

TENDER DOCUMENT

FOR

**SUPPLY, ERECTION, TESTING AND
COMMISSIONING 2 No. of 2000KVA, 11KV,
DIESEL GENERATOR SETS**



**INDIAN INSTITUTE OF SCIENCE
BANGALORE -560012**

**Website : <http://www.iisc.ac.in/opportunities/tenders/>
Contact : 080 - 2293 2202/2765**

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SECTION 1

TENDER NOTIFICATION

INDIAN INSTITUTE OF SCIENCE BANGALORE 12

Tender Notification No. **09/CCMD/2016-17**

Dated **28-10-2016**

Sealed item rate tenders in Two cover system (Technical & Financial Bids) accompanied by E.M.D. by way of Crossed Demand Draft drawn in favour of the Registrar, Indian Institute of Science are invited in duplicate from the eligible Registered under SUPER GRADE CLASS (ELECTRICAL), Karnataka/equivalent grade of other States/Manufacturer(License not required) ,Contractors of CPWD/KPWD/MES/Railways for the following work:--4

Tender documents may be downloaded from the website www.iisc.ac.in/opportunities/tenders/ from 07.11.2016 to 28.11.2016, for a non-refundable fee (for two sets) as indicated in the Table below, in the form of Demand Draft on any Nationalized/ Scheduled bank payable at Bangalore in favour of “Registrar, Indian Institute of Science”. Interested tenders may obtain further information at the same address.

The Technical Bid & Financial Bid shall be submitted in two separate sealed covers duly superscribed as TECHNICAL & FINANCIAL BID. These two covers shall be submitted in a single cover duly superscribing the name of the work with name and address of the tenderer addressed to the Project Engineer cum Estate Officer, CCMD on or before 05.12.2016. up to 3.00 p.m

Sl. No.	Name of the Work	Estimated Cost (Rs. in lakhs)	E.M.D. Rs.	Cost of Tender Documents Rs.	Time for completion of work
01	Supply, erection, testing and commissioning of 2 Nos. of 2000KVA – 11KV D.G. Sets	448.00	6,72,000/-	10,000/-	10(TEN) MONTHS

1. Schedule of dates

a) Commencement of downloading the tender documents

07/11/2016

b) A Pre-bid meeting will be held on 21.11.2016 at 4.00 P.M at the office of the Centre for Campus Management and Development to clarify the issues if any and to answer the question on any matter that may be raised at that stage of “Instructions to of the Tenderers” of the Tender document.

c) Last date for downloading the tender document 28/11/2016

d) Receipt of duly filled tenders along With cost of Tender documents and EMD enclosed in Technical bid on 05.12.2016 upto 3.00P.M

2. Eligible criteria :

- a) The agency / Manufacturers should have executed a single work of similar nature work in Government/Semi-Government costing not less than 80% of the estimated cost of this tender work in any of the financial year during the preceding five years from 2011-12 to 2015-16
 - b) The agencies who have executed similar nature of work are eligible to obtain the tender documents.
 - c) The agency should have given a financial turnover with a minimum of Rs.896.00 lakhs in any two consecutive years in the preceding five years from 2011-12 to 2015-16.
3. The eligible Contractors satisfying the above conditions can obtain the Tender forms and other related details including specification and schedule of quantities from the Project Engineer cum Estate Officer, CCMD, IISc after paying the prescribed fee in the form of Demand Draft.
 4. The tenderer shall submit the cost of Tender documents and E.M.D in the form of Demand Draft separately drawn in favour of the Registrar, IISc along with the technical bid.
 5. Conditional tenders ARE LIABLE TO BE REJECTED
 6. The last date for submission of duly filled tender form along with the Tender document and EMD is 05.12.2016 up to 3.00 P.M. and the technical bid will be open on the same day at 3.30 P.M or otherwise the next convening working day during office hours.
 7. Financial bid of technically qualified agencies only will be opened. The date and time of opening the financial bids of successful agencies will be intimated separately.
 8. The firm seeking exemption of tender fees and EMD shall produce sufficient document proof for having registered with NSIC for claiming exemption.
 9. The institute reserves the right to accept or reject any or all tenders without assigning any reasons thereof.

REGISTRAR

SECTION 2
INSTRUCTIONS TO TENDERERS (ITT)

Part A. General

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3. Qualification of the Tenderer
4. One Tender per Tenderer
5. Cost of Tendering
6. Site Visit

Part B. Tender Documents

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A. General

1. Scope of Tender

- 1.1 The Indian Institute of Science, Bangalore (Referred to as Employer/Owner in these documents) invites tenders following Two Cover tender procedure, from eligible Tenderers, for the work (as defined in this document and referred to as "the work") detailed in the Table given in the Invitation for Tenders (IFT).

2. Eligible Tenderers

- 2.1 Tenderers shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of India/ Karnataka/any state.
- 2.2 Tenders from Joint ventures are not acceptable.
- 2.3 Tenderer must be a class-1 Electrical Contractor with Super Grade Licence Class .

3. Qualification of the Tenderer:

- 3.1 All Tenderers shall provide the requested information accurately and in sufficient detail as mentioned in Section 3: Qualification information.
- 3.2 To qualify for award of this contract, each Tenderer in its name should have in the last five years i.e 2012-2013 to 2015-2016)
 - (a) achieved in at least two financial years a minimum financial turnover (in all classes of Electrical Engineering works only) of value not less than (as mentioned in the notification) usually not less than two times the estimated value of this contract;
 - (b) satisfactorily completed(at least 80% of the contract value), as prime contractor, at least one similar work such as of value not less than (as mentioned in the notification) usually not less than 80% estimated value of contract.
 - (c) executed the following minimum quantities of works in the past 3 years excluding that of IISc:

- supplying ,installation and commissioning of 1 x 2000kVA, 11KV class & above ratings.

3.3 Even though the Tenderers meet the required criteria, they are subject to be disqualified if they have:

- made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or
- participated in the previous Tender for the same work and had quoted unreasonably high tender prices and could not furnish rational justification.

4. One Tender per Tenderer:

4.1 Each tenderer shall submit only one tender for one package. A tenderer who submits or participates in more than one Tender will cause all the proposals with the Tenderer's participation to be disqualified.

5. Cost of Tendering:

5.1 The tenderer shall bear all costs associated with the preparation and submission of tender, and the Employer will in no case be responsible and liable for those costs.

6. Site visit:

6.1 The Tenderer at his/her own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract the Work. The cost of visiting the Site shall be at the Tenderer's own expenses.

B. Tender documents

7. Content of Tender documents

- 7.1 The set of tender documents shall have all the Sections given in Section 2.
- 7.2 Both the sets should be completed and returned with the tender.

8. Clarification of Tender Documents

- 8.1 A prospective tenderer requiring any clarification of the tender documents may notify the Employer in writing or by cable (hereinafter “cable” includes telex and facsimile) at the Employer’s address indicated in the invitation to tender. The Employer will respond to any request for clarification which he receives earlier than 15 days prior to the deadline for submission of tenders. Copies of the Employer’s response will be forwarded to all purchasers of the tender documents, including a description of the enquiry but without identifying its source.
- 8.2 Pre-tender meeting:
 - 8.2.1 The tenderer or his/her authorized representative is invited to attend a pre-tender meeting ; place and date will be intimated.
 - 8.2.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
 - 8.2.3 The tenderer is requested to submit any questions in writing or by cable to reach the Employer not later than one week before the meeting.
 - 8.2.4 Minutes of the meeting, including the text of the questions raised (without identifying the source of enquiry) and the responses given will be transmitted without delay to all purchasers of the tender documents. Any modification of the tender documents ,which may become necessary as a result of the pre-tender meeting shall be made by the Employer exclusively through the issue of an Addendum and not through the minutes of the pre-tender meeting.
 - 8.2.5 Non-attendance at the pre-tender meeting will not be a cause for disqualification of a tenderer.

9. Amendment of Tender documents

- 9.1 Before the deadline for submission of tenders, the Employer may modify the tender documents by issuing addenda.
- 9.2 Any addendum thus issued shall be part of the tender documents and shall be communicated in writing or by cable to all the purchasers of the tender documents.
- 9.3 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend as necessary the deadline for submission of tenders.

C. Preparation of Tenders

10. Documents comprising the Tender

- 10.1 The tender submitted by the Tenderer shall be in two covers and shall contain the documents as follows:
 - 10.1.1 First Cover :
 - (a) Earnest Money Deposit;
 - (b) Qualification Information as per formats given in Section 3;
 - 10.1.2 Second Cover:
 - (a) The Tender (in the format indicated in Section 4)
 - (b) Priced Bill of Quantities (Section 9); and any other materials required to be completed and submitted by Tenderers in accordance with these instructions. The documents listed under Sections 3, 4, 6 and 9 shall be filled in without exception.

11. Tender prices

- 11.1 The contract shall be for the whole works as described in Scope of Tender, based on the priced Bill of Quantities submitted by the Tenderer.
- 11.2 The Tenderer shall fill in rates and prices and total (both in figures and words) for all items of the Work described in the Bill of Quantities along with total tender price (both in figures and words). Items for which no rate or price is entered by the Tenderer will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities. Corrections, if any, shall be made by crossing out, initialing, dating and rewriting.

11.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause, shall be included in the rates, prices and total Tender Price submitted by the Tenderer.

11.4 The rates and prices quoted by the Tenderer shall be subject to adjustment during the performance of the Contract in accordance with the provisions of Sub part of the Conditions of Contract

12. Tender validity

12.1 Tenders shall remain valid for a period not less than ninety days after the deadline date for tender submission specified in Sub part 16. A tender valid for a shorter period shall be rejected by the Employer as non-responsive.

12.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the Tenderers may extend the period of validity for a specified additional period. The request and the Tenderers' responses shall be made in writing or by cable. A Tenderer may refuse the request without forfeiting his earnest money deposit. A Tenderer agreeing to the request will not be required or permitted to modify his tender, but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Sub part 13 in all respects.

13. Earnest money deposit

13.1 The Tenderer shall furnish, as part of his tender, earnest money deposit in the amount as shown in column 4 of the Table of IFT for this particular work. This earnest money deposit shall be in the form of Demand draft, in favour of "The Registrar, Indian Institute of Science" payable at Bangalore.

13.2 Instruments having fixed validity issued as earnest money deposit for the tender shall be valid for 45 days beyond the validity of the tender.

13.3 Any tender not accompanied by an acceptable earnest money deposit shall be rejected by the Employer as non-responsive.

13.4 The earnest money deposit of unsuccessful Tenderers will be returned within 30 days of the end of the tender validity period.

13.5 The earnest money deposit of the successful Tenderer will be discharged when the Tenderer has signed the Agreement and furnished the required Performance Security.

- 13.6 The earnest money deposit may be forfeited:
- (a) if the Tenderer withdraws the Tender after tender opening during the period of tender validity;
 - (b) if the Tenderer does not accept the correction of the Tender Price, pursuant to Sub part 24; or
 - (c) in the case of a successful Tenderer, if the Tenderer fails within the specified time limit to
 - (i) sign the Agreement; or
 - (ii) furnish the required Security deposit

14. Format and signing of Tender

- 14.1 The Tenderer shall prepare one original and a copy of the documents comprising the Tender as described in Sub part 10 of these Instructions to Tenderers, and clearly marked "ORIGINAL" and "COPY" as appropriate. In the event of discrepancy between them, the original shall prevail.
- 14.2 The original and a copy of the Tender shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Tenderer. All pages of the tender where entries or amendments have been made shall be initialed by the person signing the tender
- 14.3 The Tender shall contain no alterations or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the Tenderer, in which case such corrections shall be initialed by the person signing the Tender.

D. Submission of Tenders

15. Sealing and marking of tenders

- 15.1 The Tenderer shall seal the original and a copy of the Tender in separate envelopes, duly marking the envelopes as "ORIGINAL" and "COPY". These envelopes (called as inner envelopes) shall then be put inside one outer envelope.
- 15.2 The inner and outer envelopes shall
- (a) be addressed to the Employer at the following address:

The Project Engineer cum Estate Officer,
Centre for Campus Management and Development,
Indian Institute of Science,
Bangalore – 560 012

(b) bear the following identification:

- Tender for[name of contract]
- Tender Reference No.....[insert number]

- 15.3 In addition to the identification, the inner envelopes shall indicate the name and address of the Tenderer to enable the tender to be returned unopened in case it is declared late, pursuant to Sub part 17.
- 15.4 If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the Tender.

16. Deadline for submission of the Tenders

- 16.1 Tenders must be received by the Employer at the address specified above no later than as mentioned in the notification. In the event of the specified date for the submission of tenders being declared a holiday for the Employer, the tenders will be received up to the appointed time on the next working day.
- 16.2 The Employer may extend the deadline for submission of tenders by issuing an amendment in accordance with Sub part 9, in which case all rights and obligations of the Employer and the Tenderers previously subject to the / prescribed in Sub part 16 will be returned unopened to the Tenderer.

18. Modification and Withdrawal of Tenders

- 18.1 Tenderers may modify contents of First or Second Covers separately for each Cover or withdraw their Tenders by giving notice in writing before the deadline prescribed in Sub part 16.
- 18.2 Each Tenderer's modification separately for each Cover or withdrawal notice shall be prepared, sealed, marked, and delivered in accordance with Sub part 14 & 15, with the outer and inner envelopes additionally marked "MODIFICATION FOR FIRST/SECOND COVER" or "WITHDRAWAL", as appropriate.

- 18.3 No Tender may be modified after the deadline for submission of Tenders.
- 18.4 Withdrawal or modification of a Tender between the deadline for submission of Tenders and the expiration of the original period of Tender validity specified in Sub part 12.1 above or as extended pursuant to Sub part 12.2 may result in the forfeiture of the earnest money deposit pursuant to Sub part 13.
- 18.5 Tenderers may only offer discounts to, or otherwise modify the prices of their Tenders by submitting Tender modifications in accordance with this Sub part, or included in the original Tender submission.

E. Tender opening and evaluation

19. Opening of First Cover of all Tenders and evaluation to determine qualified Tenderers:

- 19.1 The Employer will open the First Covers of all the Tenders received (except those received late or withdrawn), including modifications for First Cover made pursuant to Sub part 18, in the presence of the Tenderers or their representatives who choose to attend on the date and the place specified in Sub part 16. In the event of the specified date of Tender opening being declared a holiday for the Employer, the Tenders will be opened at the appointed time and location on the next working day.
- 19.2 Envelopes marked "WITHDRAWAL" shall be opened and read out first. The First Cover of Tenders for which an acceptable notice of withdrawal has been submitted pursuant to Sub part 18 shall not be opened.
- 19.3 The Tenderers names, the presence or absence of earnest money deposit (amount, format and validity), the submission of qualification information and such other information as the Employer may consider appropriate will be announced by the Employer at the opening. Late and withdrawn Tenders will be returned unopened to tenders.
- 19.4 The Employer shall prepare minutes of the Tender opening, including the information disclosed to those present in accordance with Sub-Sub part 19.3.
- 19.5 The Second Cover of all the Tenderers including modifications for Second Cover shall be placed in a large cover and securely sealed in the presence of the tenderers or their representatives, who are present and also get the

same signed by all those tenderers or their representatives. The large cover shall be kept in safe custody by the Employer.

- 19.6 The Employer will evaluate and determine whether each tender (a) meets the eligibility criteria defined in ITT Sub part 2; (b) is accompanied by the required earnest money deposit as per stipulations in ITT Sub part and (c) meets the minimum qualification criteria stipulated in ITT Sub part 3. The Employer will draw out a list of qualified Tenderers.

20. Opening of Second Cover of qualified Tenderers and evaluation:

- 20.1 The Employer will inform all the Qualified Tenderers the time, date and venue fixed for the opening of the Second Cover containing the priced Tenders. The Employer will open the Second Covers of Qualified Tenderers at the appointed time and date in the presence of the Tenders or their representatives who choose to attend. In the event of the specified date of Second Cover opening being declared a holiday for the Employer, the Second Covers will be opened at the appointed time and location on the next working day.
- 20.2 Envelopes marked “MODIFICATION FOR SECOND COVER” shall be opened and the submissions therein read out in appropriate detail.
- 20.3 The Tenderers' names, the Tender prices, the total amount of each Tender, any discounts, Tender modifications and withdrawals, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. No Tender shall be rejected at Tender opening.
- 20.4 The Employer shall prepare minutes of the Second Cover Tender opening, including the information disclosed to those present in accordance with Sub-Sub part 20.3.

21. Process to be confidential

- 21.1 Information relating to the examination, clarification, evaluation, and comparison of Tenders and recommendations for the award of a contract shall not be disclosed to Tenderers or any other persons not officially concerned with such process until the award to the successful Tenderer has been announced. Any effort by a Tenderer to influence the Employer's processing of Tenders or award decisions may result in the rejection of his Tender.

22 Clarifications of Tenders

- 22.1 To assist in the examination, evaluation, and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Tender shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders in accordance with Sub part 24.
- 22.2 Subject to sub-Sub part 22.1, no Tenderer shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, it should do so in writing.
- 22.3 Any effort by the Tenderer to influence the Employer in the Employer's Tender evaluation, Tender comparison or contract award decisions may result in the rejection of the Tenderers' Tender.

23. Examination of Tenders and determination of responsiveness

- 23.1 Prior to the detailed evaluation of Tenders, the Employer will determine whether each Tender; (a) has been properly signed; and; (b) is substantially responsive to the requirements of the Tender documents.
- 23.2 A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Tender documents, the Employer's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.
- 23.3 If a Tender is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

24. Correction of errors

- 24.1 Tenders determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:

- (a) where there is a discrepancy between the rates in figures and in words, the lower of the two will govern; and
- (b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.

24.2 The amount stated in the Tender will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, with the concurrence of the Tenderer, shall be considered as binding upon the Tenderer. If the Tenderer does not accept the corrected amount the Tender will be rejected, and the earnest money deposit may be forfeited in accordance with Sub-Sub part 13.6 (b).

25. Evaluation and comparison of Tenders

25.1 The Employer will evaluate and compare only the Tenders determined to be substantially responsive in accordance with Sub part 23.

25.2 In evaluating the Tenders, the Employer will determine for each Tender the evaluated Tender Price by adjusting the Tender Price as follows:
(a) making any correction for errors pursuant to Sub part 24; and
(b) making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Sub Sub part 18.5.

25.3 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Tender evaluation.

25.4 The estimated effect of the price adjustment conditions under Sub part 41 of the Conditions of Contract, during the implementation of the Contract, will not be taken into account in tender Evaluation

25.5 If the tender of the successful tenderer is seriously unbalanced in relation to the Employer's estimate of the cost of the work to be performed under the contract, the Employer may require the Tenderer to produce detailed price analyses for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Sub part 29 be increased at the expense of the successful Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful under the contract.

F. Award of Contract

26. Award criteria

- 26.1 Subject to Sub part 27, the Employer will award the Contract to the Tenderer whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the lowest evaluated Tender Price, provided that such Tenderer has been determined to be (a) eligible in accordance with the provisions of Sub part 2, and (b) qualified in accordance with the provisions of Sub part 3.

27. Employer's right to accept any Tender and to reject any or all Tenders

- 27.1 Notwithstanding Sub part 26, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

28. Notification of award and signing of Agreement

- 28.1 The Tenderer whose Tender has been accepted will be notified of the award by the Employer prior to expiration of the Tender validity period by cable, telex, e-mail or facsimile confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").
- 28.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of Security deposit in accordance with the provisions of Sub part 29.
- 28.3 The Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be kept ready for signature of the successful Tenderer in the office of Employer within 30 following the notification of award along with the Letter of Acceptance. Within 20 days of receipt, the successful Tenderer will sign the Agreement and deliver it to the Employer.

- 28.4 Upon the furnishing by the successful Tenderer of the Performance Security, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

29. Security deposit

- 29.1 Within 20 days of receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Security deposit in any of the forms given below for an amount equivalent to (as mentioned in the notification) of the Contract price plus additional security for unbalanced tenders in accordance with Sub part 25.5 of ITT and Sub part 44 of the Conditions of Contract. :
- Demand Draft or
 - A bank guarantee in the form given in Section 10; or
- 29.2 If the security deposit is provided by the successful Tenderer in the form of a Bank Guarantee, it shall be issued either by a Nationalized/Scheduled bank.
- 29.3 The security deposit if furnished in demand draft can, if requested, be converted to interest bearing securities at the cost of the contractor.
- 29.4 Failure of the successful Tenderer to comply with the requirements of Sub-Sub part 29.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Earnest money deposit.

30 Advance Payment and Security:

- 30.1 The Employer will provide on advance payment on the contract price as stipulated in the Conditions of Contract.

SECTION 3
QUALIFICATION INFORMATION

Qualification Information

(To be enclosed in a separate sealed envelope)

The information to be filled in by the Tenderer hereunder will be used for purposes of Computing Tender capacity as provided for in Sub part 3 of the Instructions to Tenderers.

- 1.1 Name of the Tendering Company/Firm/Agency: _____
- 1.2 Name of the Proprietor/Director : _____
- 1.3 Full Address of Reg. Office with Regn.No : _____
- 1.4 Telephone No. and Fax No. : _____
- 1.5 E-mail address : _____
- 1.6 PAN/ GIR/ TIN No. (Attach Attested Copy) : _____
- 1.7 Service Tax Regn No.(Attach attested Copy) : _____
- 1.8 Total value of Electrical Engineering works executed and payments received in the last five years (in Rs. Lakhs)
- | |
|----------------|
| 2011 – 12 |
| 2012 - 13..... |
| 2013 - 14..... |
| 2014 - 15..... |
| 2015 - 16..... |

1.9 Work performed as Principal Contractor (in the same name) on works of similar nature over during the five years specified in 1.2 above.

Project Name	Name of Employer	Description of Work	Value of Contract (Rs Lakhs)	Contract No.	Date of issue of work order	Specified period of completion	Actual date of completion	Remarks explaining reasons for delay in completion of work
1	2	3	4	5	6	7	8	9

1.10 Quantities of work executed as principal contractor (in the same name) during the last five years specified in 1.2 above:

Year	Name of the work	Name of Employer	Quantity of Work	Remarks (Indicate correct reference)
2011-12 2012-13 2013-14 2014-15 2015-16				

1.11 Information on works for which Tenders have been submitted and works which are yet to be completed as on the date of this Tender.

(A) Existing commitments and on-going works:

Description of work	Place	Contract No. & Date	Name and Address of Employer	Value of Contract (Rs Lakhs)	Stipulated period of Completion	Value of work remaining to be completed (Rs Lakhs)	Anticipated date of completion
1	2	3	4	5	6	7	8

(B) Works for which Tenders already submitted:

Description of work	Place	Name and Address of Employer	Estimated value of work (Rs Lakhs)	Stipulated period of Completion	Date when decision is expected	Remarks if any
1	2	3	4	5	6	7

- 1.12 Reports on the financial standing of the tenderer, such as profit and loss statements and auditor's reports for the last five years;
- 1.13 Qualification and experience of the key technical and management personnel in permanent employment with the tenderer and those that are proposed to be deployed on this contract, if awarded.
- 1.14. Name, address, and telephone, telex, and fax numbers of the Tenderers' bankers who may provide references if contacted by the Employer.
- 1.14 Evidence of access to financial resources to meet the qualification requirement specified in ITT Sub part 3.3 (b): Cash in hand, Letter of Credit etc..
- 1.16 The proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

SECTION 5

TECHNICAL SPECIFICATION FOR 2000KVA 11KV DIESEL GENERATOR SET

TECHNICAL SPECIFICATION FOR 2000KVA 11KV DIESEL GENERATOR SET WITH ACCOUSTIC ENCLOSURE AND ASSOCIATED WORKS

1. INTRODUCTION

Indian Institute of Science with all sophistication in respect of service facilities provided. Usage of electricity will be extensive and all pervasive. It is estimated that the electrical demand load would be 4000KVA for the entire facility. It would be necessary to provide a standby captive source of electrical power for the entire facility. For this purpose for 2 Nos. 2000 KVA 11KV Diesel Generating Sets, Prime Rated to be installed. These shall be of the radiator-cooled type with other specification as follows.

2. SYSTEM DESCRIPTION:

The Control Panel of the DG sets will be of Auto Synchronizing and auto load sharing with AMF type and will be supplying power to common Bus after DG Synchronizing by Paralleling of the same. Each D.G. Set will have programmable microprocessor based control panel with control and monitoring facilities of engine and alternator parameters and also auto synchronizing and load sharing facilities. There need to be NGR Panel, VCB panel, Two incoming one BUS coupler two outgoing with 630Amps VCB with over current, over voltage, under voltage, over frequency, under frequency Ventilation panel

The Generator output shall be connected to 11KV HT VCB DG Control Panel by using 11KV 3C 240 sq. mm Al. Ar. XLPE cable.

For the exhaust connectivity a freestanding Exhaust Pipe Structure is proposed. Vendor has to make analysis on account of exhaust flow, back pressure etc., and check the adequacy of the chimney. The height of the chimney shall be strictly as per the statutory norms of State Pollution Control Board.

3. STANDARDS

The design, material, construction, manufacture, inspection, testing and performance of the Engine/ Generator sets shall comply with all currently applicable standard, regulations and safety codes in the locality where the equipment shall be installed.

Standards to which the equipment covered in this tender shall be designed, manufactured, inspected and tested are listed below:-

ISO – 3046 Parts 1 to 4

BS – 4999 all parts including part 71 / equivalent standards.

IEC Standards for electrical and electronic equipments.

A.S.M.E. Boiler and pressure vessel code for welding procedures and welder

Qualification for all diesel engine sub systems.

TEMA Standards for tubular heat exchangers.

4. SCOPE

The specification covers Design, Manufacture and Testing at works of **2 Nos.2000 KVA, 11 KV Prime duty (No standby duty DG is recommended) Diesel Generator sets** with associated accessories and 11 KV Switchgear including Synchronizing Panel, Neutral Isolator / Neutral Grounding Resistor Panel.

The D.G. Sets are intended for use as emergency sets to start on AMF (Automatic Start on Mains Failure) and capable of a minimum of 50 - 60% step load and prime power continuous rating as per BS 5514 not less than 2000KVA at 0.8 PF. The speed of D.G. Sets shall not exceed 1500RPM and shall be of four-stroke design for operation on high-speed diesel.

The D.G. Sets with Radiator mounted on the skid, shall be capable of achieving 100% rated within 15 seconds of initialing a start & 10% over Load for 1hr in every 12hours of operation. The D.G.Sets are intended for operating in parallel with provision for auto synchronizing and auto load sharing. The offer for the D.G. Sets shall include well designed ventilation and fuel systems, start up batteries with associated chargers, interconnecting piping, system and protection earthing with neutral grounding resistor and isolating facility, local control & AMF, 11 KV DG switchgear, cabling to the switchgear and necessary gadgets for interfacing to building management system (BMS) to make the generating system complete in all respects, including acoustic control to meet statutory requirements.

The scope of services include delivery at site, positioning on foundation (Civil works will be done by some other agency), erection, testing & commissioning of DG sets with associated 11KV switchgear, running of DG sets on full loads, performance testing of the complete system to prove guaranteed parameters for fuel oil consumption, acoustics and temperature rise, including but not limited to the following.

- Supply, installation, testing and commissioning of 11KV D.G.Sets Radiator mounted on Skid
- Silencers, Exhaust piping including the outlets, insulation up to chimney.
- Earthing system (system earthing & protection earthing) with earthing resistor.
- Heavy duty antivibration spring type movement for the DG sets including hardware.
- Pipe lines from storage tank to intermediate tank, day tanks and spill tank with associated pumps, valves, including necessary level sensors /over flow controls, float valve in each day tank complete with support structures and civil works.
- Brush less exciter and voltage regulators
- Generator Lubrication systems including pumps, piping, oil coolers, oil filters and reservoir.
- RTDs, BTDs and Space Heaters in Alternator (Anti condensation Type)

- Exhaust Silencers (Residential Type) with Insulation.
- AMF and engine instruments and control panel comprising electronic governor, automatic voltage regulator, facility for auto synchronizing, auto-load and VAR sharing, basic minimum engine protection & annunciation, auto synchronizing and breaker control switch.
- Power DB for auxiliaries, with necessary accessories and interlocks.
- DC power supply through adequately rated DC Battery and panel mounted Battery Charger.
- Ventilation system as / if required to maintain the temperature of the DG room within 10 degree C + ambient, with all DG sets running continuously.
- Supply and installation of free standing Chimney to connect the Generators.
- Fuel required for load test shall be included.
- Post Load testing 990Lts of Diesel need to be filled prior to Handing over.
- All necessary consumables such as Diesel, Oil, Coolant, D.M.Water need to be in Vendors Scope.
- Load Testing 2Hrs.30mins 100% ie.2000KVA need to be performed at Site independently.
- Synch of 2x2000KVA need to be performed and exhibited with 50% load sharing At site.
- Each D.G.Sets need to be load tested at 25%- 30mins, 50%- 30mins, 75%- 30mins, 100%-30mins, 110%- 30mins prior to Synch between both the D.G.Sets.
- Post Synch Both D.G.Sets need to run for 1hour in synch mode.
- Preparation of shop drawings and getting approval, arranging inspection and obtaining safety certificate from the Electrical Inspectorate
- Submission of wiring diagram, operation, maintenance and installation manuals, Test Certificates, Technical Leaflets etc.,
- The offer shall include necessary start up spares, fuel and lube oil required for commissioning and trial running of sets until handover.
- Generator Neutral Isolator Panel with Neutral Grounding Resistor connected to earth pit (S) through separate cables.
- Laying of 11KV 3C 240sq mm Cable from Generator to the incoming terminal of the 11KV HT VCB DG Control Panel and to the NIS/NGR Panel.
- Terminal box on Generator AMF / Control panel, generator, 11KV VCB Panel & PLC panel with inter connections through control, instrument cables,
- Terminal box for BMS interface (cabling to BMS by other agencies)
- PLC panel (Separate or part of relay – metering panel) with auxiliary connections through control / instrument cables to Generator/Engine, 11KV VCB Panel, to have auto load dependent start-stop arrangement.
- Battery with charger,
- Incoming pipes flanges from underground storage tank to intermediate tank.
- Protection earthing grid with connections to earth pits and to the body of generator/Engine, DG Aux switchgear, DCDB, PB stations etc.,
- DG Aux switchgear incoming terminals, outgoing terminals connected to fans, pump motors through power cables/control cables as applicable.

- Emission Testing At Site need to conducted during the Load Test by Approved Labs KSPCB.

5. SERVICES:

- Obtaining approval of local CEIG with regards to layout, clearances and earthing drawings and permission for energizing the DG Sets.
- After installation, exhaust gas sample shall be collected and tested in a laboratory to see the conformance with the emission norms laid by PCB for this engine rating. Necessary data shall be furnished to the customer and / or their agency who are liasioning with PCB for clearance.
- Required parameters for foundation to be provided by the DG vendor. Erection, testing and commissioning of the DG sets including all items covered under the scope of supply.
- Load test at site on each set shall be for a minimum period of four (2Hrs.30mins). Fuel oil and all other consumable required for the test shall be supplied by the contractor.
- Cleaning debris and scraps from DG premises equipment and auxiliaries on completion of the entire installation.
- Minor touchup painting of the equipment under reference.

6. SITE CONDITIONS:

Reference Design ambient for Electrical equipment	- 40 degree C
Attitude	- 930m above MSL
Max. Summer dry bulb temperature	- 40 degree C
Max. Winter dry bulb temperature	- 7.8 degree C
Relative Humidity	- Max.82% Min.45%
Design Humidity	- 100%
Environment	- Tropical, moderately Polluted.
Installation	- DG sets indoor

7.0 REQUIREMENTS OF DIESEL GENERATOR UNITS

7.1 GENERAL

Standard Diesel Engine Alternator sets and auxiliary equipments are as indicated in the product information published by the Manufacture. Engine Alternator sets shall be suitable for parallel operation in conjunction with paralleling switchgear provided by others.

The engine power (KW) shall be sufficient to deliver full rated generator set KVA, when operated at rated rpm, equipped with all engine-mounted parasitic and external loads and operated at specified site conditions. The D.G.Set need to be for Prime Power operation as per IS3046.

Engine Alternator sets shall meet IEEE emergency power requirement to start and be on line within 15 seconds of to feed the distribution loads.

The Engine Alternator sets shall be assembled on a robust base by the Engine Alternator manufacturer. In addition the supplier shall provide dimensions of a concrete foundation block to match the generator set base, sized to dampen effects of disturbing vibrating forces. The foundation shall be isolated from the building structure. The generator set base shall be designed and built by the Engine Alternator manufacturer to resist deflection, maintain alignment, and minimize resonant linear vibration.

Vibration isolators shall be of resilient rubber design and installed between the Engine Alternator set base and the mounting surface. The isolators shall bolt to the Engine Alternator set base and foundation block. The pads shall be resistant to heat and aging, and antifreeze, diesel fuel, and cleaning compounds.

The Engine Alternator sets transient response shall conform to IEEE requirements.

7.2 DESIGN OF CONSTRUCTION REQUIREMENTS

Diesel generator sets shall be designed without harmful vibration stresses specially, during acceleration and deceleration.

Harmful tensional vibration stresses shall not occur within the range 10% above to 10% below rated idle speed and from 15% above to 10% below rated synchronous speed.

Moving parts shall be designed to withstand, without damage, 115% of the rated synchronous speed. However the generator, exciter and flywheel shall be designed to withstand over speed of 25% without damage.

DG Sets shall be able to withstand all stresses imposed during normal operation, testing and overload.

Equipment shall be designed and manufactured to withstand damage during transit, storage at site and after installation under the specified conditions.

All dimensions shall be in mm. All nuts, studs and bolts shall be designed and fabricated to metric units.

Nuts shall be hexagonal and bolt holes shall be spot faced for nuts.

Materials shall be as per specifications and shall be new and first class in all respects.

Castings and forgings shall conform to their respective material specifications and shall be free from flaws, machined true and a workman like manner.

Identical parts shall be interchangeable.

The design shall provide for ease of access during inspection, maintenance and repairs.

Fuel oil and lube oil piping shall be located as far as possible away from engine exhaust lines. Pressurized lines shall be installed in such a way that damage to neighboring equipment is prevented in the event of pipe break and pipe whip.

Materials for expansion bellows on exhaust and pressurized combustion air cooler and engine, silencer and exhaust pipe down streamside of silencer shall be of suitable grade stainless steel.

The coupling between engine and alternator may be rigid or flexible as required.

Simplex filters with bypass filter for servicing shall be provided in lube oil circuits.

7.3 BASE

The DG units shall be mounted on a rigid fabricated steel sub – cast. Latitudinal beams shall be rigidly cross-braced to avoid warping or bucking in transit or installation and the complete assembly shall be machined and drilled where necessary.

Anti-vibration mounding of an approved make shall be provided to absorb and damp out vibrations, which would otherwise be transmitted to the foundation and nearby structures.

7.4 TOOLS

A set general maintenance Basic tools shall be furnished for each DG set.

7.5 PIPING (As applicable)

Piping for cooling water, oil etc, shall be designed fabricated and tested in accordance with IS / ISO pressure piping code.

All terminal connections and all pipe joints shall as far as possible be of welded constructions, screwed terminal connection shall be avoided.

Piping design and installation shall be suitable for periodic testing.

7.6 PROTECTION DURING SHIPMENT

Materials shall be handled and stored so that they are protected against corrosion, damage or ingress of foreign matter.

Flanges, openings, nozzles and terminals shall be thoroughly cleaned and adequately protected to prevent entry of extraneous material during transit and storage. Parts shall be suitably marked to facilitate matching during erection.

7.7 PAINTING

Machined and finished surfaces shall be protected against formation of rust and corrosion by application of a rust inhibitor.

All steel surfaces which are to be painted shall be thoroughly cleaned, degreased and given one shop coat of primer, prior to assembly.

All castings shall be sand blasted, degreased and cleaned before painting. Primary and final painting for work done at factory and site should be done by contractor.

7.8 INSPECTION

The contractor shall have rigid inspection procedure laid down to ensure quality of workmanship, compliance with material specifications and drawings, mechanical accuracy of components, identity and acceptability of all terminal, parts and equipment, both in his and his sub contractors works.

8.0 TECHNICAL REQUIREMENTS OF THE DIESEL ENGINE AND AUXILIARY SYSTEM

8.1 DIESEL ENGINE

Engine Approved makes - MTU/CATERPILLAR/PERKINS/CUMMINS

The diesel engine shall be four-stroke, single acting, mechanical injection type and shall furnished with at least the minimum equipment according to BS 5514 / ISO standard practices. The horsepower rating, required auxiliaries, guarantees of fuel consumption, parallel operation, governor characteristics and performance, torsional vibration and materials and workmanship shall be in accordance with BS 5514 / ISO standard practices.

The engine shall be equipped with a flywheel. The engine shall be provided with an exhaust gas turbo-charge with after – cooler and an integral air filter and silencer.

8.1.1 DESIGN AND CONSTRUCTION REQUIREMENTS OF DIESEL ENGINE

8.1.1.a BED PLATE

Bedplates shall be of alloy cast iron or fabricated steel. In the case of steel bed plates, welding shall be done in a continuous process. The fabrication shall be stress relieved after welding.

8.1.1.b CRANK CASE

Crankcase shall be of alloy iron casting with integral transverse diaphragm or alternatively of fabricated steel construction provided with heavy steel inner side plates to form water compartments around the cylinders. Access to bearings, camshaft, governor drive and water jackets shall be provided in the webs, journals and bearings to carry lubricating oil under pressure to the main connecting rod bearings.

8.1.1.c MAIN AND BIG END BEARINGS

Main and big end bearings shall be detachable pre finished sheets with high grade bearing materials and shall be easily fitted without scraping or hand fitting. The big end dimensions shall be such that the connecting rods can be with drawn through the cylinder liners.

8.1.1.d BALANCING GEAR

Engine shall be inherently balanced. Where this is not possible, engine shall be fitted with a balancing system driven from the crankshaft.

8.1.1.e CONNECTING RODS

Connecting rods shall be I beam sections of high grade drop forged steel and shall carry the big end bearings.

8.1.1.f CONNECTING LINERS

The cylinder liners shall be of the separately inserted 'Wet' type cast in alloy iron and specially machined in their bores to give an oil retaining surface. They shall be flanged at their up ends and secured by the cylinder heads, with the lower ends located and sealed in the crank case by rings of synthetic materials resisting oil, water and heat.

8.1.1.g PISTONS

Piston shall be forged aluminum alloy or cast iron alloy and machined on their outer surface to a system of graduated cold clearance to provide good heat transfer qualities and maximum bearing surfaces consistent with clearances. The pistons shall be fitted with compression rings and oil scraper rings of hardened cast iron alloy.

8.1.1.h CYLINDER HEAD AND VALVE GEAR

The valve operating gear assembly shall be oil lubricated and shall be oil totally enclosed in alloy iron castings bolted to the crank case with narrow joint washer interposed between the head and top of liner to provide a gas tight seal. Each cylinder head shall have inlet and exhaust valves of heat resistant steel, which seat on wear – resistant inserts. Each cylinder head shall also be fitted with a fuel injector, combined pressure relief and compression release device, if required. The combustion chamber roof part walls and fuel injector sleeves shall be accessible for cleaning purpose. Each valve shall be loaded by concentric coil springs and shall operate in long detachable valve guides.

The valves shall be operated from the camshafts one for each bank of cylinders, by roller tipped cam followers. The valve gear mechanism shall be enclosed by light detachable covers.

8.1.1.i CAMSHAFT

The camshafts, one for each bank of cylinders, shall be built up in replaceable sections of heat treated precision-machined steel with Chromium plating and jointed by muff-couplings, the outer diameters of each rotate in gun-metal. Bushes housed in the crank case casting. All cams shall have hardened profiles. Inlet and exhaust cams shall be in one piece and keyed to the soft. Fuel injection cams of the split removable type shall be down loaded in angler location.

8.1.1.j CAMSHAFT DRIVE

The camshaft may be either chain or gear driven. Gears shall employ in the “hunting tooth” principle to ensure even wear. In the case of chain drives chain tensioning gear shall be located so that it is readily accessible.

8.1.1. k FLY WHEEL

The fly wheel shall be of mild steel statically balanced after machining and shall have graduated markings around its periphery to facilitate checking of valve and fuel pump timing. Flywheel shall have sufficient mass and inertia to meet specified limits of variation of generator eliminates torsional vibration within the operating speed limits of the governor and over speed trip, barring slots shall be provided around the flywheel rim of hand barring.

8.1.1.l EXHAUST MANIFOLDS

Exhaust manifolds may be single/double branch type insulated design utilizing Ni-resist Casting to guard against high temperature growth and cracking.

8.1.1.m FUEL OIL SYSTEMS

Fuel oil will be stored outdoors in bulk oil storage tanks provided by the purchaser. The purchaser will provide pipe connections from the tank to the fuel-oil day tank.

The supplier shall provide a 990L day tank, fabricated out of sheet steel, for each DG sets. The day tank shall be situated outside a DG room on a suitable concrete structure to be provided by the purchaser. The day tank shall be provided with necessary level controls to operate the alarm indications.

An engine driven pump shall be provided to deliver the fuel oil from the supply line through strainers containing closely woven filtering material to the injectors.

The supplier shall provide all necessary piping, fitting, supports, valves and accessories to complete the fuel oil system.

Each Day tank shall be provided with two [2] nos. level alarm switches for:-

High level (900 ltr) / Low level corresponding to 30 mts fuel capacity of tank or 150 ltr.

Each tank shall be provided with a calibrated transparent tube for indicating the fuel level. Each tank shall be provided with a manhole, vent and drain nozzles, over flow pipe. Details of nozzles and also their orientation shall be furnished. All pipes shall be connected through flanged joints.

8.1.1.n FUEL OIL PIPING ROUTING

Fuel oil piping routing inside the DG room shall be in the basement and shall be shown by the supplier. A single line diagram of the piping showing sizes of pipes, valves, etc., shall be furnished with the tender.

8.1.1. o LUBRICATING OIL SYSTEM

Automatic pressure lubrication shall be provided by a gear type pump at the free end of the engine and driven from the crankshaft. Pressure switches shall be provided to give alarm if the pressure falls below a set value and subsequently trip the unit when the minimum safe pressure limit is reached. A dipstick shall be provided for level measurement. All necessary accessories such as pressure gauges, temperature indicators, pressure relief valves, bypass valves, pressure switches for alarm and controls shall be provided by the supplier together with all interconnecting piping, fitting supports, valves etc.

8.1.1. p ENGINE STARTING SYSTEM

Starting of the diesel engine shall be by electrical means. The diesel engine shall be provided with adequately rated battery of the lead acid type complete with all accessories, stand, interconnection etc.

8.1.1.q AIR INTAKE AND EXHAUST SYSTEM

The supplier shall provide an air filter and residential type silencer with the turbo charger. Air will be taken from the diesel room as started elsewhere in this tender.

The exhaust system shall consist of an exhaust gas driven turbo charger with lagged piping interconnecting cylinder head outlets with turbo charger inlets. Exhaust manifold shall be of fabricated steel and it shall be suitably lagged. Exhaust gas from turbo charger shall be led out through necessary pipes, adapters etc., to an exhaust gas silencer.

Expansion joints shall be provided to take care of thermal deformations. Pressure drop in the exhausts piping including silencer, bends, expansion joints etc., shall be compatible with exhaust gas leaving the engine. The exhaust piping shall be duty throughout the length from the engine outlet up to the outlet point inside the room with high temperature resistant thermal wool, with chicken mesh and on top lagged with aluminum sheet wrapping. Bending radius of bends shall be not less than 3 internal diameters of chosen piping. A drain plug shall be fitted at the lowest point for condensate extraction. Exhaust pipe shall be raised above the highest point of the building and shall meet the regulations of pollution control board. Suitable supports shall be provided for proper installation of exhaust pipe.

The silencer shall be mounted so that its weight is not supported by the engine. Exhaust pipe size shall be sufficient to ensure that the exhaust back pressure does not exceed the maximum limitations specified by the engine / generator set manufacturer. Piping size shall not be less than 10" dia with B Class MS pipes duly supported.

The muffler and all indoor exhaust piping shall include lagging to maintain a surface temperature not exceeding 65 Deg; C. The insulation shall be installed so that it does not interfere with the functioning of the flexible exhaust fitting.

Engineering data sheets detailing silencer attenuation, construction materials and all relevant physical dimensions in detail shall be provided. Data shall include bends, necessary adapters, tail pipe, brackets, supports, joints, bolts, diameter of exhausting piping, size of thimbles for penetrating walls, type of insulation for silencer, etc.

Exhaust system shall consists of the following:

- Exhaust pipe & Bends : Class 'B' M S pipe,
- Special exhaust silencer insertion loss value 25 dB (A),
- Freestanding chimney as per the specifications .

8.2 GOVERNING SYSTEM

The digital governing system shall conform to accuracy class A1 as per BS 5514 : Part 4. In addition when a 93KW motor for 2000KVA having a starting current of 3 Full load current (FLC) is started, the frequency dip and recovery time shall not be more than 5% and 3 Secs respectively.

Governor shall have the following features.

It shall be capable of operating both as an 'isochronous' or a 'speed droop' governor. The speed parallel operation shall be adjustable from 0-5% of the engine.

The governor system shall be provided with electronic devices, which would sense change in generator kW load and initiate corresponding change in governor setting prior to a signal being received from normal speed governing.

Governor shall be suitable for operation without external source of power supply.

A KW load sensing facility shall be available in the engine governor / controller. A over speed trip shall be provided to automatically shut off fuel in case the set reaches 110% rated speed.

An engine mounted emergency stop push button shall be provided.

8.2.1 REQUIREMENT OF SPEED GOVERNOR

Speed governor shall have steady state transient response and recovery times fully conforming to class A1 governors as per BS 5514 part-IV.

8.2.2 MOTORS FOR AUXILIARY SYSTEMS

Motors if any for the auxiliary systems shall be suitable for 3 Phase, 415 +/- 10%, 50Hz +/- 3% AC supply. Motors shall comply with the requirements of BS 4999 and BS 5000 for power station auxiliary duty. Degree of protection of motors shall conform to IP 55.

9.0 REQUIREMENTS OF GENERATOR AND EXCITATION SYSTEM

9.1 SCOPE

This specification generally describes the generators and associated equipment, excitation system and voltage regulator.

9.2 STANDARDS APPLICABLE

The Equipment and accessories covered by this specification shall be designed, Manufactured and tested in compliance with the following latest relevant standards in order that specific aspects under working conditions are taken care of :

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|-------------------------------|---|
| 1. a. IEC Publication No.34-1 | : Recommendations for rotating electrical machines. |
| b. IEC Publication No.34-1A | : Supplement to publication No.34-1 |
| 2. British Standard 4999 | : Specification and general requirements for rotating electrical machinery. |
| 3. Indian Standard 4722:1968 | : Rotating electrical machinery |
| 4. IEEE: 115 | : Test Procedure for synchronous machines. |
| 5. IS 4691 / 1968 | : Degrees of protection. |

The equipment and accessories for which Indian standards are not available shall be designed, manufactured and tested in accordance with the latest standards published by other recognized national standards institution.

The equipment shall also conform to the latest Indian Electricity Rules as regards safety, earthing and other essential provisions specified there in for installation and operation of electrical plants.

9.3 GENERATOR SPECIFICATIONS

The alternator shall be continuously rated, three phase. Three wire, rotating field, self-excited, brush-less type alternating current machine, direct coupled to the diesel engine prime mover. The whole unit shall be designed and constructed to operate as one unit. Mechanical degree of protection of alternator shall conform to IP-22.

The diesel engine and alternator shall be mounted on a common steel base frame for grouting into or floating on a concrete foundation for fitting to embedded steel channels. Coupling shall be provided with coupling guards.

The deviation factor of the open circuit line-to-line terminal voltage of the alternator shall not exceed 0.1.

Alternator shall be capable of withstanding, without damage a 30 second three phase short circuit at its terminals when operating at rated KVA and power factor at 5% over voltage, with fixed excitation.

Alternator shall be capable of carrying a one-minute overload of 50% of normal rated current with the field set for normal rated load excitation.

Alternator shall be designed to be capable of operating in parallel with other DG sets of similar rating and / or grid.

Alternator winding shall be insulated with class F insulation. The machine shall be naturally ventilated. 3 wire type embedded temperature detectors for winding and bearing shall be provided.

Alternator shall have amply dimensioned terminal boxes for easy termination of aluminum power cables to terminate leads from space heaters; windings and bearing temperature detectors; to accommodate protection CTs.

Terminal box shall be suitable for cable entry from top bottom or sides.

9.4 GENERATOR REACTANCE :

Sub-transient reactance shall be low to maintain fault contribution from the generation within permissible limits. The transient reactance should be as low as possible consistent with the need to limit voltage drop on sudden application of load.

9.5 GENERATOR CONSTRUCTION

9.5.1 GENERAL

All parts of the generator and accessories shall be capable of withstanding electrical, mechanical, thermal and other stresses experienced in operation and during short consistent with the need to limit voltage drop on sudden application of load.

Spacer blocks and wedges used in the construction of stator windings shall be made of non-shrinkable material. Binding of coils shall be non-continuous, preferable using glass cord or equivalent. Generator stator and field windings shall be insulated with class F insulation. Core plate insulation shall also be class F. All armature winding connections shall be brazed strand to strand to provide maximum margin against local overheating.

9.5.2 BEARING INSULATION

Insulation shall be provided to break the paths of stray current at two places in series with provision made for determining the insulation resistance each insulation piece. The insulation under the bearing pads shall be made of non-hygroscopic material.

9.5.3 STATOR FRAME

Stator frame shall be of one-piece construction, fabricated from heavy steel pipe and designed for minimum noise and vibration.

All stationary parts of the generator shall be designed to avoid resonance at 50Hz, 100Hz and 200Hz.

Generator shall be designed with B3 construction i.e., with two end shields and foot mounted.

9.5.3 ROTOR

Rotor shall be properly balanced at rated speed, critical speeds over speeds.

9.5.4 VENTILATION

Generator shall be air cooled with shaft mounted fan.

Shaft mounted fans shall be provided to effect air circulation through the ventilation system.

9.5.5 CONNECTION

The 3 phase windings of the generator shall be arranged for star connection and shall be suitable for operation with the neutral grounded.

9.5.6 STATOR TERMINALS AND TERMINAL ARRANGEMENT

The two terminals of each phase winding shall be brought out of the generator frame at approved locations. Terminal markings shall be in accordance with BS 622. The direction of rotation shall be marked on the suit purchaser's cables/ bus ducts and enclosed to safeguard against short-circuits by rodents etc., Suitable cable glands or cable sealing boxes as specified shall be provided on the enclosure to facilitate entry of the cables.

9.5.7 TERMINALS

The lines and neutral ends of each phase winding of the generator shall be brought out two separate terminal boxes. The line end terminal box shall be phase segregated for HV machines and phase insulated for LV machines. Terminals boxes shall have facilities for mounting CTs specification on 6 suitable located terminals.

Cables sizes shall be as indicated in the Generator Data Sheet enclosed, if applicable.

Fault withstand capability of the terminal box shall be 18.4 KA for 1 Sec.

9.5.8 CURRENT TRANSFORMERS

Current transformers, two per phase shall be provided at the neutral end of the generator with rating as in Generator Data Sheet for over current, differential and restricted earth fault protection.

Offer for current transformers shall be accompanied by Ratio and phase angle errors and complete error for protection class CTs

Magnetization characteristics extending at least up to 150% of the excitation current at knee point voltage for both class PS and protection CTs.

Current transformers shall have terminal blocks with facility for short circuiting grounding the secondary.

9.5.9 TEMPERATURE DETECTORS

A minimum of two platinum resistance type temperature detectors shall be provided per phase of the generator, between the coils of the stator windings and two on bearings. The resistance value of the RTDs shall be 100 ohms at 0 deg C. The supplier may provide additional RTDs for measuring temperatures at specific points in the machine. In addition to RTD, supplier may provide additional monitoring equipment if required to monitor equipment condition.

Temperature detectors of resistance type shall be provided, in accordance with America Standard Specification C.50-1. One RTD shall be embedded in each bearing.

The detectors shall be installed at locations where the highest temperatures may be expected. The leads of the temperature detectors shall be brought in a neat and adequate manner to an easily accessible terminal box on the generator frame. The minimum size of the leads shall be 1.5 Sq.mm. The leads shall be protected against stray electrical fields mechanical damage.

The temperature detectors with their leads shall be accurately calibrated. Test reports giving results of the calibrations shall be submitted for purchaser's scrutiny.

A drawing indicating locations of the detectors shall be furnished.

9.5.10 SPACE HEATERS

Space heaters of adequate capacity rated for 240V, 50Hz single phase service shall be provided for the generator, exciter and associated cubicles to maintain inside temperature sufficiently above outside ambient so that condensation of atmospheric moisture is prevented when the equipment is not in service.

The heaters shall be mounted in an accessible location. In the case of the machines, they shall be located in the lower part. Terminals of the space heaters shall be brought out to a separate terminals box.

KW rating of the space heater shall be indicated.

9.6 EXCITATION SYSTEM

9.6.1 BRUSH LESS EXCITATION SYSTEM

The brush less excitation system shall have the following provisions:-

A revolving armature AC exciter directly coupled to the generator rotor at the outboard end shall be provided. The output of the AC exciter shall be rectified by the rotating diodes connected as a 3-phase bridge.

The rotating rectifier components shall be contained against centrifugal forces by adequately designed retaining ring. The rectifier design shall be based on the basis of one high power diode and fuse per parallel path. Suitably rated heat sinks which will also act as a fan shall be provided for each diode.

DC outgoing poles shall preferably be segregated by locating Rectifier Bridge on either side of the shaft. Each arm of the bridge shall be made of more than one high power diode arm arrangement in a suitable configuration to ensure that the cells withstand all fault conditions to which they may be subjected.

The total number of diode arms shall be such that failure of up to 25% diode arms will not cause restrictions on the unit operation at its rated condition, including field forcing. Suitably rated varistors etc., shall be provided to give a path for the reverse polarity induced currents resulting from the generator pull-out, power swing and any other abnormal conditions. Diodes and associated protective devices shall be mounted radially. It shall be ensured that the rectifying junctions are held in compression under speed.

Excitation system shall have thermal capability equal to or better than the field of requirement of the generator, when operating at rated KVA and at any voltage between 5% below and 5% above rated voltage.

Exciter rated voltage shall be at least 110% of the rated machine excited voltage. Exciter ceiling voltage shall not be less than 130% of the exciter rated voltage.

Insulation of exciter shall be class F.

9.6.2 VOLTAGE REGULATOR

The voltage regulator shall be automatic, high speed, non-band type with provision for current compounding. The voltage regulating system shall be suitable for automatic control of voltage.

Steady state accuracy of the voltage regulator from non-load to rated load shall be within +/- 2.5% of rated generator voltage of any one phase at any p.f between 1.0 and 0.8 lagging from cold to hot variations.

The voltage regulator shall be capable of supplying excitation current in the event of a 3-phase short circuit at the generator terminals to facilitate operation of the protective devices and under all conditions of loading specified.

Alternator shall have a reliable 3 phase voltage sensing compound excitation system having:

Capability to build-up the voltage from residual magnetism.

Protection against low speed operation.

Voltage / hertz responsive feature.

Provision to manually adjust the alternator voltage within +/- 5%

9.6.3 GROUNDING

A non-corrodible metal pad shall be welded or brazed at two different locations on the frame and shall have a threaded hold at the center for connecting the cable lugs by means of hexagonal head bolts and spring washers.

Two independent grounding points shall be provided on opposite sides near the bottom. Grounding points shall be suitable for the following grounding strip.

- Machine : 50 X 6mm Cu. Flat
- Power Panels : 25 X 6mm Cu. Flat
- Control Panels: 25 X 3mm Cu. Flat

10.0 PERFORMANCE REQUIREMENT OF THE DIESEL GENERATOR UNITS

The DG sets and the associated auxiliary system shall be designed to provide a stand by source of power of a high reliability.

The DG set shall be capable of starting from cold condition and reaching synchronous speed and ready to take load in a period of ten (10) seconds from the initiation of start impulses without suffering undue stress, wear and tear. The DG sets shall be capable of accepting the maximum rated load of the generator within a period of thirty (30) seconds from the initiation of start impulse.

The DG sets shall be capable of operating at rated load on the generator

- in isolation
- in parallel with similar DG sets.

Diesel generator shall be capable of delivering continuously at the terminals of the alternator **1600 KW Prime duty for 2000 KVA sets at 0.8 P.F at 11KV** when the ambient surrounding the alternator is 40 deg C, intake air for combustion 40 deg C.

The DG sets shall be capable of peak-output of 10% in excess of the rated output for a period of one (1) hour in every 12 hours of continuous running at rated load, without exceeding permissible temperature limits and with a faintly visible exhaust.

The DG sets shall be capable of meeting the specified performance when using commercially available HSD oil to as per IS: 1460-1974.

The DG sets shall be capable of starting on their own when external power supply is not available

Diesel generator shall maintain output accuracy of +/-1% of voltage and +/- 0.25% of frequency at the terminals of the alternator under steady state condition

During recovery from transients caused by step load increase or resulting from the disconnection of the largest single load the speed of the D.G.set shall not exceed 115% of the nominal. Further, the transient following the complete loss of load shall not cause the speed of the unit to attain the over speed set point.

The sub transient and transient reactance of the generator shall be chosen to meet the above requirements.

The voltage and frequency of the generator shall be adjustable between + / - 5% and + / - 2.5% of the nominal values respectively from local D.G. control panel and remote control panel.

10.1 ITEMS OF GUARANTEED PERFORMANCE

Following items of performance shall be guaranteed by the supplier in respect of the DG sets and auxiliaries, when operating under specified site conditions given in Annexure.

Net electrical power output at specified power factor and terminal voltage under specified conditions considering de-rating factors as given in ISO standards.

- Fuel oil consumption at full load.
- Lubricating oil consumption at full load.
- Jacket water temperature to and from engine. (As applicable)
- Lubricating oil temperature to and from engine.
- 10% overload for one hour in every 12 hour of continuous running at rated load.
- Generator efficiency at $\frac{1}{2}$, $\frac{3}{4}$ and full load at specified power factor and terminal voltage.
- Governor response and over speed capability.
- Voltage regulator response.
- Contractor shall indicate the tolerance applicable to each of the guaranteed parameters above and the reference standard.

10.2 DIESEL ENGINE DRIVEN GENERATOR

The engine/generator sets shall meet the following parameters:

- A governed speed of 1500 rpm.
- Rated 0.8-power factor for prime operation.
- To operate at 11000 Volts, 3 phase, 3 wires, 50 Hz at 1000 meters elevation Above sea level.
- Temperature range of 25 Deg; C to 45 Deg C.
- Equip generator with a liquid cooled diesel engine.
- Engine-mounted radiator
- Alternators shall be of reputed make (STAMFORD / LEROY SOMMER/TDPS), salient pole, brush less, synchronous, revolving field, air-cooled and drip-proof and OPEN DELTA connected with a separately excited system using a permanent magnet generator.
- The alternators shall be capable of withstanding, without adverse effects. Overspeeds of 25 percent above the governed speed for the duration of one minute.
- Generators shall have the capability to provide minimum of 300 percent of rated three-phase current for 10 seconds.
- Engine mounted fuel filter.
- Phase segregated terminal box shall be provided which shall be suitable for terminating 11KV 3C 240 sq.mm. XLPE, earthed type cable. The neutral terminal shall be brought out in a separate terminal box on the opposite end.
- THD at no load shall be < 3%
- 3 Nos. single phase 11 kV / $110\text{ V} / \sqrt{3}$ PTS shall be supplied for AVR sensing.
- Exhaust System – Exhaust system shall be connected to a freestanding chimney. The chimney shall be suitable for connecting all Generators. .

11.0 REQUIREMENTS OF 2000 KVA, 11 KV D.G.SET.

11.1 DIESEL ENGINE:

Diesel Engine, Water Cooled, Turbo charged, with After Cooler, suitable for Generating Set applications, developing 2319 BHP for 2000 KVA DG SET @ 1500 RPM under NTP conditions of BS:5514, with an overload capacity of 10% for one

hour, in any 12 continuous hours operation. The Engine is equipped with the following standard accessories as per the specification given in this Tender.

11.2 COOLING SYSTEM

Consists of Radiator with Fan, Engine Mounted Water Pump, Thermostat, Corrosion Inhibitor Coolant and Self Control piping.

11.3 FUEL SYSTEM

Consists of PT fuel pump, Injectors, Fuel Filters and Self Contained piping.

11.4 LUBRICATING SYSTEM

Consists of Oil Pump, Strainer Lube Oil Cooler, Oil Filter, Bypass Filter and Self Contained piping.

11.5 AIR INTAKE SYSTEM

Consists of Dry Type Filter, Air Cleaner Manifold with necessary connections and turbocharger with after cooler

11.6 EXHAUST SYSTEM

Consists of Exhaust Manifold, Flexible and Residential Silencer.

11.7 GOVERNING SYSTEM

Digital Governor Controller.

11.8 STARTING SYSTEM

24V D.C. Starter Motor, Battery Charging Alternator with in-built regulator.

11.9 DG CONTROLLER PANEL (Near the DG set)

Consists of the following parameters with Digital indication.

Water Temperature.

Lube Oil Pressure.

Engine RPM.

Running Hours.

Fault code display

Emergency push button

Auto – Manual selector

Other feather touch switches

11.10 In the Relay metering Panel

Battery Voltage.

Voltage between phases

Current in each phase

Power Factor

KWhr

Battery charger failure.

11.11 Trip Indication LED Red Display for

High Water Temperature.

Engine Over Speed.

Low Lube oil pressure.

Low Coolant Water Level.

Battery charger failure.

Sensor Fault.

11.12 Accessories

Flywheel Housing.

Flexible Coupling.

Coupling guard.

11.14 ALTERNATOR

Standard design Alternator rated at 1600 KW for 2000 KVA DG SET at 0.8 PF, 11 KV, 3Phase, 3 wires, 1500 RPM, 50 Hz. Brush less design in screen protected, drip proof, IP :22 enclosure with WTD & BTDs, Space Heater Insulation Class "F" Band of Voltage Regulation +/- 2.5% of rated voltage from no load to full load. The Alternator generally conforms to BS: 2613/5000.

11.15 BASE FRAME

Sturdy, Fabricated, Welded construction, Channel Iron Base Frame for mounting the above Diesel Engine and Alternator.

11.16 FUEL TANK

990 Liters capacity Fuel Tank for ONE each DFwith supporting stands complete with level indicator, fuel inlet and outlet, air vent, drain plug, inlet arrangement for direct filling and set of 5 ft. long fuel hoses.

11.17 BATTERIES :

Set of 4-Nos. 12 Volts, 27 Plates, Dry Uncharged Batteries.

11.18 ANTI VIBRATION MOUNTS :

Set of Anti Vibration Mounting Pads.

11.19 GENERATOR DATA SHEET

Rated frequency	: 50 Hz
Number of phases	: 3
Winding Connections	: Wye
Generator continuous outputs rating	: 1600 KW
Rated Voltage of Generator	: 11000V
Power factor	: 0.8 lag
Over load capacity for one (1) h in every 12 h of continuous running at rated load	: 10%
One (1) min over load	: 50% of normal rated current With the field set for normal Rated load excitation.
Type of neutral	: Resistance earthed to limit the earth fault within 10A.
Type of insulation	
a. Armature winding	: Suitable for 11000V
b. Field winding	: Suitable for 11000V
c. Connections	: Suitable for 11000V
d. Core Insulation	: Suitable for 11000V
Temperature rise at max. Continuous Rating over 40 deg C	: Temperature rise as per standards.
a. Armature winding (by resistance)	: 100 Deg C
b. Field winding (by resistance)	: 100 Deg C
c. Core and mechanical parts in contact with adjacent insulation (by thermometer)	: 80 Deg C
Type of enclosure	: Screen protected drip-proof IP22
Permissible voltage variation of	

voltage for satisfactory operation
at rated KVA, rated Speed and rated
power factor. : + / - 1.5 %

Excitation system : Brush less type rotating armature, stationary.

Voltage regulator

a. Voltage setting range of the
regulator voltage. : + / - 5% of rated

b. Steady state accuracy of voltage : Less than + /- 0.5 of regulator from no-load
to rated generator voltage full load

c. Quadrature droop circuit provided : Yes
limit the reactive KVA.

Maximum period to recover the : 0.5 sec
Generator voltage to the set value for a step
application or rejection of rated power factor.

Time for which generator shall be Capable of
with standing without injury a three phase short
circuit at this terminals when operating at rated
KVA and power factor at 5% over voltage with
fixed excitation : 10 sec

Voltage wave form telephone
harmonic Factor of line-to-line terminal voltage : 3 % max

Over speed rating : 125% of rated speed for 2 minutes

Short circuit ratio : Not less than 0.5 Current Transformer rating

Neutral CT for restricted earth : 50 / 5A, CI: 5P10 15VA fault Protection
required at terminals.

Terminals shall be suitable for : 11 KV 3C 240 sq. mm Al. Ar. XLPE
cable
connection of

Temperature detection

a. Type of temperature detector : Platinum resistance type

b. Number of temperature detectors : Minimum two / phase of
the generator between the coils of the
stator winding two on bearings.

- c. Value of resistance of temp. detector. : 100 ohms at 0 Deg C
- Terminal box
- a. Line side : 1 No.
 - b. Neutral side : 1 No.
 - c. WTD,BTD & Space Heaters : 1 No.
 - d. CT terminals : 1 No.

Terminal box enclosure : IP 54

Terminal box fault withstand capability : To withstand terminal fault level for 1.0 sec

Anti condensation heater with fuse And Thermostatic control : to be provided

Generator shall be microprocessor controller based suitable for auto synchronizing and auto load sharing.

THE D.G.SETS SHALL BE PROVIDED WITH MODBUS COMMUNICATION CARD FOR INTEGRATION WITH IBMS.

11.20 MAKE OF MATERIALS

ENGINE : CUMMINS / CATERPILLAR / MTU / PERKINS

ALTERNATOR : STAMFORD / LEROY SOMER / TDPS/KIRLOSKAR

12.0 QUESTIONNAIRE FOR DIESEL GENERATOR TO BE FILLED BY VENDER

DATA SHEET / COMPLIANCE OF SPECIFICATIONS / GUARANTEED TECHNICAL PARTICULARS FOR 2 Nos. 2000 KVA RATING DIESEL GENERATOR.			
SL.NO.	DATA	CLIENTS REQUIREMENTS	VENDOR'S CONFIRMATION
1	DG SETS		
	Manufacture	Specify	
	Rating of sets	2000 KVA	
	Model No. & Type	Specify	
	Qty.	2 Nos.	
	Rating of highest load that should be started		
	Application	Prime power generation	
	Anti-vibration mounting	Required	
	Sound proofing	Acoustic enclosure for the set preferred.	
	Total static weight with enclosure.	Specify in Kgs.	
	Total dynamic weight with enclosure.	Specify in Kgs.	
	Exhaust line with silencer & chimney	Specify in Kgs.	
	DIMENSIONAL DETAILS		
	Dimensions (L X B X H) detail requirements of the following DG set without acoustic		
	Length (mm)		
	Width (mm)		
	Height (mm)		
	Foundation size:		
	Length (mm)		
	Berth (mm)		
	Height (mm)		

(mm)		
ENGINE		
Make	Specify	
Model No.	Specify	
Name plate rating	Specify	
BHP	Specify	
Engine speed	Specify	
Method of starting	THROUGH BATTERY	
Aspiration	Water cooled Turbo charged	
Emission	Conformity to PCB norms formulated by the Ministry of environment	
Lube oil heater	Required	
Lube oil consumption	Specify in Litres	
Lube oil pump	Engine driven only	
Standby lube oil pump	Not Required	
Engine noise level Bare engine with acoustic enclosure	Specify in db at 1 mtr.	
	Specify in db at 3 mtrs	
	Specify in db at 6 mtrs	
Minimum operating time without cooling water at full load	Specify in minutes	
Combustion air flow	Meter cube / hour or CFM	
Derating under site conditions:	Specify - if any	
No. Of cylinders	Specify	
Type of construction	Inline / V type	
Cubic capacity		
Bore & Stroke		
Compression Ratio		
Max continuous power at flywheel	KW	
Piston speed		
Turbo charger after cooling	YES / NO	
Maximum time to start from cold & attain rated speed & ready to take load	Specify in seconds	
Rated Speed & ready to take load	Sec	

Short time overload capacity	110% for 1 hr in 12 hrs of operation	
Brake Mean Effective Pressure		
COOLING SYSTEM		
Method of Jacket cooling:	Water	
Heat Removal	Radiator with expansion tank	
Radiator fan	Engine driven	
Total radiated heat	Specify	
Operating weight		
Qty of coolant		
Cooling system of alternator		
Temp. rise of armature winding		
Temp. rise of field winding		
FUEL OIL SYSTEM		
Fuel oil	High speed Diesel	
Fuel tank level indication	Required	
Fuel consumption at		
a) Full load	Specify in Litres/kW/hr	
b) 75% load	Specify in Litres/kW/hr	
c) 50% load	Specify in Litres/kW/hr	
Fuel tank (Day tank) capacity	Liters or as specified	
Fuel transfer pump drive	Engine driven	
Specific fuel consumption	Liters/KW	
EXHAUST SYSTEM		
Exhaust silencer type	Heavy duty Residential / hospital type	
Exhaust noise level (with silencer)	65 db at 1 meter to be measured as per BS 5615	
Heat rejection to exhaust system	Specify	
Max. Permissible back pressure	Specify	
Exhaust gas flow	Specify	
Exhaust gas temperature	Specify	
Chimney length	Refer technical specs.	
Chimney height	Specify as required, building height is around 33 M	
Emission Limits (gAcw-hr)		

	for		
	NOX	9.2	
	HC	1.3	
	CO	3.5	
	IPM	0.3	
	Smoke Limit absorption coefficient, (at full load)	0.7	
	WI		
	GOVERNOR		
	Make	Specify	
	Model No	Specify	
	Type	Digital only, give details	
	Adjustable droop provided	Required	
	Response time	As per class A1	
	Recovery time	As per class A1	
	Speed raise / lower from panel	Required	
	ALTERNATOR		
	Make	Specify	
	Model No	Specify	
	No. of phases	3 phase and neutral	
	Enclosure	IP 22/23	
	Terminal voltage & frequency	11000 V AC & 50 Hz	
	Time permitted to build up rated voltage	5 seconds max.	
	Permissible voltage dip	10%	
	Rating of biggest motor to be started DOL with permissible voltage dip when the generator is		
	a) Unloaded	Specify	
	b) 80 % loaded	Specify	
	c) 50 % loaded	Specify	
	Rating of highest load that should be started		
	Rating	2000 KVA at 0.8 P.F	
	Insulation class-Armature	Class F	
	Field	Class F	

Winding temp. Indication Type	Specify	
Bearing temp. Indication Type	Specify	
Inertia time constant	Specify kW-Sec / KVA	
Bearing type	Specify	
RFI suppression	Required	
Short circuit withstand time	Specify	
Overload withstand capacity	Min. 150 % for 15 Sec.	
Neutral Earthing	Solidly Earthed	
TYPE OF COOLING		
Cooling system of Alternator		
Temp. rise of Armature Winding		
Temp. rise of Field Winding		
EFFICIENCY OF ALTERNATOR		
a) At 100% MCR & rated p.f.	Specify	
b) At 75 % MCR & rated p.f.	Specify	
Max continuous & momentary unbalanced load capacity	Specify	
Asymmetrical short circuit withstand capability & duration	Specify	
Open circuit transient time constant	Specify	
Short circuit ratio	Specify	
EXCITER		
Type of excitation	Brush less	
Capacity in KW	Specify	
Operating voltage & current	Specify	
Duration of field forcing	Specify	
Class of insulation	Specify	
AVR		
Type of A V R	Self regulated	
Mounting of AVR	Specify	
Voltage Regulation		

Dead band %	Specify	
Response time	Specify	
Voltage of operation	Specify	
Line drop compensator provided to maintain bus voltage constant	Required	
Range of voltage adjustment	Specify	
ENGINE MOUNTED PANEL		
Lube oil Pressure indicator	Required	
Make	Specify	
Type	Specify	
Cooling water Temperature indicator	Required	
Make	Specify	
Type	Specify	
Engine Speed Indicator	Required	
Make	Specify	
Type	Specify	
Any other indicator required for the engine protection to be recommended by the vendor.	Specify	
Control	Microprocessor based, specify	
Auto/Manual position selector		
Switch for DG control	required	
No. of starting commands in single Attempt in Auto position	Minimum. 3 starts	
Time gap between commands	in secs	
ALARM / TRIPS ON ENGINE SIDE		
Low fuel oil level alarm	Required	
Low lube oil pressure alarm & trip	Required	
Over speed alarm & trip	Required	
Engine High water temperature alarm & trip	Required	

	Engine 'Fail to start' alarm	Required	
3	CONTROL & POWER PANEL		
	Cabinet Construction	Floor mounted	
	Degree of protection	IP52	
	Access	Front / Back	
	Cable entry	TOP and as per site requirements	
	Controller	Integrated Microprocessor:	
	Make	Specify	
	Model No	Specify	
	Type	Specify	
	No. of starting commands in single attempt in Auto position min.	3 minimum	
	Time gap between commands	Specify in seconds	
	Active and reactive load sharing with other DG's	AUTO	
	Auto stop on resumption of main supply	Required	
	Protection / Load Control / Synchronizing/ Engine monitoring etc as per specifications	YES / NO.	
4	BATTERY CHARGER		
	TYPE		
	Make		
	Model	SMPS BASED	
	Charger rating		
	Float charger mode to be provided	Required	
	Boost charger mode to be provided	Required	
	Metering	Voltmeter and Ammeter	

	Indication for Charger mode		
	BATTERY		
	Make		
	Type	LEAD Acid	
	Capacity in AH		
	Back up duration in Hrs		
	Battery voltage	12 V	
	End Cell voltage	12 V	
	Nos. of starts without Recharging	3	
	Location: Inside acoustic enclosure		
5	DG SET SYSTEM – GENERAL DATA		
	Mounting & weights		
	Anti-vibration mounting		
	Make		
	Quantity		
	Sound proofing required	Yes, acoustically insulated enclosure– Outdoor.	
	Weight of equipments		
	i) Engine	kg	
	ii) Alternator	kg	
	Total weight of DG set:		
	Static	kg	
	Dynamic	kg	
6	MISCELLANEOUS		
	Noise level for all other motors / pumps etc	65 db at 1 meter to be measured as per BS 5615	
	Exhaust pipe size from DG to scrubber inlet	Specify in MM	

13.0 TECHNICAL SPECIFICATION FOR NEUTRAL ISOLATOR WITH NEUTRAL GROUNDING RESISTOR PANEL

13.1 SCOPE

This specification generally describes the neutral isolator and neutral grounding resistor panel and associated accessories.

13.2 STANDARDS APPLICABLE

The Equipment and accessories covered by this specification shall be designed, Manufactured and tested in compliance with the following latest relevant standards in order that specific aspects under working conditions are taken care of :

IEEE-32 for Resistance rating & temp is concerned
IS-2147 for the type of enclosure.

13.3 GENERAL CONSTRUCTION

Free standing, Floor mounting, Indoor type, Panel fabricated out of CRCA sheet of 2mm thick with suitable reinforcements and with louvered sheets provided on outside and covered with fine mesh to make the unit vermin proof.

11 kV, 100A, vacuum contactors shall be used for the D.G. Set Neutral Isolation. The Neutral Grounding resistors shall be provided in the neutral earthing conductor to limit the fault current to 100A in the event of a line to ground fault.

The resistance shall be of Punched stainless steel material and rated 100A for 10 sec with resistor value of 63.5 ohms.

The top of the resistor portion will have a perforated sheet of 2.1mm hole to let out the heat dissipated by the NGR during fault conditions.

The paint finish shall be of Siemens gray as per shade RAL – 7032 both inside and outside.

Foundation holes will be provided in the bottom channel base of the unit for grouting the panel to foundation. The cable entry can be either from Top or Bottom through undrilled removable type Gland plates.

13.4 RESISTOR BANK CONSTRUCTION

The grids will be of punched out of SS steel grade ASTM-A240-304. Grids thus made will be assembled on to a threaded MS rods having interleaving porcelain separators as inter grid insulation. The Inter grid connection is by SS hardware. The resistance will be assembled in the form of banks and the number of banks will be stacked one above the other in the Resistance compartment.

13.5. REQUIREMENTS OF NGR PANEL

The panel shall comprise the following components.

1 No. 11KV, SP, 400A Vacuum contactor rated suitably with aux.contacts.

1 No. 11KV Epoxy Cast Resin CT, Ratio 50 / 5, 5P10, 15VA for E/F Relay.

3 Nos. 11KV Epoxy Cast Resin CT, Ratio 150 / 5A, 15VA, PS class for Differential Protection.

1 Set of reputed make panel Lamp, Panel Heater, and Control Fuses.

1 Set of 100A Rated Aluminium Busbar.

Sets of Punched SS Grid Resistor unit of rating 100A, 63.5 ohms, 10 Secs with a Max.Temp.rise of 375deg C.

Sets of Green & Red Indicating Lights for Isolator ON / OFF.

Sets of CT & Control Terminals.

By using a combination of isolating devices as per the Single Line Diagram enclosed, flexibility of running the Generators in Solo & Parallel modes are possible. The remote switching of the Isolating devices may be done by using either a PLC or Contactor Logic and the scope of the same is to be included in the offer.

13.6 GUARANTEED TECHNICAL PARTICULARS

(Of the Grid Offered – Punched SS)

- | | |
|----------------------------|-----------------------------|
| 01. Type of Grid | : Punched SS. ASTM-A240-304 |
| 02. Ohmic Value | : 63.5 ohms |
| 03. Tolerance on cold ohms | : + or -7.5% |
| 04. Duty Rating | : 10 Secs |
| 05. Rated voltage | : 11 KV |
| 06. Rated Current | : 100 Amps |

- 07. Type of Cooling : Natural Air
- 08. Type of enclosure : IP-42 (Panel)
- 09. Installation : Indoor
- 10. Interconnection : 25 X 6 mm Copper Flat
- 11. Max.Temp.rise Resistor : 375 deg C as per IEEE-32
- Enclosure : 55 deg C as per IEEE-32
- 12. Type of protection for : Resistor portion

13.7 MAKE OF MATERIALS

- NGR Panel : Reputed Manufactures
- HT Isolators : Pentagon/Essen/Crompton
- CTs & PT : Kappa/Kalpa/Instrans
- PBs & Lamps (LED) : BCD/RASS
- MCBs : MDS/HPL/ABB/Indokopp
- Local Remote Switch : Kaycee/Switron
- Terminals : Connectwell

13.8 TESTING

The following tests shall be conducted at your works on each of the equipment and in house test certificates shall be given in duplicate for reference & records.

Cold Ohmic value test at room temperature(with in + or – 7.5% tolerance)

Megger test between grids & ground by 2500V meggar.

High Voltage withstand test of 2.5KV for 1 minute for LT circuit.

High Voltage withstand test of 28KV for 1 minute for HT circuit.

14.0 TECHNICAL SPECIFICATION FOR 11KV HT 4 VCB GENERATOR BREAKER PANEL

14.1 SCOPE

This specification covers the design, manufacture and supply of 11 KV 4 VCB Generator Breaker Switchboard incorporating draw out vacuum circuit breaker for 11 KV.

14.2 INTRODUCTION

The 11 KV Switchboard shall be capable of continuous and reliable operation at the full load rating specified where continuity of operation is of prime importance. Workmanship shall be of the highest grade and the entire construction in accordance with the best modern practice. The HT Breaker shall be capable of withstanding the severest stresses likely to occur in actual service and of resisting rough handling during transport.

The HT Switch board shall have only an incoming feeder at present and the panel is to be of extendable type for adding load breaking switch at later date for receiving dual source of supplies, if required.

Circuit breaker shall be suitable to withstand inrush Magnetizing currents of HT Panels and capacitor bank ON and OFF.

14.3 SYSTEM

The HT system shall be suitable for the following:

Rated voltage : 11 KV, 3 phase

Rated frequency : 50 Hz

Fault level : 350MVA

Type of cubicle:

Bus : Copper

Enclosure : IP52

Maximum busbar temp. : 85 ° C

Circuit breaker type : Vacuum

Operating duty : 0-3 min-CO-3 min CO
Control voltage : 80V DC

14.4 STANDARDS

The design, manufacture and testing of the various equipment covered by this specification shall comply with the latest issue of the following standards:

IS 13118- General requirements of circuit Breaker for Voltages above 1000V.

IS 3427 - Metal enclosed switchgear & control gear (1 kV to 11 kV)

IS 37 - Marking and arrangement of switchgear Busbars

IS 2705 - Specifications for current HT Panels

IS 3156 - Specifications for voltage HT Panels

IS 3231 - Electrical relays for power System Protection

IS 1248 - Electrical indicating instruments

IS 722 - Integrating meters

IS 6875 - Control switches and push buttons

IS 694 - PVC insulated cable with copper Conductor wiring.

15.0 SPECIFICATION FOR 11 KV INDOOR SINGLE PANEL VCB

15.1 SPECIFIC REQUIREMENTS

15.1.1 CONSTRUCTION

The panel structure shall house the components to the major weight of the equipment such as circuit breaker, main horizontal busbars and other of the components is adequately supported without deformation or loss of alignment during transit & operation.

The Switchgears shall have necessary internal sheet metal barrier to form separate compartments for buses, instruments, relays, cable connections etc. Adequate barriers shall permit personnel work safely within an empty compartment with the busbars energized. Checking and removal of components shall be possible without disturbing the feeder. All auxiliary equipment shall be easily accessible to facilitate their operation and maintenance. It shall be possible to set all relays and measuring instruments without de-energizing the Switchgear.

All doors and openings shall be fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors, generous overlap shall be assured between sheet steel surfaces with closely spaced fasteners to prevent the entry of dust

The panel shall have a rear cable chamber housing the cable and connections. The design shall ensure generous availability of space for easy installation and maintenance. Cabling and adequate safety for working in one section without coming into accidental contact with live part in an adjacent section.

The HT switchboard shall be constructed only of materials capable of withstanding the mechanical, electrical and thermal stresses, as well as the effects of humidity, which are likely to be encountered in normal service. All insulating materials used in construction of the equipment shall be non-hygroscopic materials, duly treated to withstand the effects of high humidity high temperature tropical ambient service conditions. Creepage distances shall comply to those specified in relevant standards.

The panel shall be provided with space heater to prevent condensation and the same shall be equipped with differential thermostat to automatically cut in and cut out the heater so as to maintain interior of 5

□ C above the ambient

The height of the panel shall not be more than 2100 mm. The total depth of the panel shall be adequate to cater for proper cabling space.

Provision shall be made for permanently earthing the frames and other metal parts of the HT switchboard through an aluminum earth busbar running throughout the full length of the switchboard at the bottom. Draw out type switching units shall have sliding ground contact. It shall be possible to earth the switchboard at two independent points on either end for connections to the external earthing network of the plant.

It shall be possible to extend the switchgear in either direction at a future date. Ends of busbars shall be suitably drilled for this purpose.

Suitable eye bolt for lifting of panel shall be provided. On removing the eye bolts no holes offering access to panel shall be provided.

15.1.2 BUSBARS

The busbars shall be epoxy molded or PVC sleeved and made of high conductivity electrolytic grade copper. The current in all current carrying paths should not exceed 1.20 A/sq.mm. The bus bar chamber shall be totally maintenance free.

The switchboard shall comprise 3 phase main busbars. The bus bar shall be of uniform section throughout and shall be sized to continuously carry the rated current without exceeding the temperature rise of 40

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Busbars shall be colour coded for easy identification of individual phases.

Bus bars shall be supported at regular intervals and both busbars and supports shall be adequately sized and braced to withstand short circuit level without deformation. All bus supports shall be non-carbonizing material resistant to acid alkalis and shall have non-hygroscopic characteristics.

For long busbars suitable expansion joints shall be provided. Thermal design of the busbars shall be based on the installation of the switchgear in poorly ventilated condition.

Busbars shall be housed in a separate chamber, which shall be accessible for inspection only with special tools.

The rating of busbars shall be same as that of incomer breaker rating.

15.1 .3 INSULATION LEVELS:

The insulation level corresponding to the rated voltage are:

Normal Voltage : 11 KV

Highest system voltage : 12 KV

One minute Power Frequency: 28 kV

Withstand voltage

1.2/50 micro second impulse : 75 kV

Clearance in air

Phase to phase : 130 mm
Phase to earth : 90 mm

15.1.4 CIRCUIT BREAKERS

Circuit Breakers shall be of vertically drop down, horizontally drawout type triple pole, vacuum circuit breaker .

The normal current rating of breakers should be at least 1.6 times the maximum loading of circuit it controls. The rupturing capacity of breaker should be at least 1.25 times the calculated fault level of busbars.

The breakers shall have motor operated spring charged mechanism with anti-pumping contactor. The control circuit shall be suitable for local as well as remote control.

The breaker sockets and plugs should be heavily silvered plated. It should have adequate auxiliary contacts required by plant control schematics plus 20% spare contacts for future use. Auxiliary contactors or relays should be used to multiply the contacts.

The operating mechanism shall be robust design with a minimum number of linkages to ensure maximum reliability. The operating mechanism shall be such that the breaker is at all times free to open immediately the trip coil is energized. It is to be ensured that all the three poles open/close in unison to avoid any eventuality of single-phase operation of the generator.

The breaker shall have the distinct positions indicating:

- 'Service' Position : With main and auxiliary contacts connected.
- 'Test' Position : With power contacts fully disconnected and control circuit contacts connected.
- 'Isolated' Position : With both power and control contacts fully disconnected.

The breaker trolley shall remain inside the cubicle even in the draw out position.

The trolley of the circuit breaker shall be so inter-locked that:

It shall not be possible to isolate it from the connected position, or to plug it in from the isolated position with the breaker closed.

The circuit breaker can be closed only when it is in one of the three positions or when it is fully out of the panel.

It shall not be possible to open the breaker compartment door unless the breakers drawn to the isolated position or test position.

Inadvertent 'pushing in' of the draw out circuit breaker in service position, with auxiliary circuit plug not in the position shall be prevented.

Automatic safety shutters shall be provided to ensure the inaccessibility of live parts after the breaker is drawn-out.

The circuit breaker trolley 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.

Circuit breakers of identical rating shall be interchangeable.

15.1.5 EARTH SWITCHES

Each breaker shall be provided independent earth switch (make proof) to earth the cable side terminals. Optionally an earth trolley shall be provided for all the breakers.

15.1.6 CURRENT TRANSFORMERS

The Current Transformer Panel shall be cast resin insulated type of adequate capacity and proper characteristics on secondary as specified. The current density should not be more than 1 amp/sq.mm.

CTs shall withstand stresses originated from short circuit. They shall have ratios, output and accuracy as specified.

They shall be mounted on the switchboard stationary part.

The secondary CT leads from all panels should be terminated on the front of the board on easily accessible shorting type terminal connectors so that operation and maintenance can be carried out when the panels are in service.

CT's shall be given the heat and run test.

CT Ratio: suitable ratio Dual Core

CTs shall be of class 1.0 accuracy for measurement & 20VA 5P10 for Protection.

The exact ratio should be checked with client / Consultant before delivery of Panel.

15.1.7 VOLTAGE TRANSFORMER

The Voltage Transformer shall be cast resin insulated type. It shall be draw out type and easily accessible so that the same can be attended to or replaced when the panels are in service condition.

The voltage HT Panels shall be protected through HRC fuses on both primary and secondary side. They shall have ratios, outputs and accuracies specified.

The draw out mechanism shall disconnect the primary connection before the VT or its primary fuses become accessible.

The rating of the PT is 11KV/ 3 / 110V/ 3 Class 1.0 200VA burden

15.1.8 INDICATING / INTEGRATING METERS

All indicating instruments shall be of flush mounting, Digital type size of the Indicating instruments shall be of 96 x 96 mm.sq.

Ammeter, Voltmeter with Selector switches should be provided.

All auxiliary equipment's such as shunts, transducers, CT's, VT's that are required shall be included in the draw out type.

15.1.9 INDICATING LAMPS

Indicating lamps shall be of the LED type low watt consumption, provided with series resistor where necessary and with translucent lamp covers. Bulbs and lenses shall be easily replaceable from the front.

Following indicators are required on the panel having lens colors as follows:

Breaker ON	: RED
Breaker OFF	: GREEN
Breaker racked IN	: RED
Breaker racked OUT	: GREEN
Auto trip	: AMBER
Trip circuit healthy	: WHITE
Spring charged	: BLUE
Test position	: YELLOW

15.1.10 RELAYS

All protective relays shall be back connected, draw out type, suitable for flush mounting and fitted with dust tight covers. All relays shall be mounted on the front of the panel and shall be specified as per requirement. The current and the voltage coils shall be treated as specified.

All relays shall have built-in flag to indicate operation. It shall be possible to reset the flag without opening the relay case. All tripping relays shall be suitable to operate on the specified DC voltage.

GE make CDG 61or Eqvt. 2O/C (50-200%)and 1 E/F (20-80%) relay with highest Instantaneous element.

15.1.11 CONTROL SWITCHES AND PUSH BUTTONS

Control switches shall be of the heavy-duty rotary type with nameplates duly marked to show the operation. They shall be semi-flush mounting with only the front plate and operating handle projecting.

Circuit breaker control switches shall be of the spring return to neutral type, while local / remote selector switches and instrument selector switches shall be of stay-out type.

15.1.12 INTERNAL WIRING

Internal wiring and inter-panel wiring for all circuit shall be carried out with 1100/660 V grade, single core, multi strand, PVC insulated copper wire of minimum 2.5 sq.mm for CT and other control circuit.

The wiring shall be neatly bunched adequately supported and properly routed and terminated in the respective terminals with suitable lugs. There shall not be more than two wires connected at a terminal.

Wires shall be identified by numbered ferrules at each end. The ferrules shall be of ring type and non-deteriorating material.

All control circuits shall have HRC fuses mounted in front of the panel and shall be easily accessible.

15.1.13 TERMINAL BLOCKS

Terminal blocks for the LT connections shall be of 660 V grade of stud type and of adequate current rating.

The insulating barriers shall be provided between adjacent terminals. Provision shall be made for label inscription on terminal block. Cables should never be terminated directly on components. Provision shall be made for CT terminals shorting links, remote ON/OFF

pushbutton, remote ON/OFF indication and remote ammeter. 20% spare terminals shall be provided on each terminal block.

15.1.14 CABLE TERMINATION

The HT switchboard shall be designed to facilitate both incoming and outgoing power connection through 11KV 3core 240 sq.mm.Al. Ar. XLPE insulated cables FROM THE BOTTOM ENTRY.

Ample space for connection of these cables and suitable byfrication between incoming and outgoing cables are to be provided at the rear of the Switchboard. The cable termination arrangement shall be of adequate size and design to receive the required number of cables as specified. Proper cable clamping arrangements shall be provided.

Detachable gland plate of adequate thickness shall be provided for the cable entry into the panel. Sufficient space shall be provided to avoid sharp bending and easy connection.

Suitable shrouds shall be provided to prevent accidental contact with live outgoing terminations of other feeders while carrying out maintenance on one feeder.

15.1.15 LABELS

Nameplates of approved design shall be provided to represent circuit designation for each feeder. Material for nameplates shall be PVC sheet with rear engraving. They shall be firmly secured with fasteners.

15.1.16 PAINTING

All metal surfaces shall be chemically cleaned, degreased and pickled in acid to produce a smooth clean surface, free of scale, grease and rust.

After cleaning, phosphating and passivation treatment, the surface shall be given two coats of zinc rich epoxy primer and baking in the oven.

After primer, it shall be given two coats of stoving type Epoxy paint in light grey as per IS-5 shade sufficient quantity of touch up paint shall be furnished for application at site.

15.1.17 TESTS

The 11 kV switchboard shall be tested for routine tests as per the relevant Indian Standards, prior to dispatch and certificate issued.

15.1.18 INSPECTION

Stage 1 Inspection : During Assembly of Panel

Stage 2 Inspection : Before Dispatch

15.1.19 COMMISSIONING

The quoted price shall be inclusive of all necessary commissioning spares.

Commissioning should be done at free of cost by you.

15.1.20 AUXILIARY SWITCHES

Each circuit breaker shall be provided with auxiliary switches to interrupt the supply to the Closing mechanism and complete the trip circuit, when the circuit breaker is in the 'Closed' position and to cover all the necessary indication, interlocking and control facilities.

All secondary connection between the fixed and moving portions of circuit breaker equipment shall be by means of plug and socket connections, arranged so as to eliminate positively any false indication when the moving portion is racked in to the service location.

Each circuit breaker shall be provided with 4 NO + 4 NC auxiliary contacts as spare in addition to the other functional requirements.

15.1.21 SPECIFICATION AND SCHEDULE OF 11KV INDOOR HT VCB PANEL

SL.N o.	DESCRIPTION	REMARKS
1	QUANTITY	1NO.
2	RATING	11KV
3	BREAKING CAPACITY	350 MVA
4	CURRENT RATING	800A / 630A
A	CLOSING COIL VOLTAGE	240V AC
B	TRIP COIL VOLTAGE	240V AC
C	DUTY CYCLE	O-3min-CO-3 MIN- CO
D	HIGHEST SYSTEM VOLTAGE	12KV
5	INSULATION LEVEL	75 KV Peak
6	BUSBARS	COPPER
7	PAINTING (POWDER COATED / EPOXY)	631 of IS5
8	NUMBER OF POLES	3
9	TYPE	HORIZONTAL DRAWOUT / HORIZONTAL ISOLATION MOTOR OPERATED
10	MECHANISM	MANUAL/MOTOR
11	MOTOR VOLTAGE	230V AC /110V THROUGH POWER PACK
12	AUXILIARY CONTACT	4NO + 4NC
13	MINIATURE CIRCUIT BREAKER	4NOS
14	ANTI-PUMPING DEVICE	TO BE PROVIDED
15	POWER PACK	TO BE PROVIDED
16	CURRENT TRANSFORMER : Qty	3 Nos.
A	RATIO	125/5-5A
B	CLASS	CL 1.0, 5P10
C	BURDEN	20VA
D	SHORT TIME RATING	18.4 KA for 1 SEC
17	POTENTIAL TRANSFORMER : Qty	1 No.
A	RATIO	11KV,3Ph/110V 3Ph
B	CLASS	CL 1.0
C	BURDEN	200VA
18	TRIP / NEUTRAL / CLOSE - SWITCH	TO BE PROVIDED
19	LOCAL REMOTE SWITCH	TO BE PROVIDED
20	INDICATING LAMPS	8 NOS
21	ALARM SCHEME	HOOTER
22	SPACE HEATER WITH ON/OFF	1 NO

	SWITCH/ THERMOSTAT	
23	CABLE ENTRY	BOTTOM ENTRY FOR BOTH I/C & O/G CABLES
24	3 OVER CURRENT AND 1 EARTH FAULT	--
25	INPUT & OUTPUT	1 Run of 11KV 3C x 240 Sq.mm Al. XLPE CABLE

16.0 TECHNICAL REQUIREMENTS OF 11KV HT 4 VCB GENERATOR BREAKER PANEL

INCOMING VCB PANEL – 2 Nos.

OUTGOING VCB PANEL – 2 Nos.

Each Panel Consists of 1 No. 11KV 630A 350 MVA (18.4 KA) EDO Horizontal Isolation, Horizontal draw out type Vacuum Circuit Breaker with Over Current, Short Circuit and Earth Fault Releases and comprising the following:

- Motor/Manual spring charging mechanism.(Motor suitable for 230V AC)
- 3 Nos.11KV 630A Vacuum Interrupters.
- Closing coil suitable for 24V / 110V DC.
- Tripping coil suitable for 24V / 110V DC.
- 8NO+8NC Auxiliary switch.
- Mechanical On/Off Indication.
- Mechanical spring charge/discharge indication.
- Breaker position indicator.
- Mechanical operating counter.
- Automatic safety shutters.
- Secondary self-aligned plug in contacts.
- Anti-pumping feature.

1Set of triple pole 630A Air insulated Electrolytic grade Copper bus bar of 1.2A/sq.mm

3Nos. Epoxy Resin Cast Double Core Current Transformer of ratio 125/5-5A with class 1.0, 20VA for Metering and 5P10, 20VA burden for Protection.

3Nos. Epoxy Resin Cast single core Current Transformer of ratio 125/5A with class PS for Differential protection for Incoming Panel only.

1No. Epoxy resin cast draw out type 11KV/ transformer with 200VA burden. □ 13 phase potential class

1No. Trip/Neutral/Close Breaker Control Switch.

1No. Local/Remote selector switch

1Set R Y B phase indication lamps.

1No. ON / OFF / TRIP Indication lamps.

1No. Spring charged Electrical indication lamp.

1set Power terminals suitable to receive XLPE cables.

17.0 TECHNICAL REQUIREMENTS 11 KV 800A TP COPPER MAIN BUSBAR

The short circuit rating of the busbars shall be 18.4 KA. The busbar shall be epoxy molded and made of high conductivity electrolytic grade copper. The current in all current carrying paths should not exceed 1.20 A/sq.mm. The bus bar chamber shall be totally maintenance free.

The switchboard shall comprise 3 phase main busbars. The bus bar shall be of uniform section throughout and shall be sized to continuously carry the rated current without exceeding the temperature rise of 40

Busbars shall be colour coded for easy identification of individual phases. □ C over the ma

Bus bars shall be supported at regular intervals and both busbars and supports shall be adequately sized and braced to withstand short circuit level without deformation. All bus supports shall be non-carbonizing material resistant to acid alkalis and shall have non-hygroscopic characteristics.

For long busbars suitable expansion joints shall be provided. Thermal design of the busbars shall be based on the installation of the switchgear in poorly ventilated condition.

Busbars shall be housed in a separate chamber, which shall be accessible for inspection only with special tools.

17.1 MAKE OF MATERIALS

Measuring instruments Digital	: Konzerv/IMP/AE/Consol/Cadel
Energy meter (Sealable type)	: Konzerv/AE/IMP/Meco/Consol/L&T
Power contactors	: ABB/Telemecanique/L&T/Crompton
Current transformer	: Kappa/Kalpa/Cortina/Indcoil
Overload relays/Timers	: L&T/ABB/Telemecanique
Indication lamps/Pushbuttons	: LED star/Vaishnav
Line Voltage monitor	: Minilec (VMR).
Three attempt starter	: PIC or eqt.
Low fuel sensor	: PIC or eqt.
Control relays	: L&T/Ariva
Selector switches	: Kaycee/L&T.
DC hooter with audible control	: Vaishnav
Control wire	: Finolex - FRLS
MCB	: MDS/Merlengerin/ABB/Siemens
Phase reversal protection	: Minilec (VMR)
11 KV HT VCB	: ABB/Siemens/Schneider/MEI

18.0 DG POWER SYNCHRONISATION SYSTEM

18.1 FUNCTIONAL REQUIREMENT

DG Monitoring and Controls including Synchronization, Load sharing between the DGs.

Communication with the DG Electronic Governors on hard wired interface.

Power monitoring and Breaker status monitoring at the main incomers of the DGs

Accurate Power monitoring at the various down side feeder points like AC Loads, Lighting loads, Water Treatment Plant etc., This should also enables Tariff Calculation Development wise / area wise.

Control and individual breakers up to the block loads to enable load shedding. The load shedding scheme should be in the order of priority / criticality.

Integration with Building Automation System to enable effective Chiller control and load shedding.

18.2 SYSTEM DESCRIPTION

The system shall be equipped with load demand monitoring and control to automatically program the generator sets to start, parallel and share system loads, which includes the control of all outgoing changeovers. This shall include:

Power monitoring of all Generators and transformer.

Auto Load sharing between the generators.

The switchgear load sensing circuits shall monitor station load demand and determine how many generator units are to run, when they are to be started, stopped, and at what levels of loads. The system load circuits shall be kilowatt sensing from the switchgear bus and completely adjustable.

Adjustable time delays shall be incorporated in the pickup and drop-off load sensing circuits to avoid unnecessary starting and stopping on load surges. Load sensing circuits shall be automatically passed to the next sequenced generator unit, if any safety shutdowns occur.

The system shall include automatic and manual, control to fully utilize the available power. At no time shall the generators be paralleled with the utility.

18.3 PROGRAMMABLE LOGIC CONTROLLERS (PLC)

All required logic shall be derived using a PLC. It shall have facility for monitoring the status of the generator parameters and breakers, generating alarms, controlling the breakers and for monitoring the power at every breaker. The output relay contacts shall have adequate making and breaking capacity. All necessary transducers for inputting the data to the PLC shall be in the supplier's scope.

18.4 SYNCHRONIZATION

The PCC (Power command controller) or Generator Synchronizing Module (GSM) takes Current Transformer (CT) and Potential Transformer (PT) inputs from the synchronizing bus and PT inputs from the reference bus and shall perform the following functions:

- a) Synchronization.
- b) Load sharing (Active & Reactive).
- c) Anti motoring.
- d) Power monitoring.

This feature shall facilitate the automatic synchronization of generators onto a reference bus. The PCC / GSM shall compare the synchronizing and reference bus parameters

continuously. When the synchronization conditions are met, the PCC / GSM shall issue a "close breaker command" to close the breaker.

When the system reaches the required limits the PCC / GSM shall give a command to the PLC or directly to close the breaker, in turn synchronizing the Generator with the other generator sets.

18.5 LOAD SHARING

Apart from auto synchronization, the PCC / GSM shall have a built-in load sharing feature. Active load sharing shall be achieved by adjusting the engine speed via the governor, whereas Reactive load sharing shall be achieved by varying the AVR. These commands shall be generated by the PLC / PCC and the outputs given shall be potential free contacts.

18.6 POWER MONITORING

In addition to the synchronization function, the PCC / GSM shall provide extensive array of monitoring information for systems wired in Wye Delta or open delta. The PCC / GSM shall monitor different electrical parameters of the synchronizing bus and parameters of the Reference bus.

18.7 COMMUNICATION WITH GOVERNOR

The interface with the generator governors shall be of a format suitable for effective communication with the electronic governor fitted to the generators.

The interface shall be able to:

- (a) Effectively raise and lower the speed of the engine.
- (b) Provide all the engine related data including diagnostics and Alarm information from the engine..

19. TECHNICAL SPECIFICATION FOR RELAY, MONITORING AND ANNUNCIATION PANEL:

19.1 SCOPE

This section describes the requirement of control, instrumentation and protection for the diesel generator sets.

19.2 CODES AND STANDARDS

The design, manufacturing and performance of equipment shall comply with all currently applicable standards, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the vendor of his responsibility.

Unless otherwise specified, equipment shall conform to the latest applicable Indian or IEC Standards. The Indian Standards is IS : 8623.

19.3 CONTROL AND ACCESSORY EQUIPMENT

110V DC will be provided by the purchaser. If voltage other than 110V DC is required by the supplier, necessary arrangement shall be made by the supplier, necessary arrangement shall be made by the supplier, within the cubicle, to obtain the necessary voltage/s by providing transformers, inverter / Converter etc.

Control supply shall be controlled within the cabinet by adequately rated heavy duty, load break isolator / switch, HRC fuses, MCB etc., as the case may be.

19.4 AUXILIARY CONTACTOR FOR BATTERY CHARGER.

A suitable auxiliary contractor shall be provided for connection the battery charger to the main supply. A contactor shall be provided with an isolating switch and shall be so arranged as to disconnect the battery charger during engine starting.

19.5 FUSES

All fuses shall be of HRC cartridge conforming to IS : 2208 mounted on plug in type fuse bases having a prospective current rating of not less than 80 kA. Fuses shall be provided with visible operation indicators to show that they have operated. All accessible live connections shall be adequately shrouded and it shall be possible to change fuses with the circuit live, without danger of contact with live metal. Insulated fuse pulling handle shall be supplied with each control cabinet.

19.6 INSTRUMENTAL TRANSFORMERS

Current and Voltage transformers shall conform to the requirements of IS : 2705 and IS : 3156 respectively. Unless otherwise specified it shall be the responsibility of the vendor to ensure that the class and VA burdens of instrument transformers provided are adequate for the meters and relays connected to them. Facilities shall be provided to short circuit and ground the CT secondary in the CT secondary leads to carry out current and ground the CT secondary in the CT secondary leads to carry out current and phase angle measurements with CTs in service. Voltage transformers shall be provided with suitably rated primary and secondary fuses.

19.7 CONTROL TRANSFORMERS

All AC control equipments shall be suitable for operation on 1 phase, 110V, 50Hz system. Suitable rated 415 / 110V control transformers as required shall be supplied as an integral part of the control cabinet. Each control transformer shall be complete with isolation facilities, primary and secondary HRC fuses. One end/ center point of the control transformer secondary shall be earthed.

19.8 INDICATING INSTRUMENTS & METERS

Electrical indicating instruments shall be of moving iron type having 144mm square, 90 deg scale. These shall be mounted flush on the panel with only the flanges projecting. Dials shall be white with black numbers and lettering. Parallax free dial shall be provided. Ammeters measuring upto 10A shall be directly connected, while those measuring above 10A shall be connected through CTs. Voltmeters shall be connected through suitable selector switches and protected by the indicating instruments and meters shall be 1.0

19.9 RELAYS & TIMERS

All protective relays shall be of rectangular in shape, suitable for flush mounting with only the dust tight covers projecting beyond the cabinet door. Relays shall be equipped with external reset, positive action operation indicator visible from the front. Voltage relays shall have sufficient capacity for continuous energisation, using external resistors, if necessary.

Unless otherwise specified, auxiliary relays can be of fixed type mounted inside the cabinet but shall be provided with individual dust-tight covers. Auxiliary relays shall be rated to operate satisfactorily between 70% and 100% of rated voltage.

Number of relays and timers shall be as per requirement. The relay / timer coil voltage shall be 110V DC. There shall be adequate spare contacts which shall be exclusive for the use of purchaser. All contacts on relays / timers shall be wired up to terminal blocks.

19.10 CONTROLS & SELECTOR SWITCHES

Control and instrument switches shall be of totally type having enclosed contacts which are accessible by removing the cover and shall be provided with properly designated escutcheon plates. Clearly marked to show the operating positions. Control switches shall have momentary contacts, spring return to center, with pistol-grip handle. Instruments and selector switch shall have stay-put contacts. The number of contacts and their operation in each switch shall be as per the requirements of the connected circuit.

19.11 PUSH BUTTONS

All push buttons shall be of push-to-actuate type having 2 NO and 2 NC self reset contacts, they shall be provided with integral escutcheon plates, engraved with their functions.

19.12 INDICATING LAMPS

Indicating lamps shall be of the filament LED type having double contact bayonet caps and low watt consumption. Lamps shall be provided with series resistors.

19.13 SPACE HEATER

Strip type space heaters of adequate capacity shall be provided inside each cabinet to prevent condensation of moisture. Space heaters shall be rated for 1 ph, 240V, 50Hz supply. Heaters shall be complete with ON-OFF switches, HRC fuses in phase, link on neutral and a thermostat to control switching of the heater. Power supply shall be provided from purchaser's panel.

19.14 INTERIOR LIGHTING AND RECEPTACLES

Control cabinet shall be provided with a 1 ph, 240V, 50 Hz lighting fixture for interior illumination controlled by an ON-Off switch. In addition to the above, a 1 ph, 240V, 50Hz, 3pin receptacle shall be provided.

19.15 ALARM AND SUPERVISION SYSTEM

The alarm and supervision system shall have:

A push button for clearing the audible alarm (visual annunciation will persist)

A push button for clearing the visual annunciation after the fault has been cleared.

A push button for testing the illuminated transparencies

All alarm devices shall be suitable for operation on 110V DC.

19.16 PANEL INTERNAL WIRING

Control panel shall be supplied completely wired, ready for purchaser's external connections at the terminals blocks. All wiring and cables shall be carried out with PVC insulated, stranded copper conductor wire / cables. Power circuits shall be wired with stranded copper conductors of adequate sized to suit the rated current. The minimum size shall be 4sqmm control, alarm indication circuits shall be wired with stranded copper conductors of size not less than 1,5 Sq. mm CT circuits shall be wired with stranded copper conductor size not smaller than circuits shall be wired stranded copper conductor size not smaller than 2.5 Sq. mm

Power and control wiring shall be separately run and neatly bunched.

Wiring affected by stray electro magnetic fields shall e suitably shielded or run as twisted pairs where applicable.

Wiring for control switches, lamps, meters etc., mounted on doors shall be bunched together and supported in a loop in order to prevent any excess strain being applied to the wiring when the door is opened.

All covers both internal and external, which are removable to allow access to compartments shall be inscribed 'Danger'.

Engraved core identification ferrules, marked to correspond with the wiring diagram shall be fitted at both ends shall not fall off when wire is removed. Spare auxiliary contacts of all relays, contacts etc., shall be wired to terminals blocks.

All wiring shall be terminated on terminal blocks using solder less crimping type tinned copper lugs. Insulating sleeves shall be provided at all the wire terminations. All wiring shall be nearly bunched and cleared within the cabinet. Wiring troughs shall be provided for vertical panel wiring and for interconnecting wiring between front and rear and rear section of the cabinet.

One piece moulded, 650 V grade terminal blocks complete with insulated barriers, terminals studs, washers nuts and lock nuts and identification strips shall be used. Terminals for power connections shall be adequately rated for the circuit current and the rated for other terminal blocks for control etc., shall not be less than 15A. At least 20% spare terminals shall be provided. Terminal blocks for control, indicating etc., shall be suitable for connecting two conductors of purchaser's cables of following sizes:-

1. Potential and control circuit : Two of 2.5 Sq mm stranded Copper conductor.
2. CT Circuits : Two of 4 Sq mm or four of Sq mm stranded copper, conductors.

Terminal blocks shall be numbered for identification and grouped according to function. Terminal blocks for CT secondary loads shall be provided with short circuiting and earthing facilities. There shall be minimum clearances of 250mm between the first row of terminal blocks and the associated gland plate. Also the clearance between the first row of terminal blocks shall be minimum of 100 mm.

19.17 EARTHING TERMINALS

Control panel shall have to separate earthing terminals suitable for necessary earthing conductors of size specified

19.18 CONTROL PANEL

Panel shall be cold rolled sheet steel enclosed, of thickness not less than 2.5 mm free standing, floor mounting, indoor type, dust and vermin tight, degree of protection IP – 54, with front accessibility having concealed hinged doors, with key locked and handles and bolted rear and side covers.

Ventilation louvers shall be at the side and /or back and shall be fitted with fine mesh screens to prevent entrance of rodents or large insects.

Foundation channel with nuts, bolts, spring washers, 3mm thick undrilled gland plate, cable gland shall be part of the supply.

Components mounted on the panel shall be flush type. Arrangement of components shall be such as to render easy accessibility for maintenance and troubleshooting. Heating emitting components like resistors shall be shielded from others by fiber glass sheet separators or similar materials.

19.19 MAINS OPERATED BATTERY CHARGING EQUIPMENT

The battery charger shall be of the static type employing semi-conductor devices, the whole being enclosed in an adequately ventilated enameled corrosion resistant sheet steel case of an approved type. This shall be part of relay & monitoring panel, mounted inside the same.

The charger shall be incorporated within the control panel with its associated instruments and controls mounted on the control panel. The instruments and controls shall match those of the main panel.

The charger shall have an illuminated indicator on the panel front to show when the charger is switched on. The charger shall be of adequate size and shall at all times monitor the battery conditions and automatically control the charging rate to suit the state of the battery, maintaining it in a properly charged condition when not in use. Following a period of use,

the charger shall automatically re-charge the battery in the shortest practicable time consistent with battery welfare and the size and output of the charger shall match battery size and shall at all times monitor the battery conditions the charging rate to maintain the state of the battery, maintaining it in a properly condition when not in use.

19.20 PROTECTION

The diesel generator shall be tripped under the following conditions:-

- 110V DC control supply failure.
- Over-speed of diesel generator set
- Low lube oil pressure
- excitation failure .
- Incomplete start after a present time.
- High jacket water temperature.
- DG differential protection.
- Reverse power protection.
- Earth fault protection.
- Emergency stop.

19.21 ALARM AND INDICATIONS

Local Alarm on Panel:

The following alarms shall be included in the alarms and supervision system:

- High jacket water temperature (As applicable)
- Low lube oil pressure
- Generator bearing temperature high.
- Generator winding temperature high
- Fuel oil day tank level low.
- Fuel oil day tank level high.
- 110V DC control supply failure.
- Reverse power trip
- Over current trip
- DG earth fault .
- Emergency stop.
- Starting failure.

Local Lamp Indication on each Diesel Control Panel :

The following Meters shall be included in the Metering Chamber of the Panel

1 No. Ammeter with selector switch. (0 – 200A)
 1 No. Voltmeter with selector switch. (0 – 12KV)
 1 No. Frequency Meter.
 1 No. KW Meter
 1 No. KVA Meter
 1 No. KWHr Meter
 1 No. P F Meter
 1 No. Trivector Meter

The Following Protection relays shall be included in the Relay Panel:

- IDMT Three O/C + E/F relay with highest
- Over / Under Voltage Relay.
- Reverse Power Relay
- Restricted Earth Fault Relay
- Differential Relay
- Auto Synchronizing Relay
- Auto Load Sharing Relay
- Thermal Overload
- Over / Under Frequency
- Loss of Field
- PT Fuse Failure

The following Auxiliaries shall be included

1 No. Multipoint Temperature Scanner for WTDs & BTDS.
 1 No. Motorized Potentiometer for speed / voltage, raise / low.
 1 Set of Indicating Lamps for Load ON DG & Load ON Mains.
 1 No. Emergency Push Button.

19.22 MAKE OF MATERIALS :

Panel	: Any CPRI appd. Fabricator
Numerical Relay	: L&T/Ariva
Digital Meters	: Conzerv/AE/ICD/Elecon/IMP/Cadel
Trivector Meter	: L&T/Conzerv/ICD
Indicating Lamps	: Tecknic/L&T
Selector Switches	: Kaycee/L & T
DC Hooter with audible control	: Vaishnav

Control Wiring : Finolex/Polycab/RR
MCB : MDS/Merlengerin/ABB/Siemens
Power contactors : ABB/Telemecanique/L&T
Terminals : Connectwell
Auto Synch & Auto Load Relay : Woodward/DIEF

20.0 FREE STANDING CHIMNEY

Total Gas flow from 2 x 2000 KVA – 1 Set : To be confirmed by vendor.

Temp - deg C : To be confirmed by vendor.

Chimney material : IS 2062

Design code : IS 6533

Wind Load : as per IS 875 (Part 3)-1987

Earth Quake stability : as per IS 1893 – 2002

Foundation to be designed : To withstand wind load and earthquake

Painting : Anti corrosive black painting shall be carried out on the
Inner surface of the chimney. Shall confirm to IS 158 – 1968.

Note: The exhaust from the Generators shall be directly exhausted to atmosphere without any treatment. This requirement shall meet the norms of State Pollution Control Board.

21.0 BATTERY AND BATTERY CHARGER

21.1 BATTERY

Batteries – 25 Plate, 180 AH, heavy duty

Batteries shall be of lead acid type, heavy duty Automotive power mounted near the generator. A corrosion resistant battery rack shall be provided for mounting. Battery shall have sufficient capacity to provide for the engine/generator safety circuits, for 24 hours without recharging. The batteries shall be suitable for 6 successive attempts each of 10 secs duration with a gap of 5 sec forward starters. The battery bank shall be provided with steel stand and a containment tray. Also a rubber mat shall be provided below the battery rack. Battery shall be confirming to IS : 1651.

21.2 BATTERY CHARGER

A current limiting battery charger shall be provided to automatically recharge the batteries. Battery charger shall have boost and trickles charging features with built in voltage regulators. Battery Charger shall be suitable for operation on 230V AC, 50 Hz supply with variation of +/- 10%. The charger shall charge at 2.17 Volts per cell and float at 2.33 Volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressors, DC Ammeter, and fused AC input. The amperage output shall be not less than 10A. Each Generator shall be provided with separate battery charger.

The following indications shall be required:

Input supply on.

Battery charge/discharge current.

Output voltage.

Voltage free change-over contacts shall be wired to the outgoing terminal block of the unit to provide external indication of the following conditions:

Input AC supply fail.

The charger must be large enough to provide for a 100 percent increase in the charging needs of the batteries for future sets.

Battery charger with suitable cut-out circuit shall be provided for charging battery from EB mains when DG is not running. Suitable capacity dynamo shall be provided for charging the batteries when DG is in operation. A separate voltmeter and ammeter shall be provided for monitoring battery voltage and current.

21.3 CAPACITY

180 Ah 12 V - 4 Nos.

21.4 MAKE OF MATERIALS

Battery Charger : Chabbi/HBL NIFE/Dubas Amara raja/Powerica/Joshi
Battery :Exide/AMCO/Amararaja/Panasonic/Stadard

22 ACOUSTIC ENCLOSURE

The acoustic enclosure is made of 1.6 mm thick CRCA sheets and structural/ sheet metal base frame painted in Munsell shade. The walls of the enclosure are insulated with fire retardant Rock wool.

The enclosure has the following features:

- Designed to have optimum power out of Genset with out any de-rating factor.
- Designed to have sufficient approach, operation and service space.
- Air inlet louvers specially designed to provide sufficient fresh air availability for operation of the D.G.set.
- Made on special purpose CNC machines for consistency in quality and workmanship
- Powder coated for long lasting service life and superior finish
- With UV resistant powder coating, withstands extreme environments
- Use of special hardware for longer life
- Insulation material meets exacting IS 8183 specifications for better sound attenuation
- Flush styling - no projections
- Fluid drains for lube oil.

23.10 PROPELLER FANS

Propeller fans shall have MS powder coated or epoxy coated diaphragm. The impellers shall be die cast aluminium or MS powder coated epoxy coated with adequate gauge sheet. The fans shall be statically and dynamically balanced. The fans shall be suitable for mounting vertically and should withstand higher temperatures. The fans shall be suitable for 3-phase operation as specified in the tender conditions. The vendor shall clearly determine whether propeller fans are required and confirm expressly at the time of tendering itself.

Note: Other than GI sheet of insulation works all other materials shall be powder coating.

23.11 MAKE OF MATERIALS

Glass wool : Twaiga / Lloyd / eqt.
Fresh air / Exhaust fan : GEC / Almonard / Nadi

23.0 FUEL HANDLING SYSTEM

23.1 DAY TANK (990 L Capacity)

The design and construction of the tank shall comply with:

- IS: 10987:1992 and the other complimentary and reference standards stated there in.
- Rules and Regulations of the Chief Inspector of Explosives
- India Petroleum Rules 1956.

All site welding shall be carried out by fusion welding. For all butt welds, the root run and final run shall be carried out.

The HSD tanks shall be of min 3 mm thick M S construction, horizontal, cylindrical in shape with plain ends and shall be suitable for storage of fuel upto a maximum temperature of 50 Deg C at atmospheric pressure. Tanks shall be painted externally to prevent corrosion and shall have a reflecting surface. The external surface of the storage tanks shall be cleaved to remove rust, scale, etc. and apply two coat of zinc chromate anti-rust primer followed by two coats of finishing paint - epoxy paint.

The tank shall be designed for a pressure of 0.05 MPA when full of water. Minimum corrosion allowance of 1.5 mm shall be considered. The design temperature shall be the lowest one-day mean temperature where the tank is to be installed.

The following accessories shall be part of the tank:

- Filling point and Drain off point
- Dip Connection
- Vent pipe
- Over flow pipe
- Drain-pipe

- Continuous Level gauge with dial type indicator on top of the tank.
- 550 mm dia manhole with cover and locking arrangement.
- High /Low level sensors
- Lifting lugs
- Painting with Anti corrosive treatment.
- Spill tray to be located below the tank and all around it
- Metal Support structure, wear plates, stiffeners etc

23.2 PIPING

All fuel piping shall be minimum 25mm dia M.S Class B and as per IS: 1978 and IS: 2062. All fittings shall be of heavy duty. Flanges shall conform to ASA-Class 150 weld neck. The piping shall generally be installed in already prepared under ground trenches with fixing hardware as required.

23.3 VALVES

All valves shall be ball type and of cast steel body with gunmetal or stainless steel ball only. All the valves shall be pressure tested as per ASA-class 150. The valves shall conform to IS 10611, IS 11792.

24.0 TECHNICAL SPECIFICATION FOR HT CABLES

Cable shall be capable of satisfactory performance when laid on trays, trenches, conduits, ducts and when directly buried in the ground.

Cables shall be capable of operating satisfactorily under a power supply system voltage variation of +10%, frequency variation +5%, and combined voltage and frequency variation of +10%.

Cables shall normally be laid under the following conditions:

1. In air : Ambient temperature of 45 °C
2. In ground : Ground temperature of 35 °C
3. Depth of laying in ground : 1000mm(11KV)

: 1200mm(22&33KV)

4. Thermal resistivity : 120 □C cm/watt

5. In conduit : Space factor of not more than 60%

6. In trays : Single layer, touching each other

7. The maximum conductor temperature for operation under Normal rated current carrying conditions and under short circuit conditions are as follows:

MAXIMUM CONDUCTOR TEMPERATURE & STANDARD INSTALLATION CONDITIONS

- Maximum Conductor temperature at continuous load 90 □C
- Ambient Air temperature 45 □C
- Ground Temperature 30 □C
- Thermal resistivity of soil 150 □C cm/W
- Thermal resistivity of XLPE 350 □C cm/W
- Thermal resistivity of PVC 70□C cm/W
- 11kv XLPE cables shall rated to carry 18.4 KA FOR 0.5 Sec
- Method of laying - Multi core cables laid singly
Single core cables laid in trefoil
Touching / in flat formation

24.1 XLPE Construction

Voltage grade : 11KV
Conductor : Well compacted Aluminium
Conductor screen : This shall be extruded shield in the same operation as the insulation.
The semiconductor polymer shall be cross liked.
Insulation : Shall be cross-liked polyethylene.
Laying up : The core shall be laid up with Polypropylene filling and tape.
Inner sheath : Shall be extruded PVC
Armour : Single galvanized steel wire/strip armour
Outer sheath : Shall be extruded ST-2 type PVC.

General : The cable shall withstand all mechanical and thermal stresses under steady state and transient operating conditions.

Operation and Maintenance Manuals

24.2 CONDUCTOR

The conductor consists of annealed copper wires compacted having a smooth circular shape as per IS: 8130-84.

24.3 CONDUCTOR SCREEN

The conductor screen consists of a layer of smooth black extruded semi-conducting XLPE compound firmly bonded with the insulation. This eliminates electrical discharges at the interface between conductor and insulation.

24.4 INSULATION

The insulation consists of super clean XLPE compound. The extrusion process is conducted in clinically clean environment. The insulation thickness conforms to IS: 7098.

24.5 INSULATION SCREEN

The screen consists of smooth black semi conducting XLPE compound firmly bonded with a smooth interface with the insulation. The conductor screen, insulation and insulation screen are extruded simultaneously in Dry cure process.

24.6 MOISTURE BARRIER

To make the cable longitudinally watertight a semi conducting tape is applied over the core to prevent water penetration in the cable. The tape is of non-woven material which has non-biodegradable characteristics.

24.7 COPPER WIRE SCREEN

Copper wires are applied to carry the necessary earth fault current. A counter open helix copper tape is provided over the copper wires.

24.8 POLY –ALUMINIUM FOIL

Aluminium foil coated with polyethylene used longitudinally as a moisture barrier is designed for making cable lighter in weight.

24.9 JACKETING

The jacketing material consists of extruded black PVC or high-density polyethylene (HDPE). A graphite coat is provided over the outer surface of the sheath.

Current ratings of PVC cable shall be arrived on the basis of the circuits being protected by Class 'P' fuses or circuit breakers / contractors with a setting not exceeding 1.5 times the rated current for installation in air, and not exceeding 1.3 times the rated current for installation in ground.

The following letter designations shall be used to specify type of cables:

- A - Aluminium conductor
- C - Copper conductor
- Y - PVC insulation or PVC sheath or
Overall PVC Jacket (over armour)
- F - GI Flat steel (strip) armour
- W - Galvanised round steel wire armour

Letter designations for cables shall be indicated in the following order:

Conductor size

Insulation

Sheath

Armour

Overall jacket

- Cables for control circuits shall be of solid Copper
- Conductor for size of 2.5 sq.mm/1.5 SQMM. Copper Conductor cables shall be designated by the absence of the letter. "A" indicating the Aluminium conductor, which shall be the size of 4 sqmm. for control circuits.

Contractor has to work out complete requirement of cables

24.10 TESTING OF CABLES

24.10.1 TESTS

The cables shall be tested in accordance with the IS: 694/1554/7098.

- PVC insulated cables (for voltage up to 1100V:IS 694)
- PVC insulated cables (heavy duty): IS 1554 – Part I.
- Cross-linked polyethylene insulated PVC sheathed cables: IS 7098 – Part I.

Cable Insulation Tests shall be conducted between phases and between phase and earth for each length of cable, before and after jointing. As such all phase cables may be checked before being laid for above tests. On completion of cable laying work, the following tests shall be conducted in the presence of the Consultant Employer.

24.10.2 Construction tests

Test for conductor and compaction.

For copper conductor:

1. Persulphate test for tinned copper only
2. Annealing test

Test for aluminium conductor:

1. Tensile test
2. Wrapping test
3. Annealing test
4. Resistance test for both copper and aluminium

- Test of eccentricity of insulation.
- Test for thickness of insulation
- Test for laying up along with Polypropylene tape and fillers.
- Virgin material test for PVC insulation.
- Test for thickness of inner sheath
- Test for armouring and armour coverage which should be more than 95%
- Test for thickness of outer sheath
- Insulation Resistance Test (sectional and overall)
- Continuity resistance test.
- Sheathing continuity test.
- Cable size, sequential and manufacturers identification marking on the outer sheath.
- Earth test.

All tests shall be carried out in accordance with relevant Indian Standard Code of Practice and Local Electricity Rules. The Contractor shall provide necessary instruments, equipment and labour for conducting the above tests and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the Consultant/Employer.

24.11 APPLICABLE STANDARDS

PVC insulated cables (for voltage upto 1100V:IS 684

PVC insulated cables (heavy duty): IS 1554.

Cross-linked polyethylene insulated

PVC sheathed cables: IS7098.

25.0 CABLING SYSTEM FOR COMPLETE PLANT

25.1 GENERAL

The cabling system covers the design as per relevant national / international standards. It shall be responsibility of contractor to work out a detailed layout for the complete plate cable system. The layout drawing shall be furnished for the approval of Engineer before commencement of installation including cable trays, cable racks, accessories, tray supports, conduit etc.

25.2 CABLE LAYOUT

The following points shall be noted while planning cabling system for the plant
Inside the building either cable tray or cable trench shall be planned as per cabling requirement.

25.3 LAYING OF CABLES

Cables shall be laid as per the specifications given below:

25.4 CABLES - TRENCHES

Cables shall be laid in the trenches wherever called for. The depth of the trenches shall not be less than 1000 mm (11KV) below the finished ground level. The width of the trenches shall not be less than 1000mm. Where more than one cable is laid, a coaxial distance of not less than 450 mm shall be allowed between the cables. The trenches shall be cut square with vertical sidewalls and with uniform depth. Suitable shoring and propping may be done to

avoid caving-in of trench walls. The floor of the trench shall be rammed level. The cables shall be laid in trenches over rollers placed inside the trench.

The cable drums shall be laid unrolled in the direction of the arrow marked on the drum for unrolling.

Wherever cables are bent, the minimum-bending radius shall not be less than 12 times the diameter of the cable. Cables shall be laid in the trenches / trays and shall be clamped by using heavy duty saddles at regular intervals.

The Cable entries through pipes from outside to inside the building shall run in GI pipes and shall be sealed water tight with approved type of sealant to avoid water entering the building

Cable route markers to be provided as per standards

25.5 MAKE OF MATERIALS :

HT CABLE : Universal/CCI/Gloster/Polycab/havels

LT CABLE : Universal/Polycab/Nicco/Gemscab /havels

26.0 EARTHING

26.1 SCOPE

Supply, fabrication, installation, testing and commissioning of earth pits. Conforming to relevant IS Specifications and standards. The scope includes all related civil work for making pit, providing suitable covers and writing identifications marks etc.

26.2 GENERAL

All the non-current carrying metal parts of electrical installation shall be earthed as per IS: 3043. All equipments, metal conduits, rising main, cable armour, switch gear, distribution boards, meters, cable glands and all other metal parts forming part of the work shall be bonded together and connected by two separate and distinct conductors to earth electrodes

26.3 REFERENCE STANDARDS:

IS-3043 - 1966 - Code of practice for Earthing:

Earthing shall generally be carried out in accordance with the provision of above standard and the requirements of Indian Electricity Rules, 1956 as amended from time to time and the relevant regulations of the Electricity supply Authority concerned. The following Indian Electricity Rules are particularly applicable: - 32, 51, 61, 62, 67, 69, 88 (2) & 90.

26.4 COPPER PLATE EARTH STATION

Plate electrodes shall be made of 3mm thick copper plate of 600X 600mm size. The plate shall be buried vertically in ground at a depth of not less than 2.5 meters to the top of the plate. The pit should be filled with charcoal/ and saltin such a way that the electrode is encased to a minimum thickness of 300mm all round. The electrode, to the extent possible, should be buried in a depth where subsoil water is present. Earth leads to the electrode shall be laid in a heavy-duty GI pipe and connected to the plate electrode with brass bolts, nuts and washers.

A GI pipe of not less than 40mm dia shall be clamped with bolts vertically to the plate and terminated in a wire meshed funnel. The funnel shall be enclosed in a masonry chamber of 450mm x 450mm dimensions. The chamber shall be provided with GI frame and CI inspection cover. The earth station shall also be provided with a suitable permanent identification label tag.

26.5 EARTHING CONDUCTOR

All earthing conductors shall be of high conductivity copper/GI strips and shall be protected against mechanical damage and corrosion. The connection of earth electrodes shall be strong, secure and sound and shall be easily accessible. The earth conductors shall be rigidly fixed to the walls, cable trenches, cable tunnel conduits and cables by using suitable clamps.

Main earth bus shall be taken from the main medium voltage panel to the earth electrodes. The number of electrodes required shall be arrived at taking into consideration the anticipated fault on the medium voltage network.

Earthing conductors shall be run from the exposed metal surface of the equipment and connected to a suitable point on the sub main or main earthing bus. All Switch Boards, Distribution Boards, Disconnecting Switches and Isolators shall be connected to the earth bus. Earthing conductors shall be terminated at the equipment end using suitable lugs, bolts, washers and nuts.

All/conduits, cable armouring etc., shall be connected to the earth all along their run by earthing conductors of suitable cross sectional area. The electrical resistance of earthing conductors shall be low enough to permit the passage of fault current necessary to operate a fuse/protective device and Circuit Breaker and shall not exceed 2 ohms.

26.6 PRECAUTIONS

Earthing system shall be mechanically robust and the joints shall be capable of retaining low resistance always. All the joints shall be mechanically and electrically continuous and effective. Joints shall be protected against corrosion.

26.7 GENERAL REQUIREMENTS

All medium voltage equipment shall be earthed by two separate and distinct connections with earth through an earth electrode.

In the case of high voltages the neutral points shall be earthed by not less than two separate and distinct connections with earth each having its own electrode at the generating station or substation and may be earthed at any other point provided no interference is caused by such earthing. If necessary, the neutral may be earthed through suitable impedance.

As far as possible all earth connections shall be visible for inspection. All connections shall be carefully made and shall be inadequate for the purpose for which they are intended otherwise loss of life or serious personal injury may result.

Each earth system shall be so devised that the testing of individual earth electrode is possible. The value of any earth system resistance shall not be more than 5 Ohms unless otherwise specified.

A drawing showing the main earth connection and earth electrodes be prepared for each installation.

26.8 GENERAL SUBMISSIONS

The successful vendor shall provide the following details for approval before starting the works.

Drawing showing sectional elevation of equipments.

Weights of equipments.

Outline drawing showing entry of cable to power and controls.

Schematics for power and controls

Digital input details for Generator relay and controlling.

26.9 INSPECTION, TESTING AND DISPATCH

Inspection and testing shall be carried out based on this specification and with approved drawings certified by the consultant / Client. The Client and their consultants shall have the right to carry out stage inspection and shop visit to review the manufacturing progress. All routine and type tests specified shall be carried out during final inspection. 15 days advance notice shall be given for carrying out the final inspection.

Any fuel charges for load testing shall be included in the offer, which shall be indicated separately in the Offer. Bidder shall ensure that a competent testing authority calibrates all meters and equipment used testing and the calibration certificates are valid at the time of carrying out test. After completion of inspection and testing Bidder shall furnish all as built

documents in two sets. Only on receipt of final documents the release order for dispatch of equipment shall be issued.

26.10 DELIVERY AND HANDLING

The engine/generator sets shall be delivered to site properly packaged and mounted on pallets or skids to facilitate handling of heavy items. Factory- fabricated type containers or wrappings shall be utilized for engine/generator and components, which shall protect equipment from damage. Engine-driven generator equipment shall be handled carefully to prevent physical damage to equipment and components. Any damaged equipment shall be removed from site and replaced with new equipment.

26.11 INSTALLATION AND COMMISSIONING

Installation & Commissioning shall be carried out based on the latest requirement of the various statutory authorities such electrical inspector, factory inspector, pollution control board, regulatory authority, and any other statutory agency appointed by the purpose by the state / central / municipal bodies. The document / drawings required for obtaining the approval shall be prepared by the bidder.

The Bidder shall obtain the approval for the installation from all the above agencies. All official payment made for such approvals shall be reimbursed at actual on submission of original receipts.

After installation as per the final approved drawing, the Bidder shall carry out the site testing as specified in presence of consultant. DG shall be taken over by Client only on acceptance by the consultant and satisfactory test results.

The Employer shall witness the commissioning.

A minimum of seven working days notice shall be given to the Consultant / Employer prior to the start of commissioning.

A Specialist Agency approved by the Consultant / Employer shall be responsible for the testing and satisfactory performance of the complete synchronizing system.

26.12 SITE REGULATIONS FOR INSTALLATION WORK

Site discipline shall be observed by all the Bidders / erection contractors personnel inside the premises of the site. The contractor and his personnel shall abide by all the rules and regulations laid down by the client. The contractor shall be required to carryout the installation work simultaneously with other installation work being executed by other contractors and shall extend all co-operation required.

Electrical Power required for construction, installation and commissioning of DG shall be provided by the client at one point near meter location. The Bidder shall have his own cabling and switch gear for power distribution to his work place. Cabling and switchgear arrangement shall be provided in accordance with rules and regulation duly approved by the consultant.

SIEL will not be responsible for any damages / compensation payable in case of any accident / injuries to any of the contractors personnel. In case of any accident at site in connection with the execution of work contractor shall report the accident within 24 hours to the client. All transports of material to and from site shall be marked clearly and visibly and shall be accompanied by appropriate documents.

26.13 GUARANTEE

The performance figures indicated in attached questionnaire form shall be guaranteed within the tolerance specified or as permitted by relevant standards. In case of failure of equipment to meet the guaranteed performance, client reserves the right to reject the equipment. However, client also Reserves the right to use the rejected equipment until the Bidder supplies new equipment meeting the guaranteed performance requirements. If any equipment supplied by the Bidder fails at site during erection, commissioning or service [within guarantee period), the Bidder shall repair and put back into successful operation the failed equipment within the time frame and procedure of repair agreed with the client depending on nature of failure at no extra cost to the client.

The bidder shall clearly specify the parts covered under replacement warranty and details of service provided during warranty period.

The guarantee period shall be not less than 24months from the date of commissioning of DG set or 30 months from the date of manufacturing of DG whichever is earlier.

26.14 SERVICE

Manufacturers shall have established network of service centers capable of servicing the specified equipments. The Personnel shall be factory trained and shall be available for servicing

26.15 PROPOSED LAYOUT

The diesel generator units and their auxiliaries will be installed in the Utility Building ground floor. Supplier shall recommend his layout and indicate space requirement. The DG sets will be arranged to draw air from outdoors. Exhaust will be discharged through a vertical mounted muffler into individual exhaust pipe.

Contractor shall indicate the number of air changes required for site conditions for safe operation of DG set. Manufacturer shall indicate the heat load to be removed from DG set room.

26.16 DOCUMENTATION AND TESTING

The following documents, drawings etc shall be submitted along with the offer:

- Technical document of AVR, Governor, etc...
- Schematic diagram of engine control panel with accessories like AVR on details etc.
- Single line diagram for the whole system – control and power
- Detailed specification sheet for all auxiliary components giving material specifications, make / model, capacity, rating etc.
- Foundation details.

26.17 TESTING

The following tests shall be carried out at the Bidders works for the assembled DG Set in presence of Consultants / Architects / Clients.

Routine tests shall be conducted in the presence of Client / Consultant at the factory before shipping by simulating faults to check the proper functioning of the Generators and Alternators.

Load test using water load shall be carried out in the presence of Client / Consultant to prove the efficiency of the system.

Alignment between engine and alternator by authorized representative from the company.

Operational test for satisfactory functioning.

Relay tests – wherever applicable.

Insulation resistance check on alternator and relay panel (if relay panel is supplied by DG vendor)

26.18 TEST ON ENGINE

25% load for 1 hour.

50% load for 1 hour.

75% load for 1 hour.

100% load for 1 hour followed by 30 min. running at 110% of load

26.19 TESTS ON CONTROL PANEL

Insulation resistance test
High voltage withstand test
Functional and operation test
Secondary injection test on meters & relays :
Mechanical testing of components.

26.20 SITE TESTING

(To be carried out by Bidder witnessed by Client if factory test is not conducted):

Load test for one hour at full load.
100% load for 1 hour followed by 30 min. running at 110% of load
AMF sequence checking with all interlocks in line.
Measurement of starting time from cold condition.

Load will be provided by customer. Consumables (for excess of first fill) will be provided by the customer.

26.21 INSPECTION, OPERATION, MAINTENANCE MANUALS

The bidder shall submit the type test and routine test certificates along with delivery of DG set. Bidder shall submit two sets of as built drawings, operation and maintenance manual, Spare parts manuals of all components duly certified by the consultants after installation.

26.22 AS BUILT DRAWINGS

Bidder shall submit dimensional drawing showing location of all equipments inside the acoustic room housing the DG set and the cable route .The hard and soft copy of proposed DG set is to be enclosed with foundation details.

3 Sets of hard copies and all drawings in a CD.

- General Arrangement drawings
- Sectional Elevation
- Exhaust routing etc.,
- Chimney details
- Maintenance instructions.
- Manuals
- Spare parts with part numbers.
- All routine and site test reports.

26.23 PRODUCT DATA SHEET

Enclosed elsewhere in this document, vendors go through and provide inputs wherever necessary and confirm parameters asked for.

26.24 TRAINING

The Employer 's technical team shall be trained in all aspects of operation, maintenance and administration of the system

26.25 STATUTORY CLEARANCES

The Bidder will be responsible for the statutory clearances from the electrical inspector, pollution control board (lab report), regulatory authority, and any other statutory agency appointed for the purpose by the state / central / municipal bodies. The documents / drawings required for obtaining the approval shall be prepared by the bidder.

26.26 SPECIAL NOTES

Major civil works like RCC foundation etc in not included in the scope. However All other works and materials, tools, tackles, hardware, consumables, fuel, oil etc. including grouting of the foundation bolts, metal support structure, scaffolding as required and necessary hardware to complete and commission the installation is deemed as included in the offer unless specifically stated and agreed to by the Client before the placement of order.

The Bidder shall be responsible for providing foundation drawings and load calculation to the Consultant / Client for making necessary foundations.

26.27 ENERGY CONSERVATION APPLICATIONS

Please furnish the various methods that have been adopted in the engine, alternator and fuel systems to produce maximum energy per litre of diesel consumed with statistical data's.

27.1 SPECIFIC REQUIREMENTS

27.1.1 NOISE LIMIT FOR GENERATOR SETS RUN WITH DIESEL

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Noise limits for diesel generator sets, shall be as follows:

- i. Noise from DG set shall be controlled by providing an acoustic enclosure or by treating the room acoustically, at the users end.

ii. The acoustic enclosure or acoustic treatment of the room shall be designed for minimum 25 dB (A) insertion loss or for meeting the ambient noise standards, whichever is on the higher side (if the actual ambient noise is on the higher side, it may not be possible to check the performance of the acoustic enclosure/acoustic treatment. Under such circumstances the performance may be checked for noise reduction upto actual ambient noise level, preferably, in the night time). The measurement for Insertion Loss may be done at different points at 0.5 m from the acoustic enclosure/room, and then averaged.

a. The DG set shall be provided with proper exhaust muffler with insertion loss of minimum 25 dB(A).

These limits shall be regulated by the State Pollution Control Boards and the State Pollution Control Committees.

Guidelines for the manufacturers/users of Diesel Generator sets shall be as under:

1. The manufacturer shall offer to the user a standard acoustic enclosure of 25 dB(A) insertion loss and also a suitable exhaust muffler with insertion loss of 25 dB(A).

2. The user shall make efforts to bring down the noise levels due to the DG set, outside his premises, within the ambient noise requirements by proper siting and control measures.

3. Installation of a DG set must be strictly in compliance with the recommendations of the DG set manufacturer.

4. A proper routine and preventive maintenance procedure for the DG set should be set and followed in consultation with the DG set manufacturer which would help prevent noise levels of the DG set from deteriorating with use.

II. REQUIREMENT OF CERTIFICATION

Every manufacturer or importer (herein after referred to as "supplier") of DG set (herein after referred to as "product") to which these regulations apply must have valid certificates of Type Approval and also valid certificates of Conformity of Production for each year, for all the product models being manufactured or imported from 1st July, 2003 with the noise limit specified in paragraph 1.

III. SALE, IMPORT OR USE OF DG SETS NOT COMPLYING WITH THE RULES PROHIBITED

No person shall sell, import or use of a product model, which is not having a valid Type Approval certificate and Conformity of Production certificate.

V. NODAL AGENCY

1. The Central Pollution Control Board shall be the nodal agency for implementation of these regulations.
2. In case of any dispute or difficulty in implementation of these regulations, the matter shall be referred to the nodal agency.
3. The nodal agency shall constitute a Committee to advise it on all matters; including the disputed matters, related to the implementation of these regulations.

VI. AUTHORIZED AGENCIES FOR CERTIFICATION

The following agencies are authorized to carry out such tests as they deem necessary for giving certificates for Type Approval and Conformity of Production testings of DG sets and to give such certificates:-

Automotive Research Association of India, Pune

National Physical Laboratory, New Delhi

Naval Science & Technology Laboratory, Visakhapatnam

Fluid Control Research Institute, Palghat

National Aerospace Laboratory, Bangalore

VII. COMPLIANCE AND TESTING PROCEDURE

The compliance and testing procedure shall be prepared and published by the Central Pollution Control Board, with the help of the certification agencies.

MISSION STANDARDS FOR DIESEL ENGINES (ENGINE RATING MORE THAN 0.8MW (800KW) FOR POWER PLANT GENERATOR SET APPLICATIONS AND OTHER REQUIREMENTS

1. EMISSION LIMITS

The emission limits for new diesel engines more than 800 kw, for gensets applications shall be as given in the Table below:

TABLE

Parameter		Area Category	Total engine rating of the plant (includes existing as well as new generators sets)	Generator sets commissioning date		
				Before 1/7/2003	Between 1/7/2003 And 1/7/2003	On or after 1/7/2005
Nox(as NO ₂)(AT 15% O ₂), dry basis, in ppmv		A	Upto 75MW	1100	970	710
		B	Upto 150MW			
		A	More than 75MW	1100	710	360
		B	More than 150MW			
NMHC (as C) (at 15% O ₂), mg/Nm ³		Both A & B		150	100	
PM (at 15% O ₂), mg/Nm ³	Diesel Fuels-HSD & LDO	Both A & B		75	75	
	Furnace Oils-LSHS & FO	Both A & B		150	100	
CO (at 15% O ₂), mg/Nm ³		Both A & B		< 2%		
Sulphur content in fuel		A		< 4%		
		B				
Fuel specification		For A only	Up to 5MW	Only Diesel Fuels (HSD,LDO) shall be used		

Stack height (for generators sets commissioned after 1/7/2003)	Stack height shall be maximum of the following, in meter: i. $14 Q^{0.3}$, Q = Total SO ₂ emission from the plant in kg/hr. ii. Minimum 6m above the building where generator set is installed. iii. 30 m.
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2. APPLICABILITY

These rules shall apply to all new diesel engines for genset applications (herein after referred to as 'engine') manufactured in India and all diesel engines for genset applications and diesel gensets (herein after referred to as 'product'), imported into India, after the effective date: Provided that these rules shall not apply to:

- a. Any engine manufactured or engine or product imported for the purpose of export outside India, or;
- b. Any engine or product intended for the purpose of sample only and not for sale in India.

3. REQUIREMENT OF CERTIFICATION

Every manufacturer of engine or every importer of engine or product must have valid certificates of Type Approval and certificates of Conformity of Production for each year, for all engine models being manufactured or for all engine or product models being imported, after the effective date with the emission limit as specified in paragraph 1.

4. SALE, IMPORT OR "USE OF ENGINE OR PRODUCT NOT COMPLYING WITH THESE RULES

No person shall sell, import or use an engine or a product which is not having a valid Type Approval certificate and Conformity of Production certificate as per paragraph 3.

5. REQUIREMENT OF CONFORMANCE LABELING

- i. All the engines (individually or as part of the product) shall be clearly engraved 'Genset Engine' on the cylinder block.
- ii. The engine or the product must be affixed with a conformance label meeting the following requirements: -
 - a. The label shall be durable and legible;
 - b. The label shall be affixed on a part necessary for normal operation of the engine or the product and not normally requiring replacement during the life of the engine or the product.
 - iii. The conformance label must contain the following information:

- a. Name and address of the engine manufacturer or the engine or product importer (if the address is given in the owner's manual, it may not be included in the label);
- b. Statement that 'this engine or product conforms to the Environment (protection) Rules, 1986';
- c. Type approval certificate number;
- d. Date of manufacture of engine or in case of import, the date of import of the engine or the product.

6. COMPLIANCE WITH BIS SPECIFICATIONS

All engines up to 20 kw (individually or as part of the product) shall carry ISI mark and meet relevant BIS specifications (IS 1000 1).

7. NODAL AGENCY

The Central Pollution Control Board shall be the, nodal agency for implementation of these rules.

In case of any dispute or difficulty in implementation of these rules the matter shall be referred to the nodal agency.

The nodal agency shall constitute a Committee to advise it on all matters, including the disputed matters, related to the implementation of these rules.

29.3 AUTHORIZED AGENCIES FOR CERTIFICATION

The following agencies are authorized to carry out such tests as they deem necessary for giving certificates of Type, Approval and Conformity of Production tests for Diesel engines and to give such certificates:-

Automotive Research Association of India

29.4 COMPLIANCE AND TESTING PROCEDURE

The compliance and testing procedure shall be prepared and published by the Central Pollution Control Board with the help of the Certification Agencies.

29.5 FUEL SPECIFICATION

The specification of commercial fuel applicable for -diesel gensets shall be the same as applicable for commercial HSD (High Speed Diesel) applicable for diesel vehicles in the area, from time to time."

Bidder shall submit dimensional drawing showing location of all equipments inside the acoustic room enclosure housing the DG sets. The hard and soft copy of proposed DG set is to be enclosed with foundation details.

List of Make of material

1. ENGINE	: CUMMINS / CATERPILLAR / MTU / PERKINS
2. ALTERNATOR	: STAMFORD/LEROY SOMER DPS/KIRLOSKAR
3. NGR Panel	: Reputed Manufactures
4. HT Isolators	: Pentagon/Essex/Crompton
5. CTs & PT	: Kappa/Kalpa/Instrans
6. PBs & Lamps (LED)	: BCD/RASS
7. MCBs	: MDS/HPL/ABB/Indokopp
8. Local Remote Switch	: Kaycee/Switron
9. Terminals	: Connectwell
10. HT CABLE	: Universal/CCI/Gloster/Polycab/havels
11. LT CABLE	: Universal/Polycab/Nicco/Gemscab /havels
12. Measuring instruments Digital	: Conzerv/IMP/AE/Consol/Cadel
13. Energy meter (Sealable type)	: Conzerv/AE/IMP/Meco/Consol/L&T
14. Power contactors	: ABB/Telemecanique/L&T/Crompton
15. Current transformer	: Kappa/Kalpa/Cortina/Indcoil
16. Overload relays/Timers	: L&T/ABB/Telemecanique
17. Indication lamps/Pushbuttons :	: LED star/Vaishnav
18. Line Voltage monitor	: Minilec (VMR).
19. Three attempt starter	: PIC or eqt.
20. Low fuel sensor	: PIC or eqt.
21. Control relays	: L&T/Ariva
22. Selector switches	: Kaycee/L&T.
23. DC hooter with audible control	: Vaishnav
24. Control wire	: Finolex - FRLS
25. MCB	: MDS/Merlengerin/ABB/Siemens
26. Phase reversal protection	: Minilec (VMR)
27. 11 KV HT VCB	: ABB/Siemens/Schneider/MEI
28. Panel	: Any CPRI appd. Fabricator
29. Numerical Relay	: L&T/Ariva
30. Digital Meters	: Conzerv/AE/ICD/Elecon/IMP/Cadel
31. Trivector Meter	: L&T/Conzerv/ICD
32. Indicating Lamps	: Tecknic/L&T
33. Selector Switches	: Kaycee/L & T
34. DC Hooter with audible control	: Vaishnav
35. Control Wiring	: Finolex/Polycab/RR
36. MCB	: MDS/Merlengerin/ABB/Siemens
37. Power contactors	: ABB/Telemecanique/L&T
38. Terminals	: Connectwell
39. Auto Synch & Auto Load Relay	: Woodward/DIEF
40. Glass wool	: Twaiga / Lloyd / eqt.
41. Fresh air / Exhaust fan	: GEC / Almonard / Nadi

SECTION 5

CONDITIONS OF CONTRACT (CC)

General Condition of the Contract

- a) This “General rules and directions to contractors “shall also form part of the tender document.
- b) The Tenders are valid for 3(three) months from date of opening.
- c) Time is the essence of the contract. Time of completion allowed is SIX months from the date of work order.
- d) The letter of intent shall be issued soon followed by the formal work order.
- e) The contractor is expected to visit the site and study the probable routes of transportation of material to the site before quoting.
- f) The successful tenderer is required to sign an agreement for the due fulfillment of the contract and start the work immediately on of the acceptance of his tender. A draft of the articles of the agreement is enclosed.
- g) All the items of the work are to be executed as per relevant IS specifications.
- h) Only first quality materials shall be allowed for the work. The samples of all materials shall be got approved by the Engineer-in-charge before supplying for the work. For all items prior approval will have to be taken from Engineer-in-charge.
- i) It is entirely the responsibility of the contractor to arrange for and provide all materials required for successful completion of the work.
- j) The rates quoted by the contractor shall include all taxes, conveyance, loading and unloading charges, labour supervision thereof, of all tools and implements, incidental charges and all that is required for the complete work.
- k) All the routine tests for DG set , 11KV class and 11KV switch gears panels etc., to be carried out at the factory in the presence of the IISc representative and test certificate produced along with the catalogue and maintenance manual and the agency at his cost shall arrange for such inspection. However, no separate payments shall be made in this regard.
- l) Schedule of quantities (Bill of Quantities) along with technical specifications is attached herewith. It should however, be clearly understood that these quantities are liable to alterations by omission, addition or variation, at the discretion of the Engineer-in-charge.

- m) The Contractor has to agree and strictly abide to all the conditions stipulated in the tender and any offers with deviation or request for deviation are liable to be rejected.
- n) The Contractor shall obtain the Clearance certificate from Chief Electrical Inspectrate to Government(CEIG), Chennai after completion of work. Requisite fee for CEIG inspection and approval shall be paid by IISc. Final bill will be paid only after the clearance certificate from CEIG is received.
- o) The debris arises during the progress of work should be cleared then and there to keep the surrounding clean and tidy, such debris shall, if not cleared, be cleared at Contractors risk and cost.
- p) Right to recovery for Loss / Damage: Any cost incurred by the Institute in connection with any improper performance of this contract by the Contractor, his workmen, servants pr agents and any money which may become payable to Institute as aforesaid and by way of any omission and commission of work, all compensation for any losses or damages, shall be deemed to be money due under the terms of this contract and may be deducted by the Institute from any money due or accruing to the Contractor by the Institute or may be recovered by the Institute from the Contractor in any other manner as deemed fit.
- q) The guarantee shall be 12 months from the date of handing over the installation duly energized.
- r) The contractor has to prepare a time schedule for the complete work in detail and submit to Engineer-in-charge in triplicate within 10 days from the day of letter of intent. This shall be modified to suit the civil construction work.
- s) Registrar / Director, IISc reserves the right for accepting or rejecting any or all the tenders without assigning any reason thereof.

Clause 1.: SECURITY DEPOSIT

- (a) The person/persons whose tender may be accepted (hereinafter called the contractor which expression shall unless the context otherwise requires, include his heirs, executors, administrators and assigns) shall pay Earnest Money Deposit indicated in Column (ii) of the table given below and shall permit Institute (a) to deduct FSD at the percentage mentioned in Column (iii) of the table given below of all moneys payable for work done under the Contract, at the time of making such payments to him/them and (b) to hold such deductions as Further Security Deposit (FSD).

Estimated cost of the work	E.M.D Percentage	F.S.D Percentage
(i)	(ii)	(iii)
Upto Rs.20,00,000/-	2 ½%	5%
Rs.20,00,000/- upto Rs.1.00 Crore	2%	5 ½%
Rs.1.00 crore upto Rs.10 crores	1½%	6%
10 crores and above	1%	6 ½%

- (b) Addition or Reduction in Security Deposit.

The EMD for the tendered work and additional amount of Security Deposit at the rates mentioned in Sub-clause 1(a) above should be, paid by the contractor. If a portion of the work is withdrawn from the Contractor under the provisions of Clause 12(a), the Project Engineer cum Estate Officer(CCMD), Indian Institute of Science(hereinafter referred to as the Project Engineer cum Estate Officer) may allow a proportionate reduction in the amount of the Security Deposit.

- (c) Dues to Institute, to be set off against Security Deposit.

All compensation or other sums of money payable by the Contractor to Institute under the terms of this contract may be realized or deducted from any Security Deposit payable to him or from any sums which may be due or may become due by Institute to the Contractor on any account whatsoever and in the event of his security deposit being reduced by reason of any such realization or deduction as aforesaid, the Contractor shall, within ten days thereafter, make good in cash any sum or sums which have been deducted from, or raised by sale of his security deposit or any part thereof.

- (d) Refund of Security Deposit (EMD & FSD):

The Security Deposit lodged/paid by a Contractor shall be refunded to him after the final bill is paid or after twelve months from the date of completion of the work, during which period the work should be maintained by the Contractor in good order, whichever is later.

Clause 2. : PENALTY FOR DELAY

- (a) Written Order to Commence Work

After acceptance of the tender, The Project Engineer cum Estate Officer, CCMD shall issue a written order to the successful tenderer to commence the work. The Contractor shall enter upon or commence any portion of work only with the written authority and instructions of The Project Engineer cum Estate Officer, CCMD. Without such instructions the Contractor shall have no claim to demand for measurements of or payment for, work done by him.

- (b) Program of work

The time allowed for carrying out the work as entered in the tender shall be strictly observed by the contractor. It shall be reckoned from the date of handing over the site to the Contractor not less than 75 percent of work site area comprising a continuous block. The work shall throughout the stipulated period of the contract be proceeded with, all due diligence (time being deemed to be the essence of the contract on the part of the Contractor). To ensure good progress during the execution of the work, the contractor shall be bound (in all cases in which the time allowed for any work exceeds one month) to comply with the time schedule according to the programme of execution of the work as agreed upon and enclosed to the agreement.

- (c) Review of progress and responsibility for delay etc.,

The Project Engineer cum Estate Officer, CCMD shall review the progress of all works with the contractor during the first fortnight of every month. Such a review shall take into account the programme fixed for the previous month, obligations on the part of the Contractor.

- (d) Apportioning of responsibility for delay between Contractor and Institute.

In case the progress achieved falls short by more than 25 percent of the cumulative programme, the reasons for such shortfall shall be examined and a record made thereof apportioning the responsibilities for the delay between the contractor and the Institute. This record should be signed in full and dated both by The Project Engineer cum Estate Officer, CCMD and the Contractor.

- (e) Shortfall in progress made up subsequently.

To the extent the shortfall is assessed, as due to the delay on the part of the contractor, a notice shall be issued to him by The Project Engineer cum Estate Officer, CCMD to make up the shortfall . If the shortfall is not made up before the progress of the work is reviewed during the second month succeeding the month in which the shortfall was observed, the Contractor shall be liable to pay penalty as indicated in Clause 2(h) below.

- (f) Grant of extension of time.

If the delay is attributable to reasons beyond the control of the Contractor, requisite extension of time shall be granted by The Project Engineer cum Estate Officer, CCMD in accordance with Clause 5 after obtaining the approval of his higher authorities, wherever necessary.

- (g) Settlement of dispute regarding shortfall in progress.

In case of dispute between The Project Engineer cum Estate Officer,CCMD and Contractor regarding the responsibility for the shortfall in progress, the matter shall be referred to the Director, IISc., who shall thereupon give a decision within fifteen days from the date of receipt of reference. The decision of the Director shall be final and binding on the contractor and The Project Engineer cum Estate Officer,CCMD.

- (h) Penalty for delay

In respect of the shortfall in progress, assessed as due to the delay on the part of contractor as per Clause 2(b) and 2 (c), the contractor shall be liable to pay as penalty an amount equal to one percent of the estimated value of the balance work assessed according to the programme, for every week that the due quantity of work remains incomplete; provided always that the total amount of penalty to be paid under the provisions of this clause shall not exceed 7 ½ percent of the estimated cost of the entire work as shown in the tender, provided further that in the event of the contractor making up the shortfall in progress within the stipulated or extended time of completion, the penalty so recovered may be refunded on an application in writing by the contractor.

Note: *If The Project Engineer cum Estate Officer, CCMD considers it necessary he shall be entitled to take action as indicated in Clause 3 (d) also.*

- (i) Adjustment of excess/over payments.

Excess/over payments as soon as they are discovered should be adjusted in the next running account bill of the contractor and in case the final bill has already been paid, the excess/over payment made shall be recovered from the Security Deposit of the contractor together with interest at such percentages as Institute may decide from time to time, from the date of such excess or over payment to the date of recovery.

Clause 3.: ACTION WHEN WHOLE OF SECURITY DEPOSIT IS FORFEITED

In any case in which under any clause or clauses of this contract the contractor shall have rendered himself liable to pay compensation and/or penalty amounting to the whole of his security deposit including the amount deducted in installment from his bills as Further Security Deposit, The Project Engineer cum Estate Officer, CCMD on behalf of the Director, IISc., shall have power to adopt any of the following courses as he may deem best suited in the interest of Institute.

- (a) Forfeiture of Security Deposit

Without prejudice to Institute's right to recover any loss from the Contractor under sub-clauses (b) and (c) of Clause 3 of the Contract, to rescind the contract (of which rescission notice in writing to the contractor under the hand of The Project Engineer cum Estate Officer, CCMD shall be conclusive evidence). And in that case, the security deposit of the contractor including whole or part of the lump sum deposited by him and also the amount deducted from his bills as Further Security Deposit, shall stand forfeited and be absolutely at the disposal of the Institute.

- (b) Debiting cost of labour and materials supplied.

To employ labour paid by the Institute and to supply materials to carry out the work or any part of the work, debiting the contractor with the cost of the labour and the price of the materials (as to the correctness of which cost and price the certificate of the The Project Engineer cum Estate Officer, CCMD

shall be final and conclusive against the contractor) and crediting him with the value of the work done; in all respects in the same manner and at the same rates as if it had been carried out by the contractor under terms of this contract, and in that case the certificate of the The Project Engineer cum Estate Officer, CCMD as to the value of the work done shall be final and conclusive against the contractor.

(c) Recovery of extra cost on unexecuted work

To measure up the work of the contractor and to take such part thereof as is remaining unexecuted out of his hands and to give it to another contractor to complete it in which case any expenses which may be incurred in excess of the sum which would have been paid to the original contractor, if the whole work had been executed by him (as to the amount of which excess expenses the certificate in writing of the The Project Engineer cum Estate Officer, CCMD shall be final and conclusive) shall be borne and paid by the original contractor and shall be deducted from any money due to him by Institute under this contract.

(d) Action against unsatisfactory progress

If the contractor does not maintain the rate of progress as required under Clause 2 and if the progress of any particular portion of work is unsatisfactory even after taking action under Clause 2(c) and 2(d), the The Project Engineer cum Estate Officer, CCMD shall be entitled to take action under Clause 3(b) or 3(c) at his discretion in order to maintain the rate of progress after giving the contractor 10 days notice in writing whereupon the contractor will have no claim for any loss sustained by him owing to such actions .

(e) No compensation for loss sustained on advance action

In the event of any of the above courses being adopted by the Project Engineer cum Estate Officer,CCMD, the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased, or procured any materials, entered into any agreements or made any advances on account of, or with a view to the execution of the work or the performance of the contract. And in case the contract shall be rescinded under the provision aforesaid the contractor shall not be entitled to recover or be paid any sum for any work thereof actually performed by him under his contract, unless and until the Project Engineer cum Estate Officer,CCMD shall have certified in writing the performance of such work and the amount payable in respect thereof, and he shall only be entitled to be paid the amount so certified.

Clause 4.: CONTRACTOR TO REMAIN LIABLE TO PAY COMPENSATION IF ACTION IS NOT TAKEN UNDER CLAUSE-3.

- (a) In any case in which any of the powers conferred upon the the Project Engineer cum Estate Officer, CCMD by Clause 3 thereof shall have become exercisable and the same shall not have been exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor for which under any clause hereof he is declared liable to pay compensation or penalty amounting to the whole of his security deposit and the liability of the contractor for past and future compensation or penalty shall remain unaffected.
- (b) Power to take possession of or require removal of or sell contractor's properties.

In the event of the The Project Engineer cum Estate Officer, CCMD taking action under sub-clause (a) or (c) of Clause 3, he may, if he so desires, take possession of all or any tools, plant, materials and stores, in or upon works or the site thereof or belonging to the contractor, or procured by him and intended to be used for the execution of the work or any part thereof, paying or allowing for the same in account at the contract rates; or in the case of contract rates not being applicable, at current market rates, to be certified by the The Project Engineer cum Estate Officer, CCMD whose certificate thereof shall be final. In the alternative, the Project Engineer cum Estate Officer, CCMD may after giving notice in writing to the contractor or his clerk of the works, foreman or other authorised agent, require him to remove such tools, plant, materials or stores from the premises within a time to be specified in such notice; and in the event of the contractor, failing to comply with any such requisition, the Project Engineer cum Estate Officer, CCMD may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and at his risk in all respect, and the certificate of the The Project Engineer cum Estate Officer, CCMD as to the expense of any such removal; and the amount of the proceeds and expense of any such sale shall be final and conclusive against the contractor.

Clause 5.: GRANT OF EXTENSION OF TIME

- (a) If the contractor shall desire an extension of the time for completion of the work, on the ground of his having been unavoidably hindered in its execution or on any other ground, he shall apply in writing to the Project Engineer cum Estate Officer, CCMD before the expiry of the period stipulated in the tender or before the expiry of 30 days from the date on which he was hindered as aforesaid or on which the cause for asking for extension occurred, whichever is earlier and the Project Engineer cum Estate Officer, CCMD or other competent authority may if in his opinion, there are reasonable grounds for granting an extension, grant such extension as he thinks necessary or proper. The decision of such competent authority in this matter shall be final.
- (b) The time limit for completion of the work shall be extended commensurate with its increase in cost occasioned by alterations or additions and the certificate of the Project Engineer cum Estate Officer, CCMD or other competent authority as to such proportion shall be conclusive.

Clause 6.: ISSUE OF FINAL CERTIFICATE – CONDITIONS REGARDING

(a) On completion of the work the contractor shall report in writing to the Project Engineer cum Estate Officer, CCMD the completion of the work. Then he shall be furnished with a certificate by the Project Engineer cum Estate Officer, CCMD of such completion, but no such certificate shall be given nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall have been executed, all scaffolding, surplus materials and rubbish, and shall have cleaned thoroughly all wood work, doors, windows, wall, floor or other parts of any building, in or upon which the work has been executed, or of which he may have had possession for the purpose of executing the work, nor until the works shall have been measured by the Project Engineer cum Estate Officer, CCMD or other competent authority, or where the measurements have been taken by his Engineer-in-charge until they have received the approval of the Project Engineer cum Estate Officer, CCMD or other competent authority, the said measurements being binding and conclusive against the contractor. If the contractor shall fail to comply with the requirements of this clause as to the removal of scaffolding, surplus materials and rubbish, and cleaning on or before the date fixed for the completion of the work the Project Engineer cum Estate Officer, CCMD or other competent authority may, at the expense of the contractor, remove such scaffolding, surplus materials and rubbish, and

dispose of the same as he think fit and clean off such dirt etc., as aforesaid and contractor shall be liable to pay the amount of all expenses incurred but shall have no claim in respect of any such scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

(b) **CLOSURE OF CONTRACT PENDING COMPLETION OF MINOR ITEMS.**

In cases where it is not desirable to keep the building contract open for minor items, such as flooring in the bath rooms, etc., which can be carried out only after installation of sanitary work the main contract may be finalized after getting a supplementary agreement executed in the prescribed form by the same contractor for doing the residual work.

Clause 7. : CONTRACTOR TO SUBMIT BILLS MONTHLY IN PRINTED FORM

- (a) A bill shall be submitted by the contractor on or before 15th of each month for all items of work executed in the previous month as required by IISc.
- (b) All bills shall be prepared in the prescribed printed or electronic form in PDF format in quadruplicate and handed over to the Engineer-in-charge in charge of the work/ the Project Engineer cum Estate Officer, CCMD's Office and acknowledgment obtained.
- (c) The charges to be made in the bills shall always be entered at the rates specified in the tender in full or in part as the case may be, in the case of any extra work ordered in pursuance of these conditions, and not mentioned or provided for in the tender, the charges in the bills shall be entered at the rates hereinafter provided for such work.
- (d) Scrutiny of Bills and measurement of work

The details furnished by the Contractor in the bill will be completely scrutinized and the said work will be measured by the Engineer-in-charge in the presence of the Contractor or his duly authorized agent. The countersignature of the contractor or the said agent in the measurement book will be sufficient proof to the correctness of the measurements, which will be binding on the contractor in all respects. If the contractor does not submit the

bills within the prescribed time, the Project Engineer cum Estate Officer, CCMD may depute within seven days of the prescribed date, an Engineer-in-charge to measure up the said work. The countersignature of the contractor shall be obtained in the Measurement Book concerned with reference to which the Institute may prepare the bill.

- (e) One copy of the passed bill will be given to the Contractor without any charge.

Clause 8.: PAYMENT PROPORTIONATE TO WORK APPROVED AND PASSED.

- a) No payment shall be made for any work estimated to cost rupees five thousand or less until after the whole of the work shall have been completed and certificates of completion given. But in the case of works estimated to cost more than Rs. 5,000 the contractor shall on submitting the bill and after due verification by the Engineer-in-charge as per Clause 7(d) entitled to necessary payment proportionate to the part of the work then approved and passed by The Project Engineer cum Estate Officer, CCMD or other competent authority whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the contractor.

- b) Payment at reduced rates

The rates for several items of works agreed to within shall be valid only when the items concerned are accepted as having been completed fully in accordance with the stipulated specifications. In cases where the items of work are not accepted as so completed, the Project Engineer cum Estate Officer, CCMD or other competent authority may make payment on account of such items at such reduced rates as he may consider reasonable in the preparation of final or on account bills.

- c) Payment or intermediate certificates be regarded as advances:

All such intermediate payments shall be regarded as payments by way of advance against the final payments only and not as payments for work actually done and completed, and shall not preclude the Project Engineer cum Estate Officer, CCMD or other competent authority from requiring any bad, unsound imperfect or unskillful work to be removed or taken away and

reconstructed or re-erected nor shall any such payment be considered as an admission for the due performance of the Contract or any part thereof in any respect or the accruing of any claim, nor shall it conclude determine or affect in any other way the powers of the Project Engineer cum Estate Officer, CCMD or other competent authority as to the final settlement and adjustment of the accounts, or otherwise or in any other way vary or affect the contract.

d) Submission of Final bill and its settlement

The contractor shall submit the final bill within one month of the date of actual completion of the work in all respects. His claims shall be settled (except those under dispute) within five months after the final bill is submitted in acceptable form.

e) Disputed items

Note: The contractor shall submit a list of the disputed items within 30 days from the disallowance thereof and if he fails to do this, his claim shall be deemed to have been fully waived and absolutely extinguished.

Clause 9.: DEFINITION OF WORK

(a) The expression 'Work' or 'Works' where used in these conditions, shall unless there be something in the subject or context repugnant to such construction, be construed to mean the work or works contracted to be executed under or in virtue of the contract, whether temporary or permanent and whether original, altered, substituted or additional.

(b) Work to be executed in accordance with specifications, drawings, orders etc.

The contractor shall execute the whole and every part of the work in the most sound and substantial and workmanlike manner, and in strict accordance with the specifications both as regards materials and workmanship. The contractor shall also conform exactly, fully and faithfully to the designs, drawings and instructions in writing relating to the work signed by the Project Engineer cum Estate Officer, CCMD or other competent authority and lodged in his office and to which the contractor shall be entitled to have access at such office, or on the site of the work for the purpose of inspection during office hours. The contractor shall also be responsible for the delivery of structure in sound conditions and the execution of the work strictly in accordance with the specifications of the work.

- (c) Action where there is no specification

In the case of any class of work for which there is no such specification, then in such a case of the work shall be carried out in all respects in accordance with the instructions and requirements of the Project Engineer cum Estate Officer, CCMD or other competent authority.

- (d) Work as per Specifications and IS Codes.

The detailed specification, which forms a part of contract, accompanies the tender document. In carrying out the various items of work as described in Schedule B of the tender documents and the additional, substituted, altered items of work these detailed specification shall be strictly adhered to, supplemented by relevant provisions of the Indian standard specifications, the code of practice; etc., The Indian standard specification and the code of practice to be followed shall be the latest versions of those listed in the detailed technical specifications. Any class of work, not covered by the detailed technical specifications, shall be executed in accordance with the instructions and requirements of the engineer and the relevant provisions of the Indian standard specifications.

Clause 10. : ALTERATION IN QUANTITY OF WORK, SPECIFICATION AND DESIGN, ADDITIONAL WORK, DELETION OF WORK

- (a) The Project Engineer cum Estate Officer, CCMD shall have power to make any alternations in, omissions from additions to or substitutions for the original specification, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work. For that purpose or if for any other reason it shall in his opinion be desirable, he shall have power to order the Contractor to do and the contractor shall do any or all the following -
- (b) Increase or decrease the quantity of any work included in the contract.
 - (c) Omit any such work.
 - (d) Change the character or quality or kind of any such work,
 - (e) Change the levels, lines, positions and dimensions of any part of the work,
 - (f) Execute additional work of any kind necessary for the completion of the works and
 - (g) change in any specified sequence, methods or timing of construction of any part of the work.

10.a) Contractor bound by Project Engineer cum Estate Officer, CCMD's instructions

The Contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Project Engineer cum Estate Officer, CCMD or other competent authority and such alteration shall not in any way vitiate or invalidate the contract.

Orders for variations to be in writing

- (i) No such variations shall be made by the Contractor without an order in writing of the Project Engineer cum Estate Officer provided that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is the result of the quantities exceeding or being less than those stated in the 'Schedule B' provided also that if for any reason the Project Engineer cum Estate Officer, CCMD shall consider it desirable to give any such order verbally, the Contractor shall comply with such order without any confirmation in writing of such verbal order given by the Project Engineer cum Estate Officer, CCMD, whether before or after the carrying out of the order, shall be deemed to be an order in writing within the meaning of the clause; provided further that if the Contractor shall within seven days confirm in writing to the Project Engineer cum Estate Officer, CCMD and if such confirmation is not contradicted in writing within fourteen days by the Project Engineer cum Estate Officer, CCMD, it shall be deemed to be an order in writing by the Project Engineer cum Estate Officer, CCMD.
 - (ii) Any additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the Contractor on same conditions in all respects on which he agreed to do the main work and same rates as are specified in the tender for the main work. However, change in the unit rates tendered and accepted shall be considered in respect of items under which the quantity of work performed exceeds tendered quantity by more than 25 percent and this actual change in rate will be restricted only to such excess quantity (i.e. beyond 125 percent of the tendered quantity).
- (b) Rate for excess quantity beyond 125 percent of tendered quantity

The Additional quantity which exceeds 125 percent of the tendered quantity shall be paid at the rates entered in or derived from Schedule of Rates prevalent at the time of executing additions and alterations plus or minus the overall percentage of the original tendered rates over the current Schedule of

Rates (KPWD) of the year in which the tender is accepted (as per the comparative Statement prepared at the time of acceptance of the tender).

(c) Rates for additional, substituted, altered items of work

If the additional, substituted or altered work includes any class of work for which no rate is specified in the contract, then such work shall be carried out at the rates specified for or derived from similar item of work in the agreement. In the absence of similar items in agreement, rate shall be as specified for or derived from similar items in the schedule of rates of KPWD prevalent at the time of execution of such additional substituted or altered items of works, plus or minus the overall percentage of original tendered rates over the current schedule of rates of (KPWD) the year in which tender is accepted as mentioned in sub clause (b) above. With regard to the question whether the additional, substituted or altered item/items of work/works is / are similar or not, to that/those in the agreement / in the Schedule of Rates of KPWD and the decision of the Director shall be final and binding on the contractor.

(d) Determination of rates for items not found in Estimate or Schedule of Rates

If the rates for additional, substituted or altered work cannot be determined in the manner specified in sub clauses (b) and (c) above, then the contractor shall within 7 days of the date of receipt by him of the order to carry out the work, inform The Project Engineer cum Estate Officer,CCMD of the rates which it is his intention to charge for such class or work, supported by analysis of the rate or rates claimed. Thereupon the Project Engineer cum Estate Officer,CCMD shall determine the rate or rates on the basis of observed data and failing this, on the basis of prevailing market rates. Under no circumstances the contractor shall suspend the work on the plea of non-settlement of rates for items falling under this clause. In the event of any dispute regarding the rates for such items the decision of the Director, IISC shall be final.

Clause 11.: TIME LIMITS UNFORSEEN CLAIMS

Under no circumstances whatever shall the contractor be entitled to any compensation from Institute on any account unless the contractor shall have submitted claim in writing to the Project Engineer cum Estate Officer, CCMD or other competent authority within 30 days of the cause of such claim occurring.

Clause 12.: NO CLAIM TO ANY PAYMENT OR COMPENSATION FOR DELETION OF WHOLE OR PART OF WORK

a) If at any time after the execution of the contract documents, the Project Engineer cum Estate Officer, CCMD or other competent authority shall, for any reason whatsoever, require the whole or any part of the work as specified in the tender, to be stopped for any period or require the whole or part of the work (i) not to be carried out at all or (ii) not to be carried out by the tendered contractor, he shall give notice in writing of the fact to the contractor who will thereupon suspend or stop the work totally or partially as the case may be. In any such case, except as provided hereunder, the contractor shall have no claim to any payment of compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full but which he did not so derive in consequence of the full amount of the work not having been carried out, or on account of any loss that he may be put on account of materials purchased or agreed to be purchased, or for unemployment of labour recruited by him. He shall not also have any claim for compensation by reason of any alterations having been made in the original specifications, drawings, designs and instructions, which may involve any curtailment of the work, as originally contemplated.

(b) Payment for materials already purchased or ordered by contractor.

Where, however, materials have already been purchased or agreed to be purchased by the contractor before receipt by him the said notice the contractor shall be paid for such materials, at the rates determined by the Project Engineer cum Estate Officer, CCMD or other competent authority provided they are not in excess of requirements and are of approved quality, and/or shall be compensated for the loss, if any, that he may be put to, in respect of materials agreed to be purchased by him, the amount of such compensation to be determined by the Project Engineer cum Estate Officer, CCMD or other competent authority whose decision shall be final.

(c) Labour charges during stoppage of work

If the contractor suffers any loss on account of his having to pay labour charges during the period during which the stoppage of work has been

ordered under this clause, the contractor shall on application, be entitled to such compensation on account of labour charges as the Project Engineer cum Estate Officer, CCMD or other competent authority, whose decision shall be final, may consider reasonable. Provided that the contractor shall not be entitled to any compensation on account of labour charges if in the opinion of the Project Engineer cum Estate Officer, CCMD or other competent authority, the labour could have been employed in the same locality by the contractor for the whole or part of the period during which the stoppage of the work has been ordered as aforesaid.

(d) Time limit for stoppage of work

The period of stoppage ordered by the Project Engineer cum Estate Officer, CCMD or other competent authority should not ordinarily exceed six months. Thereafter the portion of works stopped may be treated as deleted from this agreement if a notice in writing to that effect is given to the Project Engineer cum Estate Officer, CCMD or other competent authority by the contractor within seven days after the expiry of the above period.

(e) Execution of work deleted

The portion of work thus deleted may be got executed from the same contractor on supplemental agreement on mutually agreed rates, which shall not exceed current Schedule of Rates (KPWD) plus or minus tender percentage,

Clause 13.: ACTION AND PENALTY IN CASE OF BAD WORK

If at any time before the security deposit is refunded to the contractor, it shall appear to the Project Engineer cum Estate Officer, CCMD or other competent authority that any work has been executed with unsound, imperfect or unskillful workmanship or with materials of inferior quality, or that any materials or articles provided by him for the execution of the work are unsound or of a quality inferior to that contracted for, or are otherwise not in accordance with the contract, it shall be lawful for the Project Engineer cum Estate Officer, CCMD or other competent authority to intimate this fact in writing to the contractor and then notwithstanding the fact that the work, materials or articles complained of may have been paid for, the contractor shall be bound forthwith to rectify, or remove and reconstruct the work so specified on whole or in part as the case may require, or if, so required shall remove the materials or articles at his own charge and cost and in the event of his failing to do so within a period to be specified by the Project Engineer cum Estate Officer, CCMD or the competent authority in the written intimation aforesaid, the contractor shall be liable to pay a penalty not

exceeding one percent on the amount of the estimate for every day not exceeding ten days during which the failure, so continues and in the case of any such failure the Project Engineer cum Estate Officer, CCMD or other competent authority may rectify or remove, and re-execute the work or remove and replace the materials or articles complained of, as the case may be at the risk and expense in all respects of the contractor should the Project Engineer cum Estate Officer, CCMD or other competent authority for any valid reasons consider that any such inferior work or materials as described above is to be accepted or made use of, it shall be within his discretion to accept the same at such reduced rates he may fix thereof.

Clause 14.: WORK TO BE OPEN TO INSPECTION - CONTRACTOR OR RESPONSIBLE AGENT TO BE PRESENT

- (a) All works under or in course of execution or executed in pursuance of the contract shall at all time be open to the inspection and supervision of the The Project Engineer cum Estate Officer, CCMD or other competent authority and his Engineer-in-charge, and the contractor shall at all times during the usual working hours, and at all other times at which reasonable notice of the intention of the Project Engineer cum Estate Officer, CCMD or other competent authority Engineer-in-charge to visit the work shall have been given to the contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing present for the purpose. Orders given to the contractor duly authorised agent shall be considered to have the same force and effect as if they had been given to the contractor himself.
- (b) Employment of technical staff
The Contractor shall employ the following technical staff during execution of this work:
 - (i) One Graduate Engineer when the cost of the work to be executed is 'Rs. 5 lakhs or more',
 - (ii) One qualified Engineering Diploma Holder when the cost of work to be executed is more than Rs. 2 lakhs but less than Rs. 5 lakhs;
 - (iii) In addition to (i) and (ii) above, the contractor shall employ different types of such technical personnel as may be required and sufficient for execution of work and directed by the Project Engineer cum Estate Officer,CCMD to ensure efficient execution of work.

The technical staff so employed, should be available at site whenever required by Engineer in-charge to take instructions.

- (c) If the contractor fails to employ the technical staff as aforesaid, he shall be liable to pay a sum of Rs. 10000 (Rupees TEN thousand only) for each month of default in the case of Graduate Engineers and Rs. 5000 (Rupees Five thousand only) for each month of default in case of Diploma Holders.
- (d) If the Contractor himself possesses the required qualification and is available at the site for receiving instructions from the The Project Engineer cum Estate Officer, CCMD and other competent authority vide sub-clause (a) above it will not be necessary for the technical staff to be available at site for receiving instructions.

Clause 15.: NOTICE TO BE GIVEN BEFORE WORK IS COVERED UP

The contractor shall give not less than five days notice in writing to the Project Engineer cum Estate Officer, CCMD or his Engineer-in-charge in charge of the work before covering up or otherwise placing beyond the reach of the measurement any work in order that the same may be measured; and correct dimensions thereof taken before the same is so covered up or placed beyond the reach of measurement, and shall not cover up or place beyond the reach of measurement, and work without the consent in writing of the Project Engineer cum Estate Officer, CCMD or other competent authority or his Engineer-in-charge in charge of work; and if any work shall be covered up or placed beyond the reach of measurement, without such notice having been given or consent obtained, the same shall be uncovered at the contractor's expense, and in default thereof no payment or allowance shall be made for such work or for the materials with which the same was executed.

Clause16.: CONTRACTOR LIABLE FOR DAMAGE DONE, AND FOR IMPERFECTIONS FOR TWELVE MONTHS AFTER CERTIFICATE OF COMPLETION

If the Contractor or his workmen or servants shall break, deface, injure or destroy any part of a building in which they may be working, or any building, road fence, enclosure or grassland or cultivated ground contiguous to the premises on which the work or any part thereof is being executed, or if any damage shall be done to the work, while it is in progress from any cause whatever or if any imperfections become apparent in it within Twelve months of the grant of a certificate of completion, final or otherwise, by the Project Engineer cum Estate Officer, CCMD or other competent authority the contractor shall make good the same at his own expenses, or in default the Project Engineer cum Estate Officer, CCMD or other competent authority

may cause the same to be made good by other workmen, and deduct the expenses (of which the certificate of the Project Engineer cum Estate Officer, CCMD or other competent authority shall be final) from any sums that may be due or may thereafter become due to the contractor, or from his Security Deposit or the proceeds of sale thereof, or of a sufficient portion thereof.

Clause 17.: CONTRACTOR TO SUPPLY PLANT, LADDERS, CAFFOLDINGS, ETC., AND IS LIABLE FOR DAMAGES ARISING FROM NON-PROVISION OF LIGHT, FENCING ETC

The contractor shall supply at his own cost all materials, plant, tools, appliance, implements, ladders, scaffolding, and temporary works required for the proper execution of the work whether in the original, altered or substituted form and whether included in the specification, or other documents forming part of the contract or referred to in these conditions or not, and which may be necessary for the purpose of satisfying or complying with the requirements of the Project Engineer cum Estate Officer, CCMD or other competent authority as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore, to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out works, and counting, weighing and assisting in the measurement or examination at any time and from time to time of the work or the materials. Failing this, the same may be provided by the Project Engineer cum Estate Officer, CCMD or other competent authority at the expense of the contractor and expense may be deducted from any money due to the contractor under the contract or from his security deposit or the proceeds of sale thereof, or of a sufficient portion thereof. The contractor shall provide necessary fencing and lights required to protect the public from accident, and shall also be bound to bear the expense of defense of every suit, action or other legal proceedings, that maybe brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any suit, action or proceedings to any person, or which may with the consent of the contractor be paid for compromising any claim by any such person.

Clause 18.: MEASURES FOR PREVENTION OF FIRE

The contractor shall not set fire to any standing jungle, trees, brushwood or grass without a written permit from the Project Engineer cum Estate Officer, CCMD. When such permission is given, and also in all cases when destroying cut or dug up trees, brushwood grass, etc., by fire the contractor shall take necessary measures to prevent such fire spreading to or otherwise damaging surrounding property.

Clause 19.: LIABILITY OF CONTRACTOR FOR ANY DAMAGES DONE IN OR OUTSIDE WORK AREA

Compensation for all damages done by contractor or his men whether in or beyond the limits of Institute property including any damage caused by spreading of fire mentioned in Clause 18 shall be estimated by the Project Engineer cum Estate Officer, CCMD and the estimate of the Project Engineer cum Estate Officer, CCMD, subject to the decision of the Director, IISc on appeal shall be final and the contractor shall be bound to pay the amount of the assessed compensation on demand failing which the same will be recovered from the contractor as the damages in the manner prescribed in clause 1(c) or deducted by the Project Engineer cum Estate Officer, CCMD or other competent authority from any sums that may be due or become due from Institute to the contractor under this contract or otherwise.

The contractor shall bear the expenses of defending any action or other legal proceedings that may be brought by any person for injury sustained by him owing to neglect of precautions to prevent the spread of fire and shall pay any damages and cost that may be awarded by the court in consequence.

Clause 20.: EMPLOYMENT OF FEMALE LABOUR

The employment of female labourers on works in the neighbourhood of soldier barracks should be avoided as far as possible.

Clause 21.: WORK ON NOTIFIED HOLIDAYS

No work shall be done on any notified holiday without the sanction in writing of the Project Engineer cum Estate Officer, CCMD or other competent authority

Clause 22. : WORK NOT TO BE SUBLET

- (a) The contract shall not be assigned or sublet by the contractor,. However, any specific portion of the work which is of a specialised nature and normally not executable by a general contractor could be got done by the specialised agencies which are executing such works, after obtaining the specific approval of the Project Engineer cum Estate Officer, CCMD in writing in each case. Such consent to sublet the work, if given, shall not relieve the contractor from any liability or obligation under the contract and he shall be responsible for the acts, defaults and neglects of any sub-contractor or his agents, servants or workmate as fully as if they were the acts, defaults or neglects of the contractor, his agents, servants or workmen.
- (b) Consequences of subletting work without approval, becoming insolvent, bribing etc., by contractor and action against the contractor.

If the contractor shall assign or sublet his contract or any portion thereof without the specific approval of the Project Engineer cum Estate Officer, CCMD or attempts to do so or become insolvent or commence any proceedings to get himself adjudicated as insolvent or make any composition with his creditors or attempts so to do or if any bribe, gratuity, or indirectly be given, promised or offered by the contractor or any of his servants or agents to any officer or person in the employ of Institute in any way relating to his office or employment or if any such officer or person in the employment or if any such officer or person shall become in any way directly or indirectly interested in the contract, the Project Engineer cum Estate Officer, CCMD or other competent authority may thereupon by notice in writing rescind the contract and the security deposit of the contractor shall thereupon stand forfeited and be absolutely at the disposal of Institute and the same consequences shall ensure as if the contract had been rescinded under Clause 3 here of and in addition, the contractor shall not be entitled to recover or be paid for any work actually performed under contract.

- (c) Recovery of excess payments based on excess measurements and action against contractor.

Whenever it is noticed that excess payments have been made to the contractor based on excess measurements recorded by the Engineer-in-charge in the measurement book and countersigned by the contractor or his duly authorised agent, action shall be taken to recover the excess payments together with interest immediately. Action may also be taken to remove the name of the contractor from the approved list of contractors and also to black-list him.

- (d) Change in classification of excavations accepted not permitted.

Once the measurements mentioning the classification of the excavations are recorded in the measurement book and the same is signed by the contractor or his authorised agent in token of acceptance, no request for reclassification by the contractors shall be entreated.

- (e) Criminal proceedings against IISc Officers and Contractor for the lapses.

Institute also reserve the right to initiate criminal proceedings against the concerned Institute Officers who are directly responsible for the lapse and the contractors who have colluded with the officers of the Institute in the lapse and fraudulently received amounts not due to them legitimately.

Clause 23.: SUM PAYABLE BY WAY OF COMPENSATION TO BE CONSIDERED AS REASONABLE COMPENSATION WITHOUT REFERENCE TO ACTUAL LOSS.

All sums payable by a contractor by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied for the use of Institute without reference to the actual loss or damage sustained and whether any damage has or has not been sustained.

Clause 24.: SETTLEMENT OF DISPUTES -TIME LIMIT FOR DECISION

- (a) If any dispute or difference of any kind whatsoever were to arise between the Project Engineer cum Estate Officer, CCMD and the contractor regarding the following matters namely,
- (i) The meaning of the specifications designs, drawing and instructions herein before mentioned,
 - (ii) The quality of workmanship or materials used on the work and
 - (iii) Any other question, claim right, matter, thing whatsoever, in any way arising out of or relating to the contract, designs, drawings, specification, estimates, instructions, or orders, or those conditions, or failure to execute the same whether arising during the progress of the work, or after the completion, termination or abandonment thereof, the dispute shall, in the first place, be referred to the Director, IISc. The Director, IISc shall within a period of fifteen days from the date of

being requested by the Contractor to do so give written notice of its decision to the Contractor.

(b) Director's decision final.

Subject to other form of settlement hereafter provided, the Director's decision in respect of every dispute or difference so referred shall be final binding upon the contractor. The said decision shall forthwith be given effect to and contractor shall proceed with the execution of the work with all due diligence.

(c) Remedy when Director's decision is not acceptable to contractor

In case the decision of the Director is not acceptable to the contractor, he may approach the Law Court at Bangalore for settlement of dispute after giving due written notice in this regard to the Director within a period of ninety days from the date of receipt of the written notice of the decision of the Director.

(d) Time limit for notice to approach Court of law by contractor

If the Director has given written notice of his decision to the contractor and no written notice to approach the law court has been communicated to him by the contractor within a period of ninety days from receipt of such notice, the said decision of Director shall be final and binding upon the contractor.

(e) Time limit for notice to approach law court by contractor when decision is not given by Director, IISc as at (b).

If the Director fails to give notice of his decision within a period of ninety days from the receipt of the contractor's request in writing for settlement of any dispute or difference as aforesaid, the Contractor may within ninety days after the expiry of the first named period of ninety days approach the Law Courts at Bangalore giving due notice to the Director.

(f) Contractor to execute and complete work pending settlement of dispute.

Whether the claim is referred to the Director or to the Law Courts, as the case may be, the contractor shall proceed to execute and complete the works with all due diligence pending settlement of the said dispute or differences.

(g) Obligations of The Project Engineer cum Estate Officer,CCMD and contractor shall remain unsettled during considerations of dispute.

The reference of any dispute or difference to the Director or the Law Court may proceed notwithstanding that the works shall then be or be alleged to be

complete, provided always that the obligations of the Project Engineer cum Estate Officer, CCMD and the contractor shall not be altered by reason of the said dispute or difference being referred to the Director or the Law Court during the progress of the works.

Clause 25.: CONTRACTOR TO PAY COMPENSATION UNDER WORKMEN'S COMPENSATION ACT.

(a) The contractor shall be responsible for and shall pay any compensation to his own workmen payable under the relevant Workmen's Compensation Act for injuries caused to the workmen. If Institute pays such compensation on behalf of the contractor it shall be recoverable by Institute from the contractor under as per relevant clauses.

(b) Contractor to pay expenses of providing medical aid to workmen.

The contractor shall be responsible for and shall pay the expenses of providing medical aid to any workman who may suffer a bodily injury as a result of an accident. If Institute incurs such expenses, the same shall be recoverable from the contractor forthwith and be deducted without prejudice to any other remedy of Institute, from any amount due or that may become due to the contractor.

Clause 26.: CONTRACTOR TO PROVIDE PERSONAL SAFETY EQUIPMENT FIRST AID APPARATUS, TREATMENT Etc

The contractor shall provide all necessary personal safety equipment and first aid apparatus for the use of the persons employed on the site and shall maintain the same in good condition suitable for immediate use, at any time and shall comply with the following regulations in connection therewith: -

- (i) The worker will be required to use the equipment so provided by the contractor and the contractor shall take adequate steps to ensure proper use of the equipment by those concerned.
- (ii) When work is carried on in proximity to any place where there is a risk of drowning; all necessary steps shall be taken for the prompt rescue of any person in danger.
- (iii) Adequate provision shall be made for prompt first - aid treatment of all injuries likely to be sustained during the course of the work.

Clause 27.: MINIMUM AGE OF PERSONS EMPLOYED BY CONTRACTOR

- (a): No contractor shall employ any person
 - (i) who is under age of 18 years.
 - (ii) Who does not produce a valid certificate of vaccination against smallpox in respect of himself/ herself as well as all the members of his/her family.
- (b) The contractor shall provide potable water facilities to the workers. Similar amenities shall be provided to the workers engaged on large works in urban area.
- (c) Removal of persons not satisfying conditions (a) (i) & (ii)

The Project Engineer cum Estate Officer,CCMD or other authority is authorised to direct the removal or to remove through - his own agency, from the work any person referred to in sub-clauses (a) above not satisfying these conditions and no responsibility shall be accepted by the Institute for any delay caused in the completion of the work by such directions for removal.

- (d) Payment of fair and reasonable wages by contractor.

The contractor shall pay fair and reasonable wages, which shall not be less than the minimum wages fixed by Govt. of Karnataka from time to time to the workmen employed by him in the contract undertaken by him. In the event of any dispute arising between the contractor, and his workmen on the ground that the wages paid are not fair and reasonable the dispute shall be referred without delay to The Project Engineer cum Estate Officer,CCMD or other competent authority, who shall decide the same. The decision shall not in any way affect the conditions in the contract regarding the payment to be made by Institute at the agreed tender rates.

Clause 28.: CONTRACTOR NOT ENTITLED TO ANY CLAIM OR COMPENSATION FOR DELAY IN EXECUTION OF WORK IN BORROW PITS.

The contractor shall not be entitled to claim compensation if there is any delay in the execution of the work on account of water standing in borrow pits and compartments. The rates are inclusive for hard or cracked soil, excavation in mud, sub-soil water or water standing in borrow pits and no claim for extra rate shall be entertained, unless otherwise specified.

Clause 29: METHOD OF PAYMENT OF BILLS

Payment to contractors shall be made by cheques drawn by the Institute

Clause 30: SET OFF AGAINST ANY CLAIM OF INSTITUTE

Any sum of money due and payable to the contractor (including the security deposit refundable to him) under this contract may be appropriated by the Institute and set off against any claim of Institute in respect of a payment of a sum of money arising out of or under any other contract made by the contract with the Institute.

Clause 31 RATES INCLUSIVE OF ALL TAXES.

- (a) The rates to be quoted by the contractor must be inclusive of all kinds of direct and indirect taxes, sales tax, Service Tax, labour cess, statutory levies etc., levied by the state government / Central Government or any local body or authority. No extra payment on this account will be made to the contractor.
- (b) All quarry fees, octroi dues levied by the state or any local body or authority and ground rent, if any, charged by the The Project Engineer cum Estate Officer, CCMD for stacking materials should be paid by the contractor.

Advice to site personnel when working near underground Electrical cables

Important Note: Always assume that Electrical cables are present. Treat any cables found anywhere as LIVE.

During the course of the excavation, all site workers should exercise the following precautions:

- a) Whenever possible, hand dig near underground services. Spades and shovels are safer than picks or forks.
- b) Watch out for signs and the position of cables as work continues.
- c) Do not use hand-held power tools directly over the marked alignment of an underground electricity cable identified by the competent person. Only use such tools if the work cannot feasibly be carried out by hand tools.
- d) For hand- held power tools used for the purpose of breaking paved concrete surfaces, a horizontal clearance of 250 mm from any underground electricity cable must be maintained. Otherwise, a clearance of 500 mm around any underground electricity cable nearby must be maintained.
- e) Keep a clear distance of 1 m between the side of any distribution cable and the bucket of a mechanical excavator, and for transmission cables , the distance is extended to 3 m.
- f) Keep a clear distance between underground electricity cables and other utility plant (e.g. gas and water pipes, telecommunication cables, etc.). The distance should be at least 300 mm for cables of below 66 kV and at least 1 m for cables of 66 kV and above.
- g) Do not build existing underground electricity cables into a manhole or other structure or encase them in concrete.
- h) Always provide adequate support and anchoring of exposed underground electricity cables according to the electricity supplier's recommendations.
- i) Report any electrical accident or damage to an underground electricity cable or its sheath, to Engineer-in-charge, CCMD. Even if there is no immediate danger, damage could lead to danger at a later date. Evacuate everyone from the immediate area of the damage but do not attempt to remove any objects or to touch injured persons, who are in contact with the damaged cable because the cable may still be LIVE.

- j) Even if the underground electricity cable seems to be disconnected and abandoned, do not attempt to drill or cut into it, or to dismantle it until approval has been given by the Engineer-in-charge, CCMD.
- k) All backfilling of excavations must be done carefully and warning tapes, tiles, protection plates or other protection must be replaced in their original position. The electricity supplier should be approached for make-up cable protection materials if they are missing or damaged before the backfilling. The same backfilling materials should be used unless otherwise agreed with the electricity supplier. If in doubt, the contractor must seek advice from CCMD on the specific requirements, etc.
- l) Damaging underground electricity cables is dangerous and can often cause flashover, explosion or fire.
- m) Damage can result from excavation or penetration of the ground.
- n) Underground electricity cables may be found in roads, footpaths and on sites.

SECTION 6
PRICE BID

INDIAN INSTITUTE OF SCIENCE
Price Bid

SI No	Discription	Unit	Qty	Rate (INR)		Amount (INR)		Total Amount Figures & words
				Supply	Install	Supply	Install	
Part A								
1	<u>DG set (Recommendations in complete as per technical Specifications)</u>							
	a D.G.Set 2000kVA, Prime Rated cos phi 0,8 11000 Volts equipped consisting of : - Common Steel base frame Diesel engine size at the Prime Power Alternator 11kV, 1500RPM, with BTD, RTD	No	2					
	a DG Installation & Commissioning charges	Nos	2					
	b Unloading & position	No	2					
	c Load testing charges with 2000KVA/1600KW Load Bank for 2 hours	Job	1					
2	<u>VCB Panel</u>							
	11 KV HT VCB PANEL Design, Manufacture, supply, installation, testing & commissioning of following HT VCB Panels.							
	a HT VCB panel consisting of 2 incommer & 1 Outgoing VCB's 630amps	Set	1					
	b NGR/NIS	No.	2					
3	<u>11 KV HT Cables</u>							
	a Supply, laying, testing and commissioning of 11KV, 3C x 240Sqmm XLPE Cable stranded aluminium conductor screened, XLPE insulated	Mtrs	250					
4	<u>Cable End Terminations</u>							
	a Supply, installation, testing & commissioning of Cable End terminations for 11KV, 3C x 240Sqmm XLPE Cable using recommended termination kit as per manufacturer recommendations in complete as per technical specification & drawing.	No.	18					
5	<u>CONTROL PANEL AUTO SYNC & AUTO LOAD SHARING</u>							
	a Design, supply, Installation, testing & commissioning of required control (PLC) system complete as per technical specification & drawing details with BMS Compatability	No.	2					
6	<u>EXHAUST PIPING</u>							
	a Design, manufacture, supply, installation, testing and commissioning of Class "B" MS exhaust piping of 10' with nessary thermal insulation with aluminium cladding between Engine and silencers and up to entrance of the Exhaust pipe,	Mtr.	40					
	b Required Steel Supports	Kgs	5000					
	c Bellows for 16" Dia Exhaust	Nos	2					

	d Exhaust pipe 16" with aluminum clading 24SWG 50mm minaral wool 96 kg density	Mtrs	80				
7	<u>EARTHING WORKS</u>						
	a Supply, installation, testing and commissioning of GI pipe electrode for equipment body earthing.,complete per technical specification & Drawing details.	No.	5				
	b Supply, installation, testing, commissioning Earth pit having copper plate electrode for neutral earthing.,complete per technical specification & Drawing details.	No.	4				
8	<u>EARTHING STRIPS</u> Supply, installation, testing and commissioning of earth strip as described in specifications & drawing, complete in all respects.						
	a 50X6 GI Strip Mtr	Mtr	300				
	b 50X6 Copper Strip Mtr	Mtr	200				
9	<u>MISCELLANEOUS WORKS</u>						
	a A1 size drawing display board with laminated drawings No.	No.	2				
	b Shock treatment chart in English and local language duly framed with glass cover. No.	No.	2				
	c Danger board in English and local language. No.	No.	2				
	d 440V class enameled danger board of 150 x 150 mm size No.	No.	2				
	e 11KV class enameled danger board of 150 x 150 mm size No.	No.	2				
	f Supply & installation of 4.5kg class Co2 type portable fire extinguisher No.	No.	2				
	g First aid box complete with all standard first aid material. No.	No.	2				
	h Set of two sand buckets with stand No.	No.	4				
	i Supply & Installation of required number of charged battery						
	j battery stand, battery leads etc. complete	Sets	2				
10	<u>FUEL SYSTEM</u> a Design, manufacture, supply, installation, testing and commissioning of Fuel supply system comprising 990 Ltr Day tank, interconnecting pipes 40mm dia 30mts/set Diesel, oil, coolant, DM water for load testing and 990 Ltrs Diesel while handing over Emission Testing Charges by KSPCB Authrosied agency	Set	2				
11	<u>Approvals</u> Preparation of necessary Drawings for DG Set, getting approval from the Chief Electrical Inspectorate / Electricity board / Pollution Control Board before taking up work and to furnish Completion Report arranging for Inspection,giving trial run on load, obtaining approval for commissioning the sets by paying necessary fee for inspection, etc., complete. (Necessary statutory fees will be re-imbursed after producing the receipts).	LS	1				
Total- A							

Part B

<p>12 Buy back of Existing 1000KVA DG , 11KV voltage class DG set as in wearin bases conditions to be released and taken along with related panels(NGR, LAVT, CRP and Excitation). Make Engine : Cummins and Alternator : Kirloskar. Note: This item being buyback of the old retrived items total of this item is to be deducted from the Part A total.</p>	Set	2					
Total -B							
Grand Total (Part A - Part B) =							

Signature of the Contractor