

Tender no. IIMA / CCSP /034 / 2016-17 Dated 28.09.2016

Indian Institute of Management, Ahmedabad

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Tender for Making, Installation, Commissioning & Maintenance of 100 Solar Power operated Bore wells (Tube wells) related electrical work like Solar panel, Electrical panel, Starter and Electrical Pump connections etc.

NOTICE INVITING TENDER AND SCHEDULE OF EVENTS

NIT NO. CCSP/034

Date: 28/09/2016

Sealed item rate tenders under two bid system are invited from bona fide experienced & reputed contractors of financial standing meeting the pre-qualifying requirement for the job given below

Name of Work:	Making, Installation, Commissioning & Maintenance of 100 Solar Power operated Bore wells (Tube wells) related electrical work like Solar panel, Electrical panel, Starter and Electrical Pump connections etc.
Tender No. / NIT No.	IIMA / CCSP /034 / 2016-17 Dated 28.09.2016
Tender Cost	Non- refundable Rs.1000.00 (Rupees: One thousand only) payable by demand draft or pay order in favor of Indian Institute of Management Ahmedabad, payable at Ahmedabad.
Earnest Money Deposit (EMD)	Rs. 2,00,000/- (Rupees: Two lakh rupees only) by demand draft in favor of Indian Institute of Management Ahmedabad, payable at Ahmedabad
Contract Period	One year from the date of submission of bid.
Defect Liability Period	Two years from agreement date. Guarantee period four years from agreement date.
Issue of Tender	Through Website and Newspaper on 30/09/2016
Pre Bid Meeting	At 3.00 pm on 07/10/2016 for clarifications of queries if any, the address mentioned below. Bidders who are unable to attend the meeting are requested to send their queries up to 6.00 pm on 06/10/2016.
Submission/ Receipt of Tender	At 3.00 pm on dated 10/10/2016 at: Electrical office main campus, Indian Institute of Management, Ahmedabad, Gujarat (India), 380 015, Phone +91 79 66324611, Email : elecengr@iima.ac.in
Opening of Tender Part-I	Technical bid shall be opened on the same day i.e. 10/10/2016 at 3.30 pm in the presence of authorized representatives of contractors who are present.
Part – II (Price Bid)	Will only be opened the technically acceptable contractors on 10/10/2016 at 3.30 pm at the same venue.

Bids shall be submitted in two separate sealed envelopes marked as technical bid and price bid:

1. Part-I shall contain original offer (technical bid) along with EMD draft in favor of Indian Institute of Management, Ahmedabad.
2. Part-II shall contain only price bid as per Bill of Quantities without any condition. The prices shall be filled up both in figure and in words, and the total amount shall be calculated and rounded off to the nearest Rupee. No overwriting or use of correction fluid shall be accepted. Any correction shall be legible and signed by the authorized signatory.
3. Both these envelopes should be kept in a third enveloped which should be properly sealed.

PRE-QUALIFICATION CRITERIA

1. The applicant should be approved MNRE SPV channel partner & have obtained rating from the rating Agency (CRISIL / CARE / ICRA / FITCH / BRICKWORKS etc.), either of 1A, 1B,1C, 2A, 2B,2C, 3A, 3B ,3c at the time of scheduled date of opening of Technical bid, are eligible.
2. The bidder should have executed at least fifty (50) solar pump installations in the last four years for Government Bodies/Semi government Institutions/ or Private customers.
3. Vendor has to submit the make & model of the pump for approval along with the performance characteristics. The proposed solar pump of 5 HP rating shall have test certificate of performance for the rated head and discharge from NABL/MNRE approval laboratory or MNRE test center.

The bidder should furnish the information of the following while submitting bids:

1. About their firm / company.
2. Detail of different type & number of equipment possessed by them.
3. The bidder should sign with firm's stamp on all the pages of bids.

TERMS & CONDITIONS

Tender documents can be downloaded from our website www.iimahd.ernet.in. Here downloading the tender document from IIMA, however, not imply that the bidder is considered qualified.

Tender/ offers may be sent by post/ courier to the office of tender submission authority namely:

Manager Electrical, Main campus

Indian Institute of Management,

Vastrapur, Ahmedabad- 380015

However, IIMA accepts no responsibility for any loss/ delay/ non-receipt of offers not submitted in person. Offers received late/ incomplete are liable for rejection.

EMD as mentioned above shall be paid separately by DEMAND DRAFT in favour of Indian Institute of Management Ahmedabad, payable at Ahmedabad.

During opening of Technical Bid (i.e. Part-1) the name of Tenderers who have submitted their offers along with details of Earnest Money Deposit will only be read out and NO other information/ details whatsoever will be read out.

The offer of the Tenderer shall be valid for a period of 60 days from the last date of submission of Tender/ revised offer (if any).

In deciding upon the selection of contractors for the work, great emphasis will be put on the ability and competency of contractors to provide high quality workmanship according to the time schedule and in close co- ordination with other agencies.

IIMA reserves the right to accept/ reject any or all tender in part or full, without assigning any reason whatsoever.

If the last date of receiving/opening of the tenders coincide with a holiday, then the next working day shall be the receiving/opening date.

DETAILED EVALUATION

Further examination/evaluation of only such bids, accompanying requisite EMD mentioned as above, shall be taken up as per the satisfaction PQ Criteria.

IIMA reserves right to award similar job at same rates on mutually agreed terms and conditions for a period of one year from the last date of submissions of bids.

SPECIAL NOTES

The Solar water pumping system will be installed at mainly three villages. Their detailed addresses are mentioned below:

Village	District	State	BHEL Office
Kahna Saiya	Bhopal	Madhya Pradesh	Bhopal
Aurangabad	Haridwar	Uttarakhand	Haridwar
Siddihalli	Davanagere	Karnataka	Bangalore

Table shows the number of pumps to be installed at each location in a cluster format totaling three clusters and eight demonstration pumps.

SWP Tracking System	Siddihalli	Aurangabad	Kahna Saiya	Demo Installations	Total
Non Tracking	49	19	21	6 [#]	95
Tracking	1	1	1	2 [@]	5
Total	50	20	22	8	100

BHEL Noida (1), IIM Ahmedabad (1), Lakadaram (1), Jayrambati (2) and Asoor (1)

@ Lakadaram and Asoor- one each at most. May be even converted to without tracking system.

Please note that the digging of bore well work would be done at 99 locations, and not for the IIM Ahmedabad location. Only Solar Modules with 5 HP Pump would be installed at the IIM Ahmedabad.

The overall system shall operate satisfactory and efficient under ambient temperature of 50 degrees Celsius for all the location. Depth Variation would be an actual for each site. Scope of work may be sometimes added or deleted.

BID EVALUATION SCHEME

1. IIMA reserves the right to accept/ reject any tender in part or full, without assigning any Reason whatsoever.
2. IIMA reserves the right to divide the work between two or more agencies.
3. IIMA reserves their right to negotiate the quoted price.

PAYMENT TERMS

Total Payment will be paid in the following installments:

1. First Installment: At the time of Supply of Material - 30 % of the Total Cost.
2. Second Installment: After Successful Installation of the system and with the satisfaction of IIMA - 45 % of the Total Cost.
3. Third Installment: After 12 Month of the satisfactory working report by the committee - 10 % of the Total Cost.
4. Fourth Installment: After 24 Month of the satisfactory working report by the committee - 5 % of the Total Cost.
5. Fifth Installment: After 36 Month of the satisfactory working report by the committee - 5 % of the Total Cost.
6. Sixth Installment: After 48 Month of the satisfactory working report by the committee - 5 % of the Total Cost.

TENDER DOCUMENTS

SECTION – I

GENERAL & SPECIAL CONDITIONS OF CONTRACT

TENDER DOCUMENTS
VOLUME - I
DETAILED CONTENTS - PART I
GENERAL AND SPECIAL CONDITIONS OF CONTRACT

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GENERAL CONDITIONS OF CONTRACT

A. DEFINITIONS AND INTERPRETATIONS:

1. Definitions and Meanings:

In this Contract including these Conditions, the Specification, the Priced Bills of Quantities, Special Conditions of Contract and other documents forming part of the contract, unless expressly stated therein to the contrary, the following expressions shall have the meanings hereby assigned to them:

(a) Employer shall mean the 'Owner' or the 'Client' who is desirous of getting executed the work/putting up the project and on whose behalf this tender/enquiry is floated and shall include his/their legal representative/s assignee/s or successors.

The name and address of the employer are given in the tender notice.

(b) The term 'The Contract' shall collectively mean the Tender, Acceptance of Tender, these General Conditions and conditions as laid down in Special Conditions of Contract, the drawings, the Specifications, Notes on the Bill of Quantities, the Priced Bill of Quantities and other documents referred to therein, as detailed, in Para 32 of the Instructions to Tenderers - (Volume-II) any other related communication.

(c) The term 'Tenderer' shall mean the firm/party/individual who quotes against this enquiry/tender.

The term the 'contractor' shall mean the successful tenderer whose tender has been accepted by the Owner/Consultant and on whom a letter of intent or work order has been placed and shall include his heirs, legal representative and assigns.

(d) The term 'The Works' shall mean the works described in the contract documents and contracted to be executed under this contract whether temporary or permanent and whether original, altered, substituted or additional.

(e) The terms 'approved' and 'directed' shall mean approved or directed by the Owner/Architect/ Consulting Engineer.

(g) The term 'the site' shall mean all land allotted by the Owner/Architect/Consulting Engineer for the use of the contractor for the purpose of these works.

(h) The term 'I.S. and/or B.S.' shall mean the 'Indian and/or British Standard Specifications as issued by the Bureau of Indian Standards/British Standards Institution current at the date of acceptance of the tender.

- (i) Mobilization Period:
The contractor shall start the work at site within 15 days (or as mutually agreed upon during negotiations) from the date on which the letter of intent/work order (whichever is earlier) is issued, called the mobilization period.
- (j) Time Limit:
The time limit for completion of work as mentioned in para-33 of Instructions to Tenderers (Volume-II) shall be calculated from the expiry of mobilization period or from the date of handing over of the site, to the contractor to commence work, whichever is later.
- (k) Virtual Completion:
The works (part or whole) shall be considered virtually complete, if the building/works are in the opinion of the consultant, substantially completed and ready for its specified use, pending minor rectification works.

2. Headings to the Conditions:

The headings to these conditions shall not affect the interpretation thereof.

3. Singular and Plural:

Words imparting the singular only also include the plural and vice-versa where the context so requires.

B. CONTRACT DOCUMENTS ETC.:

4. Contract Documents:

The contract is confidential and the contract documents must be strictly confined to the contractor's own use (except as far as confidential disclosures to sub-contractors or suppliers is necessary) and to the purpose of the contract. The Owner/Architect/Consulting Engineer shall furnish to the Contractor free of cost, two sets of the signed Tender Documents including Specifications, during progress of the works. The contractor shall keep one copy of all drawings, the Tender Documents including Priced Bills of Quantities and Specifications on the site and the Owner/Architect/Consulting Engineer or his representatives shall at all reasonable times have access to them.

Further copies of the aforesaid documents may be obtained from the Owner/Architect/Consulting Engineer on payment of the necessary charges for drawings, Specifications and blank Bills of Quantities.

All documents including the Contract documents and copies thereof, furnished to the contractor, shall be returned to the Owner/Architect/Consulting Engineer on the completion of the works or earlier termination of the contract.

5. Security Deposit & Performance Guarantee:

Security Deposit: The Employer shall deduct a sum at the rate of 5% of the gross amount of each running bill till the sum along with the sum already deposited as earnest money will amount to security deposit of 5% of the tendered value of the work. In case, if the work value of the complete project is revised from the tendered value, the security deposit will be accordingly revised. This amount of Security Deposit shall be released after defects liability period after rectification of the defects, if any, pointed out during the defects liability period. The amount retained by the Employer shall not bear any interest. All compensation or other sums of money payable by the Contractor to the Employer under the terms of this contract may be deducted from his Earnest Money and Security Deposit. Unless such deposit has become otherwise payable, the Contractor within ten days shall make good in cash the amount so deducted.

Performance Guarantee: Besides Earnest money and security deposit, an irrevocable Performance Guarantee of 5% of the tendered amount shall be submitted by the contractor for his proper performance of the contract agreement in the form of fixed deposit receipt/Government Securities/Guarantee Bond/banker's cheque of a scheduled bank/demand draft as approved by the Employer. The Performance Guarantee shall be initially valid up to the stipulated date of completion plus 60 days beyond that. In case the time for completion of work gets enlarged, the contractor shall get the validity of Performance Guarantee extended to cover such enlarged time for completion of work. After obtaining Consultants certificate of virtual completion of the work, the Performance Guarantee shall be returned to the contractor, without any interest.

Release of Security Deposit shall be as per clause 57 for Final Bill-Part-I (Volume-I).

C. EXECUTION OF WORKS-GENERAL:

6. Standing trees on site:

The contractor shall keep harmless and maintain all the standing trees on the site unless otherwise directed by the Owner/Architect/Consulting Engineer.

7. Site Drainage:

All water that may accumulate on the site during the progress of the works, or in trenches and excavation from whatever source it may be, shall be removed at once from the site to the entire satisfaction of the Owner/Architect/Consulting Engineer.

8. Nuisance:

The contractor will not at any time do cause or permit any nuisance on the site or do anything which shall cause unnecessary disturbance or inconvenience to the employer and to the other contractors engaged on the site and to the owners, tenants or occupiers of other properties near the site and to the public generally and will secure the efficient protection of all streams and waterways against pollution.

9. Power & Water:

POWER WILL BE PROVIDED ON CHARGEABLE BASIS.

Note: It is to be clearly understood that the employer will not be responsible for any failure and/or shortage of power/water supply during the course of execution of the work. No extra payment whatsoever will be admissible on this account. In case of failure and/or shortage of power / water supply, the contractor shall make arrangement for alternative sources, with prior approval and consent from the Owner. In such case the contractor shall be paid for / reimbursed the expenses for power / water supply.

10. Works to be Carried Out:

The contractor shall, except where otherwise stated, include all labour, materials, tools, plant, equipment and transport which may be required in preparation for and for the full and entire execution and completion of the works as shown on drawings, and as described in the Priced Bills of Quantities and Specifications.

The drawings, Specifications and Priced Bills of Quantities shall be deemed to have been prepared in accordance with good practice and recognized principles and the descriptions given therein shall be held to include waste on material carriage, carrying in return of empties, hoisting, setting, fitting and fixing in position and all other labour necessary in and for the full and entire execution and completion as aforesaid, to the entire satisfaction of the Owner/Architect/Consulting Engineer. In the event of any dispute as to what was necessary for the entire execution and completion of the works as aforesaid, the opinion of the Owner/Architect/Consulting Engineer shall be final and binding to both the Contractor and Owners.

Any error in description or in quantity in the Priced Bills of Quantities, or any omission there from shall not vitiate the contract or release the contractor from the execution of the whole or any part of the works comprised therein according to the drawings and Specifications or from any obligations under the contract.

In the case of discrepancy between the Priced Bills of Quantities, the Specifications and/or the drawings, the Owner/Architect/Consulting Engineer shall be the sole deciding authority as to which shall prevail, and their decision shall be final, binding

and conclusive.

The contractor shall be deemed to have carefully examined and to have full knowledge of the Special Conditions, General Conditions, Specifications, Notes on Bills of Quantities, Priced Bills of Quantities, Drawings and other documents forming part of the contract and also to have satisfied himself as to the nature and character of the works to be executed and of the site, local facilities of access and all other relevant matters and details to affect the execution and completion of the works in accordance with the terms and conditions of the contract. No extra charges consequent on any misunderstanding or otherwise will be allowed.

If certain items are to be carried out but are not included in the Specifications, the same should be executed according to the Specifications of Bureau of Indian Standards / Good Engineering Practice / As Directed by Engineer-in-Charge/Architect.

11. Covering-in work:

The contractor shall give reasonable notice in writing to the Owner/Architect/Consulting Engineer whenever any work is to be permanently covered or concealed, whether by earth or other means and in default of so doing, shall, if required by the Owner/Architect/Consulting Engineer, uncover such work at his own expense.

Should the contractor refuse or neglect to comply with this condition, the Architect/Consulting Engineer may employ other workmen to open up the same and the cost thereof as certified by the Owner/Architect/Consulting Engineer, whose certificate shall be final, binding and conclusive on all parties to the Contract, shall be borne by the Contractor. Notwithstanding all above at any time prior to the expiry of the maintenance period, the Contractor shall, if and when required by the Owner/Architect/Consulting Engineer make openings down to any part of the works to allow for its full examination and if the said work is found in any way defective, all expenses of such examinations and making good the defective work shall be borne by the Contractor.

Extra soil required for filling etc. shall be obtained only from those places for which the Owner/Architect/Consulting Engineer has given prior written approval.

12. Tools, Plants & Equipment:

The Contractor shall at his own expense supply, bring to the site, use and maintain all tools, plant and equipment's required for the execution of the contract. All tools, plant and equipment brought to the site shall not be removed off the site without the prior written approval of the Owner/Architect/Consulting Engineer. But whenever the works are finally completed or the contract is terminated for reasons other than the default of the contractor, the contractor shall forthwith remove from

the site all tools, plants and equipment (other than such as may have been provided by the employer) at his own expense.

13. Stores and Materials - General:

The Contractor shall, at his own expense, supply all stores and materials required for the Contract.

All stores and materials to be supplied by the Contractor shall be the best of the respective kind described in the Specifications and Priced Bills of Quantities and shall conform to the specifications in each and every respect. The contractor, if so required by the Owner/Architect/Consulting Engineer shall furnish the Owner/Architect/Consulting Engineer with proof to the satisfaction that the stores and materials proposed to be used or already incorporated in the works, conform to the Specifications.

The Contractor shall at his own expense and without delay, supply samples of stores and materials proposed to be used in the execution of the work as may be required by the Owner/Architect/Consulting Engineer for their approval. The Owner/Architect/Consulting Engineer may reject all stores and materials, which in their opinion do not correspond both in quality and character with the approved samples.

If for some reasons, the contractor cannot procure and supply the stores and materials as described in the Specifications and Priced Bills of Quantities, the same shall be substituted by stores and materials as approved and specified by the Owner/Architect/Consulting Engineer, which will be binding to all the parties concerned.

14. Stores and Materials - On Site:

- (i) Stores and materials required for the works are to be kept/stored by the contractor only at the places to be indicated by the Owner/Architect/Consulting Engineer.
- (ii) The Owner/Architect/Consulting Engineer shall have power to inspect and examine at any time any stores and materials intended to be used in or on the works, either on the site or at any factory or workshop or other places where such stores or materials are being constructed or manufactured or any place where the same are lying or from which they are being obtained and the Contractor shall give such facilities as may be required to be given for such inspection and examination.
- (iii) The contractor shall arrange to carry out various tests on the building materials as required and specified on a regular basis. The contractor shall also maintain proper records and registers for such tests and test results and keep the Owner/Architect/Consulting Engineer informed of the same. The

records and registers for materials, tests and test reports shall be available at site for inspection by the Owner/Architect/Consulting Engineer. The costs of sampling, arranging for testing, testing and maintenance of records etc. shall be borne by the contractor.

- (iv) The Owner/Architect/Consulting Engineer shall be entitled to have tests carried out/ conducted of any stores or materials supplied by the contractor who shall provide at his own expense all facilities which the Owner/Architect/Consulting Engineer may require for this purpose. If at the discretion of the Owner/Architect/Consulting Engineer an independent expert is employed to make any such tests, his charges shall be borne by the contractor, only if the test discloses that the said stores or materials are not in accordance with the provision of the Contract; otherwise these charges shall be borne by the Owners.
- (v) Should the Owner/Architect/Consulting Engineer consider at any time during the construction or reconstruction or prior to the expiration of a period of twelve calendar months after the works have been handed over to the employer (hereinafter referred to as the `maintenance period') that the stores or materials provided by the contractor are unsound, or of a quality inferior to that contracted or not meeting the standards of the Bureau of Indian Standards or otherwise not in accordance with the contract (in respect whereof the decision of the Owner/Architect/Consulting Engineer shall be final binding and conclusive) notwithstanding that the stores or materials may have been inadvertently passed, certified, and paid for, the contractor shall forthwith remove the stores or materials and provide other proper and suitable stores or materials at his own expense and in the event of his failing to do so within a period to be specified by the Owner/Architect/Consulting Engineer, the Owner/Architect/Consulting Engineer may get them removed and replaced by other agency at the risk and expense of the contractor. The liability of the contractor under this condition shall not extend beyond the maintenance period aforesaid, except as regards stores or materials for which the Owner/Architect/Consulting Engineer shall have provisionally given notice to the contractor to replace.

15. Octroi and other Duties:

For all the materials, all charges on account of octroi or sales tax and/or other duties and royalties on materials obtained by the contractor for the works, shall be borne by the Contractor.

This however shall not be applicable on items with basic rates for which the basic rates are FOR site and the items issued by the owners. Sales tax on Works Contract, as applicable, shall be borne by the Contractor. Owners shall make necessary deductions towards this from the payments to be made to the contractor.

16. Removing stores and materials from site:

All stores and materials brought to the site shall not be removed off the site without the prior written approval of the Owner/Architect/Consulting Engineer. But whenever the works are finally completed, the Contractor shall at his own expense forthwith remove from site all surplus stores and materials originally supplied by him and upon such removal, the same shall (again) vest in the contractor. All stores and materials issued to the contractor by the employer for incorporation or for fixing in the works and which making an allowance for reasonable wear and tear and/or waste, have not on completion of the works been so incorporated, shall be returned by the contractor or fixed at his own expense to the place of issue, after weighing/counting/measuring the same as directed by the Engineer-in-Charge/Architect.

D. EXECUTION OF WORKS - SUPERVISION:

17. Execution of work:

The Contractor shall be entirely responsible for the due execution of the contract in all respect in accordance with the Tender Documents including drawings, Specifications, Bills of Quantities and all other terms and conditions of the contract.

18. The works shall be executed in a workman like manner and to the satisfaction in all respects of the Owner/Architect/Consulting Engineer who shall communicate or confirm his instructions to the Contractor in respect of the execution of the work in a 'Work Site Order Book' to be maintained at the site office of the Owner/Architect/Consulting Engineer (or in Contractor's site Office) and the Contractor shall visit this office daily and shall confirm receipt of such instructions etc. by signing the relevant entries in this book. Such entries shall be deemed as 'Orders or Notices' in writing within the intent and meaning of these conditions.

19. Contractor's supervision:

The contractor shall either himself supervise the execution of the contract or shall appoint a competent agent approved by the Owner/Architect/Consulting Engineer to act in his stead. If the contractor fails to appoint a suitable agent on being ordered to do so, the Owner/Architect/Consulting Engineer shall have full powers

to suspend the execution of the works until such date as a suitable agent is appointed and the Contractor shall be held responsible for the delay so caused to the works.

Orders given to the contractor's agent shall be considered to have the same force as if they had been given to the Contractor himself.

The contractor or his agent shall be in attendance at the site during all working hours, and shall superintend the execution of the works with each additional assistance in each trade, as the Owner/Architect/Consulting Engineer may consider necessary.

The contractor or his accredited agents shall attend, when required and without asking any charge for doing so, either the office (Head office and/or field office) of the Architect/ Consulting Engineer or the works to receive instructions.

The Owner/Architect/Consulting Engineer shall have full powers, and without giving any reason, to require the Contractor immediately to cease to employ in connection with this contract any agent, servant or employee whose continued employment in the works is, in his opinion, undesirable.

Notwithstanding the supervision by the Owner/Architect/Consulting Engineer during the execution of the work, the contractor shall be fully responsible for the supervision of the work and shall not be entitled to plead any default on the part of the Owner/Architect/Consulting Engineer for supervising the work.

20. Labour:

The contractor shall employ labour in sufficient number to ensure timely completion of the works with workmanship of the degree required by the specifications and to the satisfaction of the Owner/Architect/Consulting Engineer.

The contractor shall, in respect of his work-people and staff employed in connection with the contract, observe terms and conditions of employment and pay rates of wages not less favourable than those fixed from time to time, by the appropriate local wage-fixing authority, or in the absence of such authority not less favourable than those commonly recognised by good employers in the trade in the locality where the work is carried out.

The Contractor shall remain liable for the payment of all wages or other monies to his work people or employees under payment of Wages Act, 1936, Employer's Liability Act 1938, Workmen's Compensation Act, 1923, or any other act or enactment's relating thereto and rules framed there under from time to time.

The Contractor shall work only on and during hours of a working day unless he obtains the prior written approval of the Owner/Architect/Consulting Engineer to do otherwise. If such approval is given, the Employer shall incur no liability in respect of any excess cost arising there from.

The Contractor shall furnish to the Owner/Architect/Consulting Engineer every morning a 'Labour Return' showing the number of labours employed by respective trade.

The contractor shall not employ in connection with the works any person who has not completed his eighteenth year of age.

The contractor shall, notwithstanding the provision of any conditions to the contrary, ensure payment of fair wages to labourers indirectly engaged on the work, including any labour engaged by his labour contractors and/or sub-contractors in connection with the said works, as if the labourers had been directly employed by him.

Vis-à-vis the employer, the contractors shall be primarily responsible for all payments to be made under and for the observance of the contractor's labour regulations as aforesaid, without prejudice to his right to claim indemnity from his sub-contractors and/or labour contractors.

21. Accommodation for Labour etc.: (No Labour Camp Permitted)

The contractor shall not be permitted to provide temporary living accommodation, for his workmen engaged in the job, on the site. He shall, however, be allowed, subject to prior concurrence of the Owner/Architect/Consulting Engineer to provide temporary accommodation for a limited number of people engaged on watch and ward duty at the work site, all at his own expenses. Such accommodation shall be of the scale and standard as approved by the local municipal and/or other authorities and shall also be to the satisfaction and approval of the Owner/Architect/Consulting Engineer.

The contractor shall also erect on the work site and maintain the same, all at his own cost, all necessary temporary workshops, stores, offices, etc. as are required for the proper execution of works. The planning, siting and erection of these buildings shall be to the approval of the Owner/Architect/Consulting Engineer and shall comply with the standards and requirements of the local municipal and/or other authorities.

The contractor shall also be responsible for providing on the site, necessary temporary water closets, sanitary latrines, urinals and washing platforms etc. for his work people and also for the representatives of Employer and Architects, all to the requirements and satisfaction of the local municipal and/or other authorities and the Owner/Architect/Consulting Engineer.

All fees and other charges legally payable to the local municipal authorities and/or any other authorities in respect of the matters concerning and relating to this clause shall be the responsibility of the contractor, who shall pay the said fees and other charges as and when and in the manner required and/or prescribed by the

concerning laws, bye-laws and regulations etc.

On completion of the works, the Contractor shall remove the whole of such temporary accommodation etc. provided by him and leave the area clean and tidy to the satisfaction of the Owner/Architect/Consulting Engineer.

No extra payment shall be allowed to the contractor for the fulfillment of this condition.

22. Setting out the works:

The Owner/Architect/Consulting Engineer shall supply dimensioned drawings, levels and other information necessary to enable the contractor to set out the works. The Contractor shall set up the works and shall provide and fix all setting out apparatus required and shall solely be responsible for the correctness and maintenance of the setting out and the levels and other information furnished by him.

23. Excavation:

Materials of any kind obtained from excavation on the site shall remain the property of the employer and shall be disposed of as the Owner/Architect/Consulting Engineer directs. All usable stuff obtained from the excavations, shall be carefully stacked at site as directed by the Owner/Architect/Consulting Engineer without any extra charge.

24. Foundations:

The contractor shall not lay any foundations until the excavation for the same has been examined and approved in writing by the Owner/Architect/ Consulting Engineer.

25. Safety code:

(a) Excavation and Trenching:

All trenches, 1.5 meters or more in depth, shall at all times be supplied with at least one ladder for each 30 meter in length or fraction thereof. Ladder shall be extended from bottom of trench to at least one meter above surface of the ground. Sides of a trench shall be stepped back or as and where necessary irrespective of depth or depths, be given suitable slope, or securely held by timber bracing, so as to avoid the danger of sides collapsing, at the contractors own risk and cost. Excavated material shall not be placed within 1.5 meters of edge of trench or within a distance equal to half of depth of trench, whichever is more and in no case the same will be placed in areas to be excavated. All surplus excavated material shall be disposed off at the required place as directed by the Architect. Cutting shall be done from top to bottom; under no circumstances shall undermining or undercutting be done.

- (b) Suitable scaffolds shall be provided for workmen for all work which cannot safely be done from the ground, or from solid construction, except for such short period works as can be done safely from ladders. When ladder is used, an extra mazdoor (labourer) shall be engaged for holding the ladder and if the ladder is used for carrying materials as well, suitable footholds and handholds should be provided and the ladder shall be given an inclination not steeper than 1 to 4 (1 horizontal and 4 vertical).
- (c) Scaffolding or staging more than 3.25 meters above or below the ground floor, swung or suspended from an overhead support or with stationery support, shall have a guard rail properly attached, bolted, braced and otherwise secured at least 1 meter high above the floor or platform of such scaffolding or staging and extending along the entire length of the outer/external side and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
- (d) Working platform, gangways and stairways shall be so constructed that they do not sag unduly or unequally, and if height of a platform or gangway or stair ways is more than 3.25 meters above or below ground level (or floor level), it shall be closely bordered/guarded have adequate width and be suitably fenced, as described in (c) above.
- (e) Every opening in floor of a building or in a working platform shall be provided with suitable means to prevent fall of persons or materials by providing suitable fencing or railing with a minimum height of one meter.
- (f) Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 meters in length. Width between side rails in a ladder shall in no case be less than 300mm. for ladder up to and including 3 meters in length. For longer ladders this width shall be increased at least 6 mm for each additional 300mm. of length. Uniform step spacing shall not exceed 300mm.
- (g) All scaffolds, ladders and safety devices mentioned or described herein shall be maintained in a safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use.
- (h) No materials on any of the sites shall be so stacked or placed as to cause danger or inconvenience to any person of the public. The contractor shall provide all necessary fencing and lights to protect public from accidents and shall be bound to bear expenses of defence of every suit, action or other proceedings at law that may be 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 such action or proceedings to any such person or which may with the consent of the contractor be paid to compromise any claim by any such person.

- (i) Adequate precautions shall be taken to prevent danger from electrical equipment.
- (j) Demolition:
Before any demolition work is commenced and also during the process of the work:
 - (i) All roads and open areas adjacent to the work site shall either be closed or suitably protected,
 - (ii) No electric cable or apparatus which is liable to be source of danger or a cable or apparatus used by operator shall remain electrically charged,
 - (iii) All practical steps shall be taken to prevent danger to persons employed, from risk of fire or explosion, or flooding. No floor roof or other part of a building shall be so overloaded with debris or materials as to render it unsafe.
- (k) Safety and Protection:
All necessary personal safety equipment as considered adequate by the Owner/Architect/ Consulting Engineer shall be available for use of persons employed on the site and maintained in a condition suitable for immediate use, and the contractor shall take adequate steps to ensure proper use of equipment by those concerned.
 - (i) Workers employed on mixing asphaltic materials, cement and lime mortars/concrete shall be provided with protective footwear and protective hand gloves.
 - (ii) Those engaged in welding works shall be provided with welders' protective eye-shields.
 - (iii) Those engaged in handling any material, which is injurious to eyes, should be provided with protective goggles.
 - (iv) Stone breakers shall be provided with protective goggles and protective clothes and seated at sufficiently safe intervals.
 - (v) When workers are employed in sewers and manholes, which are in use, the contractor, shall ensure that the manhole covers are opened and manholes are ventilated at least for an hour before workers are allowed to get into them. Manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to

prevent accident to public.

- (vi) Whenever men/women are employed on the work of lead painting, the following precautions shall be taken.

No paint containing lead or lead products shall be used except in the form of pastes or ready-made paint. Suitable masks shall be supplied, for use by workers, when paint is applied in the form of spray or a surface having lead paint dry rubbed and scrapped. Overall shall be supplied by the Contractor to workmen and adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

- (l) When work is done near any place where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger. Adequate provision shall be made for prompt first aid treatment of all injuries likely to be sustained during the course of the work.

- (m) Use of hoisting machines and tackles including their attachments, anchorage and supports shall conform to the following:

- (i) These shall be of good mechanical construction, sound material and of adequate strength and free from patent defect and shall be kept in good working order.

- (ii) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years shall be in-charge of any hoisting machine including any scaffold winch nor shall such person give signals to operator.

- (iii) In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or lowering or as means of suspension, safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with safe working load. In case of hoisting machine having a variable safe working load, the safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or of any gear referred to above in this paragraph shall be loaded beyond safe working load except for the purpose of testing.

- (iv) In case of departmental machine, safe working load shall be notified by the Owner/Architect/Consulting Engineer and/or the Employer. As regards contractor's machines, the contractor shall notify safe working load of each machine to the Owner/Architect/Consulting

Engineer whenever he brings it to site of work and get it verified by the Owner/Architect/Consulting Engineer.

- (n) Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with such means as will reduce to the minimum the risk of accidental decent of load; adequate precautions shall be taken to reduce to a minimum risk of any part of the suspended load becoming accidentally displaced. When workers are employed on electrical installations, which are already energised, insulating mats, wearing apparel such as gloves, sleeve and boots, as may be necessary shall be provided. Workers shall not wear any rings, watches and carry keys or other materials, which are good conductors of electricity.
- (o) These safety provisions shall be brought to the notice of all concerned by display on a notice board located at a prominent place at the work spot. Persons responsible for ensuring compliance with the safety code shall be named therein by the contractor.
- (p) To ensure effective enforcement of the rules and regulations relating to safety precautions, arrangements made by the contractor shall be open to inspection by the Owner/Architect/Consulting Engineer or their representatives and the inspecting officers who include any Labour Enforcement Office, or Assistant Labour Commissioner or the Chief Labour Commission Organization.
- (q) Notwithstanding the above conditions (a) to (p) the contractor is not exempted from the operation of any other Act or Rule in force.
The Contractor shall at his own expense arrange for the safety provisions indicated from (a) to (o) above or as required by the Owner/Architect/Consulting Engineer in respect of all labour directly or indirectly employed for performance of the works and shall provide all facilities in connection therewith. In case the contractor fails to make arrangements and provide necessary facilities as aforesaid, the Owner/Architect/Consulting Engineer shall be entitled to do so and recover the costs thereof from the contractor. However, responsibility of any accident remains with the contractor.
Failure to comply with model rules for labour welfare, safety code or the provisions relating to report on accidents shall make the contractor liable to pay to Employers as liquidated damages an amount not exceeding Rs.500/- for each default or materially incorrect statement. The decision of the Owner/Architect/Consulting Engineer in such matters based on reports from the Inspection Officers as defined above shall be final and binding and

deductions for recovery of such liquidated damages may be made from any amount payable to the contractor.

E EXECUTION OF WORKS - TIME AND DELAYS:

26. Time:

The time is the essence of the contract and whole of works are to be completed within the time limit, specified in Tender Notice (Volume-II) from the date of issue of work order/letter of intent or from expiry of mobilization period or from the date of handing over the site, whichever is later.

The employer through the Architect or Consulting Engineer reserve their right to fix up the further 'Priorities' and 'Phasing' of the work in which order the works are to be executed. For this purpose, the Owner/Architect/Consulting Engineer will be entitled to indicate the dates of commencement and completion of various sections and/or part of the works within the overall time mentioned in the contract and the contractor will be bound to abide by the said dates. Failure to do so shall make the contractor liable for the compensation for delay as per clause-30 of these conditions. Provided always that the Owner/Architect/Consulting Engineer while indicating the date of commencements and completions, as aforesaid shall give adequate considerations to the prevailing circumstances and allow reasonable time for the completion of each section and/or part of the works as the case may be.

Sufficient drawings to start the line out and excavation will be issued to the Contractor initially. Further drawings and details will be issued progressively such that work progress does not suffer.

27. Time and Progress chart: (Commonly referred to as Bar Chart):

As soon as possible after the contract has been entered into and before the work under it is begun, the contractor shall submit to the Owner/Architect/Consulting Engineer, 'Time and Progress Chart' of the various parts/Sections of the job in direct relations to the time referred to above and shall indicate the forecast of the dates for commencement and completion of the various trades progress or sections of the work. This chart shall be the basis to gauge the progress or otherwise of the works. During the progress of the works, this chart may be amended as required by agreement between the Owner/Architect/Consulting Engineer and the Contractor within the limitation of the time imposed by the Clause-3 of Form of Tender (Volume-II) to allow for any particular requirement of the employer to suit the exigencies of the work.

28. Suspension of work:

The contractor shall suspend the execution of the works or any part or parts thereof, whenever called upon, for whatever reasons it might be, in writing by the Owner/Architect or Consulting Engineer to do so, and shall not resume work thereon until so directed in writing by them. The contractor will be allowed extension of time for completion not less than the period of suspension but no other claim in this respect, for compensation or otherwise, however will be admitted.

29. Extension of time:

If in the opinion of the Owner/Architect/Consulting Engineer the work is delayed:

- i) By force majeure or
 - ii) By reason of abnormally bad weather or
 - iii) By reason of serious loss or damage by fire, or
 - iv) By reason of civil commotion, local combination/grouping of workmen, strike, or lock-out, affecting any of the trades employed on the work, or
 - v) By delay on the part of nominated sub-contractors or nominated suppliers which the contractors, in the opinion of the Architect, had taken all practical steps to avoid, or reduce, or
 - vi) By delay on the part of other contractor or tradesmen engaged by the employers to execute work forming part of this contract, or
 - vii) By reason or any other cause, which are beyond contractors' control,
- The Owner/Architect/Consulting Engineer shall make fair and reasonable extension, in the completion dates of individual items of work and of the contract as a whole. The Owner/Architect/Consulting Engineer will communicate such extension to the contractor, in writing. In the event of contractor not agreeing to the extension granted by the Owner/Architect/Consulting Engineer as aforesaid, the matter will be referred to the Arbitration in accordance with the clause 73 as given hereafter. No other claim in this respect for compensation or otherwise however will be admissible.

The Owner/Architect/Consulting Engineer will, have the power to grant post-facto Extension of Time'.

Upon the happening of any such event causing delay, the contractor shall immediately give notice thereof in writing to the Owner/Architect/Consulting Engineer but shall nevertheless use constantly his best endeavor to prevent or make good the delay and shall do all that may reasonably be required to the satisfaction of the Owner/Architect/Consulting Engineer to proceed with the works.

30. Compensation for delay:
If the contractor fails to complete the works and clear the site on or before the contract or the extended date(s)/period(s) of completion, he shall without prejudice to any other right or remedy of the Employer on account of such breach, pay as compensation, an amount equal to half percent (1%) of the contract value of the whole work(s) for every week that the whole of work remains incomplete, provided that the total amount of compensation to be paid under this condition shall not exceed five percent (5%) of the contract value. The amount of compensation may be adjusted or set off against any sum payable to the contractor, under this contract.

F EXECUTION OF WORKS - DEVIATIONS & VARIATIONS:

31. Reduction in scope of contract:
If any time after the commencement of the works, the Employer shall, for any reason whatsoever, not require the whole work or part thereof as specified in the tender document to be carried out, the employer shall be at liberty to give notice in writing of the fact to the contractor, who shall have no claim to any payment or compensation whatsoever on account of profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the full amount of the works not having been carried out. Such reduction in the scope of the contract shall not be considered as a deviation under clauses 32, 33, 34 below.
The contractor shall, however, be paid for the amount of works actually executed including such additional works as may be rendered necessary by such reduction of works or as may be ordered by the Owner/Architect/Consulting Engineer at rates in Priced Bills of Quantities.
32. Employer's right to execute other works:
The employer shall have right to execute other works (whether or not in connection with the works) on the site contemporaneously with the execution of the works and the Contractor shall give reasonable facilities for such purposes. The employer also reserve the right of taking over, at any time, any portion of the site which the employer may require and the contractor shall at his own expense clear such portions of the site forthwith.
33. Deviations - order in writing:
The contractor in no circumstance shall make any alteration, addition to or omission from the works as described in the Priced Bills of Quantities and Specification and as shown on drawings, except in pursuance of the written instructions of the Owner/Architect/Consulting Engineer. 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 not the result of an order given under this Clause but is the result of the quantities exceeding or being less than those stated in the Bills of Quantities. Provided also that if for any reason the Consultant shall consider it desirable to give any such order verbally, the contractor shall comply with such order and any confirmation in writing of such verbal order given by the Consultant whether before or after the carrying out of the order shall be deemed to be an order in writing within the meaning of this clause. Provided further that if the contractor shall confirm in writing to the Consultant any verbal order of the Consultant and such confirmation shall not be contradicted in writing by the Consultant it shall be deemed to be an order in writing by the Consultant.

The Employer may, however, make additions, deletions, alterations, omissions and deviations in the Specifications and scope of work at their sole discretion. Whenever the employer intends to exercise such rights, their intention shall be communicated to contractor through the Owner/Architect/Consulting Engineer, whose order in writing shall specify the deviations which are to be made, the proposed basis of payment, the extra time allowed, if any, and the date of completion of the entire Contract. Any objection by the Contractor to any matter concerning the order shall be notified by him in writing to the Owner/Architect/Consulting Engineer within seven days from the date of such order but under no circumstances shall the progress of the works be stopped (unless so ordered by the Owner/Architect/Consulting Engineer) owing to any differences of opinion or controversy that may arise from such objection. In default of such notification, the Contractor shall be deemed to have accepted the order and the conditions stated therein.

34. Variation:

Power to Consultant to Fix Rates:

If the nature or amount of any variation-omission or addition relative to the nature of the whole of the Contract work or to any part thereof shall be such that in the opinion of the Consultant the rate or price contained in the contract for any item of the works is by reason of such omission or addition rendered unreasonable or inapplicable, the Consultant shall fix such other rate or price as in the circumstances he shall think reasonable and proper.

Provided also that no variation of rate or price under this Clause shall be made unless as soon after the date of the order as is practicable and in the case of extra or additional work before the commencement of the work or as soon thereafter as is practicable, notice shall have been given in writing:

- (a) By the Contractor to the Consultant of his intention to claim extra payment or a varied rate or

(b) By the Consultant to the Contractor of his intention to vary a rate or price as the case may be.

35. Assignment or transfers of contract:

The contractor shall not without the prior written approval of the Owner/Architect/Consulting Engineer subject, assign or transfer the Contract, or any part thereof, or any share, or interest therein. No sum of money to become payable under the Contract shall be payable to any person other than the Contractor.

In the event of the Contractor's contravening this condition, the Employer shall be entitled to place the contract elsewhere on the Contractor's account and at his risk and the Contractor shall be liable for any loss or damage which the Employer may sustain as the consequences or arising out of such replacing of the Contract.

36. Orders under contract:

All orders, notices, etc., to be given under the contract shall be in writing, typescript or printed and if sent by registered post to the last known place of abode or business of the Contractor or to his field office shall be deemed to have been served on the date when in the ordinary course of post it would have been delivered to him.

The contractor shall comply with all orders and directions given to him without delay.

G EXECUTION OF WORKS - INDEMNITIES & INSURANCES:

37. Patent rights and Royalties:

For all the works in the scope of contractors i.e. materials as well as execution, the Contractor shall fully indemnify the employers against any action, claim or proceeding relating to infringement or the use of any patent or design or any alleged patent or design rights, and shall pay any royalties which may be payable in respect of any item or article or part thereof included in the contract. In the event of any claims being made or action brought against the Employer by a third party in respect of any such matters as aforesaid, the Contractors shall immediately be notified thereof, who thereupon shall take such action as will immediately release the Employer from any liabilities whatsoever arising out of or relating to such claims and actions of the third party. The employer shall retain the full right to deduct and/or recover from the Contractor's dues any sum as may be necessary to immediately release the Employer from the aforesaid liabilities and pay the same to the party or parties concerned under advice to the contractor. Any such payment or payments shall be deemed to have been actually paid to the Contractor, so far as the Employer is concerned. Any action for the recovery and/or to challenge the rights of the demanding party shall be the sole responsibility of the Contractor and the Employer

shall have nothing to do with the same.

38. Notice and Fees:

- (i) The Contractor shall give all notices and pay all fees required to be given by any statutory provision or by the regulations and/or by-laws of any local authority and/or any public service, company or authority in relation to the execution of works and by the rules and regulations of all public bodies and companies whose properties or rights are affected or may be affected in any way by the works. The contractor shall pay and indemnify the Employer against any fees, or charges demandable by law under such acts, regulations and/or by-laws in respect of the works.
- (ii) The employer will repay or allow to the contractor all such sums as Owner/Architect/Consulting Engineer shall certify to have been made properly payable and paid by the contractor in respect of such fees.

39. Parliamentary acts etc:

The Contractor shall conform in all respects with the provisions of any general or local act of Parliament and/or state Legislature and also with the Regulations of Bye-Laws of any local or other statutory authority which may be applicable to the work or to any temporary work and with such rules and regulations of public bodies and companies as aforesaid and shall keep the Employers indemnified against all penalties and liabilities of every kind for breach of any such Act, Regulations or Bye-Laws.

40. Precautions against risk - General:

The contractor shall be responsible, at his own expense, to take precautions to prevent loss or damage from any and all risk, and to minimize the amount of any such loss or damage, and for the provision of all protective works, casings, and coverings etc., required for the purpose, until the works have been handed over complete to the Employer. For this purpose, the Contractor should take necessary Insurance Policy/Policies.

The Contractor shall provide all watchmen necessary for the protection of the site, the works and of materials and plant and of all things on the site, during the progress of the works and shall solely be responsible for and shall take all reasonable and proper steps for protecting, securing, lighting and watching all places on or about the works and site which may be dangerous to whomsoever.

The Contractor shall at all times indemnify and keep indemnified the Employer against all claims which may arise out of all risks of fire, accidents or damage which may occur on the site to the works or works relating to this work from whatever because it may be and which may be preferred against the Employer.

Notwithstanding that all reasonable and proper precautions may have been taken by the Contractor at all times during the progress of works, Contractor shall nevertheless be held entirely responsible for all damages whether to the works themselves or to any other property or to the lives, persons or property of others during the progress of the works and the period of maintenance.

In any case the Contractor shall be bound to bear the expenses of defense of every suit, action or other proceedings at law relating to injury of any persons or the works themselves or any other property etc. and shall pay the damages and costs, which may be awarded in any such, action or proceedings.

41. Workmen's compensation:

This is a statutory obligation under Master and Servants Law as well as Labour Law for providing compensation to any worker, whether permanent or casual daily wages, who meets with an accident at site or at any other place while he was discharging his duty. Contractor shall take Workmen's Compensation Policy as per provision of Workmen's & Sub-contractors Compensation Act to cover his/all permanent and temporary employees at site. Before the start of the work, the Contractor must submit a copy of all required policy including contractors all risk policy to the owner.

42. Insurance against accident etc. To workmen:

(i) The Contractor shall indemnify the owner and insure against any damages or compensation payable at law in respect or in consequence of fire or any accident or any injury to any workmen or other persons in employment of the contractor or any sub-contractor save and except an accident or injury resulting from any act or default of the owner, his agents or servants and shall continue such insurance during the whole of the time that any persons are employed by him on the works provided always that in respect of any persons employed by any sub -contractor the contractor's obligation to insure as aforesaid shall be satisfied if the Sub-contractor shall have insured against liability in respect of such persons in such manner that the Owner is indemnified under the policy.

(ii) Without limiting his obligations and responsibilities under clause-64 hereof the Contractor shall insure in the joint names of the Owner and the Contractor against all loss or damage from whatever cause arising (other than the excepted risks) for which he is responsible under the terms of the contract.

43. Insurance of materials, plants etc.:
- It is advisable that the contractor takes adequate insurance for the materials, constructional plant and other things brought on site by the contractor to the full value of such materials, constructional plant, temporary works and other things.
44. Third party insurance:
- Before commencing the execution of the works the Contractor (but without limiting his obligations and responsibilities under Clause 40 & 41 hereof) shall insure against any damage loss or injury which may occur to any property or to any person (including property and employees of the Owner) by or arising out of the execution of the Works or Temporary Works or in the carrying out of the Contract otherwise than due to the matters referred to in the clause-39 hereof.
- The minimum amount of a single policy at all the times to cover third party shall be Rs.2.50 lakhs.
45. General provisions as to insurance-remedy on contractor's failure to insure:
- (i) All insurances to be effected by the Contractor under clauses 40 to 44 hereof or otherwise under the contract shall be effected with an insurer and in terms approved by the Owner (which approval shall not be unreasonably withheld) and the Contractor shall produce to the Owner/Consultant or the Owner/Consultant's representative the policy or policies of insurance and the receipt of the payments within one month of the work order/starting of work whichever is later. Otherwise the payment of the Contractor's bill, if any, can be withheld till the same are submitted.
 - (ii) All such insurance shall (save as otherwise expressly provided) be kept in force by the Contractor in such manner that the Owner and Contractor are covered during the period of construction of the Works and are also covered during the period of Maintenance for loss or damage arising from a cause occurring prior to the commencement of the Period of Maintenance and for any loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations under Clause-64 hereof.
 - (iii) If the Contractor fails to effect and keep in force the insurances referred to in Clause 40 to 44 hereof or any other insurance which he may be required to effect under the terms of the Contract, the Owner may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the Owner as aforesaid from any payment due or which may become due to the Contractor or recover the same as a debt due from the Contractor. However, under this clause contractor cannot escape from his liability.

46. Employer's obligation:
Employer will take insurance to cover full value:
- (i) For the property under execution, including the cost of materials issued to the Contractor by the Employer end.
 - (ii) For any possible damage to the surrounding /adjoining property, if there is a possibility of such damage, during the execution of the work.
- Note: This insurance is generally taken such that the value / amount of insurance is increasing progressively as the work progresses at site.
47. Fair wage:
The Contractor shall pay not less than fair wage to labourers engaged by him on the work. 'Fair Wage' means wages not less than "Government of Gujarat minimum wages" of labour in force as fixed by the administrative and/or wage fixing authorities on the date of issue of Notice of Tender.
The Contractor shall notwithstanding the provision of any condition to the contrary, cause to be paid fair wages to labourers indirectly engaged on this work, including any labour engaged by his labour contractor and/or sub-contractors in connection with the said work as if the labourers had been directly employed by him.
In respect of all labour directly or indirectly employed in the work for the performance of the contractor's part of this agreement, the Contractor shall comply or cause to be complied with the "labour regulations" framed by the local authorities and any breach thereof shall be deemed to be breach of this part of this contract agreement in all intentions and purposes.
The Employer shall have the right to deduct from the payment due to the contractor, any sum required or estimated to be required for making good the loss suffered by a worker or workers, by reason of non-payment of wages or of deductions made from his or their wages and the observance of Regulations.
The regulation aforesaid shall be deemed to be a part of this contract and breach thereof shall be deemed to be a breach of this contract.
48. Medical facilities:
The Contractor shall arrange to provide necessary medical attendance and aid, including the provisions and use of drug and medical supplies to his own labour and employees. The Employer shall have no concern whatever for the matter.
49. Maternity benefit rules for female workers employed by contractor:
Maternity benefit rules for female workers employed by the Contractors, leave and pay during leave shall be regulated as follows: -
- (a) Leave:
 - (i) In case of delivery:
Maternity leave not exceeding 8 weeks - 4 weeks up to and including

the day of delivery and 4 weeks following that day.

- (ii) In case of miscarriages:
Up to 3 weeks from the date of miscarriage.

(b) Pay:

- (i) In case of delivery:
Leave pay during maternity leave will be at rate of women's average daily earnings calculated on the total wages earned on the days when full time work was done during a period of three months immediately preceding the date on which notice is given that she expects to be confined or at the minimum per day rate as per prevalent regulations whichever is greater.
- (ii) In case of miscarriage:
Leave pay at the rate of average daily earning calculated on the total wages earned on the days when full time work was done during the period of 3 months immediately preceding the date of such miscarriage.

H EXECUTION OF WORKS - MEASUREMENTS & PAYMENTS:

50. Approval of works by stages:

All work embracing more than one process shall be subject to examination and approval at each stage thereof and the Contractor shall give due notice in writing to the Owner/Architect/Consulting Engineer when each stage is ready. In default of such notice being received, the Owner/Architect/Consulting Engineer shall be entitled to approve quality and extent thereof and in the event of any dispute the decision of the Owner/Architect/Consulting Engineer thereon shall be final and conclusive.

51. Inspection of the work:

The Owner/Architect/Consulting Engineer/Employer shall have power at any time to inspect and examine any part of the works and the Contractor shall give such facilities as may be required to be given for such inspection and examination.

Should the Owner/Architect/Consulting Engineer consider, at any time during the construction or reconstruction or prior to the expiration of the maintenance period, that any work has been executed with unsound, imperfect or unskillful workmanship or of a quality inferior to that contracted for, or not otherwise in accordance with the Contract (in respect whereof the decision of the Owner/Architect/Consulting Engineer shall be final, binding and conclusive) the Contractor shall on demand in writing from the Owner/Architect/Consulting Engineer specifying the fault, notwithstanding the same may have been

inadvertently passed, certified and paid for, forthwith rectify or remove and reconstruct the work so specified, in whole or in part as the case may require, at his own expense, and in the event of his failing to do so within a period to be specified by the Owner/Architect/Consulting Engineer in their demand aforesaid, Employer may arrange to carry out the work by other means at the risk and expense in all respects of the Contractor under the condition that the same shall not extend beyond the maintenance period except as regards workmanship which the Owner/Architect/Consulting Engineer shall have previously given notice to the Contractor to rectify.

In case the Employer carrying out any work at the risk and expense of the Contractor under the provisions of this condition, the Employer may do so by any means and agency at their sole discretion and the cost thereof as certified by the Owner/Architect/Consulting Engineer shall be final, binding and conclusive on the parties.

There will be a third party inspection of the work during execution and after the work is completed.

There will be a yearly inspection of the site for the checking of the satisfactory working and verify the things.

52. Records and measurements:

The Contractor shall submit to the Owner/Architect/Consulting Engineer 'Dimension Sheets' in approved form, detailing the measurements of all works done by him in pursuance of this Contract. Such 'Dimension Sheets' shall be submitted in four copies, and one copy shall be returned to the Contractor duly certified by the Owner/Architect/Consulting Engineer, on the basis of which the Contractor shall submit the On-Account Bills and Final Bill. The 'Dimension Sheets', certified by the Owner/Architect/Consulting Engineer shall be final record as to the quantities of work actually executed under this Contract and shall be conclusive evidence in respect thereof. Unless otherwise specified, the whole works are to be measured as per method stipulated in the latest BIS Code IS:1200 or General Good Engineering Practice and the interpretation thereof by the Owner/Architect/Consulting Engineer shall be final and binding on the contracting parties and photographs.

In the event of any dispute as to the method of measurements, the opinion of the Owner/Architect/Consulting Engineer shall be final, binding and conclusive to all concerned.

53. Valuation:
All works measured shall be valued on the basis of the rates of priced bill of quantities attached in so far as such rates or prices apply. Where the rates in the priced bill of quantities do not apply, the value shall be based upon rates or prices deduced there-from so far as it is practicable to do so or otherwise such rates are to be determined by the Owner/Architect/Consulting Engineer as per clause-54.
54. Altered, additional & substituted works - extra items / non tender items:
- (i) If the rates for the additional or substituted works are specified in the Contract for the work, Contractor is bound to carry out additional, altered or substituted works at the same rates as are specified in the Contract of the work.
 - (ii) If the rates for the additional, altered or substituted works are not specifically provided in the Contract for the work, the rates will be derived from the rates for a similar class of work as specified in the Contract for the work.
 - (iii) If the rates for altered, additional or substituted works cannot be determined in the manner specified in sub-clauses (i) and (ii) above, the Contractor shall within seven days of receipt of order to carry out work, inform the Owner/Architect/Consulting Engineer the rates which he intends to charge for such class of work. This shall be supported by detailed analysis of the rate or rates claimed, wherein a total of 15 percent towards Contractors expenses, overheads profits etc. shall be added to the costs of material and labour along with the necessary and original supporting bills/vouchers. The Owner/Architect/Consulting Engineer shall then determine the rate or rates payable and ask the Employer to pay the Contractor accordingly. However, the Owner/Architect/Consulting Engineer by notice in writing will be at liberty to cancel his order to carry out such class of work and arrange to carry out in such a manner, as he may consider advisable. **But under no circumstance, the Contractor shall suspend the work on the plea of non-settlement of the rates of items falling under this clause.**
55. Day work:
When extra work cannot be properly measured or valued, the Contractor shall be allowed day work prices at the net rates stated in the Priced Bills of Quantities or, if not stated, in accordance with local day work rates and wages in district provided that in either case vouchers specifying the daily time and, if required by the Owner/Architect/Consulting Engineer workman's name and material employed be submitted for verification to the Owner/Architect/Consulting Engineer, or his

representative not later than the end of the week following the week in which the work has been executed.

The Contractor shall on demand produce before the Owner/Architect/Consulting Engineer all such original receipted vouchers, muster rolls, time sheets and other documents as in the opinion of the Owner/Architect/Consulting Engineers are necessary for the proper assessment of the rates. In case where the rates are to be based on muster rolls and time sheets, these documents shall be produced before the Owner/Architect/Consulting Engineer on the very day the labour was engaged for his check and signature to certify to that effect. The entire responsibility to this respect falls on the Contractor and in the event of the Contractor's failure to do so, the Owner/Architect/Consulting Engineer shall be entitled to assess the 'labour expended' and allow for such 'labour elements' in the proposed rates.

In case of any disputes and disagreement as to the rates to be paid for the items of works executed or to be executed under this Contract, the matter shall be referred to the Arbitration in terms of the clause 73, but the **Contractor shall not under any circumstances, suspend the work on account of the said disputes and disagreement.**

The Contractor must under all circumstances carry out the works or the items of works as directed by the Owner/Architect/Consulting Engineer and on completion of the Contract refer the matters in dispute to the Arbitration under clause 73, for the final settlement of the issue involved.

56. Ad hoc payments:

No Mobilization Advance, No Material Advance

Up to 70% of the running bill amount, based on measurements submitted by the Contractor, may be certified by the Owner/Architect/Consulting Engineer as an ad hoc payment after preliminary scrutiny of the submitted bill.

Generally, no ad hoc payment shall be certified on any bill, till the clarifications sought by the Architect/Consulting Engineer on the previous bills are satisfactorily complied with by the Contractor.

The Owner/Architect/Consulting Engineer shall from time to time certify the sums to which the Contractor is entitled to after retaining an amount deemed proper by Owner/Architect/Consulting Engineer and forward the said certificate to Employer for payment of the sum certified. A copy of the said certificate shall be issued to the Contractor who shall, on presenting any such certificate to the Employer be entitled to payment thereof within fifteen days from the date of presentation.

Any certificate relating to work done or materials delivered may be modified or corrected by any subsequent interim certificate or by the final certificate and no

certificate of the Owner/Architect/Consulting Engineer supporting a payment shall be, by itself, conclusive evidence that any work or materials for which it is related are in accordance with the Contract, and that such works are approved finally.

The payment under the interim certificate shall be made purely as an advance against the job done which will ultimately be adjusted against the Final Bill.

The minimum value of work for which the Contractor will be entitled interim payment will be as per Form of Tender (Volume-II).

57. Final bill:

The contractor shall submit his final bill within three months after the date of virtual completion of work mentioned in the certificate as per clause 1(k) of Volume-I. In case final bill is not submitted within three months after the date of virtual completion of work, the last R. A. bill submitted by the contractor will be entertained. Contractor shall obtain a virtual completion certificate from Architects/Consulting Engineers on virtual completion of the work.

The contractor shall submit to the Owner/Architects/Consulting Engineer his "Final Bill" drawn in approved manner on the basis of the "Dimension Sheets" certified by the Owner/Architects/ Consulting Engineer. The Final Bill shall be accompanied by all abstracts, vouchers etc. supporting it.

No other claim will be entertained after the receipt of the Final Bill.

The contractor shall be entitled to be paid up to 95% (ninety five percent) of the final sum less the payments already received by them and value of materials supplied by the employer on various "On account bills".

2/3 (two third) of the balance 5% will be paid to the contractor based on the certificate given by the Architects/Consulting Engineer after the expiry of six months from the date of issue of completion certificate, as per clause 62 of Volume-I, by the Architects/Consulting Engineer and the remaining 1/3 (one third) will be paid after the expiry of maintenance period of twelve months from the date of issue of completion certificate.

No charge shall be allowed to the contractor on account of the preparation of the final bill. Period of payment shall be as per Form of Tender.

Final bill will not, however be paid until the contractor has cleared the site to the satisfaction of the Architects/Consulting Engineers/Employers and a "No Demand Certificate" as per Performa given below is given by the Contractor.

Performa for
NO DEMAND CERTIFICATE

(A Certificate to be signed and stamped by the Contractor on his letterhead, at the time of receiving payment of final bill).

We hereby abide by the fact that we have no claim whatsoever against the work carried out so far except certified by SMPS Consultants Private Limited vide their letter No. SPL/...../ Dated.....

Signature of the Contractor Name & Address of the Contractor.

58. Claims:

Should there be any claim of the Contractor arising out of or relating to the performance of the Contract (of whatever nature such claim may be) the Contractor shall give notice of such claim specifying the claim, cause of claim and details in support of the valuation of the claim, to the Employer and to the Owner/Architect/Consulting Engineer within fifteen days from the date of happening of the event leading to the cause of claim, failing which, no such claims will be considered.

59. Issue of certificates & payment of bills:

Payment of Bills will be made by means of "electronic transfer" cheque to the contractor within the periods mentioned below:

- | | | |
|-------|-------------------------------------|--|
| (i) | For Interim Certificate | Thirty days from the date of issue of Interim Certificate |
| (ii) | For Final Certificate | Sixty days from the date of issue of Final Certificate |
| (iii) | Period for Submission of Final Bill | Ninety days from the date of issue of Work Completion Certificate by Architects |
| (iv) | Period of Issuing Final Certificate | Thirty days from the date of Submission of the Final Bill by contractors. (Incomplete Final Bill will not be accepted by the Architects) |

60. Recovery from contractor:

Whenever under the Contractor, any sum of money shall be recoverable from or payable by the contractor, the same may be deducted from any sum then due or which at any time thereafter may become due to the contractor under the contract.

61. Valuation of sub-standard works: (all sub-standard work has tube replaced if not useable)

Any item or items of work which are found to be executed by the contractor with faulty workmanship not in accordance with the tender specifications, such items

shall be valued and paid for at reduced rate(s) deemed fit solely at the discretion of the Owner/Architect/Consulting Engineer provided always that these will not cause any harm with regard to the strength and stability of the structure(s). Such payments of sub-standard work do not relieve the contractor of his responsibility for the stability / performance of the item of work or the structure as a whole and does not prejudice the right of the employer for his claims against defects during maintenance period due to such sub-standard works.

62. Completion certificate:

- (i) As soon as the work is completed, the Contractor shall give notice of such completion to the Owner/Architect/Consulting Engineer and within **20 days of receipt of such notice, the Owner/Architect/Consulting Engineer shall inspect the work and shall furnish the Contractor with a certificate of completion (as per Performa given below) indicating (a) the date of completion, (b) defects to be rectified by the Contractor and/or (c) items for which payment shall be made at reduced rates.** When separate periods of completion have been specified for items or groups of items, the Owner/Architects/Consulting Engineers shall issue separate Completion Certificates for such items or groups of items. No Certificate of completion shall be issued, nor shall the work be considered to be complete till the Contractor has removed, from the premises on which the work has been executed, all scaffoldings, sheds, and surplus materials (except such as are required for rectification of defects), rubbish and all huts and sanitary arrangements required for his workmen on the site in connection with the execution of the work as shall have been erected by the Contractor for the workmen and cleaned all dirt from all parts of work sites, in, upon or about which the work has been executed or of which he may have had possession for the purpose of the execution thereof and cleaned floor, gutters and drains, eased doors and sashes, locks and fastening, labels and keys and hand them over to the Owner/Architect/Consulting Engineer or Employer or his representative and make the whole premises fit for immediate occupation or use to the satisfaction of the Owner/Architect/Consulting Engineer. If the Contractor shall fail to comply with any of the requirements of these conditions as aforesaid, on or before the date of completion of the works, the Owner/Architect/Consulting Engineer may at the expense of the Contractor, fulfill such requirements and dispose of the scaffoldings, surplus materials and rubbish etc. as he may think fit and the Contractor shall have no claim in respect of any such scaffolding or surplus materials except for any sum actually realized by the sale thereof, less the cost of fulfilling the

requirements and any other amount that may be due from the Contractor. If the expense of fulfilling such requirements is more than the amount realized on such disposal as aforesaid, the Contractor shall forthwith on demand pay such excess.

- (ii) If at any time before completion of the entire work, items or groups of items for which separate periods of completion have been specified, have been completed, the Owner/Architect/Consulting Engineer with the consent of the Contractor, take possession of any part or parts of the same (any such part(s) being hereinafter in this condition referred to as 'the relevant part' notwithstanding anything expressed or implied elsewhere in this Contract).
 - (a) Within twenty days of the date of completion of such items or groups of items or on possession of the relevant part, the Owner/Architect/Consulting Engineer shall issue a completion certificate for the relevant part as in condition (i) above provided the Contractor fulfils his obligations under that condition for the relevant part.
 - (b) The maintenance period in respect of such items and the relevant part shall be deemed to have commenced from the certified date of completion of such items or relevant part as the case may be.
 - (c) For the purpose of ascertaining compensation for delay under clause 30 in respect of any period during which the works are not completed, the relevant part will be deemed to form a separate item or group, with date of completion as given in the Contract or as extended under clause 29 and actual date of completion as certified by the Architect under this condition.

PROFORMA
FOR
CERTIFICATE OF COMPLETION

To
M/s.

Ref: Your letter dated _____

Re: Virtual Completion for Bore well Work of _____ for M/s. _____ at _____

Reference to the above and as requested by you, we hereby certify that the civil construction work of _____ for M/s. _____ at _____ was

virtually completed as on _____.

Thanking you,

Yours faithfully,

For

Notes:

- (1) This certificate shall be issued by the consultants on a written request by the contractors after completing the work; excluding the points of minor repairs.
- (2) After the client has taken possession of the premises or has started using the premises or has consented to issuance of such certificate to the contractor.
- (3) The maintenance period of the contract starts from the date of virtual completion of the works.

63. Nominated sub-contractors:

All Specialists, Merchants, Tradesmen and others (Executing any work or supplying and fixing any goods for which basic rates or prime cost price or provisional sums are included in the Bills of Quantities and or Specification) who may be nominated or selected by the Owner/Architect/Consulting Engineer are hereby declared to be Sub-Contractors employed by the Contractor and are herein referred to as nominated Sub-Contractors.

The Sub-Contractor shall meet with the following conditions:

- (a) The nominated Sub-Contractor shall indemnify the Contractor against the same obligations in respect of the Sub-Contract as the Contractor is under in respect of this Contract.
- (b) The nominated Sub-Contractor shall indemnify the Contractor against claims in respect of any negligence by the Sub-Contractor, his staff or agents or any misuse by him or them of any scaffolding, plant or other property of the Contractor or under any workman's compensation act in force.
- (c) Payment shall be made by the Contractor to the nominated Sub-Contractor within fourteen days of the receipt of the Owner/Architect/Consulting Engineer's certificate provided that before any certificate is issued the Contractor shall upon request furnish to the Owner/Architect/Consulting Engineer proof that all nominated Sub-Contractors amounts included in previous certificates have been duly discharged, in default whereof the Employer may pay the same (to such nominated sub-contractors) upon a certificate of the Owner/Architect/Consulting Engineer and deduct the amount thereof from any sums due to the Contractor. The exercise of this power shall not create private of Contract between Employer and Sub-Contractor.

I EXECUTION OF WORKS - MAINTENANCE:

64. Maintenance:

The Contractor guarantees the whole of the materials and the work. He shall protect the works until the completion of the same as certified in writing by the Owner/Architect/Consulting Engineer.

He shall also maintain in good condition the whole of the works until the expiration of the maintenance period of twelve months after the certified completion of the works as a whole or in sections, and he shall also be liable for the soundness and stability thereof, and be responsible for injury to any person or property owing to any settlement, failure, defect, damage or fault due to any cause whatsoever other than earthquake or fire during this period. However the Contractor shall indemnify the owner as per clauses 41 & 42 against such accidents. This liability and responsibility is in addition to the liability and responsibility under the clause 40 hereof and shall not be affected or removed by any certificate of satisfaction or for payment of money which the Owner/Architect/Consulting Engineer may at any time give or has given. Moreover, the Contractor shall, at his own cost, restore such settlement, failure, defect, damage, or fault without charge to the Employer or the Employer may restore such settlement, failure, defect, damage at the Contractor's risk and cost. In any case the Contractor shall be liable for and shall pay and make good to the Employer or other person or parties being entitled thereto, all losses, costs and expenses they or any of them may be put to or be liable to by reason or in consequence of the settlement, failure, damage or defect and the Employer may deduct the amount of losses, cost or expense from any sum due or to become due to the Contractor or may recover the same from him.

In the event of the works being taken possession of and occupied by the Employer, under the provisions of these conditions, the Contractor shall be liable for the cost of maintenance, during 12 months from the date of completion, as certified in writing by the Owner/Architect/Consulting Engineer and the Owner/Architect/Consulting Engineer's certificate as to the amount of cost of completing the works under this contract and as to the amount of the cost of the maintenance during the said term of twelve months shall be final, binding and conclusive upon all parties to this contract.

The Employer shall, notwithstanding, be at liberty to use the said work during the maintenance period.

The defects or other faults which may appear within the said maintenance period and which in the opinion of the Owner/Architect/Consulting Engineer who shall be the sole deciding authority in this respect have arisen from material or workmanship not in accordance with the Contract shall be rectified by the Contractor at his own

cost to the satisfaction of the Owner/Architect/Consulting Engineer. The contractor shall deploy best resources to carry out the rectification works in shortest possible period in response to the notice issued by the Owner/Architect/Consulting Engineer specifying the defects and directing the rectification thereof. Failing this rectification, the Employer will be at liberty to rectify the said defects by and through any other agency at their sole discretion entirely at the risk and cost of the Contractor. In the event of such rectification being carried out by the employer on default of the Contractor, the Employer shall be entitled to recover from the Contractor and/or deduct from the Contractor's dues such sum of money as may be certified by the Owner/Architect/Consulting Engineer as has been reasonably expended by the Employer for the rectification of the said defects. The certificate of the Owner/Architect/Consulting Engineer in this respect as aforesaid shall be final, binding and conclusive to the parties. Provided always that the liability of the Contractor under this condition shall not extend beyond the maintenance period as aforesaid except as regards the defects and faults which the Owner/Architect/Consulting Engineer may have previously given notice to the Contractor to rectify.

65. Liability of damage, defective and imperfect work:

The Contractor shall guarantee the installation/work for a period of 12 months from the date of issue of completion certificate. Any damage or defect or imperfection that may arise or lie undiscovered at the time of issue of completion certificate, connected in any way with the equipment or materials supplied by him or in the workmanship shall be rectified or replaced by the contractor at his own expense as deemed necessary by the Owner/Architect/Consulting Engineer or in default, the Owner/Architect/Consulting Engineer may cause the same to be made good by other agency and deduct expenses (for which the certificate of Owner/Architect/Consulting Engineer shall be final) from any sums that may be then due to or at any time thereafter, become due to the Contractor or from his security deposit.

J SPECIAL RISKS AND FRUSTRATION:

66. (i) No liability for war, etc. Risks:

NOTWITHSTANDING ANYTHING CONTAINED IN THE CONTRACT, the Contractor shall be under no liability whatsoever whether by way of indemnity or otherwise for or in respect of destruction of or damage to the Works (save to the work condemned under the provisions of clause 14(v) hereof prior to the occurrence of any special risk hereinafter mentioned) or

Temporary works or to property, whether of the Owner or third parties or for all in respect of injury or loss of life which is the consequence, direct or indirect of war, hostilities (whether war be declared or not), invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power riot, civil war or commotion or disorder otherwise than among the Contractor's own workmen (hereinafter comprehensively referred to as 'the said special risk'), and the Owner shall indemnify and save harmless the Contractor against and from the same and against and from all claims, demands, proceeding damages costs, charges and expenses whatsoever arising there from or in connection therewith and shall compensate the Contractor for any loss of or damage to property of the Contractor used or intended to be used for the purpose of the Works and occasioned either directly or indirectly by the said special risks and for the purpose of this condition the expression "Property of the Contractor" shall include any plant brought to on the site by the Contractor, the property in which is vested in the Owner under the terms of clause 12 hereof.

- (ii) Damage to works, etc. By special risks:
If the Works or Temporary Works or any materials (whether for the former or latter) on or near to the Site shall sustain destruction or damage by reason of any of the said special risks as per clause 66 (i) to (v) the Contractor shall nevertheless be entitled to payment for any permanent work and for any materials so destroyed or damaged and the Contractor shall be entitled to be paid by the Owner the cost of making good any such destruction or damage whether to the Works or the Temporary Works so far as may be required by the Consultant or as may be necessary for the completion of the works on a basis as the Consultant may certify to be reasonable.
- (iii) Projectile missiles, etc.:
Destruction, damage, injury or loss of life caused by the explosion or impact whenever and wherever, occurring of any mine bombs, shell, grenade or other projectile missile, munitions or explosive of war shall be deemed to be a consequence of the said special risks.
- (iv) Increased costs arising from special risks:
The Owner shall repay to the Contractor any increased cost of or incidental to the execution of the Works (other than such as may be attributable to the cost of reconstructing work condemned under the provisions of clause 65 hereof prior to the occurrence of any special risk) which is howsoever attributable to or consequent on or the result of or in any way whatsoever connected with the said special risk (subject however to the provision in this

condition hereinafter contained in regard to Outbreak of War). But the Contractor shall, as soon as any such increase of cost shall come to his knowledge, forthwith notify the Consultant thereof in writing.

(v) Outbreak of war:

If during the currency of the Contract there shall be an outbreak of war (whether war is declared or not) in any part of the world which whether financially or otherwise materially affects the execution of the work the contractor shall unless and until the contract is determined under the provisions in this condition continue his best endeavor to complete the execution of the Work provided always that the Owner shall be entitled at any time after such outbreak of war to determine this Contract by giving notice in writing to the Contractor and upon such notice being given this Contract shall (save as to the rights of the parties under this condition and to the operation of clause 73 hereof) terminate but without prejudice to the rights of either party in respect of any antecedent breach thereof.

(vi) Removal of plant on determination:

If the Contract shall be determined under the provisions of the last preceding sub-clause the Contractor shall with all reasonable dispatch remove from the Site all Constructional Plant and shall give similar facilities to his Sub-contractors to do so.

(vii) Payment if contract determined:

If the Contract shall be determined as aforesaid, the Contractor shall be paid by the Owner (in so far as such amounts or items shall not have already been, covered by payments on accounts, made to the Contractor) for all work executed prior to the date of determination at the rates and prices provided in the Contract and in addition: -

- (a) The amount payable in respect of any preliminary items so far as the work or service comprised therein has been carried out or performed and a proper proportion as certified by the Consultant of any such items of the work or service comprised therein, which has been partially carried out or performed.
- (b) The cost of materials or goods reasonably ordered for the Works or Temporary Works which shall have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery (such materials or goods becoming the property of the Owner upon such payment being made by him).
- (c) A sum to be certified by the Consultant being the amount of any expenditure reasonably incurred by the Contractor in the

expectation of completing the whole of the Works insofar as such expenditure shall not have been covered by the payment in this sub clause before mentioned.

- (d) Any additional sum payable under the provisions of sub clauses (i) (ii) and (iv) of this clause.
- (e) The reasonable cost of removal under sub-clause (vi) of this Clause and (if required by the Contractor) return thereof to the Contractor's main plant yard.

Provided always that against any payments due from the Owner under this sub-clause, the Owner shall be entitled to be credited with any outstanding balance due from Contractor for advance (if any) in respect of plant and materials and any sum previously paid by the owner to the contractor in respect of the execution of the Works.

67. Payment in event of frustration:

In the event of the Contract being frustrated whether by war or otherwise howsoever, the sum payable by the Owner to the Contractor in respect of the work executed shall be the same as that which would have been payable under clause 66 hereof if the Contract had been determined under the provisions of clause 66 hereof.

K MISCELLANEOUS:

68. Relics, Antiquities etc.:

Any finds such as relics or antiquity coins, fossils etc. met with during the course of excavation shall remain the property of the Employer.

69. Temporary office, workshops, stores etc.:

The Contractor shall during the progress of the work provide, erect and maintain at his own expense all necessary temporary workshops, stores, offices etc., as are required for the proper and efficient execution of the work. The planning, setting and execution of the buildings shall be to the approval of the Owner/Architect/Consulting Engineer and these shall at all times be kept tidy and in a clean and sanitary condition to the entire satisfaction of the Owner/Architect/Consulting Engineer, at the Contractor's expense.

70. Temporary office for resident engineer: (not applicable)

71. Termination of contract for default:

The Employer may, without prejudice to any other right or remedy which shall have accrued or shall have accrued thereafter to the Employer, terminate the Contract as a whole or so far as it is applicable to that section or sections of works in which the

Contractor has made default, by giving seven days clear notice, in any of the following cases.

If the Contractor,

- (a) Being an individual, or if a firm, any partner thereof shall at any time be adjudged bankrupt or have a receiving order or orders for administration of his estate made against him or shall take any proceedings for liquidation or compensation under any Bankruptcy Act for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport to do so or if any application be made under any Insolvency Act for the time being in force for the sequestration of his estate or if a trust deed be granted by him for benefit of his creditors, or
- (b) Being a company shall pass a Resolution or the Court shall make an order for the liquidation of its affairs or a receiver or a Manager on behalf of the Debenture Holders or circumstances shall arise which entitle the Court or debenture holders to appoint receiver or Manager; or
- (c) Refuses or persistently neglect to comply with a notice in writing from the Owner/Architect/Consulting Engineer requiring him to remove defective work or improper materials etc. or,
- (d) Fails to comply with any of the terms and conditions of the Contract, or after "Seven Day Notice" in writing with orders properly issued there under, or,
- (e) Suspends the works or part of it before completion without reasonable cause, or fails to proceed with the works with reasonable diligence; or,
- (f) Fails to complete the works and clear the site on or before the date of completion, or
- (g) Assigns, transfers, sublet or attempts to assign, transfer, or sublet, any portion of the works without the prior written approval of the Owner/Architect/Consulting Engineer.
- (h) Fails to execute the work as per the Specifications and with desired workmanship.

Whenever the Employers exercise their authority to cancel the contract under the conditions, the Employer may complete the works by any means at the Contractor's risk and expense. The contractor shall be entitled to receive payment for the work to the value thereof less the cost of completion of the works in his default as certified by the Owner/Architect/Consulting Engineer (which certificate shall be final, binding and conclusive) and if the cost so certified, exceeds the sum of the Contract, the Employer may recover the deficit from the Contractor by other means.

Provided always that the Contract shall not be terminated for defaults mentioned in Para (c), (d), (e) and (f) above unless the Contractor continues with such default for seven days after notice in writing by registered post has been given to him by the Owner/Architect/Consulting Engineers and a copy of the same has been obtained by the Employer.

In the event the Contract is terminated in part as aforesaid, the Contractor will not be released from any of his obligation remaining to be done by him.

In the event of any such termination as aforesaid, the Employer shall, without being responsible to the Contractor for the fair wear and tear of the same, be entitled to seize and take possession and have free use of all materials, tools, tackle or other things which may be on the site, for use in carrying out or reconstructing the work to the exclusion of any right of the Contractor over the same and the Employer shall be entitled to retain and apply any balance sum which may otherwise be then due on the Contractor by him, to the payment of the cost of execution of such work as aforesaid.

If the cost of executing the work as aforesaid shall exceed the balance due to the Contractor and the Contractor fails to make good the deficit, the said materials, tools, tackle construction plant or other things, the property of the Contractor as may not have been used up in the completion of the works, may be sold by the Employer, and the proceeds be applied towards the payment of such difference. The Contractor on demand shall pay any outstanding balance existing after crediting the proceeds of such sale from the Employer. But when all expenses, costs and charges incurred in the completion of the work are paid by the Contractor all such materials, tools, tackle, construction plant or other things not used in the completion of the works and remaining unsold shall be removed by the Contractor.

72. Jurisdiction:

All disputes arising out of or relating to the Contract shall be deemed to have arisen in Ahmedabad and only courts having jurisdiction over Ahmedabad shall determine the same.

73. Arbitration:

All disputes between the parties to the Contract arising out of or relating to the Contract, other than those for which decision of the Owner/Architect/Consulting Engineer is, by the Contract, expressed to be final, binding and conclusive, shall after written notice by either party of the Contract to the other of them be referred to the Joint Arbitration of the two Arbitrators, one to be nominated by each party. The parties may nominate any person they consider fit to be their Arbitrator notwithstanding the fact that such person may be connected with the work either as Owner/Architect/Consulting Engineer or as the Employer of the parties. The

Arbitrator shall appoint an 'Umpire' within 30 days from the date of entering upon the reference. The Arbitrators shall be deemed to have entered into the reference from the date when they notify the parties under joint signatures of their having entered into the reference. The Arbitrators and/or the 'Umpire' shall have the power to enlarge the time for publication of the award with the mutual consent of the parties without referring the matter to the Court under Section 28 of the Arbitration Act. Save as aforesaid, the arbitration proceeding shall be subject to the provisions of the Indian Arbitration Act of 1940 and any subsequent amendments thereto.

Unless the parties otherwise agree such reference shall not take place until after the completion, alleged completion or abandonment of the works or the termination of the Contract.

If the parties agree to refer the matter in dispute to the Arbitration before the completion of the Contract, the works under the Contract shall be continued by Contractor during the arbitration proceedings, unless the matter is such that the works cannot possibly be continued until the decision of the Arbitrators or of Umpire, as the case may be, is obtained (and save as which are otherwise expressly provided in the Contract) no payment due and payable by the Employer shall be withheld on account of such arbitration proceedings unless it is the subject matter or one of the subject matters of the dispute under reference.

The Arbitrators/Umpire at their sole discretion shall fix the venue of such arbitration. The award of the Arbitrators and/or Umpire shall be final, conclusive and binding on both the parties to the Contract.

SPECIAL CONDITIONS OF CONTRACT

1. **SPECIAL CONDITIONS IN CONJUNCTION WITH GENERAL CONDITIONS ETC:**
Special Conditions of Contract shall be read in conjunction with the General Conditions of Contract, Specifications of work, Drawings and other documents forming part of this contract wherever the context so requires.
2. **SPECIAL CONDITIONS TO OVERRIDE GENERAL CONDITIONS IN CASE OF VARIANCE:**
Where any portion of the General Conditions of Contract is repugnant to or at variance with any provisions of the Special Conditions of Contract, then unless a different intention appears the provisions of the Special Conditions of Contract shall be deemed to over-ride the provisions of the General Conditions of Contract and shall to the extent of such repugnancy, or variations, prevail.
3. **INSPECTION OF SITE BEFORE SUBMISSION OF TENDER:**
The Contractor must visit the site of work before submission of the tender to fully satisfy himself on all questions relating to and concerning the existing conditions of site and performance thereon. The contours and the levels if indicated in the drawings are approximate and tentative only. He must fully acquaint himself before submission of tender as to the facilities of site, limitations as to the extent and position of working space, the existing facilities like access roads etc. for transportation of materials and storing and stacking the same at places within the site and for all other matters concerning the site and effecting the performance of the work. No claim shall be admitted on ground as mentioned here above.
4. **ADMISSION TO SITE:**
The contractor will not be allowed to enter on or take possession of the site until instructed to do so by the Owner/Architect/Consulting Engineer.
The Contractor shall provide all necessary temporary access roads to works as may be directed by the Owner/Architect/Consulting Engineer and shall adopt, alter and maintain the same as required and directed by the Owner/Architect/Consulting Engineer during the currency of the works and shall clear away and make good on the completion of the works, all at his own expense and as directed by the Owner/Architect/Consulting Engineer. No photographs of the site or of the works or any part thereof shall be taken, published, or otherwise circulated without the prior permission of the Employer. The Owner/Architect/Consulting Engineer shall have the power to exclude from the site any person whose admission thereto may be in his opinion undesirable for any reason whatsoever.
5. **STAKING OUT BASE LINES AND LEVELS:**
The Contractor shall layout his work subject to the approval of the Owner/Architect/Consulting Engineer and shall be responsible for all measurements

in connection herewith. The Contractor shall at his own expense furnish all stakes, platforms, equipments, ranges and labour that may be required in setting or laying any part of the work. The Contractor shall be held responsible for the proper execution of the work to such lines and grades as may be established or indicated on the drawing etc.

The Contractor shall check the bench marks, levels etc. established in the drawings before setting out any lines and levels and shall provide Theodolite, dumpy levels, prismatic compass, chains, steel tapes and all other surveying instruments found necessary for carrying out the work at his own expense.

If any discrepancies are found in levels, benchmarks etc., the same shall be informed immediately in writing to the Owner/Architect/Consulting Engineer for his decisions. The Owner/Architect/Consulting Engineer's decision in this regard shall be final and binding. No claim shall be admitted on any grounds as stated here above.

6. USE OF EXPLOSIVE:

The Contractor shall have to obtain permission from the Employer before use of explosive on any work or on the site. If explosives are required to be used for any work, the same shall be stored in a special storage container to be provided by and at the cost of the Contractor in accordance with the laws/rules relating to the possession and storage of explosives for the time being in force. The Contractor shall forthwith obtain a license required by such law for the storage and use of explosives, and all operations in which or for which explosives are employed shall be at the sole risk and responsibility of the Contractor and the Contractor shall fully and effectively indemnify the Employer. The Contractor shall be responsible for any accident to workmen, public or property due to blasting operation.

7. MAKE AND OTHER DETAILS OF MATERIALS:

The Contractor shall furnish a list of the makes and other details of various materials he proposes to use on the work and this would be subject to the approval of the Owner/Architect/Consulting Engineer.

8. LIST OF MACHINERY:

The Contractor shall, along with the tender submit a schedule of machinery and equipment he proposes to use at site in support of his assurances to adhere to the time schedule specified for the entire completion of work.

9. CERTIFIED PLUMBERS:

Certified plumbers shall be employed by the contractor on the work for all plumbing and sanitation works.

10. LICENSED ELECTRICAL SUPERVISORS AND LINEMEN:

The contractor must employ licensed electrical supervisors and linemen to execute

the work.

11. ENGINEERS AND OVERSEERS:

The contractor must employ qualified engineers at site to supervise the works and shall also employ qualified overseers for the supervision of the works and quality control of materials. The contractor shall along with the tender; submit a probable organization structure that he proposes to maintain at site during the execution of the work i.e. from commencement till completion of work.

12. BUFFER PERIOD:

No compensation will be levied if the work is completed within 10 days after the due date of completion. This will however be at the sole discretion of the Owner/Architect/Consulting Engineer.

13. MOBILIZATION ADVANCE: (NO MOBILIZATION ADVANCE)

TENDER DOCUMENTS

SECTION – II A

**SPECIFICATION FOR BORE – WELL, SUBMERSIBLE/SURFACE PUMP,
ELECTRICAL WORK
AND
BILLS OF QUANTITIES FOR BORE – WELL, ELECTRICAL WORK**

SECTION – II - A

Tendered Amount Rs. _____

Sub Total _____

Less: _____ % rebate offered

By the Contractor : Rs. _____

Net Amount of Tender : Rs. _____

(Schedule - CV-8) _____

Signature & Seal of Employer

Signature & Seal of Contractor

GENERAL NOTES

1. The contractor shall visit the site of works before submission of tender. They shall fully acquaint themselves before submission of tender as to the extent and position of working space, the existing facilities like excess roads etc.
2. All charges on account of octroi terminal or sales tax or other duties applicable shall be borne by the contractor.
3. The contractor shall at his own expense supply, bring to the site, use and maintain and carry back all tools, plants and scaffolding required for execution of works.
4. The contractor shall provide all watchmen necessary for the protection of the site, the work and of materials, plant and all things on the site during the progress of the works and shall solely be responsible for and shall take all reasonable and proper steps for protecting, site (with proper boundary & with sign board of "work in progress" / "Danger zone" etc.) & securing, lighting and watching all places on or about the works and site which may be dangerous to whomsoever.
5. Quantities shown in the bills of quantities are approximate and may vary during execution.
6. Rate shall include all material, labour cost, taxes and duties as applicable.
7. Contractor shall guarantee for the yield as specified in specifications and bills of quantities.
8. Contractor shall submit the water analysis report on work completion before handing over the bore for regular operation. Rate shall include the charges for such testing.
9. Contractor shall arrange for electroplating of the bore at his own cost and submit the report of the same to client/consultant. Rates for the same shall be quoted separately on JOB basis as specified in bills of quantities.
10. Contractor will observe and fulfill all Government Statutory rules such as labour contract license, PF, Insurance of his employees and third party risk, safety rules and other rules applicable in execution of job and shall produce all such necessary records when asked.
11. Contractor shall submit strata chart in the standard form as mentioned in specifications.

Seal of Signature of Tenderer

Seal of Signature of Employer

INSTRUCTIONS TO THE TENDERERS

1. All the work shall be carried out as per the specifications or as directed by consulting engineer/client engineer.
2. Rates quoted include clearance of the site (Prior to commencement of work and at its close) in all respect and shall hold good for work under all conditions at site.
3. The time limit for completion of tube well and two recharge well will be one-month acceptance of tender.
4. Contractor shall provide a proof of possessing or valid tie-up agreement with borewell drilling agency for the following machines required for construction of tube well, of his own along with quotation. In absence of such proof the quotation shall not be entertained.
 - (i) At least one No. of drilling rig (having heavy duty mud pump) capable to drill up to a depth 20% more than the bore hole specified in the tender.
 - (ii) One air compressor having capacity of minimum 8.5 Cum. /min. at 7.0 kg/Sq.cm.
 - (iii) Suitable welding set, one truck and one water tanker.
5. The works shall conform to the following Indian Standards:
 - IS : 2800 - 1979 Code of Practice for Construction and Testing of Tube wells
 - IS : 8110 - 1976 Requirements for well screens and slotted pipes.
 - IS : 69035- 1979 Method of Determination of Water level in Bore hole.

Technical specification Details:

Supply of Solar Photovoltaic (SPV) Water Pumping System

I. SCOPE OF WORK

Supply, Installation and Commissioning of Complete Solar Photo Voltaic Pumping System comprising of SPV modules, VFD/Inverter, Remote Monitoring, AC Submersible Pump, Mounting Structure, Tracking, Cables, HDPE Pipe etc. as per MNRE Specifications, inclusive of AMC for 4 years.

II. INTRODUCTION

(A) SOLAR PHOTOVOLTAIC (SPV) WATER PUMPING SYSTEM:

1. PV Module: (PV Array)

- Minimum Capacity in the range of 200 watt peak to 5 KWp.
- PV array Capacity for 5 HP Pump is 5000WP (Minimum),
- Should be mounted on a suitable structure with a provision of tracking the sun as mentioned in the specification

2. Motor Pump set (submersible-stainless steel):

- A.C. Induction Motor Pump set with suitable inverter (230Volt/415Volt) (Minimum 2 Star Rating)

3. Electronics:

- Maximum Power Point Tracker (MPPT)
- Controls / Protections.
- Inverter

4. Interconnect Cables of suitable size, "On-Off" switch and LCD Display showing following parameters:

- 1) Frequency of VFD
- 2) Voltage,
- 3) Current,
- 4) Output Watt and
- 5) Cumulative KWH

(B) PERFORMANCE SPECIFICATION AND REQUIREMENTS (DUTY CYCLE)

Solar PV Water Pumps with PV array minimum capacity in the range of 200 Wp to 5 KWp to be installed at specified locations in jurisdictions of IIMA and BHEL.

Under the “Average Daily Solar Radiation” condition of 7.15 KWh/m² on the surface of PV array (i.e. coplanar with the PV Modules), the minimum water output from a Solar PV Water Pumping System at different “Total Dynamic Heads” should be as specified below:

For A.C. 2 star rating Induction Motor Pump set with a suitable Inverter: (230Volt / 415Volt)

- (1). 90 liters of water per watt peak of PV array, from a Total Dynamic Head of 10 meters (Suction head, if applicable, minimum of 7 meters) and with the shut off head being at least 12 meters.
- (2). 45 liters of water per watt peak of PV array, from a Total Dynamic Head of 20 meters (Suction head, if applicable, up to a maximum of 7 meters) and with the shut off head being at least 25 meters.
- (3). 32 liters of water per watt peak of PV array, from a Total Dynamic Head of 30 meters and the shut off head being at least 45 meters.
- (4). 19 liters of water per watt peak of PV array, from a Total Dynamic Head of 50 meters and the shut off head being at least 70 meters.
- (5). 13 liters of water per watt peak of PV array, from a Total Dynamic Head of 70 meters and the shut off head being at least 100 meters.

The actual duration of pumping of water on a particular day and the quantity of water pumped could vary depending on the solar intensity, location, season, etc.

Indicative performance specifications for the Shallow and Deep well SPV Water Pumping Systems are given as under.

Description	Solar Deep Well (Submersible) Pumping Systems	
	I	II
Model		
PV array	5000 Wp	5000 Wp
Motor Pump set Capacity	5HP Submersible with electronic controller	5HP Submersible with electronic controller
Total Dynamic Head	50 M	100 M
Module mounting structure	MS hot dipped galvanized, Three times Manual Tracking Facilities	MS hot dipped galvanized, Three times Manual Tracking Facilities
Water Output*	95,000 liters per day from a total head of 50 mtrs. (Shut off head being at least 70 mtrs)	40,800 liters per day from a total head of 100 mtrs. (Shut off head being at least 150 mtrs)

* Water output figures are on a clear sunny day with three times tracking of SPV panel, under the “Average Daily Solar Radiation” condition of 7.15 KWh/sq. m on the surface of PV array (i.e. coplanar with the PV Modules)

Notes:

For higher or lower head / PV capacity, or in between various models; water output could be decided as per the clause B (Performance specifications and requirements) specified earlier.

(C) PV ARRAY:

The SPV water pumping system should be operated with a PV array capacity in the range of 200 Watts peak to 5000 Watts peak, measured under Standard Test Conditions (STC). Sufficient number of modules in series and parallel could be used to obtain the required PV array power output. The power output of individual PV modules used in the PV array, under STC, should be a minimum of 200 Watts peak, with adequate provision for measurement tolerances.

Use of PV modules with higher power output is preferred.

Indigenously produced PV module (s) containing mono / multi crystalline silicon solar cells should be used in the PV array for the SPV Water Pumping systems.

1. Modules supplied with the SPV water pumping systems should have certificate as per IEC 61215 specifications or equivalent National or International/ Standards.
2. Modules must qualify to IEC 61730 Part I and II for safety qualification testing.
3. The efficiency of the PV modules should be minimum 14% and fill factor should be more

than 70%.

4. The terminal box on the module should have a provision for “Opening” for replacing the cable, if required.
5. There should be a Name Plate fixed backside the module which will give:
 - a. Name of the Manufacturer or Distinctive Logo.
 - b. Capacity of SPV water pumping systems.
 - c. Model Number
 - d. Serial Number
 - e. Year of manufacture
 - f. Project Name and Year
6. Each PV module must use a RF identification tag (RFID), which must contain the following information:
 - a. Name of the manufacturer of PV Module
 - b. Model or Type Number
 - c. Serial Number
 - d. Month and year of the manufacture
 - e. I-V curve for the module
 - f. Peak Wattage of the module at 16.4 volts
 - g. I_m , V_m and FF for the module
 - h. Unique Serial No and Model No of the module
 - i. Project Name and Year

(D) MOTOR PUMP-SET (Minimum 2 Star Rating in case of AC) (230Volt/415Volt):

The SPV water pumping systems may use follow types of motor pump set:

(a) Submersible Motor pump set

The “Motor Pump Set” should have a capacity of, 5 HP (Minimum 2 Star Rating in case of AC motor) and should have the following features:

1. The AC centrifugal motor pump set with the impeller mounted directly on the motor and with appropriate mechanical seals which ensure zero leakage.
2. The motor of the capacity should be AC type. The suction and delivery head will depend on the site specification condition of the field.
3. The submersible pumps could also be used according to the dynamic head of the site at which the pump is to be used.
4. The suction / delivery pipe (HDPE), electric cables, floating assembly, civil work and other fittings required to install the system.

5. The following details should be marked indelibly on the motor pump set

- a) Name of the Manufacturer or Distinctive Logo
- b) Capacity of Motor Pump Set
- c) Model Number.
- d) Serial Number
- e) Year of Manufacture.

All parts of the pump and the motor of the submersible pumps should be made of stainless steel. The manufacturer should certify that all external parts of motor used in submersible pump which are in contact with water are of stainless steel.

The manufacturers of pumps should self-certify that, the pump and **all external parts of motor used in submersible pump which are in contact with water, are of stainless steel**. The pumps used for solar application should have a 5 years warranty so it is essential that the construction of the pump be made using parts which have a much higher durability and do not need replacement of corrode for at least 5 years.

IMPORTANT NOTE: Provision for remote monitoring of the installed pumps must be made in the controllers or the inverters either through integral arrangement or through external fitted arrangement. It should be possible to ascertain the daily water output, power generated by PV Array, the UP Time of the pumping during the year, nos. of days the pump was unused or under break down/repairs.

(E). MOUNTING STRUCTURES:

The PV modules should be mounted on metallic structures of adequate strength and appropriate design, which can withstand load of modules and high wind velocities up to 150 km per hour. The support structure used in the pumping system should be hot dip galvanized iron with minimum 80 micron thickness.

The structure design (along with the civil work) declared by the manufacturer should technically be full proof / sufficiently strong against the prevailing wind load. The manufacturing firm will be fully responsible for any damages caused by high wind velocity within guarantee period. The parameters of prevailing wind speed, soil conditions, load, and upward lift should be taken care of while preparing the design and the same is required to be mentioned on design. Bidder has to provide minimum 4 Nos. of such module mounting structure for 5 HP pumps to sustain enough load and to make capable against high wind velocity. However, IIMA may relax this minimum condition to meet with any technical requirement.

However, manufacturer / supplier shall ensure that mounting structure is efficient, strong enough to sustain load and is capable against high wind velocity.

The standalone type cylindrical base panel mounting structure is required.

(F) TRACKING: -

To enhance the performance of SPV water pumping system, manual tracking system must be provided so that the panel can be manually adjusted three times a day (east-south-west) to face the sun optimally. This adjustment could be done in the early morning, noon and afternoon time to increase total solar radiation on the solar panel surface substantially. This provision helps the motor pump-sets to start early in the morning and function efficiently till late in the afternoon, thereby increasing the total output of the pumping system. Also, the arrangement for seasonal tilt angle adjustment should be provided to adjust the optimal tilt throughout the year.

(G) ELECTRONICS AND PROTECTIONS:

1. Maximum Power Point Tracker (MPPT) should be included to optimally use the Solar panel and maximize the water discharge.
2. Inverter could be used if required, to operate an A.C. Pump. The inverter must have IP54 protection or must be housed in a cabinet having at least IP 54 protection.
3. Adequate protections should be incorporated against dry operation of motor pump set, lightning, hails and storms.
4. Full protection against open circuit, accidental short circuit and reverse Polarity should be provided.

(H) OTHER ASSESSORIES:

ON / OFFSWITCH

Interconnect Cables, "On-Off" switch and LCD Display showing following parameters

1. Frequency of VFD,
2. Voltage,
3. Current,
4. Output Watt
5. Cumulative KWH.

A good reliable switch suitable for AC use is to be provided with the motor pump set. Sufficient length of cable should be provided for inter-connection between the PV array and the motor pump set.

Earthing: The PV array structure shall be grounded properly using adequate nos. of Earthing pits. All metal casing should be thoroughly grounded.

(I) PERFORMANCE SPECIFICATIONS AND GUARANTEE:

Solar PV Water Pumps with PV module capacity in the range of 200 Watt to 5 KwP may be installed on a suitable bore-well / tube well etc. Indicative Performance Specifications for the Shallow and Deep well SPV Water Pumping Systems are given in clause 3. (B) Above.

The PV Modules must be warranted for output wattage, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years.

(K). OPERATION AND MAINTENANCE MANUAL:

An Operation and Maintenance Manual, in Gujarati language, should be provided with the solar PV pumping system. The Manual should have information about solar energy, photovoltaic, modules, AC motor pump set, mounting structures, electronics and switches. It should also have clear instructions about mounting of PV module, DO's and DONT's and on regular maintenance and Trouble Shooting of the pumping system. Name and address of the person or Centre to be contacted in case of failure or complaint should also be provided. A guarantee card for the modules and the motor pump set should also be provided to the beneficiary.

Minimal Technical Requirements/Standards for off-grid/Stand-Alone solar photovoltaic (PV) power plants/systems to be deployed under the National Solar Mission (as per MNRE ordered dated 16.06.10)

Item/component	Applicable IEC/equivalent BIS Standard	
	Standard Description	Standard Number
PV Modules: Crystalline Silicon Terrestrial PV Modules	Must conform to the latest edition of IEC/equivalent BIS Standards for module design qualification and type approval.	IEC 61415/IS14286 IEC 61730 Part 1 & 2
Power Conditioners/Inverters *	Efficiency Measurements Environmental Testing	IEC 61683 IEC 60068 2(6,21,27,30,75,78)
Charge Controller/ MPPT Units*	Design Qualification Environmental Testing	IEC 61093 IEC 60068 2(6,21,27,30,75,78)
Storage Batteries	General Requirements & Methods of Test Tubular Lead Acid test.	IEC 61427 IS 1651/IS 133369
Cables	General Test and Measuring Methods PVC insulated cables for working Voltages up to and including 1100 V-Do, UV resistant for outdoor installation	IEC 60189 IS 694/ IS 1554 IS/IEC 69947
Switches/ Circuit Breakers/Connectors	General Requirements Connectors-safety	IS/IEC 60947 part I,II,III EN 50521
Junction Boxes/Enclosure	General Requirements	IP 65 (for outdoor)/IP 21 (for indoor) IEC 62208
SVP System Design	PV Stand-alone System design Verification	IEC 62124
Installation Practices	Electrical installation of buildings Requirements for SPV power supply systems.	IEC 60364-7-712

*Must additionally conform to the relevant national/international Electrical Safety Standards.

** Also refer Addendum No. 32/49/2010-11-PVSE dated 19.08.2010

The supplier is supposed to produce I V curve for every panel at the time of billing / supply for pre-dispatch / after supply random testing.

Latest specifications / amendment in the standards if any accepted by MNRE will be allowed.

BOREWELL

1.0 DEFINITION:

With respect to the methods of construction the wells are classified as open dug wells, bored wells, driven wells and tube wells.

There is no defined demarcation between a "well" and a "bore hole". A bore hole may be defined as a shaft of any diameter between 100mm to 900 mm or more. A drilled well is usually referred to as "bore hole".

Artesian well is a well, penetrated in ground water confined beneath an impervious stratum under sufficient pressure and from which water rushes up over the surface without pumping.

Tube wells are wells of small diameter and consist of tubes or pipes bored into the ground to tap ground water supplies.

In this contract a tube well shall mean satisfactory completion of:

- (a) A bore hole drilled to a maximum desired depth in all sorts of soil, kankar, boulder, soft or hard rock. The nature of formation viz. kankar, soft or hard rock shall be classified by the Consultant and in case of dispute either for maximum desired depth of soil or rocky formation, the decision of the Consultant shall be final and binding to the contractor. The estimated depths are approximate and the contractor may have to go to higher or lower depths as per actual conditions of strata generally available in the locality.
If hard strata, which are quite difficult for drilling, are met with and if they can be classified as soft or hard rock the same will be paid extra as per tender item.
- (b) The installation of casing and housing pipes, complete with strainers or slotted pipes including bail plug, reducer, clamp and well top.
- (c) The placing of gravel pack. All gravel as per specification shall be supplied by the contractor.
- (d) The development of tube well including gravel pack with the object of obtaining a minimum yield of 5000-6000 liters of water per hour with pumping levels and draw down as per conditions and standards for the locality. Where the depression of 50% higher than the normal one cannot be obtained, the tube well shall be developed so as to yield a discharge of 20% in excess of the discharge generated for the locality concerned.

2.0 DRILLING PROCEDURE:

- (a) The contractor shall employ the hydraulic direct rotary method (i.e. by direct rotary drilling rigs fitted with heavy duty reciprocating mud pump). The drills shall be diamond drills or shot drills. In firm formation either a fish tail bit or a diamond shaped bit shall be used.
In the direct-mud rotary drilling method, the borehole is advanced by rapid rotation of a drill bit mounted on the end of the drill rods. The bit cuts and breaks the material at the bottom of the hole into small pieces (cuttings). The cuttings are removed by pumping

drilling fluid (water or water mixed with a fluid enhancer, such as bentonite) down through the drill rods and bit and up the annulus between the borehole and the drill rods. The drilling fluid also serves to cool the drill bit and stabilize the borehole wall, to prevent the flow of fluids between the borehole and surrounding earth materials, and to reduce cross-contamination between aquifers.

Despite these obstacles, direct-mud rotary drilling can be the best alternative, especially for deep wells or wells completed into well-lithified rocks. When direct-mud rotary methods are used, hole diameters should be 3 inches to 5 inches larger than the outer diameter of the well casings to allow effective placement of filter and sealing materials. Two-inch diameter monitoring wells should, therefore, be installed within 5.5-inch or larger holes.

/ OR /

Reverse circulation rig set ups usually consist of a support vehicle, an auxiliary vehicle, as well as the rig itself. The support vehicle, normally a truck, holds diesel and water tanks for resupplying the rig. It also holds other supplies needed for maintenance on the rig. The auxiliary is a vehicle, carrying an auxiliary engine. These engines are connected to the rig by high pressure air hoses. Although RC rigs have their own booster and compressor to generate air pressure, extra power is needed which usually isn't supplied by the rig due to lack of space for these large engines.

- (b) All water bearing strata, decided by the Consultant shall be tapped after getting testing result of Electro logging.
- (c) The excavated material shall be brought up by hydraulic process in which water or mud-laden fluid is pumped down the hole and carries up the excavated material as it returns to the surface.
- (e) In drilled wells an annular space at least 40mm wide between the well casing and the natural formation shall be grouted with cement in order to provide a water tight seal to prevent the surface water from reaching the ground water. The depth of seal shall be at least 3 meters below ground surface, or a depth according to the position as regards danger from contamination. The cement grout mixture shall consist of 43kg of cement and 20 liters of clean water to which hydrated lime shall be added to the extent of 10 percent of cement volume.
- (f) The contractor shall have to use fresh potable water so that the mud salinity is less than 2000 ppm.
- (g) In case of sandy soil, at the time of drilling required quantity of BANTONITE to be added in mud removing circulation water to prevent collapse of wall without charging any extra cost for BANTONITE.

3.0 PRECAUTIONS:

- (a) All the three processes viz. breaking-loosening, grinding and removal shall be well

coordinated i.e. carried out simultaneously.

- (b) Caving shall not be permitted to occur.
- (c) In alluvial formations casing pipe shall be put in immediately after the boring is done, to prevent collapse of well.

Note: In rotary method, compressed air may also be used to blow the material to the surface.

4.0 MATERIALS:

Materials for drilling includes all filters or slotted pipes, housing and casing pipes, bail plug, reducer, clamp, well top etc.

5.0 BORE HOLE:

- (a) From ground level to a depth of 3 mt. below the bottom end of housing pipe minimum diameter shall be 150 mm.
- (b) From 3.0mt. Below the bottom end of the housing pipe to the bottom of drilled depth minimum diameter shall be 150 mm.

6.0 PIPES:

6.1 The casing pipes and filters or slotted pipes, having 6 to 8" NB with thickness: 6.5/7 mm shall be connected to each other. The bottom of combination of casing pipes and strainers or slotted pipes shall rest on clay or gravel.

Small length of plain pipe may be used at the bottom end of a strainer (or slotted pipe) that has a cap or bail plug fixed to it. The bottom of blind pipe, generally 1.2 to 1.5m in length, shall be a little above the bottom of the bore, otherwise, it will give way under the weight of the whole pipe length.

6.2 Housing pipes are generally of 200mm nominal diameter. Length of housing pipes shall be as per the condition prevailing at the tube well location.

6.3 Well Screens and Slotted Pipes:

Types of well screens and slotted pipes are of following various pipes.

- i) Plain slotted pipes
- ii) Bridge slotted pipes
- iii) Mesh wrapped screens
- iv) Cash type wire-wound screens
- v) Pre-packed resin bonded gravel screens
- vi) Brass screens

6.3.1 Materials:

The screen shall be made of either corrosion-resistant material or steel pipes having

sufficient thickness to guard against the effect of corrosion and to ensure reasonable life of tube well. The thickness of steel pipes shall conform to the table given in IS: 8110-1976.

6.3.2 Length of Screen:

The length of screen shall be sufficient to obtain the designed specific yield from the tube well. The length of individual pipe shall be such as to afford easy handling for transport and lowering into wells, and removal and at the same time to arrive at minimum wastage in using combinations of various lengths inside the wells and to ensure that the combinations from the nearest requirement to obtain the estimated specific capacity of tube well. To account for possibility of inaccuracy in logging, screen shall not be placed in at least 0.3 meter on both sides of stratum.

6.3.3 Diameter of Screen:

Diameter of screen shall be according to the designed yield of the tubewell. It shall be ensured that the area of opening available in the screen for flow of water, after giving allowance for possible coverage of gravel logging, incrustation etc. shall produce a screen entrance velocity of not more than 0.03 meter/second. However, in areas where sufficient sand thickness is not available a maximum entrance velocity of 0.05 meter/second may be permitted.

6.3.4 Slot size:

The shape and size of the slot shall be such that the gravel or aquifer material is not allowed to block the open space. Based on the sieve analysis of the aquifer material, the size of the slot opening shall be determined in such a way that the finer fractions of the formations are removed during the development stage of well and the coarser fractions remain outside. The slots shall not be too wide to cause entry of the gravel and result in plugging. Sharp edges on the periphery of the pipe may offer resistance to flow and hence it is preferable to have smooth rounded face.

The normal standard slot sizes shall be 1.6, 3.2 and 5mm.

6.3.5 Distribution of slots:

The slots shall be cut in a pattern designed to get even distribution of flow all over the periphery of the pipe. The slots shall be distributed in rows as closely and evenly as possible, staggering the slots between each row. From strength point of view, horizontal slots in pipes are not preferred.

6.3.6 General Requirements

- (i) The screen shall possess adequate resistance to corrosion and incrustation due to chemical content of soil and water.
- (ii) The slotted pipes and screens shall be given anticorrosive protective treatment.

- (iii) Well screens shall be both threaded and socketed or plain level ended or collared or male and female so that convenient lengths could be added.
- (iv) The slots shall not be cut within 12mm on either side of longitudinal Welded joints of the pipes.
- (v) The plain space after thread cutting over the larger diameter pipes shall not be less than 150mm so that wrenches could easily be used on plain space only.

6.4 In case, screwed and socketed pipes are to be used the sockets/reducer shall be spot welded at minimum six points for both jointing, pipes on both the ends of socket/reducer over and above this, the joint shall be strengthened by 4 vertical strips welded on both the pipes ends and socket. In this case the strips shall be of suitable dimensions or socket/reducer shall be circumferentially welded.

In case screwed and socketed pipes are not available, the plain end pipes shall be used and shall have to be welded circumferentially welded and butt jointed uniformly by Ferro speed welding electrodes of S.W.G. followed by curved strips of dimensions shown below.

Dimensions of curved strips:

For pipes above 220 mm and up to 320mm diameter	For pipes up to 220mm diameter
Length - 200mm	150mm
Width - 125mm	100mm
Thickness - 10mm	8mm

The dimensions of the curved strips shall be as per the table given above or as directed by the consultant.

6.4.1 Precautions:

The strips shall be completely welded so as to form a firm butt joint and also to keep the joining pipes in correct alignment. During welding alignment of the pipes shall be checked with 'Spirit level'.

6.5 Bail plug:

At the bottom of the pipes, a bail plug shall be placed. It has 0.3m long blind pipe sealed off by any suitable method and having 25mm dia. iron bar welded across at a distance of 0.3m from the bottom of sealing cup or any other acceptable hooking device.

6.6 Reducer:

The casing and housing pipes shall be connected by the reducer of approved quality so as to make connection watertight.

6.7 The contractor shall have to apply three coats of painting to the joints and the iron strips shall be used in the welded joints at the site of work. He shall also have to mend any damage

to the painting during transit, to the satisfaction of the Consultant by applying additional coats of painting to the damaged area. The paint shall be of approved quality.

6.8 The contractor shall have to provide the spacer of standard size as directed by the Consultant.

6.9 Verticality of Housing and Casing Pipes:

- (i) All housing pipes shall be so installed that they have minimum possible deviation from the vertical plumb.
- (ii) The deviation of bore-hole axis shall not exceed beyond 1cm. in 3m of boring. If the deviation is more than this, tube well up to 225mm shall be accepted with a reduced rate of 20% from the tender rates. However, the above deviation will be taken in one direction only. The measurements of deviation shall be taken in presence of contractor if desired by him and in case of dispute the decision of the Consultant shall be final and binding on the contractor.

6.10 In case of artesian tube wells their artesian condition can be removed i.e. Overflow of water can be stopped by fitting about 1.8mt. long pipes, eccentricity of which shall be measured, otherwise full payment shall be made without insisting on measurement of eccentricity.

6.11 Housing clamp:

A steel clamp of sufficient length shall be provided for securing at the top of the housing pipe. The clamp shall rest on 2 wooden sleepers to be provided by contractor.

6.12 In case the consulting engineer/Architect desires to install fibre glass reinforced pipes instead of M.S. pipes having the same diameter the contractor shall have to lower the F.R. pipes. If necessary the detailed specifications shall be given at the time of installation.

7.0 GRAVEL PACK:

- (a) Each tube well shall be gravel packed with at least minimum calculated quantity.
- (b) The gravel shall be procured from approved location. All gravel shall consist of hard well rounded particles reasonably uniform in diameter and shall be of a size determined after analyzing the character of the water bearing formation tapped. The gravel shall be got approved from the consulting engineer before bringing the same on site. Generally the size of the gravel shall be 5mm to 8mm for coarse and 3mm to 5mm for fine sand as the case may be.
- (c) In rotary method, the pipe assembly is lowered into position and gravel packing may be done up to a suitable depth below the bottom of the housing pipe in the first instance. Thereafter, the gravel packing up to the required depth is completed after keeping the housing pipe vertical within limits. The gravel packing operation shall be continued till filter is constructed around the slotted pipe or screen so as to ensure that no sand flows in the well under normal operation condition of the tubewell. To achieve uniform gravel packing around the pipe assembly inverted

- cones shall be used.
- (d) The larger the diameter of shrouding the better the result will be. The thickness of the gravel shroud around the screen shall generally be not less than 10 cm. or more than 22cm.
 - (e) In case, the method includes plastering of drilling hole by mud or betonies, following procedure shall have to be followed for gravel packing if required by Consultant.
 - (i) After the hole is drilled to the required depth the drilling mud, standing in hole shall be thinned down by introducing clean potable water in drilling hole at the bottom.
 - (ii) Housing pipes, casing pipes and filters of slotted pipes shall be lowered in Drilling hole only after operation above is completed.
 - (iii) Introduce the pipe through the housing pipe to the bottom of string of casing pipes and filters and start pumping in fresh water so that it comes out at the top of the drilling hole. Gravel shall be packed in the tube well only while water is flowing out at the top. Water shall thus be pumped in tube well throughout the entire period of the gravel packing.
 - (iv) Before gravel packing starts it shall be ensured that thickness of mud plaster is reduced to minimum.
 - (f) Record shall be maintained of the correct quantity of gravel put in each tubewell and this information in strata charts shall be supplied by contractor.
 - (g) Gravel shall be fed in the well in such a way that no pockets are formed. Gravel pack shall extend right to the ground level in case reducer is used and if any gravel subsides while developing, required quantity shall be added to bring it to ground level. In case a ground seal is used, the annular space between the drilling hole outside of housing pipes shall be filled with earth which will be properly consolidated by tamping.

8.0 DEVELOPMENT:

Following methods can be used for development:

- (a) After the tube well has been fully gravel packed, as much as possible mud mixture from the well shall be brought out by backwashing through mud pump with clean water.
- (b) Initial development shall be carried out by means of compressed air, air compressor; to be used shall be of adequate capacity (not less than 1100 CFM to 450 CFM.) and developing pressure not less than 150 to 600 PSI. For this developing 75mm inside diameter or any other suitable pipes shall be used as suction pipes. Bottom of suction pipes shall be at midway of each water bearing stratum and shall be developed till water is sand free. In this process the bottom

of suction pipe shall be moved up and down within the thickness of each water bearing stratum. Thus each water bearing stratum shall have to be developed separately by compressed air pumping. Developing shall start with top most aquifer and proceed to the bottom most.

After each aquifer has been developed individually as mentioned above, there will be cumulative developing of all aquifers by means of compressed air as directed by the Consultant. This cumulative development shall continue till water becomes reasonably sand free. During this developing all attempts shall be made by giving jerks to take out from aquifers as much sand as possible. After all aquifers have been thus developed sounding shall be taken and if there is filling it shall be removed.

- (c) After the operation (b) above, has been completed the tube well shall be further developed by means of a bore hole turbine pump.
- (i) By which over pumping shall be done at 15% to 25% higher discharge than the expected discharge from the tubewell.
 - (ii) Capable of being lowered to the bottom end of housing pipe.
 - (iii) Filled with a depth gauge.
 - (iv) This development shall continue till water remains sand free at continuous maximum discharge of pump.

After the water is sand free the well shall be pumped at least for 4 hours nonstop at maximum discharge. At the end of this four hours pumping, discharge and pumping level shall be measured by contractor and this information shall be supplied with strata chart. During 4 hours, pumping continuously at maximum discharge, water shall be sand free.

- (v) The development process by borehole pump mentioned above shall Continue till:
- (a) The well ceases to absorb further gravel
 - (b) Depression ceases to improve
 - (c) Discharge ceases to improve
 - (d) Water is sand free
- (vi) The final discharge shall be free from sand with maximum tolerance of 20 parts of sand in one million parts of water by volume after 20 minutes of starting the pump.
- (vii) If after final development and pumping by borehole turbine pump mentioned is paras (i) and (ii) above, the depression remains greater than 30mt. then the well shall be developed for the further period of 12 hours. If during this further period there is no improvement in the depression, the development shall cease.

- (viii) After development by turbine pump the contractor shall remove all sand of filling which may have accumulated in filter pipes at the bottom.
- (ix) If maximum discharge is not obtained within 9mt. of draw down then discharge at 9.0 meters shall be measured and reported. This is to be done only after well is pumped for 4 hours at maximum discharge continuously.

9.0 RECORDS:

- (a) Samples of stratum taken at every 3m. or at the change of strata, shall be carefully preserved at site in a sample box of the design to be specified by Consultant and shall be available for inspection by the Consultant Improved methods of logging shall be adopted if possible.
- (b) A strata chart in the standard form required by and approved by the Consultant shall be maintained at the site and shall contain the following information.
 - (i) Description and depth of various strata encountered.
 - (ii) Spring level below ground level.
 - (iii) Diagram showing exact location of filters, blind pipes and housing pipes for each bore.
 - (iv) Position of joints between slotted and blind pipes.
 - (v) Rate of progress of drilling.
 - (vi) The quantity of gravel initially put in the well and the quantity of gravel, added during development. Precise record of all actions with time record during development shall be kept and shall be available at well sites for inspection. Five copies of strata charts shall be forwarded to Consultants after handing over the well.

10.0 CHOKED STRAINERS:

Clogging of screens is the most frequent source of trouble. Choking can be divided under two headings, (i) Mechanical choking and (ii) Chemical choking.

Chemical action will deteriorate strainers by corrosion which shall be very much reduced by providing a large slit area or low velocity of inflow, which will mean less depression head and reduced liberation of carbon dioxide.

Reversed motion of water called "back blowing" or "back washing" shall be carried out to promote flow of sand particles which have clogged the passage. Surging is done by raising and lowering plunger.

Incrustation of lime shall be removed by pouring sulphuric or hydrochloric acid into the well, allowing it to remain several hours and surging to dislodge the loosened material. This is called "acidification" or "acidizing". Mechanical choking (due to sand or silt) shall be avoided if the velocity of in flow is lower than the optimum velocity capable of disturbing the materials surrounding the

strainer.

Where the screens cave in or collapse or corrode and leak, allowing water to escape into ground, replacement is necessary. If the well is of a large diameter a smaller casing shall be placed inside old one.

11.0 PUMPING TESTS FOR ACCEPTANCE

Before a tube well is accepted by Consultant the representative of the consultant will supervise 4 hours duration step draw down test and a 6 hours duration aquifer performance test. These tests, after complete development shall be done and the tube well is allowed to rest for 12 hours. These tests shall be conducted by means of a borehole turbine pump at discharges to be decided for each tubewell but not more than 3800 litres per minute. The pump unit shall be fitted with device for measure at regular intervals over a 'V' notch or any other suitable method. These pumping tests shall be in addition to developing by compressed air and by borehole turbine pump mentioned above.

12.0 DISINFECTION:

The well shall be disinfected after completion of test for yield. All the exterior parts of the pump coming in contact with the water shall be thoroughly cleaned and dusted with powdered chlorine compound. In fact it shall be disinfected every time a new pump is installed or the one replaced after repairs.

A stock solution of chlorine shall be prepared by dissolving fresh chlorinated lime. For obtaining an applied standard concentration of 50 ppm. 1 liter of the stock solution shall be used to treat 300 liters of water.

13.0 GROUTING AND SEALING:

Grouting and sealing of tube well shall be done if required by the owner, depending upon the site conditions and quality of the discharge of the strata encountered. To ensure that the grout will provide satisfactory seal, it shall be applied in one continuous operation. Sealing of the tube well shall be done by grouting the annular space between bore and the housing pipe, thickness of grouting depending upon the quality of water.

14.0 HANDING OVER OF THE TUBEWELL:

A tube well shall be offered for acceptance by the contractor only after:

- (a) Drilling, developing, gravel packing.
- (b) Pumping tests have been done.
- (c) Arriving at specified sand content in the water. To measure sand content 100cc. Measuring flask or any other suitable measuring devices, provided by the

contractor, shall be used. Samples shall be taken at the interval of 2 hours and average results of these samples shall be taken in consideration as the average sand content of water.

The tube well shall be handed over to the owner in a complete shape. The housing pipe shall be closed by a well cap for the period between the completions of the tube well and the installation of the pump set.

Consultant, for the purpose of acceptance, will sign the acceptance certificate in token of acceptance and otherwise give in writing the reason for rejection.

15.0 INSTRUCTIONS:

- (a) No drilling beyond the estimated depth shall be done without prior approval of Consultant.
- (b) Pump tests shall be conducted on all wells. Contractor shall inform the consulting Engineer as soon as the well is developed and is ready for the test. The test shall be
 - (i) Step draw down test (4hrs. long) on varying discharges and on subsequent day.
 - (ii) Aquifer performance test (6 hrs. long) on constant discharge.
- (c) For the record of the hard and soft rocky strata met with the contractor shall keep the log book of the drilling work undertaken by him. The log book shall give the details of work done including the hours of work and strata met with. He shall also inform the consultant immediately as soon as such strata are met with.

16.0 SUBMERSIBLE WATER PUMP:

16.1 This section relates to supply and installation of submersible pump set in the tube well with all necessary equipment to put the pump in the tube well and all the materials such as submersible pump, M.S. pipes, cast iron / M.S. couplings, clamps, electrical cables for submersible pump, electrical control panel with all necessary safety controls etc.

16.2 Pump:

The submersible pump shall be of approved make as mentioned in Bills of Quantities and shall give suitable discharge of water per hour at required head. The submersible pump shall be provided along with an appropriate copper cable the length of which shall be minimum 20.0m more than the depth of the pump in the well. Similarly, PVC insulated copper wire shall be provided for water level indicator.

16.3 Pipes:

The pipes shall be 'C' class MS pipes conforming to IS 1239. The coupling to be used to couple two pipe lengths shall be of the special type and thickness. All the pipe connections, with pump and with other pipes, shall be threaded connections.

16.4 Clamps:

Minimum four clamps, heavy duty and special clamps shall be supplied with the pumps. The clamps shall be made out from 125mm x 20mm MS flats. The clamps shall be sufficiently long so that they rest on the casing pipe of the well.

16.5 Electrical Control Panel:

The electrical control panel shall include the following with suitable rating:

- (a) DOL starter up to 5 HP motor or star delta starter for 7.5HP and higher rating motors or soft starter (with RS 485 Port).
- (b) Main incoming switch (MCCB)
- (c) Control fuses
- (d) Single phase preventer
- (e) Water level controller
- (f) All internal wiring and push button indicating lamps for all controls.
- (g) Voltmeter with selector switch
- (h) Ammeter with selector switch
- (i) MFM with RS 485 Port
- (j) Water level Controller

L. T. POWER MOTOR CONTROL PANELS

1. SCOPE:

- (A) This specification covers the scope of design, fabrication, assembling, and inspection at vender's works and delivery in properly packed condition to project site of cubical pattern MV Metal Enclosed Switchgear.
- (B) The switchgear would comprise of Motor Control Center (MCC).
- (C) Change over switch with suitable wiring

2. CODES AND STANDARDS:

- (A) The equipment shall be designed to conform to the requirements of following Indian Standards:
 - (a) IS: 8623 and IEC-439 : Factory built assemblies of switchgear and Control gear.
 - (b) IS: 4237 : General requirements for switchgear and Control Gear for voltage not exceeding 1000 Volts.
 - (c) IS: 2147 : Degree of protection provided by enclosures for low Voltage switchgear and control gear.
 - (d) IS: 375 : Marking and arrangement of bus bars.
- (B) Individual equipment housed in the Medium Voltage Switchgear shall conform to the following IS specifications.
 - (a) IS: 4046(Part-II), (1978) Air break switches and fuses combination Units for voltage not exceeding 1000 Volts (Specific requirement for the direct Switching of individual motors) i.e. suitable for AC23 duty.
 - (b) IS: 2208 (1962) and Low Voltage Fuses.
IS: 9224 (1979)
 - (c) IS: 1248 Direct acting electrical indicating Instruments.

- | | | |
|-----|--|--|
| (d) | IS: 694 (1977) and
IS: 8130 (1976) | PVC insulated cables and aluminum
conductors. |
| (e) | IS: 2959 | Contactors |
| (f) | IS: 8544 | Thermal overload relay |
| (g) | Indian Electricity Rules | As amended up to date |
| (h) | Approval From T.A.C. /F.I.A. OR C.P.R.I. Tested. | |

3. DESIGN & CONSTRUCTION REQUIREMENTS:

- (a) The switch board shall be for indoor application, metal enclosed, dust & vermin proof, free standing, floor mounting, compartmentalized, modular type & extensible on both sides.
- (b) The switch board shall be fabricated from CRCA sheet steel having following minimum thickness:
 - (i) Frames, load bearing members & large doors : 2.03 mm (14 swg)
 - (ii) Partitions & small doors : 2.03 mm (14 swg)
 - (iii) Front, back & side covers : 2.03 mm (14 swg)
- (c) The board shall be divided in to distinct vertical sections, each comprising of:
 - (i) Cable should enter from the Bottom.
- (d) The switchboard shall be provided with degree of protection of not less than IP 52 as per IS 2147.
- (e) Suitable sized thick neoprene gaskets shall be provided all round the perimeter of Doors, Covers etc. for making the construction dust & vermin proof.
- (f) Power/control terminals in the cable alleys for each module & also the bus bar Chamber shall be covered with hinged & bolted type hilum shrouds respectively to Prevent accidental contact when the door/cover is withdrawn. In each feeder Module, the phase barrier of hilum sheet shall be provided between the adjacent Phases. Size of terminals to be decided as per cable size mentioned in the SLD. MCCB Terminals to be shrouded.
- (g) Gland plate of 5 mm thickness shall be provided at the top or bottom of the board, and gland plate shall be of non -magnetic type..
- (h) Main earth bus of aluminum flat shall be suitably placed running throughout the Length of the switchboard.
- (i) All the hardware's used in the construction of the switchboard shall be chromium

/zinc plated passivated type with spring washers to avoid loosening of the fixed parts.

4. METAL TREATMENT AND PAINT FINISH :

(a) Pre Treatment Chemical Process:

All sheet steel work used in the construction of the switchboards shall be Pre-Treated with 7-tank chemical process as specified in the specific requirement sheet Before applying the two coats of zinc chromate primer followed by synthetic Enamel/epoxy paint as follows:

7-Tank Process:-

1. Degreasing: - In this process the M.S. Sheets shall be effectively cleaning by dipping in hot alkaline degreasing solution for the period of about 10-20 minutes.
2. Water Rinsing: - After degreasing process the M.S. sheets shall be rinsed in to the water for the period of about 1-2 minutes to remove the loosened oil, grease and adhering alkali from the surface.
3. Derusting: - In this process the M.S. sheets shall be pickled in dilute sulphuric acid to remove oxide scales and rust formation for the period of about 30 minutes.
4. Water Rinsing: - After the derusting process the M.S. sheets shall be rinsed in to the water for the period of about 1-2 minutes to remove the traces of acidic solution from the surface.
5. Phosphating: - In this process the M.S. sheets shall be dipped in to the zinc phosphating solution for the period of about 30 minutes to facilitate durable coating of the paint on the metal surfaces.
6. Water Rinsing: - After the phosphating process the M.S. Sheets shall be rinsed in to the water for the period of about 1-2 minutes to remove the traces of phosphate solution from the surface.
7. Passivation: - In this process the M.S. sheets shall be dipped in to the de-oxalate solution for the period of about 1 minute to retain and augment the effects of phosphating on the surface.

After completion of 3-tank/7-tank process a fine grained, smooth and compact coating of iron/zinc phosphate shall be produced, which is an excellent base for paint and provide under film protection against corrosion. The coating shall meet the Indian Standard Specification IS: 3618-1966 class C.

(b) Drying: After the above pretreatment chemical process, the M.S. sheets shall be

- dried either by means of hot air circulation oven (staving) or by means of Blast of Compressed air (air drying).
- (c) Primer Coating: Primer coating with two coats of highly corrosion resistant zinc chromate primer shall be done before applying the final paint finish.
 - (d) Paint Finish: The final finishing of epoxy powder coatings /epoxy paint of suitable shade shall be matt finish powder coated (Color Code: RAL 7035).

5. MATERIAL/COMPONENT SPECIFICATIONS:

- (A) Indicating Instruments:
 - (a) Ammeters and Voltmeters shall be of moving iron spring controlled (MISC) industrial type suitable for flush mounting of size 144x144/96x96 Sq.mm. of suitable range as specified in the schematic drawing of the Switchboard.
Ammeters with suppressed scale current rating shall be provided for specific Requirements.
 - (b) Energy meter (KWH meter) of direct reading 3-phase 4 wire unbalance type Shall be provided wherever specified in the schematic drawing of the Switchboard. It should be mounted inside the compartment but can be read Through cutout on the compartment door.
 - (c) Power factor meter (PF meter), frequency meter (Hz meter), Watt meter (KW meter) etc. shall be provided if specified in the schematic drawing of the switchboard.
- (B) Indicating Lamps:
 - (a) Indicating lamps shall be of LED type, 110V AC. The lamps shall have Translucent lenses to diffuse light.
 - (b) Indicating lamps shall be provided in the respective colors i.e. Red, Yellow, Blue, Green, Amber, White etc. as required in the schematic Drawing of the switchboard.
- (C) Push Buttons:
 - (a) Push buttons shall be rated for 10 Amp at 240 Volt AC and provided with 1 NO + 1 NC auxiliary contacts.
 - (b) On/start push button actuator shall be of Green color, off/stop push Button actuator shall be of Red Color and O/L relay reset push Button actuator shall be of Black Color.
- (D) Internal Wiring:
 - (a) All power/control wiring of the switchboard shall be made with 1100 Volt Grade Black/Gray FRLS-PVC insulated flexible/stranded copper

Wires. 4 sq.mm wire for power circuit.

UP TO 63 AMP SWITCH FLEXIBLE CABLE USE ABOVE THAT USE BUSBAR FOR INCOMING POWER

10 SQMM CU FLEXIBLE WIRE = 32 AMP SWITCH

25 SQMM CU FLEXIBLE WIRE = 63 AMP SWITCH

50 SQMM CU FLEXIBLE WIRE = 100 AMP SWITCH

- (b) The size of control wiring shall be 2.5 sq.mm. Except for CT secondary Circuit of 2.5 sq.mm. Wire.
- (c) Pin type crimping lugs shall be provided for flexible wire terminations.
- (d) Power wiring shall be terminated preferably on stud/clamp type Terminal Blocks, whereas, control wiring shall be terminated on clip-on type Terminal blocks.
- (e) All electrical connections are made vibration proof by proper tightening by using plain washers and spring washers etc.
- (f) All control and indication circuit to be designed for 230V AC. The control Supply can be tapped from the relevant Bus bars by providing suitable Ratings control fuses/MCBs.

(E) Space Heater:

Space heater with thermos state and switch shall be provided in each cable alley of the cubical switchboard if specified in the specific requirement sheet.

(F) Labels:

Labels shall be of anodized aluminum with white engraving on black background. The engraving shall provide at the back side of label. Acrylic sheet not to be used. They shall be properly secured by fasteners at convenient location on each feeder Module, busbar chamber and cable alley of the cubical switchboard.

6. TESTS:

The switchboards shall be tested for all the following routine tests in accordance with IS: 8623 of specification for Factory Built Assembly (FBA) of switchgear & Control gear for voltage up to and including 1000 V AC and 1200 V DC.

- (i) Inspection of the switchboard including inspection of wiring and electrical operational test, where necessary.
- (ii) High voltage test
- (iii) Insulation resistance test (Megger test)

7 DRAWINGS AND DOCUMENTATION:

- (a) General Arrangement (GA) drawings indicating front, rear, side, sectional views, dimensions of the feeder modules and overall dimensions of the switchboards shall be furnished along with the offer.
- (b) After getting the order, the supplier should submit two sets of the following drawings and technical data to us for our review and approval.
 - (i) General Arrangement (GA) drawings indicating front, rear, side, sectional views, dimensions of the feeder modules and overall dimensions of the switchboards.
 - (ii) Single line diagrams of the switchboards.
 - (iii) Control schematic drawings for various types of feeders.
 - (iii) Bills of quantity sheet indicating details of components (Make, Cat. No., Rating, Type etc.) in each feeder of the switchboards.
- (c) According to the changes/comments we have mentioned, the supplier should submit the final three sets of the above drawings/documents for our reference and record. One will remain with us, one with client and one will be return back to supplier duly signed & sealed.
- (d) Test certificates for all ratings of breakers, different rating of current transformers, voltage transformers, protective relays, MCBs/ switches, contactors and RCCBs to be submitted.

Approved Make of Components:

Sr. No.	Item Description	Approved Make
A	Switch/Fuse Switch Unit	Siemens/ L&T/ Schneider M/G/ ABB
B	MCCB / MPCB (25 KA – 50 KA) (100% Icu = Ics)	Siemens (3VL) / ABB / L&T(D Sine) / Schneider Electric (NS)
C	Control Fuse Base & Fuse link /MCB	Siemens / L&T/ Schneider ELECTRIC M/G
D	Contactors	Siemens / L&T/ Schneider ELECTRIC/ABB
E	Indicating Lamp	L & T/ Teknic/ Siemens / Schneider
F	ON/OFF Push Button	L & T/ Teknic/ Siemens / Schneider
G	Current Transformer	Indcoil/ Ashmor/Harshal/ Kappa/ AE
H	Selector Switch	Kaycee/ Salzer / GM
I	Ammeters & Voltmeters (Analog Type)	AE/ Rishabh /Meco/ Equivalent
J	Load Manager (Electronic Type)	Conzerve EM6400 / HPL Socomec Diris40 / EL Measure

K	Multifunction Meter (Electronic Type)	Conzerve/HPL Socomec / EL Measure
L	Energy Meter (Electronic Type)	L&T / HPL/Conzerve / Havell'S
M	Cable Lug	Dowell'S/ 3 M
N	Aluminum Bus bar	Banco/ Hindalco
O	Flexible Copper Wire	R R Kable / Finolex / Lap Cable
P	Change Over Switches	HPL Socomec / H H Elcon / C & S
Q	Borewell Pump Motor Set	KSB, Varuna, Texmo, CRI, Groundfos or Equivalent
R	Upvc Pipe	Ashirvad or equivalent
S	Outer Pipe	Jindal, Tata or Asian

Specific Requirement Sheet

A System Particulars:

- 1 Voltage : 415 + 10%
- 2 Frequency : 50 Hz + 3%
- 3 No. of phases/wire : 3 Phase & 4 wire
- 4 System grounding : Effective (Solidly earthed)
- 5 Fault level : 40 KA RMS

B Construction:

- 1 Type : Non Compartmental modular design
- 2 Types of feeders :
 - (a) SFU/MCCB/ Change Over : Not draw out type
- 3 No. of fronts : Single FRONT

C Components:

- 1 Main bus bars
 - 1.1 Material : Copper
 - 1.2 Rating : As per single line diagram
 - 1.3 Material of bus bar support : SMC/DMC
 - 1.4 Current density : 1 sq.mm = 1.50 Amp
- 2 Earth bus
 - 2.1 Material : Aluminum
- 3 Accuracy class of Instruments
 - (a) Ammeters : 0.5
 - (b) KWh meters/PF meters : 0.5
- 4 Indicating Instruments - sizes : Incoming 144mm², Outgoing 96 mm² with 240/180 Degree scale
- 5 Cable entry
 - Incoming : Top/Bottom Cable
 - Outgoing : Top/Bottom /Cable(Finalized at the time of order finalizing)
- 6 Cable glands Plate : 5 MM THICK MS PLATE
- 7 Painting (Type & shade) : Ral 7032 Powder coating or Painting with Seven Tank process Surface Finishing

ELECTRICAL SUPPLY ITEM

1.0 SCOPE

This specification along with data sheets covers requirements for design, manufacture and supply of XLPE cables.

2.0 STANDARDS

This cable shall be comply with latest edition of the following standards as applicable:

- | | | |
|-----|---------------|--|
| 2.1 | IS: 1554 | PVC insulated (heavy duty) electric cables. |
| 2.2 | IS: 7098 | Cross-linked polyethylene insulated PVC sheathed cables. |
| 2.3 | IS: 694/ 1990 | Conductors for insulated electric cables and flexible cords. |

Note:-

- (1) L.T. Power cables should be XLPE Armored Cable AL. Conductor

3.0 GENERAL CONSTRUCTION

3.1 XLPE Cable

- 3.1.1 Power cables for 433V up to & including 11 KV system shall be Aluminum/Copper conductor, XLPE insulated, sheathed & overall PVC sheathed.
- 3.1.2 The conductors shall be stranded and compacted circular for all cables.
- 3.1.3 The core insulation shall be with cross linked polyethylene insulating compound dry cured, applied by extrusion. It shall be free from voids & withstand all mechanical & thermal stresses under steady state & transient operating conditions. It shall conform to the properties given Table-1 of IS: 7098 (Part-2).
- 3.1.4 The insulation screen shall consist of non-metallic extruded semi-conducting compound in combination with a non-magnetic metallic copper screen. Unless specified otherwise, the copper screen for all the three cores together shall be capable of carrying the single line to ground fault current value and the duration specified in the data sheet. Vendor shall furnish calculation in support of selection of the size of copper screen along with bids.

- 3.1.5 The inner sheath shall be applied over the laid up cores by extrusion and shall conform to the requirements of suitable compound of IS: 5831. The extruded inner sheath shall be of uniform thickness. In case of single core cables, there shall be extruded inner sheath between insulation metallic screen & armored.
- 3.1.6 The outer sheath of the cables shall be applied by extrusion over the armored and shall be of PVC compound conforming to the requirements of suitable type compound of IS: 5831. The thickness of outer sheath shall be as per IS: 7098-part-2 for both unarmored & armored cables.
- 3.1.7 The dimensions of the insulation, inner sheath shall be governed by values given in IS: 7098 Part-2
- 3.1.8 Where specified 1100V grade power cables may also be XLPE insulated & shall meet the requirement specified in IS: 7098 (Part-1).

3.2 Solar Cable

For this type of application needs to be ultraviolet radiation resistant and suitable for wet locations.

4.0 TESTING AND INSPECTION

The cables shall be tested & inspected at the manufacturer's works. All the materials employed in the manufacture of the cable shall be subjected, both before & after manufacture, to examination, testing & approval by Consultants/owner. Manufacturer shall furnish all necessary information concerning the supply to Consultants/Owner's inspectors. The inspector shall have free access to the manufacturer's works for the purpose of inspecting the process of manufacture in all its stage & he will have the power to reject any material which appears to him to be of unsuitable description or of unsatisfactory quality. The vendor shall give at least 4 weeks advance notice to the purchaser, regarding the data testing to enable him or his representative to witness the tests.

5.0 XLPE CABLES

- 5.1. After completion of manufacture of cables & prior to dispatch, the cables shall be subjected to type, routine, acceptance & special tests as detailed below
Consultants/Owner reserves the right to witness all tests with sufficient advance notice from vendor. The test reports for all cables shall be got approved from the Engineer before dispatch of the cables.
- 5.2 All routine tests, acceptance tests, type tests & additional type tests for improved fire performance shall be carried out on cables as listed in IS:1554 (Part-1), and IS: 7098(Part-2)
- 5.3 The inner and outer sheath of XLPE cables shall be subjected to all the tests applicable for PVC cables. The test requirements for insulation & sheath of PVC cables shall be as per latest revision of IS: 5831.

6.0 PACKING AND MARKING

- 6.1 Cable shall be dispatched in non-returnable wooden or returnable steel drums of suitable barrel diameter, securely battened with the take-off end fully protected against mechanical damage. The wood used for construction of the drum shall be properly seasoned, sound and free from defects. Wood preservatives shall be applied to the entire drum. Ferrous parts used shall be treated with a suitable rust preventive finish or coating to avoid rusting during transit or storage.
- 6.2 On the flange of the drum, necessary information such as project title, manufacturer's name, type size, voltage grade of cable, length of cable in meters, drum no., cable code, and BIS certification mark, gross weight etc. shall be printed. An arrow shall be the drum with suitable instruction to show the direction of rotation of the drum.
- 6.3 A tolerance of plus or minus 3% shall be permissible for each drum. However overall tolerance on each size of cable shall be limited to +2%. Offers with short / non-standard length are liable for rejection. If non-standard drum lengths are specified in the inquiry, the same shall be supplied.

ELECTRICAL INSTALLATION WORK

(A) INSPECTION

- (i) The switch board shall be checked as per inspection manual of supplier.
- (ii) Meters, relays etc. shall be checked and tightened before installation.
- (iii) All mechanical fasteners shall be checked and tightened before installation.

(B) INSTALLATION

- (i) The L.T. power distribution, section pillar, main mcbdb shall be assembled and aligned together and installed as per installation manual of the switchboard supplier and installation shall confirm to Indian Standard IS: 3072-1965.
- (ii) Meters & relays shall be fixed in positions and connected as per the supplier's drawings.
- (iii) All earthing connections of earthing system shall be visible for periodical checking.
- (iv) The entire equipment earthing shall be done as per drawing and shall confirm to Indian Standard IS: 3043-1966 and detailed specification given under separate heading of "EARTHING" of these specification.

(C) TESTING & COMMISSIONING:

Prior to commissioning the L.T. power distribution panels, section pillar, main mcbdb and each floor mcbdb following tests shall be carried out by the contractor.

- (i) Phase sequence test.
- (ii) Insulation resistance test.
- (iii) High voltage tests - 2000 volts. (Only for LT panel)
- (iv) Testing of all meters.

POWER CABLING:

(A) GENERAL:

L.T. XLPE cables shall be laid, tested and commissioned in accordance with drawings, specifications, relevant Indian Standard Specification and manufacturer's instructions.

(B) LAYING OF CABLES:

Installation shall be carried out in a neat workman like manner by skilled experienced and competent workmen in accordance with the standard practice.

Cable shall be laid preferably in one place length to avoid joints, if straight joints are found necessary, these can be introduced with prior approval of the Engineer-in-Charge. The cost of straight joint, however, shall not be home by the Department. But in no case joint shall be within the conduit GI pipe and duct.

Proper care should be exercised in handling the cable to avoid formation of kink etc. and should it become necessary, a cable shall be bent to a radius not less than 20 times the overall diameter of the cable in ring main.

Method of installation routing of cable etc. shall in every case be subject to the Department's approval and the contractor shall modify and or certify at no extra cost to the Department any portions of the installation, which do not meet with the Department's approval. All damages lo the civil and other works like damages in telephone cable, drainage pipe. Water pipe. Power supply cable and breakages of brick work of central verse etc. on the account shall he made good as per original by the contractor at no extra cost of the Department.

The electrical contractor while notifying the civil contractor for such work shall furnish the proper drawings fully explaining the work involved or indicates at site actual work to be carried out as may be required by the civil contractor. The electrical contractor shall also notify the civil contractor in writing for finishing up as required of any such work as soon as the electrical work with respect to the same has been completed.

Where cables pass through Hume pipes, contractor shall fix hard wood bush round the cables at the ends of the Hume pipe. Where the cables pass through the floors or chambers and in such otter situations, as the Engineer shall require, the contractor shall seal cable holes in a manner approved by the Engineer-in-Charge where cable pass through roads, nallas, and etc. cable must be protected by Hume pipe of diameter not less than 100 mm should be used.

The cable route shall be the shortest and there shall be minimum interference with built-up areas, lawns etc.

Care shall be exercised for providing suitable props for supporting other service lines on earth at the time of excavation. Where cutting of a lawn become inevitable it should be with the approval of the Engineer-in-Charge

Excavation of the trenches shall be executed with vertical sides and the trenches shall be kept as straight as possible the exact location of each trench shall be settled by the Engineer-in-Charge on the site when the contractor is in a position to commence each portion of the work.

Cables shall be laid at depth of 1000 mm depth below ground level in the case of LT cables and 1200 mm depth below ground level in the case of HT cables. A cushion of sand not less than 100 mm shall be provided both above and below the cable, joint boxes and other accessories. HT and LT. Cables shall not be laid in the same trench and/or alongside of water main. The cable shall be laid in excavated trench, 100 mm layer of sand shall be spread over the cable. The cable then shall be lifted and placed over the sand bed. The second layer of 100 mm sand then be spread over the cable. The relative position of the cables laid in the same trench shall be preserved and the cables shall not cross each other as far as possible.

After the cables are laid, the trenches shall be filled in layers, the earth in each layer being well rammed by spraying water and consolidated and sufficient allowance made for settlement. The extra earth over the trench should be removed from the place of trench to a place as decided by the Engineer-in-Charge at site.

Ends of cables shall be properly sealed to prevent entry of moisture prior to installation. Here it is as a specified as 1/2 core in multi core cables, the 1/2 core shall be neutral conductor having reduced section.

For all multi core cables each core and tails shall be brought out marked and or colored in an approved manner.

Cable termination shall be done with suitable compression brass glands in PVC cables. The armored shall be connected to the ring main earth in pole with duplicate with wires as per the relevant IS specifications.

The core insulation over each conductor shall, however, be retained throughout the run of the conductor up to the end where lugs shall be fitted thereon for connections. The joint shall be mechanically strong and pressure tested.

The sample of item should be got approved prior to use of item by the tenderer from the Engineer in-Charge.

(C) CABLES TERMINATION:

Cable termination shall be done in terminal cable box using cable glands and solder less crimping sockets with heavy duty long neck.

(D) PROTECTION OF CABLES:

The cable shall be protected by placing burnt bricks on two side and over the cables on the top layer of sand for the full length of underground cable. Where more than one cable is running in the same trench, the bricks shall cover all the cables and shall project a minimum of 80 mm on either side of the cables.

Cables under road crossings and any surfaces subjected to heavy traffic, shall be protected by running them through Hume pipes of suitable size.

(E) EXCAVATION AND BACK FILLING:

Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layers not exceeding 250 mm. Each layer shall be properly rammed and consolidated before laying the next layer. The contractor shall restore all surfaces, roadways, sidewalks, curbs, walls or other works cut by excavation to their original condition satisfactory to the consultant.

(F) MARKERS AND WARNING PLATES:

Approved CI cables markers shall be provided along the route of the cables at every 3 meter distance and at both ends of road crossing, indicating HV cables and MV cables

as applicable. Special CI markers shall be provided at all buried cable joints indicating "Electrical Cable Joints".

(G) TESTING OF CABLE:

Prior to burring the cables following tests shall be carried out:

Insulation test between phase to phase and phase to earth for each length of cable before and after jointing.

On completion of cable laying work and jointing the following tests shall be conducted in the presence of the architects/consulting engineers.

- (a) Insulation resistance test.
- (b) Continuity resistance test.
- (c) Earth test.
- (d) High voltage test.

All tests shall be carried out in accordance with relevant Indian Standard code of practice and Indian Electricity Rules. The contractor shall provide necessary instruments, equipment and labor for the above test and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the architect/consulting engineers.

APPLICABLE CODES & STANDARDS & RULES

The following codes, rules and Indian standard specifications amended as on date will apply to the best of their meaning to the equipment and the contract:

Sr. No.	Description	Code
1	Switch fuse units on cubical switchboards.	IS 4047 – 1967
2	Switchgear bus bar	IS 375 – 1963
3	H.R.C. fuse links	IS 2208 – 1962
4	Distribution fuse boards	IS 2675 – 1966
5	Enclosures for low voltage switch gears	IS 2147 – 1962

6	P.V.C. Cables insulated electrical cable (wire) for working voltage up to 1.1kv	IS 1554 – 1988
7	Steel boxes for enclosure of electrical accessories	IS 5133 - 1969 (Part - I)
8	PVC insulated cable for working voltage up to & including 1.1kv	IS 694 - 1977 (Part - II)
9	Earthing	IS 3043
10	Switchgear	IS 3072 – 1965
11	Metal enclosed switchgear and control gear for voltage above 1000 volts but not exceeding 11000 volts.	IS 3427 – 1969
12	Danger notice plate	IS 225 – 1963
13	General requirement for switchgear and control gear for voltage not exceeding 1000 volts.	IS 4237
14	Indian Electricity rules 1956 amended up to date.	
15	Indian Electricity act. (1910).	
16	National Electric Code, 1986	
17	Indian Electricity Supply Act, 1948	

NOTES ON BILL OF QUANTITIES

The rates for the following items of work generally include.

1.0 L.T. DISTRIBUTION PANELS/SECTION PILLARS/SUB SECTION PILLARS

- 1.1 Grouting of panels including supply and fixing of required size M.S. channel.
- 1.2 Assembly of the panel.
- 1.3 Checking of all connection with Busbar, switches, meters, connector strips etc.
- 1.4 Touching of all damaged paint.
- 1.5 Testing of panel before commissioning.
- 1.6 Setting of all relays.
- 1.7 Checking of all interlocking system.

2.0 CABLING:

- 2.1 Supply of power cables as per specification at site
- 2.2 Embedding, conduits and allied fittings in walls, floors etc. during construction and / or in chase including cutting chases and making good as necessary in the case of concealed cable work.
- 2.3 Providing and fixing approved saddles, hangers, trays etc. and grouting the same as required for exposed cables where called for.
- 2.4 Effecting adequate and proper connections at terminations.
- 2.5 Ensuring that provision is left in various buildings structures and trenches as the work progress for incorporation of cable supports at a later date.
- 2.6 Providing all fixing accessories such as clamping devices, nuts and bolts, screws etc.
- 2.7 Clamping to supports where cable laid in trenches.
- 2.8 Excavation of trenches and bringing the trenches to exact level as required.
- 2.9 Providing sealing compound, crimped, solder etc. at joints and terminations as called for.
- 2.10 Providing proper supports for cable terminal boxes as called for.
- 2.11 Wherever cables pass through walls / ceiling, providing sleeves, making holes and making good as necessary.
- 2.12 Providing cable identification tags.
- 2.13 Providing cable marker.
- 2.14 Dressing of the cable as per the satisfaction of the engineer in charge or consulting engineer.

3.0 EARTHING:

- 3.1 Supply of earthing strips, wires, electrodes etc. as per enclosed specification
- 3.2 All fixing accessories such as brass saddles, brass screws, rawl plugs etc.
- 3.3 Jointing by tinning, riveting, soldering and welding.
- 3.4 Cutting chase, holes and making good the same wherever required.
- 3.5 All masonry work including earth work for earthing stations, earthing strips and wires.
- 3.6 Effecting adequate and proper interconnections.

TESTING:

GENERAL:

At the completion of the work, the entire installation shall be subject to following tests:

- (a) Wiring continuity test
- (b) Insulation resistance test
- (c) Earth continuity test
- (d) Earth resistivity test

Over and above any other instruments for testing, labor and materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

TESTING OF WIRING:

All wiring systems shall be tested for continuity of circuits, short circuits and earthing after wiring is complete and before energizing.

INSULATION RESISTANCE TEST:

The insulation resistance shall be measured by applying between earth and the whole system of conductors or any section thereof, with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 660 volts for medium voltage circuits.

Where the supply is derived from A.C. three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase conductor and the neutral. The insulation resistance measured as above shall not be less than 50 divided by the number of points on the circuit provided that the whole installation shall not be required to have an insulation resistance greater than one mega ohm. The insulation resistance shall not be measured between all conductors connected to one phase conductor of the supply and all the conductors connected to the middle wire or to the neutral or to the other phase conductors of the supply. Such a test shall be carried out after removing all metallic connections between the two poles of the installation and in these circumstances the insulation resistance between conductors of installation shall not be less than that specified above.

The insulation resistance between the case of frame work of housing and power appliances and all live parts of each appliance shall not be less than that specified in the relevant Indian Standard Specifications and where there is no such specification shall not be less than half a mega ohm.

TESTING OF EARTH CONTINUITY PATH:

The earth continuity conductor metallic envelopes of cables shall be tested for electric continuity and electrical resistance of the same along with the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the complete installation shall not exceed one ohm.

EARTH RESISTIVITY TEST:

Earth resistivity test shall be carried out in accordance with Indian Standard Code of Practice for earthing IS: 3043 - 1966. All tests shall be carried out in the presence of the architect.

BILLS OF QUANTITIES – SECTION – II A FOR 5 HP SOLAR PUMPING SYSTEM

Sr. No.	Description	Quantity	Unit	Rate	Amount
1	Photovoltaic Modules (Poly/Multi Crystalline)				
2	Solar Pump Controller	100 nos.			
3	Module Mounting Structure (As per described in Technical Specification)				
4	DC Cable	Suitable Size			
5	Solar Pump (5 HP AC) (Surface and Submersible)	100 nos.			
6	AC Cable	Suitable Size			
7	Change Over Switch (With Suitable Wiring)	100 nos.			

BILLS OF QUANTITIES – SECTION – II B FOR UNDER GROUND BORE WELL

Sr. No.	Description	Quantity	Unit	Rate	Amount
1	Drilling borehole of 300 mm dia for installing 50 mm dia M.S. capping by direct rotary drilling method in all sorts of soil as specified and directed by the engineer in charge. (Refer item 11 for location of bore).				
1.1	Up to 30 mt. depth from ground	30	Rmt.		
1.2	From 31 to 60mt depth	30	Rmt.		
1.3	From 61 to 90mt depth	30	Rmt.		
1.4	From 91 to 120mt depth	30	Rmt.		
1.5	From 121 to 150mt depth	30	Rmt.		
1.6	From 151 to 180mt depth	30	Rmt.		
1.7	From 181 to 210mt depth	30	Rmt.		
1.8	From 211 to 240mt depth	30	Rmt.		
2	Providing and installing 150 mm dia. M.S class-C (heavy) 7.00 mm thick (M S E.R.W Casing Pipe) housing pipe with ISI make V - wire L.C.G 1.5 mm screen pipe approximately 100 mt length by hydraulic rotary method as specified. (Jindal / TATA/Johnson Make)				
2.1	Up to 30mt. depth from ground	30	Rmt.		
2.2	From 30 to 90 mt depth	60	Rmt.		
2.3	From 90 to 200 mt depth	110	Rmt.		
2.4	From 201 to 240 mt depth	40	Rmt.		
	Note: Rate includes for providing and installing all necessary equipments.				

3	(Welding charges and providing and fixing top cap, clamp, reducer, boil plug etc. complete as specified, shall be included in the above scope i.e. from 2.0)				
	Extra for providing and installing strainer pipe, fitting it with casing pipes at all depths as directed and specified.				
	Note: The rate is extra over the rate is item No.2 wherein per Rmt. Rate for casing pipe is given and is to be paid for the difference in rates in strainer pipe work and casing pipe work only shall be quoted here.				
3.1	For 300 mm dia pipe	100	Rmt.		
4	Providing and laying well graded gravel of size 8mm - 12mm as specified and directed for packing.	35	Cmt.		
5	Carrying out electro logging test for the bore and submitting the test report and strata chart.	1	Job		
6	Carrying out initial development of bore by compressor for 8 to 10 hrs. and as directed and specified.(Bore well)	100	No.		
	Note: Rate shall include for all necessary equipments, tools, plants, fuels etc.				
7	Carrying out cumulative development of bore by compressor as directed and specified.	Rate Only	Hrs.		
	Note: Rate shall include for all necessary equipments, tools, machinery, fuels etc. and taking sounding after all aquifer have been developed.				
7.1	Carrying out pumping test for acceptance of bore continuous for 24 hrs.	Rate Only	Nos. per bore well		

Sr. No.	Description	Quantity	Unit	Rate	Amount
	Note: Rate shall include for all necessary equipment, tools plants, fuels etc. (As per expected yield of bore) (----- LPM)				
8	Cement grouting and sealing of the tube well as directed and specified by the Consultant.		No. per bore well		
	Notes:				
	1. Basic rate of cement is Rs.275.00 per bag for site and the rate shall include for all necessary equipments, tools, plants etc. complete.				
	2. Before execution of item 7.0 test reports of Electro logging shall be submitted to the Consultant and instructions from the Consultant shall be followed to get required quality of water.				
9	Providing and installing 50 mm dia. UPVC column pipes with all necessary connections/fittings/fixtures etc. Complete all levels as specified and directed. (Astral or any equal brand)	140	Rmt. (as per water level in bore and draw down)		
10	Supply, installation, testing and commissioning of submersible pump with necessary cables and electrical panel boards with following basic specifications:	100	NOS.		
	As per water requirement LPM + Total Head				
	Pump Make: KSB, Grundfos, Lubi equivalent				
	Pump Model : As per manufacturer (submit Data sheet)				
	Pump 5 HP : H.P.	100			
	Discharge : LPM	-----			
	Head : mt.	150			

Sr. No.	Description	Quantity	Unit	Rate	Amount
	Pump dia : mm	As per pump manufacturer			
	Discharge pipe size : 50 mm.	100			
	Casing pipe dia : 150 mm	130			
11	Cable : R R Kables / Finolex flat PVC				
	cable size : 4c x 10 sq.mm PVC insulated, PVC Sheathed flat, FINOLEX or equivalent make Multistrend copper conductor. (FOR DOL/soft starter)	100	Mtr.		
	Motor should be Star-Delta / ATS Starter operated.				
12	SUPPLY & INSTALLATION OF Electrical starter Panel	100	Nos.		
	Electrical control panel for bore well pump -5 HP as specified & directed with all required equipment & accessories. I/C MCCB , Change over switch/Soft Starter/ DOL starter, MFM / Hour Meter With RS 485 Port & Converter-RS 485 Port To USB/UTP/Fiber Optic With Gsm Card Compitable, Single Phase Preventer Meter water level controller & space heater & lamp / cooling fan should be equipped in panel				
	TOTAL COST	-----	-----		
	Less : Rebate @ %				
	Seal and signature	Seal and signature			
	of employer	of contractor			

BOQ- SECTION II-D FOR ELECTRICAL INSTALLATION WORK FOR BORE WELL / RECHARGE WELL

Sr.no.	Description	Quantity	Unit	Rate	Amount
1	CABLE TRAY AND M.S SUPPORTS FOR PIPE , TRAY, MCC , PUSHBUTTON STATION , ETC.(SITE FABRICATED)				
	The job includes supply and fabrication of Water Pipe , cable tray, panel base frames, all types of supports or brackets from mild steel angle, channels, flats, etc. with all necessary materials and equipments such as structural steel, welding machine, welding rods grinder, scraper, hardware, paints, etc. including fixing, grouting of cables, trays, supports, brackets either in wall or suspended from the slab by using Anchor fastener bolts (supply rate of Anchor fastener not consider in rate) etc. All M.S. parts shall be painted with two coats of red oxide and two coats of approved colour enamel paint.	0.5	ton		
2	SUPPLY & INSTALLATION OF CABLE TRAY (Hot Deep GI)				
	Supply, installation of hot dip galvanized, heavy duty, ladder/perforated type cable trays as mentioned below. The rate shall include following.				
	(a)Supply of required sized cable trays made from minimum 14 SWG M. S. sheet with cross, tees, bends, reducers, coupler fittings etc.				
	(b)Fixing of G.I. / M.S hangers, suspension hooks, clamps, clips etc. and only fixing of supporting brackets made out of M.S. channel/angle. (any steel material & fabrication not including in this rate				
	(c) Fixing of anchor fastener with minimum 10 mm. dia. bolts for				

	suspension and fixing of hangers, brackets and supports. In case of cable tray are suspended from R.C.C. slab				
	(d)Fixing of cable tray on the support, brackets, hangers, with all necessary G.I. hardware's like bolt, nut, washers, etc.				
	The rate shall include the cost of all necessary tools, hardware's, materials, labour, etc. but shall not include the cost of supply of M.S. angle/channel supports. The work shall be carried out as per the slandered practice and				
	as per the guide line given by cable tray manufacturers and to the satisfaction of engineer in charge or consultants.				
	TRAY MADE OUT OF 2MM SHEET / 80-100 MM micron hot dip galvanized				
2.1	200 MM x 50 mm PERFORATED CABLE TRAY	250.0	Mtrs		
3	SUPPLY & LAYING OF L.T CABLE -				
	In case of laying the cables on wall/ready-made trench/trays, the job also includes supply and fixing of M.S. supports at every minimum distance of 1000 mm and G.I. cable clamps at every interval of 300 mm. Fixing of AL. cable tag at both the end for identification of the cable. The job includes the testing of cables before and after laying. The work shall be completed generally as per technical specification given under heading of "CABLING" and as per the satisfaction of engineer-in- charge/consulting engineer.				
Sr.no.	Description	Quantity	Unit	Rate	Amount
	The rate for laying the cable will also include the following activities.				

	(a) Laying of cables with all necessary tools and equipments.				
	(b) Providing and fixing of clamps made out of 25 x 3 G.I. strips, , G.I. spacers in readymade trench including drilling of hole, welding if required, hardware like bolts, nuts, washers, etc.				
	(c) Dressing of cable in group.				
	(d) In case of cable laid in cable tray, rates for supply of tray and supports shall not be considered in this item and same shall be considered in cable tray (site fabricated) item rate.				
	(e) Testing of cables by mugger before and after laying and after connection at both the end.				
A	Supply & laying Of 4 C X 10 SQMM AL ARM XLPE Cable	100	Mtrs		
B					
4	TERMINATION OF L.T. CABLE (Double compression type cable gland)				
	Cable connection charges for 1.1 KV aluminum PVC sheathed armoured cable. The job includes supply of necessary materials like crimping tools, PVC tapes, aluminum/copper solder less sockets,				
	Double compression type cable glands, labour etc. as required to complete the job. Also testing of the cable before and after connection. The work shall be completed generally as per technical specification given under heading of "CABLING" and to the satisfaction of engineer-in- charge/consulting. Where ever required bimetallic washer, jelly / pest shall be applied for avoid oxidation at terminal.				

A	4 C X 10 SQMM CU ARM XLPE Cable		Nos.		
B					
5	SUPPLY & INSTALLATION OF Junction boxes / control panel				
A	SUPPLY & INSTALLTION Of weather proof (IP 65) EMG. PUSH BUTTON with lockable key - thermoplastic material hosing to be consider	100	nos.		
B	SUPPLY & INSTALLTION Of weather proof (IP 65) Junction box with 160 Amp 3P+N MCCB - thermoplastic material hosing to be considered (size of J.B. to connect 3.5C X 70 Sq.mm. AL cable & 160 A MCCB to be mounted.	100	nos.		
6	All in all maintenance contract (after the satisfactory commissioning)				
	1 st year				
	2 nd year				
	3 rd year				
	4 th year				

Sr.no.	Description	Quantity	Unit	Rate	Amount
7.0	SUPPLY AND INSTALLATION OF MAINTANCE FREE EARTHING PIT				
	Providing and Preparing an Maintenance free earthing pit at location as shown in the drawing including laying and installation of all necessary materials such as Hot Dip Galvanized earth electrode, strips, wires, Chemical for bonding, R.C.C. or brick chamber, C.I. frame with cover and to complete the job as required and as per technical specification given under the heading of "EARTHING" and to the satisfaction of consultants/engineer-in-charge				
	BORE FOR PIT DEPTH 3.5 MTRS.				
	Bore depth 3.5 mtrs. & qty of back fill compound for less 1 ohm resistance to be achieve				
	Black soil mix with back filled compound / using vibrator for at the time of installation				
	RATES INCLUDING BACK FILLING COMPAND HI TECH GRADE				
	STRIP INSERTED IN PIPE OR PIPE IN PIPE TYPE ELECTRODE				
A	By using 38 mm Hot Deep Galvanized Earthing Rod Electrode of 3 M long	100	Nos.		
	APPROVED MAKE - UNIVERSAL / ASHLOK / GALXY / INDELEC/ ERRICO				
8.0	SUPPLY AND FIXING OF EARTHING GRID BY COPPER/Hot Deep Galvanized STRIP (80 - 100 microns)				
	Providing, Fixing, connecting and testing earth grid by using copper/G.I./Hot deep Galvanized earth strips for earthing of				

	substation equipments. At the joint of two strips a section of 100 mm suitable thickness copper/G.I. strip to be fixed, with brass nuts bolts and brassing or welding shall be painted with black bitumen paint.				
	The job also include fixing & laying of 50 mm dia Hot Deep Galvanized. pipe when strip is entering in the building structures etc.				
A	25 X 3 mm Hot Dip Galvanized Earthing Strip	75	Mtrs		
B	10 Sqmm CU Flexible Cable For Bore Earthing	175	Mtrs		
9	GENERAL DESCRIPTION OF POINT WIRING :				
	Providing and commissioning of point wiring (light point, fan point, plug point, and all other types of point as mentioned here below) in concealed ,semi concealed or open conduit manner as directed by architect/consulting engineer by using 660/1100 volts grade minimum 1.5 sq.mm. or above copper conductor PVC insulated flexible ISI or FIA approved make wire/cable and 1.5/2.5 sq. mm green coloured PVC insulated wire in entire conduit length for earthing. The wiring is to be drawn in 25 mm dia ISI approved minimum 2.0mm wall thickness rigid PVC conduit with all necessary accessories such as bend, elbow, C.I. junction box (minimum 2" deep) spacers, clamps PVC junction boxes and outlet boxes. High deep CI Junction box shall be used in concealed wiring system.				

Sr.no.	Description	Quantity	Unit	Rate	Amount
	The M.S./Modular type Switchbox shall be purchased from the switches and accessories supplier' only and M.S Switchbox shall be Zinc Pasivated. The Junction and outlet boxes shall be made out of 2 mm M.S. sheet with two coats of red oxide and two coats of enamel paints/Modular Plastic Materials. The switch boxes shall be provided with required no of 6 Amp/16 Amp ON/OFF ISI/FIA approved switches and socket outlets of approved makes as mentioned in the bill of quantities. All the socket outlet shall be provided with socket outlet top pin.				
A	Wiring as above point wiring general description but for 2 no of Modular type 6 Amp three/five pin socket outlet with 2 no. of 6A modular type ON/OFF switch by using 2.5 Sq.mm Copper Flexible PVC wire for power and 1.5 Sq.mm Copper flexible wire for earthing. The socket outlet and switch shall be mounted on the switch box at convenient location (Not with other switches).The rate shall include the cost of socket outlet top pin.	100	nos.		
	power from nearest mcdbd				
		TOTAL AMOUNT PART		----- =====	