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Name of Work: **Providing and fixing solar hot water SS tank in place of existing defective tanks at VH (Dinning Hall) & GH-I Mess.**

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NIT amounting to **Rs. 2,95,156/-** is approved.

Executive Engineer
I.W.D. Elect. & AC Divn.
I.I.T., Kanpur

Superintending Engineer
Central Office, I.W.D.
I.I.T., Kanpur

PART-A

**INDIAN INSTITUTE OF TECHNOLOGY KANPUR
INSTITUTE WORKS DEPARTMENT
Electrical & Air-conditioning Division
E-TENDER NOTICE**

NIT No. 25/SOLAR/2018/305

Dated : 30.11.2018

The Executive Engineer, IWD, I.I.T., Kanpur on behalf of Board of Governors of IIT Kanpur invites online item rate tender from specialized agencies for the following work:-

Sl. No	Name of work and location	Estimated cost put to tender (In Rs.)	Earnest Money (In Rs.)	Period of Completion (in Month)	Last date & time of submission of tender	Period during which EMD, Cost of Tender Document, e-Tender Processing Fee and other Documents shall be submitted	Time & date of opening of tender
1	Providing and fixing solar hot water SS tank in place of existing defective tanks at VH (Dinning Hall) & GH-I Mess.	2,95,156/-	5903/-	02 Months	Upto 3.30 PM on 12.12.2018	After last date and time of sub-mission of tender and upto 3:30 PM on 14.12.2018	At 3:30 PM on 17.12.2018

The E-tender documents is available on www.tenderwizard.com/IIT

(Vinay Kumar Tiwari)
Executive Engineer(AC)

Copy to:

1. Institute website: www.iitk.ac.in/iwd/tenderhall.htm
2. Notice Board

Information and e-Tendering for Contractors

1. The intending tenderer must read the terms and conditions of FORM-6 for e-Tendering carefully. He should only submit his tender if he considers himself eligible and he is in possession of all the documents required.
2. Information and Instructions for tenderer posted on website shall form part of tender document.
3. The tender document consisting of plans, specifications, the schedule of quantities of various types of items to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents can be seen and downloaded from website www.tenderwizard.com/IIT or www.iitk.ac.in free of cost.
4. But the tender can only be submitted after uploading the mandatory scanned documents as per list given below.
5. The intending tenderer has to fill all the details such as Banker's name, Demand Draft/Fixed Deposit Receipt /Pay Order/ Banker's Cheque/Bank Guarantee number, amount and date.

The amount of EMD can be paid by multiple Demand Draft / Pay Order / Banker's Cheque / Deposit at call receipt / Fixed Deposit Receipts along with multiple Bank Guarantee of any Scheduled Bank if EMD is also acceptable in the form of Bank Guarantee.

6. Those contractors not registered on the website mentioned above, are required to get registered beforehand. If needed they can be imparted training on online bidding process as per details available on the website.
7. The intending tenderer must have valid class-III digital signature to submit the tender.
8. On opening date, the contractor can login and see the tender opening process. After opening of tenders he will receive the competitor tender sheets.
9. Contractor can upload documents in the form of JPG format and PDF format.
10. Contractor must ensure to quote rate of each item. The column meant for quoting rate in figures appears in pink colour and the moment rate is entered, it turns sky blue.

In addition to this, while selecting any of the cells a warning appears that if any cell is left blank the same shall be treated as "0".

Therefore, if any cell is left blank and no rate is quoted by the tenderer, rate of such item shall be treated as "0" (ZERO).

List of Documents to be scanned and uploaded within the period of tender submission:

- *Copy of Registration with the Department if any or specialized agencies or MNRE approval.*
- *Required experience / completion certificates of similar nature of works.
The works certificates submitted by the bidder clearly indicate that:*
 1. *The completion certificate cost of the relevant works.*
 2. *Actual date of completion of the work.*
- *Details of turn over during the last three years.*
- *Copy of bank solvency certificate*
- *Copy of GST registration*
- *E.M.D. and details of processing fee.*

FORM -6 FOR e-Tendering

The Superintending Engineer, IWD, I.I.T., Kanpur on behalf of Board of Governors of IIT Kanpur invites online item rate tenders from specialized agencies for the following work(s):

Providing and fixing solar hot water SS tank in place of existing defective tanks at VH (Dinning Hall) & GH-I Mess..

- 1.1 The work is estimated to cost **Rs. 2,95,156/-** This estimate, however, is given merely as a rough guide.
- 1.2 The authority competent to approve NIT for the combined cost and belonging to the major discipline will consolidate NITs for calling the tenders. He will also nominate Division which will deal with all matters relating to the invitation of tenders.

2 Criteria of eligibility

- **Copy of Registration with the Department if any or specialized agencies of solar hot water works or MNRE approved.**
 - **The Tenderer should have completed satisfactorily at least *3 similar works each of value 40% of the estimated cost or *2 similar works of 60% of the estimated cost or *1 similar work of 80% of estimated cost during the last 7(seven) years. (at least one work of them should be in Central Govt. /Central Autonomous bodies/ Central PSU/State PSU /State Govt.),,**
 - **Details of average annual financial turnover on relevant solar hot water related works should be at least 100% of the estimated cost during the last 3 consecutive financial years .**
 - **List of works completed of the requisite magnitude along with the attested copies of certificates of satisfactory completion”.**
 - **Copy of GST registration**
 - **Having a bank solvency certificate not less of 40% of estimated cost.**
3. Agreement shall be drawn with the successful tenderers on prescribed Form No. CPWD 7 (or other Standard Form as mentioned) which is available as a Govt. of India Publication and also available on website www.iitk.ac.in Tenderers shall quote his rates as per various terms and conditions of the said form which will form part of the agreement.
 4. The time allowed for carrying out the work will be **2 Months** from the date of start as defined in schedule 'F' or from the first date of handing over of the site, whichever is later, in accordance with the phasing, if any, indicated in the tender documents.
 5. The site for the work is available.*
 6. The tender document consisting of plans, specifications, the schedule of quantities of various types of items to be executed and the set of terms and conditions of the contract to be complied with and other necessary documents except Standard General Conditions of Contract Form can be seen on website www.tenderwizard.com/IIT or www.iitk.ac.in other necessary documents also can be seen in the office of the EE, IWD Electrical and Air-conditioning Division, IIT, Kanpur between hours of 3:00 PM to 3:00 PM from **01.12.2018 to 12.12.2018** free of cost.
 7. After submission of the tender the contractor can re-submit revised tender any number of times but before last time and date of submission of tender as notified.

8. While submitting the revised tender, contractor can revise the rate of one or more item(s) any number of times (he need not re-enter rate of all the items) but before last time and date of submission of tender as notified.
9. When tenders are invited in three stage system and if it is desired to submit revised financial tender then it shall be mandatory to submit revised financial tender. If not submitted then the tender submitted earlier shall become invalid.

10. Earnest Money can be paid in the form of Treasury Challan or Demand Draft or Pay order or Banker's Cheque or Deposit at Call Receipt or Fixed Deposit Receipt (drawn in favour of **Director, IIT, Kanpur** along with Bank Guarantee of any Scheduled Bank wherever applicable.

A part of earnest money is acceptable in the form of bank guarantee also. In such case, 50% of earnest money or Rs. 20 lac, whichever is less, will have to be deposited in shape prescribed above, and balance in shape of Bank Guarantee of any scheduled bank.

- (i) **Cost of Tender Document – Rs. 590/-** (Including GST) drawn in favour of the Director IIT, Kanpur through e-payment
- (ii) **e-Tender Processing Fee – Rs. 885/-** (including GST) drawn in favour of "**ITI Limited**" payable at Delhi through e-payment

Treasury Challan or Demand Draft or Pay Order or Banker's Cheque or Deposit at Call Receipt or FDR or Bank Guarantee against EMD, Cost of Tender Document and Cost of Tender Processing Fee shall be placed in single sealed envelope superscripted as "Earnest Money, Cost of Tender Document and Cost of Tender Processing Fee" with name of work and due date of opening of the tender also mentioned thereon.

Copy of Enlistment Order and certificate of work experience wherever applicable and other documents if required and specified in this bid document shall be scanned and uploaded to the e-Tendering website within the period of tender submission and certified copy of each shall be deposited in a separate envelop marked as "Other Documents".

Both the envelopes shall be placed in another envelope with due mention of Name of work, date & time of opening of tenders and to be submitted in the office of Superintending Engineer after last date & time of submission of tender and up to 03:30 PM **on 14.12.2018**.

The documents submitted shall be opened at 4.00 PM on **14.12.2018**.

Online tender documents submitted by intending tenderers shall be opened only of those tenderers, whose Earnest Money Deposit, Cost of Tender Document and e-Tender Processing Fee and other documents placed in the envelope are found in order.

The tender submitted shall be opened at 03:30 PM on **17.12.2018**.

11. The tender submitted shall become invalid and cost of tender & e-Tender processing fee shall not be refunded if:
 - (i) The tenderers is found ineligible.
 - (ii) The tenderers does not upload all the documents as stipulated in the tender document.
 - (iii) If any discrepancy is noticed between the documents as uploaded at the time of submission of tender and hard copies as submitted physically in the office of tender opening authority.
12. The contractor whose tender is accepted will be required to furnish performance guarantee of 5% (Five Percent) of the tendered amount within the period specified in Schedule F. This guarantee shall be in the form of cash (in case guarantee amount is less than ` 10000/-) or Deposit at Call receipt of any scheduled bank/Banker's cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay order of any Scheduled Bank of any scheduled bank (in case guarantee amount is less than ` 1,00,000/-) or Government Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the prescribed form. **In case the contractor fails to**

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

13. Intending Tenderers are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their tenders as to the nature of the ground and sub-soil (so far as is practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect their tender. A tenderers shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charge consequent on any misunderstanding or otherwise shall be allowed. The tenderers shall be responsible for arranging and maintaining at his own cost all materials, tools, & plants, water, electricity access, facilities for workers, and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a tender by a tenderer implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work and local conditions and other factors having a bearing on the execution of the work.
14. The competent authority on behalf of the Board of Governors, IIT, Kanpur does not bind itself to accept the lowest or any other tender and reserves to itself the authority to reject any or all the tenders received without the assignment of any reason. All tenders in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the tenderers shall be summarily rejected.
15. Canvassing whether directly or indirectly, in connection with tenderers is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable for rejection.
16. The competent authority on behalf of Board of Governors, IIT, Kanpur reserves to himself the right of accepting the whole or any part of the tender and the tenderers shall be bound to perform the same at the rate quoted.
17. The contractor shall not be permitted to tender for works in the IIT Kanpur responsible for award and execution of contracts, in which his near relative is posted a Divisional Accountant or as an officer in any capacity between the grades of Superintending Engineer and Junior Engineer (both inclusive). He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any gazetted officer in the IIT Kanpur. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this Department.
18. No Engineer of Gazetted Rank or other Gazetted Officer employed in Engineering or Administrative duties in an Engineering Department of the Government of India is allowed to work as a contractor for a period of one year after his retirement from Government service, without the prior permission of the Government of India in writing. This contract is liable to be cancelled if either the contractor or any of his employees is found any time to be such a person who had not obtained the permission of the Government of India as aforesaid before submission of the tender or engagement in the contractor's service.
19. The tender for the works shall remain open for acceptance for a period of **ninety (90) days** from the date of opening of tenders if any tenderer withdraws his tender before the said period or issue of letter of acceptance, whichever is earlier, or makes any modifications in the terms and conditions of the tender which are not acceptable to the department, then the

Government shall, without prejudice to any other right or remedy, be at liberty to forfeit 50% of the said earnest money as aforesaid. Further the tenderers shall not be allowed to participate in the retendering process of the work.

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

- a) The Notice Inviting Tender, all the documents including additional conditions, specifications and drawings, if any, forming part of the tender as uploaded at the time of invitation of tender and the rates quoted online at the time of submission of tender and acceptance thereof together with any correspondence leading thereto.
- b) Standard C.P.W.D. Form 7 or other Standard C.P.W.D. Form as applicable.

20.1.1 The tender document will include following three components:

Part A:-

CPWD-6, CPWD-7 including schedule A to F for the major component of the work, Standard General Conditions of Contract for CPWD 2014 as amended/modified up to **12.12.2018**.

Part B:-

General/specific conditions, specifications and schedule of quantities applicable to major component of the work.

Part C:-

Schedule A to F for minor component of the work. (SE/EE in charge of major component shall also be competent authority under clause 2 and clause 5 as mentioned in schedule A to F for major components), General/specific conditions, specifications and schedule of quantities applicable to minor component(s) of the work.

20.1.2 The tenderers must associate himself, with agencies of the appropriate class eligible to tender for each of the minor component individually.

20.1.3 The eligible tenderers shall quote rates for all items of major component as well as for all items of minor components of work.

20.1.4 Entire work under the scope of composite tender including major and all minor components shall be executed under one agreement.

20.1.5 Security Deposit will be worked out separately for each component corresponding to the estimated cost of the respective component of works. The Earnest Money will become part of the security deposit of the major components of work.

Superintending Engineer
For & on behalf of the Board of Governors, IIT, Kanpur

ITEM RATE TENDER AND CONTRACT FOR WORK

- (A) **Tender for the work of:** | **Providing and fixing solar hot water SS tank in place of existing defective tanks at VH (Dinning Hall) & GH-I Mess..**

TENDER

I/We have read and examined the Notice Inviting tender, schedule, A,B,C,D,E&F. Specifications applicable, Drawings & Designs, General Rules and Directions, Conditions of Contract, clauses of contract, Special conditions, Schedule of Rate & other documents and rules referred to in the conditions of contract and all other contents in the tender document for the work.

I/We hereby tender for the execution of the work specified for the Board of Governors, IIT, Kanpur within the time specified in Schedule 'F', viz., schedule of quantities and in accordance in all respects with the specifications, designs, drawings and instructions in writing referred to in Rule-1 of General Rules and Directions and in Clause 11 of the Conditions of contract and with such materials as are provided for, by, and in respects in accordance with, such conditions so far as applicable.

We agree to keep the tender **open for (90) ninety days from the date of opening of tender** and not to make any modifications in its terms and conditions.

A sum of **Rs. 5903/-** is hereby forwarded in Cash/Receipt Treasury Challan/Deposit at call Receipt of a Scheduled Bank/Fixed deposit receipt of scheduled bank/demand draft of a scheduled bank/bank guarantee issued by scheduled bank as earnest money. If I/we, fail to furnish the prescribed performance guarantee or fail to commence the work within prescribed period I/we agree that the said Board of Governors, IIT, Kanpur or his successors in office shall without prejudice to any other right or remedy be at liberty to forfeit the said earnest money absolutely. Further, if I/we fail of commence work as specified, I/we agree that Board of Governors, IIT, Kanpur or his successors in office shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein and to carry out such deviations as may be ordered, up to maximum of the percentage mentioned in Schedule 'F' and those in excess of that limit at the rates to be determined in accordance with the provision contained in Clause 12.2 and 12.3 of the tender form.

Further, I/We agree that in case of forfeiture of earnest money or both Earnest Money & Performance Guarantee as aforesaid, I/We shall be debarred for participation in the re-tendering process of the work.

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

I/We hereby declare that I/we shall treat the tender documents drawings and other records connected with the work as secret/confidential documents and shall not communicate information derived there from to any person other than a person to whom I/we am/are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

Dated _____ ** _____

Witness: **

Address: **

Occupation: **

**
Signature of contractor
Postal Address **

ACCEPTANCE

The above tender (as modified by you as provided in the letters mentioned hereunder) is accepted by me for and on behalf of the Board of Governors, IIT, Kanpur for a sum of Rs. _____ (Rupees _____)

The letters referred to below shall form part of this contract Agreement:-

- a) _____
- b) _____
- c) _____

For & on behalf of the Board of Governors, IIT,
Kanpur

Dated _____

Signature _____
Designation _____

Operative schedules shall be supplied separately to each intending tenderer)

SCHEDULE 'A'

Schedule of Quantities:

SCHEDULE 'B'

Schedule of materials to be issued to the contractor:

S. No.	Description of item	Quantity	Rates in figures & words at which the material will be charged to the contractor	Place of issue
1	2	3	4	5
-----NIL -----				

SCHEDULE 'C'

Schedule of Tools and Plants to be hired to the contractor

S. No.	Description	Hire charges per day	Place of issue
1	2	3	4
-----NIL -----			

SCHEDULE 'D'

Extra schedule for specific requirements/document for the work, if any: **As attached in tender form.**

SCHEDULE 'E'

Schedule of component of other Materials, Labour, POL etc. for price escalation : **N.A.**

SCHEDULE 'F'

Reference to General Conditions of contract.

Name of Work:	Providing and fixing solar hot water SS tank in place of existing defective tanks at VH (Dinning Hall) & GH-I Mess.		
Estimated cost of the work:	Air-conditioning Items of Work		2,95,156/-
Earnest money			5903/-
Performance Guarantee	5% of the tendered value of the work		
Security Deposit	5% of the tendered value of the work		
General rules and direction :			

Definitions:

2(v)	Engineer-in-Charge		
	For Air-conditioning & Refrigeration/Electrical items of work	Executive Engineer, Institute Works Department IIT, Kanpur	
2(vi)	Accepting Authority	Superintending Engineer, Institute Works Department IIT, Kanpur	
2(vii)	Percentage on cost of materials and labour to cover all overheads and profits	15%	
2(viii)	Standard Schedule of Rates:		
	Electrical Items of Work:	D.S.R. 2016 with up to date correction slips	
2(ix)	Department:	Central Public Works Department	
2(x)	Standard CPWD contract Form:	GCC 2014, CPWD form-7 as modified & corrected up to 12.12.2018 (Whether correction vide latest circulars are incorporated or not in this document).	
Clause 1	i) Time allowed for submission of Performance Guarantee from the date of issue of letter of acceptance	15 Days	
	ii) Maximum allowable extension beyond the period as provided in i) above	7 Days	
Clause 2	Authority for fixing Compensation under Clause 2	Superintending Engineer, Institute Works Department IIT, Kanpur. Or successor thereof	
Clause 2 A	Whether Clause 2A shall be applicable	No	
Clause 5	i) Number of days from the date of issue of letter of acceptance for reckoning date of start	22 Days	
	ii) Time allowed for execution of work	2 Months	
Authority to decide	Extension of time	Superintending Engineer, Institute Works Department IIT, Kanpur	
Clause 6/ 6A		Only clause 6 applicable.	
Clause 7	Gross work to be done together with net payment/Adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment	Not applicable	
Clause 10A	Material to be provided by the contractor.	Applicable	
Clause 10B (ii), (iii)	Whether clause 10-B (ii) and 10-B (iii) shall be applicable.	Not Applicable	

Clause 10 C	Component of labour expressed as percentage of value of work		---
Clause 10 CA	Materials covered under this clause.	Nearest material(other than cement, reinforcement bars and structural steel) for which All India Whole sale price Index is to be followed.	Base price of all the materials covered under clause 10 CA
	1. Cement (PPC)	Nil	NIL
	2. Steel	Nil	Nil
Clause 10 CC	Increase/Decrease in Price of materials/wages		Not Applicable

Clause 11 Specification to be followed for execution of work:

For electrical works CPWD specifications 2013 internal and external electrical works

For Air conditioning & Refrigeration item of works CPWD Specifications 2017 HVAC for Air-conditioning & refrigeration works with up to date correction slips.(Hereinafter called CPWD specifications also)

Clause 12

12.2 & 12.3 Deviation limit beyond which clause 12.2 & 12.3 shall apply for building work ---

Clause 16 Competent Authority for Deciding reduced rates:

For electrical/civil/Air-conditioning& refrigeration items of work **Superintending Engineer, Institute Works Department IIT, Kanpur**

Clause 18 List of mandatory machinery, tools & plants to be deployed by the contractor at site. **Ladders, Multimeter, drill machine, crimping tools, spanner set, blower, Gas Charging line with equipment, welding torch etc**

Clause 36 (i) Requirement of technical Representative(s)

For supervision of air-conditioning/refrigeration & civil as well as electrical items of work, technical representatives of the respective disciplines will be required to be deployed.

SALIENT/MANDATORY REQUIREMENTS FOR THE TENDER

Name of Work: **Providing and fixing solar hot water SS tank in place of existing defective tanks at VH (Dinning Hall) & GH-I Mess.**

- 1 The tenderer is advised to read and examine the tender documents for the work and the set of drawings available with Engineer-in-charge. He should inspect and examine the site and its surroundings by himself before submitting his tender.
- 2 Separate schedule of quantity is included in this tender for air conditioning & refrigeration items of work. If the tenderer wants to offer any unconditional rebates on their rates, the same should also be offered in the respective components of schedule separately. The contractor shall quote the item rates in figures and words accurately so that there is no discrepancy in rates written in figures and words.
- 3 Time allowed for the execution of work is **02 Months.**
- 4 The contractor(s) shall submit a detailed program of execution in accordance with the master programme/milestone within ten days from the date of issue of award letter.
- 5 Contractor has to arrange and install field laboratory during the currency of work and nothing extra will be paid on this account.
- 6 Quality of the project is of utmost importance. This shall be adhered to in accordance with the provisions of CPWD specifications and guidelines given in the relevant paras.
- 7 Contractor has to deploy required Plant and machinery on the project. In case the contractor fails to deploy the plant and machinery whenever required and as per the direction of the Engineer-in-charge, he (Engineer-in-charge) shall be at a liberty to get the same deployed at the risk and cost of the contractor.
- 8 The contractor shall comply with the provisions of the Apprentices Act 1961, and the rules and orders issued there under from time to time. If he fails to do so, his failure will be a breach of the contract and the Superintending Engineer/Executive Engineer may in his discretion, without prejudice to any other right or remedy available in law, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.
- 9 Temporary Electric connection shall be issued as per request and the water charges shall be recovered as per rule.

PART-B

QUALITY ASSURANCE OF THE WORK

Sampling of Materials:

1. The contractor shall procure all the materials at least in advance so that there is sufficient time to testing and approving of the materials and clearance of the same before use in work.
2. All materials brought by the contractor for use in the work shall be got checked from the Engineer-in-Charge or his authorized representative of the work on receipt of the same at site before use.
3. The contractor shall be fully responsible for the safe custody of the materials issued to him even if the materials are in double lock and key system.

SPECIAL CONDITION FOR SAFETY AT THE WORK SITE

The contractor will identify one of the supervisors for taking care of implementation of Safety systems.

The Contractor should follow the following General Guidelines governing the safety rules as laid down under:

1. Smoking is strictly prohibited at workplace.
2. Nobody is allowed to work without wearing safety helmet. Chinstrap of safety helmet shall be always on. Drivers, helpers and operators are no exception.
3. No one is allowed to work at or more than three meters height without wearing safety belt and anchoring the lanyard of safety belt to firm support preferably at shoulder level.
4. No one is allowed to work without adequate foot protection.
5. Usage of eye protection equipment shall be ensured when workmen are engaged for grinding, chipping, welding and gas-cutting. For other jobs as and when site safety co-coordinator insists eye protection has to be provided.
6. All safety appliances like Safety shoes, Safety gloves, Safety helmet, Safety belt, Safety goggles etc. shall be arranged before starting the job.
7. All excavated pits shall be barricaded & barricading to be maintained till the backfilling is done. Safe approach to be ensured into every excavation.
8. Adequate illumination at workplace shall be ensured before starting the job at night.
9. All the dangerous moving parts of the portable / fixed machinery being used shall be adequately guarded.
10. Ladders being used at site shall be adequately secured at bottom and top. Ladders shall not be used as work platforms.
11. Material shall not be thrown from the height. If required, the area shall be barricaded and one person shall be posted outside the barricading for preventing the tre-passers from entering the area.
12. Other than electricians no one is allowed to carry out electrical connections, repairs on electrical equipment or other jobs related thereto.
13. All electrical connections shall be made using 3 or 5 core cables, having a earth wire.
14. Inserting of bare wires for tapping the power from electrical sockets is completely prohibited.

15. A tools and tackles inspection register must be maintained and updated regularly.
16. Debris, scrap and other materials to be cleared from time to time from the workplace and at the time of closing of work everyday.
17. All the unsafe conditions, unsafe acts identified by contractors, reported by site supervisors and / or safety personnel to be corrected on priority basis.
18. No children shall be allowed to enter the workplace.
19. All the lifting tools and tackles shall be stored properly when not in use.
20. Clamps shall be used on Return cables to ensure proper earthing for welding works.
21. Return cables shall be used for earthing.
22. All the pressure gauges used in gas cutting apparatus shall be in good working condition.
23. Proper eye washing facilities shall be made in areas where chemicals are handled.
24. Connectors and hose clamps are used for making welding hose connections.
25. All underground cables for supplying construction power shall be routed using conduit pipes.
26. Spill trays shall be used to contain the oil spills while transferring / storing them.
27. Tapping of power by cutting electric cables in between must be avoided. Proper junction boxes must be used.

(Rajeev Garg)
Superintending Engineer

SPECIAL TERMS & CONDITIONS

1. In the Contract (as hereinafter defined) the following definitions words and expressions shall have the meaning hereby assigned to them except where the context otherwise required.
 - i) Institute shall mean the Indian Institute of Technology (IIT), Kanpur
 - ii) The President shall mean the Board of Governor, IIT Kanpur.
 - iii) The Engineers In-charge, who shall administer the work jointly, shall mean the Executive Engineer (Electrical & Air-conditioning) for electrical and Air-conditioning works.
 - iv) Government or Govt. of India shall mean the Indian Institute of Technology represented by its Director.
 - v) The term Director General of Works shall mean the Chairman, Building & Works Committee of the Institute.
 - vi) Accepting authority shall mean the Director, IIT Kanpur or his authorized representative.
 - vii) Superintending Engineer shall mean the Superintending Engineer of the Institute, who as overall In-charge and head of the Institute Works Department, shall direct the contract.
 - viii) Site Engineers shall mean the Sr. Assistant Engineer /Assistant Engineer/Jr. Engineer (Electrical) for Electrical & Air-conditioning works, appointed by the Institute Works Department.

2. Duties & Powers :

- i) Site Engineers :

The duties of the Site Engineer(s) are to watch and supervise the works and the workmanship employed in connection with the works, and to test and examine any materials to be used. He shall have no authority to relieve the contractor of any of his duties or obligations under the contract nor, except as expressly provided here under, to order any work involving delay or any extra payment by the Institute, nor to make any variation in the works.

The Engineer-in-charge, from time to time in writing, delegate to the Site Engineer (s) any of the powers and authorities vested in them. Any written instruction or written approval given by the Site Engineer (s) to the contractor within the terms of such delegation (but not otherwise) shall bind the contractor and the Institute as though it had been given by the Engineer-in-charge / Architect provided always as follows :

- a) Failure of the Site Engineer (s) to disapprove any work or materials shall not prejudice the power of the Engineer In-charge / Architect to subsequently disapprove such work or materials and to order the pulling down, removal or breaking up thereof.

- b) If the contractor is dissatisfied by reason of any decision of the Site Engineer (s), he shall be entitled to refer the matter to the Engineer-in-charge / Architect, who shall thereupon confirm reverse or vary such decision.
- ii) The scope of contract comprises the construction, completion and maintenance of the works for (12) months after the completion and the provision of all labour, materials, construction of plant equipment and transpiration, temporary works and everything, whether of temporary or permanent nature required in and for such construction, completion and maintenance so far as the necessity for providing the same is specified in or reasonably be inferred from the contract. The contractors shall make his own arrangements for the store storage of materials, accommodation for his staff etc. and no claim for the temporary accommodation from the contractor shall be entertained.

The contractor shall carry out and complete the said work in every respect in accordance with this contract and as per the directions and to the satisfaction of the Engineer-in-charge/Architect. Issue of further drawings and /or written instructions, detailed directions and explanations which are hereinafter collectively referred to as instructions of the engineer-in-charge/ Architect's in regards to:-

- a. The variation or modification of the design, quality, or quantity of works or the addition or omission or substitution of any work.
- b. Any discrepancy in the drawings or between the schedule of quantities and /or drawings and/or specifications.
- c. The removal from the site of any materials brought thereon by the contractor and the substitution of any other material thereof.
- d. The dismissal from the works of any persons employed thereupon.
- e. The opening up for inspection of any work covered up.
- f. The amending /making good of any defects.

The contractor shall forthwith comply with and duly execute any instructions of work comprised in such engineers-in-charge instructions, provided always that the verbal instructions and explanations given to the contractor or his representative upon the works shall, if involving a variation , be confirmed in writing by the contractor within seven days and is not dissented in writing within a further seven days by the Engineer-In-Charge/Architect, such shall be deemed to be instructions of the Engineer-In-charge/Architect within the scope of the contract.

3. Contract Document:

- 3.1 The several documents, forming the contract, are to be taken as mutually explanatory of one another and in case of ambiguities or discrepancies the same shall be explained and adjusted by the Engineer-In-Charge who shall thereupon issue to the contractor its interpretation directing in what manner the work is to be carried out. In case the contractor feels aggrieved by the interpretation of the Institute then the matter shall be referred to the Superintending Engineer and his decision shall be final, conclusive and bind on both parties.
- 3.2 The drawings etc. shall remain in the custody of the Institute. Two complete sets of drawings, specification and bill of quantities shall be furnished by the Engineer-In-Charge to the contractor in such time which must not delay the progress of the construction and

the Institute shall furnish copies of any additional drawings, which in their opinion may be necessary for the execution of any part of the work. One complete set shall be kept on the work site and the Engineer-In-Charge and his representatives shall be, at all reasonable times, have access to the same. The contractor shall study the drawings thoroughly before the commencement of work. In case of any discrepancy, the contractor shall seek clarification before proceeding with the works. Figured dimensions are in all case to be accepted in preference to the scaled sizes. Large scale details shall take preference over small scale one.

The contractor shall give adequate notice in writing to the Engineer-in-charge of any further drawings or specification that may be required for the execution of the works or otherwise under the contract.

The Engineer-in-charge shall have full powers and authority to supply the contractor from time to time during the progress of the work such drawings and instructions as shall be necessary for proper execution and the contractor shall carry out and be bound by the same.

- 3.3 The successful tenderer shall be required to enter into an agreement with the Institute. The Bill of Quantities & rates filled by the successful tenderer in, the General Condition of the Contract for CPWD works 2010, CPWD specifications for Civil, Electrical & Air-conditioning works, the special conditions, additional specifications, negotiation letter and the award letter etc. shall form part of the agreement to be signed by the successful tenderer. The cost of stamp paper and stamp duty, required for the agreement, shall be borne by the contractor.

4. **Contract Agreement:**

The contractor shall, when called upon to do so, enter into and execute a contract agreement in the form annexed as annexure 'A' with such modifications as may be necessary. The contract agreement, inclusive of its enclosures, shall remain in the custody of the Superintending Engineer, Institute Works Department, IIT Kanpur and the made available him as and when required contractor shall however be supplied, an attested copy there free of cost.

5. All tenders are required to deposit earnest money in the form of FDR/CDR in the only duly endorsed in favour of Director, IIT Kanpur. Earnest money should be enclosed in a separate sealed envelope and tender documents should be enclosed in a another envelope superscribed “ **EARNEST MONEY- NAME OF WORK “ ITEM RATE-TENDER-NAME OF WORK**” on the top of envelope. At the time of opening of tender earnest money envelope will be opened first and in case earnest money is not found in the requisite from or amount envelope containing item rate tender of the party concerned shall be opened and will be summarily rejected and documents submitted will be confiscated by the Institute.
6. Canvassing in connection with tenders is prohibited and the tenders, submitted by the tenderers who resort to canvassing, are liable for rejection.
7. Tenderers shall have to sign the attached declaration (Appendix B) and if the declaration is not found to represent a true statement of facts the contract is liable to be cancelled, earnest money forfeited and the contractor shall have no claim on the Institute.
8. Tenderes are not allow to make additions and alterations in the tender document. Any additions and alternations, if incorporated in the tender, shall be at the tender's risk since the modified tender is liable for rejection.

Conditional tenders violative of the spirit and the scope or the terms & conditions of the tender, are liable to be rejected without assigning any reasons. Tenders with any form of rebate shall be rejected summarily.

9. Water and electricity required for electrical & air-conditioning works shall be supplied free of charge.
10. Stamps duty on the security money shall also be the born by contractor as per prevailing notification of U.P Govt.
11. Value Added Tax on work contract as per prevailing notification of U.P.Govt.shall be also be recovered from the contractor bill.
12. Income tax shall be deducted as per prevalent law.
13. **Conditions for Electrical and Air-conditioning Works:-**
 - 13.1 All chase cuttings in the wall, for recessed conduits & boxes and drilling the holes shall be done with power operated machines only. No chase shall be allowed to be cut manually with the use of hammer & chisel.
 - 13.2 All cuttings in cement plaster and brick shall be made good by using cement mortar 1:3 (1 part cement, 3 part coarse sand)
 - 13.3 The cut surfaces shall be repaired by an experienced mason only so as to match the repaired plaster with the original.
 - 13.4 All such repaired surfaces shall be cured for 3 to 4 days to keep the surfaces wet, using water spray machine (hand/motor operated) and avoid unnecessary flooding of the area.
14. **Payment shall be regulated as under**
 - a.) 75% of the tendered rate on receipt of materials at site.
 - b.) 15% of the tendered rate on installation and connection.
 - c.) 10% of the tendered rate on testing and commissioning.
15. **Drawings/Data required prior to commencement of electrical/air-conditioning works:-**
 - 16.1 The following drawings shall be provided by the Architect/Engineer-In-Charge of the work:-
 - i) Conduit layout for lights, fans, socket outlets, telephone outlets, network & fire alarm system and sub mains showing size of conduits, no. of wires and size of wires in each run, location and size of accessories like junction boxes, ceiling boxes for hooks, draw boxes and switch boxed etc.
 - ii) Cable routing drawings showing details of size, type and no. of cables and mode of installation.
 - iii) Ducting /chilled water pipe line/refrigerant pipe/drain pipe/unit positioning etc., drawing showing details of size, type, and mode of installation.
 - 16.2 Following drawings shall be furnished by the contractor for the approval of the Engineer-In-charge.
 - i.) G.A and schematic drawings of MV switchgear/distribution /Plant/AHU/ FCU/Fire Alarm panel showing material and size of sheet steel/bus bars / inter connections and make and ratings of switchgear i/c details of protection, metering, indicating and inter lock etc.
 - ii.) Ducting /chilled water pipe line/refrigerant pipe /drain pipe etc., drawing showing details of size, type and mode of installation.

17. **Completion drawings:**

On completion of works and before issuance of completion certificate, the contractor submit completion drawings in the form of three complete set of originals (reproducible)

- i) As built GA and schematic drawings of Indoor & outdoor ac units installations.
- ii) Technical literature, test certificates, and operation and maintenance manuals for window/split/tower ac units & their compressors required.

18. **Works Inspection and Testing of Equipment:**

- a.) Prior to dispatch of equipment the Institute reserves the right to inspect the same at the manufacturer's works and the contractor shall provide and secure every reasonable access and facility at the manufacturers works for inspection, for witness of all acceptance and routine tests as per relevant Indian Standards. Contractor shall give a reasonable notice of about 15 days for the purpose of test, and witness of all major equipments.
- b.) Pre-commissioning test: All routine tests shall be carried out on the electrical & air-conditioning equipment. Protective & measuring devices should be checked for calibration of window/split/tower ac units should be checked for air quantities and temperature. All grills/diffusers should be checked for balanced air quantities.

19. Rates: The work shall be treated as on works contract basis and the rates tendered shall be for complete item of work and all charges for items contingent to the work, such as packing, forwarding, insurance, freight and delivery at site for the materials to be supplied by the contractor, watch and ward of all materials at the site, labour related expenses as per relevant labour laws, testing of materials/ samples etc. excluding Goods & Service tax (GST)

20. **Taxes & Duties:**

20.1 Being an indivisible works contract, no other tax is payable other than GST. The GST shall be as applicable to IIT Kanpur as per Government rules.

21. The earnest money of the unsuccessful tenderers shall be refunded on written request, within 1(one) month of the award of work. The earnest money of the successful tenderer shall however be adjusted towards the security deposit.

22. The tender document & drawings in respect of the work can be seen in the o/o Sr. Electrical Engineer

23. The tender document contains _____ pages. No page of the tender document shall be removed, mutilated, detached, or cancelled.

24. Rates for finished works shall be given for each items separately, both in words & figures. In the event of non compliance the tender shall be deemed incomplete and liable for rejection.

25. All entries by the tenderer should be made in one ink and one hand writing only. Tenders should be filled in legible hand writing and should not contain erasures, corrections and

overwriting as far as possible. However if it becomes necessary, each correction etc. should be properly attested under dated signature.

26. The work shall be executed on the basis of the following CPWD specifications:
 - i) Electrical & HVAC Works :
 - General specifications for Electrical Works Part-1 (Internal) 2005 with up to date corrections.
 - General specifications for electrical works (external) 1994 with upto date corrections.
 - General specifications for electrical works Part-VII (DG set) 2006 with upto date corrections.
 - General specifications for electrical works Part-IV Sub-station- 2007 with upto date corrections.
 - General specifications of HVAC works 2004 with upto date corrections.
27. For the purpose of clause 12 of the General conditions of contract the following schedule of rates shall be applicable.
 - i) Electrical Works: Electrical Works, air-conditioning & refrigeration works: Based upon prevailing market rates
28. The special conditions listed above shall take precedence over all above provisions of the contract. The General Condition of contract for CPWD works shall be generally followed including the clause 21 i.e. work shall not be sublet.
29. The contractor shall have to execute the work in such place and condition where other agencies will also be engaged for other works such as site grading, filling and leveling, interiors, landscape, and electrical and mechanical engineering works, etc. No claim shall be entertained due to work being executed in the above circumstances.
30. No contractor, to whom the provisions of the BOCW Act apply, shall be allowed to commence work on the campus unless he has produced the 'Registration Certificate' issued by the office of Dy. CLC (Central).
31. The contractor shall engage only such workers who are registered as beneficiaries with U.P. BOCW Welfare Board and in case of engagement of new workers; he shall ensure the submission of applications for registration of such workmen within appropriate time.
32. A certificate for administrative convenience shall be obtained from the contractor covered under BOCW Act whether he has engaged 10 or more workmen while working in the Institute and only thereafter, Cess @1% from the bills raised by him shall be deducted at source for all running works. Cess, so deducted shall be deposited with the BOCW Welfare Board.
33. As per clause 36 (I) of GCC: It should be noted that license wire man shall only be allowed for the wiring work.

TECHNICAL SPECIFICATION:

Section 1

PIPE WORK

1. General

All piping work shall conform to quality standards and shall be carried out as per specifications and details given hereunder & shall follow the applicable on relevant Indian standards.

2. Pipes

- 2.1 All pipes upto 150 MM shall be M.S. E.R.W tube (black steel) heavy class as per I.S. 1239-79, Part-I with amendment-I of January '81.

3. Fittings

- 3.1 The dimensions of the fittings shall conform to I.S.1239/69 Part-II unless otherwise indicated, in the specifications.
- 3.2 All bends in sizes upto and including 150 MM dia. shall be readymade of heavy duty, wrought steel of appropriate class.
- 3.3 All bends in sizes 200 MM and larger dia. shall be fabricated from pipes of the same dia. and thickness, with a minimum of 4 sections, and having a minimum centre line radius of 1.5 diameter of pipes.
- 3.4 All fittings such as branches reducers etc. in all sizes shall be fabricated from pipes of the same Dia. and thickness, and its length should be at least twice the dia. of the pipe.
- 3.5 The branches may be Butt welded straight to the main line, without making a separate fitting, where specified on drawings or required by Engineer-In-Charge.
- 3.6 Blank ends are to be formed with flanged joints and 6 MM thick blank insertion of rubber gasket between flange pair for 150 mm and over, in case where, a future extension is to be made otherwise blank end discs of 6 mm thickness are to be welded on, with additional cross stiffeners from 50 mm x 50 mm M.S. Heavy angles, for sizes upto 350 MM dia. All ends larger than 400 MM dia. shall have dished ends.

4. Flanges

- 4.1 All flanges shall be of mild steel as per I.S. 6392/71 and shall be steel slip-on-type, welded to the pipes, flange thickness shall be as per BS10.
- 4.2 Flanges may be tack welded into position, but all final welding shall be done with joints dismantled. 3 mm thick gaskets shall be used with all flanged joints. The gaskets shall be fibre re-inforced rubber as approved by the Engineer-In-Charge. Special adhesive compound shall be used between flanges of steam, air and gas lines.
- 4.3 Flanges shall be used as follows :-
- 4.3.1 Counter flanges for equipment having flanged connections.
- 4.3.2 Flanged pairs shall be used on all such equipment, which may require to be isolated or removed for service e.g. Pumps, refrigeration machines, air handling units etc.
- 4.3.3 All threaded valves shall be provided with nipples and flanged pairs on both sides to permit flange connections, for removal of valves from main lines for repair/replacement.

5. Valves

5.1 Butterfly Valves

- 5.1.1 The butterfly valve shall consist of cast iron body preferably in two piece construction.
- 5.1.2 The disc shall consist of disc pivot and driving stem shall be in one piece centrally located.
- 5.1.3 The valve seat shall be synthetic material suitable for water duty. It shall line the whole body.
- 5.1.4 The disc should move in slide bearings on both ends with 'o' ring to prevent leakage.

- 5.1.5 The handle should have arrangement for locking in any set position.
- 5.1.6 All valves 200mm Dia. and above shall be gear operated.
- 5.1.7 The valve should be suitable for 12 Kg/cm² working pressure.

6. **Ball Valves**

- 6.1 All Valves 40 mm Dia. and below shall be of Gun Metal Ball type Valves with (FPT) female threads conforming to class 2 of IS 778 and mating flanges fitting.
- 6.2 All Ball valves shall be ISI Marked.

7. **Balancing Valves**

- 7.1 The balancing valves upto 80 mm Dia. shall be of gunmetal screwed type conforming to BS 5154 or equivalent specifications.
- 7.2 The valve shall be cast gunmetal ASTM B-62 and complete with non rising spindle. PTFE disc seal cast metal hand wheel.
- 7.3 The port opening shall permit precise regulation of flow rate, by accurately measuring the pressure drop across the port.
- 7.4 The valve shall be completed with two ports for connections to a mercury manometer, to measure the pressure drop, as well as a drain port.
- 7.5 The spindle shall have a shielded screw to set the flow at the desired level.
- 7.6 This valve shall be used wherever specified.

8. **Dual Plate Check Valves**

- 8.1 The body of the check valve shall be made from a single piece casting in cylindrical shape.
- 8.2 There shall be two plate, which shall be hinged in the centre of the circle. Both plates shall be have springs attached to them for assisting in closing action of the valve.
- 8.3 There shall be properly/designed metal to metal seal between the plates and the outer body, to ensure non leaking sealing.
- 8.4 The valve design shall confirm to API 594 or equivalent specifications.

9. **Automatic/Dynamic Balancing Valve.**

- 9.1 Automatic Dynamic Balancing Valve shall be of forged brass (upto 40mm dia.) grey iron (above 40mm dia.) construction of 1350K Pa pressure and 120°C temperature rating. The valves shall have precision calibrated, stainless steel carriage to achieve the desired/pre-fixed flow rates irrespective of the pressure fluctuations in the water lines within a range of 10-210 K. Pa. The flow rate within a tolerance of $\pm 5\%$ will be achieved by automatic adjustment of the open orifice area in response to the pressure differential changes. The end connection upto 80mm dia. should be threaded and for above 80mm dia. it should be flanged.

10. **Strainers**

- 10.1 The strainers shall either be pot type or 'Y' type with cast iron or fabricated steel body, tested upto pressure applicable for the valves as shown on the drawings.
- 10.2 The strainers shall have a perforated bronze sheet screen with 3 mm perforation and with a permanent magnet, to catch iron fillings.
- 10.3 Pot strainers shall be provided with flanged connections and 'Y' strainers shall be provided with flanged ends.
- 10.4 The strainers shall be designed to facilitate easy removal of filter screen for cleaning, without disconnection of pipe line.

11. **Other Valves**

- 11.1 All gauge cocks shall be of gunmetal plug type, complete with siphon (brass chrome plated).
- 11.2 All drain valves shall be of gunmetal with a hose union connection on one hand.

12. **'V' Form Thermometers (Industrial Type)**

- 12.1 The body shall be of aluminium alloy with anodized gold colored surface. The casing shall be adjustable side ways for reading from the front. The glass capillary shall be triangular in shape

with the blue mercury filled in glass. Scale of reading shall be of the range 0°C to 50°C/32°F to 120°F.

12.2 Thermometer shall be suitable for 12 mm connections with long stem, so that thermometer is removable without damaging the insulation. M.S. socket to be welded on pipes shall be provided with thermometer.

13. **Joining**

13.1 All pipe lines shall be welded type.

13.2 Square cut plain ends will be welded for pipes upto and including 100 MM Dia.

13.3 All pipes 125 MM Dia. or larger will be bevelled by 35 DEG. before welding.

14. **Pipe Supports/Hangers**

14.1 Pipe supports shall be provided and installed for all piping wherever indicated, required or otherwise specified. Wherever necessary, additional hangers and supports shall be provided to prevent vibration or excessive deflection of piping and tubing.

14.2 All vertical pipe support shall be made of 10mm M.S. Rods and the horizontal support shall be of M.S. angles of 50x50x4 mm thick.

14.3 Pipe supports shall be adjustable for height and prime coated with rust preventive paint & finish coated with black paint using approved grade of paint.

The spacing of pipe supports shall not be more than that specified below :-

<u>Nominal pipe size MM</u>	<u>Spacing (Metres)</u>	
15	...	1.25
20 & 25	...	2.00
32,30,50 & 65	...	2.50
80,100 & 125	...	2.50
150 & Above	...	3.00

14.4 Extra supports shall be provided at the bends and at heavy fittings like valves to avoid undue stresses on the pipes. Pipe hangers shall be fixed on wall and ceiling by means of approved metallic dash fasteners.

14.5 Insulated piping shall be supported in such a manner as not to put undue pressure on the insulation, cause condensation. The pipe supports or Saddles shall be of PUF, factory fabricated to suit pipe sizes.

14.6 Hangers shall be supported from structural steel, concrete inserts & pipe racks, as specifically approved.

14.7 No hangers shall be secured to underside of light weight roof decking and light weight floor glass.

14.8 Mechanical equipment shall be suspended midway between steel joints and panel points.

14.9 Drilling or punching of holes in steel joint members will not be permitted.

14.10 Contractor shall make shop drawing for fixing of support for approval.

15. **Miscellaneous**

15.1 Provide all pipe work as required to make the apparatus connected complete and ready for regular and safe operation. Unless otherwise noted, connect all apparatus and equipment in accordance with manufacturer's standard details, as approved by Engineer-In-Charge.

15.2 Provide valves and capped connections for all low points in piping system, where necessary or required for draining systems. Provide Isolating valves & Drain valves in all risers to permit repairs without interfering with the rest of the system.

15.3 During construction, temporarily close, open ends of pipes with sheet metal caps, where necessary, or required to prevent debris from entering the piping system.

15.4 Support piping independently of all equipment so that the equipment is not stressed by the piping weight or expansion.

15.5 To facilitate the maintenance, repair and replacement:

- 15.5.1 Provide shut-off valves where indicated and for individual equipment, units at inlet and outlet, to permit unit removal for repairs, without interfering with the remainder of the system. Additional shut-off valves shall be provided as required to enable all systems to be fully sectionalized. By-pass and stop valves shall be provided for all automatic control valves as specified.
- 15.5.2 Arrange piping for maximum accessibility for maintenance and repair, locate valves for easy access and operation. No valves shall be installed with handles pointing down, unless unavoidable.
- 15.5.3 Cut the pipes accurately according to measurements, established at building site & work into place without springing or forging.
- 15.5.4 Where pipes are to be buried under ground, they should be coated with one coat of bituminous paint. The top of the pipes shall not be less than 75 CM. from the ground level. Where this is not practical permission of Engineer-In-Charge shall be obtained for burying the pipes at lesser depth. The pipes shall be surrounded on all sides by sand cushions of not less than 15 CM. After the pipes have been laid and top sand cushions provided, the trench shall be refilled with the excavated soil, excess soil shall be removed from the site of work by the contractor.

16. **Sleeves**

- 16.1 Where pipes pass through floors, walls, etc provide Galvanized steel pipe sleeves 50 MM larger than outside diameter of pipe. Where pipes are insulated, sleeves shall be large enough to ample clearance for insulation.
- 16.2 Where pipes pass through outside walls or foundations, the space between pipe and sleeve shall be filled with rock wool covered with GI sheet.
- 16.3 The centre of pipes shall be in the centre of sleeves, and sleeves shall be flushed with the finished surface.

17. **Arrangement and alignment of piping**

- 17.1 All piping shall be arranged and aligned in accordance with the drawings as specified. Where special conditions are encountered in the field, the arrangement and alignment of piping shall be as directed by the Engineer-In-Charge.
- 17.2 The piping shall be installed in a uniform manner, parallel or perpendicular to walls or ceilings, and all changes in directions shall be made with fittings. The horizontal piping shall be run at right angles and shall not run diagonally across rooms or other piping. wherever possible all piping shall be arranged to provide maximum head room.
- 17.3 All piping shall be installed as directly as possible between connecting points in so far as the work of other trades permits. Where interference occurs with another trade whose work is more difficult to route, this contractor shall reroute his pipes as required to avoid interference, at the discretion of the Engineer-In-Charge.
- 17.4 All piping shall be carefully installed to provide for proper alignment, slope and expansion.
- 17.5 The stresses in pipe lines shall be guided and pipes shall be supported in such a manner that pipe lines shall not creep, sag or buckle.
- 17.6 Anchors and supports shall be provided wherever necessary to prevent any misalignment of piping.
- 17.7 Small tubing gauges, controls or other equipment installed on any apparatus, shall not be coiled nor excessive in length, but shall be installed neatly, carefully bent at all changes in direction, secured in place and properly fastened to equipment at intervals to prevent sagging.
- 17.8 The piping shall be grouped wherever practical and shall be installed uniformly in straight parallel lines in either vertical or horizontal positions.

18. **Testing**

- 18.1 In general, tests shall be applied to piping before connection of equipment and appliances. In no case shall the piping, equipment or appliances be subjected to pressures exceeding their test ratings.

- 18.2 The tests shall be completed and approved before any insulation is applied. Testing of segments of pipe work will be permitted, provided all open ends are first closed, by blank offs or flanges.
- 18.3 After tests have been completed the system shall be drained and flushed 3 to 4 times and cleaned of all dust and foreign matter. All strainers, valves and fittings shall be cleaned of all dirt, fillings and debris.
- 18.4 All piping shall be tested to hydraulic test pressure of at least one and half times the maximum operating pressure but not less than 10 kg/cm² for a period of not less than 12 hours. All leaks and defects in the joints revealed during the testing shall be rectified to the satisfaction of the Engineer-In-Charge, without any extra cost.
- 18.5 All the piping systems shall be tested in the presence of the Engineer-In-Charge or their authorized representative. Advance notice of test dates shall be given and all equipments, labour, materials required for inspection, and repairs during the test shall be provided by the contractor. A test shall be repeated till the entire systems are found to be satisfactory to the above authority. The tests shall be carried out for a part of work if required by Engineer-In-Charge in order to avoid hindrance in the work of the insulation contractor.
- 18.6 Miscellaneous piping, tests with air at 10.5 kg/cm² for a minimum of 24 hours without drop in pressure.
- 18.7 The contractor shall make sure that proper noiseless circulation is achieved through all piping systems. If due to poor bond, proper circulation is not achieved, the contractor shall bear all expenses for carrying out the rectification work including finishing of floors, walls and ceiling damaged in the process of rectifications.
- 18.8 The contractor shall provide all labours and materials to make provision for removing water and throwing it at the proper place, during the testing or/and after the testing to avoid damages to employer or other contractors' properties. Any damages caused by the contractor to the employer or other contractors' properties, shall be borne by the contractor.

19. **Drain Piping**

- 19.1 The drain piping shall be medium class galvanized steel as per IS 1239/1979.
- 19.2 The fittings shall be of 'R' brand or "Unik" or equal forged with screwed connections.
- 19.3 The gate valves shall be of gun metal duly ISI marked on each valve.
- 19.4 Pipe crosses shall be provided at bends, to permit easy cleaning of drain line.
- 19.5 The drain line shall be provided upto the nearest drain trap and pitched towards the trap.
- 19.6 Drain lines shall be provided at all the lowest points in the system, as well as at equipments, where leakage of water is likely to occur, or to remove condensate and water from pump glands.

20. **Painting**

- 20.1 All pipes supports, hangers, etc., shall be given two coats of red oxide primer.
- 20.2 All pipes, which are not to be insulated, shall then be given two coat of finish paint, of a type and colour, as approved by the Engineer-In-Charge.

Section 2 TESTING AND COMMISSIONING

1. General

- 1.1 The contractor must perform all inspection and tests of the solar hot water SS tank as a whole and of components individually as required, under the supervision of the Engineer in charge/Site engineer, in accordance with the provisions of the applicable MNRE/BIS standards or approved equal in addition to furnish necessary test certificates from manufacturers.
- 1.2 The system shall then be commissioned, tested and balanced to fulfil the intent and purpose for which it is designed.
- 1.3 In addition continuous Run Tests shall be carried out during peak weather condition.

2. Associated Works at Site.

- 2.1 All electrical items will be subjected to inspection at any stage during manufacturing activity. Routine electrical test as per relevant codes. Inspection of manufacturer's test certificates.
- 2.2 Inspection of raw materials to be used for fabrication and assembly and inspection of manufacturer's certificates.

Section 3

SOLAR HOT WATER TANK

Technical specification

The Solar hot water stainless steel tank shall be complete in all respects and shall generally comply with the specifications as given hereunder.

- a) 1000 liter capacity tank made of SS 316 quality sheet of 2 mm thickness with circular dish ends duly pressed.
 - b) The tank will be duly argon tig welded using SS 316L. quality filler wire.
 - c) The tank will be pressure tested for leaks at 2 kg/cm²
 - d) The tank will be PUF insulated with thickness of 50 mm all around.
 - e) It would be clad with SS mirror finish sheet & end caps of powder coated aluminum duly pressed.
 - f) The tank would be erected on a M.S stand as per approved by the Engineer In Charge.
 - g) All inlet & outlet connection would be provided in SS nipple/couplings.
 - h) The exterior of the tank must be properly insulated so that the hot water temperature does not decrease by more than 8 degree centigrade in about 16 hours time.
1. **Solar Collector Panel:** This consists of an absorber which is a copper plate across which riser tubes run at both ends. The absorber plate and tubes are painted with selective coating which has a unique property of high absorptivity and low emissivity. Most widely used collectors are flat plate type in accordance with IS 12933(PART-II) 2003. Solar flat plate collector cover plate made of toughened glass. Sheet for absorber made of copper. Absorber made of copper sheet and copper tube.
 2. **Collector support structure:** The structure should be in position to withstand wind velocity of 175 km/hr and shall be made with MS angle/channel (as per site requirement) of size not less than 40x40x5mm and shall have a vertical support at top and bottom edge of the collectors suitable paint (black) should be applied. The vertical structure shall be properly grouted to the floor.
 3. **Overheating:** During periods of high radiation and low hot water demand, overheating may occur in the collector or storage tanks, protection against overheating must be considered for all portions of solar water heating system.
 4. **Cold water tank:** The cold water tank should be PVC tank of the capacity equivalent to solar water heater system capacity or proper support with angle clamps should be done as per tender. The tank should be syntax or equivalent make with ISI mark.
 5. **a) Piping and fitting:** Medium class GI pipe as reqd. or (as per tender) shall be used the piping length should be as small as possible with minimum joints and elbow. They must be leak proof, bends should be preferred to elbows since they have less pressure drop. The pipe must be properly insulated and made water proof by covering with aluminum foils. The execution of civil work should be as per site requirement or as per instruction of work in charge.
 - b) Pipe fitting should be ISI marked and of heavy duty.
 - c) **Gasket for Flanges:** 3 mm thick gasket of Neoprene/synthetic rubber gasket shall be used for sealing the joints between flanges.
 - d) **Composite Pipes:** Composite pipes be as per Indian Standard IS 15450: 2004. The composite pipe shall be of PE-RT/AL/PE-RT for hot water use, which can withstand upto 95° C and pressure of 1 MPa.

6. **Valves and gauges:** The, valves and its seals should be such that it is able to bear maximum temperature and compatible with fluid (water) used. These valves must be placed properly such that its function ca") not deactivated by anything, each valve used between the union.
7. The hot water piping shall be. done with 2 nos. water tap, 1 no. temperature meter 1 no. flow meter for each solar water heater further, piping with suitable sanitary fittings of 2 nos. gate valve of suitable size in incoming cold water line & outlet of hot water tank should be provided at desired points as per occupant requirement. The quantity of pipe line is indicative and may vary depending on site requirement. Temperature indicator should be standard & reputed make ISI mark and further, piping with suitable sanitary fittings.
8. During the work execution, the contractor will be responsible for any damage of the system, because of mishandling like- glasses of solar panels.

LIST OF APPROVED MAKES

1.	<i>SS 316 PUF insulated solar hot water tank</i>	<ul style="list-style-type: none">• <i>SOLCHROME</i>• <i>RAYZ</i>• <i>TATA BP</i>• <i>RACOLD</i>
2.	<i>Gate Valve</i>	<ul style="list-style-type: none">• <i>Leader</i>• <i>Sant</i>• <i>Zoloto</i>
3.	<i>GI Pipe</i>	<ul style="list-style-type: none">• <i>Tata /Jindal (Hissar)/QST</i>
4.	<i>Electrical backup</i>	<ul style="list-style-type: none">• <i>Spare hot</i>• <i>Racold</i>• <i>Dasspass</i>
5.	<i>PVC tank</i>	<ul style="list-style-type: none">• <i>Syntex</i>• <i>Polycon</i>
6.	<i>Thermostat</i>	<ul style="list-style-type: none">• <i>ISI marked</i>
7.	<i>Solar Flat Plate Collector Panel</i>	<ul style="list-style-type: none">• <i>Solchrome</i>• <i>RAYZ</i>• <i>Tata BP</i>• <i>Racold</i>
8.	<i>S.S sheet</i>	<ul style="list-style-type: none">• <i>Jindal/ National/SAIL</i>