TECHNICAL SPECIFICATIONS & TERMS AND CONDITIONS FOR SOLAR WATER HEATER (FPC/ETC)

Prepared by

Committee for Technology Assessment and Analyzing the installation of Solar Water Heater Systems in Government House/Buildings

TERMS AND CONDITIONS

1. 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:-

a) Drawing showing over all dimensions and all other details including sectional view of the equipments.
b) List of parts with reference to nos.
c) Manual of instructions for the operation, maintenance and repairs/equipment and special fittings, if any.
d) Checking methods and schedule for cleaning the system.
e) Any other relevant technical data which would be of assistance for efficient operation and maintenance of the system including energy savings etc.

2. The tender should be selected on the basis of average annual financial turn over which should be at least 50% of estimated cost during last three consecutive financial years and also on the basis of minimum one work done of the 80% or two works of each 60% value put to tender

3. 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.

4. 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 minor complaints within 48 hours of receiving the complaint otherwise penalty to be recovered per day as decided by the Engineer-in-incharge.

5. The system and the solar collectors should be guaranteed for six year after the day of handing over. This include first three year with spare parts and next three year without spare parts. He/She shall submit list for recommended spears to be required in maintenance with price along with their offer. Manufacturer or their authority/accredited dealer shall be consider for eligibility to participate in tenders

6. The supplier 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 winter 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 supplier 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 15days notice to the original manufacturers/contracts at his cost & risk.

7. All the elements of the system which fail due to manufacturing defect within the period of guarantee shall be replaced by the tenderer free of cost.

8. An amount of 10% of the total cost of the system will have to be deposited by contractor, as security which will be reimbursable after 6 years i.e. completion of warranty period.

Note: - These terms & conditions will be in addition to already exiting terms & conditions of the concerned Department.

TECHNICAL SPECIFICATIONS
FOR SOLAR WATER HEATER (FPC/ETC)

1. Solar flat plate collector components	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. Solar flat plate collector specifications	1. Solar flat plate collector shall conform to IS 12933 (part 1) with amdt no.1 & 2. 2. and IS : 12933 (part 2)/2003 and various components shall be as under:- a) Cover plate: cover plate shall be toughened glass and thickness of 4.0 mm (min) conforming to section -1 of IS: 12933(pt-2)/2003 the solar transmittances of the cover plate shall be minimum 82 percent at near normal incidence. b) Collector box: collector box shall be made of aluminum sections only type grade, size, workmanship and finish of the material used shall be as per section-2 of IS: 12933 (pt-2)/2003: the minimum thickness of aluminum shall be as under: 1. Channel section for sides 1.6 mm 2. Sheet for bottom 0.7 mm 3. Support for glass retaining 1.2 mm 4. Sheet for entire body 1.0 mm
a) Absorber	Absorber Shall Consist of riser, Header and Sheet for absorber. The Diameter of header shall be 25.4 + /-0.5mm and thickness 0.71mm. The Diameter of riser shall be 12.7 + /-0.5 mm and thickness 0.56mm and made of copper only. The distance between the risers from center to center shall be 120mm. type grade, size , workmanship and finish of the material used shall be as per section- 3 of IS : 12933 (pt -2) /2003. 1. Riser and header assembly designed for working pressure up 24.5 k pa (2.5 kg/ cm square) shall be tested for leakage at a minimum hydraulic pressure of 490 k pa (5 kg/ cm square). (a) Sheet for absorber: sheet for absorber shall be made of copper only. Type Grade, size, workmanship and finis of the material used shall be per Section -3 of IS: 12933 (pt -2) /2003. A sample piece of the absorber for Having minimum area of 400 square cm. shall be heated in an oven at Temperature of 175 degree c for 2 hours. After heating, the sample Shall be taken out from the oven and cooled at room temperature. The Cooled sample shall be inspected visually for damages, if any.

	There Shall not be any appearance of blistering / rupture / peeling off of the Coated /painted surface and of weakening of the bonding between.
b) Absorber sheet and risers/ headers	(a) Collector box insulation shall be provided at back and sides. Thermal resistance (R) of insulation material shall be minimum 0.96 m square degree c/w for back insulation and minimum 0.48 m square degree c/w for side insulation. This shall be derived after determining thermal conductivity (k) value at 100 degree c mean temperature in accordance with IS: 3346. Collector box insulation shall conform to sec. 4 of IS 12933 (pt – 2) / 2003. (b) Gaskets and grommets: gaskets and grommets shall conform to Sec. 5 of IS 12933 (pt-2)/ 2003.
3. ASSEMBLY OF COLLECTORS	The load of the absorber should not be on the insulation. It should be taken by the collector box. The air gap between the glazing and the absorber should be 25mm (+5mm). Insulation should not be allowed to slide. Glazing shall be fixed on the collector box by using EPDM/Neoprene/Synthetic rubber channels. 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 aluminum 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. Top surface along the edge between the glass and the aluminum angle shall be caulked with suitable sealants such as zinc oxide based/rubber based/silicon rubber based or polysulphide rubber sealants.

4. Solar Evacuated tubes collector specifications (ETC collectors should be approved from MNRE)	**1.Inner tank Material** a) Stainless Steel SS 316 b) SS304-2B (22SWG) **2. Hot water tank insulation density** a) High Density injected PUF insulation: 50mm, b) High des PUF (play urethane foam) Installation of 50mm thickness between inner outer tank ensures maximum heat rotenone ever season (maximum up to 72 hours. **3. Tank Stand and supports** a) Mild Steel with suitable anti corrosive coating. **4. Working pressure of the system** a) Normal, Gravity Feed, Less than 1 Kg/cm2. b) Recommended Operating Pressure:10 Bars. **5. Tank test Pressure** a) Factory Pressure Tested for 2 Kgs/Cm2. **6. Solar Evacuated tube dimension** a) Double walled glass Outer Tube Dia 47$\pm$0.7mm, Tube leangth-1500$\pm$5mm. & Inner Diameter: 33.4mm. b) Thickness of tube at least 1.60 mm. **7. Tube assembling frame** a) Mild steel section with PP coating. **8. Tube assembling frame size** a) Length-2.10mtrs. Width-3.20mtrs, Height-1.50mtrs. 9. **Cold water tank** a) 2.4 mtrs. From the terrace level. **10. Backup Provide** a) Electrical heaters: - 1.5 kW with thermostat, 2.0 kW with thermostat. **11. Tube coating** a) Copper coated tubes with selective absorptive coating Graded Al-N.
5. GASKET FOR FLANGES	3 mm thick gasket of Neoprene/synthetic rubber gasket shall be used for sealing the joints between flanges.
6.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 35mmx35mmx4mm; 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.

7. 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.
8. STORAGE TANK(HOT WATER	a) Material Stainless Steel (SS 316/ IS 1730 grade)
b) Thickness	**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 1000 lpd 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 be 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 250deg.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. Aluminum 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.
9. PIPING	**a) Material** Medium class (B class) GI as per IS 1239 shall be used for piping. **b) 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 aluminum 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.
10. 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.
11.INSTRUMENTATION	Temperature gauge: 1 No. (for Hot Water Storage Tank/Outlet) Gun metal strainer: 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 up to 200 LPD thereafter 1 tap per 200 LPD superior qualities for distribution line.
12.COLDWATER TANK	HDPE/LDPE material with Gun metal float valve (ISI marked) equal to the capacity of Hot water storage tank.
13.STANDS&PEDESTALS FOR THE TANKS	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.
14. 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.
15.HEAT EXCHANGER	(**<u>a) Shell-in-Tube Type</u>** **(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 construction. **(ii) Tube Thickness** Minimum 22 SWG, but may be higher depending upon the designed pressure requirements. **<u>(b) Coil-type Heat Exchanger</u>** For thermosyphen systems only. May be used by incorporating Cu/SS coils/retender inside the storage tank. (i) Material Copper/SS tube of ¾" dia. (ii) Thickness Minimum 22 SWG. May be higher depending upon the pressure requirements. (iii) No. of coils and flow Pattern. 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 an per sq.m of the absorber area of the system (for 100 LPD system the copper tube length of 7 meter is required).
16. ELECTRICAL B ACK UP (only upto 1000 lpd)	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 unarmored cable, thermostat of Siemens/Danfoss/Honeywell Make with MCB of 16 Amp. For 600 lpd-6 KW For 800 lpd-9 KW For 1000 lpd-9 KW
17. Electrical back up control panel For 6 KW	1. DP switches 20 Amp. — Anchor make or equivalent 2. MCCB 4 pole 16 Amp For 6KW and 32 Amp for 9 KW — Legarand, Schneider, L&T, Siemens, ABB make. 3. Contactor 25-32 Amp. — L&T/Schneider/Siemens make 4. Amp. Meter 1x30Amps. — Rishabh,AE,L&T 5. Volt meter 0-500V — -do- 6. Amp. Selector Switch — AE/Rishabh/ KAAYCEE, L&T BCH,GE 7. Voltage Selector Switch — -do-

	8. Thermostat for auto cut (6KW) Danfoss/Sieman/Honeywell
18. Electrical back-up control panel for 9 KW	1. DP switches 1x32 Amp. Anchor make or equivalent 2. Amp.mtr. 1x30 Amps. Rishabh, AE,L&T 3. Volt mtr. 0-500 volts -do- 4.Amp.Selector switch AE/KAAYCEE/L&T/BCH,GE 5. Voltage Selector switch -do- 6. MCCB 4 pole 20 Amp. -do- 7.Thermostat for auto cut (9KW) Danfoss/Sieman/Honeywell 8. Contactor 25-32 Amp. L&T/Schneider,Seimens make Wire should not be less than 4mm 3 cores, Cu, armored/ unarmoredCabelsPlaza/Havels/National/Paragon/NICCO/Bonton/Finolex type.