

ICS 29.100.01

CCS P 60



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 51396-2019

**Standard for design of parabolic trough solar thermal power
plant**

Issued on: November 22, 2019

Implemented on: June 1, 2020

**Issued by: Ministry of Housing and Urban-Rural Development of the
People's Republic of China;
State Administration for Market Regulation**

Table of Contents

- 1 General
- 2 terms
- 3 Basic Regulations
- 4 Power system
 - 4.1 General provisions
 - 4.4 Scheduling automation
 - 4.5 System communication
 - 4.6 Energy Metering
- 5 Solar resource analysis
 - 5.1 General provisions

1 General

1.0.1 This standard is formulated to standardize the design of trough-type solar thermal power plants and meet the requirements of safety, reliability, advanced technology, and economical rationality.

1.0.2 This standard applies to new construction, expansion and reconstruction of trough solar thermal power plants using steam turbine generator sets, and also applies to trough solar thermal utilization parts combined with other forms of power generation.

1.0.3 The design of trough solar thermal power station should be based on grid access conditions, solar energy resources, hydrology, meteorology, geology and other relevant data.

1.0.4 The design of the trough-type solar thermal power station shall not only comply with the provisions of this standard, but also comply with the provisions of the current relevant national standards.

2.0.1 collector

The equipment that tracks the movement of the sun, receives solar radiation and transfers heat to the heat transfer medium is usually composed of a series of modules in series, driven by the same common unit and has only one tracking system.

2.0.2 Concentrator concentrator

The component of the collector consists of reflective elements that focus solar radiation

energy onto the collector tubes.

2.0.3 parabolic trough collector

The concentrator has a parabolic section and a trough-shaped heat collector, referred to as a heat collector.

2.0.4 receiver tube

A transparent tubular device that receives and transmits heat in the collector. A certain degree of vacuum is drawn between the tube wall and the heat absorber, and the heat absorber has a selective absorption surface.

2.0.5 Parabolic mirror parabolic mirror

The concentrator has a reflective mirror with a parabolic section, and the reflective mirror is installed on the curved base of the concentrator.

2.0.6 active length of a receiver

When the temperature of the heat-absorbing body of the heat-collecting tube is 25°C, the length from the heat collector to the top of the heat-absorbing body.

2.0.7 collector loop

The trough collectors are connected in series, and the heat transfer fluid flows sequentially through the collector tubes in each collector. A collector circuit consists of one or more rows of collectors connected in series.

2.0.8 solar field

The area where solar energy is collected and converted into heat, generally consisting of a trough collector circuit and its connections.

2.0.9 solar field net collection area

The sum of the net daylighting areas of the collectors on the collector field. The vertical projection of the reflection/refraction component of the collector through the plane of the daylight opening constitutes the net heat collection area of the collector, which needs to be added to the non-overlapping vertical projection of the steel receiver pipe on the daylight plane.

2.0.10 solar thermal power plant

A facility that collects solar energy and converts direct solar radiation into electrical energy through a thermal process, generally consisting of a heat collection field and a power

generation area.

2.0.11 parabolic trough solar thermal power plant

The heat collection field is a solar thermal power station composed of trough collectors and their connections.

2.0.12 irradiance

The radiant energy received by an object in unit time and unit area, the unit is. W/m².

2.0.13 normal direct irradiance direct normal irradiance (DNI)

The irradiance of direct radiation in a plane perpendicular to the beam.

2.0.14 transmittance

The ratio of bin transmission to incident radiant flux.

2.0.15 absorption ratio absorption

The ratio of absorbed to incident radiant flux on a bin.

2.0.16 emission ratio emittance

Under the same conditions, the ratio of the radiant energy emitted by the surface of a certain material to the radiant energy emitted by a black body.

2.0.17 heat transfer fluid heat transfer fluid

The fluid used to transfer heat between the various components in the system in a solar thermal power plant.

2.0.18 heat transfer oil

A kind of special oil with good thermal stability for indirect heat transfer.

2.0.19 molten salt molten salt

A non-aqueous inorganic salt melt, most of which are ionic crystals in solid state, form an ionic melt after melting at high temperature. Usually composed of alkali or alkaline earth metals and halides, nitrates, carbonates, sulfates and phosphates.

2.0.20 Low-boiling-point substance

The substance whose distillation temperature is lower than the initial boiling point when not in use in the organic heat carrier.

2.0.21 high-boiling-point substance

Through the heating test by the simulated distillation method, the boiling point of the sample is higher than that of the substance without the final boiling point of the organic heat carrier.

2.0.22 design point design point

In a solar thermal power generation system, it is used to determine a certain year, a certain day, a certain time of the system parameters and the corresponding meteorological conditions and direct solar normal irradiance, etc.

2.0.23 solar multiple

When the unit is running under rated load conditions, the ratio of the heat absorbed by the heat collector field to the heat provided by the heat collector field to the generator set under the design point condition. The heat provided by the collector field to the generator set includes the heat loss of the steam generation system.

2.0.24 Sensible heat thermal storage

It is a method to make the system store or release heat by changing the temperature of the heat storage medium without phase change.

2.0.25 Storage capacity of heat storage system

The complete heat release that can be provided by the heat storage system under certain start-up conditions.

2.0.26 rated charge power rated charge power

Thermal power entering the storage system at rated flow and temperature.

2.0.27 rated discharge power rated discharge power

Thermal power provided by the thermal storage system under rated flow and temperature conditions.

2.0.28 identification system identification system

A coding system that gives a physical object a unique mark to distinguish it from other physical objects.

3 Basic Regulations

3.0.1 The site selection of the trough solar thermal power station should comprehensively consider local planning, resources, construction conditions and other factors, and be