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Solis

2 May 2023

8:00 am – 9:00 am | PDT, Los Angeles
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7:00 pm – 8:00 pm | GST, Dubai



Tristan Rayner

Editor
pv magazine

pv magazine
webinars

Repowering old central inverters with new string inverters




Igor Mogilevski

Product Solutions and Engineering Director North America
Solis

Welcome!

Do you have any questions? ? 

Send them in via the Q&A tab.  We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 

We'll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience.  



2022-2023 Solis US PV String Inverters for US/Canada



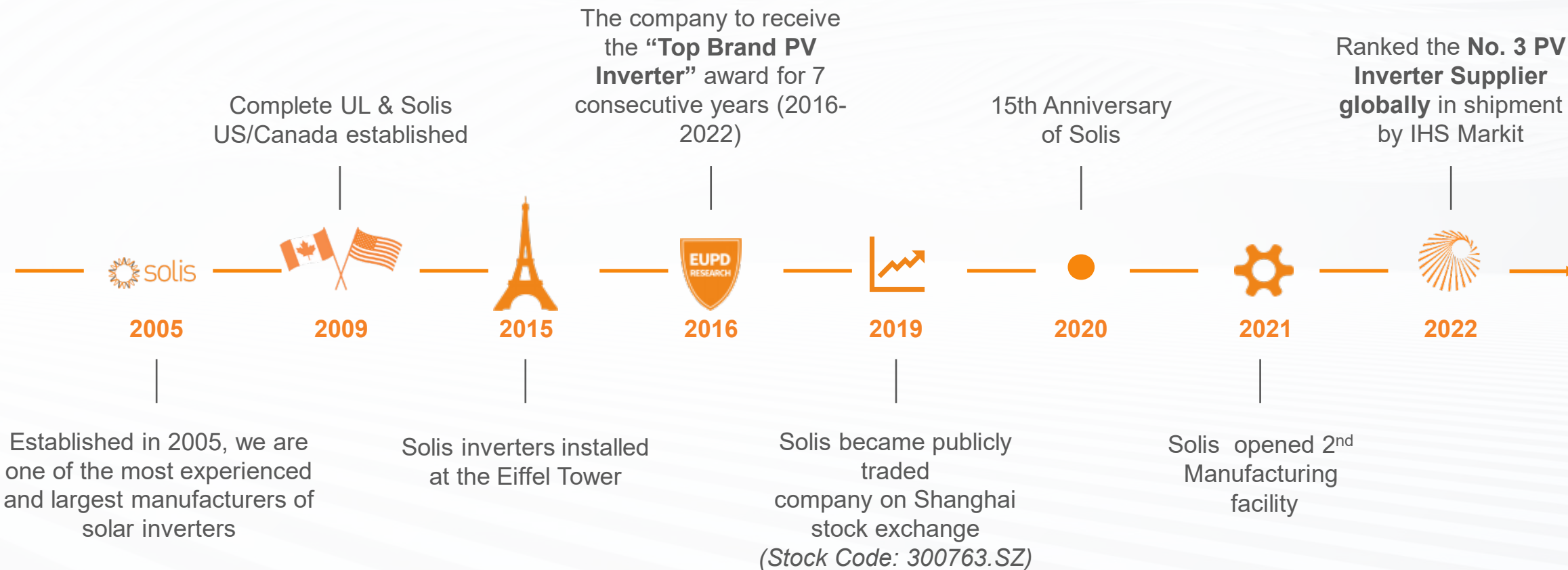
300 MW Tidal Flat PV Power Project, China

Made by Ginlong Technologies Co., LTD.

Stock Code: 300763.SZ ◀

History of Ginlong Technologies Co., and the Solis Brand Name

World's largest publicly-traded company with a sole focus on string inverters.



Solis Global Manufacturing

– Annual Manufacturing Capacity 40 GW

Manufacturing for markets in over 100 countries around the World

Original Factory – 20 GW Capacity



**Second facility opened in 2021
40GW**



**New Vietnam factory – Open 2023
4GW**



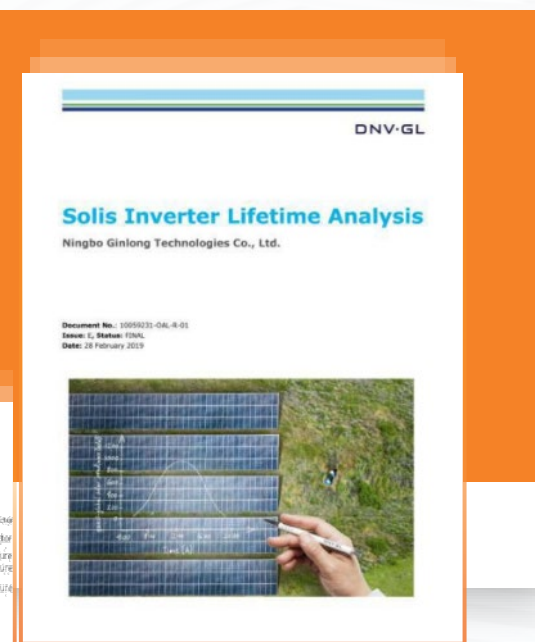
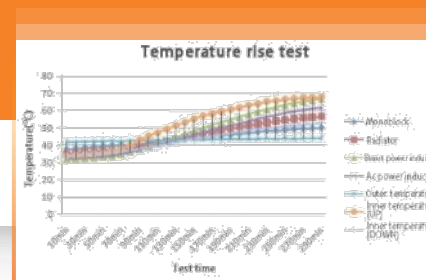
Solis Global Product Validation – Solis Inverters Deliver Long Life

25⁺ years

The inverter life models presented were positively impacted by the long and impressive track record of PV inverters designed and manufactured by Solis. The useful life projections are at or near the top of the string inverter life projections by DNV GL.



Source DNV GL



Latest DNV-GL report published April 2021

Solis North America – Broad UL-Listed Solutions Portfolio

Residential Grid Tie Inverters

- 3.6-10K single-phase
- Supports up to 700W module



Residential Hybrid PV / Energy Storage Inverter

- 3.8-11.4K single-phase
- On grid or off grid
- High-voltage DC-coupled
- UL 9540 Certified



Commercial Rooftop Solution

- 25-100K 3-phase 480VAC
- High Power MPPTs accept Y-connectors
- High current MPPT input up to 40Amps per MPPT.
- 3-10 MPPT Inputs



Additional 208V Commercial Inverters

- 30K 3-phase 208VAC
- High current MPPT input up to 40Amps per MPPT



Large Commercial, Small Utility Inverters

- 125-185K, 600VAC
- High current MPPT inputs
- Rugged NEMA 4X enclosures
- PLC communications
- 9-12 MPPT inputs



Large Utility String Inverters

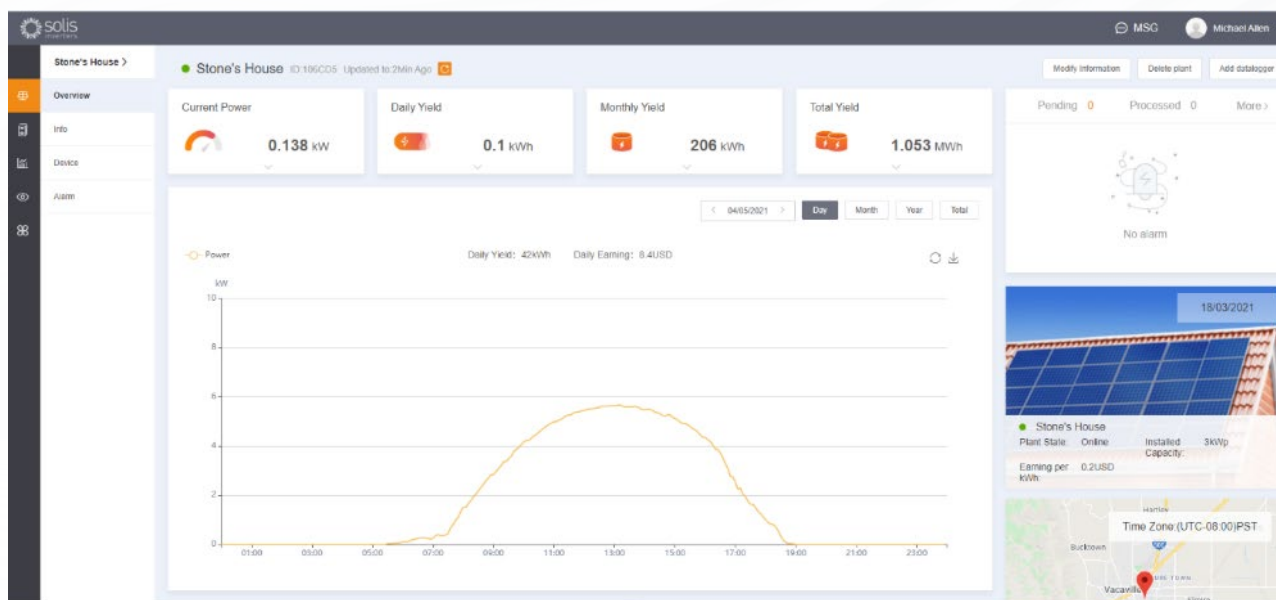
- 255-350K, 800VAC
- Ethernet , PLC Communication
- Full skid solution, Ac combiners, MV transformer and communication equipment .
- 12 MPPT Inputs

IEEE1547 2018

UL1741 SA UL1741 SB

Solis North America – Solis Monitoring Platform – SolisCloud (v3.0)

- ✓ Data monitoring, 2-way communication, remote control, remote FW update and troubleshooting support



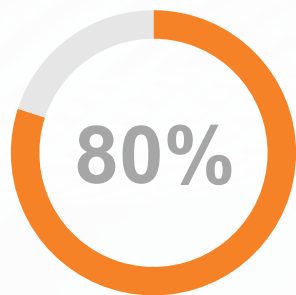
Download *SolisCloud* mobile phone Apps:
 iPhone: App Store
 Android: Google Store



- The SolisCloud is free monitoring platform
- SolisCloud real-time, data capture **every 5 min.**
- Remote Troubleshooting saving truck rolls
- Remote I/V Curve Scanning
- Cloud to Cloud data push protocol for 2-way communications

Solis North America – Tier 1 Service and RMA Support

- ✓ Customers can reach out to the large Solis US-based team of Experienced Installers and Inverter Technicians at any time, multi-lingual staff available via call, email or online portal



Ticket Response Time

Over 80% of tickets are responded to within 1h, after that the remaining 20% are handled within 1-48 hours. We expedite and prioritize RMA tickets

Total Calls: **3,800**

Average Wait time: **1m 16s**

Average Duration: **5m 38s**

Solis uses a CRM System to ticket and track every call





2023 Solis Repowering Solutions



300 MW Tidal Flat PV Power Project, China

Made by Ginlong Technologies Co., LTD.

Stock Code: 300763.SZ ◀

Repowering – Inverter Replacement

Legacy Inverter Replacement

- **Solar Plants that are 7 years and older with 600-1000 VDC inverters are due for replacement for the following reasons**

Inverter failures

Costly maintenance / repairs

Part availability issues

No Warranty support

- **How to Replace an Inverter**

Direct replacement is not a feasible option

- **Alternative Options**

1000/1500 VDC String Inverters when PV grounding is not required

1000/1500 VDC String Inverters and additional isolated DC-DC converters when PV grounding is required



Repowering – Inverter Replacement

Key Design Considerations

- Systems with output voltage range of 360-800 VAC are considered
- Max short circuit current from the PV determines the # of string be connected to single MPPT input
- Output Power is derated based on input and output voltage as necessary
- PID Repairing Function for ungrounded PV strings
- Systems with PV panels which require positive or negative grounding will require an isolated DC-DC converter
- Solis Inverters that are considered:
 - **S5-GC100K-US** is suggested for 480 VAC Systems
 - **Solis-185K-EHV-5G-US-PLUS** is suggested for 600 VAC systems
 - **Solis-255K-EHV-5G-US-PLUS** is suggested for 800 VAC systems

Satcon PowerGate Plus



PowerGate Plus 500kW

Pout- 500kW

Voc- 600VDC

Vmp-320-600VDC

Vout- 480VAC

PowerGate Plus 680kW

Pout- 625/680kW

Voc-1000VDC

Vmp- 550-850VDC

Vout- 360VAC



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robat Docum

Repowering Satcon PowerGate Plus Inverter with Solis String Inverters

Inverter Parameters	S5-GC100K-US	PowerGate Plus 500kW	PowerGate Plus 680kW
Max Input DC Voltage	1000 VDC	600 VDC	1000 VDC
MPPT Range at Full Power	550 – 850 VDC	320 – 600 VDC	550-850 VDC
Input Voltage Range	180-1000 VDC	320 – 600 VDC	550-850 VDC
Nominal VAC Out	480 VAC	480 VAC	360 VAC
Output Voltage Range	360-480 VAC	480VAC	360VAC
Rated Inverter Power (kW)	100 kW	500 kW	680 kW
Power Derating at 320 VDC	90% Pn		
Power Derating at 550 VDC	100% Pn		
Power Derating at 360 VAC	75% Pn		
Solis Inverter Repowering Solution			
Derated Inverter Power		90 kW	75kW
Number of Inv. for Retrofit		6	9



S5-GC100K-US

Repowering PowerGate Plus

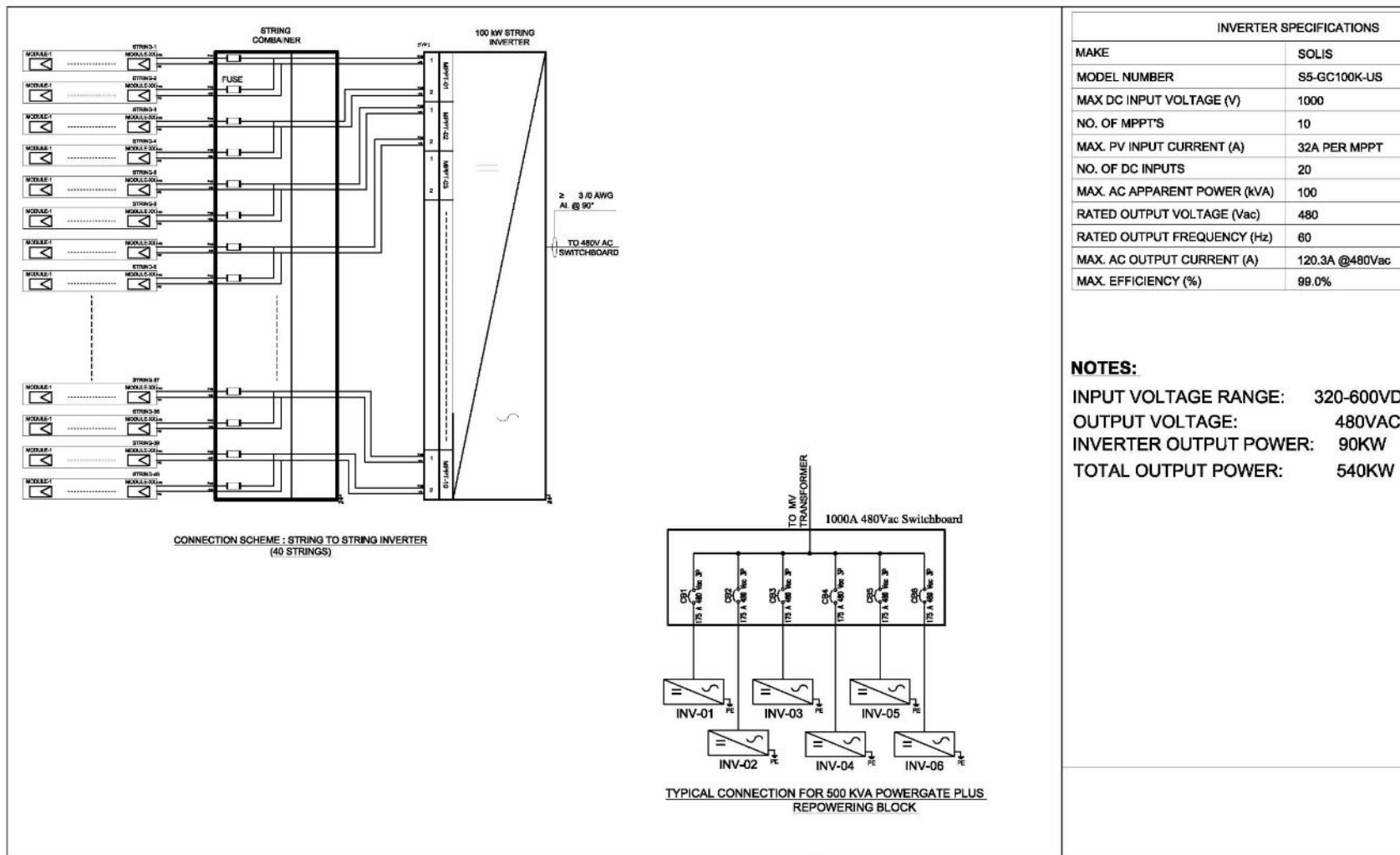
Repowering PowerGate Plus 500kW

- Output Voltage must be 480VAC
- When Input Voltage is 320VDC
 - Output Power of the inverter is derated to 90%Pn
- **Total Power available from the inverter is 90kW**
- **6 x 100kW x 90% = 540kW**

Repowering PowerGate Plus 680kW

- When output Voltage is 360VAC
 - Output Power of the inverter is derated to 75%Pn
- When Input Voltage is 550VDC
 - Output Power of the inverter is rated to 100%Pn
- **Total Power available from inverter is 75kW**
- **9 x 100kW x 75% = 675kW**

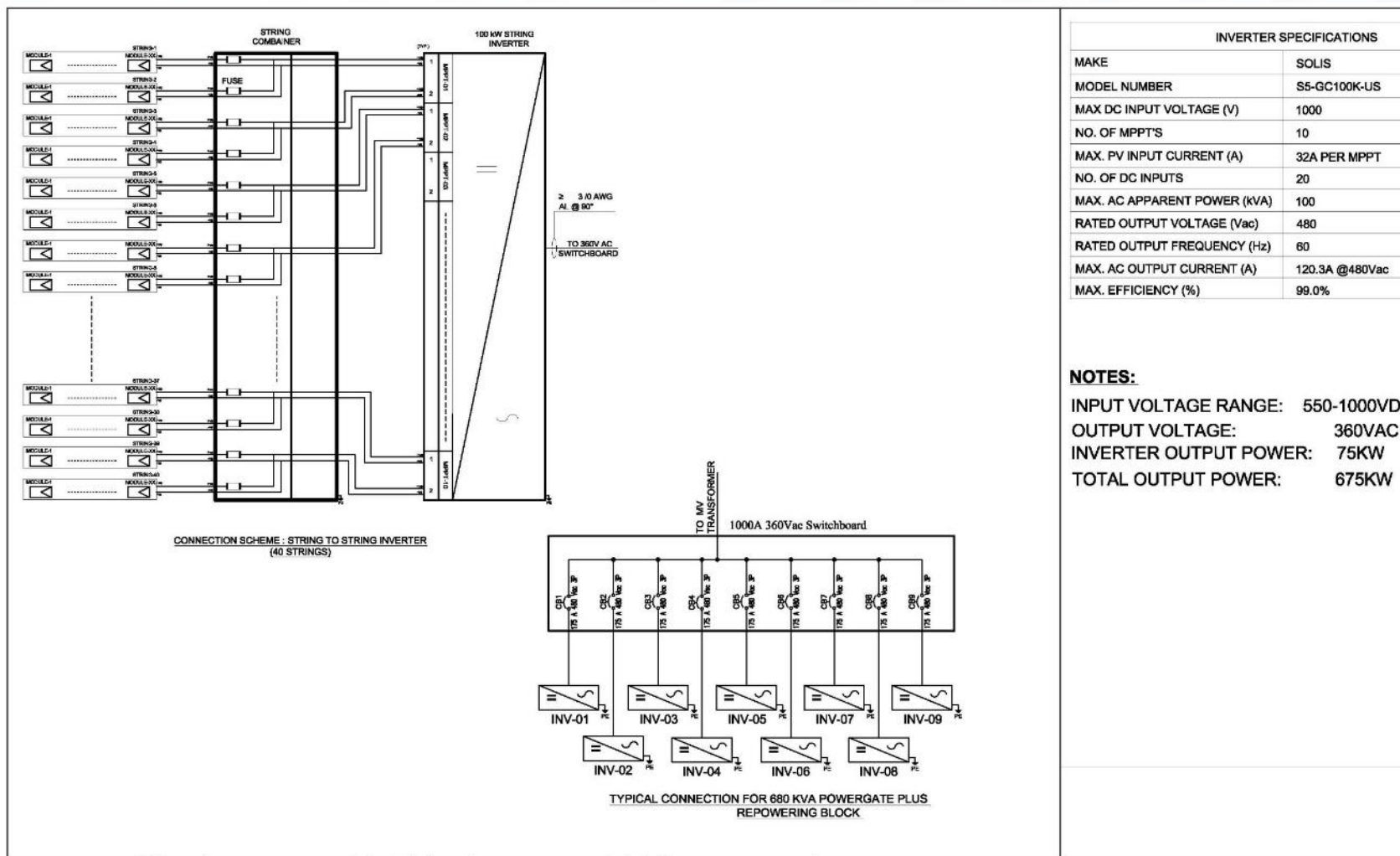
Repowering PowerGate Plus 500kW SLD



INVERTER SPECIFICATIONS	
MAKE	SOLIS
MODEL NUMBER	S5-GC100K-US
MAX DC INPUT VOLTAGE (V)	1000
NO. OF MPPT'S	10
MAX. PV INPUT CURRENT (A)	32A PER MPPT
NO. OF DC INPUTS	20
MAX. AC APPARENT POWER (kVA)	100
RATED OUTPUT VOLTAGE (Vac)	480
RATED OUTPUT FREQUENCY (Hz)	60
MAX. AC OUTPUT CURRENT (A)	120.3A @480Vac
MAX. EFFICIENCY (%)	99.0%

NOTES:
 INPUT VOLTAGE RANGE: 320-600VDC
 OUTPUT VOLTAGE: 480VAC
 INVERTER OUTPUT POWER: 90KW
 TOTAL OUTPUT POWER: 540KW

Repowering PowerGate Plus 680kW SLD



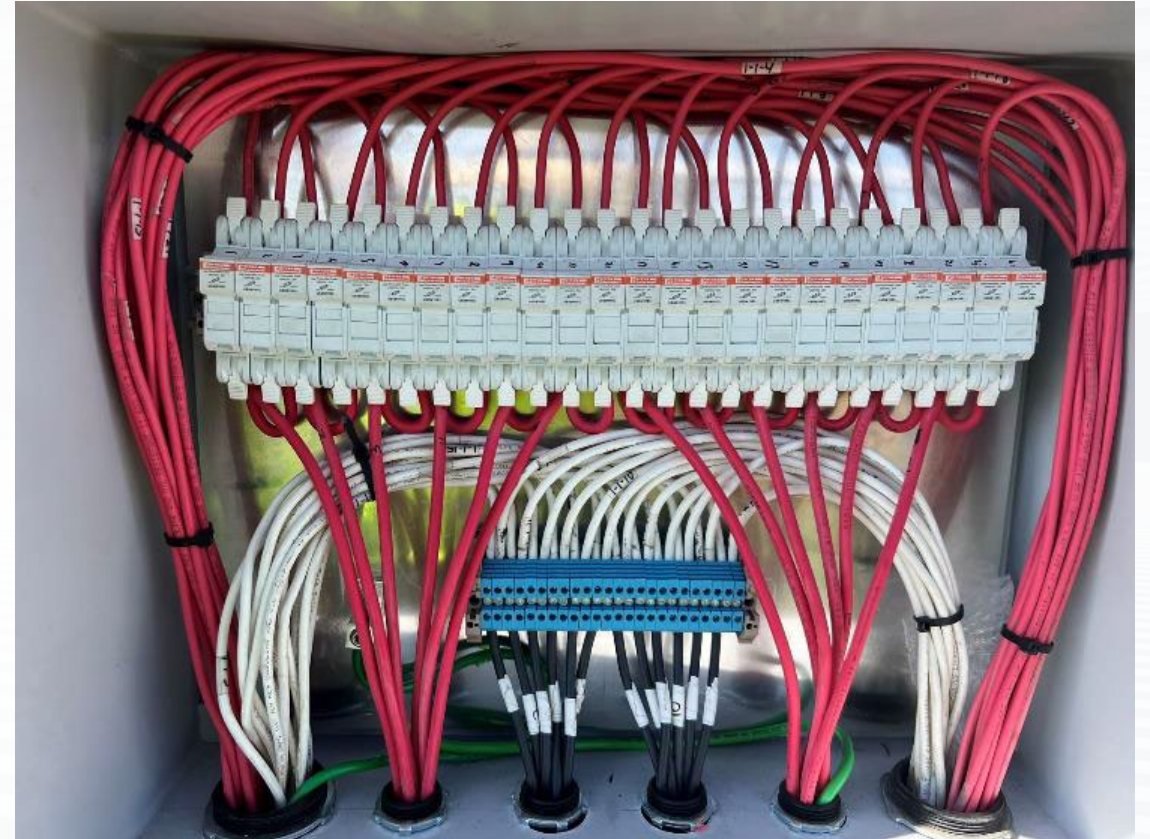
INVERTER SPECIFICATIONS

MAKE	SOLIS
MODEL NUMBER	S5-GC100K-US
MAX DC INPUT VOLTAGE (V)	1000
NO. OF MPPT'S	10
MAX. PV INPUT CURRENT (A)	32A PER MPPT
NO. OF DC INPUTS	20
MAX. AC APPARENT POWER (KVA)	100
RATED OUTPUT VOLTAGE (Vac)	480
RATED OUTPUT FREQUENCY (Hz)	60
MAX. AC OUTPUT CURRENT (A)	120.3A @480Vac
MAX. EFFICIENCY (%)	99.0%

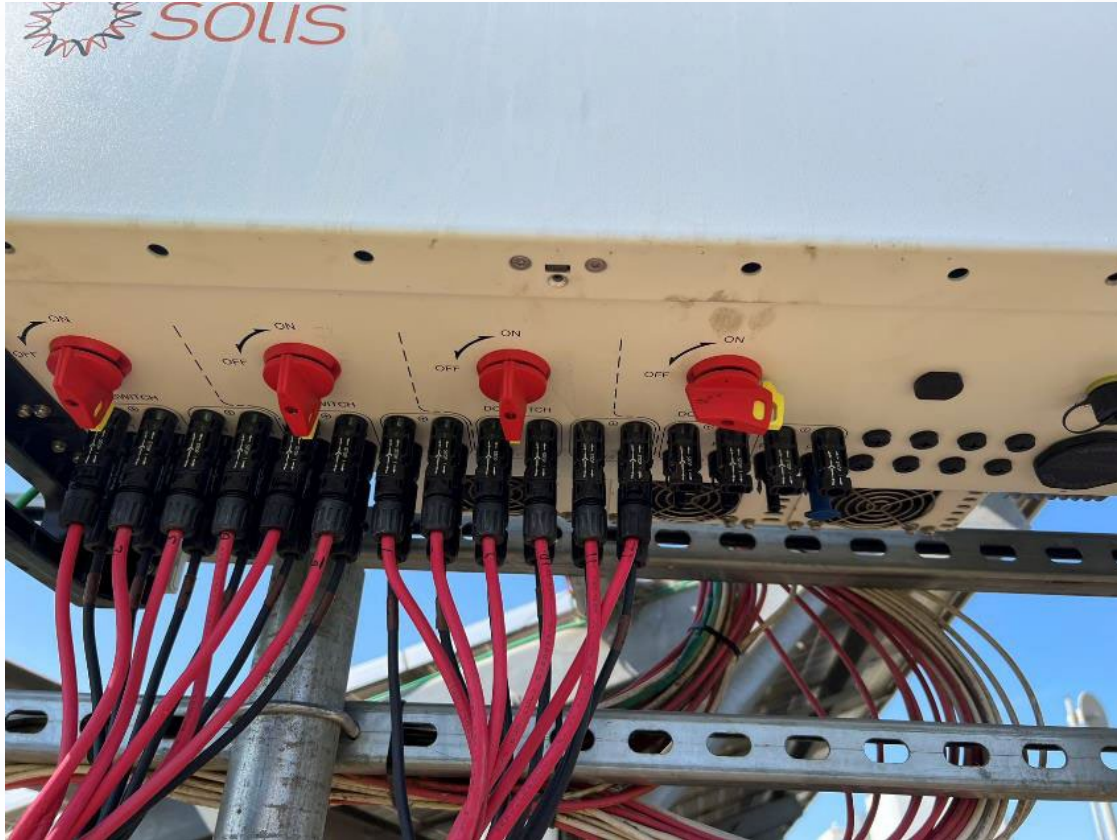
NOTES:

INPUT VOLTAGE RANGE: 550-1000VDC
 OUTPUT VOLTAGE: 360VAC
 INVERTER OUTPUT POWER: 75KW
 TOTAL OUTPUT POWER: 675KW

S5-GC100K-US Site Installation Pictures



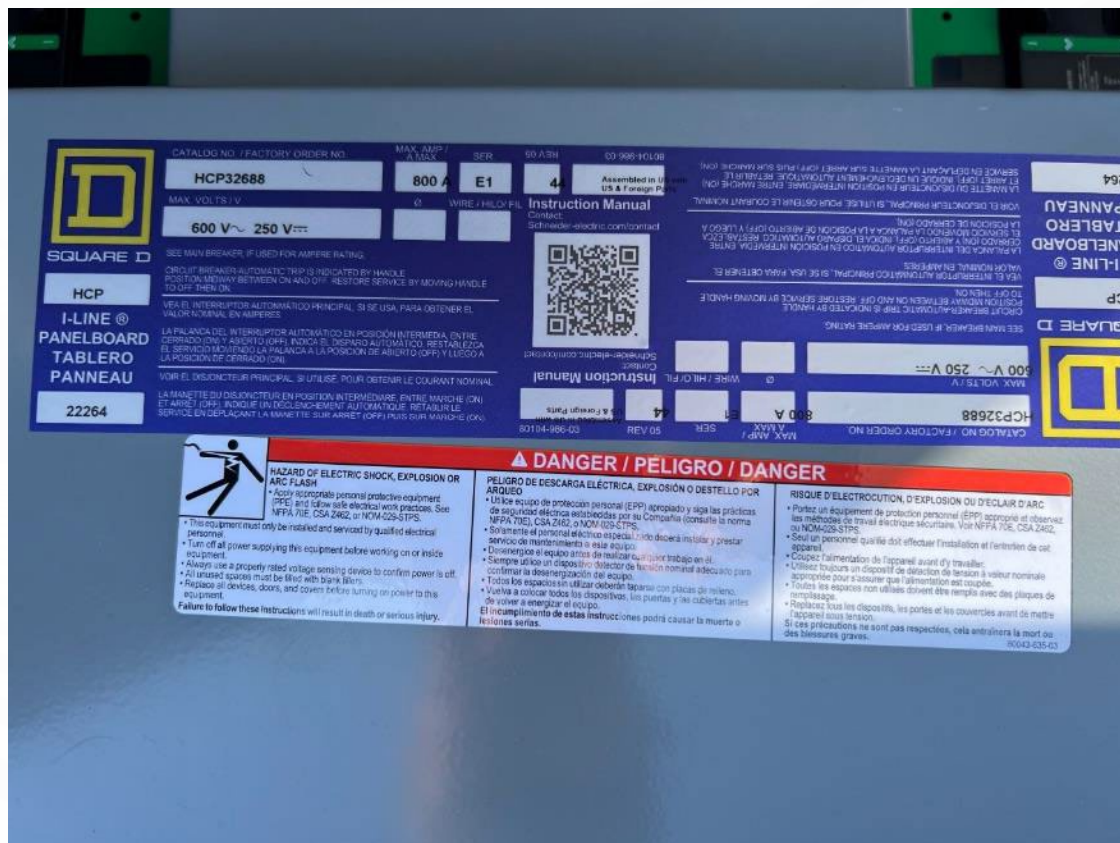
S5-GC100K-US Site Installation Pictures



S5-GC100K-US Site Installation Pictures



S5-GC100K-US Site Installation Pictures



Advance Energy



AE 500NX

Pout-500kW

Dual Array

Voc- ±600VDC

Vmp- ±330-550VDC

Vout- 480VAC



AE 500NX-1kV

Pout-500kW

Single Array

Voc-1000VDC

Vmp- 600-1000VDC

Vout- 420VAC

AE 1000NX

Pout-1000kW

Dual Array

Voc- ±1000VDC

Vmp- ±550-1000VDC

Vout- 800VAC



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robat Docum

Repowering AE 500NX and 500NX-1kV Inverter

Inverter Parameters	S5-GC100K-US	AE 500NX	AE 500NX-1kV
Max Input DC Voltage	1000 VDC	±600 VDC	1000 VDC
MPPT Range at Full Power	550 – 850 VDC	±330 – 550 VDC	600-1000 VDC
Input Voltage Range	180-1000 VDC	±330 – 550 VDC	600-1000 VDC
Nominal VAC Out	480 VAC	480 VAC	420 VAC
Output Voltage Range	360-480 VAC	480VAC	420VAC
Rated Inverter Power (kW)	100 kW	500 kW	500 kW
Power Derating at 330 VDC	91% Pn		
Power Derating at 600 VDC	100% Pn		
Power Derating at 420 VAC	87.5% Pn		
Solis Inverter Repowering Solution			
Derated Inverter Power		91 kW	87.5 kW
Number of Inv. for Retrofit		6	6



S5-GC100K-US

Repowering AE 500NX and 500NX-1kV Inverter

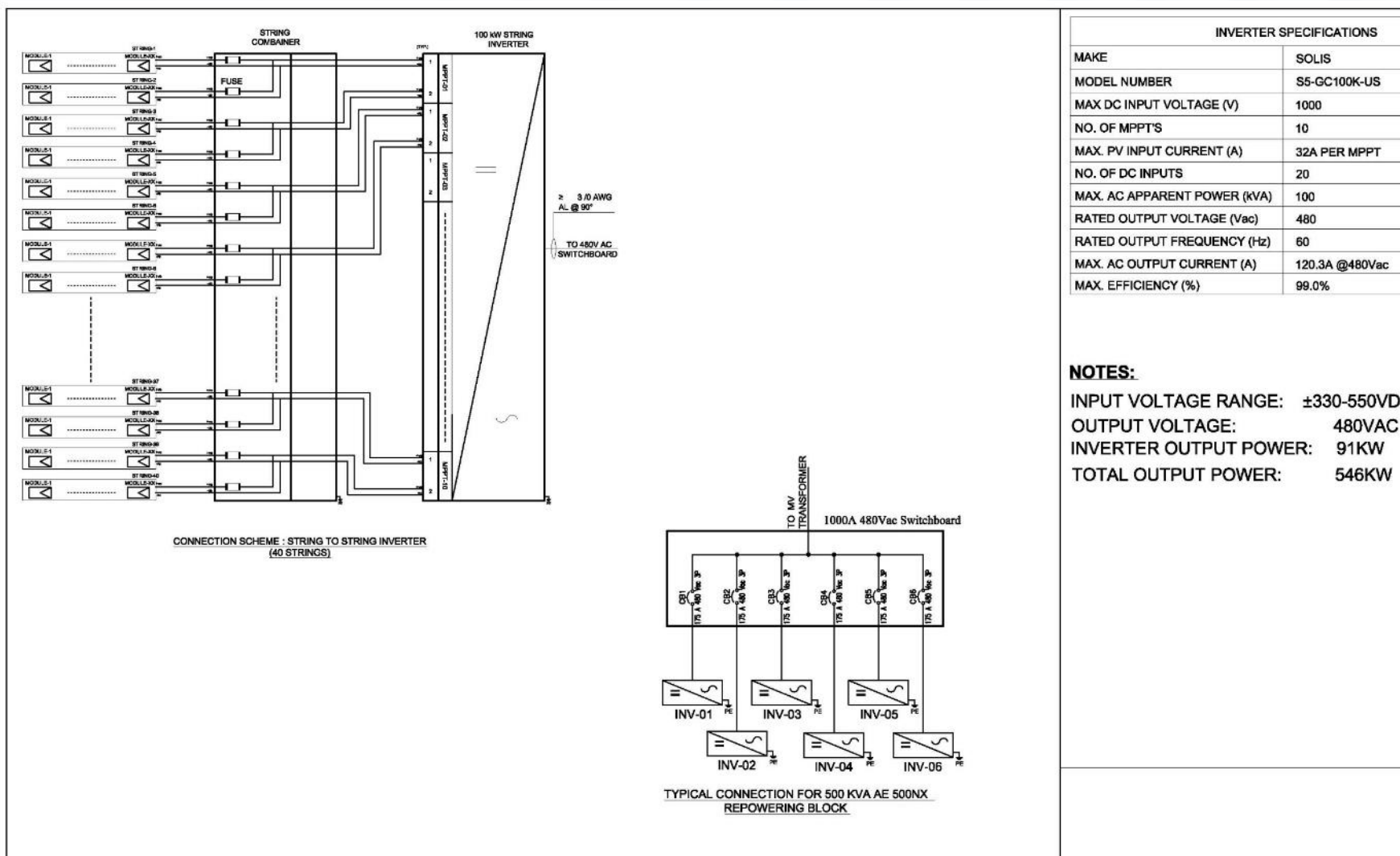
Repowering AE 500NX

- Output Voltage must be 480VAC
- When Input Voltage is $\pm 330\text{VDC}$
 - Output Power of the inverter is derated to 91%P_n
- **Total Power available from the inverter is 91kW**
- **6 x 100kW x 91% = 546kW**

Repowering AE 500NX 1kV

- When Output Voltage is 420VAC
 - Output Power of the inverter is derated to 87.5%P_n
- When Input Voltage is 600VDC there is no power derating
- **Total Power available from inverter is 87.5kW**
- **6 x 100kW x 87.5% = 525kW**

Repowering AE 500NX 500KW SLD



INVERTER SPECIFICATIONS	
MAKE	SOLIS
MODEL NUMBER	S5-GC100K-US
MAX DC INPUT VOLTAGE (V)	1000
NO. OF MPPT'S	10
MAX. PV INPUT CURRENT (A)	32A PER MPPT
NO. OF DC INPUTS	20
MAX. AC APPARENT POWER (kVA)	100
RATED OUTPUT VOLTAGE (Vac)	480
RATED OUTPUT FREQUENCY (Hz)	60
MAX. AC OUTPUT CURRENT (A)	120.3A @480Vac
MAX. EFFICIENCY (%)	99.0%

NOTES:

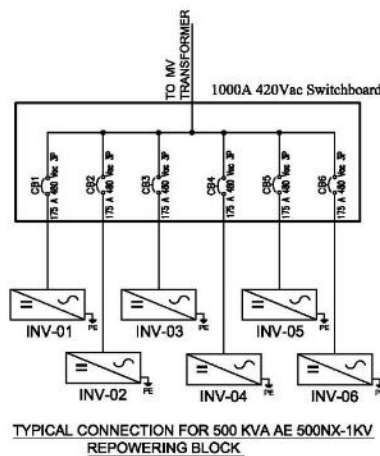
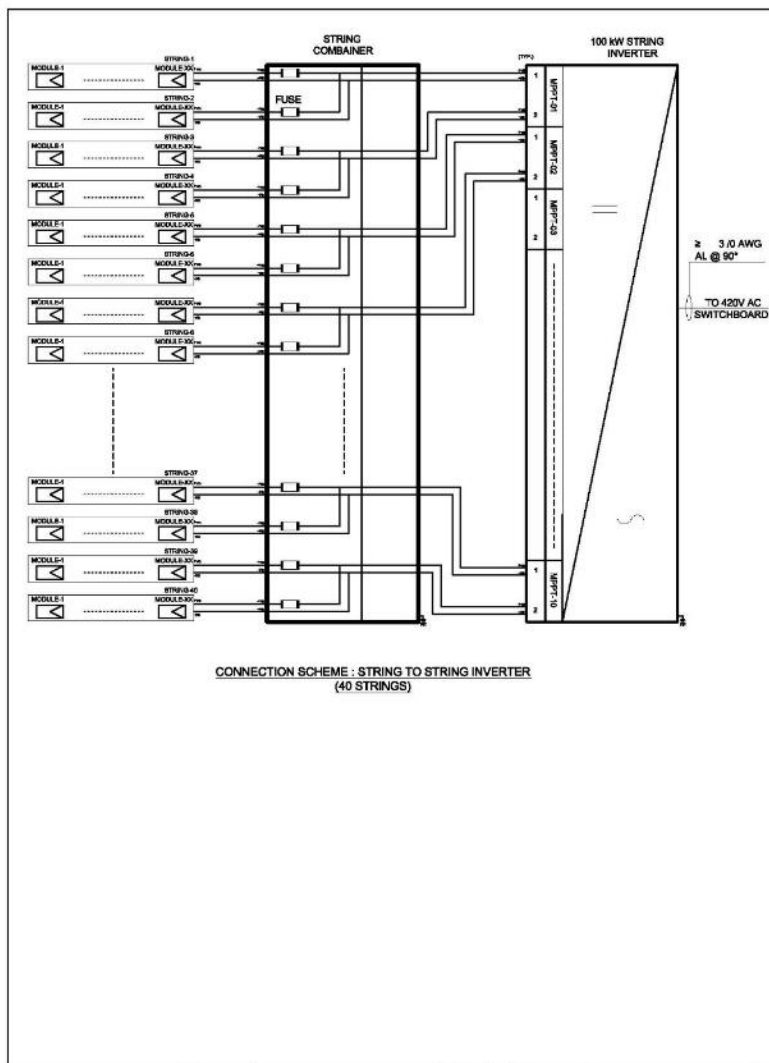
INPUT VOLTAGE RANGE: ±330-550VDC

OUTPUT VOLTAGE: 480VAC

INVERTER OUTPUT POWER: 91KW

TOTAL OUTPUT POWER: 546KW

Repowering AE 500NX-1KV 500KW SLD



INVERTER SPECIFICATIONS	
MAKE	SOLIS
MODEL NUMBER	S5-GC100K-US
MAX DC INPUT VOLTAGE (V)	1000
NO. OF MPPT'S	10
MAX. PV INPUT CURRENT (A)	32A PER MPPT
NO. OF DC INPUTS	20
MAX. AC APPARENT POWER (kVA)	100
RATED OUTPUT VOLTAGE (Vac)	480
RATED OUTPUT FREQUENCY (Hz)	60
MAX. AC OUTPUT CURRENT (A)	120.3A @480Vac
MAX. EFFICIENCY (%)	99.0%

NOTES:

INPUT VOLTAGE RANGE: 600-1000VDC
 OUTPUT VOLTAGE: 420VAC
 INVERTER OUTPUT POWER: 87.5KW
 TOTAL OUTPUT POWER: 525KW

Repowering AE 1000NX Inverter

Inverter Model: Solis-255K-EHV-5G-US-PLUS

Inverter Parameters	Solis-255K-EHV-5G-US-PLUS	AE 1000NX
Max Input DC Voltage	1500 VDC	±1000 VDC
MPPT Range at Full Power	870 – 1300 VDC	±550 – 1000 VDC
Input Voltage Range	550-1500 VDC	±550 – 1000 VDC
Nominal VAC Out	800 VAC	800 VAC
Output Voltage Range	600-800 VAC	800VAC
Rated Inverter Power (kW)	255 kW	1000 kW
Power Derating at 550 VDC	50% P _n	
Power Derating at 800 VAC	100% P _n	
Max Input DC Voltage	1500 VDC	
Solis Inverter Repowering Solution		
Derated Inverter Power		125 kW
Number of Inv. for Retrofit		8

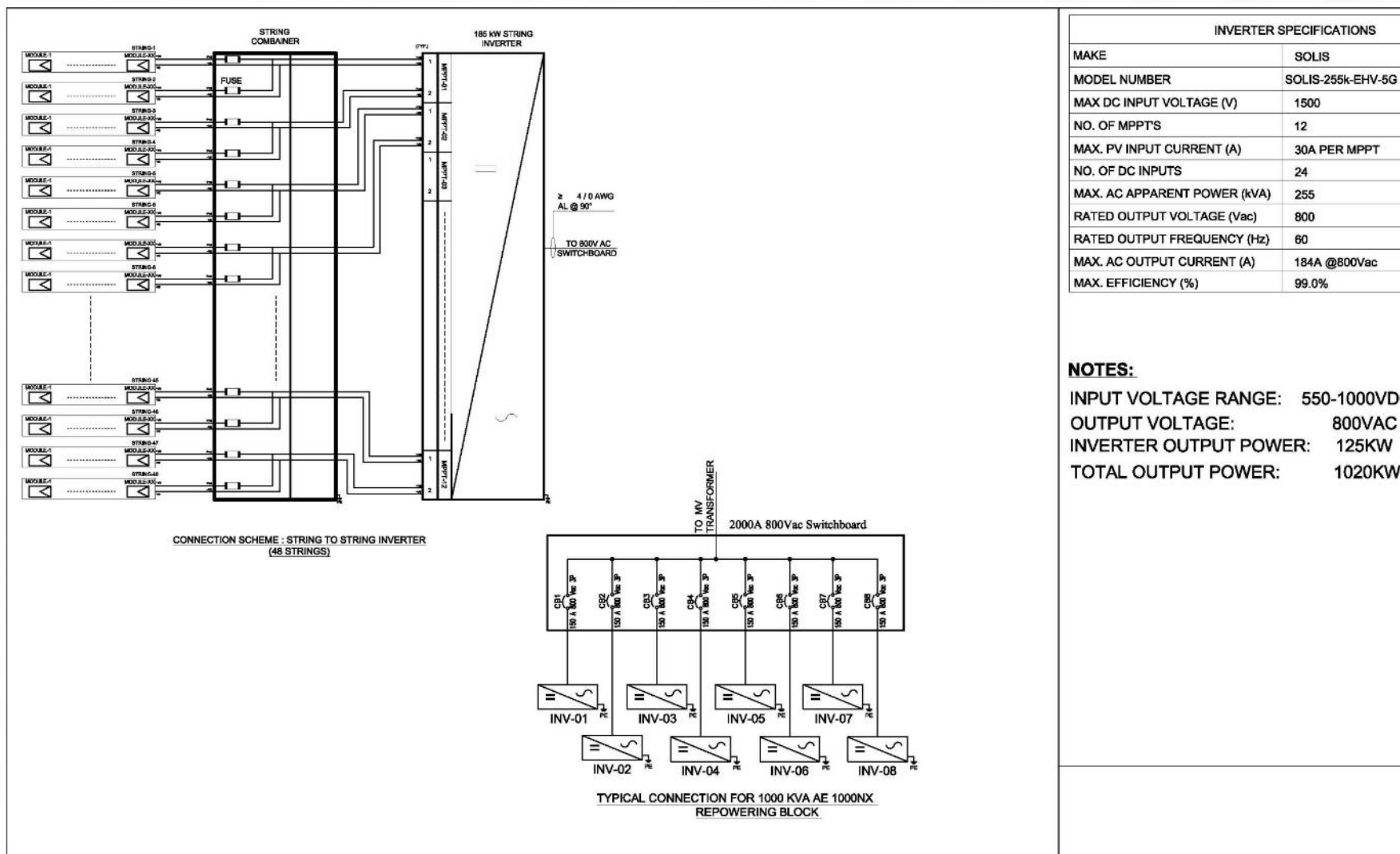


Solis-255K-EHV-5G-US-PLUS

Repowering AE 1000NX

- Output Voltage must be 800VAC
- When Input Voltage is $\pm 550\text{VDC}$
 - Output Power of the inverter is derated to 50%Pn
- **Total Power available from the inverter is 125kW**
- **8 x 255kW x 50% = 1020kW**

Repowering AE 1000NX 1000KW SLD



ABB



ULTRA-1400-TL

Pout-1560kW

Voc-1000VDC

Vmp- 645-850VDC

Vout- 690VAC



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Solis Repowering Solution

Inverter Model: Solis-255K-EHV-5G-US-PLUS

Inverter Parameters	Solis-255K-EHV-5G-US-PLUS	ULTRA-1400-TL
Max Input DC Voltage	1500 VDC	1000 VDC
MPPT Range at Full Power	870 – 1300 VDC	645 – 850 VDC
Input Voltage Range	550-1500 VDC	645 – 850 VDC
Nominal VAC Out	800 VAC	690 VAC
Output Voltage Range	600-800 VAC	690VAC
Rated Inverter Power (kW)	255 kW	1400 kW
Power Derating at 645 VDC	66% P _n	
Power Derating at 690 VAC	85% P _n	
Max Input DC Voltage	1500 VDC	
Solis Inverter Repowering Solution		
Derated Inverter Power		143 kW
Number of Inv. for Retrofit		10

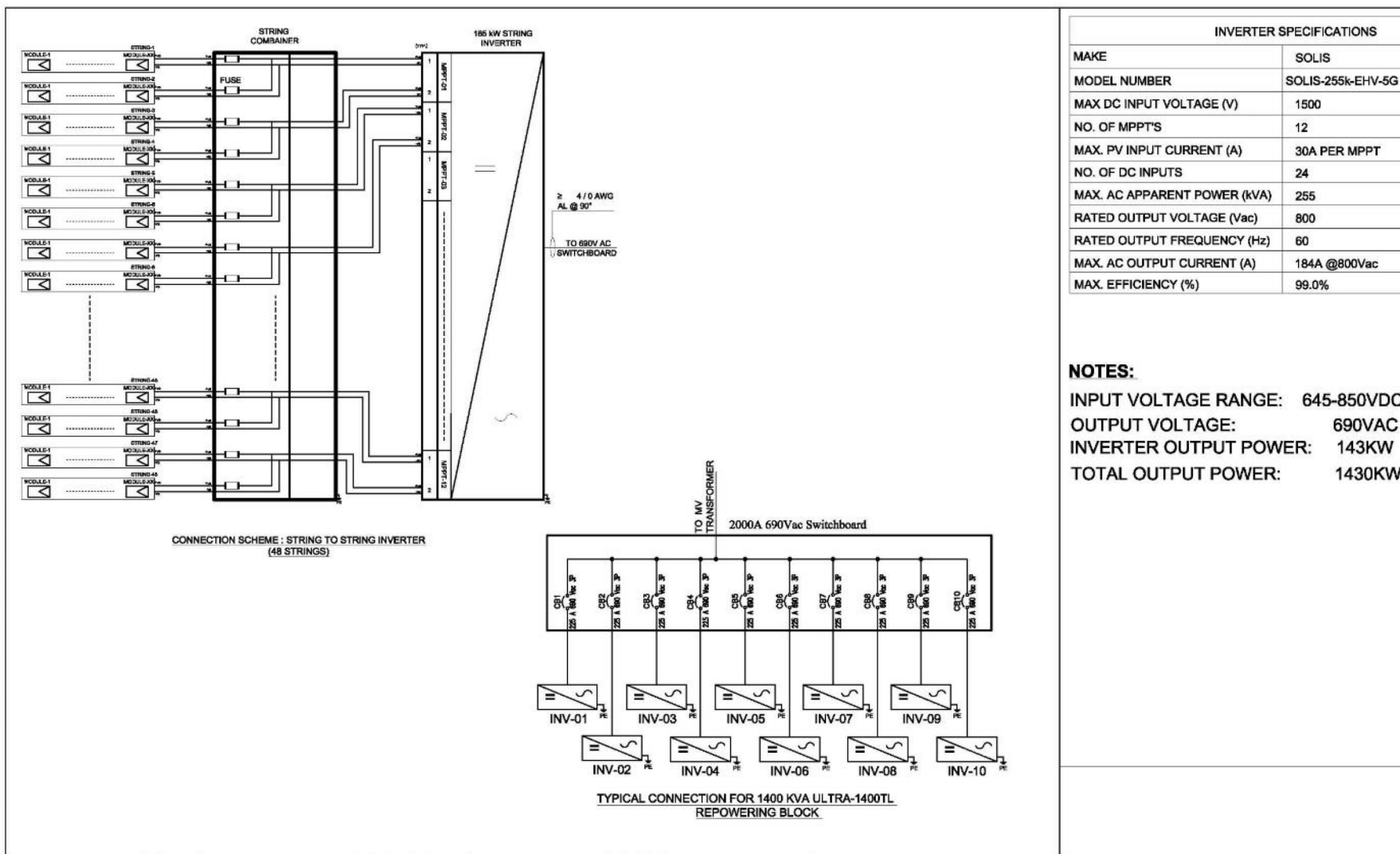


Solis-255K-EHV-5G-US-PLUS

Repowering ULTRA-1400-TL

- When Output Voltage is 690VAC
Output Power of the inverter can be derated to 85%Pn
- When Input Voltage is 645VDC
Output Power of the inverter is derated to 66%Pn
- **Total Power available from the inverter is 143kW**
- **10 x 255kW x 56% = 1430kW**

Repowering ULTRA 1400TL SLD



INVERTER SPECIFICATIONS	
MAKE	SOLIS
MODEL NUMBER	SOLIS-255k-EHV-5G
MAX DC INPUT VOLTAGE (V)	1500
NO. OF MPPT'S	12
MAX. PV INPUT CURRENT (A)	30A PER MPPT
NO. OF DC INPUTS	24
MAX. AC APPARENT POWER (kVA)	255
RATED OUTPUT VOLTAGE (Vac)	800
RATED OUTPUT FREQUENCY (Hz)	60
MAX. AC OUTPUT CURRENT (A)	184A @800Vac
MAX. EFFICIENCY (%)	99.0%

NOTES:

INPUT VOLTAGE RANGE: 645-850VDC
 OUTPUT VOLTAGE: 690VAC
 INVERTER OUTPUT POWER: 143KW
 TOTAL OUTPUT POWER: 1430KW

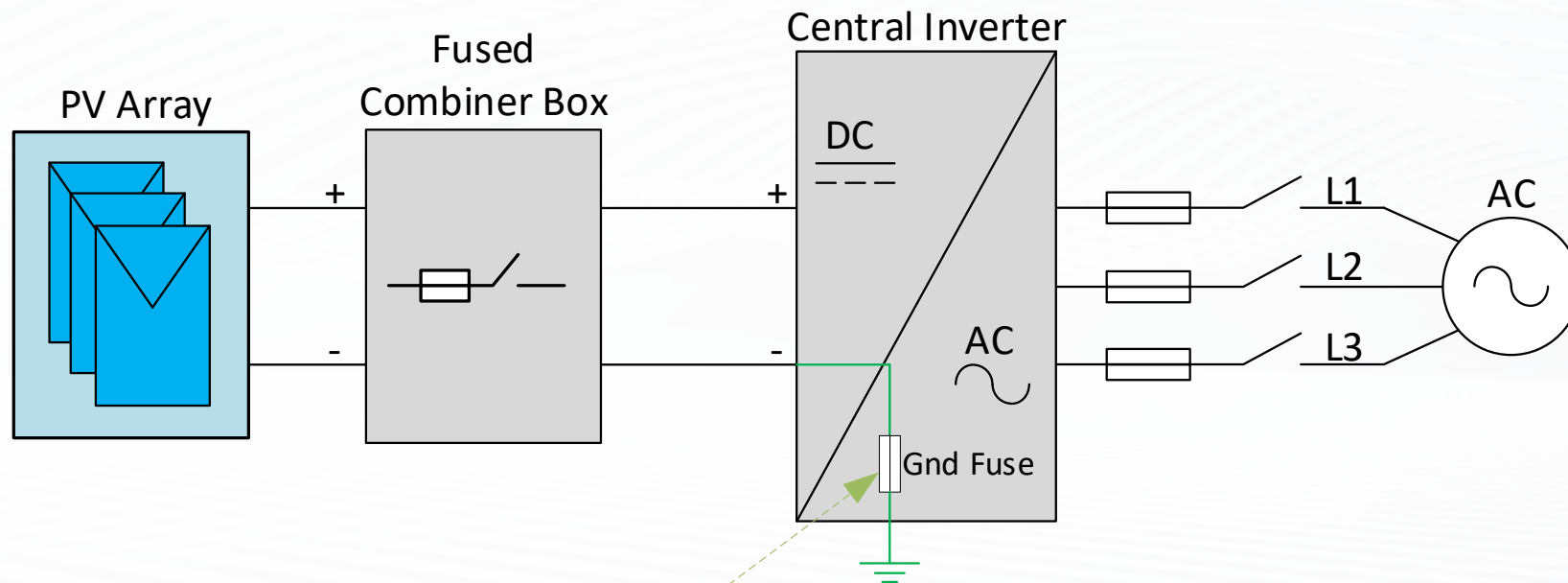
First Solar (Negatively Grounded) PV Modules & SunPower (Positively Grounded) PV Modules

Repowering – Inverter Replacement with Grounded PV

- String Inverters are transformerless type
- String inverters do not ground the PV on either positive or negative side
- Grounding the PV on the negative or positive side will cause ground faults
- When a PV array needs to be grounded additional isolation is needed
- Isolated DC-DC converters provide a solution for PV grounding

Repowering – Inverter Replacement with Grounded PV

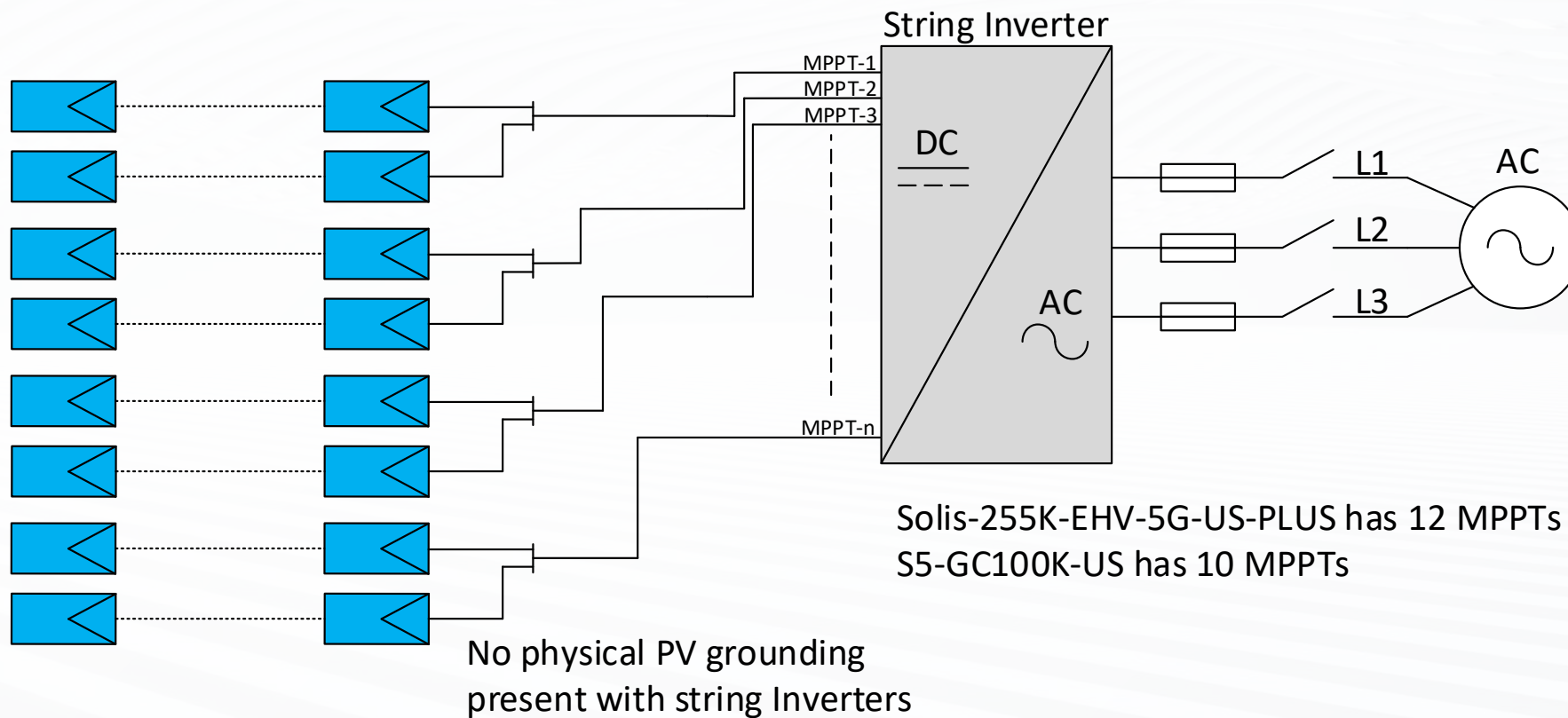
Array Grounding with Central Inverters



PV Array is grounded through ground fuse in the inverter.
Example showing negative grounding

Repowering – Inverter Replacement with Grounded PV

No Array Grounding with String Inverters



Repowering – Inverter Replacement with Grounded PV

Use Solis String Inverters with 3rd Party DC-DC Converters

DC-DC Converter Model: SPOT 1000

- Galvanically isolated input and output
- Input grounding- positive negative or floating
- Output Grounding- floating
- MPPT Input Voltage Range 200-880V
- String Level or Combiner Box Level Input Connections



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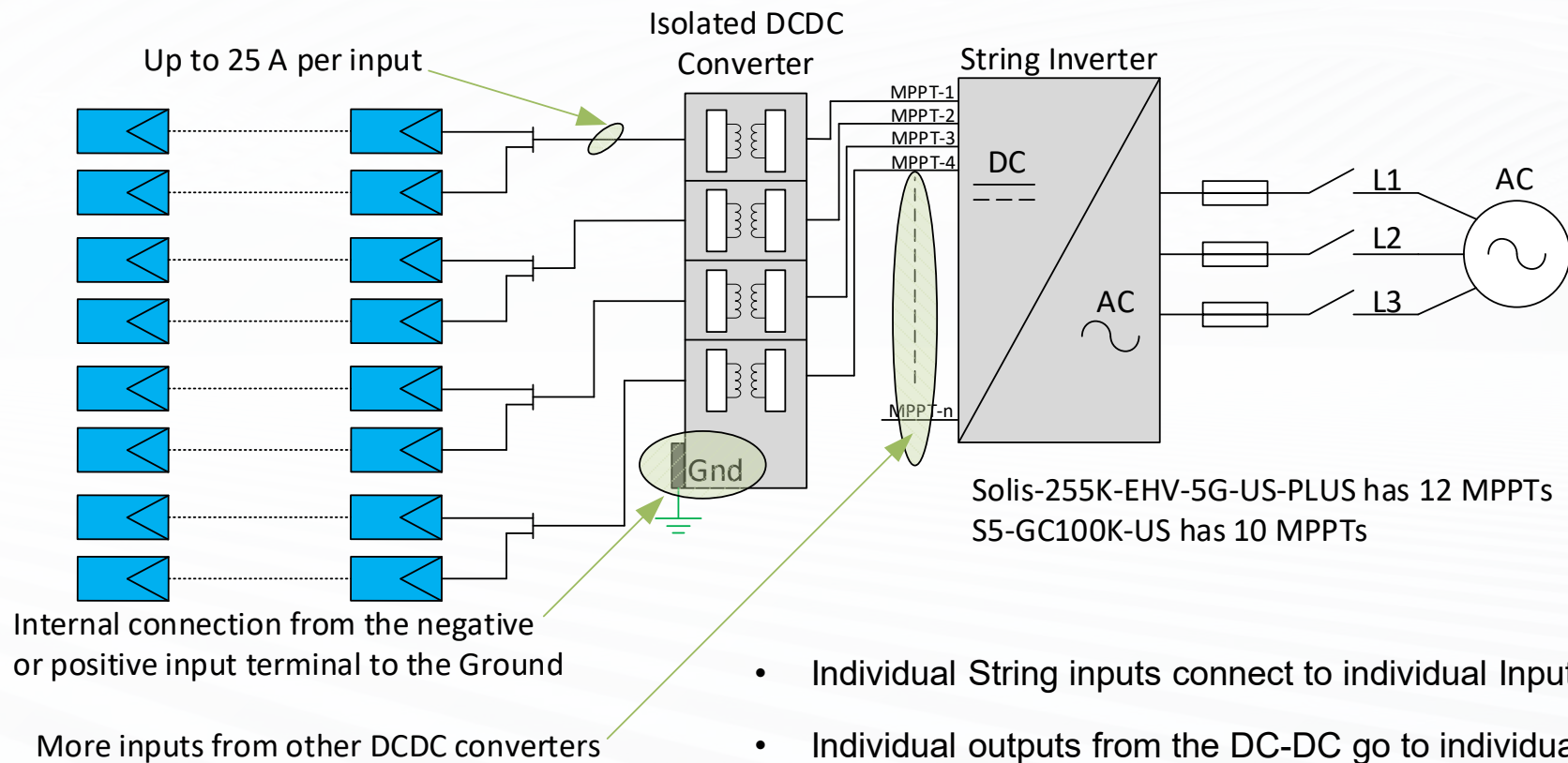
Solis-255K-EHV-5G-US-PLUS



S5-GC100K-US

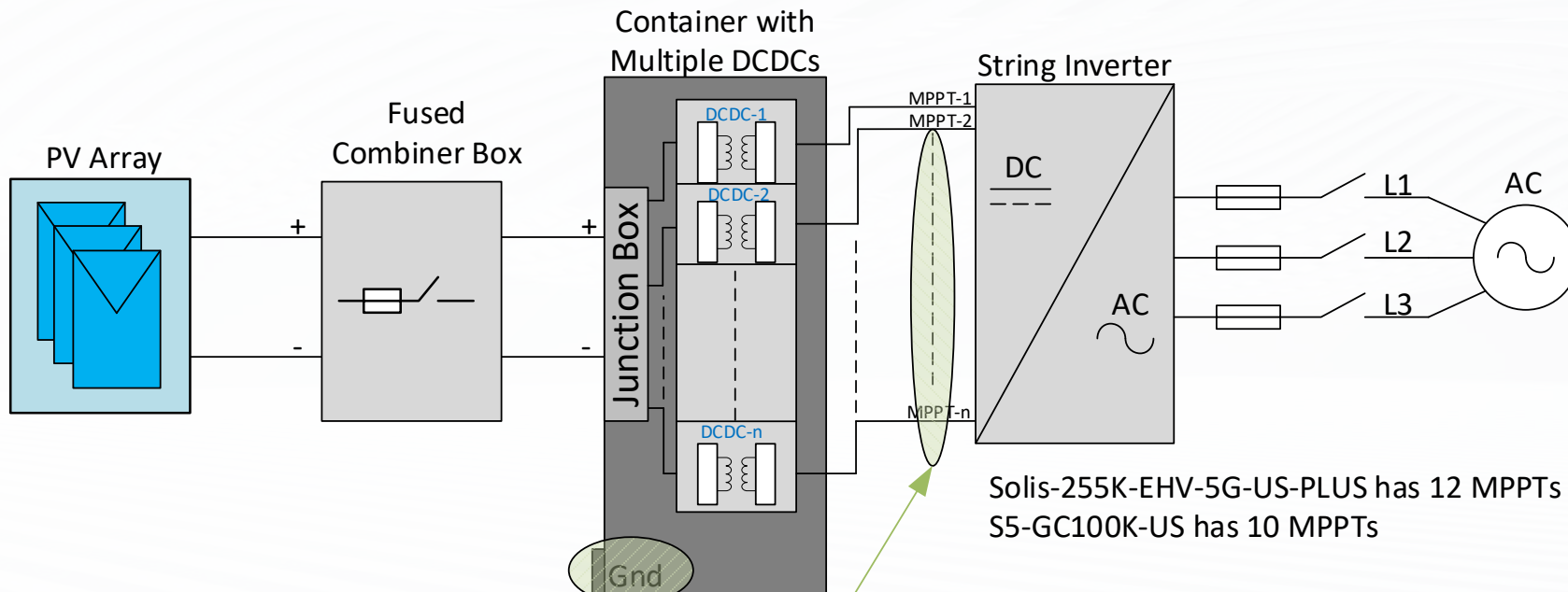
Repowering – Inverter Replacement with Grounded PV

Grounded Array with String Level DCDC Converter Approach



Repowering – Inverter Replacement with Grounded PV

Grounded Array with Combiner Box Level DCDC Converter Approach



Internal connection from the negative or positive input terminals to the Ground

More inputs from other DCDC converters

- Combined Strings connect to the DCDC converter combined Input Terminal
- Individual outputs from the DCDC go to individual MPPT inputs on the Inverter

Contact the Solis Team

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Thank you

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GINLONG TECHNOLOGIES CO., LTD.



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2 May 2023

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Q&A



Igor Mogilevski

Product Solutions and Engineering Director North America
Solis

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CATL launches 500 Wh/kg condensed matter battery

by Marija Maisch



Most-read online!

Europe entering golden age for PPAs, says Pexapark

By Pilar Sánchez Molina



Coming up next...

Thursday, 4 May 2023

5:00 PM - 6:00 PM CEST, Berlin

11:00 AM – 12:00 PM EDT, New York City

Tuesday, 30 May 2023

3:00 PM – 4:00 PM BST, London

4:00 PM – 5:00 PM CEST, Berlin

Many more to come!

**Greening
hydrogen, the
promise beyond
the hype**

**The importance of
manufacturing
execution systems
in the growing PV
industry**

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Tristan Rayner
Editor
pv magazine

**Thank you for
joining today!**