of time being given to the said M/s (name of Vendor) which under law relating to the sureties would but for the provisions have the effect of releasing us. You will have full liberty without reference to us and without affecting this guarantee, postpone for any time or from time to time the exercise of any of the powers and rights conferred on you under the contract with the said M/s \_\_\_\_\_ (Name of Vendor) and to enforce or to forbear from endorsing any power or rights or by reason of time being given to the said M/s \_\_\_\_\_ (Name

Supply, Installation, Testing and Commissioning of Tier III – Uptime Design and Facility certified Data Centre at CDAC, Sector-62, Noida



of Vendor) which under law relating to the sureties would but for the provisions have the effect of releasing us.
Your right to recover the said sum of Rs/- (Rupees
The guarantee herein contained shall not be determined or affected by the liquidation or winding up, dissolution or change of constitution or insolvency of the said M/s (Name of Vendor) but shall in all respects and for all purposes be binding and operative until payment of all dues to CDAC in respect of such liability or liabilities.
Our liability under this guarantee is restricted to Rs
We have power to issue this guarantee in your favour under Memorandum and Articles of Association of our Bank and the undersigned has full power to do under the power of Attorney dated.
Notwithstanding anything contained herein:
Our liability under this guarantee shall not exceed Rs (in words)
This bank guarantee shall be valid up to (27 months from date of installation) & unless a suit for action to enforce a claim under guarantee is filed against us within one month from the date of expiry of guarantee, all your rights under the said guarantee shall be forfeited and we shall be relieved and discharged from all liabilities there after i.e., after one month from the date of expiry of this Bank guarantee
We are liable to pay the guaranteed amount or any parts thereof under this bank guarantee only and only if you serve upon us a written claim or demand or before
The Bank guarantee will expire on
Granted by the Bank
Yours faithfully,
For (Name of Bank)
SEAL OF THE BANK
Authorized Signatory



# 41. Annexure F – Check List

S. No.	Documents to be Submitted	Submitted (Yes / No)	Reference Page No.
1.	e-packet 1: Shall contain the following documents -	(===,)	
a)	Covering Letter as per Annexure - A.		
b)	Authority Letter as per Annexure – B.		
	If the tender is made by a proprietary firm it shall be signed by the proprietor above his full name and the full name of his firm with its current address.		
	If the tender is made by a firm in partnership, it shall be signed by all the partners of the firm above their full names and current address, or by a partner holding the power of attorney for signing the tender in which case a certified copy of the power of attorney shall accompany the tender. A certified copy of the partnership deed, current address of the firm and the full names and the current addresses of all the partners of the firm shall also accompany the tender.		
	If the tender is made by limited company or a limited corporation, it shall be signed by a duly authorized person holding the power of attorney for signing the tender in which case a certified copy of the power of attorney shall accompany the tender. Such limited company or corporation may be required to furnish satisfactory evidence of its existence before Contract is awarded.		
c)	Online EMD transfer acknowledgement with UTR/Transaction Reference Number.		
d)	Undertaking to the effect that a Security Deposit of 10% of the order value will be submitted in case C- DAC decides to place the Purchase Order.		
e)	Undertaking to the effect that the bidder is not black-listed or barred from participation in bidding process by any Central/ State Government, Government Department, Government Undertaking, Public Sector Unit (PSU) or autonomous institution, as on date of submission of bids.		
f)	Tender Acceptance Letter, as per Annexure – D.		
g)	Documents Check-list as per Annexure - F		
2.	e – Packet 2 Shall contain the following documents –		
a)	A copy of Certificate of Incorporation, Partnership Deed / Memorandum and Articles of Association / any other equivalent document showing date and place of incorporation, as applicable.		



b)	A copy of GST registration certificate.	
c)	The following documents from the end client / end user (in case of turnkey) are required for at least one / two / three Data Center Build Facility (as per the pre-qualification criteria –clause 5) during last Five years:	
	copies of purchase orders or contracts in the name of bidder,	
	successful installation and completion reports	
	Tier III or higher (design & built) from Uptime Institute / TIA 942 Rated 3 or higher certificates from EPI.	
	In case of in-house projects the copies of purchase order placed to the implementation agency may be provided (covering all the items & work mentioned in this tender) and all other documents as mentioned above may be submitted.	
d)	The self-certified copies of audited balance sheets or the certificate/s from a Chartered Accountant for the financial year 2016-17, 2017-18, 2018-19 indicating the annual sales turnover.	
e)	A copy of PAN Card of the Organization.	
f)	IT returns for last three years	
g)	A photo copy of the commercial bid actually submitted without prices (prices blocked) and copy of commercial terms and conditions (in detail) as included in the commercial bid. C-DAC reserves the right to reject the bid in case of any discrepancy observed in the un-priced commercial bid and the actual commercial bid.	
h)	Manufacturer authorization certificate as per Annexure-C.	
i)	All the necessary documents in support of eligibility criteria stipulated in clause (5) pre-qualification criteria.	
j)	Copy of the Consortium agreement (in case of consortium bidder)	
3.	e-Packet – 3 Shall contain the following documents –	
a)	The executive summary of the bid submitted	
b)	Duly filled Technical Bid (covering the details of solution, technical specifications, makes and models of items, diagrams, layouts, all drawings etc.)	
	The details of electrical power consumption, foot-print, ambient temp, temperature range targeted, discrimination curves, short circuit calculations, cable schedule along with voltage drop calculations, battery sizing and back up calculations etc.	
d)	Details of diesel consumption on various loading conditions.	



e)	Design Basis Report along with annual average Power Usage Effectiveness (PUE) calculations for 25%, 50%, 75% and 100 % of IT load.		
f)	f) Design basis and analysis of cooling solution at full and partial load conditions including complete details, assumptions made and the specific references/standards used for the same. The bidder has to submit software selection of the products related to cooling solution considering site ambient conditions		
g)	Technical Compliance		
h)	The printed catalogue / leaflet/brochures published by the principal manufacturer of the items quoted to be submitted along with the Technical Bid.		
i)	Legal / statutory permissions required, if any.		
j)	Undertaking from OEM of all the equipment in the given format		
4.	e –packet 4 : Shall be uploaded online in excel sheet BOQ format only		
a)	Price Bid as per BOQ format		



# 42. Annexure G – SLA Condition during warranty period

#### **Ticket prioritization**

The priority level assigned to tickets are as per the following table:

Priority	Definitions	Impact
Critical	System or Equipment not functioning or critical malfunctioning due to which it does not perform as intended.	System Affected
Non- Critical	All other Issues which do not affect the equipment performance, like general alarms, faulty non critical parts, etc.,	System not affected & unlikely to be affected for next 7 days.

#### **Response and remediation times**

The response and remediation for the different ticket priorities shall be provided as follows:

Priority	Response	Remediation
Critical	4 (clock hours)	48 (clock hours)
Non-Critical	24 (Clock Hours)	4 (Business Days)

#### **Penalties**

The penalty for SLA breach shall be in the form of the charges mentioned and to be paid by the bidder to release the PBG otherwise PBG shall be invoked by CDAC and the penalties shall be deducted from it.

Priority	Factor	Penalty
Critical	Every Day of delay in the Service	0.5% of PBG amount
Non-Critical	Every Day of delay in the Service	0.1% of PBG amount

The penalties will be calculated on quarterly basis and accordingly the bidder has to clear the dues periodically. In case the bidder fails to clear the pending dues the same shall be accumulated along with interest, accordingly the PBG shall be revoked against the pending dues of the bidder at the end of the warranty period and the remaining amount shall be paid to the bidder. This is pre-judice to the CDAC's right to cancel the contract, in case of unsatisfactory service.



Tender No. CDAC/DCIS/TIERIII/30(05)/19-20

# SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF TIER III – UPTIME DESIGN AND FACILITY CERTIFIED DATA CENTER AT CDAC, SECTOR-62, NOIDA

# Volume-II SCOPE OF WORK AND SCPECIFICATIONS

Centre for Development of Advanced Computing,

(An Autonomous Scientific Society of Ministry of Electronics and Information Technology, Govt. of India),

Anusandhan Bhawan, C-56/1, Institutional Area Sector-62,

Noida 201309



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# A. Scope of Work

Turnkey implementation of Tier-III Certified Data Center at Research & Development and Academic Center situated at Sector-62 Industrial Area, Noida with the following subsystems:

#### A.1 Civil Works

- i. Removing of existing AHU, proper closure of ducts, existing partitions, AC Ducts, removal of Tiles, Cutting and Chipping of existing floors and Disposing of debris.
- ii. Closing of windows from inner side.
- iii. Civil and Interior works comprising construction of fire rated walls, partitions, false ceiling, flooring and associated works as per specifications.
- iv. Providing and fixing removable raised/false access flooring comprising of modular load bearing floor panels supported on hot dip galvanized rectangular frameworks.
- v. Necessary civil works for installing electrical and HVAC systems in accordance with the local regulatory requirements.
- vi. Construction of foundation for Transformer and DG Sets as per the OEM recommendations.
- vii. Establishing the BMS Room, NOC Room, and Meeting Room infrastructure
- viii. Establishing the Pantry and Toilet Cubical infrastructures.
- ix. Pest control and Anti-termite treatment.

## A.2 Electrical Works

- i. Supply, Installation, Testing and Commissioning of DG Sets, LT Panels, Synchronization Panel and all other electrical panels.
- ii. Supply, laying and termination of LSZH cables as per the Data Center Electrical SLD.
- iii. Supply, Installation, Testing and Commissioning of UPS Systems with battery bank
- iv. Supply, Installation, Testing and Commissioning of earthing system for the Data Center
- v. Supply and installation of Cable trays and raceways with necessary support bars and accessories. The bidder shall perform chipping of floor for raceways and the floor shall be finished as per CDACs requirement.
- vi. Trenching and laying of LT cables from Power House to Data Center Electrical Rooms with redundant path. Cable trench shall adhere to the standards.
- vii. For non-critical Loads, Output of existing building 80kVA UPS shall be used. The Output panel is located in the 2nd floor the Data Center Building
- viii. Supply, Installation, Testing and Commissioning of Transformer for the Data Center is in the scope of CDAC. The bidder shall supply, lay and terminate cables from the output of utility panel

# A.3 HVAC System

Precision Cooling System: Design, supply, installation, testing and commissioning of Precision Air-conditioning System for Server Room. All the Precision AC outdoor units shall be located on the terrace of the Data Center Building. Water Inlet for the PAC humidifier circuit will be provided by CDAC. It is the scope of the bidder to supply and lay piping up to the PAC units with necessary control valves as per the requirement (Water Inlet for the PAC humidifier circuit will be provided by CDAC).

Comfort Air-conditioning System: Design, supply, installation, testing and commissioning of comfort air-conditioning system for all other rooms with required ducting and necessary piping. All the Comfort AC Outdoor units shall be floor mounted/wall mounted as per site condition.

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## A.4 Safety and Security System

Safety and Security System: Design, supply, installation, testing and commissioning of safety and security systems comprising of:

- Fire Detection and Alarm System
- Aspiration based fire detection system (VESDA)
- NOVEC 1230 based Fire Suppression System
- Access Control System
- CCTV Surveillance System
- Water Leakage Detection System
- Rodent Repellant System
- Intelligent Building Management System

## A.5 Passive Networking

Passive networking solution: Design, supply, installation, testing and commissioning of fiber and copper based cabling system for the Data Center

## A.6 Uptime Certification

The bidder shall provide all necessary documents (like but not limited to Data sheets, GA Drawings, Heat Load Calculation sheets, any certifications required from OEM, etc.) required for the Tier III Certification of Data Center. Obtaining Tier III design certification from Uptime Institute is in the scope of CDAC / its authorized agency, while the bidder has to provide, necessary documents and support for Tier III Design Certification.

The bidder shall be responsible for providing heat load banks during pre-ISAT and Tier III Facility Certification. All the necessary documents (like but not limited to As-Built drawings, Data sheets, Installation Reports, Commissioning Reports, Configuration Reports, User Manuals, Test Certificates, Warranty Certificates, Support Matrix, etc.) and support required for Tier III Certification of Constructed Facility is in the scope of the bidder. CDAC will coordinate with Uptime Certification and shall make the necessary payment required for facility certification to Uptime Institute. The Bidder shall conduct necessary pre-ISAT in the presence of CDAC / its authorized agency.

If incase the Tier III Facility Certification fails due to any malfunction/failure of the equipment the bidder shall be the sole responsible for the recertification process and its payments for Uptime Institute. The bidder shall take the entire responsibility and shall obtain the Tier III Facility Certification from Uptime Institute if the facility certification test fails during first attempt.

# A.7 Migration Services

Physical shifting of existing 23 racks and its IT components from the Data Center located at Anusandhan Bhawan, C-56/1, Institutional Area Sector-62, Noida to the new Data Center.

## A.8 Miscellaneous

Comprehensive Warranty for all the equipment for a period of two years from the date of issue of Provisional Acceptance Certificate by CDAC.

All necessary approvals, permissions, certifications, etc. from fire department, electricity boards, pollution control board and local authorities is in the scope of the bidder.

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The project is a turnkey project and hence any additional supply/works, which are not explicitly mentioned in the document but required to complete the installation, are in the scope of the bidder.

# B. Data Center Design Requirements

## **B.1 Location and Environment**

The location of the proposed Data Center is at its Research & Development and Academic Center situated at Sector-62 Industrial Area, Noida.

Data Center subsystems shall be designed for the following ambient conditions:

Temperature (Max) : 46.3° C
 Temperature (Min) : 1.2° C
 Relative Humidity : 5 to 95%
 Seismic : Zone IV

Bidders shall visit the site and carry out detailed site survey and the certificate to this effect has to be enclosed along with the bid documents.

## **B.2 Functional Areas of the Data Center**

Area allocated for the Data Center is around 8120 sqft in Ground and First Floor. Data Center shall have the following functional areas:

- Server Room
- Staging Room
- Telco Room
- Central Network Room
- Electrical Rooms
- Battery Rooms
- BMS Room
- NOC Room
- Discussion Room

The proposed layouts of various functional areas of the Data Center are as per the 'Data Center Interior Layout drawing.

#### **B.2.1 Server Room**

The proposed Data Center will have a capacity to install 86 IT Racks in Server Room, 2 IT Racks in Network Room, 1 IT Rack in Staging room and 6 IT Racks in Telco Room. The total of 95 IT Racks are proposed in this facility.

# **B.2.2 Electrical Room and Battery Room**

Modular UPS with N+N redundancy is required for the electrical load of IT Racks of the Data Center. UPS Rooms (having the UPS systems and Electrical Panels) and Battery Rooms for the Data Center are located in the Ground floor.

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# **B.3 Phased implementation**

Data Center will be implemented in two phases. All the civil works and safety & security systems shall be designed and implemented in the first phase itself. The capacity components such as UPS Systems, Precision Cooling Systems and Network components shall be implemented in phases. Present scope of the bidder shall be for Phase-1 only.

Scope of work for Phase-1 and Phase-2 areas mentioned:

S. No.	Subsystem/Component	Phase 1	Phase 2	
1.	Civil and Interior Works	100%	-	
2.	DG Sets	2 Nos.	2 Nos.	
3.	Power synchronization panels for DG Sets	100%		
4.	UPS systems	2 x250kVA	2 x 250 kVA	
5.	Main LT Distribution	100%	-	
-	Douge distribution to rocks	21 Racks in Server	65 Racks in Server	
6.	Power distribution to racks	Room-A	Room-B	
7	Dunning Continue for the Company Dogge	21 Racks in Server	65 Racks in Server	
7.	Precision Cooling for the Server Room	Room-A	Room-B	
8.	Power distribution to Precision Cooling	21 Racks in Server	65 Racks in Server	
ο.	Units	Room-A	Room-B	
9.	Comfort air conditioning for all other	100%	_	
٦.	rooms	10070		
	Fire Alarm, Aspiration, Access Control,			
10.	Rodent Repellent, Water Leakage and	100%	-	
	BMS System			
11.	Fire Suppression System Piping	100%	-	
12.	Fire Suppression System Cylinders, Gas	Server Room-A	Server Room-B	
12.	and Nozzles	Server Room A	Server Room-B	
13.	Racks	30 Racks	65 Racks	
		Server Room-A,		
14.	Passive Networking:	Staging Room,	Server Room-B	
17.	Cable ducting and trays	Network Room,	Server Room B	
		Telco Room		
15.	Passive Networking:	21 Racks in Server	65 Racks in Server	
13.	Fiber & copper cabling	Room-A, Staging	Room-B	

Supply, Installation, Testing and Commissioning of Tier III – Uptime Design and Facility Certified Data Center at CDAC, Sector-62, Noida



	Rack, Network	
	Racks, Telco Racks	



## **B.4 Power Supply Distribution**

The total IT load for the Data Center is calculated as below:

S. No.	Equipment Description	Qty	Load per Unit (kW)	Total Load (kW)	Connected Load (kW)	Load Factor
Α	Critical IT Load					
	Phase-1					
1	Server Rack - Low Density	15	4.00	60.00	60.00	1
2	Server Rack - Medium Density	4	6.00	24.00	24.00	1
3	Network Rack	2	2.50	5.00	5.00	1
4	Central Network Racks	2	3.00	6.00	6.00	1
5	Staging Rack	1	4.00	4.00	4.00	1
6	Telco Rack	6	2.00	12.00	12.00	1
	Total Critical IT Load in Phase-1	30		111.00	111.00	
	Phase-2					
1	Server Rack - Low Density	47	4.00	188.00	188.00	1
2	Server Rack - Medium Density	12	6.00	72.00	72.00	1
3	Network Rack	6	2.50	15.00	15.00	1
	Total Critical IT Load	65		275.00	275.00	
	Total Critical IT Load of Data Center	95		386.00	386.00	

a) Total IT load in Data Center (Phase -1 & Phase-2) : 386 kW

(Includes IT loads in Server Room, Staging Room

Central Network Room and Telco Room)

• Phase-1 IT Load : 111 kW

• Phase-2 IT load : 275 kW

b) Total load in the Data Center inclusive of both phases : 720.92 kW.

• Data Center Load in Phase-1 : 279.42 kW

### **Capacity requirements for Data Center are:**

a) Phase-1

• DG Set : 2 x 500 kVA

• UPS System : 2 x 250kVA

b) Phase-2

DG Set : 2 x 750 kVA
 UPS System : 2 x 250kVA

# **B.5 Cooling System**

• Precision Air Conditioning system is required for Server Room.

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- N+1 redundancy shall be provided for cooling system in Server Room
- Redundancy for Comfort Air Conditioning (to achieve N+N redundancy) is required for Electrical Rooms, Battery Rooms, Staging Room, Central Network Room, Network Room BMS Room, and Telco Room.
- Comfort Air Conditioning Units without Redundancy shall be provided for NOC Room Reception, Sr. Manager Cabin and Meeting Room.
- Outside Ambient Temperature to be considered for the design is 46.3° Celsius.
- The Precision cooling system shall be designed for Cold Aisle temperature of 22±1° Celsius.
- Relative Humidity shall be maintained at 50% ± 5 for the Server Room.
- Nominal room temperature for comfort cooling system shall be 25° Celsius.
- The cooling system shall be designed as per ASHRAE standards and recommendations.
- Redundancy and concurrent maintainability shall be ensured for all critical capacity components (UPS, AC Units, etc.) and distribution components (panels, cables, switch gears, etc.).

# **B.6 Safety and Security Systems**

S. No.	Parameter	Requirement		
		Addressable Sensors.		
	Fire Detection	Mix of heat detectors and optical smoke detectors.		
1.		Multiple zones		
		Aspiration based detection system (VESDA)		
		Automatic Gas based suppression.		
2	Fire suppression	Environment friendly gas to be used.		
2.	rife suppression	NOVEC 1230 based Fire Suppression System		
		Multiple zones are required.		
		Biometric and Smart card for critical areas.		
2	Access Control	Smartcard for other non-critical areas.		
3.		Centralized monitoring and recording.		
		Access logs storage for 60 days		
	ССТУ	IP Based CCTV Cameras.		
4		Centralized monitoring and recording.		
4.		Backup for 30 days on storage system.		
		Archiving solution is required.		
_	Other security	Rodent Repellant System		
5.	systems	Water Leakage Detection System		
6.	Standards	NFPA, TIA942, Local standards/regulatory codes.		

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# **B.6.1 Fire Detection and Suppression coverage requirement**

Area	Fire Detection Required	VESDA	Automatic Fire Suppression Required	Number of Fire suppression zones	Clean Agent based Manual fire extinguishers (Minimum requirement)
Server Room	Yes	Yes	Yes	1	1
Telco Room	Yes	Yes	No	0	1
BMS Room	Yes	No	No	0	1
Staging Room	Yes	Yes	No	0	1
Central Network Room	Yes	Yes	No	0	1
Electrical Room-1	Yes	Yes	No	0	1
Electrical Room-2	Yes	Yes	No	0	1
Battery Room-1	Yes	Yes	No	0	1
Battery Room-2	Yes	Yes	No	0	1
Network Room	Yes	No	No	0	1
Manager Room	Yes	No	No	0	1
NOC Room	Yes	No	No	0	5
Discussion Room	Yes	No	No	0	1
Reception, Corridor and Lobby Area	Yes	No	No	0	2

The above are minimum requirements. The design shall be as per the relevant NFPA and local standards.



# **B.7 Passive Networking**

S. No.	Parameter	Requirement
1.	Racks	Two Network Racks of 42U x 800 x 1200mm and 19 Server Racks of 42U x 600 x 1200 mm shall be provided of Server Room
		One Server Rack of 42U x 600 x1200 mm shall be provided for the Staging Room
		Two Network Racks of 42U x 800 x 1200 mm shall be provided for the Central Network Room
		6 Nos of 42U x 600mm (2 Post) Open Stack Racks shall be provided in Telco Room
2. Network Cable Management		Fiber Runners and wire baskets for Phase-1 requirement
3.	Network cabling	Network cabling to be deployed for Server Room (Phase-1)
		Hybrid (Fiber and Copper) cabling to racks using cable management systems like the cable trays, cable baskets and fiber runners.
		Suitable for flexible network architecture deployment
4.	Telco connectivity	Redundant connectivity to Telecom entrance room.
5.	Redundancy	Path redundancy for the network cabling
6.	Speed	Design for 10Gbps
7.	Standards	EIA 568, EIA606 and other relevant standards.

# **B.8 Design Requirement**

The following are the design considerations of the Data Center:

- **High Availability:** All subsystems of the Data Center shall be designed and implemented as per the TIA942 standards.
- Energy Efficiency: The Data Center shall be designed with an energy efficient design and shall conform to the best practices of Green Data Center. The target average PUE shall be better than 1.8.
- **Modular Design:** The Data Center design shall be modular so that the capacities can be added on demand

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# C. Technical Specifications

## C.1 Civil and Interior Works

The scope of civil works shall include but not limited to the following:

- Interior Design
- Pest Control
- Permanent walls and partitions (Fire rated)
- False Ceiling
- False Flooring
- Thermal Insulation
- Painting (Fire rated)
- Doors (Fire rated)

Any civil, masonry, trenching and fabrication works required for Transformer, DG Sets installation, Electrical installation, Earthing, HVAC installation and other subsystems installations.

Any other civil works required at site

All the Civil works are to be carried out as per the interior layout drawings.

Interior Design and Layout

The interior has to be aesthetically designed and as per the approved color scheme of CDAC.

Layout of the Data Center is as per the drawing in the subsequent page.

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## **Data Center Layout Diagrams as enclosed**



## C.1.1 Partitions and Walls

- Partitioning walls using 2 hour fire rated 200mm light weight Aerocon blocks in the Data Center.
- All partition walls shall be full height from true floor to true ceiling with discontinuity beams at 3 meters height wherever tie beams are not available.
- All piercings on walls for conduiting / cabling on all the rooms of the Data Center shall be closed with appropriate fire sealant.

## **C.1.2 Gypsum Partition**

Full height partition wall of 75 mm thick fire line gyp-board partition using 12.5 mm thick double fire line gyp-board on both sides with GI steel metal vertical stud frame of size 50 mm fixed in the floor and ceiling channels of 50 mm wide to provide a strong partition. Fixing is by self-tapping screw with vertical studs being at 610 mm intervals. The same shall be inclusive of making cutouts for switchboard, sockets, grill etc. It shall also include preparing the surface smoothly and all as per manufacture's specification etc. finally finishing with one coat of approved brand of fire resistant coating.

### C.1.3 Doors

- All Frameless glass doors made out of 12 mm Thick Clear Fully Tempered (Heat Soaked) glass unit with Stainless steel patch fittings complete with 30mm dia C /D type SS handle of Approved lengths and sizes with patch lock and Concealed floor-mounted spring
- All metal doors should be 2-hour fire rated metal doors with sizes as per drawing and requirement.
- All doors should be equipped with DORMA/equivalent make door closers or floor spring and other required hardware.
- All doors should have all accessories to fit devices for access control system.
- All metal doors shall have a fire rated vision glass of size 12"x9".

# C.1.4 False Ceiling

Providing and fixing tiled false ceiling of approved materials of size 595x595 mm in true horizontal level, suspended on inter locking metal grid of hot dipped galvanized steel sections (galvanized @ 120 grams/ sqm, both side inclusive) consisting of main "T" runner with suitably spaced joints to get required length and of size 24x38 mm made from 0.30 mm thick (minimum) sheet, spaced at 1200 mm center to center and cross "T" of size 24x25 mm made of 0.30 mm thick (minimum) sheet, 1200 mm long spaced between main "T" at 600 mm center to center to form a grid of 1200x600 mm and secondary cross "T" of length 600 mm and size 24x25 mm made of 0.30 mm thick (minimum) sheet to be interlocked at middle of the 1200x600 mm panel to form grids of 600x600 mm and wall angle of size 24x24x0.3 mm and laying false ceiling tiles of approved texture in the grid including, required cutting/making, opening for services like diffusers, grills, light fittings, fixtures, smoke detectors etc. Main "T" runners to be suspended from ceiling using GI slotted cleats of min. size 26 x 26 x 25 x1.6 mm fixed to ceiling with 12.5 mm dia and 50 mm long dash fasteners, min. 4 mm GI adjustable rods with galvanized butterfly level clips of min size 85 x 30 x 0.5 mm spaced at 1200 mm center to center along main T, bottom exposed width of 24 mm of all T-sections shall be pre-painted with polyester paint, all complete

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GI Metal Ceiling Lay in perforated beveled/Tegular edge global white color tiles of size 595x595 mm and 0.5 mm thick with 8 mm drop; made of GI sheet having galvanizing of 100 gms/sqm (both sides inclusive) and 20%-22% perforation area with 1.5-1.8 mm dia holes and having NRC (Noise Reduction Coefficient ) of 0.5, electro statically polyester powder coated of thickness 60 microns (minimum), including factory painted after bending and perforation, and backed with a black Glass fiber acoustical fleece.

## C.1.5 Access flooring

Server Room should be equipped with raised floor of 200mm.

#### **False Floor Panels**

- Access floor shall have false flooring panels of 18 gauge steel 600 x 600 coated with 50-micron epoxy conductive paint. Floor panel shall be finished with 1.5mm thick antistatic high-pressure laminate with 2mm thick PVC trim edge all-round.
- The interior of the panels shall be filled with non-combustible lightweight cementitious compound.
- The false floor should have a load bearing capacity of at least 1250kg per square meter (UDL) and at least 450kg point load.
- No data cabling will be installed under the false floor in the Server Room.
- Ramps to be provided for transitioning to elevated floor area at entrance of Server Room.
   Ramp is to be designed and installed to building code requirements.
- Special tools and tackles required for operation and maintenance of access flooring should be supplied in two sets.

#### **Under Structure**

- Pedestal assembly shall be of snap lock type consisting of base assembly 100 x 100 x 2 mm with full bead weld to steel base plate with embossing and four numbers of holes, which shall be fixed to the floor with screws.
- Steel pipe riveted to base plate shall engage the pedestal head assembly. Head shall be formed steel and full bead weld to stud, with four flanges having shape and size as per standard approved manufacturers' specifications.
- Pedestal head flanges shall be provided with holes for screws for fastening the G.I. Stringers.
   No sharp edges or corners shall be exposed from pedestal head when floor panel is removed.
- G.I. rod, fully threaded shall be locked to pedestal head. The entire head assembly is engaged in the base assembly by means of nut and check nut.

#### Stringer

- Stringer system is hot dipped galvanized sheet, construction having channel, with prepunched counter and holes at both ends of the top face for securing the stringers on to the pedestal head to be fixed with screw ensuring maximum lateral stability in all directions.
- The grid formed by the pedestal and stringer assembly shall receive the floor panel. The stringer system would be earthed properly by using copper wire. This is required for some of the servers for transient grounding.

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## C.1.6 Vinyl Flooring

- 2mm thick Antistatic vinyl flooring to be provided for Electrical Rooms, Battery Rooms and Ramp for the Server Room.
- The floor shall be permanently conductive.
- The flooring shall be chemical resistant and slip resistant.

## C.1.7 Painting

- Server Room, Telco Room, Central Network Room, Staging Room, BMS Room, NOC Room, Electrical Room, and Battery Room shall be painted with 2 coats of fire retardant anti dust type painting.
- Gypsum / Plaster of Paris paste of thickness 5 8 mm putty over cement plaster shall be provided so as to ensure a level and smooth texture to the exposed walls and columns.
- The existing surfaces are to be cleaned and scratched and markers are kept before the application of putty.
- After the material has dried upon application, it is to be smoothened by means of rubbing it with sandpaper.
- Upon this smoothened surface one coat of primer and two coats of plastic emulsion paint of approved make & shade is to be applied.

## C.1.8 Pest Control

The bidder shall carry out pest control measures for walls, partitions and other civil works executed by them as per the specifications outlined by Bureau of Indian Standards or other bodies. The pest control shall be done for all external walls, ceilings, furniture and civil works using suitable chemical emulsions as per specifications of BIS and industry standard practices. Anti-termite treatment under existing cavity floors shall be done using suitable chemical emulsion.

### C.1.9 Miscellaneous Works

- Providing & fixing glow signage on both sides of the door shutters marking PUSH / PULL along with other signage marking different work areas and emergency exit signs in the Data Center.
- ii. Removing of existing partition walls, false ceiling, plumbing works, removal of tiles, Cutting & Chipping of existing floors and disposing of debris. The walls/partitions shall be dismantled with prior approval of CDAC without affecting the structure of the building and with minimal disturbance to the existing offices in the building. The debris shall be collected, transported and disposed out of the plant premises by the bidder at their own cost and risk.
- iii. A ramp shall be constructed near the Server Room main door for the access floor level difference from true floor level using 2-hour fire rated materials.
- iv. Civil works for panels, earthing and other required electrical installation as per local regulatory requirements and site conditions.
- v. Any other civil works required to complete the works in the Data Center shall be in the scope of the bidder.
- vi. Providing and fixing of closed shoe rack with seating in Ante Room approved by CDAC Engineer in-charge as per catalogue of preferred makes. The shoe rack shall accommodate atleast 12 pairs of shoes.

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vii. All the dismantled materials will be inspected by the CDAC Engineer-in charge and the usable materials shall be handed over to CDAC

#### C.1.10 Toilet Cubicles

Toilet cubicles made up of 12 mm thick compact laminated HPL sheet of approved colour. Width and length shall be 1 M -1.2 M and 1. 5 M - 1.8 M respectively and height 1.98 M (Including bottom Gap of 150mm) with door Size of 1750 mm (H) X 610mm (W) using Merino or equivalent with U and F Channels, top rail, coat hook, Privacy Thumb turn c/w Occupancy Indicator, Door Knob, Hinges with Cover, Adjustable Foot – 316 Grade, Rubber Lining for Groove , S.S. Screws 304 G & P.V.C Wall Plugs etc. complete. All accessories shall be SS 304 Grade as per direction of EIC. Accessories Standard – Merino Make Stainless Steel – 304 Grade Accessories

- ✓ SS 'U' Channel
- ✓ SS'F' Channel
- ✓ SS Top Rail
- ✓ SS coat Hook
- ✓ SS Privacy Thumb turn c/w Occupancy Indicator
- ✓ SS Door Knob
- ✓ SS Hinges with Cover
- ✓ SS Adjustable Foot 316 Grade
- ✓ Rubber Lininig for Groove
- ✓ SS Screws 304G & P.V.C. Wall Plugs

## C.1.11 Urinals

Flat back urinals shall be fitted with sensors for automatic flushing shall be firmly fitted on finished wall by means of 50mm long brass screws and suitable plugs. The arrangement of waste pipes and discharge to the floor trap shall be as directed by Engineer. For single urinal, the discharge may be direct to the floor trap through a 40mm dia waste pipe. For range of urinals the discharge may be collected to the common discharge pipe by 40mm dia pipe shall be led to the 100mm SWG half round channel laid on the floor leading to the floor trap.

# C.1.12 Water closet-pedestal type

Pedestal type water closet shall be rigidly fixed on the finished floor by means of 75mm long brass screw with suitable plugs. The cistern shall be supported on pair of cast iron or rolled steel cantilever brackets firmly fixed on wall with brass screws and suitable plugs. The flush pipe from the cistern shall be 40mm dia chromium plated. Brass bend fitted to the closet by means of rubber adopter. The closet shall be provided with double plastic seat cover confirming to IS:2548 and chromium plated hinges

#### C.1.13 Wash hand basin

Wash hand basin shall be fitted in position to true level on a pair of cast iron brackets rigidly fixed on wall with 50mm long brass screws and suitable plugs. The type of waste pipes and their connection shall be as directed by the Engineer

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### C.1.14 Porcelain sink

Porcelain sink of size as indicated in the bill of quantities shall be levelled properly and fitted in position on a pair of cast iron cantilever brackets firmly embedded in the wall in cement mortar (1:4) The sink shall be fitted with chromium plated brass waste fittings of standard size. The type of waste pipes and their connections shall be as directed by the Engineer

## C.1.15 Miscellaneous Civil Works

The work shall be executed in accordance with the specifications and drawings enclosed, the working drawings, the Bill of quantities and instructions issued from time to time. Wherever these specifications are found wanting in any way, the C.P.W.D. specifications shall apply.

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## C.2 Electrical Works

### C.2.1 Diesel Generator Sets

Two numbers of 500 kVA Prime Power Diesel Generator Sets with rated output of 415V, 3 phase, 50Hz, 0.8 lagging power factor and having acoustic enclosure shall be provided as per the detailed technical specifications mentioned below.

Diesel Generator set comprising of diesel engine with radiator cooling and with all standard features coupled to alternator with Class H insulation and VPI epoxy impregnated winding, coupled together and mounted on a rigid base frame and comprising of following accessories like:

- Day fuel tank of 990 liters with electrically operated fire-rated solenoid valve for filling the integral fuel tank along with manual bypass valves.
- Batteries: 2 numbers of 12 Volts / 180Ah
- Electronic control panel
- Acoustic Enclosure suitable for outdoor applications.
- Modbus interface (RS485) for status monitoring in BMS

#### **Reference Standards**

Diesel Engine Power	: ISO 3046-1
Speed Governor	: ISO 3046-4
Generator	: IS 4722 / IS 13364
Permissible limits of Noise level of Rotating Machines	: IS 12065
Diesel Fuel	: IS 1460
Hot dip-Galvanizing steel	: IS 2629
Codes of fire safety	: IS 3034
Battery & Charging	: IS 7372
Degree of Protection of generator	: IP 23 as per IS 4691
Degree of Protection of Control panel	: IP 41 as per IS 2147
Control Panel	: IS 8623 Part I

## a. Engine

- Engine shall have the following accessories:
- Air Inlet System
- Cooling System
- Exhaust System
- Fuel System
- Lubrication System
- Flywheel & Flywheel Housing
- Charging System
- Control System
- Instrumentation



## b. Base Frame and Coupling

Diesel engine and alternator are coupled together with closed coupling and placed on robust, sturdy iron base frame specially designed to absorb vibrations for the smooth operation of the D.G. set. Spring mounted Anti-vibration mounting shall be supplied.

#### c. Alternator

Stamford/Leroy Somer make alternator shall be used.

Alternator shall have the following specifications:

Make	: Stamford/Leroy Somer	
Output	: 500 kVA	
No: of Phase	: 3	
Power factor	: 0.8 lag	
Reference Altitude	: 1000 meters above MSL	
Ambient Temp	: 48.3°C	
No: of poles	: 4 pole	
Insulation Class	: H	
Excitation type	: Brushless	
Voltage Regulator	: AVR	
Voltage Regulation	: +/- 1%	

#### d. Fuel Tank

990 liters capacity external fuel tank made up of quality M.S. sheet tested for leak and pressure and supplied with filling point, breather, and level indicator with graduation, outlet valve, drain plug, lifting hooks and provision for return fuel.

#### e. Battery

2 Nos. 12 V dry uncharged suitable plates of batteries along with terminated lead connectors including inter connection cables will be supplied. Suitable MS battery stand with proper earthing will be provided.

The power supply shall be provided to battery charging from redundant circuits and shall be concurrently maintainable.

#### f. Acoustic Enclosure

Acoustic enclosure is state-of-art construction and specially designed to meet the stringent norms laid by MOEF / CPCB, meeting the noise barrier of 75 dB @ 1 meter. Distance from the enclosure at free field conditions. The Enclosure is fabricated to have optimum serviceability. The air inlet louvers are specially designed such that the system operates at rated load even at 50 °C ambient temperature. These sound attenuators are fabricated using special purpose CNC machines for consistency in quality and workmanship. All the five sides are powder coated for superior finish and long lasting life. Stainless steel hardware in addition to IS 8183 specification material shall be used to achieve better noise insulation resulting in the best sound attenuation. The enclosure shall be containerized type housing the Engine, Alternator, Fuel Tank, and Batteries.

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TECHNICAL PARTICULARS of DG SET		1
Description	Units	Rating
Prime Rated output	kVA	500
Engine Cooling		Turbocharged, Air-to-
		Water cooling
Cylinder arrangement		As per OEM
Bore and stroke	MM	As per OEM
Compression ratio	Ratio	16.5:1
Rated speed	RPM	1500
Lube oil & filter change period	Hours	500
Minimum continuous load	%	20
Piston speed	Mtrs/sec	7.2
Engine KW at rated RPM	Kw (HP)	As per OEM
Fuel stop power as per ISO-3046	Kw (HP)	As per OEM
Frequency regulation, steady state	%	+/- 0.25
Governor type	-	Electronic, Isochronous
Governor class	-	ISO 8528-5 G2
Engine over speed shutdown	RPM	1800
Lube Oil System		
Lube oil filter filtration capacity	Microns	12
Recommended lube oil grade		CH4 15W40
Total system capacity	Liters	38
Combustion/Air Intake		
Combustion air flow	cfm	1280
Air filter	Type	Dry type - replaceable
Coolant System		
Recommended coolant		Engine extended life
		coolant
Total system capacity)	Liters	85
Cooling system ambient capability	°C	50
Engine Electrical System		
Туре		
Charging alternator volts/current	V DC /	24V negative earth
	Amps	28 / 70

Pollution Control Board Certificate should be provided for the installed DG Sets.



### g. EXHAUST PIPING

- The exhaust piping shall be fabricated with suitable thickness of MS pipes. Vendor shall confirm the adequacy & submit the calculation for that before approval.
- The horizontal run of exhaust piping shall be supported on spring supports. The vertical run shall have expansion bellows.
- A weather cowl shall be provided at the top.
- The pipe shall be painted after fabrication with heat resistant paint.
- The exhaust piping and the silencers shall be insulated using 50mm thick mineral wool all along the length. The insulation shall be cladded with 24 G aluminum sheet.
- The exhaust pipe shall be lead up to a height stipulated by the authorities or 3M above the Enclosure level (whichever is higher)
- All lifting tools and tackles used for the erection shall have valid safety certification



## C.2.2 DG AMF, Auto Synchronization and Auto Load Sharing Panel

AMF and Synchronizing switchgear shall be of metal enclosed, freestanding, trench mounting, dust and vermin proof outdoor type, Extendable type, outdoor type and shall comprising of the following. All meters and relays shall be mounted on the front panels. Below listed meters and relays are required for the safe operation of the 415V, 0.8 P.F Diesel generator set. Any meters/ relays / equipment's required for the safe operation that is not mentioned in drawing/document/BOQ shall be included in this package:

- Ammeter with selector switch
- Voltmeter with selector switch
- Hour Run Counter
- Winding temp & Bearing temp to be made available for metering
- Frequency meters
- KW meters
- KVA meters
- KVAR meters
- Power factor meters
- Energy Monitors
- Over current relays
- Earth fault relays
- Field relays
- Reverse Power relays
- Trip circuit supervision relays
- Check synchronizing relays
- Differential protection relays
- Over voltage relays
- Under voltage relays
- Combined Over and under frequency relays.
- Master trip relays
- Low Forward power Relay
- Loss of Excitation
- Negative Phase Sequence
- Voltage Restrained IDMTL overcurrent relay
- Stand By Earth Fault
- Over voltage
- Neutral Displacement Relay
- Restricted earth Fault Relay
- Dead Bus Relay
- Over flux
- Control Supply Supervision
- Local / remote control switch.
- Breaker control switch
- Emergency stop switch
- Signal lamps for circuit breakers.
- Fault indicator (audio alarm and visual)
- Push buttons



- Current / potential transformers for parallel running / metering protection.
- Panel illumination, space heater etc.
- Battery charger unit
- Generator Control Unit (GCU) for auto mains failure start, auto synchronizing, auto load sharing

## a. Synchronizing Panel

Bidder shall provide set of potential free contacts with RS485 Compatible to facilitate with BMS operation

- Storage Tank status
- DG set ON/OFF status
- Day tank level low/high
- Lube oil pressure low/high
- Cooling water temperature low/high
- Battery low/high
- Auto/manual status of DG Sets,
- Engine & Alternator healthy status
- DG Breaker On, Off & trip status.
- Voltage will be monitored for line as well as for bus also.
- The DGAMF panel will have provision of potential and potential free contacts for interfacing with engine control panel and BMS panel.

Monitoring electrical parameters V, I, HZ, PF, KW, KWH, KVAR

## b. Operation Philosophy for D.G sets

- The controls for DG sets will be Microprocessor based, automatic starting on mains failure and stopping, synchronizing, parallel operation and load sharing controls to provide high reliability and optimum performance. The parallel operations shall be fully integrated microprocessor based controls eliminating the need for separate paralleling control devices with state of art features for controls, monitoring and adjustment of the systems parameters. Current shall be regulated to typically 300% for faults when a short circuit is sensed. The systems shall communicate with BACnet/Modbus or equal protocols for seamless interfacing with BMS systems for monitoring the DG set operations.
- During normal condition, the power supply will be fed from the grid and the DG breakers shall normally be open.
- When the EB supply fails or drops to a certain preset value the control system shall give the starting command to the master DG sets after the respective EB breaker are open.
- When the DG sets attains the rated voltage, frequency assessed by relays (PLC based) the command for the D.G breakers closing shall be initiated according to the demand
- DG sets shall work on sequential starting basis with preset time
- AMF switchgear shall command the respective DG set according to the required load demand.
- The neutral of only one DG set in each bus section will be earthed at any one time through the neutral switching contactors with closing and opening of contactors controlled by microprocessor based DG set control systems with appropriate logic..
- DG sets should be able to get black started in less than 30 sec.



#### c. Manual Mode

In this mode, the required DG shall be started manually and Synchronization shall also be achieved manually. The required DG shall be selected using the DG Selector Switch, Voltage and Frequency of the DG to be synchronized shall be adjusted by using the joysticks speed raise/lower switch. All protection will remain in manual mode also.

#### d. Automatic Mode

- This is fully automatic mode in which the DG set starting/ synchronizing on mains failure as well as DG set stopping on Mains restoration shall be carried out automatically by the PLC/ Controller system with power transducer. If load is higher, then the software automatically start DGs.
- After the sets are synchronized. The system shall also ensure correct KW and KVAR sharing between the sets both active and reactive. It will also perform the function of auto load management i.e. switching OFF and ON the DGs as per the load.
- The system shall allow the operator to select the start-up sequence for DG starting.
- The starting/ stopping of DG outgoing feeders of respective DGs shall also be controlled by PLC.
- The DG start sequence can be pre-selected by the operator.

## e. Automatic Starting and Stopping of Engines

- On sensing of Grid failure the PLC/ Controller shall (after a settable time delay) issue the start command to all engine, if the DG set does not start in the first cranking, two more cranking attempts shall be made. Even then if the Engine fails to start, then "Engine Fails to Start" alarm shall be generated and PLC shall proceed with starting the next DG in sequence selected.
- After the DG set has been started and put on Load, the PLC shall continue to control its voltage and frequency PLC/ Controller shall also continuously monitor the DG loading. If the loading exceeds a settable limit, (after a time delay), the next DG shall be started to prevent DG overloading. This process shall continue till all the DGs have been started.
- If at any point of time, the DG load falls a maximum settable limit, then after a time delay, the PLC/ controller shall issue start command to the next DG to prevent over loading of the DGs. As and when combined DG's reaches its minimum settable value the PLC/ Controller will issue command to prevent under loading of DG and avoid any fuel wastage. The DGs shall be switched off after a further settable time delay to ensure adequate cooling down of the engines.
- After resumption of grid power supply, voltage relay at incomer of LVS-5 (Typical) will sense
  the line voltage & timer will initiate "OFF" command for DG incomer of LVS-5 after a
  predefined time interval. Then grid incomer of LVS-5 will be given close command after
  ensuring that DG incomer is "OFF". DG set will be running on no-load for a predefined time
  and will be safe shut down automatically.

## f. Automatic Synchronization

• In auto synchronizing mode, the synchronization shall be achieved by the PLC/ controller which shall automatically control the voltage and frequency and issue close command to the breaker. PLC/ Controller system. One power monitor/ power transducer shall be provided

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for each DG set along with main processor unit, power supply, digital input and output module. System shall be complete with P.C with window based operator interface. All PLC/ Controller will communicate to PC.

• PLC / Controller shall monitor the Synchronization time. If the Synchronization is not achieved in a settable time. "DG FAILED TO SYNCRONIZE" alarm shall be generated and synchronization shall be aborted.

## g. MCC for DG Auxiliaries

Motor control center with requisite number of starter feeders for all the auxiliaries such as lube oil, primary pumps, and fans shall be supplied. All power and control components such as MCCBs, Starters, auxiliary relays, time switches, single phase preventer, under voltage relay, over voltage relay and thermostatic control of fans.

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### C.2.3 LT and Control Cables

This specification covers the design, manufacture, testing, inspection at Manufacturer's works and supply of power and control cables as detailed in Data Sheet conforming to specific requirements mentioned in this specification. The estimated quantities are given in the price schedule. However, the System Integrator shall recheck the quantities and supply according to the requirements.

#### a. Codes and Standards

The design manufacture and performance of cables shall comply with the requirements of the latest editions of the codes and standards. The cables covered by this specification shall, unless otherwise stated, be designed manufactured and tested in accordance with the latest revisions of relevant Indian standards.

IS: 7098 (PART-I)-1988 : Cross-linked polyethylene insulated PVC Sheathed Cables for working

voltages up to 1100V.

IS: 7098 (PART-II)-1985 : Cross-linked polyethylene insulated PVC sheathed cables for working

voltages from 3.3 kV up to and including 33 kV.

IS 1255 – 1983 : Code of practice for installation and maintenance of Power cables

IS: 8130 : Conductors for insulated electric cables and flexible cords.

IS: 5831 : PVC insulation and sheath of electric cables.

IS 5891 – 1970 : Recommended short circuit rating of high voltage PVC cables

IS 3961 – 1987 : Recommended current rating

IS:3975 : Mild steel wires, strips and tapes for armoring of cables.

IS:2633 : Methods of testing weight, thickness and uniformity of Coating on

hot dipped galvanized articles.

IS: 209 : Specification of zinc.

IS: 10418 : Wooden drums for electric cables.

IEC: 540 & 540A : Test methods for insulation and sheaths of electric Cables and cords.

IS: 10462 (PART-I) : Fictitious calculation method for determination of Dimensions of

protective coverings of electrometric and thermoplastic insulated

cables.

IS: 10810 (PART 58) : Oxygen Index test

BS 7655 LTS 2 : Flammability Characteristics of cables IEC 60092-SHF-1 : Flammability Characteristics of cables IEC-332 : Flammability Characteristics of cables SS4241475 class F3 : Flammability Characteristics of cables

ASTM-D-2843 : Determination of smoke generation of outer sheath under fire

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

IS:3975 : Mild steel wires, strips and tapes for armoring of cables.

ASTM-D-2863 : Measurement of minimum oxygen concentration to support candle

like combustion of plastics

IEC: 60331-21 : Tests for electric cables under fire conditions circuit integrity

Procedures and requirements -Cables of rated voltage up and

including 0.6/1.0kV.

IEC: 60332-1 : Test of the fire behavior on single core or single cable (flame

retardancy)

IEC: 60332-3 : Tests of the fire behavior on bunched cables (reduced flame

propagation)

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## b. Design Feature

The cable shall maintain their insulating properties as required by the operating conditions when subjected to maximum ambient temperature of 50°C and a maximum conductor temperature of 90°C.

The conductor temperature during short circuit shall not exceed 250°C. Cables shall be suitable for short time overload.

The cables shall maintain its required insulating properties when exposed environment and mechanical stresses resulting during installation and operation.

Cables shall be suitable for installation on multi-tier ladder type cable trays running horizontally or vertically in the buildings as well as in the concrete cable trenches, RCC Hume/ GI pipes, and outdoor cable trays with restricted ventilation. No forced ventilation is envisaged for the cables. Cables shall also be suitable for lying underground directly.

#### c. General Construction

- Outer sheath of all XLPE / PVC cables shall be black in color and the minimum value of oxygen index shall be 29 at 27 ± 2°C. In addition, suitable chemicals shall be added into the PVC compound of the outer sheath to protect the cable against rodent and termite attack.
- Sequential marking of the length of the cable in meters shall be provided on the outer sheath at every one meter. The embossing shall be legible and indelible.
- The overall diameter of the cables shall be strictly as per the values declared in the technical information furnished along with bids subject to a maximum tolerance of ± 2mm
- PVC/Rubber end caps shall be supplied free of cost for each drum with a minimum of eight per thousand meter length. In addition, ends of the cables shall be properly sealed with caps to avoid ingress of water during transportation and storage.
- Cable bending radius for multi core cables should not exceed 12D, where D is the diameter
  of cable.
- Voltage grade would be according to required voltage.
- Number of cores for power would be one, two, three, three and half or four as per design. Number of cores for control cable shall be four & above or as specified.
- All the cables shall be rated at 650V for control cables and 1100V for power and auxiliary cables for armoured and unarmored cables.
- XLPE insulated cables shall be rated for continuous operation at maximum conductor temperature of 90deg C and for a maximum short circuit temperature of 250°C.

#### d. 1.1kV Power & Control Cables

- All power/control cables for use on medium voltage systems shall be heavy- duty type, 1100V insulated, FRLS XLPE for LT and FRLS PVC for control cables of sizes and quantity as per the Master SLD/Cable Schedule.
- Sheathing of cable shall be of PVC for both XLPE & PVC insulated cable.
- The conductors shall be 'stranded' for both aluminum and copper cables. Conductors of nominal area less than 25 Sq. mm shall be circular only. Conductors of area 25 Sq. mm and above may be circular or shaped. Cables with reduced neutral conductor shall have sizes as per Tables 1 of IS 1554 (Part-I).

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- The thickness of insulation and the tolerance on thickness of insulation shall as per table 2 of IS: 1554 Part 1. Control cables having 6 cores and above shall be identified with prominent and indelible English numerals on the outer surface of the insulation. Color of the numbers shall contrast with the color of insulation with a spacing of maximum 50mm between two consecutive numbers. Color coding for cables up to 5 cores shall be as per Indian standard.
- Armoring for multi-core cables shall be by single round galvanized steel wires where the
  calculated diameter below armoring does not exceed 13mm and by galvanized steel strips
  where this dimension is greater than 13 mm. Requirement and methods of tests for armor
  material and uniformity of galvanization shall be as per IS-3975 and IS-2633. The dimensions
  of armor shall be as per table 5 of IS: 1554(Part-1).
- Conductors shall be smooth, uniform in quality, free from scale, spills, splits and any other
  defects. There shall be no joints in individual strands except those made in the base rod or
  wire before final drawing.

#### e. XLPE Cables

- System Voltage: 11kV, 3Phase, 50 Hz unearthed as per the system design requirement.
- Power cables for 1.1 kV up to and including 11 kV systems shall be Aluminum or Copper conductor as shown in the Drawings; XLPE insulated, screened, sheathed, armored and overall PVC sheathed as detailed below.
- The conductor shall be stranded and compacted circular for all cables.
- All cables rated 3.8/6.6kV and above shall be provided with both conductor screening and insulation screening. The conductors shall be provided with non-metallic extruded semiconducting shielding.
- The core insulation shall be with cross-linked polyethylene insulating compound applied by extrusion. It shall be free from voids and shall withstand all mechanical and thermal stress under steady state and transient operating conditions. It shall confirm to the properties given in Table-1 of IS: 7098 (PART-II).
- The insulating shielding shall consist of non-metallic extruded semi-conducting compound in combination with a nonmagnetic metallic screening of copper. The copper screen shall be capable of carrying the single line to ground fault current as per specified duration in datasheet.
- The conductor screen, XLPE insulation and insulation screen shall all be extruded in one operation by "Triple Extrusion" process to ensure perfect bonding between the layers. The core identification shall be by colored stripes or by printed numerals.
- The inner sheath shall be applied over the laid up cores by extrusion and shall conform to the requirements of type ST2 compound of IS: 5831. The extruded inner sheath shall be of uniform thickness for multi core cables, the armoring shall be by galvanized steel strips. If armoring is specified for single core cables in the data sheet, the same shall be with H grade hard drawn aluminum round wire of 2.5 Sq. mm diameter. Also in case of single core cables, there shall be extruded inner sheath between insulation metallic screen and armoring."
- The outer sheath of the cables shall be applied by extrusion offer the armoring and shall be of PVC compound confirming to the requirements of type ST2 compound of IS: 5831. The thickness of outer sheet shall be as per amendment No. 1 to table 5 of IS: 7098 part 2. (for both armored and unarmoured cables.)
- The dimensions of the insulation, inner sheath and armor materials shall be governed by values given in Table 2,3 and 4 (Method "b") of IS: 7098 Part-II. Aluminum cables shall be used for HT distribution. The type of insulation for cable will be XLPE & the type of inner

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sheathing will be PVC wrapped PVC extruded. The type of amour shall be unarmored /armored /tape armored. Outer sheath shall be PVC.

- The fire survival cables shall meet the following additional requirements:
  - ✓ The insulation shall be of EPR or equivalent material with glass mica tape below or above insulation.
  - ✓ The cables shall meet requirement of circuit integrity test for a minimum period of 3 hours at maximum temperature of 950°C.
  - ✓ Vendor shall have the test certificate for circuit integrity test as per IEC: 60331-21."

#### f. Cable Accessories

- The termination and straight through jointing kits for use on the systems shall be suitable for the type of cables offered as per IS:13573
- The accessories shall be supplied in kit form. Each component of the kit shall carry the manufacture's mark of origin.
- The kit shall include all stress grading, insulating and sealing materials apart from conductor fittings and consumable items. An installation instruction sheet shall also be included in each kit.
- The contents of the accessories kit including all consumables shall be suitable for storage without deterioration at a temperature of 45° with self-life extending to more than 5 years.
- TERMINATING KITS: The terminating kits shall be suitable for termination of the cables to indoor switchgear or to a weather-proof transformer/motor. For outdoor terminations, weather shields/sealing ends and any other accessories required shall also form part of the kit. The terminating kits shall be one of the makes/types mentioned in the data sheet.
- JOINTING KITS: The straight through jointing kits shall be suitable for installation on overhead trays, concrete lined trenches, and ducts and for underground burial with uncontrolled backfill and possibility of flooding by water and chemicals. These shall have protection against any mechanical damage and suitably designed to be protected against rodent and termite attack. The inner sheath similar to that provided for cables shall be provided as part of straight through joint."

#### g. Tests

Type tests should have been carried out to prove the general qualities and design of given type of termination /jointing system. The type tests shall include the following tests conforming to IS specification. The type test certificates shall be submitted along with the offer.

- Rated withstand AC voltage test
- Partial discharge test
- Rated withstand surge voltage test
- Continuous AC voltage test with cyclic current load (umber of heating cycles-3)
- Partial discharge test
- Continuous AC voltage test with cyclic current load (Number of heating cycles-60) Thermal short circuit test
- Continuous AC voltage test with cyclic current load (Number of heating cycles-63)
- Rated withstand surge voltage test
- D.C. voltage test
- Test under the influence of moisture



• Dynamic short circuit test



#### C.2.4 Automatic Transfer Switches

Automatic Transfer Switches (ATS)shall be suitable for 415V 3 Phase 4 wire system and shall withstand a fault current of minimum 50KA for 1 second. Each ATS shall consist of an inherently double throw power transfer switch mechanism and a microprocessor controller to provide automatic operation. All transfer switches and controllers shall be the products of the same manufacturer.

#### a. Codes and Standards

The automatic transfer switches and controls shall conform to the requirements of:

- UL 1008 Standard for Transfer Switch Equipment
- IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment
- NFPA 70 National Electrical Code
- NFPA 99 Essential Electrical Systems for Health Care Facilities
- NFPA 110 Emergency and Standby Power Systems
- IEEE Standard 446 IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- NEMA Standard ICS10-1993 (formerly ICS2-447) AC Automatic Transfer Switches
- UL 508 Industrial Control Equipment.

#### b. Accessories

### **Mechanically Held Transfer Switch**

- The transfer switch shall be electrically operated and mechanically held. The electrical
  operator shall be a momentarily energized, single-solenoid mechanism. Main operators
  which include over current disconnect devices, linear motors or gears shall not be
  acceptable. The switch shall be mechanically interlocked to ensure only two possible
  positions, normal or emergency.
- The switch shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value and contact temperature rise is minimized for maximum reliability and operating life.
- All main contacts shall be of silver composition. Switches shall have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.
- Inspection of all contacts shall be possible from the front of the switch without disassembly
  of operating linkages and without disconnection of power conductors. Switches shall have
  front removable and replaceable contacts. All stationary and moveable contacts shall be
  replaceable without removing power conductors and/or bus bars
- Where neutral conductors must be switched as shown in the drawings, the ATS shall be
  provided with fully rated overlapping neutral transfer contacts. The neutrals of the normal
  and emergency power sources shall be connected together only during the transfer and
  retransfer operation and remain connected together until power source contacts close on
  the source to which the transfer is being made. The overlapping neutral contacts shall not



- overlap for a period greater than 100 milliseconds. Neutral switching contacts which do not overlap are not acceptable.
- Where neutral conductors are to be solidly connected, a neutral conductor plate with fully rated AL/CU pressure connectors shall be provided.

## c. Microprocessor Controller

- The controller's sensing and logic shall be provided by a single built-in microprocessor for maximum reliability, minimum maintenance, and the ability to communicate serially through a serial communication module.
- A single controller shall provide twelve selectable nominal voltages for maximum application flexibility and minimal spare part requirements. Voltage sensing shall be true RMS type and shall be accurate to ± 1% of nominal voltage. Frequency sensing shall be accurate to ± 0.2%. The panel shall be capable of operating over a temperature range of 10 to + 50 °C.
- The controller shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the controller to be disconnected from the transfer switch for routine maintenance. Sensing and control logic shall be provided on multi-layer printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers. The panel shall be enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance. The protective cover shall include a built-in pocket for storage of the operator's manuals.
- All connections shall be wired to a common terminal block to simplify field-wiring connections.
- The controller shall meet or exceed the requirements for Electromagnetic Compatibility (EMC) as follows:
  - ✓ IEEE472 (ANSI C37.90A) Ring Wave Test.
  - ✓ ENC55011 1991 Class A Conducted and Radiated Emission.
  - ✓ EN61000-4-2 Electrostatic Discharge Immunity, Direct Contact & Air Discharge.
  - ✓ EN61000-4-3 Radiated Electromagnetic Field Immunity.
  - ✓ EN61000-4-4 Electrical Fast Transient Immunity.
  - ✓ EN61000-4-5 Surge Immunity.
  - ✓ ENV50141 HF Conducted Disturbances Immunity.



### C.2.5 Data Center Electrical Panels

#### a. Standards

The equipment covered by this specification shall, unless otherwise specified be in accordance with relevant IEC/IS specification. The degree of protection shall not be less than IP-52 mentioned in IEC-144 / IS-5.

#### b. Construction

The switchboards shall be of multi-cubicle/compartmental or multi box factory-built air-insulated type, fully enclosed with doors for access to the interior. 2mm thick steel sheet shall be used for the fabrication of doors for the panels and 1.6mm thick steel sheet for body.

The complete panels shall not be more than 1800 mm high with the channel base and the depth shall be preferably within 1200 mm wide measured from rear to front faces. The working height shall be minimum 450 mm to maximum 1650 mm. The width of the panel will depend upon the no. of circuits to be accommodated. The design shall be such as to permit extension at site on either end.

The panels shall be designed to facilitate cable entry from the top/bottom through entry holes of removable plates provided at the top/bottom of the cubicle.

The switchboard shall be vermin proof and suitable for use in tropical climate. All ventilating louvers and holes shall be covered with fine wire mesh from inside. A suitable rust resisting primer paint shall be applied on the panel after the same is polished and the primer shall be evenly sprayed. The color of the exterior of the panel shall be of same color as that of the main control & relay panel. The color of the interior panel should be as to provide a color contrasting background for the wiring inside the cubicle.

The switchboards shall be mounted on channel and shall be complete with channel bottom plates, grouting bolts, earthing bolts, washers, cable glands, etc.

Single and three phase switches as well as the fuse terminals provided on the panel shall be of best quality and easy in operation.

#### c. Bus bars

Bus bars shall be aluminum, suitably sized for the specified continuous current rating mentioned in the SLD and short circuit current rating of 50 KA (rms) for 3 sec. Necessary precaution shall be taken to avoid bimetallic action if aluminum conductors are to be connected to copper bus. Means shall be provided for identifying various phases of bus bars by red, yellow and blue print.

Bus support shall be of arc resistant, non-tracking, low absorption type insulators of high impact strength to withstand normal and fault condition stresses.

#### d. Circuit breakers

AC Air Circuit Breakers shall be fully draw out type, housed in separate compartments having a continuous current carrying capacity, breaking capacity as per approved scheme. The circuit breakers shall be provided with trip coil and closing coil operated from suitable control voltage to be arranged by bidder. Spring operated mechanism shall be provided for breaker closing. The

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breaker shall be provided with trip free, automatically operated mechanism & push button to trip the breaker as well as to close the breaker electrically.

The breaker shall be provided with two over current and one earth fault IDMT type relay. One ammeter and one voltmeter with their respective selector switches shall also be provided in incoming breakers.

ACB shall comply with standards IS/IEC 60947-1 & 2 and shall have a rated operational voltage of 415V AC, rated insulation voltage of 1000 volts AC, rated impulse voltage of 12kV.ACB shall have the breaking performance  $I_{cs} = I_{cu} = I_{cw}$  (1sec)

The circuit breaker shall be provided with auxiliary contacts for Close / Open and trip circuit healthy indicating lamp. Two sets of spare auxiliary contacts of each open and close position shall be provided.

ACB shall have a Ready to close mechanism preferably having a ready to close mechanical indication on front of ACB. All EDO ACBs ready to close indication contact which shall be used to give a single indication via indicating lamps on panel door if ACB is ready to be closed, after checking all the given conditions (UV release energized, Shunt release de-energized, spring charged, Breaker is not "ON", Breaker has not tripped on fault, Breaker is not mechanically interlocked with other breaker and ACB is not racked in completely in service position) ensuring safety for user and electrical distribution.

Separately powered, individual fault trip indication LEDs (For overload, short circuit, earth fault and trip unit failure) shall be available on the trip unit which shall function even if the display fails.

All ACBs in main LT panel shall surely be provided with zone selective interlocking which helps in reducing the thermal and dynamic stress on installation during short circuit and ground faults.

Circuit breaker trip unit shall have a display for measurement of current and voltage. It shall be possible to view last 5 trip cause on trip unit.

The door of the circuit breaker compartment shall be interlocked so that (1) the door cannot be opened while the breaker is in closed position and (2) when the door is open the breaker cannot be closed. However, facility, to defeat this interlock shall be provided for testing purposes. The circuit breaker shall have three defined position namely (a) Service (b) Test and (c) Isolated. The circuit breaker can be closed in test position.

#### e. Moulded Case Circuit Breakers

MCCBs shall comply with standards IS/IEC 60947-1 & 2. It shall have a rated operational voltage (Ue) of 415V, insulation voltage (Ui) of 690 V (AC 50/60 Hz) & impulse voltage (Uimp) of not less than 8kV. having a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (Icu) at 415V and as per system fault levels (refer SLD).

MCCBs shall be current limiting type preferably having an encapsulated double break design having two fixed contacts, one moving contacts and two arc chutes per pole. The design is required to minimize the effects of short circuit currents i.e. limit the let through energy and improve the life of cables.

MCCBs shall be equipped with a "push to trip" button in front to test operation and simultaneous opening of all poles together.

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The electrical life of MCCBs shall be 8,000 operations up to 250A & 4000 operations up to 630A

All cable termination shall be done using circular lugs.

Thermal magnetic trip units for 250A and below shall have variable overload settings from 0.7 to 1 Ir and fixed short circuit settings and above 250A Microprocessor trip units shall have variable overload settings from 0.5 to 1 Ir and variable short circuit settings from 2 to 10Ir

Where ever it is required based on electrical distribution network need, MCCB shall have Earth Fault Protection as a provision. MCCB Earth Fault Protection should have following settings and features:

#### **Selection of Ir MCCB rating**

Earth fault sensitivity selection from 20% – 60% In.

The time delay selection in case of Earth Fault from 0.5 to 3 Sec/instantaneous.

There shall be a separate fault differentiation indication (LED) for Over current and Earth fault. Indication for over current and earth fault tripping shall be extended to the panel door via indication lamps

Separate LED shall be there to show healthiness of earth fault protection system

EF protection module shall be suitable for 3P 4W system. It shall take the input from neutral for correct earth fault protection.

Earth fault module shall have auxiliary contacts for earth fault signaling.

#### f. Miniature circuit breakers

The MCBs shall be air break types capable of safely breaking the fault current of the associated feeder. The MCB shall have a quick make, quicker break mechanism complete with position indicator.

The MCBs shall comply with the relevant IS Standard.

The audio alarm for tripping of AC circuit breaker or blowing of fuse shall be made with facility of canceling the alarm. Individual lamp indication shall be provided in the AC switchboard and the same will continue to glow till the fault is rectified.

Indicating lamps of control switches

Indicating lamps shall be LED type provided with colored dust protecting type lens. Lamps shall be of very low wattage consumption and heat generated due to continuous burning shall not deteriorate lamp cover.

### g. Space Heaters

The AC switch board shall be provided with thermostat controlled space heaters through hand operated switch.

#### h. TVSS

All the LT panels shall be provided be with Transient Voltage Surge Suppressor (TVSS) having Response time <0.5ns, Let-through Voltage 600V-800V

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## i. Internal wiring

Internal wiring of the AC switchboard shall be done by means of stranded copper conductor, PVC insulated and sheathed cable conforming to IS: 1554 (Part-I). Minimum size of the wiring shall be such as to allow only 5% drop of voltage at the remote end of the longest outgoing feeder from the AC panel board 2.5% drop in case of starting of motor of the remote end. Multi way terminal blocks of copper stud moulded construction complete with screws, nuts, washers, etc. shall be provided for terminating the internal wiring and outgoing cables. Control terminals shall be clamp type.

Each wire shall be identified at both ends & shall be properly tagged & ferruled in compliance with approved drawings. Wires shall not be spliced or tapped between terminal points.

Wires shall be neatly bunched and adequately supported as to prevent sagging, strain and termination.

All spare contacts of the equipment shall be wired upto the terminal block. At least 10% spare terminals shall be provided in each cubicle. There shall be sufficient space between the terminals for easy connection of the leads. More than two connections in a stud shall be avoided. Lock nut with washer shall be provided in each stud.

## j. Grounding

A copper strip ground bus rated to carry maximum fault current shall be provided along the entire length of the distribution board. Ground bus comprising of Aluminum conductors, as alternative shall not be acceptable.

Each casing of the equipment provided in the board shall be connected directly to the ground bus in accordance with I.E. rules. The ground bus shall be brought out to two terminals at the two ends of the switchboard for connection with the station earthling system.

## k. Tropical finish

All electrical equipment, accessories and insulation of wiring shall have fungus protection involving special treatment on insulation and metal against fungus, insect & corrosion.

## I. Insulation

The insulation at any point in the distribution board shall be of at 1.1 KV grade.

## m. Cable glands

All feeders shall be provided with suitable dust tight screwed double compression heavy duty brass cable glands conforming to the relevant IS Standard. Gland shall project above the gland plate. Terminating cables shall be armoured and the armor rods shall be connected to earth bar.

#### n. Meters

MFM needs to comply Class 1 as per IEC62053-23 with a minimum sampling rate of 64 Samples / Cycle.

MFM needs to be capable of measuring V,A, PF, F, All energy parameters, Power parameters, Demand Parameters, Import / Export, Peak Demand with Date Time Stamping

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MFM needs to measure individual harmonics upto 31st over communication for V & A.

MFM needs to have calibration LED and communication LED and also provided with RS485 port for communication. User needs to be capable of putting communication off, if required from the front display

Third Party type tested documents for the accuracy needs to be produced.

## o. Relays & Contactors

Two over current relays and one earth fault relay shall be provided in each of the incoming breaker. The relays shall be IDMT type. The relays shall be suitable for operation with a temperature range of 0°C to 50°C. The contacts of the relay shall be silvered. When open, the contacts shall withstand a voltage of 115% of the normal circuit voltage. The relays shall not deteriorate in performance due to ageing of any constituent material.

The over current relay shall have a setting from 50% to 200% and that of earth fault relay from 20% to 80% of the rated secondary current of the C.T. The operating voltage of the trip & closing coil shall be 220 V DC +/- 10%. Contactors, if used shall be of same voltage rating.

## p. Current transformer of the breaker

Current transformer used for incoming L.T. Switchgear shall be air cooled of accuracy class of 5P and 1 for protection and metering respectively. VA burden & CT ratio will be such as to suit the requirement. The insulation level of the C.T. shall be suitable for 1.1 KV grade service.

## q. Packing and Dispatch

All equipment shall have to be dispatched suitably and securely packed in wooden crates, suitable for handling during transit by rail and / or road.

Tests at Factory and Test Certificates

The switchboard wiring should withstand a test of 3 kV power frequency voltage for one minute. Other tests shall be carried out as per relevant IEC/IS specification. Three (3) copies of such test reports are to be submitted to Purchaser for approval before the switchboard is actually dispatched.

The Bidder shall give at least 14 (fourteen) days advance notice of the date when the test will be carried out.

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# C.2.6 Uninterrupted Power Supply (UPS)

### a. 250kVA Modular UPS

The bidder shall offer 250kVA (Frame Capacity) True online double conversion modular parallel Architecture UPS with 3 phase input and 3 phase output with hot swappable power modules for 150kVA (minimum module rating to be from 25kVA to 50kVA) hot scalable up to 250kVA/kW in the same frame with addition of power modules. The UPS Shall have 15 minutes battery backup on rated load.

### **Module AC Input**

- Voltage Range: 340V to 460V
  Frequency Range: 45~65Hz
- Power Walk-In: maximum 90 seconds. Field selectable from 1-90sec selectable.
- Power Factor: Input power factor shall be > 0.99 without any optional filter at rated UPS full output load.
- Current Distortion: Less than<3% at full rated UPS output load at input Voltage THDv <1%

### **UPS Module AC Output**

- Three-phase, 4-wire plus ground.
- Load Rating: 100% continuous load rating for any combination of linear and non-linear loads.
- Voltage Stability: ±1% output voltage stability in steady-state condition for input within permitted limits and loads from 0 to 100%.
- Bypass Line Sync Range: Field selectable: 0.5 to 3.0 Hz.
- Frequency Stability: Frequency regulation shall be ± 0.1% in Battery mode or in asynchronization condition
- Frequency Slew Rate: the slew rate shall be <1Hz per sec.
- Efficiency: It is defined as output KW / input KW:
  - ✓ AC to AC efficiency should be minimum 90% in double conversion mode across load at 20%.
- Phase Unbalance: 120º ±1º el. for 100% balanced loads.
- Voltage Transients: Complies with IEC/EN62040-3, Class1,
- Transient Recovery Time: Return to within 5% of steady state output voltage <100msec</li>
- Distortion: (100% rated load with crest factor 3:1)
  - ✓ Less than 1% total harmonic distortion (THD) for linear loads
  - ✓ <3% THD for 100% balanced non-linear loads as specified by IEC/EN62040-3
- Module Overload Capability at Rated Output Voltage:
  - √ 150% of UPS rated output for load for 60 seconds.
  - √ 125% of UPS rated output for ten minutes.

## **Bypass Static Switch**

- Voltage Range:
  - ✓ Upper limit: +10%,
  - ✓ Lower limit: -10%,
- Frequency Range: ±5%
- Overload Capability:
  - √ 150% for 30 seconds



- ✓ 700% for 600msec
- ✓ 1000% for 100msec

# **UPS Specifications**

S. No.	Specification	Requirement
1.	Capacity (in KVA / KW)	250 kVA/250 kW 3-Phases Input / 3-Phase Output.
2.	Technology and Capability	<ul> <li>a) True Online configuration double conversion UPS.</li> <li>b) Modular UPS with hot swappable power Modules and Static switch modules.</li> <li>c) DSP (Digital Signal Processor) / Microprocessor based control, using IGBT devices and high switching frequency PWM.</li> <li>d) PFC controlled IGBT rectifier with Active power factor Correction (APFC).</li> <li>e) Capability to operate in N+1 / N+X PRS -Parallel Redundant Configuration.</li> <li>f) Each module should have independent controller addition to main controller; (Or) Each UPS should have dual redundant hot swappable control modules and in any case failure of main controller does not result in system failure or loss of power module redundancy.</li> </ul>
3.	Temperature (design ambient)	0 to 40°C
4.	Relative Humidity	< 90%
5.	IP Class	IP20
6.	Acoustic Noise measured at 1 Mt distance	<71db
7.	Input facility -Phases / Wires	3-Phase / 4-Wire & Ground (R, Y, B -Phases & Ground)
8.	Nominal Input Voltage	340V to 460V.
9.	Nominal Input Frequency	Nominal Input Frequency
10.	Input Frequency Range	50Hz (± 5%)
11.	Input Power Factor	> 0.99 on Full load
12.	Input Current Harmonic Distortion (THDi)	<5 % on Full Load
13.	Generator Compatibility	Compatibility to gen set supply used for this project
14.	Input Protection	<ul><li>a) Input to Rectifier</li><li>b) Input to Bypass</li><li>c) Manual Bypass (In-built)</li></ul>
15.	Over voltage/under voltage	Yes
16.	Input Frequency variation protection	Yes
17.	Surge protection	Yes
18.	Phase sequence change	The UPS should have protection at Input side for phase sequence change
19.	Nominal Output Voltage	380/400/415Vac (Three Phase Four-wire)

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20	Output Voltage Beginsting	1/ 10/		
20. 21.	Output Voltage Regulation	+/- 1%		
21.	Nominal Output Frequency	50Hz (± 5%)		
22.	Output Frequency	+/- 0.05 Hz (Free Running / Self Clocked Mode)		
22	Regulation	+ / - 6 % (Synchronized to Mains Mode, Selectable)		
23.	Output Wave Form	Pure sine wave		
24.	Output Voltage Distortion	<= 3% (For 100% Linear / Resistive Load)		
25	(THDu)	<= 5% (For 100% Non-Linear)		
25.	Crest Factor	3:1 On Full Load		
26.	Unbalanced load on phases	100% unbalanced load should be allowed		
27.	Voltage symmetry with 100%	+/- 1%		
20	Unbalanced Load	W		
28.	Output Protection	Yes		
29.	Output short circuit	Yes		
	Protection.			
30.	Over-temperature	Yes		
24	protection.	Double to control season above and the control of t		
31.	Rectifier / Charger	Built-in, solid-state charger with appropriate ratings		
32.	Battery Charger Ripple	Ripple free charging		
33.	DC bus voltage ripple	< 1 RMS		
34.	Overall Efficiency	Efficiency : 96 %		
35.	Output N-E voltage	<= 1.0 Volt		
36.	Transfer Time (Mode of	Nil from Mains mode to Battery Mode		
	operation)	Nil from Battery Mode to Mains mode		
37.	Transfer Time (Inverter to	< 1 ms (Synchronized Mode)		
	Bypass / Bypass to Inverter)	< 10 ms (unsynchronized Mode)		
	A transfer O Birdingstingst	Should be provided to take care of uninterrupted		
38.	Automatic & Bi-directional	transfer of load from Inverter to bypass (under overload		
	static by-pass (In-built)	/ fault conditions) & automatic retransfer from bypass		
	Increase Overland consists	to inverter (on removal of overload / fault conditions)		
20	Inverter Overload capacity	125% for 10 minutes		
39.	(Mains Mode & Battery	150% for 60 seconds		
40	Mode)	15 minutes on retail load		
40.	Backup Required	15 minutes on rated load		
41.	Battery Type	Sealed Maintenance Free (SMF), valve regulated		
42	Duration in which totally	9 10 hours		
42.	discharged batteries are to	8 -10 hours		
12	be recharged	or as nor design standard of Manufacturer		
43.	Nominal DC bus Voltage	or as per design standard of Manufacturer		
44.	During Battery float mode	To be specified by bidder		
45.	During Battery Boost mode	To be specified by bidder		
46.	Battery charging with temp. Compensation	Should be available		
47.	Ripple voltage at full load	<2% RMS without Battery and <1% with Battery		
48.	Type of battery charging			
	circuit.	Constant Voltage with Current Limit		
49.		1.65 to 1.8 auto adjustable with load % (back-up time).		
	Battery End Cell Voltage	However, Battery sizing should based on end cell		

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		voltage as 1.7V DC
50.	LED Mimic	Mimic provided on front panel to indicate power flow
		to the critical load with an indication of the availability
		of the rectifier, battery, automatic, bypass, inverter and
		load
51.	Alarms and Status	All faults conditions to be displayed in LCD with alarm
	Information	(sound)
	Metering	Input Voltage (Line to Neutral)
		Bypass frequency
		Bypass Voltage (Line to Line and line to Neutral)
		Bypass Frequency
		Output Voltage (Line To Neutral)
		Output Current per Phase (L1, L2, L3)
52.		Output Frequency
52.		Output load current (%) (L1, L2, L3)
		Output Load (%) Average
		Output Real power (KW) (L1, L2, L3)
		Output Apparent power (KVA)
		(L1, L2, L3)
		Battery Current ( charge/discharge)
		Battery Voltage
53.	Communication ports	Ethernet (10/100/1000)/RS232/RS485
54.	Protocols	HTTP/SNMP/Mod-bus/Ethernet with Modbus TCP
54.		support
55.	Width (in mm)	Specify
56.	Depth (in mm)	Specify
57.	Height (in mm)	Specify
58.	All Modes Protection	(L-L, L-N, L-G, N-G)
59.	Surge Current Capacity	200KA
60.	Fault Current rating	200Ka/C
61.	Connection Type	Parallel
62.	Response Time	<0.5NanoSec
63.	Status Indication	LEDs and Dry Contacts
64.	Protection Level	< 0.8 kV
65.	EMI /RFI Attenuation	45db Typical
66.	Certifications	UL1449
67.	Credentials	The Manufacturer should have ISO 9001 and 14001
		Certificates



# C.2.7 Lighting

Lighting system includes supply, erection and commissioning of all associated parts and accessories required for construction, operation and maintenance of complete system comprising of lighting fixtures complete with lamps, supports and accessories, exhaust fans, lighting panels, galvanized rigid steel conduits, lighting wires, G.I. earth wire, receptacles, switchboards, switches, junction boxes, pull out boxes complete with accessories, power cables, conduits, and allied accessories for such lighting system.

The electrical installations shall meet the requirement of Indian Electricity Act - 2003.

The following illumination level has to be maintained at 1000mm height from finished floor level for each area:

- Server Room and Telco Room 500 Lux
- All other Rooms, Security Area and Corridors of the Data Center 300 Lux

## a. Lighting Fixture

- The lighting fixtures shall be designed for use in 230 +/- 10% V, 50Hz, AC system.
- The emergency lighting fixtures shall be designed for use in 220 V +/10% AC System (or other suitable level DC system).
- All equipment and accessories shall be suitable for continuous operation.
- All lighting fixtures complete with lamps/LEDs, tubes and accessories shall be within the scope of the bidder.
- Light fittings shall be so arranged that the required lux values specified are maintained uniformly, with supply of required fixtures and supports.

## b. Lamps

- Luminaries will be selected to suit architectural, functional and aesthetic requirement.
- Energy efficient LED lighting using 600mm x 600mm fixtures shall be used at all locations in the Data Center.
- In common areas and along the walls of the rooms, LED down lights shall be used as appropriate.
- Reflector, if used, shall be made out of high purity aluminum scientifically designed for high optical performance.
- The distribution of fittings over the three-phase supply shall be such that any particular area is not completely void of supply in case of failure in any phase.
- All accessories and fittings shall be within the scope of supply of the bidder.

## c. Receptacle with plug

All receptacles shall be of flush mounting type complete with individual plug and switches. The receptacle shall be 5A/15A/230V, 2-Pole, 3-Pin type with 3rd pin grounded and suitable for indoor and outdoor installation.

## d. Switch and switchboard

 All switchboard/boxes shall be fabricated from 14 SWG sheet steel and shall be hot dip galvanized.

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- All switchboards shall have adequate space to accommodate all accessories and wires.
- All switches shall have quick make and quick break mechanism. Modular small duty switches shall be piano type with service marking on the switches.

## e. Lighting cables

- All lighting cables shall be 1.1 KV graded PVC insulated with stranded copper conductor.
   Multicore cables shall have extruded PVC inner sheath and overall extruded PVC outer sheath.
   Entry of the cables shall be through suitable and appropriate cable sockets and glands.
- Final casing wiring / cable routing shall be done based on fixture location and other site conditions.
- The size and number of cores of all the cables shall be determined as per scheme requirement. The size of cables shall be supported by cable-sizing calculation.
- All cables used in the Data Center shall be Fire Retardant, Low Smoke, Zero Halogen (LSZH)
   type
- Cable shall be standard product of reputed manufacturer and shall conform to relevant Indian Standards.

### f. Junction box

The Junction Box shall be of 14 SWG sheet steel with hot dip galvanized and have screwed cover. The junction boxes shall be square/rectangular type. Each junction box shall have the following marking with indelible ink:

- Circuit numbers on the top.
- Circuit numbers with ferrule (inside).
- Danger sign in case of 415 V junction box.

## g. Terminals

- Multi-way terminal block of approved make 1100V grade and of approved type complete with screws, nuts, washers and marking strip shall be furnished for termination of incoming and outgoing wires. Each terminal shall be used for only one termination.
- 20% spare terminal blocks shall be provided for future use.

## h. Grounding

All lighting panels/distribution boards, junction boxes, switchboard, fixtures, etc. shall be grounded in compliance with the provision of IE Rules.

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# C.2.8 Cable Trays and Raceways

The cable trays / ladders shall be fabricated according to the design specified by IEC 61537 and should be tested for Safe Working Load (SWL)

Fabrication of Tray / Ladder and accessories at site and welding is not permitted. In unavoidable circumstances, if any cut or holes are made in the trays/Ladder/accessories, zinc spray need to be applied over the surface. The metal edge has to be protected by edge protection sleeves to avoid cable damage. Edge of the supports has to be protected with plastic END caps. Screwed connections and internal fixing Devices should not create any damage to the cable when correctly fixed. Sudden or jerky motions shall not be used to tighten reusable screw connections.

Cables shall run in cable tray/ladder mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures using mounting accessories

## a. Cable tray

The cable tray and all accessories shall be fabricated from sheet steel and has to be hot dip galvanized against corrosion confirming to ISO 1461-1999 for installations in both indoor and outdoor applications & should have a Base Perforation Class B according to IEC 61537. The cable trays shall be supplied in standard lengths of 3000mm and the width of the tray shall be as follows.

Width: 50, 100, 150, 200, 300, 400, 500, 600 & 750 mm.

All the cable tray accessories like Bends, TEESs, Cross overs, etc. should be designed in accordance with IEC 61537 and shall be factory fabricated. The accessories shall be from the same material as of the tray and modular type, it should be connected with the trays by using fasteners. Typical details of trays, fittings and accessories, etc.

For Cable trays designed, tested and confirming to IEC 61537, thickness of cable tray should be according to the manufacturer's catalogue. For locally fabricated and non tested tray, thickness should be 2 mm up to span length of 1.5 meter, 2.5 mm for span length between 2 to 3 meter and 3 to 4 mm for span length between 4 and 10 meter

#### b. Cable ladder

The cable Ladder and all accessories shall be fabricated from sheet steel and has to be hot dip galvanized against corrosion confirming to ISO 1461-1999 for installations in both indoor and outdoor applications & should have a Free Base Area classification Y according to IEC61537. The cable ladders shall be supplied in standard lengths of 3000/6000 mm and the width of the tray shall be as follows.

Width: 200 to 1200 mm in multiples of 100 mm

Maximum rung spacing in the ladder shall be 300mm. The rungs should be made of C profiles suitable to fix cables by special metal clamps according to the drawing. The ladder shall be of riveted and foldable type for easy transportation and to avoid damage during transportation and storage. All the ladder accessories like Bends, TEESs, Cross overs, etc. should be designed in accordance with IEC 61537 and shall be factory fabricated. The accessories shall be made from the same material as of the ladder and modular type, it should be connected with the ladder by using fasteners.

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For Cable Ladders designed, tested and confirming to IEC 61537, thickness of cable Ladder should be according to the manufacturer's catalogue. For locally fabricated and non-tested Ladder, thickness should be 2.5 mm up to span length of 1.5 to 2-meter, 3 mm for span length between 2.5 to 4 meter and 3 to 4 mm for span length between 5 and 10 meter

## c. Cover for cable trays / ladder

Cover for trays/ladders to protect the cable insulation from falling objects, water droplets, and harmful effects of ultraviolet rays and accumulation of dust. The cover shall be made either from Hot Dip Galvanized sheet steel or superior quality Double Dip Galvanized Sheets. For Outdoor application, Double dip Galvanized material shall be used. The covers should be fitted properly to the Ladder / Tray by using pre-fixed and tested locks which ensure that covers are fitted rigidly to Tray / Ladder. For outdoor application in high wind areas, additional cross over beadings to be used for fixing the cover on tray / ladder of width more than 500 mm.

## d. Mounting accessories (supports and brackets)

The mounting accessories shall be fabricated from steel and has to be hot dip galvanized against corrosion confirming to ISO 1461-1999 for installations in both indoor and outdoor applications and should be of completely modular type. All supports, and Brackets should be factory made, hot dip galvanized after completing welding, cutting, drilling, other machining operations and tested according to IEC 61537 according to the arrangements in the enclosed drawing. The system shall be designed such that it allows easy assembly at site by using Bolts and Nuts. The main support and brackets shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hard ware etc. to form various arrangements required to support the cable trays. Welding of the components at the site shall not be allowed.

## e. Corrosion protection

The cable tray / ladder/accessories shall be of HOT DIP Galvanized (ISO 1461-1999) for installations in corrosive atmospheres both indoor and outdoor application. Sample tray / ladder / accessories / mounting accessories and supports should be salt spray tested according to ISO 9227 for > 500 hours. (\*550 hours according to class 6 for Hot dip Galvanized surface as per ISO) as per standards.

## f. Testing and Certification

Cable tray / Ladder, bend, T Bend, cross, and all supports are to be tested for Safe Working Load (SWL), deflections, Impact resistance, Salt Spray & Electrical continuity test according to IEC 61537. The cable tray/ladder should not deflect more than 1/100<sup>th</sup> of the span length at SWL in Mid span and the transverse deflection of all mounting accessories at SWL shall not exceed 1/20 th of the length. The cable tray / cable ladder should be tested up to 1.7 times SWL at minimum and maximum room temperature. The temperature classification of cable tray system should be - 5 to + 150°C.

### g. GI Raceways & Junction Boxes

The raceways shall be made out of 1.6mm GI sheet with cover on top. The cable raceways shall be complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories and hardware (i.e. bolts, nuts, screws. washers, etc.) It shall be used to lay in floor screeding/ceiling. If the screeding is done before laying raceways, necessary chipping work with floor

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cutting machines, shall be done by the electrical System Integrator. After laying floor shall be finished with necessary cement works. The body of all raceways shall be earthed using minimum 4Sq.mm copper flexible wires.

## h. MS Raceways

The raceways shall be made out of 1.6mm CRCA sheet with removable cover on top. It shall be powder coated after seven tank treatment with epoxy powder. The color of power & networking raceways shall be different & it shall be decided during shop drawing approval. The cable raceways shall be complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories and hardware (i.e. bolts, nuts, screws. washers, etc.) It shall be used to lay in ceiling. It shall be complete with necessary hitech rod supports. There shall not be any junction boxes & top cover should be openable type for cable pulling/laying etc.. The body all raceways shall be earthed using minimum 4Sq.mm copper flexible wires.

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# C.2.9 Data Center Earthing

Proper grounding of Data Center equipment, often called network grounding or the data center grounding infrastructure, is defined by TIA/EIA-942 Telecommunications Infrastructure Standard for Data Centers, and goes beyond the requirements of the National Electrical Code (NEC) to protect equipment and improve system reliability. The bidder shall follow both TIA and NEC; however whenever NEC does not cover any aspect or there is difference between the two, TIA/EIA-942 would prevail.

IEEE Std. 1100-2005 (IEEE recommended Practice of Powering Grounding) shall also be acceptable. Earthing schematic shall be submitted along with electrical SLD with details of conductors.

## a. Design criteria

The two goals of the grounding system are (1) to equalize electrical potentials and (2) to create a low resistance path to ground to ensure equipment safety and personnel safety. It should facilitate proper operation of protection system during earth fault in the system. Five basic principles shall be used when designing a grounding system to accomplish these goals:

As the grounding system is no more reliable than its weakest link, only high-quality components shall be used and trained professionals must make all connections.

The grounding system shall be visually verifiable so as to be able to visually inspect degradation of any component of the grounding system, from the equipment to the rack, to the common bonding network (CBN), to the earth. The system shall be accessible during moves, adds, and changes, ensuring long-term system reliability and scalability.

The grounding system shall be adequately sized to prevent premature equipment failure that contributes to increased operating costs.

The grounding system shall make each rack to bond directly to the CBN, thereby directing current away from sensitive electronics.

All metallic components in the Data Center e.g., equipment, racks, cabinets, ladder racks, enclosures, and cable trays shall be bonded to the grounding system to ensure all conductive materials at the same electrical potential to minimize current flow.

### b. Installation Criteria

The bidder shall, however, be liable for proper quantification for the work.

The design shall ensure that the ground resistance shall be within the limit. The composite of all ground electrodes connected together must have an impedance of less than 1 ohms to ground. If this impedance exceeds 1 ohm, then additional driven ground rods or a chemically assisted grounding electrode must be added to reduce this value to below 1 ohm.

Safe earthing electrode of 80mm diameter 3 meter length pipe-in-pipe technology with electrodite backfill compound shall be used. The number of earth pits shown mentioned in the earthing drawing are minimum quantity required. Based on the soil resistivity additional electrodes shall be used.

Copper flats of appropriate sizing shall be used for connecting to the earth pits and also for interconnection of the earthpits.

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Standby Generator or UPS system are considered to be separately derived systems (by the definition in NEC Article 100.I) and, therefore, must be separately grounded in accordance with NEC Article 250-30.

Methods for attaining low impedance to ground for data processing grounding electrode may include:

- An array of grounding electrodes spaced at least 12 ft apart
- A buried ground loop with multiple ground rods
- Chemically enhanced grounding electrodes
- Ufer grounds or other types of grounding systems.

Once the grounding electrode has been established (location, low impedance, minimum length, configuration, etc.), all electrical distribution components associated with the data center should be connected to a central ground bus. This ground bus is an insulated, isolated ground bus and is intended for a signal reference ground—not an equipment, safety ground. It will be connected to the isolated ground bus in the UPS, the PDUs, the branch circuit panels, and the isolated ground conductors going to the individual server racks. This bus will be completely isolated within the data center room from the green-insulated or bare, safety-grounding conductor that is connected to the conduit, boxes, panel board cabinets, server rack frames, UPS enclosures, generator frames, and the like. It is critical to the data center grounding system's integrity that there are no connections between these two systems within the data center and, in fact, no connections anywhere—with the exception of a single bonding jumper specifically located to minimize the interactions between the electrical distribution system and the data center ground system.

Thus by providing two separate low-impedance grounding electrodes (one for the main electrical service and one for the sensitive electronic system), and connecting them with the smallest bonding conductor permitted by the NEC (i.e., the conductor with the highest impedance), a reliable, low-noise, low-impedance, virtually isolated, signal reference ground for electronic systems.

Apart from the two types of grounding system mentioned above one more type of earthing, named Signal reference earthing, needs to be implemented with braided copper wire tied with false floor pedestal. It will eventually create a mesh system the level of which will be in between power and data cable trays.

Because most racks and cabinets are made of painted components that are bolted together, there remains uncertainty about electrical continuity from one rack component to the next. In the Data Center, rack and cabinet continuity is important for safety; electrostatic discharge (ESD) protection; and the proper grounding of switches, servers, and power strips. Continuity may not exist if the installer fails to scrape paint between sections of rack or use specially designed paint-piercing hardware.

To avoid loosening of grounding connectors over time, permanent copper compression lugs shall be used instead of setscrews to fasten conductor.

Failing to create an electrical bond between the structural components of racks and cabinets can trap currents within sections of them, resulting in potential safety hazards, failure of ESD protection, and ungrounded equipment. So components, such as hardware and jumper cables are to be tested for their ability to create electrical bonds and carry current.



# C.3 HVAC System

# C.3.1 Precision Air Conditioning System

Precision Air Conditioning System shall be designed to suit the site condition and the load density requirements. Inrow cooling units shall be used for the Server Room.

Direct Expansion type Precision Air Conditioners shall be of high sensible cooling capacity and high Sensible Heat Ratio (atleast 95%). These units shall have low running costs, achieved by means of sophisticated design, latest & proven technology, combined with an accurate selection of the components.

Phase-2 details are provided only of the design requirement. All the PACs required for Phase-1 and Phase-2 shall be identical. Bidder shall submit the design for Phase-1 as well as Phase-2 requirement. However, the supply of PACs shall be for the cooling requirements of Phase-1.

PAC units should be designed based on 22±1 °C Cold Aisle Temperature and Relative Humidity of 45% to 55% for the rated IT Load in the Server Room.

## a. Design Requirements

- The system shall be designed to maintain temperature conditions within the row(s) of racks
- The operation can be concisely characterized as follows: the racks draw in cool air from the front and discharge warm air at the rear.
- The high-density units, designated In Row Cooling module, draw in local air from the hot aisle and discharge cool air to the cold aisle. The units are installed alongside the highdensity dissipation racks.
- The Close control system shall be a factory assembled unit. It shall be floor mounted, optimized for maximum cooling capacity in a minimum footprint.
- The system shall be designed for blow/draw-through air arrangement to insure even air distribution to the entire face area of the coil. The unit shall be capable to be mounted between the racks or at the end of row. The unit shall modulate cooling capacity and airflow based on requirements.
- Inrow Cooling Unit shall have inbuilt Automatic Transfer Switch for switching between two sources of power supply.
- Overall cooling capacity of cooling should be designed considering present IT load and CFM of minimum 40 for every kW of IT Load

#### b. Cabinet Construction

- The structural frame is composed of galvanized sheet metal, externally epoxy powder coated, internally insulated with open-cell form. This type of panel is designed to ensure a good level of thermal and acoustic insulation.
- Exterior panels shall be 18-gauge steel density foam insulation. Insulation complies with flame spread and smoke developed rating of 25/50. Front and rear exterior panels shall be 18-gauge perforated steel with free area, and equipped with a keyed lock to provide a means of securing access to the internal components of the unit
- The frame shall be constructed of 16 gauge formed steel welded for maximum strength. All units shall provide maintenance from the front and rear, allowing units to be placed within a row of racks

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- All exterior panels and frame shall be powder coated for durability and attractive finish
- Air tightness is ensured by adhesive seals located around the entire perimeter of each panel. The uprights an internal panel are made of galvanized sheet steel.
- All the structural materials are recyclable and CFC free.

### c. Fans

Units shall be offered with diagonal fans with integral suction nozzle. The Fan shall be High efficiency, external rotor electronically commutated (EC) motor with integrated electronics, True soft start characteristics (inrush current lower than operating current), The fans, with modulating speed as a function of intake air temperature.

Each fan must be equipped with integral thermal protection. The fans must be maintenance free design and construction. The fan section shall be designed for higher air flow. The fan shall be protected over temperature of motor, electronics, locked rotor protection, short circuit of motor output.

Variable Speed Fans: The unit is equipped with variable speed, electrically commutated, backward incline fans complete with Inlet Volute.

Fan Protection: discharge finger guard

## d. Cooling Coil

Direct Expansion: Cooling coil shall use raised lance type corrugated aluminum fin and with OEM design for copper tube coils. Fin shall be a minimum of recommended thickness. Tube wall shall be a minimum thickness in wall. Coil end supports shall be a minimum 18-gauge galvanized steel. Coil shall be rated for a maximum pressure of 500 PSIG (3447.3 kPa). Coil header is equipped with a drip plate in the bottom to capture and direct the condensation accumulating on the suction header tube to the drain pan. Coil has 6 circuits complete with brass distributor and copper distribution tubes.

### e. Compressor

The unit shall be configured with a DC inverter /variable speed reciprocating hermetic/scroll compressor using a matched VFD. As a result, the compressor speed can be varied through a range to accommodate varying load conditions. The firmware to include oil return protection in cases where pipe velocities may drop to low speeds during low loading periods.

- Compressor is electrically protected.
- Compressor utilizes a noise cap for noise reduction.
- Sight glass provided for air cooled system oil charging.

## f. Condensate Pump

Factory Installed and wired condensate pump shall pump at. Pump shall have dual internal floats and reservoir made of polymeric materials to prevent corrosion.

### g. Filters

• The standard filters shall be 30% efficient per ASHRAE Standard 52.1, UL Class 2 (as per ASHRAE 52.2). Filters shall be EN779 G4 or better in efficiency. The pleated filters shall be replaceable from the rear of the unit.

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• The optional filter shall be 85% efficient per ASHRAE Standard 52.1 (MERV13 per ASHRAE 52.2, EN779 F7).

### h. Humidifier

Humidifier shall be able to modulate capacity. The humidifier shall be self-contained, steam-generating type, factory piped and wired, with disposable cylinder and automatic solid-state control circuit. Humidifier canisters shall be replaceable. The humidifier controller shall communicate directly to the microprocessor controller and provide complete status and control at the operator interface. Humidifier shall control flush cycling and conductivity via automated controls. Humidifier shall be capable of producing steam as per OEM design

### i. Electric Reheat

- Reheat elements shall be low watt density, wired for three-phase, loaded equally on all three phases and shall be electrically and thermally protected by both automatic and manual reset cutouts.
- Reheat coils shall be stainless steel, fin tubular construction. Heater casing shall be G90 galvanized steel.
- Heater shall be provided with self-engaging electrical connectors upon installation. Heater with manually connected conductors are not acceptable.

## j. Temperature and Humidity sensors

- Internal Temperature Sensors: Thermistor temperature sensors shall be mounted behind the front / rear doors to provide control inputs based on supply and return air temperature. Sensor accuracy shall be within +/- 1 degree accuracy.
- Remote Temperature Sensors: Three remote rack inlet temperature sensors shall be shipped with the unit to provide control input based on rack inlet temperature.
- Internal Humidity Sensors: Humidity sensors shall be mounted behind both the front and rear doors and shall provide control input based on humidity in front supply air. Humidifier sensor shall be +/- 3-5% RH accuracy full scale.
- Water Sensors: Internal supply and return chilled water temperature sensors shall be installed into sealed wells. Wells are filled with thermal conducting heat transfer grease to provide accurate temperature sensors

## k. Microprocessor Controller

Monitoring and Configuration: The master display shall allow monitoring and configuration of the air conditioning unit through a menu-based control. Functions include status reporting, set-up, and temperature set points. report the operational status of the connected air conditioning unit.

Controls: The microprocessor controller shall come equipped with control keys to allow the user to navigate between menus, select items, and input alpha numeric information.

Alarms: The microprocessor controller shall activate a visible and audible alarm in the occurrence of the following events:

- Cool Fail
- Rack inlet temperature violation
- Rack inlet temperature sensor fault



- Air filter clogged
- Air filter run hours exceeded
- Filter DP sensor failure
- Supply air sensor fault
- Return air sensor fault
- Supply air high temperature violation
- Return air high temperature violation
- Fan fault
- Fan run hours exceeded
- Water detection fault
- Condensate pump fault
- Condensate run hours exceeded
- Humidifier water conductivity high violation
- Humidifier fault tolerance exceeded
- Humidifier low water
- Humidifier excessive output reduction
- Humidifier drain fault
- Humidifier cylinder full
- Humidifier replace cylinder
- Humidifier RS485 communication fault
- Humidity high/low violation
- Supply humidity sensor fault
- · Return humidity sensor fault
- Heater fault
- Heater run hours exceeded Group communication fault
- Containment DP sensor failure
- Containment DP high violation
- Input contact fault
- Invalid supply setpoint

Logging: The microprocessor controller shall log and display all available events. Each alarm log shall contain time/date stamp as well as operating conditions at the time of occurrence.

Controller shall display the run time hours for major components.

## I. Network Management Card

The unit shall include a network management card to provide management through a computer network through TCP/IP. Management through the network should include the ability to change set points as well as view and clear alarms.

### m. Sequencing

The units should have sequencing as an inbuilt feature. The units shall be designed to work for equal number of run hours. Also, in case of fault, the standby unit should start. Run time for each of the units shall be programmable.

The microprocessor control system shall be supplied with the following cards:

RS485 serial adapter for data transfer to a central supervisor system with MODBUS protocol.

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## n. Refrigerant Piping

- Each refrigerant circuit shall be suitable for operation on R-407C or R-410A and shall include the following items:
- Expansion valve with pressure equalization
- Removable liquid line drier / filter
- Liquid line sight glass with moisture indicator
- Hand shut off valves

## o. Water Storage and piping for Humidifier

For the water requirement for humidification, a separate water tank of adequate capacity has to be provided on the terrace and necessary piping has to be done to the indoor units the PACs. Water inlet to this tank will be provided by CDAC. Necessary control mechanisms are in the scope of the bidder.

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## C.3.2 Aisle Containment

- The Cold Aisle containment shall be constructed between two symmetrical rows of racks facing each other in Cold Aisle.
- The Cold Aisle containment shall be modular to enable to add the racks.
- All the components used in the Aisle containment shall be 120 minutes fire rated.
- Entry and Exit Doors of the Cold Aisle should be of double leaf and have swing type mechanism.
- Each door should have CRCA frame with fire rated glass of 4 mm thick.
- Frame of the door should have 4 vertical MS Columns of rectangular section with thickness of 1.5mm.
- Four columns should be grouted to real floor or can be fixed to the base frame of rack.
- Doors must have a Steel Picture Frame fabricated in 1.2mm thick CRCA sheet as per "IS 513 Grade D" standards.
- Glass doors should be mounted on the frame to provide 120° door opening.
- PU Foam Gasket shall be used across the metal edges of the door to prevent any leakage on cold air.
- Doors should have automatic door closers.
- Polyamide Cable Brushes should be fitted at the bottom of doors to avoid leakage of cold air when doors are closed.
- Powder coating for door frames and support frames shall comply with ROHS requirement to avoid hazardous substance contamination in the Data Center. Pre-treatment nano ceramic process shall be followed.
- Powder coating thickness shall be 80-100 microns.

## a. Top Panels

- Top of the cold aisle shall be covered with either fire rated Glass or Polycarbonate panels.
- Top panels shall be fixed in CRCA frame per "IS 513 Grade D" with thickness of 1.2 mm.
- Glass/polycarbonate in the top panels shall be of 4 mm thick.
- Top panel must be tool less installation to offer quick access to area above the contained aisle during the maintenance activity.
- Top Panel must have opening for Smoke Sensor/ Suppression System wherever necessary.



# C.3.3 Comfort Air Conditioning System

Comfort air-conditioning systems shall maintain room temperature of 24°C with the outside ambient temperature of 48.3° C.

All outdoor units shall be placed on the terrace.

All outdoor units shall be on grouted MS steel structure of suitable sizing. This steel structure must be painted black color after two coats of primer.

## a. Ceiling Mounted Ductable Type Unit

Unit shall be suitable for ceiling mounted type. The unit shall include pre filter, fan section & DX-coil section. The housing of unit shall be light weight powder coated galvanized steel. The unit shall have high static fan for ductable arrangement.

These units shall be ceiling suspended with suitable supports to take care of operating weight of the unit, without causing any excessive vibration & noise. The cold air supplied by these units will be supplied to the area to be air conditioned, through duct system specified in the tender. Each indoor unit must have electronic expansion valve operated by microprocessor thermostat-based temperature control to deliver cooling/ heating as per the heat load of the room. The Sound Pressure level of unit at the highest operating level shall not exceed 38 dB (A), at a vertical distance of 1.5 m below the units with duct connected to the unit. The unit must have provision of adding drain pump kit if required & specified. The drain pump must be suitable to lift drain up to 1000 mm from the bottom of the unit.

# b. High Wall Mounted Units

The units shall be high wall mounted type. The unit shall include pre-filter, fan section & DX coil section. The housing of unit shall be lightweight powder coated galvanized steel. Unit shall have an attractive external casing with supply and return air grills.

Wall mounted units must be compact & stylish design that does not detract from the décor of the room. Each indoor unit must have electronic expansion valve operated by microprocessor thermostat-based temperature control to deliver cooling/ heating as per the heat load of the room.

The unit must have provision of adding drain pump kit if required & specified. The drain pump must be suitable to lift drain up to 1000 mm from the bottom of the unit. The sound pressure level of unit at the highest operating level shall not exceed 46 dB(A). Refrigerant control in the indoor unit shall be through Electronic Expansion Valve.

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# C.4 Safety and Security Systems

# C.4.1 Fire Alarm System

The main FACP Central Console shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, control circuits, and notification appliance circuits, local and remote operator terminals, printers, annunciators, and other system-controlled devices. GUI Based software shall be provided along with the system for integration with BMS and monitoring of the Fire Alarm System.

Fire Alarm Control Panel shall contain Liquid Crystal Display unit of atleast 4" display area to present vital information to operators concerning a fire situation, fire progression, and evacuation details.

In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:

- Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
- Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
- Detect the activation of any initiating device and the location of the alarm condition.
  Operate all notification appliances and auxiliary devices as programmed. In the event of CPU
  failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat
  the corresponding SLC loop control modules and associated detection devices as
  conventional two-wire operation. Any activation of a detector in this mode shall
  automatically activate associated Notification Appliance Circuits.
- Visually and audibly annunciate any trouble, supervisory, security or alarm condition on operator's terminals, panel display, and annunciators.
- When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
  - ✓ The system alarm LED shall flash.
  - ✓ A local peizo-electric audible device in the control panel shall sound a distinctive signal.
  - ✓ The display unit shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
  - ✓ Printing and history storage equipment shall log and print the event information along with a time and date stamp.
  - ✓ All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
- When a trouble condition is detected and reported by one of the systems initiating devices or appliances, the following functions shall immediately occur:
  - ✓ The system trouble LED shall flash.
  - ✓ A local piezo-electric audible device in the control panel shall sound a distinctive signal.
  - ✓ The display unit shall indicate all information associated with the trouble condition, including the type of trouble point and its location within the protected premises.
  - ✓ Printing and history storage equipment shall log and print the event information along with a time and date stamp.

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- ✓ All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (trouble notification appliances and/or relays) shall be activated.
- When a supervisory condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
  - ✓ The system trouble LED shall flash.
  - ✓ A local piezo-electric audible device in the control panel shall sound a distinctive signal.
  - ✓ The display unit shall indicate all information associated with the supervisory condition, including the type of trouble point and its location within the protected premises.
  - ✓ Printing and history storage equipment shall log and print the event information along with a time and date stamp.
  - ✓ All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.
- When a security alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
  - ✓ The system security LED shall flash.
  - ✓ A local piezo-electric audible device in the control panel shall sound a distinctive signal.
  - ✓ The display unit shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
  - ✓ Printing and history storage equipment shall log and print the event information along with a time and date stamp.
  - ✓ All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
- When a pre-alarm condition is detected and reported by one of the systems initiating devices or appliances, the following functions shall immediately occur:
  - ✓ The system pre-alarm LED shall flash.
  - ✓ A local piezo-electric audible device in the control panel shall sound a distinctive signal.
  - ✓ The display unit shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
  - ✓ Printing and history storage equipment shall log and print the event information along with a time and date stamp.
  - ✓ All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

## a. Operator Control

## **Acknowledge Switch**

- Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition. In addition, the FACP shall support Block Acknowledge to allow multiple trouble conditions to be acknowledged with a single depression of this switch.
- Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.



#### **Signal Silence Switch**

Depression of the Signal Silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.

#### **Drill Switch**

Depression of the Drill switch shall activate all programmed notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

#### **System Reset Switch**

Depression of the System Reset switch shall cause all electronically latched initiating devices to return to their normal condition. Initiating devices shall re-report if active. Active notification appliance circuits shall not silence upon Reset. Systems that de-activate and subsequently reactivate notification appliance circuits shall not be considered equal. All programmed Control-By-Event equations shall be re-evaluated after the reset sequence is complete if the initiating condition has cleared. Non-latching trouble conditions shall not clear and re-report upon reset.

### Lamp Test

The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.

### Scroll Display Keys

There shall be Scroll Display keys for FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. Depression of the Scroll Display key shall display the next event in the selected queue allowing the operator to view events by type.

#### Print Screen

Depression of the PRINT SCREEN switch shall send the information currently displayed on the 640-character display to the printer.

## b. System Capacity and General Operation

- The control panel shall be capable of expansion via up to 4 SLC modules. Each module shall support a maximum of 250 analog/addressable devices for a maximum system capacity of 1000 points. The system shall be capable of 1000 annunciation points per system regardless of the number of addressable devices.
- The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a liquid crystal display, individual, color coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either the owner or installing company.
- All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.
- The FACP shall be able to provide the following software and hardware features:

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Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.

Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.

Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.

Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.

The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.

Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special

NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the requirements of NFPA 72.

Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.

On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop.

History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.

Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.

The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.

Drill: The system shall support means to activate all silence fire output circuits in the event of a practice evacuation or "drill". If enabled for local control, the front panel switch shall be held for a minimum of 2 seconds prior to activating the drill function.



Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.

Two Wire Detection: The system shall support standard two wire detection devices specifically all models of System Sensor devices

Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions

Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.

Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.

Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.

Print Functions: The system shall provide means to obtain a variety of reports listing all event, alarm, trouble, supervisory, or security history. Additional reports shall be available for point activation for the last Walk Test performed, detector maintenance report containing the detector maintenance status of each installed addressable detector, all network parameters, all panel settings including broad cast time, event ordering, and block acknowledge, panel timer values for Auto Silence, Silence Inhibit, AC Fail Delay time and if enabled, Proprietary Reminder, and Remote Reminder timers, supervision settings for power supply and printers, all programmed logic equations, all custom action messages, all non-fire and output activations (if pre-programmed for logging) all active points filtered by alarms only, troubles only, supervisory alarms, pre alarms, disabled points and activated points, all installed points filtered by SLC points, logic zones, annunciators, releasing zones, special zones, and trouble zones.

Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.

Resound based on type for security or supervisory: The system shall indicate a Security alarm when a monitor module point programmed with a security Type Code activates. If silenced alarms exist, a Security alarm will Resound the panel sounder. The system shall indicate a Supervisory alarm when a monitor module point programmed with a supervisory Type Code activates. If there are silenced alarms, a Supervisory alarm will Resound the panel sounder.

Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.



Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.

Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector to up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result or product of all cooperating detectors chamber readings.

Tracking/Latching Duct (ion and photo): The system shall support both tracking and latching duct detectors either ion or photo types.

ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.

NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.

Security Monitor Points: The system shall provide means to monitor any point as a type security.

One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.

Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.

1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.



1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.

10 trouble equations per device: The system shall provide support for up to 10 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.

Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.

Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

## c. Central Processing Unit

- The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the Central Processing Unit.
- The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-byevent programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
- The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
- The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
- Consistent with UL864 standards, the CPU and associated equipment are to be protected so that voltage surges or line transients will not affect them.
- Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.
- The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.



- The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
- The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.
- The CPU shall provide one high-speed serial connection for support of network communication modules.
- The CPU shall provide double pole relays for FIRE ALARM, SYSTEM TROUBLE, SUPERVISORY, and SECURITY. The SUPERVISORY and SECURITY relays shall provide selection for additional FIRE ALARM contacts.

## d. Display

- The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
- The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
- The system display shall provide a backlit alphanumeric Liquid Crystal Display (LCD) of atleast
  4" screen size. It shall also provide ten Light-Emitting-Diodes (LEDs), that indicate the status of
  the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY,
  SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, and
  CPU FAILURE.
- The system display shall provide a alphanumeric keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming.
   Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.
- The system display shall include the following operator control switches: ACKNOWLEDGE, SIGNAL SILENCE, RESET, DRILL, and LAMP TEST. Additionally, the display interface shall allow scrolling of events by event type including, FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. A PRINT SCREEN button shall be provided for printing the event currently displayed on display screen of the FACP.

## e. Loop (Signaling Line Circuit) Control Module

- The Loop Control Module shall monitor and control a minimum of 300 intelligent addressable devices. This includes 150 intelligent detectors (Ionization, Photoelectric, or Thermal) and 150 monitor or control modules.
- The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
- The Loop Control Module shall provide power and communicate with all intelligent addressable detectors and modules on a single pair of wires. This SLC Loop shall be capable of operating as a NFPA Style 6 (Class B) circuit.
- The SLC interface board shall be able to drive an NFPA Style 6 twisted unshielded circuit up to 12,500 feet in length. The SLC Interface shall also be capable of driving an NFPA Style 6, no twist, no shield circuit for limited distances determined by the manufacturer. In addition, SLC wiring shall meet the listing requirements for it to exit the building or structure. "T"-tapping shall be allowed in either case.

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- The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.
- The system to have redundant loops in case of emergency

### f. Enclosures

- The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
- The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
- The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
- The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.

## g. Power Supply

- The Addressable Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
- The Addressable Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
- The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
- The Addressable Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
- The Addressable Main Power Supply shall be power-limited per UL864 requirements.

## h. System Circuit Supervision

- The FACP shall supervise all circuits to intelligent devices, transponders, annunciators and peripheral equipment and annunciate loss of communication with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and print the information in the history buffer and on the printer.
- Transponders that lose communication with the CPU shall sound an audible trouble and light an LED indicating loss of communications.
- Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off-normal position.

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 All speaker and emergency phone circuits shall be supervised for opens and shorts. Each transponder speaker and emergency phone circuit shall have an individual ON/OFF indication (green LED).

## i. Field Wiring Terminal Blocks

All wiring terminal blocks shall be the plug-in/removable type and shall be capable of terminating up to 12 AWG wire. Terminal blocks that are permanently fixed to the PC board are not acceptable.

## j. Controls with associated LED Indicators

- Speaker Switches/Indicators
  - ✓ The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
  - ✓ The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.
- Emergency Two-Way Telephone Control Switches/Indicators
  - ✓ The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
  - ✓ The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

### k. Remote Transmissions

- Provide local energy or polarity reversal or trip circuits as required.
- The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
- Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
- Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

### I. System Expansion

Design the main FACP and required components so that the system can be expanded in the future (to include the addition of twenty percent more circuits or zones) without disruption or replacement of the existing control panel. This shall include hardware capacity, software capacity and cabinet space.

## m. Field Programming

- The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/ information.
- It shall be possible to program through the standard FACP keyboard all system functions.
- All field defined programs shall be stored in non-volatile memory.
- Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the

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life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.

- The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
- The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

## n. Specific System Operations

- Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.
- Alarm Verification: Each of the Intelligent Addressable Smoke Detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification function shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification during the field programming of the system or anytime after system turn-on. Alarm verification shall not require any additional hardware to be added to the control panel. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

## o. System Point Operations

- Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
- System output points shall be capable of being turned on or off from the system keypad or the video terminal.
- Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
  - ✓ Device Status.
  - ✓ Device Type.
  - ✓ Custom Device Label.
  - ✓ Software Zone Label.
  - ✓ Device Zone Assignments.
  - ✓ Analog Detector Sensitivity.
  - ✓ All Program Parameters.
- System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system statuses

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- System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 1000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
- The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
- Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
- If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
- The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.



# **C.4.2 Fire Suppression Systems**

#### a. General

The bidder shall supply, install, test and put in operation NOVEC 1230 based fire suppression system for the following rooms:

#### • Server Room-A

The fire suppression system shall include and not be limited to gas release control panel, PESO approved seamless cylinders, discharge valve (with solenoid or pneumatic actuator) as the case may be, discharge pipe, check valve and all other accessories required to make a complete operation system meeting applicable requirements of NFPA 2001 standards and installed in compliance with all applicable requirements of the local codes and standards.

The system design should be based on the specifications contained herein, NFPA 2001 and in accordance with the requirements specified in the design manual of the clean agent. The bidder shall confirm compliance to the above along with their bid.

The system shall be properly filled and supplied by an approved OEM (Original Equipment Manufacturer)

The key components of the system, namely, valves and its accessories, actuators, flexible discharge and connection hoses, check valves, pressure switch, and nozzles shall be FM/UL listed. The NOVEC 1230 gas shall:

- Comply with NFPA 2001 standard
- Have the approval from US EPA (Environmental Protection Agency) for use as a total flooding fire extinguishing for the protection of occupied space:
- Be given Underwriters' Laboratories Inc. (UL, USA) component listing for the NOVEC 1230 gaseous agent.
- Must have zero ozone depletion potential (ODP)
- Have a minimal life span in atmosphere, with atmospheric life time of less than 5 days
- be efficient, effective and does not require excessive space and high pressure for storage;
- commercially available

The gas release panel shall be capable for integration to Fire Alarm System.

## b. Design Condition

The NOVEC 1230 agent is stored in seamless steel cylinders and dry nitrogen is added to provide additional energy to give the required rapid discharge. At the normal operating pressure of 25 bar at 21°C, the agent is a liquid in the container.

The designer shall consider simultaneous total flooding of all voids within the protected volume. The system shall be designed in accordance with the OEM's Design Manual.

In order to extinguish a fire using clean agent, the concentration of agent delivered to each void shall be above the minimum design concentration. The following shall be considered while designing the system.

The minimum design concentration shall be 4.2%. Class A Design concentration.

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If the protected volume has a floor and / or ceiling void the spaces shall be included in the protected volume, employing a minimum design concentration not below that of the main room compartment.

The discharge nozzles shall be located within the protected volume in compliance to limitations and with regard to spacing, floor and ceiling coverage, etc. The nozzles shall be positioned such that they would cover the entire area up to the extreme corners of the area under protection and the design concentration will be established in all parts of the protected volumes.

The final numbers of discharge nozzles shall be according to the OEM's product manual.

The average pressure at each nozzle shall not be less than 6.034 Bar.

The gas flow calculations shall be carried out on special software given by the OEM. The software should support usage of seamless cylinders which have a different design compared to the standard containers used worldwide. The system acceptance report shall show the resulting concentration in each independent void to be above 4.2% and the average pressure at each nozzle to be not less than 6.034 Bar.

The agent discharge time shall not exceed 10 seconds and not less than 5 seconds.

The design concentration shall follow at minimum NFPA 2001 for under floor, room and ceiling space. Unless otherwise approved, room temperature for air-conditioned space shall be taken around 20°C. For non-air conditioned space, the temperature shall be taken around ambient temperature. The system shall be designed with minimum design concentration of 4.2 % as applicable to Class A & C fire.

The bidder should carry out the piping Isometric design and validate the same with a hydraulic flow calculation generated by using the agent's design software. Appropriate fill density to be arrived at based on the same.

The system shall be so designed that a fire condition in any one protected area shall actuate automatically the total flooding of clean agent in that area independently. The entire system shall incorporate inter-alia detection, audible and visual alarms, actuation and extinguishing.

## c. System Components

## **Cylinders**

Each cylinder shall be seamless steel type manufactured from billets and tested in accordance with IS 7285 / BS 5045 standard and approved by PESO.

The cylinder/valve assembly shall have suitable metallic protection for the valve enabling transportation of the filled cylinders safely.

The cylinders shall be super-pressurized with dry Nitrogen to 25 bar. The cylinder shall be capable of withstanding any temperature between -30° C and 70° C.

All cylinders shall be distinctly and permanently marked with the quantity of agent contained, the empty cylinder weight, the pressurization pressure and the zones they are protecting.

### **Cylinder Valve**

The Valve assembly shall be mounted directly on the cylinder and should NOT have any adaptor provision between the cylinder and Valve as per requirements of PESO. Cylinders with adaptor between valve assembly shall be rejected as it is a violation of the PESO norms.

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Each cylinder valve shall have a provision for fixing a supervisory pressure switch and a safety burst disc to protect the cylinder from over pressure. The cylinder valve shall have a disabling plug to prevent accidental discharge of the valve during transportation and installation.

Each valve shall to be fitted with a pressure gauge for monitoring loss of pressure.

The master cylinder valve is to be released electrically which is performed by means of a solenoid valve arrangement. Pilot cylinder actuation and pyrotechnic devices shall not be used.

### **Cylinder Valve Actuators**

In a single cylinder system, the cylinder shall have a solenoid operated actuator and a manual actuator incorporating a strike knob mounted on top of the solenoid operated actuator. Multi cylinder systems shall have the same fitted on to the master cylinder and pressure operated actuators fitted on each slave cylinder. All actuators shall be original OEM make and locally manufactured actuators shall not be used.

#### Hoses

Each cylinder valve shall be provided with a plug in type flexible rubber discharge hose of minimum 40mm size with a test pressure of 52 Bar. Each hose shall be permanently marked with the test pressure and OEM's part number. Multi cylinder systems shall have an interconnect hose for each cylinder. All hoses shall be original OEM make and locally manufactured hoses shall not be used.

#### **Manifold with Check valve**

The manifold shall be fabricated from ASTM A106 Schedule 80 seamless pipe and shall have integral check valves provided for each cylinder. The Manifold shall preferably be supplied by the original equipment manufacturer instead of fabricating the same at site.

## **Refilling and Maintenance**

In case of any leakage or accidental discharge of the agent, it should be possible to re-fill the cylinders from a valid PESO approved OEM filling station in India itself. The bidder should indicate the source of re-filling and the time that will be taken for re-filling and replacement.

### **Piping and Fittings**

All piping shall be ASTM A-106, Grade-B, Schedule 40 seamless pipes and all fitting shall be of ASTM A-105.

#### **Documentation**

The bidder should prepare & submit along with the bid documents, the piping isometric drawing and support the same with a UL listed hydraulic flow calculation generated using the agent's design software. The calculations shall validate the fill density assumed by the bidder.

The bidder shall submit copies of datasheets of hardware used in the system. The bidder shall also submit copy of PESO approval letter for the cylinder proposed to be used.

The bidder shall also submit calculations to evidence the quantity of agent considered for the system.

The successful vendor must submit, along with the supply invoice, a certificate of authenticity for the agent, duly checked and vetted by the OEM.

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# C.4.3 VESDA System

#### a. General

The bidder shall supply and install the VESDA system for the Server Room, Network Room, Telco Room, Staging Room, Electrical Rooms and Battery Rooms.

# b. Design Requirements

- Shall consist of a highly sensitive LASER-based smoke detector, aspirator, and filter.
- It shall have a display featuring LEDs and a Reset/Isolate button. The system shall be configured by a Programmer that is either portable or PC based.
- The system shall allow programming of:
  - ✓ up to three smoke threshold alarm levels;
  - ✓ time delays;
  - ✓ faults in airflow, detector, power and filter as well as an indication of the urgency of the fault;
- Three relay outputs for remote indication of alarm and fault.
- 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.
- Interface to the Building Management system shall be provided.
- Performance Requirements
- Shall be tested and approved to cover up to 500 SqM.
- Shall be approved to provide very early smoke detection and provide up to three output levels corresponding to Alert (optional), Pre-Alarm and Fire. These levels shall be programmable and able to be set at sensitivities ranging from 0.005 20% obsc/m.
- Shall report any fault on the unit using the fault relay or via VSM.
- Shall be self monitoring for filter contamination.
- Shall incorporate a flow sensor in the pipe inlet port and provide staged airflow faults.

## c. Detector Assembly

- The Detector, Filter, Aspirator and Relay Outputs shall be housed in an enclosure and shall be arranged in such a way that air is drawn from the fire risk and a sample passed through the Dual Stage Filter and Detector by the Aspirator.
- The Detector shall be LASER-based type and shall have an obscuration sensitivity range of 0.005 20% obs/m.
- The Detector shall have up to three independent field programmable smoke alarm thresholds across its sensitivity range with adjustable time delays for each threshold between 0-60 seconds.
- The Detector shall also incorporate the facility to transmit a fault either via VESDAnet or relav.
- The detector shall have a single pipe inlet which must contain a flow sensor. Both Minor and Urgent flow faults for both high and low shall be reported.
- The filter must be a two-stage disposable filter cartridge. The first stage shall be capable of filtering particles in excess of 20 microns from the air sample. The second stage shall be ultra- fine, removing more than 99% of contaminant particles of 0.3microns or larger, to

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provide a clean air barrier around the detector's optics to prevent contamination and increase service life.

- The aspirator shall be a purpose-designed rotary vane air pump. It shall be capable of supporting a single pipe run of 50m, or two or three pipe runs, with a transport time of less than 60 seconds or as appropriate codes dictate.
- The Assembly must contain relays for alarm and fault conditions. The relays shall be software programmable (latching or non-latching). The relays must be rated at 2 AMP at 30 VDC. Remote relays shall be offered as an option and either configured to replicate those on the detector or programmed differently.
- 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 even shall be recorded. Each detector (zone) shall be capable of storing up to 12,000 events.

# d. Displays

- The detector will be provided with LED indicators only.
- Each Detector shall provide the following features at a minimum:
- Independent high intensity alarm indicators for Pre-Alarm and Fire (Alert indicated by the Pre-Alarm LED flashing) corresponding to the alarm thresholds of the detector
  - ✓ Fault indicator
  - ✓ OK indicator
  - ✓ Isolate indicator

A single button supporting the following features:

- Reset (a single push of the button) Unlatches all latched alarm conditions on the assigned VLC zone.
- Isolate (push and hold) Isolates the individual VLC zone (inhibits Alarm and Fault relays and initiates the Fault relay).

#### e. Programmers

Programming of VESDA controller shall be performed using a Windows® application running on a PC.

Programmer shall support the following features at a minimum:

- Programming of any device on the VESDAnet system.
- Viewing of the status of any device in the system.
- Adjustment of the alarm thresholds of a nominated detector.
- Initiation of Auto Learn™, to automatically configure the detector's alarm threshold settings to suit the current environment.
- Multi-level password control.
- Programmable latching or non-latching relay operation.
- Programmable high and low flow settings for airflow supervision.
- Programmable maintenance intervals.
- Facilities for referencing with time dilution compensation. (VN only)
- Testing of relays assigned to a specific zone to aid commissioning.



# f. Device Networking Requirements

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

The unit shall be capable of being configured in a fault tolerant loop for both short circuit and open circuit.

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

# g. Digital Communication Port

Should comply to EIA RS485 Protocol.

# h. Application

#### **Detection Alarm Levels**

The laser based aspirating detection system shall have up to three (3) independently programmable alarm thresholds. The three alarm levels may be used as follows:

Alarm Level 1 (Alert) : Activate a visual and audible alarm in the fire risk area.

Alarm Level 2 (Pre-Alarm) : Activate the electrical/electronic equipment shutdown relay and

activate visual and audible alarms in the Security Office or other

appropriate location.

Alarm Level 3 (Fire) : Activate an alarm condition in the Fire Alarm Control Panel to call

the Fire Brigade and activate all warning systems.

NOTE: The alarm level functions as listed are possible scenarios. Consideration should be given to the best utilization of these facilities for each application and the requirements of local authorities.

#### **Initial Detection Alarm Settings**

Initial settings for the alarm levels shall be determined by the requirements of the fire zone.

Default settings of the unit shall be:

• Alarm Level 1 (Alert) : not configured

: (0.08% Obs/m if configured)

Alarm Level 2 (Pre-Alarm) : 0.14% Obs/mAlarm Level 3 (Fire) : 0.2% Obs/m

#### **Alarm Delay Thresholds**

Alarm delay threshold shall be programmable for the following:

- Alarm Level 1 (Alert)
- Alarm Level 2 (Pre-Alarm)
- Alarm Level 3 (Fire)



#### i. Fault Alarms

The Detector Fault relay shall be connected to the appropriate alarm zone on the Fire Alarm Control Panel in such a way that a Detector Fault would register a fault condition on the FACP. The fault relay shall also be connected to the appropriate control system.

(Check local Codes, Standards or Regulations to determine whether compliance with this set-up is required).

# j. Power Supply and Batteries

The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 2 hours standby battery back up is required followed by 30 minutes in an alarm condition.

In case common UPS power supply is used, the above backup conditions shall have to be adhered.

# k. Sampling Pipe Design

#### **Sampling Pipe**

- The sampling pipe shall be smooth bore with an internal diameter between 15-25mm.
   Normally, pipe with an outside diameter of 25mm and internal diameter of 21mm should be used.
- 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.
- All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
- The pipe shall be identified as Aspirating Smoke Detector Pipe (or similar wording) along its entire length at regular intervals not exceeding the manufacturer's recommendation or that of local codes and standards.
- All pipes should be supported at not less than 1.5m or that of the local codes or standards.
- The far end of each trunk or branch pipe shall be fitted with 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**

- Sampling holes of 2mm, or otherwise appropriately sized holes, shall not be separated by
  more than the maximum distance allowable for conventional point detectors as specified in
  the local code or standard. Intervals may vary according to calculations. For AS1670 the
  maximum allowable distance is 10m. For BFPSA the maximum allowable distance is 10m. For
  NFPA the maximum allowable distance is 30 ft.
- Each sampling point shall be identified in accordance with Codes or Standards.
- 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 or roof structure and forced ventilation systems.

#### Installation

• The bidder shall install the system in accordance with the manufacturer's System Design Manual.

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- The Capillary Sampling Network where false ceilings are installed, 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.
- 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 have specified otherwise.
- The Capillary tube shall terminate at a Ceiling Sampling Point specifically designed and approved by the manufacturer. The performance characteristics of the Sampling Points shall be taken into account during the system design.



# **C.4.4 Access Control System**

# a. Specifications of Biometric Finger Scan Reader

S. No.	Features	Minimum Required Parameters
1.	Transmission Frequency	13.56 MHz
2.	Technology	iClass
3.	Security	64 bit authentication keys. The data flow between
	Security	card & Reader should be encrypted
4.	Graphical Display	LCD display
5.		Should be configured as a Reader – Enroller,
	Function	Enroller Only & Reader Only (All three are
		mandatory)
6.	Enrollment of fingerprint	Yes
	templates iClass Smart Cards	
7.	Read Range	Minimum 3.5"
8.	Operating Voltage	10 – 12V DC
9.	Operation	Indoor use
10.	Housing	Polycarbonate
11.	Fingerprint Sensor	Optical
12.	Sensor Resolution	500 dpi
13.	Timing	Fingerprint Capture: Less than 2 Sec
14.	Tilling	Verification of captured finger: Less than 1 Sec
15.	False Acceptance Rate	Less than 0.01%
16.	False Rejection Rate	Less than 0.01%
17.	Fingerprint Enrollment Software	Yes
18.	Technology Compliance	iClass 15693 & 14443B
19.	Certifications	UL
20.	Operating Temperature	0° C to 50° C
21.	Operating Humidity	10% to 90% relative humidity (Non-Condensing)

# b. Specifications of Smart Card Reader

S. No.	Features	Minimum Required Parameters
1.	Transmission Frequency	13.56 MHz
2.	Technology	iClass
3.	Socurity	64 bit authentication keys. The data flow between
	Security	card & Reader should be encrypted
4.	Audio Visual Indication	Yes
5.	Card Compatibility	iClass 15693 & 14443B
6.	Operating Voltage	10 – 12V DC
7.	Operation Indoor use	
8.	Cable Distance	150 meters (Wiegand)
9.	Read Range	Minimum 3"
10.	Certifications	UL
11.	Operating Temperature	0 °C to 45 °C
12.	Operating Humidity	10% to 90% relative humidity (Non-Condensing)

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# c. Specifications of Access Controller

S. No.	Features	Minimum Required Parameters	
1.	Reader Inputs	Four	
2.	Universal Inputs	Six	
3.	Tamper Input	One	
4.	Digital Lock Inputs	Two	
5.	Processor	50 MHz with 128 MB RAM and 32 MB Flash	
6.	Processor For Reader Inputs	Yes (Dedicated Processor for each Reader)	
7.	Communication	10/100 Ethernet Port	
8.	Memory	Minimum 4,00,000 personnel Records	
9.	Area Lockdown Support	Yes	
10.	Real Time Clock	Yes	
11.	Encryption	128-bit	
12.	SNMP Network Management support	Yes	
13.	Visual Indicator	Yes	
14.	Mounting	Wall / Ceiling Mount	
15.	Battery Backup	5 hours	
16.	Technology Compatibility	Wiegand	
17.	Card Reader Power	5V DC & 12V DC (Jumper Selectable)	
18.	Wiring Distance	150 meters (Wiegand)	
19.	Indicator LED	Yes	
20.	Push Button Switches	Yes (For clearing the memory & Resetting the IP Address)	
21.	Offline Mode Operation	Yes (In the event of Network failure)	
22.	Enclosure	Yes	
23.	Certifications	UL	
24.	Operating Temperature	0 °C to 45 °C	
25.	Operating Humidity	10% to 90% relative humidity (Non-Condensing)	

# d. Specifications of Smart Card

S. No.	Features	Minimum Required Parameters
1.	Transmission Frequency	13.56 MHz
2.	Technology	iClass
3.	Memory	2KB
4.	Multiple Biometric Image Storage	Yes
5.	Card Compatibility	iClass 15693 & 14443B
6.	Read Range	Minimum 3"
7.	Card Construction	Flexible PVC Laminate
8.	Transaction Time	Less than 100 ms
9.	Memory Type	EEPROM
10.	Write Endurance	Minimum 100000 Cycles
11.	Data Retention	10 years
12.	Operating Temperature	0 °C to 45 °C
13.	Operating Humidity	10% to 90% relative humidity (Non-Condensing)

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# e. Specifications of Access Control Software

S. No.	Minimum Required Parameters
1.	Compatibility with any Windows Operating System
2.	Compatibility with MYSQL / SQL / ORACLE
3.	Support for TCP/IP communication
4.	Provision for Alarm Monitoring for Battery, Mains Supply, Door Opened too Long, Door
	Forced Opened, Unauthorized Swipe & Controller Tampering
5.	Support for unlimited number of Card Database & Transactions
6.	Specify Card Activation & Expiry Date
7.	Support for Biometric, Pin & Smart Card Applications
8.	Management of Dual Access Levels to a single card
9.	Remote Locking & Unlocking of Doors
10.	Remote management of Controllers
11.	Customization of Door User time for every card holder
12.	One Client License
13.	Two Stages of Alarm Management (Acknowledgement on Receipt & closure on
	Investigation)
14.	Management of Minimum 100 Readers
15.	Access Privileges on the basis of Time & Date
16.	Creation of holiday schedules to cover maintenance and Vacations / Holidays
17.	Setting of Time / Date from Client Workstation
18.	Permission to activate any control output for a specific event such as alarm
19.	Programmable Shunt time to control the door opening time
20.	Area Control by using Hard Anti Pass back, Soft Anti Pass back, Timed Anti Pass back,
	Occupancy Limit, Multi man principle, Area Lock down, Threat level conditioning
21.	Alarm Management
22.	Camera Integration & Image Comparison
23.	Automatic User Log off
24.	Cardholder Management & Enrollment
25.	Creation & Maintenance of User Database
26.	Assignment of Access Privileges

# f. Specifications of Workstation for Access Control System

S. No.	Features	Minimum Required Parameters
1.	Processor	Intel Core i7, min 3 GHz
2.	RAM	8 GB DDR, 1333 MHz
3.	Hard Disk	1 TB SATA
4.	Expansion Ports	4 USB 3.0, 1 Line-in, 1 Line-out, 1 Microphone, 1 LAN, 1 VGA
5.	Keyboard & Mouse	Yes, Wireless
6.	Ethernet Port	10/100/1000 Base-T Network Interface
7.	Chipset	Intel
8.	Included Software	Windows 8.1 Operating System
		McAfee Antivirus valid for 3 years
		Recovery CD Creator
		Hard Drive based application recovery for reinstallation of

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		appliances & drivers
		Hard Drive based system recovery with option to keep user
		data files intact
		Microsoft Internet Explorer
		Microsoft Windows Live applications
9.	Screen	21" LED monitor



# C.4.5 IP Based CCTV Surveillance System

- The IP based Closed Camera surveillance system shall use state of the art technology and shall comply to UL standards.
- IP based Cameras and IP Digital Video Management System provider should be from the same OEM.
- All the cameras proposed shall be Power Over Ethernet (PoE) with option for 24V ac input.
- The system shall support open architecture and shall not have any proprietary equipment to ensure future compatibility with third party systems.
- The scope shall include supply, installation, testing, commissioning and maintenance of the IP based CCTV system proposed.
- Scope shall include supply, installation, testing and commissioning of cameras, managed network switches, network video recorders/severs, Digital Video Management Software (DVMS) software, workstations, monitors, racks, console cables, UPS, etc. The specifications for these components shall be as mentioned below.
- The location of the Cameras shall be such that no blank spots are observed in the Server Room Area. All the doors of the Data Center shall be monitored. Cameras shall be provided for all the rooms and corridors in the Data Center. All the external equipment pertaining to Data Center shall be under CCTV Surveillance.
- The above mentioned are minimum requirements the bidder is required to offer. If additional cameras are required to ensure there are no blank spots in the Server Rooms, the bidder has to incorporate them as well.

# a. Specifications for IP Based Varifocal Lens Dome camera with IR illumination (for Server Room & other Critical Areas)

S. No.	Description	
1.	1/3" Progressive High Definition CMOS Sensor	
2.	Wide dynamic range	
3.	Minimum Illumination: Color 0.1 lux and B/W 0.03 lux, 0 lux with IR	
	illuminator ON.	
4.	3mm - 9mm varifocal, Auto Iris lens	
5.	Adjustable Horizontal coverage between 40° to 110°	
6.	Manual pan/tilt adjustment up to 350°/+-90°	
7.	Automatic Gain Control, Back Light Compression, White balance: On/Off	
8.	3D Noise reduction: On/Off	
9.	IR Cut filter	
10.	Tamper Detection: On/Off	
11.	Compression: Dual stream, H.264	
12.	Resolution: 1980 x 1080 @ 25FPS and up to 720 x 576 @ 12FPS on stream	
	1 and stream 2 respectively at the same time	
13.	Bandwidth: configurable - 64Kbps to 8Mbps	
14.	Built-in Multi-zone motion detection	
15.	Protocols: Unicast, Multicast, RTP, TCP, UDP, HTTP, IGMP, ICMP, DHCP,	
	DNS	
16.	10/100 Base-T Auto sensing, Half/Full Duplex (RJ45)	
17.	S/N Ratio: ± 50db	

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18.	IR Sensitivity: 700 to 1100nm
19.	Built in Micro SD card slot to support up to 32GB storage for local recording
20.	Power: 802.3af PoE and 12VDC/24VAC auto sensing
21.	Vandal resistant clear bubble surface mount enclosure.
22.	Operating Temp: 0° C to 50° C
23.	Humidity: 90% (Non-condensing)
24.	UL, CE and FCC certified
25.	ONVIF Compliance

## b. Network Video Recorder / Server supporting 64 video streams

- The Network video recorder / sever shall support a maximum of 64 video inputs per network video recorder / server.
- The total NVR shall have a internal hard disc capacity of up to 2 TB or 30 days of video storage (whichever is maximum) at 1280x1080 resolution, 25 frames per second for the installed cameras with provision for 25% additional cameras in RAID configuration. When the number of cameras increases further, the storage should be upgradeable in modular fashion.
- The NVR shall support central archive storage of a NAS storage solution in case of extended storage. Offered software shall provide automatic scheduled backup facility so that selected cameras, selected time video shall be backed up on central storage at specified time.
- The NVR / server shall be able to record individual camera with selectable frame rate
- The NVR / server shall support remote administration, monitoring and management of video, audio and data.
- The NVR shall support health and event monitoring of the system.
- The NVR shall support logical camera grouping.
- The NVR / server should support H.264, MPEG4 & MJPEG formats
- The network video recorder shall be able to record videos in CIF (352x288), VGA (640x480) 4CIF/D1 CIF resolutions (720x576), HD 720 (1280x720) & HD 1080 (1920x1080).
- NVR hardware shall be off-the-shelf server hardware of suitable specifications from HP/IBM/Dell/Cisco.
- Necessary operating system and the system software licenses required shall be included.

# c. Digital Video Management System (DVMS) software features

- The software shall manage and support video from IP cameras and encoders through the Ethernet.
- Remote administration, monitoring and management of video and audio, shall be possible through the software.
- The DVMS software shall be able to display a minimum of 16 videos on the screen. It shall be possible to get the following information.
  - ✓ Host name
  - ✓ IP address
  - ✓ Serial number
  - ✓ Software version
  - ✓ Trap destination
  - ✓ Model number



- ✓ System name
- ✓ Number of hard drives on system
- ✓ Misc. hard drive status'
- ✓ Number of system cameras
- ✓ Camera names
- ✓ Camera input numbers
- ✓ Camera status (recording, no signal, scene loss)
- ✓ Number of days of video storage on disk
- ✓ Licensed product name
- ✓ Product ID
- ✓ Camera list change
- ✓ Service changes
- ✓ System restart
- ✓ Hard drive event
- ✓ System shutdown
- ✓ Alarm events
- ✓ Video deleted sooner than expected
- ✓ Windows events
- The DVMS software shall allow users to monitor and manage any IP devices through a single digital video surveillance application.
- The DVMS shall support open architecture platform expands the capabilities of legacy devices and maximizes investments in current and future security technology.
- The DVMS shall support third-party applications, video analytics and data transaction information.



# C.4.6 Rodent Repellent System

# a. General Objective

The objective is to protect the entire premises viz., all the voids against rodents. The purpose is to keep the rodents away from the floor by generating very high frequency sound waves (above 20 KHz) which are not audible to human ear but irritates rodents. The objective is to protect all the cables below floor, above ceiling & room void from damage caused by rodents.

# b. Scope

- The system proposed is to protect all the equipment, areas with relevant type of high frequency sound producing device called satellites or transducers.
- Once powered up these transducers produce very high frequency variable sound waves (above 20 KHz) continuously which irritate the rodents and are forced to evacuate the place.
- The system shall cover minimum of 10000 sqft area per controller & shall be able to connect minimum 20 transducers per controller. Each transducer shall be capable of covering minimum 400 sqft of area.
- Transducers can be tested periodically by means of a test switch provided on the Main console.
- Applicable Standard
- The OEM shall have an IDEMI and CFTRI certification for its products.

## c. System Components

#### **Satellites**

The satellites or transducers shall be circular ceiling mounted low profile units that produce high decibel sound waves at very high frequency not less than 20 KHz. These satellites shall cover an area not less than 400 sqft. for room void application, for ceiling void & floor void applications.

No looping is permitted while connecting the satellites to the main controller. Every satellite connected to the controller shall have a dedicated connection with the controller.

#### Controller

The controller shall support 20 Transducers and shall come with a pair of stands and brackets. The controller shall be installed in BMS room and the transducers in the problematic areas i.e. above and below false ceiling and below false flooring.

#### **Controller Features**

- 10000 square feet of area coverage per Controller.
- Shall drive up to 20 Transducers with minimum 400sft coverage each.
- LCD display with on-board controls are required for changing the following parameters:
- Wave Speed: It can have a maximum value of 130 and a minimum value of 60 frequency sweeps per minute. The incremental size is 5.
- Wave Density: It can have a maximum value of 100 and a minimum value of 80 divisions within a frequency band. The incremental size is 10.
- Frequency Band Time: Is an indicator of the time for which the controller would operate in a pre-programmed frequency band. There are 3 bands available: Band A, Band B, and Band C.

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This parameter can have maximum value of 10 minutes and a minimum value of 1 minute per band. Depending upon the time frame set for each band, the controller will switch the bands automatically.

- Machine/Controller ID: It can have any value within the range of 1 to 255.
- Password Protection: Every controller is password protected. To change the parameters mentioned above you have to key in the password. The password can be changed if required. The password can be any 5 digit number.
- Frequency Testing: This feature will enable the user to test and verify the frequency that is being transmitted from the controller to the transducer. This feature would be particularly useful during systems audit.
- Transducer Testing: All the 20 transducers can be tested in an audible range one at a time by using this feature.
- Provision for restoring all the parameters to the factory default setting
- Inbuilt RS/EIA-485 transmission up to 1.2 kms to protected area (BMS Room).
- Provision of a termination switch so that the controller data can be transferred to the computer and can be subsequently viewed by installing CRMS Software.
- Daisy chain protocol for interfacing 64 controllers (nodes)
- Independent Driver for each transducer.
- Independent test facility for each transducer.
- Transducer should cover up to 500 sq. feet of area above false ceiling, below false ceiling and below false flooring or up to 400 sq. feet of area above false ceiling, below false ceiling and below false flooring
- Frequency band of > 20 KHz and <60 KHz is pre tuned for 100 different frequencies.
- UL and CE approved transformers for power supply.

GUI Software Compatibility having the following Features:

- Facility to configure controller parameters for all controllers in one go (broadcast) or for an individual controller.
- Facility to schedule / generate a consolidated Health Status Report of all the controllers and / or an individual controller.
- This is possible either with the help of the inbuilt scheduler (Daily, Weekly, Fortnightly and Monthly Schedules) or in real time.
- Individual folders for individual Controller reports with the folder name same as the machine
  id. This folder will contain the report in text format and the PCB image of the corresponding
  controller.
- One single folder for the consolidated report. This folder will contain only the report in text report and shall depict the status of all controllers.
- PCB snapshot of the controller for faulty transducer drivers.
- Configurable control of the image quality of the PCB snapshot, thereby enabling the customer to manage the computer memory effectively.
- Admin Level password for report generation and scheduling.
- Service Level password for parameter configuration of all / individual controllers.
- Test facility to check if the signal is being transmitted to the transducer from the drivers on the PCB.
- Ping facility to check if all the controllers installed at the customer site are in the daisy chain network. If not then the corresponding controller will have an 'Offline' status else it will have an 'Online' status.



- Configurable ping acknowledgement / return time. This would be the time for which CRMS software would wait for the Controller to respond before it confirms the status of the controller as 'Online' or 'Offline'.
- Test Facility to test all controllers in a sequential mode or in an individual mode.
- Online servicing/maintenance via web meetings.
- RS/ EIA 485 to RS/EIA 232C converter to transfer the controller data to the serial port of your computer.



# C.4.7 Water Leakage Detection System

#### a. General

The Bidder shall be responsible to supply, deliver, install, test, commission and maintain of a proven technology and industry standard solution for a water detection system in the Data Center.

The complete system shall include electronic alarm panel, sensing cable, 4x20 alphanumeric display, and auxiliary equipment, as indicated on the design drawings. The system shall simultaneously detect the presence of water at any point along the cable's length and switch the module's leak alarm relays.

The sensing cable shall be of such construction by using Non-conductive polymers in the leak detection cable's construction. The Sensing Cable shall be an abrasion resistant polymer cores to increases the strength of the cable. Pressure on the sensing cable shall not create a false alarm.

Sensor Cable shall be provided with pre-connectorized sensing cable components.

#### b. Alarm Panel

- The alarm panel shall be capable of monitoring up to (30 meters) of sensing cable.
- The alarm Panel shall have LEDs indicating "power" (green), "alarm" (red), and "continuity" (yellow). The system shall sound an audible alarm upon sensing a leak. The unit can then continue to monitor and will re-alarm if there are any major changes. Once the alarm condition has been cleared, the panel is reset with a single keystroke. The Panel shall have 4x20 alpha numeric display with adjustable contrast.
- Basic Features of the alarm panel
- In addition to detecting leaks, the system shall warn of fault conditions and indicates when service is required.
- An event history log allows leaks (and other events) to be tracked.
- Both the events history log and any user settings are held in non -volatile memory. Event log shall stores 50 date and time stamped alarm.
- The alarm module will be powered by 230 VAC. The panel shall have a pair of contacts open on an alarm, and a pair of contacts close on an alarm. These contacts shall be used to actuate other alarms and shall be capable of switching 10 amps at 230V AC.
- In additions, the panel shall be provided with RS-485 series port for connection to Building Management System & shall have slave Modbus RTU protocol.
- The module enclosure shall be NEMA 1, constructed of 18- gauge steel and shall be powder coated.

## c. Sensing Cable

The water sensing cable shall detect the presence of water and other conductive fluids. The sensing technology shall be very low current AC signal and not DC signal to avoid corrosion when subject to wetness for long period.

## d. Accessories

A Complete system accessory (leader cable, end terminations, etc.) shall be provided by the system manufacturer.

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#### e. Performance

Leak Size Required to Alarm: Maximum wetted length of cable required to produce an alarm with tap water shall be no greater the 1 centimeter. Sensitivity shall be adjustable at panel module.

Continuous Coverage: The system shall provide continuous, distributed coverage of the area to be protected. System shall have not less than 4 physical zones.

Supervision: The system shall be continuously monitored for continuity. The loss of continuity in any of the wires shall energize the continuity LED and set the alarm.

Cleaning: If required, cleaning the cable without removing it shall be possible using a damp cloth.

Drying: The cable shall dry and reset at the panel within 15 seconds of removal from free water. No shaking, wiping, air-drying, or other mechanical action shall be required to dry the cable.

The alarm panel shall have a voltage free-contact (N.O./N.C) for external interfacing.



# C.4.8 Building Management System

# a. System Description & Input Output Summary

The system will consist of a flat, open architecture that utilizes high-speed communication protocol between all controlled and controlling devices.

The following will be monitored by the Building Management System:

- Access Control System
- Fire Alarm System
- Fire Suppression System
- Temperature and Humidity monitoring for Server Rooms, UPS Rooms, Battery Room, Staging Room and Telco Room
- Hydrogen Gas Detection for the Battery Room
- Water Leak Detection System
- VESDA System
- Rodent Repellent System
- Main LT panels incoming power parameters
- UPS System parameters
- PAC System parameters
- DG Set parameters
- DG Sets fuel levels

Microprocessor based Direct Digital Distributed Controllers (DDC) shall interface with sensors, actuators and control systems to carry out followings functions :

- Individual input/output point scanning, processing and control.
- Centralized operation of the plant (remote control).
- Dynamic graphic details of the Data Center.
- Energy Management through optimization of all connected electrical and mechanical plants.
- Alarm Detection and early recognition of faults.
- Time, event and holiday scheduling as well as temporary scheduling.
- Prevention of unauthorized or unwanted access.
- Communication interfaces and control.

The control system shall be designed such that mechanical equipment will be able to operate under stand-alone control. In general, the operation of any controllers on the network shall not rely on any other controller for its functional operation. System controllers that require a master computer will not be considered. Function specific modules may be used to supplement the functionality resident in each controller. As such, in the event of a network communication failure or the loss of any other controller on the communication network, the control system shall continue to independently operate under local control of the resident program stored in nonvolatile memory as detailed herein. In such a case, each individual controller shall continue to perform basic functions until a network connection can be restored.

The number of controllers for central plant room equipment shall be decided by the bidder. Overall, the system shall be provided with 15% spare capacity, with spare of at least 15% points on each controller.



There shall be one control station located in BMS Room. The computer shall be sized to cover the graphic display memory and planning information. The display shall be in the form of dynamic color graphics and text format with menu driven pop-up windows and help facility.

## b. Reference Standards

Control system components shall be new and in conformance with the following applicable standards for products specified:

- ANSI/EIA 709.1 (Lon Talk Protocol)
- Lon Mark Certified (Version 3.1 Guidelines)
- BACnet/IP
- Modbus
- UL 916 (Energy Management Equipment)
- OPC

#### c. Products

Utilize standard components for all assemblies. Custom hardware, operating system, and utility software are not acceptable.

All products (PCU's, TDCU's and ID's) shall contain Lon Works/ BacNet/ Modbus networking elements to allow ease of integration of devices from multiple vendors.

All materials, equipment and software shall be standard components, regularly manufactured for this and other systems and custom designed for this project. All systems and components shall be thoroughly tested.

#### d. Central Stations Hardware

- The Control stations shall comprise of Personal Computer (PC) providing high-level operator interface with the system. The terminals shall be capable of providing the operator with the facility for remote system interrogation, control, and retrieval / storage of logged data, annunciation of alarms and reports, analysis of recorded data and the formatting of management reports.
- The control station shall consist of the following minimum configuration with all of them suitable for the power supply voltage of 230 V AC  $\pm$  10%, 50 Hz + 3%.
- PC with Core i7 Processor, 4GB RAM, 1TB hard disk, keyboard and optical mouse
- 21" LCD display
- Suitable dot matrix printer for printing of Alarms
- Windows 7 Operating System and other required software shall be included.

## e. Central Station Software

- As a minimum, the menu driven command and operating software shall permit the operator to perform the following tasks.
- Configure the network.
- Create control sequences.
- Graphical interface to systems.

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- Provide additional third party software to permit the operator to manage hard drive files such as access, delete, copy, modify, etc. The package shall be object oriented and permit the user to manage directories upon boot-up. The file management software shall organize directories and sub-directories using files, file folder objects.
- On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext.
- Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system supervisor shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- System Diagnostics. The system shall automatically monitor the operation of all HVAC control workstations, printers, modems, network connections, and nodes. The failure of these devices shall be annunciated to the operator.
- Reports and Logs. Provide a reporting package that allows the operator to select, modify, or
  create reports. Each report shall be definable as to data content, format, interval, and date.
  Report data shall be archived on the hard disk for historical reporting. Provide the ability for
  the operator to obtain real time logs of designated lists of objects. Reports and logs shall be
  stored on the PC hard disk in a format that is readily accessible by other standard software
  applications including spreadsheets and word processing. Reports and logs shall be readily
  printed to the system printer. Data shall be transferable to other software packages so as to
  create custom reports.
- Web Browser Access: The DDC system shall provide total integration of the facility infrastructure systems with user access to all system data, either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet.

# f. Graphical Object-Oriented Programming Software

- The system shall include a graphical object-oriented programming function which shall be used to create all control sequences utilized in Programmable Nodes (PN). The graphical object-oriented programming function shall provide programming elements to be connected together to create a logic diagram. The graphical object-oriented programming function shall include elements for mathematical, logical, timing, setpoint, display and input/output functions to create logic diagrams that represent sequences of operation for PNs.
- Program elements shall be able to be combined into a custom template that can then be used as a standard function.
- Program checkout and debug tools shall include display of real-time and/or simulated system variables and inter-object data on the programming screens. The user shall be able to assign fixed or variable values to inputs during the dynamic debugging of the control sequence.
- The graphical programming tools shall provide the ability to print I/O lists, lists of standard network variables and lists of all parameters to be viewed by the HMI.

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- The programming software shall reside on each POT (Portable Operator Terminal) and OWserver for programming and/or configuring each model of PN on the project. The applications shall be downloaded and executed at the appropriate nodes. The software shall allow for updated applications via the network from the OW.
- DDC programs are to be provided to meet the control strategies as called for in the sequence of operation sections of these specifications. Each PN shall have availability of a full library of DDC algorithms, intrinsic control operators, arithmetic, trigonometric, logic, Proportional Control, Proportional plus Integral (PI), Proportional plus Integral plus Derivative (PID), and relational operators for implementation of control sequences. 2-position, floating, standard i/o and counter inputs, time based data, curve fit function, psychometric functions, integration.
- All DDC setpoints, gains, and time constants associated with DDC programs shall be available to the operator for display and modification via the POT, DDU or OW interface.
- Library of Applications: A library of control, application, and graphic objects shall be provided to enable the creation of applications and user interface screens. Provide the capability to cut & paste objects and libraries into applications for a node/system. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together, using a built-in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface display shall not be acceptable.
- Provide integral trend-logging presentation in the programming screen.
- Print capability, with page break reference tags to allow down to 8 ½"x 11" size paper
- Off-line simulations (step function, continuous run function, simulation of external inputs)
- Dynamic presentation of logic in on-line state (all intermediate values)
- Text to logic screens
- Memory monitoring
- Power cycle restart function
- Run-time capability
- Calculator objects, including if-then-else, log, ln, exponential and trigonometric functions.
- Recognize standard network variable type data (nvi) and create network variables to put on the network (nvo)

# g. Programming Objects

- Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-toone, or one-to-many relationships. Linked objects shall maintain their connections to other objects, regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification.
- Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.

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- The software shall provide the ability to view the logic in a monitor mode. When on-line, the
  monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the
  logic execution. When off-line (debug), the monitor mode shall allow the user to set values
  to inputs and monitor the logic for diagnosing execution before it is applied to the system
  (step function and run mode, integral trend logging).
- The system shall support object duplication within the Owner's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

# h. Object Libraries

- A standard library of object function blocks shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
- The function blocks in this library shall be capable of being copied and pasted into the user's
  database and shall be organized according to their function. In addition, the user shall have
  the capability to group objects created in their application and store the new instances of
  these objects in a user-defined library.
- Start-Stop Time Optimization Object. Provide a start-stop time optimization object to
  provide the capability of starting equipment just early enough to bring space conditions to
  desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped
  before the scheduled un-occupancy time just far enough ahead to take advantage of the
  building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop
  time object properties based on the previous day's performance.
- Application Specific Node Configuration software Tools: Provide application specific node configuration software tools that will permit the individual network nodes to be configured and commissioned with appropriate parameters. This software will reside on the POT. Functionality shall include:
  - ✓ Recognize all Standard Configuration Parameters (SCPTs)
  - ✓ Provide capability for setting all Standard Configuration Parameters (SCPTs)
  - ✓ Translation capability for user defined configuration parameters
  - ✓ Monitoring capability for nvo's from the nodes
  - ✓ Ability to set the values for nvi's to the nodes

# i. Network Management

Network Management Software for Windows network management software tool shall be used to assign domain, subnet, and node addresses to nodes; configure all routers and repeaters; define network data connections between Lon Works®/BacNet Device/Modbus Device network variables, known as "binding;" and record binding data into node addressing tables, and create a database of all addressing and binding information for all nodes on the network.

Network management shall include the following services: browse all network variables on nodes; Attach, Detach, Manage, Add, Remove, and Replace nodes; plus transmission error off-line, on-line reporting.

The network management database shall be resident in the operator workstation server, ensuring that anyone with proper user name/password authorization has access to the network management database at all times.



The software shall have Client/server capability to allow multiple users ability to manipulate the database simultaneously.

# j. Human-Machine Interface - Operator Workstation Software (OWS)

The HMI shall be a client/server architecture to allow multiple client access to an Ethernet connected server. The workstation shall operate also as a stand-alone workstation/server.

The software shall enable an operator to interact with various devices including network nodes (Lon work/Modbus/BacNet), recorders, input/output (I/O) systems, intelligent transmitters, and other field devices.

It shall provide the following functions:

- ✓ Calendar.
- ✓ Scheduling.
- ✓ Trending.
- ✓ Alarm monitoring and routing.
- ✓ Time synchronization.
- ✓ Time zone handling
- ✓ Integration of controller data
- ✓ Object linking and embedding for process control (OPC) for connectivity to third party OPC compliant software/devices
- ✓ Color graphic display
- ✓ On-line plots
- ✓ Use Microsoft NT security
- ✓ System documentation generation
- ✓ Dynamic data exchange (DDE)
- ✓ Dispatch of a single time schedule to all programmable nodes

System Configuration: At a minimum, the HMI shall permit the operator to perform the following tasks, with proper password access:

- ✓ Create, delete, upload, or modify control strategies.
- ✓ Add/delete objects to the system.
- ✓ Tune control loops through the adjustment of control loop parameters.
- ✓ Enable or disable systems
- ✓ Generate text file reports to a networked printer.
- ✓ Select points to be alarmable and define the alarm state.
- ✓ Configure alarms to be sent to Microsoft windows mail client
- ✓ Select points to be trended over a period of time and initiate the recording of values automatically.
- ✓ Provide different levels of security to every object in the HMI database
- ✓ Modify and create users with passwords and access levels and also be able to use currently logged on users and passwords

#### k. Event Alarm Notification and Actions

• The HMI software shall provide alarm recognition, storage, routing, management, and analysis.



- The HMI software shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or widearea network.
- Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
  - ✓ To alarm.
  - ✓ Return to normal.
  - ✓ To fault.
- Provide for the creation of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, fire, etc.
- Provide timed (schedule) routing of alarms by class, object, group, or node.
- Provide alarm generation from "runtime" and /or event counts for equipment maintenance.
   The user shall be able to reset runtime or event count values with appropriate password control.
- Control equipment and network failures shall be treated as alarms and annunciated.
- Alarms shall be annunciated in the following manners as defined by the user:
- Screen message text.
- Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
  - ✓ Day of week.
  - ✓ Time of day.
  - ✓ Recipient.
  - ✓ Short Message Service (SMS)
  - ✓ Auto answer (at OWS) and auto dial (from node)
  - ✓ Graphic with flashing alarm object(s).
  - ✓ Printed message, routed directly to a dedicated alarm printer.
  - ✓ Audio messages.
- The following shall be recorded by the OWS HMI software for each alarm (at a minimum):
  - ✓ Time and date.
  - ✓ Location (building, floor, zone, office number, etc.).
  - ✓ Equipment (air handler #, accessway, etc.).
  - ✓ Acknowledge time, date, and user who issued acknowledgement.
  - ✓ Number of occurrences
- Alarm actions may be initiated by user defined programmable objects created for that purpose.
- Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- A log of all alarms shall be maintained by the OWS HMI and shall be available for review by the user.
- Attach a graphic screen, text notes, and/or plant status report, to each alarm, as defined by user.
- Repeat/nuisance alarms must have feature to be disabled, and a feature for monitoring disabled alarms.
- The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. An alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms.



• The dedicated alarm window shall provide user selectable colors for each different priority of alarm.

# I. Data Collection and Storage Requirements

- The OWS HMI shall have the ability to collect data for any property of any object and store this data for future use.
- The data collection shall be performed by objects, resident in the node, and if desired OWS, shall have, at a minimum, the following configurable properties:
- For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
- For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
- For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
- Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
- All log data shall be stored in a database in the OWS HIM and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
- Systems that cannot provide log data in HTML formats at a minimum shall not be acceptable.
- The OW shall have the ability to archive its log data either locally (to itself), or remotely to a OWS server. Provide the ability to configure the following archiving properties, at a minimum:
  - ✓ Archive on time of day.
  - ✓ Archive on user-defined number of data stores in the log (buffer size).
  - ✓ Archive when log has reached its user-defined capacity of data stores.
  - ✓ Provide ability to clear logs once archived.

# m. Audit Log

- Provide and maintain an Audit Log that tracks all activities performed on the OWS HMI. Provide
  the ability to specify a buffer size for the log and the ability to archive log based on time or
  when the log has reached its user-defined buffer size. Provide the ability to archive the log
  locally to OWS HMI or to a server. For each log entry, provide the following data:
  - ✓ Time and date.
  - ✓ User ID.
  - ✓ Change or activity: i.e., change setpoint, add or delete objects, commands, etc.
  - ✓ Database Backup And Storage
- The OW shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
- Shall have the ability to automatically complete full or partial backups; and have the ability to full or partial restore. Partial is defined as only items that have changed in the database.
- Copies of the current database and, at the most recently saved database shall be stored in the OW. The age of the most recently saved database is dependent on the user-defined database save interval.
- Graphical Real-Time Displays. The HMI, shall at a minimum, support the following graphical features and functions:

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- Graphic screens shall be developed using any drawing package capable of generating and importing a GIF, BMP, DWG, DXF, or JPG file format. In addition to, or in lieu of a graphic background, the HMI shall support the use of scanned pictures.
- Graphic screens shall contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML, or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
- Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
- Commands to start and stop binary objects shall be done by clicking the selected object and selecting the appropriate command from the pop-up menu. Data entry may be typed or mouse entered.
- Adjustments to analog objects, such as set points, shall be done by clicking the selected object and entering value or using a graphical slider to adjust the value.
- The OWS shall be able to support multiple graphic objects at the same time. If tiled, then each graphical object shall be fully scalable or aspect locked.
- Trend Displays (variable versus time) A trend display shall show the values of points plotted versus time similar to a strip chart recorder. Eight tags shall be trended per trend. The HMI software shall provide real-time and historical trending (for data which had been logged). This may be achieved by either color graphic page display or an Microsoft excel based display.
- Real-Time Trends shall contain real-time data without consuming hard disk space.
- Historical Trends Logs A historical trend log display presents data stored on the computer's hard disk.
- X-Y Plots (variable versus variable) An x-y plot shall dynamically represent the real-time or historical relationship one variable plotted against another variable.
- Automatic Generation All trends and plots shall be self-generated and not require any programming by the user.
- The HMI software shall provide dialog boxes and menu picks for configuring trends and plots.
- Any analog or binary data may be trended or plotted.
- The software shall store pre-configured presentation of trends to facilitate operator call-up of trend log displays. It shall be possible to call up a trend log with pre-assigned data.
- Graphics Builder The HMI software shall provide a graphics builder.
- Display Documentation The graphics builder shall provide show, simulate, review, and document animation functions to allow the user to identify, diagnose, change, and document animation points on each display.
- A library of vendor-supplied objects will be included. These objects, widgets, and symbols must be continuously scalable. These items shall be editable by the user.
- A library of animated graphic objects shall be included.
- Animation The Graphics Builder will animate process graphics with real-time data from field devices.
- Multi-State Color Animation shall be provided to change a graphic object's color from a palette
  of colors.
- Alarm Color Color animation for normal, alarm, and alarm acknowledged states for both analog and binary point tags shall be provided. The user shall define the foreground and background colors for each state.
- Alarm Blink Objects and text data shall blink based on alarm state and acknowledged state.
- Text and Numeric Animation The software shall display the numeric value of an analog point, text of a text point, and the descriptors of a binary point. Display Linking The software shall



- provide a display linking function. Clicking the object associated with the link changes the display to a new user-defined display.
- Pickable/Non-Pickable The software shall enable active points to be selected with the mouse and accessed. It shall be possible to make a point non-pickable: the dynamic information shall be displayed, but the operator will not be able to access a detail display, change the value, etc. based on security settings of the software.
- Ability to open external executable files from button click
- Ability to open HTML web pages from button click
- Ability to view Microsoft Excel files from button click
- On-Line Help. Provide a context sensitive help system to assist the operator in operation and editing of the system. Help screens shall be available for all applications and shall provide the relevant data for that particular screen.
- Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data.
- System security shall be selectable for each operator.
- The system administrator shall have the ability to set passwords and security levels for all other operators.
- Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object.
- Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected.
- All system security data shall be stored in an encrypted format.
- Each object in the HMI database must be able to have a security policy applied to it.
- System Diagnostics. The system shall automatically monitor the operation of network connections and controllers. The failure of any device shall be annunciated to the operator.
- DDE Server The HMI software shall be able to communicate and exchange data with any Third Party DDE compliant application.
- MICROSOFT REPORT GENERATION The HMI software shall be able to seamlessly interact with Microsoft Office Products, including Excel, with no additional programming.

## n. Direct Digital Controller (DDC) Hardware Requirement

- DDC controllers shall be capable of fully "stand- alone" operation i.e. in the event of loss of communication with other DDC's or Control Station, they shall be able to function on their own.
   The controllers shall be Lon Works/BacNet/Modbus based products.
- The controllers shall consist of minimum single 32-bit microprocessors for reliable throughput, based with EEPROM based Operating System.
- The memory available to the controller board as working space for storage of the Operating system software and data files shall be decided on the basis of number of points being controlled by them.
- The controllers shall be UL listed and conforming to CE (Euro norms).
- Controllers requiring nickel-cadmium/lithium battery to support the full operation of the RAM, shall have battery back-up up to 12 hours in the event of a localized mains failure. The battery shall not be required to supply power to actuators, valves, dampers etc.
  - ✓ In addition to the above battery reserve a further battery shall be provided to retain the RAM for a minimum of 2 days, after the expiration of the standard battery.



- ✓ A low battery alarm shall be provided with each Controller and with an indication at the Control Station.
- ✓ In case the memory is stored on EEPROM, the battery backup will not be required.
- The Controllers shall have proportional control, Proportional plus Integral (PI) Control, Proportional plus Integral plus Derivative (PID) Control, Two Position Control and Time Proportioning Control and algorithms etc., all in its memory and all available for use by the user, i.e. all the control modes shall be software selectable at any time and in any combination. The analog output of Proportional Control, PI Control, and PID Control shall continuously be updated and output by the program shall be provided. Between cycles the analog output shall retain its last value. Enhanced integral action in lieu of Derivative function shall not be acceptable.
- The controllers shall have a resident real time for providing time of day, day of week, date, month and year. These shall be capable of being synchronized with other clocks in the network.
- Back-up power shall support the clock. Upon power restoration all clocks shall be automatically synchronized.
- The microprocessor based DDC's shall be provided with power supply, A/D and D/A converters, memory, and capacity to accommodate a maximum of 18 input/output (I/O) hardware points (with or without an expansion board). DDC's with a lower capacity of points shall preferably be provided at the locations with relatively less input/output points.
- If the controllers provided by the bidder have the configurable plug in function cards, then the following minimum specifications shall have to be met:
  - ✓ In addition to the basic outstation, a minimum of two slots shall be provided for the insertion of plug-in function cards.
  - ✓ The cards shall provide for analog or digital, input or output, hardwired connections to the installed plant.
  - ✓ The quantity and combination of these cards shall be determined by the requirements of the plant in that location with the concurrence of the Owner/ Consultant.
- The DDC's shall have 15% spare capacity (digital/analog input/output) to give flexibility for future expansion.
- All DDC controllers shall be capable of handling voltage, milli-ampere, resistance or open and closed contacts inputs in any mix, if required.
- Analog inputs/outputs of the following minimum types shall be supported:
  - ✓ 4-20 mA.
  - √ 0-1 volts.
  - ✓ 0-10 volts.
  - ✓ 0-5 volts, and
  - ✓ 2-10 volts.
  - ✓ Resistance Signals (either PTC or NTC)(PT 100, PT 1000, PT 3000, Balco 500, NI 1000)

Digital input/output types to be supported shall be, but not limited to the following:

- ✓ Normally-open contacts.
- ✓ Normally-closed contacts.

Modulating outputs shall be true proportional outputs and not floating control type.

• Controller's packaging shall be such that complete installation and check out of field wiring can be done prior to the installation of electronic boards.



- All board terminations shall be made via plug-in connectors to facilitate trouble-shooting, repair and replacement. Soldering of connections shall not be permitted.
- Controllers shall preferably be equipped with diagnostic LED indicators with at least indication for Power up Test OK, and Bus Error. All LEDs shall be visible without opening the panel door.
- It shall be possible for the controllers to accept regulated uninterrupted power supply to maintain full operation of the controller functions (control, logging, monitoring and communications) in the event of a localized mains failure.
- Controllers requiring fan cooling are not acceptable.
- There shall be the facility for accessing controller data information locally, via a portable plug-in keypad display which can be common to all controllers and normally removed to prevent unauthorized tampering. Alternatively each controller shall have a keypad and display integral with its casing for local interrogation and adjustment. In either case, access to the system thus provided shall be restricted by passwords in the same way as at the main operator terminal.
- In case the Portable Operator Terminals (POT) is required to program the controllers, sockets shall be provided for same. Attachment of POT shall not interrupt or disable normal panel operation or bus connection in any way.
- The controllers shall be housed in vandal proof boxes to protect them from tampering by any unauthorized personnel. All DDC controllers used in plant room spaces and external application shall be housed IP66/IP54 rating enclosures.
- It shall be possible to add new controllers to the system without taking any part of the system off-line.

# o. Direct Digital Controllers Capabilities

- The Controllers shall have a self-analysis feature and shall transmit any malfunction messages to the Control Station. For any failed chip the diagnostic tests, printout shall include identification of each and every chip on the board with the chip number/location and whether the chip "Passed" or "Failed" the diagnostic test. This is a desired requirement as it would facilitate trouble-shooting and ensure the shortest possible down time of any failed controller. Controllers without such safety feature shall be provided with custom software diagnostic resident in the EEPROM. The Bidder shall confirm in writing that all controllers are provided with this diagnostic requirement.
- Operating system (O.S.) software for controllers shall be EPROM resident. Controllers shall have resident in its memory and available to the programs, a relevant library of algorithms, intrinsic control operators, arithmetic, logic and relational operators for implementation of control sequences.
- In the event of failure of communication between the controllers and/or Control Station terminal, alarms, reports and logs shall be stored at the controllers and transmitted to the terminal on restoration of communication.
- In the event of memory loss of a Controller, or the expiration of back-up power, on start-up of
  the unit the necessary data-base shall be downloaded automatically and without operator
  instruction. Controllers requiring a manual intervention for the re-boot of software are not
  desired.
- Where information is required to be transmitted between controllers for the sharing of data such as outside air temperature, it shall be possible for global points to be allocated such that information may be transmitted either on change of incremental value or at specific time intervals.
- Controllers must be able to perform the following energy management functions as a minimum.



- ✓ Time & Event programs
- ✓ Holiday Scheduling
- ✓ Maximum and Distributed power demand
- ✓ Optimum start and stop program
- ✓ Night purge
- ✓ Load reset
- ✓ Zero energy band
- ✓ Duty cycle
- ✓ Enthalpy analysis and control
- ✓ Run Time Totalization
- ✓ Sequencing and Optimization
- ✓ Exception scheduling
- Detailed description of software features and operating sequence of all available energy management software shall be submitted with the tender for evaluation by the Consultant.
- The DDC Controllers shall have Adaptive Control capability whereby the control software measures response time and adjusts control parameters accordingly to provide optimum control. The software shall allow self-tuning of the variable control loops (all or any of P, P+I, P+I+D) of the AHU's and chiller system so as to provide the most efficient and optimized controls at different load conditions. The energy management programs shall update their parameters based on past experience and current operating conditions.
- Alarm Lockout shall be provided to prevent nuisance alarms. On the initial start up of air handler and other mechanical equipment a "timed lockout" period shall be assigned to analog points to allow them to reach a stable condition before activating an alarm comparison logic. Bidders shall indicate their proposed system alarm handling capability & features.
- Run time shall be accumulated based on the status of a digital input point. It shall be possible to total either ON time or OFF time. Run time counts shall be resident in non-volatile memory.
- It shall be possible to accommodate Holiday and other planned exceptions to the normal time programs. Exception schedules shall be operator programmable up to one year in advance.
- Distributed power demand program shall be based on a sliding window instantaneous demand trend algorithm. The DDC interfaced to the demand meter shall calculate the demand, forecast the demand trend, compare it to the established demand limits, and initiate load shedding or re-establishment of loads as required. Shedding shall be on a sequential basis with least important loads shed first and restored last.

#### p. Data Communication

The communication between controllers shall be via a dedicated communication network as per Lon Works/BACnet/Modbus recommended standards. Controllers microprocessor failures shall not cause loss of communication of the remainder of any network. All networks shall support global application programs, without the presence of a host PC.

Each controller shall have equal rights for data transfer and shall report in its predetermined time slot. There shall be no separate device designated as the communication's master. Those systems using dependent controllers shall be pointed out by the bidder and a dual redundant transmission media with automatic switching and reporting in the event of line faults will have to be provided.

The communication network shall be such that:

• Every DDC must be capable of communicating with all DDCs.

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 Network connected devices with no messages to transmit shall indicate "No failure" message each cycle. Lack of this message after successive retries shall constitute a communication or device failure

# q. Electric and Electronic Controls Related Equipment

#### **General Requirements**

All controls shall be capable of operating in ambient conditions varying between 0 to 55 °C and 90% R.H. non-condensing.

All Control devices shall have a 20mm 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 bidder 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 are mentioned in the respective section.

## (ii) Pipe work 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 230V a.c and all accessible live parts shall be shrouded. An earth terminal shall be provided.

#### r. 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:

The temperature sensors may be of any of the following types:

- PT 100, PT 1000, PT 3000
- NI 100, NI 1000
- Balco 500.
- Thermistor
- NTC1800

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# s. 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.

#### t. 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.

## u. Level Switch

The level switches shall have to meet the following requirement:

Type : Float Type/Capacitance type/Conductivity type

Mounting : To suit application.

Connection : Flanged ANSI 150 lbs RF Carbon steel

Float material : 316 SS

Stem Material : 316 SS

Output : 2 NO, 2 NC potential free

Switch Enclosure : IP 55

#### v. Thermostat

Thermostat shall be snap acting fixed differential type thermostat for air-conditioning application for actuating the two way valve at each fan coil unit with HI-MED-LO fan switch and system setting OFF-FAN-COOL. Switching off must break fan circuit. Thermostat shall be provided with necessary relays to operate valve of cooling coil.

## w. Electronic Metering

Electronic metering shall be provided on the main LT panel at incoming and outgoing feeders. These meters shall be installed in the LT panel by the Electrical bidder. The electrical bidder shall also provide necessary CT, PT and 220 V power input for the meters. All further control wiring and networking of the meters shall be in scope of BAS bidder.

The specifications for the electronic meters to be supplied by BAS bidder is as follows:

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Type: Static Power Meter of Class 1.0 accuracy.

#### Instantaneous Measurements:

- V (1-n), V (1-1) & 1 per ph.& avg. V & I unbalance
- PF per ph.& total, frequency
- Power &Bi-directional energy (active, apparent, reactive)
- Peak & Predictive Demand (I, W, VA, VAR totals)
- V & I harmonics (Individual & Total)
- Time of use (internal calendar, multiple daily tariff, energy & demand accumulators).

#### Features:

- Event Triggered
- Sequence of event
- Panel mountable
- Internal battery backup
- Transducer less connection via standard CT / PT

Display: Local LCD display panel user formattable display with scrollable screens.

Software interface shall be ensured by bidder for the electronic meters. Systems requiring transducers for duplicating the data shall not be accepted.

All the instantaneous measurements shall be displayed on the control stations and the data shall be logged. It shall be possible to access minimum / maximum logging of any parameter with alarm annunciation for unusual measurements. The system shall also accept user defined "Set-Point" limit of any parameter.

#### x. Enclosures for Controllers and Electrical Panels

All the controllers shall be housed in Lockable Vandal proof boxes which shall either be floor mounted or wall mounted. These shall be free standing, totally enclosed, dust and vermin proof and suitable for tropical climatic conditions.

The panel shall be metal enclosed 14 SWG CRCA sheet steel cubicle with gaskets between all adjacent units and beneath all covers to render the joints dust proof. All doors and covers shall be hinged and latched and shall be folded and braced as necessary to provide a rigid support. Joints of any kind in sheet metal shall be seam welded with welding slag grounded off and welding pits wiped smooth with plumber metal.

Note: All panel enclosures used in plant room spaces and external to building shall be suitable for outdoor application (IP 54 protection) and UL listed.

# y. Conduits and Wiring

Prior to laying and fixing of conduits, the bidder shall carefully examine the drawings indicating the layout, satisfy himself about the sufficiency of number and sizes of conduits, sizes and location of conduits and other relevant details. Any modifications suggested by the Bidder shall be approved by CDAC before the actual laying of conduits is commenced.

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#### z. Conduits / Trunker

Conduits and accessories shall conform to relevant Indian Standards. PVC conduits of required diameter shall be used as called for in the schedule of quantities. Joints between conduits and accessories shall be securely made, with help of adhesive.

The conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer.

#### aa. Connections

All jointing methods shall be subject to the approval of the Architect/Engineer. Separate conduits shall run for all power wiring.

The threads and sockets shall be free from grease and oil. Connections between conduit and controller metal boxes shall be by means of brass hexagon smooth bore bush, fixed inside the box and connected through a coupler to the conduit. The joints in conduits shall be smooth to avoid damage to insulation of conductors while pulling them through the conduits.

#### bb.Bends in Conduit

Where necessary, bends or diversions may be achieved by means of bends and/or circular inspection boxes with adequate and suitable inlet and outlet screwed joints. In case of recessed system each junction box shall be provided with a cover properly secured and flush with a finished wall surface. No bends shall have radius less than 2½ times the outside diameter of the conduit.

# cc. Signal Cabling & Communication Cabling

The signal cable shall be of the following specifications:

a) Wire : Annealed Tinned Copper b) Size : 1.5 sq. mm, 7 strands

c) No. of conductors : Two (One pair)

d) Shielding Type : Aluminum polyester shield.

e) Jacket : Chrome PVC

f) Nominal DCR : 17.6 ohm/km for conductor and 57.0 ohm/km for shield

g) Nominal OD : 8.5 mm

h) Nominal capacitance : 130 pF/m between conductors at 1 KHz 180 pF/m

between one conductor and other conductors connected to shield.

i) Color : Black and Red



# C.4.9 Public Addressing System

#### a. General

The bidder 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. The bidder shall make sure that all power tapping of the speakers must be carried out. The bidder 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.

# b. 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.

## c. System Design

The PAVA system shall be connected on the same Fire Alarm loop. The system shall be decentralized in nature; each distributed rack DAU (Distributed Amplifier Unit) shall have all the DSP (Digital Signal Processing), messages, and 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 carparks. 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.

System shall have following functions

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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

# d. 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 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.

Rated Output Voltage(RMS) : 120W/240W/480W 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)

## e. 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

# f. 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

#### g. 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 12 Zones and have all call facility. The

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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:

- 12 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)

#### h. Controller

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 (OdB 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 an 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.

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

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1 Channel audio signal left and right channel output

### i. CD/DVD Player

The CD/DVD player shall be capable playing MP3 audio tracks from USD or DVD or CD. Speaker

### j. Cables

- All cables associated with PA System shall be of following specifications:
- The 2-core speaker cable shall connect to the speakers by screw terminals before which it shall 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 / 2.5 Sq. mm insulated, PVCFRLS sheathed control Cable as per IS 694.
- These Cables shall laid in G.I. Conduits concealed/surface.

#### k. Call Station Cables

Call station cables should be 4pair CAT6 STP (Shielded Twisted Pair) type, RJ45 Shielded Male Connectors should crimp it.

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# C.5 Racks

S. No.	Parameter	Tender Specifications			
		19" 42U racks mounted on the floor			
1. Type		Floor Standing Server Rack - 42U with Heavy Duty Extruded Aluminum Frame for rigidity. Top cover with FHU provision. Top & Bottom cover with cable entry gland plates. Heavy Duty Top and Bottom frame of MS. Two pairs of 19" mounting angles with 'U' marking. Depth support channels - 3 pairs with an overall weight carrying Capacity of 1000Kgs.  Each network/server rack will be supplied with 5 numbers of 1U blanking panels, 8 numbers of 2U blanking panels and 3 numbers of 4U blanking panels  All racks must be lockable on all sides with unique key for each rack  Racks should have Rear Cable Management channels, Roof and base cable access. Cable Brushes shall be provided  Cabinet shall have form factor of not more than 1.05 when compared between overall height to usable height.  Baying kit shall be provided for each rack			
		Server Rack: 42U x 600mm x 1200mm			
2.	Size	Network Rack: 42U x 800mm x 1200mm			
3.	Wire Managers	Two vertical and four horizontals			
4	Doors	The racks must have steel (grill / mesh) front / rear doors and side panels. Racks should NOT have glass doors / panels.  Front and Back doors should be perforated with at least 63% or higher perforations.			
4.	Doors	higher perforations.  Both the front and rear doors should be designed with quick release hinges allowing for quick and easy detachment without the use of tools.			
5.	Metal	Aluminum extruded profile			
6.	Side Panel	Detachable side panels (set of 2 per Rack)			
7.	Earthing	Rack shall be provided with proper earthing arrangement in both front and rear with use of an earthing squid.			



## **C.6 Intelligent Power Distribution Unit (IPDU)**

- No of output sockets: IEC 320 C13 x 20 Nos minimum and IEC 320 C19 x 4 Nos minimum.
- Input current rating: single phase 32A
- +/-1% Accurate Metering of electrical parameters
- 100% rated magnetic hydraulic circuit breaker.
- Socket Level Metering PDU.
- IPDU should provide following measurement parameters: Current (A), voltage (V), real power (W), apparent power (VA), consumption (kWh), power factor, frequency and crest factor
- All plug types, input as well as outlet should confirm to best industry standards and should have locking capability to avoid accidental dislodging.
- Communication module in the rack PDU should be Hot Swappable.
- It should have LED at each socket to know the status like on, off, over current and undercurrent.
- Embedded data log and event log feature.
- Local display
- Authentication: Local, remote: Active directory, LDAP, Radius etc.
- It should have IPv4 & IPv6 support
- RJ45 Ethernet pluggable connectivity
- Following remote management should be supported: On board web interface, CLI, SNMPv1,2,3, SSH, Telnet.
- It should have low power consumption in the range of maximum 5W to 8W on idle.
- It should have switching capability like On, Off, Recycle, Lock, Unlock, Outlet Grouping Capability along with graceful shutdown facility,
- It should have adjustable threshold values with an alarm function
- There should also be an audible alarm from the PDU in case of an alert.
- PDU should provide the capability of reporting error thru email or any other method
- Suitable Operating temperature should be 0 to 60°C
- IT should have capability to connect sensors for temperature, air humidity, door contacts etc.
- It should have capability of connecting minimum 4 PDUs in an Array



## C.7 Network Cabling

#### a. Requirement

- Every row of racks in the Server Room shall have a Network rack placed at the end of the row
- The network rack shall aggregate cables from each server rack and also house the end-of-row switches.
- Cables from server racks will be terminated in network racks in the same row as well as the next row for redundancy.
- 06 runs for CAT6A cable shall be provided from each Server Rack to End of Row Network Rack of the same row and additional 06 runs shall be provided to the End of Row Network Rack of the neighboring row.
- Each End of Row Network Rack shall have 6 runs of Cat6A cabling to each of the Central Network Rack
- Each Central Network Rack shall have 6 runs of Cat6A cabling to each of the Telco Rack
- Each Central Network Rack shall have 6 runs of Cat6A cabling to Staging Rack
- 1 x 6-core OM4 fiber cabling shall be provided from each Server Rack to End of Row Network
  Rack of the same row and additional 1 x 6-core OM4 fiber shall be provided to the End of
  Row Network Rack of the neighboring row.
- 1 x 6-core OM4 fiber cabling shall be provided from each Central Network Rack to each of the End of Row Network Rack.
- 1 x 6-core OM4 fiber cabling shall be provided from each Central Network Rack to each of the Telco Rack
- 1 x 6-core OM4 fiber cabling shall be provided from each Central Network Rack to Staging Rack
- All cables shall be LSZH type
- All cables shall be laid on overhead cable trays with redundant routes as per the enclosed drawing.
- Cat6 cabling shall be used for the data outlets in all other areas of the Data Center as per 'Data outlet points location drawing'.



# b. Copper Cabling Solution

S. No.	Specification
1.	Channel Performance
a)	Channel Performance
	The Category 6A/ Class EA UTP SCS shall comply with the following standards
	• ISO/IEC 11801:2010
	<ul> <li>EN 50173 Part 1 through Part 5:2010 and 2011</li> </ul>
	ANSI/TIA-568-C
	• IEC 60603-7-4
	<ul> <li>IEEE 802.3 applications as outlined in section 2</li> </ul>
	<ul> <li>Local/National Codes and Regulations</li> </ul>
b)	The Category 6A/ Class EA UTP system should support the following IEEE
	Ethernet applications
	• 802.3e - 1BASE5
	• 802.3i - 10BASE-T
	• 802.3u - 100BASE-TX, 100BASE-T4
	• 802.3y - 100BASE-T2
	• 802.3z - 1000BASE-X
	• 802.3ab - 1000BASE-T
	802.af - Power Over Ethernet (15.4W)
	802.3at - Power Over Ethernet Enhancements (25.5W)
	802.3az - Energy Efficient Ethernet
c)	Additionally the Category 6A/ Class EA UTP SCS shall be capable of supporting
	the following Fiber Channel Applications Standards, per Technical Committee
	11 of INCITS:
	• 1GFC-BASE-T
	2GFC-BASE-T
	4GFC-BASE-T
d)	The proposed Category 6A UTP SCS, when configured as a worst-case 100
	meter channel shall provide performance headroom over limits specified by
,	Cat6A
e)	NEXT (Near End Cross Talk): Minimum 3 dB above the standards; Should
	support a minimum of 4 connector Channel with a minimum 3 dB guaranteed NEXT
f)	Insertion Loss: < 3%
	Return Loss: <1.0db
g) h)	The SCS must consist of individual components provided by the same
'''	manufacturer. "Mix and Match" products are not allowed as there is no
	guarantee that the overall channel will meet Category 6A Channel
	requirements if constructed with components from different vendors.
i)	The Category 6A cable and Category 6A channel components shall be
.,	manufactured by a single manufacturer. The manufacturer shall warrant the
	Category 6A channel cable, components, and applications for a period of 20
	years.
j)	The 20 year warranty shall be a transferable warranty and has component
	replacement policy in case of manufacturing defect



S. No.	Specification						
k)	The Category 6A system should support channels that are shorter than 15						
	meters for 2, 3, 4 connector channels without any minimum length						
	requirements.						
2.	Horizontal Cable						
a)	The Cable should meet ANSI/TIA 568C.2 Category 6A Specifications						
b)	The cable should consist of Eight 23 AWG copper conductors. Copper Clad						
,	Aluminum or any other combinations are not allowed						
c)	The Cable should be round in shape						
d)	The weight of the cable box of 1000 Feet should not be less than 34.7 lb. ± 5lb						
e)	The nominal Jacket thickness should be 0.05 ± 0.02 inches						
f)	The nominal Outside diameter should be 0.285 ± 0.075 inches						
g)	The cable should support the installation temperature: 0 to 60 OC.It should support Operating temperature of -20 to 60 OC						
h)	The cable shall be available in Low-Smoke, Zero Halogen (LSZH) compatibility						
	and the LSZH version must comply with the following Fire Safety standards:						
	ISO/IEC 60332-3-22: Vertical Flame Spread						
	• ISO/IEC 60754-2: Acidity						
	ISO/IEC 61034-2: Smoke Density						
i)	The cable and cordage shall be True UTP components that do not include						
	internal or external shields, screened components or drain wires. However						
	the end connecting cordage can be UTP/FTP. No Special Grounding						
	requirements.						
j)	The horizontal cable shall have a unique print string on the cable jacket. This						
	unique identifier shall also be used for on-line reference to a full set of factory						
	tests that were performed on a sample from the same mater reel. The test						
	parameters shall include NEXT, PSNEXT, Return Loss, Attenuation, ELFEXT and						
	PSELFEXT. The on-line reference must be available on the SCS vendor public						
	website, such that it can be accessed at any time.						
3.	Category 6A - 10Gigabit outlets						
a)	The 8-pin modular (RJ-45) jacks shall comply with IEC 60603-7-4						
b)	The Category 6A outlets shall be backward compatible with Category6 and						
	5Ecords and cables.						
c)	The Category 6A outlets shall be of a universal design supporting T568 A & B						
	wiring.						
d)	The information outlet shall have a Current Rating of 1.5 A at 20°C						
e)	The information outlet must support 90 degree cable termination.						
f)	3rd Party Verification test certificates shall be provided to show compliance to						
·	ISO/IEC 11801 Amendment 2 testing for Cat 6A components.						
g)	The information outlet will have insertion life of 750 cycles minimum.						
4.	Modular RJ45 Patch Cords						
a)	SCS must support patch cord lengths of 1 meter minimum and equipment						
	cords of 2 meter minimum and the Patch cords shall be available in Stranded						
	construction						
b)	Cords shall be equipped with 8-pin modular plugs on each end.						



S. No.	Specification
c)	All cords shall be round, and consist of copper conductors, tightly twisted into
	individual pairs.
d)	Nominal cordage diameter shall not exceed 8.24 mm.
e)	Plugs shall be designed with an anti-snag latch to facilitate easy removal
	during move, add and change processes.
f)	The LSZH version must comply with the following Fire Safety standards:
	ISO/IEC 60332-3-22: Vertical Flame Spread
	• ISO/IEC 60754-2: Acidity
	ISO/IEC 61034-2: Smoke Density
g)	3rd Party verification of the Fire Safety/ Environmental tests listed above must
	be provided as part of the bid response.
h)	The cordage shall be UTP components that do not include internal or external
	shields, screened components or drain wires.
i)	The patch cords will have insertion life of 750 cycles minimum.
5.	24-Port Unloaded Patch Panel
a)	When configured in worst-case 100 meter channels with full cross-connects
	and consolidation points with the other products proposed in this tender, the
	panel shall be capable of delivering the minimum guaranteed channel
	performance
b)	The panel shall have horizontal cord organizers available as to improve patch
	cord management
c)	The patch panel type shall be a 1U straight unloaded patch panel for 19" rack
	mounting capable of supporting 24 unshielded modular 8-pin connectors
	compliant with IEC 60603-7-4 while meeting the Channel Performance as
	specified in Amendment 1 to ISO/IEC 11801:2002
d)	The panel shall be available in 24-port configurations with universal A/B
	labeling and 110 connector terminations on rear of panel allowing for quick
	and easy installation of 22 to 24 AWG cable
e)	The panel shall be equipped with a removable rear mounted cable
()	management bar and front and rear labels
f)	The panel shall be UL and cUL Listed
g)	Operating Temperature Range = -10°C to 60°C
h)	Storage Temperature Range = -40°C to 70°C
i)	Humidity = 95% noncondensing
j)	Nominal Solid Conductor Diameter = 0.025 to 0.020 in (0.64 to 0.51 mm) (22
1.	to 24 AWG)
k)	Nominal Stranded Conductor Diameter: 0.025 to 0.020 in (0.64 to 0.51 mm
1)	(22 to 24 AWG)
I)	Insulation Types = All plastic insulates (including PVC, irradiated PVC,
m)	Polyethylene, Polypropylene, PTF Polyurethane, Nylon and FEP)  Insertion Life = 750 minimum insertions of an FCC 8-Position
m)	
	Telecommunications Plug



# c. Multimode Fiber

S. No.	Specification
1.	OM4 Multimode Fiber Cable
a)	Multimode optical fiber cable, 50/125 micron graded index,, required for indoor /outdoor applications, loose tube jelly field, Water blocked buffer tube, strengthening members, outer sheath resistant to UV, moisture, sunlight, suitable for harsh environment, support 10 G Ethernet up to 550 m, should confirm or exceed the ISO/IEC 11801:2002; IEC 60794-1-2 E1; IEC 60794-1-2 E3; IEC 60794-1-2 F1; IEC60794-1and ITU Recommendation G.651standards standards for Fiber and cable performance specifications.
2.	Patch Chord
a)	Patch cord with LSZH jacket, F8 2.0x4.1 mm, turquoise (aqua), multimode G50 50/125 $\mu$ m (OM4), bend-optimized. Mounted on one side with SC-Duplex connectors in acc. with IEC 61754-4. Zirconia ceramic) ferrule with a PC polished end face geometry, connectors qualified in acc. with IEC 61753-1 for category U (uncontrolled environment). Beige connector housing (multimode), material PBT / UL 94 V-0, black duplex clip, 1 x black and 1 x red strain relief, material TPE / UL 94 V-0 and plastic dust cover. Optical specifications (random mated): Performance: Insertion loss (IL) Grade Bm for 100% of the tested specimen: $\leq$ 0.50 dB / typical $\leq$ 0.15 dB Return loss (RL) Grade 3: $\geq$ 35 dB
3.	LIU
a)	Loaded with LC couplers & adaptor plates for 6/12/ 24/48 fibers 50/125 micron MM, 19" rack mountable metallic distribution enclosure slide & tilt drawer type 1 U/2U, should have inbuilt / pre-installed splice tray with all clamps, harnessing rings, ties etc., Material: box, powder-coated sheet steel / front panel



### C.8 Miscellaneous items

### a. 55" LED Monitors

LED Monitor for the NOC Room shall be a professional grade 55" monitor having the following minimum specifications:

S. No.	Feature	Requirements
1.	Screen Size	55"
2.	Aspect Ratio	16:9
3.	Resolution	1920 x 1080 (Full HD)
4.	Panel	LED backlit/edge lit
5.	Connectivity	HDMI(2), DVI-D, DP, RS232C, RJ45, USB
6.	Built in speakers	Required
7.	Power Supply	100-240V ac, 50 Hz.
8.	EMC	FCC Class "A" / CE
9.	Accessories comprising of Remote	Required
	Control with battery, signal cables,	
	power cord	
10.	Wall mount bracket	Required
11.	Bezel Thickness	Less than 3.7mm

### b. 47" LED Monitors

LED Monitor for the BMS Room shall be a professional grade 47" monitor having the following minimum specifications:

S. No.	Feature	Requirements
1.	Screen Size	47"
2.	Aspect Ratio	16:9
3.	Resolution	1920 x 1080 (Full HD)
4.	Panel	LED backlit/edge-lit
5.	Connectivity	HDMI (2), DVI-D, DP, RS232C, RJ45, USB
6.	Built in speakers	Required
7.	Power Supply	100-240V ac, 50 Hz.
8.	EMC	FCC Class "A" / CE
9.	Accessories comprising of Remote	Required
	Control with battery, signal cables,	
	power cord	
10.	Wall mount bracket	Required

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# c. Workstation for BMS

S. No.	Features	Minimum Required Parameters						
1.	Processor	Intel Core i7, min 3 GHz						
2.	RAM	8 GB DDR, 1333 MHz						
3.	Hard Disk	1 TB SATA						
4.	Expansion Ports	4 USB 3.0, 1 Line-in, 1 Line-out, 1 Microphone, 1 LAN, 1 VGA						
5.	Keyboard & Mouse	Yes, Wireless						
6.	Ethernet Port	10/100/1000 Base-T Network Interface						
7.	Chipset	Intel						
8.	Included Software	Windows 10 Operating System						
		McAfee Anti Virus valid for 3 years						
		Recovery CD Creator						
		Hard Drive based application recovery for reinstallation of applications & drivers						
		Hard Drive based system recovery with option to keep user data files intact						
	Microsoft Internet Explorer							
		Microsoft Windows Live applications						
9.	Screen	21" LED monitor						



# C.9 Installation, Testing and Commissioning

## C.9.1 Engineering

Upon award of the contract, the bidder shall complete the engineering design of the Data Center in line with the design requirements and specifications. The bidder shall submit preliminary design, detailed design and test plan. The submittals shall include but not limited to:

- Preliminary design document
- Detailed design document
- Samples and Datasheets
- GFC drawings
- BOQ as per the design
- Acceptance test plan

Only after approval of the design documents and BOQ, the bidder can initiate their procurement process.

### **C.9.2 Procurement**

After the design approval of every subsystem, the bidder shall go ahead with the procurement and construction as per the approved design, GFC drawings and BOQ.

When the materials are received at site, CDAC will inspect the materials as per the test/inspection plan. Based on the inspection, the bidder shall prepare a Material Inspection Report (MIR), which shall be jointly signed by the authorized signatories of the bidder, and CDAC. The bidder shall keep all the materials in their own safe custody until installation, commissioning and provisional acceptance.

## C.9.3 Testing

The bidder shall conduct necessary tests for verification of compliance with the technical specifications. The testing shall be conducted for all critical components such as UPS, Batteries, PDUs, Cables, Panels, HVAC systems, etc. However, the tests shall not be limited to these components. CDAC may require testing of any other components during execution of the projects.

# **C.9.4 Test Categories**

- The following tests shall be conducted for acceptance of the equipment and the system before final acceptance of the system.
  - ✓ Sample Approvals
  - ✓ Pre-Factory Acceptance Testing
  - ✓ Factory Acceptance Testing (FAT)
  - ✓ Pre-commissioning test (after installation) for total integrated system.
- These tests shall be carried out by the bidder including those supplied by sub-vendors, if any.
- Bidder shall arrange all necessary test instruments, manpower, test-gear, accessories, etc.
- All technical personnel assigned by Bidder shall be fully conversant with the system specifications and requirements. They shall have the specific capability to make the system operative quickly and efficiently and shall not interfere or be interfered by other concurrent

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testing, construction and commissioning activities in progress. They shall also have the capability to incorporate any minor modifications/suggestions put forward by CDAC Engineer.

- Bidder shall arrange power supply and any temporary commissioning facility including communication system required for installation/testing/commissioning.
- Test Plan: The Bidder shall submit to CDAC 'Test Plans' well in advance of commencement of actual testing in each of the above mentioned test categories.

The plans shall include:

- System/Equipment functional and performance description (in short) and Tests to be conducted and purpose of test.
- Test procedures (including time schedule for the tests) and identification of test inputs details and desired test results

## **C.9.5 Test Report**

The observations and test results obtained during various tests conducted shall be compiled and documented to produce Test Reports by Bidder. The Test Reports shall be given for each equipment/item and system as a whole. The report shall contain the following information to a minimum:

- Test results
- Comparison of test results and anticipated (as per specifications) test result as given in test plans and reasons for deviations, if any.
- The data furnished shall prove convincingly that
  - ✓ The system meets the Guaranteed Performance objectives
  - ✓ Mechanical and Electrical limits were not exceeded.
  - ✓ Failure profile of the equipment during the tests are well within the specified limits

# **C.9.6 Failure of Components**

Till the system is accepted by the CDAC, a log of each and every failure of components shall be maintained. It shall give the date and time of failure, description of failed component, circuit, module, component designation, effect of failure of component on the system/equipment, cause of failure, date and time of repair, mean time to repair etc. Detailed documentation for the same shall be submitted to CDAC for future reference.

If a malfunction and/or failure of a unit/module/sub-system/equipment repeats during the test, the test shall be terminated and Bidder shall replace the necessary component or module to correct the deficiency. Thereafter, the tests shall commence all over again from the start.

If after the replacement the equipment still fails to meet the specification, Bidder shall replace the equipment with a new one and tests shall begin all over again. CDAC's approval shall be obtained for any allowable logical time required to replace the failed component/unit/module/sub-system.

# C.9.7 Readjustments

No adjustments shall be made to any equipment during the acceptance tests. If satisfactory test results cannot be obtained unless readjustments are made, Bidder shall carry out only those readjustment needed to ready the equipment/system for continuance of tests. A log of all such adjustments shall be kept giving date and time, equipment, module, circuit, adjustments, reasons,

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test result before and after adjustment, etc. Fresh acceptance tests shall be conducted after the readjustments have been completed.

## **C.9.8 Sample Approvals**

The bidder shall provide samples of various components such as civil/interior materials (such as tiles), cables, accessories, furniture, etc. prior to their procurement. For components such as UPS, HVAC Systems, Power Distribution Units, etc. where samples cannot be provided, the bidder shall submit OEM datasheets of those components for approval by CDAC. The bidder shall go ahead with the procurement only after CDAC's approval.

## C.9.9 Pre Factory Acceptance Testing

The Bidder on his own, exactly in line with FAT, shall conduct pre-factory acceptance testing and test reports for the same shall be forwarded to CDAC Engineer before start of FAT.

# C.9.10 Factory Acceptance Testing (FAT)

CDAC may require factory acceptance testing to some or all the components to be supplied and installed by the successful Bidder.

Factory Acceptance Test shall be conducted in presence of CDAC/authorized agency for the following equipment's such as DG Sets, Low Voltage Panels, Synchronization Panels, UPS Systems, Precision Cooling Units.

Travel and lodging expenses required for the Factory Acceptance Test is in the scope of bidder.

Factory acceptance tests shall be carried out after review and approval of FAT procedure/documents as per bid requirements and review of Pre-Factory acceptance results & shall be conducted at the manufacturing facilities from where the respective equipment/subsystems are offered. The factory acceptance testing shall be conducted in the presence of the CDAC Engineer. The tests shall be carried out on all equipment/items including those supplied by sub-vendors and factory acceptance certificates shall be issued.

CDAC reserves the right to waive factory acceptance testing to some or all the equipment.

The factory tests shall include but not be limited to:

#### a. Equipment Testing

- Mechanical checks to the equipment for dimensions, inner and outer supports, finishing, welds, hinges, terminal boards, connectors, cables, painting, etc.
- Electrical checks including internal wiring, external connections to other equipment, etc.
- Check for assuring compliance with standards mentioned in the specifications.
- Individual check on each/module/sub-assembly in accordance with the modes and diagnostics programs of the Bidder.
- Checks on power consumption and heat dissipation characteristics of various `equipment
- Environment testing and other laid down tests in Type Tests plan of the specification of the equipment.
- Functional testing

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 Any other test not included in FAT document but relevant to the project as desired by the CDAC at the time of Factory Acceptance Testing.

### b. System Integration Testing

Functional and performance test should be conducted for each complete system/component that requires integration with other components/subsystems of the Data Center. The interfacing subsystems/components can be simulated reflecting the production scenario.

All functions of the BMS shall be demonstrated in totality with integration with all the test systems concerned.

#### C.9.11 Installation

After successful completion of Factory Acceptance Testing, dispatch clearance has to be obtained from CDAC subsequent to which equipment shall be sent to site for installation. Equipment without factory acceptance certificates and dispatch clearance shall not be acceptable at site.

Prior to installation, all equipment shall be checked for completeness as per the specifications of equipment required. Installation shall be carried out in accordance with the installation manuals and approved installation drawings in the best workmanship.

Bidder shall bring all installation tools, accessories, special tools, test gears, spare parts etc. at his own cost as required for the successful completion of the job.

If during installation and commissioning any repairs are undertaken, the maintenance spares supplied with equipment shall not be used for the repair. Bidder shall arrange his own spare parts for such activities till such time the system has been finally accepted by the CDAC. A detailed report & log of all such repairs shall be made available by the Bidder to CDAC and shall include cause of faults and repair details, within 2 weeks of fault occurrence.

A detailed time schedule for these activities shall be submitted by Bidder to CDAC to enable their representatives to be associated with the job.

Bidder shall supply all installation materials required for proper installation of the equipment. These shall include all accessories, protection/safety accessories and any other components to complete the installation as per the technical specifications and local/international standards/best practices.

The installation of equipment shall be done as to present neat and clean appearance in accordance with approved installation document drawings.

# C.9.12 Pre-Commissioning

On completion of installation of equipment, the correctness and completeness of the installation as per Manufacturer's manual and approved installation documents shall be checked by the Bidder on his own.

A list of Pre-Commissioning tests (same as approved by the CDAC for site acceptance testing) and activities shall be prepared by Bidder and the test shall be carried out by the Bidder on his own. After the tests have been conducted to the Bidder's own satisfaction, the Bidder shall provide the test results for review by CDAC and then offer the system for Site Acceptance Testing.

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During pre-commissioning, if any fault occurs to any equipment or system, Bidder shall identify the same and provide report/history of all faults to the CDAC.

During installation and pre-commissioning of the systems, Bidder shall have enough number of commissioning spares so that the installation is not held up because of non-availability of commissioning spares. Bidder shall ensure that the spares meant for operation and maintenance are not used during installation and commissioning.

## C.9.13 Integrated Site Acceptance Testing (ISAT)

On completion of Supply, Installation, Testing and Commissioning of the Data Center, site acceptance testing shall be conducted as per approved site acceptance test procedures and its constituents by the Bidder under the presence of CDAC. Provisional Acceptance Certificate shall be issued on successful completion of acceptance Testing, Tier III Facility Certification and complying to all other requirements of Provisional Acceptance as mentioned in Special Conditions of Contract.

The tests shall include, but not be limited the following:

- Checks for proper installation as per the approved installation drawings for each equipment/item and system as a whole.
- Guaranteed performance specifications of individual equipment/item.
- Self-diagnostics test on individual equipment
- Compliance to standards/best practices
- Integration testing between various subsystems
- Load Testing of the DG Sets, UPS, Systems, PACs to the rated capacity of the Data Center

For the Load Testing of the PACs and the UPS systems, Bidder shall arrange the heat load banks for the specified maximum IT load. Heat load banks shall have to be arranged by the Bidder during Uptime Institute's testing of the Data Center Constructed Facility.

# C.9.14 Spares

### a. Mandatory Spares

The bidder shall maintain sufficient mandatory spares for meeting the Service Level Requirement specified in the tender. The Bidder shall provide a list of mandatory spares as a part of their technical bid. and of

Spares shall be provided from the same manufacturing facilities/location from where the respective equipment, subsystems are offered.

Bidder shall provide the address, contact person, telephone number and email id of the manufacturer of the spare parts. The Bidder shall warrant that spare parts for the system would be available for minimum of 10 years (MAF shall have this statement) from the date of supply.

### b. Commissioning Spares

The commissioning spares shall be arranged by the Bidder to cater to the requirement during installation, commissioning, site acceptance testing, trial run and warrantee period. These spares shall be readily available with the Bidder. These commissioning spares are different from mandatory spares and Bidder shall not use mandatory spares as commissioning spares.

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### c. Quality Assurance

- Bidder shall submit the details of Quality Assurance program followed by him beginning with raw materials, active, passive and fabricated components, units, sub-assemblies, assemblies, wiring, interconnections, structures, etc. to finished product. Bidder shall obtain and forward the Quality Assurance Program for equipment supplied by Sub-vendor, if any.
- CDAC reserves the right to inspect and test each equipment at all stages of production and commissioning of the system. The inspection and testing shall include but not be limited to raw materials, components, sub-assemblies, prototypes, production units, guaranteed performance specifications, etc.
- For Factory inspection and testing, Bidder shall arrange all that is required e.g., quality assurance personnel, space, test gear, etc. for successful carrying out of the job in the presence of CDAC, at Bidder's cost, at the Manufacturer's works.
- CDAC shall have free entry and access to any and all parts of the Manufacturer's facilities associated with manufacturing and testing of the system at any given time.
- It shall be explicitly understood that under no circumstances shall any approval of CDAC relieve the Bidder of his responsibility for material, design, quality assurance and the guaranteed performance of the system and its constituents.
- Bidder shall invite CDAC, at least 10 days in advance, of the date at which system shall be ready
  for Inspection and Testing. All relevant documents and manuals, approved engineering
  drawings, etc. shall be available with CDAC well in advance of the start of Inspection and
  Testing.

CDAC's Engineer or his representative shall, after completion of inspection and testing to their satisfaction, issue factory acceptance certificates and dispatch clearance to release the equipment for shipment. No equipment shall be shipped under any circumstances unless a factory acceptance certificate and dispatch clearance has been issued for it, unless agreed otherwise by CDAC.

### C.9.15 Maintenance

The contractor shall maintain systems in a first class and safe manner during guarantee period. Such maintenance shall be for the entire systems except when failure occurs due to work performed by others. Responsibility entails periodic inspection by the supervisor / technician and unlimited call back service including nights, weekends and holidays. Apart from the above, this maintenance shall include one visit by Engineer per month with visit timings adjusted so as not to coincide with the busiest usage period. Call back service shall be responded and restored as per the SLA parameters provide at the Annexure G in the Vol. 1 document. There shall be no compensation for call back service regardless of the time of day, holidays etc. The contractor shall anticipate demand on supplies and parts and keep an inventory of a reasonable number of spare parts, at his own cost, on site in a self-provided lockable metal cabinet or at the nearest Service Centre in NCR, so that the remediation / restoration can be provided as per the SLA.

If the SI fails to meet the above, Performance Bank Guarantee will be forfeited.

- Carry out preventive and periodic maintenance required as per the recommendations of the OEM, the cost of consumables required for periodic maintenance such as oil, filters, lubricants, batteries, refrigerants, etc. during the warranty period will be to the account of the Bidder.
- Provide periodic maintenance/audits required by the appropriate regulatory authority such as local electricity boards, fire safety authorities, CCOE, etc.

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- To maintain adequate spares onsite for ensuring the SLA. The Bidder has to provide a list of spares to be maintained during the support period as a part of the technical bid.
- All the equipment supplied for the Data Center shall be with three years warranty.
- Scheduled on-site service support and call-based on-site service support to be provided during the warranty period for all the equipment/systems of the Data Center by the OEMs/System Integrators of various systems. Bidder has to provide the following details:
- Details of OEMs/System Integrators of various systems
  - ✓ Warranty documents
  - ✓ Confirmation letters from OEMs/System Integrators for:
  - ✓ providing the service support for the warranty period
  - ✓ their commitment to the response time
  - ✓ escalation matrix
  - ✓ providing patches, upgrades and updates to the supplied software and ensure they are applied after due diligence and approval by the CDAC Engineer in-charge.

Decision of CDAC Engineer-in-charge is final and binding.



### C.9.16 Submittals

The bidder shall submit the documents including but not limited to the following as part of the technical bid:

- Detailed DC layout with cross section view
- Detailed electrical SLD for the entire Data Center
- Detailed Earthing Scheme as per IEEE 1100 and TIA 942 compliance.
- Detailed layouts of the Panels
  - ✓ Cable Tray Layouts
  - ✓ HVAC piping layout.
  - ✓ Lighting and Switch socket layout.
  - √ Fire Detection & Suppression layout and gas calculation sheet duly signed by OEM.
  - ✓ CCTV Layout covering entire DC area, and DG & Transformer area.
  - ✓ Drawing indicating locations of sensors and configuration diagrams for Access Control System, Rodent Repellant System and Water Leak Detection Systems.
- Datasheet/Technical Brochures of all the Equipment proposed in Data Center
- Detailed BOQ for all components and subsystems. Each subsystem BOQ shall contain detailed break-up of the components and quantities without prices.
- OEM/Manufacturer Authorization letter in Original duly signed by authorized signatory of OEM for DG Sets, UPS, PAC, PDU, Racks, Networking Infrastructure, Safety and Security Systems and BMS.
- Proof of Document (PO with Make & Model Mentioned) for deployment of the quoted Make and Model of the equipment DG Sets, UPS, PAC, PDU, Racks, Networking Infrastructure, Safety and Security Systems and BMS in a Uptime Institute Tier III certified site.
- List of documents for demonstrating compliance to Eligibility Criteria.
- Support Methodology
- Escalation Matrix
- How the bidder shall meet the SLA
- The bidder shall provide a comprehensive list of periodic maintenance tasks for all subsystems/equipment
- List of onsite spares

These submittals form part of technical evaluation process.

Any bid not compliant to this requirement is liable to be rejected.

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# D. Approved Makes of components

- 1. The bidder shall use high quality components from reputed OEMs. The make/model number of all components must be specified for all the components.
- 2. All the components/equipment used shall be manufactured in a facility with minimum quality certification of ISO 9001:2008.
- 3. The components/equipment shall be ISI certified wherever required/applicable.
- 4. Proof of installation in an Uptime Certified facility should be submitted for all the major items which are mandatory for the certification

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# Supply, Installation, Testing and Commissioning of Tier III – Uptime Design

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
A A.1	Civil Works Partitions						
A.1.1	Providing and laying autoclaved aerated cement blocks masonry with 200mm thick aerocon blocks of required size made using fly ash as basic raw material, blocks conforming to IS 2185 Part 3 (1989) having density in oven dry condition 551 - 650 Kg/Cum, minimum Compressive strength 3 N/mm 2, thermal conductivity in air dry condition 0.24 W/mK, in super structure above plinth level in cement mortar 1:4 (1 cement : 4 coarse sand ) including providing and placing in position 2 Nos 6 mm dia M.S. bars at every third course of masonry work	Sqft	3662	Volume-II C.1.1			
A.1.2	Providing and applying plaster to wall with 18 mm thick cement plaster in two coats under layer 12mm thick cement plaster 1:5 (1 cement: 5 coarse sand) and top layer 6mm thick cement plaster 1:3 (1 cement: 3 coarse sand) finished rough with sponge. on external wall surfaces, including scaffolding, curing, etc. upto 10 m height from Ground level, complete all as per specifications and direction of Engineer in Charge.	Cu.ft	7324	Volume-II C.1.1			
A.1.3	Providing and fixing 50mm thick Aerocon or equivalent approved makes Cement Sandwich Panels reinforced cement bonded plain sheets on either side enclosing a light weight core composed of portland cement, binders and a mix of silicaceous and micacious material aggregate with tongue and groove arrangement. The aerated panels should have excellent acoustic properties and fire rated for two hours (3 inch thick panels) with necessary support arrangement for Closure of windows and Partition between Server Room-AandB	Sqft	570	Volume-II C.1.1			
A.1.4	Providing and fixing 75mm overall thickness full height partition in straight or curved profile, with 12.5 mm thick gypsum board of approved make conforming to IS: 2095: part I. upto ceiling height consisting of G.I. frame and required board including providing and fixing of frame work made of special section power pressed/ roll form G.I. sheet with zinc coating of 120 gms/sqm(both side inclusive), consisting of floor and ceiling channel 50mm wide having equal flanges of 32 mm and 0.50 mm thick, fixed to the floor and ceiling at the spacing of 610 mm centre to centre with dash fastener of 12.5 mm dia meter 50 mm length or suitable anchor fastener or metal screws with nylon plugs and the studs 48 mm wide having one flange of 34 mm and other flange 36 mm and 0.50 mm thick fixed vertically within flanges of floor and ceiling channel and placed at a spacing of 610mm centre to centre by 6 mm dia bolts and nuts, including fixing of studs along both ends of partition fixed flush to wall with suitable anchor fastener or metal screws with nylon plugs at spacing of 450 mm centre to centre, and fixing of boards to both side of frame work by 25 mm long dry wall screws on studs, floor and ceiling channels at the spacing of 300 mm centre to centre. The boards are to be fixed to the frame	Sqft	2860	Volume-II C.1.2			
A.1.5	Supplying and fixing in position of 6 mm thick toughened glass partition with 3M frost film using Prefinished MDF profiled beading to be supported to the gypsum partition, etc. Complete. MDF beading finished using duco paint.	Sqft	560				
A.2	Doors						
A.2.1	Supply and Installation of Fire rated double leaf steel Door of minimum 45mm thickness of size 1500 x 2400mm of Two hours fire rating with fire rated square vision panel of size 380 mm X 380 mm. Door frame shall be double rebate profile of size 143 x 57 mm made with minimum 1.6mm thick galvanized steel sheet including SS ball bearing butt hinges, mortice sash lock, SS lever handle with internal thumb turning arrangement, heavy duty type and external key operation including heavy duty floor spring of Dorma or equivalent make etc complete	Nos	3	Volume-II C.1.3			
A.2.2	Supply and Installation of Fire rated double leaf steel Door of minimum 45mm thickness of size 1200 x 2400mm of Two hours fire rating with fire rated square vision panel of size 380 mm X 380 mm. Door frame shall be double rebate profile of size 143 x 57 mm made with minimum 1.6mm thick galvanized steel sheet including SS ball bearing butt hinges, mortice sash lock, SS lever handle with internal thumb turning arrangement, heavy duty type and external key operation including heavy duty floor spring of Dorma or equivalent make etc complete	Nos	4	Volume-II C.1.3			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
A.2.3	Supply and Installation of Fire rated single leaf steel Door of minimum 45mm thickness of size 1200 x 2400mm of Two hours fire rating with fire rated square vision panel of size 380 mm X 380 mm. Door frame shall be double rebate profile of size 143 x 57 mm made with minimum 1.6mm thick galvanized steel sheet, including SS ball bearing butt hinges, mortice sash lock, SS lever handle with internal thumb turning arrangement, heavy duty type and external key operation including heavy duty floor spring of Dorma or equivalent make etc complete	Nos	7	Volume-II C.1.3			
A.2.4	Providing and Erecting in position Fully glazed double leaf door of 1500 mm (W) x 2400 mm (H) fixed glass in 12 mm thick Toughened Glass on Patch fittings of the size 3'0" X 7'0" each including top patch fitting, bottom patch fitting, patch lock, Floor Spring of reputed manufacturer and S.S handle 600mm long, 30mm dia including frosted film of Ilumar or approved make, shade and design on the glass. All damages to the floor work to be reinstated without any extra cost including the cost of other fittings and fixtures and necessary hardware, necessary holes, joints to be sealed with silicone sealant complete in all respects etc and directions of Engineer. (Door Floor Spring of Dorma BTS type, heavy duty and for single and double leaf doors and single and double actions or equivalent approved	Nos	1	Volume-II C.1.3			
A.2.5	Providing and Erecting in position Fully glazed single leaf door of 1000 mm (W) x 2100 mm (H) fixed glass in 12 mm thick Toughened Glass on Patch fittings of the size 3'0" X 7'0" each including top patch fitting, bottom patch fitting, patch lock, Floor Spring of reputed manufacturer and S.S handle 600mm long, 30mm dia including frosted film of Ilumar or approved make, shade and design on the glass. All damages to the floor work to be reinstated without any extra cost including the cost of other fittings and fixtures and necessary hardware, necessary holes, joints to be sealed with silicone sealant complete in all respects etc and directions of Engineer. (Door Floor Spring of Dorma BTS type, heavy duty and for single and double leaf doors and single and double actions or equivalent approved	Nos	2	Volume-II C.1.3			
A.2.6	Providing and fixing 35 mm thick ISI marked flush doors, the shutter shall be exterior grade phenol formaldehyde (PF) resin bonded, BWR grade conforming to IS: 2202 (Part I) decorative type, core of block board construction with frame of 1st class hard wood and well matched teak 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters including lipping, cutting rebate in shutter, 4 Nos. ISI marked Stainless steel ball bearing hinges 102x76x3mm in size with S.S. screws of approved make etc. The door shall be finished with 1 mm thick decorative high pressure laminated sheet of plain / wood grain in gloss / matt / suede finish of approved make with high density protective surface layer and reverse side of adhesive bonding quality conforming to IS: 2046 Type S, all complete as per direction of Engineer in Charge	Nos	3	Volume-II C.1.3			
A.3	Flooring and False Ceiling						
A.3.1	Providing and fixing removable raised/false access flooring of approved make with possible height adjustment upto +/- 25 mm, comprising of modular load bearing floor panels supported on hot dip galvanized rectangular frameworks of 600 x 600 mm, consisting of stinger and Pedestal assembly etc. including cutting of tiles wherever required, all complete, as per the drawings, specifications, and directions of Engineer-in-charge.  a) Providing pedestal assembly all steel construction hot dipped galvanized at required spacing to form modular framework. The Pedestal head assembly shall consist of a 90 x 90 x 4mm embossed head mechanically riveted to a 19mm dia rolled formed stud of suitable length and 2 check nuts for level adjustment and arresting vertical movement. The pedestal head shall have an anti-vibrational conductive cap with inbuilt isolating spacers for Panel and stringer location. The Pedestal Base assembly shall consist of 32 mm OD pipe mechanically locked on a press for perpendicularity and then welded to a base plate of 150 x 150 x 4mm thick with stiffening folds for enhanced strength and excellent grip to glue. The sub structure assembly shall be suitably anchored to the floor with suitable adhesive and fasteners of appropriate size. b) Stringers system in all steel construction hot dipped galvanized of rectangular size 20 x 32 x 1.20 mm made of min. 1.2 mm thick sheet, having holes at both ends for securing the stringers on to the pedestal head using fully	Sqft	3310	Volume-II C.1.5			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
A.3.2	Providing and laying 2 mm thick antistatic PVC vinyl flooring of approved quality and colour conforming to the IS: 3462/1986 on the finished concrete/floor/terrazzo tiles flooring or any hard surface with necessary approved adhesive for laying antistatic PVC sheet/roll including cleaning the floor before and after laying of PVC flooring and providing thin copper strip of size about 20.00 x 0.20 mm along the periphery of room and below each joint of two sheets wherever directed with copper screws/ rivets @600 mm c/c.	Sqft	825	Volume-II C.1.6			
A.3.3	Providing and fixing false ceiling at all height including providing and fixing of frame work made of special sections, power pressed from M.S. sheets and galvanized with zinc coating of 120 gms/sqm (both side inclusive) as per IS : 277 and consisting of angle cleats of size 25 mm wide x 1.6 mm thick with flanges of 27 mm and 37mm, at 1200 mm centre to centre, one flange fixed to the ceiling with dash fastener 12.5 mm dia x 50mm long with 6mm dia bolts, other flange of cleat fixed to the angle hangers of 25x10x0.50 mm of required length with nuts and bolts of required size and other end of angle hanger fixed with intermediate G.I. channels 45x15x0.9 mm running at the spacing of 1200 mm centre to centre, to which the ceiling section 0.5 mm thick bottom wedge of 80 mm with tapered flanges of 26 mm each having lips of 10.5 mm, at 450 mm centre to centre, shall be fixed in a direction perpendicular to G.I. intermediate channel with connecting clips made out of 2.64 mm dia x 230 mm long G.I. wire at every junction, including fixing perimeter channels 0.5 mm thick 27 mm high having flanges of 20 mm and 30 mm long, the perimeter of ceiling fixed to wall/partition with the help of rawl plugs at 450 mm centre, with 25mm long dry wall screws @ 230 mm interval, including fixing of gypsum board to ceiling	Sqft	1200	Volume-II C.1.4			
A.3.4	Providing and fixing tiled false ceiling of approved materials of size 595x595 mm in true horizontal level, suspended on inter locking metal grid of hot dipped galvanized steel sections ( galvanized @ 120 grams/ sqm, both side inclusive) consisting of main "T" runner with suitably spaced joints to get required length and of size 24x38 mm made from 0.30 mm thick (minimum) sheet, spaced at 1200 mm center to center and cross "T" of size 24x25 mm made of 0.30 mm thick (minimum) sheet, 1200 mm long spaced between main "T" at 600 mm center to center to form a grid of 1200x600 mm and secondary cross "T" of length 600 mm and size 24x25 mm made of 0.30 mm thick (minimum) sheet to be interlocked at middle of the 1200x600 mm panel to form grids of 600x600 mm and wall angle of size 24x24x0.3 mm and laying false ceiling tiles of approved texture in the grid including, required cutting/making, opening for services like diffusers, grills, light fittings, fixtures, smoke detectors etc. Main "T" runners to be suspended from ceiling using G1 slotted cleats of min. size 26 x 26 x 25 x 1.6 mm fixed to ceiling with 12.5 mm dia and 50 mm long dash fasteners, min. 4 mm G1 adjustable rods with galvanized butterfly level clips of min size 85 x 30 x 0.5 mm spaced at 1200 mm center to center along main T, bottom exposed width of 24 mm of all T-sections shall be pre-	Sqft	4100	Volume-II C.1.4			
A.4	Painting						
A.4.1	Providing and applying of putty of average 2mm thick over plaster surface to prepare the surface even and smooth in line and level complete to the entire satisfaction of Engineer-in-charge Providing and applying of one coat of primer and two coats of fire retardant paint over the finished surface complete to the entire satisfaction of Engineer-in-charge  Miscellaneous Works	Sqft	9428	Volume-II C.1.7			
7.3							
A.5.1	Providing and fixing pictograms in 304 grade 2 mm thick brush finished Stainless steel at all levels and locations prepared using silk printing technology/ etching, filling with industrial paint in required colours and baking to the required condition at required temperature for obtaining desired shine and gloss, in required font, design, pattern and size including buffing, polishing etc. and fixing by high quality chemical tape/ adhesive of approved make on prepared surface, all complete as per architectural drawings and direction of Engineer in charge	Nos	120	Volume-II C.1.9			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
A.5.2	Providing and fixing at all levels and locations, informatory/ directional/warning signages in required font, design, pattern and size made of 4 mm thick odourless Acrylic sheets of make Cast/ Acrylite/ or approved equivalent, conforming to specific gravity of 1.19, tensile strength of 69 MPA, percentage elongation of 4.2 %, modulus of elasticity 2800 MPA (ASTM – D638), refractive index of 149, (ASTM-D542) Rockwell hardness of M94 (ASTM – D785), water absorption of 0.2 % (ASTM – D570) total light transmission of 92 % (ASTM – D 1003) chemical, UV and weather resistant, having excellent insulation properties, abrasions resistant of approved color, of approved quality and make, with beveled edges having self adhesive self luminescent vinyl sheet (film thickness > 150 micron, luminescent duration 4-6 hours) of make 3M/ Avery or approved equivalent over which the signage/ letter cutout made of vinyl sheet (film thickness > 80 micron) of make 3M/ Avery or approved equivalent is pasted in required colour, font, design, pattern, including fixing over walls/ partition/glass etc, fixing by high quality chemical tape of make 3M/ Avery or approved equivalent on prepared surface, all complete as per architectural drawings and direction of Engineer in charge.	Nos	100	Volume-II C.1.9			
A.5.3	Removing of exisitng AHU, proper closure of ducts, existing partitions, AC Ducts, removal of Tiles, Cutting and Chipping of existing floors and Disposing of debris.	Lot	1	Volume-II C.1.15			
A.5.4	Supply and fixing of Ramp using plain metal sheet, L angle and necessary supports complete as required	No.	1	Volume-II C.1.15			
A.5.5	Supply and applying of Pest Control	Lot	1	Volume-II C.1.15			
A.5.6	Supply and construction of foundation for the Diesel Generator as per the OEM specifications with required materials and accessories complete as required	Nos	2	Volume-II C.1.15			
A.5.7	Supply and construction of foundation for Transformer as per the OEM specifications with required materials and accessories complete as required	Lot	1	Volume-II C.1.15			
A.5.8	Supply and construction of foundation outdoor electrical panels for a height of 600mm from the ground level. This shall required path/provision of laying of cables with required materials and accessories complete as required	Lot	1	Volume-II C.1.15			
A.5.9	Providing and fixing 18mm thick Granite of approved color and shade, gang saw cut mirror polished premoulded and prepolished machine cut for kitchen platforms of required size, approved shade, colour and texture, at all levels, laid over 20mm thick base cement mortar 1:4 (1cement: 4 coarse sand) with joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing, moulding and polishing to edge to give high gloss finish etc. complete at all levels.	Sqm	10	Volume-II C.1.15			
A.5.10	Supplying and installing overhead pantry cabinet unit of depth 450 mm and required height and length as per site and made of 18mm thick, factory laminated, BWP ply confirming to IS 710 in approved finish and shade and having all edges sealed with hot pressed PVC straight edge banding. The unit shall be hung to the wall with anchor fasteners/ clamps of approved quality and strength. The cabinet unit consists of fascia/ drop and shelves with openable shutters fitted with approved quality chrome plated metallic auto hinges, SS handles of approved design and required sizes, clamps, anchor fasteners and other required fittings and accessories all complete including necessary arrangement for strengthening of the unit for hanging (if required) with seasoned, chemically treated, painted hard wood battens/ frame standards, and direction of engineer in charge.	Sqm	6	Volume-II C.1.15			
A.5.11	Providing and laying ) Flamed/ sand blasted finish Granite stone flooring in required design and patterns, in linear as well as curvilinear portions of the toilet all complete with 18 mm thick stone slab over 20 mm average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer in-Charge	Sqm	26	Volume-II C.1.15			
A.5.12	Supply and fixing of 1200mm x 900mm Glass Magnetic Dryerase Board of approved make, made of 4mm thick glass, aluminium/ GI hanger clips, including fixing with required screws etc. all complete as per drawings, specifications and direction of Engineer in charge	Nos	6	Volume-II C.1.15			

Supply used fixing of Trailler cauchers made up of 12 mm this consequent with Used and Approved colors with profession consignation or provident with Used and Approved Colors with Charge with Cover, Applicate for 3.15 Grant Application of Common Strategy (Coverage and Common Strategy) (Coverage and Coverage and Cove	S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
A 5.1 and out set Others A Committee Annyte Control of Studies Savanimal FJ Act and out set Others A Committee Commi	A.5.13	HPL sheet of approved colour with door using Merino or equivalent with U and F Channels, top rail, coat hook, Privacy Thumb turn c/w Occupancy Indicator, Door Knob, Hinges with Cover, Adjustable Foot - 316 Grade, Rubber Lining for Groove, SS Screws 304 G and P.V.C Wall Plugs etc. complete. All accessories	Nos	5				
wall mounting European type water close with CP boths, nuts, C Ichair or other hanging arrangement, with concelled PVC Bushing drivers, 36 filters (bushing paper) and paper and part full pates and internal filtries, slow falling seat cover with 18.4.5.15 isd. CP. Pursay highs pates and internal filtries, slow falling seat cover with 18.4.5.16 isd. CP. Pursay highs pates and internal filtries, slow falling seat cover with 18.4.5.16 isd. CP. Pursay and foors wherever required. Cap between fixtures and walls shall be coloured polyuliphote sealant. Hidroware Wc model No. 20097 and cistern model No. 508179 concession or approved copyolation.  Providing, fising, testing and commissioning of white coloured vitreous china large flat back battery based infrared sensor operated urinal basin having pre- and post full-integ paperly of 250 in and 500 ml respectively, including Cl. Parisay in an and all accessions for finding the unabanic stating and making the wolk and floors, wherever required. Cap between fixtures and walls have a pre- providing, fising, testing and commissioning of fist quality vitreous china wash basin with 32 mm dia CP waste of standard pattern. 32 mm dia CP waste of standard pa	A.5.14	approved equivalent make/model. Acrylic solid surface of Shade Savannah(F) and size $910$ mm $\times$ $610$ mm fixed on to the wall with SS 'L' clamps of size $50$ mm $\times$ $4$ mm $ 4$ nos per Urinal Partition complete in all respects as per directions of	Nos	2				
ange flat back battery based infrared sensor operated unial basin having pre and post fullshing capacity of 250 ml and 500 ml respectively, including C.I. A.5.18 CP Brass union and all accessories for fings the unial basin, units gradient with inbult waste with C.P flage. Nos 2 Volume-II clinical waste with commentation of the commentation of t	A.5.15	wall mounting European type water closet with CP bolts, nuts, CI chair or other hanging arrangement, with concealed PVC flushing cistern, 3/6 liters flushing capacity including flush plates and internal fittings, slow falling seat cover with lid, C.P. brass hinges rubber buffers, with all accessories, including cutting and making good the wall and floors wherever required. Gap between fixtures and walls shall be filled up with approved polysulphide sealant.  Hindware WC model No. 20047 and cistern model No. 508179 concealo or	Nos	5				
basin with 32 mm dia C.P waste of standard pattern, 32mm dia C.P bottle trap, 32 mm dia C.P pipe to wall and CP wall flange, and rubber acceptors for waste concettion, R.S. or C.I. painted brackets botts, nuts, including making provision for faucets etc. cutting and making good the wall and floor, wherever required. Gap shall be filled with silicon sealant wherever required. All accessories shall be of Jaquar make or approved equivalent Hindware Model No. 10065 or approved equivalent Hindware Model No. 10065 or approved of equivalent Providing, fixing, testing and commissioning of stainless Steel A ISI 304 (18/8) kitchen sink of approved make, single bowl of overall size 1040 mm x 510 mm bowl depth 200 mm as per I.S. 13983 with single drain board with CP cast and stainless steel plug 40 mm including painting of fittings and brackets, and stainless steel plug 40 mm including painting of fittings and brackets, cutting and making good the walls wherever required. Gaps filled with silicon sealant wherever required all complete  A.5.12 Supply, installation, testing and commissioning of CP Auto closing type Pillar cock with 450 mm long SS braided flexible connection pipe complete in all respect including cutting and making good the walls wherever required.  A.5.20 Providing, fixing, testing and commissioning of CP two way bib cock, including all fittings and accessories, all complete  A.5.21 and washers, CP, wall fiange with any other terms, all complete including cutting and making good the walls wherever required.  A.5.22 Providing, fixing, testing and commissioning of CP, health faucet assembly including fixing of Wall hook and 1 meter long flexible tube, all complete  A.5.22 Providing and fixing CP flap type toilet paper holder including cutting and making good the walls wherever required.  A.5.24 Providing and fixing CP flap type toilet paper holder including screws, washers and rawl plug etc., all complete.  A.5.25 Providing and fixing CP flap type toilet paper holder including screws, washers and rawl plug etc	A.5.16	large flat back battery based infrared sensor operated urinal basin having pre and post flushing capacity of 250 ml and 500 ml respectively, including C.I. hangers, 15mm dia inlet to built in spreaders with inbuilt waste with C.P flange, C.P Brass union and all accessories for fixing the urinal basin, cutting and making the walls and floors, wherever required. Gap between fixtures and walls shall be filled up with approved polysulphide sealant.	Nos	2				
kitchen sink of approved make, single bowl of overall size 1040 mm x 510 mm bowl depth 200 mm as per 1.5. 1398s with single drain board with CP cast and stainless steel plug 40 mm including painting of fittings and brackets, cutting and making good the walls wherever required, Gaps filled with silicon sealant wherever required all complete  A.5.19 Cock with 450 mm long SS braided flexible connection pipe complete in all respect including cutting and making good the walls wherever required.  A.5.20 Providing, fixing, testing and commissioning of CP two way bib cock, including all fittings and accessories, all complete  A.5.21 and washers, C.P. wall flange with any other items, all complete including cutting and making good the walls wherever required.  A.5.22 Providing, fixing, testing and commissioning of CP. health faucet assembly including fixing of Wall hook and 1 meter long flexible tube, all complete  A.5.22 Providing and fixing C.P flap type toilet paper holder including cutting and making good the walls and floors wherever required  A.5.24 Providing and fixing C.P flap type toilet paper holder including cutting and making good the walls and floors wherever required  A.5.25 Providing and fixing Tissue/Towel Paper dispenser including screws, washers and rawl plug etc., all complete  A.5.26 Supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessarry accessories and direction of Engineer in charge	A.5.17	basin with 32 mm dia C.P waste of standard pattern, 32mm dia C.P bottle trap, 32 mm dia C.P pipe to wall and CP wall flange, and rubber acceptors for waste connection, R.S. or C.I. painted brackets bolts, nuts, including making provision for faucets etc. cutting and making good the wall and floor, wherever required. Gap shall be filled with silicon sealant wherever required. All accessories shall be of Jaquar make or approved equivalent	Nos	4				
A.5.19 Cock with 450 mm long SS braided flexible connection pipe complete in all respect including cutting and making good the walls wherever required.  A.5.20 Providing, fixing, testing and commissioning of CP two way bib cock, including all fittings and accessories, all complete  Providing and Fixing 15mm dia C.P. angle valves, as per IS: 8931 with C.P. nuts and washers, C.P. wall flange with any other items, all complete including cutting and making good the walls wherever required.  A.5.21 Providing, fixing, testing and commissioning of C.P. health faucet assembly including fixing of Wall hook and 1 meter long flexible tube, all complete  A.5.23 Providing and fixing C.P flap type toilet paper holder including cutting and making good the walls and floors wherever required  A.5.24 Providing and fixing Tissue/Towel Paper dispenser including screws, washers and rawl plug etc., all complete  A.5.25 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  A.5.26 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  A.5.26 Providing and fixing of plumbing works for the pantry toilets using PPR pipes for supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessary accessories and direction of Engineer in charge	A.5.18	kitchen sink of approved make, single bowl of overall size 1040 mm x 510 mm bowl depth 200 mm as per I.S. 13983 with single drain board with CP cast bottle trap Jaquar Model No. ALD-769B or approved equivalent, C.I. brackets and stainless steel plug 40 mm including painting of fittings and brackets, cutting and making good the walls wherever required, Gaps filled with silicon	Nos	1				
A.5.20 all fittings and accessories, all complete  Nos 6 C.1.15  Providing and Fixing 15mm dia C.P. angle valves, as per IS: 8931 with C.P. nuts and washers, C.P. wall flange with any other items, all complete including cutting and making good the walls wherever required.  Nos 6 Volume-II C.1.15  A.5.21 Providing, fixing, testing and commissioning of C.P. health faucet assembly including fixing of Wall hook and 1 meter long flexible tube, all complete  Nos 5 Volume-II C.1.15  A.5.23 Providing and fixing C.P flap type toilet paper holder including cutting and making good the walls and floors wherever required  Providing and fixing Tissue/Towel Paper dispenser including screws, washers and rawl plug etc., all complete  A.5.24 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete  A.5.25 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  Providing and fixing of plumbing works for the pantry toilets using PPR pipes for supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessarry accessories and direction of Engineer in charge	A.5.19	Cock with 450 mm long SS braided flexible connection pipe complete in all	Nos	4				
A.5.21 Providing and Fixing 15mm dia C.P. angle valves, as per IS: 8931 with C.P. nuts and washers, C.P. wall flange with any other items, all complete including cutting and making good the walls wherever required.  A.5.22 Providing, fixing, testing and commissioning of C.P. health faucet assembly including fixing of Wall hook and 1 meter long flexible tube, all complete  A.5.23 Providing and fixing C.P flap type toilet paper holder including cutting and making good the walls and floors wherever required  A.5.24 Providing and fixing Tissue/Towel Paper dispenser including screws, washers and rawl plug etc., all complete  A.5.25 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete  A.5.26 Providing and fixing of plumbing works for the pantry toilets using PPR pipes for supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessarry accessories and direction of Engineer in charge	A.5.20		Nos	6				
A.5.22 including fixing of Wall hook and 1 meter long flexible tube, all complete  Nos 5 C.1.15  A.5.23 Providing and fixing C.P flap type toilet paper holder including cutting and making good the walls and floors wherever required  A.5.24 Providing and fixing Tissue/Towel Paper dispenser including screws, washers and rawl plug etc., all complete  A.5.25 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete  A.5.26 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  A.5.26 Providing and fixing of plumbing works for the pantry toilets using PPR pipes for supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessarry accessories and direction of Engineer in charge	A.5.21	Providing and Fixing 15mm dia C.P. angle valves, as per IS: 8931 with C.P. nuts and washers, C.P. wall flange with any other items, all complete including	Nos	6	Volume-II			
A.5.23 making good the walls and floors wherever required  A.5.24 Providing and fixing Tissue/Towel Paper dispenser including screws, washers and rawl plug etc., all complete  A.5.25 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  A.5.26 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  Providing and fixing of plumbing works for the pantry toilets using PPR pipes for supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessarry accessories and direction of Engineer in charge	A.5.22	including fixing of Wall hook and 1 meter long flexible tube, all complete	Nos	5				
A.5.24 Providing and fixing Tissue/Towel Paper dispenser including screws, washers and rawl plug etc., all complete  A.5.25 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  Providing and fixing of plumbing works for the pantry toilets using PPR pipes for supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessarry accessories and direction of Engineer in charge	A.5.23		Nos	7				
A.5.25 Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  Providing and fixing soap dish holder Including screws, washers and rawl plug etc., all complete.  Providing and fixing of plumbing works for the pantry toilets using PPR pipes for supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessarry accessories and direction of Engineer in charge	A.5.24	Providing and fixing Tissue/Towel Paper dispenser including screws, washers	Nos	2	Volume-II			
Providing and fixing of plumbing works for the pantry toilets using PPR pipes for supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessarry accessories and direction of Engineer in charge	A.5.25	Providing and fixing soap dish holder Including screws, washers and rawl plug	Nos	3	Volume-II			
B   Electrical Works		Providing and fixing of plumbing works for the pantry toilets using PPR pipes for supply and PVC pipes for drain using necessary taps, valves, bends, etc. with necessarry accessories and direction of Engineer in charge	Lot	1	Volume-II			
B.1 Diesel Generator		Electrical Works Diesel Generator						

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
B.1.1	Supply of 500kvA Diesel Generator having 280kW (at Output) Diesel Generator Set suitable for continuous rated (DG set has to deliver 280kW at the output excluding all Aux. supplies) required for its operation, complete with Diesel Engine suitable for Generator application, developing 1500RPM with directly coupled to 280kW at 0.8 Power factor, 415V, 3 Phase, neutral, 50 cycles per second, PMG/ self excited, self regulated, with brushless excitation, Alternator generally confirms to BS:5000/IS:4722. DG set shall be complete with radiator, residential type silencer, electronic governor, MS mounting frame, fuel piping from Day tank to DG sets, 24VDC Battery along with Battery charger, Battery mounting frame, oil level indicator with gauge board, and all other accessories and auxiliaries all complete as per SLD, drawings and Technical specifications. Diesel Generator set shall be mounted on cushy foot or similar type of vibration Isolators. The DG Set shall be suitable for auto-mains failure start, auto synchronization, auto load sharing and auto / manual operations. DG Set should have communication capability to integrate with BMS system via Modbus protocol with RS485 communication port so that DG set like diesel consumption, Power, current frequency, voltage and any fault alarm etc. as per	Nos	2	Volume-II C.2.1			
B.1.2	Installation of 500kVA Diesel Generator	Nos	2	Volume-II C.2.1			
B.1.3	Supply and providing exhaust piping complete with exhaust pipe of suitable size, fibre glass insulation with aluminium cladding, pipe accessories like flanges, bends, elbows, rain protection hoods, stainless steel flexible bellow etc Necessary stack structural support shall be included from scope of DG exhaust pipe. All the calculation to be submitted and approval to be taken before execution. Height of exhaust pipe shall be as per pollution Board norms. The exhaust piping shall be fixed with stack supporting structure with MS angle supports, using necessary clamps, anchor bolts, vibration isolation pads, etc., the same need to be considered.	Mtrs	30	Volume-II C.2.1			
B.1.4	Supply, laying and testing of Power and Control cabling using 1100V grade, signal cable of 650V grade, multi core/pair, copper/ alumninum conductor, PVC insulated armour cable including its termination with double compression brass glands, lugs etc between DG set, Control panel, DG AMF and fuel starters etc. (Power/Control cable schedule shall be submitted by bidder before execution for approval)	Lot	1	Volume-II C.2.3			
B.1.5	Supply and installation of the cable trays (Ladder/ perforated) along with cable tray cover as per IS for above mentioned cables shall be supplied and installed at site as per requirement.	Lot	1	Volume-II C.2.8			
B.1.6	Supply and installation of Earthing of DG Set including supply and laying of earthing material with necessary accessories complete as required (4 Nos. Cupper & 2 Nos. G.I.)	Nos	6	Volume-II C.2.9			
B.1.7	Supply, fabrication, erection, testing and commissioning of MS HSD day tank of 990 Ltrs capacity with necessary nozzles for inlet, outlet, over flow nozzles and level indicator (HL, IL, LL) with graduation, flanged ends, etc. including Structural support. Rate shall include for giving one coat of primer and two coats of synthetic enamel paint of approved colour as per IS:2379-1963, all complete as per relevant standards and explosive norms, drawings, specifications. This shall include piping from Day tank to the DG Set with necessary accessories complete as required	Nos	2	Volume-II C.2.1			
B.2	Electrical Panels						
B.2.1	Supply, installation, Testing and commissioning of compartmentalized Outdoor Type Synchronization Panel powder coated cubical panel board, free standing type, suitable for 3 phase 4 wire, 415 volts 50Hz AC supply, fabricated with CRCA sheet steel of not less than 2 mm thick, dust and vermin proof, with ventilation louvers, cable alleys, detachable gland plate, ISMC 100 channel iron base frame with following capacity, insulated aluminium bus bar, incoming and outgoing switch gears, Multifunction meters, interconnection, earthing etc., with necessary bus bar chambers, MV danger notice board, 3 phase indicating LED lamps with toggle switches and HRC control fuse, etc. This shall include the required DG controller and PLC/ microprocessor based as per single line diagram, technical specifications suitable for parallel operation of 4 Nos. of 280KW DG sets. The quoted price shall include D.G monitoring module as per specification. Any other components required for meeting the requirement for synchronization of DG sets as per DG working scheme shall be part his scope. Earthing of LV panels including supply and laying of earthing material (as applicable) i.e 50*10 sq.mm, 75*10 sq.mm, 16mm GI flexible rope, 10 mm GI flexible rope etc.for full width of board with 2 termination points, etc with necessary accessories complete as as per the specifications and Electrical SLD.	Nos.	2	Volume-II C.2.2			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
B.2.2	Supply, Installation, Testing and Commissioning of compartmentalized Indoor Type LT Panel, powder coated cubical panel board, free standing type, suitable for 3 phase 4 wire, 415 volts 50Hz AC supply, fabricated with CRCA sheet steel of not less than 2 mm thick, dust and vermin proof, with ventilation louvers, cable alleys, detachable gland plate, ISMC 100 channel iron base frame with following capacity, insulated aluminium bus bar, incoming and outgoing switch gears, Multifunction meters, interconnection, earthing etc., with necessary bus bar chambers, MV danger notice board, 3 phase indicating LED lamps with toggle switches and HRC control fuse, GI Earth strips of size 50mm x 6mm for full width of board with 2 termination points, etc with necessary accessories complete as per the specifications and Electrical SLD	Nos	2	Volume-II C.2.5			
B.2.3	Supply, Installation, Testing and Commissioning of compartmentalized Indoor Type HVAC Panel, powder coated cubical panel board, free standing type, suitable for 3 phase 4 wire, 415 volts 50Hz AC supply, fabricated with CRCA sheet steel of not less than 2 mm thick, dust and vermin proof, with ventilation louvers, cable alleys, detachable gland plate, ISMC 100 channel iron base frame with following capacity, insulated aluminium bus bar, incoming and outgoing switch gears, Multifunction meters, interconnection, earthing etc., with necessary bus bar chambers, MV danger notice board, 3 phase indicating LED lamps with toggle switches and HRC control fuse, GI Earth strips of size 50mm x 6mm for full width of board with 2 termination points, etc with necessary accessories complete as per the specifications and Electrical SLD	Nos	2	Volume-II C.2.5			
B.2.4	Supply, Installation, Testing and Commissioning of compartmentalized Indoor Type UPS Output Panel, powder coated cubical panel board, free standing type, suitable for 3 phase 4 wire, 415 volts 50Hz AC supply, fabricated with CRCA sheet steel of not less than 2 mm thick, dust and vermin proof, with ventilation louvers, cable alleys, detachable gland plate, ISMC 100 channel iron base frame with following capacity, insulated aluminium bus bar, incoming and outgoing switch gears, Multifunction meters, interconnection, earthing etc., with necessary bus bar chambers, MV danger notice board, 3 phase indicating LED lamps with toggle switches and HRC control fuse, GI Earth strips of size 50mm x 6mm for full width of board with 2 termination points, etc with necessary accessories complete as per the specifications and Electrical SLD	Nos	2	Volume-II C.2.5			
B.2.5	Supply, Installation, Testing and Commissioning of compartmentalized indoor Type PSB #1 and #2, powder coated cubical panel board, free standing type, suitable for 3 phase 4 wire, 415 volts 50Hz AC supply, fabricated with CRCA sheet steel of not less than 2 mm thick, dust and vermin proof, with ventilation louvers, cable alleys, detachable gland plate, ISMC 100 channel iron base frame with following capacity, insulated aluminium bus bar, incoming and outgoing switch gears, Multifunction meters, interconnection, earthing etc., with necessary bus bar chambers, MV danger notice board, 3 phase indicating LED lamps with toggle switches and HRC control fuse, GI Earth strips of size 50mm x 6mm for full width of board with 2 termination points, etc with necessary accessories complete as per the specifications and Electrical SLD	Nos	2	Volume-II C.2.5			
B.2.6	Supply, Installation, Testing and Commissioning of compartmentalized UPS PSB #3, powder coated cubical panel board, wall mount type, suitable for 3 phase 4 wire, 415 volts 50Hz AC supply, fabricated with CRCA sheet steel of not less than 2 mm thick, dust and vermin proof, with ventilation louvers, cable alleys, detachable gland plate, insulated aluminium bus bar, incoming and outgoing switch gears, Multifunction meters, interconnection, earthing etc., with necessary bus bar chambers, MV danger notice board, 3 phase indicating LED lamps with toggle switches and HRC control fuse, GI Earth strips of size 50mm x 6mm for full width of board with 2 termination points, etc with necessary accessories complete as per the specifications and Electrical SLD	Nos	1	Volume-II C.2.5			
B.2.7	Supply, Installation, Testing and Commissioning of Distribution Boards suitable for single phase made of sheet metal construction with cutouts of required size for operating the MCB/MCCB knobs in the inner cover, with powder coated metal frame and body with double door and comprising of copper bus bars, neutral and earth bar with tapped holes, Bakelite phase barriers, PVC insulator shoes for incoming wires, necessary cable adaptor boxes for incoming, required MCBs, SI Series RCCBs etc. mounted on DIN rail, Surface / flushed / Recess mounted on walls and other accessories as per the specifications and Electrical SLD	Nos	3	Volume-II C.2.5			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
B.2.8	Supply, Installation, Testing and Commissioning of Distribution Boards suitable for three phase made of sheet metal construction with cutouts of required size for operating the MCB/MCCB knobs in the inner cover, with powder coated metal frame and body with double door and comprising of phase copper bus bars, neutral and earth bar with tapped holes, Bakelite phase barriers, PVC insulator shoes for incoming wires, necessary cable adaptor boxes for incoming, required MCBs, SI Series RCCBs etc. mounted on DIN rail, Surface / flushed / Recess mounted on walls and other accessories as per the specifications and Electrical SLD	Nos	5	Volume-II C.2.5			
B.2.9	Supply, Installation, Testing and Commissioning of 63A TPN Automatic Transfer switch with powder coated cubical panel board, wall mount type, suitable for 3 phase 4 wire, 415 volts 50Hz AC supply, fabricated with CRCA sheet steel of not less than 2 mm thick, dust and vermin proof, with ventilation louvers, cable alleys, detachable gland plate, insulated aluminium bus bar, interconnection, earthing etc., with necessary bus bar chambers, MV danger notice board, 3 phase indicating LED lamps with toggle switches and HRC control fuse, GI Earth strips with 2 termination points, etc with necessary accessories complete as as per the specifications and Electrical SLD	Nos	1	Volume-II C.2.4			
B.3	UPS Systems						
B.3.1	Supply of 250kVA/kW (Frame Capacity) True online double conversion modular parallel Architecture UPS with 3 phase input and 3 phase output with modules for 150kVA/kW (minimum module rating to be 50kVA/kW). The UPS Shall have 15 minutes battery backup on full load. This shall include connecting cables, Battery rack, battery breaker and all complete necessary accessories as per drawings, technical specifications, relevant standards	Nos	2	Volume-II C.2.6			
B.3.2	Installation of 250kVA/KW UPS Systems	Nos	2	Volume-II C.2.6			
B.4	LT Cables						
	Supply and laying of 1.1kV grade, XLPE insulated, aluminium/Copper conductor, galvanized steel tape armored/unarmored power cable as per specifications. The cable shall be laid in indoor/outdoor trenches (RCC/Buried) / cable trays as required. The cable shall be clamped at regular intervals to the supports in trench or to cable trays or brick wall using clamps and fasteners as per technical specifications, relevant standards and Electrical SLD			Volume-II C.2.3			
B.4.1	Supply and laying of 3.5C x 400 Sq.mm Aluminium armored FRLS Cable	Mtrs	2880	Volume-II C.2.3			
B.4.2	Supply and laying of 3.5C x 300 Sq.mm Aluminium armored FRLS Cable	Mtrs	160	Volume-II C.2.3			
B.4.3	Supply and laying of 3.5C x 240 Sq.mm Aluminium armored FRLS Cable	Mtrs	165	Volume-II C.2.3			
B.4.4	Supply and laying of 4C x 240 Sq.mm unarmored Aluminium flexible FRLS Cable	Mtrs	320	Volume-II C.2.3			
B.4.5	Supply and laying of 4C x 50 Sq.mm armored Aluminium FRLS Cable	Mtrs	160	Volume-II C.2.3			
B.4.6	Supply and laying of 4C x 35 Sq.mm armored Aluminium FRLS Cable	Mtrs	320	Volume-II C.2.3			
B.4.7	Supply and laying of 3C x 10 Sq.mm armored Aluminium FRLS Cable	Mtrs	880	Volume-II C.2.3			
B.4.8	Supply and laying of 4C x 25 Sq.mm armored Aluminium FRLS Cable	Mtrs	1075	Volume-II C.2.3			
B.4.9	Supply and laying of 4C x 6 Sq.mm unarmored copper flexible FRLS Cable	Mtrs	140	Volume-II C.2.3			
B.4.10	Supply and laying of 3C x 10 Sq.mm unarmored copper flexible FRLS Cable	Mtrs	240	Volume-II C.2.3			
B.4.11	Supply and laying of 3C x 6 Sq.mm unarmored copper flexible FRLS Cable	Mtrs	1730	Volume-II C.2.3			
B.4.12	Supply and laying of 3C x 2.5 Sq.mm unarmored copper flexible FRLS Cable	Mtrs	900	Volume-II C.2.3			
B.4.13	Supply and laying of 1C x 1.5 Sq.mm copper flexible wire	Mtrs	1200	Volume-II C.2.3			
B.4.14	Supply and laying of 1C x 50 Sq.mm unarmored copper flexible FRLS Cable	Mtrs	150	Volume-II C.2.3			
B.4.15	Supply and laying of 1C x 25 Sq.mm unarmored copper flexible FRLS Cable	Mtrs	150	Volume-II C.2.3			
B.4.16	Supply and laying of 1C x 6 Sq.mm unarmored copper flexible FRLS Cable - Green	Mtrs	800	Volume-II C.2.3			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
	Supply and termination of below listed PVC/XLPE cable with tinned copper lugs, nickel plated brass double compression cable glands, tapping, crimping, and all other accessories, etc. including supply of all materials all complete as per drawings, technical specifications, relevant standards			Volume-II C.2.3			
B.4.17	Supply and termination of 3.5C x 400 Sq.mm Aluminium armored FRLS Cable	Sets	66	Volume-II C.2.3			
B.4.18	Supply and termination of 3.5C x 300 Sq.mm Aluminium armored FRLS Cable	Sets	8	Volume-II C.2.3			
B.4.19	Supply and termination of 3.5C x 240 Sq.mm Aluminium armored FRLS Cable	Sets	12	Volume-II C.2.3			
B.4.20	Supply and termination of 4C x 240 Sq.mm unarmored Aluminium flexible FRLS Cable	Sets	16	Volume-II C.2.3			
B.4.21	Supply and termination of 4C x 50 Sq.mm armored Aluminium FRLS Cable	Sets	8	Volume-II C.2.3			
B.4.22	Supply and termination of 4C x 35 Sq.mm armored Aluminium FRLS Cable	Sets	6	Volume-II C.2.3			
B.4.23	Supply and termination of 3C x 10 Sq.mm armored Aluminium FRLS Cable	Sets	32	Volume-II C.2.3			
B.4.24	Supply and termination of 4C x 25 Sq.mm armored Aluminium FRLS Cable	Sets	44	Volume-II C.2.3			
B.4.25	Supply and termination of 4C x 6 Sq.mm unarmored copper flexible FRLS Cable	Sets	12	Volume-II C.2.3			
B.4.26	Supply and termination of 3C x 10 Sq.mm unarmored copper flexible FRLS Cable	Sets	16	Volume-II C.2.3			
B.4.27	Supply and termination of 3C $\times$ 6 Sq.mm unarmored copper flexible FRLS Cable	Sets	130	Volume-II C.2.3			
B.4.28	Supply and termination of 1C x 50 Sq.mm unarmored copper flexible FRLS Cable	Nos	50	Volume-II C.2.3			
B.4.29	Supply and termination of 1C x 25 Sq.mm unarmored copper flexible FRLS Cable	Nos	50	Volume-II C.2.3			
B.4.30	Supply and termination of 1C $\times$ 6 Sq.mm unarmored copper flexible FRLS Cable - Green	Nos	100	Volume-II C.2.3			
B.5	Cable Trays, Raceways and Conduit						
	Supply and Installation GI Ladder / Perforated type cable trays factory fabricated out of 14 G sheet steel, supporting angle frame at every 1.2 m or as approved, bottom angle fasteners, anchor grip bolts, synthetic enameled painting for support structure (2 coats of primer red oxide + 2 coats of synthetic enameled painting), etc. The tray shall be suspended from ceiling using anchor bolt and angle iron supports or mounted from wall. Hot Dip Galvanizing shall meet the applicable IS standard.			Volume-II C.2.8			
B.5.1	600 mm x 50 mm hot Dip Galvanized - GI Ladder Type	Mtrs	100	Volume-II C.2.8			
B.5.2	450 mm x 50 mm hot Dip Galvanized - GI Perforated	Mtrs	200	Volume-II C.2.8			
B.5.3	300 mm x 50 mm hot Dip Galvanized - GI Perforated	Mtrs	250	Volume-II C.2.8			
B.5.4	150 mm x 50 mm hot Dip Galvanized - GI Perforated	Mtrs	100	Volume-II C.2.8			
	Supply and installation of fabricated 14 SWG G.I race ways / junction boxes for drawing wires for Raw power, UPS power and communication. The race ways shall be complete with base and cover, junction boxes as required, extension pieces, couplers, end plates, earthing including mechanically cutting chases in floor/ wall etc. and making the same good. The race way shall be surface / Concealed type to brick wall / flooring with necessary fixing accessories. All the raceway will have double compartments and all complete as per specifications and relevant standards			Volume-II C.2.8			
B.5.5	450 mm x 50 mm hot Dip Galvanized	Mtrs	80	Volume-II C.2.8			
B.5.6	300 mm x 50 mm hot Dip Galvanized	Mtrs	150	Volume-II C.2.8			
B.5.7	150 mm x 50 mm hot Dip Galvanized	Mtrs	200	Volume-II C.2.8			
	Supply and laying of 2 mm thick rigid FRLS grade PVC conduit in conduit system using conduit accessories like junction boxes, collars, bends, elbows, binding wires, etc. including cutting, chasing wherever required in wall/ ceiling/flooring and making same good all complete as per technical specifications and relevant standards,			Volume-II C.2.8			
B.5.8	25 mm dia conduit	Mtrs	900	Volume-II C.2.8			
B.5.9	32 mm dia conduit	Mtrs	200	Volume-II C.2.8			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
B.6	Earthing						
B.6.1	Supply, installation, testing and commissioning of Chemical type earthing, 3.0 Mtrs long, 80mm dia T-39 type (Chemical type) earth pipe set with back fill compound, bus for termination, SS bolts, nuts, and washers etc. including excavation, refilling and complete as required, including heavy duty cast iron cover (Medium duty) all complete as per drawings, specifications, relevant standards, and direction of Engineer in charge	Nos	10	Volume-II C.2.9			
	Supply and running of below listed sizes of electrolytic copper / GI earth conductor tapes / wires and laid along with cable or clamped to brick wall, etc., as required. Flexible cables to be run in suitable PVC FRLS conduits. All the accessories to be consider for running the strips / Cables etc. All copper flats to be run in sleeves with accessories as required and all complete as per drawings, specifications, relevant standards, and direction of Engineer in charge			Volume-II C.2.9			
B.6.2	50mm x 6mm GI strip	Mtrs	400	Volume-II C.2.9			
B.6.3	50mm x 6mm Copper strip	Mtrs	100	Volume-II C.2.9			
B.7	Lighting						
	Supply, erection, testing and Commissioning of luminaries complete with fixture, lamps, ballast, driver, starter, HPF condenser, standard down rod/chain, connecting cord, PVC/GI Flexible, Poles etc, . The rate shall include all necessary fixing accessories like MS hooks, MS supports, fasteners, etc. and all complete as per drawings, specifications, relevant standards, and direction of Engineer in charge			Volume-II C.2.7			
B.7.1	Recessed/surface ceiling luminaire LED 36W LED, 230V, direct light emission, metal housing, powder coated white, or anodising, opal PMMA satin diffuser in synthetic material, halogen-free internal wiring, integral HF electronic control gear Protection class I, IP40 L = 595 mm, B = 595mm, H = 70mm	Nos	206	Volume-II C.2.7			
B.7.2	RECESSED ceiling downlighter for LED 15 W, 230V, direct light emission, support profile anodised, 1450 Lm, aluminium cast with rapid connection Luminance COB LED), integral HF electronic control gear Detec.	Nos	38	Volume-II C.2.7			
B.8	Point Wiring						
B.8.1	Supply, installation, wiring of modular 3 Nos Single phase 6 Amps multi pin flush type Modular socket outlets controlled by individual 1 Nos.20 Amps flush type Modular SP switch in a Metal box with all complete as per technical specifications and relevant standards	Nos	80				
B.8.2	Supply, installation, wiring of modular 1 Nos Single phase 6 Amps multi pin flush type Modular socket outlets controlled by individual 1 Nos.6 Amps flush type Modular SP switch in a Metal box with all complete as per technical specifications and relevant standards	Nos	25				
B.8.3	Supply, installation, wiring of modular 1 Nos Single phase 6/16 Amps multi pin flush type Modular socket outlets controlled by individual 1 Nos.20 Amps flush type Modular SP switch in a Metal box with all complete as per technical specifications and relevant standards	Nos	15				
	Point wiring of lighting fixtures, using 1100 volts grade 2 Runs of 2.5 sq.mm multi strand copper conductor for main circuit and individual Light fixtures to be connected with 1.5 sqmm multi strand copper conductor, FRLS insulated wires drawn in 20/25mm dia size 2mm thick rigid FRLS PVC/GI conduit in a concealed / open conduit system. The wiring shall be complete with all conduit and wiring accessories like deep junction boxes, collars, tees, bends, elbows, MS boxes, GI pull wires, clamps, spacers, base plate for spacers, screws, etc. The rate shall include light switch, providing mounting boxes with tapped holes for lights switches, moulded front plates with brass screws earthing of all points using 1.5 sq.mm multi strand FRLS insulated copper conductor wires., DB to switch control will be measured as circuit wiring. The switch boxes shall be flush mounted in brick wall and all complete as per drawings, specifications, relevant standards.						
B.8.4	Two light points controlled by 6 A flush type modular switch	Nos	37				
B.8.5 B.8.6	Three light points controlled by 6 A flush type modular switch Four light points controlled by 6 A flush type modular switch	Nos Nos	33 19				
0.0.0		1105	13				
B.8.7	Supplying and fixing outdoor type 63A, 415V, TPN Industrial type socket outlet, with 4 pole and earth, metal closed plug top along with 63 A "C" curve, TPN MCB, in sheet steel enclosure, on surface or in recess, with chained metal cover for the socket outlet and complete with connections, testing and commissioning etc. as required.	Nos	7				

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
B.8.8	Supplying and fixing indoor type 32A, 230V, DP Industrial type socket outlet, with double pole and earth, metal closed plug top along with 32A "C" curve, DP MCB, in sheet steel enclosure, on surface or in recess, with chained metal cover for the socket out let and complete with connections, testing and commissioning etc. as required.	Nos	18				
B.9	Mobile Industrial Plug and Sockets						
B.9.1	Supply and Installation of 32A 3 pin Mobile Industrial Plug and Socket with necessary accessories complete as required	Nos	65				
B.9.2	Supply and Installation of 63A 3 pin Mobile Industrial Plug and Socket with necessary accessories complete as required	Nos	8				
B.9.3	Supply and Installation of 32A 5 pin Mobile Industrial Plug and Socket with necessary accessories complete as required	Nos	6				
B.10.1	Miscellaneous Works Supply and fixing of First Aid Box	Lot	1				
	Supply and fixing of First Aid Box	Lot	1				
B.10.3	Supply and installation of exhaust fan for the Battery Rooms with a Digital Time Switch for switching on for fixed duration every day with 3 speed motor, vibration isolator ,starter,etc for fresh air. Noise level < 55 dba @ 1.0m distance. The fan shall be with casing made from mild steel duly enamel painted, adjustable pitch die cast aluminium impeller (HUB & BLADES), mounting brackets, neoprene rubber gasket to minimize vibration, inlet screen, non return damper at outlet and rated Motor with class-H insulation suitable for high temperature operation once for 250°C for 2 hours Motor with all required complete. (800CFM)	Nos	2				
B.10.4	Supply of Rubber Mat of 10mm thickness of appropriate size in front and rear of all floor mount Electrical panels and Battery Racks	Lot	1				
D 10 F	Preparation works for DG foundation area, trenching in power house,	1 = 4	1				
B.10.5	construction of trrench as per site condition, civil works, etc. any other works required for Data Center works	Lot	1				
B.10.6	Making of Cable Trench from for Laying of cables along with 2 layers of Sand and one layer of Cuddupa Stone above the Cable. This including the excavation and Closing of trench after Cable laying. Size of the Trench: 900mm (W) x 1000mm (D)	Mtrs	120				
С	HVAC System						
C.1	Supply of 30kW DX based Inrow type Precision air conditioner with in-built automatic transfer switches, horizontal air flow pattern, can be placed in-						
C.1.1	between the racks or at the ends of rows, close to the heat source with 30kW Nominal capacity. Cold Aisle temperature should be maintained at 20+/-1 deg C, 50+/-5% RH. Unit should have Variable Capacity Scroll/tandem / inverter compressor compatible with R410a/R407 refrigerant, crane case heater, locking disconnect switch, EC fan, Adjustable modular baffle system, Heater, Humidifier, G4 (EU4) gravimetric + Clogged Filter, 2 no rack sensor. Out door Condenser unit shall comprise of Copper coil with Aluminium fins and Axial fan with fan speed controller motor. The microprocessor control system shall have advanced diagnostic and maintenance support, enabling multiple units to communicate and work together as a team to precisely control temperature and humidity across a room. In addition, the controller network should provide a choice of Teamwork, Lead/Lag and Cascade functions.	Nos	5	Volume-II C.3.1			
	Nominal capacity. Cold Aisle temperature should be maintained at 20+/-1 deg C, 50+/-5% RH. Unit should have Variable Capacity Scroll/tandem / inverter compressor compatible with R410a/R407 refrigerant, crane case heater, locking disconnect switch, EC fan, Adjustable modular baffle system, Heater, Humidifier, G4 (EU4) gravimetric + Clogged Filter, 2 no rack sensor. Out door Condenser unit shall comprise of Copper coil with Aluminium fins and Axial fan with fan speed controller motor. The microprocessor control system shall have advanced diagnostic and maintenance support, enabling multiple units to communicate and work together as a team to precisely control temperature and humidity across a room. In addition, the controller network should provide a choice of Teamwork, Lead/Lag and Cascade functions.  Installation of 30kW DX based inrow type Precision air conditioner units	Nos	5				
C.1.2	Nominal capacity. Cold Aisle temperature should be maintained at 20+/-1 deg C, 50+/-5% RH. Unit should have Variable Capacity Scroll/tandem / inverter compressor compatible with R410a/R407 refrigerant, crane case heater, locking disconnect switch, EC fan, Adjustable modular baffle system, Heater, Humidifier, G4 (EU4) gravimetric + Clogged Filter, 2 no rack sensor. Out door Condenser unit shall comprise of Copper coil with Aluminium fins and Axial fan with fan speed controller motor. The microprocessor control system shall have advanced diagnostic and maintenance support, enabling multiple units to communicate and work together as a team to precisely control temperature and humidity across a room. In addition, the controller network should provide a choice of Teamwork, Lead/Lag and Cascade functions.  Installation of 30kW DX based inrow type Precision air conditioner units  Supply and installation of Outdoor stands for each unit. (as per the site conditions with the rust proof material to be approved by CDAC officers and with minimum ground clearance of 5 Ft.)			C.3.1 Volume-II			
C.1.2	Nominal capacity. Cold Aisle temperature should be maintained at 20+/-1 deg C, 50+/-5% RH. Unit should have Variable Capacity Scroll/tandem / inverter compressor compatible with R410a/R407 refrigerant, crane case heater, locking disconnect switch, EC fan, Adjustable modular baffle system, Heater, Humidifier, G4 (EU4) gravimetric + Clogged Filter, 2 no rack sensor. Out door Condenser unit shall comprise of Copper coil with Aluminium fins and Axial fan with fan speed controller motor. The microprocessor control system shall have advanced diagnostic and maintenance support, enabling multiple units to communicate and work together as a team to precisely control temperature and humidity across a room. In addition, the controller network should provide a choice of Teamwork, Lead/Lag and Cascade functions.  Installation of 30kW DX based inrow type Precision air conditioner units  Supply and installation of Outdoor stands for each unit. (as per the site conditions with the rust proof material to be approved by CDAC officers and with minimum ground clearance of 5 Ft.)  Providing and fixing 18G hard drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Suction Line	Nos	5	Volume-II C.3.1 Volume-II			
C.1.2 C.1.3	Nominal capacity. Cold Aisle temperature should be maintained at 20+/-1 deg C, 50+/-5% RH. Unit should have Variable Capacity Scroll/tandem / inverter compressor compatible with R410a/R407 refrigerant, crane case heater, locking disconnect switch, EC fan, Adjustable modular baffle system, Heater, Humidifier, G4 (EU4) gravimetric + Clogged Filter, 2 no rack sensor. Out door Condenser unit shall comprise of Copper coil with Aluminium fins and Axial fan with fan speed controller motor. The microprocessor control system shall have advanced diagnostic and maintenance support, enabling multiple units to communicate and work together as a team to precisely control temperature and humidity across a room. In addition, the controller network should provide a choice of Teamwork, Lead/Lag and Cascade functions.  Installation of 30kW DX based inrow type Precision air conditioner units  Supply and installation of Outdoor stands for each unit. (as per the site conditions with the rust proof material to be approved by CDAC officers and with minimum ground clearance of 5 Ft.)  Providing and fixing 18G hard drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports	Nos	5	Volume-II C.3.1  Volume-II C.3.1  Volume-II C.3.1  Volume-II C.3.1			
C.1.2 C.1.3 C.1.4	Nominal capacity. Cold Aisle temperature should be maintained at 20+/-1 deg C, 50+/-5% RH. Unit should have Variable Capacity Scroll/tandem / inverter compressor compatible with R410a/R407 refrigerant, crane case heater, locking disconnect switch, EC fan, Adjustable modular baffle system, Heater, Humidifier, G4 (EU4) gravimetric + Clogged Filter, 2 no rack sensor. Out door Condenser unit shall comprise of Copper coil with Aluminium fins and Axial fan with fan speed controller motor. The microprocessor control system shall have advanced diagnostic and maintenance support, enabling multiple units to communicate and work together as a team to precisely control temperature and humidity across a room. In addition, the controller network should provide a choice of Teamwork, Lead/Lag and Cascade functions.  Installation of 30kW DX based inrow type Precision air conditioner units  Supply and installation of Outdoor stands for each unit. (as per the site conditions with the rust proof material to be approved by CDAC officers and with minimum ground clearance of 5 Ft.)  Providing and fixing 18G hard drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Suction Line  Providing and fixing 18G hard drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports	Nos Nos Mtrs	5 5 200	Volume-II C.3.1  Volume-II C.3.1  Volume-II C.3.1  Volume-II Volume-II			
C.1.2 C.1.3 C.1.4	Nominal capacity. Cold Aisle temperature should be maintained at 20+/-1 deg C, 50+/-5% RH. Unit should have Variable Capacity Scroll/tandem / inverter compressor compatible with R410a/R407 refrigerant, crane case heater, locking disconnect switch, EC fan, Adjustable modular baffle system, Heater, Humidifier, G4 (EU4) gravimetric + Clogged Filter, 2 no rack sensor. Out door Condenser unit shall comprise of Copper coil with Aluminium fins and Axial fan with fan speed controller motor. The microprocessor control system shall have advanced diagnostic and maintenance support, enabling multiple units to communicate and work together as a team to precisely control temperature and humidity across a room. In addition, the controller network should provide a choice of Teamwork, Lead/Lag and Cascade functions.  Installation of 30kW DX based inrow type Precision air conditioner units  Supply and installation of Outdoor stands for each unit. (as per the site conditions with the rust proof material to be approved by CDAC officers and with minimum ground clearance of 5 Ft.)  Providing and fixing 18G hard drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Suction Line  Providing and fixing 18G hard drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Return Line	Nos Nos Mtrs	5 5 200 200	Volume-II C.3.1  Volume-II C.3.1  Volume-II C.3.1  Volume-II C.3.1  Volume-II Volume-II			
C.1.2 C.1.3 C.1.4 C.1.5	Nominal capacity. Cold Aisle temperature should be maintained at 20+/-1 deg C, 50+/-5% RH. Unit should have Variable Capacity Scroll/tandem / inverter compressor compatible with R410a/R407 refrigerant, crane case heater, locking disconnect switch, EC fan, Adjustable modular baffle system, Heater, Humidifier, G4 (EU4) gravimetric + Clogged Filter, 2 no rack sensor. Out door Condenser unit shall comprise of Copper coil with Aluminium fins and Axial fan with fan speed controller motor. The microprocessor control system shall have advanced diagnostic and maintenance support, enabling multiple units to communicate and work together as a team to precisely control temperature and humidity across a room. In addition, the controller network should provide a choice of Teamwork, Lead/Lag and Cascade functions.  Installation of 30kW DX based inrow type Precision air conditioner units  Supply and installation of Outdoor stands for each unit. (as per the site conditions with the rust proof material to be approved by CDAC officers and with minimum ground clearance of 5 Ft.)  Providing and fixing 18G hard drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Suction Line  Providing and fixing 18G hard drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Return Line  Supply and filling of R410a/407 Refrigerant Gas  Supply and laying of Interconnecting copper cabling between indoor and	Nos Nos Mtrs Mtrs	5 5 200 200	Volume-II C.3.1  Volume-II C.3.1  Volume-II C.3.1  Volume-II C.3.1  Volume-II C.3.1			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
C.1.10	Supply and laying of 25mm dia ball valves for Fresh water piping	Nos.	8	Volume-II C.3.1			
C.2	Cold Aisle Containment			0.0.=			
	Supply and installation of Cold Aisle Containment for the Server Room with swinging doors. The doors shall have automatic door closure, locking mechanism, etc. with necessary accessories complete as required			Volume-II C.3.2			
C.2.1	Double Door -1200 mm x 2100 mm	Nos	1	Volume-II C.3.2			
C.2.3	Hydro mechanical Door Closure	Nos	1	Volume-II C.3.2			
C.2.4	Passive Top Panel/600 Wide/Metal and Toughened Glass/1200	Nos	12	Volume-II C.3.2			
C.2.5	Passive Top Panel/800 Wide/Metal and Toughened Glass/1200	Nos	1	Volume-II C.3.2			
C.2.6	Vertical Panel/ Metal/600-150	Nos	24	Volume-II C.3.2			
C.2.7	Vertical Panel/ Metal/800-150	Nos	2	Volume-II C.3.2			
C.2.8	Vertical Panel/ Metal/1200-150	Nos	2	Volume-II C.3.2			
C.3	Cooling for Other Areas						
C.3.1	Supply, installation, testing and commissioning of Air cooled ductable ceiling mounted package unit, comprising of scroll compressors of 11.0 TR (Nominal) capacity, cooling coil, evaporator, blower and washable/cleanable filter all housed in a powder coated sheet metal cabinet of robust construction and one number Air cooled condenser unit consisting of condenser fan, copper condenser coils, including pressure testing, gas charging with R407C/ 410A refrigerant suitable for operation on 3 phase, 415 V, 50 Hz A.C supply etc. for NOC Area This shall include the following  - Microprocessor controller with necessary features for power saving, precise control on Temperature, Programmable operation, fault diagnostics, Auto Restart, Anti recycle Timer and protection from single phasing, Over load and phase reversals  - Initial gas charging  - Outdoor Unit Stands along with complete accessories as required	Nos	3	Volume-II C.3.3			
C.3.2	Supply and installation of ducting for the 11 TR Ductable units using 24GSS sheet with required diffusers and necessary accessories complete as required for NOC Area	Job	1	Volume-II C.3.3			
C.3.3	Supply, installation, testing and commissioning of Air cooled ductable ceiling mounted package unit, comprising of scroll compressors of 11 TR (Nominal) capacity, cooling coil, evaporator, blower and washable/cleanable filter all housed in a powder coated sheet metal cabinet of robust construction and one number Air cooled condenser unit consisting of condenser fan, copper condenser coils, including pressure testing, gas charging with R407C/ 410A refrigerant suitable for operation on 3 phase, 415 V, 50 Hz A.C supply etc. for Electrical Room This shall include the following  - Microprocessor controller with necessary features for power saving, precise control on Temparature, Programmable operation, fault diagnostics, Auto Restart, Anti recycle Timer and protection from single phasing, Over load and phase reversals  - Initial gas charging - Outdoor Unit Stands along with complete accessories as required	Nos	4	Volume-II C.3.3			
C.3.4	Providing and fixing 19G soft drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Suction Line	Mtrs	150				
C.3.5	Providing and fixing 19G soft drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Return Line	Mtrs	150				

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
C.3.6	Supply, installation, testing and commissioning of Air cooled High wall Split AC unit of 2.0 TR (Nominal) capacity with inverter technology, cooling coil, evaporator, blower and washable/cleanable filter all housed in a cabinet of robust construction and one number Air cooled condenser unit consisting of condenser fan, copper condenser coils, including pressure testing, gas charging with R407C/ 410A refrigerant suitable for operation on single/three phase, 230/415 V, 50 Hz A.C supply etc. for Battery Rooms, Central Network Room and Discussion Room This shall include the following - Microprocessor controller with necessary features for power saving, precise control on Temperature, Programmable operation, fault diagnostics, Auto Restart, Anti recycle Timer and protection from single phasing, Over load and phase reversals - Initial gas charging - Outdoor Unit Stands - 4kVA Voltage Stabilizer along with complete accessories as required	Nos	8	Volume-II C.3.3			
C.3.7	Supply, installation, testing and commissioning of Air cooled High wall Split AC unit of 1.5 TR (Nominal) capacity with inverter technology, cooling coil, evaporator, blower and washable/cleanable filter all housed in a cabinet of robust construction and one number Air cooled condenser unit consisting of condenser fan, copper condenser coils, including pressure testing, gas charging with R407C/ 410A refrigerant suitable for operation on single/three phase, 230/415 V, 50 Hz A.C supply etc. for Telco Room, Central Network Room, Network Room and Staging Room This shall include the following  - Microprocessor controller with necessary features for power saving, precise control on Temperature, Programmable operation, fault diagnostics, Auto Restart, Anti recycle Timer and protection from single phasing, Over load and phase reversals  - Initial gas charging  - Outdoor Unit Stands  - 2kVA Voltage Stabilizer along with complete accessories as required	Nos	9	Volume-II C.3.3			
C.3.9	Providing and fixing 19G soft drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Suction Line	Mtrs	360	Volume-II C.3.3			
C.3.10	Providing and fixing 19G soft drawn Copper refrigerant piping with 9 mm thick tube nitrile rubber cover including accessories bracing between indoor and outdoor air-cooled condensers of the following size with necessary supports and fittings as required - Return Line	Mtrs	360	Volume-II C.3.3			
C.3.11	Supply and Installation of 25 mm CPVC pipe for Humidifier and drain piping with 6 mm thick nitrile rubber insulation including elbows, connectors, U traps, Y connections, connections and flexible tubing if any for all units to the nearest toilet /pantry drain/ or to the main shaft available as per site conditions and per directions of the Architect/Consultant/ Site engineer.	Mtrs	200	Volume-II C.3.3			
C.3.12	Supply and Installation of 32 mm CPVC pipe for Humidifier and drain piping with 6 mm thick nitrile rubber insulation including elbows, connectors, U traps, Y connections, connections and flexible tubing if any for all units to the nearest toilet /pantry drain/ or to the main shaft available as per site conditions and per directions of the Architect/Consultant/ Site engineer.	Mtrs	50	Volume-II C.3.3			
C.3.13	Supply and installation of metal structure for mounting of comfort AC outdoor units. Outdoor units shall be stacked one above the other	Lot	1	Volume-II C.3.3			
C.3.14	Supply, installation, Testing and Commissioning of Sequencer Units suitable for 2 units	Nos	7	Volume-II C.3.3			
D.1	Safety and Security System Fire Alarm System						
D.1.1	Supply, Installation, Testing and Commissioning of Fire Alarm System comprising of Microprocessor based Addressable 2 loop Fire Alarm Control panel having a maximum of 159 detectors and 159 devices in each detection loop with required zone, Battery charger cum battery backup for 24 Hours in Normal condition and 2 Hours in Alarm Condition complete with necessary accessories as required  The panel shall be integrated with BMS, Access Control System and PA System.  This includes GUI software for Fire Alarm Panel	No.	1	Volume-II C.4.1			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
D.1.2	Supply installation Testing and commissioning of Analogue Addressable Multisensor detector (Photo + Thermal) with Detector base with all mounting accessories, complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	74	Volume-II C.4.1			
D.1.3	Supply installation Testing and commissioning of Hydrogen Sensor with all mounting accessories, complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	2	Volume-II C.4.1			
D.1.4	Supply installation Testing and commissioning of Response Indicator with all mounting accessories, complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	31	Volume-II C.4.1			
D.1.5	Supply, Installation, Testing and Commissioning of Addressable Dual Action Manual Pull Station (Lift and Pull) with Address Switch and all mounting accessories, complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	9	Volume-II C.4.1			
D.1.6	Supply, Installation, Testing and Commissioning of Addressable Hooter cum Strobe with 20Hz to 20 KHz operating frequency with minimum 8 distinct sound patterns, complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	10	Volume-II C.4.1			
D.1.7	Supply installation Testing and commissioning of Addressable Control/Relay Modules with all mounting accessories, complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	12	Volume-II C.4.1			
D.1.8	Supply installation Testing and commissioning of Addressable Monitor Modules with all mounting accessories, complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	10	Volume-II C.4.1			
D.1.9	Supply installation Testing and commissioning of Addressable fault Isolator Modules with all mounting accessories, complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	8	Volume-II C.4.1			
D.1.10	Supply and fixing of Clean agent - 4 Kg hand held fire extinguisher	Nos	16	Volume-II C.4.1			
D.1.11	Supply and installation of local scar alarm with door position sensor and necessary accessories	Nos	1	Volume-II C.4.1			
D.1.12	Supply and laying of 2 twisted pair x 1.5 mm, Multistranded AT Copper, Shielded, Fire Survival, Zero Halogen Low Smoke Armoured cable, red in Colour, laid on surface with GI saddle- spacers every0.3 meters. Complete with GI Junction Box, lugs, cable compression glands, cable tags and Ferruling.	Mtrs	1400	Volume-II C.4.1			
D.2	Aspiration Based Detection System						
D.2.1	Supply, Installation, Testing and Commissioning of Single Zone dual Pipe Laser detector Assembly (comprising of detector, filter, aspirator, and relay outputs, on-board bar graph display, auto cleaning of Laser chamber) with on board bar graph display. The panel shall have Modbus / BacNet output for High Level Interface for Soft Integration with the BMS system and FAS through relay. This shall include power supply unit and other necessary accessories complete as required	Nos	4	Volume-II C.4.3			
D.2.2	Supply, Installation, Testing and Commissioning of Sampling Pipes for Primary and Secondary Sampling, smooth Inner Bore 21mm ID and 25 mm outer dia, Plenum Rated, Sch.40, PVC Pipes with Fittings, Hi-quality Supports, accessories and Sealing compound; Red colour sampling point labels.	Mtrs	150	Volume-II C.4.3			
D.2.3	Supply, Installation, Testing and Commissioning of Capillary Sets complete with tube and sampling point assembly including all accessories all complete as per drawings, specifications, relevant standards, and direction of Engineer in charge.	Nos	20	Volume-II C.4.3			
D.2.4	Supply and laying of 2 twisted pair x 1.5 mm, Multistranded AT Copper, Shielded, Fire Survival, Zero Halogen Low Smoke Armoured cable, red in Colour, laid on surface with GI saddle- spacers every0.3 meters. Complete with GI Junction Box, lugs, cable compression glands, cable tags and Ferruling.	Mtrs	100	Volume-II C.4.3			
D.3	Fire Suppression System						
D.3.1	Supply, Installation, Testing and Commissioning of 2 - Zone NOVEC 1230 gas based Fire Suppression System with Gas Release Panel with necessary accessories complete as required  Lincoln and positioning of 120 OLER Children with Bota Valvo and possession.	Nos	1	Volume-II C.4.2			
D.3.2	Supply and positioning of 120.0 Ltrs. Cylinder with Beta Valve and necessary accessories complete as required	Nos.	3	Volume-II C.4.2			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
D.3.3	Supply of NOVEC 1230 agent	Kgs	230	Volume-II C.4.2			
D.3.4	Supply and installation of Beta Primary Completer Kit complete comprises of: - Solenoid With Gauge Assembly - Discharge Hose - Manual Pneumatic Actuator - Flexible interconnecting hose - Warning Sign and Name plate - Tee and Connectors - Cylinder Supervisory Switch	Nos	1	Volume-II C.4.2			
D.3.5	Supply and installation of Mid Slave Cylinder Accessories -Pressure Operated Control Head -Actuation Hose, 30" -Male Branch Tee, 5/16" Flare x 1/8"NPT -Discharge Hose, 2" x 31"	Nos	1	Volume-II C.4.2			
D.3.6	Supply and installation of End Slave Cylinder Accessories -Pressure Operated Control Head -Actuation Hose, 30" -Discharge Hose, 2" x 31" -Master Cylinder Adaptor Kit -Male Elbow, 5/16' Flare x 1/8" NPT	Nos	1	Volume-II C.4.2			
D.3.7	Supply and installation of Discharge Nozzle	Nos	6	Volume-II C.4.2			
D.3.8	Supply and installation of M.S. Seamless pipes as per ASTM A 106 Gr.B, schedule 40 with necessary fittings for entire Server Room -A and B	Lot	1	Volume-II C.4.2			
D.3.9	Supply, Installation, Testing and Commissioning of Directional Sounders with 20Hz to 20 KHz operating frequency with minimum 8 distinct sound patterns to indicate Exit doors and direct occupants for safe and fast evacuation, complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	1	Volume-II C.4.2			
D.3.10	Supply, Installation, Testing and Commissioning of manual release switch complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	1	Volume-II C.4.2			
D.3.11	Supply, Installation, Testing and Commissioning of abort complete with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	1	Volume-II C.4.2			
D.3.12	Supply and laying of 2 twisted pair x 1.5 mm, Multistranded AT Copper, Shielded, Fire Survival, Zero Halogen Low Smoke Armoured cable, red in Colour, laid on surface with GI saddle- spacers every0.3 meters. Complete with GI Junction Box, lugs, cable compression glands, cable tags and Ferruling.	Mtrs	50	Volume-II C.4.2			
D.4	Access Control System						
D.4.1	Supply, Installation, Testing and Commissioning of IP Based 4 reader access controller with power supply unit, enclosure, etc. Complete with all necessary accessories as required	Nos	5	Volume-II C.4.4			
D.4.2	Supply, Installation, Testing and Commissioning of Fingerprint based Biometric cum smart card reader with mounting plates and necessary accessories complete as required	Nos	10	Volume-II C.4.4			
D.4.3	Supply, Installation, Testing and Commissioning of smart card reader with mounting plates and necessary accessories complete as required	Nos	10	Volume-II C.4.4			
D.4.4	Supply of Iclass Smart Cards	Nos	200	Volume-II C.4.4			
D.4.5	Supply, Installation, Testing and Commissioning of Emergency Break Glass Unit with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	9	Volume-II C.4.4			
D.4.6	Supply, installation, testing and commissioning of 1200lbs Electromagnetic lock for double leaf metal doors along with magnetic contact as per the technical specification and as per requirement and complete in all respect.  Potential free contact should be included in above	Nos	4	Volume-II C.4.4			
D.4.7	Supply, installation, testing and commissioning of 600lbs Electromagnetic lock for double leaf doors along with magnetic contact as per the technical specification and as per requirement and complete in all respect.  Potential free contact should be included in above	Nos	1	Volume-II C.4.4			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
D.4.8	Supply, installation, testing and commissioning of 1200lbs Electromagnetic lock for single leaf metal doors along with magnetic contact as per the technical specification and as per requirement and complete in all respect.  Potential free contact should be included in above	Nos	4	Volume-II C.4.4			
D.4.9	Supply, installation, testing and commissioning of 600lbs Electromagnetic lock for single leaf doors along with magnetic contact as per the technical specification and as per requirement and complete in all respect.  Potential free contact should be included in above	Nos	1	Volume-II C.4.4			
D.4.10	Supply and laying of 2 twisted pair x 1.5 mm, Multistranded AT Copper, Shielded, Fire Survival, Zero Halogen Low Smoke Armoured cable, black in Colour, laid on surface with GI saddle- spacers every0.3 meters. Complete with GI Junction Box, lugs, cable compression glands, cable tags and Ferruling.	Mtrs	400	Volume-II C.4.4			
D.4.11	Supply and laying of 4 twisted pair x 1.5 mm, Multistranded AT Copper, Shielded, Fire Survival, Zero Halogen Low Smoke Armoured cable, yellow in Colour, laid on surface with GI saddle- spacers every0.3 meters. Complete with GI Junction Box, lugs, cable compression glands, cable tags and Ferruling.	Mtrs	300	Volume-II C.4.4			
D.4.12	Supply and laying of 8 twisted pair x 1.5 mm, Multistranded AT Copper, Shielded, Fire Survival, Zero Halogen Low Smoke Armoured cable, blue in Colour, laid on surface with GI saddle- spacers every0.3 meters. Complete with GI Junction Box, lugs, cable compression glands, cable tags and Ferruling.	Mtrs	350	Volume-II C.4.4			
D.5	CCTV Surveillance System						
D.5.1	Supply installation testing and commissioning of Indoor Application IP Dome camera with 1/3" CMOS, Progressive Scan, HD1080P, 2 MP Resolution, Dual H.264 streaming or better, 25 FPS, Tamper detection, Wide dynamic Range 60 dB and Above, 3D Noise reduction, IR cut filter, Smart IR to Avoid Over exposure, Minimum Illumination:0.001 Lux, 3mm Fixed lens or better, Built-in IR illuminators effective up to 30 meters, Night Visibility for low light conditions, PoE and standard 12VDC/24VAC power input, Built-in PIR Sensor for Human Detection, Audio IN and Audio out for two way audio communication using suitable microphones and speakers, Built in Micro SD card slot for local recording, indoor surface mount enclosure, Mounted on True Ceiling / False ceiling as per site requirement (including required accessories(including required accessories(including required accessories) like Patch Cord, IO with Back Box etc. as per schematic and specification provided.), CE / UL certified, ONVIF Compliance POC for Camera is required, if proposed camera does not pass the POC the contractor shall propose better model or different make (Complying to the specifications) at no extra cost to client.	Nos	52	Volume-II C.4.5			
D.5.2	Supply installation testing and commissioning of outdoor Application IP Bullet camera with 1/3" CMOS, Progressive Scan, HD1080P, 2 MP Resolution, Dual H.264 streaming or better, 25 FPS, Tamper detection, Wide dynamic Range 60 dB and Above, 3D Noise reduction, IR cut filter, Smart IR to Avoid Over exposure, Minimum Illumination:0.001 Lux, 3mm Fixed lens or better, Built-in IR illuminators effective up to 30 meters, Night Visibility for low light conditions, PoE and standard 12VDC/24VAC power input, Built-in PIR Sensor for Human Detection, Audio IN and Audio out for two way audio communication using suitable microphones and speakers, Built in Micro SD card slot for local recording, indoor surface mount enclosure, Mounted on True Ceiling / False ceiling as per site requirement (including required accessories(including required accessories like Patch Cord, IO with Back Box etc. as per schematic and specification provided.), CE / UL certified, ONVIF Compliance POC for Camera is required, if proposed camera does not pass the POC the contractor shall propose better model or different make (Complying to the specifications) at no extra cost to client.	Nos	6	Volume-II C.4.5			
D.5.3	Supply installation testing and commissioning of 64 channel Network Video Recorder with Digital Video Management Software for seamless integration with third party application for unlimited Management server/Recording server/Client PC for centralize monitoring, recording and video management with 64 Camera Licenses and with 5 client licenses	Nos	1	Volume-II C.4.5			
D.5.4	Supply installation testing and commissioning of storage system for 60 cameras	Lot	1	Volume-II			
D.5.5	for 30 days considering 5Mbps quality recording Supply installation testing and commissioning of manageable access switches 24 x 10/100/1000 PoE switch with 2 x 1G combo ports and 2 x 1G SFP SR modules per switch	Nos	3	C.4.5 Volume-II C.4.5			
D.5.6	Supply installation testing and commissioning of 6U Wall mount rack with power manager, fans and accessories	Nos	2	Volume-II C.4.5			
D.6	Rodent Repellent System						

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
D.6.1	Supply, Installation, testing and commissioning of Microprocessor based Master Controller Console capable of connecting 24 Satellites per console in a single loop, and having minimum 40 characters LCD display, with on-board controls for generating frequencies from 20Khz to 60 Khz, including all accessories such as racks etc, all complete as per drawings, specifications, relevant standard	Nos	4	Volume-II C.4.6			
D.6.2	Supply, Installation, testing and commissioning of Transducer Satellite Stations with blinking LED Indication, capable of Emitting Ultrasonic sound of frequencies 20 Khz and higher with a coverage area of 500 sqft or more in all types of voids, including all accessories all complete as per drawings, specifications, relevant standards	Nos	74	Volume-II C.4.6			
D.6.3	Supply, Installation, testing and commissioning of single pair 14/40 SWG, specially coated, FRLS, sheathed Armoured cable laid on surface with GI saddle-spacers every 0.3 meters, complete with GI Junction Box, lugs, cable compression glands, cable tags, hold down clips, and ferruling, including all accessories all complete	Mtrs	1650	Volume-II C.4.6			
D.7	Water Leakage Detection System						
D.7.1	Supply, Installation, testing and commissioning of Water leak detection panel with 4 zone detection module, sound cum strobe units, Modbus for integration with BMS and and necessary accessories complete as required	Nos	2	Volume-II C.4.7			
D.7.2	Supply and laying of Water Leak detection cable sensor of 25 Mtrs	Nos	8	Volume-II C.4.7			
D.8	Building Management System						
D.8.1	Supply, Installation, Configuring, Testing and Commissioning of BMS Server software including Access Control System Software for real-time Processing of all Data being mapped in to the system by the DDCs and Protocol Integrators. Client version BMS software for "Monitor and Control" application, complete with Advance Graphics for Real-time Graphical Depiction of the Status and Controls and also the Access / CCTV interface to Present a Powerful Single GUI for all the HVAC, Electrical, Fire, Security, for the Entire Data Center Facility. SMS and E-mail alarm notification module with unlimited user capability, SMS Paging and Email Facility for transmitting specified alarms to designated personnel. Protocol Integration Modules for High Level integration with following 3rd Party Equipments as mentioned in the data point summary. The Protocol Integrator/ Convertor shall be Capable to Integrate Open protocol systems on BACnet /Modbus/LONWORKS/M-Bus/J-Bus Protocol Made available on IP, or on serial RS 485 / 232 interface. IP based 32 Bit freely programmable Direct Digital controllers (DDCs), complete with BMS Housing Panel. The Panel shall be MS Powder Coated, IP 55 Rating for indoor. The BMS Panel shall be with proper mounting accessories for DDCs such as DIN Rails,	Nos	1	Volume-II C.4.8			
D.8.2	Supply, Installation, Testing and Commissioning of Temperature and Humidity Sensor with MS Powder coated Junction Box for mounting on Surface, Cable lugs at Ends, cable compression glands, cable tags and Ferruling.	Nos	20	Volume-II C.4.8			
D.8.3	Supply and laying of 4 twisted pair x 1.5 mm, Multistranded AT Copper, Shielded, Fire Survival, Zero Halogen Low Smoke Armoured cable, yellow in Colour, laid on surface with GI saddle- spacers every0.3 meters. Complete with GI Junction Box, lugs, cable compression glands, cable tags and Ferruling.	Mtrs	800	Volume-II C.4.8			
D.8.4	Supply and laying of 8 twisted pair x 1.5 mm, Multistranded AT Copper, Shielded, Fire Survival, Zero Halogen Low Smoke Armoured cable, blue in Colour, laid on surface with GI saddle- spacers every0.3 meters. Complete with GI Junction Box, lugs, cable compression glands, cable tags and Ferruling.	Mtrs	600	Volume-II C.4.8			
D.9	Public Addressing System			-			
D.9.1	Supply, Installation, Testing and commissioning of Public address/Voice Evacuation panel with sufficient number of amplifiers to operate all the speakers with at least 20% spare capacity with 8 number of zones, Microphone, Digital auto-messenger, Power supply unit, should have free contacts for zonal integration with fire alarm system, facility to trigger auto-messaging in all the zones simultaneously and manual operation of individual zone complete with MS rack.	Nos	1	Volume-II C.4.9			
D.9.2	Supply, Installation, Testing and commissioning of 6 Watt Ceiling mount public address speakers to generate 80 dB at 1 mtr.	Nos	20	Volume-II C.4.9			
D.9.3	Supply, Installation, Testing and commissioning of 6 Watt Wall mount public address speakers to generate 80 dB at 1 mtr.	Nos	20	Volume-II C.4.9			
D.9.4	Supply and laying of 2 twisted pair x 1.5 mm, Multistranded AT Copper, Shielded, Fire Survival, Zero Halogen Low Smoke Armoured cable, black in Colour, laid on surface with GI saddle- spacers every 0.3 meters. Complete with GI Junction Box, lugs, cable compression glands, cable tags and Ferruling.	Mtrs	300	Volume-II C.4.9			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if any
E . 1	Passive Networking						
E.1.1	Supply and installation of 42U x 600mm x 1200mm Server Racks with single leaf metal perforated front and rear doors. The rack shall have 50mm base frame, 1U, 2U, 4U blanking panels. The rack shall not have any fan modules and cutouts shall be properly closed. The rack shall have top and bottom cable entries at the rear side with cable brushes. This shall include all necessary accessories complete as required.	Nos	20	Volume-II C.5			
E.1.2	Supply and installation of 42U x 800mm x 1200mm Network Racks with single leaf metal perforated front and rear doors. The rack shall have 50mm base frame, 1U, 2U, 4U blanking panels. The rack shall not have any fan modules and cutouts shall be properly closed. The rack shall have top and bottom cable entries at the rear side with cable brushes. This shall include all necessary accessories complete as required.	Nos	5	Volume-II C.5			
E.1.3	Supply and installation of 42U x 800mm Open Network Racks with mounting kits and all necessary accessories complete as required.	Nos	6	Volume-II C.5			
E.1.4	Supply and fixing of Power Distribution Unit - Vertically Mounted, 32AMPs with 25 Power Outputs. (20 Power outs of IEC 320 C13 Sockets and 5 Power outs of 5/15 Amp Sockets), Electronically controlled circuits for Surge and Spike protection, IED readout for the total current being drawn from the channel, 32AMPS MCB, 5 KV AC isolated input to Ground and Output to Ground	Nos	20	Volume-II C.5			
E.1.5	Supply and fixing of Intelligent Power Distribution Unit with branch circuit monitoring - Vertically Mounted, 32AMPs with 25 Power Outputs. (IEC 320 C13 x 20 Nos minimum and IEC 320 C19 x 3 Nos minimum), Electronically controlled circuits for Surge and Spike protection, LED readout for the total current being drawn from the channel, 32AMPS MCB, 5 KV AC isolated input to Ground and Output to Ground	Nos	38	Volume-II C.6			
E.2	Cablofil						
	Supply and installation of 400mm x 105mm wire basket system with all required support structures and necessary accessories complete as required.						
E.2.1	105 mm (H) x 400 mm (W) Hot dip Galvanized Cable tray	Nos	50				
_	Kitasstr CMWB-AP Drop Kit	Nos Nos	5 20				<del>                                     </del>
	Jointing screws for Threaded Rods	Nos	60				
	RCSN 3000mm Channel	Nos	10				
E.3	Fiber Runner  Supply and installation of 6 x 2 Fiber Runner system with all required support structures and necessary accessories complete as required.						
	6-foot horizontal straight section 2 x 6	Nos	35				
	6-foot horizontal straight section snap-on cover 2x6 90º horizontal elbow	Nos Nos	35 10				
_	2x6 90° Horizontal Elbow Cover	Nos	10				
	2x6 Four Way Elbow	Nos	4				
	2x6 Four Way Elbow Cover 2x6 T Junction	Nos Nos	2				<del>                                     </del>
	2x6 T Junction Cover	Nos	2				
	2x6 snap-fit junction	Nos	10 20				
	2-Inch Express Exit low profile 2x2 flex tube attachment	Nos Nos	20				
	New Threaded Rod Bracket Kit	Nos	100				
E.4.1	OM4 Fiber Cabling  Supply and laying of 6-core MM 50/125 micron OM4 Indoor Fiber Cable, LSZH	Mtrs	500	Volume-II C.7			
E.4.2	Supply, fixing and splicing of 12F, 1U, LC MM OM4, Loaded with Pigtails, Splice tray, adapter and splice protectors	Nos	28	Volume-II C.7			
E.4.3	Supply, fixing and splicing of 48F, 1U, LC MM OM4, Loaded with Pigtails, Splice tray, adapter and splice protectors	Nos	16	Volume-II C.7			
E.4.4	Supply of LC-LC Multimode 50/125 micron OM4 Duplex Patch Cord, 2 Meter	Nos	60	Volume-II C.7			
E.4.5	Supply of LC-LC Multimode 50/125 micron OM4 Duplex Patch Cord, 3 Meter	Nos	60	Volume-II C.7			
E.5	Cat6A Cabling			Volume-II			
	Supply and laying of Cat 6A LSZH Cable Boxes, 305 Mtrs  Supply and termination of Cat 6A Shielded die-cast Jack without dust cover,	Boxes	25	C.7 Volume-II			
E.5.2	180° cable exit Supply and fixing of Cat 6A, 24-port unloaded, Angled Jack Panel, SL-Series with	Nos	636	C.7 Volume-II			
E.5.3	labels and clear label covers, Height, 1U for Active	Nos	46	C.7			

S. No.	Description	Unit	Qty (A)	Refernce Clause	Reference to the Technical Data Sheets	Compliance to the RFP Specifications (Yes/No)	Remarks if an
E.5.4	Supply of 10G, Cat 6A, LSZH, Stranded Patchcord, 2 Meter	Nos	60	Volume-II C.7			
E.5.5	Supply of 10G, Cat 6A, LSZH, Stranded Patchcord, 3 Meter	Nos	60	Volume-II C.7			
E.6	Cat6 Cabling						
E.6.1	Supply and laying of Cat 6 LSZH Cable Boxes, 305 Mtrs	Boxes	27	Volume-II C.7			
E.6.2	Supply and termination of Cat 6 UTP Jack with Strain relief and bend limiting boot	Nos	568	Volume-II C.7			
E.6.3	supply and fixing of Cat 6, 24-port unloaded Modular Straight Jack Panel with rear cable support bar, labels and clear label covers, Height, 1U	Nos	25	Volume-II C.7			
E.6.4	Supply of Cat 6, LSZH, Stranded Patchcord, 2 Meter	Nos	150	Volume-II C.7			
E.6.5	Supply of Cat 6, LSZH, Stranded Patchcord, 1 Meter	Nos	150	Volume-II C.7			
E.6.6	Supply and fixing of Quad Face Plates with back box and accessories	Nos	70	Volume-II C.7			
E.6.7	Supply and fixing of Dual Face Plates with back box and accessories	Nos	50	Volume-II C.7			
F	Displays and Desktops						
F.1	Supply and installation of desktop Computer with Windows 10 Operating System as per the technical specifications for BMS and Access Control	Nos.	2	Volume-II C.8			
	Supply and installation of Ceiling mount Interactive Digital Multimedia		1	Volume-II			
F.2	Projector with 3000 lumen and wireless connectivity for Meeting Room	No.	1	C.8			
F.2 F.3	Projector with 3000 lumen and wireless connectivity for Meeting Room  Supply and installation of Professional grade 55" Video Wall LED Monitors arranged as 2 nos of 2x2 matrix for the NOC Room as per the technical	No.	8	C.8 Volume-II C.8			
	Projector with 3000 lumen and wireless connectivity for Meeting Room Supply and installation of Professional grade 55" Video Wall LED Monitors			Volume-II			
F.3	Projector with 3000 lumen and wireless connectivity for Meeting Room  Supply and installation of Professional grade 55" Video Wall LED Monitors arranged as 2 nos of 2x2 matrix for the NOC Room as per the technical specifications  Supply and installation of Professional grade 47" Video Wall LED Monitors for	Nos.	8	Volume-II C.8 Volume-II			
F.3 F.4	Projector with 3000 lumen and wireless connectivity for Meeting Room  Supply and installation of Professional grade 55" Video Wall LED Monitors arranged as 2 nos of 2x2 matrix for the NOC Room as per the technical specifications  Supply and installation of Professional grade 47" Video Wall LED Monitors for the BMS Room as per the technical specifications  Uptime Certification  Travel, Lodging and Miscellaneous Expenses for Uptime Certification	Nos.	8	Volume-II C.8 Volume-II			
F.3 F.4	Projector with 3000 lumen and wireless connectivity for Meeting Room  Supply and installation of Professional grade 55" Video Wall LED Monitors arranged as 2 nos of 2x2 matrix for the NOC Room as per the technical specifications  Supply and installation of Professional grade 47" Video Wall LED Monitors for the BMS Room as per the technical specifications  Uptime Certification  Travel, Lodging and Miscellaneous Expenses for Uptime Certification  Heat Load banks after commissioning of equipment's and load testing during uptime certification	Nos.	8 2	Volume-II C.8 Volume-II			
F.3 F.4 G.1	Projector with 3000 lumen and wireless connectivity for Meeting Room  Supply and installation of Professional grade 55" Video Wall LED Monitors arranged as 2 nos of 2x2 matrix for the NOC Room as per the technical specifications  Supply and installation of Professional grade 47" Video Wall LED Monitors for the BMS Room as per the technical specifications  Uptime Certification  Travel, Lodging and Miscellaneous Expenses for Uptime Certification  Heat Load banks after commissioning of equipment's and load testing during	Nos.	2	Volume-II C.8 Volume-II			

C No	Davamatav		Cunnification	Compliance	Remarks
S. No.	Parameter		Specification	(yes/ No)	
1	Prime Rated output	kVA	500		
2	Engine Cooling		Turbocharged, Air-to-Water		
2	Engine Cooling		cooling		
3	Cylinder arrangement		As per OEM		
4	Bore and stroke	MM	As per OEM		
5	Compression ratio	Ratio	16.5 : 1		
6	Rated speed	RPM	1500		
7	Lube oil & filter change period	Hours	500		
8	Minimum continuous load	%	20		
9	Piston speed	Mtrs/sec	7.2		
10	Engine KW at rated RPM	Kw (HP)	As per OEM		
11	Fuel stop power as per ISO-3046	Kw (HP)	As per OEM		
12	Frequency regulation, steady state	%	+/- 0.25		
13	Governor type	-	Electronic, Isochronous		
14	Governor class	-	ISO 8528-5 G2		
15	Engine over speed shutdown	RPM	1800		
16	Lube Oil System				
	Lube oil filter filtration capacity	Microns	12		
17	Recommended lube oil grade		CH4 15W40		
	Total system capacity	Liters	38		
18	Combustion/Air Intake				
19	Combustion air flow	cfm	1280		
19	Air filter	Туре	Dry type - replaceable		
20	Coolant System				
21	Recommended coolant		Engine extended life coolant		
21	Total system capacity	Liters	85		
	Cooling system ambient capability	°C	50		
22	Engine Electrical System				
23	Туре	V DC / Amps	24V negative earth		
	Charging alternator volts/current		28 / 70		

S. No.	Description	Compliance (Yes/No)	Remarks
А	The Precision Air Conditioner shall be of high sensible cooling capacity and high SHR (atleast 95%).		
В	PAC units should be designed based on 22±1 °C Cold Aisle Temperature and Relative Humidity of 45% to 55% for the rated IT load in the Server Room.		
С	Design Requirement		
1	The system shall be designed to maintain temperature conditions within the row(s) of racks		
2	The operation can be concisely characterized as follows: the racks draw in cool air from the front and discharge warm air at the rear.		
3	The high-density units, designated In Row Cooling module, draw in local air from the hot aisle and discharge cool air to the cold aisle. The units are installed alongside the high-density dissipation racks.		
4	The Close control system shall be a factory assembled unit. It shall be floor mounted, optimized for maximum cooling capacity in a minimum footprint.		
5	The system shall be designed for blow/draw-through air arrangement to insure even air distribution to the entire face area of the coil. The unit shall be capable to be mounted between the racks or at the end of row. The unit shall modulate cooling capacity and airflow based on requirements.		
6	Inrow Cooling Unit shall have inbuilt Automatic Transfer Switch for switching between two sources of power supply.		
7	Overall cooling capacity of cooling should be designed considering present IT load and CFM of minimum 40 for every kW of IT Load		
8	The system shall be designed to maintain temperature conditions within the row(s) of racks		
D	Cabinet Construction		
1	The structural frame is composed of galvanized sheet metal, externally epoxy powder coated, internally insulated with open-cell form. This type of panel is designed to ensure a good level of thermal and acoustic insulation.		
2	Exterior panels shall be 18-gauge steel density foam insulation. Insulation complies with flame spread and smoke developed rating of 25/50. Front and rear exterior panels shall be 18-gauge perforated steel with free area, and equipped with a keyed lock to provide a means of securing access to the internal components of the unit		
3	The frame shall be constructed of 16 gauge formed steel welded for maximum strength. All units shall provide maintenance from the front and rear, allowing units to be placed within a row of racks		
4	All exterior panels and frame shall be powder coated for durability and attractive finish		
5	Air tightness is ensured by adhesive seals located around the entire perimeter of each panel. The uprights an internal panel are made of galvanized sheet steel.		
6	All the structural materials are recyclable and CFC free.		
E	Fans		
1	Units shall be offered with diagonal fans with integral suction nozzle. The Fan shall be High efficiency, external rotor electronically commutated (EC) motor with integrated electronics, True soft start characteristics (inrush current lower than operating current), The fans, with modulating speed as a function of intake air temperature.		

		Compliance	_
S. No.	Description	(Yes/No)	Remarks
2	Each fan must be equipped with integral thermal protection. The fans must be maintenance free design and construction. The fan section shall be designed for higher air flow. The fan shall be protected over temperature of motor, electronics, locked rotor protection, short circuit of motor output.		
3	Variable Speed Fans: The unit is equipped with variable speed, electrically commutated, backward incline fans complete with Inlet Volute.		
4	Fan Protection: discharge finger guard		
F	Cooling Coil		
1	Direct Expansion: Cooling coil shall use raised lance type corrugated aluminum fin and with OEM design for copper tube coils. Fin shall be a minimum of recommended thickness. Tube wall shall be a minimum thickness in wall. Coil end supports shall be a minimum 18-gauge galvanized steel. Coil shall be rated for a maximum pressure of 500 PSIG (3447.3 kPa). Coil header is equipped with a drip plate in the bottom to capture and direct the condensation accumulating on the suction header tube to the drain pan. Coil has 6 circuits complete with brass distributor and copper distribution tubes		
G	Compressor		
1	Air filters shall be of box type, made of self-extinguishing, artificial-fiber cellular material. The frame containing the filter material shall be made of metal.		
Н	Compressor		
1	The unit shall be configured with a DC inverter /variable speed reciprocating hermetic/scroll compressor using a matched VFD. As a result, the compressor speed can be varied through a range to accommodate varying load conditions. The firmware to include oil return protection in cases where pipe velocities may drop to low speeds during low loading periods		
2	Compressor is electrically protected.		
3	Compressor utilizes a noise cap for noise reduction.		
4	Sight glass provided for air cooled system oil charging		
- 1	Condensate Pumps		
1	Factory Installed and wired condensate pump shall pump at. Pump shall have dual internal floats and reservoir made of polymeric materials to prevent corrosion.		
J	Filter		
1	The standard filters shall be 30% efficient per ASHRAE Standard 52.1, UL Class 2 (as per ASHRAE 52.2). Filters shall be EN779 G4 or better in efficiency. The pleated filters shall be replaceable from the rear of the unit.		
2	The optional filter shall be 85% efficient per ASHRAE Standard 52.1 (MERV13 per ASHRAE 52.2, EN779 F7).		
K	Humidifier		
1	Humidifier shall be able to modulate capacity. The humidifier shall be self-contained, steam- generating type, factory piped and wired, with disposable cylinder and automatic solid-state control circuit. Humidifier canisters shall be replaceable. The humidifier controller shall communicate directly to the microprocessor controller and provide complete status and control at the operator interface. Humidifier shall control flush cycling and conductivity via automated controls. Humidifier shall be capable of producing steam as per OEM design		
L	Electric Reheat		

S. No.	Description	Compliance	Remarks
	Reheat elements shall be low watt density, wired for three-phase, loaded equally	(Yes/No)	
1	on all three phases and shall be electrically and thermally protected by both		
	automatic and manual reset cutouts.		
2	Reheat coils shall be stainless steel, fin tubular construction. Heater casing shall be G90 galvanized steel.		
3	Heater shall be provided with self-engaging electrical connectors upon		
	installation. Heater with manually connected conductors are not acceptable.		
M	Temperature and Humidity Sensor		
	Internal Temperature Sensors: Thermistor temperature sensors shall be mounted behind the front / rear doors to provide control inputs based on supply		
1	and return air temperature. Sensor accuracy shall be within +/- 1 degree		
	accuracy.		
2	Remote Temperature Sensors: Three remote rack inlet temperature sensors shall be shipped with the unit to provide control input based on rack inlet		
	temperature.		
	Internal Humidity Sensors: Humidity sensors shall be mounted behind both the		
3	front and rear doors and shall provide control input based on humidity in front		
	supply air. Humidifier sensor shall be +/- 3-5% RH accuracy full scale.		
	Water Sensors: Internal supply and return chilled water temperature sensors		
4	shall be installed into sealed wells. Wells are filled with thermal conducting heat		
	transfer grease to provide accurate temperature sensors		
N	Microprocessor control system		
1	The control panel/user terminal shall be microprocessor-based system and shall provide the following features:		
2	It should be fitted with a backlit LCD display and keys to move between and		
	change parameters.		
3	<ul> <li>By means of the user terminal, it should be possible to set the air- conditioner's operating parameters, monitor the trend of the main working</li> </ul>		
	parameters and read any alarm messages		
4	a) Modes of operation (cooling, heating, humidification, de-humidification)		
5	b) Displays of actual Temperature and actual Relative Humidity.		
6	c) Date, time and unit identification display.		
7	d) System component Auto / Manual status display on the controller screen.		
8	The following alarms shall be available:		
9	a) Visual system alarm indication (along with mutable audio alarm as well).		
4.5	b) Alarm display menu (incorporating various system alarms like temperature		
10	high/low, humidity high/low, Compressor HP/LP, Wet floor and loss of air flow)		
11	c) The unit should show the settings & operating parameters of the other units.		
12	d) Programmable services interval indication display / alarm.		
12	e) Displays the units are switched off by supervision system, thru timer, by		
13	inversion Cycle, switched off by fire/smoke, switched off by flooding.		
14	The unit shall also incorporate the following protections:		
15	a) High pressure trip- Manual reset for each compressor		
16 17	<ul><li>b) Low pressure trip- Manual reset for each compressor.</li><li>c) Single phasing preventers.</li></ul>		
18	d) Reverse phasing		
19	e) Phase unbalancing		

S. No.	Description	Compliance (Yes/No)	Remarks
20	f) Phase failure		
21	g) Overload tripping (MPCB) of all components		
	Safety Interlocks: Operation of heaters & humidifiers shall be possible only		
21	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.		
0	Microprocessor Controls		
1	Following information shall be available on the display on the units:		
	a. Room temperature and humidity		
	b. Supply fan working status		
	c. Compressor working status		
	d. Electric heaters working status		
	e. Manual / Auto unit status		
	f. Temperature set point		
-	g. Humidity set point		
	h. Working hours of main component i.e. Compressor, fan, heater, humidifier		
	i. Unit working hours		
	j. Current date and time		
	k. Type of alarm (with automatic reset or block)		
	I. The last 100 intervened alarms		
2	The Microprocessor shall be able to perform following functions:		
	a. Testing of the working of display system.		
	b. Password for unit calibration values modification.		
	c. Automatic reset of program.		
	d. Cooling capacity control.		
-	e. Compressor starting timer.		
	f. Humidifier capacity limitation.		
	g. Date & time of last intervened alarm.		
	h. Wrong password alarm. i. Start / Stop status storage		
3	Following alarms shall be displayed on screen of microprocessor unit:		
3	a. Airflow loss.		
	b. Compressor low pressure.		
	c. Compressor high pressure.		
	d. High / low room temperature.		
	e. High / low room humidity.		
	f. Filter Clogged alarm		
P	Sequencing:		
1	The units should have sequencing as an inbuilt feature.		
	The units shall be designed to work for equal number of run hours. Also in case		
2	of fault, the standby unit should Start.		
3	The units should have weekly programmer.		
4	The microprocessor control system shall be supplied with RS485 serial adapter		
	for data transfer to a central supervisor system with MODBUS protocol.		
Q	REFRIGERANT PIPING		
	Each refrigerant circuit shall be suitable for operation on R-407C or R-410A and		
	shall include the following items:		
1	a) Expansion valve with pressure equalization		
2	b) Removable liquid line drier / filter		
3	c) Liquid line sight glass with moisture indicator		
4	d) Hand shut off valves		

6. No.	Parameter	Specification	Compliance (Yes/No)	Remarks
	Capacity (in KVA / KW)	250 kVA/250 kW 3-Phases Input / 3-Phase Output.		
		a) True Online configuration double conversion		
		UPS.		
		b) Modular UPS with hot swappable power Modules and		
		Static switch modules.		
		c) DSP (Digital Signal Processor) / Microprocessor based		
		control, using IGBT devices and high switching frequency		
		PWM.		
		d) PFC controlled IGBT rectifier with Active power factor		
	Technology and Capability	Correction (APFC).		
		e) Capability to operate in N+1 / N+X PRS –Parallel		
		Redundant Configuration.		
		f) Each module should have independent controller		
		addition to main controller; (Or) Each UPS should have dual		
		redundant hot swappable control modules and in any case		
		failure of main controller does not result in system failure or		
		loss of power module redundancy.		
2	Towns and the desired and block			
3. 4.	Temperature (design ambient) Relative Humidity	0 to 40°C < 90%		
5.	IP Class	IP20		
6.	Acoustic Noise measured at 1 Mt distance	<71db		
	Input facility -Phases / Wires	3-Phase / 4-Wire & Ground (R, Y, B -Phases & Ground)		
	Nominal Input Voltage	340V to 460V.		
	Nominal Input Frequency	Nominal Input Frequency		
	Input Frequency Range	50Hz (± 5%)		
	Input Power Factor	> 0.99 on Full load		
	Input Current Harmonic Distortion (THDi)	<5 % on Full Load		
	Generator Compatibility	Compatibility to gen set supply used for this project		
	,	a) Input to Rectifier		
	Input Protection	b) Input to Bypass		
		c) Manual Bypass (In-built)		
	Over voltage/under voltage	Yes		
	Input Frequency variation protection	Yes		
	Surge protection	Yes		
		The UPS should have protection at Input side for phase		
	Phase sequence change	sequence change		
	Nominal Output Voltage	380/400/415Vac (Three Phase Four-wire)		
	Output Voltage Regulation	+/- 1%		
	Nominal Output Frequency	50Hz (± 5%)		
		+/- 0.05 Hz (Free Running / Self Clocked Mode)		
	Output Frequency Regulation	+ / - 6 % (Synchronized to Mains Mode, Selectable)	•	
	Output Wave Form	Pure sine wave		
		<= 3% (For 100% Linear / Resistive Load)		
	Output Voltage Distortion (THDu)	<= 5% (For 100% Non-Linear)		
	Crest Factor	3 : 1 On Full Load		
	Unbalanced load on phases	100% unbalanced load should be allowed		
	Voltage symmetry with 100% Unbalanced			
	Load	+/- 1%		
	Output Protection	Yes		
	Output Protection.	Yes		
	Over-temperature protection.	Yes		
		Built-in, solid-state charger with appropriate ratings		
	Rectifier / Charger	Duncin, Sonu-State Charger with appropriate ratings		
	Rectifier / Charger	Pinnle free charging		
	Battery Charger Ripple	Ripple free charging		
	Battery Charger Ripple DC bus voltage ripple	< 1 RMS		
	Battery Charger Ripple DC bus voltage ripple Overall Efficiency	< 1 RMS Efficiency : 96 %		
	Battery Charger Ripple DC bus voltage ripple	< 1 RMS Efficiency: 96 % <= 1.0 Volt		
	Battery Charger Ripple DC bus voltage ripple Overall Efficiency	< 1 RMS  Efficiency : 96 % <= 1.0 Volt  Nil from Mains mode to Battery Mode		
	Battery Charger Ripple DC bus voltage ripple Overall Efficiency Output N-E voltage	< 1 RMS Efficiency: 96 % <= 1.0 Volt		

S. No.	Parameter	Specification	Compliance (Yes/No)	Remarks
	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)		
	Inverter Overload capacity (Mains Mode &	125% for 10 minutes		
	Battery Mode)	150% for 60 seconds		
	Backup Required	15 minutes on rated load		
	Battery Type	Sealed Maintenance Free (SMF), valve regulated		
7.	Duration in which totally discharged batteries are to be recharged	8 -10 hours		
8.	Nominal DC bus Voltage	or as per design standard of Manufacturer		
9.	During Battery float mode	To be specified by bidder		
10.	During Battery Boost mode	To be specified by bidder		
11.	Battery charging with temp. Compensation	Should be available		
12.	Ripple voltage at full load	<2% RMS without Battery and <1% with Battery		
13.	Type of battery charging circuit.	Constant Voltage with Current Limit		
14.	Battery End Cell Voltage	1.65 to 1.8 auto adjustable with load % (back-up time). However, Battery sizing should based on end cell voltage as 1.7V DC		
15.	LED Mimic	Mimic provided on front panel to indicate power flow to the critical load with an indication of the availability of the rectifier, battery, automatic, bypass, inverter and load		
16.	Alarms and Status Information	All faults conditions to be displayed in LCD with alarm (sound)		
		Input Voltage (Line to Neutral) Bypass frequency Bypass Voltage (Line to Line and line to Neutral) Bypass Frequency		
		Output Voltage (Line To Neutral) Output Current per Phase (L1, L2, L3)		
47	Mataria	Output Frequency		
17.	Metering	Output load current (%) (L1, L2, L3)		
		Output Load (%) Average		
		Output Real power (KW) (L1, L2, L3)		
		Output Apparent power (KVA)		
		(L1, L2, L3)		
		Battery Current ( charge/discharge)		
		Battery Voltage		
18. 19.	Communication ports Protocols	Ethernet (10/100/1000)/RS232/RS485  HTTP/SNMP/Mod-bus/Ethernet with Modbus TCP support		
20.	Width (in mm)	Specify  Specify		
21.	Depth (in mm) Height (in mm)	Specify Specify		
23.	All Modes Protection	(L-L, L-N, L-G, N-G)		
24.	Surge Current Capacity	200KA		
25.	Fault Current rating	200Ka/C		
26.	Connection Type	Parallel		
27.	Response Time	<0.5NanoSec		
28.	Status Indication	LEDs and Dry Contacts		
29.	Protection Level	< 0.8 kV		
30.	EMI /RFI Attenuation	45db Typical		
31.	Certifications	UL1449		-
32.	Credentials	The Manufacturer should have ISO 9001 and 14001 Certificates		





































