

RATE CONTRACT

**Haryana Renewable Energy Development Agency
(Department of Renewable Energy, Haryana)
SCO-48, Sector-26, Chandigarh- 160019.**

**Telephone : 0172- 2790918, 2790117, 2791917 Fax No. 0172-2790928
E-mail : hareda @ chd.nic.in, Website: www.hareda.gov.in**

Rate Contract No. HAREDA/2009-2010/ 1642-45 Dated: 19 -6 - 2009

To

1. M/s Suntech Solar Technologies,
Plot No. 170, Phase-I, Industrial Area,
Panchkula- 134113. (Contact No. 09779915446)
2. M/s Inter Solar Systems (P) Ltd.,
Plot No. 901-A, Industrial Area
Phase-II, Chandigarh-160002.
Tel. No. : 0172- 5086113, 2655349, Fax No. 0172-5086113
3. M/s Sunglow Enterprises,
286, Industrial Area, Phase-1,
Chandigarh- 160002 (Tel. No. : 0172-6611286)
4. M/s Solwin Energy, Pvt. Ltd.,
370-71/2, 1st floor Hospital road,
Jangpura, New Delhi -110014
Tel No. 011-24379961-4, Fax: 011-24378591

**SUBJECT: RATE CONTRACT FOR SUPPLY, INSTALLATION AND COMMISSIONING OF
SOLAR WATER HEATING SYSTEM IN THE STATE OF HARYANA**

Reference : (i) This office tender enquiry No. HAREDA/2008/SWHS/RC opened on 4.11.08.
(ii) Your quotation submitted against the said tender enquiry followed by your
subsequent last letter.

Dear Sir,

You are hereby informed that your above referred tender read with subsequent letter mentioned above for the stores specified in the schedule- A annexed has been accepted. This Rate Contract will be governed by the terms and conditions given in schedule-B . The rate contract and the schedules annexured here to shall be sole responsibility of this Rate Contract/ transaction.

2- This rate contract shall be valid from 19-6 -2009 to 18- 6- 2010 for supply , installation and commissioning of solar water heating system (s) of various capacity, additional works and the AMC/during subsequent years after warranty period .

3- The other terms and conditions and specifications not mentioned in the schedule- B, shall be as per DNIT.

4- Please acknowledge receipt of this Rate Contract within a weeks time from the date of issue by returning the second copy duly signed and stamped by authorized representative of your firm.

5- M/s Solwin Energy Pvt. Ltd. , New Delhi being considered under new suppliers category will be eligible for 10% trial orders only as per the DNIT.

6. This Rate Contract contains 12 pages, including this page.

Annexures:

1. Schedule "A" - Description of Stores, Prices, Duties/ Taxes.
2. Schedule "B" - General Terms & Conditions of the Contract.
3. Schedule "C" -TECHNICAL SPECIFICATIONS OF SWHS

Yours faithfully,

Encl: As above

Sr. Technical Manager
for Director, Haryana Renewable Energy
Development Agency (HAREDA), Chd.

Schedule-A

DESCRIPTION OF STORES, PRICES, DUTIES/ TAXES

(1) Capacity –wise approved firms & rates of Solar Water Heating Systems

Sr. No.	Capacity of the system	*Total cost including transportation, packaging, installation, commissioning, VAT / taxes/ duties etc. with 3 years guarantee	Name of the firm(s) approved
1.	100 LPD	Rs.23,000/-	M/s.Suntech Solar Technologies, Panchkula
			M/s.Sunglow Enterprises, Chandigarh
			M/s Solwin Energy, Delhi
2.	200 LPD	Rs.39,000/-	M/s.Suntech Solar Technologies, Panchkula
			M/s.Sunglow Enterprises, Chandigarh
			M/s Solwin Energy, Delhi
3.	300 LPD	Rs.55,000/-	M/s.Suntech Solar Technologies, Panchkula
			M/s.Sunglow Enterprises, Chandigarh
			M/s Solwin Energy, Delhi
4.	400 LPD	Rs.71,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Sunglow Enterprises, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s Solwin Energy, Delhi
5.	500 LPD	Rs.87,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s.Sunglow Enterprises, Chandigarh
			M/s Solwin Energy, Delhi
6.	600 LPD	Rs.1,04,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Sunglow Enterprises, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s Solwin Energy, Delhi
7.	800 LPD	Rs.1,42,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Sunglow Enterprises, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s Solwin Energy, Delhi
8.	1000 LPD	Rs.1,67,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Sunglow Enterprises, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s Solwin Energy, Delhi
9.	1500 LPD	Rs.2,40,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Sunglow Enterprises, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s Solwin Energy, Delhi
10.	2000 LPD	Rs.3,05,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Sunglow Enterprises, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s Solwin Energy, Delhi
11.	3000 LPD	Rs.4,52,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Sunglow Enterprises, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s Solwin Energy, Delhi
12.	4000 LPD	Rs.6,00,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Sunglow Enterprises, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s Solwin Energy, Delhi
13	5000 LPD	Rs.7,50,000/-	M/s.Inter Solar Systems Pvt. Ltd, Chandigarh
			M/s.Sunglow Enterprises, Chandigarh
			M/s.Suntech Solar Technologies, Panchkula
			M/s Solwin Energy, Delhi

*The systems with 100 to 1000 LPD capacity are with electrical back up and 1500 LPD to 5000 LPD are without electrical back up.

(2) Approved Rates of additional works for all capacity of systems.

a) Cold Water Piping per running meter

(i)	15 NB	Rs. 90/-
(II)	20 NB	Rs. 130/-
(iii)	25 NB	Rs. 160/-
(iv)	32 NB	Rs. 240/-
(v)	40 NB	Rs. 285/-

(b) Hot Water Piping per running meter

(i)	15 NB	Rs. 220/-
(II)	20 NB	Rs. 320/-
(iii)	25 NB	Rs. 350/-
(iv)	32 NB	Rs. 420/-
(v)	40 NB	Rs. 450/-

(c) RCC/ cft Rs. 140/-

(d) Steel Structure per Kg Rs. 45/-

(e) Electric Wiring armoured per running meter

(i)	2.5 mm ²	Rs. 70/-
(ii)	4 mm ²	Rs. 90/-

(f) Taps

(i)	15 NB	Rs. 100/-
(ii)	20 NB	Rs. 125/-

(g) AMC Charges (after expiry of guarantee period)

(i)	AMC charges with spares	Rs. 8/- per liter
(ii)	AMC charges without spares	Rs. 5/- per liter

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Schedule- B

GENERAL TERMS AND CONDITIONS OF CONTRACT
(SOLAR WATER HEATING SYSTEMS OF 100 LPD TO 5000LPD)

1. Works imparting the singular number shall be included the plural and vice versa where the context so requires.
2. The item rate quoted shall be for the completed item of work at site as described and specified and shall be inclusive of all taxes, duties, royalties, etc. insurance package and any other levy.
3. The contractor shall provide everything necessary for the proper execution of the work according to specifications and instruction.
4. All materials and workmanship shall be as of the respective kind as described in the bill of quantities.
5. (i) The work shall be carried out strictly in accordance with the specification. The contract will be deemed to have read the same carefully before submitting their quotations.
(ii) Wherever the above specifications are found wanting, latest PWD/MNRE/HAREDA and/or ISI specifications shall be followed.
6. All materials to be incorporated in the work shall be approved from the HAREDA before being used in the work. The rejected materials shall be removed from the site at the cost of tenderer.
7. HAREDA or the purchaser or his duly authorized representative shall have at all times access to contractor's premises or works and shall have the power to inspect and examine the materials and workmanship of the equipment during its manufacture. If the equipment is being manufactured in sub-contractors works, the contractor shall obtain for the purchaser and his duly authorised representative's permission to inspect and examining the workmanship of the equipment there.
8. The contractor shall make arrangements at his own cost for all tests required to ascertain quality/workmanship of materials and the work done by him.
9. Notwithstanding any inspection or test carried out by the purchaser or his representative, the manufacturer or supplier shall carry out his own tests to ensure consistent performance and shall furnish guarantee for each unit of equipment supplied and installed. **HAREDA may also get random testing done through an approved testing center at the cost of the contractor/firm.**
10. The contractor shall make his own arrangements for water and electricity required by him during the installation.
11. It will be **deemed that the contractor has visited site**, made his own assessment of the nature of work before submitting the quotation **and no claim on this account** shall be admitted by the HAREDA.
12. Installation of the complete system shall be done under the **supervision of PO/APO of the concerned district or HAREDA's representatives.**
13. The contractor shall provide at his own expense all necessary tools, tackles, spannes, wrenches, jacks, ladder, winches, ropes, welding sets, concrete mixer, road roller etc. for the erection of the work and shall be responsible for unloading and transport of material covered by this contract from the nearest station to the site of erection.
14. The contract shall plan his erection and inform the purchaser accordingly **at least one week** in advance. The contractor shall furnish his schedule for the different erecting phase to the purchaser or his duly authorized representative.
15. The items and quantities given in the bill of quantities are approximate and are subject to variation/addition, omissions, etc. and contractor shall have to execute the altered, additional items and quantities at the rates quoted by him. No extra claim on this account shall be entertained by the HAREDA.

16. The painting scheme for the system shall be as mutually agreed upon between the purchaser and manufacturer.
17. All exposed parts of the equipment, fittings and spares shall be suitably protected against rust and effects of weather and dust.
18. In case the progress and/or quality of work being executed by the contractor is found by the HAREDA to be unsatisfactory, the balance defective or/ improper work will be executed through other agencies at the risk and cost of the contractor.
19. Rates for additional, altered or substituted items shall be worked out in the following manner:
 - (i) The rates for such items shall be derived from the quoted rates of similar and other items in the bills of quantities. In case, it is not possible to do the same, rates shall be analysed taking into account market price of material charges. Over the above costs, 10% (Ten Per Cent) shall be added to cover contractor's overheads and profits. The quantities of material, labour and wastages shall be taken as per standard practice of CPWD.
20. On completion of the work, the contractor shall clear the structure its surroundings of all debris, rubbish, contractors tools and plants, at his own cost.
21. The manufacturer shall supply all technical literature and drawing considered necessary for the installation, operation and maintenance of the equipment and its fittings. These shall essentially include:-
 - i) Drawing showing over all dimensions and all other details including sectional view of the equipments.
 - ii) List of parts with reference to nos.
 - iii) **Manual of instructions for the operation, maintenance and repairs/equipment and special fittings, if any.**
 - iv) **Checking methods and schedule for cleaning the system.**
 - v) Any other relevant technical data which would be of assistance for efficient operation and maintenance of the system including energy savings etc.
22. The supplier shall train purchaser's personnel for the operation and maintenance of the equipment for a particular period, mutually agreed between the supplier and the customer.
23. Each tender is separate and independent document and should not be combined with any other tender in any matter/manner.
24. The suppliers will have to undertake repair of the system installed by them, in case of any defect arising out of any point of time. Supplier will attend the complaints within **fifteens days** of receiving the complaint and will report to PO/APO(IREP) concerned about remedial steps taken by them to the satisfaction of the user and PO/APO(IREP).
25. **PERFORMANCE & GUARANTEE**
 - a. All elements of the system which fail due to manufacturing defects within a period of **three years** from the date of commissioning shall be replaced by the tenderer free of cost. However, the replacement of components like glass etc. will be restricted to **one year**.
 - b. The contractor shall guarantee the performance of the system for the **rated output of 60 degree C** in terms of quantity of hot water and the temperature in peak winters for which the system is designed. If it is not achieved, the necessary additions/modifications including installation of extra collectors shall be done by the contractor without charging any extra price. However, the purchaser reserves the right to have this job completed for achieving the rated output by other manufacturers/after serving 15 days notice to the original manufacturers/contractors at his cost & risk.
 - c. The system and the Solar collectors should be guaranteed for minimum projected life of **15 years**. The guarantee period shall commence from the date of commissioning of the system.
26. Solar Water Heating System will consist of broadly of the following elements:-

- i) Flat plate collectors of 'A' size as per IS 12933 of 2003 as amended from time to time as per enclosed specifications.
- ii) Insulated pipes connecting Solar Absorber Panels
- iii) Hot Water Storage Tanks (stainless steel)
- iv) Electrical Back Up (only up to 1000LPD systems)
- v) Cold Water Storage Tank with support stand
- vi) Necessary Civil and other support structure for collectors, tanks and piping within the system as per requirement
- vii) Instrumentation and controls like temperature indicators (one), Stainer, taps(two for systems upto 200 lpd and one additional tap per 200 lpd) and pump for forced systems etc.
- viii) The specifications of various sub-components of the system should be as per the latest BIS/HAREDA.
- ix) Heat Exchanger

27. Scope of work

Scope of work includes design, fabrication, supply, installation, commissioning of complete solar water heating system of required specifications and other components of storage tank including additional works required at site etc.

- 28. The suppliers will have to undertake repair of the system installed by them, in case of any defect arising out of any point of time. Supplier will attend the complaints within fifteen days of receiving the complaint and will report to PO/APO(IREP) concerned about remedial steps taken by them to the satisfaction of the user and PO/APO(IREP).

29. Completion/ delivery period:

Capacities (in lpd)	Time of completion (in months)	Capacities (in litre per day)	Time of completion (in months)
100 LPD	1	1000 LPD	2
200 LPD	1	1500 LPD	2
300 LPD	1	2000 LPD	2
400 LPD	1.5	3000 LPD	2
500 LPD	1.5	4000 LPD	3
600 LPD	1.5	5000 LPD	3
800 LPD	2		

30. TIME SCHEDULE, PENALTY/LIQUIDATED DAMAGES

(i) The time for and date of delivery or dispatch stipulated in the supply order shall be deemed to be the essence of the contract, and should the contractor fail to deliver or dispatch any consignment within the period prescribed for such delivery or dispatch stipulated in the supply order, the delayed consignment will be subject to **2% penalty per consignment per month recoverable on the value of the stores supplied.** In case of non-payment of the contractor, recovery will be made from his bills or amount of Earnest money or security deposited with Director, HAREDA, provide also that :

- (a) No recovery of penalty will be made if the Indenting Officer accepts the delayed supplies by extending the delivery period up to 2 weeks by recording in writing that the exceptional circumstances were beyond the control of the supplier and there was no loss to the Government.
- (b) Whether the delay on the part of the supplier is of more than 2 weeks, the matter for extension of delivery period will be preferred by the Indenting Officer to the Director, HAREDA with a certificate that there are genuine reasons for delay on the part of the supplier and no loss will result to Government. In case extension in delivery period is allowed, the case will be decided on merits by the Director, HAREDA. The extension will be allowed by the Director, HAREDA to the extent of purchasing powers delegated to him. In case the delivery period is amended, no penalty for supplies made during the extended period will be recovered from the supplier.
- (c) On the failure of the suppliers to make supply within the extended period or otherwise and the receipt of such information in the office of the Director, HAREDA, **risk purchase at the cost of the supplier will be made by the Director, HAREDA within 2 months of the expiry of stipulated delivery period by inviting short terms quotations** from the Registered and other known suppliers. The difference of excess cost thus, incurred will be recovered from the supplier from his pending bills, earnest money or security

whichever is available. This procedure will be adopted after serving a registered notice to the supplier to supply stores within 15 days.

- (ii) The Contractor shall not
 - (a) assign or sublet the contract without written approval of the officer sanctioning the contract.
 - (b) disclose details of the conditions governing this contract to unauthorized persons (Indenting against this contract is permissible only for the bonafide use of Governments departments and quasi public and not for private parties or for the private use of the Government officers).

(iii) In the event of the contractor failing duly and properly to fulfill or committing breach of any of the terms and conditions of the contract or repeatedly supplying goods liable to rejection hereunder or failing, declining, neglecting/ or delaying to comply with any demand or requisition or otherwise not executing the same in accordance with the terms of this contract, or if the contractor or his agents or servants being guilty of fraud in respect of the contract or any other contract entered into by the contractor or any of his partners or representatives thereof with Government directing, giving, promising or offering any bribes, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise to any person in the employment of Government in any way relating to such officers or person of persons, office or employment or if the contractor or any of his partners become insolvent or apply for relief as insolvent debtor or commence any insolvency proceedings or make any composition with his/ their creditors or attempts to do so then without prejudice to Government rights and remedies otherwise, **HAREDA/Government shall be entitled to terminate this contract forthwith and to blacklist the contractor purchase or procure or arrange from Government's stocks or otherwise at the contractor's risk and at the absolute discretion of the Director, HAREDA** as regards the manner, place or time of such purchases, such supplies as have not been supplied or have been rejected under this agreement or are required subsequently by Government thereunder and in cases where issues in replacement are made from Government's stocks or supplies, the cost of value of stocks or supplies together with all incidental charges or expenses, shall be recoverable from the contractor on demand and the contractor shall not be entitled to benefit from any profit which may accrue to Government.

31. INSPECTION OF MATERIAL

The material will be dispatched/ installed by the supplier after inspection by the Director, HAREDA or his/ her representative at his premises or at site and acceptance of the same. The supplier shall provide without any extra charge, all materials, tools, testing equipments, labour and assistance of every kind which the inspecting officer may consider necessary for any test or examination which he may require to be made on the supplier premises. HAREDA can also get the systems tested from any Govt. approved test centre/ laboratory and the expenses shall be borne by the supplier.

32. Payment Terms

- (i) 25% advance against bank guarantee of equivalent amount valid for six months if the value of a work order exceeds Rs.5.0 lacs;
- (ii) 60% on supply of the devices supported with material receipt issued by the user and duly verified by P.O/ A.P.O of the concerned district;
- (iii) 15% after 45 days from the date of commissioning supported by Joint Commissioning Report issued by USER and the APO/PO concerned.

33. The rates are FOR any where in Haryana inclusive of all taxes, octroi, VAT etc.

34. HAREDA reserves the right to award the work to any supplier/manufacturer or distribute the same to more than one firm/supplier.

35. All other terms & conditions shall be as per the DNIT

-X-X-X-X-X-X-X-X-X-X

Schedule-C

DETAILED TECHNICAL SPECIFICATIONS OF VARIOUS COMPONENTS OF SOLAR WATER HEATING SYSTEMS

1. ABSORBER MATERIAL	Absorber shall be of copper sheet and copper tube.
Thickness of sheet Riser	34 SWG (191) Diameter : 12.7±0.5mm Thickness : 0.56 mm (IS 2501) Number : 10
Header	Diameter : Minimum 25±0.5 mm Thickness : 0.71 mm Number : 2 Projection out side: 40 mm±0.5 mm Including flanges of the collector box.
Space between Riser Tubes	120 mm maximum from centre to centre of the riser. The free edges at the sides not to exceed 60 mm from the centre of the extreme end riser tube. For independent fins or joints in the sheet an overlap of minimum 2 mm shall be provided.
Bonding between Riser & Sheet	Full length of all risers shall be welded with the absorber sheet. In case of brazing/soldering/tig welding of continuous nature, un-brazed/un-soldered portion should not exceed more than 10% of the length of the riser. For brazing/soldering, minimum 60% tin solder or suitable brazing material shall be used. The flux used in soldering shall be mechanically removed and neutralised with the solution of sodium carbonate to avoid corrosion after installation. The flux used should be non greasy and non corrosive.
Coating	Selective coating with absorbitivity >0.92 and emmissivity<0.2
2. FLAT PLATE COLLECTOR Overall Dimensions(mm)	Size Length Width Height A 1860±10 1240±10 100±10
3. COLLECTOR BOX MATERIALS Aluminium	Aluminium extruded sections of size approximately 100 mmx25mm channel sections(within the tolerance given above) and of thickness 1.6 mm for the sides 0.71 mm aluminium sheet for the bottom(Tolerance 10%).
	1.2 mm thick aluminium angle (dimensions 25mmx25mmx1.2mm) retainer for glass
Fabrication of the Box	Side channel shall be welded by inert arc or gas brazing to ensure leak proof continuity of the joints of the box.
Attachment of Bottom Sheet	Bottom sheet may be joined with spot welding or self threaded nickel plated screws .In case of screw joint wooden battens shall be provided to secure the screws. The screwed/riveted joint shall be made leak proof by sealing paste of Zinc Oxide based or rubber based or silicon rubber based or epoxy based sealing compounds.
4. TESTING OF RISER-HEADER ASSEMBLY	It should be tested for leakage and strength at a minimum hydraulic/neumatic pressure of 4-5 kg/sq.cm.
5. COLLECTOR BOX INSULATION Back Insulation	Insulation shall be provide at back and sides. Thermal registance (R) of insulation material shall be minimum 0.96 sq.m deg.C/W for back insulation and minimum 0.48 sq.m deg. C/W for side insulation. This shall be derived after

<p>Material name Rock wool Glass wool Mineral wool</p> <p>Side insulation</p>	<p>determining thermal conductivity (K) value at 100 deg.C mean temperature in accordance with IS 3346. The thickness of the insulation material (L) may be derived by the equation $R = L / K$ or the insulation materials with following specifications may be used:</p> <table border="1" data-bbox="703 389 1230 559"> <thead> <tr> <th>K</th> <th>R</th> <th>Thickness</th> <th>density</th> </tr> <tr> <th>W/MK</th> <th>sq.mC/W</th> <th>(MM)</th> <th>(KG/Cum)</th> </tr> </thead> <tbody> <tr> <td>0.029</td> <td>1.67</td> <td>50</td> <td>48</td> </tr> <tr> <td>0.03</td> <td>1.67</td> <td>65</td> <td>24</td> </tr> <tr> <td>0.028</td> <td>1.67</td> <td>50</td> <td>48</td> </tr> </tbody> </table> <p>The insulation must with stand a temperature of 250 deg. C. Aluminium foil of thickness 0.015mm to 0.021mm shall be used for covering the back insulation</p> <p>25 mm thick insulation of specification as mentioned above. Aluminium foil of thickness 0.015 mm to 0.021mm shall be used of covering the side insulation. Glass wool Resin Bonded/Rockwool/Rigid Polyurethene of Thickness 25mm, minimum shall be used so as to achieve R value=0.08 as per IS 3346:1980.</p>	K	R	Thickness	density	W/MK	sq.mC/W	(MM)	(KG/Cum)	0.029	1.67	50	48	0.03	1.67	65	24	0.028	1.67	50	48
K	R	Thickness	density																		
W/MK	sq.mC/W	(MM)	(KG/Cum)																		
0.029	1.67	50	48																		
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<p>6. FRONT GLAZING Material thickness Transmittance General appearance of glass Aperture area Spacing between cover plate and Absorber surface</p>	<p>Single piece glass Toughened -4.0±0.2 mm (IS 2553(Part-I) 82% (Minimum) Free from bubbles/rough surface 2.30sq.mt.(approx.)for size A collector 20 to 40 mm</p>																				
<p>7. HEADER FLANGES</p>	<p>Brass flanges of 62±3 mm diameter and minimum thickness of 4 mm with provision of four number of GI plated nuts bolts with diameter of 6mm-8mm shall be used. Flanges shall be brazed to the header and brazing tested for leakage at the test pressure of 10kg/sq.cm. In no case crude soldered flanges shall be used. The assembly of the flanges should be at right angle to the header area to ensure proper assembly at the site of installation.</p>																				
<p>8. GROMMET</p>	<p>Suitable sealing between the inlet and outlet of header and casing of the following materials shall be provided. Neoprene, EPDM, Silicon rubber or butyle rubber etc. The grommet shall be suitable for a temp. upto 125 deg. C and mechanical loading during transportation of collectors. Typical size of grommet may be 40 mm outer dia and 25mm inner dia.</p>																				
<p>9. ASSEMBLY OF COLLECTORS</p>	<p>The load of the absorber should not be on the insulation. It should be taken by the collector box.</p> <p>The air gap between the glazing and the absorber should be 25mm (±5mm). Insulation should not be allowed to slide.</p> <p>Glazing shall be fixed on the collector box by using EPDM/Neoprene/Synthetic rubber channels.</p> <p>The glass should be firmly held, without strain taking into account the expansions of glass. A typical example is by retaining the glazing with the help of self tapping screws and aluminium angle retainer of dimensions 25 mmx25mmx1.5mm fixed on the top of the box it shall be ensured that the screws are not touching the glass edge.</p> <p>Top surface along the edge between the glass and the aluminium angle shall be caulked with suitable</p>																				

	sealants such as zinc oxide based/rubber based/silicon rubber based or polysulphide rubber sealants.																				
10. GASKET FOR FLANGES	3 mm thick gasket of Neoprene/synthetic rubber gasket shall be used for sealing the joints between flanges.																				
11. COLLECTOR SUPPORT FRAME	The structure should be in a position of withstand a wind velocity of 100 kms/hr. shall be made with angle iron of 35 mmx35mmx4mm; will have vertical support at top and bottom edge of the inclined plane of the collector at a distance of 1.5 M or less. The vertical support shall be firmly grouted with the roof.																				
12. PAINTING OF STANDS	Proper cleaning and degreasing of the surface should be done with the help of three in one solution before painting. Two coats of zinc chromate red oxide primer shall be applied followed by two coats of enamel paint of suitable colour as per NIT.																				
13. STORAGE TANK(HOT WATER)																					
a) Material	Stainless Steel (SS 304/ IS 1730 grade)																				
b) Thickness	<table border="1"> <thead> <tr> <th>Minimum thickness</th> <th>Tank capacity</th> </tr> </thead> <tbody> <tr> <td>20 gauge</td> <td>(0.91mm)for 100 lpd</td> </tr> <tr> <td>20 gauge</td> <td>(0.91mm) for 200 lpd</td> </tr> <tr> <td>20 gauge</td> <td>(0.91mm)for 500 lpd</td> </tr> <tr> <td>18 gauge</td> <td>(1.2mm)for 1000lpd</td> </tr> <tr> <td>18 gauge</td> <td>(1.2mm)for 1500 lpd</td> </tr> <tr> <td>18 gauge</td> <td>(1.6mm)for 2000 lpd</td> </tr> <tr> <td>16 gauge</td> <td>(1.6mm)for 3000 lpd</td> </tr> <tr> <td>16 gauge</td> <td>(2.0mm) for 4000 lpd</td> </tr> <tr> <td>16 gauge</td> <td>(2.0mm)for 5000 lpd</td> </tr> </tbody> </table>	Minimum thickness	Tank capacity	20 gauge	(0.91mm)for 100 lpd	20 gauge	(0.91mm) for 200 lpd	20 gauge	(0.91mm)for 500 lpd	18 gauge	(1.2mm)for 1000lpd	18 gauge	(1.2mm)for 1500 lpd	18 gauge	(1.6mm)for 2000 lpd	16 gauge	(1.6mm)for 3000 lpd	16 gauge	(2.0mm) for 4000 lpd	16 gauge	(2.0mm)for 5000 lpd
Minimum thickness	Tank capacity																				
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18 gauge	(1.2mm)for 1000lpd																				
18 gauge	(1.2mm)for 1500 lpd																				
18 gauge	(1.6mm)for 2000 lpd																				
16 gauge	(1.6mm)for 3000 lpd																				
16 gauge	(2.0mm) for 4000 lpd																				
16 gauge	(2.0mm)for 5000 lpd																				
c) Insulation and installation	All sockets and internal fittings of the tanks should of stainless steel. 100 mm thick insulation of 48 kg/cu.m. density having approx. k value_0.03 W/mk and R value 3.34 sq.m deg.C/W to withstand a temp. of 250 deg. C. Thin polythene sheet shall be used as covering between the glass wool and the cladding sheet besides the retaining material such as chicken mesh etc.																				
	Aluminium sheet of thickness 24 SWG shall be used for cladding the tank insulation. The storage tank shall be properly installed at site using enameled coated appropriate size angle iron stands, girder, cement concrete pedestals of 1:2:3 ratio or any other specific provision suitable to site to ensure the stability against heavy storm etc.																				
	but not less than 1'x1'x6" dimensions. External of the tank should be properly insulated so that hot water temperature does not decrease by more than 5 deg.C in about 16 hrs. times.																				
14. PIPING																					
Material	Medium class (B class) GI as per IS 1239 shall be used for piping.																				
Insulation	25mm thick insulation of 48kg/cu.m. density and K value+0.03 W/MK R value+1.67 sq.m. C/W to withstand and temp. of 250 deg. C be used. Thin plastic sheet shall be used as covering between glass wool and aluminium cladding besides other retaining material like chicken mesh etc. 26 SWG thick aluminium sheet shall be used for cladding the insulated pipe.																				

	The pipe line should be properly supported and fixed with clamp with the help of suitable size stand/civil structure (cement concrete ratio 1:4) ISI mark strainer of standard make should be fitted in the main cold water supply line before the system/
15. VALVES/NIPPLE/TESS /BENDS	Gun metal valve ISI marked shall be used. Nipple/tees and bends of ISI marked of medium class GI (B class) shall be used. Air vents in each row are to be provided.
16. INSTRUMENTATION	Temperature gauge: 1 No. (for Hot Water Storage Tank/Outlet) Gun metal stainer: 1 No. (at Cold Water inlet) Water meter -1 at the inlet of cold water tank. Maximum 2 nos. of chrome plated brass taps for systems upto 200 lpd and thereafter 1 tap per 200 lpd of superior quality for distribution line.
17. COLD WATER TANK	HDPE/LDPE material with Gun metal float valve (ISI marked) equal to the capacity of Hot water storage tank.
18. STANDS & PEDESTALS FOR THE TANKS (hot water tank/ cold water tank)	The tanks will be mounted on stands made out of angle iron frame of 35x35x4mm up to 2000 liters and 65x65x6mm for capacity above 2000 liters with each leg duly grouted with PCC 1:2:4 of 1'x1'x1' size. The cold water tanks will be placed over angle iron frame having 4 cross members in 4 legs with 5mm thick MS sheet for full bottom support fixed of 4 horizontal members based on the size of the cold water tank.
19. SYSTEM LAYOUT & DESIGN	Maximum number of collectors in series should not be more than ten. Maximum number of collectors in parallel in one row without the use of any piping connections should not be more than six. Air venting at appropriate places without hindrance of a spring leaded valve to prevent air locking in the system should be provided. For this purpose, the system shall have, at a suitable point, atmospheric pressure conditions preferably in the high temperature zone. System shall have a suitable expansion/make up tank at a high point in the system to ensure that collectors run full all the times. Capacity of this expansion/make up tank should be 1.5% of the system capacity for all systems.
20. PUMP	In case of forced system, pump of suitable size with DTC/FTC control has to be provided as per site requirements.
21. HEAT EXCHANGER (a) Shell-in-Tube Type (i) Material	Copper for forced systems only Shell in tube type heat exchanger may be used if U-type construction is not employed and if V-type construction is employed, then minimum 4 Nos. of heat exchangers will be used in series. Shell shall be designed for 1.5 times of the designed operating pressure and shall be tested for two times the operating pressure. In case of mild steel shell, corrosion allowance of 1.6 mm shall be provided. Shell shall be designed as per the BIS-2825. All the elements of heat exchanger shall be as per relevant Indian Standard or as per TEMA Class C

<p>(ii) Tube Thickness</p> <p>(b) Coil-type Heat Exchanger</p> <p>(i) Material</p> <p>(ii) Thickness</p> <p>(iii) No. of coils and flow Pattern</p>	<p>construction.</p> <p>Minimum 22 SWG, but may be higher depending upon the designed pressure requirements.</p> <p>For thermosyphen systems only. May be used by incorporating Cu/SS coils/retender inside the storage tank</p> <p>Copper/SS tube of 3/4" dia</p> <p>Minimum 22 SWG. May be higher depending upon the pressure requirements.</p> <p>Shall be so designed to ensure the pressure drop less than 0.3 kg/cm. The surface area of the heat exchanger should not be less than 0.2 m² per sq.m of the absorber area of the system (for 100 lpd system, the copper tube length of 7 meter is required).</p>
<p>22. ELECTRICAL BACK UP (only upto 1000 lpd)</p> <p>Electrical back up control panel for 6 KW</p> <ol style="list-style-type: none"> 1. DP switch 20 Amp. 2. MCCB 4 pole 10 Amp. 3. contactor 16 Amp. 4. Amp. Meter 1x30Amps. 5. Volt meter 0-500V 6. Amp. Selector Switch 7. Voltage Selector Switch 8. Thermostat for auto cut <p>Electrical back-up control panel for 9 KW</p> <ol style="list-style-type: none"> 1. DP switch 1x32 Amp. 2. Amp.mtr. 1x30 Amp. 3. Volt mtr. 0-500 volts 4. Amp. Selector switch 5. Voltage Selector switch 6. MCCB 4 pole 20 Amp. 7. Thermostat for auto cut 8. Contactor 16 Amp. 	<p>For 100 lpd - 2 KW For 200 lpd- 2 KW For 300 lpd- 2x2 KW For 400 lpd- 2x2 KW For 500 lpd- 2x2 KW Electrical wiring of 2:5 mm sq. 2 core unarmoured cable, thermostat of Radsson /Bajaj Make with MCB of 16 amp.</p> <p>For 600 lpd- 6 KW For 800 lpd-9 KW For 1000 lpd-9 KW</p> <p>Anchor make or equivalent ABB/Siemens /Havel make L&T make Rishop -do- AE/KAAYCEE -do- -do-</p> <p>Anchor make or equivalent Rishop make -do- AE/KAAYCEE -do- -do- ABB/Sieman/Havel L&T make Wire should be of not less than 4mm s. 3 core, Cu, armoured type</p>