

MINIMUM TECHNICAL SPECIFICATIONS OF VARIOUS COMPONENTS OF SOLAR STEAM/ PRESSURIZED HOT WATER/OIL GENERATING SYSTEMS

(Revised based on inputs received from some experts/manufacturers)

The solar steam/pressurized hot water/oil generating system will comprise of automatically tracked parabolic concentrators and balance of system (BOS) for conditioning and utilizing thermal energy in working fluid. The working fluid can be in the form of water, steam and organic or inorganic fluid. BOS may consist of solar thermal receivers, steam/ hot water/oil pipelines, feed water/oil pumps, tank assemblies, steel structures and civil works, instrumentation like pressure gauges and temperature indicators etc. It will be hooked up with conventional system already in use for specific applications. In case of new systems, fossil fuel based boiler, vessels for cooking/ vapour absorption machine for cooling etc may be provided as the case may be. Minimum technical specifications of various components of the system will be as per below:

Concentrators	
Shape & make of each concentrator	Of any shape made of reflecting mirror(s) fixed to a supporting frame / structure
Aperture area	10 sq. m minimum (for Scheffler dishes, it will be $\pi/4$ x lengths of major & minor axis of the ellipse)
Reflecting mirrors i) Material* ii) Reflectivity iii) Mirror fixing	i) High quality glass mirrors for outdoor use with protective layers of coating on back surface and sides to protect from exterior weathering effect or any other reflecting material of similar reflectivity and durability. For coastal and colder regions, special protections to be made. ii) 90% minimum with a maximum degradation of 10% over its life span. Warranty/ guaranty to be provided for a period of five years. To be replaced immediately by the supplier if found deteriorating during this period. iii) With positive locking or sticking by industry proven outdoor-rated adhesives. Due protection of mirror coatings be taken while fixing the mirrors. Tying of mirrors with wires not acceptable. For high wind areas special protection to be made. * For newer upcoming technologies, reflectors other than glass mirrors will also be acceptable subject to fulfillment of all the above requirements
Concentration ratio (Aperture/ Receiver areas)	Over 80 for single axis and 120 for double axis tracking concentrators
Tracking Arrangement	
<ul style="list-style-type: none"> • Any reliable automatic tracking mechanism with motorized reverse in evening & park at morning position including safe position in case of abnormal operating conditions. • Made of standard components; to be protected from rain, dust & outside environment • Tracking accuracy : +/- 0.5 degree (to be ensured using field-calibrated inclinometer) 	

Heat receivers, Headers and piping
<ul style="list-style-type: none"> • Tested working fluid pressure: 1.5 times of designed pressure • Receivers : Of boiler/standard industry quality to sustain required temperature and pressure • Header material and piping : Designed & manufactured as per IBR/ standard industry quality
Insulation
<ul style="list-style-type: none"> • All working fluid piping to be insulated with minimum thickness of 50 mm of PUF or rock wool. Headers or water-steam tank, insulated sides of receiver etc. to have minimum insulation of 75 mm. For colder regions facing sub zero temperatures, minimum thickness will be 100 mm and 150 mm respectively. In such regions cold water pipe lines including valves etc. will also be insulated. Insulation on receivers should withstand a minimum temperature of 600c. • All insulated components to have Al sheet or powder coated steel sheet cladding as per industrial practices so as not to allow rain water to sip in the insulation.
Frames & supporting structure
<ul style="list-style-type: none"> • Strong enough to avoid any deformation of the reflector dish during manhandling/ tracking/under wind pressure of 200 km per hour • Of mild steel/ any other strong material with epoxy/anti-rust coating
Instrumentation & Controls
<ul style="list-style-type: none"> • Complete with all instrumentation such as pressure gauge, temperature indicator, fluid level indicators, safety valves, fluid meter etc. Data acquisition and control system with online monitoring to be installed for automatic monitoring, control and record of all important process parameters in installations above 500 sq. m. of dish area.
Other requirements
<ul style="list-style-type: none"> • Systems with Scheffler dishes having single axis automatic tracking arrangement will not be installed with more than 30 dishes at a place. <u>For bigger systems, the dishes have to be of two axis automatic tracking mechanism.</u> • All parts/components will be of weather resistant design/specifications to withstand natural weathering outdoors under local climatic conditions, for a minimum period of 15 years. Warranty for a minimum period of 5 years will be provided by the supplier. Necessary spares will also be provided so that the user do not face any problem atleast during the warranty period. • The steel structures provided to support various components of the system will be fabricated in such a way that they are able to take load (both wind load and static dead load) of the whole system. In case the terrace where the system is to be installed is not strong enough to bear the loads, these should be transferred into columns and beams and the proposed load arrangement must be discussed with the concerned civil engineering department and their approval obtained. • The personnel of the buyer/user institution will be trained by the supplier in the operation and maintenance of the system and its back-up system. Proper manuals will be prepared and provided to the user. Log book will also be supplied to the and user so that proper documentation is maintained. • The other important features of system will be i) it will have easy access to the user and proper walkway and platforms will be supplied for easy operation and maintenance of the system wherever necessary ii) safety features such as safety valves etc will be incorporated in the system so that system does not explode under pressure and iii) proper instrumentation as mentioned above will be provided so that user could see the status of system and take precautions /corrective steps if the system does not behave as expected.

Note:

General

- i) Any improvements in the above specifications of all types of solar concentrating systems, leading to cost reduction and/ or and higher efficiency of the system will be acceptable.*
- ii) The manufacturer/ supplier will provide the details of his system in the proposal with schematic diagram showing each and every component, its working procedure, tracking arrangement, technical specifications with quantum and size of various components and other highlights, if any alongwith a test report of his dish from one of the Test Centers of MNRE.*

Cost & size of system

- i) Approximate cost of installed systems with above specifications should not be more than Rs. 12,000 to 14,000 per sq. m. of dish area for single axis tracked systems and Rs. 14,000 to 16,000 for two axis tracked systems depending on site and data acquisition & control system installed with cost decreasing for increased size of systems. This cost is for retrofitted systems and excludes cost towards boiler, utensils for cooking/VAM & its accessories for cooling as applicable, civil works, AMC etc. For newer systems, the cost towards boiler, utensils for cooking and VAM and its accessories for air-conditioning etc may be extra by 20 to 30% respectively. In high altitude areas and difficult terrain, the cost may further increase by 20 to 25%. Another 3 to 5% could be towards operation, maintenance & AMC for 5 years.*
- ii) Scheffler dishes are now being manufactured with 16sq. m. of aperture area. A solar steam generating system using these dishes may not be suitable for cooking food for less than 250 people. As a thumb rule 3 to 4 dishes of 16 sq. m. each should be sufficient for cooking food for around 250-300 people depending on site. For bigger system, dishes will be added accordingly but will reduce proportionately due to lower heat losses. For example, a 10 dishes system (160 sq. m.) may be sufficient to cook food for around 1000 people.*
