

ISO 9846:2025-08 (E)

Solar energy - Calibration of a pyranometer using a pyrhelimeter

Contents		Page
Foreword		v
Introduction		vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Selection of methods	7
5	Alternating sun-and-shade method (shade/unshaded method)	8
5.1	Principle	8
5.2	Apparatus	9
5.2.1	Pyranometer	9
5.2.2	Pyrhelimeter	9
5.2.3	Solar tracker	9
5.2.4	Shade device	10
5.2.5	Data acquisition system	11
5.3	Measurement conditions	11
5.4	Measurement site	12
5.5	Installation	12
5.6	Calibration procedure	13
5.6.1	Preparatory phase	13
5.6.2	Measurement phase (single series)	13
5.6.3	Data sampling	15
5.7	Calculation of sensitivity	15
5.7.1	Initial data rejection and filtering	15
5.7.2	Calculation of individual sensitivity values	16
5.7.3	Computation of the sensitivity of the test pyranometer	16
5.7.4	Evaluation of the final results	17
6	Continuous sun-and-shade method (component sum)	17
6.1	Principle	17
6.2	Apparatus	18
6.2.1	Pyranometers	18
6.2.2	Pyrhelimeter	18
6.2.3	Solar tracker	18
6.2.4	Shade device	18
6.2.5	Data acquisition system	18
6.3	Measurement conditions	18
6.4	Measurement site	18
6.5	Installation	19
6.6	Calibration procedure	19
6.6.1	Preparatory phase	19
6.6.2	Measurements	19
6.6.3	Data sampling	19
6.7	Calculation of sensitivity	19
6.7.1	Initial data rejection and filtering	19
6.7.2	Calculation of individual sensitivity values	19
6.7.3	Computation of the sensitivity of the test pyranometer	20

6.7.4	Evaluation of the final results	20
7	Collimation tube method	20
7.1	Principle	20
7.2	Apparatus	21
7.2.1	Pyranometer	21
7.2.2	Pyrheliometer	21
7.2.3	Solar tracker	21
7.2.4	Collimation tube	21
7.2.5	Data acquisition system	22
7.3	Measurement conditions	23
7.4	Measurement site	23
7.5	Installation	23
7.6	Calibration procedure	23
7.6.1	Preparatory phase	23
7.6.2	Measurements	23
7.6.3	Data sampling	23
7.7	Calculation of sensitivity	23
7.7.1	Initial data rejection and filtering	23
7.7.2	Calculation of individual sensitivity values	24
7.7.3	Computation of the sensitivity of the test pyranometer	24
7.7.4	Evaluation of the final results	24
8	Calibration uncertainty	24
9	Certificate of calibration	25
	Annex A (informative) Shade disc devices and solar tracker alignment	27
	Annex B (informative) Calculation of the sun incidence angle on an inclined plane	30
	Annex C (informative) Motivation on number of measurement days	32
	Annex D (informative) Extended version of the sun-and-shade method	34
	Annex E (informative) Sample averaging of the alternating sun-and-shade method	35
	Annex F (informative) The Forgan alternate method	36
	Annex G (informative) Comparison of the alternating sun-and-shade method (ASSM), continuous sun-and-shade method (CSSM) and collimation tube method (CTM)	38
	Annex H (informative) Uncertainty evaluation for pyranometer calibration	39
	Annex I (informative) Introduction of a new pyranometer sensitivity	42
	Bibliography	43