

## INDIAN INSTITUTE OF TECHNOLOGY MANDI NOTICE INVITING TENDER

The Superintending Engineer, IIT Mandi invites on behalf of BoG item rate tenders on single stage system (Price Bid) from annually pre-qualified firm of CPWD as well as enlisted with CPWD and HPPWD in the field of DG set work in appropriate category for the tender for **“Supply, installation, testing & Commissioning of 160 KVA silent type DG set with AMF panel at administrative block of IIT Mandi at Mandi”**.

The enlistment of the contractors should be valid on the last date of sale of tenders.

In case only the last date of sale of tender is extended, the enlistment of contractor should be valid on the original date of sale of tenders.

In case both the last date of receipt of application and sale of tenders are extended, the enlistment of contractor should be valid on either of the two dates i.e. original date of sale of tender or on the extended date of sale of tenders.

1.1 The work is estimated to cost Rs. 17,08,365/-. This estimate, however, is given merely as a rough guide.

1.1.1 The authority competent to approve NIT for the combined cost and belonging to the major discipline will consolidate NITs for calling the tenders. He will also nominate Division which will deal with all matters relating to the invitation of tenders.

For composite tender, besides indicating the combined estimated cost put to tender, should clearly indicate the estimated cost of each component separately. The eligibility of tenderer will correspond to the combined estimated cost of different components put to tender.

1.2 Tenders will be issued to eligible contractors provided they produce definite proof from the appropriate authority, which shall be to the satisfaction of the competent authority, of having satisfactorily completed similar works of magnitude specified below:-

### Criteria of eligibility for issue of tender documents

1.2.1 Conditions for Non-CPWD contractors only, if tenders are also open to non-CPWD contractors. For works estimated to cost up to Rs. 15 Crore.

Three similar works each of value not less than 40% of estimated cost or two similar work each of value not less than 50% of estimated cost or one similar work of value not less than 80% of estimated cost (rounded to nearest Rs. 10 lac) in last 7 years ending last day of the month previous to the one in which the tenders are invited.

Note :- For works costing above Rs. 3 Crore but up to Rs. 15 Crore, when tenders are open to non-CPWD contractors also, then class II contractors of CPWD shall also be eligible if they satisfy the eligibility criteria specified in 1.2.1 above.

1.2.2 Criteria of eligibility for CPWD as well as non-CPWD contractors.

For works estimated to cost above Rs. 15 Crore.

Three similar works each of value not less than 40% of estimated cost or two similar work each of value not less than 60% of estimated cost or one similar work of value not less than 80% of estimated cost (rounded to

nearest Rs. 10 lac) in last 7 years ending last day of the month previous to the one in which the tenders are invited.

The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum, calculated from the date of completion to the last date of receipt of application for tender.

### 1.2.3 To become eligible for issue of tender, the tenderer shall have to furnish an affidavit as under :-

I/We undertake and confirm that eligible similar works(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/we shall be debarred for tendering in IIT Mandi in future forever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to forfeit the entire amount of Earnest Money Deposit/Performance Guarantee.

2. Agreement shall be drawn with the successful tenderer on prescribed Form No. CPWD 7/8 which is available as a Govt. of India Publication. Tenderer shall quote his rates as per various terms and conditions of the said form which will form part of the agreement.
3. The time allowed for carrying out the work will be 90 days from the date of start as defined in schedule 'F' or from the first date of handing over of the site, whichever is later, in accordance with the phasing, if any, indicated in the tender documents.
4. The site for the work is available.

OR

The site for the work shall be made available in parts as specified below:-

5. Tender document consisting of plans, specifications, the schedule of quantities of the various classes of work to be done and the set of terms & conditions of contract to be complied with by the contractor whose tender may be accepted and other necessary documents can be seen in the office of the SE, IIT Mandi at Kamand campus between hours of 11:00 AM & 03:00 PM from 25-01-2015 to 04-02-2015 everyday except on Saturday, Sunday and Public Holidays. For other details & tender documents please visit the tender link of IIT Mandi website [www.iitmandi.ac.in](http://www.iitmandi.ac.in) or Central Public Procurement Portal website [www.eprocure.gov.in](http://www.eprocure.gov.in). Interested party may download tender document from these site, in such cases cost of the tender document i.e. Rs 500/- (Five Hundred only) in the shape of DD in favour of Registrar, IIT Mandi payable at Mandi (H.P.) of any schedule bank shall be submitted by the tenderer at the time of submission of tender.
6. (i) Tenders shall be accompanied with Earnest money of Rs. 34,170/- (Rupees Thirty Four Thousand One Hundred and Seventy only) in the shape of Deposit at Call receipt of a scheduled bank/fixed deposit receipt of a scheduled bank/demand draft of a scheduled bank issued in favour of Registrar, IIT Mandi, payable at Mandi.  
  
ii) The tender, earnest money and the cost of tender document shall be placed in separate sealed envelopes, each marked "Tender", "Earnest Money" and "Cost of Tender document" respectively. All the envelopes shall be submitted together in another sealed envelope with the name of work, NIT no. and due date of opening written on envelope, which will be received upto 01:00 PM on 05-02-2015 at Kamand campus of IIT Mandi and will be opened by the undersigned on same day at 03:30 PM in Kamand campus of IIT Mandi in the presence of intending tenders or his authorized representative. The envelop marked "Tender" of only those tenderers shall be opened, whose earnest money, placed in the other envelope, is found to be in order.
7. The contractor whose tender is accepted, will be required to furnish performance guarantee of 5% (Five Percent) of the tendered amount within the period specified in Schedule F. This guarantee shall be in the form of DD in favour of Registrar IIT Mandi payable at Mandi (H.P.).

In case the contractor fails to deposit the said performance guarantee within the period as indicated in Schedule 'F'. including the extended period if any, the Earnest Money deposited by the contractor shall be forfeited automatically without any notice to the contractor.

8. The description of the work is as follows: "Supply, installation, testing & Commissioning of 160 KVA silent type DG set with AMF panel at administrative block of IIT Mandi at Mandi" and further details as per schedule of quantity. Copies of other drawing and documents pertaining to the works will be open for inspection by the tenderers at the office of above mentioned officer.

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

9. The competent authority on behalf of the BoG does not bind itself to accept the lowest or any other tender and reserves to itself the authority to reject any or all the tenders received without the assignment of any reason. All tenders in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the tenderer shall be summarily rejected.
10. Canvassing whether directly or indirectly, in connection with tenderers is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable to rejection.
11. The competent authority on behalf of BoG reserves to himself the right of accepting the whole or any part of the tender and the tenderer shall be bound to perform the same at the rate quoted.
12. The contractor shall not be permitted to tender for works in the IIT Mandi responsible for award and execution of contracts, in which his near relative is posted a Divisional Accountant or as an officer in any capacity between the grades of Superintending Engineer and Junior Engineer (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any gazetted officer in the Indian Institute of Technology or in the Ministry of Urban Development. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this Department.
13. No Engineer of gazetted rank or other Gazetted Officer employed in Engineering or Administrative duties in an Engineering Department of the Government of India is allowed to work as a contractor for a period of one year after his retirement from Government service, without the previous permission of the Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found any time to be such a person who had not obtained the permission of the Government of India as aforesaid before submission of the tender or engagement in the contractor's service.
14. The tender for the works shall remain open for acceptance for a period of ninety (90) days from the date of opening of tenders/Ninety days from the date of opening of financial bid in case tenders are invited on 2/3 envelop system (strike out as the case may be) if any tenderer withdraws his tender before the said period or issue of letter of acceptance, whichever is earlier, or makes any modifications in the terms and conditions of the tender which are not acceptable to the department, then the Government shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money as aforesaid. Further the tenderer shall not be allowed to participate in the retendering process of the work.

15. This notice inviting Tender shall form a part of the contract document. The successful tenderer/contractor, on acceptance of his tender by the Accepting Authority shall within 15 days from the stipulated date of start of the work, sign the contract consisting of:-

- a) The Notice Inviting Tender, all the documents including additional conditions, specifications and drawings, if any, forming the tender as issued at the time of invitation of tender and acceptance thereof together with any correspondence leading thereto.
- b) Standard C.P.W.D. Form 7/8

-sd-  
Superintending Engineer

Copy to:

1. CPP Portal/IIT Mandi website.
2. Notice Board.

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Superintending Engineer

## GENERAL & COMMERCIAL TERMS AND CONDITIONS

**Name of work:-** Supply, installation, testing & Commissioning of 160 KVA silent type DG set with AMF panel at administrative block of IIT Mandi at Mandi.

### 1.0 GENERAL

The work shall be executed as per CPWD's general specification for Electrical Works Part-I (Internal)-2013, Part-II (External)-1994, Part-VII (DG Sets) 2013, IE Rules, Indian Standards amended upto date and as per direction of Engineer-in-Charge. The additional specifications are to be read with above and in case of any variations, specifications given alongwith the tender shall apply.

### 2.0 LOCATION

The work is to be executed at **IIT Mandi at Mandi (Himachal Pradesh)**. The contractor is advised to visit the site before submission of their tender and ensure that equipment being offered by them shall be accommodated in the spaces available.

### 3.0. RATES

- 3.1. The rates quoted by the tenderer, shall be firm and inclusive of all taxes (including works contract tax), entry tax, duties and levies and all charges for packing, forwarding, insurance, freight, delivery, installation, testing, commissioning etc. at site including temporary constructional storage, risks, overhead charges, general liabilities/obligations etc. The service tax, if any, shall not be included in the quoted rates. It shall be reimbursed separately on production of documentary proof by the firm for its payment for this work.
- 3.2. Octroi exemption certificate will be issued by the department, if required by the contractor. However, the department is not liable to reimburse the octroi duty in case exemption certificates are not honored by the concerned authorities.
- 3.3. The contractor has to carry out routine and preventive maintenance as per manufacturer's standards for a period of 12 months from the date of handing over. However, all consumables (fuel/lube oil etc) and spare parts including filters will be supplied by the department.

### 4.0 SUBMISSION OF TENDER:-

#### 4.1 Type of Contract:

The work to be awarded by this tender shall be treated as indivisible works contract.

- 4.2 The tender shall be submitted in sealed envelope.

## IMPORTANT POINTS FOR THE ATTENTION OF TENDERERS

### COMMERCIAL CONDITIONS

- 5.0 Type of Contract: The work to be awarded by this tender shall be treated as indivisible works contract.

#### Submission and opening of tenders:

#### PRE-BID CONFERENCE

The pre-bid conference shall be held on 29.01.2015 in the office of Superintending Engineer , IIT Mandi at Kamand campus. The pre-bid conference with the prospective tenderers is being held to enable them to seek clarification on the technical specifications and in tender documents that they may consider necessary for

submission of tenders. All clarifications sought for will be finalized during the pre-bid conference and confirmatory minutes for the pre-bid conference will be uploaded on the tender website. All prospective tenderers are requested to attend the same before submission of their tender. However it is upto the prospective tenderers to take part in the pre-bid conference. Non attendance of pre-bid conference does not debar the prospective tenderer from participating & submission of tender. No separate pre-bid conference will be conducted for the firms who do not attend the pre-bid conference on the date & time fixed for the purpose. The firms can send letter also on or prior to date of pre-bid seeking clarification, if any.

The Minutes of pre-bid meeting shall be issued by the IIT, Mandi within three days of pre-bid conference and uploaded on website. It will be the responsibility of the firms to check the same from website personally before submission of their tender. The submission of price bid by the firm will be construed to be in compliance of NIT and amended conditions/specifications.

- 5.1 The tenderers are advised not to deviate from the technical specifications/ items, commercial terms and conditions of NIT like terms of payment, guarantee, arbitration clause, escalation etc.
- 5.2 Tenders shall be opened by Superintending Engineer, IIT, Mandi on the due date and time in the presence of tenderers or their authorized representatives who wish to remain present.
- 5.3 Scrutiny/evaluation of the Tenders shall be done by the department. In case it is found that the Tenders (Technical Bid cum Price Bid) of a tenderer is not in line with NIT specifications/ requirements and/ or contains too many deviations, the department reserves the right to reject the bid of such firm(s) without making any reference to the tenderer(s).
- 5.4. Necessary clarifications/confirmations required by the department shall have to be furnished by the tenderer within the time given by IIT, Mandi for the same. The tenderer will have to depute his representative to discuss with the officer(s) of the IIT, Mandi as and when so desired. In case, in the opinion of the IIT, Mandi a tenderer is taking undue long time in furnishing the desired clarifications, his bid will be rejected without making any reference.
- 5.5 IIT, Mandi reserves the right to reject any or all the price bids and call for fresh prices/ tenders as the case may be without assigning any reason.

#### **6.0 CONFORMITY WITH STATUTORY ACTS, RULES, STANDARDS AND CODES**

- i) All components shall conform to relevant Indian Standard Specifications, wherever existing, amended to date.
- ii) All electrical works shall be carried out in accordance with the provisions of Indian Electricity Act, 2003 and Indian Electricity Rules, 1956 amended to date. They shall also conform to CPWD General Specifications for Electrical Works, Part-I: Internal 2005 and Part-II External, 1994 and Par-VII (DG Sets) 2013, amended to date.

#### **7.0. SAFETY CODES AND LABOUR REGULATIONS**

- i) In respect of all labour employed directly or indirectly on the work for the performance of the contractor's part of work, the contractor at his own expense, will arrange for the safety provisions as per the statutory provisions, B.I.S. recommendations, factory act, workman's compensation act, CPWD codes and instructions issued from time to time. Failure to provide such safety requirements would make the tenderer liable for penalty for Rs.200/- each violation. In addition the Engineer-in-charge shall be at liberty to make arrangements and provide facilities as aforesaid and recover the cost from the contractor.
- ii) The contractor shall provide necessary barriers, warning signals and other safety measures while executing the work of DG Set Installation, cables etc. or wherever necessary so as to avoid accident.

He shall also indemnify IIT, Mandi against claims for compensation arising out of negligence in this respect. Contractor shall be liable, in accordance with the Indian Law and Regulations for any accident occurring due to any cause. IIT, Mandi shall not be responsible for any accident occurred or damage incurred or claims arising there from during the execution of work. The contractor shall also provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the contractor due to the above provisions thereof.

## **8.0 WORKS TO BE ARRANGED BY IIT, Mandi**

Unless otherwise specified in the tender documents, the following works shall be arranged by IIT, Mandi.

- i) Space for accommodating all the equipments and components involved in the work. However, watch and ward shall be responsibility of the contractor.
- ii) Power supply (single/three phase).

## **9.0 WORKS TO BE DONE BY THE CONTRACTOR**

Unless otherwise mentioned in the tender documents, the following works shall be done by the contractor and therefore, their cost shall be deemed to be included in their tendered cost - whether specifically indicated in the schedule of work or not:-

- i) Necessary foundation for DG set will be provided by IIT, Mandi. However foundation detail shall be supplied by agency.
- ii) Making good all damages caused to the structure during installation and restoring the same to their original finish.
- iii) Minor building works necessary for installation of equipments, foundation trench for fuel line and cable, making of opening in walls or in floors and restoring them to their original condition/finish and necessary grouting etc., as required.
- iv) All supports for exhaust and water pipes, chimney, bus trunking (if included in scope of contract), cables, anti-vibration pads etc as are necessary.
- v) All electrical works and neutral earthing, body earthing, required for engine and alternator, main board/control panels, and control wiring including loop earthing if specified in Schedule of work.
- vi) All pipes, bus trunking and/or cable connections.
- vii) POL i.e. HSD oil and lub oil for diesel engine for testing & commissioning and for trial run as per conditions of the contract.
- viii) Painting of all exposed metal surface of equipments and components with appropriate colour.
- ix) Clearance/Approval of the complete installation from CPCB/State Pollution Control Board/Central Electricity Authority (CEA)/Local Bodies and other Licensing Authorities, wherever required.

## **10.0. POWER SUPPLY AND WATER SUPPLY**

### **10.1. Power Supply**

- i) Unless otherwise specified, 3 phase, 415 volts, 50 Hz power supply shall be provided by the department free of charge to the contractor at one point for installation at site suitable for 10 KW load.

Termination switchgear, however, shall be provided by the contractor. Further extension, if required shall be done by the contractor.

- ii) The contractor shall not use the power supply for any other purpose than that for which it is intended for. No major fabrication work shall be done at site. Power shall be used only for welding/cutting works. The power supply shall be disconnected in case of such default and the contractor shall then have to arrange the required power supply at his cost.

#### **Water Supply**

Water supply shall be made available to the contractor by the Department free of charge at one point.

#### **11.0. MACHINERY FOR ERECTION**

All tools and tackles required for unloading/handling of equipments and materials at site, their assembly, erection, testing and commissioning shall be the responsibility of the contractor.

#### **12.0. COMPLETENESS OF THE TENDER, SUBMISSION OF PROGRAMME, APPROVAL OF DRAWINGS AND COMMENCEMENT OF WORK.**

##### **i) Completeness of Tender**

All sundry equipments, fittings, assemblies, accessories, hardware items, foundation bolts, supports, termination lugs for electrical connections, cable glands, junction boxes and all other sundry items for proper assembly and installation of the various equipments and components of the work shall be deemed to have been included in the tender, irrespective of the fact that whether such items are specifically mentioned in tender documents or not.

##### **ii) Submission of Programme**

Within ten days from the date of receipt of the letter of acceptance, the successful tenderer shall submit his programme for submission of drawings, supply of equipments, installation, testing, commissioning and handing over of the installation to the Engineer-in-Charge.

##### **iii) Submission of drawings**

The contractor shall submit the drawings to the Engineer-in-Charge for approval before start of work.

##### **iv) Commencement of Work**

The contractor shall commence work as soon as the drawings submitted by him are approved.

#### **13.0. DISPATCH OF MATERIALS TO SITE AND THEIR SAFE CUSTODY**

The contractor shall dispatch materials to site in consultation with the Engineer-in-Charge. Suitable lockable storage accommodation shall be made available free of charge temporarily. Watch & ward, however, shall be the responsibility of contractor. Programme of dispatch of material shall be framed keeping in view the the time frame for completion of work..

#### **14.0. CO-ORDINATION WITH OTHER AGENCIES**

The contractor shall co-ordinate with all other agencies involved in the work so that the work of other agencies is not hampered due to delay in his work.

## **15.0. INDEMNITY**

The successful tenderer shall at all times indemnify IIT, Mandi, consequent upon this works contract. The successful tenderer shall be liable, in accordance with the Indian Law and Regulations for any accident occurring due to any cause and the contractor shall be responsible for any accident or damage incurred or claims arising therefrom on IIT, Mandi during the period of erection, construction and putting into operation the equipments and ancillary equipment under the supervision of the successful tenderer in so far as the latter is responsible. The successful tenderer shall also provide all insurance including third party insurance as may be necessary to cover the risk. No extra payment would be made to the successful tenderer on account of the above.

## **16.0. QUALITY OF MATERIALS AND WORKMANSHIP**

- i) The components of the installation shall be of such design so as to satisfactorily function under all conditions of operation.
- ii) The entire work of manufacture/fabrication, assembly and installation shall conform to sound engineering practice. The entire installation shall be such as to cause minimum transmission of noise and vibration to the building structure.
- iii) All equipments and materials to be used in work shall be manufactured in factories of good repute having excellent track record of quality manufacturing, performance and proper after sales service.

## **17.0. CARE OF THE BUILDING**

Care shall be taken by the contractor during execution of the work to avoid damage to the building. He shall be responsible for repairing all such damages and restoring the same to the original finish at his cost. He shall also remove all unwanted and waste materials arising out of the installation from the site of work from time to time.

## **18.0. INSPECTION AND TESTING**

It shall be as per CPWD Specifications for DG Sets Part-VII - 2013 (Para 1.15).

## **19.0. Safety Measures.**

All equipments shall incorporate suitable safety provisions to ensure safety of the operating personnel as per manufacturers' standard practice.

## **20.0. STATUTORY CLEARANCE(S)**

Approval/clearance of the complete installation shall be obtained by the contractor from CPCB/State Pollution Control Board/Local Bodies/Central Electricity Authority (CEA)/other Licensing Authorities, wherever required. However, application shall be made by Department and any statutory fee, as applicable, shall be paid by Department directly to the Govt. Authorities concerned.

## **21.0. GUARANTEE**

All equipments shall be guaranteed, against unsatisfactory performance and/or break down due to defective design, workmanship or material, for a period of 12 months from the date of taking over the installation by the department. The equipments or components, or any part thereof, so found defective during guarantee period shall be forthwith repaired or replaced free of cost, to the satisfaction of the Engineer-in-Charge. In case it is felt by the department that undue delay is being caused by the contractor in attending the defect/fault removed, the same will be got done by the department at the risk cost of the contractor. The decision of the Engineer-in-Charge in this regard shall be final.

## 22.0. PAYMENT TERMS

22.1. The following percentage of contract rates shall be payable against the stages of work shown herein:

Sr.No.	Stage of work	Engine and Alternator Set & AMF Panel	All other items.
I	After initial inspection (wherever specified) and delivery at site in good condition on pro-rata basis.	80%	80%
II	On completion of pro-rata installation.	15%	15%
III	On commissioning and completion of successful running in period and taking over of the DG Set by the department.	5%	5 %

22.2 Service tax shall re-imbursed separately on production of documentary proofs.

22.3 Deduction of Security Deposit shall be governed by standard/relevant clauses of CPWD-7/8.

## 23.0. TENDER DRAWINGS, DRAWINGS FOR APPROVAL & COMPLETION DRAWINGS.

### 23.1. Tender Drawings.

The drawings appended with the tender documents are intended to show space allotted for various equipments. The equipments offered shall be suitable for installation in the spaces shown in these drawings.

### 23.2. Drawings for approval on award of the work

The contractor shall prepare & submit three sets of following drawings and get them approved from the Engineer-in-Charge before the start of the work. The approval of drawings, however, does not absolve the contractor not to supply the equipments/materials as per agreement, if there is any contradiction between the approved drawings and agreement.

- i) Layout drawings of the equipments to be installed including control cables, fuel/lube oil pipes and supports/structure for exhaust piping, chimney and bus ducts/cable trays.
- ii) Drawings including section, showing the details of erection of entire equipments.
- iii) Electrical wiring diagrams from engine-alternator set to electrical control panel, electrical control panel to essential LT Board including the sizes and capacities of the various electrical/control cables and equipments.
- iv) Dimensional drawings of acoustic enclosure/engine-alternator set and electrical control panel.
- v) Drawings showing details of supports for pipes, chimney cable trays, ducts etc.
- vi) Any other drawings relevant to the work.

### 23.3. Drawings/Documents to be furnished on completion of installation.

23.3.1 The sets of following laminated drawings shall be submitted by the contractor while handing over the installation to the Department. Out of these three, one set shall be laminated on a hard base for display in the DG Set room/room where AMF panel is installed. One set shall be displayed in Junior Engineer's Room. In addition, drawings will be given on Compact Disk (CD):

- i) DG Set installation drawing giving complete details of all the equipments, including their foundation.

- ii) Line diagram and layout of all electrical control/AMF panels giving switchgear ratings and their disposition, cable feeder and their layout.
- iii) Control wiring drawings with all control components and sequence of operations to explain the operation of control circuits in AMF panel/PCC.

23.3.2

- i) Manufacturer's technical catalogues of all equipments and accessories.
- ii) Operation and Maintenance Manual of all major equipments, detailing all adjustments, operation and maintenance procedure.

**24.0.**

**AFTER SALES SERVICES**

The contractor shall ensure adequate and prompt after sales service free of cost during guarantee period, and against payment after the guarantee period is over, in the form of maintenance, spares and personnel as and when required during normal life span of the equipments and shall minimize the breakdown period. In case of equipment supplied by other manufactures the firm furnishes a guarantee from the manufacturer for the same before the DG Set installation is taken over.

Name of work:- Supply, installation, testing & Commissioning of 160 KVA silent type DG set with AMF panel at administrative block of IIT Mandi at Mandi.

**ADDITIONAL TERMS AND CONDITIONS**

- 1 All the works should be carried out as per General Specifications for elect. Part-I (Internal) 2005, Part-II (External) 1994, Part-VII DG Set 2013 Amended upto date and should also comply with relevant provisions of the Indian Electricity Rules and Indian Electricity Act amended upto date.
- 2 All the materials to be used on work shall be got approved by the contractor from the Engineer-in-charge before their use on work. All rejected materials should be removed from the site of work immediately.
- 3 The work shall be carried out with good workmanship and as per instructions of Engineer-in-charge.
- 4 All repairs and patch works shall be neatly carried out to match with original finish and all damages done to the building/road during the execution of electrical works shall be the responsibility of the electrical contractor and same will have to be made good immediately by him at his own cost to the entire satisfaction of the Engineer-in-charge.
- 5 The contractor/his supervisor is bound to sign the site order book as and when required by the Engineer-in-charge and carry out the instructions record therein.
- 6 The contractor is fully responsible for safety of material at site till final handing over to the department. The contractor shall have to make alls such arrangement for safe storing the materials and watch and its ward at his own cost.
- 7 The work shall not be taken over in parts unless otherwise agreed to by the Engineer-in-charge.
- 8 All debris due to electrical work shall be removed and shall be cleared by the contractor as soon as his work is completed.
- 9 The contractor shall have to make his own arrangement for transportation from the point of issue of stores to site and safe custody of the materials issued departmentally and nothing extra will be paid to him on this account.
- 10 The contractor shall ensure that all the persons executing the electrical work have the valid electrical license. Consequences arising due to the fault for not complying with the above conditions would be contractor's responsibility.
- 11 Earthing shall have to be done in the presence of Engineer-in-charge or his representative.
- 12 The contractor will make his own arrangement at his own cost for all general and electrical tools and plants required for the work.
- 13 The VAT on the whole work shall be recoverable from every running bill of the Contractor and amount so recovered will be deposited with the Sales Tax department.
14. The DG Set, essential shall be got inspected at manufacturers works prior to dispatch by Engineer-in-charge or his authorised representative for which Contractor shall give advance intimation to Engineer-in-charge.
- 15 Manufacturers test certificates of engine; alternator and essential panel should be submitted by the firm at the time of supply for which no payment shall be made.

- 16 The firm shall have to submit calculation showing auxiliary consumption of power developed i.e. for cooling, battery charging and conversion efficiency etc. and net power available for alternator.
- 17 The firm shall have to submit copy of environmental clearance certificate duly self attested.
- 18 KWH Meter of suitable rating shall be provided; fuel tank shall be calibrated so that oil consumption per KWH at 25 %, 50 % & 100 % of full load is measured during testing at work of manufacturer or OEM.

Name of work:- Supply, installation, testing & Commissioning of 160 KVA silent type DG set with AMF panel at administrative block of IIT Mandi at Mandi.

## SPECIFICATION AND ADDITIONAL CONDITIONS OF DIESEL GENERATOR SET

### 1.0 Technical

Detailed technical specifications for the equipments and installations are indicated hereunder:-

#### 1.1. Diesel Engine: - As per CPWD Specifications for Electrical Works Part-VII (2013) for DG Sets.

- i) All the Engine accessories shall be as per CPWD Specifications mentioned above. The Governor shall be of at least class A1 as per ISO 3046/BS 5514 for 160 KVA.
- ii) The Silencer should be dry type spark arrestor suitable for outdoor mounting. However, the residential type silencer as per standard design of the manufacturer for approved model is also acceptable.
- iii) Fuel service tank of minimum as 285 Ltrs for 160 KVA (Inbuilt) DG Sets.

#### 2.0 Alternator: - The Alternator shall be rated for a prime output of specified KVA and NTP and it should be as per CPWD Specifications for Electrical Works Part-VII for DG Sets 2013.

### 3.0 AMF Panel.

#### 3.1. General Features

The AMF panel shall be fabricated out of sheet steel, totally enclosed, dust, damp and vermin proof free standing floor mounted type and front of board operated. It shall preferably be made into sections such that as far as feasible, there is no mixing of control, power D.C. and A.C. functions in the same section and they are sufficiently segregated, except where they come together on unit like relay/contactors etc is necessary. Sheet steel used for fabrication shall not be less than 2.0 mm thick. Hinged doors shall be provided at the rear and front, preferably double leaf, for each section for access to routine inspection from the rear etc. All indicating lamps, instruments meters etc. shall be in the front. The degree of protection required will be IP 42 conforming to IS 2147-1962.

#### 3.2. Earthing arrangement

One No. 25 mm x 5 mm copper strip shall be run at the rear of the board/connecting all the sections suitable bonding to earth. Earth terminals shall be vibration proof with all hardware of nonferrous or galvanized/plated and passivated in case of ferrous hardware.

#### 3.3. Gland Plates

Removable gland plates sectionalized for receiving various cables that are to enter on to the section and undrilled or with suitable knockout shall be provided at the bottom of the panel sections. Where heavy cables are to be brought and suitable clamps shall also be incorporated to relieve the stress on the glands due to the weight and bends of the cable covers.

#### 3.4. Terminal blocks and wirings

Terminal blocks of robust type and generally not less than 15 Amps capacity, 250 V grade for DC upto 100 V and 660 Volts grade for AC and rest of the junctions shall be employed in such a manner that they are freely accessible for maintenance. All control and small wiring from unit to unit inside the panel shall also be done with not less than 2.5 sq.mm copper conductor PVC insulated and 660 volts grade. Suitable colour coding can be adopted. Wiring harness shall be

neatly formed and run, preferably function wise and as far as feasible segregated voltage wise. All ends shall be identified with ferrules at the ends.

### **3.5. Lables**

All internal components shall be provided with suitable identification lables suitably engraved. Lables shall be fixed on buttons, indication lamps etc.

### **3.6. Painting**

The entire panel shall be given primer coat after proper treatment and two coats of final paint of approved shade before assembly of various items.

### **3.7. Equipment requirements:**

The control cubical shall incorporate in the assembly, equipments as under:-

- a) Control system equipments and components such as relays, contractors, circuit breakers etc as required for automatic/manual operation.
- b) Necessary controls for testing the generating set's healthiness, with test mode, on mains.
- c) Necessary instruments and accessories such as voltmeter power factor meter ammeter, selector switches,
- d) Necessary indication lamps, fuses, terminal blocks, push buttons control switches etc. as required.
- e) Necessary set shut down devices due to faults/abnormalities with indications alarm.
- f) Necessary battery charger and wiring from mains supply.
- g) Necessary excitation control and voltage regulating equipment.

## **4.0 System operation**

These facilities provided the following operational requirements.

### **4.1. Manual Mode**

- a) In a manual mode it shall be feasible to start up the generator set only by the operator pressing the start push button.
- b) Alternator contactor/circuit breaker close and trip preparation shall be also through operator only, by processing the appropriate button on the panel, closure shall be feasible only after alternator has built up full voltage.
- c) Engine shut down, except otherwise due to faults, shall be manual, by pressing a 'stop' button.

### **4.2. Test Mode**

- a) When under 'test' mode, the engine shall get the start signal even though the main supply is healthy and the alternator start building up voltage but the set not take load by closing of alternator contractor/breaker. However, if during the test mode the power supply has failed the load shall be automatically get transferred to alternator.
- b) However, it should be possible to load the set locally, through a TEST contactor (which cannot be closed when the set is in the normal "MANUAL" mode).

### **4.3. Auto mode**

The DG set should be able to start on failure of mains supply and vice versa.

#### **4.4. Engine shut down and alternator protection equipments**

Following shut down and protection system shall be integrated in the control panel.

##### **4.4.1. Engine**

- i) Low lub. Oil pressure shut down.
- ii) High coolant (water) temp shut down.
- iii) Engine over speed shut down. The type of arrangement offered should be indicated in the tender.

##### **4.4.2. Alternator**

It shall have overload short circuit and earth leakage protection to trip the circuit breaker/contactors in the event of overloads backed up with MCCBs for short circuit protection, and/or in the event of earth faults, the O/L trip to be adjustable between 80% to 120% E/L trip to be adjustable between 10% to 40%. An alternator over voltage trip also shall be incorporated. MCCBs shall be for 31 MVA at 415 Volts rupturing capacity confirming to ISS.

#### **5.0 Earthing System:-**

This shall conform to CPWD General Specifications for electrical works Part-I Internal 2013 upto date.

#### **6.0 Installation**

- i) Suitable vibration isolation mountings shall be provided by the Contractor, as per the recommendations of the manufacturer of the DG Set and approved by the Engineer-in-charge of the work.
- ii) The scope of work include delivery of DG Set at site including loading, unloading, handling etc and also placement of the same on the foundation. All necessary tools, tackles, labours etc. required for the purpose shall be arranged by the Contractor.
- iii) The sets shall be accurately leveled so as to ensure trouble free and smooth operation.
- iv) All pipe work, cable work etc shall be carried out in a workman like manner to the satisfaction of the Engineer-in-Charge. The work includes all sundry materials and flexible connections as required to avoid transmission of vibrations.
- v) The work shall also include suitable supports for pipes cable etc if required.

#### **7.0 Battery Charger Kit**

When set is not in operation, controlled from the load side so that the charger shall only be energised when mains are energised. It shall remain off when the set is in operation. This shall consist of:-

- a) Mains transformer of adequate rating with tapping on secondary side for TRICKLE/BOOST CHARGING.
- b) Rectified Bridge type Rectifier.
- c) DC Voltmeter 0-30 Volt, Square flush mounting type.
- d) DC Ammeter 0-30 A Square flush mounting type.
- e) Charge rate (Trickle/Boost) selector switch.
- f) Facia window indicate to battery charger "ON" indication.

## **8.0. Installation of Panel**

- a) The Contractor shall also provide suitable foundation bolts for the installation of control panel.
- b) The panel shall be accurately leveled so as to ensure trouble free and smooth operation.
- c) All cable work etc. shall be carried out in a workman like manner to the satisfaction of the Engineer-in-Charge. The work includes all sundry materials and flexible connections as required to avoid transmission of vibrations.
- d) For providing control & power cables required at site between Alternator to Standard Panel. No extra payment shall be made on this account.

## **9.0. Installation of DG Set**

1. The alternator coupled to the diesel engine with horizontal coupling shall be mounted on a heavy duty common base plate of suitable steel channel of welded construction. The foundation shall be made as per the CPWD Specifications.
2. The contractor will execute the work so as to comply all the requirements of competent Pollution Control Board.
3. The Contractor shall have to extend the exhaust pipe as per CPWD Specifications.
4. All exhaust joints shall be welded to prevent escape of flue gases and smoke inside the Generator room. Asbestos rope shall be fixed on full length (inside the room) of exhaust pipe which is in the scope of work.
5. All the connection from tank to the Engine shall be provided with MS pipe fixed on ground with suitable clamps/saddles etc as required.
6. Multi core copper cable to be used for control connection from control panel to DG Set should be having size of each wire not less than 2.5 Sq. mm.
7. Anti corrosive solution shall be filled (first filling) by the contractor free of cost in the cooling system.
8. Prevention/Protective covering on the sand filling around foundation shall be liability of contractor.
9. Power cable will be supplied by IIT, Mandi, However necessary terminations will be in the scope of agency as per item of BOQ.

## **10.0 TECHNICAL SPECIFICATION FOR ACOUSTIC ENCLOSURE**

- 10.1. As per CPWD norms, restriction has been imposed for new DG Sets upto 1000 KVA for noise level. Therefore, in terms of these norms, acoustic enclosure should be type tested at the climatic conditions specified in though one of the authorized laboratory.
- 10.2. **Installation.**
  - 10.2.1. Acoustic enclosures are supplied with built in Anti Vibration Mountings (AVMs). As such Gen Set can be installed directly on the level surface.
  - 10.2.2. Exhaust piping outlet should not be turned towards window/ventilator of home or occupied building. Provision of rain cap should be ensured.

### **10.3. Service Accessibility.**

- 10.3.1. Genset/Engine control panel should be visible from outside the enclosure.
- 10.3.2. Routine/periodical check on engine/alternator (filter replacement and tappet setting etc) should be possible without dismantling acoustic enclosure.
- 10.3.3. For major repairs/overhaul, it may be required to dismantle the acoustic enclosure.
- 10.3.4. Sufficient space should be available around the Genset for inspection and service.

### **10.4. General Design Guidelines.**

- 10.4.1. To avoid re-circulation of hot air, durable sealing between radiator and canopy is must.
- 10.4.2. Ventilation fans are must for the Gensets cooled by heat-exchanger/cooling tower system.
- 10.4.3. Exhaust piping inside the enclosures must be lagged (except below).
- 10.4.4. Temperature rise inside the enclosure should not be more than 5°C for maximum ambient above 40° C and it should be below 10° C for ambient below 40° C.
- 10.4.5. There should be provision for oil, coolant drain and fill. Fuel tank should have provision for cleaning.

### **10.5. Specifications for Acoustic Enclosure.**

- 10.5.1. The acoustic enclosure shall be designed and manufactured conforming to relevant standards suitable for out door installation exposed to weather conditions, and to limit overall noise level to 75 dB (A) at a distance of 1 mtr. from the enclosure as per CPCB norms under free field conditions.
- 10.5.2. The construction should be such that it prevents entry of rain water splashing into the enclosure and allows free and quick flow of rain water to the ground in the event of heavy rain. The detailed construction shall conform to the details as under:-
- 10.5.3. The enclosure shall be fabricated out of the CRCA sheet of thickness not less than 1.6 mm on the outside cover with inside cover having not less than 0.6mm thick perforated powder coated CRCA sheet.
- 10.5.4. The hinged doors shall be made from not less than 16 SWG (1.6 mm) thick CRCA sheet and will be made air tight with neoprene rubber gasket and heavy duty locks.
- 10.5.5. All sheet metal should be powder coated.
- 10.5.6. The enclosure should be powder coated.
- 10.5.7. The enclosure should accommodate the daily service fuel tank of the DG Set to make the system compact. There should be provision of gauge, which should show the level of the fuel even when the DG set is not running. The gauge should be calibrated. The fuel tank should be filled from the outside as in automobiles and should be with a lockable cap.
- 10.5.8. The batteries should be accommodated in the enclosure in battery rack.
- 10.5.9. The canopy should be provided with high enclosure temperature safety device.

- 10.5.10. The acoustic lining should be made up of high quality insulation material i.e. glass/mineral wool of minimum 50 mm thickness up to 500 KVA capacity and 75 Kg/cubic meter to 100 Kg/cubic meter for sound absorption as per standard design of manufacturer's to reduce the sound level as per the CPCB norms. The insulation material shall be covered with fine glass fiber cloth and would be supported by perforated MS sheet duly powder coated.
- 10.5.11. The enclosure shall be provided with suitable size and No. of hinged type doors along the length of the enclosure on each side for easy access inside the acoustic enclosure for inspection, operation and maintenance purpose. Sufficient space will be provided inside the enclosure on all sides of the DG set for inspection, easy maintenance and repairs.
- 10.5.12. The canopy should be as compact as possible with good aesthetic look.
- 10.5.13. The complete enclosure shall be of modular construction.
- 10.5.14. The forced ventilation shall be as per manufacturer design using either engine radiator fan or additional blower fan(s). if the acoustic enclosure is to be provided with forced ventilation then suitable size of axial flow fan (with motor and auto-start arrangement and suitable size axial flow exhaust fan to take the hot air from the enclosure complete with necessary motors and auto start arrangement should be provided. The forced ventilation arrangement should be provided with auto stop arrangement to stop after 5 minutes of the stopping of DG Sets.
- 10.5.15. The acoustic enclosure should be suitable for cable connection/connection through bus trunking. Such arrangement on acoustic enclosure should be water proof and dust-proof confirming to IP-65 protection.

Name of work:- Supply, installation, testing & Commissioning of 160 KVA silent type DG set with AMF panel at administrative block of IIT Mandi at Mandi.

Acceptable Makes

Following are the makes/manufacturers for diesel engines and alternators.

- |                                |   |
|--------------------------------|---|
| a) 160 KVA Diesel Engine       | i) Cummins Model No.6CTA8.3G with 205 BHP<br>ii) Ashok Leyland Model No.AL6DTIDG4 with 197 BHP<br>iii) Kirloskar Model No.6K 1080 TA G2 with 200 BHP. |
| b) Alternators                 | Kirloskar/ Stamford/ NGEF/ Leroy Summer   |
| c) Cushy foot mountings        | GERB/ Dunlop.   |
| d) MCCB                        | L&T (D-Sine)/ Siemens (VL)/ABB(Timax)<br>/Legrand (DNX)/Schneider Electric (NS).  |
| e) Contactor                   | Siemens/Legrand/Schneider/ABB/L&T   |
| f) Measuring Instruments       | A.E/ Rishab   |
| g) Battery                     | Exide/Prestolite/Cummins.   |
| h) Control Cable & Power Cable | Finolex/L&T/BCH/CappKable/Havells (It should be ISI marked)   |
| i) CTs                         | AE/ Kappa   |
| j) Selector Switches           | L&T/ Kay Cee/ BCH   |
| k) Indicating Lamp             | BCH/ L&T  |
| l) MS Pipe/GI pipe             | Jindal (Hisar)/ TATA  |
| j) Acoustic Enclosure          | Manufactured by OEM/OEA of above makes of engine and as per CPCB norms.   |
| k) AMF Panel"                  | Manufactured by OEM/OEA of above makes of engine/DG Sets.   |
| l) Changeover switch           | H-HELCON/ L&T/BCH.  |

**Note:** Manufacturer's test certificates of all materials i.e DG Set and AMF Panel etc are required at the time of supply. The year of manufacturing should be current or not earlier than six months from the date of opening of price bid.

**TABLE OF MILE STONE**

Sr.No.	Description of Milestone (Physical)	Time Allowed in Days (from date of start)	Amount to be with-held in case of non achievement of mile stone.
1	Submission of drawings, copy of order etc for approval of Department.	10 Days	0.5%
2	Placing of order for equipments/ material.	25 Days	1.0%
3	Supply of DG Set, AMF Panel & other fixtures.	45 Days	1.5%
4	Installation of DG Set, AMF Panel and other fixtures.	80 Days	1%
5	Earthing.	85 Days	0.5%
6	Testing and commissioning of DG Set.	90 Days	0.5%

Time allowed for execution of work : Three Months

## SCHEDULE OF QUANTITY

**Name of work :** - Supply, installation, testing & Commissioning of 160 KVA silent type DG set with AMF panel at administrative block of IIT Mandi at Mandi.

Sr. No.	Description of items	Qty.	Unit	Rate(In Rs)		Amount (In Rs)
				(In Figure)	(In Word)	
1	Providing, Installing, Testing and Commissioning of 'Silent Type' Diesel Generating set having Prime Power Rating of <b>160 KVA</b> , 415 volts at 1500 RPM, 0.8 lagging power factor at 415 V suitable for 50 Hz, 3 phase system, for 0.85 Load Factor and consisting of the followings:	1	no.			
a)	<b>Diesel Engine:</b>					
	Diesel engine 4 stroke water cooled, electric start, of suitable BHP at 1500 RPM suitable for above output of alternator at 40 Degree C, 50% RH & at 1000 Meter MSL and conforming to BS 5514, BS 649, IS 10000, capable of taking 10% over loading for one hour after 12 hours of continuous operation. The engine will be fitted complete with all the required accessories.					
b)	<b>Enginemounted Instrument Panel fitted with and having digital display for following:</b>					
	(i) Start-stop switch with key					
	(ii) Water temperature indication					
	(iii) Lubrication oil pressure indication					
	(iv) Lubrication oil temperature indication					
	(v) Battery charging indication					
	(vi) RPM indication					
	(vii) Over speed indication					
	(viii) Low lub. Oil trip indication					
	(ix) Engine Hours indication					
c)	<b>Alternator :</b>					
	Synchronous alternator rated at <b>160 KVA</b> , 415 volts at 1500 RPM, 3 phase 50 Hz, AC supply with 0.8 lagging power factor at 40 Degree C, 50% RH & at 1000 Meter MSL. The alternator shall be having SPDP enclosure, brushless, continuous duty, self-excited and self-regulated through AVR conforming to IS: 4722/BS 2613 suitable for tropical conditions and with class-F/H insulation.					
d)	<b>BaseFrame &amp; Foundation:</b>					
	Both the engine and alternator shall be mounted on suitable base frame made of MS channel with necessary reinforcement which shall be installed on suitable cement concrete foundation and vibration isolation arrangement as per recommendations of manufacturer.					
e)	<b>Fuel Tank:</b>					
	Daily service fuel tank of 285 liters capacity fabricated out of 3mm thick M.S. sheet complete with all standard accessories and fuel piping between fuel tank and diesel engine with MS class 'C pipes of suitable dia. Complete with valves, level indications & accessories as required as per specifications.					
f)	<b>Exhaust System:</b>					
	Dry exhaust manifold with hospital exhaust silencer and catalytic convertor.					
g)	<b>Starting System:</b>					
	12V/24V DC starting system comprising of starter motors: voltage regulator and arrangement for initial excitation complete with suitable nos. of batteries (25 plates, 180 Amp. Hour capacity lead acid type) as required as per specifications.					
h)	Acoustic and weather proof enclosure with arrangement for fresh air intake for cooling of the engine & alternator, extraction, discharging hot air in to the atmosphere as per specifications.					
2	Supplying and fixing exhaust gas piping of suitable dia. welded black M.S. B Class pipe conforming to IS:3589 cut to required lengths and installed with necessary bends, supports and clamps, anti-vibration mountings, insulation of exhaust system with mineral wool/Rockwool, 50mm thick wiremesh& aluminum cladding etc., as required as per specifications.	3	Mtrs			

Sr. No.	Description of items	Qty.	Unit	Rate(In Rs)		Amount (In Rs)
				(In Figure)	(In Word)	
3	Fabricating, Installing, Testing & Commissioning of weather proof <b>AUTO-MATIC MAINS FAILURE</b> for operation of DG sets including auto bypass panel, suitable for 160 KVA silent type DG set complete with relays, timers, set of CTs for metering & protection and energy analyser to indicate currents, phase and line voltages, frequency, power factor, KWH, KVARH & provision for overload, short circuit, restricted earth fault, under frequency, control cabling from AMF cum synchronizing panel to diesel generating sets and elsewhere, if required, all complete and inter locking including the following:	1	No.			
a)	3 Nos. 300 A, 4pole, 36 KA MCCB					
	2 No's 300 A 3 pole power contactor with 2 NO+2 NC					
	Auto/Manual/Test/Off selector switch					
	2 No's over voltage & 2 No's under voltage relays					
	3 No's CT's of suitable capacity					
	Energy analyzer unit to indicate current, voltage, frequency, power factor and KWH					
	Indicating lamps for load on mains and load on set					
	MCB's for instruments					
	Battery charger complete with transformer/rectifier, DC voltmeter and ammeter, selector switch for trickle, off and boost					
	Mains supply failure monitor					
	Supply failure timer					
	Restoration timer					
	Control unit with three impulse automatic engine start/stop and failure to start lockout					
	On/Off/Control circuit switch with indicator					
	Audio annunciation for					
	i) High water temperature					
	ii) Low lubricating oil pressure					
	iii) Engine over speed					
	iv) Engine fails to start					
	v) Full load warning					
	Providing by-pass arrangement for AMF panel. 2 No's 300 Amp on-load changeover switch including connections, testing and commissioning etc. as required.					
4	Supplying and making end termination with brass compression gland and aluminium lugs for following size of PVC insulated and PVC sheathed / XLPE aluminium conductor cable of 1.1 KV grade as required.	4	Nos.			
a)	3.5C x 150sqmm					
5	Supplying, installation, testing and commissioning copper earth plate type 600 x 600 x 3 mm thick including all accessories & masonry enclosure with cover plate having locking arrangement & watering pipe of 2.7 m long etc with charcoal/coke and salt as required.	3	Set			
6	Supplying and laying 25 mm X 5 mm copper strip at 0.50 metre below ground as strip earth electrode, including connections, terminations with nut bolt, spring, washers, soldering etc as required ( Jointing shall be done by overlapping and with 2 sets of brass nut bolt and spring washers spaced at 50 mm )	30	Mtrs			
<b>Total</b>						

-sd-  
Superintending Engineer