

HELIOSTAT PERFORMANCE TEST

Photo or simplified scheme
of general heliostat configuration



Heliostat manufacturer name	HelioStatFactory
Name of heliostat model	FOCUS
Serial number(s) or other identifier(s)	PX5
Total number of heliostats investigated	1
Name and address of testing laboratory	R&D Testing Center, Street Name, City, Country
Testing location	Heliostat Testing Platform, 52428 Jülich, Germany
Date of testing period	30.05.23 - 15.08.23
Date of erection of heliostat	01.04.22
Reference to guideline version	SolarPACES Heliostat Performance Guideline v1.0 from 30.05.23
Report format	This report and data CD

Date, signature and stamp of independant qualification
organization/company

n	Full Parameter Name (Symbol)	Value	Unit	Meas.Technique	Measurement Report
HELIOSTAT CONFIGURATION					
1	HelioConfig.CoordinateSys.GCS	see report	-	Laser dist.meter	Hel_Main.pdf
2	HelioConfig.CoordinateSys.HCS	see report	-	Laser dist.meter	Hel_Main.pdf
3	HelioConfig.CoordinateSys.CCS	see report	-	Laser dist.meter	Hel_Main.pdf

4	HelioConfig.CoordinateSys.AS	see report	-	Laser dist.meter	Hel_Main.pdf
5	HelioConfig.General.Type	T-shape	-	Laser dist.meter	Hel_Main.pdf
6	HelioConfig.Conc.Outline	rectang.	-	Laser dist.meter	Hel_Main.pdf
7	HelioConfig.Conc.Dimension	[6.6; 6.7]	m	Laser dist.meter	Hel_Main.pdf
8	HelioConfig.Conc.ReflectiveArea	40.1	m ²	Laser dist.meter	Hel_Main.pdf
9	HelioConfig.Panel.Outline	rectang.	-	-	-
10	HelioConfig.Panel.Dimension	[3.0; 1.1]	m	Laser dist.meter	Hel_Main.pdf
11	HelioConfig.Panel.Number	[2; 6]	-	-	-
12	HelioConfig.Panel.Type	glass mirror panels	-	-	-
13	HelioConfig.Panel.Material	silver coated glass	-	-	-
14	HelioConfig.Axes.Alignment	[az. axis vert.; el. axis horiz.]	-	-	-
15	HelioConfig.Axes.HeightOfSecondaryAxis	2.14	m	Laser dist.meter	Hel_Main.pdf
16	HelioConfig.Axes.DistanceAx1Ax2	0.15	m	Laser dist.meter	Hel_Main.pdf
17	HelioConfig.Axes.DistanceConcToSecondaryAxis	0.10	m	Tape meter	Hel_Main.pdf
HELIOSTAT OPTICS					
18	Optics.Panel.CurvatureMounted	flat	-	-	-
19	Optics.Panel.CurvatureMethod	tensionless	-	-	-
20	Optics.Conc.NominalShape	parabolic	-	-	-
21	Optics.Conc.NominalShapeNumericValue	[55] or [25;1500] or matrices	m	-	-
22	Optics.Conc.HelioRefOrientationTemp	[az=0°; el=30°; T=20°C]	-	Inclinometer, TC	Hel_Shape.pdf
23	Optics.Conc.SD_SamplingRate	1000	values/m2	-	Hel_Shape.pdf
24	Optics.Conc.SD_ShareEvalSurf	97	%	-	Hel_Shape.pdf
25	Optics.Conc.SD_2D	sR: 1.46 RMS: 2.06 (100%)	mrاد	Deflectometry	Hel_Shape.pdf
26	Optics.Conc.SD_2D*	sR: 1.09 RMS: 1.54 (98%)	mrاد	Deflectometry	Hel_Shape.pdf
27	Optics.Conc.SD_2DHighFraction	sR: 6.95 RMS: 9.83 (2%)	mrاد	Deflectometry	Hel_Shape.pdf
28	Optics.Conc.SDx /SDrad	RMS: 1.76 MEAN: 0.19 STD: 1.76 (100%)	mrاد	Deflectometry	Hel_Shape.pdf
29	Optics.Conc.SDx* /SDrad*	RMS: 1.10 MEAN: 0.00 STD: 1.11 (98%)	mrاد	Deflectometry	Hel_Shape.pdf
30	Optics.Conc.SDxHighFraction/ SDradHighFraction	RMS: 9.75 MEAN: 9.75 STD: 0.35 (2%)	mrاد	Deflectometry	Hel_Shape.pdf
31	Optics.Conc.SDy /SDtan	RMS: 1.08 MEAN: -0.03 STD: 1.09 (100%)	mrاد	Deflectometry	Hel_Shape.pdf
32	Optics.Conc.SDy* /SDtan*	RMS: 1.08 MEAN: -0.03 STD: 1.09 (100%)	mrاد	Deflectometry	Hel_Shape.pdf
33	Optics.Conc.SDyHighFraction / SDtanHighFraction	RMS: - MEAN: - STD: - (0%)	mrاد	Deflectometry	Hel_Shape.pdf
34	Optics.Conc.SD_NonGaussianDistr	No	-	Deflectometry	Hel_Shape.pdf
35	Optics.Conc.SDmat	2 matrices, see CD	mrاد	Deflectometry	Hel_Shape.pdf +CD
36	Optics.Conc.SD_NonResolvedStruct	No	-	Deflect.+Visual	Hel_Shape.pdf

37	Optics.Conc.SD_DiffBetwRegions	No	-	Deflect.+Visual	Hel_Shape.pdf
38	Optics.Conc.DefGravity_dxdydz	5 times; 3x[m;n] matrix	mm	Photogrammetr.	Hel_Shape.pdf +CD
39	Optics.Conc.DefTemp_dxdydz_perK	3x[m;n] matrix	mm/K	Photogrammetr.	Hel_Shape.pdf +CD
40	Optics.Conc.DefGravity_deltaSDmat	5 x 2 matrices and elevation vector, see CD	mrاد	Photogrammetr.	Hel_Shape.pdf +CD
41	Optics.Conc.DefTemp_deltaSDmat_perK	2 matrices, see CD	mrاد/K	Photogrammetr.	Hel_Shape.pdf +CD
42	Optics.Reflectance.SolarWeightedSpecular	95.0	%	Reflectom.	Refl_Report.pdf
43	Optics.Reflectance.HighlySpecularMirror	Yes	-	see reflectance guideline	Refl_Report.pdf
44	Optics.Focus.Variability	fix focal length	-	-	-
HELIOSTAT TRACKING					
45	Tracking.Axes.Concept	[el.motor/gear dr.; el.motor/gear dr.]	-	-	Hel_Main.pdf
46	Tracking.Axes.Control	[closed loop; cl. loop]	-	-	Hel_Main.pdf
47	Tracking.Axes.MinMaxRangeAxis1	[-80; 80]	°	Inclinometer	Hel_Main.pdf
48	Tracking.Axes.MinMaxRangeAxis2	[-180; 180]	°	Inclinometer	Hel_Main.pdf
49	Tracking.Axes.TimeToMoveMinMaxRange	[360; 300]	s	Electr. time clock	Hel_Main.pdf
50	Tracking.Accuracy.TrackingTestConditions	[$az_{min} = -30^\circ$; $az_{max} = +30^\circ$; $el_{min} = 20^\circ$; $el_{max} = 65^\circ$; $T = 20^\circ\text{C}$; $v_{wind} = 2\text{m/s}$]	-	-	Hel_Main.pdf
51	Tracking.Accuracy.Track_2D	sR: 0.75 RMS: 1.06	mrاد	Beam on target	Hel_Track.pdf
52	Tracking.Accuracy.Track_x_HCS	RMS: 0.75 MEAN: 0.01 STD: 0.75	mrاد	Beam on target	Hel_Track.pdf
53	Tracking.Accuracy.Track_y_HCS	RMS: 0.75 MEAN: 0.00 STD: 0.75	mrاد	Beam on target	Hel_Track.pdf
54	Tracking.Accuracy.Tracking_HCS-TimeCorrelation	[0.1; -0.2]	-	Beam on target	Hel_Track.pdf
55	Tracking.Accuracy.Tracking_HCS-XYCorrelation	0.2	-	Beam on target	Hel_Track.pdf
56	Tracking.Safety.EmergDefocusTime	[15; 20] @ 21°C	s	Inclinom.+Clock	Hel_Track.pdf
57	Tracking.Safety.StowPosition	face down, -10°	- /°	Inclinometer	Hel_Track.pdf
HELIOSTAT CONTROL					
58	Control.Instrumentation.Communication	wired, RS485	-	-	Hel_Control.pdf
59	Control.Instrumentation.ControlReactionTime	spec: [0.11; 0.15]; measured: MEAN: 0.10 MAX: 0.13 STD: 0.02	ms	Oscilloscope	Hel_Control.pdf
60	Control.General.DriveSupplyType	electrical @230 V	-	-	Hel_Control.pdf
61	Control.Power.InputVoltage	spec: [220; 230; 240]; measured: MEAN: 228.3 MAX: 230.2 STD: 1.6	V	Specification / voltmeter	Hel_Power.pdf
62	Control.Power.InputPowerStandby	spec: 3.0W @21°C; meas: 2.9W @25°C	W	Power meter	Hel_Power.pdf
63	Control.Power.InputPowerEmergDefocus	spec: [400; 450] @21°C; meas.: MEAN: 397 MAX: 450 STD: 40 @25°C	W	Power meter	Hel_Power.pdf

64	Control.Power.InputPowerColdStart	spec: [190; 200] @20°C; meas.: MEAN: 189 MAX: 200 STD: 7 @15°C	W	Power meter	Hel_Power.pdf
LIMITS & TOLERANCES					
65	LimitsTol.WindSpeed.NormalOperation	8	m/s	Specification	
66	LimitsTol.WindSpeed.ReducedOperation	20	m/s	Specification	
67	LimitsTol.WindSpeed.GustSurvival	40	m/s	Specification	
68	LimitsTol..OperatingTemp	[-20;50]	°C	Specification	
ORIENTATIVE COSTS					
69	Cost..Total	1'900 (Morocco)	€	Specification	
70	Cost..SpecificWithoutFoundation	80.0	€/m ²	Specification	