CEA I PV MAGAZINE PROGRAM TEST REPORT

SUPPLIER | DMEGC Solar

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1. INTRODUCTION

As part of CEA's engagement in developing and supervising PV Magazine's test program at Gsola, CEA has developed a testing protocol and flowchart, a scoring system, a methodology and a reporting structure that it will be used to run this program. This report presents the test results and scoring grades for this product.

2. SCORING SYSTEM

2.1. Test flowchart and protocol

The following is a high-level flowchart of the testing procedure, describing the steps, and tests to be followed. Detailed checklists have been delivered to Gsola, that will also serve as records of the process.

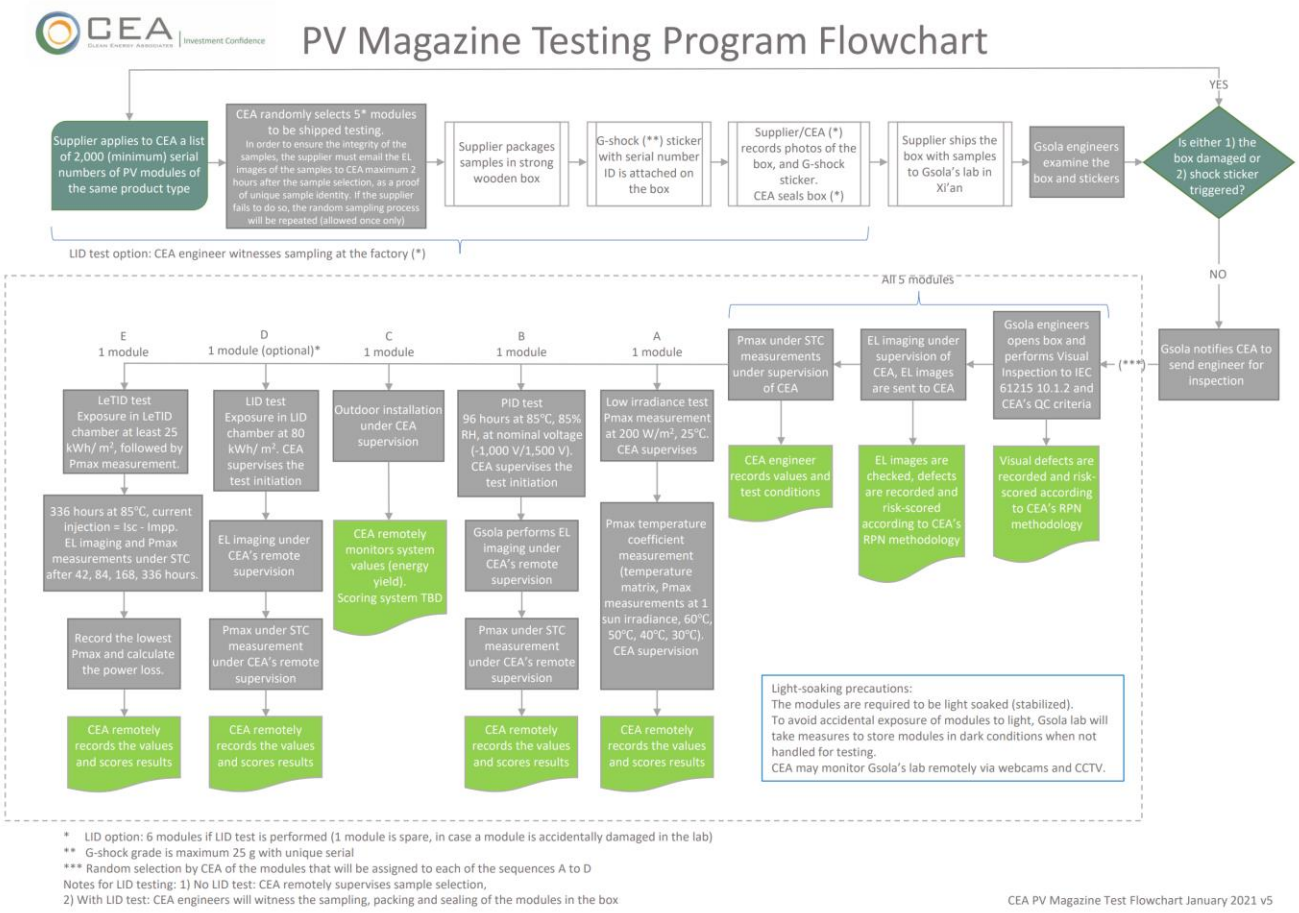


Figure 1 Test flowchart

2.2. Scoring methodology

For every product, 5 samples have been shipped to Gsola's lab to conduct the tests and inspections according to the above flowchart.

The following table describes the inspections and tests that have been applied on all products:

Table 1 Test/inspection grading system overview

	Test/inspection	# of samples	Method	Values	Average grade weight	Grades
1	Visual inspection	5	Inspection	RPN Scores	10%	1-100
2	EL image inspection	5	Inspection	RPN Scores	10%	1-100
3	Low irradiance efficiency loss	1	Test	%	25%	1-100
4	Pmax Temperature coefficient	1	Test	%/°C	25%	1-100
5	PID loss	1	Test	%	30%	1-100
6	LID loss (optional)	1	Test	%	NA	1-100
7	LeTID	1	Test	%	NA	1-100
8	Outdoor installation and yield measurement	1	Energy Yield Monitoring	Periodic kWh/kWp	NA	NA

Notes:

1. The RPN scoring method has been developed by CEA and is used to evaluate and create risk scores of Visual and EL defects.
2. The weights are used to calculate the average grade for tests 1-5.

A number within the 1-100 range will be used to grade the results, so that the overall ranking of the products will reflect general industry practices and requirements:

Table 2 Detailed scoring system

	Grade range:	100	90	80	70	60	50	40	30	20	10	0
1	Visual inspection (RPN scores)	0	0.74	2.20	4.39	7.30	10.94	15.30	20.39	26.20	32.74	≥ 40
2	EL image (RPN scores)	0.00	2.03	4.62	7.75	11.43	15.65	20.43	25.75	31.62	38.03	≥ 45.00
3	Low irradiance loss	≤ -2.00%	-0.02%	1.78%	3.41%	4.87%	6.16%	7.27%	8.21%	8.98%	9.58%	≥ 10.00%
4	Pmax Temp. coefficient	≥ -0.300%	-0.343%	-0.382%	-0.417%	-0.448%	-0.475%	-0.498%	-0.517%	-0.532%	-0.543%	≤ -0.550%
5	PID loss	≤ 0.0%	0.7%	1.6%	2.7%	4.0%	5.5%	7.2%	9.1%	11.2%	13.5%	≥ 16.0%
6	LID loss (optional)	≤ -0.50%	0.35%	1.20%	2.05%	2.90%	3.75%	4.60%	5.45%	6.30%	7.15%	≥ 8.00%
7	LeTID	≤ 0%	0.30%	0.60%	0.90%	1.20%	1.50%	1.80%	2.10%	2.40%	2.70%	≥ 3.00%

Notes:

1. The Visual and EL Inspection RPN scores will be divided by the number of samples, to normalize the score, as the total number of samples may vary.
2. The correspondence of the scores/test results to the grades follows a binomial or linear relationship, anchored to certain key values that are generally accepted and employed in the PV industry. For example, a PID loss of 5%,

which is the pass/fail threshold of the related IEC standard, will give a grade close to 50. In this sense, grades below 50 indicate a product performance that is below a generally acceptable threshold.

The scoring system shown in Table 2 is preliminary, and will be adjusted as the testing program develops, in order to better reflect the products standing per industry standards.

2.3. Selection methodology

We follow three testing sample selection methods:

1: Sample randomly selected by CEA from a large production lot

2: Sample purchased from the market by CEA

3: Sample provided by supplier, without random selection

The DM605G12RT-B66HSW testing samples were selected according to method 3.

3. TEST DETAILS

A sample lot consists of 5 modules, one of which has been used as a spare for the chamber and outdoor testing, in case a module is accidentally damaged during handling at the lab. Refer to Table 3 and Table 4 for test sample and product information.

Table 3 Test sample information

Sample #	Serial number
1	DMAASWXC51244VH02186
2	DMAASWXC51244VH04546
3	DMAASWXC51244VH09159
4	DMAASWXC51244VH08134
5	DMAASWXC51244VH11362

Table 4 Product information

Model	DM605G12RT-B66HSW
Cell technology	TOPCon
Cell number	132
Cell format	210x182 mm
Number of busbars	16
Junction box	IP68, 3 bypass diodes
Laminate construction	Glass
Bifaciality ratio	80±5%

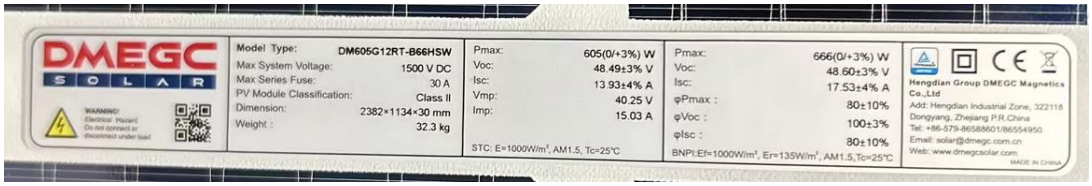


Figure 2 Product nameplate

3.1. Visual inspection

All 5 modules of each product sample lot have undergone visual inspection, according to CEA's quality criteria for visual inspection. The defects found has been evaluated according to CEA's scoring system. The scoring system is a modified version of CEA's proprietary RPN (risk priority number) system, based on the formula RPN score = Severity x Detectability.

Table 5 Product picture

Front Side	Rear Side
	

The following table shows the visual inspection results, normalized for the number of tested modules:

Table 6 Visual inspection results

DM605G12RT-B66HSW	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Score	Grade
Visual inspection	None	None	None	None	None	0	100

3.2. EL image Inspection

The same sample lot was inspected for EL defects.
Table 7 shows the EL inspection results normalized for the number of tested modules. Visual and EL inspection scores are shown below in Figure 3.

Table 7 EL image inspection results

DM605G12RT-B66HSW	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Score	Grade
EL image inspection	None	None	None	None	None	0	100

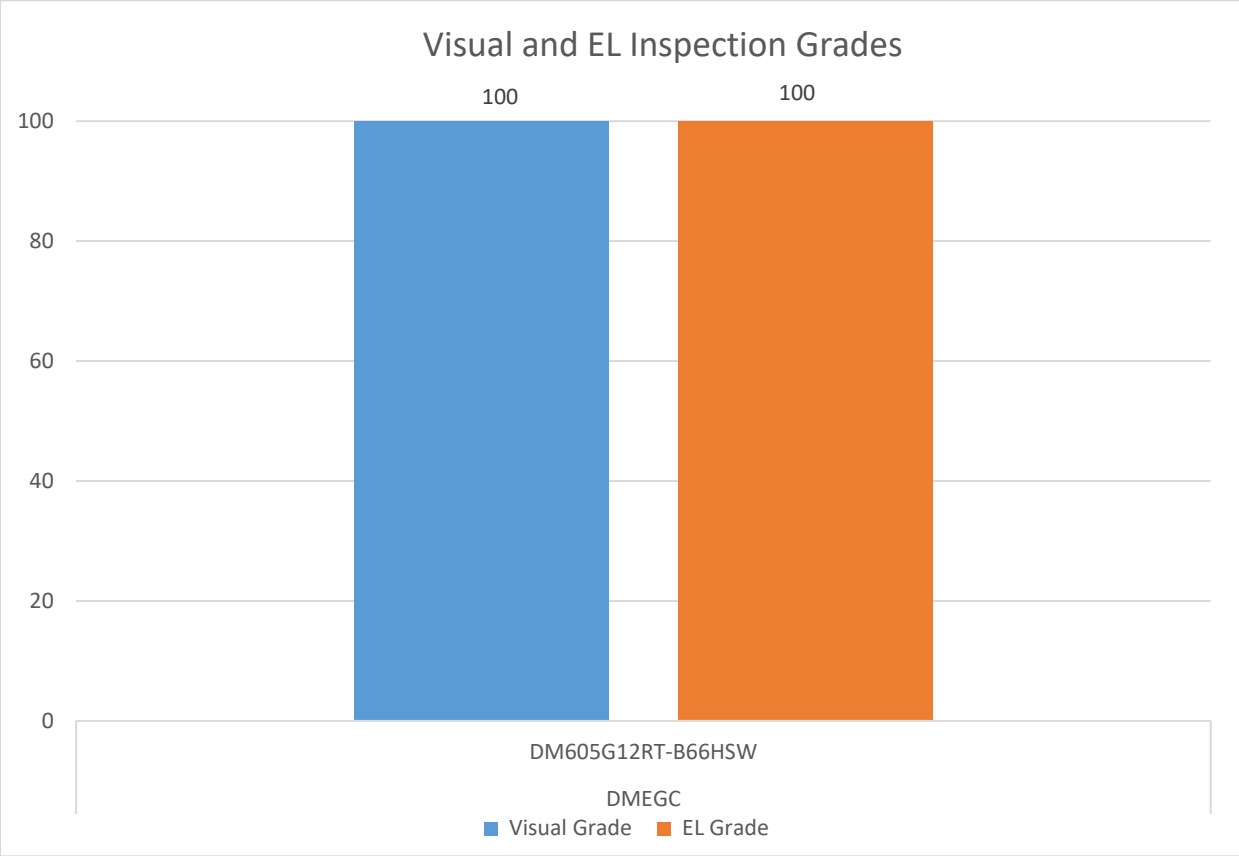


Figure 3 Visual and EL inspection results

3.3. Low irradiance efficiency loss test

The efficiency loss is calculated by the following formula:

Efficiency loss = 1- [(Pmax at low irradiance conditions / Pmax at STC) * (1,000/200)]

Table 8 and Figure 4 show the low irradiance efficiency test results for the front side.

Table 8 Low irradiance test results

DM605G12RT-B66HSW	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Grade
Front side low irradiance efficiency loss (%)	3.85%					67

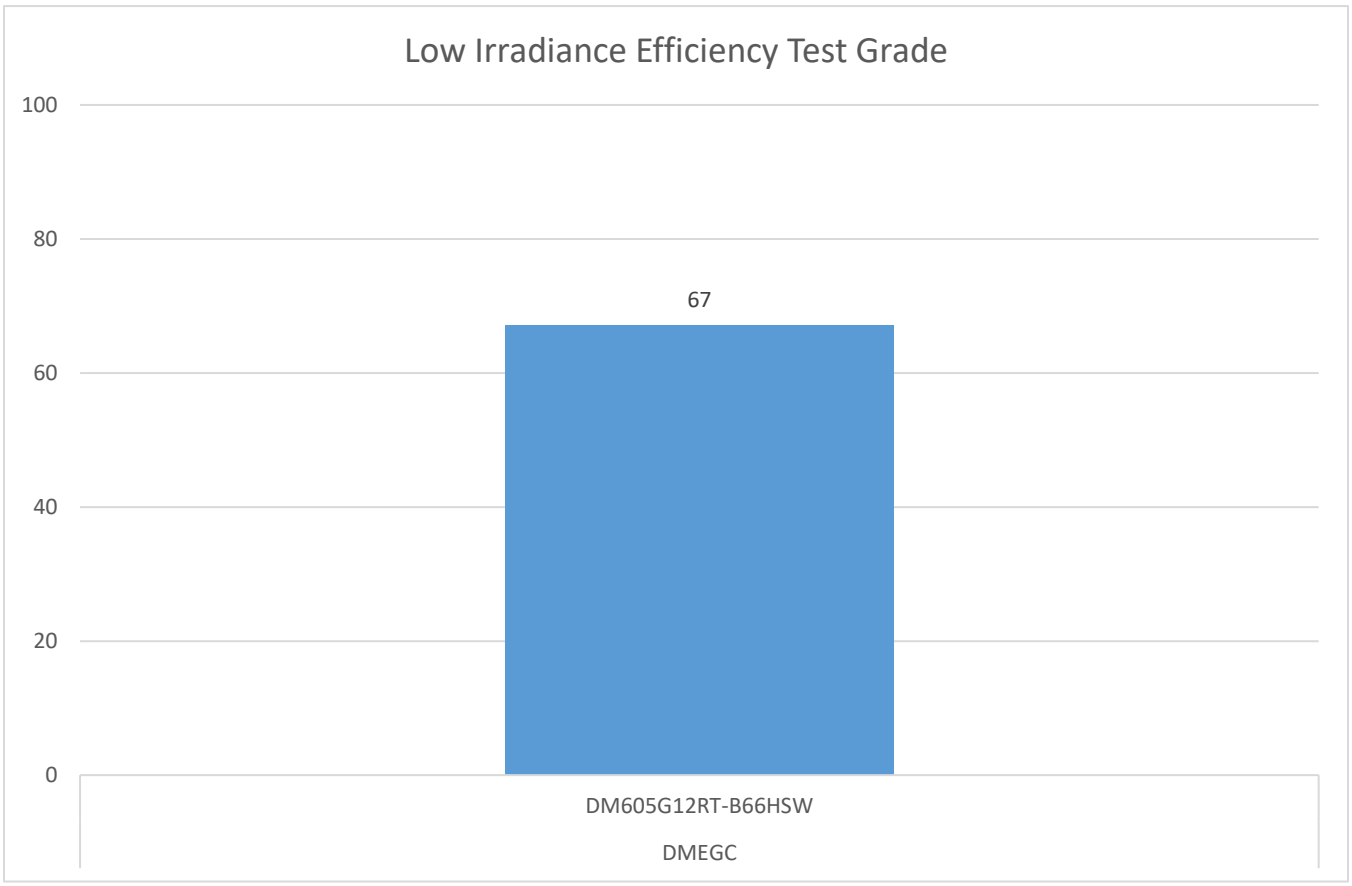


Figure 4 Low irradiance test result

3.4. Pmax temperature coefficient test

Table 9 and Figure 5 depict the Pmax temperature coefficient test results.

Table 9 Pmax temperature coefficient test result

DM605G12RT-B66HSW	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Grade
Pmax Temperature coefficient (%/°C)	-0.276%					105

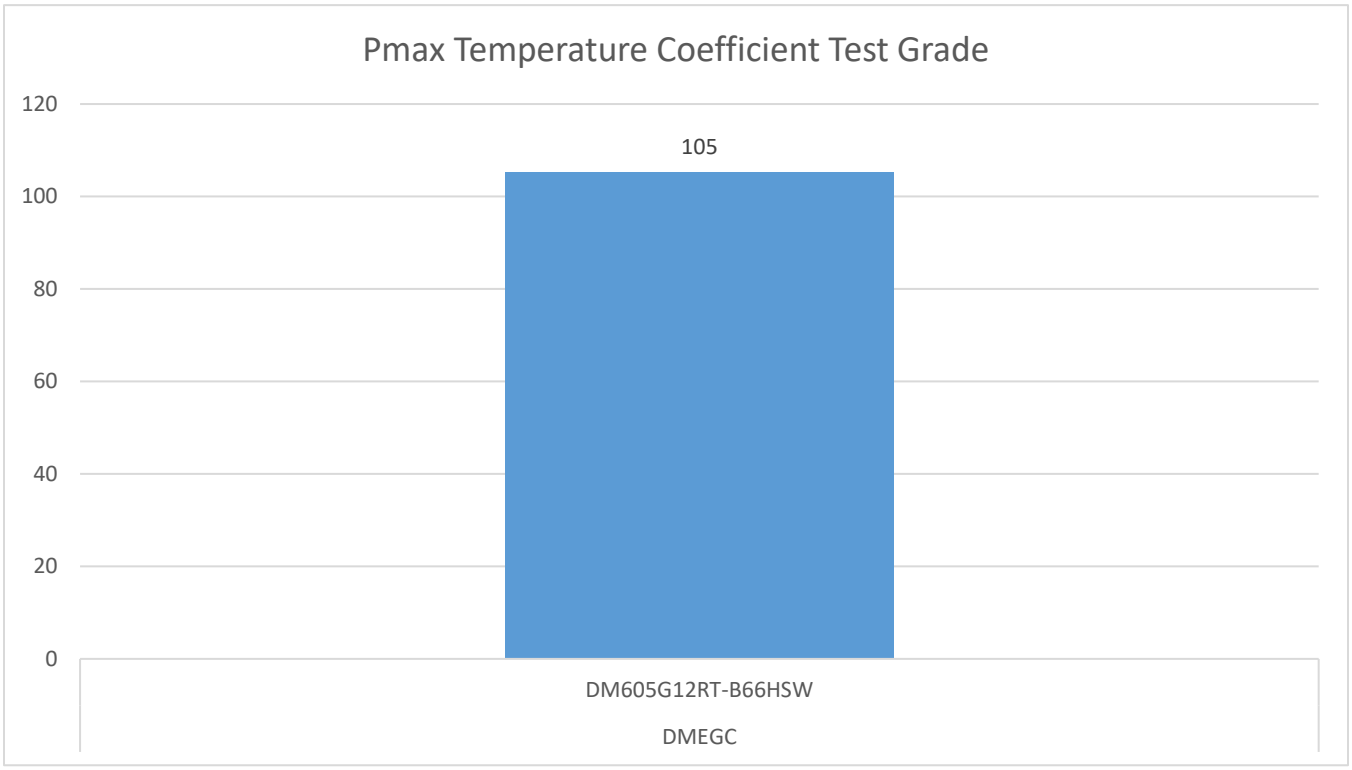


Figure 5 Pmax temperature coefficient test result

3.5. PID loss test

Table 10 and Figure 6 depicts the PID loss test results for the front side at **1500 V**:

Table 10 PID loss test result

DM605G12RT-B66HSW	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Grade
Front side PID loss (%)		0.86%				88

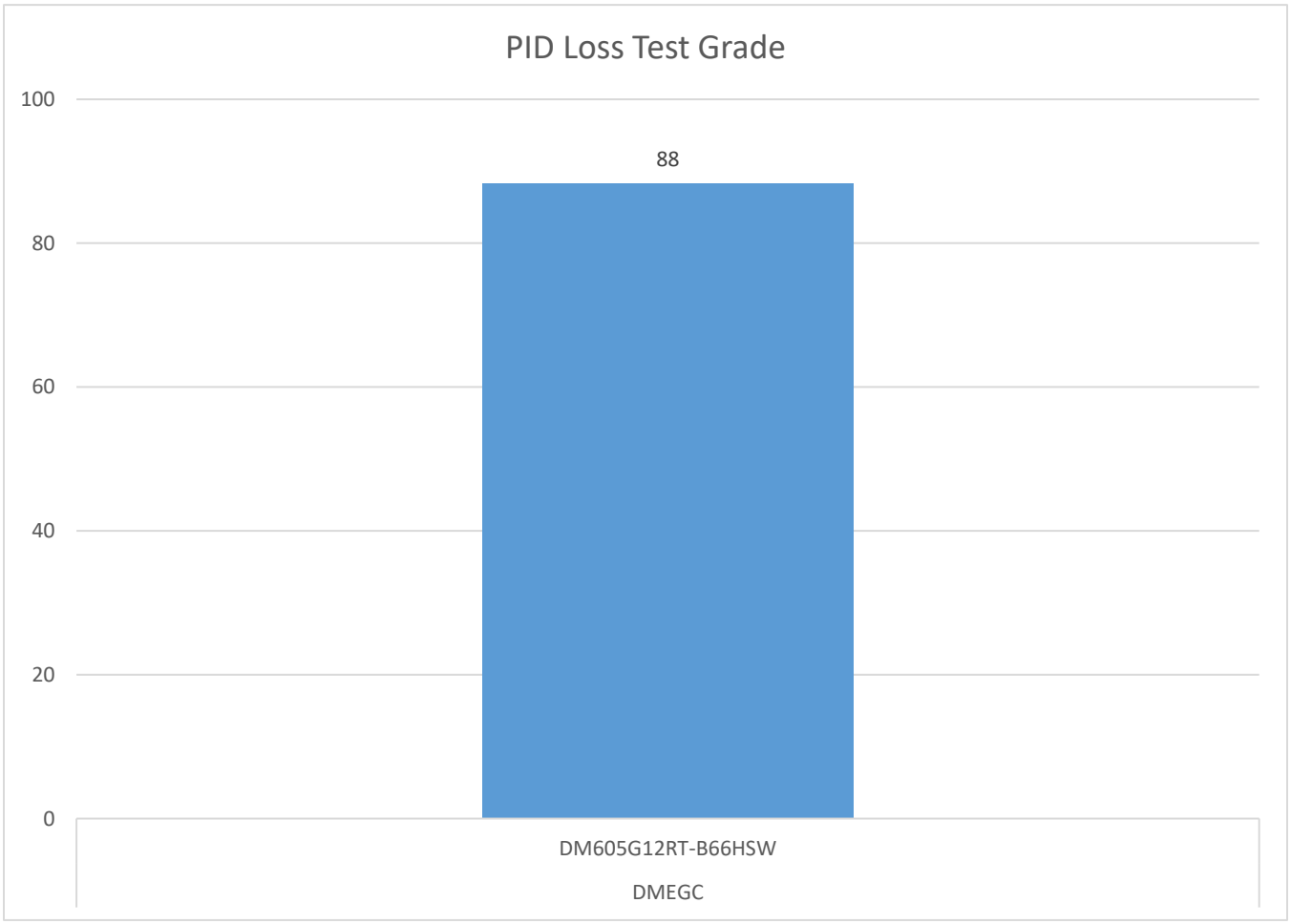


Figure 6 PID loss test result

3.6. Bifaciality ratio

The bifaciality ratio test result is not graded. We list the results here for informational purposes. The table below shows the bifaciality ratio results:

Table 11 Bifaciality ratio test results

DM605G12RT-B66HSW	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average
Bifaciality ratio (%)	77.01%	77.60%	77.78%	77.27%	77.37%	77.40%

The bifaciality ratio is calculated from the following formula:

Bifaciality ratio = (Pmax rear surface / Pmax front surface) * 100%

3.7. Score overview

Figure 7 shows the overview of the test scores. Figure 8 shows the average score.

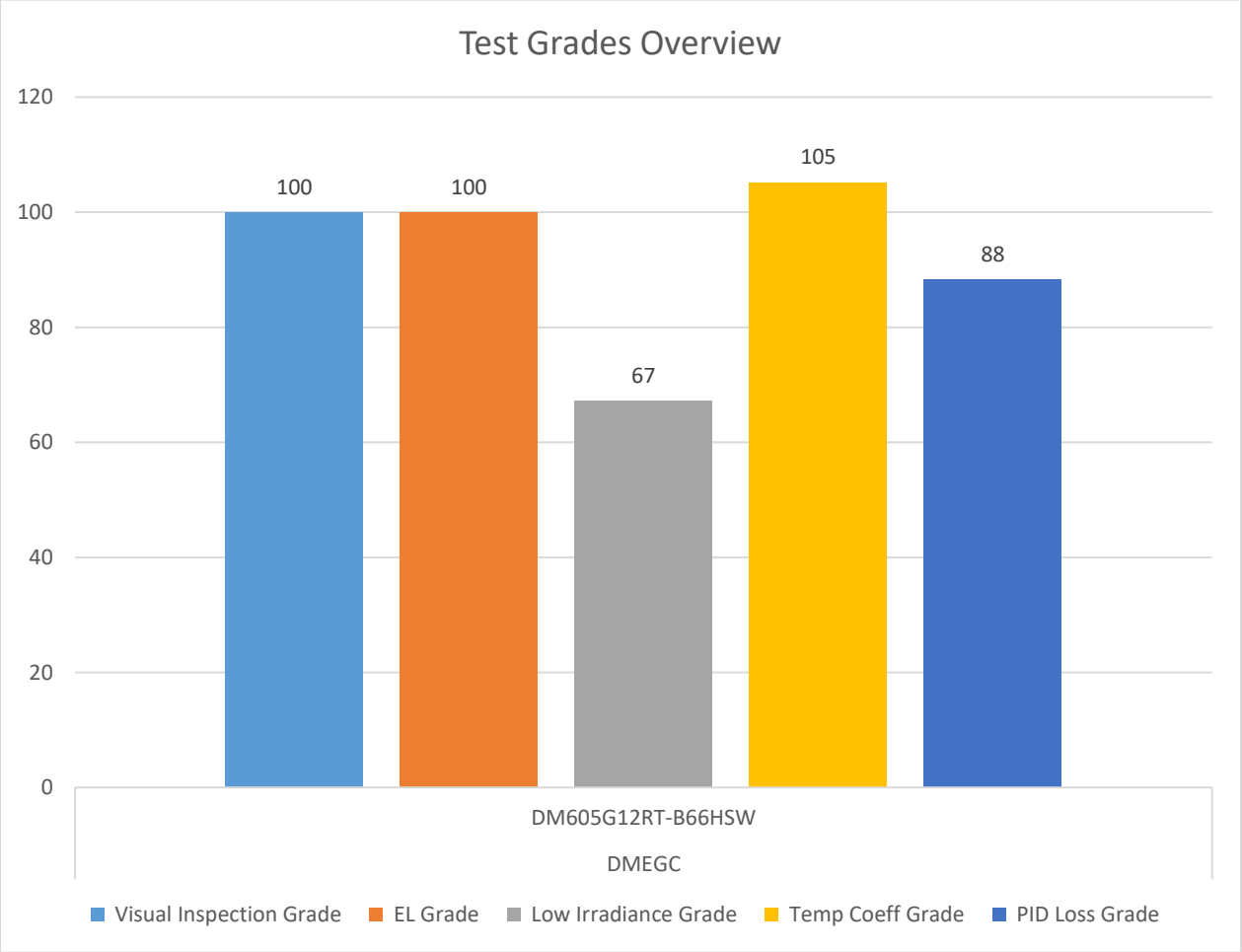


Figure 7 Test results overview

NOTE: The Average grade does **NOT** include the LID test, as it is optional and not performed for all products.

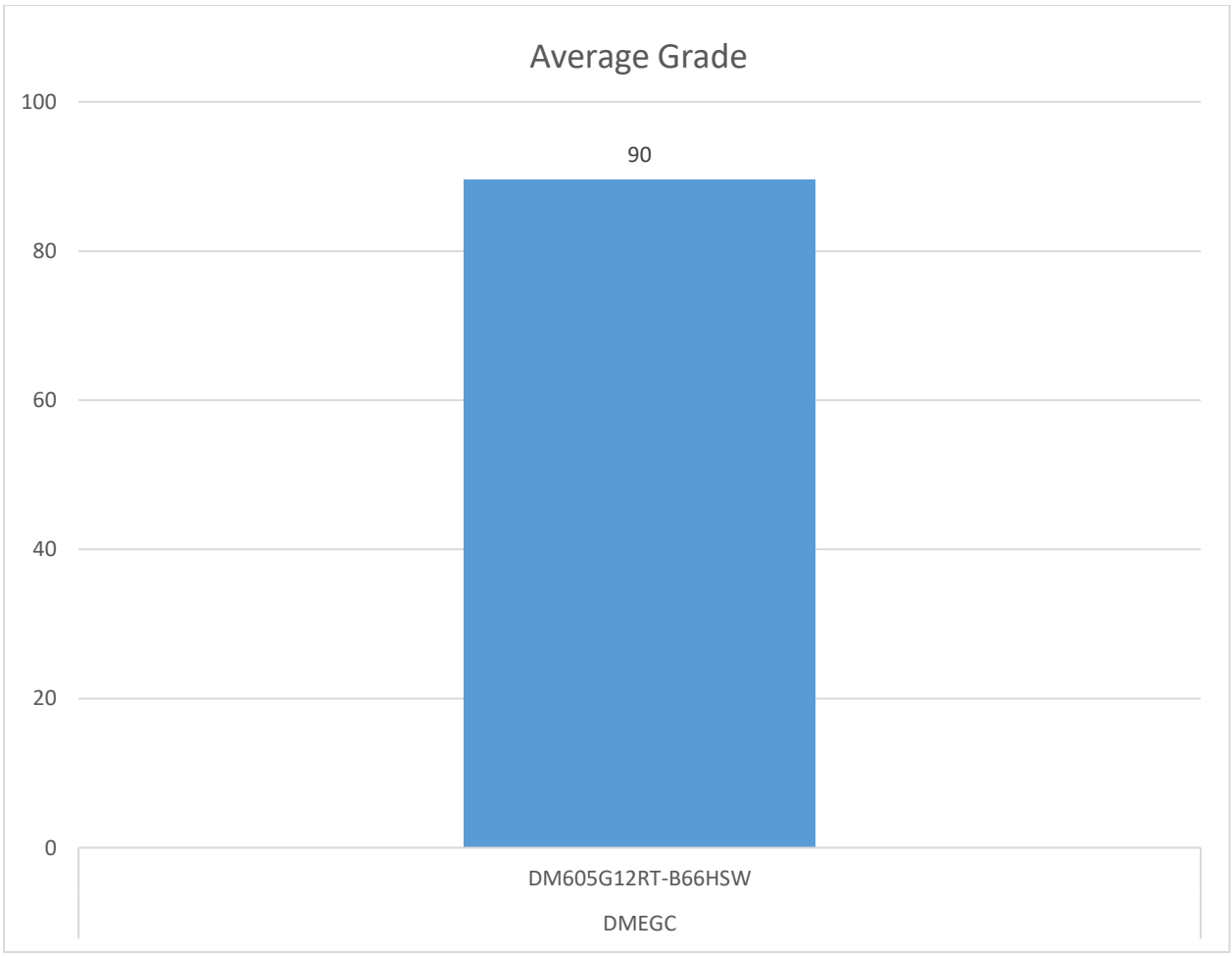


Figure 8 Average test grade

Appendix 1 – DM605G12RT-B66HSW Datasheet

Commercial / Utility

DMEGC SOLAR

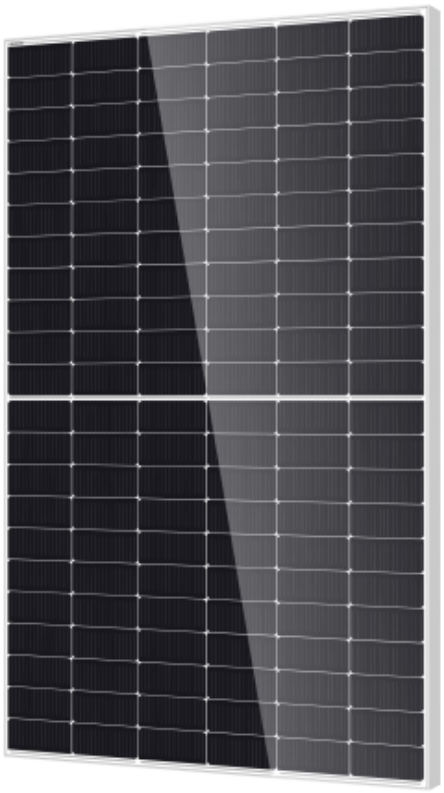
N-Type

Bifacial Module with Double Glass

Type: DMxxxG12RT-B66HSW

Power Range: 605 - 620 W

Max. Efficiency: 23.0%



Bifacial Module Application

Up to 25 % higher electricity yields due to active cell technology in bifacial glass/glass modules on both sides.

Better Performance

Our modules perform better on sunny and hot days thanks to its optimized temperature coefficient.

Excellent Low Light Performance

Our modules can also provide higher power output under low light conditions, such as sunset, cloudy, or dawn.

Excellent Quality

More than 40 years' experience of manufacturing and intensive quality tests above the IEC standard ensures reliable modules and a secured investment.

Assumption of Environmental, Social and Governance Responsibility (ESG)

DMEGC stands for his responsibility. Production is certified according to SA 8000 (ILO standards).

Certifications

SA 8000	ILO Standards. Social responsibility standards
ISO 9001	Quality management system
ISO 14001	Environmental management system
ISO 45001	Occupational health and safety management system
ISO 50001	Energy management system

SolarPower Europe Member

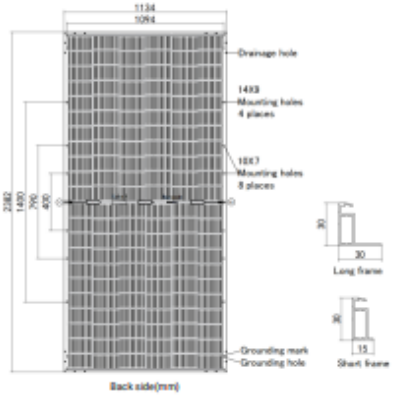
A member of Hengdian Group

DMxxxG12RT-B66HSW

DMEGC SOLAR

Module Specification

Cell Type	N -type Mono-crystalline , 132 (6x22)
Dimensions (mm)	2382 x 1134 x 30
Weight (kg)	32.3
Front Cover	2 mm heat strengthened glass with anti -reflective coating
Rear Cover	2 mm heat strengthened glass
Junction Box	3 Diodes, IP68 according to IEC 62790
Cables	4mm²/Portrait: 350mm (+)/250mm(-) Landscape: 1300mm(+)/1300mm(-) Length can be customized
Connector Type	PV-ZH202B or MC4-EVO 2A (1500V)



Electrical Specifications[1]

Module Type	DM605G12RT-B66HSW		DM610G12RT-B66HSW		DM615G12RT-B66HSW		DM620G12RT-B66HSW	
Testing Condition	STC[2]	NMOT[3]	STC	NMOT	STC	NMOT	STC	NMOT
Maximum Power (Pmax/W)	605	461	610	465	615	469	620	472
Maximum Power Current (Imp/A)	15.03	12.21	15.09	12.26	15.15	12.31	15.20	12.35
Maximum Power Voltage (Vmp/V)	40.25	37.77	40.45	37.95	40.65	38.14	40.85	38.33
Short-circuit Current (Isc/A)	15.93	12.84	15.99	12.89	16.05	12.94	16.11	12.99
Open-circuit Voltage (Voc/V)	48.49	46.67	48.69	46.86	48.89	47.05	49.09	47.25
Module Efficiency STC (%)	**22.4**		**22.6**		**22.8**		**23.0**	

[1]Measurements according to IEC 60904-3, Measurement tolerance: ISC / VOC: ± 3 %, Bifacially: 80 % ± 5 %
[2] STC (Standard Test Condition): Radiation 1000 W/m², Module temperature 25℃, AM = 1.5
[3] NMOT:Radiation 800W/m² , Ambient temperature 20℃, AM = 1.5, Wind Speed 1 m/s

BIFACIAL OUTPUT - REARSIDE POWER GAIN

10 %	Pmax (STC)	666	671	677	682
20 %	Pmax (STC)	726	732	738	744
30 %	Pmax (STC)	787	793	800	806

Certifications and Warranty

Certifications	IEC 61215, IEC 61730
	Ammonia Corrosion Test: IEC 62716
	Salt Mist Corrosion Test: IEC 61701
	PID (IEC TS 62804); LeTID (IEC TS 63342)
	Dust & Sand (IEC 60068)
WEEE Registration No.	DE 50188598
Product Warranty	15 years
Peak Power Warranty	30 years linear warranty

1.) First year: min. 99 %. 2.) From the 2nd year: Max. 0.4 % degradation annually. 3.) Min. 87.4 % in the 30th year.

Operating conditions

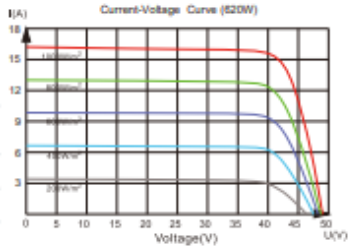
Operating Temperature (℃)	-40 to +85
Maximum System Voltage(V)	1500 DC (IEC)
Overcurrent protection rating (A)	30
Power Performance Tolerance (%)	0 / +3
Protection class	II
Max. Test Load, Push/Pull (Pa)	Snow 5400 / Wind 2400
Max. Design Load, Push/Pull (Pa)	3600 / 1600
Fire Rating Class	Class C

Temperature Characteristics

Nominal Module Operating Temperature (NMOT)	42 ± 2℃
Temperature Coefficient of Pmax (%/℃)	-0.29
Temperature Coefficient of Voc (%/℃)	-0.25
Temperature Coefficient of Isc (%/℃)	+0.048

Packaging

Container	40' HQ
Pallet Dimensions(mm)	2396 × 1140 × 1250
Pieces per Pallet	36
Pieces per Container	720



Statement: The installation instructions and the warranty conditions must be followed. Due to technological progress, product parameters will be adjusted accordingly.When signing the contract, the latest data of the company shall prevail.

DMEGC SOLAR

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