Version 7.2.11

PVsyst - Simulation report

Grid-Connected System

Project: New Project

Variant: New simulation variant

No 3D scene defined, no shadings

System power: 1300 Wp

Windhoek - Namibia

Author

PVsyst V7.2.11
VC0, Simulation date:
11/11/22 01:21
with v7.2.11

Project summary

Geographical Site
Windhoek
Namibia

Situation

Latitude	-22.56 °S
Longitude	17.08 °E
Altitude	1677 m
Time zone	UTC+1

Project settings

Albedo	0.20

Meteo data
Windhoek
Meteonorm 8.0 (2012-2019), Sat=100% - Synthetic

System summary

Grid-Connected System

No 3D scene defined, no shadings

PV Field Orientation

Fixed plane	
Tilt/Azimuth	23 / 0 °

Near Shadings
No Shadings

User's needs
Unlimited load (grid)

System information

PV Array

Nb. of modules	5 units
Pnom total	1300 Wp

Inverters

Nb. of units	0.5 unit
Pnom total	2100 W
Pnom ratio	0.619

Results summary

Produced Energy	2585 kWh/year	Specific production	1989 kWh/kWp/year	Perf. Ratio PR	78.00 %

Table of contents

General parameters

Grid-Connected System — **No 3D scene defined, no shadings**

PV Field Orientation

Orientation		Sheds configuration	Models used	
Fixed plane		No 3D scene defined	Transposition	Perez
Tilt/Azimuth	23 / 0 °		Diffuse	Perez, Meteonorm
			Circumsolar	separate

Horizon
Free Horizon

Near Shadings
No Shadings

User's needs
Unlimited load (grid)

PV Array Characteristics

PV module

Manufacturer	Yingli Solar
Model	YL260P-29b
(Original PVsyst database)	
Unit Nom. Power	260 Wp
Number of PV modules	5 units
Nominal (STC)	1300 Wp
Modules	1 String x 5 In series
At operating cond. (50°C)	
Pmpp	1160 Wp
U mpp	137 V
I mpp	8.5 A

Inverter

Manufacturer	Generic
Model	4.2 kWac inverter with 2 MPPT
(Original PVsyst database)	
Unit Nom. Power	4.20 kWac
Number of inverters	1 * MPPT 50% 0.5 unit
Total power	2.1 kWac
Operating voltage	125-500 V
Pnom ratio (DC:AC)	0.62

Total PV power

Nominal (STC)	1 kWp
Total	5 modules
Module area	8.1 m²
Cell area	7.3 m²

Total inverter power

Total power	2.1 kWac
Nb. of inverters	1 unit
	0.5 unused
Pnom ratio	0.62

Array losses

Thermal Loss factor
Module temperature according to irradiance
Uc (const) 20.0 W/m²K
Uv (wind) 0.0 W/m²K/m/s

DC wiring losses
Global array res. 272 mΩ
Loss Fraction 1.5 % at STC

LID - Light Induced Degradation
Loss Fraction 1.3 %

Module Quality Loss
Loss Fraction -0.8 %

Module mismatch losses
Loss Fraction 2.0 % at MPP

Strings Mismatch loss
Loss Fraction 0.1 %

IAM loss factor
Incidence effect (IAM): User defined profile

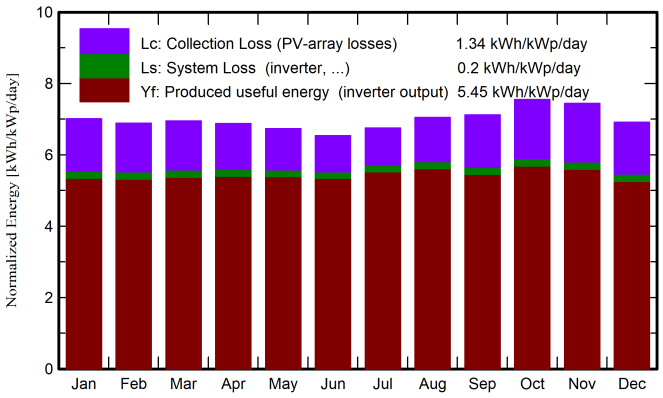
0°	20°	40°	60°	70°	75°	80°	85°	90°
1.000	1.000	1.000	0.960	0.880	0.800	0.670	0.430	0.000

Main results

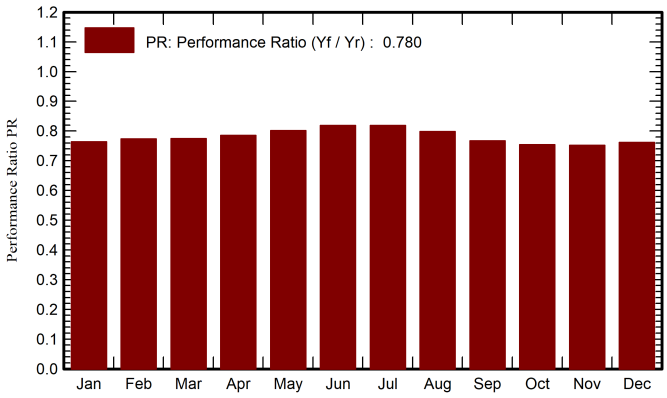
System Production

Produced Energy	2585 kWh/year	Specific production	1989 kWh/kWp/year
		Performance Ratio PR	78.00 %

Normalized productions (per installed kWp)



Performance Ratio PR



Balances and main results

	GlobHor kWh/m²	DiffHor kWh/m²	T_Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	PR ratio
January	239.4	75.08	23.97	217.3	210.7	223.9	215.7	0.763
February	198.2	64.61	22.92	192.7	187.5	201.2	193.9	0.774
March	202.0	57.00	22.04	215.5	210.6	224.9	216.8	0.774
April	174.9	43.88	19.60	206.3	203.0	218.4	210.8	0.786
May	159.2	29.25	17.58	208.8	205.3	225.1	217.5	0.801
June	141.0	22.93	14.59	196.1	192.7	215.8	208.6	0.818
July	155.0	29.34	14.19	209.3	205.8	230.4	222.7	0.819
August	176.2	32.35	17.59	218.4	215.0	234.5	226.7	0.798
September	192.1	43.19	21.11	213.5	209.3	220.5	212.8	0.767
October	231.9	49.53	23.90	234.1	229.2	238.0	229.5	0.754
November	241.8	56.94	23.77	223.3	217.4	226.6	218.3	0.752
December	240.2	71.71	24.80	214.3	207.9	220.4	212.2	0.762
Year	2352.0	575.81	20.49	2549.5	2494.3	2679.8	2585.3	0.780

Legends

GlobHor	Global horizontal irradiation
DiffHor	Horizontal diffuse irradiation
T_Amb	Ambient Temperature
GlobInc	Global incident in coll. plane
GlobEff	Effective Global, corr. for IAM and shadings
EArray	Effective energy at the output of the array
E_Grid	Energy injected into grid
PR	Performance Ratio

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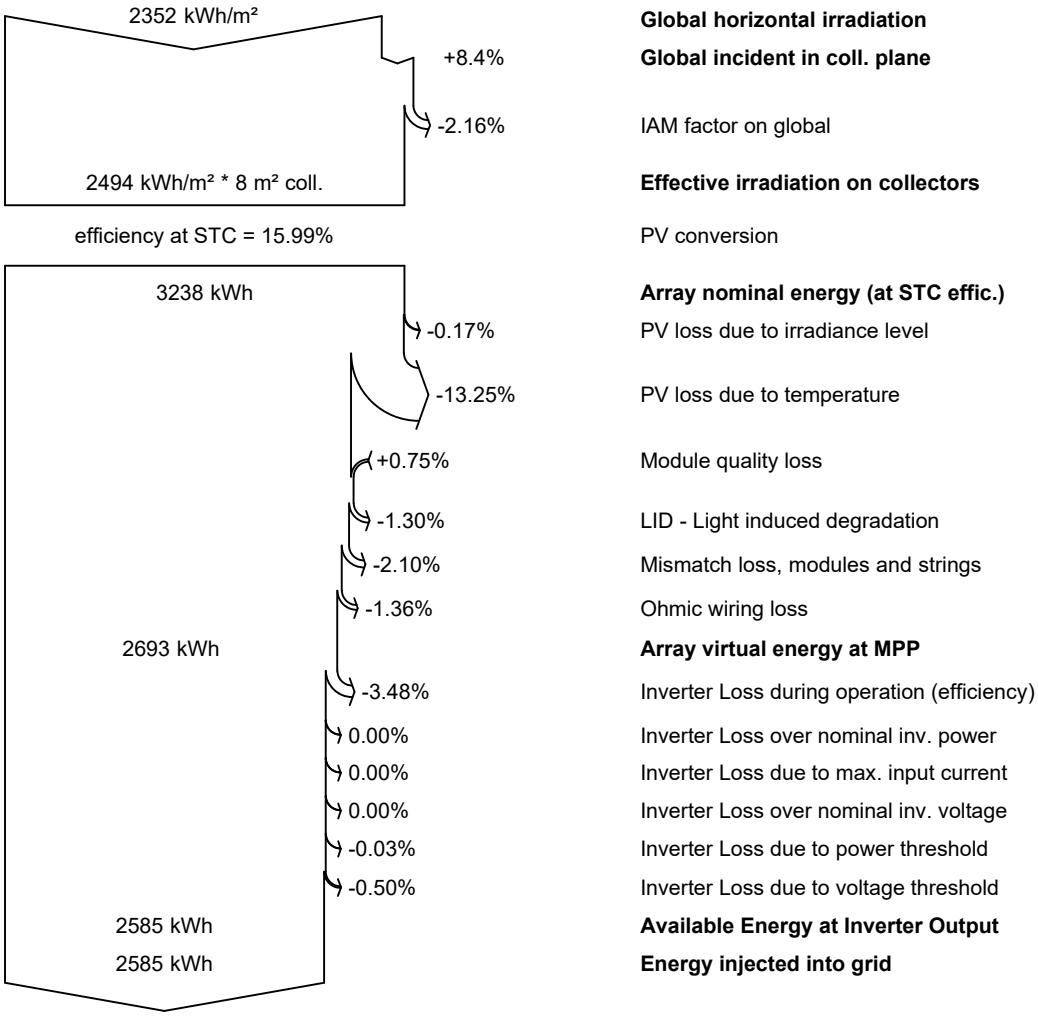
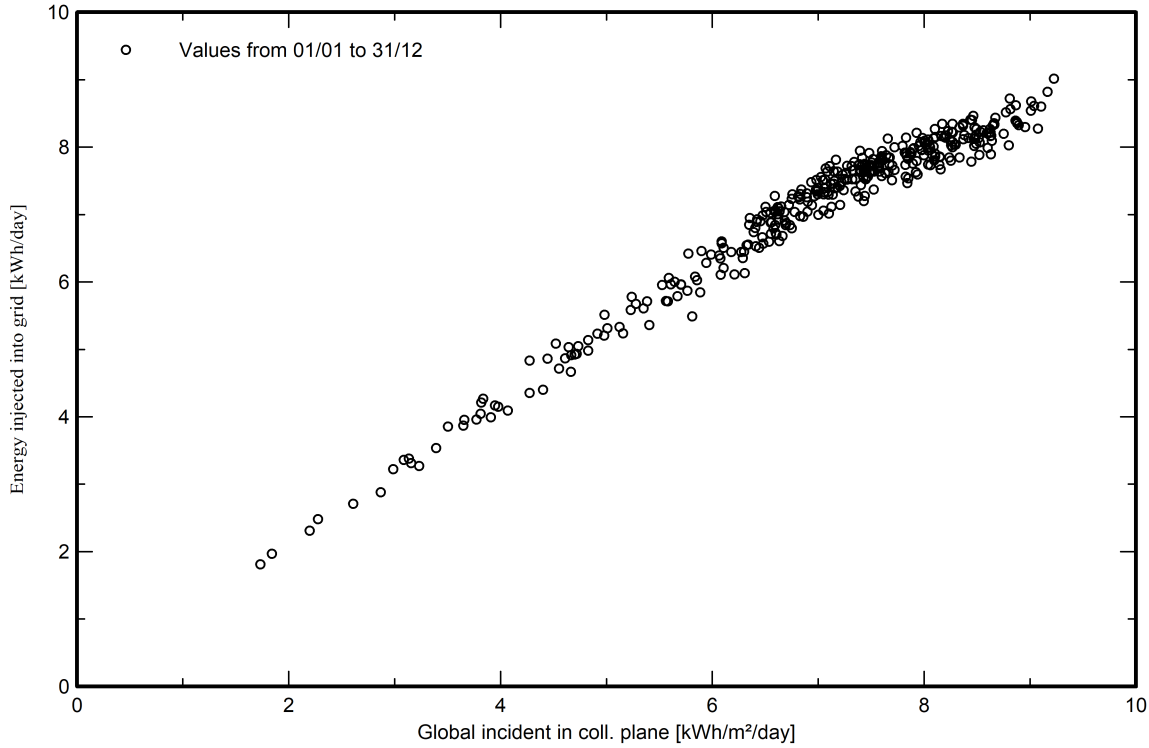
with v7.2.11

Loss diagram

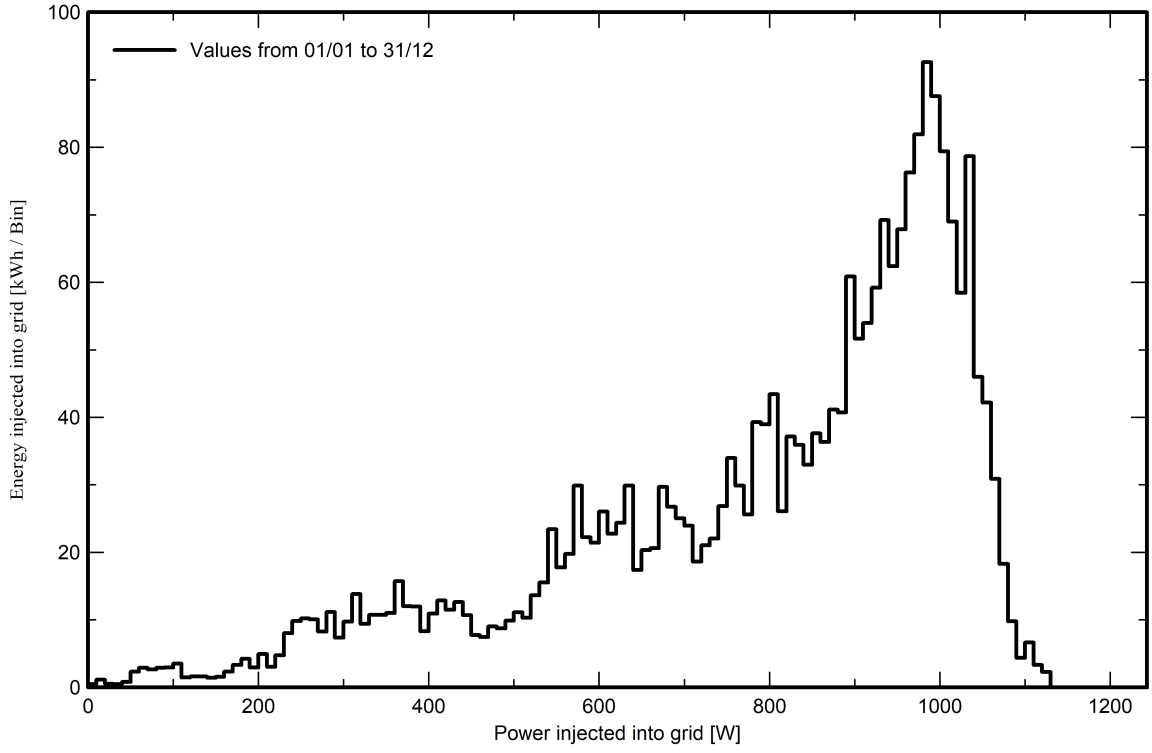


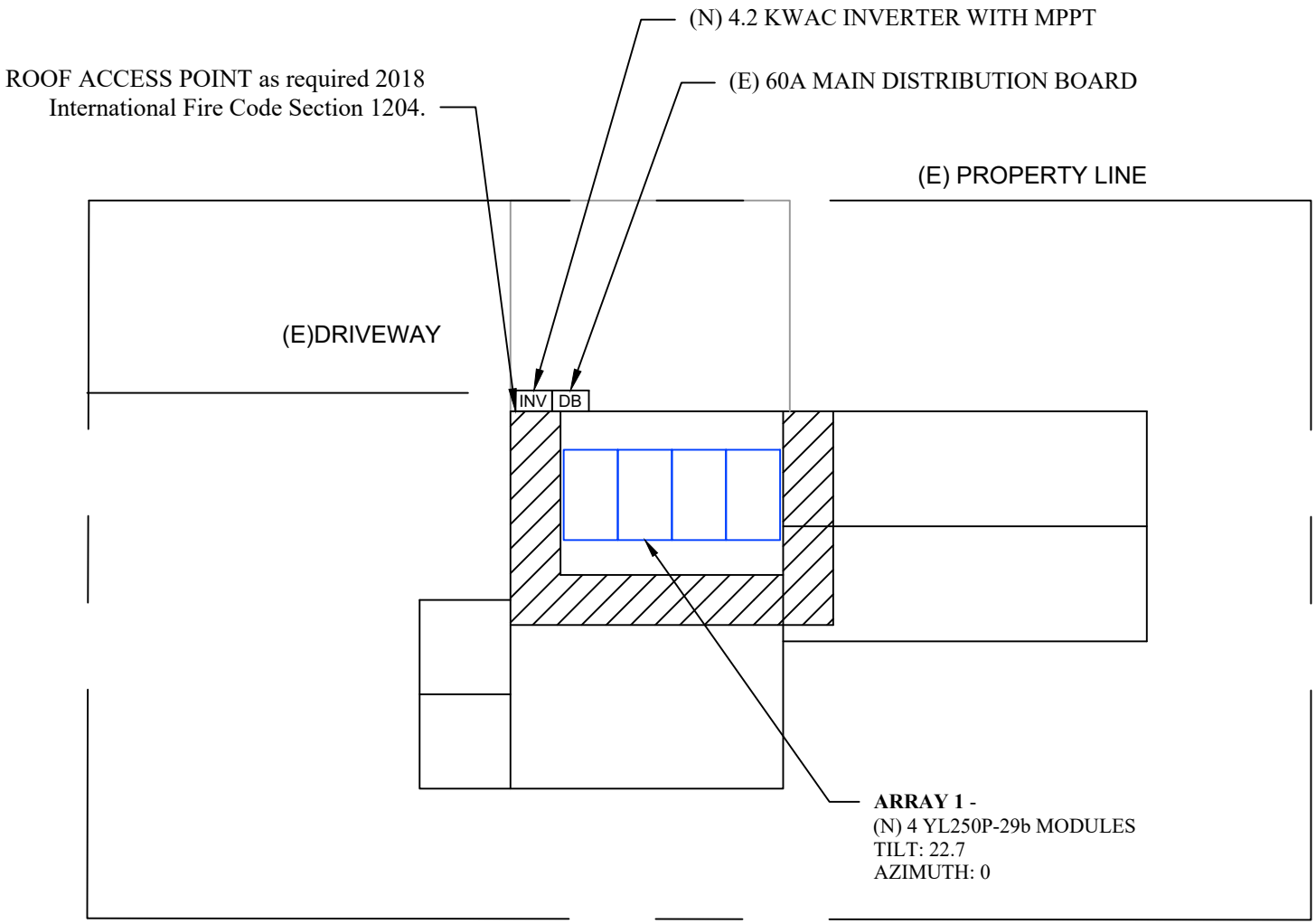
Special graphs

Daily Input/Output diagram



System Output Power Distribution





General Notes

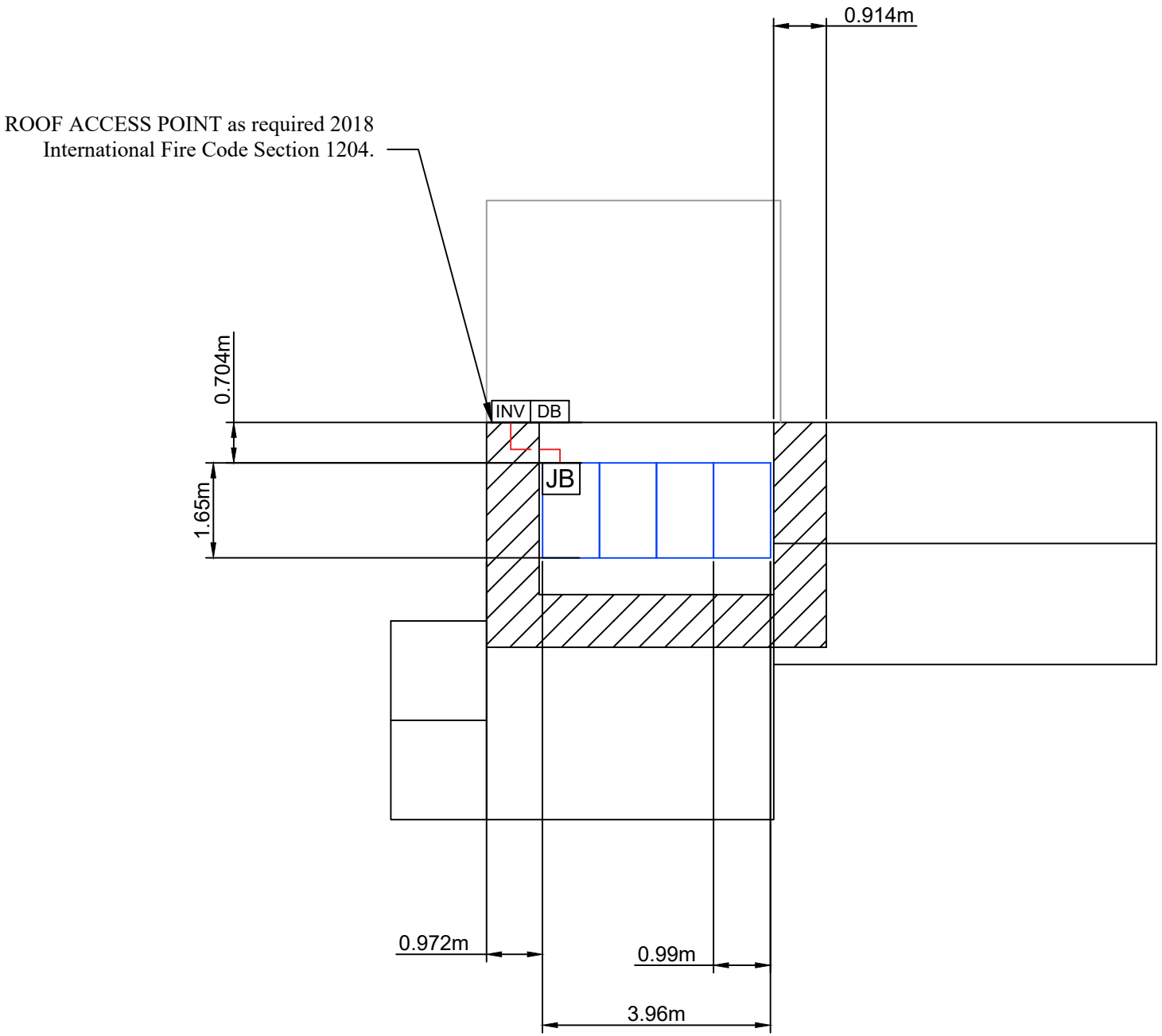
INV	INVERTER
DB	MAIN DISTRIBUTION BOARD
	0.9144m FIRE CODE PATHWAY

Revision/Issue	Date

JURGEN_T_VIAKONDO
JVIAKONDO@GMAIL.COM

CLIENT
CLIENT_NAME
WINDHOEK
NAMIBIA

Project	Sheet
GRID_CONNECTED	SITE_PLAN
09.11.2022	
SCALE	



General Notes

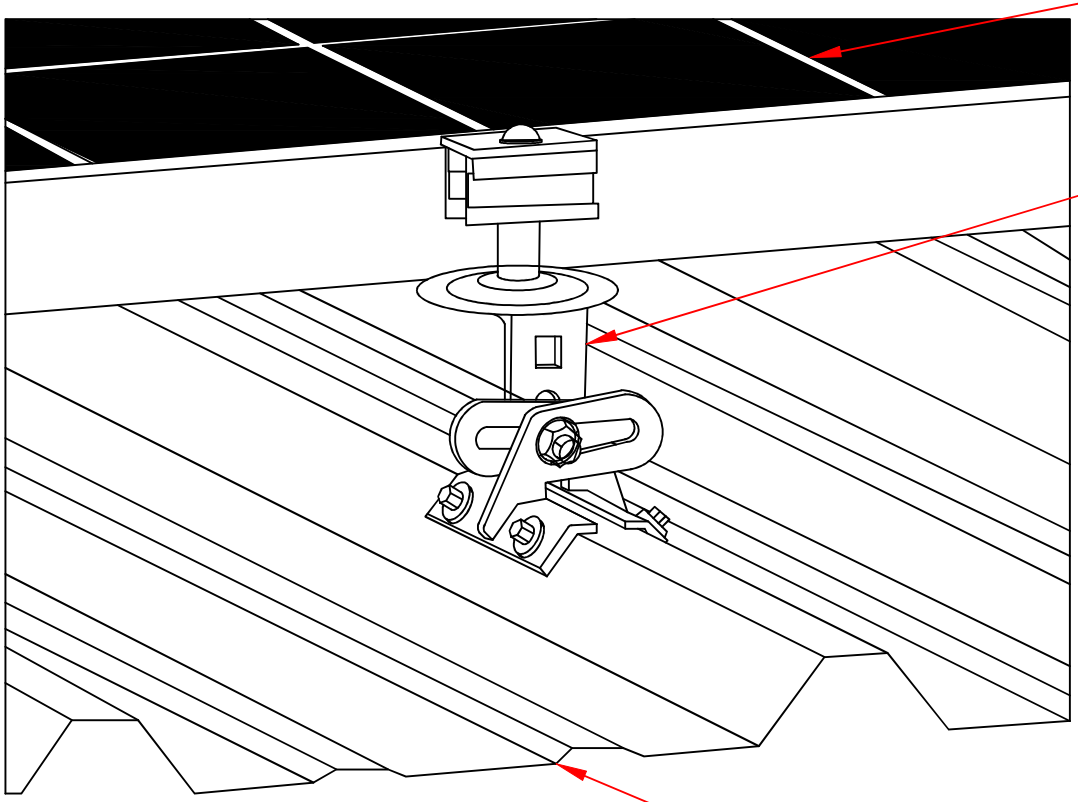
INV	INVERTER
DB	MAIN DISTRIBUTION BOARD
	0.9144m FIRE CODE PATHWAY
JB	JUNCTION BOX
	CONDUCTOR

No.	Revision/Issue	Date

DESIGNER
JURGEN_T_VIAKONDO
JVIAKONDO@GMAIL.COM
0813941459

CLIENT
CLIENT_NAME
WINDHOEK
NAMIBIA

Project: GRID_CONNECTED	Sheet: ROOF_PLAN
Date: 09.11.2022	
Scale: SCALE	



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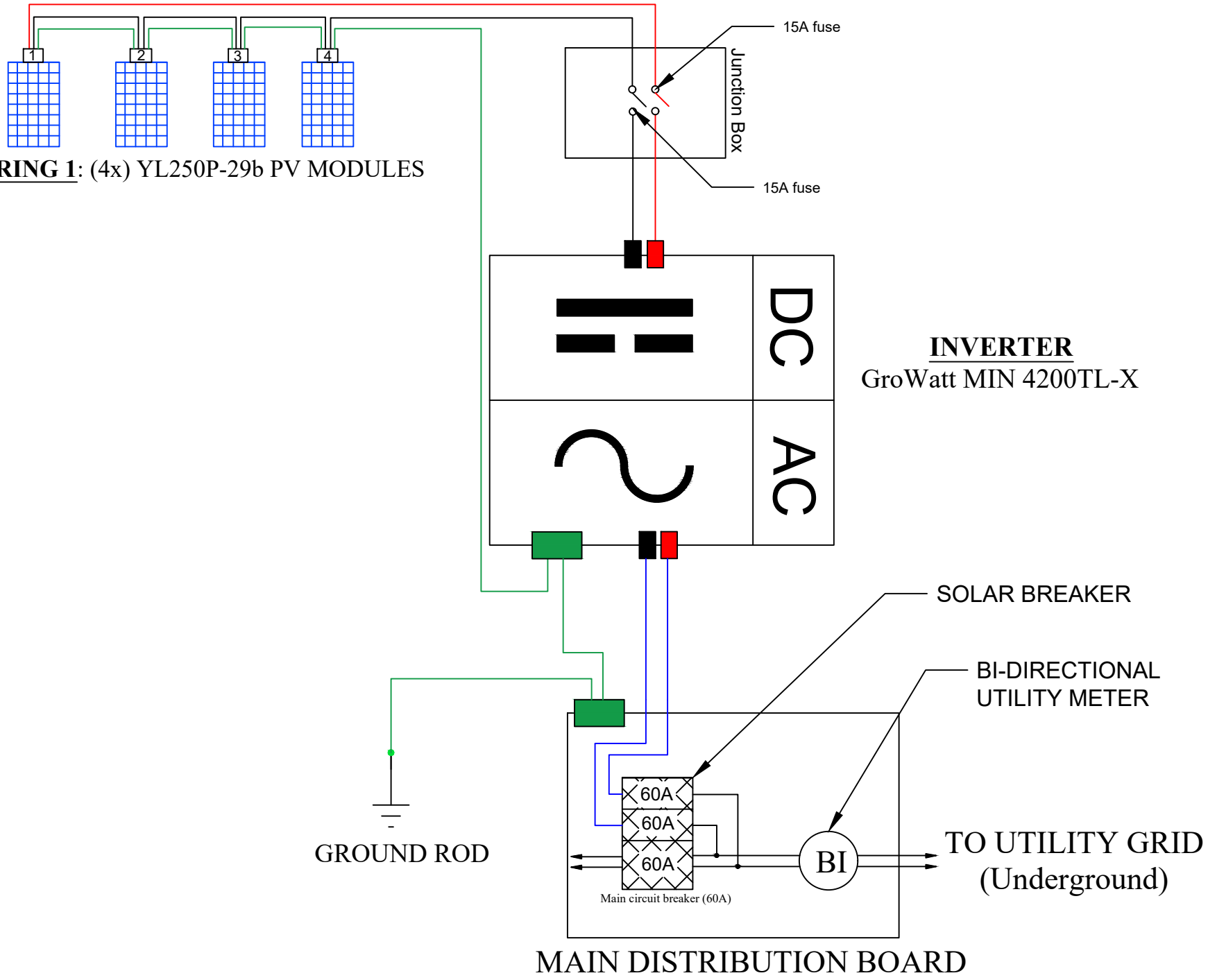
GRID_CONNECTED	Sheet
09.11.2022	MOUTING_AND_ROOFING



STRING 1: (4x) YL250P-29b PV MODULES

INVERTER
GroWatt MIN 4200TL-X

GROUND ROD

TO UTILITY GRID
(Underground)

MAIN DISTRIBUTION BOARD

General Notes
10 AWE at 90°C Free air cable (RED)
10 AWE at 90°C Free air cable (BLACK)
10 AWE at 90°C Free air cable (GREEN)
10 THHN Stranded Copper Wire in Conduit
CIRCUIT BREAKER
FUSE

Revision/Issue	Date

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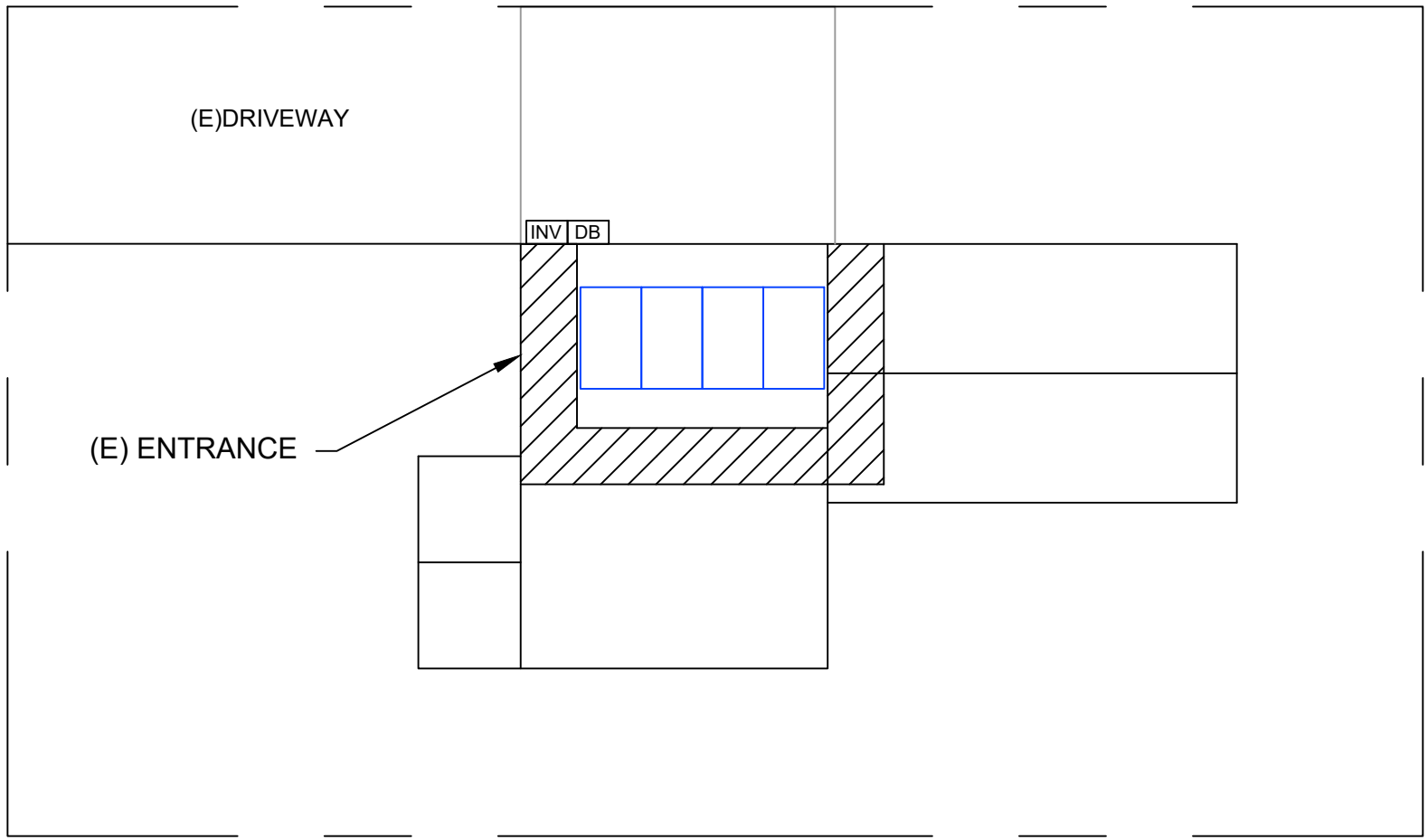
GRID_CONNECTED	Sheet
09.11.2022	LINE_DIAGRAM



Revision/Issue	Date

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GRID_CONNECTED

09.11.2022

Sheet
HOUSE

YGE 60 CELL SERIES

YL260P-29b
YL255P-29b
YL250P-29b
YL245P-29b
YL240P-29b

YINGLI SOLAR

U.S. Soccer Powered by Yingli Solar

YINGLI SOLAR YGE SERIES **Our signature product line is a top performer in every application, from rooftop systems to utility-scale power plants.**

BUILT TO PERFORM

- High performance, multicrystalline solar cells deliver a module series efficiency of up to 15.9%, reducing installation costs and maximizing the kWh output per unit area.
- Tight positive power tolerance of 0 / +3% ensures modules are delivered at or above rated power, improving system performance through the reduction of module mismatch loss.
- With proven experience in over 7 GW of projects worldwide, Yingli modules deliver reliable performance in residential, commercial, and utility-scale applications.

PROVEN QUALITY AND RELIABILITY

- Robust, corrosion resistant aluminum frame independently tested to withstand wind and snow loads of up to 2400Pa and 5400Pa, respectively, ensuring mechanical stability.
- Independent labs certify that Yingli modules resist the highest levels of ammonia and salt mist, demonstrating their reliable performance in challenging environmental conditions.
- Manufacturing facility certified by TÜV Rheinland to the following standards: ISO9001 Quality Management System, ISO 14001 Environmental Management System, and BS OHSAS 18001 Occupational Health and Safety.

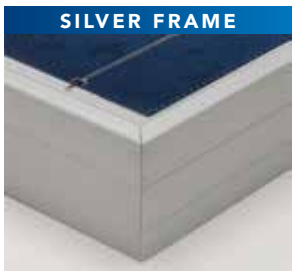
WARRANTIES

Leading limited power warranty* ensures 91.2% of rated power for 10 years, and 80.7% of rated power for 25 years.

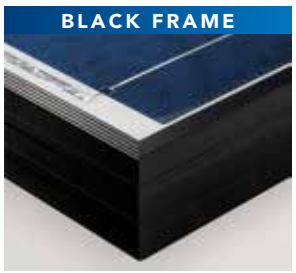
10-year limited product warranty.

* In compliance with our warranty terms and conditions.

SILVER FRAME



BLACK FRAME



QUALIFICATIONS & CERTIFICATES

UL 1703 and ULC 1703, CEC, FSEC, ISO 9001:2008, ISO 14001:2004, BS OHSAS 18001:2007, SA8000

c UL us LISTED (PHOTOVOLTAIC MODULE) 44DD

TÜVRheinland CERTIFIED www.tuv.com ID 0088888888

U.S. TARIFF-COMPLIANT

If you buy from Yingli Americas, Yingli Americas acts as the importer and complies with all applicable tariffs. Customers can buy from Yingli Americas with no worry that they will be liable for any import tariffs.

YGE 60 CELL SERIES

Powered by YINGLI

ELECTRICAL PERFORMANCE

Electrical parameters at Standard Test Conditions (STC)

Module type			YL260P-29b	YL255P-29b	YL250P-29b	YL245P-29b	YL240P-29b
Power output	P_{max}	W	260	255	250	245	240
Power output tolerances	ΔP_{max}	%	-0 / +3				
Module efficiency	η_m	%	15.9	15.6	15.3	15.0	14.7
Voltage at P_{max}	V_{mpp}	V	30.3	30.0	29.8	29.6	29.3
Current at P_{max}	I_{mpp}	A	8.59	8.49	8.39	8.28	8.18
Open-circuit voltage	V_{oc}	V	37.7	37.7	37.6	37.5	37.5
Short-circuit current	I_{sc}	A	9.09	9.01	8.92	8.83	8.75

STC: 1000W/m² irradiance, 25°C cell temperature, AM 1.5g spectrum according to EN 60904-3
Average relative efficiency reduction of 3.3% at 200W/m² according to EN 60904-1

Electrical parameters at Nominal Operating Cell Temperature (NOCT)

Power output	P_{max}	W	189.7	186.0	182.4	178.7	175.1
Voltage at P_{max}	V_{mpp}	V	27.6	27.4	27.2	27.0	26.8
Current at P_{max}	I_{mpp}	A	6.87	6.79	6.71	6.62	6.54
Open-circuit voltage	V_{oc}	V	34.8	34.8	34.7	34.6	34.6
Short-circuit current	I_{sc}	A	7.35	7.28	7.21	7.14	7.07

NOCT: open-circuit operating cell temperature at 800W/m² irradiance, 20°C ambient temperature, 1m/s wind speed

THERMAL CHARACTERISTICS

Nominal operating cell temperature	NOCT	°C	46 +/- 2
Temperature coefficient of P_{max}	γ	%/°C	-0.42
Temperature coefficient of V_{oc}	β_{Voc}	%/°C	-0.32
Temperature coefficient of I_{sc}	α_{Isc}	%/°C	0.05
Temperature coefficient of V_{mpp}	β_{Vmpp}	%/°C	-0.42

OPERATING CONDITIONS

Max. system voltage	600V_{DC} or 1000V_{DC}
Max. series fuse rating	15A
Limiting reverse current	15A
Operating temperature range	-40 to 185°F (-40 to 85°C)
Max. hailstone impact (diameter / velocity)	25mm / 23m/s

CONSTRUCTION MATERIALS

Front cover (material / thickness)	low-iron tempered glass / 3.2mm
Cell (quantity / material / dimensions / number of busbars)	60 / multicrystalline silicon / 156mm x 156mm / 2 or 3
Encapsulant (material)	ethylene vinyl acetate (EVA)
Frame (material / color / edge sealing)	anondized aluminum alloy / silver or black / silicone or tape
Junction box (ingress protection rating)	≥IP65
Cable (length / cross-sectional area)	1100mm / 4mm²
Connector (type / ingress protection rating)	MC4 or Amphenol H4 / ≥IP67

The specifications in this datasheet are not guaranteed and are subject to change without prior notice.
This datasheet complies with EN 50380:2003 requirements.

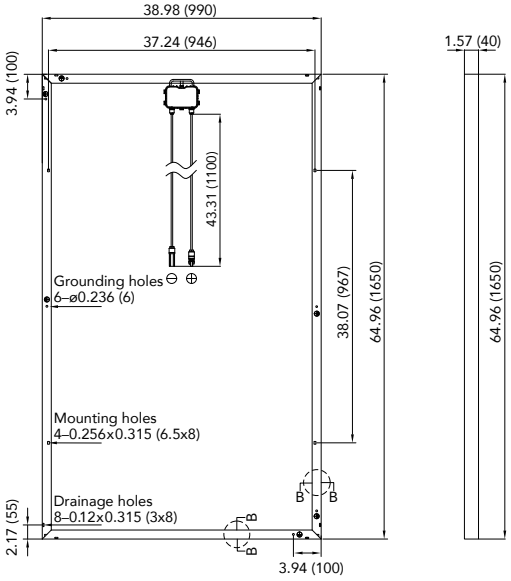
GENERAL CHARACTERISTICS

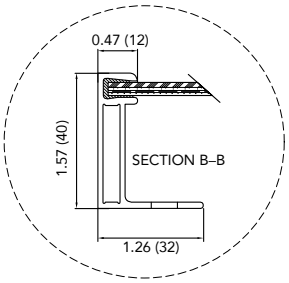
Dimensions (L / W / H)	64.96in (1650mm) / 38.98in (990mm) / 1.57in (40mm)
Weight	40.8lbs (18.5kg)

PACKAGING SPECIFICATIONS

Number of modules per pallet	26
Number of pallets per 40' container	28
Packaging box dimensions (L / W / H)	67.32in (1710mm) / 45.67in (1160mm) / 46.38in (1178mm)
Box weight	1133lbs (514kg)

Units: inch (mm)





Warning: Read the Installation and User Manual in its entirety before handling, installing, and operating Yingli modules.

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www.soligent.net

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- Supports export control
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Datasheet	MIN 2500TL-X	MIN 3000TL-X	MIN 3600TL-X	MIN 4200TL-X	MIN 4600TL-X	MIN 5000TL-X	MIN 6000TL-X
Input Data							
Max. recommended PV power (for module STC)	3500W	4200W	5040W	5880W	6440W	7000W	8100W
Max. DC voltage	500V	500V	550V	550V	550V	550V	550V
Start voltage	100V	100V	100V	100V	100V	100V	100V
MPP work voltage range/ nominal voltage	80V-500V /360V	80V-500V /360V	80V-550V /360V	80V-550V /360V	80V-550V /360V	80V-550V /360V	80V-550V /360V
Max. input current	12.5A/12.5A	12.5A/12.5A	12.5A/12.5A	12.5A/12.5A	12.5A/12.5A	12.5A/12.5A	12.5A/12.5A
Max. short-circuit current	16A/16A	16A/16A	16A/16A	16A/16A	16A/16A	16A/16A	16A/16A
Number of independent MPP trackers / strings per MPP tracker	2/1	2/1	2/1	2/1	2/1	2/1	2/1
Output (AC)							
Rated AC output power	2500W	3000W	3600W	4200W	4600W	5000W	6000W
Max. AC apparent power	2500VA	3000VA	3600VA	4200VA	4600VA	5000VA	6000VA
Max. output current	11.3A	13.6A	16A	19A	20.9A	22.7A	27.2A
AC nominal voltage	230V(160V-300V)	230V(160V-300V)	230V(160V-300V)	230V(160V-300V)	230V(160V-300V)	230V(160V-300V)	230V(160V-300V)
AC grid frequency	50Hz/60Hz, ± 5Hz	50Hz/60Hz, ± 5Hz	50Hz/60Hz, ± 5Hz	50Hz/60Hz, ± 5Hz	50Hz/60Hz, ± 5Hz	50Hz/60Hz, ± 5Hz	50Hz/60Hz, ± 5Hz
Adjustable power factor	0.8leading… 0.8lagging	0.8leading… 0.8lagging	0.8leading… 0.8lagging	0.8leading… 0.8lagging	0.8leading… 0.8lagging	0.8leading… 0.8lagging	0.8leading… 0.8lagging
THDi	<3%	<3%	<3%	<3%	<3%	<3%	<3%
AC connection	Single phase	Single phase	Single phase	Single phase	Single phase	Single phase	Single phase
Efficiency							
Max.efficiency	98.2%	98.2%	98.2%	98.4%	98.4%	98.4%	98.4%
Euro weighted efficiency	97.1%	97.1%	97.2%	97.5%	97.5%	97.5%	97.5%
MPPT efficiency	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%
Protection Devices							
DC reverse polarity protection	yes	yes	yes	yes	yes	yes	yes
DC switch	yes	yes	yes	yes	yes	yes	yes
DC surge protection	Type II	Type II	Type II	Type II	Type II	Type II	Type II
Output over current protection	yes	yes	yes	yes	yes	yes	yes
AC surge protection-varistor	yes	yes	yes	yes	yes	yes	yes
Ground fault monitoring	yes	yes	yes	yes	yes	yes	yes
Grid monitoring	yes	yes	yes	yes	yes	yes	yes
Integrated all - pole sensitive leakage current monitoring unit	yes	yes	yes	yes	yes	yes	yes
General Data							
Dimensions (W / H / D) in mm	375/350/160	375/350/160	375/350/160	375/350/160	375/350/160	375/350/160	375/350/160
Weight	10.8KG	10.8KG	10.8KG	10.8KG	10.8KG	10.8KG	10.8KG
Operating temperature range	- 25°C ... + 60°C	- 25°C ... + 60°C	- 25°C ... + 60°C	- 25°C ... + 60°C	- 25°C ... + 60°C	- 25°C ... + 60°C	- 25°C ... + 60°C
Noise emission (typical)	≤35 dB(A)	≤35 dB(A)	≤35 dB(A)	≤35 dB(A)	≤35 dB(A)	≤35 dB(A)	≤35 dB(A)
Altitude	4000m	4000m	4000m	4000m	4000m	4000m	4000m
Self-Consumption night	< 1W	< 1W	< 1W	< 1W	< 1W	< 1W	< 1W
Topology	Transformerless	Transformerless	Transformerless	Transformerless	Transformerless	Transformerless	Transformerless
Cooling concept	Nature Convection	Nature Convection	Nature Convection	Nature Convection	Nature Convection	Nature Convection	Nature Convection
Environmental Protection Rating	IP65	IP65	IP65	IP65	IP65	IP65	IP65
Relative humidity	100%	100%	100%	100%	100%	100%	100%
Features							
DC connection	H4/MC4(opt)	H4/MC4(opt)	H4/MC4(opt)	H4/MC4(opt)	H4/MC4(opt)	H4/MC4(opt)	H4/MC4(opt)
AC connection	Connector	Connector	Connector	Connector	Connector	Connector	Connector
Display	OLED+LED	OLED+LED	OLED+LED	OLED+LED	OLED+LED	OLED+LED	OLED+LED
Interfaces: RS485 / USB / Wi-Fi/ 4G / RF	yes / yes / opt / opt / opt	yes / yes / opt / opt / opt	yes / yes / opt / opt / opt	yes / yes / opt / opt / opt	yes / yes / opt / opt / opt	yes / yes / opt / opt / opt	yes / yes / opt / opt / opt
Warranty: 5 years / 10 years	yes / opt	yes / opt	yes / opt	yes / opt	yes / opt	yes / opt	yes / opt

CE, IEC62109, G83, VDE0126-1-1, VFR2014, G59, AS4777, AS/NZS 3100, CEI0-21, VDE-AR-N4105, EN50438, CQC, IEC61683, IEC60068, IEC61727, IEC62116

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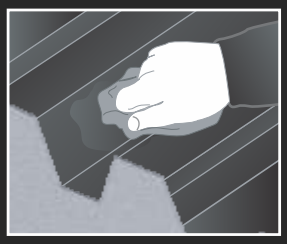
1



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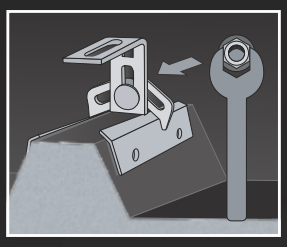

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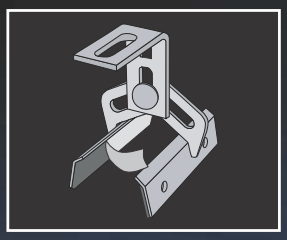

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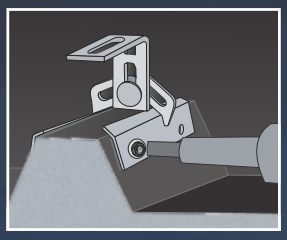


ProteaBracket™

ProteaBracket™ is the most versatile attachment solution on the market, fitting most metal trapezoidal sheet profiles with and without intermediate insulation. It features an adjustable attachment base and multiple solar module attachment options (illustrated on back) to accommodate varying widths and heights. There are no messy sealants to apply and no chance for leaks; the ProteaBracket comes with factory-applied, adhesive rubber sealant to ensure quick installation and a weather-proof fit.

The ProteaBracket is mounted directly onto the crown of the panel, straddling the profile. No surface preparation is necessary; simply wipe away excess oil and debris, align, and apply. Secure ProteaBracket through all 6 pre-punched holes.

ProteaBracket is the perfect match for the S-5-PV Kit, for a solar attachment solution that is both economical and easy to use.

S-5!® ProteaBracket™ is a versatile bracket that adjusts easily to most trapezoidal roof profiles.

S-5! PV kits have an M8 bolt and are suitable for use with all S-5! clamps.

S-5!®
The Right Way

ProteaBracket™ is the perfect solar attachment solution for most trapezoidal exposed-fastened metal roof profiles. No messy sealants to apply: the factory-applied adhesive rubber sealant weather-proofs and makes installation easy.

S-5!® holding strength is unmatched in the industry.

Each **ProteaBracket™** comes with a factory-applied, adhesive rubber sealant on the base. A structural A2 stainless steel bimetal attachment bracket, ProteaBracket is compatible with most common metal roofing materials.

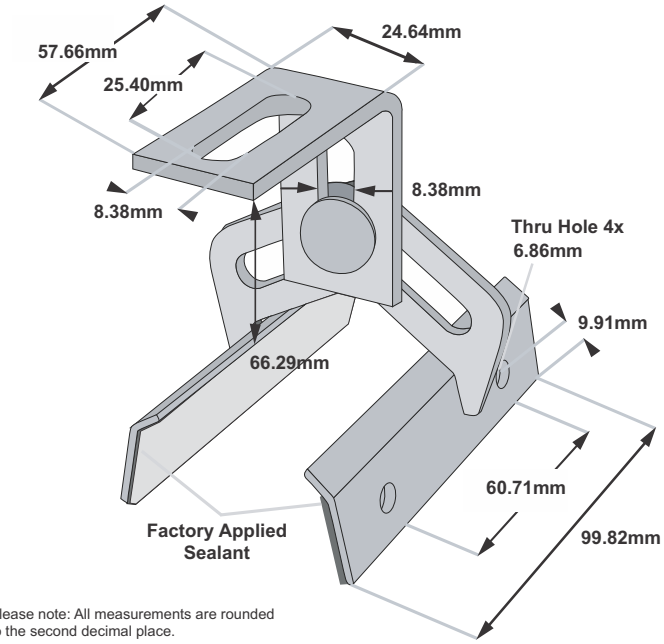
All four pre-punched holes must be used to achieve tested strength. For design assistance, contact Safintra South Africa (and see our website **www.safintra.co.za**), or visit **www.S-5.com** for the independent lab test data that can be used for load-critical designs and applications. Also, please visit S-5! website for more information including metallurgical compatibilities and specifications.

Multiple Attachment Options:

ProteaBracket™ with Top Rail option for PV attachment

ProteaBracket™ with S-5-PV Kit option (if not using a rail)

ProteaBracket™



Please note: All measurements are rounded to the second decimal place.

FLUTELINE

VERSATILE

S-5!® Warning! Please use this product responsibly!

S-5! Brackets and clamps are not tested for performance as part of a Fall Arrest or Personal Safety system. These applications need to be tested as a dynamic system and warranties or test results must be issued by the system provider.
Safintra, Safal Group and its subsidiaries provide no warranties or any assurances in this application, and will accept no claims of any nature whatsoever arising out of any such applications.

Products are protected by multiple international patents. For published data regarding holding strength, bolt torque, patents and trademarks visit the S-5! website at www.S-5.com.

Sole Agents for Africa:

SAFINTRA
world class roofing systems

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