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TECHNICAL SPECIFICATION

Photovoltaic systems – Specifications for solar trackers

colour inside

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- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62727, which is a technical specification, has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
82/651/DTS	82/711/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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PHOTOVOLTAIC SYSTEMS – SPECIFICATIONS FOR SOLAR TRACKERS

1 Scope and object

This technical specification provides guidelines for the parameters to be specified for solar trackers for photovoltaic systems and provides recommendations for measurement techniques. No attempt is made to determine pass/fail criteria for trackers.

The purpose of this test specification is to define the performance characteristics of trackers and describe the methods to calculate and/or measure critical parameters.

This specification provides industry-wide definitions and parameters for solar trackers. Each vendor can design, build, and specify the functionality and accuracy with uniform definition. This allows consistency in specifying the requirements for purchasing, comparing the products from different vendors, and verifying the quality of the products. In addition, this specification will clarify terminology and definitions for trackers and provide examples of measurement techniques.

This technical specification will be a foundation for other standards to follow, including (but not limited to) design qualification and reliability.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply. For additional tracker-specific terminology, see Clause 5.

2.1
photovoltaics
PV
devices that use solar radiation to generate electrical energy

2.2
concentrating photovoltaics
CPV
devices that focus magnified sunlight on photovoltaics to generate electrical energy. The sunlight could be magnified by various different methods, such as reflective or refractive optics, in dish, trough, lens, or other configurations.

2.3
concentrator module
CPV module
a group of receivers (PV cells mounted in some way), optics, and other related components, such as interconnections and mechanical enclosures, integrated together into a modular package. The module is typically assembled in a factory and shipped to an installation site to be installed along with other modules on a solar tracker.

Note 1 to entry: A CPV module typically does not have a field-adjustable focus point. In addition, a module could be made of several sub-modules. The sub-module is a smaller, modular portion of the full-size module, which might be assembled into the full module either in a factory or in the field.

2.4
concentrator assembly
a concentrator assembly consists of receivers, optics, and other related components that have a field-adjustable focus point and are typically assembled and aligned in field

EXAMPLE: A system that combines a single large dish with a receiver unit which must be aligned with the focal point of the disk.

Note 1 to entry: This term is used to differentiate certain CPV designs from the CPV modules mentioned above.

3 Specifications for solar trackers for PV applications

a) Specification template

All trackers complying with this specification should provide, as part of their product marking and documentation, a table in the form specified below (see Table 1). See later clauses and subclauses of this Technical Specification for further explanation of individual specifications.

Some of the specifications within the table are optional; however, if a tracker manufacturer chooses to include optional information, it should be reported and measured in the specific way shown in Table 1 (and in some cases, also described later in this Technical Specification).

Engineering safety factors should be dictated by appropriate local standards and applications details and documented by the tracker manufacturer.

The specification template below is a visual example only and should not be read as a list of requirements.

Table 1 – Tracker specification template

Characteristic	Example	Notes/Clause/Subclause
Manufacturer	The XYZ Company	
Model number	XX1090	
Type of tracker	CPV Tracker, Dual Axis	4.2, 4.3
Payload characteristics		
Minimum/maximum mass supported	100/1 025 kg	4.8.3
Payload center of mass restrictions	0-30 cm distance perpendicular to mounting surface	4.8.3
Maximum dynamic torques allowed while moving	Azimuth (Θ_z): 10 kN·m Θ_x, Θ_y: 5 kN·m [should provide a set of diagrams to clarify torques and which axes they are relative to]	4.13.2, 7.3
Maximum static torques allowed while in stow position	[should provide a set of diagrams]	4.13.1, 7.3
Installation characteristics		
Allowable foundation	Reinforced concrete	4.6.2
Foundation tolerance in primary axis	± 0,5°	4.9
Foundation tolerance in secondary axis	± 0,5°	4.9
Electrical characteristics		
Includes backup power?	No	N/A

Characteristic	Example	Notes/Clause/Subclause
Daily energy consumption	1 kWh typical 5 kWh maximum	4.7.1
Stow energy consumption	kWh typical 1 kWh maximum	4.7.2
Input power requirements	100-240 VAC, 50-60 Hz, 5 A	No specifics defined
Tracking accuracy		
Accuracy, typical (low wind, min deflect point)	0,1°	5.4.6
Accuracy, typical (low wind, max deflect point)	0,3°	5.4.6
Accuracy, 95th percentile (low wind, min deflect point)	0,5°	5.4.6
Accuracy, 95th percentile (low wind, max deflect point)	0,8°	5.4.6
Mean wind speed during the “low wind” test conditions	3 km/h	5.4.6
Accuracy, typical (high wind, min deflect point)	0,7°	5.4.6
Accuracy, typical (high wind, max deflect point)	1,0°	5.4.6
Accuracy, 95th percentile (high wind, min deflect point)	1,1	5.4.6
Accuracy, 95th percentile (high wind, max deflect point)	1,6°	5.4.6
Mean wind speed during the “high wind” test conditions	12 km/h	5.4.6
Weight and area of payload installed during testing	500 kg payload evenly distributed over a 50 m^2 area	5.4.2.1
Payload center of mass installed during testing	Payload center of mass 20 cm above the module mounting surface	5.4.2.1
Control characteristics		
Control algorithm	Hybrid	4.5
Control interface	None	4.8.9
External communication interface	Ethernet/TCP-IP	No specific description
Emergency stow provided?	Yes, at wind speeds 100 km/h	4.6.4, 4.12.3
Stow time	4 minutes	4.6.4
Clock accuracy	1 second per year	N/A
Mechanical design		
Range of motion, primary axis	± 160° azimuth	4.6.3.3
Range of motion, secondary axis	10°-90° elevation	4.6.3.3
System stiffness	Azimuth (Θ_z): 0,05° / 1 000 N·m, Θ_x: 0,1° / 1 000 N·m Diagrams attached show applied loads and observed deflection	6.3
Backlash	0,1° maximum	6.2
Environmental conditions		
Maximum allowable wind speed	Design values:	4.12.3

Characteristic	Example	Notes/Clause/Subclause
during tracking	80 km/h with 0 % terrain slope, open country, 60 km/h with 8 % terrain slope, suburban, urban Tested to: 60 km/h with 0 % terrain slope, open country	
Maximum allowable wind speed in stow	Design values: 150 km/h horizontal wind, 120 km/h with 10 % slope Tested to: 80 km/h with 0 % slope	4.12.4
Temperature operational range	–20 °C to +50 °C	4.12.1
Temperature survival range	–40 °C to +60 °C	4.12.2
Snow rating	Up to 20 kg/m^2 of snow load allowed	4.12.5

For an alternate template for the presentation of accuracy specifications see Table 2.

4 Tracker definitions and taxonomy

4.1 General

Solar trackers are mechanical devices used to point PV modules towards the sun or to direct sunlight on PV cells or modules. Photovoltaic trackers can be classified into two types: standard photovoltaic (PV) trackers and concentrated photovoltaic (CPV) trackers. Each of these tracker types can be further categorized by the number and orientation of their axes, their actuation architecture and drive type, their intended applications, and their vertical supports and foundation type.

4.2 Payload types

4.2.1 Standard photovoltaic (PV) module trackers

4.2.1.1 Uses

Standard photovoltaic trackers are used to minimize the angle of incidence between incoming light and a photovoltaic module. This increases the amount of energy produced from a fixed amount of power generating capacity.

4.2.1.2 Type of light accepted

Photovoltaic modules accept both direct and diffuse light from all angles. This means that systems implementing standard photovoltaic trackers produce energy even when not directly pointed at the sun. Tracking in standard photovoltaic systems is used to increase the amount of energy produced by the direct component of the incoming light.

4.2.1.3 Accuracy requirements

In standard photovoltaic systems, the energy contributed by the direct beam drops off with the cosine of the angle between the incoming light and the module. Thus trackers that have accuracies of ± 5° can deliver more than 99,6 % of the energy supplied by the direct beam. As a result, high-accuracy tracking is not typically used.