ICS 27.160
CCS F 12

NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB/T 47516-2026

Safety requirements for solar trackers

太阳跟踪器安全要求

Issued on: April 30, 2026 **Implemented on: November 1, 2026**

Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC

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Foreword

This document conforms to GB/T 1.1-2020 "Standardization Work Guidelines Part

1.Structure and Drafting Rules of Standardization Documents". Drafting is scheduled. Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents. This

document was proposed by the Ministry of Industry and Information Technology of the People's Republic of China. This document is under the jurisdiction of the National Technical Committee on Standardization of Solar Photovoltaic Energy Systems (SAC/TC 90). This document was drafted by: Jiangsu Zhongxinbo New Energy Technology Co., Ltd., Huzhou Litian Intelligent Technology Co., Ltd., and State Power Investment Corporation. Yellow River Upper Reaches Hydropower Development Co., Ltd., Northwest Survey and Design Institute of China Power Construction Group Co., Ltd., and LONGi Green Energy Technology Co., Ltd. Limited Liability Company, Harbin Institute of Technology (Weihai), Zhejiang Provincial Academy of Quality Sciences, Trina Solar Co., Ltd., Jiangsu Guoqiang Xingsheng Energy Co., Ltd. Source Technology Co., Ltd., Suzhou Jusheng Solar Energy Technology Co., Ltd., Suzhou Juzhiyi Intelligent Technology Co., Ltd., Xiamen Jingsheng Energy Source Technology Co., Ltd., and Guangdong Midea Refrigeration Equipment Co., Ltd. The main drafters of this document are. Yang Ying, Tao Hua, Wang Shitao, Pang Xiulan, Li Zhenguo, Xiao Bin, Sun Mingjian, Sun Kai, Qiang Shengguan, Jiang Jianping, and Su Wen. Zhang Min, Peng Cheng, Wan Zhenhua, Hu Guobo, Zhou Ping, Jiang Haihao. Solar tracker safety requirements

1.Scope This document specifies the requirements, testing methods, and technical data for solar trackers. This document applies to the design, manufacture, and application of single-axis solar trackers.

4.1 Mechanical Structure Safety

4.1.1 Mechanical structural strength Reasonable design and construction should be adopted to ensure that it meets the requirements with appropriate reliability and economy within the specified design service life. It meets all functional requirements, possesses sufficient safety and corrosion resistance, and satisfies the ultimate limit state and normal service limit state.

4.1.2 Static wind load The solar tracker should be able to withstand static wind loads under wind pressures with a local return period of not less than 50 years. The static wind load requirements are as follows:

a) Static wind load applies to all arrays of solar trackers.

b) Static wind load requirements are independent of the wind protection strategy or tilt angle designed for the wind.

c) The static wind load calculation is based on the solar tracker's structural design, geometry, wind speed, safety factor, and the structure under evaluation. Wind load zones for components and connection nodes.

d) Static wind loads should be divided into two cases. balanced and unbalanced (acting on the component surface) loads, including wind pressure formula (1) and standard load. The calculation of formula (2) for load and formula (3) for torque of chord length and load region.

The static wind load torque coefficient is shown in Figure 1. The calculation of substructure components and connection nodes should refer to the static wind load torque coefficient. 1) Connection between photovoltaic modules and purlins; 2) Connection between purlins and spindle; 3) Connections between spindles; 4) Connection between the main shaft and the column; 5) Connection between the spindle and the torsion fixed point (usually a rotary drive or a linear drive).

4.1.3 Dynamic wind load Based on static wind loads, dynamic wind loads caused by wind-induced vibration should be considered, using aeroelastic wind tunnel reports and related dynamic data. The wind load factor serves as the design basis to ensure that the structure will not suffer aeroelastic stability failure.

4.1.4 Torsional stiffness The solar tracker should have minimum torsional stiffness to ensure its stability when operating at low wind speeds. Apply a [condition] to the longest portion between the torsion fixation point and the free end of the solar tracker, or the longest portion between two torsion fixation points. The minimum torsional stiffness is determined by a uniform torque (unbalanced load), and the resulting torsional deformation (torsion of the torsional foot from the unloaded position) should not exceed 10°. The magnitude of the uniform torque is proportional to Lref2 (the square of the chord length), as shown in formula (4).

4.1.5 Snow Load The design value of snow load shall comply with the provisions of GB 50009, and the basic snow load shall be determined based on a return period of at least 25 years.

4.1.6 Seismic Load In seismic fortification areas, the impact of seismic action on the structure should be considered, and the structural design should comply with the provisions of GB/T 50011.

4.1.7 Limiting Mechanism The limit mechanism is an important function of the solar tracker and should meet the following requirements.

a) The control software simulates the closing and opening of the limit switch to trigger a warning message.

b) Close the limit switch again, and the warning message will disappear.

c) There are usually three types of limit switches. 1) Soft limit switch, implemented by setting position parameters in software; 2) Hard limit switches, implemented by position sensors mounted on the structure; 3) Mechanical limit switch, implemented by adding an additional mechanical limit mechanism.

4.2.1 Protection against electric shock

4.2.1.1 General Rules All electrical systems and components of the solar tracker should be protected against electric shock in the following ways. --Direct contact protection; --Indirect

contact protection.

4.2.1.2 Direct Contact Protection Direct contact with live parts should be prevented by using an enclosure or barrier and insulation of the live parts. When direct contact does occur, protective measures must be taken to ensure... Ensures that contact with live parts will not cause the risk of electric shock. Protective impedance isolates faults and limits overcurrent.

4.2.1.3 Indirect Contact Protection Indirect contact protection is achieved through equipotential bonding or local equipotential bonding, and double or reinforced insulation.

4.2.2 Overcurrent Protection If the current in any circuit of the solar tracker controller may exceed the rating of any component or the current carrying capacity of any wire, an overcurrent protection device should be provided. Flow protection device.

4.2.3 Insulation withstand voltage The current-carrying components and external parts of the solar tracker controller shall be adequately insulated and shall meet the requirements of

9.6.5 of GB/T 29320-2024. Insulation requirements.

4.2.4 Lightning protection grounding The lightning protection grounding of the solar tracker shall meet the requirements of

9.6.4 of GB/T 29320-2024.

4.2.5 Motor overheating The motor should have overheat protection, which can be achieved in the following ways. --Overcurrent protection; --Over-temperature protection; --Block protection.

4.2.6 Power outage

4.2.6.1 In the event of power interruption or voltage drop, undervoltage protection should be provided to ensure that the normal operation of the solar tracker is not damaged.

4.2.6.2 After the voltage is restored or the input power is connected, the automatic or accidental restart of the solar tracker should be prevented.

4.2.7 Short circuit It should have short-circuit protection measures so that the controller will not malfunction or be damaged, nor will it cause electric shock to the operator, if the field operation terminal is connected incorrectly. harm.

4.2.8 Control Circuit The nominal value of the control circuit voltage should be consistent with the normal operating mode voltage of the control circuit, and should include the following requirements.

a) For circuits with an AC frequency of

50 Hz, the nominal voltage should not exceed 230 V.

b) The nominal voltage of the DC control circuit should not exceed 36 V.