

# HYUNDAI SOLAR MODULE

## HG SERIES

G12 PERC Shingled  
HiE-S435HG HiE-S440HG HiE-S445HG



Shingled  
Technology



For Both Residential  
& Commercial  
Applications



More Power  
Generation  
In Low Light



### G12 PERC Shingled

G12 PERC Shingled Technology provides ultra-high efficiency with better performance in low irradiation. Maximizes installation capacity in limited space.



### Mechanical Strength

Tempered glass and reinforced frame design withstand rigorous weather conditions such as heavy snow and strong wind.



HYUNDAI

### Reliable Warranty

Global brand with powerful financial strength provide reliable 25-year warranty. (Australia and Europe Only)



### UL / VDE Test Labs

Hyundai's R&D center is an accredited test laboratory of both UL and VDE.

## Hyundai's Warranty Provisions



- **25-Year Product Warranty**
- On material and workmanship  
**Australia and Europe Only**



- **25-Year Performance Warranty**
- Initial year: 98.0%
- Linear warranty after second year: with 0.55%p annual degradation, 84.80% is guaranteed up to 25 years

## About Hyundai Energy Solutions Co., Ltd

Established in 1972, Hyundai Heavy Industries Group is one of the most trusted names in the heavy industries sector and is a Fortune 500 company. As a global leader and innovator, Hyundai Heavy Industries is committed to building a future growth engine by developing and investing heavily in the field of renewable energy.

As a core energy business entity of HHI, Hyundai Energy Solutions has strong pride in providing High-quality PV products to more than 3,000 customers worldwide.

## Certification



**Iris Hellas**  
Technology Innovations  
[www.irishellas.com](http://www.irishellas.com)



## Electrical Characteristics

		Mono-Crystalline Module (HiE-S <sub>1</sub> HG)		
		435	440	445
Nominal Output (Pmpp)	W	435	440	445
Open Circuit Voltage(Voc)	V	43.6	43.7	43.8
Short Circuit Voltage (Isc)	A	12.79	12.90	13.01
Voltage at Pmax (Vmpp)	V	36.2	36.3	36.4
Current at Pmax (Imp)	A	12.02	12.13	12.23
Module Efficiency	%	20.9	21.1	21.4
Cell Type	-	PERC Mono-Crystalline Silicon Shingled		
Maximum System Voltage	V	1,500		
Temperature Coefficient of Pmax	%/°C	-0.34		
Temperature Coefficient of Voc	%/°C	-0.27		
Temperature Coefficient of Isc	%/°C	0.04		

\*All data at STC(Standard Test Conditions). Above data may be changed without prior notice.

\*Tolerance of Pmax:0~+5W

\*Measuring uncertainty of power:±3%

\* Performance deviation of Voc [V], Isc [A], Vm[V] and Im[A]:±3%.

## Mechanical Characteristics

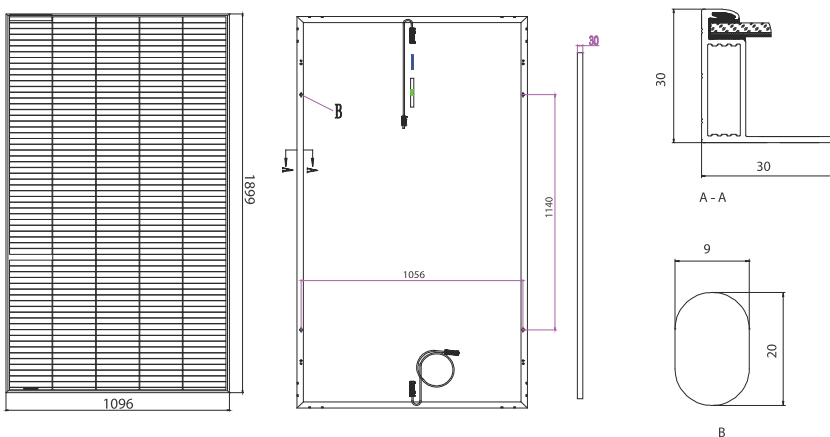
Dimensions	1,899 × 1,096 × 30 mm (L × W × H)		
Weight	21.8kg		
Solar Cells	320 Cells, PERC Mono-crystalline Shingled (210 × 210mm)		
Output Cables	4mm <sup>2</sup> ,+500mm/-1100mm(Vertical), +220mm/-180mm(Horizontal)	Connector	Stäubli : MC4-Evo2
Junction Box	IP68, TUV&UL, two diodes		
Construction	Front Glass: AR Coated tempered glass, 3.2mm Encapsulation: EVA (Ethylene-Vinyl-Acetate)		
Frame	Anodized Aluminum		

## Installation Safety Guide

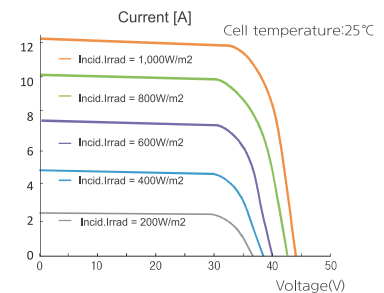
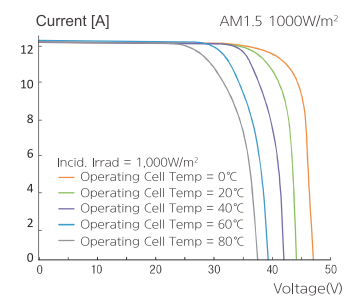
- Only qualified personnel should install or perform maintenance.
- Be aware of dangerous high DC voltage.
- Do not damage or scratch the rear surface of the module.
- Do not handle or install modules when they are wet.

Nominal Operating Cell Temperature	42.3°C ( ±2°C )
Operating Temperature	-40 ~ 85 °C
Maximum System Voltage	DC 1,500 / 1,000 (IEC)
Fire Rating	Class C
Series Fuse Rating [A]	25
Maximum Surface Load Capacity	Front 5,400 Pa Rear 2,400 Pa

## Module Diagram (Unit: mm)



## I-V Curves



Manufactured in China

**HYUNDAI**  
ENERGY SOLUTIONS



Sales & Marketing  
sales@hyundai-es.co.kr

Printed Date : 06/2022

## Hyundai Limited Warranty for PV Modules ("Limited Warranty")

Effective February 1, 2022

Customer Name	
Contract No.	
Date of Issue	
Project Name (If Applicable)	

The following warranty ("Limited Warranty") is provided by Hyundai Energy Solutions Co., Ltd. ("HYUNDAI") in regards to the photovoltaic modules ("MODULE(S)") supplied to the original end customer and subsequent owners at the original installation site (collectively referred to as "CUSTOMER"). The Warranties defined herein apply only to the MODULES which (a) are sold directly by HYUNDAI or through one of its authorized local distributors and (b) have a legible Hyundai Energy Solutions Co., Ltd. logo and product serial number. The start date for all of the following warranties is the earlier of either: (i) the date of installation; or (ii) the 90<sup>th</sup> day (natural day) after the delivery at the end-customer's site of the HYUNDAI MODULES("Warranty Start Date"). HYUNDAI reserves right to revise the terms of this Limited Warranty without prior notice.

This Limited Warranty shall apply to the following Products:

- HiE-SxxxUH (xxx = 445-480, in increment of 5)
- HiE-SxxxSI (xxx = 395-455, in increment of 5)
- HiE-SxxxUI (xxx = 420-455, in increment of 5)
- HiE-SxxxVI (xxx = 460-505, in increment of 5)
- HiE-SxxxUF (xxx = 370-400, in increment of 5)
- HiE-SxxxSG (xxx = 325-380, in increment of 5)
- HiE-SxxxUG (xxx = 350-380, in increment of 5)
- HiE-SxxxVG (xxx = 380-420, in increment of 5)
- HiE-SxxxKN (xxx = 535-555, in increment of 5)
- HiE-SxxxDJ (xxx = 635-670, in increment of 5)
- HiE-SxxxHG (xxx = 425-445, in increment of 5)
- HiE-SxxxHG(FB) (xxx = 420-440, in increment of 5)
- HiE-SxxxDG (xxx = 405-425, in increment of 5)
- HiE-SxxxDG(FB) (xxx = 400-420, in increment of 5)

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## 1. Product Warranty

- A. HYUNDAI warrants to the CUSTOMER that the MODULES supplied shall, for the duration of twenty-five (25) years from the Warranty Start Date (“Product Warranty Period”), be free from defects in materials and workmanship under normal application, installation, use, and service conditions.

If the MODULES fail to conform to this warranty during this Product Warranty Period, (a) HYUNDAI has the right to choose the net value of the defective MODULES or the current market MODULE price refunded to the CUSTOMER, the so-called defective MODULES of the net value of the MODULES purchased at the time on the basis of the first deduction of 16% depreciation, subsequent annual deductions 3.5% depreciation, depreciation is calculated from the date of the warranty, up to 25 years; (b) Free repair or replacement of defective MODULES, and to provide the initial sale of the delivery point of free delivery service, the MODULES and parts to be replaced are owned by HYUNDAI.

- B. The remedies set forth in this clause shall be the sole and exclusive remedy available to the CUSTOMER for any product defect, and shall not be available beyond the Product Warranty Period for any reason whatsoever.

## 2. Performance Warranty

- A. As for single glass MODULES:

HYUNDAI warrants to the CUSTOMER that for a period of one (1) year from Warranty Start Date the actual power output of the MODULES will be no less than 98.0% of the Nominal Power\* at STC\*\*, as specified on the date of sale in HYUNDAI’s product datasheet. From the second year, the actual power output will decline annually by no more than 0.55%p for a period of remaining twenty-four (24) years, so that by the end of the twenty-five (25) year, an actual output of at least 84.8% of the Nominal Power\* at STC\*\*, as specified on the date of sale in HYUNDAI’s product datasheet will be achieved.

- B. As for double glass MODULES:

HYUNDAI warrants to the CUSTOMER that for a period of one (1) year from Warranty Start Date the actual power output of the MODULES will be no less than 98.0% of the Nominal Power\* at STC\*\*, as specified on the date of sale in HYUNDAI’s product datasheet. From the second year, the actual power output will decline annually by no more than 0.45%p for a period of remaining twenty-nine (29) years, so that by the end of the thirty (30) year, an actual output of at least 84.95% of the Nominal Power\* at STC\*\*, as specified on the date of sale in HYUNDAI’s product datasheet will be achieved

If the MODULES fail to reach the guaranteed power output levels set out above provided that such loss in power is verified by HYUNDAI, (a) HYUNDAI has the right to choose the net value of the defective MODULES or the current market MODULE price

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refunded to the CUSTOMER, the so-called defective MODULES of the net value of the MODULES purchased at the time on the basis of the first deduction of 16% depreciation, subsequent annual deductions 3.5% depreciation, depreciation is calculated from the date of the warranty, single glass MODULES up to 25 years, double glass MODULES up to 30 years; (b) Free repair or replacement of defective MODULES, and to provide the initial sale of the delivery point of free delivery service, the MODULES and parts to be replaced are owned by HYUNDAI.

- C. The remedies set forth in this clause shall be the sole and exclusive remedies provided for any performance deficiencies, and shall not be available beyond the aggregate specified Performance Warranty Periods for any reason whatsoever.

### 3. Exclusions and Limitations

- A. A warranty claim under any of the foregoing Warranties must be filed within the applicable warranty period.
- B. The Warranties do not apply to any MODULE, which in HYUNDAI's sole and absolute judgment, has been subjected to:
- (a) Damage and/or failure caused by use on a mobile unit including, but not limited to, vehicles, vessels, etc.;
  - (b) Damage and/or failure caused by non-compliance with national and local electric codes;
  - (c) Damage and/or failure caused by installations not in conformance with the MODULE(S) specifications, installation manuals, operation manuals, or labels attached to the MODULE(S);
  - (d) Damage and/or failure caused by improper wiring, installation, or handling;
  - (e) Damage and/or failure caused by devices and/or parts other than the MODULE(S) or by mounting methods of such devices and/or parts;
  - (f) Damage and/or failure caused by improper or incorrectly performed maintenance, operation or modification;
  - (g) Damage and/or failure caused by removal from the original place of installment;
  - (h) Damage and/or failure caused by repairs not in accordance with HYUNDAI's instructions;
  - (i) Damage and/or failure caused by inappropriate handling during storage, packaging or transportation; without limitation including damage caused by improper treatment, overloading, electro-chemical or electrical influences, or any other circumstances that may arise through no fault of HYUNDAI;
  - (j) Damage and/or failure caused by external shock such as flying objects or external stress;
  - (k) Damage and/or failure caused by direct contact with environmental pollution such as soot, acid rain or industrial chemicals including ammonia;

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- (l) Damage and/or failure caused by direct contact with salt water;
  - (m) Damage and/or failure caused by natural forces (earthquakes, tornados, floods, lightning, hurricanes, heavy snow, hail, etc.) and fire, power failures, power surges or other unforeseen circumstances that are beyond HYUNDAI's control;
  - (n) Damage and/or failure caused by terrorist acts, riots, war or other man-made disasters;
  - (o) Damage and/or failure caused by external stains or scratches that do not affect output;
  - (p) Damage and/or failure caused by sound, vibration, rust, scratching, or discolorations that are the result of normal wear and tear, aging or continuous use; or
  - (q) Damage and/or failure caused by MODULE(S) installed in a location that exceeds operating conditions.
  - (r) Repair or modifications by someone other than an approved service technician of HYUNDAI.
- D. The Product Warranty and Performance Warranties shall be applied exclusively of one another. HYUNDAI, at its sole option and in its sole discretion, will decide whether the cause of the claim is applicable to the Product Warranty or any of the Performance Warranties.
- E. HYUNDAI will decide, at its sole and absolute option, whether to collect replaced MODULES or not. In the case HYUNDAI decides to collect all or some of the replaced MODULES, HYUNDAI will cover transportation (other than air transport) costs for returning the MODULES. In the case HYUNDAI decides not to collect any replaced MODULES, HYUNDAI will not cover any transportation costs for returning the MODULES. In any case, HYUNDAI will not cover any of the costs associated with the installation, removal, reinstallation, discarding or packaging of the MODULES. If the collected MODULES are found not to be covered under these Warranties at HYUNDAI's sole and absolute judgement, CUSTOMER is obliged to cover all associated costs mentioned above.
- F. In the event that any model or make of MODULES for which a claim is made under either of the foregoing Warranties have been discontinued or materially altered, HYUNDAI reserves the right to replace the MODULES with any other module type that may be different in output, size, color or material.
- G. Any repaired or replaced MODULES under these Warranties will hold only the remaining warranty period applicable to the original MODULES.
- H. The Warranties provided under this Limited Warranty shall only extend to MODULES that have been installed within the sales area.
- I. Our goods come with guarantees that cannot be excluded under the Australian Consumer Law. You are entitled to a replacement or refund for a major failure and compensation for any other reasonably foreseeable loss or damage. You are also entitled to have the

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goods repaired or replaced if the goods fail to be of acceptable quality and the failure does not amount to a major failure.

#### **4. Severability**

If any court or competent authority finds any clause or portion of any clause of this Limited Warranty invalid, illegal, or unenforceable, that portion will be deemed to be deleted only to the extent required, and the validity and enforceability of the rest of the Limited Warranty shall not be affected.

#### **5. Assertion of Claims**

The assertion of claims under this Limited Warranty presupposes that the Customer has (i) informed the authorized reseller/distributor of our Module(s) in writing of the alleged claim, or that; (ii) this written notification has been sent directly to HYUNDAI in the event that the authorized reseller/distributor no longer exists (e.g. due to discontinuance of business or bankruptcy). Any such assertion of claims must be accompanied by the original sales receipt as the proof of purchase and time of purchase of HYUNDAI Module(s). The assertion of the claim must occur within thirty (30) days (natural day) from the date that the defects occurred. The return of Module(s) may only occur after the written authorization of HYUNDAI has been given.

#### **6. Force Majeure**

HYUNDAI shall bear no responsibility or liability for the non-performance or delay of any duties or obligations arising out of this Limited Warranty due to natural disasters, industrial disputes, government regulations, civil riot or war, or any other event outside HYUNDAI's control that is not reasonably known or understood at the time of sale of the MODULES.

#### **7. Liability**

THE FOREGOING WARRANTIES AND REMEDIES ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, REPRESENTATIONS, OR CONDITIONS, EXPRESS OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE. HYUNDAI NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT ANY OTHER LIABILITY IN CONNECTION WITH THE SALE, INSTALLATION, MAINTENANCE, OR USE OF THE GOODS. HYUNDAI SHALL BEAR NO RESPONSIBILITY OR LIABILITY WHATSOEVER FOR ANY DAMAGE OR INJURY TO PERSONS OR PROPERTY, OR FOR ANY OTHER LOSS OR INJURY RESULTING FROM ANY CAUSE WHATSOEVER ARISING OUT OF OR RELATED TO THE NEGLIGENT USE, MISUSE OR NEGLIGENT INSTALLATION OF THE MODULES. UNDER NO CIRCUMSTANCES SHALL HYUNDAI BE LIABLE FOR

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DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE APPLICABLE MODULE(S), NOR FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES, HOWSOEVER CAUSED. LOSS OF USE, LOSS OF PROFITS, LOSS OF PRODUCTION AND LOSS OF REVENUES ARE SPECIFICALLY EXCLUDED.

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**\*"Nominal Power"** is the power in watt peak that a MODULE generates in its maximum power point.  
**\*\*"STC(Standard Test Conditions)"** is as follows: (a) light spectrum of AM 1.5, (b) an irradiation of 1,000 W/m<sup>2</sup> and (c) a cell temperature of 25 °C. The measurements must be carried out at HYUNDAI or an independent test institute agreed to by HYUNDAI in advance, in accordance with IEC60904 as tested at the junction box connectors per the calibration and testing standards of HYUNDAI. These measurements will be considered valid at the production date of the MODULES with an equipment tolerance of ±3%. HYUNDAI's calibration standards shall be in compliance with the standards applied by international institutions accredited for this purpose.

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