



HLL BIOTECH LIMITED
(Subsidiary of HLL Lifecare Limited)
(A Government of India Enterprise)

TENDER DOCUMENT FOR
SUPPLY AND INSTALLATION OF HT DG SET
AT HLL BIOTECH LIMITED, CHENGALPATTU
PROJECT NO: 120310
DOCUMENT NO: NPI-120310-ELC-S1-TD-02
REVISION NO.: 01
JULY 2014
PROJECT NAME: INTEGRATED VACCINES COMPLEX

Client : 	TENDER DOCUMENT FOR SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF HT DG SET AT IVC HBL, CHENGALPATTU	nne pharmaplan®
Project No : 120310	DOCUMENT NO : NPI-120310-ELC-S1-TD-02	Revision : 01 Date : 2014.07.30

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CHAPTER 1.1

GENERAL INFORMATION & TENDER ENQUIRY DOCUMENT

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SECTION I

Notice Inviting Tender (NIT) HLL Biotech Ltd.

INVITES TENDER FOR SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF 2 Nos of 11 KV 2.0 MVA DG SETS AT INTEGRATED VACCINES COMPLEX, CHENGALPATTU

Tenders are invited from vendors for Design, Supply, Installation, Testing and Commissioning of the following:

S.No	System	Capacity / Size	Qty	EMD	Tender fee
1	DG SET	11 KV,2MVA(Prime duty, net output)	2 Nos	Rs.12,00,000/-	Rs.3,150/-

Note: The list may vary (increase / decrease) during order finalisation.

Details regarding important dates are as follows:

S.No.	Description	Schedule
i.	Pre Bid Meeting Date & Time	07-08-2014, at 11:00 HRS
ii.	Pre Bid Meeting Venue	HLL Biotech Limited, Ticel Biopark Campus (Module no. 013-015), CSIR Road, Taramani, Chennai- 600 113
iii.	Closing date & time for receipt of Tender	21-08-2014, at 15:00 Hrs
iv.	Time and date of opening of Technical Bids	21-08-2014, at 15:30 Hrs
v.	Venue of Opening of Techno Commercial Tender	HLL Biotech Limited, Ticel Biopark Campus (Module no. 013-015), CSIR Road, Taramani, Chennai- 600 113

Interested parties may visit www.lifecarehll.com / www.hllbiotech.com & <http://eprocure.gov.in/cppp> to download the Tender. Subsequent amendments/ addendum if any will be published in these websites, The parties are advised to visit the website regularly for updates. Tenders in sealed envelopes superscribing

**“TENDER FOR SUPPLY, INSTALLATION TESTING AND COMMISSIONING OF
2 Nos of 11 KV, 2.0 MVA DG SETs
At Integrated Vaccines Complex, Chengalpattu
Tender No. NPI-120310-ELC-S1-TD-02**

To be submitted to the address mentioned in Serial no. v of the table above.

The main envelope containing sealed Price and Technical Bids should be sealed and superscribed with “NOT TO BE OPENED before ----- (The tenderer should mention the date & time of tender opening)”.

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INSTRUCTIONS TO BIDDERS

1. The successful bidder will have to enter into a written Contract / Agreement with the Purchaser, the terms and conditions of which are enclosed herewith.
2. The tender should be signed in long hand, dated, duly stamped and witnessed at all places provided therein. Also all pages, drawings, corrections/alterations should be initialled /stamped.
3. Bidder must be careful to deliver a bonafide tender. Any tender which proposes any alterations to any of the conditions laid down or which proposes any other conditions or any description whatsoever is liable to be rejected.
4. Submission of tenderers' quotation by a telegram/fax/mail will not be considered.
5. Tenders must be accompanied by a certified true copy of the Power of Attorney in favour of the signatory to the tender which should inter alia empower him/her to bind the firm to Arbitration Clause given in the Articles of Agreement and Contract conditions.
6. In case a blank tender is being submitted, it should be marked prominently '**BLANK**' on the envelope and signed by the authorized person.
7. In view of postal and other delays, the tenders should be posted sufficiently in advance of the last date fixed for receipt of tenders or be sent by a special messenger. Tender received late shall be liable for rejection.
8. **It must be clearly understood that the contract is an Item wise contract.**
9. Prices shall be written in ink and shall be entered both in figures and words. In case of discrepancy, the figure quoted in words shall be taken as accurate. In case of any discrepancy in the unit rate and amount, the unit rate shall be taken as accurate.
10. Prices quoted by the bidder shall be firm and valid even if the contract is split in to two or more parts among different bidders.
11. The bidder shall be deemed to have been allowed in his rates and prices for the provision, maintenance and final removal of all temporary works of whatsoever nature. No specific item of any or particular temporary shed/work will be measured and paid for separately.
12. The bidder shall include the proposed quality assurance program containing overall quality management and procedural requirements to be adhered to during the execution of the contract to maintain effective quality assurance system as outlined by the recognized codes for various works in their offer, along with quality assurance manual, officials responsible for the same and their organizational approach for quality control.
13. Bidder should furnish the following details along with their offer : -
 - Quality Assurance plan
 - Bar chart / Project schedule

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GENERAL INFORMATION

PROJECT LOCATION	:	HLL Biotech Limited, Chengalpattu, Chennai.
PROJECT TITLE	:	Integrated Vaccines Complex (IVC)
CORPORATE OFFICE	:	HLL Biotech Limited Ticel Biopark Ltd, Module no 13-15 CSIR Road, Taramani Chennai – 600113 Tel No: +91 44 22544949/974/970 NNE Pharmaplan India Limited Noida : B-15, Sector 2 Noida – 201 301 Tel: +91 120 – 4775100, Fax: +91 120 – 4775200
ENGINEERING CONSULTANT	:	Bangalore Office: # 12, Achiah Shetty Layout R.M.V. Extension Sadashivanagar Bangalore – 560080 Tel.: +91 80 49056300
CLIMATE	:	Maximum Relative Humidity: 88% Maximum Temperature: 39.4°C Minimum Temperature: 18.3°C Ref: ISHRAE Handbook
ACCESS TO SITE	:	By Road (Chennai to Chengalpattu GST Road) Nearest Railway Station is Chennai Nearest airport is Chennai

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1. Introduction

HLL Biotech Limited (HBL), a 100% subsidiary company of HLL Lifecare Limited, (a CPSU under Ministry of Health & Family Welfare, Government of India) is implementing "The Integrated Vaccines Complex (IVC) - a project of national importance' at Chengalpattu, near Chennai. The proposed complex is a state of the art facility with cGMP compliance for manufacturing vaccines required for the immunization programme of Government of India.

HLL Biotech Limited has associated with NNE Pharmaplan India Limited, hereinafter called as "NPI" has been appointed as "Engineering Consultants". NNE Pharmaplan shall design and engineer this facility, incorporating the latest GMP Standards and best practices. This facility shall be built as per the latest International trends and upon completion, shall be in compliance with Indian FDA (Schedule M), WHO/GMP regulations.

One amongst the several other jobs is to supply, install, test and commission 2 Nos of 11 KV 2 MVA DG Sets.

The scope of work involved is detailed in the subsequent paragraphs and is precise to the extent possible. However, it is expected from the supplier to consider and supply all those required for successful installation and functioning of the equipment / system.

2. Scope of Vendor

- The scope of vendor would be to comply with Specification in part-II
- Quote is for the Set as per Specification & BOQ. The price should include all taxes & duties, insurance, Transportation, P&F, Octroi : documentation; start-up & commissioning; complete qualification package and training and charges whatsoever required to complete the task in all respects to ensure the equipment operation is in accordance with the requirements of tender specifications
- The complete system should be supplied and installed as per the statutory regulations.
- Quality and Project Planning: The Quality and Project Plan should define the activities to be performed, their timing, who will perform them, the control mechanisms to be used, and the deliverable items. Project Time Schedule must be submitted for that purpose. This Proposal should define:
 - ✓ Project Milestones
 - ✓ Project Activities
 - ✓ Planned start and end date of each activity
- System Build (assembly and system integration): The final assembly of the mechanical, electrical, and control components (hardware and software) into an integrated functional system should be performed by the vendor – according to the approved drawings (e.g. installation drawing, P&ID, electrical diagrams).
- Construction Review: The integrated functional system will be reviewed against the Specification and the approved drawings (e.g. installation drawing, GA drawing and P&ID, electrical diagrams).
 - a) Testing: Vendor to describe testing not related to specific user requirements, but which is required for other purposes, e.g. Functional Testing: The Functional Testing is not related to specific user requirements, but is required for other purposes, e.g. to comply with regulatory requirements applicable to the manufacture of the system.

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- Installation: Installation is a set of activities that have to be completed before system acceptance testing can start. Such activities include: putting in place, levelling, connecting media (including electrical power), turning on and checking for leakages, fixing any leakages, checking direction of rotation for electrical motors, calibration, etc. The installation –has to be performed by the vendor.

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SECTION – II

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3	Language of Tender
4	Eligible Tenderers
5	Eligible Goods and Services
6	Tendering Expense & Tender Fee
B	TENDER ENQUIRY DOCUMENTS
7	Contents of Tender Enquiry Documents
8	Amendments to Tender Enquiry Documents
9	Clarification of Tender Enquiry Documents
C	PREPARATION OF TENDERS
10	Documents Comprising the Tender
11	Tender Currencies
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16	Documents Establishing Tenderer's Eligibility and Qualifications
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E	TENDER OPENING

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SI. No.	Topic
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A. PREAMBLE

1. Definitions and Abbreviations:

1.1 The following definitions and abbreviations, which have been used in these documents shall have the meanings as indicated below:

1.2 Definitions:

- (i) "Purchaser" means the organization and / or its representatives (consultants) purchasing goods and services as incorporated in the Tender Enquiry document.
- (ii) "Tender" means Bids / Quotation / Tender received from a Firm / Tenderer / Bidder.
- (iii) "Tenderer" means Bidder/ the Individual or Firm submitting Bids / Quotation / Tender
- (iv) "Supplier" means the individual or the firm supplying the goods and services as incorporated in the contract.
- (v) "Goods" means the articles, material, commodities, livestock, furniture, fixtures, raw material, spares, instruments, machinery, equipment, medical equipment, industrial plant etc. which the supplier is required to supply to the purchaser under the contract.
- (vi) "Services" means services allied and incidental to the supply of goods, such as transportation, installation, commissioning, provision of technical assistance, training, after sales service, maintenance service and other such obligations of the supplier covered under the contract.
- (vii) "Earnest Money Deposit" (EMD) means Bid Security/ monetary or financial guarantee to be furnished by a tenderer along with its tender.
- (viii) "Contract" means the written agreement entered into between the purchaser and/or consignee and the supplier, together with all the documents mentioned therein and including all attachments, annexure etc. therein.
- (ix) "Performance Security" means monetary or financial guarantee to be furnished by the successful tenderer for due performance of the contract placed on it. Performance Security is also known as Security Deposit.
- (x) "Consignee" means the organization/person to whom the goods are required to be delivered as specified in the Contract. If the goods are required to be delivered to a person as an interim consignee for the purpose of despatch to another person as provided in the Contract then that "another" person is the consignee, also known as ultimate consignee. Consignee is HLL BIOTECH LIMITED, Chennai.
- (xi) "Specification" means the document/standard that prescribes the requirement with which goods or service has to conform.
- (xii) "Inspection" means activities such as measuring, examining, testing, gauging one or more characteristics of the product or service and comparing the same with the specified requirement to determine conformity.
- (xiii) "Day" means calendar day.

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1.3 Abbreviations:

- (i) "TE Document" means Tender Enquiry Document
- (ii) "NIT" means Notice Inviting Tenders.
- (iii) "GIT" means General Instructions to Tenderers
- (iv) "SIT" means Special Instructions to Tenderers
- (v) "GCC" means General Conditions of Contract
- (vi) "SCC" means Special Conditions of Contract
- (vii) "DGS&D" means Directorate General of Supplies and Disposals
- (viii) "NSIC" means National Small Industries Corporation
- (ix) "PSU" means Public Sector Undertaking
- (x) "CPSU" means Central Public Sector Undertaking
- (xi) "LSI" means Large Scale Industry
- (xii) "SSI" means Small Scale Industry
- (xiii) "LC" means Letter of Credit
- (xiv) "DP" means Delivery Period
- (xv) "BG" means Bank Guarantee
- (xvi) "ED" means Excise Duty
- (xvii) "CD" means Custom Duty
- (xviii) "VAT" means Value Added Tax
- (xix) "CENVAT" means Central Value Added Tax
- (xx) "CST" means Central Sales Tax
- (xxi) "RR" means Railway Receipt
- (xxii) "BL" means Bill of Lading
- (xxiii) "FOB" means Free on Board
- (xxiv) "FOR" means Free On Rail
- (xxv) "DAP" means Delivered At Place (Consignee site)
- (xxvi) "INCOTERMS" means International Commercial Terms as on the date of Tender Opening
- (xxvii) "MOH&FW" means Ministry of Health & Family Welfare, Government of India.
- (xxviii) "RT" means Re-Tender.

2. Introduction

- 2.1 The Purchaser has issued these TE documents for purchase of goods and related services as mentioned in subsequent paragraphs which also indicates, inter alia, the required delivery schedule, terms and place of delivery.
- 2.2 This section GIT (Section II - "General Instruction to Tenderers") provides the relevant information as well as instructions to assist the prospective tenderers in preparation and submission of tenders. It also includes the mode and procedure to be adopted by the purchaser for receipt and opening as well as scrutiny and evaluation of tenders and subsequent placement of contract.
- 2.3 The tenderers shall also read the Special Instructions to Tenderers (SIT) related to this purchase, as contained in Section III of these documents and follow the same accordingly. Whenever there is a conflict between the GIT and the SIT, the provisions contained in the SIT shall prevail over those in the GIT.
- 2.4 Before formulating the tender and submitting the same to the purchaser, the tenderer should read and examine all the terms, conditions, instructions, checklist etc. contained in the TE documents. Failure to provide and/or comply with the required information, instructions etc. incorporated in these TE documents may result in rejection of its tender.

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3. Language of Tender

- 3.1 The tender submitted by the tenderer and all subsequent correspondence and documents relating to the tender exchanged between the tenderer and the purchaser, shall be written in the English language, unless otherwise specified in the Tender Enquiry. However, the language of any printed literature furnished by the tenderer in connection with its tender may be written in any other language provided the same is accompanied by an English translation and, for purposes of interpretation of the tender, the English translation shall prevail.
- 3.2 The tender submitted by the tenderer and all subsequent correspondence and documents relating to the tender exchanged between the tenderer and the purchaser, may also be written in the Hindi language, provided that the same are accompanied by English translation, in which case, for purpose of interpretation of the tender etc, the English translations shall prevail.

4. Eligible Tenderers

- 4.1 This invitation for tenders is open to all suppliers who fulfil the eligibility criteria specified against clause 16 of GIT Sec. II in this document.

5. Eligible Goods and Services

- 5.1 All goods and related services to be supplied under the contract shall have their origin in India or any other country with which India has not banned trade relations. The term "origin" used in this clause means the place where the goods are mined, grown, produced, or manufactured or from where the related services are arranged and supplied.

6. Tendering Expense and Tender fee

- 6.1 **Tender Expense:** The tenderer shall bear all costs and expenditure incurred and/or to be incurred by it in connection with its tender including preparation, mailing and submission of its tender and for subsequent processing the same. The purchaser will, in no case be responsible or liable for any such cost, expenditure etc regardless of the conduct or outcome of the tendering process.
- 6.2 **Tender Cost/Tender fee:** The tenderer should submit the tender fee of INR 3150 to be checked (Rupees Three Thousand one hundred fifty only) in the form of Demand Draft or Banker's cheque in favour of HLL Biotech limited, payable at Chennai. The DD/ Banker's cheque has to be enclosed along with the technical bid which is non-refundable. In case of cancellation of tender by HBL, the tender cost/fee shall be refunded. Tender received without tender fee shall be liable for rejection.

B. TENDER ENQUIRY DOCUMENTS

7. Content of Tender Enquiry Documents

- 7.1 In addition to Section I – "Notice inviting Tender" (NIT), the TE documents include:

- Section II – General Instructions to Tenderers (GIT)
- Section III – Special Instructions to Tenderers (SIT)
- Section IV – General Conditions of Contract (GCC)
- Section V – Special Conditions of Contract (SCC)
- Section VI – List of Requirements
- Section VII – Technical Specifications
- Section VIII – Quality Control Requirements
- Section IX – Qualification Criteria
- Section X – Tender Form

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- Section XI – Price Schedules
- Section XII – Questionnaire
- Section XIII – Bank Guarantee Form for EMD
- Section XIV – Manufacturer's Authorisation Form
- Section XV – Bank Guarantee Form for Performance Security
- Section XVI – Contract Forms A & B
- Section XVII – Proforma of Consignee Receipt Certificate
- Section XVIII – Proforma of Final Acceptance Certificate by the consignee
- Section XIX – Check List for the Tenderers
- Section XX – Consignee List
- Section XXI – Integrity Pact
- Section XXII – Instruction of Ministry of Shipping & Transport, New Delhi, India
- Section XXIII – Schedule of Fiscal Aspects

7.2 The relevant details of the required goods and services, the terms, conditions and procedure for tendering, tender evaluation, placement of contract, the applicable contract terms and also the standard formats to be used for this purpose are incorporated in the above-mentioned documents. The interested tenderers are expected to examine all such details etc to proceed further.

8. Amendments to Tender Enquiry documents

- 8.1 At any time prior to the deadline for submission of tenders, the purchaser may, for any reason deemed fit by it, modify the TE documents by issuing suitable amendment(s) to it.
- 8.2 Such an amendment will be notified in the website of www.hllbiotech.com/www.lifecarehll.com/http://eprocure.gov.in/cppp. The interested parties are advised to regularly visit the website for further updates.
- 8.3 In order to provide reasonable time to the prospective tenderers to take necessary action in preparing their tenders as per the amendment, the purchaser may, at its discretion extend the deadline for the submission of tenders and other allied time frames, which are linked with that deadline.

9. Clarification of Tender Enquiry documents

- 9.1 A Tenderer requiring any clarification or elucidation on any issue of the TE documents may take up the same during the pre bid meeting. The purchaser will respond to such request by publishing the response / clarification in the official websites.

C. PREPARATION OF TENDERS

10. Documents Comprising the Tender

- 10.1 The Two Bid System, i.e. “**Technical Bid**” and “**Price Bid**” prepared by the tenderer shall comprise the following:

A) Technical bid (Un-priced Bid)

- i) Earnest money furnished in accordance with GIT clause 18.1 alternatively, documentary evidence as per GIT clause 18.2 for claiming exemption from payment of earnest money.
- iii) Tender Form as per Section X (Without mentioning the price).

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- iv) Documentary evidence, as necessary in terms of GIT clauses 4 and 16 establishing that the tenderer is eligible to submit the tender and also qualified to perform the contract if its tender is accepted.
- v) Tenderer/Agent who quotes for goods manufactured by other manufacturer shall furnish Manufacturer's Authorisation Form.
- vi) Power of attorney in favour of the signatory of the tender document.
- vii) Documents and relevant details to establish in accordance with GIT clause 17 that the goods and the allied services to be supplied by the tenderer conform to the requirement of the TE documents.
- viii) Supporting documents as per section IX along with relevant copies of orders and end users' satisfaction certificate.
- ix) Vendor has to specify the make & model of the DG Sets intend to supply against this tender.
- x) DELETED
- xi) Checklist as per Section XIX.
- xii) Vendor should submit all other details like drawings, technical details as required in tender.
- xiii) Tender fee in the format specified in Clause 6.2 of GIT.

B) Price Bid:

The Tender form as per Section X & Price schedule as per section XI duly filled, sealed and signed should be submitted with the prices indicated.

10.2 Note to the Bidder(s)

1. All pages of the Tender should be page numbered and indexed.
2. It is the responsibility of tenderer to go through the TE document to ensure furnishing all required documents in addition to above, if any.

10.3 The tender should be signed in long hand, dated, duly stamped and witnessed at all places provided therein. Also all pages, drawings, corrections/alterations should be initialled/stamped.

10.4 A tender, which does not fulfill any of the above requirements and/or gives evasive information/reply against any such requirement, shall be liable to be ignored and rejected.

10.5 Tender sent by fax/telex/cable/electronically shall be ignored.

11. Tender Currencies

11.1 The tenderer shall quote only in Indian Rupees.

11.2 DELETED

11.3 Tenders, where prices are quoted in any other way shall be treated as non-responsive and rejected.

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12. Tender Prices

- 12.1 The Tenderer shall indicate on the Price Schedule provided under Section XI all the specified components of prices shown therein including the unit prices and total tender prices of the goods and services proposes to supply against the requirement. All the columns shown in the price schedule should be filled up as required. If any column does not apply to a tenderer, same should be clarified as “NA” by the tenderer.
- 12.2 The price of the schedule complete in all respect will be evaluated and the L1 party will be identified.
- 12.3 DELETED
- 12.4 While filling up the columns of the Price Schedule, the following aspects should be noted for compliance:
- 12.4.1 The prices quoted in the price schedule shall be inclusive of all applicable taxes & duties, insurance, Transportation, P&F, Octroi etc. The quoted price shall also be inclusive for the services to be provided to obtain the necessary statutory approvals required for this work. However the Purchaser will reimburse the applicable government fees paid on behalf of Purchaser by the tenderer.
- 12.5 DELETED
- 12.6 For insurance of goods to be supplied, relevant instructions as provided under GCC Clause 11 shall be followed.

13. DELETED

14. Firm Price

- 14.1 Unless otherwise specified in the SIT, prices quoted by the tenderer shall remain firm and fixed during the contract period and not subject to variation on any account. However, for the Price for the Items listed in the Schedule of quantities, the unit price quoted shall remain same irrespective of quantity variation.

15. Alternative Tenders

- 15.1 Alternative Tenders are not permitted.

16. Documents Establishing Tenderers Eligibility and Qualifications

- 16.1 Pursuant to GIT clause 10, the tenderer shall furnish, as part of its tender, relevant details and documents establishing its eligibility to quote and its qualifications to perform the contract if its tender is accepted.
- 16.2 The documentary evidence needed to establish the tenderer’s qualifications shall fulfil the following requirements:
- a) In case, the tenderer offers to supply goods, which are manufactured by some other firm where, the tenderer has been duly authorised by the goods manufacturer to quote for and supply the goods to the purchaser. The tenderer shall submit the manufacturer’s authorization letter to this effect as per the standard form provided under Section XIV in this document.

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- b) The tenderer has the required financial, technical and production capability necessary to perform the contract and, further, it meets the qualification criteria incorporated in the Section IX in these documents.
- c) In case the tenderer is not doing business in India, it is duly represented by an agent stationed in India fully equipped and able to carry out the required contractual functions and duties of the supplier including after sale service, maintenance & repair etc. of the goods in question, stocking of spare parts and fast moving components and other obligations, if any, specified in the conditions of contract and/or technical specifications.
- d) In case the tenderer is an Indian agent/authorized representative quoting on behalf of a foreign manufacturer for the **restricted item**, the Indian agent/authorized representative is already enlisted under the Compulsory Enlistment Scheme of Ministry of Finance, Govt. of India, operated through Directorate General of Supplies & Disposals (DGS&D), New Delhi.

17. Documents establishing Good's Conformity to Tender Enquiry document.

- 17.1 The tenderer shall provide the required as well as the relevant documents like technical data, literature, drawings etc. along with their bid submission to establish that the goods and services offered in the tender fully confirm to the goods and services specified by the purchaser in the TE document. For this purpose the tenderer shall also provide a **clause-by-clause commentary on the technical specifications and other technical details incorporated by the purchaser in the TE documents to establish technical responsiveness of the goods and services offered in its tender.**
- 17.2 No deviations will be entertained towards this tender. In case there is any variation and/or deviation between the goods & services prescribed by the purchaser and that offered by the tenderer, the tenderer shall list out the same and get it clarified during pre-bid meeting.
- 17.3 If a tenderer furnishes wrong and/or misleading data, statement(s) etc. about technical acceptability of the goods and services offered by it, its tender will be liable to be ignored and rejected in addition to other remedies available to the purchaser in this regard.

18. Earnest Money Deposit (EMD)

- 18.1 Pursuant to GIT clauses 7.1 and 10.1 the tenderer shall furnish along with its tender, earnest money for amount as shown in the NIT. The earnest money is required to protect the purchaser against the risk of the tenderer's unwarranted conduct as amplified under sub-clause 18.7 below.
- 18.2 The tenderers who are currently registered and, also, will continue to remain registered during the tender validity period with National Small Industries Corporation, New Delhi for the specific goods as per tender enquiry specification shall be eligible for exemption from EMD. Vague stipulations in the Registration Certificates such as "to customers' specification" etc. will not be acceptable for exemption from furnishing of earnest money. In case the tenderer falls in these categories, it should furnish copy of its valid registration details (with NSIC). The EMD should be furnished in the name of "HLL Biotech Limited, payable at Chennai".
- 18.3 The earnest money shall be denominated in Indian Rupees or equivalent currencies as per GIT clause 11.2. The earnest money shall be furnished in the form of Bank Guarantee
- 18.4 EMD in the form of bank guarantee should be provided from any scheduled commercial bank in India as per the format specified under Section XIII of this tender.
- 18.5 The earnest money shall be valid for a period of forty-five (45) days beyond the validity period of the tender. As validity period of Tender as per Clause 19 of GIT is 120 days, the EMD shall

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be valid for 165 days from Technical Bid opening date. Tender received without EMD shall be liable for rejection

18.6 The EMD of technically disqualified parties shall be returned without any interest after opening of price bids of technically qualified parties. The EMD of unsuccessful bidders in price bid will be returned to them without any interest, after expiry of the tender validity period, but not later than thirty days after conclusion of the resultant contract. Successful tenderer's earnest money will be returned without any interest, after receipt of performance security from that tenderer.

18.7 Earnest Money is required to protect the purchaser against the risk of the Tenderer's conduct, which would warrant the forfeiture of the EMD. Earnest money of a tenderer will be forfeited, if the tenderer withdraws or amends its tender or impairs or derogates from the tender in any respect within the period of validity of its tender or if it comes to notice that the information/documents furnished in its tender is incorrect, false, misleading or forged without prejudice to other rights of the purchaser. The successful tenderer's earnest money will be forfeited without prejudice to other rights of Purchaser if it fails to furnish the required performance security within the specified period.

18.8 In the case of Bank Guarantee furnished from banks outside India (i.e. foreign Banks), it should be authenticated and countersigned by any scheduled commercial bank, but not cooperative banks in India by way of back-to-back counter guarantee.

19. Tender Validity

19.1 If not mentioned otherwise in the SIT, the tenders shall remain valid for acceptance for a period of 120 days (One hundred and twenty days) from the date of tender opening prescribed in the TE document. Any tender valid for a shorter period shall be treated as unresponsive and rejected.

19.2 In exceptional cases, the tenderers may be requested by the purchaser to extend the validity of their tenders up to a specified period. Such request(s) and responses thereto shall be conveyed by surface mail or by fax/ telex/cable followed by surface mail. The tenderers, who agree to extend the tender validity, are to extend the same without any change or modification of their original tender and they are also to extend the validity period of the EMD accordingly. A tenderer, however, may not agree to extend its tender validity without forfeiting its EMD.

19.3 In case the day up to which the tenders are to remain valid falls on/ subsequently declared a holiday or closed day for the purchaser, the tender validity shall automatically be extended up to the next working day.

20. Signing and Sealing of Tender

20.1 The tenderers shall submit their tenders as per the instructions contained in GIT Clause 10

20.2 The tender shall either be typed or written in indelible ink and the same shall be signed by the tenderer or by a person(s) who has been duly authorized to bind the tenderer to the contract. The letter of authorization shall be by a written power of attorney, which shall also be furnished along with the tender.

20.3 The tender shall be duly signed at the appropriate places as indicated in the TE documents and all other pages of the tender including printed literature, if any shall be initialled by the same person(s) signing the tender. The tender shall not contain any erasure or overwriting, except as necessary to correct any error made by the tenderer and, if there is any such correction; the same shall be initialled by the person(s) signing the tender.

20.4 The tenderer should seal the tender and write the address of the purchaser and the tender reference number on the envelope. The inner envelopes are then to be put in the bigger outer

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envelope, which will also be duly sealed and marked. The sentence “NOT TO BE OPENED before.....” (The tenderer is to put the date & time of tender opening)” is to be written on the bigger envelope. If the outer envelope is not sealed and marked properly as above, the purchaser will not assume any responsibility for its misplacement, premature opening, late opening etc.

- 20.5 The document seeks quotation following Two BID System, in two parts. First part will be known as ‘Technical Bid’, and the second part ‘Price Bid’ as specified in clause 10 of GIT. Tenderer shall seal ‘Technical Bid’ and ‘Price Bid’ separately and covers will be suitably super scribed. Both these sealed covers shall be put in a bigger cover and sealed and procedure prescribed in Paras 20.1 to 20.4 followed.

D. SUBMISSION OF TENDERS

21. Submission of Tenders

- 21.1 Unless otherwise specified, the tenders are to be submitted to **The Chief Executive Officer, HLL Biotech Limited, Tichel Biopark Campus (Module no. 013-015), CSIR Road, Taramani, Chennai- 600 113**
- 21.2 The tenderers must ensure that they submit their tenders not later than the closing time and date specified for submission of tenders. It is the responsibility of the tenderer to ensure that their Tenders whether sent by post or by courier or by person, reaches the address mentioned in GIT 21.1 by the specified clearing date and time.
- 21.3 In the event the specified date for submission of tender falls on / is subsequently declared a holiday or closed day for the purchaser, the tenders will be received up to the appointed time on the next working day.

22. Late Tender

- 22.1 A tender, which is received after the specified date and time for receipt of tenders will be treated as “late” tender and will be ignored and not considered.

23. Alteration and Withdrawal of Tender

- 23.1 The tenderer, after submitting its tender, is permitted to alter / modify its tender so long as such alterations / modifications are received duly signed, sealed and marked like the original tender, within the deadline for submission of tenders. Alterations / modifications to tenders received after the prescribed deadline will not be considered.
- 23.2 No tender should be withdrawn after the deadline for submission of tender and before expiry of the tender validity period. If a tenderer withdraws the tender during this period, it will result in forfeiture of the earnest money furnished by the tenderer in its tender. In case of alterations / modifications to tender, the latest alteration/modification will supersede information given in earlier tender.

E. TENDER OPENING

24. Opening of Tenders

- 24.1 The purchaser will open the tenders at the specified date and time and at the specified place as indicated in the NIT. In case the specified date of tender opening falls on / is subsequently declared a holiday or closed day for the purchaser, the tenders will be opened at the appointed time and place on the next working day.

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- 24.2 Authorized representatives of the tenderers, who have submitted tenders on time, may attend the tender opening, provided they bring with them letters of authority from the corresponding tenderers.

The tender opening official(s) will prepare a list of the representatives attending the tender opening. The list will contain the representatives' names & signatures and corresponding tenderers' names and addresses.

- 24.3 Two - Tender system as mentioned in para 20.5 above will be as follows. The Technical Bids are to be opened in the first instance, at the prescribed time and date as indicated in NIT. These Tenders shall be scrutinized and evaluated by the competent committee/ authority with reference to parameters prescribed in the TE document. During the Technical Bid opening, the tender opening official(s) will read the salient features of the tenders like brief description of the goods offered, delivery period, Earnest Money Deposit, Tender Fee and any other special features of the tenders, as deemed fit by the tender opening official(s). Thereafter, in the second stage, the Price Bid of only the Technically qualified offers (as decided in the first stage) shall be opened for further scrutiny and evaluation on a date notified after the evaluation of the Technical Bid. The prices, special discount if any of the goods offered etc., as deemed fit by tender opening official(s) will be read out.

F. SCRUTINY AND EVALUATION OF TENDERS

25. Basic Principle

- 25.1 Tenders will be evaluated on the basis of the terms & conditions already incorporated in the TE document, based on which tenders have been received and the terms, conditions etc. mentioned by the tenderers in their tenders. No new condition will be brought in while scrutinizing and evaluating the tenders.

26. Preliminary Scrutiny of Tenders

- 26.1 The Purchaser will examine the Tenders to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed stamped and whether the Tenders are generally in order.
- 26.2 Prior to the detailed evaluation of Price Bid, pursuant to GIT Clause 33, the Purchaser will determine the substantial responsiveness of each Tender to the TE Document. For purposes of these clauses, a substantially responsive Tender is one, which conforms to all the terms and conditions of the TE Documents without material deviations. Deviations from, or objections or reservations to critical provisions such as those concerning Performance Security (GCC Clause 5), Warranty (GCC Clause 15), EMD (GIT Clause 18), Taxes & Duties (GCC Clause 20), Force Majeure (GCC Clause 26) and Applicable law (GCC Clause 31) will be deemed to be a material deviation. The Purchaser's determination of a Tender's responsiveness is to be based on the contents of the tender itself without recourse to extrinsic evidence.
- 26.3 If a Tender is not substantially responsive (Non-Responsive), it will be rejected by the Purchaser and cannot subsequently be made responsive by the Tenderer by correction of the nonconformity.
- 26.4 The tenders will be scrutinized to determine whether they are complete and meet the essential and important requirements, conditions etc. as prescribed in the TE document. The tenders, which do not meet the basic requirements, are liable to be treated as non – responsive and will be summarily ignored. A non-responsive tender is one which deviates technically or commercially from any specific provision in the tender enquiry.

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26.5 The following are some of the important aspects, for which a tender shall be declared non – responsive and will be summarily ignored:

- (i) Tender form as per Section X (signed and stamped) not enclosed
- (ii) Tender is unsigned.
- (iii) Tender validity is shorter than the required period.
- (iv) Required EMD (Amount, validity etc.) / exemption documents, tender fee (amount) have not been provided.
- (v) Tenderer has quoted for goods manufactured by other manufacturer(s) without the required Manufacturer's Authorisation Form as per Section XIV.
- (vi) Tenderer has not agreed to give the required performance security.
- (vii) Goods offered are not meeting the tender enquiry specification.
- (viii) Tenderer has not agreed to other essential condition(s) specially incorporated in the tender enquiry like terms of payment, liquidated damages clause, warranty clause, dispute resolution mechanism applicable law.
- (ix) Poor/ unsatisfactory past performance.
- (x) Tenderers who stand deregistered/banned/blacklisted by any Govt. Authorities.
- (xi) Tenderer is not eligible as per GIT Clauses 4.1 & 16.1.
- (xii) Tenderer has not quoted for the entire quantity as specified in the List of Requirements in the quoted schedule.
- (xiii) The signed Integrity Pact not enclosed by the Tenderer.

27. Minor Infirmary /Irregularity/Non-Conformity

27.1 If during the preliminary examination, the purchaser find any minor informality and/or irregularity and/or non-conformity in a tender, the purchaser may waive the same provided it does not constitute any material deviation and financial impact and, also, does not prejudice or affect the ranking order of the tenderers. Wherever necessary, the purchaser will convey its observation on such 'minor' issues to the tenderer, asking the tenderer to respond by a specified date. If the tenderer does not reply by the specified date or gives evasive reply without clarifying the point at issue in clear terms, that tender will be liable to be ignored.

28. Discrepancies in Prices

28.1 If, in the price structure quoted by a tenderer, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless the purchaser feels that the tenderer has made a mistake in placing the decimal point in the unit price, in which case the total price as quoted shall prevail over the unit price and the unit price corrected accordingly.

28.2 If there is an error in a total price, which has been worked out through addition and/or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected accordingly; and

28.3 If there is a discrepancy between the amount expressed in words and figures, the amount in words shall prevail, subject to sub clause 28.1 and 28.2 above.

28.4 If, as per the judgement of the purchaser, there is any such arithmetical discrepancy in a tender, the same will be suitably conveyed to the tenderer by registered / speed post/e-mail. If the tenderer does not agree to the observation of the purchaser, the tender is liable to be ignored & rejected.

29. Discrepancy between original and copies of Tender

Deleted

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30. Qualification Criteria

30.1 Tenders of the tenderers, who do not meet the required Qualification Criteria prescribed in Section IX, will be treated as non - responsive and will not be considered further.

31. **DELETED**

32. Schedule/ Package -wise Evaluation

32.1 In case the List of Requirements contains more than one schedule/ Package, the responsive tenders will be evaluated and compared separately for each schedule/package. The tender for a schedule/ package will not be considered if the complete requirements prescribed in that schedule/ package are not included in the tender.

33. Comparison of Tenders

33.1 Unless mentioned otherwise in Section – III – Special Instructions to Tenderers and Section – VI – List of Requirements, the comparison of the responsive tenders shall be carried out on the basis of price quoted in Price schedule (Section XI).

34. Additional Factors and Parameters for Evaluation and Ranking of Responsive Tenders

34.1 **DELETED**

34.2 The purchaser's evaluation of tender will also take into account the additional factors, if any, incorporated in SIT in the manner and to the extent indicated therein.

34.3 The Purchaser reserves the right to give the price preference to small-scale sectors etc. and purchase preference to central public sector undertakings as per the instruction in vogue while evaluating, comparing and ranking the responsive tenders.

35. Tenderer's capability to perform the contract

35.1 The purchaser, through the above process of tender scrutiny and tender evaluation will determine to its satisfaction whether the tenderer, whose tender has been determined as the lowest evaluated responsive tender is eligible, qualified and capable in all respects to perform the contract satisfactorily. If, there is more than one schedule/ package in the List of Requirements, then, such determination will be made separately for each schedule/ package.

35.2 The above-mentioned determination will, inter alia, take into account the tenderer's financial, technical and production capabilities for satisfying all the requirements of the purchaser as incorporated in the TE document. Such determination will be based upon scrutiny and examination of all relevant data and details submitted by the tenderer in its tender as well as such other allied information as deemed appropriate by the purchaser.

36. Contacting the Purchaser

36.1 From the time of submission of tender to the time of awarding the contract, if a tenderer needs to contact the purchaser for any reason relating to this tender enquiry and / or its tender, it should do so only in writing.

36.2 In case a tenderer attempts to influence the purchaser in the purchaser's decision on scrutiny, comparison & evaluation of tenders and awarding the contract, the tender of the tenderer shall be liable for rejection in addition to appropriate administrative actions being taken against that tenderer, as deemed fit by the purchaser.

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G. AWARD OF CONTRACT

37. Purchaser's Right to accept any tender and to reject any or all tenders

37.1 The purchaser reserves the right to accept in part or in full any tender or reject any or more tender(s) without assigning any reason or to cancel the tendering process and reject all tenders at any time prior to award of contract, without incurring any liability, whatsoever to the affected tenderer or tenderers.

38. Award Criteria

38.1 Subject to GIT clause 37 above, the contract will be awarded to the lowest evaluated responsive tenderer decided by the purchaser in terms of GIT Clause 35.

39. Variation of Quantities at the Time of Award/ Currency of Contract

39.1 At the time of awarding the contract, the purchaser reserves the right to increase or decrease by up to fifty (50) per cent, the quantity of goods and services mentioned in the schedule (s) in the "List of Requirements" (rounded off to next whole number) without any change in the unit price and other terms & conditions quoted by the tenderer.

39.2 If the quantity has not been increased at the time of the awarding the contract, the purchaser reserves the right to increase by up to fifty (50) per cent, the quantity of goods and services mentioned in the contract (rounded off to next whole number) without any change in the unit price and other terms & conditions mentioned in the contract, during the currency of the contract after one year from the Date of Notification of Award.

40. Notification of Award

40.1 Before expiry of the tender validity period, the purchaser will notify the successful tenderer(s) in writing, by registered / speed post/ courier or by fax/telex/cable (to be confirmed by registered / speed post/courier) that its tender for goods & services, which have been selected by the purchaser, has been accepted, also briefly indicating therein the essential details like description, specification and quantity of the goods & services and corresponding prices accepted. The successful tenderer must furnish to the purchaser the required performance security within Ten days from the date of dispatch of this notification, failing which the EMD will be forfeited and the award will be cancelled. Relevant details about the performance security have been provided under GCC Clause 5 under Section IV.

40.2 The Notification of Award shall constitute the conclusion of the Contract.

41. Issue of Contract

41.1 Promptly after notification of award, the Purchaser/Consignee will mail the contract form (as per Section XVI) duly completed and signed, in duplicate, to the successful tenderer by registered / speed post/courier.

41.2 Within twenty one days from the date of the contract, the successful tenderer shall return the original copy of the contract, duly signed and dated, to the Purchaser by registered / speed post/courier.

41.3 Deleted

42. Non-receipt of Performance Security and Contract by the Purchaser/Consignee

42.1 Failure of the successful tenderer in providing performance security and / or returning contract copy duly signed in terms of GIT clauses 40 and 41 above shall make the tenderer liable for

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forfeiture of its EMD and, also, for further actions by the Purchaser/Consignee against it as per the clause 24 of GCC – Termination of default.

43. Return of E M D

43.1 The earnest money of the successful tenderer and the unsuccessful tenderers will be returned to them without any interest, whatsoever, in terms of GIT Clause 18.7

44. Publication of Tender Result

44.1 The name and address of the successful tenderer(s) receiving the contract(s) will be mentioned in the notice board/bulletin/web site of the purchaser.

45. Corrupt or Fraudulent Practices

45.1 It is required by all concerned namely the Consignee/Tenderers/Suppliers etc to observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, the Purchaser: -

(a) defines, for the purposes of this provision, the terms set forth below as follows:

- (i) “corrupt practice” means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution; and
- (ii) “fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Purchaser, and includes collusive practice among Tenderers (prior to or after Tender submission) designed to establish Tender prices at artificial non-competitive levels and to deprive the Purchaser of the benefits of free and open competition;

(b) will reject a proposal for award if it determines that the Tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;

(c) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract by the purchaser if it at any time determines that the firm has engaged in corrupt or fraudulent practices in competing for, or in executing the contract.

46. Integrity Pact (IP)

The Integrity Pact (IP) will be one of the conditions in this tender enquiry. It will be considered to be a material deviation resulting into ignoring and rejecting the tender if the tenderers do not agree to accept it. The detailed terms of the IP are given below:

The Public Authority commits that:

- No official will demand or accept any illicit gratification to give any of the parties an advantage at any stage of the project.
- All necessary and appropriate technical, legal and administrative information related to the contract will be made public
- None of the officials will make available confidential information to a bidder/supplier to give unfair advantage in the contract
- Declaration by all concerned officials any conflict of interest and disclosure of own and family assets

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- Officials will report to appropriate government authority about any breach/attempt to breach a commitment.

The Bidder commits that:

- they will not offer any illicit gratification to obtain unfair advantage
- they will not collude with other parties to impair transparency and fairness
- they will not accept any advantage in exchange for unprofessional behaviour
- will disclose all payments made to agents and intermediaries
- it will demonstrate existence of organization-wide code of conduct forbidding unethical practices

Penalties:

For failure to implement IP, officials will be subject to penal action and bidders will face cancellation of contract, forfeiture of bond, liquidated damages and blacklisting. Action will not require criminal conviction but be based on “no-contest” after the evidence is made available or there can be no material doubts. Disputes in IP implementation would be resolved by arbitration detailed in IP.

Integrity Pact has to be signed and submitted by the Tenderer along with the filled up Tenders, failing which the Tender is liable to be rejected. Integrity Pact is enclosed in Section-XXI

47. Paying Authority:

- 47.1 The payment for the supply, installation and commissioning of the DG Sets package and any other payment mentioned in the tender enquiry will be made by “HLL Biotech Limited”.

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**SECTION - III
SPECIAL INSTRUCTIONS TO TENDERERS (SIT)**

SI. No.	GIT Clause No.	Topic	SIT Provision
A	1 to 6	Preamble	No Change
B	7 to 9	TE documents	No Change
C	10 to 20	Preparation of Tenders	No Change
D	21 to 23	Submission of Tenders	No Change
E	24	Tender Opening	No Change
F	25 to 33, 35,36	Scrutiny and Evaluation of Tenders	No Change
G	37 to 47	Award of Contract	No Change

In case of any conflict between the provision in the GIT and that in the SIT, the provision contained in the SIT shall prevail.

The Tenderer has to mandatorily quote for all the equipments as per the Price Schedule (in Section XI) failing which the Tender shall be disqualified and rejected.

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**SECTION - IV
GENERAL CONDITIONS OF CONTRACT (GCC)
TABLE OF CLAUSES**

SI No.	Topic
1	Application
2	Use of contract documents and information
3	Patent Rights
4	Country of Origin
5	Performance Security
6	Technical Specifications and Standards
7	Packing and Marking
8	Inspection, Testing and Quality Control
9	Terms of Delivery
10	Transportation of Goods
11	Insurance
12	Spare parts
13	Incidental services
14	Distribution of Dispatch Documents for Clearance/Receipt of Goods
15	Warranty
16	Assignment
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SECTION – IV

GENERAL CONDITIONS OF CONTRACT (GCC)

1. Application

- 1.1 The General Conditions of Contract incorporated in this section shall be applicable for this purchase to the extent the same are not superseded by the Special Conditions of Contract prescribed under Section V, List of requirements under Section VI and Technical Specification under Section VII of this document.

2. Use of contract documents and information

- 2.1 The supplier shall not, without the purchaser's prior written consent, disclose the contract or any provision thereof including any specification, drawing, sample or any information furnished by or on behalf of the purchaser in connection therewith, to any person other than the person(s) employed by the supplier in the performance of the contract emanating from this TE document. Further, any such disclosure to any such employed person shall be made in confidence and only so far as necessary for the purposes of such performance for this contract.
- 2.2 Further, the supplier shall not, without the purchaser's prior written consent, make use of any document or information mentioned in GCC sub-clause 2.1 above except for the sole purpose of performing this contract.
- 2.3 Except the contract issued to the supplier, each and every other document mentioned in GCC sub-clause 2.1 above shall remain the property of the purchaser and, if advised by the purchaser, all copies of all such documents shall be returned to the purchaser on completion of the supplier's performance and obligations under this contract.

3. Patent Rights

- 3.1 The supplier shall, at all times, indemnify and keep indemnified the purchaser, free of cost, against all claims which may arise in respect of goods & services to be provided by the supplier under the contract for infringement of any intellectual property rights or any other right protected by patent, registration of designs or trademarks. In the event of any such claim in respect of alleged breach of patent, registered designs, trademarks etc. being made against the purchaser, the purchaser shall notify the supplier of the same and the supplier shall, at his own expenses take care of the same for settlement without any liability to the purchaser.

4. Country of Origin

- 4.1 All goods and services to be supplied and provided for the contract shall have the origin in India or in the countries with which the Government of India has trade relations.
- 4.2 The word "origin" incorporated in this clause means the place from where the goods are mined, cultivated, grown, manufactured, produced or processed or from where the services are arranged.

5. Performance Security

- 5.1 Within Ten days (10) from date of the issue of notification of award by the Purchaser/Consignee, the supplier, shall furnish performance security to the Purchaser/Consignee for an amount equal to Five percent (5%) of the total value of the

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contract, valid up to sixty (60) days after the date of completion of all contractual obligations by the supplier, including the warranty obligations.

5.2 The Performance security shall be denominated in Indian Rupees as detailed below:

a) It shall be in the form of Bank Guarantee issued by any Scheduled Commercial bank in India, in the prescribed form as provided in section XV (B) of this document in favour of the Purchaser. The validity of the Fixed Deposit receipt or Bank Guarantee will be for a period up to sixty (60) days after the date of completion of all contractual obligations by the supplier, including the warranty obligations.

5.3 Deleted

5.4 In the event of any amendment issued to the contract, the supplier shall, within twenty-one (21) days of issue of the amendment, furnish the corresponding amendment to the Performance Security (as necessary), rendering the same valid in all respects in terms of the contract, as amended.

5.5 Subject to GCC sub – clause 5.3 above, the Purchaser/Consignee will release the Performance Security without any interest to the supplier on completion of the supplier's all contractual obligations including the warranty obligations & after receipt of Consignee's certificate.

6. Technical Specifications and Standards

6.1 The Goods & Services to be provided by the supplier under this contract shall conform to the technical specifications and quality control parameters mentioned in 'Technical Specification'; 'Quality Control Requirements' under Sections VII and Section VIII of this document.

7. Packing and Marking

7.1 The packing for the goods to be provided by the supplier should be strong and durable enough to withstand, without limitation, the entire journey during transit including transshipment (if any), rough handling, open storage etc. without any damage, deterioration etc. As and if necessary, the size, weights and volumes of the packing cases shall also take into consideration, the remoteness of the final destination of the goods and availability or otherwise of transport and handling facilities at all points during transit up to final destination as per the contract.

7.2 The quality of packing, the manner of marking within & outside the packages and provision of accompanying documentation shall strictly comply with the requirements as provided in Technical Specifications and Quality Control Requirements under Sections VII and VIII and in SCC under Section V. In case the packing requirements are amended due to issue of any amendment to the contract, the same shall also be taken care of by the supplier accordingly.

7.3 Packing instructions:

Unless otherwise mentioned in the Technical Specification and Quality Control Requirements under Sections VII and Section VIII and in SCC under Section V, the supplier shall mark on three sides of the package with the following with indelible paint of proper quality:

- a. contract number and date
- b. brief description of goods including quantity
- c. packing list reference number

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- d. country of origin of goods
- e. consignee's name and full address and
- f. supplier's name and address

8. Inspection, Testing and Quality Control

8.1 DELETED

8.2 The Technical Specification and Quality Control Requirements incorporated in the tender shall specify what inspections and tests are to be carried out and, also, where and how they are to be conducted. If such inspections and tests are conducted in the premises of the supplier or its supplier(s), all reasonable facilities and assistance, including access to relevant drawings, design details and production data, shall be furnished by the supplier to the purchaser's inspector at no charge to the purchaser.

8.3 DELETED.

8.4 DELETED

8.5 DELETED

8.6 The purchaser's/consignee's have the contractual right to inspect, test and, if necessary, reject the goods after the goods' arrival at the final destination. The supplier shall either replace the rejected goods or make all alterations necessary to meet the specifications and standards, as required, free of cost to the purchaser and resubmit the same for conducting the inspections and tests again

8.7 Goods accepted by the purchaser/consignee and/or its inspector at initial inspection and in final inspection in terms of the contract shall in no way dilute purchaser's/consignee's right to reject the same later, if found deficient in terms of the warranty clause of the contract, as incorporated under GCC Clause 15.

8.8 DELETED

9. Terms of Delivery

9.1 Goods shall be delivered by the supplier in accordance with the terms of delivery specified in the Schedule of Fiscal Aspects.

10. Transportation of Goods

10.1 DELETED

10.2 Transportation of domestic goods including goods already imported by the supplier to be done by the supplier himself and the goods to be delivered at the site of the consignee at his own cost.

11. Insurance:

Unless otherwise instructed in the SCC, the supplier shall make arrangements for insuring the goods against loss or damage incidental to manufacture or acquisition, transportation, storage and delivery.

The supplier shall be responsible till the entire stores contracted for arrival in good condition at destination. The transit risk in this respect shall be covered by the Supplier by getting the stores duly insured. The insurance cover shall be obtained by the Supplier and should be valid till 3 months after the receipt of goods by the consignee.

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If the equipment is not commissioned and handed over to the consignee within 3 months, the insurance will be extended by the supplier at their own cost till the successful installation, testing, commissioning and handing over of the goods to the consignee.

12. Spare parts

12.1 If specified in the List of Requirements and in the resultant contract, the supplier shall supply/provide any or all of the following materials, information etc. pertaining to spare parts manufactured and/or supplied by the supplier:

a) The spare parts as selected by the Purchaser/Consignee to be purchased from the supplier, subject to the condition that such purchase of the spare parts shall not relieve the supplier of any contractual obligation including warranty obligations; and

b) In case the production of the spare parts is discontinued:

- i. Sufficient advance notice to the Purchaser/Consignee before such discontinuation to provide adequate time to the purchaser to purchase the required spare parts etc., and
- ii. Immediately following such discontinuation, providing the Purchaser/Consignee, free of cost, the designs, drawings, layouts and specifications of the spare parts, as and if requested by the Purchaser/Consignee.

12.2 Supplier shall carry sufficient inventories to assure ex-stock supply of consumable spares for the goods so that the same are supplied to the Purchaser/Consignee promptly on receipt of order from the Purchaser/Consignee.

13. Incidental services

13.1 Subject to the stipulation, if any, in the SCC (Section – V), List of Requirements (Section – VI) and the Technical Specification (Section – VII), the supplier shall be required to perform the following services.

- i. Installation & commissioning, Supervision and Demonstration of the goods
- ii. Providing required jigs and tools for assembly, minor civil works required for the contractual services.
- iii. Completion of the installation.
- iv. Training of Consignee for operating and maintaining the goods
- v. Supplying required number of operation & maintenance manual for the goods

14. Distribution of Dispatch Documents for Clearance/Receipt of Goods

The supplier shall send all the relevant despatch documents well in time to the Purchaser / Consignee to enable the Purchaser/Consignee clear or receive (as the case may be) the goods in terms of the contract.

Unless otherwise specified in the SCC, the usual documents involved and the drill to be followed in general for this purpose are as follows.

Within 24 hours of despatch, the supplier shall notify the purchaser and other concerned if mentioned in the contract, the complete details of despatch and also supply the following documents to them by registered post / speed post (or as instructed in the contract):

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- (i) Four copies of supplier's invoice showing contract number, goods description, quantity, unit price and total amount;
- (ii) Two copies of packing list identifying contents of each package;
- (iii) Inspection certificate issued by the nominated Inspection agency, if any.
- (iv) Certificate of origin (wherever applicable)
- (v) Insurance Certificate;
- (vi) Manufacturers/Supplier's warranty certificate & In-house inspection certificate.

15. Warranty

- 15.1 The supplier warrants comprehensively that the goods supplied under the contract is new, unused and incorporate all recent improvements in design and materials unless prescribed otherwise by the purchaser in the contract. The supplier further warrants that the goods supplied under the contract shall have no defect arising from design, materials (except when the design adopted and / or the material used are as per the Purchaser's/Consignee's specifications) or workmanship/operation or from any act or omission of the supplier, that may develop under normal use of the supplied goods under the conditions prevailing in India.
- 15.2 This warranty shall remain valid for 1 (one) year after the goods or any portion thereof as the case may be, have been delivered to the final destination and installed and commissioned at the final destination and accepted by the Purchaser/Consignee in terms of the contract, unless specified otherwise in the SCC.
- a. No conditional warranty like mishandling, manufacturing defects etc. will be acceptable.
 - b. Warranty will be inclusive of all accessories and it will also cover all wearable & non wearable components.
 - c. Replacement and repair will be under taken for the defective goods.
 - d. Proper marking has to be made for all spares for identification like printing of installation and repair dates.
- 15.3 In case of any claim arising out of this warranty, the Purchaser/Consignee shall promptly notify the same in writing to the supplier. The period of the warranty will be as per G.C.C clause number 15.2 above irrespective of any other period mentioned elsewhere in the bidding documents.
- 15.4 Upon receipt of such notice, the supplier shall, within 24 hours on a 24(hrs) X 7 (days) X 365 (days) basis respond to take action and to repair or replace the defective goods or parts thereof, free of cost, at the ultimate destination within 48 hours. The supplier shall take over the replaced parts/goods after providing their replacements and no claim, whatsoever shall lie on the purchaser for such replaced parts/goods thereafter. The penalty clause for non-rectification will be applicable as per tender conditions.
- 15.5 In the event of any rectification of a defect or replacement of any defective goods during the warranty period, the warranty for the rectified/replaced goods shall be extended to a further period of twelve (12) months from the date such rectified / replaced goods starts functioning to the satisfaction of the purchaser.
- 15.6 If the supplier, having been notified, fails to respond to take action to repair or replace the defect(s) within 24 hours on a 24(hrs) X 7 (days) X 365 (days) basis, the purchaser may proceed to take such remedial action(s) as deemed fit by the purchaser, at the risk and expense of the supplier and without prejudice to other contractual rights and remedies, which the purchaser may have against the supplier.

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15.7 During Warranty period, the supplier is required to visit consignee's site at least once in 3 months for preventive maintenance of the goods.

15.8 DELETED

15.9 DELETED

15.10 The Supplier shall always accord most favoured status to the Purchaser vis-à-vis its other Purchasers of its equipments/machines/goods etc. and shall always give the most competitive price for its machines/equipments supplied to the Purchaser/Consignee.

16. Assignment

16.1 The Supplier shall not assign, either in whole or in part, its contractual duties, responsibilities and obligations to perform the contract to any third party, except with the Purchaser's prior written permission.

17. Sub-Contracts

17.1 The Supplier shall notify the Purchaser in writing of all sub contracts awarded under the contract if not already specified in its tender. Such notification, in its original tender or later, shall not relieve the Supplier from any of its liability or obligation under the terms and conditions of the contract.

17.2 Sub contract shall be only for bought out items and sub-assemblies.

17.3 Sub contracts shall also comply with the provisions of GCC Clause 4 ("Country of Origin").

18. Modification of contract

18.1 If necessary, the purchaser may, by a written order given to the supplier at any time during the currency of the contract, amend the contract by making alterations and modifications within the general scope of contract in any one or more of the following:

- a) Specifications, drawings, designs etc. where goods to be supplied under the contract are to be specially manufactured for the purchaser,
- b) Mode of packing,
- c) Incidental services to be provided by the supplier
- d) Mode of despatch,
- e) Place of delivery, and
- f) Any other area(s) of the contract, as felt necessary by the purchaser depending on the merits of the case.

18.2 In the event of any such modification/alteration causing increase or decrease in the cost of goods and services to be supplied and provided, or in the time required by the supplier to perform any obligation under the contract, an equitable adjustment shall be made in the contract price and/or contract delivery schedule, as the case may be, and the contract amended accordingly. If the supplier doesn't agree to the adjustment made by the Purchaser/Consignee, the supplier shall convey its views to the Purchaser/Consignee within twenty-one days from the date of the supplier's receipt of the Purchaser's/Consignee's amendment / modification of the contract.

19. Prices

19.1 Prices to be charged by the supplier for supply of goods and provision of services in terms of the contract shall not vary from the corresponding prices quoted by the supplier in its tender.

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20. Taxes and Duties

- 20.1 Supplier shall be entirely responsible for all taxes, duties, fees, levies etc. incurred until delivery of the contracted goods to the purchaser's destination.
- 20.2 Further instruction, if any, shall be as provided in the SCC.
- 20.3 No exemption certificate will be provided by the consignees for customs duty, central Excise duty etc.
- 20.4 HBL will issue a 'C' form for interstate sale.
- 20.5 DELETED.

21. Terms and Mode of Payment

21.1 Payment Terms

Payment shall be made subject to recoveries, if any, by way of liquidated damages or any other charges as per terms & conditions of Contract. Payment shall be made in Indian Rupees as specified in the Schedule of fiscal aspects.

- 21.2 The supplier shall not claim any interest on payments under the contract.
- 21.3 Where there is a statutory requirement for tax deduction at source, such deduction towards income tax and other tax as applicable will be made from the bills payable to the Supplier at rates as notified from time to time.
- 21.4 DELETED
- 21.5 The payment shall be made in the currency / currencies authorised in the contract.
- 21.6 The supplier shall send its claim for payment in writing, when contractually due, along with relevant documents etc., duly signed with date, to the purchaser.
- 21.7 While claiming payment, the supplier has also to certify in the bill that the payment being claimed is strictly in terms of the contract and all the obligations on the part of the supplier for claiming that payment has been fulfilled as required under the contract.
- 21.8 DELETED

22. Delay in the supplier's performance

- 22.1 The supplier shall deliver the goods and perform the services under the contract within the time schedule specified by the Purchaser/Consignee in the List of Requirements (Section VI) and as incorporated in the contract.
- 22.2 Subject to the provision under GCC clause 26, any unexcused delay by the supplier in maintaining its contractual obligations towards delivery of goods and performance of services shall render the supplier liable to any or all of the following clauses:
- (i) Imposition of liquidated damages,
 - (ii) Forfeiture of its performance security and
 - (iii) Termination of the contract for default.

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- 22.3 If at any time during the currency of the contract, the supplier encounters conditions hindering timely delivery of the goods and performance of services, the supplier shall promptly inform the Purchaser/Consignee in writing about the same and its likely duration and make a request to the Purchaser/Consignee for extension of the delivery schedule accordingly. On receiving the supplier's communication, the Purchaser/Consignee shall examine the situation as soon as possible and, at its discretion, may agree to extend the delivery schedule, with or without liquidated damages for completion of supplier's contractual obligations by issuing an amendment to the contract.
- 22.4 When the period of delivery is extended due to unexcused delay by the supplier, the amendment letter extending the delivery period shall, inter alia contain the following conditions:
- a. The Purchaser/Consignee shall recover from the supplier, under the provisions of the clause 23 of the General Conditions of Contract, liquidated damages on the goods and services, which the Supplier has failed to deliver within the delivery period stipulated in the contract.
 - b. That no increase in price on account of any ground, whatsoever, including any stipulation in the contract for increase in price on any other ground and, also including statutory increase in or fresh imposition of customs duty, excise duty, sales tax/ VAT, Service Tax and Works Contract Tax or on account of any other tax or duty which may be levied in respect of the goods and services specified in the contract, which takes place after the date of delivery stipulated in the contract shall be admissible on such of the said goods and services as are delivered and performed after the date of the delivery stipulated in the contract.
 - c. But nevertheless, the Purchaser/Consignee shall be entitled to the benefit of any decrease in price on account of reduction in or remission of customs duty, excise duty, sales tax/ VAT, Service Tax and Works Contract Tax or any other duty or tax or levy or on account of any other grounds, which takes place after the expiry of the date of delivery stipulated in the contract.
- 22.5 If the supplier fails to perform the entire scope of work mentioned within the stipulated time period, the supplier is required to apply to the Purchaser/Consignee for extension of time period and obtain the same before completion. In case the supplier does not obtain an extension, Liquidate Damages as per Clause 23 shall be applicable.

23. Liquidated damages

- 23.1 Subject to GCC clause 26, if the supplier fails to deliver any or all of the goods or fails to perform the services within the time frame(s) incorporated in the contract, the Purchaser/Consignee shall, without prejudice to other rights and remedies available to the Purchaser/Consignee under the contract, deduct from the contract price, as liquidated damages, a sum equivalent to 0.5%(Zero point Five Percent) of the work value per week of delay or part thereof on delayed supply of goods and/or services until actual delivery or performance subject to a maximum of 5% (Five percent) of the contract value. Once the maximum is reached Purchaser/Consignee may consider termination of the contract as per GCC 24.

During the above-mentioned delayed period of supply and / or performance, the conditions incorporated under GCC sub-clause 22.4 above shall also apply.

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24. Termination for default

- 24.1 The Purchaser/Consignee , without prejudice to any other contractual rights and remedies available to it (the Purchaser/Consignee), may, by written notice of default sent to the supplier, terminate the contract in whole or in part, if the supplier fails to deliver any or all of the goods or fails to perform any other contractual obligation(s) within the time period specified in the contract, or within any extension thereof granted by the Purchaser/Consignee pursuant to GCC sub-clauses 22.3 and 22.4.
- 24.2 In the event of the Purchaser/Consignee terminates the contract in whole or in part, pursuant to GCC sub-clause 24.1 above, the Purchaser/Consignee may procure goods and/or services similar to those cancelled, with such terms and conditions and in such manner as it deems fit and the supplier shall be liable to the Purchaser/Consignee for the extra expenditure, if any, incurred by the Purchaser/Consignee for arranging such procurement / services.
- 24.3 Unless otherwise instructed by the Purchaser/Consignee, the supplier shall continue to perform the contract to the extent not terminated.

25. Termination for insolvency

- 25.1 If the supplier becomes bankrupt or otherwise insolvent, the purchaser reserves the right to terminate the contract at any time, by serving written notice to the supplier without any compensation, whatsoever, to the supplier, subject to further condition that such termination will not prejudice or affect the rights and remedies which have accrued and / or will accrue thereafter to the Purchaser/Consignee.

26. Force Majeure

- 26.1 Notwithstanding the provisions contained in GCC clauses 22, 23 and 24, the supplier shall not be liable for imposition of any such clause so long the delay and/or failure of the supplier in fulfilling its obligations under the contract is the result of an event of Force Majeure.
- 26.2 For purposes of this clause, Force Majeure means an event beyond the control of the supplier and not involving the supplier's fault or negligence and which is not foreseeable and not brought about at the instance of , the party claiming to be affected by such event and which has caused the non – performance or delay in performance. Such events may include, but are not restricted to, acts of the Purchaser/Consignee either in its sovereign or contractual capacity, wars or revolutions, hostility, acts of public enemy, civil commotion, sabotage, fires, floods, explosions, epidemics, quarantine restrictions, strikes excluding by its employees , lockouts excluding by its management, and freight embargoes.
- 26.3 If a Force Majeure situation arises, the supplier shall promptly notify the Purchaser/Consignee in writing of such conditions and the cause thereof within twenty one days of occurrence of such event. Unless otherwise directed by the Purchaser/Consignee in writing, the supplier shall continue to perform its obligations under the contract as far as reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.
- 26.4 If the performance in whole or in part or any obligation under this contract is prevented or delayed by any reason of Force Majeure for a period exceeding sixty days, either party may at its option terminate the contract without any financial repercussion on either side.
- 26.5 In case due to a Force Majeure event the Purchaser/Consignee is unable to fulfil its contractual commitment and responsibility, the Purchaser/Consignee will notify the supplier accordingly and subsequent actions taken on similar lines described in above sub-paragraphs.

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27. Termination for convenience

- 27.1 The Purchaser/Consignee reserves the right to terminate the contract, in whole or in part for its (Purchaser's/Consignee's) convenience, by serving written notice on the supplier at any time during the currency of the contract. The notice shall specify that the termination is for the convenience of the Purchaser/Consignee. The notice shall also indicate inter alia, the extent to which the supplier's performance under the contract is terminated, and the date with effect from which such termination will become effective.
- 27.2 The goods and services that are complete and ready in terms of the contract for delivery and performance within thirty days after the supplier's receipt of the notice of termination shall be accepted by the Purchaser/Consignee following the contract terms, conditions and prices. For the remaining goods and services, the Purchaser/Consignee may decide:
- a. To get any portion of the balance completed and delivered at the contract terms, conditions and prices; and / or
 - b. To cancel the remaining portion of the goods and services and compensate the supplier by paying an agreed amount for the cost incurred by the supplier towards the remaining portion of the goods and services.

28. Governing language

- 28.1 The contract shall be written in English language following the provision as contained in GIT clause 3. All correspondence and other documents pertaining to the contract, which the parties exchange, shall also be written accordingly in that language.

29. Notices

- 29.1 Notice, if any, relating to the contract given by one party to the other, shall be sent in writing or by cable or telex or facsimile or e-mail and confirmed in writing. The procedure will also provide the sender of the notice, the proof of receipt of the notice by the receiver. The addresses of the parties for exchanging such notices will be the addresses as incorporated in the contract.
- 29.2 The effective date of a notice shall be either the date when delivered to the recipient or the effective date specifically mentioned in the notice, whichever is later.

30. Resolution of disputes

- 30.1 If dispute or difference of any kind shall arise between the Purchaser/Consignee and the supplier in connection with or relating to the contract, the parties shall make every effort to resolve the same amicably by mutual consultations.
- 30.2 If the parties fail to resolve their dispute or difference by such mutual consultation within twenty-one days of its occurrence, then, unless otherwise provided in the SCC, either the Purchaser/Consignee or the supplier may give notice to the other party of its intention to commence arbitration, as hereinafter provided the applicable arbitration procedure will be as per the Arbitration and Conciliation Act, 1996 of India. In the case of a dispute or difference arising between the Purchaser/Consignee and a domestic Supplier relating to any matter arising out of or connected with the contract, such dispute or difference shall be referred to the sole arbitration of the arbitrator to be appointed by the Chairman, of the employer. . The award of the arbitrator shall be final and binding on the parties to the contract subject to the provision that the Arbitrator shall give reasoned award in case the value of claim in reference exceeds Rupees One lakhs (Rs. 1,00,000/-)

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30.3 Venue of Arbitration: The venue of arbitration shall be the place from where the contract has been issued.

31. Applicable Law

31.1 The contract shall be governed by and interpreted in accordance with the laws of India for the time being in force.

31.2 Jurisdiction

The courts at Chennai, Tamil Nadu shall have exclusive jurisdiction for all disputes and difference arising out of this contract.

32. General/ Miscellaneous Clauses

32.1 Nothing contained in this Contract shall be constructed as establishing or creating between the tenderer on the one side and the Purchaser on the other side, a relationship of master and servant or principal and agent.

32.2 Any failure on the part of any Party to exercise right or power under this Contract shall not operate as waiver thereof.

32.3 The Supplier shall notify the Purchaser/Consignee of any material that change would impact on performance of its obligations under this Contract.

32.4 Each member/constituent of the Supplier shall be jointly and severally liable to and responsible for all obligations towards the Purchaser/Consignee/Government for performance of contract/services including that of its Associates/Sub Suppliers under the Contract.

32.5 Indemnities

32.5.1 The Supplier/its Indian Agent shall at all times, indemnify and keep indemnified the Purchaser/Government of India against all claims, damages, cost and expenses arising from the incorporation in or use of work of any such articles, processes or supplies made under this agreement. Supplier shall at all times indemnify the purchaser against all claims which may be made for any infringement of any Intellectual Property Rights (IPR) while providing its services. However the liability of the Suppliers/its Indian Agents raised on the above circumstances is limited to the overall contract value.

32.5.2 The Supplier/its Agent shall, at all times, indemnify and keep indemnified the Purchaser/Consignee/Government of India against any claims in respect of any damages or compensation payable in consequences of any accident or injury sustained or suffered by its employees or agents or by any other third party resulting from or by any action, omission or operation conducted by or on behalf of the supplier/its associate/affiliate etc.

32.5.3 All claims regarding indemnity shall survive the termination or expiry of the contract.

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SECTION – V

SPECIAL CONDITIONS OF CONTRACT (SCC)

The Special Conditions of Contract (SCC) will apply for this purchase. The corresponding clauses of General Conditions of Contract (GCC) relating to the SCC stipulations have also been incorporated below.

These Special Conditions will modify/substitute/supplement the corresponding (GCC) clauses.

Whenever there is any conflict between the provision in the GCC and that in the SCC, the provision contained in the SCC shall prevail.

1. GENERAL

These special conditions shall be read in conjunction with the General Conditions of contract, Job Specifications, Drawings and other documents forming part of this contract wherever the context so requires.

Notwithstanding the sub-division of the documents into these sections and volume every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the context in so far as it may be practicable to do so.

The several documents forming the contract are to be taken as mutually explanatory of one another. In case of discrepancy the following order of precedence shall be observed:

The works described in latest approved documents like drawings, design qualification and notes thereon.

- The items in the schedule of quantities.
- Particular specifications (given in Tender documents)
- Special conditions of contract.
- General conditions of contract.
- Special Instructions to tenderers
- General Instructions to tenderers

The intending supplier shall be deemed to have visited the site and familiarized himself thoroughly with the site conditions before submitting the tender or before signing the contract. Non-familiarity with the site conditions will not be considered a reason either for extra claims or for not carrying out the work in strict conformity with the drawings and specifications.

The prices quoted should include supply, installation, testing & commissioning at site & should include all applicable taxes & duties.

2. COMPLETION TIME & LIQUIDATED DAMAGES

Over all completion time shall be as mentioned in the Schedule of Fiscal Aspect. The Liquidated Damages (LD) shall be levied at the rate of 0.5% per week maximum being 5% of Total Contract Value, if the work is delayed beyond the stipulated completion time.

3. FAILURE TO ARRANGE COMMITTED MANPOWER /MACHINERY

The Supplier shall submit manpower and machinery / equipment proposed to be deployed to carry out the work within the stipulated time. Such committed manpower/machinery shall be considered as minimum requirement and failure to maintain the same at site shall be treated as deemed unfit. In such cases, the purchaser reserves the right to terminate the contract as per GCC clause 24.

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4. ACCESS TO SITE

All necessary access to working area will have to be made and maintained by the Supplier. Such temporary constructions shall have to be removed after completion of the work or if so advised by Purchaser at any point of time at no extra cost.

5. PROPERTY RIGHTS

All materials / goods / items at site whether free issue or otherwise, other than the Supplier's construction machinery, will be property of Purchaser, which shall not be removed from site of work and shall be open to inspection by Purchaser. The Supplier shall be responsible for any theft, loss and damage to such material, items, goods etc.

6. LABOUR AT SITE

Purchaser will not allow any temporary or permanent hutments or colonies at the Work Site. The Supplier will have to make his own arrangement for such labour camp(s) away from site at his own cost.

7. WATER AND ELECTRICITY FOR CONSTRUCTIONS

The Contractor (S) shall make his/their own arrangements for water and power supply required for the work and nothing extra will be paid for the same. This will subject to the following conditions:

- i. That the water used by the contractor(s) shall be fit for construction purpose to the satisfaction of the Engineer-in-charge.
- ii. The Engineer-in-charge shall make alternative arrangements for water supply at the risk and cost of the contractor(s) if the arrangements made by the contractor(s) for procurement of water are in the opinion of the Engineer-in-charge.
- iii. The contractor shall make his own arrangement for temporary electric connection and shall make necessary payment for it direct to the concerned authority. On completion of the work he shall furnish a no dues certificate from the concerned authority failing which the claims/dues of the concerned authority shall be settled by the Engineer-in-charge at the contractor's risk and cost.
- iv. The contractor should make his own arrangements for the providing back up power supply (like D.G sets of required capacity) during the work.

8. OTHER CONTRACTS / CONCURRENT WORKS

Purchaser reserves the right to let other Suppliers work in the same area in connection with his work under similar Agreement. The Supplier shall afford other Supplier s' reasonable opportunity for the introduction and storage of their materials and the execution of their work and shall properly connect and co-ordinate his work with theirs. If any part of Supplier's or sub-Supplier's work depends for proper execution or results upon the work if any other Supplier or Sub- Supplier, the Supplier shall inspect and promptly report to Purchaser any defects in such work that render it unsuitable for such proper execution and results. Failure of the Supplier to so inspect and report shall constitute an acceptance of the other Supplier's work as fit and proper for the reception of his work.

During the progress of this contract, other construction works will also be concurrently in operation. The Supplier shall co-operate with the other Supplier s working at site to the fullest extent and shall allow reaching other every facility and co-operation for execution of this work, simultaneously and satisfactorily during the erection of machinery or execution of any other activity. Supplier may have to suspend his work partially or totally in the interest of the whole project. He may also be required to dismantle or to shift his construction plant and equipments for erection of machinery and /or any other operation. In such cases, he shall not be given any compensation on account of reduction or stoppage of labour force or dismantling, shifting of his construction plant and equipments, etc.

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9. SAFETY PRECAUTIONS AT WORK

The Supplier shall make all necessary arrangements for safety of personnel working at site and ensure that all safety precautions in line with established industry practices are taken and Guide Lines issued by Statutory Authorities are complied with.

10. PROTECTION AND CLEANING

The Supplier shall protect and preserve the work from all damage or accident providing any temporary roof, window and door coverings, boxing or other construction as required by the Purchaser. This protection shall be provided for all property adjacent to the site as well as on the site.

The Supplier shall properly clean the work as it progresses and shall remove all rubbish and debris from the site from time to time as is necessary and as directed. On completion, the Supplier shall ensure that the premises and / or site are cleaned, surplus materials debris, sheds etc. removed, areas under floors cleared of rubbish, gutters and drains cleared, doors and sashes eased, locks and fastenings oiled, keys clearly labelled and handed over to the In Charge of Works so that the whole is left fit for immediate occupation or use and to the satisfaction of the Purchaser.

11. PROTECTION OF WILD LIFE

The Supplier shall ensure the safety of wild life animals in and around the site and ensure that all Statutory Regulations are complied with. He shall indemnify Purchaser against violation of Wild Life Protection Act or any such Government Regulations.

12. VALIDITY OF OFFER/RATES / PRICES

The Offer remains valid for a period of 120 days from the date of opening of tender.

After placement of Order all the rates/prices quoted by Supplier shall remain valid till the Final Acceptance Certificate / Measurement Certificate is issued by Purchaser.

The unit rates / prices quoted by the Supplier in the offer shall be firm irrespective of variation in any quantity of individual items and/or in the total contract price.

Prices and unit rates shall be valid even if the contract is split.

Prices and unit rates of any or each item shall be valid irrespective of whether the item to be executed is located at any height/depth, any floor, inside or outside the building unless otherwise specifically mentioned.

Necessary deductions towards the Employee's State Insurance as per the Act, will be made in the Supplier's bills if necessary. The Supplier shall provide the proof of ESI payments and its adherence. The Supplier should maintain all records of labour payments (including sub-Suppliers) and product as and when required by the Purchaser or ESI Authorities for assessment and recovery. In case any additional amount is demanded from the Purchaser by the authorities on any account, the Purchaser shall have the right to recover the same from the Supplier.

13. CONFIDENTIALITY

The Supplier shall not reveal the scope of supply/rates/quantities/facilities appearing in the order to any body without the knowledge of Purchaser. Violation of this Clause will be treated as breach of Contract, in which case Purchaser will reserve the right to take necessary punitive action against the Supplier.

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14. TESTING OF MATERIAL

Purchaser reserves the right to ask for any kind of test to be carried out on any construction material / consumables / finished structures / operation / performance or goods or items / bought outs. The Supplier shall bear all necessary charges for all such tests. Such tests shall be carried out by a laboratory / person approved by Purchaser.

15. ESCALATION

The rates of Supplier shall remain fixed till the completion and NO price variation on account of any increase in taxes, duties or any other reason, whatsoever, shall be payable. It is clarified that No escalation clause is applicable for this contract.

16. SUPPLIER'S INABILITY TO SUPPLY MATERIAL/ PROVIDING THE SERVICE

In case of Supplier fails to supply any item of material / services covered under contract then Purchaser will be at liberty to procure the same from open market / engaging other parties to perform the required services at the risk & cost of the Supplier and recover the same from forthcoming running bill or Security Deposit/Bank Guarantee.

17. PUNITIVE MEASURES

Purchaser will decide on punitive measures wherever reference to punitive measures or otherwise due to breach of contract is indicated in the clauses above. Decision of Purchaser in such matters shall be binding on the Supplier.

18. AMBIGUITIES IN TERMS & CONDITIONS/ QUANTITIES.

In case of any dispute or ambiguity in the interpretation of any condition contained both in the Agreement and the Special Conditions of Contract the interpretation of the Special Conditions of Contract shall prevail.

In case of interpretation of any item description in the schedule of quantities and the equivalent specifications, the item description given in the schedule of quantities shall prevail.

19. CHANGES IN CONSTITUTION

Before any change is made in the constitution of the firm, the prior approval is to be obtained by the Supplier in writing of the Accepting Authority. If the Supplier is an individual or a proprietary concern and the individual or the proprietor dies and if the Supplier is a partnership concern and one of the partners dies, then the Accepting Authority reserves the right to cancel the contract, if the Accepting Authority is not satisfied that the legal representatives of the individual firm or the proprietor of the proprietary concern and in the case of partnership, the surviving partners are capable of carrying out and completing the contract.

20. UNDER PAYMENT / OVER PAYMENT

The Purchaser reserves the right to carry out past payments, audit and technical examinations of the trial bill including all supporting vouchers, abstracts, etc., If as a result of such audit and technical examination any overpayment is discovered, it shall be recovered from any other sum due to the Supplier, which may be available with the Purchaser or he shall pay the claim on demand.

Any amount due to the Supplier under this Contract for underpayment may be adjusted against any amount then due or which may at any time thereafter become due before payment is made to the Supplier.

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21. In case of any conflict between the description of items in schedule of quantities, specifications, drawings and other tender documents, the decision of the Purchaser, in writing, shall be final binding and conclusive for the purpose of this contract. The Supplier in any case shall not delay or stop the work for the questions or disputes being referred to arbitration but shall proceed with work with all diligence until the decision of the arbitrator and shall abide by arbitrators decision.
22. The Supplier shall be responsible, in all respects, for the co-ordination of all the services work including electrical, piping and modular works or works of other Purchaser appointed agencies. Supplier shall ensure proper co-ordination for the inter-dependent / related activities between himself, services sub-Suppliers and other nominated, Specialist Suppliers etc.

The Supplier shall arrange the water, electricity and scaffoldings required on their own.
23. The Supplier shall be responsible to work out a co-ordinated work schedule with the HVAC, Civil, Electrical, Mechanical & Piping and other nominated Suppliers.
24. No other claim shall be entertained from the Supplier on the plea that the work has been executed in the above circumstances or under difficult conditions. It shall be the responsibility of the Supplier to enforce necessary discipline among his workers and staff to ensure smooth working at the site in a spirit of co-operation and amity with all other agencies. In case of any dispute, decision of Purchaser or Purchaser shall be final and binding to the Supplier.
25. The Supplier is made explicitly clear that the work is to be carried out in co-ordination with all other nominated Suppliers/ agencies, which shall be engaged to execute other services of the project. The Supplier shall submit to the Purchaser's approval, immediately the following information in order to proceed with the work.
26. Exact Layout and details of the temporary work that the Supplier wants to carry out to fulfil his obligations under the contract.
27. A general layout of storage space for material for the execution of work within stipulated time period.
28. Depending on the exigencies at the site the temporary offices, stores etc. may have to be moved or shifted and the Supplier shall do so, if so required by the Purchaser / Consultant at no extra cost to the Purchaser.
29. Purchaser shall have full power to get any materials of work to be tested by an independent agency at Supplier's expense in order to prove the soundness and adequacy.
30. If any material / equipment are supplied by the Purchaser to the Supplier free of cost, the Supplier shall receive the same at site, handle with care and store them as directed by the Purchaser. The Supplier shall be responsible for the safe custody and shall insure all materials against theft and damage by fire. The Supplier shall maintain records of consumption on daily basis.
31. The Supplier shall ensure cleanliness and keep the site free from all debris, hazardous material, loose wires, open fires or any other materials and avoid damage due to accidents, negligence etc. All the above measures including fencing etc. required to be provided during the time period of the contract, shall be provided by the Supplier at no expense to the Purchaser. The provision of all these measures does not absolve the Supplier of his liabilities as per the contract.
32. It shall be the responsibility of the Supplier to ensure that his workmen do not trespass into areas and buildings adjacent to the construction site. The Supplier shall enforce proper discipline in this regard by making proper arrangements.
33. To facilitate satisfactory completion of the work under this contract, and to co-ordinate work with other agencies working at the site, meetings will be held at the time and venue decided by the

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Consultant / Purchaser. During these meetings progress of various works will be reviewed and those matters needing clarifications / decisions to expedite the work will be taken up.

34. During progress of the work, completed portion of the building may be occupied and put to use by the Purchaser. The Supplier shall however remain fully responsible for the maintenance of all the work till the entire work covered by the Supplier is satisfactory completed and handed over to the Purchaser.
35. Safe custody of all materials and products supplied by the Supplier shall be his own responsibility till the final taking over by the Purchaser. He should therefore employ sufficient staff for watch and ward at his own expenses.
36. It shall be the responsibility of the Supplier to study carefully all the drawings, instructions etc and point out discrepancies and obtain clarifications, if any, in writing before taking up the work. He shall also be responsible to ensure that the work is carried out in accordance with Local Bye-Laws in all respects, and to ensure that he obtains all prior sanctions from all the Competent Local Authorities before he takes up the work. If, as a result of his failure to do so, in spite of the works having been carried out as per the drawings and instruction issued by the Consultant and /or the Purchaser, and/or in the presence of the representative(s) of the Consultant / Purchaser, the Supplier himself shall be solely responsible and if so directed, dismantle and reconstruct at his own cost the work/item(s) of work as per such directions. No claims in this regard will be entertained.
37. It shall be the sole responsibility of the Supplier to ensure all safety measures giving proper prior notices etc. and obtaining prior permission from concerned local authorities as per Bye-Laws or directions issued by them, all at his own cost. No claim of the Supplier in this regard shall be entertained.
38. With the submission of the tender, the Suppliers declares and agrees that all the labour and requisite materials required for the work are available for completion of the work within the period stipulated for completion of the work.
39. Any material / item / fitting / fixtures rejected by the Purchaser / Consultant shall be removed from the site within 48 hours of issue of instructions to this effect by the Purchaser / consultant. Failing this, the Purchaser shall have the rights to get these so removed at the Supplier's cost and the Supplier shall have no claim whatever in this regard.
40. The Supplier is alone responsible, for any discrepancy arising out of the definition / interpretation etc. of any matter connected with the execution of the work, which has not been got clarified prior to submission of tenders as required and all consequences arising there from.
41. The Supplier shall also include in his quoted rate barricading / fencing of construction activity area. All materials, fabrication yards, stores, manpower are to be contained within the barricaded area. The Supplier shall not be allowed to extend his activities beyond this area.
42. Deleted
43. Deleted.
44. The Supplier will be provided with open space free of cost for constructing temporary site office near the construction area.
45. It is essential that the works site be kept in an orderly and neat manner at all times. Stacking of materials, arrangement of fabrication yards, water tank for construction, equipment etc. shall be free from obstructions and easy to survey and inspect. The Purchaser should have the right to get such work as is necessary to ensure proper maintenance of the works site at the Suppliers cost, in case the Supplier fails to comply with the requirements.

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46. The Supplier has to meet all safety requirements as laid down by Purchaser at their own cost.
47. The Supplier shall use only steel scaffolding and not bamboos for any kind of work.

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SECTION – VI

LIST OF REQUIREMENTS

Refer Chapter 2.5 (Bill of Quantities)

Part II: Required Delivery Schedule:

As mentioned in the schedule of Fiscal Aspects

Part III: Scope of Incidental Services:

Installation & Commissioning, Supervision, Demonstration, Trial run and Training etc. as specified in GCC Clause 13 & Annexures of tender

Part IV: Required Terms of Delivery and Destination.

Insurance shall be borne by the Supplier.

Destination/Consignee details are given in Section XX

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Section – VII

Technical Specifications

Note 1: Tenderer's attention is drawn to GIT clause 17 and GIT sub-clause 10.1 under heading (c) preparation of tenders. The tenderer is to provide the required details, information, confirmations, etc. accordingly, failing that it's tender is liable to be ignored.

Note 2: General: Bidders are requested to make sure that they should attach the list of equipment, instruments and spares etc. for carrying out routine and preventive maintenance wherever asked for and should make sure that Electrical Safety Analyzer / Tester for Process equipments to periodically check the electrical safety aspects as per BIS Safety Standards IS-13540 which is also equivalent to IEC electrical safety standard IEC-60601 is a part of the equipments. If the Electrical Safety Analyzer/Tester is not available they should provide a commitment to get the equipments checked for electrical safety compliance with Electronic Regional Test Labs / Electronics Test and Development Centers across the country during warranty period.

Note 3: OPTIONAL ITEMS: Bidders are requested to quote for all the available options as asked in the bidding document with reasonable pricing. However the pricing for optional items will not be considered for price comparison for ranking purpose. If the firm has not quoted for any optional item (except the items of turnkey- if any) their offer will be treated as TECHNICALLY RESPONSIVE if otherwise meeting the specification.

Note:

1. **The extent of automation and optional additional features may vary during the pre-bid discussion.**
2. **The quantity of equipment mentioned in the list may vary during ordering.**

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GENERAL TECHNICAL SPECIFICATIONS

GENERAL POINTS:

1. Warranty:

- a) One year Comprehensive Warranty as per Conditions of Contract of the TE document for complete equipment and Turnkey (if any) Work from the date of satisfactory installation, commissioning, trial run & handing over of equipment to CONSIGNEE.
- b) 98% up time Warranty of complete equipment with extension of Warranty period by double the downtime period on 24 (hrs) X 7 (days) X 365 (days) basis.
- c) All software updates should be provided free of cost during Warranty period.

2. After Sales Service:

After sales service centre should be available at the city of CONSIGNEE on 24 (hrs) X 7 (days) X 365 (days) basis. Complaints should be attended properly, maximum within 48 hrs. The service should be provided by Tenderer/Indian Agent. Undertaking by the Principals that the spares for the equipment shall be available for at least 10 years from the date of supply. However if the manufacturer/agent does not have the service centres in India will have to set up the same within 45 days after award of the contract.

3. Training:

On Site training to operators/ Technicians/ staff is to be provided by Principal/ Indian Agents (if they have the requisite know-how) for operation and maintenance of the equipment to the satisfaction of the consignee.

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Section – VIII

Quality Control Requirements

DELETED

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Section – IX

Qualification Criteria

The bidder should fulfil the following qualification criteria for participating in the tender.

- The bidder must be a manufacturer or authorized assembler or dealer of assembler (authorized) of the approved makes of engine as per this tender.
- The bidder should have minimum 7 years of proven and demonstrable experience in supply and installation of HT DG sets.
- The firm must have supplied, installed and commissioned at least 4 numbers of 11 KV 2 MVA or higher rating HT DG Sets during last three years (Completion certificate / purchase orders to be attached).
- Average Annual Turnover of the bidder must not be less than INR 30 Million in the last three financial years (2011-12, 2012-13, 2013-14). Notarized copies of the Chartered Accountant certified Profit & Loss statement should be enclosed.
- Net worth of the company should be positive during the last three financial years (2011-12, 2012-13, 2013-14). Notarized copies of the Chartered Accountant certified Balance sheet statement should be enclosed.

NOTE:

1. Consortium or Joint Ventures are not allowed to participate in this tender
2. Notwithstanding anything stated above, the Purchaser reserves the right to assess the Tenderer's capability and capacity to perform the contract satisfactorily before deciding on award of Contract, should circumstances warrant such an assessment in the overall interest of the Purchaser. The Purchaser reserves the right to ask for a free demonstration of the quoted equipment to similar/identical specification at a predetermined place acceptable to the purchaser for determining technical responsiveness, before the opening of the Price Bid.
3. For 2013-14, provisional certificate certified by notary shall be submitted, if the balance sheet is not audited

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PROFORMA:

A.	General information:	
1	Name of Company	
2	Registration No.	
3	Number of Years in Operation	
4	Registered Address	
5	Operating Address	
6	Telephone No	
7	Address of Service Centre in Tamil Nadu	
8	Telefax	
9	Email Address	
10	SERVICE TAX No.	
11	PAN No.	
12	TIN No.	

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B.	FINANCE	
1	Name & Address of Banks and Branches used :	
1.1		
1.2		
1.3		
2	Annual Turnover of the Firm/ company:	
2.1	2013 – 2014:	_____ (Value in Lakhs)
	2012 – 2013:	_____ (Value in Lakhs)
	2011 – 2012:	_____ (Value in Lakhs)
3	Bidders have to submit copy of valid current Income Tax Return submitted, Sales Tax Registration failing which their offer may be liable to be rejected.	

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SECTION (C) EXPERIENCE:						
Past Project Experience:						
Sr. No.	Year awarded	Project Name	Capacity & No. of DG Sets Supplied	CONTRACT VALUE (INR)	NAME & REFERENCE (Contact details)	Authority Approval obtained by Supplier/Purchaser
1.1						
1.2						
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
1.10						
2 Details of Ongoing project:						
S. No.	Year awarded	Project Name	Rating of DG sets Supplied	CONTRACT VALUE (INR)	NAME & REFERENCE (Contact details)	Remarks
2.1						
2.2						
2.3						
2.4						
2.5						

Section – IX

FORMAT OF PERFORMANCE CERTIFICATE

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To whom it may concern

Date. _____

Certified that M/s ----- (name & address of the manufacturer) supplied -----Nos (indicate quantity) of 11 KV DG Sets, ----- (indicate the capacity of DG Sets) against our order no -----dt ----- (please indicate order no & date). The equipment was installed, commissioned & handed over to us with the All approval on ----- (indicate date) & since then the equipment has been working to our entire satisfaction.

Authorised signatory

Name:

Designation:

Company' seal

Section – X

TENDER FORM

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Date _____
To _____

HLL Biotech Limited, Chennai

Ref. Your TE document No. _____ dated _____
We, the undersigned have examined the above mentioned TE document, including amendment/corrigendum No. _____, dated _____ (if any), the receipt of which is hereby confirmed. We now offer to supply and deliver _____ (Description of goods and services) in conformity with your above referred document for the sum of _____ (total tender amount in figures and words), as shown in the price schedule(s), attached herewith and made part of this tender.

If our tender is accepted, we undertake to supply the goods and perform the services as mentioned above, in accordance with the delivery schedule specified in the List of Requirements.

We further confirm that, if our tender is accepted, we shall provide you with a performance security of required amount in an acceptable form in terms of GCC clause 5, read with modification, if any, in Section - V – “Special Conditions of Contract”, for due performance of the contract.

We agree to keep our tender valid for acceptance as required in the GIT clause 19, read with modification, if any in Section - III – “Special Instructions to Tenderers” or for subsequently extended period, if any, agreed to by us. We also accordingly confirm to abide by this tender up to the aforesaid period and this tender may be accepted any time before the expiry of the aforesaid period. We further confirm that, until a formal contract is executed, this tender read with your written acceptance thereof within the aforesaid period shall constitute a binding contract between us.

We further understand that you are not bound to accept the lowest or any tender you may receive against your above-referred tender enquiry.

We confirm that we do not stand deregistered/banned/blacklisted by any Govt. Authorities.

We confirm that we fully agree to the terms and conditions specified in above mentioned TE document, including amendment/ corrigendum if any

(Signature with date)

(Name and designation) Duly authorised to sign tender for and on behalf of

**NOTE: One Unpriced tender form to be enclosed with Technical Bid &
One Priced tender form to be enclosed with Price Bid**

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SECTION – XI A PRICE SCHEDULE

Refer Chapter 2.5 (BOQ)

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SECTION – XII

QUESTIONNAIRE

Fill up the Section XIX – Check List for Tenderers and enclose with the Tender

1. The tenderer should furnish specific answers to all the questions/issues mentioned in the Checklist. In case a question/issue does not apply to a tenderer, the same should be answered with the remark “not applicable”
2. Wherever necessary and applicable, the tenderer shall enclose certified copy as documentary proof/ evidence to substantiate the corresponding statement.
3. In case a tenderer furnishes a wrong or evasive answer against any of the question/issues mentioned in the Checklist, its tender will be liable to be ignored.

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SECTION – XIII

BANK GUARANTEE FORM FOR EMD

Whereas _____ (hereinafter called the “Tenderer”) has submitted its quotation dated _____ for the supply of _____ (hereinafter called the “tender”) against the purchaser’s tender enquiry No. _____ Know all persons by these presents that we _____ of _____ (Hereinafter called the “Bank”) having our registered office at _____ are bound unto _____ (hereinafter called the “Purchaser) in the sum of _____ for which payment will and truly to be made to the said Purchaser, the Bank binds itself, its successors and assigns by these presents. Sealed with the Common Seal of the said Bank this _____ day of _____ 20____. The conditions of this obligation are:

- (1) If the Tenderer withdraws or amends, impairs or derogates from the tender in any respect within the period of validity of this tender.
- (2) If the Tenderer having been notified of the acceptance of his tender by the Purchaser during the period of its validity:-
 - a) fails or refuses to furnish the performance security for the due performance of the contract.
or
 - b) fails or refuses to accept/execute the contract.
or
 - c) if it comes to notice that the information/documents furnished in its tender is incorrect, false, misleading or forged

We undertake to pay the Purchaser up to the above amount upon receipt of its first written demand, without the Purchaser having to substantiate its demand, provided that in its demand the Purchaser will note that the amount claimed by it is due to it owing to the occurrence of one or both the two conditions, specifying the occurred condition(s).

This guarantee will remain in force for a period of forty-five days after the period of tender validity and any demand in respect thereof should reach the Bank not later than the above date.

(Signature of the authorised officer of the Bank)

Name and designation of the officer

Seal, name & address of the Bank and address of the Branch

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SECTION – XIV

MANUFACTURER'S AUTHORISATION FORM

To

HLL Biotech Limited, Chennai

Dear Sirs,

Ref: Your TE document No _____, dated _____

We, _____ who are proven and reputable manufacturers of _____ (*name and description of the goods offered in the tender*) having factories at _____, hereby authorise Messrs _____ (*name and address of the agent*) to submit a tender, process the same further and enter into a contract with you against your requirement as contained in the above referred TE documents for the above goods manufactured by us.

We further confirm that no supplier or firm or individual other than Messrs. _____ (*name and address of the above agent*) is authorised to submit a tender, process the same further and enter into a contract with you against your requirement as contained in the above referred TE documents for the above goods manufactured by us.

We also hereby extend our full warranty as applicable as per clause 15 of the General Conditions of Contract, read with modification, if any, in the Special Conditions of Contract for the goods and services offered for supply by the above firm against this TE document.

We also hereby confirm that we shall be overall responsible for the timely delivery of the equipment, installation, testing, commissioning and validation as per the requirements stipulated and agreed in the Tender Enquiry document

Yours faithfully,

[*Signature with date, name and designation*]
for and on behalf of Messrs _____

[*Name & address of the manufacturers*]

Note:

1. This letter of authorisation should be on the letter head of the manufacturing firm and should be signed by a person competent and having the power of attorney to legally bind the manufacturer.
2. Original letter may be sent.

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SECTION – XV (A)

BANK GUARANTEE FORMAT FOR ADVANCE PAYMENT

Ref.....

Date.....

Bank Guarantee No....

To

HLL Biotech Ltd.,
Module 013-015,
Ticel Biopark Campus,
CSIR Road, Taramani,
Chennai – 600 113.

Dear Sirs,

In consideration of the HLL Biotech Ltd., hereinafter referred to as 'HBL', which expression shall unless repugnant to the context or meaning thereof include its successors, executors, administrators and assigns, having awarded to M/s. _____ having its registered office at _____ hereinafter referred to as the 'Supplier', which expression shall unless repugnant to the context or meaning thereof, include its successors, Administrators, executors and assigns, a contract hereinafter referred to as the 'Order' for _____ referred to as the 'Supply and Services' on terms and conditions set out, inter-alia in the HBL's Order No. _____ dated _____ valued _____ at _____ (in words & figures) and as the HBL having agreed to make a payment against the above ORDER, to the Supplier amounting to Rs. _____ (in words & figures) as an advance against Bank Guarantee to be furnished by the Supplier, the said advance to be adjusted against the supply and services to be performed by the Supplier, we _____ hereinafter referred to as the 'Bank' which expressions shall, unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns **having our office at _____ do hereby undertake to give the irrevocable and unconditional guarantee and** do hereby undertake to pay the HBL on first demand without any demur, **reservation, contest recourse and protest and without reference to the Supplier** any and all monies payable by the Supplier by reason of any breach by the said Supplier of any of the terms and conditions of the said order to the extent of Rs. _____ (in words & figures) till the said advance is adjusted as aforesaid at any time up to _____. We agree that the guarantee herein contained shall continue to be enforceable till the sum due to the HBL on account of the said advance is adjusted/recovered in full as aforesaid or till the HBL discharges this guarantee.

The HBL shall have the fullest liberty without affecting in any way the liability of the Bank under this guarantee, from time to time vary the advance or to extend the time for performance of the supply and services by the Supplier. The Bank shall not be released from its liability under these presents by any exercise of the HBL of the liberty with reference to the matter aforesaid.

The HBL shall have the fullest liberty, **without reference to Supplier and** without affecting this guarantee to postpone **for any time or** from time to time the exercise of any powers vested in them or of any right which they might have against the Supplier, and to exercise the same at any time in any manner, and either to enforce or to forebear to enforce any **power**, covenants contained or implied in the order between the HBL and the Supplier or any other course or remedy or security available to the HBL and the Bank shall not be released of its obligations under these presents by any exercise by the HBL of its liberty with reference to matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the HBL or any other indulgence shown by the HBL or by any other matter or thing whatsoever which under law would, but for this provision, have the effect of relieving the Bank Guarantee.

The right of HBL to recover the outstanding sum of advance with applicable costs up to Rs. _____ from the bank in the manner aforesaid will not be affected or suspended by reason of the fact that any dispute or disputes is or are pending before any officer, tribunal or court and any demand made by HBL on the Bank shall be conclusive and binding.

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The Bank further undertakes not to revoke this guarantee during its currency without prior and written consent of the **HBL and further agrees that the guarantee contained shall continue to be enforceable till the HBL discharges this guarantee.**

The Bank also agrees that the HBL shall at its option is entitled to enforce this guarantee against the bank as principal debtors, in first instance, notwithstanding any other security or guarantee that **HBL** may have in relation to the Supplier's liabilities of the said advance.

Notwithstanding anything contained herein above, our liability under this guarantee is restricted to as Rs. _____(in words & figures) and it will remain in force up to and including _____(date of completion of supply and services) and shall be extended from time to time for such periods as may be advised by M/s..... on whose behalf this guarantee has been given.

Therefore, we hereby affirm that we are guarantors and responsible to you on behalf of the Supplier up to a total amount of _____(amount of guarantees in words and figures) and we undertake to pay you, upon your first written demand declaring the Supplier to be in default under the purchase order and without caveat or argument, any sum or sums within the limits of (amount of guarantee) as aforesaid, without your needing to prove or show grounds or reasons for your demand or the sum specified therein.

This Guarantee is valid until _____ day _____.

We have power to issue this guarantee in your favour under Memorandum and Articles of Association and the undersigned has full power to do under the Power of Attorney / Resolution of Board of Directors dated.....granted to him by the Bank.

Dated.....this.....day of.....2014

Signed by

Place:

(Person duly authorised by Bank)

Witness:

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SECTION – XV (B)

BANK GUARANTEE FORMAT FOR PERFORMANCE SECURITY

To

HLL Biotech Ltd.,
Module 013-015,
Ticel Biopark Campus,
CSIR Road, Taramani,
Chennai – 600 113.

1. In consideration of HLL Biotech Limited (hereinafter called “HBL”) having agreed under the terms and conditions of Order No..... dated..... made between (here in after called “the said Supplier(s)”) for the work (herein after called “the said agreement”) for compliance of his obligation in accordance with the terms and conditions in the said agreement.

We (indicate the name of the Bank) (herein after referred to as “as Bank) hereby undertake to pay to the HBL and amount not exceeding Rs..... (Rupees..... only) on demand by HBL.

2. We (Indicate the name of the Bank) do hereby undertake to pay the amount due and payable under this Guarantee without any demure, merely on a demand from HBL stating that the amount claimed is required to meet the recoveries due or likely to be due from the said Supplier(s). any such demand made on the Bank shall be conclusive as regards the amount due and payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs..... (Rupees..... only).
3. We undertake to pay to HBL any money so demanded notwithstanding any dispute or disputes raised by the Supplier (s) in any suit or proceeding pending before any court or Tribunal relating thereto our liability under this present being absolute and unequivocal.

The payment made by us under this guarantee shall be valid discharge of our liability for payment to there-under and the Supplier(s) shall have no claim against us making such payment.

4. We (Indicate the name of Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of HBL under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineer-in-charge on behalf of HBL Certified that the terms and conditions of the said Agreement have been fully and properly carried out by the said Supplier(s) accordingly discharges this guarantee.
5. We..... (Indicate the name of Bank) further agree with HBL that HBL shall have the fullest liberty without our consent and without affecting any manner our obligations hereunder to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Supplier(s) from time to time or to postpone for any of the powers exercisable by HBL against the said Supplier(s) and to forebear or enforce any of the terms and conditions relating to the said agreement we shall not be relieved from our liability by reasons of any such variation or extension being granted to the said Supplier(s) or for any forbearance act of omission on that part of the HBL or any indulgence by HBL to the said contract(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effected or so relieving us.
6. The guarantee will not be discharged due to the change in the constitution of the Bank or the Supplier(s).
7. We..... (indicate the name of Bank) lastly undertake not to revoke this guarantee except with the previous consent of HBL in writing.

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8. This guarantee shall be valid up to unless extended on demand by HBL. Notwithstanding anything mentioned above our liability against this Guarantee is restricted to Rs..... (Rupees.....only) and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee, all our liabilities under the Guarantee shall stand discharged.

Dated the day of 20....

For
(Indicate the name of Bank)

.....
Seal, name & address of the Bank and address of the Branch

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SECTION – XVI

CONTRACT FORM

(Format for signing the agreement by the successful bidder after awarding the order)

CONTRACT FORM FOR SUPPLY, INSTALLATION, COMMISSIONING, HANDING OVER, TRIAL RUN, TRAINING OF OPERATORS & WARRANTY OF GOODS

HLL Biotech Limited, Chennai

Contract No _____ dated _____

This is in continuation to this office's Notification of Award No _____ dated _____

1. Name & address of the Supplier: _____
2. Purchaser's TE document No _____ dated _____ and subsequent Amendment No _____, dated _____ (if any), issued by the purchaser
3. Supplier's Tender No _____ dated _____ and subsequent communication(s) No _____ dated _____ (if any), exchanged between the supplier and the purchaser in connection with this tender.
4. In addition to this Contract Form, the following documents etc, which are included in the documents mentioned under paragraphs 2 and 3 above, shall also be deemed to form and be read and construed as integral part of this contract:

- (i) General Conditions of Contract;
- (ii) Special Conditions of Contract;
- (iii) List of Requirements;
- (iv) Technical Specifications;
- (v) Quality Control Requirements;
- (vi) Tender Form furnished by the supplier;
- (vii) Price Schedule(s) furnished by the supplier in its tender;
- (viii) Manufacturers' Authorisation Form (if applicable for this tender);
- (ix) Purchaser's Notification of Award

Note: The words and expressions used in this contract shall have the same meanings as are respectively assigned to them in the conditions of contract referred to above. Further, the definitions and abbreviations incorporated under clause 1 of Section II – 'General Instructions to Tenderers' of the Purchaser's TE document shall also apply to this contract.

5. Some terms, conditions, stipulations etc. out of the above-referred documents are reproduced below for ready reference:

Total value (in figure) _____ (In words) _____

1. Delivery schedule

(i) Details of Performance Security

(ii) Quality Control

- (a) Mode(s), stage(s) and place(s) of conducting inspections and tests.
- (b) Designation and address of purchaser's inspecting officer

(iii) Destination and despatch instructions

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- (iv) Consignee, including port consignee, if any
- 2. Warranty clause
- 3. Payment terms
- 4. Paying authority

(Signature, name and address of CONSIGNEE)

For and on behalf of _____

Received and accepted this contract

 (Signature, name and address of the supplier's executive duly authorised to sign on behalf of the supplier)

For and on behalf of _____

 (Name and address of the supplier)

(Seal of the supplier)

Date: _____

Place: _____

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SECTION – XVI

DELETED

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SECTION – XVII

PROFORMA OF CONSIGNEE RECEIPT CERTIFICATE

(To be given by consignee’s authorized representative)

The following store (s) has/has been received in good condition:

- 1) Contract No. & date : _____
- 2) Supplier’s Name : _____
- 3) Consignee’s Name & Address with telephone No. & Fax No. : _____
- 4) Name of the item supplied : _____
- 5) Quantity Supplied : _____
- 6) Date of Receipt by the Consignee : _____
- 7) Name and designation of Authorized Representative of Consignee : _____
- 8) Signature of Authorized Representative of Consignee with date : _____
- 9) Seal of the Consignee : _____

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SECTION – XVIII

Proforma of Final Acceptance Certificate by the Purchaser

No _____

Date _____

To

M/s _____

Subject: Certificate of commissioning of equipment/plant.

This is to certify that the equipment(s)/plant(s)/work(s) as detailed below has/have been received in good conditions along with all the standard and special accessories and a set of spares in accordance with the contract/technical specifications. The same has been installed and commissioned.

- (a) Contract No _____ dated _____
- (b) Description of the equipment(s)/plants/work(s): _____
- (c) Equipment(s)/ plant(s) nos.: _____
- (d) Quantity: _____
- (e) Bill of Loading/Air Way Bill/Railway Receipt/ Goods Consignment Note no _____ dated _____
- (f) Name of the vessel/Transporter: _____
- (g) Name of the Consignee: _____
- (h) Date of commissioning and proving test: _____
- (i) Date of approval obtained : _____

Details of accessories/spares not yet supplied and recoveries to be made on that account.

Sl. No.	Description of Item	Quantity	Amount to be recovered
---------	---------------------	----------	------------------------

The proving test has been done to our entire satisfaction and operators have been trained to operate the equipment(s)/plant(s).

The supplier has fulfilled its contractual obligations satisfactorily ## or

The supplier has failed to fulfill its contractual obligations with regard to the following:

- He has not adhered to the time schedule specified in the contract in dispatching the documents/drawings pursuant to 'Technical Specifications'.
- He has not supervised the commissioning of the equipment(s)/plant(s) in time, i.e. within the period specified in the contract from date of intimation by the Purchaser in respect of the installation of the equipment(s)/plant(s).
- The supplier as specified in the contract has not done training of personnel.

The extent of delay for each of the activities to be performed by the supplier in terms of the contract is:

The amount of recovery on account of non-supply of accessories and spares is given under Para no.02.

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The amount of recovery on account of failure of the supplier to meet his contractual obligations is _____ (here indicate the amount).

Signature
Name
Designation with stamp

Explanatory notes for filling up the certificate:

He has adhered to the time schedule specified in the contract in dispatching the documents/drawings pursuant to 'Technical Specification'.

He has supervised the commissioning of the equipment(s)/plant(s) in time, i.e. within the time specified in the contract from date of intimation by the Purchaser/Consignee in respect of the installation of the equipment(s)/plant(s).

**Training of personnel has been done by the supplier as specified in the contract
In the event of documents/drawings having not been supplied or installation and commissioning of the equipment(s)/plant(s) having been delayed on account of the supplier, the extent of delay should always be mentioned in clear terms.**

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SECTION – XIX

CHECKLIST

Name of Tenderer:

Name of Manufacturer:

SI No.	Activity	Yes/ NA	No/ Remarks
1. a.	Have you enclosed EMD of required amount for the quoted schedules?		
b.	EMD is furnished in the form of Bank Guarantee as per Section XIII?		
c.	Have you kept validity of Bank Guarantee for 165 days from Technical Bid Opening date as per clause 18 of GIT?		
d.	Have you enclosed tender fee as prescribed in TE document?		
2. a.	Have you enclosed duly filled Tender Form as per format in Section X?		
b.	Have you enclosed Power of Attorney in favour of the signatory?		
3.	Are you a SSI unit, if yes have you enclosed certificate of registration issued by Directorate of Industries/NSIC		
4. a.	Have you enclosed clause-by-clause technical compliance statement for the quoted goods vis-à-vis the Technical specifications?		
b.	In case of Technical deviations in the compliance statement, have you identified and marked the deviations?		
5. a.	Have you submitted satisfactory performance certificate as per the Proforma for performance statement in Sec. IX of TE document in respect of all orders?		
b.	Have you submitted copy of the order(s) and end user certificate?		
6.	Have you submitted manufacturer's authorization as per Section XIV?		
7.	Have you submitted prices of goods in the Price Schedule as per Section XI?		
8.	Have you ensured validity of your offer for 120 days from the Technical bid Opening date as per the TE document?		
9.	Have you furnished Income Tax Account No. as allotted by the Income Tax Department of Government of India?		
10.	Have you intimated the name and full address of your Banker (s) along with your Account Number		
11.	Have you fully accepted payment terms as per TE document?		
12.	Have you fully accepted delivery period as per TE document?		

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SI No.	Activity	Yes/ NA	No/ Remarks
13	Have you accepted the warranty as per TE document?		
14.	Have you accepted terms and conditions of TE document?		
15.	Have you furnished documents establishing your eligibility & qualification criteria as per TE documents?		
16	Have you furnished Annual Report (Balance Sheet and Profit & Loss Account) for last three years prior to the date of Tender opening?		
17	Have you enclosed signed Integrity Pact in the prescribed format?		

Notes to Bidder

1. All pages of the Tender should be page numbered and indexed.
2. The Tenderer may go through the checklist and ensure that all the documents/confirmations listed above are enclosed in the tender and no column is left blank. If any column is not applicable, it may be filled up as NA.
3. It is the responsibility of tendered to go through the TE document to ensure furnishing all required documents in addition to above, if any.

(Signature with date)

**(Full name, designation & address of the person duly authorised sign on behalf of the Tenderer)
For and on behalf of**

(Name, address and stamp of the tendering firm)

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Section – XX

Consignee

All Goods shall be delivered at

**"INTEGRATED VACCINES COMPLEX,
HLL BIOTECH LIMITED, Thirumani Village, CHENGALPATTU,
TAMILNADU PIN -603001"**

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SECTION – XXI

To be signed by the bidder and signatory competent/authorized to sign the relevant contract on behalf of HLL Biotech Limited

INTEGRITY AGREEMENT

This Integrity Agreement is made at on this Day of.....20.....

BETWEEN

President of India represented through Chief Executive Officer, HLL Biotech Limited (Hereinafter referred as the “Principal/Owner”, which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns.

AND

.....(Hereinafter referred to as the “**Bidder/Supplier**” and which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns).

Preamble

WHEREAS the Principal / owner has floated the Tender (NIT No.....) (hereinafter referred to as “**Tender/Bid**”) and intends to award, under laid down organizational procedure, contract for Hereinafter referred to as the “**Contract**”

AND WHEREAS the Principal /Owner values full compliance with all relevant laws of the land, rules, regulations, economic use of resources and of fairness/transparency in its relation with its Bidder(s) and Supplier(s).

AND WHEREAS to meet the purpose aforesaid both the parties have agreed to enter into this Integrity Agreement (hereinafter referred to as “**Integrity Pact**” or “**Pact**”), the terms and conditions of which shall also be read as integral part and parcel of the Tender Bid documents and Contract between the parties. NOW, THEREFORE, in consideration of mutual covenants’ contained in this Pact, the parties hereby agree as follows and this Pact witnesses as under:

Article 1: Commitment of the Principal /Owner

- 1) The Principal /Owner commits itself to take all measures necessary to prevent corruption and to observe the following principles.
 - (a) No employee of the Principal/Owner, personally or through any of his/her family members, will in connection with the Tender, or the execution of the Contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
 - (b) The Principal/Owner will, during the Tender process, treat all Bidder(s) with equity and reason. The Principal/owner will , in particular, before and during the Tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder (s) could obtain an advantage in relation to the Tender process or the Contract execution.
 - (c) The Principal /Owner shall Endeavour to exclude from the Tender process any person, whose conduct in the past has been of biased nature.
- 2) If the Principal/Owner obtains information on the conduct t of any of its employees which is a criminal offence under the Indian Penal code (IPC)/Prevention of Corruption Act, 1988 (PC Act) or is in violation of the principles herein mentioned or if there be a substantive suspicion in this regard, the Principal/Owner will inform the Chief Vigilance Officer and in addition can also in initiate disciplinary actions as per its internal laid down policies and procedures.

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Article 2: Commitment of the Bidder(s) / Supplier(s)

- 1) It is required that each Bidder/ Supplier(including their respective officers, employees and agents) adhere to the highest ethical standards, and report to the Government/Department all suspected acts of **fraud or corruption or Coercion or Collusion** of which it has knowledge or becomes aware, during the tendering process and throughout the negotiation or award of a contract.
- 2) The Bidder(s)/ Supplier(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the Tender process and during the Contract execution.
 - (a) The Bidder(s)/ Supplier(s) will not, directly or through any other person or firm, offer, promise or give to any of the Principal/owner's employees involved in the Tender process or execution of the Contract or to any third person any material or other benefit which he/she which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the Tender process or during the execution of the Contract.
 - (b) The Bidder(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certification, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to cartelize in the bidding process.
 - (c) The Bidder(s)/ Supplier(s) will not commit any offence under the relevant IPC/PC Act. Further the Bidder(s) /Contract(s) will not use improperly, (for the purpose of competition or personal gain).or pass on to others, any information or documents provided by the Principal/Owner as part of the business relationship, regarding plans, technical proposals and business details, including and business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
 - (d) DELETED.
 - (e) The Bidder (s)/ Supplier (s) will , when presenting his bid, disclose (with each tender as per proforma unclosed) any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the Contract.
- 3) The Bidder(s) / Supplier(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.
- 4) The Bidder (s)/ Supplier(s) will not, directly or through any other person or firm indulge in fraudulent practice means a willful misrepresentation or omission of facts or submission of fake/forged documents in order to induce public official to act in reliance thereof, with the purpose of obtaining unjust advantage by or causing damage to justified interest of others and /or to influence the procurement process to the detriment of the Government interests.
- 5) The Bidder(s)/ Supplier(s) will not, directly or through any other person or firm use Coercive Practices (Means the act of obtaining something, compelling an action or influencing a decision through intimidation, threat or the use of force directly or indirectly, where potential or actual injury may befall upon a person, his/her reputation or property to influence their participation in the tendering process).

Article 3: Consequences of Breach

Without prejudice to any rights that may be available to the Principal/Owner under law or the Contract or its established policies and laid down procedures, the Principal/Owner shall have the following rights in case of breach of this integrity Pact by the Bidder (s)/ Supplier(s) and the Bidder(s)/ Supplier(s) accepts and undertakes to respect and uphold the Principal /Owner's absolute right:

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- 1) If the Bidders / Supplier(s), either before award or during execution of Contract has committed a transgression through a violation of Article 2 above or in any other form, such as to put his reliability or credibility in question, the Principal/owner after giving 14 days' notice to the Supplier shall have powers to disqualify the Bidder (s)/ Supplier(s) from the Tender process or terminate/determine the Contract, if already executed or exclude the Bidder/ Supplier from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of transgression and determined by the Principal/owner. **Such exclusion may be forever or for a limited period as decided by the Principal/owner.**
- 2) **Forfeiture of EMD/performance Guarantee/Security Deposit:** If the Principal/owner has disqualified the Bidder(s) from the Tender process prior to the award of the Contract or terminated/determined the Contract or has accrued the right to terminate/determine the Contract according to Article 3(1), the Principal /Owner apart from exercising any legal rights that may have accrued to the Principal/Owner, may in its considered opinion forfeit the entire amount of Earnest Money Deposit, Performance Guarantee and security Deposit, Performance Guarantee and security Deposit of the Bidder/ Supplier.
- 3) **Criminal Liability:** If the Principal/Owner obtains knowledge of conduct of a Bidder or Supplier, or of an employee or a representative or an associate of a Bidder or Supplier which constitutes corruption within the meaning of Indian Penal code (IPC)/Prevention of corruption Act, or if the Principal/owner has substantive suspicion in this regard, the Principal/owner will inform the same to law enforcing agencies for further. Investigation.

Article 4- Previous Transgression

- 1) The Bidder declares that no previous transgressions occurred in the last 5 years with any other Company in any country confirming to the anticorruption approach or with Central Government or State Government or any other Central/State Public sector Enterprises in India that could justify his exclusion from the Tender process.
- 2) If the Bidder makes incorrect statement on this subject, he can be disqualified from the Tender process or action can be taken for banning of business dealings/ holiday listing of the Bidder/ Supplier as deemed fit by the Principal/owner.
- 3) If the Bidder/ Supplier can prove that he has resorted / recouped the damage caused by him and has installed a suitable corruption prevention system, the Principal/owner may, at its own discretion, revoke the exclusion prematurely.

Article 5- Equal Treatment of all Bidders/ Suppliers/Sub Suppliers

- 1) The Bidder(s) / Supplier(s) undertake(s) to demand from all sub Suppliers a commitment in conformity with this Integrity Pact. The Bidder/ Supplier shall be responsible for any violation(s) of the principles laid down in this agreement /pact by any of its Sub- Suppliers/sub-vendors.
- 2) The Principal/owner will enter into Pacts on identical terms as this one with all Bidders and Suppliers.

Article 6- Duration of the Pact

This Pact begins when both the parties have legally signed it. It expires for the Supplier/Purchaser 12 months after the completion of work under the contract or till the continuation of defect Liability period, whichever is more and for all other bidders, till the Contract has been awarded.

If any claim is made/lodged during the time, the same shall be binding and continue to be valid despite the lapse of this Pacts as specified above, unless it is discharged /determined by the competent authority, HLL Biotech Limited.

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Article 7- other Provisions

- 1) This Pact is subject to Indian Law., place of performance and jurisdiction is the Head quarters of HLL Biotech Limited of the Principal/Owner, who has floated the Tender.
- 2) Changes and supplements need to be made in writing. Side agreements have not been made.
- 3) If the Supplier is a partnership or a consortium, this Pact must be signed by all the partners or by one or more partner holding power of attorney signed by all the partners or by one or more partner holding power of attorney signed by all partners and consortium members. In case of a company, the Pact must be signed by a representative duly authorized by board resolution.
- 4) Should one or several provisions of this Pact turn out to be invalid; the remainder of this Pact remains valid. In this case, the parties will strive to come to an agreement to their original intensions.
- 5) It is agreed term and condition that any dispute or difference arising between the parties with regard to the terms of this Integrity Agreement/pact, any action taken by the Owner/Principal in accordance with this **Integrity Agreement/Pact or interpretation thereof shall not be subject to arbitration.**

Article 8- LEGAL AND PRIOR RIGHTS:

All rights and remedies of the parties hereto shall be in addition to all the other legal rights and remedies belonging to such parties under the Contract and /or law and the same shall be deemed to be cumulative and not alternative to such legal rights and remedies aforesaid. For the sake of brevity, both the Parties agree that this Integrity Pact will have precedence over the Tender /Contact documents with regard any of the provisions covered under this Integrity Pact.

IN WITNESS WHERE OF the parties have signed and executed this Integrity Pact at the place and date first above mentioned in the presence of following witnesses:

.....
(For and on behalf of Principal/owner)

.....
(For and on behalf of Bidder/ Supplier)

WITNESSES:

1.

(Signature, Name & address)

2.

(Signature, Name & address)

Place:

Date:

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Section XXII

Deleted

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Section XXIII

SCHEDULE OF FISCAL ASPECTS

Sr. No.	Particulars	Description
1.	Submission of completed Tender	21-08-2014 at 15:00 Hrs
2.	Opening of Technical Bid	21-08-2014 at 15:30 Hrs
3.	Period of completion	8 months(Supply 5 month+ Installation 3 month) from date of issue of Letter of Acceptance
4.	Advance	10% of the Purchase order value against Bank Guarantee equivalent to 110% of the advance amount and submission of Security Deposit/ Performance Security of 5% of contract value from a Scheduled Commercial Bank.
5.	Payment terms for Purchase Order (PO)	a. 60% (PO) against delivery of material at site b.10% (PO) against installation of material at site. c.10% (PO) on successful commissioning d.10% (PO) on receipt of Final Acceptance Certificate from HBL.
6.	Payment Terms for service order (SO)	a.60% (SO) against Installation of material at site b.30% (SO) on successful commissioning. c.10% (SO) on submission of all documentation and on receipt of Final Acceptance Certificate from HBL.
7.	Liquidated damages/per week	0.5% per week inclusive of Sundays & Holidays up to a maximum of 5% of Contract Value
8.	Warranty Period	1 year (Twelve) months from the date of successful handover.
9.	Earnest Money Deposit	Rs.12,00,000/- (Rupees Twelve lakh Only)
10.	Refund of Earnest Money Deposit to unsuccessful bidders	On award of contract to successful bidder
11.	Transportation & Insurance	On account of supplier
12.	B.G/ DD to be in favour of	HLL Biotech Ltd., Chennai
13.	All queries / communication to be addressed to	CHIEF EXECUTIVE OFFICER HLL Biotech Limited, Ticel Biopark Campus (Module no. 013-015), CSIR Road, Taramani, Chennai- 600 113 Email: ramanr@hllbiotech.com,sureshs@hllbiotech.com Contact No: 044 22544956/70/74 , Fax – 044 22540101
14.	Pre-bid Meeting	Venue: HLL Biotech Limited, Ticel Biopark Campus (Module no. 013 - 015), CSIR Road, Taramani, Chennai- 600 113 Date and Time: 07.08.2014 , 11:00 Hrs

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CHAPTER– 2.1

DESCRIPTION / SCOPE OF WORK

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2.1.1 INTRODUCTION

HLL Biotech Limited (HBL), a subsidiary of HLL Lifecare Limited, (a CPSU under Ministry of Health & Family Welfare, Government of India, is implementing "**an Integrated Vaccines Complex (IVC) - a project of national importance**" at Chengalpattu, near Chennai.. The proposed complex is a state of the art facility with cGMP compliance for manufacturing vaccines required for the immunization programme of Government of India.

For this purpose, HBL has decided to invite bids for appointment of Electrical contractors to build this state-of-the-art facility as per the scope of services, Technical specifications and BOQ defined in chapter 2.2 & 2.3 respectively.

NNE Pharmaplan India Limited, hereinafter called as "NPI" has been appointed as "Project Consultants". NPI shall design and engineer this facility, incorporating the latest GMP Standards and best practices. This facility shall be built as per the latest International trends and upon completion, shall be in compliance with Indian FDA (Schedule M), USFDA, EUGMP & MHRA.

One amongst the several other jobs is to plan, supply, execute & commission of power supply Distribution system as per enclosed, specifications, Bill of Quantities (BOQ) and drawings.

Hence, bids are invited from technically pre-qualified parties having experience in this type of Electrical work

The scope of work involved is detailed in the subsequent paragraphs and is precise to the extent possible. However, in order to ascertain the actual site conditions, it is requested to all contractors to visit the site and get well versed with the actual site conditions or discuss with Consultants Purchaser about the type and quantum of works involved.

2.1.2 PURPOSE

The Specification covers the general requirements for the design manufacture and testing of D.G sets for the upcoming Facility for HLL Biotech Limited at Chennai. The facility shall comprise of electrical substation, Utility block and its Ancillary buildings etc.,

This specification shall be used in conjunction with all specifications and data sheets attached.

The scope of vendor covers the design, fabrication, procurement, manufacture, assembly, testing, delivery at site including unloading of D.G sets at plant site as per specification. The scope also includes Testing and commissioning of D.G sets and putting into successful and satisfactory operation as per attached BOQ.

2.1.3 SCOPE OF SUPPLY & SERVICE:

- Supply of the D.G sets as per specification.
- Furnishing of all labour, skilled and unskilled, supervisory and administrative personnel, erection tools and tackles, testing equipment, implements, supplies, consumables like welding rods and gas, oil and grease, cleaning fluids, insulating tape, anti- corrosive paints, jute cotton waste etc. and hardware for timely and efficient execution of the erection work.
- Supply, Loading, Transportation ,Unloading, Shifting, Loading, Installation, Testing and Commissioning of Diesel Generating set in scope of supplier Scope is inclusive of collection & loading of items which are supplied separately for transportation purpose from owner's designated stores/ yard, transportation, unloading at work site, unpacking, inspection, checking of foundation level ,shifting, placing & levelling at the final location.

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- The equipments / materials shall be unloaded from transport shifted to owner's store, if store is not ready so shifting to temporary store , resifted from owner's store/temporary store to place of erection, unpacking, site assembly of loosely furnished accessories, installation on foundation (civil work done by owner), proper alignment, levelling, fixing of steel supporting channels , grip bolts and all other accessories as require & minor civil works, touch up paint but not limited to , & complete the work in all respect ready for operation & to the entire satisfaction of Engineer-In- charge.
- The items of work to be performed on all equipment and materials shall include but not limited to the following:
 - Supply, loading, transportation and unloading at site. (to contractor's stores or purchaser's store).
 - Opening, inspecting and reporting all damages & short supply items.
 - Arranging to repair and/or re-order all damaged and short supply items.
 - Packing of the equipments suitable for (all) weather conditions for proper protection.
 - Inspection of all equipment which are not inspected at manufacturer's works by employer regarding compliance with technical specifications and submission of report of the same to site in charge.
 - Storing at site with all suitable weather protection.
 - Assembly, erection and complete Installation.
 - Necessary coordination between work done by other contractors.
 - Final check-up, testing and commissioning in presence of Employer's representative
 - Trial run for thirty (30) days, rectification of defects, if any and adjustments as necessary.
 - Obtaining Employer's written acceptance of satisfactory performance

2.1.4 SCOPE OF WORK

The specification is intended to cover the design, engineering ,material, constructional features, manufacturing, inspection and testing at suppliers works, delivery to site, erection, performance testing and commissioning of the DG set complete with fuel system, exhaust system, etc., all other supporting systems complete as required. The capacity of D.G Set: -

- 2 Nos , 11 KV , 2 MVA DG Set with(prime duty ,net output) complete with all the accessories and required batteries, fuel system, cooling system, exhaust system and other auxiliary equipment etc.
- The Governing system of the Diesel gen sets shall be compatible with the Synchronizing and auto load sharing supplied by the DG supplier (Either easYgen 3200 or equivalent).
- The required controls, indications and interlocking and defeating the auto mode to manual mode shall be provided by the D.G supplier. All the required earthing of the equipments shall be supplied by D.G supplier.
- If any specific Genset protection or AMF function is required to be installed, shall be specified in offer.
- DG Auxiliary equipments panel shall be supplied along with DG sets as per requirement
- Equipment body and Neutral grounding electrodes shall be supplied and installed by DG Set supplier.
- All electrical material like Earthing electrodes, earthing strip , Outdoor Isolator panel near to DG sets if required , interconnecting control cables , DG set Auxiliary equipment and its panel etc shall be part of DG supplier.
- Synchronization of DG sets shall be done on Main Bus of Main HT panel and Main HT panel shall be supplied and installed by Electrical contractor but synchronization of DG sets shall be common responsibility of DG supplier as well as Electrical contractor , all necessary control , cabling and programming shall be done by the DG supplier
- DG Supplier will submit the control scheme of the synchronization through client/ consultant , review and approval of Synchronization Power and Control scheme is sole responsibility of DG set supplier and Electrical Contractor, after approval of Synchronization control and power scheme from client/consultant.
- Adaptor box @ Alternator shall be supplied and installed by DG supplier

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- Following are the Electrical contractor scope of work
 - Power cable from Alternator / DG sets to Main HT panel
- DG Supplier has to supply and install DG Sets and its accessories, Auxiliary MCC Panel , NGR Panel and Relay and control panel
- Battery system and battery.
- Accoustic Enclosure (Silent canopy) for DG set or Room Accoustic treatment which is specified in BOQ.
- Fuel day tank with top mounted level gauge and high & low level switches, containment tank and associated piping.
- Radiator cooling system with blower fans if required.
- Exhaust system with piping & insulation, its lagging supports (Stack of height 30m and required ducting), etc.
- Erection and commissioning of above equipment including piping.
- Approval from Statutory authority and Electrical Inspectorate
- Antivibration mounting pads.
- Foundation Bolts.

Any material or accessories which may not have been specifically mentioned but which usually is necessary for satisfactory and trouble free operation and maintenance of the equipment, shall be furnished by the vendor without any extra charge to the owner.

2.1.5 EXCLUSION:-

Civil foundation of above equipments.

2.1.6 INFORMATION REQUIRED FROM VENDOR:-

Following information shall be furnished by the contractor:-
Along with the offer

- i) Technical particulars of various equipments as format (Annexure) enclosed with this specification. This shall include the engine model no., its output at the ambient temp. and elevation, Alternator details, switchgear and control panel etc.
- ii) G.A. drawing of D G Set.

After award of work (For approval)

- i) Foundation drawings of all equipment, GA drawings of engine, alternator (clearly showing terminal arrangement in plan & in elevation) and all other equipment (within one week of the award of contract).
- ii) Terminal Box drawing of the Alternator
- iii) Cable list/schedule & interconnection diagram, interconnection diagram between Main

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HT Panel and D.G.sets, (within two weeks after award of contract).

- iv) Test certificates of equipment.
- v) Four copies of final drawings with one auto cad CD, operation, installation and maintenance manual shall be supplied well in advance before inspection.
- vi) D.G.set supplier has to check the scheme , Power and control circuit drawing of Main HT panel along with logic prepare by Electrical contractor.(Due to Synchronization of the D.G.sets with Main HT Panel)

2.1.7 COMPLETENESS

- It is not the intent to specify completely herein all details of the equipment. Nevertheless, the equipment shall be complete and operative in all aspects.
- Any material or accessories which may not have been specifically mentioned but which is necessary usual for satisfactory and trouble free operation and maintenance of the equipment, shall be furnished by the contractor without any extra charge to the Employer.

2.1.8 NOTES TO BIDDER

It is necessary to follow the following points while submitting the offer :

- All equipment shall meet the requirement of this specification. Deviations (if any) with respect to this specifications shall clearly be indicated in the offer in Annexure under "Deviations" with page no. & clause no. of specification.
- Quantities of equipment indicated herein are subject to change.

All technical particulars and other details as asked for shall be furnished in the specification only. Additional information, if desired by the bidder, can also be furnished separately.

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CHAPTER-2.2

DESIGN CRITERIA

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2.3.1 DESIGN CRITERIA:

The D.G.sets and components specified here in or not, shall be designed, manufactured and tested with the latest revisions of relevant Indian or equivalent British or International Standards.

The design, material, construction, manufacture inspection, testing and commissioning of Diesel Generator sets shall comply with all currently applicable states, regulations and safety codes in the locality where the equipment will be installed and in particular shall comply with NEMA-MGI-22 and IEC-39-1. The equipment shall also confirm to the latest applicable standards and code of practice. Nothing in this specification shall be construed to relieve the supplier of this responsibility.

Engine : ISO 3046 / DIN 6271 / BS-5514 / BS-649

Alternator : BS 2613 / IS 4722 / IEC 60034-1 & 2

Control Panel : IS 4230 for manufacturing standards

Sr. No	Code	Description
1	IS 10000	Methods of tests for internal combustion engines.
2	IS 1460	Specification for diesel fuels.
3	IS 4722	Rotating electrical machines (BS-500)
4	IS 4691	Degrees of protection provided by enclosures for rotating electrical machine.
5	BS 5514	Reciprocating Internal Combustion Engines - Performance.
6	IS 12065	Noise level
7	IS 12075	Vibration level
8	Environment (Protection) Act	Latest Notification No. GSR 371(E) dt. 17-5-2002. Rules - Second Amendment - 2001.
9	IS 13118	Specification for High Voltage A.C. Circuit Breaker
10	IS 2099	Bushings for alternating voltages above 1000V.
11	IS 2705	Current transformers : General Requirements.
12	IS 3156	Voltage Transformers : General Requirement.
13	IS 3231	Specification for electrical relays for power system protection.
14	IS 3427	AC Metal enclosed switchgear & control gear for rated voltages above 1KV and upto & including 52 KV.
15	IS 12729	General Requirements for switchgear & Control gear for voltages exceeding 1000V.

All other relevant standards

Wherever Indian Standards are not available, the D.G.sets shall conform to relevant International Standard.

- 1) All electrical components shall also conform to the latest Electricity rules as regards safety and other essential provisions.
- 2) All electrical installation work shall comply with the requirements of the following Act/Rules/Codes as amended upto date:
 - a) Indian Electricity Act.

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- b) Indian electricity Rules.
 - c) National Electric Code published by BIS.
 - d) All relevant IS codes of practice.
 - e) Regulations published by Tariff Advisory Committee.
 - f) Indian Standards for Electrical Equipment for use in Hazardous Atmospheres.
- 3) Ambient air temperature shall be taken as 45°C for the purpose of designing electrical equipments.
- 4) Nominal system supply available shall be as follows:
- a) Incoming : Provided by the client.
 - b) Utilization : 415V, 3 Ph., 4 wire, 50 Hz .
- 5) DG Sets are intended to provide prime rated of 11KV, 3 Ph. 4 wire, 50 Hz to various loads of plant.
- a) All controls shall be of 110V DC.
 - b) DG Sets shall be suitable for continuous operation (Prime duty).
 - c) DG Sets shall be started/ stopped from Engine / DG Panel/ Remote.
 - d) The height of exhaust pipes shall be in line with requirements of pollution control rules.
 - e) Main features of DG sets shall be as follows:

Si.	Rating	As per B.O.Q. at 0.8 PF, 11KV, 3 Ph, 50 Hz. As per site condition.
ii.	Duty	Continuous Prime Rated Average Load 80%
iii.	Diesel Engine	4 stroke, multi Cylinders, turbo-charged after cooled.
iv.	Speed	1500 rpm
v.	Type of cooling	Radiator Cooled
vi.	Type of alternator	Brushless, separately-excited (PMG), self-regulated
vii.	Starting	Maintenance free VRLA Batteries
Viii	Batteries	Lead Acid type
ix	Governor	Electronic compatible with the Synchronizing and auto load sharing system of the client

2.3.2 BASIC CONDITION:

- a) The selection of equipment shall be governed by fitness for purpose, safety, reliability, maintainability of spares and service, compatibility with specified future expansion, design margins, suitability for environment, economic considerations, and past service history.
- b) The SI system of units shall be used.
- c) English language shall be used for all drawings, texts and communications.

2.3.3 SERVICE CONDITION:-

- a) D.G.sets shall, in all respects, be suitable for operation outdoor under site environmental and service conditions stated in Design criteria.

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- b) For the purpose of equipment de-rating and component operability, the above specification states that the equipment design temperature shall be +45°C.
- c) Where it can be demonstrated that:
The Maximum Ambient Temperature is 45°C, the DG Sets shall be capable of continuous operation at 45°C, if Temperature exceed above 45°C then DG sets shall be rated accordingly.
- d) D.G.sets shall in all respects be suitable for operation in typical tropical area.
- e) The atmosphere is to be considered Humid and dusty. The possibility of condensation, as experienced during large temperature variations in a humid environment in the tropic.

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CHAPTER – 2.3

TECHNICAL SPECIFICATION

Client : 	TENDER DOCUMENT FOR SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF HT DG SET AT HBL , IVC CHENGALPATTU	nne pharmaplan®
Project No : 120310	DOCUMENT NO : NPI-120310-ELC-S1-TD-02	Revision : 01 Date : 2014.07.29

CHAPTER – 2.3.1

TECHNICAL SPECIFICATION FOR HT D G SET

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2.3.1 TECHNICAL SPECIFICATION OF D.G.SET:

2.3.1.1 General Constructional Features:-

- All materials used shall be of best quality and of the class most suitable for working under the Conditions specified and shall withstand the variations of temperature and atmospheric conditions at project site without distortion or deterioration or setting up of under stresses in any part, and also without affecting the strength and suitability of the various parts for the work which they have to perform.
- Crankcase shall be made from Single piece case and shall be made from alloyed cast iron, dimensionally stable due to high side walls; suspended main bearing; water cooled cylinder liners made from highly wear resistant spun type casting; light alloy oil pan.
- Similar parts, particularly removable ones, shall be interchangeable.
- Pipes and pipe fittings, screws, studs, nuts and bolts used for external connections shall be as per the relevant standards. Carbon/Mild Steel bolts and nuts exposed to the atmosphere shall be galvanized or zinc passivated.
- Nuts, bolts and pins used inside the equipments shall be provided with lock washers or lock nuts.
- Surface in contact of lubricating oil shall not be effected by the formation of acid in oil. The MOC of the part shall confirm the non corrosive against acid .Surface in contact with oil shall not be galvanized or cadmium plated.
- Rating and terminal marking plates indelibly marked shall be provided. All label plates shall be of non-corrodible material.
- All internal connections and fastenings shall be capable of operating under overloads and over-excitation allowed as per specified standards without injury. Diesel Generator shall operate continuously without injurious heating at the rated KVA.
- Diesel Generator set shall be capable of delivering the rated current at a voltage equal to 110 percent of the rated voltage without exceeding the limiting temperature rise. Load test will be witnessed by owner/consultant before dispatch.
- Unless otherwise specified, the equipment shall be designed for Operation at a frequency of 50 Hz.
- Unless otherwise stated, the set shall be capable of operating continuously. In accordance with the applicable standard loading guide at their KVA.
- Overloads shall be allowed within the conditions defined in the loading guide of the applicable standard. Under these conditions, no limitations by terminal bushings, or other auxiliary equipment shall apply.
- Generator set complete shall be Designed and constructed to withstand without damage, the effects of external short-circuits as per the specified standards. Account shall be taken of the different forms of systems faults that can arise in service, such as line to earth faults and line to line faults associated with the relevant system and equipment earthing conditions.
- Every care shall be taken to ensure that the design and manufacture of the equipment shall be such as to reduce noise and vibration to the Level acceptable to Safety norms. The supplier shall ensure that the noise level shall not be more than specified in the standards.
- The equipment shall be designed with particular attention to the Suppression of harmonic voltage, especially the third and fifth, so as to eliminate wave form distortion and form any possibility of high

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frequency disturbances reaching such a magnitude as to cause interference with communication system.

- All rated quantities subject to the supplier's guarantees shall be within the tolerances given in applicable standards.
- All statutory approvals such as EB and pollution control board NOC and approval of Electrical inspector (CEA) for installation drawing and installation work in supplier's scope.
- Earthing Grid for DG and panel/Busduct earth pit.
- All piping /hose between day tank and DG set in supplier's scope.
- AVM pads for engine & Alternative frame mounting in DG Set supplier's scope
- Cabling between DG and panel (control cable) will be in Electrical contractor scope.

2.3.1.2 Technical Specification of Diesel Generator Set:-

A. Diesel Engine

- General: Diesel Engine shall be of heavy duty robust construction, suitable for both intermittent and continuous duty.
- The Diesel Generating Set shall be installed in acoustic enclosure, automatically as well as manually operated, Prime Rated designed for 24 hours continuous operation at average load factor of 80% . The set shall consist of diesel engine coupled to suitable alternator having self, brushless, static excitation system and include all necessary accessories and control panel (DGCP) as specified in data sheets.
- Direct injection "Diesel Engine of suitable BHP, turbo charged, Radiator cooled, 4 stroke multi cylinder vertical in line, suitable for cold weather starting, heavy duty industrial design continuous rating, low noise, suitable for generating set application, coupled to alternator and complete with the accessories as specified mounted on a common base frame, suitable for erection on AVMs.
- The DG set shall be designed for ambient temperature of 45°C. The engine BHP and alternator KVA shall be designed to deliver the rated output at 45°C. The bidder should submit sizing calculation for the offered engine and alternator.
- All parts subjected to substantial temperature variations shall be designed & supported to permit free expansion and contraction without resulting in leakage, excess of clearance, harmful distortion or misalignment.
- Vibration, noise, mechanical, thermal stresses & exhaust gas conditions shall be not exceed the permissible or acceptable limits of the guiding standards / codes
- D.G. Set shall be provided with suitable acoustics so that sound level at a distance of 1M shall be achieved considering insertion loss of 25 db minimum.
- The diesel engine shall be provided with the following:-
 - I. Generator set Protection panel and Electronic governor with all accessories suitable for Grid and other sources synchronization.
 - II. Lubricating oil distribution arrangements shall be of force- feed type with gear pump, oil pan, oil filters and high pressure relief valve and lubricating oil cooler.

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- III. Fuel injection system comprising of a common fuel pump for all cylinders with fuel pumps for individual cylinder with filters, etc.
- IV. Starting system consisting of a 24 V DC electric motor operated by a Maintenance free VRLA battery.
- V. The engine shall be suitable for Prime power application and should be capable to run on 10% overload for 1 hour duration in every 12 hours of operation as per ISO regulations.
- VI. Radiator cooled system with high water temperature safety with thermostat/motorized modulating type control valves to keep the temperature of the water in the engine at all loads to avoid engine tripping on high water temperature.
- VII. Air cleaner dry type filter with suction.
- VIII. Exhaust pipe with flexible coupling (flanged type) with necessary flanges, class pipe mineral wool insulation with aluminum sheet cladding and residential silencer as mentioned in data sheet.
- IX. Turbo charge/after cooler, whichever is applicable
- X. Engine speed adjusting /stopping lever
- XI. Sensors for safety alarm and trips like over temperature of water, low lube oil pressure, over speed etc.
- XII. Suitable 'stop' device to stop the engine in case of any of the controlled variables exceed the upper or lower limit (temperature of cooling water and lubricant oil and pressures of lubricant oil)
- XIII. Engine control panel

Instrument panel consisting of the following:

A microprocessor based engine control Panel shall be provided to enable the operator to determine the Genset status and allows access to the real time data for the unit. This facilitates to monitor the Genset status and data embedded in layered screen such as:

- Engine and alternator data
- Voltage on three phases
- Current on three phases
- Percent power
- Avg AC current and kW
- Data Logging
- Power factor
- Generator frequency
- Oil pressure
- Engine hours
- Engine RPM
- Alphanumeric screen to display Alarm & Status messages

Following functions shall be put at the operator's disposal for the Genset working:

- Circuit breaker position and indication and manual control
- Alpha-Numeric display with push button access for viewing engine and alternator data and providing set up

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- Auto / Manual / Run / Stop mode selection
- Menu Selection Switch' to select menu-driven control and motoring information.
- One mushroom push button for emergency stop

Following Instrumentation shall be provided on genset:

- Starting push button and switch with key.
- AUTO / MANUAL Selector Switch.
- DG TRIP / DG ON / DG OFF / SUPPLY ON / SUPPLY OFF" Indications with LED lamps.
- Lube oil pressure gauge.
- Lube oil temperature gauge.
- Water temperature gauge.
- Mechanical tacho hour meter and RPM indicator.
- Safety control for engine shut off (TRIP) with visual indication for low tube oil pressure.
- Safety control for engine shut off (TRIP) with visual indication for high water temperature
- Safety control (TRIP) with visual indication for low fuel level.
- Electrically operated fuel solenoid- Emergency stop (Flameproof type).
- D.C. Ammeter and voltmeter to indicate status of battery & battery charger.
- HSD Service tank with all accessories such as level indicator, manhole, valve inlet and outlet, air vent, drain plug, mounting pedestals, etc. Dimension of rectangular day tank shall be decided to suit the layout with capacity as mentioned in data sheet.

Automation consisting following

The automation of the genset shall be through the Control System , with following are the key features required from controller:

- Digital Voltage Regulation
- Digital Synchronizer (Frequency, Phase, Volts)
- Isochronous Load share
- Generator set monitoring and protection

Protection

The following protections are in-built :

- High / Low AC voltage shut down
- Under Frequency shut down
- Over current warning / shut down
- Overload warning / shutdown
- Loss of Excitation shut down
- Reverse power
- Short circuit
- Reverse Var shutdown
- Sync Check, fail to synch
- Phase rotation

B. Base & Mounting

- Common Base Frame: The engine and alternator shall be coupled with monoblock flexible coupling aligned and mounted on a sturdily fabricated, welded construction and properly machined base frame made of high quality MS channels of cross section not less than the recommended size by the engine manufacturer. The base frame shall be provided with lifting holes and foundation bolt holes suitable for permanent installation on anti-vibration mountings. Two separate earthing studs shall be provided for earthing the set.

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- Mounting: The set shall be mounted on anti-vibration mounts/pads. The bidder to indicate complete details with offer regarding weight of the total set etc. and mounting details and general arrangement details of the set.

C. Cooling

- The engine cooling shall be done through a Radiator cooling system. Engine driven pump shall be used to circulate the cooled water through the cylinder jackets, charge air cooler, Lube oil cooler, valves, cylinder block & other water cooled moving parts.
- Necessary cooling water pumps complete filter, piping, valve fittings expansion joints, controls and instrumentation, pipe supports hangers etc. shall be provided along with D.G.Set and in case any item has not been indicated in the BOQ the same shall be spelt out by the contractor and included in the price quoted by the contractor.
- Radiator Cooled water circuit shall be provided with corrosion resistors.
- Thermostat, temperature gauge, with high temperature alarm trip shall be provided in the control circuit.

D. Lubrication

- Lube oil cooling shall be integrated with engine radiator cooling. No separate oil cooling system is required.
- Automatic pressure lubrication shall be provided by engine driven positive displacement type pump. The engine lubricating oil system shall comprise an engine driven pump complete with oil coolers, oil filters, bypass filters, strainers, lube oil sump pan etc. The system shall provide full flow filtration with bypass valve to continue lubrication in event of filter clogging. Also priming pump shall be provided with Auto ON/OFF during Standstill condition. The oil tank shall be fitted with level gauges for visual observation.
- Lubricating system shall also consist of pressure gauge, temperature and oil level indicators, pressure switch for “oil pressure low” alarm for interlock and alarm along with necessary piping, fittings, valves etc.

E. Fuel System

- Engine shall be suitable to run on High-Speed Diesel fuel.
- The fuel oil system of the engine shall be direct injection type provided with fuel filter with separator, fuel hoses, fuel piping, governor, injectors, shutdown valve with fuel strainer and filters.
- A “Day Tank” of 990 ltrs. capacity with top mounted mechanical oil level indicator to indicate low and high levels shall be supplied. Fuel tank shall have a containment tank in case of leakage. Capacity of tank shall be min. 110% of day tank capacity. An engine driven transfer pump shall be provided to deliver fuel oil from the supply line to the fuel oil injectors through filters (provided as per engine manufacturer’s standards). Containment tank shall have small oil pump to transfer oil to drums. Fuel tank shall have high level cut out switch.
- Fuel day tank for each DG set shall be provided with level gauge, valve and complete piping up to engine.
- Low/high level switch shall be provided with contacts in JB/Panel for pump start/stop.

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- The fuel tank shall be located near the D.G. Set and all interconnected piping from and to the tank and on the engine shall be supplied. In addition, a primary filter between day tank and transfer pump shall be provided to screen large contaminant.

F. Governor

- Electronic governor shall be provided for automatic load controls.
- Governor shall be provided for keeping constant speed within certain limits with variable load. The governor shall have following features:
 - The governor speed drop shall be adjustable between 3.5 to 4 % of the nominal speed at any load up to full load. The nominal speed shall be adjustable by $\pm 5\%$. The rate of frequency variation shall not exceed 0.5 Hz in every second. An over speed trip mechanism shall be provided to automatically cut-off fuel in case the set reaches the over speed between 110% to 130% of rated speed. In addition, mechanical stop push button shall be provided for tripping the engine.
 - Higher rating D.G. Sets shall be provided with Electronic module with necessary sensors. Control module shall be provided with in-built powers & shall have adequate control system.
- With Electronic Governor, Speed drop shall be adjustable between 1 to 10% of the nominal speed any load up to full load.
- The governor shall be provided with Electronic governor gear for remote adjustment of generator frequency working on D.C.
- D.G. set shall be provided with flexible coupling between engine & alternator, along with coupling guard.
- D.G. set shall be provided with RPM indicator/ Tachometer to trip D.G. set during over speed.

G. Aspiration And Exhaust

- Engine shall be turbo-charged with after cooled. Air intake shall be provided either with dry type replaceable filters. Air cleaner assembly shall also have service indicator, air intake manifold.
- Exhaust manifold and exhaust pipe shall be suitably insulated with mineral wool. Exhaust system shall be insulated and shall be fitted with bellows type coupling.
- Silencer shall be of the residential type.
- The height and size of the exhaust hooks shall be fixed considering the emission of gases and the environmental law of Government of India and the local authorities.
- The noise level and gas emission temperature and volume shall be as per relevant standards.

H. Flywheel

- D.G. set supplier shall be responsible for determining and providing the necessary flywheel effect. The flywheel shall be suitable for the alternator offered (double bearing type).
- The flywheel shall be statically & dynamically balanced and suitable for rotating at 125% of rated speed without showing any sign of failure. Flywheel shall be provided with suitable guards against any mechanical injury. Engine barring mechanism in the flywheel housing

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shall be provided.

I. Starting System

Engines shall be started with 24 volts starter motor complete with 1 set of 24V DC Maintenance free VRAL Battery of adequate AH rating, new dry uncharged batteries in PVC containers, with PVC insulated cables copper conductor leads from battery to motor etc, mounted on fabricated MS angle frame fitted with nylon castor wheels filling up the battery with acid to be done before starting, free of any charges. Also Engine shall be provided with battery charging alternator.

Electronic control panel shall include the display for following (but not limited to):

- Battery Voltage
- Coolant Water Temperature
- Lubricating Oil Pressure
- Engine Speed (RPM)
- Engine Hours

J. Engine Instrument/Operator Panel:

- Starting push button and switch with key, remote start / stop facility and required terminations. The start / stop push buttons will be Located in DG Panel.
- Following Indication and Control shall be provided
 - Lube oil pressure
 - Lube oil temperature
 - Water temperature .
 - RPM indicator.
 - Safety control for engine shut off (Trip with visual indication) for low lube oil pressure.
 - Safety control for engine shut off (Trip with visual indication) for high water temperature.
 - Safety control (Trip with visual indication) for low fuel level.
 - Over current and earth fault
 - Engine fail to Start
 - Battery over voltage and under voltage
 - Electrically operated fuel solenoid- Emergency stop.
 - Status of battery and battery charger.
 - Engine over speed (Trip with visual indication)
 - Any other as per Manufacturer standard

2.3.2 ALTERNATOR

- The Alternator shall be of Rated 2 MVA output at 0.8 power factor and suitable for 3 phase, 11 KV, 50 HZ system continuously rated conforming to IS 4722
- The Alternator shall be of brushless type self excited; self regulated, provided with auto voltage regulator. Band of voltage regulation shall be $\pm 1\%$ or better of rated voltage from no load to full load. The frequency shall not differ by more than $\pm 4\%$ of rated value.
- The Alternator shall be self air cooled fully tropicalised, screen protected, drip proof construction with insulation class 'H_{pk1}' temperature rise limited to F . or class F The terminal box shall be of detachable type and suitable for top Cable outgoings either on entry i.e. on left or right side looking from rear.
- The adaptor box shall be liberally sized to take cable connection Auto voltage Regulator – AVR shall be suitable for independent running and parallel operation with identical D.G. Set.

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- The alternator shall be suitable for coupling directly to the engine and the alternator shall be double-bearing type.
- Alternator shall be withstand 50% over load for 3 Sec as per Regulation
- The alternator shall be capable of carrying an unbalanced load of 25% without injurious heating of any part, provided rated current is not exceeded. The voltage unbalances consequent to 25% unbalanced load between phases shall not exceed $\pm 2\%$ of average terminal voltage, provided the power factor in any phase does not fall below 0.8.
- The alternator shall withstand a short circuit at its terminals for three seconds with excitation adjusted to develop rated voltage at no load without any damage. The subtransient fault current shall not exceed 15 times the full load current.
- The field winding shall be fully insulated from the core. The field system shall have low inductance to allow good voltage regulation.
- The alternator shall be of drip-proof construction and shall have suitable fan for cooling. The temperature rise shall be within the prescribed limits of class H insulation, when feeding a 10% overload for one hour during every 12 hour run on full rated load with the cooling air at an ambient temperature.
- The line and neutral ends of each phase winding of the Generator shall be brought out on six suitably located terminals. Sub_[pk2]-contractor shall provide suitable clamping arrangement/ supporting arrangement.
- 240V single-phase anti-condensation space heater shall be provided of adequate rating in the lower part of the stator frame. The arrangement shall be made such that space heater shall be cut out automatically, when the alternator starts running. The space heater shall be wired upto a separate terminal box.
- The alternator shall be provided with two Nos. earthing terminals, complete with nuts, spring washer and plain washer, which shall be separated from the neutral terminals.
- The neutral shall be brought out to fully insulated terminal.
- The Alternator shall be externally regulated type with a voltage variation of $\pm 2.5\%$ of the rated voltage with $\pm 2\%$ frequency variation.
- The alternator shall conform to BS:5000 or IS:4722.
- Six (6) Nos. embedded Resistant Temperature Detector (RTDs) of platinum, 100 ohms resistance at 0° to measure the winding temperature and four (4) nos. Bearing Temperature Detectors (BTDs) to measure bearing temperature shall be provided. The leads of embedded RTDs shall be wired upto the terminal block in a separate terminal box. Manufacturer shall indicate the setting values for each RTD/BTD for alarm and trip. Temperature converters and necessary alarm/indication shall be provided.
- Greasing facility with grease nipples and grease relief device shall be provided.
- All external nuts and bolts shall be of high tensile steel only.
- The alternator shall be provided with suitable flanges for termination of cables. Suitable arrangement shall be provided in the terminal box for formation of star point for Alternator neutral earthing.
- DG set shall be capable of working in synchronization with other DG sets. The supply of relays, contactors, CTs etc., required for this purpose shall be included.

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- **Stator core:** Stator core shall be built up of silicon steel laminations compressed hydraulically and rigidly supported by either case iron or steel end rings. The core shall be designed for a minimum reactance, low voltage wave form distortion and maximum efficiency stator coils shall be wound with synthetic enamel coated copper wires and main slot insulation shall be of tropicalised mica or leather old. End windings shall be taped with fiber glass tape and the complete windings are impregnated with spray finished with moisture protection varnish. Otherwise, 100% epoxy impregnation with an overcoat of resilient insulating material shall be carried out.
- **End Frames:** End frames shall be of well ribbed cast iron /fabricated sheet steel design. The end frames shall be spigotted to the stator frame and secured by easily available set screws dowels. Ventilation openings shall be cast into the vertical and bottom side faces which shall be screen protected and drip proof.
- **Bearings:** The bearings shall be of heavy duty pre lubricated cartridge design, ball or roller bearings. Double bearing alternators shall have self-aligning ball or roller bearings. The end frames of the rotor shall be removable (from stator) without disturbing the bearings.
- **The Rotor:** Rotor shaft shall be turned either from a high tensile MS bar or from a MS forging. Field coils shall be wound with synthetic enamel covered or varnish bonded and glass covered copper strips of high conductivity. Poles shall be of bolt-up type made of sheet steel of high permeability. The insulation between the pole and coil shall comprise of vanished fiber glass cloth backed mica around the body and thick insulating washers on the top and bottom of the coil. Coils shall be impregnated with resin and the complete rotor is spray finished with a moisture protection varnish suitable for tropical Conditions. However, 100% epoxy impregnation and an overcoat of resilient insulating material shall be preferable.
- **Damper windings:** Damper windings shall be provided to assist parallel operation of alternators. The damper bars of copper brazed to heavy copper and connectors shall be located in a semi-closed circular slots situated in the pole faces.
- **Ventilation:** Axial ventilation shall be employed. A direct driven centrifugal fan shall be fitted on the shaft and direct adequate airflow for efficient cooling of the alternator.
- **Terminals:** Terminals shall be housed in a suitable MS box fixed on to the stator frame. The terminals shall have ample clearance between phases and between phases to earth and shall be readily accessible. The terminals shall be suitable for receiving 2000A TPN copper Bus Duct as indicated in the schematic.
- **Temperature rise:** The alternator shall be suitable for ambient temperature of 50°C and shall be capable of withstanding 10% over load for one hour continuously.
- **Brushless Exciter – Voltage Regulators:** The alternator shall be provided with a complete rotating diode type brushless excitation system, capable of supplying the excitation current of the generator under all conditions of output from no-load to full-load and capable of maintaining voltage of the generator constant at one particular value.
 - The exciter shall have class H insulation.
 - The excitation system shall comprise a shaft-driven AC exciter with rotating rectifiers. The rectifiers shall have in built protection for over-voltage.
 - The exciter shall be fast response type and shall be designed to have a low time constant to minimize voltage transients under severe load changes. The excitation voltage response ratio shall be at least 0.8.
 - The excitation unit shall have necessary protection for field discharge and an easy arrangement to

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remagnetise in case of loss of residual magnetism.

- The performance requirements of the alternator shall be as under (In addition to Standards Indicated).
- The unit shall be capable of starting from cold condition.
- The unit shall be capable of a peak output of 10% in excess of the rated output for a period of one hour out of a total 12 consecutive hours of operation, without exceeding permissible temperature limits.
- The rated current of the main exciter shall be at least 10% more than the alternator rated exciter current and it shall have 40% overload capacity for 10 seconds.
- The unit shall operate up to 110% of the rated speed over the entire range of output without undue vibrations and noise as per relevant standard. Subcontractor will mention allowable vibration and noise level as per relevant standard.
- The exciter shall be fast response type and shall be designed to have a low time constant to minimize voltage transients under severe load changes. The excitation voltage response ratio shall be at least 0.8.
- The unit efficiencies shall be calculated according to relevant Indian Standard and IEC- 34 - 2, section 4 with all losses.
- No external supply shall be required during starting and normal running of the alternator.
- **Balancing:** The alternator rotating parts shall be dynamically balanced to a level to ensure smooth vibration free running.
- Alternator winding shall have 2/3 Pole pitch winding to take care of heating due to “Harmonics” in the system.
 - I. The Alternator shall withstand 10% overload for 1 hour at every twelve hours.
 - II. Transient Voltage Dip shall not be more than 14% on application of full load at rated power factor.
 - III. The Alternator shall be capable to withstand minimum 25% unbalance load of its rated load without exceeding the current in any of the phases beyond full load current.
 - IV. Alternator winding shall be suitable to take minimum 70% Thyristor load of rated capacity.
 - V. The alternator shall be provided with six numbers of RTDs in stator winding and four nos. in both ends bearing.
 - VI. Anti Condensation heater of 240V, 1Ph, 50Hz shall be provided with thermostat control switch.

2.3.3 ACCOUSTIC ENCLOSURE:

➤ **Acoustic Enclosure**

The acoustic enclosure proposed herein will be free standing floor mounting type independent of the DG Set. The enclosure shall be pre-fabricated, factory built and modular in construction so that it can be easily assembled at site around the DG Set.

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➤ **Accoustic Materials**

The acoustic enclosure shall be made from High class sheet metal fabricated enclosure for reducing the noise level of DG set & also acts as weather proof housing. Genset shall be a integral part of acoustic enclosure and whole construction shall be mounted on a multi-fold sheet channels & ISMC sections.

The Enclosure construction shall be fully bolted keeping in view the major service requirements all doors shall be provided with specially designed hinges and lockable handles. Sliding doors shall be provided for easy access to the DG set while minimizing the operating space requirements.

In additional Ventilating louvers will be provided for cool air entry as well as hot air discharges. Necessary forced ventilation if required shall be provided.

Battery, Fuel tank shall be housed inside the enclosure upto 750 KVA DG set and above 750 KVA DG set Battery, Fuel tank shall be housed outside the enclosure

Sound proofing of enclosure shall be done with high quality rock wool/mineral wool confirming to IS 8183. Mineral thickness to be considering as per 64 Kg/M^3 for sound absorption and acoustic enclosure panel thickness shall be 100mm thick or calculated by vendor accordingly.

For increasing the life of Accoustic material resin coated fibre glass cloth shall be provided on exposed surface of Rock wool slabs and the panels shall be supported by perforated sheets. Sheet shall be specifically designed for optimum sound attention.

➤ **Ventilation**

Accoustic enclosure shall be designed in such a way that there shall have no hot pockets around engine and it shall be provided with suitable designed engine radiator which does not allow the temperature to rise more than 70°C above ambient temperature.

To achieve optimal output and minimum sound level from the DG set, It shall be provided with suitable openings with acoustic hoods for increasing the inflow of air required for combustion & forced ventilation. Air intake system as per the recommendations and engine requirement shall be provided.

- Acoustic hoods with noise splitters shall be provided to block and reduce the sound leakage.
- The sound control system shall be designed to suppress the sound level to 75 db maximum at 1 meters distance in open free field environment as per ISO 8528 part 10 for acoustic enclosure upto 750 KVA.
- The sound control system shall be designed to reduce the sound level by 25 db in open free field environment as per ISO 8528 part 10 for acoustic enclosure above 750 KVA.

➤ **Silencer**

Specially designed Critical Grade silencer shall be provided. Silencer & engine exhaust outlet shall be connected with flexible SS below.

➤ **Vibration Isolation**

To avoid transfer of vibration from Genset to enclosure & surrounding specially designed vibration isolators shall be used.

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➤ **Construction Feature**

The construction and design of the Accoustic equipment should be rugged and durable and virtually maintenance free. All materials used for accoustic treatment shall be fire resistant/fire retardant and moisture resistant grade. For effective sealing, necessary gasketing materials shall be provided.

- The accosutic enclosure shall be compact and sleek.
- The accosutic enclosure shall be sound proof and weather proof.
- It shall confirm the statutory government Noise level norms.
- The Enclosure shall have modular in construction with the provision to assemble and dismantle easily.
- The Enclosure shall be fabricated from minimum 16 SWG-CRCA-sheet.
- The sheet metal components shall be hot dip seven tanks pretreated.
- Enclosure shall be polyester based powder coated (inside as well outside). Nut, bolts & hardware's shall be Stainless steel.
- The doors shall be gasketed with EPDM gaskets to avoid leakage of sound.
- The door handles shall be lockable type.
- The rock wool shall be further covered with fiber glass cloth and perforated powder coated sheet.
- A special Hospital Grade silencer shall be provided to control exhaust noise upto 750 KVA DG Set and above 750 KVA DG Set, a special Critical grade silencer shall be provided to control exhaust noise.
- Specially designed attenuators shall be provided to control sound at air entry to the container and exit from the container.
- Adequate ventilation shall be provided to meet air requirement for combustion and heat removal. If required, a blower shall be used to meet total air requirement & air changes.
- Temperature of enclosure shall not exceed beyond 5-7°C of ambient temp.
- To make the system vibration free, engine and alternator shall be mounted on specially designed anti-vibration pads mounted on Base frame.
- The enclosure shall be designed and layout of the equipment is such that there is easy access to serviceable parts.
- Illumination shall be provided inside the enclosure.
- The silent DG set has the following safeties:
 - ❖ High water temperature.
 - ❖ Low lub oil pressure.
 - ❖ High enclosure temperature.
 - ❖ Emergency stop push button outside the Enclosure.
 - ❖ Noise level is 75 dB(A) at distance of 1 mtr. in open free field environment as per ISO 8528 part 10.

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➤ **Performance**

The acoustic enclosure shall achieve a substantial reduction of noise Level of well over 30% from the existing higher levels ensuring that adequate ventilation is provided, wherein temperature inside enclosure is maintained to DG Set requirement.

2.3.4 D.G.SET FITTINGS & ACCESSORIES:

Following accessories shall be provided for D.G.set, but not limiting to that

- a) Mono block Flexible coupling.
- b) Air cleaner (heavy duty oil bath type / dry type)
- c) Corrosion resistant paint.
- d) Flywheel end guard
- e) Suitable Heat Exchanger
- f) Fuel pump.
- g) Electronic governor
- h) Fuel filters both on suction line and delivery side.
- i) Full flow lubricating oil filter completer with strainer in pump.
- j) Gear type lubricating oil pump.
- k) Engine driven water circulation pump
- l) Bypass filter.
- m) Engine speed adjusting/ idling lever and control board
- n) Crank case breather
- o) Fuel flexible hoses
- p) Air intake manifold with common inlet connections.
- q) Exhaust manifold outlet directed upwards.
- r) Flanged flexible exhaust connection with bolts and nuts.
- s) Turbo charger, after cooler as required.
- t) Residential type exhaust silencer with pipe flange, insert with exhaust piping
- u) Integrated engine mounting brackets.
- v) Anti – Vibration Mounts (AVM) – Make Dunlop.
- w) First charge of lubrication oil
- x) 24 Volts DC electrical starting arrangements consisting of Dynamo and self starting electric motor.
- y) Day tank – Capacity – 990 Ltrs with glass type level indicator & level controllers.
- z) Any Other Accessories required for successful completion of Entire work.
- aa) Genset protection Panel if required.
- bb) Bus Duct/Cable of appropriate rating for each DG from Alternator to Main HT Panel of client

2.3.5 VENDOR TO SUBMIT FOLLOWING IN 3 SET WITH THE OFFER (English Language):

- a) Layout drawings.
- b) Shaft HP engine calculation.
- c) Dimensions indicating height etc.
- d) Exhaust piping arrangement including Pipe diameter and height of exhaust.
- e) Exhaust stacks support calculation.

2.3.6 TESTING:

Inspection and testing shall be carried out based on latest revision of this specification and approved vendor drawing certified for construction.

Purchaser shall have right to carry out stage inspection and shop visit to review the manufacturing progress. However, manufacturer need not hold any manufacturing activity for witness of purchaser/consultant's stage inspection.

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All routine and type tests shall be carried out during final inspection.

A. Factory Tests:

Vendor shall carryout all the routine tests for engine & alternator, which shall be as per relevant BS/IS etc. The vendor shall submit their standard test procedures. However, following minimum specific tests shall be carried out on the set.

- Operation test for given loading performance data.
- Check the starting and starting time of set, to come on load.
- Test for automatic voltage regulation.
- Test for manual rheostat control for initial voltage setting.
- Tests for specific fuel consumption & specific lube oil consumption at different loads.
- Operation test to check specified operation including simulation, as required.
- Testing of governing system.
- Test the tripping operation of set on over speed and other alarms and trips for abnormal conditions.
- Testing of Generator Panel both in Auto & Manual Mode

Vendor shall submit complete data for all the equipment and test certificates for all the tests (routine and specific) carried out on the set, before final witness / inspection by customer.

B. Diesel Engine :

Following tests shall be carried out at the engine manufacturer's works, in the presence of purchaser if so desired, DG set and the auxiliaries shall be assembled at the manufacturer's works and the following tests shall be performed:

- One (1) hour at full load with fuel consumption
- 15 minutes at 110% load with fuel consumption.
- Engine starting time.
- B.H.P. test (Test certificate will be submitted)
- Noise/vibration test
- Fuel consumption at intervals of 1 hr. (total 2 hrs)
- Lube oil temperature at inlet and outlet.

These tests shall be conducted and the original test certificates shall be furnished. Copies of type test certificates conducted on similar type of D.G. set shall also be submitted.

- Engine starting time
- Fuel consumption test

C. Alternator:

The Alternator shall be subjected to following routine tests: Factory test certificate will be submitted

- Measurement of resistance of stator and rotor windings.
- Insulation resistance of stator and rotor windings.
- High voltage tests on stator and rotor windings.
- Regulation test
- Efficiency test.
- Momentary over load test
- Vibration and noise level measurement

D. Voltage Regulator:

- Sensitivity test
- Response time test

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E. Test on Control Panel :

- Insulation Resistance Test
- Functional and operation test
- Mechanical test on components

F. Site Tests:

After the erection and wiring and earthing of D.G. Set the tests as stipulated by the manufacturers shall be conducted.

- The tests shall be performed after proper installation of the diesel generating unit at site to prove the proper operation of interlock circuits and the capability of the engine to start and pick up load in the specified time, under supervision of the purchaser's representative responsible for supervision, testing and commissioning, if such service is hired by purchaser.
- Insulation resistance of the generator.
- Speed, no-load voltage and full load voltage regulation.
- Load Test of the complete DG set with control panel at an average load of 80% for 8 Hrs. and 100% Load for 1 Hour.(SAT). Fuel & load shall be provided by client.
- Fuel consumption tests by using flow meters.
- Sequence checking, interlocks checking, measurement of starting time, loading of generator etc. shall be carried out by the vendor.
- Vendor shall supply first fill of lubrication oil & fuel oil.
- Statutory clearance: VENDOR shall be responsible to obtain following clearances:-
 - Electrical Inspector (CEA)clearance
 - Supply authorities (State Electricity Board) clearance
 - State Pollution Control Board clearance.
- a) Testing of Controls: All the safety controls and protective device of the D.G. set shall be tested for correct calibration and operation. The results of the tests shall be tabulated and submitted in triplicate.

The reading shall be observed with calibrated meters. Only one meter shall be used for the test. The readings shall be properly tabulated and submitted in triplicate.

2.3.7 WARRANTY PERIOD:

- a) The D.G. set shall be guaranteed to perform without any flaw for a period of 12 months from the date of commissioning.
- b) The performance figures, indicated shall be guaranteed within the tolerance specified or as permitted by relevant standards. The following items of performance shall be guaranteed by the vendor in respect of diesel generator set and the auxiliaries. When operating under the specified site conditions and when using the specified fuel Vendor to furnish the following detail with offer.
 - Engine break horse power shall be sufficient to deliver full rated generator set capacity

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KW/ KVA when operated at rated RPM and equipped with all engine mounted parasitic and external loads such as power generator.

- Diesel Engine shall be able to deliver rated power when operating on diesel fuel having 35 degrees API SP gravity.
 - Fuel oil consumption at ½, ¾ & full loads shall be based as Fuel Oil of 35 API (16 C or 60 F), Low Heating Value (LHV) of 42, 780 Kj/ Kg (18, 390 BTU/ lb) when used at 29° C (85° andF) weighting 839 gm/ litre.
 - Start time and load acceptance of engine shall achieve on attaining rated voltage and frequency within ten (10) second.
 - Lube oil consumption at full load.
 - Generator efficiency at ½, ¾ & Full Load
 - 10% O/L for 15 Minutes. Without overheating or showing signs of undue stresses on engine & generator alternator to have 50% over load capacity for 15 sec. during starting.
 - Governor response, over speed trip and over speed capacity.
 - Voltage regulator response.
 - Specific fuel consumption per KVA Hour.
 - The complete power generation system including Engine, Alternator, Switchgear, DG Control Panel etc. shall be product of one manufacturer. All components shall be designed to achieve optimum physical and performance compatibility and proto type tested to prove integrated design capability.
- c) In case of failure of equipment to meet the guaranteed performance, purchaser reserves the right to reject the equipment. However, purchaser also reserves the right to use the rejected equipment until new equipment meeting the guaranteed performance requirements is supplied by the vendor.
- d) If any equipment supplied by the vendor fails at site during erection, commissioning or service(within the guarantee period), the vendor shall repair and put back to work within the time frame and at no extra cost to the purchaser.

2.3.8 INSURANCE:

The successful contractor shall take out transit, unloading, storing, erection and commissioning risk insurance policy, jointly in the name of Owner and Contractor and the original policy shall be deposited with the Owner.

2.3.9 INFORMATION, DATA DRAWING:

Documents for approval within 10 days of LOI/PO (4 copies/sets each in English Language)

- General arrangement drawings showing plan, elevation of the DG set and its accessories including control panels, alternator, terminal box etc. complete with overall dimension foundation planes, weight etc.
- General arrangement drawing of control panel and battery charger along with foundation plans, overall dimensions, front view etc.
- Schematic wiring diagram for the control panel and battery charge with complete BOM (make, range, size, rating accuracy class etc.) and control cable requirement.

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- Erection, testing & commissioning, operation and maintenance instruction manuals along with test certificates spare parts list (for 2 years trouble free operation) shall be furnished.
- Exhaust System details including foundation requirements.
- P & I Diagram and write-up for cooling system, lube oil system, fuel oil system, exhaust system etc.
- Piping Flow diagrams, GA drawings including complete layout.
- Acoustic Enclosure, Lighting and ventilation drawing.
- Earthing Drawing for D.G. Set and its auxiliaries.
- Complete SLD of the Power Distribution System.
- Control schematic Drawing.
- Blower fan sizing calculation.
- Index sheet of drawing.
- Foundation drawings of all equipment giving loading and un-balanced forces.
- Control wiring diagrams and block schematic diagrams showing inter-connections between various equipments.
- Schematic drawing for lube oil and cooling system.
- Governor system and voltage regulator write-up.
- DG set Instrumentation and Control system with write-up.

The Sub-contractor shall also provide seven (7) sets of Installation, operating, maintenance and major overhauling instructions manuals before inspection.

Calculations & drawings/catalogues for acoustic insulation of D.G. Panel.

Final "As Built" drawings with seven (7) sets of hard copies and One CD (soft copy) each to DRL and MM containing above drawings / calculation / documents in CAD REL. 2000 or above version and data in MS office/WIN 98/2000.

Other Requirements

- Detailed installation, operation and maintenance manuals for engine, alternator, DG control panel, battery and battery charger.
- Lubrication schedule.
- Technical literature for all equipment, including engine, alternator, DG control panel, battery and battery charger
- Complete parts list and recommended spares for 3000 hours of operation and those required during commissioning.
- Interconnection Schedule.

2.3.10 QUALITY ASSURANCE:

- Quality assurance shall follow the requirement of Quality Standard document as applicable.
- Q.A. involvement shall commence at and follow through to completion and acceptance, thus

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ensuring total conformity to Owner requirement.

2.3.11 TRAINING OF PERATOR/S:

Vendor has to provide at their works necessary training of purchaser's operators on proper operations/maintenance of the D.G. Set without any extra cost.

2.3.12 DOCUMENTS:

- The test certificates shall be furnished to the purchaser for prior approval before dispatch of any equipment from works and the approval in writing from purchaser shall be essential to effect dispatch of the equipment.
- The test reports shall furnish complete identification of the data including serial number of each equipment.
 - a) D.G. Set Test Certificates
 - b) Engine Operation & Maintenance Manuals
 - c) Engine Parts Catalogues
 - d) Alternator Operation, Maintenance & Spare Part Manuals
 - e) Alternator Test Certificates

2.3.13 DEVIATION

- Deviation from specification must be stated in writing at the quotation stage.
- In the absence of such a statement, it shall be assumed that the requirement of specification is met without any deviation.

2.3.14 INSTALLATION AND COMMISSIONING OF DG SET

- a) Subcontractor shall carry out installation work at site covering assembly of the set at site, installation of auxiliaries, DG Control Panel, cable connections, etc. and test the set for its manual and auto operation. Vendor shall submit their standard installation and commissioning format. However, the scope shall include the following:
 - Loading & unloading of DG Set and accessories at site and transportation to the place of erection as required.
 - Coupling and alignment of Engine & alternator, levelling & checking.
 - Supply of lubricating oil and grease - first charge.
 - Fixing of all loose parts of engine along with silencer, SS bellows, exhaust pipes along with their necessary supports and hot insulation of the exhaust piping.
 - Supply of Diesel oil - first fill by Purchaser.
 - Arrangement of load for testing purpose.
 - Supply of cables, glands, lugs, earthing materials, cable trays, etc.
 - Erect and align all equipments, including DG set, alternator and DG Control panels.

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- Placement of Fuel storage tank and interconnection of all piping, valves, fittings and accessories from day tank to DG set.
- Lay and terminate power and control cables between Generator, Engine and DG Control Panel, batteries. (Conduit Wiring is not acceptable).
- Earthing of generator set
- Painting.
- Cleaning all pipes internally remove debris and make all equipment ready to receive fuel, oil, power etc.
- Installation of cooling system.
- Check control circuit on auto-manual operation.
- Commission the set for its auto-starting.
- Test it on 1/2 load, 3/4 load and full load for at least 4 hours each. Check fuel oil and lubricating oil consumption calculate efficiency at each load.
- Any other activities (Exhaust System, Cooling System etc.) to complete the set and make it ready for use.
- Establishing the rated capacity of the Generator.
- Cable schedule and MTO based on layout shall be furnished by the subcontractor.
- Supply & Laying of cables between DG set and DG Control panel.
- Anti Vibration Mounting pads.
- Obtaining approval of DG Set installation from statutory authorities.

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CHAPTER – 2.3.2

TECHNICAL SPECIFICATION FOR

ELECTRICAL PANEL

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1. GENERAL INFORMATION:

The Panel shall be designed, fabrication and equipped with accessories in accordance with this specification and the applicable codes, standards indicated below. Materials and components not specifically stated in this specification but which are necessary for satisfactory and trouble free operation and maintenance of the panel shall be supplied.

The design and workmanship shall be in accordance with the good electrical engineering practices to ensure satisfactory performance and service life as specified herein.

Panel shall be suitable for an ambient temperature of 45° C.

Panel shall be metal clad, totally enclosed, rigid, floor / wall mounted, air- insulation, cubical type suitable for operation on three phase / single phase, 415 / 230 volts, 50 Hz.

Panel shall be designed to withstand the severe conditions at site, with minimum expected ambient temperature of 45°C and 50% humidity weather.

The panel also requires approval of the Purchaser or his representative at various stage of their manufacture such as design, selection, construction, testing, shipping etc.

2. CODES AND STANDARDS:

The Panel and components shall conform to the latest applicable standard mentioned below. Also this specification shall unless otherwise stated be designed, constructed and tested in accordance with the requirements of the Indian Electricity Act and Rules and latest revision of relevant Indian or equivalent British or International Standards.

STANDARDS	SPECIFICATIONS
IEC 60947	Low Voltage switchgear and control gear
IEC 62271	High Voltage Switchgear and Control gear
IEC 60439	Low voltage switchgear and control gear assemblies.
IEC 60947-1	General requirements for switchgear and control gear for voltages not exceeding 1000 Volts.
IEC 60947	Motor starters AC, for voltage not exceeding 1000 V Direct-on-line AC starters.
IEC 60044	Instrument transformers.
IEC 60051	Direct acting indicating analogue electrical- measuring instruments and their accessories.
IEC 60073	Coding principles for indicator lights and push buttons.
IEC 60189	PVC insulated cables for switchgear and control wiring.
IEC 60255	Electrical relays.
IEC 60947-2	Circuit Breakers. (Part 2)
IEC 60947-2	Specification of Air Circuit Breaker.
IEC 60947	Air-break isolators for voltage not exceeding 1000 Volts.
IEC 60258	Direct acting recording electrical measuring instruments and their accessories.
IEC 60269	Low-voltage fuses.
IEC 60417 DB	Graphical symbols for use on equipment.
IEC 60947-4	Contractors for voltages not exceeding 1000 V AC or 1200 V DC.
IEC TR 61641	Enclosed LV Switchgear and Control gear assemblies - guide for testing under conditions of arcing due to internal fault.
IEC 60445	Basic and safety principles for man-machine interface marking and identification. Identification of equipment terminals and of

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STANDARDS	SPECIFICATIONS
	terminations of certain designated conductors. Including general rules for an alphanumeric system.
IEC 62052	Class 0.5, 1 and 2 alternating current watt-hour meters.
IEC 60529	Degrees of protection provided by enclosures. (IP Code)
IEC 60617 DB	Graphical symbols for diagrams.
IEC 60947-3	Air-break switches, air-break disconnectors and Fuse combination units for voltages not exceeding 1000 V AC or 1200 V DC.
IEC 60715	Dimensions of low voltage switchgear and control gear. Standardized mounting on rails for mechanical support of electrical devices in switchgear and control gear installations.
IEC 61439 SERIES	General Rules for Power and control Switchgear Assemblies, Distribution boards Assemblies for construction sites , Assemblies for Power distribution ,etc
IEC 60529	Degree of Protection of Enclosures for low voltage switchgear

STANDARDS	SPECIFICATIONS
IS 375	Arrangement of bus bars, main connection and auxiliary wiring, marking and arrangement.
IS 335	Insulating coils.
IS 722	Integrating Instruments
IS 1248	Direct acting electrical indicating instruments.
IS 4237/ IS 13947 (Part-1) (Part-4, Sec 1)	General requirements for switchgear and control gear for voltages not exceeding 1000 Volts.
IS 13947	Motor starters AC, for voltage not exceeding 1000 V Direct-on-line AC starters.
IS 2147/ IS 13947	Degree of protection provided by enclosures. for low voltage (Part : I) switchgear and control Gear.
IS: 1822	AC motor starters of voltage not exceeding 1000V
IS 2099	Bushings.
IS 2419	Dimensions of panel mounted electrical indicating and recording instruments.
IS 2516 / IS 13947	Circuit Breakers. (Part 2)
IS 2516	Specification of Air Circuit Breaker.
IS 2607	Air-break isolators for voltage not exceeding 1000 Volts.
IS 2705	Current Transformers.
IS 4201	Application guide for CT's
IS 3155	Voltage Transformer.
IS 13947 (Part 4, sec 1)	Contractors for voltages not exceeding 1000 V AC or 1200 V DC.
IS 3072	Code of Practice of Installation and maintenance of switchgear
IS 3231	Electrical relays for power system protection.
IS 3947	Air-break switches, air-breaks' dis-connectors and Fuse combination units for voltages not exceeding 1000 V AC or 1200 V DC.
IS 4064	Fuse switch and switch fuse unit.
IS 3842	Application guide for electrical relays for AC System.
IS 4047	Heavy duty air break switches and composite units of break : switches and fuses for voltages not exceeding 1000 V.
IS 4483	Preferred panel cut-out dimensions for electrical relays.

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STANDARDS	SPECIFICATIONS
IS 5124	Induction motor starters, AC (voltage: not exceeding 1000 V) installation and maintenance of code of practice.
IS 5987	Selection of switches (voltage not exceeding 1000 V)
IS 6875	Control switches for voltages upto and including 1000VAC & 1200 DC.
IS 8588	Code of practice for thermostatic bimetals Part-I general requirements and method of tests.
IS 8623	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 V AC and 1200V DC.
IS 8828	Miniature air-break circuit breakers for voltages not exceeding 1000 Volts.
IS 8197	Terminal marking for electrical measuring Instrument and their accessories.
IS 2557	Danger notice plates.
IS 8623	Specification for factory built as symbol switch gear and control gear for voltage upto and including 1000 V AC & 1200 V D.C.
IS 8828	Miniature Circuit Breaker.
IS 9224	HRC fuse unit.
IS 6875	Control switches & push buttons.
IS 2959	Auxiliary contactor.

3. TECHNICAL SPECIFICATION OF 415 V METAL ENCLOSED PANELS:

3.1 Design Requirement

- a. The Panels shall be designed for 415 V, 3 phase, 4 wire, 50 c/s supply.
- b. Panels shall be suitable for direct-on-line starting or star delta starting as mentioned in the SLDs for the motors.
- c. Panels shall be rated for minimum fault level as mentioned in data sheets /Drawings.**(Mentioned in SLD)**
- d. Control power supply of the Panels shall be mentioned in the respective SLDs.
- e. The Panel manufacturers shall apply all de-rating factors necessary to all Components of the switchboards to comply with the conditions detailed in this specification.
- f. The ratings of motors, control-gears, breakers etc. furnished in the drawings are for tender purposes only. Any changes in the above will be intimated at the time of placement of purchase order or before fabrication of the panels.

3.2 Constructional Features

3.2.1 The Panel shall be:-

In case "RITTAL" make of enclosure is considered following constructional Features to be considered:-

- a. The Panel shall be totally metal enclosed, Symmetrical, stable profile frame construction, consisting of rolled hollow section with punching in the DIN measure raster of 25mm. All profile edges rounded. Vertical profiles with two assembly levels for space-saving interior fittings. Bayable to all sides, floor

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mounted, free standing cubicle type with MCCB, SDF and ACB with compartmentalized design of form 2 or 3b and also Panel shall be flush fronted and arranged to form a single structure with a common Busbar assembly.

- b. The Switchgear panel shall be provided with integral base frame for each vertical panel which shall be suitable for directly bolting or tack welding to the Client's base frame. The frame of individual vertical panels shall be fabricated using suitable mild steel structural section of 16 folded profile from single sheet 16SWG(1.5mm). Wherever required, stiffeners and ride up rollers shall be provided to increase stiffness of large size doors and covers.
- c. The height of the panel should not be more than 2300 mm. Maximum operating height shall be approximately 1850 mm above the floor level and minimum operating height shall be approximately 350 mm above floor level for compartment type panel.
- d. Approximately Depth of single front panel : 400 mm / 600 for wardrobe type
- e. Approximately Depth of double front panel : 800 mm
- f. Minimum feeder section width shall be 400 mm and minimum height of the feeder shall be 150 mm.

In case customized locally manufactured enclosure is considered following constructional features to be considered:-

- a. The Panel shall be totally metal enclosed, indoor, floor mounted, free standing cubicle type with MCCB , SDF and ACB with compartmentalized design and also Panel shall be flush fronted and arranged to form a single structure with a common Busbar assembly.
- b. The height of the MCC/ Sub panels should not be more than 2400 mm. Maximum operating height shall be approximately 2025 mm above the floor level and minimum operating height shall be approximately 325 mm above floor level for compartment type panel.
- c. Approximately Depth of single front panel : 400 mm
- d. Approximately Depth of double front panel : 800 mm
- e. Minimum feeder section width for starter/MCCB feeder shall be 500 mm and minimum height of the feeder shall be 250 mm.

Below constructional features are common for both type enclosure

- a. The MCC shall consist of motor starters, breakers which shall be housed in separate fixed type compartments within the MCC panel.
- b. If VFD with bypass starter arrangement specified in SLD . The panel shall consist of VFD with bypass DOL/Star-delta starters which shall be housed in separate fixed type compartments within the VFD panel.
- c. If VFD with out by pass starter arrangement specified in SLD . The panel shall consist of VFD for each motor control and which shall be housed in separate fixed type compartments within the VFD panel.
- d. Switchgear and Busbars shall be arranged to permit future extension at the both ends. End of busbar shall be suitably positioned for this purpose. Panels at extreme ends shall have opening which shall be covered by using screwed plates. Details of extended bus-bar and opening shall be clearly indicated in the suppliers drawing.

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- e. Provided with access to the feeders, bus bars, cable termination, cable alley etc. from front for single front panel and for double front access shall be both side excluding incomer of the panel. Incomer cable termination shall be considered at back side of the incomer.
- f. The spare feeders shall be provided on the top side of each vertical section of feeder. The total depth of the panel shall be adequate for proper cabling space. All Panels which are arranged side by side or other panels of that room shall have same height and depth.
- g. Structures, including doors and panels, shall be capable of withstanding the internal pressure created by faults within the structure (equal to the maximum fault-current rating for a specified duration) without danger to the operating personnel. The minimum standard required is detailed in Indian Standard. Type test certificate(s) shall be provided with the quotation. check for type test
- h. Structures shall be capable of bearing static load of Max 1.4 Tonne viz., cubicle module rack in, rack out and in no case the frame/base plate shall deform during the normal specified operation.
- i. Structures shall be provided with barriers to prevent the transfer of ionized gases between adjacent compartments except busbar chambers.
- j. Switchgear panel shall generally be self-ventilating with louvers .
- k. Interlocks, busbar shutters, covers, etc. shall be provided to prevent incorrect or unsafe operation, and to prevent access to live parts. Interlocks shall be provided to prevent opening of the front doors of cubicles whilst the circuit breaker / switch is in the closed position.
- l. In test position, drawers shall be in a situation that both upstream and downstream power connections are fully isolated from bus bar in order to ensure a maximum of safety to operators. Test position with power connection still in contact with bus bar will be rejected for safety reason
- m. Key interlocking shall be provided on door of incoming, outgoing and sectionalized Units.
- n. All circuit breaker / MCCB / SDF shall have provision for padlocking. Padlocking facility for multiple locks shall be provided in the Off / Test / Isolated position in compartment type of panels.No dedicated tool shall be required to move the mobile part from a position to another one. Operating handle on drawers will be rejected.
- o. The size of functional units should be optimised to achieve high stacking density of switchboard and shall be proposed in full or half size. Any drawer whatever its size shall be made of sheet metal material for robustness reason
- p. In order to allow thermal imaging analysis or device setting (in test position) the front face of all drawers should offer to authorized people the facility to be opened with a tool
- q. Switchgear shall be designed and constructed to facilitate inspection, cleaning, repair and maintenance and to ensure absolute safety during operation, inspection and maintenance. It shall be possible to work safely within individual compartments whilst the other switchgears are energized.
- r. Similar parts and components shall be interchangeable.
- s. Unless otherwise stated in the SLD, switchgear intended for indoor installation shall have minimum protection of IP 42 (with metallic louver) and outdoor installation shall have minimum protection of IP 55 EN 60529 and IP 56 with hood
- t. All hardware shall be corrosion resistant. All joints and connections of the panel members shall be Zinc passivated , high quality plated steel bolts(self tapping), and secured against loosening.

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- u. Outgoing feeder units shall be arranged in tier formation with single front for main LT Panel. Incomer and Bus coupler shall be located in non tiered separate cubicle.
- v. In the MCC Panels outgoing feeder units shall be in tier formation with double front or single front type mentioned in the SLD and Incomer shall be located in tiered separate cubicles with double front type & incomer is MCCB/SDF/ACB.
- w. All the feeders shall be withdraw-able or Non withdraw-able type mentioned in the SLD. For withdraw-able type feeder's Plug in arrangement is preferred over Slide in contacts for external control cable connection to the module.

3.2.2 Each vertical section shall comprise:-

In case "RITTAL" make of enclosure is considered following fabrication details to be considered:-

- a. All Cubicles / panels shall be comprise of rigid welded structural frames made pressed and roll formed CRCA sheet of thickness 16SWG (1.5mm). This structure shall house the components contributing to the major weight of the equipment, such as circuit breaker, main horizontal busbars, vertical risers and other front mounted accessories, etc.
- b. Cladding of the frames (Covers) and partitions shall be of minimum 16SWG (1.5mm) CRCA sheet, whereas doors shall be of min. 14 SWG (2 mm) sheet. All cable gland plates shall be made of 16SWG (1.5mm) thick sheets steel and should be of 3 or 4 parts. All sheet steel work forming the exterior of switchboards shall be smoothly finished, leveled and free from flaws. The corners shall be rounded.
- c. The structure shall be mounted on a rigid channel base frame of minimum standard plinth 100mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation(Transport plinth).
- d. Front and rear doors shall be fitted with dust tight Poly Euretene form gaskets which can withstand a maximum temperature of 65Deg C continuous with easy operating type fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust. The doors shall have concealed hinges. Removable covers shall be provided on the front/rear side of vertical/horizontal Busbar chamber of the cubicles with torx screw.
- e. Set of horizontal main bus bars shall be provided at the top or bottom as mentioned in the SLD and busbar rating shall be of uniform cross section throughout the length and made of high Purity electrolyte copper F20 with 99.9% Oxy free. The vertical bus bars shall be housed in separate fully enclosed chamber of minimum width 300 mm and accessible from front and rear shall be tapped off from main horizontal bus bars. A separate horizontal enclosure for all auxiliary power and control buses if required. Busbars shall be provided with the minimum clearance in air as specified and horizontal busbar chamber should be minimum of 300mm height.

In case customized locally manufactured enclosure is considered following fabrication details to be considered:-

- a. All Cubicles / panels shall be comprise of rigid welded structural frames made pressed and formed CRCA sheet of thickness not less than 12 SWG (2.5 mm). This structure shall house the components contributing to the major weight of the equipment, such as circuit breaker, main horizontal busbars, vertical risers and other front mounted accessories, etc.
- b. Cladding of the partitions shall be of minimum 14SWG (2.0 mm) CRCA sheet. All cable gland plates shall be made of 10 SWG (3.15 mm) thick sheets steel. All sheet steel work forming the exterior of switchboards shall be smoothly finished, leveled and free from flaws. The corners shall be rounded. Also

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all front door shall be of minimum 14 SWG (2.0 mm) CRCA sheet and rear door shall be of minimum of 12 SWG (2.5 mm) CRCA sheet.

- c. The structure shall be mounted on a rigid channel base frame of minimum ISMC 75. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation
- d. Front and rear doors shall be fitted with dust tight neoprene gaskets with easy operating type fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust. The doors shall have concealed hinges. Removable covers shall be provided on the front/rear side of vertical/horizontal Busbar chamber of the cubicles with CSK screw.
- e. Set of horizontal main bus bars shall be provided at the top or bottom as mentioned in the SLD and busbar rating shall be of uniform cross section throughout the length and made of high conductivity, electrolytic conductor. The vertical bus bars shall be housed in separate fully enclosed chamber of min. width 300 mm and accessible from front and rear shall be tapped off from main horizontal bus bars. A separate horizontal enclosure for all auxiliary power and control buses if required. Busbars shall be provided with the minimum clearance in air as specified.

Below features are common for both type enclosure

- a. Each compartment shall be provided with a hinged door interlocked with SDF/MCCB/breaker housed inside the compartment so that door cannot be opened unless the SDF/MCCB/breaker is in 'OFF' position. Hinged shall be Concealed and bolted type. Doors shall be provided with right angle turn type door lock.
- b. Panel shall be single/double front type as mentioned in the SLD; single front type panel shall not have access from rear side for operation and for maintenance purpose. Each switchgear shall also be fitted with a label indicating the switchgear rating and duty. Each relay, instrument switch, breaker and contactor shall be provided with a separate label.
- c. Vertical cable chamber housing of minimum length 300 mm shall be provided for the cable end connections, and power/control cable terminations and shall be provided with suitable hinged door. A Horizontal Cable chamber of minimum height 100 or 200mm shall be provided for cable glanding purpose **at the top or at the bottom required as mentioned in the SLD**. The design shall ensure generous availability of space of ease of installation and maintenance of cabling, and adequate safety for working in one vertical section without coming into accidental contact with live parts in and adjacent section.
- d. A cover plate at the top of the vertical section, provided with a ventilation hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1 mm diameter perforations to prevent entry of vermin.
- e. All busbar taps shall be insulated with close fitting non hygroscopic, thermally modified hard PVC of high dielectric strength to provide a permanent high dielectric non-aging and non tracking protection impervious to water, tropical condition and fungi. The insulation shall be non-inflammable and self extinguishing and in fast colors to indicate phases. The continuous operating temperature max 91Deg C and fire protection corresponding to UL 94-V0
- f. The joint shall be insulated in such a way as to provide for accessibility of contact bolts for maintenance. The dielectric strength and properties shall hold good for the temperature range of 0°C to 90°C. If insulating sleeve is not coloured, busbars shall be colour coded with coloured bands at suitable intervals. Both main horizontal and vertical busbars serving modules shall be insulated.
- g. Busbar joints shall be bolted & projections shall be insulated. Spring washers shall be provided to ensure good contact at the joints. Busbars shall be thoroughly cleaned at the joint locations and suitable contact grease shall be applied just before making a joint.

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- h. The busbars shall be located in air insulated enclosures. Direct access or accidental contact with the busbars and primary connections shall not be possible. All apertures and slots shall be protected by baffles to prevent accident shorting of busbars by the entry of maintenance tools. To provide a tight seal between cubicles, bushing or insulating panels shall be provided for busbars crossing from one cubicle to another.
- i. Incoming/ Outgoing terminals of the individual feeders shall be provided with insulated shrouds to avoid accidental contact with live parts.
- j. All operating devices shall be incorporated in the front of panel and shall be flush/semi-flush mounted.
- k. The apparatus and circuits shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary of degree of safety.
- l. Apparatus forming part of the panel shall have the minimum clearances as per relevant Indian Standard. Clearances shall be maintained during normal service conditions. Creepage distances shall comply with those specified in relevant standards.
- m. All insulating material shall be of DMC/SMC to withstand the effects of high humidity, high temperature, tropical ambient service conditions etc.
- n. The lifting eyes bolts(combination angle at bayed conditions) for each shipping section
- o. Functional units such as circuit breakers and fuse switches vertical section shall be provided with space heater controlled by thermostat.
- p. Metallic/insulated barriers shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact.
- q. Extra protection covers(See thro' acrylic cover) over removable cover providing access to live power equipment/circuits shall be provided with tool operated fasteners to prevent unauthorized access.
- r. Provision shall be made for permanently earthing the frames and other metal parts of the panel by the independent connections(unique feature of TS8 automatic polarization)
- s. All identical equipment and corresponding parts be fully interchangeable without any modification(LH to RH assembly).
- t. Panel shall be complete with inter-panel wiring.
- u. One metal sheet shall be provided between two adjacent vertical sections running to the full height of the switchgear except for the horizontal busbar compartment. However each shipping sections shall have metal sheets at both ends (Divider sheet is optional used as removable part at site).
- v. After isolation of the power and control connections of a circuit, it shall be possible to safely carry out maintenance with the busbars and adjacent circuits alive.

3.2.3 Metal treatment & finish:-

All steel work used in the construction of the panel should have undergone rigorous metal treatment process.

In case "RITTAL" make of enclosure is considered following Metal treatments & finish constructional features to be considered:-

- a. Oil, Grease, Dirt and Swarf shall be thoroughly removed by High pressure(1bar) warm (45DegC)multidirectional jets using Alkali Chemicals & DM water free from hazardous chemical.

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- b. After pressurized conveyor system cleaning, finishing shall be carried out with DM Water, followed by final Uniform coating with special **nano ceramic coating** - applied by high pressure jets and the coating should be environment friendly and free from phosphating and COD/BOD and deprive of toxic heavy metals like Fe & Zn (Improve the adhesion property of powder).
- c. First primer should be EC dip coat(RAL 7035)Like in automobile industry, which is free from any heavy metals, chromates and silicon thereby ensuring the RoHS compliance and Over the Primer,the final powder coating of RAL 7035 paint shall be applied and the overall paint thickness should not be above 80-130 microns. The sample sheet for the finishing paint shall be approved by Client/Consultant.
- d. The final finished thickness of paint film on steel shall not be less than 80 microns.
- e. Finished painted appearance of equipment shall present aesthetically pleasing appearance, free from dents and uneven surface.
- f. Metal parts of the Panels should have a convincing corrosion protection by undergoing 168 hours of salt spray testing to DIN ISO 7253.

In case customized locally manufactured enclosure is considered following Metal treatments & finish constructional features to be considered:-

- a. Oil, Grease, Dirt and Swarf shall be thoroughly removed by emulsion cleaning.
- b. Rust and scales shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
- c. After phosphating, finishing shall be carried out with clean water, followed by final rinsing with dilute dichromate solution and oven drying.
- d. Two coats of finishing powder coating Siemens Grey RAL 7035 paint shall be applied with each coat followed by stoving in the dust free atmosphere. The second finishing coat shall be free from imperfection like pinholes, orange pills etc. The sample sheet for the finishing paint shall be approved by Client/Consultant.
- e. The final finished thickness of paint film on steel shall not be less than 90 microns.
- f. Finished painted appearance of equipment shall present aesthetically pleasing appearance, free from dents and uneven surface.

3.2.4 Busbars:-

In case "RITTAL" make of enclosure is considered following Busbar constructional features to be considered:-

- a. Busbars and connections shall either be manufactured from non flammable hard drawn electrolytic copper to ensure correct thermal and Electrical conductivity and shall be mounted on non hygroscopic ,Polyamide (PA 6.6,25% fiber glass reinforced. The continuous operating temperature max 130 Deg C and fire protection corresponding to UL 94-V0 at sufficiently close interval to prevent busbar sag and shall effectively withstand electromagnetic stresses in the event of short circuit capacity for one second as mentioned in the SLD.
- b. Main busbar shall be rectangular cross section and shall have same cross sectional area throughout the length of the switchgear. The current rating of the neutral busbar may be half of the phase busbars. Busbars shall be capable of carrying the rated current at 415 V continuously. The busbars shall be designed to withstand a temperature rise of maximum 80Deg C above the ambient.. Vendor has to submit the Bus bar calculation of each panel along with GA drawing at the time of drawing approval with certificate and documentation if required.

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In case customized locally manufactured enclosure is considered following Busbar constructional features to be considered:-

- a. Busbars and connections shall either be manufactured from non flammable hard drawn tinned copper or high conductivity aluminium / aluminium alloy mounted on non hygroscopic ceramic or resin cast insulators at sufficiently close interval to prevent busbar sag and shall effectively withstand electromagnetic stresses in the event of short circuit capacity for one second as mentioned in the SLD.
- b. Main busbar shall be rectangular cross section and shall have same cross sectional area throughout the length of the switchgear. The current rating of the neutral busbar may be half of the phase busbars. Busbars shall be capable of carrying the rated current at 415 V continuously. The busbars shall be designed to withstand a temperature rise of 40° C above the ambient. A current density of 0.80 Amps/Sq.mm for Aluminum and 1.3 Amps/Sq. mm for Copper Bus Bars shall not be exceeded. Vendor has to submit the Bus bar calculation of each panel along with GA drawing at the time of drawing approval.

Below features are common for both type enclosure

- a. Busbars including branch connections shall be fully insulated except in the cable/bus duct compartment(s). FRP/Hylam shrouds shall be provided at joints and tapoffs. Busbars exposed to air shall be silver plated.
- b. The main horizontal busbars shall run throughout the entire length of the panel and shall be accessible for maintenance from the front as well as rear. Busbar chamber shall have separately screwed covers. All busbars, links etc. shall be provided with 3 mm thick FRP sheet/Hylam sheet to prevent accidental contacts.
- c. The busbar shall be arranged such that minimum clearances between the busbar are maintained as below.

i. Between phases	:	27mm min.
ii. Between phases and neutral	:	25mm min.
iii. Between phases and earth	:	25mm min.
iv. Between neutral and earth	:	23mm min.
- d. The busbar shall be of three phases and neutral system with separate neutral and earth bar. The busbar and interconnection between busbar and various components shall be of high conductivity, hard drawn and High tensile bolts and spring washers shall be provided at all busbar joints.
- e. Busbars and interconnection shall be insulated with heat-shrink sleeves of applicable grade and marked to indicate the phase colouring, which shall be red, yellow, blue and black unless specified otherwise. Necessary de-rating due to insulation shall be considered for sizing the busbars.
- f. To facilitate the connection and cable access, main bus bar shall be located on the top or bottom of the section and shall enable an easy connection to the bus bar in the adjacent vertical section.
- g. The main busbar should be made of copper bars spliced at each column level in order to achieve simplicity and flexibility in transportation, installation and maintenance. Sliding fishplates should be used to make the connection of the copper bars between columns.
- h. Main bus bar design shall allow for front or back cables connection, via the top or bottom plates and all these interfacing possibilities should remain available even with no busbar position change. Bars shall not exceed the section width.
- i. Busbars, at bus section switches, shall be arranged to permit safe work with one bus-section de-energized. In addition it shall not be possible for arcs to transfer across a section or coupler.

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- j. Branch connections shall be sized as per the circuit breaker / switch rating.
- k. Within the section, the vertical bus bar shall be located so that the withdrawable breakers or drawers can be connected directly on it without need of splitters. When the withdrawable unit is completely removed from its place, the power connection shall be covered with shutters.
- l. An earthing busbar sized for the full rating of the switchboard shall be provided along the full length of the switchgear structure with provision for earth cable / bar connections at each end. It shall be possible to disconnect the earth cable / bar connection to facilitate meggering, when required. Where frame leakage protection is specified a separate insulated bus bar is required in addition.
- m. The bus bars shall be designed for mounting on insulated supports that are sufficient in number to accept the electrodynamic forces resulting from the flow of the peak asymmetric short-circuit current.
- n. Busbars and connections shall be adequately sized, braced and supported to withstand the mechanical forces and thermal effects resulting from the switchgear rated short circuit current and carry certification from a recognized testing authority.
- o. The busbar shall be rated for the frame size of the main incoming breaker /ACB/SDF. Above 63 Amp MCCB/SDF incomer/outgoing shall be considered busbar only.
- p. All bus connections, joints and taps shall be short and as straight as possible, and applied with contact grease in the mating surface.
- q. Each Busbar alley shall be provided with Extra protection like Hylam sheet. Busbar should not exposed directly after removing Busbar alley cover, Perforated type of Hylam sheet shall be provided in line with Lovers on Busbar alley cover.

3.2.5 Air Circuit Breakers:-

If Circuit breakers specified in SLD it shall be comprised :

- Withdraw-able
 - Operating mechanism (EDO/MDO) shall be specified in the SLD.
 - Have the number of poles specified in the SLD.
 - Suitable for uninterrupted duty and utilization category B to IEC 60947 or Indian Standard
- a. Circuit breakers shall have four pole or three pole mentioned in SLD, manual/motorized operation, air break, and horizontal draw out type of circuit breaker as specified with a stored energy closing mechanism, integral spring charging handle, status of indicators (close/open and trip) including breaker ready to close indicator, close and trip pushbutton for manual operation and provision for pad locking in open position in addition to lock draw out mechanism.
 - b. Electrically operated breaker shall have provision for manual (mechanical) operation. A control isolating switch shall be provided on the fuse plate to isolate the supply to the charging motor.
 - c. Tripping, closing, control and indication supplies for circuit breakers shall be as shown in the SLDs.
 - d. Mechanical operation indicators shall be provided to show open & close position of the breaker and Circuit breaker operating mechanisms shall be motor wound spring. The closing spring shall be automatically recharged after discharge and be ready for next closing command. The closing spring condition - "charged" or "discharged" shall be shown via a positively driven indicator.
 - e. Breaker shall be provided for slow closing and opening of the breaker for maintenance purposes, and for manual charging and closing of electrically operated breakers during emergencies.

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- f. Circuit breakers shall be provided with trip circuit supervision to monitor trip circuit continuity and trip circuit supply. Alarm and indication facilities shall be provided for each circuit breaker and a volt free group contact provided via internal bus wiring for remote common alarm.
- g. The ACB shall have CT operated microprocessor based/solid state/thermal release providing for over current and earth fault protection specified in the SLD. The release shall have provision for settable current and time as required for respective protection. Each pole of the ACB's shall be equipped with over current and short circuit release. The ACB's shall be equipped with shunt trip and under voltage release also. The trip devices shall be direct acting. The breakers shall be of the shunt or series trip type as specified.
- h. The ACB of same rating shall be identical and interchangeable.
- i. The ACB's shall have an arc quenching device on each pole. The ACB's shall have auxiliary contacts for signaling, interlocking etc. The ACB's shall have slow close facilities for checking contact operation and contact gap adjustment.
- j. Possible to close the ACB electrically and the spring charging time shall be preferably by less than 5 seconds. The mechanism shall be of stored energy type. The electrical closing mechanism shall have a built- in anti pumping feature
- k. Circuit breakers shall be provided with 4 NO & 4 NC spare auxiliary contacts wired out to terminals.
 - i. In addition auxiliary contacts shall be provided for:-
 - ii. Circuit breaker in service position.
 - iii. Circuit breaker in test position
- l. Auxiliary contacts shall be suitable for inductive circuit switching. Auxiliary contacts multiplication shall be by latch type relays to prevent inadvertent change of contact position on loss of auxiliary supply.
- m. The breakers shall have short circuit breaking capacity of not less than 50 KA RMS at 415 Volts 50 Hz AC or as specified ion SLD.
- n. Rating and Breaking Capacity

The ACB shall have Minimum Service Breaking Capacity (Ics) equal to Ultimate Breaking Capacity (Icu) equal to With stand Capacity (Icu-Ics=Icw)
- o. A minimum short-time withstand circuit of 50 KA for 1 second or specified in SLD.
- p. Electrical overload performance at 6 times the rated current, 110% of the rated voltage as recovery voltage and 0.5 power factor.
- q. There shall be an option to select the curves (minimum 80 combinations) and also change the operating time for minimum of 8 settings for overload, 9 for short circuit and 9 settings for earth fault.
- r. There shall be facility for selecting various type of E/F protection if required
- s. Trip history feature shall be available.
- t. Neutral protection of 50 to 100% should be available.
- u. Self - diagnostic malfunction alarm for microprocessor should be available.
- v. The trip unit shall have thermal memory.
- w. I² t cropping facility shall be available for short circuit and earth fault.

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- x. Facility should be there to monitor the load and intimate a pre-trip alarm or have load-shedding feature. Three phase Bar Graph indication should be provided for each ACB
- y. Fault indication by means of LED should be available for Overload, Short Circuit and Earth Fault and also LCD display for indication of menu's, settings, recorded information and current measurement as minimum.
- z. Trip reset facility should be manual / automatic.
- aa. It shall be possible to trip (or) close the Breaker thro' RS 232C / RS 485 communication interface.
- bb. ACBs shall have the "MAKING CURRENT RELEASE"
- cc. ACBs should have the facility of changing the orientation of Termination at site without extra cost.
- dd. ACBs should have the communication upgradability without changing the trip unit at site.
- ee. ACBs should have a continuous rated Shunt Trip Coils.
- ff. ACBs should have short circuit pick up at multiples of rated set current Ir.
- gg. All 4Pole ACBs shall have full rated Neutral.
- hh. ACB shall be convertible from manual to Electrical Breaker at Site.
- ii. Dielectric test of 2.5 KV applied for one minute on main circuits. Test evidence from a recognized independent Laboratory / Institution shall be furnished for compliance of the breakers with the above requirements.
- jj. The circuit breakers shall be fitted with detachable arc chutes on each pole designed to permit rapid dispersion, cooling and extinction of the arc. Interface barriers shall be provided to prevent flashover between phases.
- kk. Arcing contacts shall be of hard wearing material of copper tungsten or silver tungsten tipped with arc resisting material and contact shall be multi-finger and spring loaded type and shall be readily replaceable. Main contacts shall be of pure silver of high pressure butt type of generous cross section.
- ll. The operating mechanism shall be of robust design, with a minimum number of linkages to ensure maximum reliability. Manually operated circuit breakers shall be provided with spring operated closing mechanism which are independent of speed of manual operation. Electrically operated breakers shall have a motor wound spring charged closing mechanism. Breaker operation shall be independent of the motor which shall be used solely for charging the closing spring.
- mm. The operating mechanism shall be such that the breaker is at all times free to open immediately the trip coil is energized.
- nn. Circuit breakers shall be individually housed in sheet metal cassettes provided with hinged doors. The breaker along with its operating mechanism shall be mounted on a robust carriage moving on guide rollers within the cassette. Isolating contacts for both power and control circuits shall be of robust design and fully self-aligning. The assembly shall be designed to allow smooth and easy movement of the breaker within its cassette.
- oo. The breaker shall have three distinct positions within the cassette as follows.
 - i. 'Service' position : with main and auxiliary contacts connected.
 - ii. 'Test' position : with power contacts fully disconnected and control circuit contacts connected.

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- iii. 'Isolated' position : with both power and control circuit contacts fully disconnected.
- pp. Test facilities shall be provided to permit operation of the circuit breaker whilst in the test position.
- qq. It shall be possible to achieve any of the above positions with the cassette door closed. Mechanical position indicators shall be provided for the three positions of the breaker.
- rr. The moving portion of the circuit breaker shall be so interlocked that:-
- i. With drawable circuit breakers and their Cubicles shall be interlocked to prevent.
 - ii. The breaker being inserted into the service position unless it is open.
 - iii. The breaker being withdrawn from the service position unless it is open.
 - iv. The breaker being closed unless it is fully in the service, withdrawn/test or earthing position.
 - v. Remote operation whilst in the withdrawn/test position.
- ss. The ACB's shall be Three-position draw out type. Any attempt to with draw the Air Circuit Breaker, which the unit is in service, will automatically trip the breaker. It shall be possible to rack the ACB to disconnected position with the door closed.
- tt. Remote electrical indication of the circuit breaker status should be possible for all the positions.
- uu. The ACBs are to be operated through a PLC programmer and should also provided with electrical interlocking in between them incase of failure of PLC. And shall have a selector switch to select PLC / Electrical Interlock mode.
- vv. Door interlock feature which prevents opening of the door with the breaker in the connected position Suitable for front and rear access.
- ww. It shall not be possible to open the hinged door of the cassette unless the breaker is drawn to the isolated position. When the breaker is in the inspection position it shall be completely withdrawn.
- xx. Inadvertent withdrawal of the circuit breaker too far beyond its supports is prevented by suitable stops.
- yy. Be fitted with busbar and cable circuit shutters.
- zz. Provision shall be available for the padlocking of the circuit access flaps in any of the three positions.
- aaa. The drawout type ACBs should have provision to padlock the safety shutters when removed from the enclosure
- bbb. Coloured red for busbar and yellow for circuit. For bus-section and coupler applications the shutters shall be labelled with the busbar number.
- ccc. Metal construction and effectively earthed to the main housing.
- ddd. The positively driven type, gravity drop shutters are not acceptable.
- eee. Capable of being individually operated by hand.
- fff. Each circuit breaker shall have provision for padlocking in the test and isolated positions and have indications for these positions.
- ggg. Each circuit breaker shall be provided with an anti pumping facility in the circuit breaker closing circuit.
- hhh. Moving portion of breakers of same rating shall be interchangeable.

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- iii. The moving portion of the circuit breaker shall be provided with a heavy duty self aligning earth contact, which shall make before and break after the main isolating contacts during insertion into and withdrawal from the service position of the breaker. Even in the isolated position positive earthing contact should exist.

3.2.6 Isolator, Fuses and Fuse Combined units:-

If SDF is specified in the SLD, it shall be comprised as follows:-

Isolator:-

- a. Isolators shall be fault make and capable of breaking the motor locked rotor current.
- b. They shall have a performance equal to uninterrupted duty, AC-23A utilization category according to Indian Standard or an equivalent standard.
- c. Isolators shall be mechanically interlocked with door/withdrawal mechanism and padlock-able in the 'open' position.
- d. Isolators shall be fitted with the specified auxiliary contacts for internal/external isolation, control and indication.

Fuses:-

- a. All control and Power circuit fuses shall be of non-deteriorating, high rupturing capacity (HRC) type and have a motor protection characteristic performance in accordance with the specified codes and standards.
- b. Fuses shall be provided with visible indication to show that they have operated.
- c. Control, indication and instrument circuits shall be protected by HRC fuses. All unearthed poles of auxiliary supplies shall be fused. Earthed poles shall be connected by a removable link.
- d. It shall be possible to remove or install the power circuit fuses during off load conditions with full voltage available on the terminals. Wherever required fuse pullers shall be provided.
- e. Fuses shall be of high rupturing capacity (HRC) fuse links and shall be in accordance with Indian Standard and having rupturing capacity of not less than 35 MVA at 415 Volts.

Isolators and fuse combination units (Switch Disconnecting Fuse)shall:-

- a. SDF shall be of the fixed or withdraw-able, double air break type in MCC panel and shall be of the fixed, double air break type in Main LT Panel.
- b. SDF shall be of the rating and number of poles as stated in the SLD.
- c. SDF shall be of the fault-make, load-break type, unless specified otherwise.
- d. SDF shall be interlocked to prevent the compartment door being opened unless the isolator is in the open position.
- e. SDF shall be heavy duty, quick make and quick break type mechanisms, designed to ensure positive operation even in the event of failure of operating springs.
- f. In SDF all fuse contacts shall be silver plated at current transfer surfaces and spring shall be stainless steel.

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- g. SDF shall be provided with a front operating handle.
- h. The Mechanical ON and OFF indicators of the SDF handle shall be clearly marked.
- i. SDF shall be provided with facilities for padlocking in the 'off' position.
- j. SDF shall be capable of withstanding the thermal and electro-magnetic stresses caused by short circuit currents for the time of operation of the associated fuse links.
- k. SDF for controlling motor circuits shall be of the load break, fault make type and shall be capable of breaking locked rotor current of the associated motor.
- l. The interior arrangement of SDF shall be such that all 'live' parts are shrouded.
- m. The Isolator and fuse shall be provided with following interlocks
- n. The fuse is not accessible unless the switch is in fully open condition.
- o. Interlocks shall be provided so as to prevent opening of the unit door when the SDF is in the ON position, and also to prevent closing of the SDF with the door not properly secured. It should, however, be possible to defeat the interlock mechanism to operate SDF with the door open intentionally.
- p. All fuses shall be of HRC cartridge type mounted on plug in type fuse bases, fuses shall be provided with visible indicators to show that they have operated.
- q. Earthing and neutral lines in main supply circuits shall be solid silver plated copper and be of bolted pattern.
- r. Fuses and links functionally associated with the same circuit shall be mounted side by side.

3.2.7 Moulded Case Circuit Breakers (MCCBs):-

If MCCB is specified in the SLD, it shall be comprised as follow

- a. MCCBs should comply with IEC 947 Part 2. / IS 13947
- b. MCCBs shall be triple pole with neutral (TPN) / four pole (FP) as specified in the SLD with extended Rotary Handle that clearly indicates the three positions: ON, OFF and TRIPPED.
- c. MCCB shall be quick break and quick make, trip free, thermal magnetic trip elements/Microprocessor based trip elements. Incoming & Outgoing power terminals of MCCBs shall have Spreader Links in order to accommodate Busbar connections.
- d. MCCB shall have fully rated for 45°C ambient temperature.
- e. Short circuit withstanding capacity shall be specified in the SLD.
- f. The MCCBs shall be provided with adjustable/fixed short circuit and over load protection with adjustable/fixed range of operating time on short circuit as specified in the SLD.
- g. Microprocessor based release MCCBs shall be with integrated CT with integral energy metering of class-1 accuracy and LCD display.
- h. The MCCBs shall be provided with front drive mechanism with door interlock with interlock defeating facility.

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- i. The insulating case of the MCCBs shall be made of high strength heat resistant, flame retardant and thermosetting material so as to provide the following important functions;
 - i. Safety for operating personnel.
 - ii. Very high dielectric strength
 - iii. High withstanding capacity against thermal and mechanical stresses.
- j. The contact system shall be maintenance free with arc extinguishing devices & properties.
- k. Termination: -

The following features shall be provided for terminals;

 - i. Interchanging capability for line & load ends
 - ii. Extended terminals to connect Aluminum cables of required runs & sizes.
 - iii. Copper cable termination without extended termination accessories.
- l. Visuals indication: -
 - i. The following visual indications shall be provided for the MCCBs;
 - ii. "ON"
 - iii. "OFF"
 - iv. "TRIP"
- m. The MCCBs shall be of Microprocessor/Thermal magnetic release based shall be specified in the SLD.
- n. MCCBs shall be of category A with a rated service breaking capacity (Ics) equal to the ultimate breaking capacity (Icu) for all the ratings.
- o. MCCB shall give pre alarm on overload.
- p. All the MCCBs should be coordinated and selected so as to achieve Total Discrimination upto Icu value with the downstream Circuit Breakers.
- q. The MCCB shall be suitable for operating Voltage of 415 V minimum and an Insulation Voltage of 690 V.
- r. The MCCB shall be Manual / Motorized operated type and motor driven supply shall be either 220 VDC or 230 VAC as indicated in the SLD.
- s. Minimum one number of NO / NC & Change Over auxiliary add on contact shall be available for "ON", "OFF", & "TRIP" positions.
- t. MCCBs shall be of double break and current limiting type to ensure the low let through energy.
- u. MCCBs for UPS/Non Linear load applications should be provided with double Neutral (1.6In) protection.
- v. For 4 pole MCCBs, the neutral contact shall make earlier than the phase but while tripping, the neutral contact shall break later than the phase for safety purposes.
- w. For 4 pole MCCBs shall be equipped for neutral protection as standard with a 3-position setting : - neutral not protected - neutral tripping threshold equal to half the phase value - neutral threshold equal to the phase value

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x. Accessories:

If the following accessories shall be specified in the SLD for MCCB, like

- i. Shunt trip suitable for 24VDC / 230VAC.
- ii. Under Voltage release suitable for 230VAC / 415VAC.
- iii. Auxiliary Add ON contact block for ON/OFF/Trip Indications.
- iv. It should be possible to connect the earth fault module.
- v. Rotary handle operating mechanism with locking arrangement in OFF position.

3.2.8 Motor Protection Circuit Breakers:-

If MPCB specified in the SLD, it shall be comprised as follow

- a. The MPCB shall conform to the latest specification of Indian Standard.
- b. The MPCB shall be with overload, single phasing and short circuit protection.
- c. It shall be possible to fit accessories on the MPCB such as aux contact, trip indication contact, rotary handle, under voltage release or shunt trip coil, etc. In case of rotary handle, the same shall have built-in door interlock, defeat & padlocking facility. The rotary handle shall be same as that for SDF or MCCB for better aesthetics.
- d. The MPCB shall have rotary handle mechanism with ON, OFF & TRIP positions. The MPCB shall have no de-rating upto 45°C service temperature. In case the MPCB needs de-rating, manufacturer shall declare the de-rated current carrying capacity at above 40°C service temperature.
- e. The contactor – MPCB combination shall be type tested for type-2 co-ordination at 50 kA or specified in SLD. The MPCB shall sense the overload faults, however the tripping shall be by the contactor only. MPCB shall trip only on short circuit faults.
- f. In case of star delta starter MPCB shall be of magnetic type and bi relay shall be provided separately.

3.2.9 Motor Starters:-

- a. Motor starters shall be direct on-line unless specified otherwise.
- b. They shall be arranged for local and remote control, with integral facilities for full testing of the MCC.
 - I. **Motor starter shall be one of the following as specified in SLD:**
 - Withdraw-able. In this case the rating of the 'plug-in' contacts needs specific approval of the Client/Consultant.
 - Fixed pattern with components fixed within the compartment. Maintenance access shall be approved by the Client/Consultant.
 - II. **Each motor starter shall consist of as specified in SLD:**
 - Isolator and line fuses or MCCB.
 - Air breaks contactor.
 - Motor protection over load relay.

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3.2.10 Contactors: -

- a. The contactors shall conform to the latest Indian Standard specification. The contactors shall be suitable for 650 V AC with impulse withstand capacity of 8 KV and shall be of AC-3 duty.
- b. The contactors shall be of full voltage, direct online, air break, single throw electromagnetic type.
- c. The contactors shall have no de-rating upto 45°C service temperatures. In case the contactors need de-rating, manufacturer shall declare the de-rated current carrying capacity at 45°C service temperature.
- d. For applications such as capacitor switching or crane duty etc, special definite purpose contactors shall be used to take care of inrush current during switching.
- e. The contactor shall be provided with at least 2 Nos. of "NO+NC" spare auxiliary contacts exclusively use for the clients.
- f. Contactors above 45 A shall have arc chamber interlock to prevent ON operation if arc chamber is not in place.
- g. Vendor to specify 10 seconds rating for the contactors offered. Contactors above 16/18 A. shall have replaceable contacts. The spare kits shall be available.

3.2.11 Over load relays: -

- a. The overload relays shall conform to the latest Indian Standard specification. The overload relays shall be suitable for 650 V AC.
- b. Overload protection shall be bi-metallic type provided together with single phasing protection and have ambient temperature compensation and also with 1NO+1NC auxiliary contacts.
- c. For motors rated 30kW and above earth fault protection shall be provided.
- d. The overload relays shall have no de-rating upto 45°C service temperatures. In case the overload relays need de-rating, manufacturer shall declare the de-rated current carrying capacity at 55°C service temperature.
- e. The overload relay shall have facility to hand reset and test and also auto / manual reset facility.
- f. For critical motors, wherever specified, microprocessor based overload relay shall be used. Static relays shall not be allowed.

3.2.12 Metering, Protection, Control and Indication:-

- a. Control and monitoring system shall be provided.
- b. Metering, protection and control shall be provided as requirement.
- c. Meters and relays shall be flush mounting and fitted in the front of the panel door.
- d. Meters and relays shall be capable of withstanding without damage the secondary currents associated with the switchgear rated fault current flowing in the primary of current transformers.
- e. External zero adjustment / calibration shall be possible on all indicating instruments to facilitate adjustment without dismantling the instrument.
- f. The instruments shall have either analog type or digital type. Analog instrument shall be 96 Sqmm with 90°C scale or 96 Sqmm with 90°C scale and shall be provided with adjusting devices in the front.

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- g. Analog instrument shall be white with black numbers and lettering. Dial shall be parallax free.
- h. Analog meter normally maximum meter reading shall be the order of 60% normal full scale deflection. Ammeters shall be scaled such that full load corresponds to between 50 and 80% of the angular deflection
- i. Voltmeter shall comply with BS-90. The dial of the meter shall be square in shape of 96 x 96 mm size. The voltmeter shall be moving iron type, flush pattern with dust and moisture proof enclosure.
- j. The voltmeter selector switch shall be arranged to provide line to line voltage reading.
- k. Ammeter shall comply with BS: 89. The dial of the ammeter shall be square in 96x96 mm in size. The ammeter shall be moving iron type, flush pattern with dust and moisture proof enclosure. Separate current transformer shall be provided for all Ammeters.
- l. Power meter shall be with Blue backlight LCD Meter (4 rows parameters display) to measure V, A, F, PF, kW, kVA, kVAR, kVARh, kWh, kVAh, Power Demand, %THD, Neutral Current, Modbus RS485 Port , CT Sec:1A/5A programmable, Input Voltage : 0-600 VAC / 0-340VAC(Direct) or 0-3.2MVAC by External VT, Accuracy Class 0.5s, Time Stamped Min/Max of all instantaneous parameters , 1 DI+1 DO, 31 Individual Harmonics, Data Logs/Event Logs(Min 80 KB memory),Time Stamped Alarms, Programmable /configurable alarms, Meter to have facility to add Ethernet module, Other expandable module options (Analog input/Output & Relay Output) etc.
- Load manager with more futures shall be with 4 digit, 3 line LED display to **measure V & A(Phase wise & Avg), Frequency from any available phase and generator RPM, PF, kW, kVA, kVAR, kVARh, kWh, kVAh, Max Demand, %THD**, Colored load bar, which gives Analog indication of the % Current Load, Meter shall have minimum 5 keys and support quick explorer type navigation, Meter shall have Auto scroll feature, OLD registers to store resetted data, Acc Class 1.0, meter to record load Run hours, Meter On hours and number of power interruptions
- Load manager with less futures shall be 4 digit, 3 line LED display to **measure V & A(Phase wise & Avg), F, PF, kW, kWh**, Colored load bar, which gives Analog indication of the % Current Load, Meter shall have minimum 5 keys and support quick explorer type navigation, Meter shall have Auto scroll feature, OLD registers to store resetted data, Acc CI 1.0, meter to record load Run hours, Meter On hours and number of power interruptions
- m. Protective relays shall, wherever possible, be of the draw out type with hand reset operation indicator. Lockout relays shall be of the hand-reset type.
- n. Status indication illuminators (green-open, red-closed, amber-tripped) and positive drive mechanical position indicators shall be provided for circuit breaker. Contacts for remote indication shall be provided.
- o. Control of circuit breakers shall be carried out at either:-
Control Switch at Cubicle Door
- p. Control of motors shall be carried out:-
At the MCC only stop & Reset Push Button
- q. Control station (Start + Stop) local shall be provided near to the motor by Purchaser if remote operation is specified in SLD.
- r. Two normally open contact and two normally closed contact (2NO + 2NC) shall be provided for remote indication or control.

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- s. The Ammeter and Voltmeter in panel shall be Digital type with in built selector switch.
- t. All protective relays shall be back connected, draw out type, suitable for flush mounting and fitted with dust tight covers.
- u. Protective relays shall be withdrawable type. Trip circuits shall be automatically broken and current transformer secondary circuits shorted, when a relay is withdrawn from its case. A marking strip shall be provided in front of each terminal block and a diagram plate at the back of each case to identify connections.
- v. Relay contacts shall withstand repeated operation and shall make or break the maximum currents in their circuits without deterioration_ All spare contacts shall also be wired up to the external terminals.
- w. Relay coils shall carry their normal currents indefinitely and such currents as can occur under fault conditions. Relay mechanisms shall not be affected by vibration or magnetic fields, which may occur in normal operation
- x. All relays in tripping circuits shall have mechanically operated flag indications and shall be hand reset type. Indicators shall be capable of being reset without opening the relay case. It shall not be possible to operate any relay by hand or to alter its setting, without opening the case. Or relays with combined functions such as inverse time and instantaneous trip, separate indications of each function as specified shall be provided.
- y. Master tripping relay (lock-out relays) shall be of the hand reset type with self coil cut off contacts and shall have at least 3 'NO' + 3 'NC' spare contacts for owner's exclusive use. Necessary multiplication by auxiliary relay shall be done.
- z. Provision shall be made for insertion of test plug at the front for testing and calibration using external source of power without disconnecting permanent wiring. Test plugs shall permit the shorting of any current transformer circuits.
- aa. Relay covers shall be of non-ignitable materials. Relays on which the function of a contact may be changed from 'NO' to 'NC' and vice-versa by simply changing the contact arrangement are preferred
- bb. All relays shall preferably be mounted in front of the panel and shall be as specified in the Technical Data Sheet or SLD. The current and voltage coils shall be rated as specified.
- cc. All measuring relays shall have 'built in' flags to indicate relay operation. It shall be possible to reset the flag without opening the relay case. Anti fungus treatment shall be provided for all relays.
- dd. All relays shall be rated for operation with 1A/5A CT secondary current and 220/110V PT secondary voltage. Relay shall be sent to their correct operating point at the factory prior to shipment.
- ee. All main protective relays shall be supplied with in-built testing facility.
- ff. Where earth fault relays are specified in the SLD, it may be necessary to incorporate time delay relays to prevent the ACB from attempting to interrupt the earth fault in excess of its rated interrupting capacity. The time delay should ensure that values of earth fault current in excess of the ACB rating. The vendor shall be responsible for ensuring proper component co-ordination. The timer relay may be incorporated within the earth fault relay, and shall have adjustable settings.

3.2.13 Miniature Circuit Breakers:-

- a. The MCB shall conform to the latest Indian Standard specification.
- b. The MCB shall have a minimum breaking capacity of 10 KA or as specified on SLD.

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- c. The MCB shall be with overload and short circuit protection
- d. The MCB shall have C class characteristics.

3.2.14 Indicating Lamps (LED TYPE):-

- a. The indicating lamps shall be LED cluster type indicating lamps with low watt consumption. Indicating lamp shall be of the double contact; bayonet cap type rated for operating for either a 230 VAC or specified AC/DC auxiliary voltage in the SLD.
- b. The lamps assembly shall be complete with cluster of LEDs, holders, lenses with transparent covers.
- c. The indicating lamps shall have built in resistor and shall be suitable for the control voltage specified.
- d. The lamps shall be LED type. The lamps shall be provided with translucent lamp covers of required colour (For ACB- ON-RED, OFF-GREEN, TRIP -AMBER. For Incomer of Panels R Phase-RED, Y phase-YELLOW, B phase-BLUE).
- e. Bulbs and covers shall be easily replaceable from the front.

3.2.15 Push Button:-

- The push button unit shall comprise of the contact element, a fixing holder, and push button actuator.
- a. The push button unit shall comprise of the contact element, a fixing holder, and push button actuator.
- b. The push button shall be momentary contact type. The contacts shall be of silver alloy and 5A at 220 V AC or 4A at 110 V DC (inductive load).
- c. Emergency stop push buttons shall be lockable in the operated position and also Emergency Push Button shall be Mushroom type head.
- d. The actuator shall be of stranded type and colour as per its usage for ON, OFF and Trip.
- e. Push button colours shall be as follows:

Stop, Open, Emergency	:- Red
Start – Close	:- Green
Trip circuit 'Healthy' check	:- Black
- f. Red push buttons shall be on the left side and green push buttons on the right side.
- g. The key shall be released from the push button in both 'Released' and 'Operated' positions and operation of the push button shall be possible in the key release position. Push button knobs for emergency stop push

3.2.16 Control & Selector Switch:-

- a. The control and selector switch shall be of the rotary type, having enclosed contacts, which are accessible by the removal of the cover.
- b. Control and selector switch for instruments shall be flush mounted on the front of the panels and desks.

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- c. Local/remote selector switches when located on switchgear cubicles, shall be mounted inside the relay compartment at an accessible location.
- d. All control switches shall be of the spring return to normal type. Circuit breaker control switch on the panel cubicle shall be lockable in the "trip" position.
- e. Circuit breaker control switches shall be 3 position spring return to 'neutral' from both 'ON' and 'OFF' positions. They shall have 'pistol grip' handle. Number of ways, locking system, lost motion device if required etc. Two spare ways shall be provided on these switched. Circuit breaker control switch on panel cubicle shall be lockable in the "trip" position.
- f. Control switches have momentary contact, Circuit breaker control switches shall be provided with sequencing device to prevent repetitive closing operations without first moving to the trip position.
- g. Selector switches shall be of the stay put type, maintained contact type.

3.2.17 Space Heaters:-

- a. One separate 220 V AC supply shall be provided for space heater etc
- b. Each vertical section of the panel shall be provided with thermostat controlled anti - condensation, industrial strip continuous duty type space heaters rated for 230 Volts $\pm 10\%$, single phase, 50 Hz. The heaters shall be provided with DP MCB.
- c. The space heaters shall be located at the bottom of the switchboard and shall be controlled through a thermostat with an adjustable setting with Double pole MCB with overload and short circuit release. The thermostat shall preferably be located in the metering/ relay chamber.
- d. Wiring of space heaters in each panel shall be grouped and brought out to easily accessible terminals for connection to power supply, through MCB.
- e. Each switchboard shall be provided with plug-socket with MCB for the connection of hand lamp rated 230 V, 50 Hz. single phases.
- f. Wiring shall be done with minimum 2.5 sq mm stranded copper conductor PVC insulated wire.
- g. Motor anti-condensation heaters (where specified) shall be supplied from the same source as those for the Panel. They shall be controlled through MCB and contactor's auxiliary contacts such that the heater is energized when the motor is stopped and totally isolated when Main Circuit Isolator or MCB is open.

3.2.18 Instrument Transformers:-

- a. Voltage and current transformers of appropriate ratio, no. of cores, output, class and accuracy for protection and metering, shall be provided as shown in the SLD. Also Voltage and current Transformer shall have separate core for Protection and separate core for Metering purpose.
- b. The Vendor shall provide details of ratio, output, class and accuracy for all the instrument transformers in technical offer.
- c. The secondary windings of instrument transformers shall be earthed at one point through a removable link, with the provision for attaching test links.
- d. Current transformers wherever required is called for CT as specified in the SLD.
- e. Current transformers shall comply with the requirements of Indian Standard.

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- f. Current transformers shall be rated to withstand the thermal and magnetic stresses resulting through fault currents equal to the switchgear fault rating.
- h. CT shall be Nar type in epoxy resin cast type rated for 415 V. In exceptional circumstances the Purchaser may authorize the use of wound primary CTs where a bar type cannot provide a suitable ratio.
- i. CT shall be provided with Class A/Class B insulation and proper polarity markings in a suitable manner.
- i. The vendor shall be responsible for the VA output of the CTs which are adequate for the relays, meters and loads connecting them.
- l. Shorting terminals for current transformers shall be provided at the outgoing terminals where external connections are required.
- m. Where current balance protection is specified the Vendor shall provide calculations together with current transformer magnetization curves to prove the through fault stability of the protection up to the switchgear fault rating. Shorting terminals for current transformers shall be provided at the outgoing terminals where external connections are required.
- n. Unless otherwise specified the CT shall meet following requirements :
- Separate cores shall be used for metering and protection.
 - Protection class CT shall have an accuracy class `5P' and an accuracy limit factor greater than '10'. Low reactance CTs shall be used for protection.
 - Current transformers for instruments shall have an accuracy class 1.0 and an accuracy limit factor less than 5.0.
 - If any of the Meters is located at field (Remote), same shall be fed through Saturated Interposing CT.
 - Current transformers shall be mounted in stationary part of switchgear.
 - These shall be capable of withstanding dynamic and thermal stresses originated by short circuit fault current for withstand time of the board.
 - Test terminal blocks shall be provided for each CT circuit.
 - Unless otherwise required for proper relaying one side of current transformer secondary shall be grounded in the compartment with the meters or relays which they serve and each current transformer group shall be grounded with a separate identified lead which may be disconnected for testing.
 - CT secondary terminals shall be provided with plastic covers to prevent inadvertent contact
- o. Voltage transformers shall be provided as per requirement and selection of PT shall be done by vendor.
- p. Voltage transformer primary winding shall be protected by High Rupturing Capacity Cartridge fuses and secondary winding shall be protected by the MCB.
- q. The PT's wherever specified shall be epoxy cast resin type. The burden and ratio and class of accuracy shall be as given in the specific requirements. Generally, PT shall have an accuracy class of 1.0 from 10% to 120% of normal voltage. However, potential transformers shall have sufficient capacity to operate with the burden imposed by the devices shown on the drawing with their accuracy classification.
- r. PT's shall be fixed type and connections between the busbars and PT shall be completely shrouded.
- s. Plug-in type test terminal blocks should be provided for each PT circuit.

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- t. Unless otherwise specified for proper relaying one side of potential transformer secondary shall be grounded at the transformer and the ground connection shall be identified and removable for testing.
- u. Voltage transformers shall have provisions for safely disconnecting the fuses and transformers from the energized Busbars.
- v. Instrument transformer nameplates shall be fixed type, output and serial numbers and Instrument Transformer shall be fixed in a position so that details can easily be read/visible when fitted in the cubicle.

3.2.19 Cable Terminations:-

- a. Cable terminating facilities and terminals shall be suitable for the specified cable type and conductor size. Consideration and provision shall be taken by the Vendor on the equipment design for the use of cables with aluminum / copper conductors as mentioned in the SLD / Switchgear schedule.
- b. Panel shall be designed either for top or bottom or combined entries and outgoing which will be confirmed by clients/consultant at the time of drawing approval.
- c. Generous size of cable compartments shall be provided, with the position of cable gland such that cables can be easily and safely terminated. A Panel with removable undrilled gland plate shall be provided.
- d. Control & Indication terminal blocks shall be mounted in a single deck arrangement. Terminal blocks for the connection of external control wiring shall be of the clamp type with a facility to connect two wires on each side of the terminal. A minimum of 20% spare terminals shall be provided in each module. And also each control terminal connection of 2 x 2.5 Sqmm standard copper wire.
- e. Cable terminal arrangements for power and control cables may be adjacent provided that they are separated by barriers or the power terminals are fully shrouded.
- f. Sufficient space shall be provided between the terminal box and the cable entry for the spreading and termination of external conductors. A minimum space of 300 mm from the gland plate to the nearest terminal block shall be provided. If it is not possible using the standard design in relation to specified cable size then the Vender shall incorporate an extended cable glanding box within its design.
- g. In MCC Panel wiring shall be in one side of the terminal block only.
- h. Positioning of cable terminations shall avoid obstruction of other cable terminations, removable covers, etc. and provide for easy access for terminating cables.
- i. Multiway terminal blocks complete with screws, nuts, washers and marking strips shall be furnished for terminating the internal wiring and outgoing cables.
- j. Power terminals shall be washer head screw type or stud type complete with crimping type connectors. Screw type terminals with screws directly impinging on conductor are not acceptable.
- k. Not more than two wires shall be connected to any terminal. If necessary a number of terminals shall be jumpered together to provide wiring points.
- l. Terminal blocks for current transformer secondary lead wires shall be provided with shorting and earthing facility. All external wiring shall be on one side of the terminal block only.

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- m. All terminal blocks shall be shrouded or provided with transparent covers. Also shrouds or covers shall be to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit. Pinch screw type terminals re not acceptable.
- n. Terminals for different voltages shall be separated by partitions.
- o. Terminal boxes (where specified) shall be suitable for dry type terminations unless otherwise specified.
- p. Cable risers shall be adequately supported to withstand the effects of rated short circuit currents without damage and without causing secondary faults.
- q. Separate cable facilities shall be provided for each cubicle and for power and control cables.
- r. Adequate support arrangement shall be provided for each cable to avoid undue strain on the cable terminations.
- s. Termination of single core cables shall be through gland plate and provision shall be made for bonding and earthing any armour.
- t. The terminal blocks shall be mounted so as not to restrict the movement of withdraw able circuit breakers.
- u. Where bus duct is specified, adequate provision shall be made for supporting and fastening of the bus duct at the switchgear. The terminals shall be provided with a sufficient pre-drilled contact area for accepting flexible connectors, and proper access shall be provided for making off (or disconnections of), the connections while the bus duct remains in place.
- v. In compartment type panel inter panel wiring within each shipping section shall be Vendor's responsibility. For wiring between shipping sections, Vendor shall provide terminal blocks on adjoining shipping sections and supply suitable connecting (jumping) wires.

3.2.20 Power & Control Wiring:-

- a. The control wiring shall be carried out with 650/1100 V grade Low Smoke Halogen free PVC insulated fire retardant stranded copper conductor wires of minimum size 1.5 Sqmm except for electronics wiring. The wiring shall be complete in all respects so as to ensure proper functioning of control, protection and interlocking scheme.
- b. Terminal for both incoming and outgoing cable shall be suitable for 1100 volts grade, aluminum/copper conductor PVC insulated and sheathed, armored cable and shall be suitable for connections of solder less sockets for the cable size as indicated on the drawing.
- c. Control & Power wiring within the switchgear shall be securely held in position (either loomed or run in conduit/trunking) neatly bunched, adequately supported and properly routed to allow easy access and maintenance. Where wiring enters or passes through compartments it shall be suitably protected mechanically protected.
- d. Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.
- e. Control & Power wiring layout shall permit alterations to individual circuits without requiring shutdown of the complete panel.
- f. All wiring for external connections shall be brought out to individual terminals on a readily accessible terminal block without joints or tees in their runs. Generally not more than two wires shall be connected to a terminal.

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- g. Bus wires for closing, tripping, control, indication, heaters etc. shall be provided and running within the switchgear shall be suitably sized and individually protected. Bus wires for Serial communication shall run in a separate tray with metallic enclosure.
- h. Flexible wires shall be used for connections on door mounted equipment. Wiring shall be loomed, wrapped in flexible PVC conduit and be firmly clamped at both ends to prevent movement at the terminations.
- i. Secondary wiring for CTs, PTs, AC auxiliary supply, DC auxiliary supply and inter panel wiring shall be done by different colours as per standard.
- j. Wiring identification shall be by numbered and/or lettered on white colour sleeves, of insulating material adjacent to the terminals. Wires with in switchgear shall be identified by white colour sleeves with letters embossed on that sleeve type wiring identification numbering system. They shall be firmly located on each wire so as to prevent free movement and they shall be indelibly marked and removal without disconnecting the wire from its terminal shall not be possible.
- k. The minimum size of power circuit shall be 4 Sqmm copper in standard phase colour and CT secondary circuits shall be wired with 2.5 Sqmm copper conductor.
- l. Control power for the motor starter module shall be taken from the control Bus. Control wiring shall have MCB & neutral link shall be mounted in front of the panel and shall be easily accessible.
- m. Not more than two wires shall be connected to a terminal.
- n. All spare contacts of ACB, Contactors aux. relays and switches shall be wired upto the terminal blocks.
- o. Each of the DC circuit shall be provided with two MCB one in the positive and the other in the negative for 2 wire DC underground system of specified voltage.
- p. Final wiring diagram of Panel's power and control circuit with ferrules number shall be submitted along with panels as one of the documents.
- q. All wiring shall be colour coded as follows
- | | | |
|---------------------------|---|--|
| i. Instrument transformer | : | Red , Yellow or Blue determined by the AC Circuit's phase with which the wire is associated. |
| ii. AC Phase wire | : | White |
| iii. AC Neutral | : | Black |
| iv. DC Circuits | : | Grey |
| v. Earth Connection | : | Green |
| vi. Power Wiring | : | Phase Colour |
| vii. CT wiring | : | Phase Colour |

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3.2.21 Auxiliary Supplies:-

- a. Auxiliary supplies (closing, tripping, control, indication, heaters, etc.) shall be mentioned in the SLD and auxiliary power supply unit shall be the separate from the panel.
- b. Where motor charging spring operating mechanism is specified for circuit breaker, it shall be rated for the rated auxiliary control supply operation.
- c. Circuit breaker closing, tripping, control and indication power shall be supplied from suitably rated DC supply units and it shall be part of the panel.
- d. All auxiliary supplies shall be individually protected within each cubicle. Individual protection shall be by suitably rated MCB.
- e. For shunt trip circuits, the protection shall be rated at least 300% of the load.
- f. Anti-condensation heater supplies shall be derived internally from each busbar section.
- g. Incoming Auxiliary Supplies shall be protected by suitably rated MCB at the point of entry to the switchboard. The Vendor shall ensure discrimination with individual circuit MCB. Volt free group contact shall be provided via internal bus wiring for remote common alarm.

3.2.22 Surge Protection Devices (SPD):-

- a. Surge Protection devices are used to protect Installation from transient voltage/Current surges caused by natural lightning or switching of heavy loads. They are an integral part of overall protection system and provide effective protection to sensitive electronics equipments against disruptive effects of surge currents.
- b. Surge Protection devices shall comply with latest relevant IEC standard i.e-IEC-61643-1 & EN-61643-11 type1.
- c. SPDs are connected in parallel to the main supply and provide an alternate low resistance safe path to surge currents to go to earth without damaging electrical installation.
- d. SPDs are classified in two categories as Class-1 & Class-2 as per their characteristic and construction. Class-1 shall be used in Main protection backed up by Class 2 SPD for final protection of individual loads/Circuits on outgoing side.

Class-1 Surge Protection Device

- a. Class-1 SPD shall be "Spark Gap" Arrestor devices. It shall be tested in accordance to 10/350 μ second test surge current waveform of 50 kA.
- b. Class -1 SPD shall be connected at Incomer of Main LT panel. The purpose of Class-1 SPD is to bypass the surge current generated due to lightning strokes and protect the sensitive loads in installation.
- c. SPDs shall limit the transient let-through voltage of not more than 4kV.
- d. Incomer side of SPD shall be connected to 3 Phases and neutral and output of SPD shall be connected to earth. The size of wire to use for SPD connection shall be minimum 35 mm². The wire on output side of SPD shall be as short and thick as possible with minimum bends/turns to avoid formation of strong magnetic fields.
- e. SPD shall be protected by 125 Amp TPN Fuse fitting on incoming side to take care of end of life situations. This breaker shall be tested to co-ordinate with the manufacturer's SPDs in accordance to IEC 60364.

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- f. The terminals shall be protected against direct contact conforming to IP2X Degree of protection to provide total safety to operation personnel.

Class-2 Surge Protection Devise

- a. Class-2 SPD shall be “Metal oxide Variastor (MOV)” type construction and shall be used to compliment the class-1 SPDs. It shall be tested in accordance to 8/20 u second test surge current waveform of 35 kA.
- b. Class -2 SPD shall be connected at the incomer of secondary level panels of main LT panel. The purpose of Class-2 SPD is for final protection of sensitive loads/circuits.
- c. SPDs shall limit the transient let-through voltage of not more than 4kV. This shall ensure effective protection of all sensitive electronics equipments in all installation against both lightning and switching surges.
- d. The incomer side of SPD shall be connected to 3 Phases and neutral and output of SPD shall be connected to earth. The size of wire to use for SPD connection shall be minimum 10 mm². The wire on output side of SPD shall be as short and thick as possible with minimum bends/turns to avoid formation of strong magnetic fields.
- e. SPD shall be protected by 32 Amp TPN fuse fitting on incoming side to take care of end of life situations.
- f. SPDs shall be of the “withdraw able cartridge” type which may be easily replaced once the life of cartridge is over. The cartridge allows simple replacements without the need to cut-off the main power supply.
- g. SPD shall have reserve indicator, which shows the intermediary state, with indication of the need to change cartridge before disconnection, but keeps the maximal protection capacity till the end.

3.2.23 Earthing:-

- a. Copper earthing bus shall be provided for the entire length of the panel and shall be rated to carry maximum fault current. Earth busbar shall be located at the bottom/top of the panel. All metallic non-current carrying parts of the switchgear shall be bonded together and connected to the switchgear earth busbar.
- b. All doors shall be bonded to the main structure by means of a flexible copper connection arranged so that it cannot be trapped as the door is opened or closed.
- c. With-drawable parts (e.g. circuit breakers) shall be effectively earthed until they are completely withdrawn with all power and control connections disconnected.
- d. Provision shall be made, for earthing cable screen and armouring to the earth busbar, near the gland.
- e. Provision shall be made for connection from earth busbar to the main earthing busbar coming from the earth pit on both side of the panel.
- f. All control, instrument and communication cables, if any, shall be earthed suitably to prevent any electromagnetic interference and ensure electromagnetic compatibility.
- g. The earth continuity conductor of each incoming and outgoing feeder shall be connected to the earth bar. The armour shall be properly connected with the earthing clamp and the clamp shall be ultimately bounded with the earth bar.
- h. Earth busbar shall be rated to carry the rated symmetrical short circuit current of associated panel for one second and earth busbar shall be supported to withstand stresses induced by the momentary current of value equal to the momentary rating of the associated Panels.

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- i. Vendor has to submit earth bus calculation along with GA Drawing at the time of Drawing approval.
- j. Each earthing point shall be marked with letter 'E'.
- k. Provision shall be made for an instrument clean earth.

3.2.24 Terminal Blocks:-

- a. Terminal blocks shall be of 650 Volts grade of stud type. Insulating barriers shall be provided between adjacent terminals.
- b. Suitable provision shall be made to terminate control/power connections in the respective module.
- c. Terminal blocks shall have a minimum current rating of 10 Amps and shall be shrouded. Provisions shall be made for label inscriptions. The wire terminations to the blocks shall be of screw type suitable for crimp type socket.

3.2.25 Name Plate:-

- a. Switchgear cubicles and components shall be identified by labels. Cubicle and compartment label designations (located at front and rear of panel) shall be in accordance with the SLD. All with-drawable components shall have a circuit label.
- b. A main label (Panel designation) shall be affixed in a prominent position on each switchboard giving the following information in bold letter:
 - Manufacturers name and type
 - Panel Tag Number
 - System voltage, phases, wires and frequency
 - Year of manufacture
 - Purchasers name
 - Order Item No
 - Characters shall be 12 mm high.
- c. The name plate for outgoing circuits shall be in two parts. One part shall have the necessary details pertaining to the compartment number of the Switch board. The other part, which shall be removable, shall contain the equipment tag number, Equipment Rating as per the SLD and shall have 5 mm high characters. Blank name plates shall be provided for all spare and vacant feeders.
- d. Labels shall be fitted on front and back of cubicles. When the operating sequence of the equipment is not evident, e.g. mechanical / key interlocking features; instruction labels shall be provided and fixed near the point of operation.
- e. Labels shall be affixed by means of self tapping screws or rivets at the top of the cubicles. Use of adhesives shall not be accepted.
- f. Labels shall be made out from anodized aluminum and shall have black characters on a white background. Warning / Danger labels shall have White lettering on a red background.
- g. Engraved name plates shall preferably be of 3 ply, (red-white-red or black - white -black) lamincold sheet. However black engraved perplex sheet nameplates shall also be applicable. Engraving shall be done with square groove cutters.
- h. Inside the feeder compartment, the electrical component, equipments, accessories like switchgear, contactor, lamp, relays etc. shall suitably be identified by providing stickers.
- i. Labels shall be printed in English Language.

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3.2.26 Danger Notice plate:-

- a. The danger plate shall be affixed in a permanent manner on operating side of the panel.
- b. The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.
- c. The danger notice plate in general shall meet the requirements of local inspecting authorities.
- d. Overall dimension of the danger notice plate shall be 200 mm wide and 150 mm high. The danger notice plate shall be made from minimum 1.6 mm thick mild steel sheet and after due pretreatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.
- e. The letter, the figure, the conventional skull and bones shall etc. shall be positioned on the plate as per recommendations of Indian Standard.
- f. The said letter, the figure and the sign of skull and bones shall be painted with white lettering on red colour background.
- g. The danger plate shall have rounded corners. Locations of fixing holes for the plate shall be decided to suit design of the panel.
- h. The danger notice plate, if possible, be of trade mark certification mark.

3.2.27 Safety Arrangements:-

- a. All terminals, connections, and other components, which may be "LIVE" when front access doors are open shall be adequately screened.
- b. Where provision is made for the padlocking of components under specific condition (Safety shutters, earthing selectors etc.) one padlock shall be supplied for each cubicle and each shall have a different lock change number with two keys being provided.

3.2.28 Accessories:-

The following accessories shall be furnished along with each switchboard.

- a. A complete set of any special tools required for operation, maintenance and testing of the switchgear shall be provided. The Vendor shall provide a list of special tools, individually priced, with his offer. A suitable storage box or wall-mounted rack shall be provided. The Vendor shall provide with his offer, separate priced lists of recommended commissioning and operating spares.
- b. The Vendor shall provide 3 extra sets of switchgear cubicle locking keys within a storage box.
- c. One (1) no. handles for withdrawing breaker from the cubicle.
- d. Commissioning spares (approved by the Client/Consultant) shall be included with the switchboard.

3.2.29 Care to be taken during designing of switchboard:-

- a. Stop push button shall be of mushroom head stay put type.
- b. Each starter will have Auxiliary contacts for 2 NO + 2 NC for Purchaser use and it shall be wired upto the terminal.
- c. Panels incomer shall be provided with Digital Ammeter and Voltmeter with in built selector switch, Phase Indication etc.

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- d. Each starter feeder shall be provided with Electrical type reset on over load condition
- e. Extra protection cover (Hylem sheet/FRP sheet) for Busbar (Main as well as Braches) shall be provided.
- f. Auxiliary supply through DP MCB and shall be connected from incomer side of ACB /MCCB.
- g. Bus bar chamber shall be provided with removable cover (door).
- h. Each Panel with Horizontal cable alley shall be provided with removable door (cover).
- i. For single front Panel, back side (Rear view) of panel shall be provided with removable door (cover).
- j. Switchgear assembly typical drawing to be submitted. Assemble switchgear on the plate and plate is removable and also MCCB to be assembling on the plate through Bracket.
- k. Necessary Exhaust System shall be provided of panel where ever required.
- l. Bus bar chamber/alley shall be provided with removable cover (door). Also each Busbar alley shall be provided with Extra Hylam sheet and perforation shall be provided in front of Lovers for Ventilation.

3.2.30 Drawings and Manuals:-

3.2.32.1 At Enquiry stage

- a. Descriptive literature of the various equipment offered with catalogues, if any.
- b. Guaranteed technical particulars of the equipment.
- c. Approximate dimensions and weight and preliminary GA drawings as follows.
- d. General arrangement showing plan, elevation and typical section views particularly typical cross sections to illustrate cable connections.
- e. Foundation plan showing location of fixing channels, floor openings etc.
- f. Schematic wiring diagram.

3.2.32.2 At Order stage

Within two weeks of order, vendor shall submit 4 sets of following documents for clients/Consultant's approval

- a. The manufacturer shall develop his own general arrangement and schematic drawing adding necessary auxiliary devices, accessories, components particular to supplied equipments etc. which are required for safe, convenient, efficient and proper operation of the Panel.
- b. Manufacturer shall submit for Client/consultant's approval the single line diagrams, general arrangement drawings, flooring and mounting detail drawings and schematic diagrams with dead load and impact load, plan, sections and foundation details.
- c. Manufacturer shall submit for Main Bus bar calculation and earth bus calculation of each panel along with GA drawings
- d. Set of General arrangement drawing for each type of panel showing constructional features and space required in the front for withdrawal of breaker and back , power and control cable entry points, location of various devices, terminal blocks, cross sectional details, bus bar supports, number of buses, Power &

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Control wiring diagram for each cubicle. These diagrams shall show any wiring inside the cubicle starting from the cubicle terminal strips. These diagrams shall be used by the owner for trouble shooting and shall show any device, terminal and wire number, shall be submitted within 15 days from the date of letter of intent for approval.

- e. Drawing and data sheet for each component with design calculation , indicating type , short circuit rating of all electrical components used , busbar size Horizontal as well as Vertical, internal wiring size , terminal size including colour and mounting details.
- f. Electrical wiring diagram inert panel, inter connection wiring diagram including terminal numbers and ferrule numbers.
- g. Bill of Material with Model number, make, type and quantity.
- h. Terminal block arrangement drawing for outgoing feeders with size.
- i. Complete relay technical particulars and recommended settings.
- j. Operation, maintenance and installation manuals, (one set to Consultants).
- k. Technical Catalogues/Leaflets of CTs, meters, lamps, etc. shall be submitted along with drawing.
- l. Client's/consultant's approval for the GA drawings is required before the fabrication of the cubicle is started.
- m. The Client/consultant's approval as the manufacturer's drawings shall not relieve the manufacturer of his responsibility for supplying equipment conforming with the relevant specifications and standards or for any other mistakes, errors or omissions in drawings for proper and correctness of functioning/operation of the system.

3.2.32.3 At Final Order Execution stage

The following shall be submitted after inspection but before dispatch of the equipment

- a. Manufacturer shall submit four sets of as built drawings with soft copy
- b. Routine test certificate (including all brought out components) in 4 sets
- c. Detail operation manuals in 4 sets
- d. Detailed erection , testing and commissioning manuals in 4 sets

3.2.33 Deviations:-

- a. Deviations from this specification are only acceptable where the Vendor has listed in his technical offer, the requirements he cannot or does not wish to comply with and the Client/Consultant has accepted, in writing, the deviations before order is placed.
- b. If the manufacturer is able to offer alternatives resulting in technical or price advantages they should submit a supplement to the main tender with a separate list of deviations.
- c. In the absence of a list of deviations it will be assumed by the Client/consultant that the Vendor complies fully with this specification.

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3.2.34 Inspection & Tests:-

- a. During fabrication, panel shall be subjected for inspection by Client/Consultant or by an agency authorized by the Client. Manufacturer shall furnish all necessary information concerning the supply to inspectors. The client/ Contractor has right to witness the test carried out on all the equipments.
- b. Tests shall be carried out at the manufacturers' works under his care.
- c. All routine tests on all major components shall be made as per relevant specification.
- d. Inspection of panel including in wiring and electrical operational tests by the client/consultant before dispatch.
- e. In addition specific tests shall be conducted to check mechanical and electrical operation and panel wiring to this specification and approved schematic drawings.
- f. Shop tests shall be witnessed by an inspector of Purchaser/ Consultant or of an agency authorized by the owner.
- g. The Vendor shall give two weeks notice for the tests prior to commencement.
- h. The Purchaser reserves the right to inspect switchgear at the Manufacturer's works at any time prior to dispatch to prove compliance with this specification. The Purchaser shall also have the right to carry out intermediate inspection at Vender's works during manufacturing stage.
- i. **Acceptance tests shall be as follows:**
 - A general visual check. This shall cover measurement of overall dimensions, location, number and type of devices, terminal boxes, location and connection of terminals etc.
 - Manual and electrical operation of CB/Relays shall be checked under the worst conditions of auxiliary supply voltage.
 - Dielectric Tests: Insulation of the main circuit that is the insulation resistance of each pole to the earth and that between the poles shall be measured.
 - Insulation resistance Test: Insulation Resistance to earth of all the control wiring should be tested with 1000 V Megger.
 - A high voltage test with 2.5 KV for one minute shall be applied between the pole and earth. Test shall be carried out on each pole in turn with the remaining poles earthed. All units racked in position and the breakers closed. Originals test certificate shall be submitted along with panel.
 - Insulation test shall be carried out both before and after high voltage test.
 - Panel will be completely assembled, wired, adjusted and tested for operation under simulated conditions to ensure correctness of wiring and proper functioning of all equipments. Operation check shall be carried out for every control function as per the approved schematic diagrams by manually stimulating the fault conditions and operation of control switches/relays etc.
 - All current carrying parts and wiring shall be subjected to a high potential test.
 - Type test certificates and results as per relevant Standards (Specification) for all the equipment offered under the scope of this specification shall be furnished.
 - The tests shall include but not necessarily limited to the following:

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- Operation under simulated service condition to ensure accuracy of wiring, correctness of control schemes, protection/ metering scheme and proper functioning of the equipment.
- All wiring and current carrying part shall be given appropriate High Voltage tests.
- Primary current and voltage shall be applied to all instrument transformers.
- Routine tests shall be carried out on all the equipment such as circuit breakers, instrument transformers, relays, meters etc. which shall be calibrated in accordance with relevant Indian standards.
- Any other test prescribed by relevant Indian Standard shall be carried out upon the Client's request.
- Four copies of test certificates shall be submitted by the vender to the owner for all the items including bought out items.
- For equipment bought from other sub - suppliers certified test reports of tests carried out at the manufacturer's works shall be submitted. Normally, all routine tests as specified in the relevant standards shall be conducted by the sub - supplier at his works.

3.2.35 Packing:-

- a. Panel shall be shipped in sections to suit ease of handling for transportation and installation.
- b. Panel shipping section shall be provided with supports in the form of suitable steel sections, lifting eyes etc. to maintain alignment of parts during shipping, handling, hoisting and installation. Location of lifting points shall be clearly marked on shipping containers and on drawings. Each shipping section shall have its weight and centre of gravity clearly marked on the container.
- c. Preparation for shipment shall protect the panel & accessories, etc. against corrosion, dampness, and breakage or vibration injury during transportation and handling.
- d. Each shipping container shall be identified with the contents, purchase order number and item number.
- e. Instructions shall be provided for reassembly of sections in the field. Where bus wiring has to be reconnected after assembly, pre-terminated and ferruled wiring looms shall be provided.
- f. The Vendor shall comply fully with the 'Packing and Shipping' instructions which form part of the Purchase Order.

3.2.36 Handling:-

- a. Panels and all its accessories shall be handled carefully in its upright position as indicated in the packing case.
- b. Lifting lugs and jacking pads shall be used for lifting of the switchgear panel. While using jacking pads utmost care shall be taken in proper application of jacks.
- c. Where switchgear panel is dragged or pulled on sleeper or rollers of the traction eyes provided at the bottom frame shall be used with suitable wire ropes and shackles.

3.2.37 Storage:-

Equipments shall be stored under shelter in a well ventilated, dry place and covered by suitable polythene or tarpaulin covers for protection against moisture.

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3.2.38 Guarantee:-

The panels shall be guaranteed for trouble free operation for a period of 12 months from the date of commissioning or 18 months from the date of arrival at site, whichever is earlier. Any defects discovered during this period shall be rectified free of charge.

3.2.39 Specified electrical requirement of 415 V panels.

- a. Design, Manufacture, offer for inspection, testing, delivery to site assistance in commissioning of the following 415 volts Metal enclosed Switchgear panels

Sr. No.	Equipment Name	Drawing	Rev
1.0	DG SET AUXILARY MCC PANEL	NPI/120310/ELC(SLD)/U2/08	01

b. Climate conditions

Design ambient temperature	:	45° C
Altitude above MS	:	8 Mtr. from MSL
Relative humidity	:	50%
Atmosphere	:	industrial

c. Electrical System Data

Normal operating voltage	:	415 V
System Earthing	:	Solidly grounded
Maximum operating voltage	:	415V ±10%
Nominal Frequency	:	50 HZ
Frequency Variation	:	± 3 %
Voltage Variation	:	±10%
Power Frequency withstand	:	2.5 KV for 1 Min.
Fault withstand	:	25 KA 1 Sec or specified in SLD.
Control supply	:	As specified in SLD

d. Common features for Panel

a) Fabrication		
a1) Material	:	CRCA Sheet steel
b) Degree of protection as per Latest edition of Indian Standard	:	Not less than IP – 42 for Indoor application

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Not less than IP – 55 for outdoor application

- c) Thickness of sheet steel in mm for customized panel enclosure :
- | | | |
|---|---------------------|---------|
| : | Frame enclosure | -2.0 mm |
| | Doors, | -2.0 mm |
| | Rear Covers & Doors | -2.0 mm |
| | Partitions | -2.0 mm |
| | Gland Plate | -3.15mm |
- c) Painting :
- | | | |
|---|--|----------|
| : | Powder coated finish not less than 90 Micron Color shade unless Specified Elsewhere. | |
| | Interior - | RAL-7035 |
| | Exterior - | RAL-7035 |
- d) Earthing Bus :
- | | |
|---|--------|
| : | Copper |
|---|--------|
- e) Minimum Clearance in live parts :
- | | | |
|---|--------------------|-----------|
| : | Phase to Phase | : 27.0mm |
| | Phase to earth | : 25.0 mm |
| | Phases and neutral | : 25.0 mm |
| | Neutral and earth | : 23.0 mm |
- f) Bus bar :
- | | | |
|---|-------------------|---|
| : | Material | Copper as specified in SLD |
| | Insulation | Air Insulated heat shrunk PVC sleeve, for Horizontal Main busbar as well as for Vertical Branches |
| | Short time rating | Suitable for 25 KA 1 Sec or as specified in the SLD. |

“RITTAL” make Panel enclosure

- g) Maximum Height of panel : 2300 mm
- h) Maximum operating height : 1850 mm
- i) Minimum operating height : 400 mm
- k) Minimum width of vertical cable alley : 300 mm
- l) Minimum width of feeder with meter and capacitor feeder : 600 mm
- Minimum feeder w/o meters : 400 mm
- m) Minimum height of feeder : 250 mm
- n) Minimum Height of Horizontal

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- Cable alley : 100 mm
- o) Minimum width of vertical Bus bar alley : 300 mm
- p) Minimum width of Horizontal Bus bar alley : 300 mm
- j) Base Frame : 100 mm From 3.0 mm CRCA Sheet

Customized Panel enclosure

- g) Maximum Height of panel : 2400 mm
- h) Maximum operating height : 1850 mm
- i) Minimum operating height : 350 mm
- k) Minimum width of vertical cable alley : 300 mm
- l) Minimum width of feeder with meter and capacitor feeder : 500 mm
- Minimum feeder w/o meters : 400 mm
- m) Minimum height of feeder : 250 mm
- n) Minimum Height of Horizontal Cable alley : 200 mm
- o) Minimum width of vertical Bus bar alley : 300 mm
- p) Minimum width of Horizontal Bus bar alley : 300 mm
- j) Base Frame : ISMC75

NOTE: TENTATIVE DIMESNION OF PANEL SHALL BE SUBMITTED ALONG WITH TECHNOCOMMERCIAL OFFER

GA DRAWING WITH FABRICATION DETAILS, POWER & CONTROL CIRCUIT DIAGRAM WILL BE SUBMITTED WITHIN WEEK AFETR ORDER CONFORMATION.

VENDOR SHALL QUOTE WITH ADDITION AND DELETION OF VARIOUS TYPE OF FEEDER (EACH RATING FEEDER IN EACH PANEL OFFER) WITH THIS OFFER.

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Important: -	
1.	Please Tick (✓) the make of material considered in tender.
2.	Detail submittals in the form of catalogues specification sheets, and samples were called for, shall be submitted one week from the date of order and approvals shall be obtained on the type of accepted make before procurement are made.
3.	Out of the approved makes of materials mentioned above, the make of materials to be used on the work shall be as decided by the Consultant/Owner jointly.
4.	In respect of materials for which approved makes are not specified above, these will be of makes to be decided by the consultant and as per sample approved before procurement.
5.	Equipments approved and supplied shall have local servicing facilities available in the region.

----- X -----

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CHAPTER – 2.3.3

TECHNICAL SPECIFICATION FOR

NEUTRAL GROUNDING RESISTOR

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2.3.3.1 Purpose:

This specification covers the general requirements for the design, manufacture and testing of Neutral Grounding Resistance (NGR).

This specification shall be used in conjunction with all specifications and data sheets attached.

The scope of vendor covers the design, fabrication, procurement, manufacture, assembly, testing, and delivery, testing and commissioning of NGR and putting into successful and satisfactory operation as per attached BOQ.

2.3.3.2 Scope of Service:-

- a) Supply of the Neutral Grounding Resistance as per specification and Data sheets.
- b) Transportation of NGR to the Employer's store at site should be the part of the scope.
- c) Unloading of the NGR are also to be considered in the scope.
- d) The items of work to be performed on all equipment and materials shall include but not limited to the following:
 - Supply, loading and transportation at site. (To Employer or Contractor's stores).
 - Arranging to repair and/or re-order all damaged and short supply items.
 - Packing of the Equipments suitable for (all) weather conditions for proper protection.
 - Final check-up, testing and commissioning in presence of Employer's representative
 - Trial run for thirty (30) days, rectification of defects, if any and adjustments as necessary.
 - Obtaining Employer's written acceptance of satisfactory performance

2.3.3.3 Civil work:-

Civil work for above equipment in scope of Electrical contractor

2.3.3.4 Information required from Vendor:-

2.3.3.4.1 Following information shall be furnished by the supplier:-

- Along with the offer
 - a) Technical particulars of various equipments as format (Annexure) enclosed with this specification.
 - b) G.A. drawing of Transformers.

2.3.3.4.2 After award of work (For approval):

- a) Foundation drawings of all equipment, GA drawings NGR and all other equipment (within two week of the award of contract).
- b) Bill of Materials
- c) Test certificates of equipment.
- d) Four copies of final drawings with one auto cad CD, operation, installation and maintenance manual shall be supplied well in advance before inspection.

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2.3.3.5 Completeness:-

- All fittings and accessories or apparatus which may not have been specifically mentioned below, but which are necessary and essential for the efficient working of the equipment, shall be deemed to be included in the scope.
- It is not the intent to specify completely herein all details design and construction of the equipment. However, the equipment shall conform, in all respects to high standard of engineering, design and workmanship and latest revisions of relevant standards at the time of offer and also be capable of performing continuous operation. the purchaser shall have the power to reject any work or material, which, in his judgement is not in full conformance therewith. Nevertheless, the equipment shall be complete and operative in all aspects.
- Any material or accessories which may not have been specifically mentioned but which is necessary usual for satisfactory and trouble free operation and maintenance of the equipment, shall be furnished by the contractor without any extra charge to the Employer.

2.3.3.6 Notes to bidder:-

It is necessary to follow the following points while submitting the offer :

- The equipment should conform in all respects to the relating standards and shall be manufactured to the highest quality of Engineering, design and workmanship. The equipment manufactured shall ensure satisfactory and reliable performance throughout the service life.
- The equipments offered shall be complete in all respects. Any material / component / accessories not specifically stated in this specification but which is otherwise necessary for trouble free operation of the equipment specified in this specification shall be deemed to be included unless excluded expressly. All such components/ accessories shall be supplied at no extra cost.
- The design and manufacturing shall be such that the equipment / components/ accessories of the same type and of identical rating shall be interchangeable. Likewise similar or corresponding parts/ components or accessories thereof shall also be interchangeable.
- Wherever and whenever a material or article or component is specified or described by the name of a particular brand or manufacturer or vendor, the specific item mentioned shall be understood as establishing type, function and quality and not as limiting competition. However, suppliers are invited to offer other similar equipments/components/accessories provided they meet with the required standards, design, duties and performance.
- All equipments offered shall confirm to type tests and shall also be subjected to acceptance and routine tests in accordance with the requirements stipulated herein.
- The Purchaser/consultant reserves the right for conducting any or all of the type tests in accordance with the relevant standards. Such type tests shall be done free of cost. Where type tests have already been conducted, the Supplier shall submit copies of the same along with tender. The type tests certificates should however be not older than five years as on the date of bid opening. Any extra cost for repeating the type tests shall be indicated in the relevant price schedules.
- All equipment shall meet the requirement of this specification. Deviations (if any) with respect to this specifications shall clearly be indicated in the offer in Annexure under "Deviations" with page no. & clause no. of specification.

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- All equipment shall meet the requirement of this specification. Deviations (if any) with respect to this specifications shall clearly be indicated in the offer in Annexure under “Deviations” with page no. & clause no. of specification.
- Quantities of equipment indicated herein are subject to change.
- All technical particulars and other details as asked for shall be furnished in the specification only. Additional information, if desired by the bidder, can also be furnished separately.

2.3.3.7 Design Criteria and Electrical System:-

2.3.3.7.1 Design Criteria:-

The NGR specified here in or not, shall be designed, manufactured and tested with the latest revisions of relevant Indian or International Standards.

The design, material, construction, manufacture inspection, testing and commissioning of NGR shall comply with all currently applicable states, regulations and safety codes in the locality where the equipment will be installed and in particular shall comply with IS or IEC Standard. The equipment shall also confirm to the latest applicable standards and code of practice. Nothing in this specification shall be construed to relieve the supplier of this responsibility.

Wherever IEC Standards are not available, the NGR shall conform to relevant local Standard.

- All electrical components shall also conform to the latest Electricity rules as regards safety and other essential provisions.
- All electrical installation work shall comply with the requirements of the following Act/Rules/Codes as amended upto date:
 - a) Indian Electricity Act.
 - b) Indian Electricity Rules.
 - c) National Electric Code of Indian.
 - d) All relevant IEC codes of practice.
 - e) Regulations published by Tariff Advisory Committee.
- Ambient air temperature shall be taken as 45°C for the purpose of designing electrical equipments.
- Nominal system supply available shall be as follows:
 - a) Incoming : Provided by the Purchaser.
 - b) Utilization : 415V, 3 Ph., 4 wires, 50 Hz.

2.3.3.7.2 Electrical System:-

The electrical arrangement of the NGR shall be as mentioned in relevant Specification and data sheet.

All components of the NGR shall be rated for the electrical system indicated in relevant document speciation and data sheet.

The NGR shall be suitable for operation with system voltage and frequency variations:

- | | | | |
|----|---------------------|---|-------|
| a) | Voltage variation | : | ± 10% |
| b) | Frequency variation | : | ± 3% |

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Two extremes of voltage and frequency variations are not to be considered to coincide.

Primary Side : 110_[pk3] KV 3 Phase 3 Wire system 50 C/Sec.
Secondary Side : 11 KV 3 Phase 3 Wire or 4 wire system 50 C/Sec Neutral resistive earthed (NGR)

2.3.3.8 Insulation:-

Insulation Requirement of Winding	Secondary
Normal Voltage in KV	11
Highest System Voltage in KV (RMS)	12
Lightning Impulse in KV (peak)	75
Short Duration Power frequency Withstand voltage kV (RMS)	28
Voltage application on Earth fault Current	6.35 KV
Rated Earth Fault current	105 Amp
Duration of Earth fault	10 Sec
Resistance required	30.25 Ω

2.3.3.9 Basic Condition:-

- a) The selection of equipment shall be governed by fitness for purpose, safety, reliability, maintainability of spares and service, compatibility with specified future expansion, design margins, suitability for environment, economic considerations, and past service history.
- b) The SI system of units shall be used.
- c) English language shall be used for all drawings, texts and communications.

2.3.3.10 Service Condition:-

- a) NGR shall, in all respects, be suitable for operation outdoor under site environmental and service conditions stated in Design criteria.
- b) For the purpose of equipment de-rating and component operability, the above specification states that the equipment design temperature shall be +45°C.
- c) The Maximum Ambient Temperature is 45°C , the NGR shall be capable of continuous operation outdoor at +45°C , if Temperature exceed above 45°C then NGR shall be rated accordingly.
- d) NGR shall in all respects be suitable for operation in typical tropical area.
- e) The atmosphere is to be considered sulphurous and dusty. The possibility of condensation, as experienced during large temperature variations in a humid environment in the tropic.

2.3.3.11 Codes and Standards:-

The NGR specified here in or not, shall be designed, manufactured and tested with the latest revisions of relevant Indian or equivalent British or International Standards.

Except otherwise stated, the NGR and associated accessories shall conform in all respects to the latest issues of standards as given below:

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IEC & BS STANDARDS	SPECIFICATIONS
IEC 60071	Co-ordination of insulation.
IEC 60085	Thermal evaluation and classification of electrical insulations
IEC 60445	Identification of equipment terminals and of terminations of certain designated conductors, including general rules for an alphanumeric system
IEC 60529	Degrees of protection provided by enclosures (IP Code).
IEC 60038	Standard Voltages
BS 115	Metallic resistance materials for electrical purposes
BS 162	Electric power switchgear and associated apparatus clearance applicable to class B apparatus
BS EN ISO 1461	Hot dip galvanised coatings on iron and steel articles
BS 7354	Code of practice for design of high voltage open terminal stations

IS & IEEE STANDARDS	SPECIFICATIONS
IS 8623	Factory built assemblies of switchgear and control gear for voltages upto and including 1000 volts AC and 1200 volts DC
IEEE 32	1972 IEEE standard, requirements, terminology and test procedure for neutral grounding devices

All other relevant standards

Wherever Indian Standards are not available, the NGR shall conform to relevant International Standard IEC and BSS.

The equipment or materials, meeting recognized National or International Standards which ensure an equal or superior quality than Indian / IEC standards specified, will also be accepted. When the equipment offered by the supplier conforms to other standards, salient points of difference between standards specified in this specification shall be clearly brought out in the offer.

2.3.3.12 Rating and Performance:-

The equipment shall be designed to comply with the resistance, current and time ratings specified on the NGR Data Sheet(s). The minimum time rating shall be 10 seconds.

2.3.3.13 Construction:-

- The resistors shall be of the metal grid type and of robust construction. The use of cast iron is not acceptable. It shall be vermin proof , weather proof , and suitable for outdoor installation Insulation shall be sufficiently robust and proven in a harsh environment.
- The resistance grids shall be constructed from chrome aluminum or stainless steel alloy strip of low temperature coefficient. Stainless steel alloy rod may also be used.
- The resistor material shall be uniform in section and free from any flaw likely to cause local heating. The grids shall be insulated with non-hygroscopic material and shall be arranged in tiers on a rigid steel framework allowing adequate air circulation between the grids.

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Interconnections shall be of high conductivity copper and shall comply with BS 7354 for clearance and IS 8623 for thermal rating.

- The resistors shall be enclosed in sheet steel enclosures of at least 3mm thick steel. The enclosure shall be vermin proof. Louvers, if provided, shall be covered with fine galvanized steel wire mesh.
- The resistor enclosures shall provide a degree of protection equal to, or better than, the IP rating stated in the Data Sheet(s).
- Resistor shall be to carry the rated current for the rated time with temperature rise not exceeding the specified limit (375°C) over the maximum specified ambient temperature when the resistor is housed in the outdoor transformer bay.
- The equipment shall be designed for floor mounting.

2.3.3.14 Enclosure:-

- The enclosure shall have an arrangement for fixing it on concrete foundations/floor and its thickness shall not be less than 3 mm.
- The terminals for neutral and earthing connection shall be housed in a separate vermin-proof, weather-proof compartment.
- A canopy shall be provided on the top. It shall also cover the terminal compartment. Hooks or handle shall be provided to lift the canopy.
- It shall be possible to periodically clean the resistor after lifting the top cover or canopy.
- It shall be possible to earth the cabinet or enclosure at two places and for this, suitable size of studs shall be provided on the sides, as low as possible, to accommodate the earth strip.
- Suitable slope shall be provided at the bottom complete with drain plug to drain water that may get collected in the NGR.

2.3.3.15 Terminations:-

- Terminals shall be bushing type and shall be suitable for terminating cables specified on the relevant data sheet. Terminal boxes, where specified, shall be adequately sized to accommodate cable stress relieving devices and a protection CT, if required. An undrilled non-magnetic gland plate shall be provided on each terminal box.
- Internal and external earth terminals (M10) shall be provided to facilitate earthing.
- Cable termination accessories including stress relieving devices, where necessary, and cable glands, will be provided by the Electrical Contractor unless specified otherwise on the NER Data Sheet(s).
- Separate terminal box(es) shall be provided for termination of auxiliary items such as alarms, CTs, heaters, etc. The gland plate shall be at least 200mm above ground.
- Terminal boxes on resistor enclosures shall be suitable for outdoor installation and have degree of protection minimum IP 55 in accordance with IEC 60529.
- Auxiliary wiring shall be stranded copper conductors, minimum size of 2.5mm². Wiring shall be crimped using self-insulated compression spade-type terminal lugs/pins which shall be suitably identified. Conductors shall be fitted with sleeve ferrules bearing the same identification as the terminal to which they are connected.

2.3.3.16 Anti-Condensation Heaters:-

- One separate 240 V AC supply shall be provided for anti-condensation unit.
- To protect sensitive components from condensed water during rapid temperature changes, the units are always fitted with space Heaters controlled through thermostat.
- Space heater shall be industrial strip continuous duty type rated for 240 Volts ±10%, single phase, 50 Hz. The heaters shall have individual ON-OFF Double pole MCB switch and controlled through thermostatically.

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- Wiring of space heaters in control cubicle shall be grouped and brought out to easily accessible terminals for connection to power supply, through MCB.
- Wiring shall be done with min 2.5 sq mm stranded copper conductor PVC insulated wire.

2.3.3.17 Cooling:-

The NGR shall be natural air cooled and any type of forced cooling will not be accepted. But wherever the louvers are being offered it shall be completely guarded on inside with a fine wire mesh (holes less than 0.5 mm to make it vermin-proof).

2.3.3.18 Name Plate:-

- NGR and control cubicles shall be identified by name plate in English
- A main name plate shall be affixed in a prominent position on breaker giving the following information in bold letter:
 - Manufacturers name and type
 - Tag Number
 - System voltage, phases, wires and frequency
 - Rated fault current and duration
 - Rated breaking capacities (symmetrical and asymmetrical)
 - Maximum Time Rating .
 - Rated insulation Level
 - Resistance at 25°C
 - Relevant Design Standard
 - Purchase Order
 - Year of manufacture
 - Purchasers name
 - Weight in KG
 - Temperature rise
 - Design Ambient Temperature
 - Enclosure Class
 - Characters shall be 12 mm high.
- Name Plate shall be affixed by means of self tapping screws or rivets at the top of the cubicles. Use of adhesives shall not be accepted.
- Name plate shall be made out from anodized aluminum and shall have black characters on a white background.
- Inside the control cubicle, the electrical component, equipments, accessories like switches, contactor, lamp, relays etc. shall suitably be identified by providing stickers.

2.3.3.19 Danger Notice Plate:-

- The danger plate shall be affixed in a permanent manner on operating side of the circuit breaker.
- The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.
- The danger notice plate in general shall meet to requirements of local inspecting authorities.
- Overall dimension of the danger notice plate shall be 200 mm wide and 150 mm high. The danger notice plate shall be made of minimum 1.6 mm thick mild steel sheet and after due pretreatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.
- The letter, the figure, the conventional skull and bones shall etc. shall be positioned on the plate as per recommendations of IS: 2551-1982.
- The said letter, the figure and the sign of skull and bones be painted white lettering on red colour background.
- The danger plate shall have rounded corners. Locations of fixing holes for the plate shall be decided to suit design of the panel.

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- The danger notice plate, if possible, be of ISI certification mark
- Warning / Danger labels shall have White lettering on a red background

2.3.3.20 Safety Arrangements:-

- All terminals, connections, and other components, which may be "LIVE" when front access doors are open shall be adequately screened.
- Where provision is made for the padlocking of components under specific condition (Safety shutters, earthing selectors etc.) one padlock shall be supplied for each cubicle and each shall have a different lock change number with two keys being provided.

2.3.3.21 Metal treatment & finish:-

All steel work used in the construction of the panel should have undergone rigorous metal treatment process like phosphated in accordance with the IS: 6005 "Code of practice for phosphating iron and steel".

- Sheet steel shall be sand blasted to remove rust and scale. Oil, Grease, Dirt and Swarf shall be thoroughly removed by emulsion cleaning.
- Rust and scales shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
- After phosphating, finishing shall be carried out with clean water, followed by final rinsing with dilute dichromate solution and oven drying.
- Two coats of finishing powder coating "opaline green" corresponding to shade No. 275 of IS-5 paint shall be applied for panel exterior. Each coat followed by stoving in the dust free atmosphere. The second finishing coat shall be free from imperfection like pinholes, orange pills etc. The finishing coat shall be suitable of all weather condition , additional PU coating shall be done. The sample sheet for the finishing paint shall be approved by Purchaser/Consultant.
- All cubicle interiors shall be painted white, so as to give a contrasting effect with cubicle wiring
- Each coat finished paint shall be of slightly different shade to enable inspection of painting. The final finished thickness of paint film shall not be less than 80 microns and shall not be more than 100 microns
- Finished painted appearance of equipment shall present aesthetically pleasing appearance, free from dents and uneven surface.
- A small quantity of paint shall be supplied free of cost for minor touching up, if any that may be required at site.
- In case the Supplier proposes to follow any other established painting procedure like electrostatic painting, the procedure shall be submitted along with offer/bid for purchaser's review and approval

2.3.3.22 Special Tools and Accessories:-

- All special tools required for erection, commissioning and maintenance of the NGR shall be provided by the Supplier..
- Supplier shall include in his scope of supply all mounting brackets, support insulators and pedestals.

2.3.3.23 Spares:-

- The Supplier shall provide with the quotation, separate priced lists of recommended commissioning and operating spares.
- Commissioning spares shall be supplied with the equipment.

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2.3.3.24 Drawings and Manuals:-

➤ At Enquiry stage

- a) Descriptive literature of the various operations offered with catalogues, if any.
- b) Guaranteed technical particulars of the circuit breaker.
- c) Approximate dimensions and weight and preliminary GA drawings as follows.
 - o General arrangement showing plan, elevation and typical section views particularly typical cross sections.
 - o Foundation plan showing location.
 - o Schematic wiring diagram.

➤ At Order stage

Within two weeks of order, vendor shall submit 4 sets of following documents for Purchaser/Consultant's approval

- a) The manufacturer shall submit general arrangement and schematic drawing adding necessary auxiliary devices, accessories, components particular to supplied equipments etc. which are required for safe, convenient, efficient and proper operation of the circuit breaker.
- b) Manufacturer shall submit for Purchaser/consultant's approval general arrangement drawings, flooring and mounting detail drawing and schematic diagrams with dead load and impact load, plan, sections and foundation details.
- c) Set of General arrangement drawing for NGR showing constructional features and space required around the NGR. Auxiliary power & control cable entry points, location of various devices, terminal blocks, cross sectional details
- d) Control wiring diagram for control cubicle. These diagrams shall show any wiring inside the control cubicle and external wiring starting from the cubicle terminal strips along with terminal & wire number. These diagrams shall be used by the employer for trouble shooting and shall show any device.
- e) Drawing and data sheet for each component with design calculation, indicating type , short circuit rating of all electrical components, internal wiring size, terminal size including colour and mounting details.
- f) Terminal block arrangement drawing.
- g) Operation, maintenance and installation manuals, (one set to Consultants).
- h) Technical Catalogues/Leaflets of NGR
- i) Purchaser's/consultant's approval of GA drawings is required before starting the manufacturing of the NGR.
- j) The Purchaser/consultant's approval as the manufacturer's drawings shall not relieve the manufacturer of his responsibility for supplying equipment conforming with the relevant specifications and standards or for any other mistakes, errors or commissions in drawings for proper and correctness of functioning/operation of the system.

2.3.3.25 Deviations:-

- o Deviations from this specification are only acceptable where the Vendor has listed in his technical offer, the requirements he cannot or does not wish to comply with and the Purchaser/Consultant has accepted, in writing, the deviations before order is placed.
- o If the manufacturer is able to offer alternatives resulting in technical or price advantages they should submit a supplement to the main tender with a separate list of deviations.
- o In the absence of a list of deviations it will be assumed by the Purchaser/consultant that the Vendor complies fully with this specification.

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2.3.3.26 Inspection and Tests:-

- During manufacturing, NGR shall be subjected for inspection by Purchaser/Consultant or by an agency authorized by the Purchaser. Manufacturer shall furnish all necessary information concerning the supply to inspectors. The Purchaser/ Contractor has right to witness the test carried out on all the equipment.
- Tests shall be carried out at the manufacturers' works under his care.
- All routine tests on all major components shall be made as per relevant specification.
- In accordance with the requirements stipulated under general requirements the NGR shall conform to IEEE 32
- The test reports of the following tests shall also be submitted:
 - Dielectric test
 - Insulation resistance test
 - Cold resistance measurement
 - Temperature rise test, one unit of each rating.
 - Temperature against resistance over full operating range.
- The order in which the test take place shall be agreed with the Purchaser/consultant before commencement.
- A copy of the type test certificate shall be included in the quotation.

2.3.3.27 Shipping and Packing:

- NGR shall be supplied as pretested modular assemblies to suit ease of handling for transportation and installation.
- The NGR unit is completely assembled shall be provided with supports in the form of suitable steel sections, lifting eyes etc. to maintain alignment of parts during shipping, handling, hoisting and installation.
- Location of lifting points shall be clearly marked on containers and on drawings. The container shall have its weight and centre of gravity clearly marked on the container.
- Preparation for shipment shall protect the NGR and accessories, etc. against corrosion, dampness, and breakage or vibration injury during transportation and handling.
- Each shipping section shall be identified with the contents, purchase order number and item number.
- Instructions shall be provided for reassembly of sections in the field.
- The Vendor shall comply fully with the 'Packing and Shipping' instructions which form the part of the Purchase Order.

2.3.3.28 Handling:

- NGR and all its accessories shall be handled carefully in its upright position as indicated in the packing case. Lifting lugs and jacking pads shall be used for lifting of the NGR Assembly. If using jacking pads utmost care shall be taken in proper application of jacks. If NGR is dragging and pulling strictly prohibited.

2.3.3.29 Storage:

- NGR shall be stored under a well ventilated, dry place and protection against ground dampness. Also NGR shipment shall be placed on wooden planks and covered by suitable polythene or tarpaulin covers for protection against moisture.
- During storage the anti-condensation heater in the operating mechanism unit must be switched on.

2.3.3.30 Guarantee:

The panels shall be guaranteed for trouble free operation for a period of 12 months from the date of commissioning or 18 months from the date of arrival at site, whichever is earlier. Any defects.

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2.3.3.31 Data Sheet:

S No	Description	Requirement
1.	NGR Application	Transformer neutral grounding
2.	Degree of Enclosure protection	Minimum IP 55
3.	Cooling Method	Natural
4.	CT Required	NO
5.	System Voltage	11 KV
6.	Rated Insulation Level	28 KV
7.	Rated Impulse peak level	75 KV
8.	Voltage on application on E/F current	6.35 kV
9.	Rated Earth Fault current	105 Amp
10.	Duration of Earth Fault	10 Sec.
11.	Resistance requirement	30.25 Ohm
12.	Frequency	50 HZ
13.	Heater required	Yes with ON/OFF , 240 VAC
14.	Incoming Cable termination	Air Insulated Terminal box suitable for 2 Run x 300 sq.mmA2XFY 11 KV cable
15.	Outgoing cable	2 Run x 100 x 10 mm Copper Earth strip direct connect to Earth pit
16.	Installation	Indoor
17.	Mounting	Free Standing
18.	Paint	RAL 7032

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CHAPTER 2.3.4

TECHNICAL SPECIFICATION FOR CONTROL AND RELAY PANEL

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2.3.4.1 Description / Scope of Work:

- **Purpose**

The Specification covers the general requirements for the design manufacture and testing of Control and relay Panels

This specification shall be used in conjunction with all specifications and data sheets attached.

The scope of vendor covers the design, fabrication, procurement, manufacture, assembly, testing, delivery at site including unloading of Panels at plant site, testing , commissioning and calibration of Control and Relay panel for 11 KV DG Sets and putting into successful and satisfactory operation as per attached BOQ.

- **Scope of Supply**

- a) Supply of the Panels as per specification and SLDs.
- b) Supply, Transportation, Unloading, Shifting, Loading, Testing , Calibration and Commissioning of Control and relay panel for DG Sets in scope of DG supplier Scope.
- c) The panel shall be unloaded from transport shifted to employer's store, if store is not ready so shifting to temporary store.
- d) The items of work to be performed on all equipment and materials shall include but not Limited to the following:
 - Supply Transportation, unloading at site. (to contractor's stores or Purchaser's store).
 - Opening, inspecting and reporting all damages & short supply items.
 - Arranging to repair and/or re-order all damaged and short supply items.
 - Packing of the Equipments suitable for (all) weather conditions for proper protection.
 - Inspection of all equipment which are not inspected at manufacturer's works by employer regarding compliance with technical specifications and submission of report of the same to site in charge.
 - Storing at site with suitable all weather protection.
 - Final check-up, testing and commissioning in presence of Employer's representative
 - Trial run for thirty (30) days, rectification of defects, if any and adjustments as necessary.
 - Obtaining Employer's written acceptance of satisfactory performance

- **Exclusion:-**

- a) Civil foundation of above equipments.

- **Information Required From Vendor:-**

Following information shall be furnished by the contractor:-

A. Along with the offer

- iii) Technical particulars of various equipments as format (Annexure) enclosed with this specification. .

- iv) G.A. drawing of Control and Relay Panel.

B. After award of work (For approval)

- a) Foundation drawings of all equipment, GA drawings Electrical Panels and all other

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equipment (within two week of the award of contract).

- b) Bill of Materials
- c) Power and control circuit diagram
- d) Test certificates of equipment.
- e) Four copies of final drawings with one auto cad CD, operation, installation and maintenance manual shall be supplied well in advance before inspection.

- **Completeness:-**

- It is not the intent to specify completely herein all details of the equipment. Nevertheless, the equipment shall be complete and operative in all aspects.
- Any material or accessories which may not have been specifically mentioned but which is necessary usual for satisfactory and trouble free operation and maintenance of the equipment, shall be furnished by the contractor without any extra charge to the Employer.

- **Notes to Bidder:-**

It is necessary to follow the following points while submitting the offer :

- The equipment should conform in all respects to the relating standards and shall be manufactured to the highest quality of Engineering, design and workmanship. The equipment manufactured shall ensure satisfactory and reliable performance throughout the service life.
- The equipments offered shall be complete in all respects. Any material / component / accessories not specifically stated in this specification but which is otherwise necessary for trouble free operation of the equipment specified in this specification shall be deemed to be included unless excluded expressly. All such components/ accessories shall be supplied at no extra cost.
- The design and manufacturing shall be such that the equipment / components/ accessories of the same type and of identical rating shall be interchangeable. Likewise similar or corresponding parts/ components or accessories thereof shall also be interchangeable.
- Wherever and whenever a material or article or component is specified or described by the name of a particular brand or manufacturer or vendor, the specific item mentioned shall be understood as establishing type, function and quality and not as limiting competition. However, suppliers are invited to offer other similar equipments/components/accessories provided they meet with the required standards, design, duties and performance.
- All equipments offered shall confirm to type tests and shall also be subjected to acceptance and routine tests in accordance with the requirements stipulated herein. The Purchaser/consultant reserves the right for conducting any or all of the type tests in accordance with the relevant standards. Such type tests shall be done free of cost. Where type tests have already been conducted, the Supplier shall submit copies of the same along with tender. The type tests certificates should however be not older than five years as on the date of bid opening. Any extra cost for repeating the type tests shall be indicated in the relevant price schedules.
- All equipment shall meet the requirement of this specification. Deviations (if any) with respect to this specifications shall clearly be indicated in the offer in Annexure under "Deviations" with page no. & clause no. of specification.

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➤ Quantities of equipment indicated herein are subject to change.

All technical particulars and other details as asked for shall be furnished in the specification only. Additional information, if desired by the bidder, can also be furnished separately.

2.3.4.2 Design criteria and Electrical System :

- **Design Criteria:-**

The Control and Relay Panel specified here in or not, shall be designed, manufactured and tested with the latest revisions of relevant Indian or equivalent British or International Standards.

The design, material, construction, manufacture inspection, testing and commissioning of Panel shall comply with all currently applicable states, regulations and safety codes in the locality where the equipment will be installed and in particular shall comply with IEC Standard. The equipment shall also confirm to the latest applicable standards and code of practice. Nothing in this specification shall be construed to relieve the supplier of this responsibility.

Wherever IEC Standards are not available, the Panels shall conform to relevant local Standard.

- 1) All electrical components shall also conform to the latest Electricity rules as regards safety and other essential provisions.
- 2) All electrical installation work shall comply with the requirements of the following Act/Rules/Codes as amended up to date:
 - a) Indian Electricity Act.
 - b) Indian electricity Rules.
 - c) National Electric Code of Indian.
 - d) All relevant IEC codes of practice.
 - e) Regulations published by Tariff Advisory Committee.
- 3) Ambient air temperature shall be taken as 45°C for the purpose of designing electrical equipments.

- **Electrical System:-**

The electrical arrangement of the switchgear, protection, metering, control, interlocking, inter-tripping, auxiliary power supply etc. shall be as shown on the SLD.

All components of the panel shall be rated for the electrical system characteristics shown on the one-line diagram(s). The rating of equipment/component shall take full account of all heat sources and other de-rating factors, non-linear loads within the enclosures. Special reference is made in respect of enhanced circuit making requirements and the DC component of fault current at breaking.

The switchgear shall be suitable for operation with system voltage and frequency variations:

- | | | |
|------------------------|---|-------|
| a) Voltage variation | : | ± 10% |
| b) Frequency variation | : | ± 3% |

2.3.4.3 Basic Condition:

- a) The selection of equipment shall be governed by fitness for purpose, safety, reliability, maintainability of spares and service, compatibility with specified future expansion, design margins, suitability for environment, economic considerations, and past service history.

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- b) The SI system of units shall be used.
- c) English language shall be used for all drawings, texts and communications.

2.3.4.4 Service Condition:-

- a) The Control and Relay Panel shall, in all respects, be suitable for operation indoor under site environmental and service conditions stated in Design criteria.
- b) The C & R panel including the electronic sub-assemblies used in control / monitoring / measurement circuits in the control compartments; etc shall be installed in a ventilated substation building.
- c) Where it can be demonstrated that:
The Maximum Ambient Temperature is 45°C; the Control and Relay Panel shall be capable of continuous operation at 45°C, if Temperature exceed above 45°C then C & R Panel shall be rated accordingly.
- d) The Control and Relay Panel shall in all respects be suitable for operation in typical tropical area.
- e) The atmosphere is to be considered Humid and dusty. The possibility of condensation, as experienced during large temperature variations in a humid environment in the tropic.

2.3.4.5 General Information:

The Panel shall be designed, fabrication and equipped with accessories in accordance with this specification and the applicable codes, standards indicated below. Materials and components not specifically stated in this specification but which are necessary for satisfactory and trouble free operation and maintenance of the panel shall be supplied.

The design and workmanship shall be in accordance with the good electrical engineering practices to ensure satisfactory performance and service life as specified herein.

Panel shall be suitable for an ambient temperature of 45° C.

Panel shall be metal clad, totally enclosed, rigid, floor / wall mounted, air- insulation, cubical type suitable for operation on three phase / single phase, 415 / 230 volts, 50 Hz , 110VDC/220VDC.

Panel shall be designed to withstand the severe conditions at site, with minimum expected ambient Temperature of 45°C and 50% humidity weather.

The panel also requires approval of the Purchaser or his representative at various stage of their manufacture such as design, selection, construction, testing, shipping etc.

The details of the project scope of work are stated in earlier chapter

The protection to be provided for DG Sets etc., shall be as follows:

- a. Main protection shall be of fast acting numerical type.
- b. Back up protection shall be Electromagnetic type .
There may be changes in components ordered as per purchase order and as per approved drawing. However, subsequent inspection and supply of panels shall confirm to the approved drawing.

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2.3.4.6 Codes and Standards:

The Panel and components shall conform to the latest applicable standard mentioned below. Also this specification shall unless otherwise stated be designed, constructed and tested in accordance with the requirements of the Indian Electricity Act and Rules and latest revision of relevant Indian or equivalent British or International Standards.

IEC STANDARDS	SPECIFICATIONS
IEC 60050	Application guide for electrical relays for protection and other relays
IEC 60255	Electrical relays for power system
IEC 60044	Instrument transformers.
IEC 60947	Low Voltage switchgear and control gear
IEC 62052	Class 0.5, 1 and 2 alternating current watt-hour meters.
IEC 60529	Degrees of protection provided by enclosures. (IP Code)
IEC 60269	Low-voltage fuses.
IEC 60686	AC static watt hour meter for active energy
IEC 60870-5-101/104	Communication protocol
IEC 61000	Numerical relay
IEC 61850	Sub-station automation
IEC 60068	Environmental testing
IEC 60664	Insulation co-ordination for equipment with low voltage system
IEC 60439	Low voltage switchgear and control gear assemblies.
IEC 60947-1	General requirements for switchgear and control gear for voltages not exceeding 1000 Volts.
IEC 60051	Direct acting indicating analogue electrical- measuring instruments and their accessories.
IEC 60073	Coding principles for indicator lights and push buttons.
IEC 60189	PVC insulated cables for switchgear and control wiring.
IEC 60258	Direct acting recording electrical measuring instruments and their accessories.
IEC 60417 DB	Graphical symbols for use on equipment.
IEC 60947-4	Contractors for voltages not exceeding 1000 V AC or 1200 V DC.
IEC 60617 DB	Graphical symbols for diagrams.
IEC 60715	Dimensions of low voltage switchgear and control gear. Standardized mounting on rails for mechanical support of electrical devices in switchgear and control gear installations.

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IS STANDARDS	SPECIFICATIONS
IS 3842	Application guide for electrical relays for protection and other relays
IS 3231	Electrical relays for power system
IS 2705	Current transformers
IS 3156	Voltage transformers
IS 6875	Push buttons and control switches (LV switching devices for control and auxiliary circuits)
IS 722	AC electricity meter
IS 8686	Static protective relay
IS 2203	Fuses
IS 5	Colours for ready mixed paints and enamels
IS 127	Ready mixed paints, brushing, finishing exterior and semi glass for general purpose white
IS 641	Paints, finishing interior white
IS 1258 part : 1-5 7-9	Direct acting indicating analogue electrical measuring instruments and their accessories
IS 2447	Degree of protection provided by enclosures for low voltage switch gear and control gear.
IS 4177	Performance tests for protective scheme used in protection of light gauge steel against corrosion
IS 4237/ IS 13947 (Part-1) (Part-4, Sec 1)	General requirements for switchgear and control gear for voltages not exceeding 1000 Volts.
IS 2147/ IS 13947	Degree of protection provided by enclosures. for low voltage (Part : I) switchgear and control Gear.
IS 2419	Dimensions of panel mounted electrical indicating and recording instruments.
IS 4201	Application guide for CT's
IS 4483	Preferred panel cut-out dimensions for electrical relays.
IS 5987	Selection of switches (voltage not exceeding 1000 V)
IS 8197	Terminal marking for electrical measuring Instrument and their accessories.
IS 2557	Danger notice plates.
IS 8623	Specification for factory built as symbol switch gear and control gear for voltage up to and including 1000 V AC & 1200 V D.C.
IS 8828	Miniature Circuit Breaker.
IS 2959	Auxiliary contactor.

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BS STANDARDS	SPECIFICATIONS
BS 142	Application guide for electrical relays for protection and other relays
BS 89/80	Indicating instruments & recorders
BS 88	Fuses

2.3.4.7 Technical Specification of Control and Relay Panel for DG Sets

- **Design Requirement**

- g. Control power supply of the Panel shall be mentioned in the respective SLDs.
- h. The Panel manufacturers shall apply all de-rating factors necessary to all Components of the C & R Panel to comply with the conditions detailed in this specification.
- i. The ratings of CT, Switch, control-gears, etc. furnished in the drawings are for tender purposes only. Any changes in the above will be intimated at the time of placement of purchase order or before fabrication of the panels.

2.3.4.8 Type of Panel

- **Simplex Panel:-**

Simplex panel shall consist of a vertical front panel with equipment mounted thereon and having wiring access from rear for control panels & front for relay/protection panels. In case of panel having width more than 800mm, double leaf-doors shall be provided. Doors shall have handles with either built-in locking facility or will be provided with pad-lock.

- **Duplex Panel:-**

Duplex panel shall be walk-in tunnel type comprising two vertical front and rear panel sections connected back-on-back by formed sheet steel roof tie members and a central corridor in between. The corridor shall facilitate access to internal wiring and external cable connections. In case of number of duplex panels located in a row side by side, the central corridor shall be aligned to form a continuous passage. Both ends of the corridor shall be provided with double leaf doors with lift off hinges. Doors shall have handles either with built-in locking facility or shall be provided with padlocks. Separate cable entries shall be provided for the front and rear panels. However, inter-connections between front and back panels shall be by means of inter panel wiring at the top of the panel.

2.3.4.9 Constructional Features

- a) Control & Relay Panel shall be of panels of duplex / simplex design, It is the responsibility of the bidder to ensure that the equipments specified and such unspecified complementary equipment required for completeness of the protective/ control schemes be properly accommodated in the panels without congestion and if necessary, provide panels with larger dimensions. No price increase at a later date on this account shall be allowed.
- b) Panels shall be completely metal enclosed and shall be dust, moisture and vermin proof. The enclosure shall provide a degree of protection not less than IP-31 in accordance with IS : 2147.
- c) The height of the panel should not be more than 2400 mm.
 - a) Approximately Depth of panel : 600 mm
 - b) Approximately Width of panel : 800/1000 mm

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- d) Panels shall be free standing, floor mounting type and shall comprise structural frames completely enclosed with specially selected smooth finished, Cold rolled sheet steel of thickness not less than 10 SWG (3.15 mm) for load bearing members of the panels such as frame, front sheet/door and Rear door etc and 14 SWG (2.0mm) for sides door, partition, cladding of partition. There shall be sufficient reinforcement to provide level surfaces and resistance to vibration and rigidity during transportation and installation.
- e) The structure shall be mounted on a rigid channel base frame of minimum ISMC 75. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation
- f) All cable gland plates shall be made of 10 SWG (3.15 mm) thick sheets steel
- g) All doors, removable covers and panels shall be provided with dust tight neoprene gaskets with easy operating type fasteners designed to ensure proper compression of gaskets conforming with IS 11149. However, XLPE gaskets can also be used for fixing protective glass doors The Door shall have concealed hinges. Removable cover shall be provided with CSK Screw. Ventilating louvers, if provided shall have screens and filters. The screens shall be made of either brass or GI wire mesh.
- h) Design, materials selection and workmanship shall be such as to result in neat appearance, inside and outside with no welds, rivets or bolt heads appearing from outside, with all exterior surfaces smooth.
- i) Panels shall have base frame with smooth bearing surface, which shall be fixed on the embedded foundation channels/insert plates. Anti-vibration strips made of shock absorbing materials, which shall be supplied by the contractor shall be placed between panel & base frame.
- j) Cable entries to the panels shall be from the bottom. Cable gland plate fitted on the bottom of the panel shall be connected to earthing of the panel/ station through a flexible braided copper conductor rigidly.
- k) Relay panels of modern modular construction would also be acceptable.
- l) The offer shall include dummy panels and filler plates wherever necessary to have continuous formation with any extra cost
- m) All cable shall be entered into panel from Bottom side of the panel. The design shall ensure generous availability of space of ease of installation and maintenance of cabling,
- n) A cover plate at the top of the vertical section, provided with a ventilation hood where necessary.
- o) All operating devices shall be incorporated in the front of panel and shall be flush/semi-flush mounted.
- p) The apparatus and circuits shall be so arranged as to facilitate their operation and maintenance and at the same time to ensure the necessary of degree of safety.
- q) Apparatus forming part of the panel shall have the minimum clearances as per relevant Indian Standard. Clearances shall be maintained during normal service conditions.
- r) The lifting eyes bolts(combination angle at bayed conditions) shall be provided
- s) Provision shall be made for permanently earthing the frames and other metal parts of the panel by the independent connections.

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- t) All identical equipment and corresponding parts be fully interchangeable without any modification

2.3.4.10 Mounting

- a) All equipment on and in panels shall be mounted and completely wired to the terminal blocks ready for external connections. The equipments on front of panel shall be mounted flush with only their bezels projection.
- b) Equipment shall be mounted such that removal and replacement can be accomplished individually without interruption of service to adjacent devices and are readily accessible without use of special tools. Terminal marking on the equipment shall be clearly visible.
- c) The centre lines of switches, push buttons and indicating lamps shall be not less than 750mm from the bottom of the panel. The center lines of relays, meters and recorders shall be not less than 450 mm from the bottom of the panel.
- d) The centre lines of switches, push buttons and indicating lamps shall be matched to give a neat and uniform appearance. Likewise the top lines of all meters, relays and recorders etc., shall be matched. The control switches of breakers and isolators shall be located on the mimic diagram corresponding to the exact position of the control equipment in the single line diagram.
- e) Final arrangement of control instruments & relays shall be as per the drawing approved by the Purchaser/consultant.
- f) No equipment shall be mounted on the doors.
- g) At existing station, panels shall be matched with other panels in the control room in respect of dimensions, colour, appearance and arrangement of equipment (center lines of switches, push buttons and other equipment) on the front of the panel.
- h) All the equipment connections and cabling shall be designed and arranged to minimize the risk of fire and damage which may be caused by fire.
- i) If any cutouts are left blank for mounting of future equipment, it shall be properly blanked off with metal plates, and wires left shall be properly insulated or terminated to a terminal block.
- j) The Contractor shall carry out cut out, mounting and wiring of the free issue items supplied by others which are to be mounted in his panel in accordance with the corresponding equipment manufacturer's drawings.

2.3.4.11 Metal treatment & finish:-

All steel work used in the construction of the panel should have undergone rigorous metal treatment process like phosphated in accordance with the IS: 6005 "Code of practice for phosphating iron and steel".

- a) Sheet steel shall be sand blasted to remove rust and scale. Oil, Grease, Dirt and Swarf shall be thoroughly removed by emulsion cleaning.
- b) Rust and scales shall be removed by pickling with dilute acid followed by washing with running water, rinsing with slightly alkaline hot water and drying.
- c) After phosphating, finishing shall be carried out with clean water, followed by final rinsing with dilute dichromate solution and oven drying.
- d) Two coats of finishing powder coating "opaline green" corresponding to shade No. 275 of IS-5 paint shall be applied for panel exterior. Each coat followed by stoving in the dust free

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atmosphere. The second finishing coat shall be free from imperfection like pinholes, orange pills etc. The sample sheet for the finishing paint shall be approved by Purchaser/Consultant.

- e) All cubicle interiors shall be painted white, so as to give a contrasting effect with cubicle wiring
- f) Each coat of primer and finished paint shall be of slightly different shade to enable inspection of painting. The final finished thickness of paint film shall not be less than 80 microns and shall not be more than 100 microns
- g) Finished painted appearance of equipment shall present aesthetically pleasing appearance, free from dents and uneven surface.
- h) A small quantity of paint shall be supplied free of cost for minor touching up, if any that may be required at site.
- i) In case the Supplier proposes to follow any other established painting procedure like electrostatic painting, the procedure shall be submitted along with offer/bid for purchaser's review and approval

2.3.4.12 Wiring:

- a) All wiring shall be of switch board type super flexible multi-stranded, tinned, annealed copper wire with suitable PVC insulation of 1.1KV grade conforming to IS-694 which has proved its utility in tropical regions against hot and moist climate and vermin (mice, white ants and cockroaches, etc.).
- b) The size of wiring in different circuits shall not be less than those specified below:

S No.	Circuits	Area of cross-section of conductor (minimum permissible size of wire)
1	Metering and relaying circuits connected to Current Transformer Circuit & Voltage Transformer circuit	2.5 sq. mm/lead
3	Energy Metering circuits connected to Current Transformer Circuit	2.5 sq. mm / lead
	Energy Metering circuits connected to Voltage Transformer circuit	2 x 2.5 sq. mm / lead
3	Audio visual annunciation, signaling and control circuits	1.5 sq. mm
4	AC/DC Auxiliary control supply circuits	1.5 sq. mm

- c) Following colour scheme shall be used for the wiring.

S No.	WIRING	Remarks
Red	Red phase of instrument transformer circuits	Red
Yellow	Yellow phase of instrument transformer circuits	Yellow
Blue	Blue phase of instrument transformer circuits	Blue
Black	Neutral connections earthed or not earthed in the instrument transformer circuits	Black
White	AC control wiring circuits using 415/ 240V auxiliary supply and cubicle lighting	Respective phase: Red, Yellow and blue Neutral : Black

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S No.	WIRING	Remarks
Grey	DC control wiring circuits	Red : Trip circuit Blue : indicating circuit Yellow: alarm circuit Green : Relay, auxiliary and other interconnections
	Lower voltage DC supply (from DC to DC converter)	- " -

- d) All cubicle wiring shall be of the grouped type and laid out in flat formation on the framework, in the interior of the panel cubicles and secured to it by means of cleats. Wiring shall be run straight and given right angle bends wherever necessary. Wiring round the hinges shall be of extra flexible conductors twisted around the axis of the wires.
- e) Longitudinal through extending throughout the full length of the panel shall be preferred for the intern panel wiring. Interconnection to adjacent panels shall be brought out to a separate set of terminal blocks located near the slot of holes meant for taking the interconnecting wires.
- f) All potential bus wiring, audible alarm, bus wiring, AC & DC control supply bus wiring, wiring for cubicle lighting and such other wiring which runs from cubicle to cubicle within the panel shall be laid down in gutters and shall be carefully screened.
- g) Wiring connected to the space heaters in the cubicle shall have porcelain headed insulation over a safe length from the heater terminals.
- h) Each wire shall be continuous from end to end and shall not have any joints within itself. Individual wires shall be connected only at the connection terminal or studs of the terminal blocks, meters, relays, instruments and other switch board devices.
- i) Wire termination shall be made with solder less crimping type and tinned copper lugs, which firmly grip the conductor. Insulated sleeves shall be provided at all the wire terminal end. Terminal ends of the wires shall be provided with numbered self-locking ferrules marked to correspond with panel wiring diagram and shall be fitted at both ends of each wire. At points of intersection where a change of number is necessary, duplicate ferrule shall be provided with the appropriate numbers on the changing end. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks. All wires directly connected to trip circuit breaker or device shall be distinguished by the addition of red coloured unlettered ferrule.
- j) The supplier should note that there would be no mezzanine floor for the control room building for cable spreading and the method of taking the cables directly into panel from the duct shall be clearly indicated.
- k) Contractor shall be solely responsible for completeness and correctness of the internal wiring and for the proper functioning of the connected equipments.

2.3.4.13 Terminal Blocks and Terminal Connectors:

- a) Terminal blocks shall be of the projecting stud type with check nuts and washers. The insulation housing of the terminal connector along with barriers shall be moulded from thermosetting resin dielectric and shall be of AC 1100V grade. The stubs shall be fully threaded and shall be of tin plated brass. The size of the stubs shall be suitable for a continuous rating of not less than 20 Amps and shall accommodate the conductor terminal with a close fit, check nuts and washers shall also be of tin plated brass. Check nuts shall be hexagonal and shall be suitable for being tightened with tubular box type spanners. The end termination facility shall be suitable for tightening with screw driver. Tin plated brass inserts shall be provided between the

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terminal connector studs for effective resistance free, electrical contact between the incoming and outgoing terminations.

- b) Terminal connectors shall be preferably of bolt and nut type for being assembled on to standard mounting channels for multi-way grouping to form terminal blocks. These terminal blocks shall be mounted vertically in columns inside the panel in a pillar type formation and shall be so located that the incoming tail ends of the control cables can be terminated to these terminal blocks easily.
- c) Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors of external cable on each side
 - All CT & PT circuits : Minimum of two of 2.5mm Sq. copper.
 - AC/DC Power Supply Circuits : One of 6mm Sq. Copper
 - All other circuits : Minimum of one of 2.5mm Sq. Copper.
- d) All terminal blocks shall be provided with removable shrouds made of transparent dielectric material rated for 1100V grade. Each shroud shall be etched or provided with a plastic marker strip to identify the circuits that are terminated.
- e) Each terminal block shall be provided with at least 20% spare terminals on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.
- f) All studs, nuts, bolts, screws etc., shall be threaded according to IS:7684. Sufficient spare quantities of all varieties and size of bolts, studs, nuts, washers and screws used in the cubicle shall be supplied to the extent of 20% along with cubicle free of cost.
- g) Where terminal blocks are arranged in different columns or rows then minimum clearance of 150 mm shall be provided between the terminal block. A minimum clearance of 250 mm shall be kept between Terminal blocks and associated cable gland plates.
- h) At the terminal connection, washers shall be interposed between wire terminals and the holding nuts. All holding nuts shall be secured with locking nuts. The connection stud shall project at least 3 mm from the lock nut surface,
- i) Wiring shall be so connected at the terminal studs that no wire terminal number ferrule gets masked due to succeeding connections. All wire shall be suitable for bending and shall meet the terminal studs at right angles with the stud axis and they shall not be skewed.
- j) Terminal blocks containing Current Transformer secondary leads shall be provided with test, isolating, short circuiting and earthing facilities / sliding link type and Voltage Transformer's secondary leads shall be provided with isolating features.
- k) Arrangement of terminal block assemblies and wiring channel within the enclosure shall be such that a row of terminal blocks is run in parallel and close proximity along each side of the wiring duct to provide for convenient attachment of internal panel wiring. The side of terminal block opposite to wiring duct shall be reserved for the employer's external cable connections. All the adjacent terminal blocks shall also share the field wiring corridor. All wiring shall be provided with adequate support inside the panels to hold them firmly and to enable free and flexible termination without causing strain on terminals.

2.3.4.14 Space for Control cable and Cable glands:

- a) All control and supply cable will be connected at the bottom of the cubicles. The bottom plates of panels shall be fitted with removable undrilled gland plates
- b) The size of gland plate which shall suit the employer's external cables quantities.

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- c) Purchaser will use screened type and made of brass or nickel plated steel and shall be suitable for PVC armoured and unarmoured cable.
- d) Necessary drawing showing the cable entry position and foundation bolt location shall be supplied by the bidder.
- e) The Cable gland plate shall be sized in such a way to accommodate required quantities of cable glands suitable for the cable sizes as described in each panel.
 - 19 C x 2.5 Sq. mm for DG Control.
 - 19 C x 2.5 Sq. mm for Circuit Breaker.
 - 10 C x 2.5 Sq. mm for Circuit Breaker.
 - 4 C x 6.0 Sq. mm for CT Circuits.
 - 2 C x 10 Sq. mm for NCT Circuits.
 - 4 C x 10 Sq. mm for PT Circuits.

2.3.4.15 Mimic Diagram:

- a) Control panel shall be provided on the front face of the panel with a coloured mimic diagram and symbol the exact representation of the system and of the circuit
- b) The mimic diagram shall represent the single line diagram of the system and indicate the relative position of each equipment in the run of the mimic diagram. Corresponding control switches shall be mounted along the mimic diagram at appropriate location.
- c) Mimic diagram shall be made preferably of anodized aluminum or plastic of approved fast colour material strip type with distinguished colours to differentiate between different voltages which shall be screwed on to the panel and can be easily cleaned. Painted overlaid mimic is also acceptable. The mimic bus shall not be less than 2mm thick. The width of the mimic bus shall be 10mm for bus bars and 7mm for other connections.
- d) Mimic diagram colour shall be follow unless and otherwise suggested by the Purchaser/consultant

Voltage class for new stations	Colour	Shade index as per IS 5
11KV	Signal red	537
415 V	Violet	796
Earth	Black	----

- e) In case of extension panels, the colour of the mimic should match with the existing colour of the mimic, which will be furnished.
- f) When semaphore indicators are used for equipment position, they shall be so mounted in the mimic that the equipment in close position shall complete the continuity of mimic.
- g) Mimic diagrams shall be incorporated with colour lamp indicators for indicating isolating switch position, one for each phase, for each bus (to indicate bus charged condition), circuit breakers status indication and also flash type lamp for auto trip shall be provided for the breaker.

2.3.4.16 Name Plate and Markings

- a) All equipment mounted on front and rear side as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved.

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- b) On the top of each panel on front as well as rear side, large and bold nameplates shall be provided for circuit/feeder designation. A label of size 40mm x 200mm (min) and the letter shall have a minimum height of 20mm.
- c) All front mounted equipment shall also be provided at the rear with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate easy tracing of the wiring.
- d) Each instrument and meter shall be prominently marked with the quantity measured e.g. KV, A, MW, etc. All instruments, relays and such other electrical devices and accessories mounted in the control panel shall be provided with name plate bearing the name of the manufacturer, serial number, type and technical rating data. These name plates shall be installed at the rear of the device inside the cubicle.
- e) All instruments and control switches shall bear clear inscription identifying its function eg, BREAKER, AMMETER, etc., similar inscription shall also be provided on each device whose function is not otherwise identified. If any switch device does not bear this inscription, separate name plate giving its function shall be provided for it. Switch shall also have clear inscription for each position indicating eg. "Trip-Neutral-Close", "ON-OFF", "R-Y-B-OFF" etc.
- f) Where equipment has ASA code number such as for relays, CBs etc., the identity plate shall bear this number with appropriate prefixes and suffixes in addition to the function name. The ASA code numbers shall be the same as the one indicated by the bidder in the detailed wiring diagram.
- g) Each panel shall be provided with a label located at the bottom corner on the front and shall contain the following details:
 - Manufacturers name and type
 - Equipment Tag Number
 - Serial No. of Equipment
 - Year of manufacture
 - Purchaser Name
 - Drawing reference number
 - Order No

The letters on name plates shall have minimum height 4 mm and the gap between lines / words shall be more than 2 mm.

- h) Engraved name plates shall preferably be of 3 ply, (red-white-red or black - white -black) lamincold sheet. However black engraved perplex sheet nameplates shall also be applicable. Engraving shall be done with square groove cutters. black characters on a white background.
- i) Labels shall be affixed by means of self-tapping screws or rivets at. Use of adhesives shall not be accepted.

2.3.4.17 Internally Mounted Equipments:

A. Space Heaters:

Each control and relay panel shall be provided with a strip type or coil type tubular enclosed space heaters to prevent condensation of moisture within the panel. It shall be installed at the base of the cubicle and operated on 240V AC single phase supply. The surface temperature shall be well below visible heat. Space heaters shall be provided with an independent switch control, fuse and an adjustable thermostat to regulate the temperature.

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B. Panel Lighting:

The interior of the cubicles shall be illuminated by fluorescent lamps. The illumination shall be free from hard shadows and shall be planned to avoid any strain or fatigue to a wire man working inside the cubicle due to any abnormal or non-uniform illumination. These lamps shall be operated through switches or door push buttons. It shall operate on 240V, AC single phase supply.

C. Power Sockets:

At least 3 nos. of 5 Amps and 2 nos. of 15 Amps, three pin round industrial power plug outlet points with MCB shall be provided at convenient place in control panel. The plug points shall be provided with electrical and mechanical cover with chain.

D. Fuses:

- a) Each panel shall be provided with necessary arrangements for receiving, distributing and isolating of DC and AC supplies for various control, signaling, lighting and space heater circuits.
- b) The incoming and sub-circuits shall be separately provided with H.R.C. fuses of adequate current and voltage rating.
- c) The short time fuse rating of Fuses shall be not less than 9 KA. Fuse carrier base shall have imprints of the fuse 'rating' and 'voltage'
- d) The fuse bases and carriers shall be mounted inside the cubicle in an easily accessible location. All fuses shall be HRC cartridge type conforming to IS: 13703 mounted on plug-in type fuse bases The fuse bases and carriers shall be moulded from the thermosetting resin dielectric or moulded standard grades phenolic Bakelite or equivalent thereof and shall be black in colour.
- e) The selection of the main and sub-circuit fuse ratings shall be such as to ensure selective clearance of sub-circuit faults. All accessible live connections to fuse bases shall be adequately shrouded. Fuses shall have operation indicators for indicating blown fuse condition. Fuse carriers and bases shall have imprints of the fuse rating and voltages.
- f) There shall be individual fuse units for each of the following circuits:
 - Signaling and Annunciation circuits.
 - V.T. secondary instrument circuits.
 - V.T. secondary, relay circuits.
 - AC & DC control circuits (shall be separate for CB & Isolators).
 - AC auxiliary circuits.
 - AC Power socket, cubicle space heater and lighting.
 - Others if any.

2.3.4.18 Earthing:

- a) All panels shall be provided with a tinned copper earthing bus extended throughout the length of the panel. Location of earth bus shall ensure no radiation interference for earth systems under various switching conditions of isolators and breakers.
- b) The size of the earthing bus shall not be less than 25 mm x 6 mm with threaded holes at a gap of 50mm with a provision of bolts and nuts for connection with cable armours and mounted equipment etc for effective earthing

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- c) When several panels are mounted adjoining each other, the earth bus shall be made continuous and necessary connection and clamps for this purpose shall be included in the scope of supply. Provision shall be made for extending the earth bus bars at a future date into new adjacent panels to be installed if any.
- d) Provision shall be made on each bus bar of the end panels for connecting Substation earthing grid. Necessary terminal clamps and connectors for this purpose shall be included in the scope of supply of Contractor.
- e) All metallic cases of instruments, relays, accessories, gland plate installed within the cubicle shall be connected to the earth bus with 1.1 KV grade standard multicore not less than 2.5 sq. mm PVC insulated conductor of green colour with yellow strip. The run of the wires shall be continuous without any joints and shall be crimped at either end with open type solder less lugs.
- f) Looping of earth connections, which would result in loss of earth connection to other devices when the loop is broken, shall not be permitted. However, looping of earth connections between equipment to provide alternative paths to earth bus shall be provided.
- g) VT & CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks where they enter the panel. Such earthing shall be made through links so that earthing may be removed from one group without disturbing continuity of earthing system for other groups.
- h) An electrostatic discharge point shall be provided in each panel connected to earth bus via 1 Mega Ohm resistor.

2.3.4.19 Indicating Lamps:

- a) Indicating lamps shall be of low watt consumption cluster LED type suitable either 240 VAC or Specified AC/DC Auxiliary voltage supply.
- b) The Indicating lamps shall be panel mounting type cutout of size 22.5 mm dia. with rear terminal connection. Lamps shall be provided with series connected resistors preferably built in the lamp assembly. Lamps shall have translucent lamp covers to diffuse lights coloured red, green, amber, clear white or blue as specified. The lamp cover shall be preferably of screwed type, unbreakable and moulded from heat resisting material.
- c) LED lamps shall be interchangeable and easily replaceable from the front of the panel. Tools, if required for replacing the LED lamps shall also be included in the scope of supply.
- d) The indicating lamps shall withstand 120% of rated voltage on a continuous basis.
- e) The colour scheme of the signal lamps shall be as follows:

Signal for	Indicating by light
CB closed	Red
CB open	Green
CB auto trip	Amber*
Trip Circuit healthy	White
DC Fail	Blue
CB spring charging indication	Blue
Red Phase ON	Red
Yellow Phase ON	Yellow

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Signal for	Indicating by light
Blue Phase On	Blue
Breaker Service Position	Red
Breaker Test Position	Red
Isolator closed	Red
Isolator open	Green
PT phases failure	White

* CB - Auto trip and to indicate abnormal conditions requiring action such as discrepancy in operation of protection circuits of alarm circuits.

- f) In the initial supply, 20% of the lamps actually used on the switch board shall be supplied in excess to serve as spares.

2.3.4.20 Test Terminal Blocks (TTB):

- a) Each control panel where metering is involved shall be installed with instrument test terminal blocks. These test terminal blocks shall be designed for use on panels with poly-phase meters to facilitate their in-situ testing. The test terminal blocks shall be mounted at the bottom end of the front face of the panel. They shall be of the projecting type semi-flush mounted with wire connected at the back. All wiring to indicating, integrating and recording instruments shall be done through the Test Terminal Block. The test terminal block shall be provided with screw type front cover such that the removal of this cover shall grant access to the terminals in the front for connecting check meters or for injection of external supply to the panel instruments.
- b) The test terminal blocks shall facilitate in-situ testing of instruments without interrupting the primary load circuit. The current terminals shall therefore be provided with shorting arrangement through links before interrupting the normal circuit for insertion of external check meters or for injection of an external supply into the panel instruments without causing an open circuit in the current transformer secondaries. The potential terminal shall be provided with sliding links for isolation of the normal supply voltage to the panel instruments from the secondaries of voltage transformer.
- c) The test terminal block shall have its insulation housing made of a moulded dielectric materials such as phonolic Bakelite or equivalent thereof with adequate insulation between current and potential terminals of different phases. The potential testing studs shall preferably be housed in narrow recesses of the block moulded insulation to prevent accidental short circuit between potential studs themselves or between potential and current terminals. The cover studs to be provided shall be suitable for sealing with lead seals so as to prevent unauthorized access to the test studs.
- d) The test terminal block rating shall be 1.1 KV, 35 Amps, The terminals shall be nickel-plated brass and their contact resistance shall be less than 1 milli ohm. The test Terminal Block shall preferably be of IMP make or any other standard link type makes.

2.3.4.21 Control Switches:

- a) Control and instrument switches shall be rotary operated type with escutcheon plates clearly marked to show operating position and circuit designation plates and suitable for flush mounting with only switch front plate and operating handle projecting out. Handles of different shapes and suitable inscriptions on switches shall be provided as an aid to switch identification.
- b) The selection of operating handles for the different types of switches shall be as follows;

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Type of Switch	Type of Operating Handle
Breaker	Pistol grip, black
Synchronizing switches	Oval, black, keyed handles (one common removable handle for a group of synchronizing switches or locking facility having common key)
Selector switches	Oval or knob, black
Instrument switches	Round, knurled, black
Trip transfer switches	Pistol grip, lockable, black

- c) The control switch of breaker shall be of spring return to neutral type. The spring return type shall be provided, with lost motion device and minimum ten ways for CB control switch. The control springs shall be strong and robust enough to prevent inadvertent operation due to light touch. The spring return type switch shall have spring return from close and trip positions to "after close" and "after trip" position respectively.
- d) Instrument selection switches shall be of maintained contact (stay put) type. Ammeter selection switches shall have make-before-break type contacts so as to prevent open circuiting of CT secondaries when changing the position of the switch. Voltmeter transfer switches for AC shall be suitable for reading all line-to-line and line-to-neutral voltages for non effectively earthed systems and for reading all line to line voltages for effectively earthed system.
- e) Lockable type of switches, which can be locked in particular positions, shall be provided when specified. The key locks shall be fitted on the operating handles.
- f) All control switches wires shall be connected at the back. The contacts of all switches shall preferably open and close with snap action to minimize arcing. Contacts of switches shall be spring assisted and contact faces shall be with rivets of pure silver or silver plated and designed for liberal rating of the duty involved.
- g) Springs shall not be used as current carrying parts. The contacts shall be provided with a dust and vermin proof removable protection cover. The protection cover shall preferably be of transparent, inflammable material made of moulded dielectric materials. Springs to be provided in the switch shall not be used as current carrying parts.
- h) The contacts provided in the switch shall not be used as continuous current carrying parts.
- i) The contact combination and their operation shall be such as to give completeness to the interlock and function of the scheme.

The contact rating of the switches shall be as follows :

Description	Contact rating in Amps	
	110V DC	240V AC
Make and carry continuously	10	10
Make and carry for 0.5 seconds	30	30
Break:		
1. Resistive load	3	7
2. Inductive load with L/R = 40 ms	0.2	---

2.3.4.22 Push Button:

- a) The push button unit shall comprise of the contact element, a fixing holder, and push button actuator.

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- b) The push button shall be momentary contact type wired back connected
- c) The Push Button shall be semi-flush mounted and where required they shall be shrouded to prevent inadvertent or undesirable operation. They shall be provided with integral inscription plates engraved with their functions
- d) All push buttons shall be with two sets of Normally Open (NO) and Normally Closed (NC) contacts. The contact faces shall be silver plated and shall be able to make/break and carry the rated current. The rated current shall be appropriate to the duty of the desired function, but not less than 5 Amps.
- e) Emergency stop push buttons shall be lockable in the operated position and also Emergency Push Button shall be Mushroom type head and stay put. The actuator shall be of stranded type and colour as per its usage for ON, OFF and Trip.
- f) Push button colours shall be as follows:
 - Stop, Open, Emergency :- Red
 - Start – Close :- Green
 - Trip circuit `Healthy` check :- Black
- g) Red push buttons shall be on the left side and green push buttons on the right side.
- h) The key shall be released from the push button in both `Released` and `Operated` positions and operation of the push button shall be possible in the key release position. Push button knob for emergency stop push.

2.3.4.23 Indicating & Integrating Instruments and Transducers for Control Panel:

A. General Requirement:

- a) All indicating and integrating instruments shall be of the switchboard type, wired back connected and semi flush mounted, with only the instrument bezels projecting on the front face.
- b) All instruments, meters and transducers shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use and shall be of such materials as to ensure freedom from warping, fading or discoloration.
- c) All instruments shall be provided with dust tight cases. All nuts, screws and threaded parts shall preferably conform to relevant standards and all indicating instruments to IS - 1248 or relevant standards.
- d) All megawatt, megavar, Bus voltage and frequency indicating instruments shall be provided with individual transducers and these shall be calibrated along with transducers to read directly the primary quantities. They shall be accurately adjusted and calibrated at works and shall have means of calibration check and adjustment at site. The supplier shall submit calibration certificates at the time of delivery. However no separate transducers are envisaged for digital bus voltmeters and digital frequency meters and the indicating meters provided.
- e) The indicating instruments shall have an accuracy class 1.0 or better or as specified in SLD. The design of the scales shall be such as to have a resolution corresponding to 50% of the accuracy class index. The integrating instruments shall have an accuracy class 0.5 or better or as specified in SLD.
- f) Unless otherwise specified, all electrical indicating instruments shall be of digital type suitable for flush mounting.

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- g) Instrument shall confirm to relevant IS Digital meters shall be of class: 0.5 and shall have digital display of 5 and 4 digits respectively, with display size, not less than 25mm (height).
- h) If Indicating Instruments has mentioned Analogue type shall follow.
- All indicating instruments shall be provided with a front of board zero pointer adjuster capable of being operated safely even when the instrument is in service. The adjustment above and below the zero point shall not be less than 3% and not more than 6% of the full scale reading. The adjuster shall be capable of being rotated through an angle of 360 degree without damage to any part of the instrument and it shall have sufficient friction or spring control to keep the adjustment in position.
- All scale markings shall be in black on white instrument dial background. Knife edge pointers and parallax free dials are preferred.
- i) All the indicating instruments shall be in conformity with relevant standards. The bidder should note that the instrument security factor of metering CT's is 5 and hence all the meters should withstand 5 times the normal secondary current without any damage.
- j) All indicating instruments shall be provided with direct reading double range scales. The scale ranges are indicated in the panel wise schedule of requirements. The ammeter and voltmeter scale ranges are to be zero end suppressed.
- k) All circuits of the instruments shall be capable of withstanding applied load of 20% greater than the rated capacity for period of eight hours.
- l) All current and/or voltage coils of meter shall withstand continuously 120% of the rated current/ voltage and 200% thereof for 0.5 seconds without loss of accuracy.

B. Ammeters:

- a) Analogue Ammeter shall comply with BS: 89. The dial of the ammeter shall be square in 96x96 mm in size. The ammeter shall be moving iron type, flush pattern with dust and moisture proof enclosure zero end suppressed, 240 degrees scale with dual range.
- b) It shall be suitable for 1 Amp (one Amp) CT secondary and flush mounting
- c) Ammeters shall be scaled such that full load corresponds to between 50 and 80% of the angular deflection

C. Voltmeters:

- a) Voltmeter shall comply with BS-90. The dial of the meter shall be square in shape of 96 x 96 mm size. The voltmeter shall be moving iron type, flush pattern with dust and moisture proof enclosure zero end suppressed, 240 degrees scale.
- b) The voltmeter selector switch shall be arranged to provide line to line voltage reading.
- c) It shall be suitable for 110 V phase to phase VT secondary and for flush mounting

D. Digital Power and Load Manager:

- a) Power meter shall be with Blue backlight LCD Meter (4 rows parameters display) to measure V, A, F, PF, kW, kVA, kVAR, kVARh, kWh, kVAh, Power Demand, %THD, Neutral Current, Modbus RS485 Port , CT Sec:1A/5A programmable, Input Voltage : 0-600 VAC / 0-340VAC(Direct) or 0-3.2MVAC by External VT, Accuracy Class 0.5s, Time Stamped Min/Max of all instantaneous parameters , 1 DI+1 DO, 31 Individual Harmonics, Data Logs/Event

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Logs(Min 80 KB memory),Time Stamped Alarms, Programmable /configurable alarms, Meter to have facility to add Ethernet module, Other expandable module options (Analog input/output & Relay Output) etc.

- b) Load manager with more futures shall be with 4 digit, 3 line LED display to measure V & A(Phase wise & Avg), Frequency from any available phase and generator RPM, PF, kW, kVA, kVAR, kVARh, kWh, kVAh, Max Demand, %THD, Colored load bar, which gives Analog indication of the % Current Load, Meter shall have minimum 5 keys and support quick explorer type navigation, Meter shall have Auto scroll feature, OLD registers to store resetted data, Acc Class 1.0,0.5 or better, meter to record load Run hours, Meter On hours and number of power interruptions.
- c) Load manager with less futures shall be 4 digit, 3 line LED display to measure V & A(Phase wise & Avg), F, PF, kW, kWh, Colored load bar, which gives Analog indication of the % Current Load, Meter shall have minimum 5 keys and support quick explorer type navigation, Meter shall have Auto scroll feature, OLD registers to store resetted data, Acc Class 1.0, 05 or better, meter to record load Run hours, Meter On hours and number of power interruptions

It shall be suitable 110 volts phase to phase VT secondary.

- d) Kilowatt hour meter with sealing arrangement.
- e) Contractor shall provide suitable sealing arrangement for the CT secondary terminals for metering core.

E. Integrating Meters:

- a) It shall of static type, 3 phase, 3/4 wire trivector meter suitable for 1 Amp, CT and 110 volts phase to phase VT secondaries. It must be flush mounted type and tropicalised. It shall have separate registers for recording kWh and kVARh consumption separately and also demands with automatic resetting at the end of the month and also to record EXPORT AND IMPORTS.
- b) The meter should be of 0.2 accuracy class.
- c) The meters shall have legible LED/LCD minimum 6 digits auto-cycle display. The meter shall have non-volatile memory requiring no battery backup.

F. Frequency Meter:

Frequency meter shall be of static type. It shall indicate frequency up to second decimal point, It shall operate from 110V, AC bus VT secondaries. It shall be flush mounted type and tropicalised.

G. Transducers:

Transducer (for Telemetry/Data Communication application) shall in general conform to IEC: 688-1 and have the following features:-

- a) The Transducers shall be suitable for measurement of active Power, reactive Power, Voltage, Current and frequency in three phase four wire unbalanced system.
- b) The input to the transducers will be from sub-station current & potential transformers. The output shall be in milli ampere D.C proportional to the input and it shall be possible to feed the out put current directly to the telemetry terminals or indicating instruments or recording instrument.
- c) The transducer characteristics shall be linear throughout the measuring range.

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- d) The transducer output shall be load independent.
- e) The input & output of the transducer shall be Galvanically isolated.
- f) Each transducer shall be housed in a separate compact case and have suitable terminals for inputs & outputs. Input side terminal connectors (from CT & PT) to be suitable for 3 phase, 4 wire connection.
- g) The transducers shall be suitably protected against transient high peaks of voltage and current.
- h) The transducer shall withstand indefinitely without damage and work satisfactorily at 120% of the rated voltage and 120% of the rated input current as applicable.
- i) The voltage, frequency & current transducers shall have an output of 4-20mA.
- j) The response time of the transducers shall be less than 1 second.
- k) The transducers shall have a working temperature range of 0-50 degree C.
- l) The accuracy class of transducers shall be 1.0 or better for voltage/current transducer, 0.5 or better for W/VAR transducer and 0.2 or better for frequency transducer.
- m) The transducers shall have a low AC ripple on output of less than 1%.
- n) The transducers shall be suitable for load resistance of 1000-1500 ohms.
- o) The PT ratios and scale ranges for the voltage & frequency transducers shall be as follows:

Voltage transducers:	11KV/110V	0-15KV
Frequency transducers	11KV/110V	45-55Hz.
- p) The current, active & reactive power transducers shall be suitable for the various CT & PT ratios (as applicable) furnished with the specification and compatible with the feeder/transformer voltage levels & ratings.
- q) The transducer shall be provided with terminal connectors for wire of maximum cross section of 4/6sq.mm. with dual screws, for rigid connections.
- r) The transducer shall have dual output.

2.3.4.24 Annunciation System:

- a) Separate Alarm annunciation system shall be provided for each control panel by means of visual and audible alarm in order to draw the attention of the operator to the abnormal operating conditions or the operation of some protective devices. The annunciation equipment shall be suitable for operation on the voltage specified.
- b) The annunciation shall be of visual and audible type. The visual annunciation shall be provided by annunciation facia, mounted flush on the top of the control panels. The audible alarm shall be provided by alarm buzzer or bell.
- c) The annunciator facia shall be provided with translucent plastic window for alarm point with minimum size of 35mm x 50mm. The facia plates shall be engraved in black lettering with respective inscriptions, which will be approved by the purchaser. Alarm inscriptions shall be engraved on each window in not more than three lines and size of the lettering shall not be less than 5mm..

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- d) Each annunciation window shall be provided with two white lamps in parallel to provide safety against lamp failure. Long life lamps shall be used. The lamp circuit shall include series resistor of adequate rating. The cover plate of the facia windows shall be flush with the panel and shall be capable of easy removal to facilitate replacement of lamps. The transparency of cover plates and wattage of the lamps provided in the facia windows shall be adequate to ensure clear visibility of the inscriptions in the control room having high illumination intensity (300 Lux), from the location of the Operator's desk.
- e) TRIP & NON-TRIP facia shall be differentiated. All TRIP facia shall have red colour and all NON-TRIP facia shall have white colour.
- f) Sequence of operation of the annunciator shall be as follows:

Sl. No.	Alarm condition	Fault contact	Visual annunciation	Audible annunciation
1	Normal	Open	OFF	OFF
2	Abnormal	Close	Flashing	ON
3	Accept push button is pressed	a) close b) open	Steady ON Steady ON	OFF OFF
4	Reset push button is pressed	a) close b) open	ON OFF	OFF OFF
5	Lamp test push button is pressed	Open	Steady ON	OFF

- g) Visual and audible annunciation for the failure of DC supply to the annunciation system shall also be provided and this annunciation shall operate on 240V AC supply with separate fuses. On failure of the power supply to the annunciation system for more than 2 or 3 secs (adjustable setting) a facia shall light up and a bell shall sound. A separate push button shall be provided for the cancellation of this audible alarm alone but the facia window shall remain steadily lighted till the supply to the annunciation system is restored. The sound of the audible alarm (bell) provided for this annunciation shall be different from the audible alarm provided for the annunciation system.
- h) A separate voltage check relay shall be provided to monitor the failure of supply (240V AC) to the scheme mentioned in the above Clause. If the failure of supply exists for more than 2 to 3 sees, this relay shall initiate visual and audible annunciation.
- i) Visual and audible annunciation for the failure of AC supply to the annunciation system shall be provided and this annunciation shall operate on Annunciation DC and buzzer shall sound.
- j) The annunciation system described above shall meet the following additional requirements :
- The annunciation system shall be capable of catering to at least 20 simultaneous signals at a time.
 - One self-resetting push button shall be provided on each panel for testing the facia window lamps. Push buttons for testing flasher and audible alarm circuit of annunciation system and for testing the annunciation supply failure monitoring circuit shall be provided. These testing circuits shall be so connected that while test is being done it shall not prevent the registering of any new annunciation that may land during the test.
 - One set each of the following push buttons shall be provided on each panel.
 - Reset push button for annunciation system.
 - Accept push button for annunciation system,
 - Lamp test push button for testing the facia windows

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- The annunciation shall be repetitive type and shall be capable of registering the fleeting signal. Minimum duration of the fleeting signal registered by the system shall be 15 milli secs.
 - Auxiliary relay for annunciation system shall have adequate auxiliary potential free contacts for use in event logger.
 - The annunciation shall be suitable for an operation with normally open fault contacts. Which close on a fault. For fault contacts which open on a fault, it shall be possible at site to change annunciators from "close to fault" to "open to fault" and vice versa.
- k) In case of static annunciator scheme, special precaution shall be taken to ensure that spurious alarm condition does not appear due to influence of external electromagnetic/ electrostatic interference on the annunciator wiring and switching disturbances from the neighboring circuits within the panels and the static annunciator shall meet the high voltage susceptibility test , impulse voltage with stand test , high frequency disturbance test– class III and fast transient disturbance test –level III as per IEC 60255
- l) One set of bell, hooter shall be provided . Each of this bell and hooter can be provided in any one of the line/bus coupler panel. The bell and hooter shall have clear resounding ringing tone audible at the far end of the control room or the station. Suitable hand reset relay devices shall be provided for the bell and hooter circuits to allow for manual cancellation of the audible alarm in token of its acceptance by an operator before rectification of the abnormality can be made.

The wiring shall be such that one set of bell and alarm cancellation relay shall be sufficient and serve in common with all the associated alarm actuating devices caused by tripping of the equipment/ breakers, Similarly there shall be one set of hooter and alarm cancellation relay shall be sufficient and serve in common with all the alarm actuating devices which do not cause tripping of the equipment/breakers.

- m) The number of facia windows required is indicated in the schedule of annunciator windows as per SLD. The facia details of windows to be connected to trip circuitry and non-trip circuitry will be furnished to the successful bidder.

2.3.4.25 Position Indicators if Applicable

- a) Position indicators of "SEMAPHORE" type shall be provided when specified as part of the mimic diagrams on panels for indicating the position of circuit breakers, isolating/earthing switches etc. The indicator shall be suitable for semi-flush mounting with only the front disc projecting out and with terminal connection from the rear. Their strips shall be of the same colour as the associated mimic.
- b) Position indicator shall be suitable for DC Voltage as specified. When the supervised object is in the closed position, the pointer of the indicator shall take up a position in line with the mimic bus bars, and at right angles to them when the object is in the open position. When the supply failure to the indicator occurs, the pointer shall take up an intermediate position to indicate the supply failure.
- c) The rating of the indicator shall not exceed 2.5 W.
- d) The position indicators shall withstand 120% of rated voltage on a continuous basis.

2.3.4.26 Protective Relays:

If protective relay is specified in SLD , it shall be comprising following

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A. General Equipments:

- a) All relays shall conform to requirements of IS 3231/IEC 50255/ IEC 6100 or other applicable standards. Relay shall be suitable for flush or semi-flush mounting on the front with connection from the rear.
- b) All main protective relay shall be Numerical type and communication protocol shall be as per IEC 61850. Further, the test levels of EMI as indicated in IEC 61850 shall be applicable to these relays.
- c) A detailed note regarding the various quality control procedures adopted by the manufacturer should be given with special reference to numerical relay components on their quality assurance tests. Information should be furnished regarding various equipment used for quality assurance tests.
- d) The numerical relays offered must have proven performance. The bidder shall give a detailed account of the field experience of the relays offered, information regarding experience in designing etc.
- e) The protection scheme at the other end of the transmission line will be furnished to the successful bidder if required. The other particulars like distance of the lines, impedance, CT ratios, PT details will be furnished to the successful bidder and should provide the protection schemes suitable for parameters furnished.
- f) The relay codes mentioned in the wiring/ schematic diagram, for auxiliary relays etc., which are part of a composite relay, shall be marked on the name plate provided. This is required to facilitate the field staff, to identify the auxiliary relay provided in the composite unit at the time of trouble shooting.
- g) All relays, other components, wiring etc shall withstand a test voltage of 2.5kV RMS, AC, 50 Hz.
- h) All AC operated relays shall be suitable for operation at 50 Hz. AC Voltage operated relays shall be suitable for 110 Volts VT secondary and current operated relays for 1 amp CT secondary. All DC operated relays and timers shall be designed for the DC voltage specified, and shall operate satisfactorily between 80% and 110% of rated voltage. Voltage operated relays shall have adequate thermal capacity for continuous operation.
- i) The protective and auxiliary relays offered shall be of proven design and based on sound principles and should conform to BS : 142 and IS : 3231 and IEC : 255 wherever applicable. The protection equipment shall be designed and applied to provide maximum discrimination between faulty and healthy circuits and its performance shall be in accordance with the BS standard 3950. The equipment shall remain in operation during transient phenomenon, which may arise during switching or other disturbances to the system. They shall be in standard cases and shall be provided with dust and vermin proof cases and covers, The covers shall be transparent and shall be removable from the front. The relay shall be suitable for semi-flush mounting only the flanges projecting in the front and with connection from the rear. The relays shall be rectangular in space and dull black or egg shell black enamel painted cases.
- j) All protective relays shall be in draw-out or plug-in type / modular cases with proper testing facilities. The testing facilities provided on the relays shall be specifically stated in the tender. Necessary test plugs shall be supplied loose and shall be included in bidder's scope of supply. Test block and switches shall be located immediately below each relay for testing. As an alternative to test block and test plug arrangements the bidder shall also quote alternative testing facility of protective relays by providing a push button which when pressed connects the testing equipment to the relay coils and injects current in the coil and automatically disconnects the trip circuits and on operation of relay gives a signal that the equipment and the circuits are correct. The above tests shall be carried out without short circuiting the CT secondary

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connections. The Purchaser reserves the right for accepting any one of the above two testing facilities. Unless otherwise specified all auxiliary relays and timers shall be supplied in non-draw out cases/ plug-in type modular cases.

- k) All AC relays shall be suitable for operation at 50 Hz AC Voltage operated relays shall be suitable for 110 Volts VT secondaries and current operated relays for 1 Amp CT secondaries as specified. DC auxiliary relays and timers shall be designed for the DC voltage specified, and shall operate satisfactorily between 80% and 110% of rated voltage. Voltage operated relays shall have adequate thermal capacity for continuous operation.
- l) All relays coils requiring a continuous voltage shall have adequate thermal capacity for continuous operation. The current and voltage coil shall be rated for the current and voltage rating specified under system details and auxiliary supply.
- m) The power supply unit shall be fully rated with liberal design in capacity.
- n) The DC supply for solid state relay shall be from DC / DC converters and these shall be ample and fully rated for all operating conditions in service. Provision of DC standby power supply will however not be acceptable.
- o) The protective relays shall be suitable for efficient and reliable operation of the protection scheme described in the specification. Necessary auxiliary relays and timers required for interlocking schemes for multiplying of contacts/ suiting contact duties of protective relays and monitoring of control supplies and circuits, lockout relay monitoring circuits etc. and also required for the complete protection schemes described in the specification shall be provided. All protective relays shall be provided with at least two pairs of potential free isolated output contacts. Auxiliary relays and timers shall have pairs of contacts as required to complete the scheme, contacts shall be silver faced with spring action. Relay case shall have adequate number of terminals for making potential free external connections to the relay coils and contacts, including spare contacts. Relay cases size shall be so chosen as not to introduce any limitations on the use of available contacts on the relay due to inadequacy of terminals. Paralleling of contacts, if any shall be done at the terminals on the casing of the relay.
- p) All protective relays and auxiliary relays except the lock out relays and interlocking relays specified shall be provided with self-reset type contacts. All protective relays and auxiliary relay shall be provided with externally hand reset positive action operation indicators with inscription subject to Purchaser/consultant approval. All protective relays which do not have built in hand-reset operation indicators shall have additional auxiliary relays with operating indicators (Flag relays) for this purpose. Similar separate operating indicator (auxiliary relays) shall also be provided in the trip circuits of protections located outside the board such as buchholtz relays, oil and winding temperature protection, sudden pressure devices, fire protection etc.
- q) There shall be no relay in the protective circuits, which shall cause tripping of the circuit breaker when the relay is de-energized.
- r) Timers shall be of the electromagnetic or static type. Pneumatic timers are not acceptable. Time delay in term of millisecs obtained by the external capacitor/resistor combination is not preferred and shall be avoided.
- s) Provision shall be made for easy isolation of trip circuit of each relay for the purpose of testing and maintenance.
- t) All protective relays and alarm relays shall be provided with one extra isolated pair of contacts wired to terminals exclusively for further use.
- u) The setting range of relays offered, if different from ones specified shall also be acceptable if they meet the functional requirement.

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- v) Any alternative/ additional protection of relays considered necessary for providing complete effective and reliable protection shall also be offered separately. The acceptance of this alternative/ additional equipment shall lie with Purchaser/consultant.
- w) Auxiliary seal-in-units provided on the protective relays shall preferably be of shunt reinforcement type. If series relays are used the following shall be strictly ensured.
- The operating time of the series seal-in-units shall be sufficiently shorter than that of the trip coil or trip relay in series with which it operates to ensure definite operation of the flag indicator of the relay.
 - Seal-in-units shall obtain adequate current for operation when one or more relays operate simultaneously.
 - Impedance of the seal-in-units shall be small enough to permit satisfactory operation of the trip coil on trip relays when D.C supply voltage is minimum.
 - Trip-Circuit seal-in is required for all trip outputs irrespective of the magnitude of the interrupted current. The trip-circuit seal-in logic shall not only seal-in the trip outputs but also the relevant initiation signals to other scheme functions (e.g. initiate signals to the circuit breaker failure function, reclosing function etc.) and the alarm output signals.
 - Two methods of seal –in are required, one based on the measurement of AC current, catering for those circumstances for which the interrupted current is above a set threshold, and one based on a fixed time duration, catering for those circumstances for which the interrupted current is small (below the set threshold).
 - For the current seal-in method, the seal-in shall be maintained until the circuit breaker opens, at which time the seal-in shall reset and the seal in-method shall not now revert to the fixed time duration method. For this seal-in method, the seal-in shall be maintained for the set time duration. For the line protection schemes, this time duration shall be independently settable for single-and three-pole tripping.
 - Seal-in by way of current or by way of the fixed duration timer shall occur irrespective of whether the trip command originates from within the main protection device itself (from any of the internal protection functions), or from an external device with its trip output routed through the main protection device for tripping Trip-circuit seal-in shall not take place under sub-harmonic conditions.
- x) All relays and their drawings shall have phase indications as R-Red, Yellow, B-blue
- y) For numerical relays the scope shall include the following:
- Necessary software & hardware shall be provided to up/down load the data to/from the relay from/to the personal computer provided in the station.
 - The relay shall have suitable communication facility for connectivity to sub-station system/SCADA. The relay shall be capable of supporting open protocol IEC 61850 protocol.
 - In case of line protection and transformer/reactor protection, the features like fault recorder and event logging function as available including available as optional feature in these relays shall be supplied and activated at no extra cost to the employer. Also necessary software/hardware for automatic uploading to station HMI shall be supplied. It is to be clearly understood that these shall be in addition to fault locator and event logger functions as specified at here after

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- The materials, the components of numerical relays shall be designed to withstand the most severe tropical climatic conditions such as corrosive atmosphere, saline, fog, damp, heat and fungus prone environment. These devices as such shall be tropicalised in such a manner so as to meet with the IEC-68 standard.
- The components shall be loaded by less than half of their rated values. The resistor shall be of carbon composition or metal oxide type and the capacitors shall be plastic film or tantalum type. Stringent measures including shielding of long internal wiring should be taken to make relays immune to voltage spikes. As per IEC, the relays must meet the requirements of IEC-255-4, appendix 'E'. Class-III regarding HF disturbance tests, IEC-255-4 regarding impulse test at 5kV and fast transient test as per IEC-801-4. Insulation barriers shall be provided to ensure that transients present in CT & VT connections due to extraneous source do not cause damage to static circuits.
- The. Cases, racks and sub-units shall preferably be of stainless steel. The screws used in cases, racks and sub-units shall be either of stainless steel or zinc plated steel.
- The material of connector terminal blocks shall be of dielectric moulded type resin. The connector plugs shall be corrosion resistive and the lugs shall be made of tinned brass with the contact face silver / gold plated. All connections with the connector plug shall be by wire wrapping.
- The numerical components forming the electronic solid state circuitry shall be mounted on printed circuit board of adequate thickness and made of stratified glass epoxy. A protective lacquer shall be applied when all the components are soldered.. All components shall be clearly marked and all wiring colour coded and tagged. Flat ribbon cable is exempted from being tagged.
- The electromechanical relay contacts shall be protected with non-inflammable plastic covers.
- The relays shall be modular units assembled in fully tropicalised draw out cases with the modules or sub-units plugged into racks. They shall be electrically isolated on the measuring side through intensity or voltage input transformers with shield bonded (at the over voltage/fixed voltage) and on the operation side through on/off relays. The layout of measurement inputs, output relays, detection circuits and visual display such as to eliminate mutual interference of the circuits involved. Internal test points shall be provided on the printed circuit at typical points of the relay diagram. These test points, if possible shall be provided on the front of the relay to enable testing during operation without having to disconnect the relay.
- Insulation barriers shall be provided to ensure that transients present for CT and VT connections due to extraneous sources do not cause damage to static circuits. The Numerical relays offered shall be tested to withstand both 5 kV impulse tests and high frequency disturbance stipulated by IEC. Details of the equipment used for tests shall be furnished.
- The relay shall be designed for designed for shock wave resistance, temperature resistance, humidity resistance, transportation resistance and storage resistance and to be insensitive to radio frequency interferences.
- The performance of numerical relay shall not be affected by transient, common mode and transient mode electromagnetic interference..

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- The solid state relays shall be stable and suitably protected against transient/ induced over voltages and noise signals. The bidder shall state clearly in his bid, special requirements, if any, for DC input arrangement or cabling considered necessary for satisfactory operation of solid state relays quoted by him.
- z) The bidder shall include in his bid a list of installations where the relays quoted have been in satisfactory operation.
- aa) The Contractor shall give a detailed account of the field experience of the relays offered. Information regarding experience within the country should be indicated, giving the approximate quantity of similar relays supplied in India. The bidder should also give an account of his experience in designing coordinating similar protective gear within the country.
- bb) The Contractor shall indicate what facilities are available with him within the country for repair / recalibration of the relays offered by him. Whether such facilities are available for the repair of imported relays included in his offer shall also be stated in the tender.
- cc) The Contractor shall indicate what facilities are available with him for commissioning these Relays. Such facilities shall cover indigenous and imported equipment.

2.3.4.27 Operational Requirement:-

- a. Normally Mains supply shall be 'ON' & load will be connected with mains supply in the Main HT panel.
- b. The D.G. set shall be provided with Automatic Mains Failure feature. When the normal power fails, The set shall start automatically means as and when the mains fail & it shall send signal through mains supervisory relay (LVM) to unit of the both D.G.Sets. A potential free contact which closes / opens on LVM shall be made available on the control panel. The D.G. set shall start on the signal after the adjustment time delay of 0-5 seconds. The timer shall be of self reset type.
- c. When the engine speeds up and alternator develops desired voltage, a signal for closing of the generator circuit breaker shall be given on control panel.
- d. The Main HT panel shall have supplies as input from both 2000 KVA D.G.set.
- e. Unit shall pass signal to D.G.set and the D.G.set will start and develop the supply. Supply is available at incomer of D.G. set's VCB in Main HT panel. Master DG sets Incomer will close immediately
- f. The parameters for other DG Power supply through controller shall be checked for synchronization between DG set on main Bus of Main HT panel. Once the parameter of DG sets will match with each other, the controller of Slave DG set will give signal to DG set's VCB to close and DG Set's VCB of slave DG set will close automatically through DG Controller.
- g. Now the DG set is synchronize on main Bus and supply power on main HT panel's common Bus and Power shall be available at downstream panel for utilization.
- h. Differential protection Relay will be installed in Main HT panel , Phase CTs and Neutral CT in Alternator shall be supplied by DG supplier , Main Purpose of DPR is to trip Main HT Panel VCB during differential in Alternator and Signal has to be given to controller from the DPR to trip the engine.
- i. AMF Module will give three impulses to start engine & if engine fail to start in three attempts which will give Audio signal. In this case engine should be started in manual mode by

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pressing manual start P.B. in which, three attempt circuit shall get by-passed & it shall also be started in Test mode by pressing test P.B. in which only three attempt circuit. Can be tested & no impulse will go to D.G.VCB to close.

- j. It shall also be possible to start the engine manually through a push button. A manual/ auto selector switch shall be provided.
- k. Initial low oil by -pass circuit & full proof scheme shall be provided such that in running condition, no impulse shall be concentrated to start cranking motor (starter) due to any fluctuation.
- l. On restoring of mains, Main HT panel with single bus, signal is given to the DG feeder of Main HT panel. The panel will transfer the load automatically to Mains and Open the D.G.VCB.
- m. An audio-visual fault annunciation system with Accept & reset facilities for following fault shall also be provided with circuit trip D.G.VCB & D.G.Set. The following signals and indication can be incorporated within the DG power panel or to be given in separate control box.
 - 1) Low Oil pressure
 - 2) Over speed
 - 3) High water jacket temp
 - 4) Engine failed to start.
 - 5) Over load relay operated
 - 6) Mains failed.
 - 7) High or low frequency.
 - 8) High or low voltage.
 - 9) Generator trouble.
 - 10) Over-current and Earth fault.
 - 11) Battery over-voltage or under-voltage.
- n. All control wiring inside the DG Control Panel shall be carried out with 2.5 sq. mm 650V grade insulated copper wires.
- o. The panel shall be provided with cubicle illuminating lamp of CFL type with door operating unit switch.
- p. Earthing of in-built components shall be provided and brought at one termination point.
- q. Control system for the diesel generator shall be of automatic mains failure or manual.
- r. During the operation, incase total requirement goes below , the auto load sharing mode shall get activated.

3.3.31 Technical Requirements

(A) Indication Window Fascia

- Low lube oil pressure
- High water temp
- Engine over speed
- O/L of alternator
- Earth fault of alternator
- Winding temp high
- Bearing temp high

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- D.G.Set on Load
- Not in Auto (Controller In Manual mode or OFF mode)

(B) Other Provisions

- Set control terminals
- Push button
- Space heater MCB
- Static battery charger with trickle/boost mode auto/manual selector switch with DC Ammeter & DC voltmeter.
- Reset push button for unhealthy condition like over speed/high water temp/low lub. oil pressure etc.

(C) AMF module

- Mains power sensing relay with timer for Auto start set while mains supply is not there.
- The AMF logic shall constantly monitor EB supply & wherever EB supply fails it shall start the DG set and give command to DG ACB to close and then give command to PurchaserACB in Main LT Panel.
- The AMF panel shall have auto/manual selector switch on Auto work, DG Set shall start automatically when EB power fails in manual mode. It shall be possible to start DG set irrespective of status of SEB supply.
- In auto mode DG can be stopped by automatic mode with manual override.

NOTE: This module shall switch ON/OFF the Standby D.G. Automatically depending on non availability / availability of main EB Power & accordingly supply power to the downstream loads. The operation shall be as under.

Case 1: On failure of Electricity Board Power:

- a) The AMF module senses the EB supply failure by means of line voltage monitors (LVM's)
- b) The LVM Contact shall start the DG automatically (an adjustable time delay is introduced here to take care of momentary EB failure so that DG does not start unnecessarily and shall break the EB breaker.
- c) After auto-starting, once the DG has attained full voltage, the DG side breaker is closed in the AMF circuit.
- d) The supply from DG is thus automatically transferred to downstream loads.

Case 2: On restoration of EB supply, the AMF module shall perform the following functions.

- a) The LMV senses presence of EB supply.
- b) LVM contact with time delay switches off the DG Side and switch on EB breaker.
- c) After some time delay, the DG will be automatically switched off (this delay is given to avoid restarting of DG if the EB supply restoration was only momentary).

2.3.4.28 Auxiliary Supply:

- a) The Purchaser shall make separate arrangement for providing low tension AC & DC power supply for control and auxiliary use. The Supplier shall give in his tender the estimate for AC & DC power required for the equipment covered by this specification.
- b) The auxiliary supply voltage available is as follows:

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S No.	Particulars	Details
1	Power devices (like drive motors etc)	415V, 3 phase, 4 wire, 50Hz AC supply with one point grounded
2	AC control and protective devices	240V, 1 phase, 2 wire, 50 Hz AC supply with one point grounded
3	DC for alarm, control and protection devices	11 KV DG Sets - 2 wire ungrounded DC supply from batteries and battery charger. The ripple content in the DC supply from the charger will be less than 2%

c) The above supply voltage may vary as follows:

S No.	Type of Supply	Variation
1	AC supply	Voltage variation +10% to -30% Frequency variation \pm 5% Both variations may occur simultaneously or independently
2	DC supply	+10% to -20%

d) Each of the foregoing supplies will be made available by Electrical Contractor / Purchaser at one terminal point for each equipment for operation of accessories and auxiliary equipments. In case of 110V, AC supply is required; the Supplier shall include adequately rated 415/110V control transformers for each equipment. Supplier scope of supply shall include distribution beyond the points of supply, including supply of interconnecting cables between instruments and terminal blocks.

2.3.4.29 Co-ordination of Drawings of associated equipments of other manufacturers:

- a) The Purchaser intends to procure all other equipments associated with these control and relay panels from other manufacturers. The supplier is therefore required to co-ordinate the control and wiring schematics of these control and relay panels with control and wiring schematic of the other equipment manufacturer.
- b) The Purchaser will intimate the supplier the details of the other equipments manufacturers on whom purchaser orders have been placed for the supply of these equipments along with such relevant details such as P.O. No. and date, delivery period, and all other technical details such as rating data, wiring diagrams etc. The supplier shall co-ordinate these diagrams with that of the associated control and relay panels, and shall also seek such clarifications as are necessary from these manufacturers under intimation to the Purchaser.
- c) The Purchaser will assist and or furnish the supplier with all relevant data as are necessary for completeness of co-ordination of the wiring diagrams and interlocking of equipment circuits.

2.3.4.30 Drawings and Manuals:

a. Tender drawings and literatures:

The following drawings and literatures shall be submitted along with tender documents.

- a) Principal layout drawings of the Simplex control and relay panels with mimic bus, disposition of meters, control switches, relays and annunciator panel, etc. These layout drawings shall be for the following views with Dimension , Weight preliminary GA Drawings :

- Plan

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- Front face of panel.
 - Inside view of panel.
- b) Descriptive literature with photographs of similar panels supplied by the manufacturer.
 - c) Pictorial and sectional views of control switches, test terminal blocks, indicating instruments, exploded views of draw out type instruments etc.,
 - d) Printed copies of Descriptive literature, general technical data, performance application, and specifications of relays, fault locators, etc.,
 - e) Elementary schematic wiring diagrams of the various metering and protective schemes.
 - f) Guaranteed technical particulars of the equipment.
 - g) Approximate dimensions and weight and preliminary GA drawings as follows.
 - h) Foundation plan showing location of fixing channels, floor openings etc.
 - i) Schematic wiring diagram.

b. Contract Drawing:

Within two weeks of order, vendor shall submit 4 sets of following documents for Purchaser's/Consultant's approval prior to manufacture:

- Drawings
- GTP
- Test report

After the drawings are approved six copies of each of the shall be supplied for immediate use.

The contract drawings shall cover the following

- a) The manufacturer shall develop his own general arrangement and schematic drawing adding necessary auxiliary devices, accessories, components particular to supplied equipments etc. which are required for safe, convenient, efficient and proper operation of the Panel based on principal layout drawing
- b) Set of General arrangement drawing for panel showing constructional features and space required in the front and back , power and control cable entry points, location of various devices, terminal blocks, cross sectional details, Power & Control wiring diagram. These diagrams shall show any wiring inside the cubicle starting from the cubicle terminal strips. These diagrams shall be used by the employer for trouble shooting and shall show any device, terminal and wire number shall be submitted
- c) Foundation drawings indicating the cable entries and trenches etc.
- d) Elementary diagrams of all controls, metering, protection, annunciation and other circuits. All devices shall be numbered according to ASA code.
- e) Cabling and wiring diagram of the front and rear cubicles and interconnections between them. Ferrule numbers device members, grouping for cable take offs etc., shall be distinctly shown.
- f) Inter-connection diagram between switch board and switchgear equipment, power transformers, instrument transformers and other associated equipment.

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- g) Dimensional outline, drilling diagram and special mounting arrangement, if any, of each type of the various devices on the switch board.
- h) Bill of Material with Model number, make, type and quantity.
- i) Individual internal wiring diagram of all devices and elementary wiring diagrams or relays for internal wiring.
- j) Construction details of the switches, terminal blocks and test blocks etc.

- **Literature:**

In the event of an order, four copies of each set of the following literatures shall be supplied.

- a) Literature describing construction, operation, testing, calibration, adjustment, rating, specifications, setting details of all the protective and auxiliary relays and control switches.
- b) Literature giving rated data, details of adjustments for calibration for the indicating instruments and integrating instruments.
- c) List of spare parts, identification number from removable parts of relays, instruments and switches etc., with the help of which the purchaser will be able to procure spare parts from the supplier at any subsequent time.
- d) Performance application of relays.
- e) Detailed internal drawings of all units / schematic diagrams of all, PCB's of the relays, reference voltages at convenient test points, functional description, operational details. This is essential for trouble shooting of the relays.
- f) The literature shall contain wave forms / voltages etc at selected points for easy identification of faulty units within the modular unit.

- **At Final Order Execution stage:**

The following shall be submitted after inspection but before dispatch of the equipment

- a) Manufacturer shall submit four sets of as built drawings with soft copy
- b) Routine test certificate (including all brought out components) in 4 sets
- c) Detail operation manuals in 4 sets
- d) Detailed erection , testing and commissioning manuals in 4 sets

- **Deviations:-**

- a) Deviations from this specification are only acceptable where the Vendor has listed in his technical offer, the requirements he cannot or does not wish to comply with and the Purchaser/Consultant has accepted, in writing, the deviations before order is placed.
- b) If the manufacturer is able to offer alternatives resulting in technical or price advantages they should submit a supplement to the main tender with a separate list of deviations.
- c) In the absence of a list of deviations it will be assumed by the Purchaser/consultant that the Vendor complies fully with this specification.

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2.3.4.31 Inspection & Tests:-

- j. During fabrication, panel shall be subjected for inspection by Purchaser/Consultant or by an agency authorized by the Purchaser. Manufacturer shall furnish all necessary information concerning the supply to inspectors. The Purchaser/ Contractor has right to witness the test carried out on all the equipments.
- k. Tests shall be carried out at the manufacturers' works under his care.
- l. All routine tests on all major components shall be made as per relevant specification.
- m. Inspection of panel including in wiring and electrical operational tests by the Purchaser/consultant before dispatch.
- n. In addition specific tests shall be conducted to check mechanical and electrical operation and panel wiring to this specification and approved schematic drawings.
- o. Shop tests shall be witnessed by an inspector of Purchaser / Consultant or of an agency authorized by the employer.
- p. The Vendor shall give two weeks' notice for the tests prior to commencement.
- q. The Purchaser reserves the right to inspect control and relay panel at the Manufacturer's works at any time prior to dispatch to prove compliance with this specification. The Purchaser shall also have the right to carry out intermediate inspection at Vender's works during manufacturing stage.
- r. **Type Tests :**

The reports for following type tests shall be submitted by the supplier for the Protective relays, Fault locator etc as per relevant standards IS - 3231 or IEC - 60255.

 - Insulation tests as per IEC 60255-5
 - DC Voltage dips and interruptions/Variation as per IEC 6100-4-29.
 - High frequency disturbance test as per IEC 61000-4 16, Class IV (Not applicable for electromechanical relays)
 - Electrostatic discharges as per IEC 61000-4-2, level; 4 (not applicable for Electromechanical relays)
 - Fast transient test as per IEC 61000-4-4, Level IV (Not applicable for electromechanical relays)
- s. **Acceptance tests shall be as follows:**
 - A general visual check. This shall cover measurement of overall dimensions, thickness of panel sheet, location, number and type of devices, terminal boxes, location and connection of terminals etc.
 - Manual and electrical operation of CB/Relays shall be checked under the worst conditions of auxiliary supply voltage.
 - Panel will be completely assembled, wired, adjusted and tested for operation under simulated conditions to ensure correctness of wiring and proper functioning of all equipments. Operation check shall be carried out for every control function as per the approved schematic

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diagrams by manually stimulating the fault conditions and operation of control switches/relays etc.

- Verification of degree of protection as per IS –2147.
- Insulation resistance Test: Insulation Resistance to earth of all the control wiring should be tested with 1000 V Megger.
- One minute HV withstand test – All equipment on panel and internal wiring shall be tested to withstand a voltage of 2.0 KV to earth for one minute.
- Insulation test shall be carried out both before and after high voltage test.
- All current carrying parts and wiring shall be subjected to a high potential test.
- The tests shall include but not necessarily limited to the following:
 - Operation under simulated service condition to ensure accuracy of wiring, correctness of control schemes, protection/ metering scheme and proper functioning of the equipment.
 - All wiring and current carrying part shall be given appropriate High Voltage tests.
 - Primary current and voltage shall be applied to all instrument transformers.
 - Routine tests shall be carried out on all the equipment, which shall be calibrated in accordance with relevant Indian standards.
- Any other test prescribed by relevant Indian Standard shall be carried out upon the Purchaser's request.
- All other components including indicating instruments and accessories installed within the panel shall be subject to type tests, routine tests and acceptance tests according to the standards to which they conform.
- Four copies of test certificates shall be submitted by the vender to the employer for all the items including bought out items.
- For equipment bought from other sub - suppliers certified test reports of tests carried out at the manufacturer's works shall be submitted. Normally, all routine tests as specified in the relevant standards shall be conducted by the sub - supplier at his works.

2.3.4.32 Spares:

- a) The supplier shall recommend in his offer a set of spares as are required for a period of 5 (five) years in respect of relays and instruments quoted. All like spare parts shall be interchangeable with respect to each other and shall therefore be suitable for the parts/components that they would replace.
- b) The supplier shall indicate the life expectancy or shelf life of all such spares and their recommended method of storage.
- c) Itemized unit price rate for each component shall be furnished in the schedule of prices in tender proposal sheets. The purchaser reserves the right to order for the spares which in his assessment are actually required.

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2.3.4.33 Maintenance Tools and Tackles:

- a) The supplier shall offer in his tender a set of special tools as are necessary for routine maintenance and testing of the equipment. These shall include amongst others relay test jacks, patch cords, etc.
- b) The supplier is required to supply these tools arranged neatly in wooden boxes.
- c) Itemized unit price rate of each such tool/equipment shall be furnished in the schedule of prices in tender proposal sheets.

2.3.4.34 Quality Assurance Plan:

- i. The supplier shall invariably furnish the following information along with his offer failing which his offer shall be liable for rejection.
 - a) Names of sub-suppliers of individual accessories.
 - b) Information and copies of test certificates in respect of bought out accessories.
 - c) List of manufacturing facilities available.
 - d) List of areas in manufacturing process where stage inspections are carried out for quality assurance and details of such tests and inspection.
 - e) Type test certificates not older than three years as on the previous date of tender opening.
- ii. The supplier shall within 30 days of placement of order, submit following information to the purchaser.
 - a) List of bought out accessories and the names of sub-suppliers selected from those furnished along with offer.
 - b) Type test certificates of the bought out accessories.
 - c) Quality assurance plan (QAP) with hold points for purchaser's inspection. The quality assurance plan and hold points shall be discussed between the purchaser and supplier before the QAP is finalized.
- iii. The supplier shall submit the routine test certificates of bought out items, at the time of routine testing of the fully assembled panel.

2.3.4.35 Training to Engineers:

- a) The Purchaser requires that training be imparted to eight Engineers of the organization in the testing, commissioning, calibration, adjustment, trouble shooting and attending to routing defects, mal-operations in the relays and instruments supplied. Such training shall be imparted at the supplier's works for a period of not less than 2 (two) weeks and shall be imparted free of cost. The to and fro travel expenses of these Engineers will be borne by the Purchaser including boarding, lodging and other incidental expenses related there to
- b) In case training is to be imparted at the works of the supplier's collaborators. Then the same shall be arranged for by the supplier.
- c) The training shall be imparted before dispatch of the equipment.

2.3.4.36 Packing:-

- a) Control and Relay Panel shall be shipped to suit ease of handling for transportation and installation.

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- b) C & R Panel shipping section shall be provided with supports in the form of suitable steel sections, lifting eyes etc. to maintain alignment of parts during shipping, handling, hoisting and installation. Location of lifting points shall be clearly marked on shipping containers and on drawings. Shipping section shall have its weight and centre of gravity clearly marked on the container.
- c) The control and relay panels shall be dispatched in suitable crates with all instruments, relays, switches and other devices mounted in position and wired. Instruments which cannot be sent in this manner may be separately dispatched.
- d) Preparation for shipment shall protect the panel & accessories, etc. against corrosion, dampness, and breakage or vibration injury during transportation and handling.
- e) Shipping container shall be identified with the contents, purchase order number and item number.
- f) Instructions shall be provided for reassembly of sections in the field. Where bus wiring has to be reconnected after assembly, pre-terminated and ferruled wiring looms shall be provided.
- g) The Vendor shall comply fully with the 'Packing and Shipping' instructions which form part of the Purchase Order.
- h) The packing list for each shipment shall indicate complete details of equipment being shipped to enable to consignee to identify the parts and to ensure that no equipment stated to have been shipped has either lost in transit or if damaged, to initiate replacement proceedings and also to enable the insurance claims to be preferred. If the invoice does not contain full details, if any part not specifically mentioned in the packing list is missing in transit the supplier shall be responsible for supply of such parts to the purchaser without any extra cost.

2.3.4.37 Handling:-

- a. Control and Relay Panel and all its accessories shall be handled carefully in its upright position as indicated in the packing case.
- b. Lifting lugs and jacking pads shall be used for lifting of the panel. While using jacking pads utmost care shall be taken in proper application of jacks.
- c. Where panel is dragged or pulled on sleeper or rollers of the traction eyes provided at the bottom frame shall be used with suitable wire ropes and shackles.

2.3.4.38 Storage:-

Equipments shall be stored under shelter in a well-ventilated, dry place and covered by suitable polythene or tarpaulin covers for protection against moisture.

2.3.4.39 Guarantee:-

The control and relay panel along with the main protection relays offered shall be guaranteed for satisfactory performance for a period of 18 months from the date of arrival at site and 12 months from the date of satisfactory commissioning of Control & Relay Panel.

The equipment/relays if found defective/failed within the above guarantee period shall be replaced or repaired by the supplier free of cost within one month from receipt of intimation. If the defective/failed equipments/relays are not replaced/repared as per the above guarantee clause, the Purchaser shall recover an equivalent amount plus 15% supervision charges from performance bank guarantee

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2.3.4.40 Specified electrical requirement of Control and Relay panel.

- a) Design, Manufacture, offer for inspection, testing, delivery to site assistance in commissioning of the Control and Relay Panel

Sr. No.	Equipment Name	Drawing	Rev
1.0	Control and Relay panel for 11 KV DG sets	NPI/120310/ELC(SLD)/U2/09	01

b) Climate conditions

Design ambient temperature	45° C
Altitude above MS	8 Mtr. from MSL
Relative humidity	50%
Atmosphere	industrial

c) Electrical System Data

Normal operating voltage	415 V
System Earthing	Solidly grounded
Maximum operating voltage	415V ±10%
Nominal Frequency	50 HZ
Frequency Variation	± 3 %
Voltage Variation	±10%
Power Frequency withstand	2.0 KV for 1 Min
Control supply	As specified in SLD

d) Common features for Panel

- a) Fabrication
- a1) Material : CRCA Sheet steel
- c) Degree of protection as per Latest edition of Indian Standard :
Not less than IP – 42 for Indoor application
Not less than IP – 56 for Outdoor application
- c) Thickness of sheet steel in mm for customized panel enclosure :
: Frame enclosure -3.15 mm
Doors, -2.0 mm
Rear Covers & Doors -2.0 mm
Partitions -2.0 mm
Gland Plate -3.15mm
- c) Painting : Powder coated finish not less than 80 microns and shall not be more than 100 micron Color shade unless

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Specified Elsewhere.
Interior -White
Exterior - Opaline Green Shad No 275

d) Earthing Bus : Tinned Copper

e) Customized Panel enclosure

- a) Maximum Height of panel : 2400 mm
- b) Maximum Depth of panel : 600 mm
- c) Minimum Width of panel : 800/1000 mm
- d) Base Frame : ISMC75

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CHAPTER – 2.3.5

TECHNICAL SPECIFICATION FOR

NEUTRAL GROUNDING RESISTOR PANEL

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1. Scope Of Supply

- a. Scope of supply shall cover Design, Engineering, Manufacture and Testing at manufacturer's Works, Packing and Transportation to site of the panel in accordance with the stipulations mentioned as hereunder.

2. Codes & Standards

- a. The panel shall generally comply with the relevant Indian Standard specifications and codes of practice.
- b. In the absence of IS for any particular equipment relevant IEC/IEEE shall be complied with.

3. Constructional Features

- a. The panel shall be completely metal enclosed, indoor type, free standing, floor-mounting type confirming to degree of protection of IP 4X.
- b. The panel shall be fabricated from CRCA sheet steel of thickness not less than 2.0 mm. The panel shall be free from undulations, dents and flaws and sufficiently reinforced to provide level surfaces, resistance to vibration and rigidity during transportation and installation.
- c. The perimeter of all doors and removable cover plates shall be provided all around with neoprene gaskets. All the hinged doors shall be provided with concealed type hinges.
- d. Lifting hooks shall be provided. All hardware shall be zinc plated and passivated.
- e. Control cable entry shall be from the bottom of the panel. Suitable separate compartment for terminals shall be provided inside the panel.
- f. Base frame shall be of ISMC-75 channels with 4 Nos. Holes to suit M12 foundation bolts.
- g. A gap of 250 mm shall be provided between terminal block and the gland plate.
- h. Cable gland support plate 3 mm thick shall be provided.

4. Resistor Features

- a. The resistor element shall be made out of jointless stainless steel punched grid type and will be able to carry the rated current for rated duration as specified in the SLD.
- b. The resistor unit mounted on the grid rods shall be fixed and assembled in tiers (separated by porcelain insulators) and fitted into a sheet steel enclosure.
- c. The complete resistor shall be designed to be lifting using lugs on top of jacking holes at the sides.
- d. Resistors shall be able to carry the specified current for a period of time as specified in the SLD with Temp rise of 760 deg C over the ambient for resistance bank while carrying rated current.
- e. Resistor design and construction shall be as per IEEE 32 standards.

5. Neutral Isolation Arrangement

- a. Vacuum contactor as shown in the SLD shall be provided in the panel for neutral isolation.
- b. The vacuum contactor shall be single pole type with 2 NO + 2 NC potential-free auxiliary contacts and any free contacts shall be wired up to terminal blocks.

6. Indications

- a. Vacuum contactor ON/OFF indication.
- b. Wiring & terminations for vacuum contactor ON/OFF and indication in remote.

7. Earth Connection

- a. Two separate terminal studs complete with washers and nuts of shall be provided for Resistor earth connection.

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8. Panel Wiring

- a. Wiring shall be carried out with 650/1100-volt grade; single core stranded copper conductor wires with PVC insulation. The maximum size of stranded copper conductor and code for wiring shall be as follows:
 - b. Control AC circuit - 1.5 mm²
 - c. CT circuit - 2.5 mm².
 - d. Potential circuit - 1.5 mm²
 - e. DC circuit - 2.5 mm²
 - f. Earthing circuit - 2.5 mm² Green flexible.
- g. Panel wiring shall be securely supported, neatly installed by lacing and tying or in wiring channels.
- h. Wire terminations shall be made with solderless, crimping type of tinned copper lugs, which firmly grip the conductor and insulation. Insulated sleeves shall be provided at all the wire terminations. More than one control wire should be crimped together. Engraved core identification plastic ferrules marked to correspond with the panel-wiring diagram shall be fitted at both ends of wire. Ferrules shall fit tightly on the wires and shall not fall off when the wire is disconnected.

9. Terminal Blocks

- a. All the terminal blocks shall be Elmex make CATM4 type and for disconnecting type terminal blocks (CT terminal blocks) shall be CATDM4 type.
- b. C.T. secondary leads shall be provided with short-circuiting and earthing facility.
- c. At least 20% spare terminals shall be provided and these shall be uniformly distributed on all rows of terminal blocks.
- d. There shall be a minimum clearance of 250 mm between the first row of terminal block and associated cable gland plate. The clearance between two rows of terminal block shall be minimum 150 mm.
- e. Not more than two wires shall be connected to any terminal. Necessary number of terminals shall be jumpered together to provide wiring points by using shorting links.

10. Labels

- a. All front mounted equipment as well as equipment mounted inside the panel shall be provided with individual labels with equipment designation engraved. The labels shall be mounted directly below the respective equipment.
- b. All front mounted equipment shall also be provided with engraved labels at the rear, corresponding to the ones shown in the panel internal wiring diagram. These shall be mounted by the side of respective equipment and shall not be hidden by the equipment wiring.
- c. The panel shall be provided at the front top with a label engraved with panel designation.
- d. Labels shall be made of non-rusting metal. Labels shall have white letters on black background. Labels shall be fastened using screws. Use of adhesive is not permitted.

11. Earthing

- a. The panel shall be fitted with an earth bus, securely fixed along the inside base of the panel. Provision shall be made for extending the earth busbars to future adjoining panels on either side. Material and size of earth bus shall be as specified in the specification sheet.
- b. All metallic cases of relays, instruments and other panel-mounted instruments shall be connected to earth bus by independent insulated copper wires as per applicable standards.
- c. PT and CT secondary neutral or common lead shall be earthed at one place only at the terminal blocks where they enter the panel.
- d. Insulation between the live terminal and earth prior to connection of the earth to the Purchaser's earth grid shall withstand a test voltage of 500V for one minute (or have resistance of not less than one mega Ohm of 500V).

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12. Painting

- a. Pre-treatment of all sheet steel work including degreasing, rust/scale removal, phosphating and oven drying shall be done as per applicable standards.
- b. After pre-treatment panel shall be powder coated as per applicable standards and the color shade shall be RAL 7032.

13. Inspection & Testing

- a. Our representative will visit works during manufacturing to assess the progress of work as well as to ascertain the quality as per approved QAP.
- b. All equipment and accessories shall be tested at works prior to despatch and certified test report shall be submitted. Testing shall be done in accordance with the relevant standards.
- c. We reserve the right to witness final test at the works. To enable us to depute our representative, prior notice as agreed shall be given by the vendor.
- d. Inspection by us, however, will not absolve the vendor from their responsibility for good design, material and for satisfactory performance of the equipment and as such, they have to make good any defects noticed subsequently.

14. Quality Assurance Plan

- a. The panel shall be manufactured as per Vendor's approved Quality Assurance Plan.

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CHAPTER– 2.4

PREAMBLE TO SCHEDULE OF QUANTITIES

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2.4 GENERAL NOTES:

- 2.4.1 All items of work mentioned in the Schedule of Quantities shall be read and executed strictly in accordance with the description of the item in the Schedule of Quantities, equipment schedule/ Data sheet ,drawing and standard specifications read in conjunction with the appropriate IS and conditions of contract.
- 2.4.2 The rate for each item of work included in the bill of quantities shall unless expressly stated otherwise include cost of:-
- All materials, fixing materials, accessories, hardware, operations, tools, equipment, consumables, civil works wherever involved and incidentals required in preparations for in the full and entire execution and completion of the work called for the item and as per specifications and drawings completely.
- a) Wastage on materials and labour.
 - b) All taxes, duties., including, sales tax, transit insurance, packing and forwarding charges, loading , transportation at site in supplier scope as per good manufacturing practice and recognized principles.
 - c) Octroi if any, receiving, unloading handling, hoisting, to all levels. setting and fixing in position, disposal of debris and all other labour necessary in accordance with Purchaser scope as per good practice and recognized principles.
 - d) Liabilities, obligations and risks arising out of conditions of contract.
 - e) Liaison service charges.
- 2.4.3 All requirements of system whether such of them are mentioned in the item or not the specifications and drawings are to be read as complimentary to and part of the schedule or quantities and any work called for in one shall be taken as required for all.
- 2.4.4 In the event of conflict between the bill of quantities and other documents, the most stringent shall apply and interpretations of the Architect shall be final and binding.
- 2.4.5 No change in unit rate shall be allowed for any change in quantity or for any other reason whatsoever.
- 2.4.6 Supply of materials shall mean supply of materials at site. The rate for supply shall include all taxes, insurance, packing and forwarding charges, transportation at site.
- 2.4.7 The installation of price of switchboards, metering panels, or any other items any supporting structure required to be paid extra exclude grouting of the same civil works etc. as required.
- 2.4.8 The supplier shall submit the Schematic diagrams, fabrication drawings with details of equipment wiring diagrams etc. to Purchaser/ Consultant for approval prior to supply / commencement of such works. The approval of these drawings will be general and will not absolve to supplier of the responsibility of the correctness of these drawings. At least four copies of the approved drawings supplied to Client/Consultant for their distribution to various agencies at site at no cost to client.
- 2.4.9 Any error in description if in quantity or omission of items from the supplier shall not vitiate this contract but shall be corrected and deemed to be a variation required by Client/consultants.
- 2.4.10 The tender shall take into account The expenses of pre-commissioning tests to be conducted as per specification of the complete installation with clients licensed agencies.
- 2.4.11 The Liaison service charges shall include the following :
- Official deposits paid to the above agencies will be reimbursed separately at actual by the Purchasers.

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2.4.12 All testing and calibration charges for the meters shall be included in the installation price of the Meter Board.

2.4.13 The tender shall take into account, the expenses of pre-commissioning tests to be conducted as per specification of the complete installation by licensed agencies.

2.4.14 DEVIATIONS:

Deviation from above specifications is only acceptable if the contractor has listed them in his technical bid and the Employer has accepted them in writing before the work order is placed. If the contractor also wants to offer alternatives resulting in technical and/or price advantages to the employer he should submit a supplement to the main technical bid.

In the absence of a list of deviations, it will be assumed by the Employer that that the contractor complies fully with this specification.

Important : -	
1.	Please Tick (✓) the make of material considered in tender.
2.	Detail submittals in the form of catalogues specification sheets, and samples were called for, shall be submitted one week from the date of order and approvals shall be obtained on the type of accepted make before procurement are made.
3.	Out of the approved makes of materials mentioned above, the make of materials to be used on the work shall be as decided by the Consultant/Employer jointly.
4.	In respect of materials for which approved makes are not specified above, these will be of makes to be decided by the consultant and as per sample approved before procurement.
5.	Equipments approved and supplied shall have local servicing facilities available in the region.

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CHAPTER– 2.5

BILL OF QUANTITIES

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Project No : 120310	DOCUMENT NO : NPI-120310-ELC-S1-TD-02	Revision : 01 Date : 2014.07.29

Sl. No.	DESCRIPTION OF WORK	UNIT	Total Qty.	SUPPLY(Inc. of all taxes)		INSTALLATION(Inc. of all taxes)		TOTAL AMOUNT IN RS.(Inc. of all taxes)
				UNIT RATE	AMOUNT	UNIT RATE	AMOUNT	
				Rs.	Rs.	Rs.	Rs.	
1	DIESEL GENERATOR :-							
1.1	Design, manufacture, supply, loading & unloading, erection, testing and commissioning of 11 KV, 2000 KVA DG Set Prime power ,Radiator cooled 1500 RPM , 3P , 50 Hz , 0.8 PF with alternator complete with standard accessories Mounted on a Channel Iron Base Frame and acoustic enclosure , all fittings and accessories as required/ as specified in the technical specification.	Nos.	2					
	2000 KVA capacity							
	>> Acoustic enclosure with Ventilation System							
	>> Radiator cooled							
	>> Residential type silencer							
	>> Anti-vibration mounts							
	>> Battery with Battery charger							
	>> Stand by Oil Pump's starter							
	>> Engine operator/instrumentation panel							
	>> The Governing system of the Diesel genets shall be compatible with the Synchronizing and auto load sharing.							
	>> Adaptor Box with Copper Busbar suitable for 2000 KVA Alternator							

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	>> 990 Ltr. MS Tank with Glass Tube type Level indicator for measurement (Tank shall be part of Accoustic enclosure)with In built fuel piping system							
	>> Other accessories as required.							
	>> 1 Hrs. FAT on 100% Load & 15 minutes . FAT on 110% Load							
	>> 8 Hrs. on average 80% load at site (SAT) , Fuel & load cost will be in scope of Purchaser							
	TOTAL FOR DIESEL GENERATOR							
2	ELECTRICAL PANELS							
	Supply, manufacturing ,testing at workshop (FAT), delivery at site, unloading at site, shifting, installation, testing & commissioning of Electrical panel as per Single Line Drawing(SLD) complete as required along with the erection materials or hardware. Panels are installed at First floor. The installation job includes aligning, leveling, grouting, any modification/ alteration to be carried out in individual shipping section for proper alignment & matching with other sections, interconnection of shipping section & requisite interpanel wiring between shipping section, testing, commissioning, release							

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				Rs.	Rs.	Rs.	Rs.	
	setting, relay setting and calibration of relays and meters as per specification, approved drawings, manufacturer's instruction if any and the direction of Engineering-charge.							
2.1	Supply, design, delivery, erection, testing and commissioning of Genset Auxiliary MCC Panel as per the specifications complete with connection of earthing etc. as required. As per reference. SLD Dwg: NPI/120310/ELC(SLD)/U2/08Rev-01 Vendor to confirm about the auxiliary equipment requirement with rating and quote accordingly.	Nos.	1					
2.2	Supply, design, delivery, erection, testing and commissioning of Genset Relay and control Panel as per the specifications complete with connection of earthing etc. as required. As per reference. SLD Dwg: NPI/120310/ELC(SLD)/U2/09Rev-01 Vender can consider combined or separate for DG Sets	Nos.	2					
2.3	NIS/NGR Panel 11KV 30.25 Ohms 105Amps for 10Secs suitable for temperature rise of 760 Deg C as per IEEE-32 As per reference. SLD Dwg: NPI/120310/ELC(SLD)/U2/10 Rev-01	Nos.	1					

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				Rs.	Rs.	Rs.	Rs.	
	TOTAL FOR ELECTRICAL PANELS							
3	EXHAUST SYSTEM							
	Supply, receive at site, store, unpack, assemble and connect Exhaust pipe as per IS 3589 ERW MS pipe industrial heavy duty with 6 mm thick with flanges, (Vendor to confirm the size of Exhaust system pipe)							
3.1	400 NB for horizontal & Vertical `	Mtr.	180					
3.2	16" Bellows	Mtr.	4					
3.3	Insulation and cladding of 400 NB pipe 50 mm Thick mineral wool of density)120Kg/M3, cladding with 24 SWG Aluminum sheet	Mtr.	180					
3.4	Silencer cladding	Nos	4					
	TOTAL FOR EXHAUST SYSTEM							
4	SUPPORTING STRUCTURE :							
	Supply & Fabrication with steel sections and erection of MS base frames , MS angle channels , flat etc for supporting various items of equipment Exhaust horizontal pipe and Residential silencer, cable tray, fuel tank stand etc with antirust coat of approved primer and two finished coats of	MT	15					

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				Rs.	Rs.	Rs.	Rs.	
	<p>approved paint Self Supporting Common MS Structure with antirust coat of approved primer and two finished coats of approved paint for 2nos of 2000Kva Dg sets.</p> <p>Including welding, bolting, chipping , grouting etc, including breaking and finishing of walls, floors etc.</p> <p>The scope is inclusive of minor civil_[pk4] work as required, supply & installation of GI hardware materials, consumables, anchor fasteners, tools & tackles and necessary labour with supervision but not limited to, and complete as per approved drawings, specification and directions of Engineer-In-Charge. Scope also includes contractor's own lifting and transporting arrangement. The scope also includes</p>							
	TOTAL FOR SUPPORTING STRUCTURE							
5	FUEL SYSTEM							
5.1	Installation of 990 Ltrs. Fuel day tank & Supply & Installation of level switch (with 2 levels only for DG Tank)	Set	2					
5.2	Installation of 990 Ltrs. Fuel make up tank & Supply & Installation of level switch (with 2 levels	Set	1					

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				Rs.	Rs.	Rs.	Rs.	
	only for DG Tank)							
5.3	Supply & Installation of 1 1/2" Class 'C' MS pipe _[pk5]	Mtr.	50					
	TOTAL FOR FUEL SYSTEM							
6	POWER AND CONTROL CABLES :-							
	Supply, transportation, Unloading, shifting, laying, testing and commissioning of 1.1KV Grade XLPE/PVC insulated copper/aluminum conductor, steel of armoured , power cables as per the specification. Also the scope includes clamping of cables by ready-made G.I. spacers, saddles or clamps fabricated out of M.S. strip 3 mm thick along horizontal/vertical runs and wherever specified, cutting of the cable as per actual measurement/cable schedule, Tracing and Clamping of Cable on cable tray, supply of all clamping materials and hardware etc., providing cable tags made out of aluminum strip and 75x20 mm in size with cable number and size punched on it. Cable tags shall be tied to cables at every 20 meter interval and at both the ends of cable							
	The same shall hold good for cable termination also. The rates quoted shall be for laying in trays, cable							

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	trenches (indoor and outdoor), pipes, buried etc.							
6.1	Supply, laying, testing & commissioning of 1.1 kV grade, armoured, PVC insulated multi core Cu conductor LT control Cable including necessary cleats, clamps end connection with gland & termination etc. for DG sets							
6.1.1	4X _[pk6] x 2.5 mm ² LT PVC insulated multi stranded type copper conductor PVC transparent outer sheathed Shielded cable	Mtr.	240					
6.1.2	8 C x 1.5 mm ² LT PVC insulated single stranded type Copper conductor PVC outer sheathed armoured cable (YWY).	Mtr.	120					
6.1.3	2 C x 2.5 mm ² LT PVC insulated single stranded type Copper conductor PVC outer sheathed armoured cable (YWY).	Mtr.	120					
6.1.4	4 C x 2.5 mm ² LT XLPE insulated single stranded type Copper conductor PVC outer sheathed armoured cable (2XWY).	Mtr.	300					
6.1.5	12 C x 2.5 mm ² LT PVC insulated single stranded type Copper conductor PVC outer sheathed armoured cable (YWY).	Mtr.	120					
6.1.6	4 C x 4.0 mm ² LT XLPE insulated single stranded	Mtr.	120					

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				UNIT RATE	AMOUNT	UNIT RATE	AMOUNT	
				Rs.	Rs.	Rs.	Rs.	
	type Copper conductor PVC outer sheathed armoured cable (2XWY).							
6.2	Supply and installation of the indoor terminations with Double compression heavy duty type Brass-Nickel cable gland , lugs & PVC Shrouds. , etc. complete as required.							
6.2.1	4C x 2.5 mm ² LT PVC insulated multi stranded type copper conductor PVC transparent outer sheathed Shielded cable . (Similar to "SKINTOP-MSR-M in LAPP make)	Nos.	16					
6.2.2	8 C x 1.5 mm ² LT PVC insulated single stranded type Copper conductor PVC outer sheathed armoured cable (YWY).	Nos.	4					
6.2.3	2 C x 2.5 mm ² LT PVC insulated single stranded type Copper conductor PVC outer sheathed armoured cable (YWY).	Nos.	4					
6.2.4	4 C x 2.5 mm ² LT XLPE insulated single stranded type Copper conductor PVC outer sheathed armoured cable (2XWY).	Nos.	8					
6.2.5	12 C x 2.5 mm ² LT PVC insulated single stranded type Copper conductor PVC outer sheathed armoured cable (YWY).	Nos.	8					
6.2.6	4 C x 4.0 mm ² LT XLPE insulated single stranded type Copper conductor PVC outer sheathed armoured cable (2XWY).	Nos.	4					

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				Rs.	Rs.	Rs.	Rs.	
	TOTAL FOR POWER & CONTROL CABLES							
7.0	EARTHING SYSTEM:							
7.1	Supply, installation, testing & commissioning of earth stations with necessary all materials (Hardware, charcoal & salt) labour, excavation & back filling etc. including supply of earth electrodes as per Indian Standard specification IS:3043 & Civil work like making of earthing chamber with Chamber cover etc. complete as required							
7.1.1	Supply and installation of earthing station as per IS standard complete with 600x600x3.15mm Copper plate earthing electrode plate, salt, charcoal, 2 nos. 40x6 mm Copper Conductor upto test link, 40 mm dia G.I. watering pipe with funnel, test link as per standard drawing. The earthing chamber size shall be 450x450 mm with heavy duty C.I. Manhole chamber duly painted and marked with pit identification number both inside and outside as per earthing Layout Drawing The scope also includes the supply of Bi-metallic plate (COPAL) to connect the earthing electrodes with grid earthing strip. As per reference Dwg: NPI/120310/ELC(STD)/S1/01Rev-00	Nos.	4					

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7.1.2	Earth Pit: Supply and Installation of earthing station as per IS standard complete with 3.0 mtrs long 100 mm dia. GI Pipe electrode with Cap and test link, salt, charcoal, etc complete with masonry chamber (made out of cement, sand etc.). The chamber size shall be fitted with 450 x 450 mm with heavy duty C.I. chamber Cover duly painted and marked with Pit Identification Number both inside and outside as per Earthing Layout Drawing. As per reference Dwg: NPI/120310/ELC(STD)/S1/03 Rev-00	Nos.	6					
7.2	Supply , transport , unloading , shiting , installation & laying of Tinned copper bare earth conductor bar / flexible wire /strip of following sizes along the cable trenches or cable trays or fixing to walls or structures or below the slab , burries individually in paved/unpaved areas including supply of earthing strip and minor civil work finishing after laying of earthing strips etc. The installation shall include drilling of holes, connection & crimping of adequate lugs, clamping, hardware material, Bolted joints shall be used for Aluminum strips. All Hardware shall be as per the MOC of Earthing strip.							
	'The scope also includes Excavation & backfilling of soil for burying the strip wherever applicable							

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				Rs.	Rs.	Rs.	Rs.	
7.2.1	50 x 6 GI. strip body earthing	Mtr.	180					
7.2.2	25 x 3 GI. strip Lightning Arrestor	Mtr.	90					
7.2.3	50 x 6 CU . strip for neutral Earthing	Mtr.	120					
7.2.4	8 SWG CU Wire	Mtr.	200					
	TOTAL FOR EARTHING SYSTEM							
8	SAFETY EQUIPMENTS:							
8.1	Safety items like Rubber Mats, Fire Extinguishers (DCP), Danger Boards, Buckets, First Aid Chart, etc. 1 no. 5 kg dry chemical type fire extinguisher, 1 no. 9 Ltr. Mechanical foam type fire extinguisher, 2 meter rubber mat, 2 nos. danger board, 1 no. bucket stand with buckets & 2 nos. first aid chart considered.	Set	2					
8.2	Lightning Arrestor , Aviation Lamp & 25X3 GI Strip for Exhaust Structure	Set	1					
	TOTAL FOR SAFETY EQUIPMENTS							
9	STATUTORY APPROVALS : Official charges to purchaser account (Statutory charges will be paid by the purchaser on submission of demand notice/challan)							
9.1	Liaison charges for obtaining approval from CEIG/CEA / State and Local Authority and Pollution	LS	1					

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	Control board for installing and running of DG Set including preparation and submission of required layout and schematic drawings.							
	TOTAL FOR STATUTORY APPROVALS							
1	TOTAL FOR DIESEL GENERATOR							
2	TOTAL FOR ELECTRICAL PANEL							
3	TOTAL FOR EXHAUST SYSTEM							
4	TOTAL FOR SUPPORTING STRUCTURE							
5	TOTAL FOR FUEL SYSTEM							
6	TOTAL FOR POWER AND CONTROL CABLE							
7	TOTAL FOR EARTHING SYSTEM							
8	TOTAL FOR SAFETY EQUIPMENTS							
9	TOTAL FOR STATUTORY APPROVALS							
	TOTAL							
	GRAND TOTAL(IN FIGURES)							
	GRAND TOTAL (IN WORDS)							

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CHAPTER– 2.6

TECHNICAL DATA SHEET

Client : 	TENDER DOCUMENT FOR SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF HT DG SET AT IVC HBL, CHENGALPATTU	nne pharmaplan®
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DATA SHEET FOR D.G.SET TO BE FILLED BY VENDOR:-

NAME OF THE MANUFACTURER: -

M/S. _____

S N	ITEMS	RATINGS/PARTICULARS
2.6.1	DIESEL GENERATING SETS	
2.6.1.1	GENERAL	
2.6.1.1.1	MAKE/TYPE	
2.6.1.1.2	BHP AT RATED RPM	
2.6.1.1.3	NOs. OF CYLINDERS	
2.6.1.1.4	TYPE OF ASIRATION	
2.6.1.1.5	OVERLOAD CAPACITY	
2.6.1.2	COOLING	
2.6.1.2.1	TYPE OF COOLING	
2.6.1.2.2	LIST OF EQUIPMENT PROVIDED IN COOLING SYSTEM	
2.6.1.3	LUBRICATING SYSTEM	
2.6.1.3.1	TYPE OF SYSTEM	
2.6.1.3.2	LIST OF EQUIPMENT PROVIDED IN LUBRICATION SYSTEM	
2.6.1.4	FUEL SYSTEM	
2.6.1.4.1	TYPE OF FUEL FOR ENGINE	
2.6.1.4.2	RELEVANT CODE NUMBER OF FUEL	
2.6.1.4.3	LIST OF EQUIPMENT PROVIDED IN FUEL SYSTEM	
2.6.1.4.4	ALL PIPING , VALVES ETC PROVIDED IN FUEL SYSTEM	
2.6.1.5	EXHAUST SYSTEM	
2.6.1.5.1	HEIGHT OF THE EXHAUST PIPE	
2.6.1.5.2	TYPE OF SILENCER	
2.6.1.5.3	ANTI VIBRATING SPRING MOUNTING PROVIDED	
2.6.1.5.4	NECESSARY INSULATION PROVIDED IN EXHAUST PIPE	

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S N	ITEMS	RATINGS/PARTICULARS
2.6.1.6	STARTING SYSTEM	
2.6.1.6.1	BATTERIES MAKE/TYPE	
2.6.1.6.2	AH RATING OF BATTERY	
2.6.2	ALTERNATOR	
2.6.2.1	MAKE	
2.6.2.2	MODEL	
2.6.2.3	RATED CONTINUOUS KW (NET OUTPUT) AS PER IS 4722 ON UNITY POWER FACTOR	
2.6.2.4	VOLTAGE VARIATION	
2.6.2.5	FREQUENCY VARIATION	
2.6.2.6	RATED SPEED	
2.6.2.7	FULL LOAD CURRENT AT RATED KVA	
2.6.2.8	INSULATION CLASS	
2.6.2.9	TEMPRETURE RISE OVER 50°C AMBIENT	
2.6.2.10	ENCLOSURE CATEGORY	
2.6.2.11	TYPE OF VOLTAGE REGULATOR	
2.6.2.12	TERMINAL BOX SUITABLE OF SANDWICH BUS DUCT	
2.6.2.13	EFFICIENCY AT RATED POWER FACTOR	
2.6.2.14	AT 100% OF LOAD	
2.6.2.15	AT 50% OF LOAD	
2.6.2.16	NO. OF RTD	
2.6.3	ACCESSORIES	
2.6.3.1	ACCESSORIES WITH ENGINE/ALTERNATOR PROVIDED AS PER SPECIFICATION	
2.6.3.2	METERING /PROTECTION AND ACCESSORIES PROVIDED IN GG CONTROL AS PER SPECIFICATION	
2.6.3.3	24 V BATTERY	
2.6.3.4	LIST OF ADDITIONAL ACCESSORIES	

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S N	ITEMS	RATINGS/PARTICULARS
2.6.2	ELECTRICAL PANEL	
2.6.2.1	MAKE	
2.6.2.2	ENCLOSURE MAKE	
2.6.2.3	LT SWITCHGEAR (GENERAL)	
2.6.2.3.1	SHEET METAL THICKNESS	
2.6.2.3.2	SHORT TIME RATING (1sec)	
2.6.2.3.3	ONE MINUTE POWER FREQUENCY WITHSTAND VOLTAGE	
2.6.2.4	BUSBAR	
2.6.2.4.1	MATERIAL OF BUSBAR & SECTION	
2.6.2.4.2	BUSBAR SLEEVING PROVIDED	
2.6.2.4.3	MAXIMUM CONTINUOUS CURRENT RATING	
2.6.2.4.4	SHORT TIME RATING (1sec)	
2.6.2.4.5	CLEARNACE IN AIR	
A	BETWEEN PHASEs	
B	BETWEEN PHASE & NEUTRAL	
C	BETWEEN PHASE & EARTH	
D	BETWEEN NEUTRAL & EARTH	
2.6.2.4.6	MAXIMUM TEMPRATURE RISE AT FULL LOAD CURRENT AT AMBIENT TEMPRATURE	
2.6.2.7	AIR CIRCUIT BREAKER	
2.6.2.7.1	MAKE	
2.6.2.7.2	TYPE	
2.6.2.7.3	NoOs. OF POLEs	
2.6.2.7.4	NOMINAL CURRENT RATING	
2.6.2.7.5	RATED VOLTAGE	
2.6.2.7.6	CURRENT RATING AT SITE CONDITION (INSIDE THE PANEL)	
2.6.2.7.7	BREAKING CAPACITY WITH RELEASE	
2.6.2.7.8	SHORT TIME RATING (1 Sec)	
2.6.2.7.9	TYPE OF RELEASE	
2.6.2.7.10	MECHNICAL TRIP PUSH BUTTON PROVIDED	
2.6.2.7.11	NOs. OF AUXILARY CONATCT & THEIR RATING	
2.6.2.7.12	MECHNICAL INTERLOCK BETWEEN ACBs PROVIDED	
2.6.2.8	MINIATURE CIRCUIT BREAKER	
2.6.2.8.1	MAKE	
2.6.2.8.2	TYPE	

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S N	ITEMS	RATINGS/PARTICULARS
2.6.2.8.3	SHORT TIME RATING (1 Sec)	
2.6.2.9	CONTACTOR	
2.6.2.9.1	MAKE	
2.6.2.9.2	TYPE	
2.6.2.9.3	RATED VOLATGE	
2.6.2.9.4	NOS. OF AUXILIARY CONATCS	
2.6.2.10	SELECTION SWITCH	
2.6.2.10.1	MAKE	
2.6.2.10.2	TYPE	
2.6.2.10.3	RATED VOLATGE/RATED CURRENT	
2.6.2.10.4	NOS. OF POSITIONS	
2.6.2.11	FUSES	
2.6.2.11.1	MAKE	
2.6.2.11.2	TYPE	
2.6.2.11.3	RATED VOLATGE	
2.6.2.12	GROUND/EARTH BUS	
2.6.2.12.1	CONTINUOUS GROUND BUS PROVIDED	
2.6.2.12.2	SIZE OF GROUND BUS	
2.6.2.12.3	MATERIAL	
2.6.2.12.4	SECTION OF GROUND BUS	
2.6.2.13	PUSH BUTTONs	
2.6.2.13.1	MAKE	
2.6.2.13.2	TYPE	
2.6.2.14	INDICATING LAMPs(LED)	
2.6.2.14.1	MAKE	
2.6.2.14.2	TYPE	
2.6.2.15	INDICATING METERS	
2.6.2.15.1	MAKE	
2.6.2.15.2	TYPE	
2.6.2.15.3	ACCURACY CLASS	
2.6.2.15.4	VA BURDEN	
2.6.2.16	CURRENT TRANSFORMER	
2.6.2.16.1	MAKE	
2.6.2.16.2	TYPE	
2.6.2.16.3	ACCURACY CLASS	
2.6.2.16.4	VA BURDEN	

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S N	ITEMS	RATINGS/PARTICULARS
2.6.2.16.5	CURRENT RATIO	
2.6.2.17	TERMINAL BLOCKs	
2.6.2.17.1	MAKE	
2.6.2.17.2	TYPE	
2.6.2.17.3	CURRENT RATING /VOLATGE GRADE	
2.6.2.17.4	SUITABLE FOR TERMINATION UPTO ----- Sqmm	
2.6.2.18	DIMENSIONS OF PANEL (mm)	
2.6.2.18.1	LENGTH	
2.6.2.18.2	WIDTH	
2.6.2.18.3	DEPTH	
2.6.2.19	PAINTING	
2.6.2.19.1	INSIDE	
2.6.2.19.2	OUTSIDE	
2.6.2.20	DIMESION OF THE PANEL BOARD (mm)	
2.6.2.20.1		
2.6.2.21	CABLE ENTRY OF THE PANEL BOARD (mm)	
2.6.2.21.1		
2.6.3	NEUTRAL GROUNDING RESISTOR	
2.6.3.1	Model and Catalogue no of NGR	
2.6.3.2	Outline Drawing in.	
2.6.3.3	Voltage Rating	
2.6.3.4	Resistance @ Design Ambient Temperature	
2.6.3.5	Maximum Average Temperature rise above design temperature	
2.6.3.6	Heater Rating	
2.6.3.7	Material of Construction	
2.6.3.8	Resistance Material	
2.6.3.9	Insulation Material	
2.6.3.10	Enclosure	
2.6.3.11	Dimension	
2.6.3.12	Length in mm	
2.6.3.13	Width in mm	
2.6.3.14	Height in mm	
2.6.3.15	Weight in Kgs	
2.6.4	CONTROL AND RELAY PANEL	
2.6.4.1	Make and Type reference of manufacturer	

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S N	ITEMS	RATINGS/PARTICULARS
2.6.4.1.1	Type	
2.6.4.1.2	Type of construction. (duplex or simplex)	
2.6.4.2	Thickness of sheet steel (mm):	
2.6.4.2.1	Door, Top and Bottom of panel	
2.6.4.2.3	Other	
2.6.4.3	Tentative overall dimensions	
2.6.4.3.1	Length	
2.6.4.3.2	Width	
2.6.4.3.3	Height	
2.6.4.4	Dead weight of panel in Kgs	
2.6.4.5	Approximate weight of panel with all components in Kgs	
2.6.4.6	Details of packing for transport	
2.6.4.7	Overall dimensions of transport package in mm.	
2.6.4.7.1	Length	
2.6.4.7.2	Width	
2.6.4.7.3	Height	
2.6.4.8	Approximate gross weight of transport package in Kgs.	
2.6.4.9	Exterior paint film thickness (microns) and paint colour	
2.6.4.10	Interior paint film thickness (microns) and paint colour	
2.6.4.11	Cubicle Lighting	
2.6.4.11.1	Volts	
2.6.4.11.2	Wattage	
2.6.4.11.3	Type of Holder and fitting whether provided with door control switch or not	
2.6.4.12	Safety earthing :	
2.6.4.12.1	Material of conductor	
2.6.4.12.2	Size	
2.6.4.12.3	Surface treatment and finish of conductor.	
2.6.4.12.4	Type of end connection	
2.6.4.13	Panel front/rear component identity board	
2.6.4.13.1	Material	
2.6.4.13.2	Size	
2.6.4.13.3	Size of lettering and colour	
2.6.4.13.4	Method of fixing	
2.6.4.14	Panel wiring :	

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S N	ITEMS	RATINGS/PARTICULARS
2.6.4.14.1	Type and material of wire conductors, insulation and voltage grade.	
2.6.4.14.2	Conductor cross sectional area or strands/gauge of wire and colour scheme adopted for :	
2.6.4.14.3	VT secondary circuits and annunciation circuit.	
2.6.4.14.4	Other Circuits.	
2.6.4.14.5	Type of wire termination	
2.6.4.15	Mimic bus details :	
2.6.4.15.1	Type painted / strip fixed	
2.6.4.15.2	Width (mm)	
2.6.4.15.3	Whether colour scheme specified will be followed	
2.6.4.15.4	If not specify deviations.	
2.6.4.16	Terminal Blocks and Connectors	
2.6.4.16.1	Make and Type reference of manufacturer	
2.6.4.16.2	Insulation and voltage grade	
2.6.4.16.3	Constructional details	
2.6.4.16.4	Current rating of studs, size and material	
2.6.4.16.5	Whether shrouding provided or not	
2.6.4.16.6	Whether space terminals provided or not	
2.6.4.16.7	Literature enclosed.	
2.6.4.17	Indicating Lamps :	
2.6.4.17.1	Wattage and voltage of lamp	
2.6.4.17.2	Size of lens and material thereof	
2.6.4.17.3	Type of lamp holder	
2.6.4.17.4	Whether provided with series resistor? If yes, specify Ohmic value power loss	
2.6.4.18	Fuse Holders and Fuses :	
2.6.4.18.1	Make and Type reference of manufacturer	
2.6.4.18.2	Insulation and voltage grade	
2.6.4.18.3	Type of Insulation material	
2.6.4.18.4	Type of fuses	
2.6.4.18.5	Rating of fuses provided for different circuits	
2.6.4.18.6	Literature enclosed.	
2.6.4.19	Control Switches for Isolators and Circuit Breaker :	
2.6.4.19.1	Make and Type reference of manufacturer	
2.6.4.19.2	Type of switch :	
A	For CBs	

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S N	ITEMS	RATINGS/PARTICULARS
B	Auto re-close	
2.6.4.20	Number of possible positions of the handle for each type of switch.	
2.6.4.20.1	No. of contacts available in each position	
2.6.4.20.2	Maximum number of contacts which can be accommodated in each position.	
2.6.4.21	Number of lost motion type slip contacts in case of CB switches.	
2.6.4.21.1	After close	
2.6.4.21.2	After trip	
2.6.4.21.3	Maximum number of slip contacts possible	
2.6.4.22	Rating of contacts :	
2.6.4.22.1	Voltage	
2.6.4.22.2	Make and carry continuous current	
2.6.4.22.3	Make and carry current for 1 Sec.	
2.6.4.22.4	Breaking resistive load current.	
2.6.4.22.5	Breaking inductive load current with L/R ratio of 40 milliseconds.	
2.6.4.22.6	Type of contacts and surface treatment	
2.6.4.22.7	Whether contacts shrouded.	
2.6.4.23	Whether locking arrangement is available	
2.6.4.24	Type of handle and standards, If any, to which it conforms.	
2.6.4.24.1	Dimensions	
2.6.4.24.2	Mounting details	
2.6.4.25	Whether detailed technical literature and drawings enclosed. (YES/NO)	
2.6.4.26	Selector Switch :	
2.6.4.26.1	Make and Type reference of manufacturer	
2.6.4.26.2	Type of handle / Switch	
2.6.4.26.3	Mounting details	
2.6.4.26.4	Number of positions	
2.6.4.26.5	Number of contracts available in each position.	
A	Open	
B	Close	
2.6.4.26.6	Making capacity of contacts	
2.6.4.26.7	Breaking capacity of contacts	
2.6.4.26.8	Whether locking arrangement is available.	
2.6.4.26.9	Whether detailed literature and drawings enclosed. (YES/NO)	

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S N	ITEMS	RATINGS/PARTICULARS
2.6.4.27	Push Button :	
2.6.4.27.1	Make and Type reference of manufacturer	
2.6.4.27.2	Mounting details	
2.6.4.27.3	Type of contact	
2.6.4.27.4	Current and voltage rating	
2.6.4.27.5	No. of contacts	
A	NO	
B	NC	
2.6.4.27.6	Whether shrouding provided to prevent inadvertent operation (YES/NO)	
2.6.4.27.7	Whether provided with integral engraved inscription plates (YES/NO)	
2.6.4.28	Auxiliary CT's VT'S :	
2.6.4.28.1	Make and Type reference of manufacture	
2.6.4.28.2	Type	
2.6.4.28.3	Ratios available	
2.6.4.28.4	Burden V A	
2.6.4.28.5	Standard to which it conforms	
2.6.4.28.6	Accuracy class	
2.6.4.28.7	Short time current / voltage rating	
2.6.4.28.8	Temperature rise	
2.6.4.28.9	One minute power frequency withstand voltage	
2.6.4.28.10	Mounting dimensional details	
2.6.4.28.11	Weight	
2.6.4.28.12	Panel in which to be provided with quantity thereof and connected ratio	
2.6.4.28.13	For CT's only	
A	Knee point voltage (KPV) (Volts)	
B	Excitation current at KPV and 50% KPV (ma)	
C	Internal impedance of primary and secondary windings in ohms	
2.6.4.28.14	Literature enclosed.	
2.6.4.29	Space Heaters :	
2.6.4.29.1	Make and Type reference of manufacture	
2.6.4.29.2	Type of space heater (Tubular / strip type)	
2.6.4.29.3	Rating Wattage	

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S N	ITEMS	RATINGS/PARTICULARS
2.6.4.29.4	Whether thermostat provided (YES/NO)	
2.6.4.30	Indicating Instruments and meters :	
2.6.4.30.1	The Supplier shall furnish guaranteed Technical particulars for all types of meters offered, in the following Performa (separate sheet shall be enclosed for each type of meter :)	
2.6.4.30.2	Make and country of manufacture	
2.6.4.30.3	Type and rating	
2.6.4.30.4	Size and weight	
2.6.4.30.5	Mounting details	
2.6.4.30.6	Rated VA burden and power consumption (In case of two energizing quantities the burden and consumption shall be furnished separately)	
2.6.4.30.7	Continuous overload rating of current / voltage coil	
2.6.4.30.8	Short time over load of current coil / potential coil	
2.6.4.30.9	Accuracy class and grade	
2.6.4.30.10	Adjustments provided	
2.6.4.30.11	Whether magnetically shielded (YES/NO)	
2.6.4.30.12	Details of tropicalisation	
2.6.4.30.13	Additional features provided	
2.6.4.30.14	Pointer position center zero / end zero	
2.6.4.30.15	Whether detailed literature enclosed. (YES/NO)	
2.6.4.30.16	Additional details for watt meter / V A R / Watt Hour Meter	
A	Whether spare dial plates for different ration being provided.	
B	Limits of error UPF at 125% and 10% of rated current.	
C	Limits of error at 0.5 PF lag at 125%, 25% and 10% of rated current.	
2.6.4.30.17	Additional details for static watt hour meter	
A	Type of registering mechanism	
B	Display sequence	
C	Parameters that can be measured	
D	Whether the meter can be used to get demand details	
E	Whether optical readout facility provided	
2.6.4.31	Instrument Test Terminal Block	
2.6.4.31.1	Make and Type reference of manufacturer	
2.6.4.31.2	Insulation class and rating	
2.6.4.31.3	Size and mounting details	

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S N	ITEMS	RATINGS/PARTICULARS
2.6.4.31.4	Type of CT terminal shorting mechanism (LINK / SCREW)	
2.6.4.31.5	Type of VT terminal Isolating Mechanism	
2.6.4.31.6	Whether detailed literatures enclosed. (YES/NO)	
2.6.4.32	General Protection Relays :	
2.6.4.32.1	The Supplier shall furnish guaranteed Technical particulars for all types of meters offered, in the following Performa (separate sheet shall be enclosed for each type of relay :)	
2.6.4.32.2	Manufacturer's name or trade marks	
2.6.4.32.3	Type designation	
2.6.4.32.4	Size and mounting details (whether in draw out case)	
2.6.4.32.5	Rated Values of both input and auxiliary energizing quantities	
2.6.4.32.6	Values of the limits of the operative range(s) of the auxiliary energizing quantity (ies)	
2.6.4.32.7	Contacts data, Number and rating of main and auxiliary contacts	
2.6.4.32.8	Rated value or setting range of the characteristic quantities and or angle	
2.6.4.32.9	Limiting short-time thermal withstand values	
2.6.4.32.10	Limiting dynamic values.	
2.6.4.32.11	Burden data (in case of poly input relays - data shall be furnished for appropriate set of input terminals).	
A	At highest tap - AC current / voltage coil	
B	At lowest tap - AC current / voltage (coil)	
2.6.4.32.12	DC power consumption.	
2.6.4.32.13	Impulse and dielectric test voltage(s)	
2.6.4.32.14	Details of accessories (If essential to the relay performance)	
2.6.4.32.15	Details of accessories (Optional items)	
2.6.4.32.16	Whether provided with seal in trip contacts	
A	Type of operating characteristics	
B	Accuracy of operating characteristics, operating time with details	
2.6.4.32.17	H.F. disturbance test voltage (s)	
2.6.4.32.18	Whether literature enclosed	
2.6.4.32.19	Type of relay flag indicator and rating of target coil	
2.6.4.32.20	In addition to the above details, the following details shall also be furnished for relays specified below :	

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CHAPTER– 2.7

LIST OF APPROVED MAKES

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APPROVED MAKES OF MATERIALS:

Sr. No.	Description	Recommended List of makes			
1.	ENGINE	CUMMINS	PERKINS	CATER PILLAR	Mitsubis hi
2.	ALTERNATOR	STAMFORD	LEROY-SOMERS	-TDPS	
3.	DC BATTERIES	HBL	AMARA RAJA	PANASONIC	
4.	RTD	RADIX	WARRIE	ALTOP	
5.	PROTECTION RELAY (NUMERICAL)	SIEMENS	ALSTOM	ABB	
6.	PROTECTION RELAY (ELECTRO-MAGNETIC)	ALSTOM	ABB	-----	
7.	SYNCHRONIZING RELAY	WOODWARD	DEIF	-----	
8.	NEUTRAL GROUNDING RESISTOR	NATIONAL RESISTOR	SG		
9.	VACUUM CONTACTOR	EPCOS	SIEMENS	-----	
10.	LOW VOLTAGE SWITCHGEAR	SIEMENS	SCHNEIDER	ABB	L & T
11.	AIR CIRCUIT BREAKER AND MCCBs	SIEMENS	SCHNEIDER	ABB	L & T
12.	ANALOG METERS	RISHAB	AE	-----	
13.	DIGITAL METER/LOAD MANAGERS / SMART DEMAND CONTROLLER	SCHNEIDER	SIEMENS	ABB	L & T
14.	ENERGY / TRIVECTOR METER	SCHNEIDER	SIEMENS	ABB	L & T
15.	KWH METER	SCHNEIDER	SIEMENS	ABB	L & T
16.	INDICATING LAMPS/PUSH BUTTONS (LED TYPE)	SIEMENS	VAISHNO	L & T	TECKNIC
17.	SELECTOR SWITCHES	SIEMENS	L & T	KAYCEE	
18.	BREAKER CONTROL SWITCH	KAYCEE	SIEMENS	L & T	
19.	AUXILIARY RELAY	OEN	OMRAN	PLY	
20.	HT CT & PT -RESIN CAST	AE	PRAGATI	MEHRU	
21.	LT-CTs & PTs -RESIN CAST	AE	KAPPA	KALPA	
22.	CONTROL FUSE AND FUSE FITTING	SIEMENS	SCHNEIDER	L & T	
23.	ELECTRONICS TIMER	SIEMENS	SCHNEIDER	L & T	

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Sr. No.	Description	Recommended List of makes				
24.	PVC WIRES-1100V (FRLS GRADE)	FINOLEX	POL YCA B	HAV ELLS	ANCHOR	
25.	SPACE HEATER	GIRISH CO	& TELELAC		-----	
26.	ANNUCIATION	MINILEC	TRINITI		-----	
27.	DIN CHANNEL/PVC CHANNEL /PVC CLAMP/BUNCHING TAP	LOCAL MAKE	-----		-----	
28.	BUSBAR	INDILCO	NALCO		JINDAL	
29.	HOOTER	MINILEC	TRINITI		-----	
30.	EARTH LEAKAGE RELAY	PROK DEVICES	MINILEC		-----	
31.	LT POWER AND CONTROL CABLES	UNIVERSAL	POL YCA B	GLO STE R	RPG	CCI
32.	LT FLEXIBLE , FLEXI-BREAD AND SCHEILDED CABLES	LAPP	HELUKABEL		SBEE	
33.	CABLE GLANDS (SINGLE /DOUBLE COMPRESSION)	DOWELLS	JAINSON		COMET	
34.	PVC GLAND	LAPP	HENSAL		HELUKABLE	
35.	VOLTAGE MONITOR	MINILEC	SIEMENS		SOFTHARD	
36.	SURGE PROTECTION DEVICE	LEGRAND	HAGER		SIEMENS	
37.	TTB	SIMCO	IMP		CANDS	
38.	NEUTRAL LINK	LOCAL MAKE	-----		-----	
39.	PANEL BOARD					
		LOTUS POWER GEAR-BANGALORE				
		12/13 Km, KANAKAPURA ROAD DODDAKALLASANDRA BANGALORE-560062 CONTACT PERSON:- SHRIKANTH BHATTA CELL NO :- +91 99452 32473 PHONE NUMBER : 080 43549000/26660528 FAX NO :- 080 26663067 E-mail ID:- shrikantha.bhatta@lotuspoweregear.co.in				

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Sr. No.	Description	Recommended List of makes
		POWER CONTROL EQUIPMENT-BANGALORE
		No. 37/2 , GOWDANAPALYA , SUBRAMANYAPURA MAIN ROAD , BANGALORE-560061 CONTACT PERSON:- RAVI CELL NO :- +91 9686682409 PHONE NUMBER : 080 26662265/2266/2435/2433 FAX NO :- 080 26664010 E-mail ID:- marketing@powercontrol.in
		OHM ENERGY MANAGEMENT SYSTEM PVT LTD.
		PLOT NO-1229, 18TH MAIN ROAD, ANNANAGAR, CHENNAI-600040. CONTACT PERSON:- RAVI SHANKAR CELL NO :- +91 8754404750 PHONE NUMBER : (044) 45536147 FAX NO :- (044) 47100074 E-mail ID:- ravishankar@ohmenergysys.com
		BALAJI ELECTRO CONTROLS PVT. LTD- BANGALORE
		No.- 36/2, MADANAYAKANAHALLI , NEAR BHORUKA SCHOOL TUMKUR ROAD ,BANGALORFE-562123 CONTACT PERSON:- HARISH H CELL NO :- +91 96111 02850 PHONE NUMBER : 080 22795438 / 23715499 E-mail ID:- infobec@balajielectrocontrols.com
		TESLA CONTROLS (INDIA) PRIVATE LIMITED
		EMSY SQUARE, No- 4 SARANYA NAGAR THIRUMUDIVAKKAM-KUNNDRTHUR MAIN ROAD THIRUMUDIVAKKAM CHENNAI – 600044 CONTACT PERSON:- A SURESHKUMAR CELL NO :- +91 97909 76751 PHONE/FAX NUMBER : 044 24780019 / 24780020 E-mail ID:- suresh@teslacontrols.in

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Sr. No.	Description	Recommended List of makes
		<p>ADARSHA CONTROL SYSTEMS PRIVATE LIMITED</p> <p># A – 273/274 6TH MAIN ROAD 2ND PEENYA INDUSTRIAL AREA, BANGALORE-560058 CONTACT PERSON:- SUNIL V KUMAR CELL NO :- +91 9535433388 PHONE NUMBER : 080 40493666/28392172 FAX NUMBER :- 080 28362174 E-mail ID:- Sunil@adarshacontrol.com</p> <p>KRINSHNA ENERGY – CHENNAI</p> <p>DP 69 , SIDCO INDUSTRIAL ESTATE THIRUMUDIVAKKAM CHENNAI -44 CONTACT PERSON:- J VENKATARAMANI CELL NO :- +91 97909 22644 PHONE NUMBER : 044 42852092/93 FAX NO :- 080 22500178 E-mail ID:- vr@krishnaenergy.net</p>
40.	PANEL ENCLOSURE	CUSTOMI SZE

Important: -	
1.	Please Tick (") the make of material considered in tender.
2.	Detail submittals in the form of catalogues specification sheets, and samples were called for, shall be submitted one week from the date of order and approvals shall be obtained on the type of accepted make before procurement are made.
3.	Out of the approved makes of materials mentioned above, the make of materials to be used on the work shall be as decided by the Consultant/Purchaser jointly.
4.	In respect of materials for which approved makes are not specified above, these will be of makes to be decided by the consultant and as per sample approved before procurement.
5.	Equipments approved and supplied shall have local servicing facilities available in the region.

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CHAPTER - 2.8

LIST OF DRAWINGS

Client : 	TENDER DOCUMENT FOR SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF HT DG SET AT IVC HBL, CHENGALPATTU	nne pharmaplan®
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Sl. No.	Title	Drawing No.	Rev.
1.	SINGLE LINE DIAGRAMs (SLD):-		
1.1	GENSET AUXILARY MCC PANEL	NPI/120310/ELC(SLD)/U2/08	01
1.2	GENSET RELAY AND CONTROL PANEL	NPI/120310/ELC(SLD)/U2/09	01
1.3	NEUTRAL GROUNDING RESISITOR PANEL	NPI/120310/ELC(SLD)/U2/10	01
2.	STANDARD DRAWINGS :-		
2.1	TYPICAL DRAWING FOR COPPER PLATE EARTH ELECTRODES	NPI/120310/ELC(STD)/S1/01	00
2.2	TYPICAL DRAWING FOR GI PLATE EARTH ELECTRODES	NPI/120310/ELC(STD)/S1/02	00
2.3	TYPICAL DRAWING FOR GI PIPE EARTH ELECTRODES	NPI/120310/ELC(STD)/S1/03	00
2.4	TYPICAL DRAWING FOR EARTHING JUMPER	NPI/120310/ELC(STD)/S1/08	00
2.5	TYPICAL DRAWING FOR EARTHING STRIP JOINTING (WELDING) PROCEDURE	NPI/120310/ELC(STD)/S1/09	00