

Appendix A - 12-5 - Lot Coverage Calculations

Delaware River Solar, LLC
 Solar Energy Facility
 Yellow Mills Road

1/11/19

Lot Coverage Calculations

Lot No.	2	3	4
PV System	1	2	3
No. of Racks per System	250	250	250
Area of a Rack (SF)	556.3	556.3	556.3
Total Area of Racks (Acres)	3.193	3.193	3.193
Area of Temp. Drive (Acres)	0.226	0.194	0.050
Area of Permanent Drive (Acres)	0.146	0.036	0.000
Area of Temp. Facilities (Acres)	0.020	0.000	0.078
Total Area of Racks and Other (Acres)	3.585	3.423	3.321
Area of Lots (Acres)	21.999	15.235	25.999
Percent Lot Coverage	16%	22%	13%
Remaining Green Space	84%	78%	87%

Definitions

No. of Racks	There are 250 Racks for each PV System		
Area of a Rack (SF)	The horizontal surface area of a rack is 55.63 SF (See Below)		
Total Area of Racks (Acres)	$556.3 \text{ SF} * 250 \text{ Racks} * (1 \text{ acre}/43,560 \text{ SF}) = 3.193 \text{ acres}$		
Area of Temp. Drive (Acres)	Area of Temporary improved drives through the interior.		
Area of Permanent Drive (Acres)	Area of Permanent (for life of the system) Entry Drive		
Area of Temp. Facilities (Acres)	Area of Temporary Construction Facilities		
Total Area of Racks and Other (Acres)	Total area of the above Impervious Surfaces		
Area of Lot (Acres)	Lot areas to the proposed property lines		
Percent Lot Coverage	Total Area of Lot Cover / Lot Areas		
Remaining Green Space	100% - Percent of Lot Coverage		

Area of a Rack (cont.)	From the Project Memorandum Drawing Index P06: Racking System , the length of the rack is 45.6' and the horizontal width is calculated to be 12.2'. The horizontal surface area is Length (45.6') * Width (12.2') = 556.3 square feet.
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Fenced Area	1	2	3
Fenced in Area	19.69	5.74	4.73
Area of remaining Green Space	12.99	3.62	3.31
Percent Green Space	66%	63%	70%
Percent Impervious Cover	34%	37%	30%

Appendix B– 12-5 – Pictures of Solar Farms – 5MW to 9MW



5.1MW System – S-Power, Fairmont, North Carolina



6.7 MW system – S-Power, Biscoe, North Carolina



6.5MW system – S-Power, East Liberty, North Carolina



9.2MW system – S-Power, Calverton, New York



6.5MW system – S-Power, Selma, North Carolina



6.5MW system – S-Power, Fairmont, North Carolina

INGECON

SUN

PowerMax U B Series
1,500 V_{dc}

TRANSFORMERLESS CENTRAL INVERTERS WITH A SINGLE POWER BLOCK

B Series inverter up to 1.8 MVA at 1500 V

Maximum power density

These PV central inverters feature more power per cubic foot. Thanks to the use of high-quality components, this inverter series performs at the highest possible level.

Latest generation electronics

The B Series inverters integrate an innovative control unit that runs faster and performs a more efficient and sophisticated inverter control, as it uses a last-generation digital signal processor. Furthermore, the hardware of the control unit allows some more accurate measurements and very reliable protections.

These inverters feature a low voltage ride-through capability and also a lower power consumption thanks to a more efficient power supply electronic board.

Improved AC connection

The output connection has been designed in order to facilitate a direct close-coupled connection with the MV transformer.

Maximum protection

These PV inverters are supplied with the combiner box already integrated. Thus, they can guarantee the maximum protection thanks to their DC load break switches and the motorized DC switch to decouple the PV generator from the inverter.

Moreover, they are also supplied with a motorized AC circuit breaker. Optionally, they can be supplied with DC fuses, smart grounding kit and input current monitoring.

Maximum efficiency values

Through the use of innovative electronic conversion topologies, efficiency values of up to 98.9% can be achieved.

Enhanced functionality

This new INGECON® SUN PowerMax range features a revamped, improved enclosure which, together with its innovative air cooling system, makes it possible to increase the ambient operating temperature.



Long-lasting design

These inverters have been designed to guarantee a long life expectancy. Standard 5 year warranty, extendable for up to 25 years.

Grid support

The INGECON®SUN PowerMax B Series has been designed to comply with the grid connection requirements UL1741SA, IEEE1547 and RULE21, contributing to the quality and stability of the electric system. These inverters therefore feature a low voltage ride-through capability, and can deliver reactive power and control the active power delivered to the grid. Moreover, they can operate in weak power grids with a low SCR.

Ease of maintenance

All the elements can be removed or replaced directly from the inverter's front side, thanks to its new design.

Easy to operate

The INGECON® SUN PowerMax inverters feature an LCD screen for the simple and convenient monitoring of the inverter status and a range of internal variables. The display also includes a number of LEDs to show the inverter operating status with warning lights to indicate any incidents. All this helps to simplify and facilitate maintenance tasks.

Monitoring and communication

Ethernet communications supplied as standard. The following applications are included at no extra cost: INGECON® SUN Manager, INGECON® SUN Monitor and its Smartphone version Web Monitor, available on the App Store. These applications are used for monitoring and recording the inverter's internal operating variables through the Internet (alarms, real time production, etc.), in addition to the historical production data.

Two communication ports available (one for monitoring and one for plant controlling), allowing fast and simultaneous plant control.

PROTECTIONS

- Integrated combiner box with DC isolators.
- DC Reverse polarity.
- Short-circuits and overloads at the output.
- Anti-islanding with automatic disconnection.
- Insulation failure DC.
- Up to 12 pairs of fuse holders (up to 15 if the combiner box is not integrated).
- Lightning induced DC and AC surge arrestors, type II.
- Motorized DC switch to automatically disconnect the inverter from the PV array.
- Low voltage ride-through capability.
- Motorized AC circuit breaker.
- Hardware protection via firmware.
- Additional protection for the power stack, as it is air cooled by a closed loop.

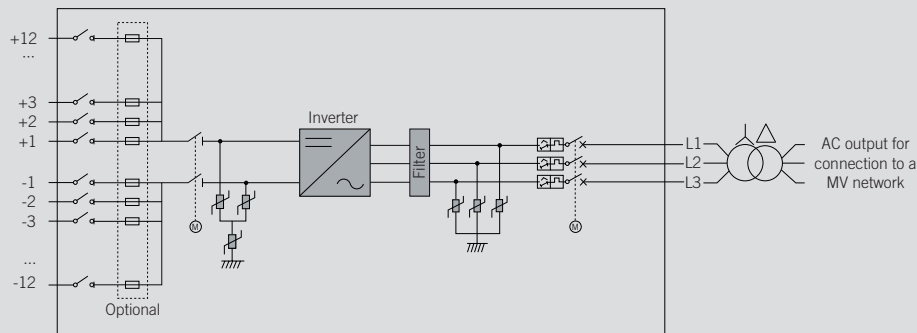
OPTIONAL ACCESSORIES

- Insulation failure AC.
- Grounding kit.
- Sand trap kit.
- Heating kit, for operating at an ambient temperature of down to -22 °F.
- DC fuses.
- Monitoring of the group currents at the DC input.
- Extendable up to 15 fuse holders per inverter.
- PID prevention kit (PID: Potential Induced Degradation).
- Night time reactive power injection.

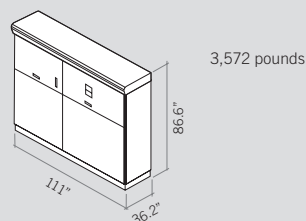
ADVANTAGES OF THE B SERIES

- Higher power density.
- Latest generation electronics.
- More efficient electronic protection.
- Night time supply to communicate with the inverter at night.
- Enhanced performance.
- Easier maintenance thanks to its new design and enclosure.
- Lightweight spares.
- It allows to ground the PV array.
- Components easily replaceable.

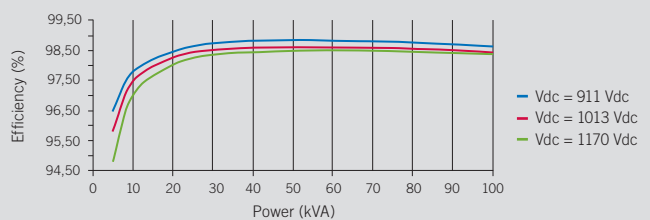
PowerMax B Series



Size and weight (inches and lbs)



Efficiency INGECON® SUN 1640TL U B630



	1170TL U B450	1245TL U B480	1400TL U B540	1500TL U B578	1560TL U B600	1600TL U B615
Input (DC)						
Recommended PV array power range ⁽¹⁾	1,157 - 1,520 kWp	1,234 - 1,622 kWp	1,389 - 1,824 kWp	1,486 - 1,952 kWp	1,543 - 2,027 kWp	1,581 - 2,077 kWp
Voltage Range MPP ⁽²⁾	655 - 1,300 V	697 - 1,300 V	783 - 1,300 V	837 - 1,300 V	868 - 1,300 V	889 - 1,300 V
Maximum voltage ⁽³⁾	1,500 V					
Maximum current	1,850 A					
N° inputs with fuse-holders	6 up to 12 (up to 15 if the combiner box is not integrated)					
Fuse dimensions	63 A / 1,500 V to 500 A / 1,500 V fuses (optional)					
Type of connection	Connection to copper bars					
Power blocks	1					
MPPT	1					
Input protections						
Overvoltage protections	Type II surge arresters					
DC switch	Motorized DC load break disconnect					
Other protections	Integrated DC combiner box / Up to 12 pairs of DC fuses (optional) / Reverse polarity / Insulation failure monitoring / Anti-islanding protection / Emergency pushbutton					
Output (AC)						
Power NEMA 3 @86 °F / @122 °F	1,169 kVA / 1,052 kVA	1,247 kVA / 1,122 kVA	1,403 kVA / 1,263 kVA	1,502 kVA / 1,352 kVA	1,559 kVA / 1,403 kVA	1,598 kVA / 1,438 kVA
Current NEMA 3 @86 °F / @122 °F	1,500 A / 1,350 A					
Power NEMA 4 @80.5 °F / @122 °F ⁽⁴⁾	1,169 kVA / 1,035 kVA	1,247 kVA / 1,104 kVA	1,403 kVA / 1,242 kVA	1,502 kVA / 1,330 kVA	1,559 kVA / 1,380 kVA	1,598 kVA / 1,415 kVA
Current NEMA 4 @80.5 °F / @122 °F ⁽⁴⁾	1,500 A / 1,328 A					
Rated voltage	450 V IT System	480 V IT System	540 V IT System	578 V IT System	600 V IT System	615 V IT System
Frequency	50 / 60 Hz					
Power Factor ⁽⁵⁾	1					
Power Factor adjustable	Yes, 0-1 (leading / lagging)					
THD (Total Harmonic Distortion) ⁽⁶⁾	<3%					
Output protections						
Overvoltage protections	Type II surge arresters					
AC breaker	Motorized AC circuit breaker					
Anti-islanding protection	Yes, with automatic disconnection					
Other protections	AC short-circuits and overloads					
Features						
Maximum efficiency	98.9%					
CEC	98.5%					
Max. consumption aux. services	4,250 W					
Stand-by or night consumption ⁽⁷⁾	90 W					
Average power consumption per day	2,000 W					
General Information						
Ambient temperature	-4 °F to +140 °F					
Relative humidity (non-condensing)	0-100%					
Protection class	NEMA 3 (NEMA 4 with the sand trap kit)					
Maximum altitude	14,770 ft (for installations beyond 3,300 ft, please contact Ingeteam's solar sales department)					
Cooling system	Air forced with temperature control (230 V phase+ neutral power supply)					
Air flow range	0 - 84 ft ³ /s (0 - 7,800 m ³ /h)					
Average air flow	45 ft ³ /s (4,200 m ³ /h)					
Acoustic emission (100% / 50% load)	<66 dB(A) at 33 ft / <54.5 dB(A) at 33 ft					
Marking	CE, ETL					
EMC and security standards	UL1741, FCC Part 15, IEEE C37.90.1, IEEE C37.90.2, CSA22.2 No107					
Grid connection standards	IEC 62116, UL1741SA, IEEE1547, IEEE1547.1, NEC CODE, Rule 21, Rule 14H, CSA22.2 No107					

Notes: ⁽¹⁾ Depending on the type of installation and geographical location. Data for STC conditions ⁽²⁾ V_{mpp,min} is for rated conditions (V_{ac}=1 p.u. and Power Factor=1) ⁽³⁾ Consider the voltage increase of the 'V_{oc}' at low temperatures ⁽⁴⁾ With the sand trap kit ⁽⁵⁾ For P_{out}>25% of the rated power ⁽⁶⁾ For P_{out}>25% of the rated power and voltage in accordance with IEC 61000-3-4 ⁽⁷⁾ Consumption from PV field when there is PV power available.

	1640TL U B630	1665TL U B640	1690TL U B650	1715TL U B660	1740TL U B670	1800TL U B690
Input (DC)						
Recommended PV array power range ⁽¹⁾	1,620 - 2,128 kWp	1,646 - 2,162 kWp	1,672 - 2,195 kWp	1,698 - 2,229 kWp	1,723 - 2,263 kWp	1,775 - 2,330 kWp
Voltage Range MPP ⁽²⁾	911 - 1,300 V	925 - 1,300 V	939 - 1,300 V	953 - 1,300 V	968 - 1,300 V	996 - 1,300 V
Maximum voltage ⁽³⁾	1,500 V					
Maximum current	1,850 A					
N° inputs with fuse-holders	6 up to 12 (up to 15 if the combiner box is not integrated)					
Fuse dimensions	63 A / 1,500 V to 500 A / 1,500 V fuses (optional)					
Type of connection	Connection to copper bars					
Power blocks	1					
MPPT	1					
Input protections						
Overvoltage protections	Type II surge arresters					
DC switch	Motorized DC load break disconnect					
Other protections	Integrated DC combiner box / Up to 12 pairs of DC fuses (optional) / Reverse polarity / Insulation failure monitoring / Anti-islanding protection / Emergency pushbutton					
Output (AC)						
Power NEMA 3 @86 °F / @122 °F	1,637 kVA / 1,473 kVA	1,663 kVA / 1,497 kVA	1,689 kVA / 1,520 kVA	1,715 kVA / 1,543 kVA	1,741 kVA / 1,567 kVA	1,793 kVA / 1,613 kVA
Current NEMA 3 @86 °F / @122 °F	1,500 A / 1,350 A					
Power NEMA 4 @80.5 °F / @122 °F ⁽⁴⁾	1,637 kVA / 1,449 kVA	1,663 kVA / 1,472 kVA	1,689 kVA / 1,495 kVA	1,715 kVA / 1,518 kVA	1,741 kVA / 1,541 kVA	1,793 kVA / 1,587 kVA
Current NEMA 4 @80.5 °F / @122 °F ⁽⁴⁾	1,500 A / 1,328 A					
Rated voltage	630 V IT System	640 V IT System	650 V IT System	660 V IT System	670 V IT System	690 V IT System
Frequency	50 / 60 Hz					
Power Factor ⁽⁵⁾	1					
Power Factor adjustable	Yes, 0-1 (leading / lagging)					
THD (Total Harmonic Distortion) ⁽⁶⁾	<3%					
Output protections						
Overvoltage protections	Type II surge arresters					
AC breaker	Motorized AC circuit breaker					
Anti-islanding protection	Yes, with automatic disconnection					
Other protections	AC short-circuits and overloads					
Features						
Maximum efficiency	98.9%					
CEC	98.5%					
Max. consumption aux. services	4,250 W					
Stand-by or night consumption ⁽⁷⁾	90 W					
Average power consumption per day	2,000 W					
General Information						
Ambient temperature	-4 °F to +140 °F					
Relative humidity (non-condensing)	0-100%					
Protection class	NEMA 3 (NEMA 4 with the sand trap kit)					
Maximum altitude	14,770 ft (for installations beyond 3,300 ft, please contact Ingeteam's solar sales department)					
Cooling system	Air forced with temperature control (230 V phase+ neutral power supply)					
Air flow range	0 - 84 ft ³ /s (0 - 7,800 m ³ /h)					
Average air flow	45 ft ³ /s (4,200 m ³ /h)					
Acoustic emission (100% / 50% load)	<66 dB(A) at 33 ft / <54.5 dB(A) at 33 ft					
Marking	CE, ETL					
EMC and security standards	UL1741, FCC Part 15, IEEE C37.90.1, IEEE C37.90.2, CSA22.2 No107					
Grid connection standards	IEC 62116, UL1741SA, IEEE1547, IEEE1547.1, NEC CODE, Rule 21, Rule 14H, CSA22.2 No107					

Notes: ⁽¹⁾ Depending on the type of installation and geographical location. Data for STC conditions ⁽²⁾ Vmp.min is for rated conditions (Vac=1 p.u. and Power Factor=1) ⁽³⁾ Consider the voltage increase of the 'Voc' at low temperatures ⁽⁴⁾ With the sand trap kit ⁽⁵⁾ For P_{out}>25% of the rated power ⁽⁶⁾ For P_{out}>25% of the rated power and voltage in accordance with IEC 61000-3-4 ⁽⁷⁾ Consumption from PV field when there is PV power available.

Appendix D - 12-5 - Decibel Scale of Common Sources of Noise

U.S. Department of Transportation
Federal Highway Administration

Noise Barrier Design Handbook

The following shows a scale relating various sounds encountered in daily life and their approximate decibel levels:

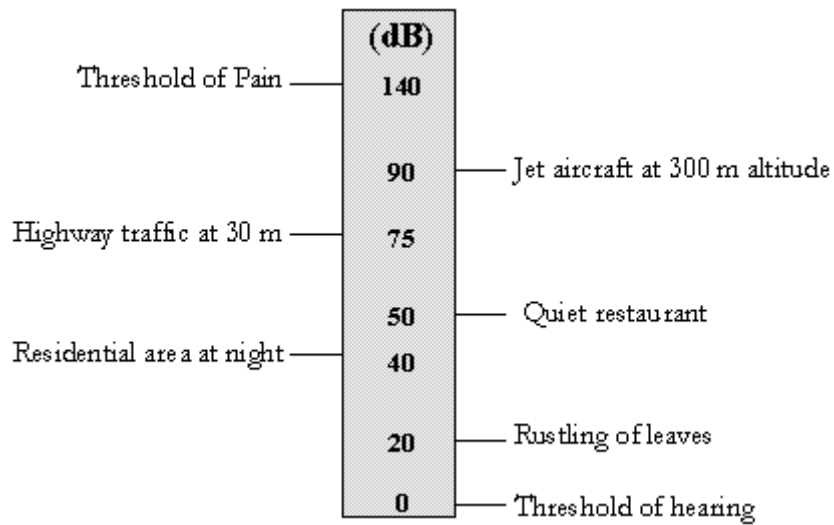


Figure 5. Decibel scale