

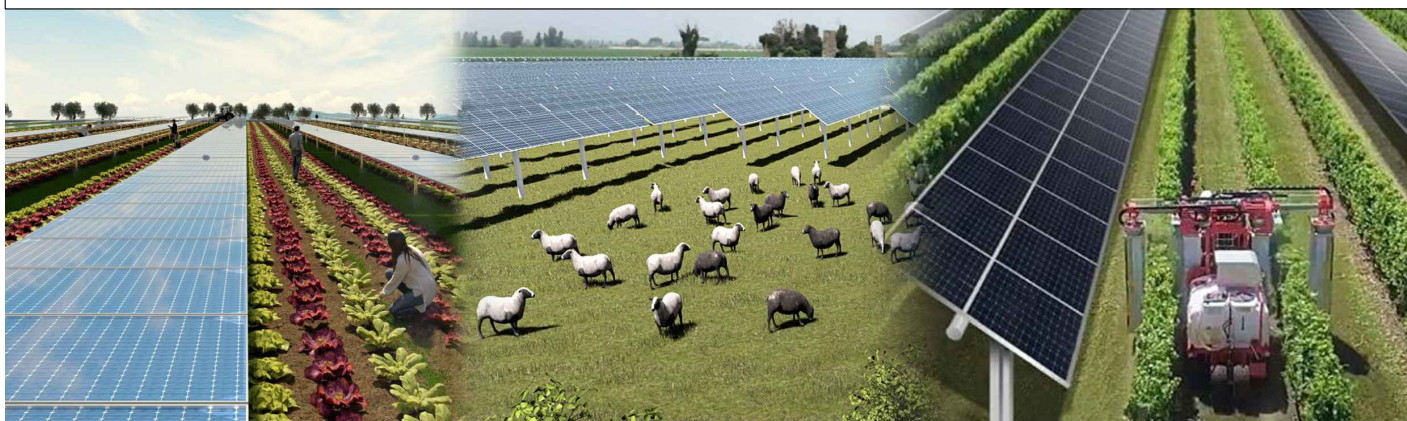


REGIONE EMILIA ROMAGNA

PROVINCIA DI MODENA

COMUNE DI CASTELFRANCO EMILIA

Progetto di un impianto agrivoltaico per la produzione di energia elettrica ubicato nel Comune di Castelfranco Emilia (MO) loc. Podere Bargellina Vecchia, strada Chiesa di Riolo della potenza nominale di 17640 kW (n. 2 lotti di impianto da 8820 kWp ciascuno) dotato di un sistema di accumulo dell'energia (energy storage system) comprensivo delle opere di rete per la connessione dell'impianto alla rete elettrica nazionale.



PROGETTO DEFINITIVO DELL'IMPIANTO DI PRODUZIONE COMPRESIVO DELLE OPERE DI RETE PER LA CONNESSIONE

ELABORATO

SCHEDA TECNICHE DEI COMPONENTI INSTALLATI

DATA: Novembre 2023

Scala: -

Nome file: NPDI2_CTF_J1 - Disciplinare descrittivo

PROPONENTE

NPD Italia II

NPDI ITALIA II S.r.l.

Galleria Passarella n. 2, 20122 Milano (MI)

Partita IVA 11987560965

PEC: npditaliaii@legalmail.it

NPD Italia II S.r.l.

Galleria Passarella, 2

20122 MILANO

P.IVA - C.F. 11987560965

ELABORATO DA:

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Dott. Sc. Amb. Enrico Forcucci
Via per Vittorito Zona PIP
65026 Popoli (PE)
Tel/Fax 085986763
PIVA 01819520683

Arch. Pasqualino Grifone
Piazza Sirena, 8
66023 - Francavilla al Mare



Agronomo Nicola Pierfranco Venti
Via A. Volta, 1
65026 Popoli (PE)

revisione	descrizione	data	Elab. n. J1
A			
B			
C			

Tiger Neo N-type 78HL4-BDV 605-625 Watt

BIFACIAL MODULE WITH
DUAL GLASS

N-Type

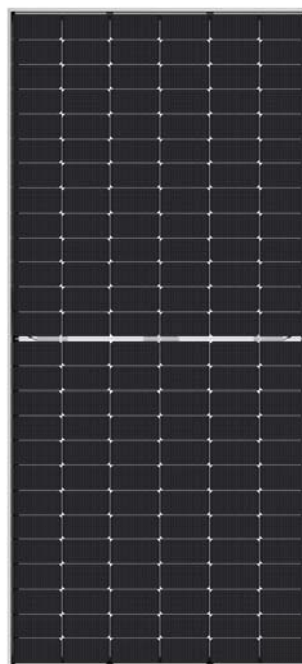
Positive power tolerance of 0~+3%

IEC61215(2016), IEC61730(2016)

ISO9001:2015: Quality Management System

ISO14001:2015: Environment Management System

ISO45001:2018
Occupational health and safety management systems



Key Features



SMBB Technology

Better light trapping and current collection to improve module power output and reliability.



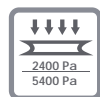
Hot 2.0 Technology

The N-type module with Hot 2.0 technology has better reliability and lower LID/LETID.



PID Resistance

Excellent Anti-PID performance guarantee via optimized mass-production process and materials control.



Enhanced Mechanical Load

Certified to withstand: wind load (2400 Pascal) and snow load (5400 Pascal).



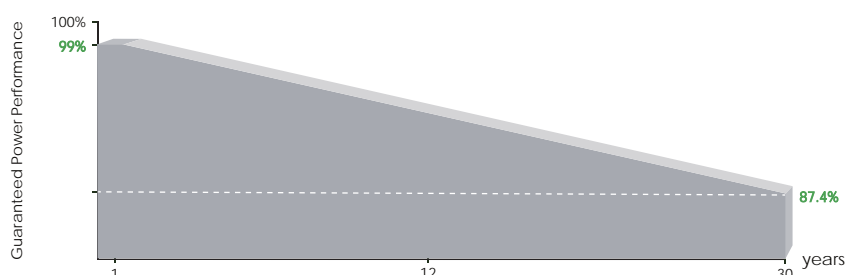
Higher Power Output

Module power increases 5-25% generally, bringing significantly lower LCOE and higher IRR.



Continuous Quality Assurance

LINEAR PERFORMANCE WARRANTY

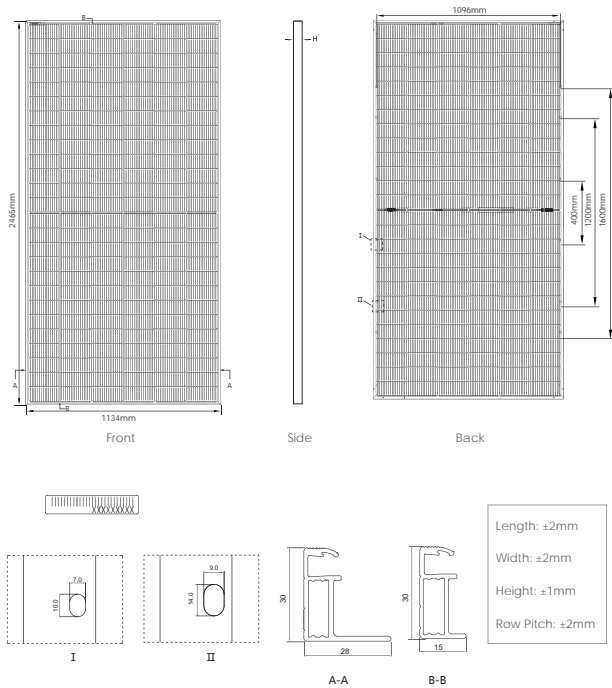


12 Year Product Warranty

30 Year Linear Power Warranty

0.40% Annual Degradation Over 30 years

Engineering Drawings



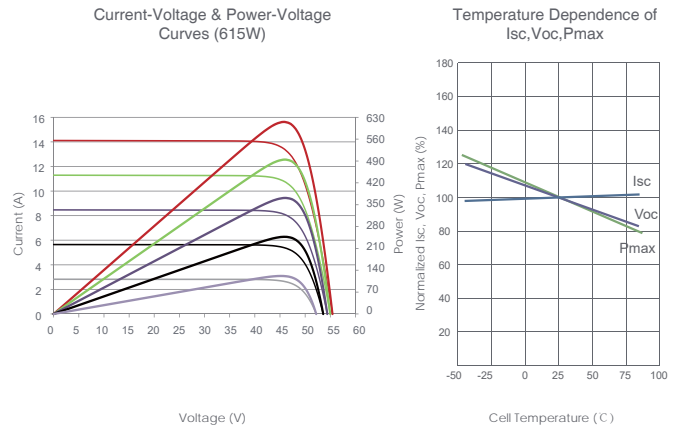
*This tolerance range applies only to the four-angle distance of the module as indicated above.

Packaging Configuration

(Two pallets = One stack)

36pcs/pallets, 72pcs/stack, 576pcs/ 40'HQ Container

Electrical Performance & Temperature Dependence



Mechanical Characteristics

Cell Type	N type Mono-crystalline
No. of cells	156 (2×78)
Dimensions	2465×1134×30mm (97.05×44.65×1.18 inch)
Weight	34.6kg (76.38 lbs)
Front Glass	2.0mm, Anti-Reflection Coating
Back Glass	2.0mm, Heat Strengthened Glass
Frame	Anodized Aluminium Alloy
Junction Box	IP68 Rated
Output Cables	TUV 1×4.0mm ² (+): 400mm, (-): 200mm or Customized Length

SPECIFICATIONS

Module Type	JKM605N-78HL4-BDV		JKM610N-78HL4-BDV		JKM615N-78HL4-BDV		JKM620N-78HL4-BDV		JKM625N-78HL4-BDV	
	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax)	605Wp	455Wp	610Wp	459Wp	615Wp	462Wp	620Wp	466Wp	625Wp	470Wp
Maximum Power Voltage (Vmp)	45.42V	42.23V	45.60V	42.35V	45.77V	42.46V	45.93V	42.57V	46.10V	42.68V
Maximum Power Current (Imp)	13.32A	10.77A	13.38A	10.83A	13.44A	10.89A	13.50A	10.95A	13.56A	11.01A
Open-circuit Voltage (Voc)	55.17V	52.41V	55.31V	52.54V	55.44V	52.66V	55.58V	52.79V	55.72V	52.93V
Short-circuit Current (Isc)	13.95A	11.26A	14.03A	11.33A	14.11A	11.39A	14.19A	11.46A	14.27A	11.52A
Module Efficiency STC (%)	21.64%		21.82%		22.00%		22.18%		22.36%	
Operating Temperature(°C)	-40°C~+85°C									
Maximum system voltage	1500VDC (IEC)									
Maximum series fuse rating	30A									
Power tolerance	0~+3%									
Temperature coefficients of Pmax	-0.30%/°C									
Temperature coefficients of Voc	-0.25%/°C									
Temperature coefficients of Isc	0.046%/°C									
Nominal operating cell temperature (NOCT)	45±2°C									
Refer. Bifacial Factor	80±5%									

BIFACIAL OUTPUT-REAR SIDE POWER GAIN

		JKM605N-78HL4-BDV	JKM610N-78HL4-BDV	JKM615N-78HL4-BDV	JKM620N-78HL4-BDV	JKM625N-78HL4-BDV
5%	Maximum Power (P_{max})	635Wp	641Wp	646Wp	651Wp	656Wp
	Module Efficiency STC (%)	22.73%	22.91%	23.10%	23.29%	23.48%
15%	Maximum Power (P_{max})	696Wp	702Wp	707Wp	713Wp	719Wp
	Module Efficiency STC (%)	24.89%	25.10%	25.30%	25.51%	25.71%
25%	Maximum Power (P_{max})	756Wp	763Wp	769Wp	775Wp	781Wp
	Module Efficiency STC (%)	27.05%	27.28%	27.50%	27.73%	27.95%

*STC: Irradiance 1000W/m² Cell Temperature 25°C

NOCT: Irradiance 800W/m² Ambient Temperature 20°C

AM=1.5

AM=1.5

Wind Speed 1m/s

SUNNY CENTRAL

2200 / 2475 / 2500-EV / 2750-EV / 3000-EV



SC-2200-10 / SC-2475-10 / SC-2500-EV-10 / SC-2750-EV-10 / SC-3000-EV-10



**Full power
up to 35 °C**

Efficient

- Up to 4 inverters can be transported in one standard shipping container
- Overdimensioning up to 225% is possible
- Full power at ambient temperatures of up to 35 °C

Robust

- Intelligent air cooling system OptiCool for efficient cooling
- Suitable for outdoor use in all climatic ambient conditions worldwide

Flexible

- Conforms to all known grid requirements worldwide
- Q on demand
- Available as a single device or turnkey solution, including medium-voltage block

Easy to Use

- Improved DC connection area
- Connection area for customer equipment
- Integrated voltage support for internal and external loads

SUNNY CENTRAL 2200 / 2475 / 2500-EV / 2750-EV / 3000-EV

The new Sunny Central: more power per cubic meter

With an output of up to 3000 kVA and system voltages of 1100 V DC or 1500 V DC, the SMA central inverter allows for more efficient system design and a reduction in specific costs for PV power plants. A separate voltage supply and additional space are available for the installation of customer equipment. True 1500 V technology and the intelligent cooling system OptiCool ensure smooth operation even in extreme ambient temperature as well as a long service life of 25 years.

SUNNY CENTRAL 1000 V

Technical Data	Sunny Central 2200	Sunny Central 2475*
Input (DC)		
MPP voltage range V _{DC} (at 25 °C / at 35 °C / at 50 °C)	570 to 950 V / 800 V / 800 V	638 V to 950 V / 800 V / 800 V
Min. input voltage V _{DC, min} / Start voltage V _{DC, Start}	545 V / 645 V	614 V / 714 V
Max. input voltage V _{DC, max}	1100 V	1100 V
Max. input current I _{DC, max} (at 25 °C / at 50 °C)	3960 A / 3600 A	3960 A / 3600 A
Max. short-circuit current I _{DC, sc}	6400 A	6400 A
Number of DC inputs	24 double pole fused (32 single pole fused)	
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²	
Integrated zone monitoring	○	
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A	
Output (AC)		
Nominal AC power at cos φ =1 (at 35 °C / at 50 °C)	2200 kVA / 2000 kVA	2475 kVA / 2250 kVA
Nominal AC power at cos φ =0.8 (at 35 °C / at 50 °C)	1760 kW / 1600 kW	1980 kW / 1800 kW
Nominal AC current I _{AC, nom} = Max. output current I _{AC, max}	3300 A	3300 A
Max. total harmonic distortion	< 3% at nominal power	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range ^{1) 8)}	385 V / 308 V to 462 V	434 V / 347 V bis 521 V
AC power frequency / range	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz	
Min. short-circuit ratio at the AC terminals ⁹⁾	> 2	
Power factor at rated power / displacement power factor adjustable ^{8) 10)}	● 1 / 0.8 overexcited to 0.8 underexcited ○ 1 / 0.0 overexcited to 0.0 underexcited	
Efficiency		
Max. efficiency ²⁾ / European efficiency ²⁾ / CEC efficiency ³⁾	98.6% / 98.4% / 98.0%	98.6% / 98.4% / 98.0%
Protective Devices		
Input-side disconnection point	DC load break switch	
Output-side disconnection point	AC circuit breaker	
DC overvoltage protection	Surge arrester, type I	
AC overvoltage protection (optional)	Surge arrester, class I	
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III	
Ground-fault monitoring / remote ground-fault monitoring	○ / ○	
Insulation monitoring	○	
Degree of protection: electronics / air duct / connection area (as per IEC 60529)	IP65 / IP34 / IP34	
General Data		
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)	
Weight	< 3400 kg / < 7496 lb	
Self-consumption (max. ⁴⁾ / partial load ⁵⁾ / average ⁶⁾	< 8100 W / < 1800 W / < 2000 W	
Self-consumption (standby)	< 300 W	
Internal auxiliary power supply	Integrated 8.4 kVA transformer	
Operating temperature range ⁸⁾	-25 °C to 60 °C / -13 °F to 140 °F	
Noise emission ⁷⁾	67.0 dB(A)	
Temperature range (standby)	-40 °C to 60 °C / -40 °F to 140 °F	
Temperature range (storage)	-40 °C to 70 °C / -40 °F to 158 °F	
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month/year) / 0% to 95%	
Maximum operating altitude above MSL ⁸⁾ 1000 m / 2000 m / 3000 m / 4000 m	● / ○ / ○ / ○ (earlier temperature-dependent derating)	
Fresh air consumption	6500 m³/h	
Features		
DC connection	Terminal lug on each input (without fuse)	
AC connection	With busbar system (three busbars, one per line conductor)	
Communication	Ethernet, Modbus Master, Modbus Slave	
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)	
Enclosure / roof color	RAL 9016 / RAL 7004	
Supply transformer for external loads	○ (2.5 kVA)	
Standards and directives complied with	CE, IEC / EN 62109-1, IEC / EN 62109-2, BDEW-MSRL, IEEE1547, UL 840 Cat. IV, Arrêté du 23/04/08	
EMC standards	IEC / EN 61000-6-4, IEC / EN 61000-6-2, EN 55022, IEC 62920, FCC Part 15 Class A, Cisp 11, DIN EN55011:2017	
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001	
● Standard features ○ Optional * preliminary		
Type designation	SC-2200-10	SC-2475-10

1) At nominal AC voltage, nominal AC power decreases in the same proportion

2) Efficiency measured without internal power supply

3) Efficiency measured with internal power supply

4) Self-consumption at rated operation

5) Self-consumption at < 75% Pn at 25 °C

6) Self-consumption averaged out from 5% to 100% Pn at 25 °C

7) Sound pressure level at a distance of 10 m

8) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.

9) A short-circuit ratio of < 2 requires a special approval from SMA

10) Depending on the DC voltage

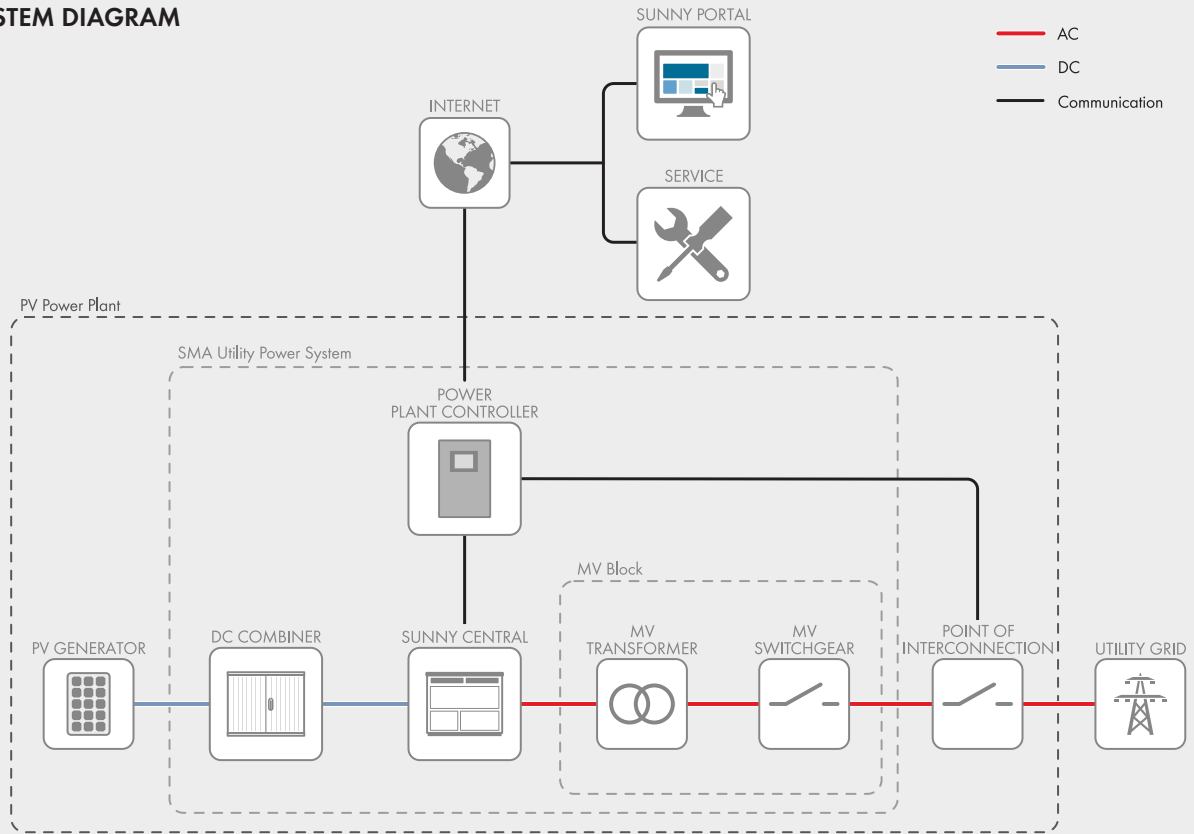
SUNNY CENTRAL 1500 V

Technical Data	Sunny Central 2500-EV	Sunny Central 2750-EV	Sunny Central 3000-EV*
Input (DC)			
MPP voltage range V _{DC} (at 25 °C / at 35 °C / at 50 °C)	850 V to 1425 V / 1200 V / 1200 V	875 V to 1425 V / 1200 V / 1200 V	956 V to 1425 V / 1200 V / 1200 V
Min. input voltage V _{DC, min} / Start voltage V _{DC, Start}	778 V / 928 V	849 V / 999 V	927 V / 1077 V
Max. input voltage V _{DC, max}	1500 V	1500 V	1500 V
Max. input current I _{DC, max} (at 25 °C / at 50 °C)	3200 A / 2956 A	3200 A / 2956 A	3200 A / 2970 A
Max. short-circuit current rating	6400 A	6400 A	6400 A
Number of DC inputs	32	32	32
Max. number of DC cables per DC input (for each polarity)	2 x 800 kcmil, 2 x 400 mm²	2 x 800 kcmil, 2 x 400 mm²	2 x 800 kcmil, 2 x 400 mm²
Integrated zone monitoring	○	○	○
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A		
Output (AC)			
Nominal AC power at cos φ = 1 (at 35 °C / at 50 °C)	2500 kVA / 2250 kVA	2750 kVA / 2500 kVA	3000 kVA / 2700 kVA
Nominal AC power at cos φ =0.8 (at 35 °C / at 50 °C)	2000 kW / 1800 kW	2200 kW / 2000 kW	2400 kW / 2160 kW
Nominal AC current I _{AC, nom} = Max. output current I _{AC, max}	2624 A	2646 A	2624 A
Max. total harmonic distortion	< 3% at nominal power	< 3% at nominal power	< 3% at nominal power
Nominal AC voltage / nominal AC voltage range ^{1) 8)}	550 V / 440 V to 660 V	600 V / 480 V to 690 V	655 V / 524 V to 721 V ⁹⁾
AC power frequency	50 Hz / 47 Hz to 53 Hz 60 Hz / 57 Hz to 63 Hz		
Min. short-circuit ratio at the AC terminals ¹⁰⁾	> 2		
Power factor at rated power / displacement power factor adjustable ^{8) 11)}	● 1 / 0.8 overexcited to 0.8 underexcited ○ 1 / 0.0 overexcited to 0.0 underexcited		
Efficiency			
Max. efficiency ²⁾ / European efficiency ²⁾ / CEC efficiency ³⁾	98.6% / 98.3% / 98.0%	98.7% / 98.5% / 98.5%	98.7% / 98.6% / 98.5%
Protective Devices			
Input-side disconnection point	DC load-break switch		
Output-side disconnection point	AC circuit breaker		
DC overvoltage protection	Surge arrester, type I		
AC overvoltage protection (optional)	Surge arrester, class I		
Lightning protection (according to IEC 62305-1)	Lightning Protection Level III		
Ground-fault monitoring / remote ground-fault monitoring	○ / ○		
Insulation monitoring	○		
Degree of protection: electronics / air duct / connection area (as per IEC 60529)	IP65 / IP34 / IP34		
General Data			
Dimensions (W / H / D)	2780 / 2318 / 1588 mm (109.4 / 91.3 / 62.5 inch)		
Weight	< 3400 kg / < 7496 lb		
Self-consumption (max. ⁴⁾ / partial load ⁵⁾ / average ⁶⁾	< 8100 W / < 1800 W / < 2000 W		
Self-consumption (standby)	< 370 W		
Internal auxiliary power supply	Integrated 8.4 kVA transformer		
Operating temperature range ⁸⁾	-25 to 60 °C / -13 to 140 °F		
Noise emission ⁷⁾	67.8 dB(A)		
Temperature range (standby)	-40 to 60 °C / -40 to 140 °F		
Temperature range (storage)	-40 to 70 °C / -40 to 158 °F		
Max. permissible value for relative humidity (condensing / non-condensing)	95% to 100% (2 month / year) / 0 % to 95%		
Maximum operating altitude above MSL ⁸⁾ 1000 m / 2000 m / 3000 m	● / ○ / ○ (earlier temperature-dependent derating)		
Fresh air consumption	6500 m³/h		
Features			
DC connection	Terminal lug on each input (without fuse)		
AC connection	With busbar system (three busbars, one per line conductor)		
Communication	Ethernet, Modbus Master, Modbus Slave		
Communication with SMA string monitor (transmission medium)	Modbus TCP / Ethernet (FO MM, Cat-5)		
Enclosure / roof color	RAL 9016 / RAL 7004		
Supply transformer for external loads	○ (2.5 kVA)		
Standards and directives complied with	CE, IEC / EN 62109-1, IEC / EN 62109-2, BDEW-MSRL, IEEE1547, Arrêté du 23/04/08		
EMC standards	CE, IEC / EN 62109-1, IEC / EN 62109-2, BDEW-MSRL, IEEE1547, Arrêté du 23/04/08 CISPR 11, CISPR 22, EN55011:2017, EN 55022, IEC/EN 61000-6-4, IEC/EN 61000-6-2, IEC 62920, FCC Part 15 Class A	CISPR 11, CISPR 22, EN55011:2017, EN 55022, IEC 62920, FCC Part 15 Class A	
Quality standards and directives complied with	VDI/VDE 2862 page 2, DIN EN ISO 9001		
● Standard features ○ Optional * preliminary			
Type designation	SC-2500-EV-10	SC-2750-EV-10	SC-3000-EV-10

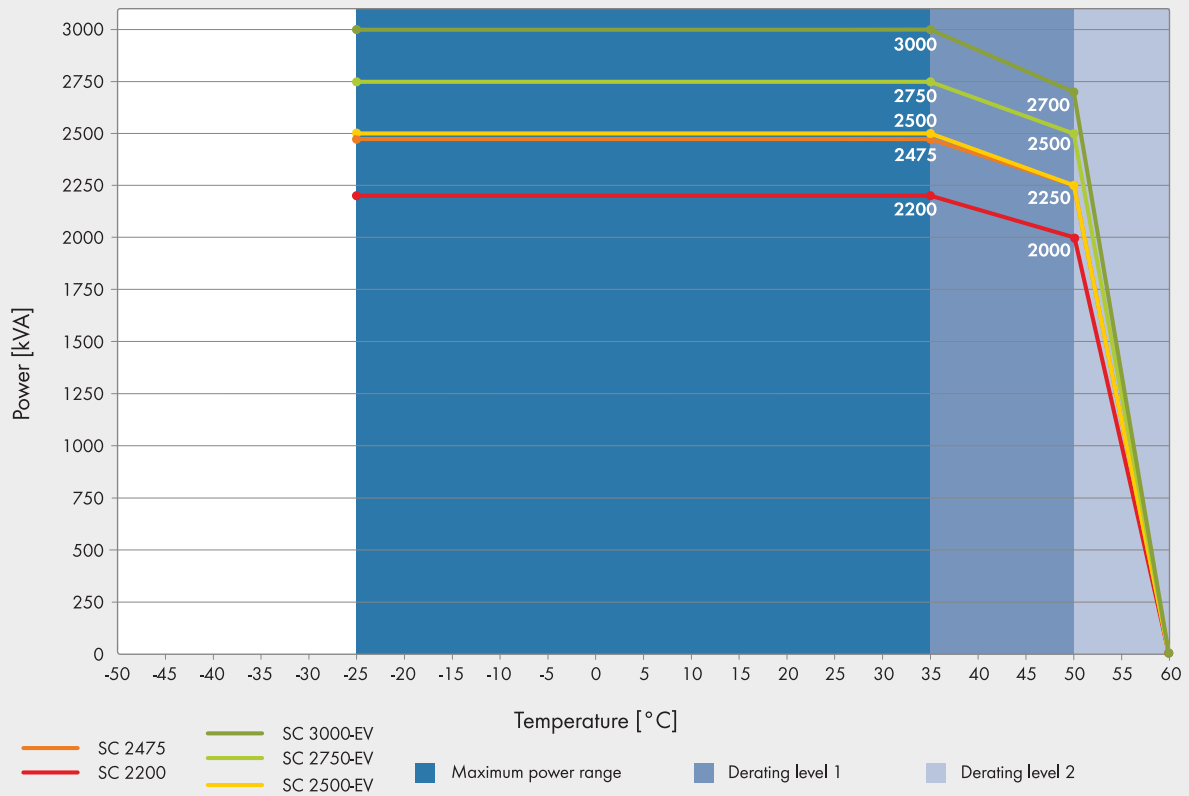
- 1) At nominal AC voltage, nominal AC power decreases in the same proportion
2) Efficiency measured without internal power supply
3) Efficiency measured with internal power supply
4) Self-consumption at rated operation
5) Self-consumption at < 75% Pn at 25 °C
6) Self-consumption averaged out from 5% to 100% Pn at 35 °C

- 7) Sound pressure level at a distance of 10 m
8) Values apply only to inverters. Permissible values for SMA MV solutions from SMA can be found in the corresponding data sheets.
9) AC voltage range can be extended to 753V for 50Hz grids only (option „Aux power supply: external“ must be selected, option “housekeeping” not combinable).
10) A short-circuit ratio of < 2 requires a special approval from SMA
11) Depending on the DC voltage

SYSTEM DIAGRAM



TEMPERATURE BEHAVIOR (at 1000 m)



MV POWER STATION

2200 / 2475 / 2500 / 2750 / 3000



MVPS 2200-20 / MVPS 2475-20 / MVPS 2500-20 / MVPS 2750-20 / MVPS 3000-20



Robust

- Station and all individual components type-tested
- Optimally suited to extreme ambient conditions

Easy to Use

- Plug and play concept
- Walk-in control rooms
- Completely pre-assembled for easy set-up and commissioning

Cost-Effective

- Easy planning and installation
- Low transport costs due to 20-foot container

Flexible

- Global solution for international markets
- Numerous options
- Compatible with MVPS 4400 – MVPS 6000

MV POWER STATION 2200 / 2475 / 2500 / 2750 / 3000

Turnkey Solution for PV Power Plants

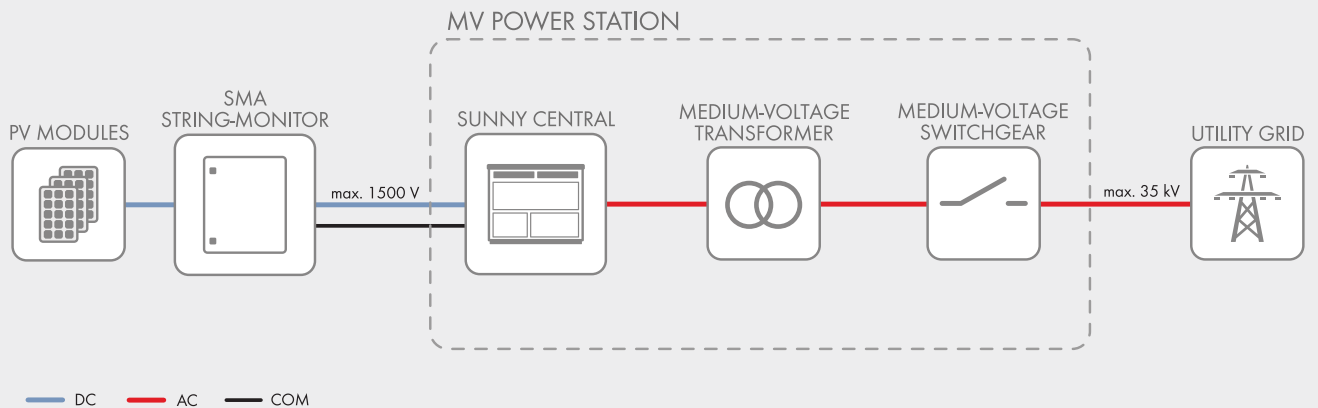
With the power of the new robust central inverters, the Sunny Central or Sunny Central Storage, and with perfectly adapted medium-voltage components, the new MV Power Station offers even more power density and is a turnkey solution available worldwide. The solution is the ideal choice for new generation PV power plants operating at 1500 V_{DC}. Delivered pre-configured in a 20-foot container, the solution is easy to transport and quick to assemble and commission. The MVPS and all components are type-tested. The MV Power Station combines rigorous plant safety with maximum energy yield and minimized deployment and operating risk.

MV POWER STATION

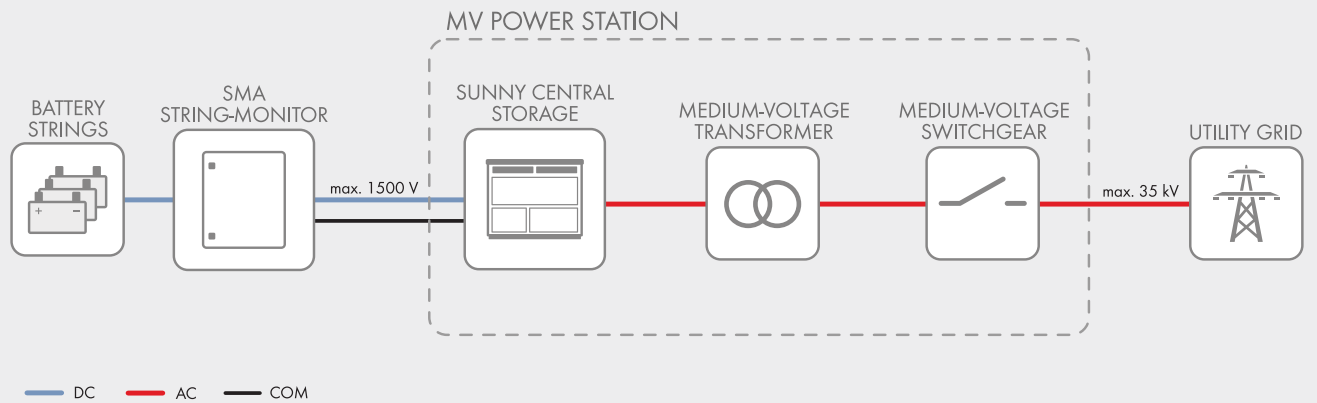
2200 / 2475 / 2500 / 2750 / 3000

Technical Data	MV Power Station 2200
Input (DC)	
Available inverters	1 x SC 2200 or 1 x SCS 2200
Max. input voltage	1100 V
Max. input current	3960 A
Number of DC inputs	24 double pole fused (32 single pole fused)
Integrated zone monitoring	○
Available DC fuse sizes (per input)	200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A
Output (AC) on the medium-voltage side	
Standard power at 1000 m and $\cos \varphi = 1$ (at 35°C / at 40°C / at 45°C) ¹⁾	2200 kVA / 2000 kVA / 0 kVA
Optionale power at 1000 m and $\cos \varphi = 1$ (at 35°C / at 50°C / at 55°C) ¹⁾	2200 kVA / 2000 kVA / 0 kVA
Typical nominal AC voltages	6.6 kV to 35 kV
AC power frequency	50 Hz / 60 Hz
Transformer vector group Dy11 / YNd11	● / ○
Transformer cooling methods ONAN ²⁾ / KNAN ²⁾	● / ○
Max. output current at 33 kV	39 A
Transformer no-load losses Standard / Ecodesign ³⁾	● / ○
Transformer short-circuit losses Standard / Ecodesign ³⁾	● / ○
Max. total harmonic distortion	< 3%
Reactive power feed-in	○ up to 60% of AC power
Power factor at rated power / displacement power factor adjustable	1 / 0.8 overexcited to 0.8 underexcited
Inverter efficiency	
Max. efficiency	98.6%
European efficiency	98.4%
CEC weighted efficiency ⁴⁾	98.0%
Protective devices	
Input-side disconnection point	DC load-break switch
Output-side disconnection point	Medium-voltage vacuum circuit breaker
DC overvoltage protection	Surge arrester type I
Galvanic isolation	●
Internal arc classification medium-voltage control room (according to IEC 62271-202)	IAC A 20 kA 1 s
General Data	
Dimensions of the 20-foot ISO container (W / H / D) ⁵⁾	6.058 m / 2.591 m / 2.438 m
Weight	< 16 t
Self-consumption (max. / partial load / average) ¹⁾	< 8.1 kW / < 1.8 kW / < 2.0 kW
Self-consumption (stand-by) ¹⁾	< 300 W
Degree of protection according to IEC 60529	Control rooms IP23D, inverter electronics IP65
Environment: standard / chemically active / dusty	● / ○ / ○
Degree of protection according to IEC 60721-3-4 (4C1, 4S2 / 4C2, 4S2 / 4C2, 4S4)	● / ○ / ○
Maximum permissible value for relative humidity	15% to 95%
Max. operating altitude above mean sea level 1000 m / 2000 m / 3000 m / 4000	● / ○ / ○ / ○ (earlier temperature-dependent de-rating)
Fresh air consumption of inverter and transformer	6500 m³/h
Features	
DC terminal	Terminal lug
AC connection	Outer-cone angle plug
Tap changer for MV-transformer: without / with	● / ○
Shield winding for MV-Transformer: without / with	● / ○
Communication package	○
Station enclosure color	RAL 7004
Transformer for external loads: without / 20 kVA / 30 kVA	● / ○ / ○
Medium-voltage switchgear: without / 2 feeders / 3 feeders	● / ○ / ○
1 or 2 cable feeders with load-break switch, 1 transformer feeder with circuit breaker, internal arc classification IAC A FL 20 kA 1 s according to IEC 62271-200	
Accessories for medium-voltage switchgear: without / auxiliary contacts / motor for transformer feeder / cascade control / monitoring	● / ○ / ○ / ○ / ○
Oil containment	○
Industry standards (for other standards see the inverter datasheet)	IEC 62271-202, IEC 62271-200, IEC 60076 , CSC certificate, EN 50588-1
● Standard features ○ Optional features – Not available	
Type designation	MVPS-2200-20

System diagram with Sunny Central



System diagram with Sunny Central Storage





SMA Solar Technology AG · Sonnenallee 1 · 34266 Niestetal · GERMANY

SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal

GERMANY

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Date 28.01.2019

**Medium Voltage Grid Connection in Italy
MVPS Compliance according to CEI 0-16**

Hereby we confirm that our Medium Voltage Power Station (MVPS) is compliant to the Italian Standard CEI 0-16. According paragraph 8.5.13 of this standard there is a limit on 20 kV grid connection for Medium Voltage Transformers (MVT), defined with a transformer power of 2000 kVA and a short circuit voltage V_{cc} of 6 %. Higher power classes are allowed in case of using higher short circuit impedances, to reduce the short circuit power according to paragraph 8.5.13. SMA will deliver the following transformers for 20 kV grid connection:

MVPS	DC Voltage	MVT power	AC Voltage	V_{cc}
2200	1000 V	2000 kVA	20 kV	> 6.00 %
2475	1000 V	2250 kVA	20 kV	> 6.75 %
2500	1500 V	2250 kVA	20 kV	> 6.75 %
2750	1500 V	2500 kVA	20 kV	> 7.50 %
3000	1500 V	2700 kVA	20 kV	> 8.10 %

There is also a limit for the maximum power of 6000 kVA that can be energized at the same time according to paragraph 8.5.14 of the standard CEI 0-16. In this case SMA Solar Technology AG can offer the option Cascade Control for a delayed switching of the MV transformers, to reduce the inrush current

Yours sincerely,

SMA Solar Technology AG

i.A. 

i. A. Thomas Weiss

Technical Product Manager

Business Unit Utility


i.A.

i. A. Bernhard Voll

Platform Product Manager

Business Unit Utility

DC-CMB-U10-16 / DC-CMB-U10-24 / DC-CMB-U10-32 /
DC-CMB-U15-16 / DC-CMB-U15-24 / DC-CMB-U15-32



Robust

- Stable housing made of glass-fiber-reinforced polyester
- Indoor and outdoor installation possible thanks to IP54 degree of protection

- Can be operated at ambient temperatures of -25°C to 60°C and at altitudes of up to 4000 m above MSL

Easy to Use

- Easy to install thanks to its compact structure and low weight
- Integrated DC load-break switch for ultra-high safety

Versatile

- For PV array voltages of 1000 V and 1500 V
- Collection and safeguarding of 16, 24 or 32 strings for flexibility during the system design phase

SMA STRING-COMBINER

For safe collection of all strings in the PV field

The boxes can be installed quickly, safely and easily both indoors and outdoors thanks to their compact dimensions, while their robust enclosure guarantees durability and reliable safety in the PV field. The SMA String-Combiners with 24 and 32 string inlets are fitted with two cable outlets per pole as standard and cover – just like the Combiner with 16 string inlets – a sealing range of 17 to 38.5 millimeters. Cables with cross-sections of 70 to 400 mm² can be inserted.

SMA STRING-COMBINER

for 1000 V_{DC} systems

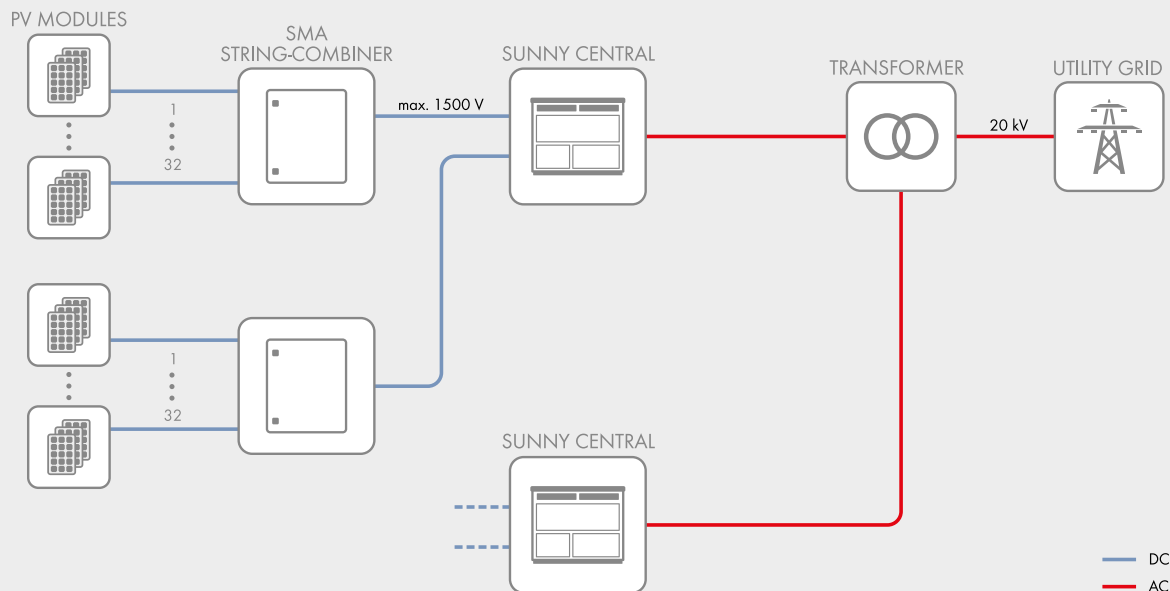
Technical Data	DC-CMB-U10-16	DC-CMB-U10-24	DC-CMB-U10-32
Input (DC)			
Rated voltage	1000 V	1000 V	1000 V
Altitude derating (rated voltage)	2001 m to 3000 m above MSL = reduction by 1.0% per 100 m 3001 m to 4000 m above MSL = reduction by 1.2% per 100 m		
Number of string inputs / fuse holders per pole	16	24	32
Rated current	13.75 A	12.5 A	12.5 A
Fuse type *	10.3 x 38 - 1000 VDC - gPV		
String connection	Connection to the fuse holder		
Sealing range of cable gland	5 mm to 8 mm		
Output (DC)			
Rated current	220 A	300 A	360 A
Temperature derating (rated current)	>50°C operating temperature = reduction by 1% per K		
DC switch (load-break switch)	250 A / 1000 V	400 A / 1000 V	400 A / 1000 V
Surge arrester	Type 2, I _n = 15 kA; I _{max} = 40 kA		
DC output	Busbar (ring terminal lug M12)		
Number of DC outputs	1	1 / 2	1 / 2
Conductor cross-section	Busbar 70 mm ² to 400 mm ²		
Sealing range of cable glands	17 mm to 38.5 mm	17 mm to 38.5 mm	17 mm to 38.5 mm
Enclosure / Ambient Parameters			
IP degree of protection according to IEC 60529	IP 54 / self-ventilated	IP 54 / self-ventilated	IP 54 / self-ventilated
Enclosure material	Glass-fiber reinforced plastic / UV-resistant		
Dimensions (W / H / D), wall mounting bracket and string cable harness included	550 / 650 / 260 mm (21.65 / 25.59 / 10.24 inch)		590 / 790 / 285 mm (23.23 / 31.10 / 11.22 inch)
Max. weight	24.2 kg (53.5 lb)	27.4 kg (60.5 lb)	34 kg (75 lb)
Protection class (according to IEC 61140)	II	II	II
Mounting type	Wall mounting		
Ambient temperature in operation / during storage	-25°C to +60°C / -40°C to +70°C		
Relative humidity	0% to 95%, non-condensing		
Max. altitude above MSL	4000 m	4000 m	4000 m
Standards			
Compliance	CE, IEC 61439-1, IEC 61439-2		
* accessory required			

SMA STRING-COMBINER

for 1500 V_{DC} systems

Technical Data	DC-CMB-U15-16	DC-CMB-U15-24	DC-CMB-U15-32
Input (DC)			
Rated voltage	1500 V	1500 V	1500 V
Altitude derating (rated voltage)	2001 m to 3000 m above MSL = reduction by 1.0% per 100 m 3001 m to 4000 m above MSL = reduction by 1.2% per 100 m		
Number of string inputs / fuse holders per pole	16	24	32
Rated current	17.2 A	13.75 A	10.31 A
Fuse type*	10.3 x 85 - 1500 VDC - gPV		
String connection	Connection to the fuse holder		
Sealing range of cable gland	5 mm to 8 mm		
Output (DC)			
Rated current	275 A	330 A	330 A
Temperature derating (rated current)	>50°C operating temperature = reduction by 1% per K		
DC switch (load-break switch)	400 A / 1500 V	400 A / 1500 V	400 A / 1500 V
Surge arrester	Type 2, I _n = 15 kA; I _{max} = 40 kA		
DC output	Busbar (ring terminal lug M12)		
Number of DC outputs	1	1 / 2	1 / 2
Conductor cross-section	Busbar 70 mm ² to 400 mm ²		
Sealing range of cable glands	17 mm to 38.5 mm	17 mm to 38.5 mm	17 mm to 38.5 mm
Enclosure / Ambient Parameters			
IP degree of protection according to IEC 60529	IP 54 / self-ventilated	IP 54 / self-ventilated	IP 54 / self-ventilated
Enclosure material	Glass-fiber reinforced plastic / UV-resistant		
Dimensions (W / H / D), wall mounting bracket and string cable harness included	550 / 650 / 260 mm (21.65 / 25.59 / 10.24 inch)		590 / 790 / 285 mm (23.23 / 31.10 / 11.22 inch)
Max. weight	25 kg (55 lb)	28 kg (62 lb)	40 kg (88 lb)
Protection class (according to IEC 61140)	II	II	II
Mounting type	Wall mounting		
Ambient temperature in operation / during storage	-25°C to +60°C / -40°C to +70°C		
Relative humidity	0% to 95%, non-condensing		
Max. altitude above MSL	4000 m	4000 m	4000 m
Standards			
Compliance	CE, IEC 61439-1, IEC 61439-2		
* accessory required			

SYSTEM EXAMPLE



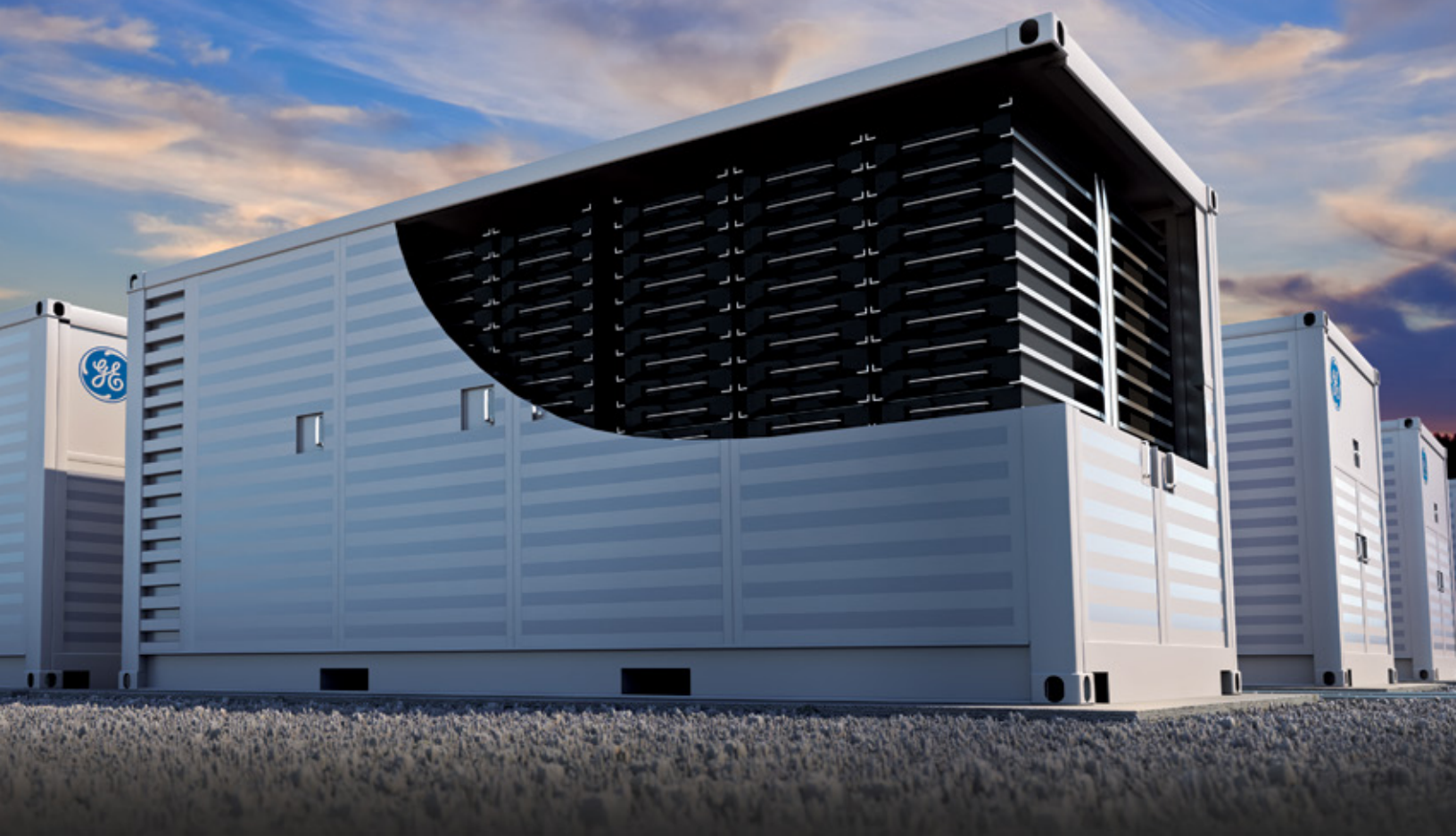


GE Power



RESERVOIR SOLUTIONS

Flexible, modular
Energy Storage Solutions
unlocking value across the
electricity network



TODAY'S ENVIRONMENT

The electricity industry is facing new challenges that have not been seen for the past 100 years. As consumers become active power producers who demand clean, reliable, and affordable power, the transforming grid needs innovative technical solutions that can unlock new business models and revenue streams.

**78% OF THE 9000GW+ OF NEW
GENERATION FORECAST TO BE BUILT BY 2040
WILL BE RENEWABLE**

**TOTAL ENERGY STORAGE SOFTWARE
REVENUE TO HIT \$3.3 BILLION BY 2025**

Sources: Bloomberg - New Energy Outlook Report
Navigant Research - Energy Storage Software Report
Navigant Research - Global DER Deployment Forecast

This change to energy generation and consumption is being driven by three powerful trends: the arrival of increasingly affordable distributed power technologies, decarbonization of the world's electricity network through the introduction of more renewable energy sources, and the emergence of digital technologies.



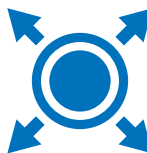
Decarbonization

The rapid deployment of low-carbon technologies such as wind and solar is making it increasingly difficult to forecast variable generation, creating challenges around grid stability, congestion and market volatility.



Digitization

A rise in the number of connected devices and smart sensors enables fast decision-making on dynamic and nodal prices, while intelligent control systems and internet-enabled software optimize power plants and the grid.



Decentralization

The growing penetration of distributed energy resources, including renewables and storage, is creating more “prosumers” (end users who are active in the power system), greatly increasing distribution grid complexity.

INTEGRATING INTERMITTENT
RENEWABLES INTO AN AGING
GRID REQUIRES **FLEXIBLE AND
RESILIENT TECHNOLOGIES,**
ABLE TO **RAMP QUICKLY AND
DYNAMICALLY ADJUST TO**
REAL-TIME GRID SIGNALS

ANNUAL INSTALLED CAPACITY OF
DISTRIBUTED ENERGY RESOURCES IS EXPECTED
TO REACH **530 GW BY 2026**

WHY ENERGY STORAGE?

A battery energy storage solution offers new application flexibility and unlocks new business value across the energy value chain, from conventional power generation, transmission & distribution, and renewable power, to industrial and commercial sectors. Energy storage supports diverse applications including firming renewable production, stabilizing the electrical grid, controlling energy flow, optimizing asset operation and creating new revenue by delivering:



Active Power Services

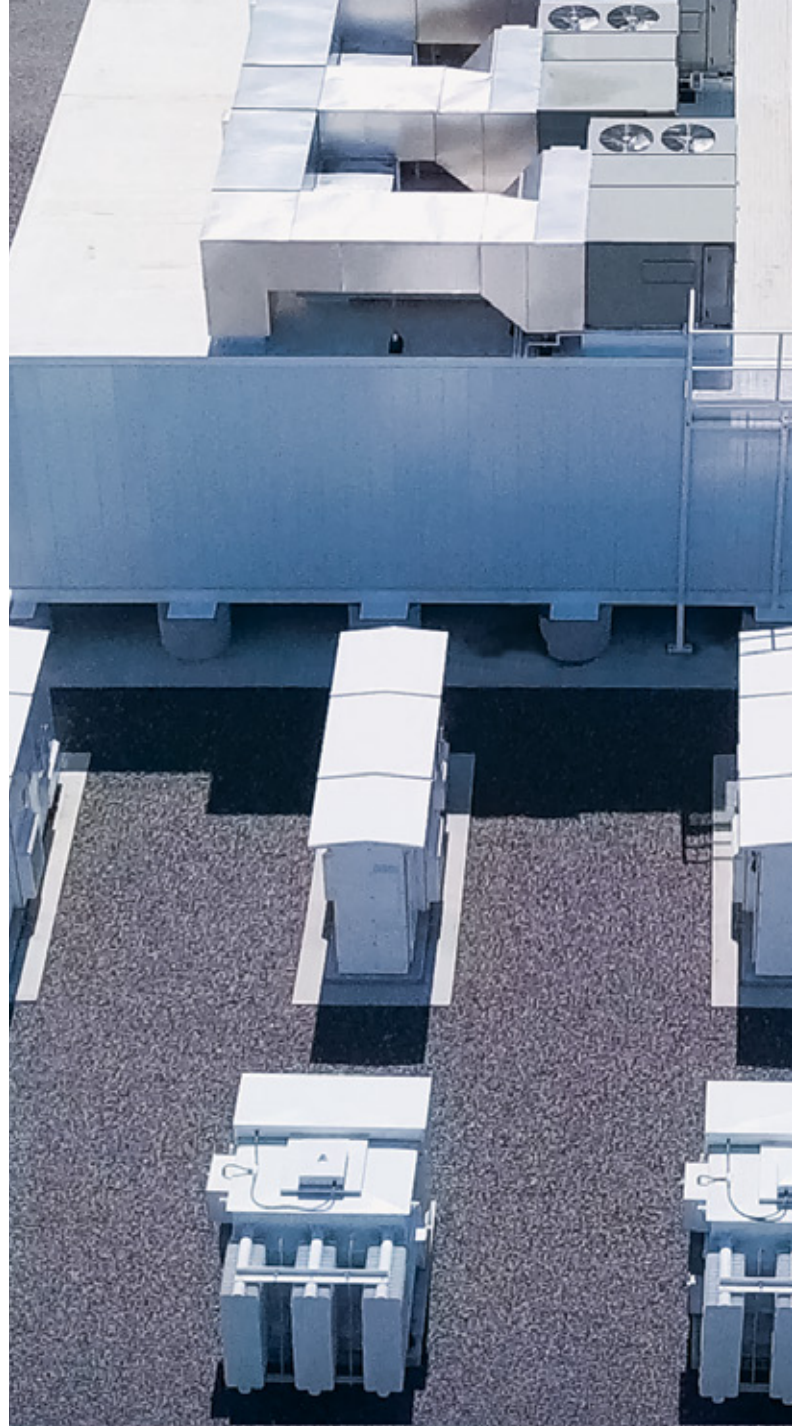
- Frequency regulation
- Frequency response
- Peak shaving/firming
- Remote power commands
- Ramp rate control
- Curtailment avoidance
- Scheduled dispatch/shifting
- Scheduled power commands
- State of charge management
- Islanding
- Black start



Reactive Power Services

- Voltage control
- Voltage droop
- Power factor control
- VAR control

\$103B INVESTMENT IN ENERGY STORAGE PROJECTS BY 2030



Outcomes achieved with GE'S RESERVOIR SOLUTION

- **ENABLE UP TO 50% MORE SOLAR ENERGY SALES** WITH ENHANCED PV TO INVERTER LOADING RATIO
- **UP TO 50% REDUCED CONSTRUCTION TIME** WITH FACTORY BUILT & TESTED SOLUTION

UNLOCKING NEW BUSINESS VALUE WITH GE'S RESERVOIR ENERGY STORAGE SOLUTION



Improve Financial Performance

Monetize assets through new revenue streams, increased asset utilization, improved yield, and reduced operating costs.



Increase Renewables Integration

Improve integration and maximize utilization of the energy generated from photovoltaics (PV) and wind turbines.



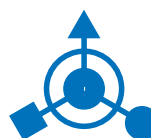
Optimize Electrical Grid

Defer upgrades, relieve congestion, control voltage, provide reserves and ancillary services, and improve reliability with backup power and black start functionality.



Reduce Energy Costs

Commercial and industrial end users can mitigate demand charges, optimize differential (Time of Day) energy prices, and benefit from additional onsite PV generation.



Develop Microgrids

Create a new and more flexible grid by locally integrating renewable generation and smart devices with energy storage and real-time communication.

Courtesy:
Convergent
Energy + Power

- **UP TO 15% EXTENDED BATTERY LIFE** UTILIZING PROPRIETARY BLADE PROTECTION UNITS
- **IMPROVE SAFETY** BY REDUCING FAULT CURRENT BY **UP TO 5X**

**GE'S RESERVOIR IS A FLEXIBLE
ASSET THAT HELPS ENABLE GRID
OPTIMIZATION**

GE APPROACH

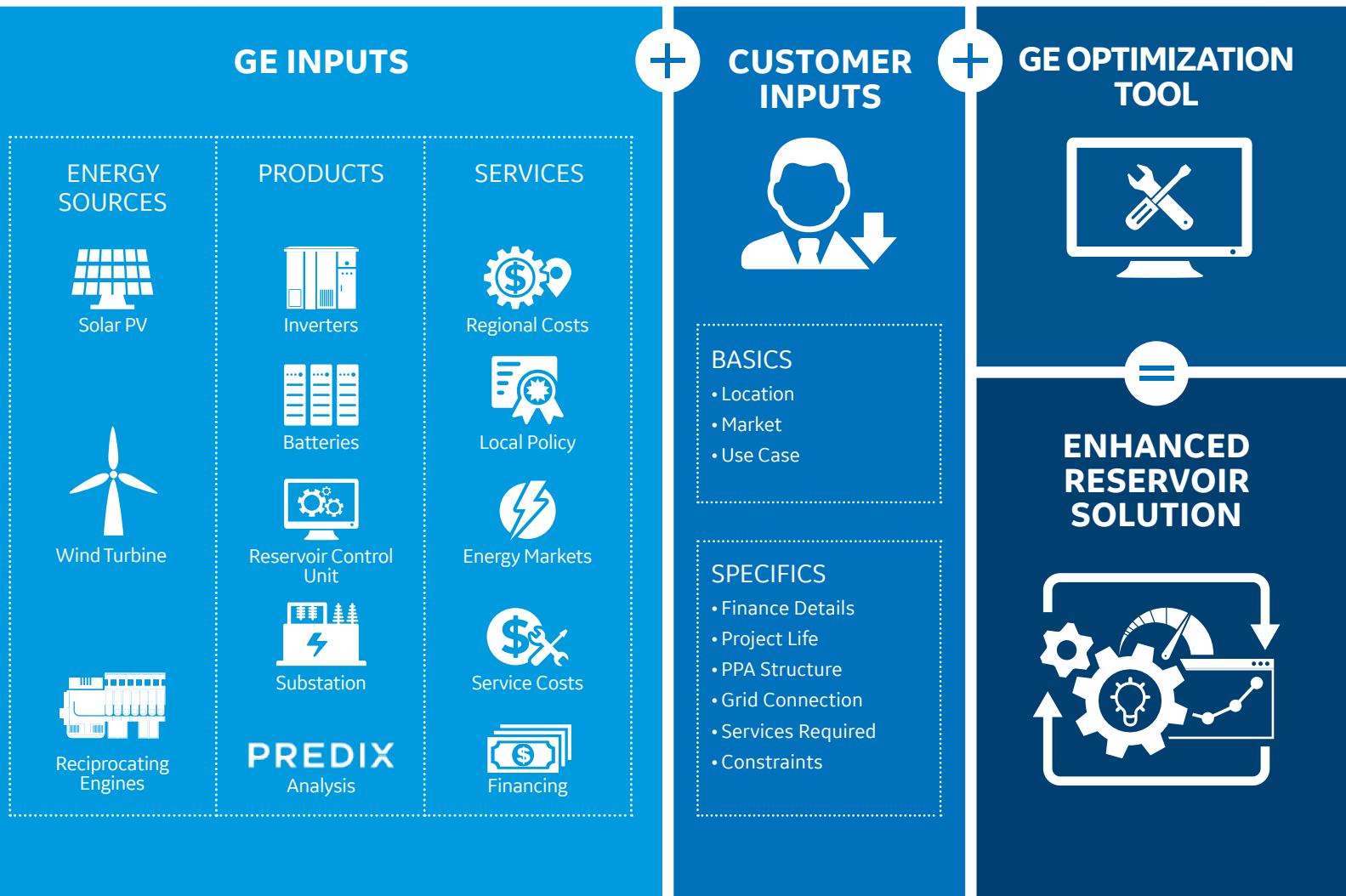
GE's broad portfolio of Reservoir Solutions can be tailored to your operational needs, enabling efficient, cost-effective storage distribution and utilization of energy where and when it's needed most. Our expert systems and applications teams utilize specialized techno-economic tools to help optimize the lifetime economics of a project. Our approach results in an investment grade business case that provides the basis of project planning and financing.

GE's System Approach



System Design Process & Optimization

Once the project scope, business objectives and services are established, GE's technical experts will define the energy sources, equipment and services required. Using advanced system planning and optimization tools, GE will deliver a tailored solution to meet the desired objectives.





GE SOLUTION

GE's Reservoir is a flexible, compact energy storage solution for AC or DC coupled systems. The Reservoir solution combines GE's advanced technologies and expertise in plant controls, power electronics, battery management systems and electrical balance of plant – all backed by GE's performance guarantees.

POWER CONVERSION

- Inverters are a bidirectional system converting AC to DC for battery charge and DC to AC for discharge
- 4 quadrant operation
- High efficiency

BATTERY MANAGEMENT

- Battery Protection Unit
- Long life Li-ion battery
- Integrated lockable disconnect
- Active string balancing
- Factory tested
- Field replacement

PURPOSE BUILT ENCLOSURES

- Ships with batteries installed
- Enhanced cooling and insulation
- Built in redundancy for 25 years of life
- Fast and flexible installation

RESERVOIR CONTROL UNIT

- Advanced functionalities to monitor batteries and help optimize asset operations
- Based on GE Mark™ Vle



FLEXIBLE SYSTEM DELIVERY

The solution can be delivered as Engineered Equipment Package (EEP), Engineering, Procurement, and Construction (EPC) turnkey solution or lease and financing arrangement.

MV TRANSFORMER

- Connects to any MV network up to 66kV through a step-up transformer
- Dry or oil-type transformer designed for both outdoor or e-house indoor environment

MV SWITCHGEAR

- MV switchgear and LV auxiliaries integrated into an ISO container for easy site installation

CONSULTING & SERVICES

- Technical and economic feasibility studies
- Network analysis
- Project management & design
- Real-time optimization services
- Long term service contracts
- Performance guarantees

SOFTWARE SUITE

- Asset performance management
- Fleet management
- Dispatch optimization

World's First Hybrid Electric Gas Turbine,
10 MW/4.3 MWh Energy Storage Solution

RESERVOIR STORAGE UNITS

The Reservoir Storage unit is a **modular** high density solution that is factory built and tested to reduce project risk, shorten timelines and cut installation costs. The Reservoir Storage unit is built with GE's Battery Blade design to achieve an industry leading energy density and minimized footprint. GE's proprietary Blade Protection Unit actively balances the safety, life and performance of each Battery Blade, extending battery life by up to 15% and reduce fault currents by up to 5X. The modular system has multiple installation and cabling options including pad or pier and is configured to minimize operation and maintenance (O&M) expenses over the life of the project with all weather capabilities and high efficiency cooling system.

ELECTRICAL INTEGRATION

- DC disconnect, service rated
- Auxiliary power equipment
- Optional combiner package for DC coupled PV
- Bottom and front entry cable option

ENCLOSURE

- High density configuration with reduced footprint
- All weather capabilities
- High efficiency cooling
- Long service life

BATTERY BLADE UNIT

- Integrated protection unit
- Serviceable with integrated lockable disconnect device
- Digital twin technology for lifecycle management
- 1500V class with less cable, fuses and switches
- Tier 1 Li-Ion cells for highest cycle life

BLADE PROTECTION UNIT (BPU)

- Active string regulation to extend life by up to 15%
- Reduce fault currents by up to 5X to improve safety
- Intelligent DC bus enables direct PV integration
- Enables safe replacement of individual battery modules
- Reduces NFPA PPE levels from HRC4 to HRC2

Large Energy Reservoir, 20' Package, 1.2 MW / 4 MWh*

* Final Specifications subject to change

SYSTEM CONFIGURATIONS

The Reservoir Solution can be designed in a power or energy configuration depending on the required application. In an energy configuration, the batteries are used to inject a steady amount of power into the grid for an extended period of time. In a power configuration, the batteries are used to inject a large amount of power into the grid over a short period of time. The configuration of power or energy is determined by the ratio of inverters to batteries.

Modular and Scalable Solution



GE'S **DC COUPLED RESERVOIR SOLUTION** ENABLES
ENHANCED PV TO INVERTER LOADING RATIO RESULTING
IN UP TO **50%** **INCREASE IN ANNUAL SOLAR**
ENERGY SALES PER SITE

TYPICAL RESERVOIR APPLICATIONS

Standalone Applications

Generation Transmission Distribution



POWER

Voltage Regulation

Compensate anomalies or disturbances (e.g., voltage magnitude, harmonics, etc.) by sending reactive energy into system.



Frequency Response

Provide fast regulation of grid frequency to balance supply and demand.



Frequency Regulation

Provide regulation of grid frequency to balance supply and demand based on signals sent by the grid operator.



Renewable Integration

Balance the local excesses or deficits of renewable generation caused by rapid weather fluctuations.



Black Start

Energize part of the generation asset without outside assistance after a blackout.



Back-Up

Store energy to maintain service continuity and grid resilience in the event of an outage.



Peak Management

Reduce grid capacity needs during peak periods with local storage.



Shifting

Buy or produce electricity at low price (off-peak) to store and sell at peak price.



ENERGY

Capacity

Store renewable energy production for peak and base load consumption.



Integrated Hybrid Solution Applications

POWER

ENERGY



Solar



Wind

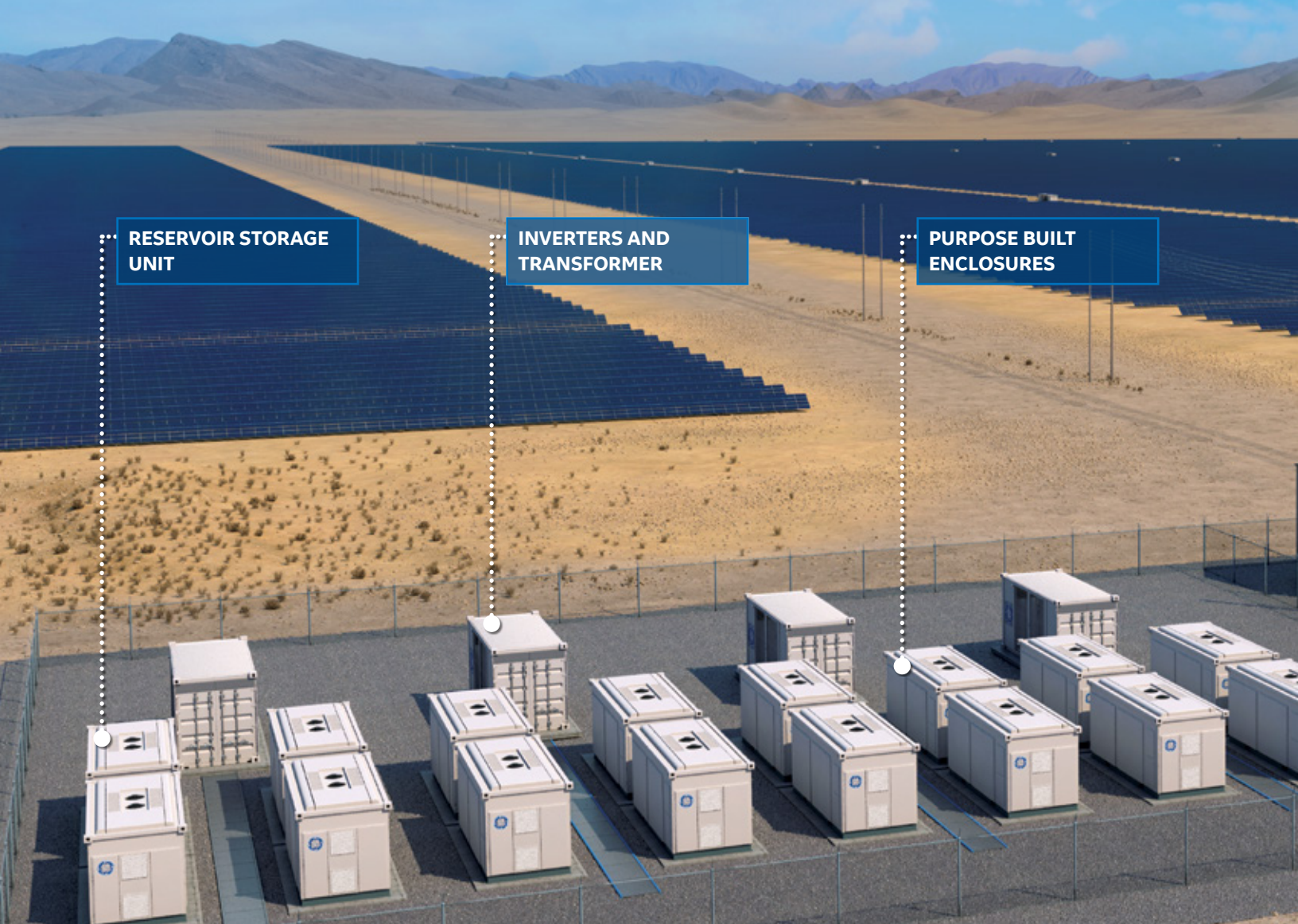


Thermal



Synthetic Inertia Compensate losses of grid inertia caused by high renewable penetration.			✓
Frequency Regulation Provide fast regulation of grid frequency to balance supply and demand.	✓	✓	✓
Firming Prevent undesirable short-duration effects from rapid fluctuations in solar generation due to intermittency and weather conditions.	✓	✓	
Improved Operations Help optimize generation fleet operations and costs.			✓
Contingency Reserve Provide fast ramp-rate to meet grid requirement for online dispatch within a short delay of operating reserve.			✓
Curtailement Avoidance Avoid output curtailment at certain times, preventing loss of energy production.	✓	✓	
Dispatchable Control solar generation at request of power grid operators or according to market needs.	✓	✓	





RESERVOIR STORAGE UNIT

INVERTERS AND TRANSFORMER

PURPOSE BUILT ENCLOSURES

KEY COMPONENTS



Reservoir Control Unit (RCU)

GE's integrated Reservoir Control Unit is a supervisory control and data acquisition system for energy storage plants.

At the heart of the system is GE's field proven Mark™ Vle control system used to monitor and control gas turbines, wind and solar energy fleets.



Inverters

GE's inverters are designed specifically for dynamic operation and high performance lithium ion batteries.

Built with enhanced technology including integral ground fault detector/interrupter low voltage, zero voltage and high voltage ride through capability (LVRT, ZVRT, HVRT).



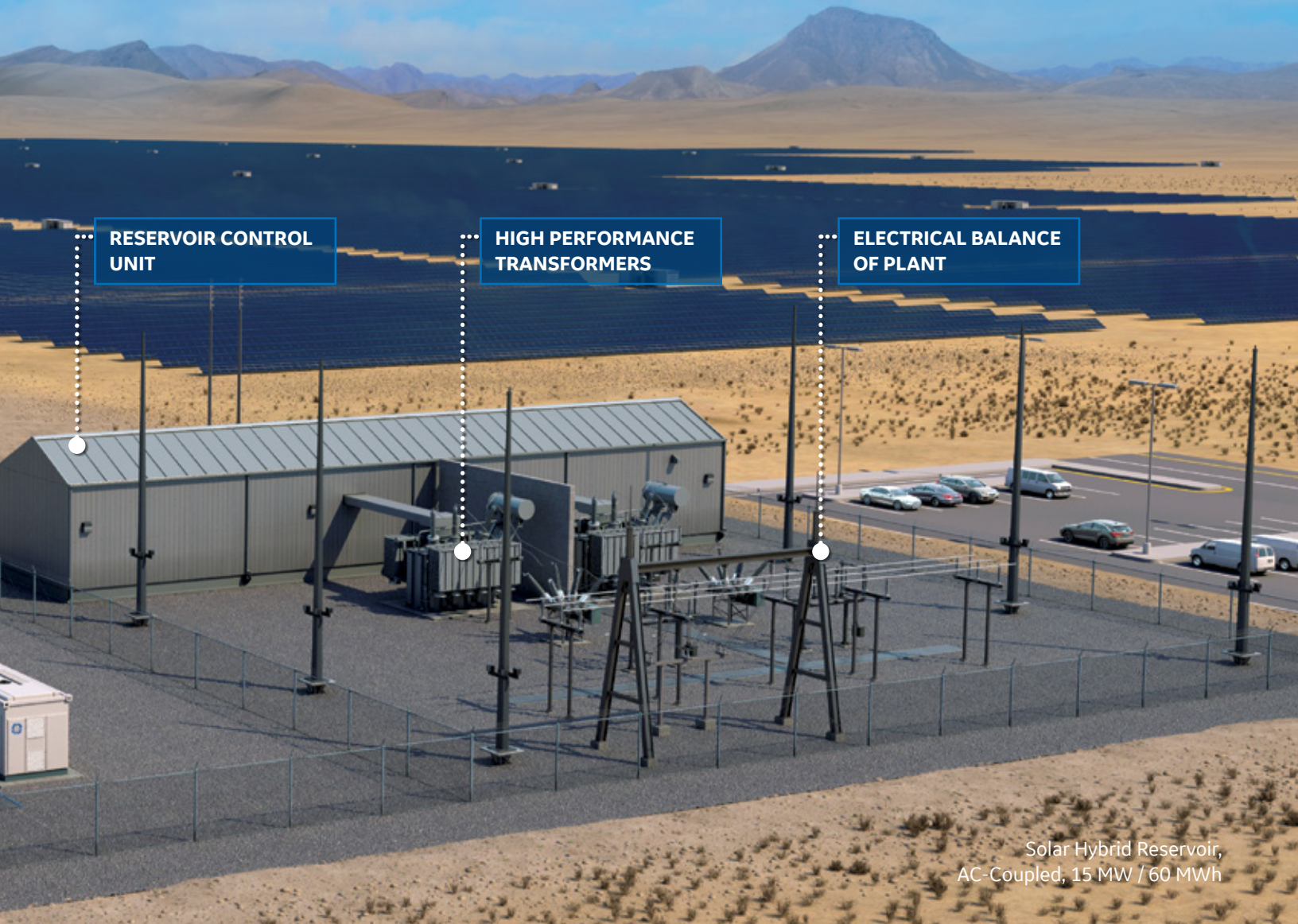
Reservoir Storage Unit

GE utilizes proven Li-Ion technology for battery storage solutions; each solution is tailored based on the customer's application. GE's battery solution exceeds industry standards for protecting against common industrial battery failure and reduces environmental impact with restricted use of substances controlled by US EPA, Global REACH and RoHS regulations.

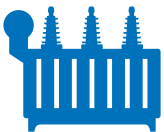
Modular &
Scalable

AC or
DC-Coupled
Systems

Performance
Guarantee



Solar Hybrid Reservoir,
AC-Coupled, 15 MW / 60 MWh



High Performance Transformers

GE provides comprehensive portfolio of HV and MV transformers. Each transformer is made for performance, efficiency and immunity to withstand electronic noise.



Electrical Balance of Plant

GE offers a comprehensive portfolio of high voltage and medium voltage substation equipment and technical expertise to ensure efficient and reliable interconnection of power generation.



Purpose Built Enclosures

GE's enclosures are prefabricated with redundant HVAC and optional fire suppression systems, and provide the following benefits:

- Low maintenance, configured with enhanced cooling and insulation with built-in redundancy for 25 years of life.
- Easy transportation, minimal installation effort on site and better battery insulation

FROM ADVANCED TECHNOLOGIES
AND PLANT CONTROLS TO BATTERY
MANAGEMENT SYSTEMS, **GE**
DELIVERS COMPREHENSIVE
STORAGE SOLUTIONS

RESERVOIR SOFTWARE SUITE

The reservoir software suite includes edge to cloud infrastructure that's scalable, adaptable and easy to use. The software suite includes:



FLEET MANAGEMENT

Fleet aggregation software designed for asset monitoring, alerts, trends and forecasting.



COMPONENT LIFE ANALYTICS

Manages battery life based on history and expected future use profiles to minimize downtime and unplanned outages.



DISPATCH OPTIMIZATION

Charges and discharges batteries based on equipment status and market conditions to maximize customer outcomes.





Reservoir Services

GE's service agreements are customized based on the customers' requirements and can lower operating costs and mitigate operational and financial risks. GE's services include:

Planned Maintenance

Routinely service equipment and keep the energy storage system online, resulting in superior fleet performance.

Unplanned Maintenance

Monitor, troubleshoot and inspect equipment, boosting uptime and lifecycle production.

Parts Plans

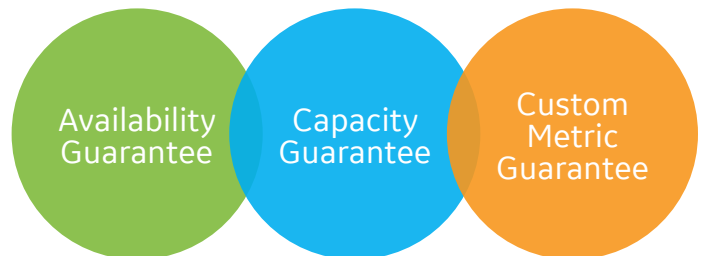
Provide full range of offerings to support preferred levels of service. Our forecasting capability, driven by fleet-wide parts consumption data configuration and management knowledge, can even help to predict what you may need.

Remote Operations Center

Provides continuous monitoring and diagnostics services 24 hours a day, 365 days a year. An on-site SCADA system enables continuous tracking of key operating parameters and detects abnormal conditions. GE technicians can then troubleshoot or reset the equipment remotely, in real-time.

Performance Guarantee

The specific performance criteria and duration of the performance guarantee will vary depending on your application, economic incentives, and requirements. Performance guarantees are only available to customers who maintain a contractual services agreement with GE and include:



Availability Guarantee

This guarantees that the battery energy storage solution will be available to charge or discharge electric energy at the nameplate power output and at the agreed-upon percentage of time.

Capacity Guarantee

The amount of energy that the battery is able to extract from and discharge to the grid can be guaranteed.

Custom Metric Guarantee

Some owners have unique measurements or metrics, such as the PJM fast response frequency regulation score. In such cases, GE works with you to assess the risks involved and define a guarantee structure that aligns the interests of both parties throughout the life of the asset.

SERVING GLOBAL CUSTOMERS WITH LOCAL EXPERTISE

GE is globally recognized for designing and delivering customized energy storage solutions for diverse applications. With regionally located technical experts, our teams work directly with customers during the lifetime of the project. To date GE has more than **207 MWh of energy storage** in operation or in construction globally.



126 MWh
in North America

Services

52+ SERVICE AND REPAIR CENTERS

17 TECHNICAL INSTITUTES

INDUSTRY EXCELLENCE



10 years
of storage experience

20 year
performance guarantee

PIONEERING



1st Hybrid EGT
storage + gas turbine peaker
in operation

Black Start
first proven emergency start
of CCGT

LOCAL EXPERTISE



40+ Countries
providing comprehensive
consulting & services

53 MWh
in Europe

21 MWh
in Asia

7 MWh
in Africa

CUSTOMER APPLICATIONS



CUSTOMER ENERGY STORAGE DEVELOPER

CHALLENGE

Local grid support

GE SOLUTION

41MW / 41MWh BESS

APPLICATION

Standalone - Generation

Capacity; demand charge management

LOCATION

United Kingdom

STATUS

Under construction

This project will relieve pressure on the host country's energy system and provide flexibility when it is most needed to deliver a more balanced, secure energy system and help reduce consumer energy cost. The focus is on building long term commercially sustainable battery storage systems that are not reliant on subsidies and incentives.



CUSTOMER INVESTOR-OWNED ENERGY COMPANY

CHALLENGE

Meeting resource adequacy requirement

GE SOLUTION

2MW / 8MWH BESS

APPLICATION

Hybrid - Solar

Solar integration

LOCATION

Southern California (US)

STATUS

In operation

"We have a history of working with GE in thermal and wind, and we are pleased to continue our long-standing collaboration into the evolving world of energy storage. GE brings a strong technical solution, along with performance guarantees."





CUSTOMER PUBLIC POWER UTILITY

CHALLENGE

Addressing local grid reliability concerns

APPLICATION

Hybrid - Thermal (EGT)
Spinning reserve

LOCATION

Southern California (US)

STATUS

In operation

GE SOLUTION

10MW / 4.3MWh BESS,
integrated controls

This project consists of two 10 MW of battery energy storage systems, each paired with GE's proven 50 MW LM6000 aeroderivative gas turbines, capable of providing instantaneous response during a spinning reserve event.



CUSTOMER DISTRIBUTION NETWORK OPERATOR

CHALLENGE

Local grid reliability

APPLICATION

Standalone - Distribution
Load shifting, frequency &
voltage regulation

LOCATION

Nice, France

STATUS

In operation

GE SOLUTION

1MW / 560 kWh BESS, EMS

Smart-solar energy demonstration project. First application of large storage integrated at microgrid level, combined with a solar PV farm.

CUSTOMER APPLICATIONS



CUSTOMER ENERGY STORAGE ASSET DEVELOPER

CHALLENGE

Balance long duration voltage and frequency irregularities

GE SOLUTION

7MW / 7MWh BESS

APPLICATION

Standalone - Transmission

Voltage control, reactive power support, frequency regulation, ramp rate control, peak shaving, load shifting

LOCATION

Ontario, Canada

STATUS

In operation

“GE worked with us to create a fully integrated energy storage solution that helps meet the growing needs of the local transmission system. The project utilizes reliable GE equipment and products ranging from enclosures through the point of utility interconnection — a strategy that is cost-efficient, simplifies system warranties and guarantees, and provides a financeable solution to our customers.”



CUSTOMER LARGE INDUSTRIAL COMPANY

CHALLENGE

Grid support; pilot program

GE SOLUTION

2MW / 2MWh BESS

APPLICATION

Standalone - Transmission

Frequency regulation

LOCATION

Belgium

STATUS

Under construction

This project will repurpose their facility in order to develop a large scale storage park. The goal of the storage park is to further develop know-how on large scale storage. In the first stage, 6 MW of li-ion battery energy storage systems will be installed to deliver primary frequency regulation for the Transmission System Operator as a first application.





CUSTOMER PUBLIC POWER UTILITY

CHALLENGE

Providing grid stability & smoothing renewable output

GE SOLUTION

33MW / 20MWh BESS

APPLICATION

Standalone - Transmission

Emergency power / black start capability, distribution management system integration, ramp rate control, frequency response, spinning reserve

LOCATION

Southern California (US)

STATUS

In operation

Located in California, which has some of the most aggressive renewable portfolio requirements in the US, this 33MW / 20MWh battery system complements the integration of renewable resources, such as solar and wind, by adding stability and improving power quality.



CUSTOMER UTILITY

CHALLENGE

Local grid reliability

GE SOLUTION

1MW / 560 kWh BESS

APPLICATION

Standalone - Transmission

Frequency regulation

LOCATION

France

STATUS

In operation

The project is part of a larger initiative to test battery storage in real conditions for the purpose of frequency regulation, stabilizing the grid and preventing blackouts.





For more information about
GE's Energy Storage Solutions visit
www.GEPower.com/EnergyStorage

Courtesy: Convergent Energy + Power

GE reserves the right to make changes to specifications of products described at any time without notice and without obligation to notify any person of such changes.

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GEA-32054-(E)
English
180320

Reservoir Storage Unit

Modular, Scalable Solutions For Utility Scale Applications

RSU-4000 Series

Overview	RSU-4000/20	RSU-4000/16	RSU-4000/12
	RSU-4000/20	RSU-4000/16	RSU-4000/12
Overview			
Nameplate Energy Capacity (KWh.dc, usable)	4184	3347.2	2510.4
Individual Battery Blades - Factory Installed	20 of 20	16 of 20	12 of 20
Maximum Power - Factory Installed (KW.dc)	1200	960	720
Maximum DC Current - Factory Installed (A)	1600	1280	960
Available Augmentation Capacity (% BOL)	0%	25%	67%
Available Augmentation Capacity (kWh.dc)	N/A	836.8	1673.6
Key Features			
Batery Management System	GE Blade Protection Unit (BPU)		
Compatible Inverters	GE RIU-2750MV		
Remote Management	Reservoir Suite		
Solar DC Coupling	Yes (DC:AC Ratio <2.8)		
Integrated PV Combiner	Yes		
Integrated Lockable Disconnect	Module & Rack Level		
Augmentation Options for Lifecycle Management	Yes		
DC Bus Control	DC-IQ Intelligent Bus		
Battery LifeCycle Management	Digital Twin Life Optimization - Optional		
Unit Validation	Factory Built & Tested		
Design life (years)	25		
Battery Information			
Battery Chemistry	Lithium-Ion, NCM		
Battery Module Design	Energy		
Continuous C-Rate	<C/3		
Pulse C-Rate	<C/3		
Voltage Class	1500V		
Nominal DC Voltage (V)	1300		
Minimum DC Voltage (V)	770		
Mechanical Information			
Package Format	20' ISO w/Exterior Acces		
Dimensions (mm) (L X W X H)	6058 x 2438 x 2890 mm		
Weight (kg)	37k	31k	25k
Fully Integrated HVAC	Dual Self-Contained 3 Ton Units (High Efficiency 10. EER)		
- Hot Climate Upgrade	+33% Cooling Capacity		
- Cold Climate Upgrade	+ Electric Heating Package		
Fire Suppression - Aerosol	Optional		
Installation	Pad/Pier		
Cable Entry	Bottom		
Weatherization	NEMA 3R, IP54		
Design Conditions			
Min Operating Temperature (C)	-40°C		
Max operating Temperature (C)	50°C (55°C w/ hot climate upgrade)		
Maximum Altitude (m)	2000		
Maximum Relative Humidity (%)	95%, non-condensing		
Seismic Zone	UBC Zone-4		
Audible Noise	<60 dB at 3M		
Certifications & Compliance			
Certifications	UN38.3, UL 1973, UL 508C, CE		
Compliance	UL1642, UNDOT 38.3, IEC 62477-1, NFPA 70E, IEC 50110, ASTM4169, IEEE 605, IEEE C37.32		

GE reserves the right to make changes to specifications of products described at any time without notice and without obligation to notify any person of such changes.



iTracker XL: engineered for safety

iTracker XL can host up to 120 large PV modules, protecting them from aeroelastic instabilities thanks to its innovative multi-drive system



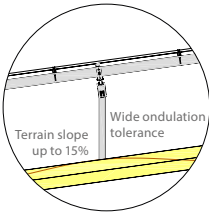
iTracker XL

Larger Tracker - Better Solutions



Leading-edge tracking algorithm

- Three-dimensional backtracking for each individual tracker
- Maximised collection of diffused radiation during cloudy periods



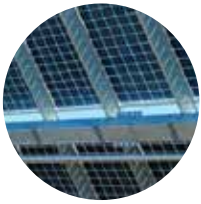
Terrain adaptability

- Maximum flexibility for complex borders and undulated terrains
- North South slopes up to 15%



Facilitated O&M

- Proprietary NFC app to support fast commissioning and seamless O&M
- Large corridors facilitate cleaning operations



Optimised for bifacial and agrivoltaics

- Gap between modules minimises shadow from torque tube
- Flexible height to meet the most demanding agrivoltaic needs



Unique wireless system

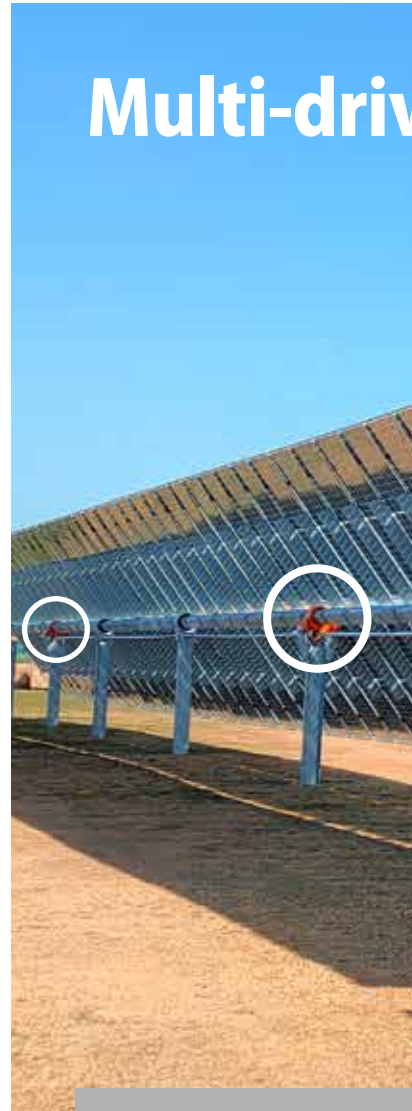
- Low power consumption and long life batteries (up to 5+ days of autonomy)
- Long range communication



Ease of installation

- Fewer foundation piles per MW minimise ramming time
- Facilitated installation of PV modules to avoid height risks

Multi-drive





Wind resilience

- Multi-drive blocks protect against dynamic instability
- Locked-in horizontal stowing minimises stress on foundations

ve!



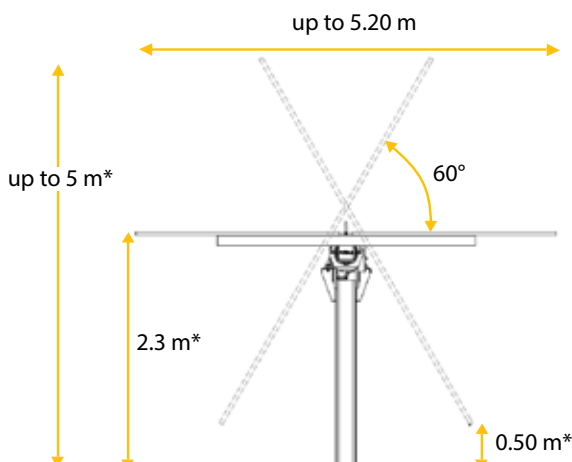
Certified quality

- Certified according to ISO 9001/14001/45001
- CE marked according to the Machinery Directive 2006/42/UE



Technical features

Tracking type	Independent single axis horizontal tracker Any tracker alignment possible (ideally along North-South direction)
Tracking algorithm	Accurate astronomical formulas; tracking precision = 1.0°. Individually customized 3D backtracking to follow terrain undulations
Rotation range	±60°
Ground cover ratio	Freely configurable by customer (between 34% and 50%)
PV Module compatibility	Framed modules; all major brands
Module mount	2 modules portrait
Drive system	independent motor serving a multidrive system for each tracker
Peak power per tracker	Up to 71 kWp per tracker (with 550Wp modules)
N° of Module per tracker	Up to 120 modules (1500 V)
PV array voltage	1000 V or 1500 V
Power supply	Self powered with dedicated small PV module and Li-FePO ₄ battery
Communication	Soltigua wireless radio network
Monitoring	Local control via SCADA; remote control available
Foundation type	Standard: driven piles
Wind resistance (Eurocodes)	In operation: up to 70 km/h in any position Stow position: up to 160 km/h in stow position
Snow resistance	Up to 1'500 N/m ² ; depending on tracker version
Tracker stowing time	≤ 6 min; 3.5 min on average
Installation tolerances	North South: ±40 mm East-West: ±25 mm standard pile; ±25 mm drive pile Height tolerance: ±40 mm Pile tilt: ±1° Twist: ±7,5°
Ground slope	Max 15% slope in longitudinal direction (North- South) Any slope in transversal direction (East-West) [max 70% local slope for rotation clearance] Local deviation from theoretical ground profile is ±150 mm
Installation method	Engineered for fast and easy assembly; no welding nor drilling required on site
Materials	HDG, Z and ZM construction steel; maintenance free bearings; triennial maintenance for slew drive
Certifications/Compliance	CE 2006/42/UE; Eurocodes EN1991-1-1/3/4; LV 2014/35/UE; EMC 2014/30/UE ; ISO 9001-2015; ISO 14001-2015 and ISO 45001-2018
Warranty	Structure: 10 years Drive batteries and electronics: 5 years Corrosion: 30 years in C2 atmospheric environment Warranty extension available
Earthing	The rotating structure is connected to the ground through its drive pile; PV module frames are connected to the rotating structure with n.1 star washer for each module



*= reference dimensions - can change based on PV module dimensions and on project specs



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CPR (UE) n° 305/11
E_{ca}

Regolamento Prodotti da Costruzione/ *Construction Products Regulation*
Classe conforme norme EN 50575:2014 + A1:2016 e EN 13501-6:2014
Class according to standards EN 50575:2014 + A1:2016 and EN 13501-6:2014

DoP n° 1036/17

EN 50618
CEI EN 60332-1-2
CEI EN 50525
CEI EN 50289-4-17 A
CEI EN 50396
2014/35/UE
2011/65/CE
CA01.00546

Costruzione e requisiti/ *Construction and specifications*
Propagazione fiamma/ *Flame propagation*
Emissione gas/ *Gas emission*
Resistenza raggi UV/ *UV resistance test*
Resistenza ozono/ *Ozone resistance*
Direttiva Bassa Tensione/ *Low Voltage Directive*
Direttiva RoHS/ *RoHS Directive*
Certificato IMQ/ *IMQ Certificate*



DESCRIZIONE

Cavo unipolare flessibile stagnato per collegamenti di impianti fotovoltaici. Isolamento e guaina realizzati con mescola elastomerica senza alogeni non propagante la fiamma.

Conduttore

Corda flessibile di rame stagnato, classe 5

Isolante

Mescola LSOH di gomma reticolata speciale di qualità conforme alla norma EN 50618
LSOH = Low Smoke Zero Halogen

Guaina esterna

Mescola LSOH di gomma reticolata speciale di qualità conforme alla norma EN 50618

Colore anime

Nero

Colore guaina

Blu, rosso, nero

Marcatura a inchiostro

BALDASSARI CAVI IEMMEQU <HAR> H1Z2Z2-K 1/1 kV
(sez) (anno) (m) (tracciabilità)

CARATTERISTICHE TECNICHE

Tensione massima: 1800 V c.c. - 1200 V c.a.

Temperatura massima di esercizio: 90°C

Temperatura minima di esercizio: -40°C

Temperatura minima di posa: -40°C

Temperatura massima di corto circuito: 250°C

Sforzo massimo di trazione: 15 N/mm²

Raggio minimo di curvatura: 4 volte il diametro esterno massimo

Condizioni di impiego

Per l'interconnessione di elementi di impianti fotovoltaici. Adatti per l'installazione fissa all'esterno e all'interno, entro tubazioni in vista o incassate o in sistemi chiusi similari.

Adatti per la posa direttamente interrata o entro tubo interrato e per essere utilizzati con apparecchiature di classe II.

DESCRIPTION

Flexible single-core cable for connection in photovoltaic installations. Insulation and sheath made of elastomeric compound, halogen free and flame retardant.

Conductor

Tinned copper flexible wire, class 5

Insulation

Special LSOH cross-linked rubber compound according to EN 50618 quality
LSOH = Low Smoke Zero Halogen

Outer sheath

Special LSOH cross-linked rubber compound according to EN 50618 quality

Cores colour

Black

Sheath colour

Blue, red or black

Inkjet marking

BALDASSARI CAVI IEMMEQU <HAR> H1Z2Z2-K 1/1 kV
(section) (year) (m) (traceability)

TECHNICAL CHARACTERISTICS

Maximum voltage U₀/U: 1800 V d.c. - 1200 V a.c.

Maximum operating temperature: 90°C

Minimum operating temperature: -40°C

Minimum installation temperature: -40°C

Maximum short circuit temperature: 250°C

Maximum tensile stress: 15 N/mm²

Minimum bending radius: 4 x maximum external diameter

Use and installation

For interconnection of photovoltaic elements. Suitable for fixed installation indoor and outdoor, in pipes exposed or embedded or in similar closed systems.
Suitable for laying directly underground or in pipe underground and to be used for class II equipment.



Formazione	Ø indicativo conduttore	Spessore medio isolante	Spessore medio guaina	Ø indicativo produzione	Peso indicativo cavo	Resistenza elettrica max a 20°C	Portata di corrente in aria libera Current rating free in air	
Formation	Approx. conductor Ø	Average insulation thickness	Average sheath thickness	Approx. production Ø	Approx. cable weight	Max. electrical resistance at 20°C	Singolo cavo Single cable 60°C	2 cavi adiacenti 2 adjacent cables 60°C
n° x mm²	mm	mm	mm	mm	kg/km	ohm/ km	A	A
1 x 1,5	1,5	0,7	0,8	4,7	34	13,7	30	24
1 x 2,5	2,1	0,7	0,8	5,2	47	8,21	40	33
1 x 4	2,5	0,7	0,8	5,8	58	5,09	55	44
1 x 6	3,0	0,7	0,8	6,5	80	3,39	70	70
1 x 10	4,0	0,7	0,8	7,9	127	1,95	95	95
1 x 16	5,0	0,7	0,9	8,8	180	1,24	130	107
1 x 25	6,2	0,9	1,0	10,6	270	0,795	180	142
1 x 35	7,6	0,9	1,1	12,0	360	0,565	220	176
1 x 50	8,9	1,0	1,2	14,1	515	0,393	280	221
1 x 70	10,5	1,1	1,2	15,9	720	0,277	350	278
1 x 95	12,5	1,1	1,3	17,7	915	0,210	410	333
1 x 120	13,7	1,2	1,3	19,8	1160	0,164	480	390
1 x 150	16,1	1,4	1,4	21,7	1460	0,132	566	453
1 x 185	17,7	1,6	1,6	24,1	1780	0,108	644	515
1 x 240	19,9	1,7	1,7	26,7	2310	0,082	775	620



CPR (UE) n°305/11
C_{ca} - s3, d1, a3

Regolamento Prodotti da Costruzione/Construction Products Regulation
Classe conforme norme EN 50575:2014 + A1:2016 e EN 13501-6:2014
Class according to standards EN 50575:2014 + A1:2016 and EN 13501-6:2014

DoP n°1043/17

CEI 20-13
CEI EN 60332-1-2
2014/35/UE
2011/65/CE

Costruzione e requisiti/Construction and specifications
Propagazione fiamma/Flame propagation
Direttiva Bassa Tensione/Low Voltage Directive
Direttiva RoHS/RoHS Directive



DESCRIZIONE

Cavo unipolare per energia con conduttore in alluminio, isolato in gomma etilenpropilenica ad alto modulo di qualità G16, sotto guaina di PVC, con particolari caratteristiche di reazione al fuoco e rispondente al Regolamento Prodotti da Costruzione (CPR).

Conduttore

Corda di alluminio rigida, classe 2

Isolante

Mescola di gomma etilpropilenica ad alto modulo di qualità G16

Guaina esterna

Mescola di PVC di qualità R16

Colore anime

Normativa HD 308

Colore guaina

Grigio

Marcatura a inchiostro

BALDASSARI CAVI REPERO® ARG16R16 0,6/1 kV (sez)
Cca-s3,d1,a3 IEMMEQU EFP (anno) (m) (tracciabilità)

CARATTERISTICHE TECNICHE

Tensione nominale U₀/U: 0,6/1 kV

Temperatura massima di esercizio: 90°C

Temperatura minima di esercizio: -15°C
(in assenza di sollecitazioni meccaniche)

Temperatura minima di posa: 0°C

Temperatura massima di corto circuito:
250°C fino alla sezione 240 mm², oltre 220°C

Sforzo massimo di trazione: 50 N/mm²

Raggio minimo di curvatura: 6 volte il diametro esterno massimo

Condizioni di impiego

Per trasporto energia nell'edilizia industriale e/o residenziale.
Adatto per impiego all'interno in locali anche bagnati o all'esterno; posa fissa su murature e strutture metalliche.
Ammissa anche la posa interrata.

DESCRIPTION

Single-core power cable with aluminum conductor, HEPR insulated (G16 quality), PVC sheathed, with special fire reaction characteristics according to Construction Products Regulation (CPR).

Conductor

Aluminium stranded wire, class 2

Insulation

Rubber HEPR compound G16 quality

Outer sheath

PVC compound, R16 quality

Cores colour

HD 308 Standard

Sheath colour

Grey

Inkjet marking

BALDASSARI CAVI REPERO® ARG16R16 0,6/1 kV (section)
Cca-s3,d1,a3 IEMMEQU EFP (year) (m) (traceability)

TECHNICAL CHARACTERISTICS

Nominal voltage U₀/U: 0,6/1 kV

Maximum operating temperature: 90°C

Minimum operating temperature: -15°C
(without mechanical stress)

Minimum installation temperature: 0°C

Maximum short circuit temperature:
250°C up to 240 mm² section, over 220°C

Maximum tensile stress: 50 N/mm²

Minimum bending radius: 6 x maximum external diameter

Use and installation

Power cable for industrial and/or residential uses.
Suitable to be used indoor and outdoor, even in wet environments; it can be fixed on walls and/or metal structures.
Suitable also for laying underground.



Formazione	Ø indicativo conduttore	Spessore medio isolante	Spessore medio guaina	Ø indicativo produzione	Peso indicativo cavo	Resistenza elettrica max a 20°C	Portata di corrente Current rating			
Formation	Approx. conductor Ø	Average insulation thickness	Average sheath thickness	Approx. production Ø	Approx. cable weight	Max. electrical resistance at 20°C	In aria libera Free in air 30°C	In tubo in aria In pipe in air 30°C	Interrato Underground 20°C	In tubo interrato Underground in pipe 20°C
n° x mm²	mm	mm	mm	mm	kg/km	ohm/km	A	A	A	A
1 x 16	4,9	0,7	1,4	9,1	109	1,91	70	64	98	75
1 x 25	6,1	0,9	1,4	10,7	151	1,20	102	88	119	95
1 x 35	7,1	0,9	1,4	11,7	185	0,868	136	110	141	115
1 x 50	8,2	1,0	1,4	13,0	230	0,641	164	131	167	134
1 x 70	9,9	1,1	1,4	14,9	315	0,443	218	175	204	173
1 x 95	11,4	1,1	1,5	16,6	405	0,320	261	209	245	196
1 x 120	13,1	1,2	1,5	18,5	510	0,253	310	250	277	238
1 x 150	14,4	1,4	1,6	20,4	620	0,206	350	280	313	250
1 x 185	16,2	1,6	1,6	22,6	750	0,164	415	334	350	300
1 x 240	18,4	1,7	1,7	25,2	955	0,125	490	392	413	331
1 x 300	20,7	1,8	1,8	27,9	1150	0,100	567	-	454	400
1 x 400	23,6	2,0	1,9	31,4	1520	0,0778	665	-	512	450
1 x 500	26,5	2,2	2,0	34,9	1850	0,0605	765	-	578	505
1 x 630	30,2	2,4	2,2	39,8	2415	0,0469	880	-	646	580

N.B. Il coefficiente di resistività termica del terreno preso a riferimento per il calcolo della portata dei cavi interrati è di 1° C.m/W, profondità di posa 0,8 m. Calcolo della portata di corrente eseguito considerando quattro cavi a contatto con temperatura dei conduttori di 90°C.

N.B. The thermal resistivity coefficient used as a reference for the calculation of the underground cables current rating is 1° C.m/W, 0,8 m installation depth. Calculation of current rating performed considering four cables in contact with conductor temperature of 90°C.



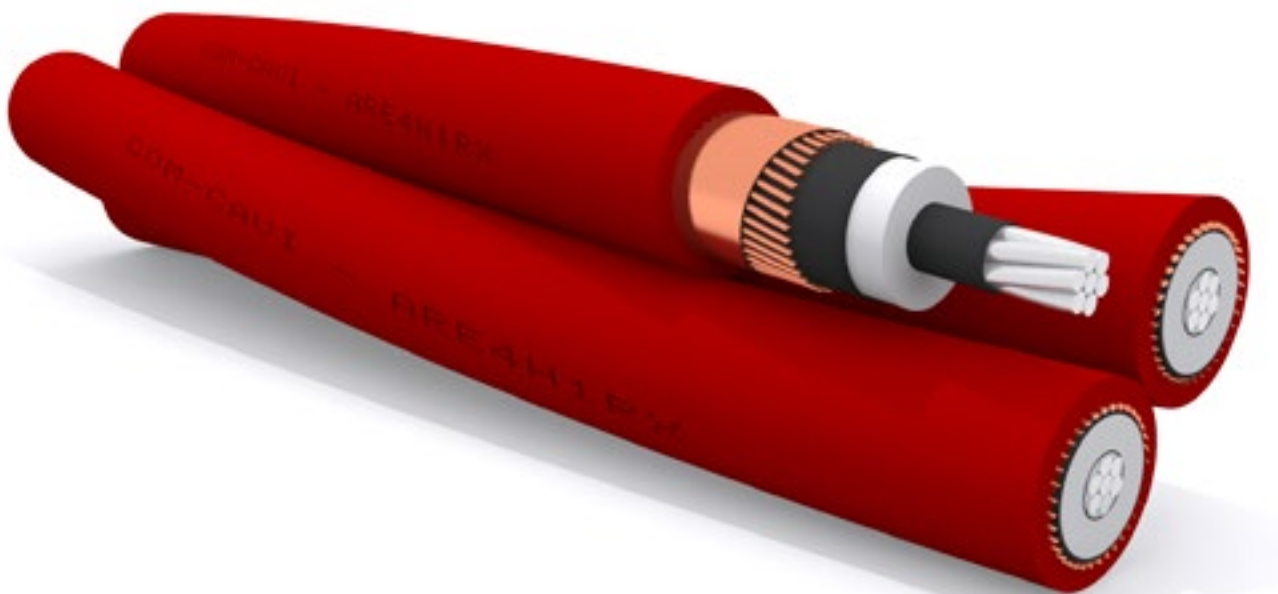
ARE4H1RX - Elica visibile 12/20 kV - 18/30 kV

MEDIA TENSIONE - ENERGIA
MEDIUM VOLTAGE - ENERGY



RIFERIMENTO NORMATIVO/STANDARD REFERENCE

Costruzione e requisiti/Construction and specifications	EC 60502-2
Propagazione fiamma/Flame propagation	CEI 20-35
Direttiva RoHS/RoHS Directive	2011/65/CE



CARATTERISTICHE FUNZIONALI:

- Tensione nominale U_0/U : : 12/20 kV - 18/30 kV
- Temperatura massima di esercizio: 90°C
- Temperatura minima di posa: 0°C
- Temperatura massima di corto circuito: 250°C

CARATTERISTICHE PARTICOLARI:

Cavi media tensione non propaganti la fiamma. Adatti per impianti eolici.

CONDIZIONI DI IMPIEGO:

Adatti per installazioni in canale interrato; tubo interrato; interro diretto; aria libera; interrato con protezione.

FUNCTIONAL CHARACTERISTICS

- Nominal voltage U_0/U : 12/20 kV - 18/30 kV
- Maximum operating temperature: 90°C
- Minimum installation temperature: 0°C
- Maximum short circuit temperature: 250°C

SPECIAL FEATURES







Medium voltage cable, not propagating flame. Suitable for wind power plants.

USE AND INSTALLATION

Suitable for installations in buried trough; buried duct; directly buried; open air; buried with protection.

ARE4H1RX - Elica visibile 12/20 kV - 18/30 kV

COSTRUZIONE DEL CAVO / CABLE CONSTRUCTION

	CONDUTTORE Materiale: Conduttore a corda rotonda compatta di alluminio	CONDUCTOR Material: stranded wire aluminium
	SEMICONDUTTIVO INTERNO Materiale: Mescola estrusa Colore: Nero	INNER SEMICONDUCTIVE Material: extruded compound Colour: Black
	ISOLANTE Materiale: Mescola di polietene reticolato Colore: Naturale	INSULATION Material: polyethylene compound Colour: Natural
	SEMICONDUTTIVO ESTERNO Materiale: Mescola estrusa Colore: Nero	OUTER SEMICONDUCTIVE Material: extruded compound Colour: Black
	SCHERMO Tipo: Fili di rame rosso e contospirale Materiale: Rame rosso (R max 3 Ω/km)	SCREEN Type: Copper wire Colour: Copper (R max 3 Ω/km)
	GUAINA ESTERNA Materiale: PVC di qualità Rz/ST2 Colore: Rosso	OUTER SHEATH Material: PVC compound, Rz quality Colour: grey

MARCATURE:

- COM-CAVI - ARE4H1RX 12/20 kV - <N° COND. X SEZIONE> <ANNO> <MARCATURA METRICA>

MARKINGS

- CCOM-CAVI - ARE4H1RX 12/20 kV - <N° CONDUCT. S SECTION> <YEAR> <METRIC MARKING>

ARE4H1RX - Elica visibile 12/20 kV

12/20 kV Dati dimensionali - size characteristics

Formazione	Ø nominale conduttore	Spessore isolante	Spessore guaina	Ø nominale cavo	Peso nominale cavo	Raggio minimo di curvatura
Size	Nominal conduct. Ø	Insulation thickness	Sheath thickness	Nominal cable Ø	Nominal cable weight	Minimum bending radius
n° x mm²	mm	mm	mm	mm	kg/km	mm
25	6,0	5,5	1,8	29,6	610	350
35	7,0	5,5	1,8	30,7	670	360
50	8,1	5,5	1,8	31,7	720	380
70	9,9	5,5	1,8	33,3	840	400
95	11,5	5,5	1,9	35,4	955	430
120	12,9	5,5	1,9	37,0	1060	450
150	14,2	5,5	2,0	38,5	1210	470
185	15,9	5,5	2,0	40,0	1345	490
240	18,3	5,5	2,1	43,2	1590	530
300	20,7	5,5	2,2	45,8	1845	570
400	23,5	5,5	2,3	49,0	2175	610
500	26,5	5,5	2,4	52,0	2620	650
630	30,1	5,5	2,5	56,2	3110	710
3x1x25	6,0	5,5	1,8	63,9	1834	350
3x1x35	7,0	5,5	1,8	66,3	2014	360
3x1x50	8,1	5,5	1,8	68,5	2164	380
3x1x70	9,9	5,5	1,8	71,9	2525	400
3x1x95	11,5	5,5	1,9	76,5	2871	430
3x1x120	12,9	5,5	1,9	79,9	3186	450
3x1x150	14,2	5,5	2,0	83,2	3637	470
3x1x185	15,9	5,5	2,9	86,4	4043	490
3x1x240	18,3	5,5	2,1	93,3	4780	530
3x1x300	20,7	5,5	2,2	98,9	5546	570
3x1x400	23,5	5,5	2,3	105,8	6538	610
3x1x500	26,5	5,5	2,4	112,3	7876	650

Per i cavi con isolamento in G7 i dati dimensionali sono da ritenersi identici.
For cables with insulation G7 dimensional data are to be considered identical.

ARE4H1RX - Elica visibile 12/20 kV

12/20 kV Caratteristiche elettriche - electrical characteristics

Formazione Size	Capacità nominale Nominal capacity	Corrente capacitiva nominale a tensione U_0 Nominal capacitive current at voltage U_0	Reattanza di fase a 50 HZ Reactance phase 50HZ	Resistenza massima in CC del conduttore a 20°C Conductor max electrical resist. CC at 20°C	Resistenza massima in CC dello schermo a 20°C Screen max electrical resist. CC at 20°C	Resistenza massima in CA del conduttore a 90°C Conductor max electrical resist. CA at 90°C	Portata di corrente Current rating A	Corrente di corto circuito del conduttore Short circuit current con- ductor (1s)
n° x mm²	mm	A/Km	Ω/Km	Ω/Km	Ω/Km	Ω/Km	in aria a 30° C interrato a 20° C Underground at 20° C Rt=1m°C/W	kA
25	0,15	0,56	0,155	1,200	3,0	1,540	136	2,3
35	0,16	0,65	0,147	0,868	3,0	1,115	160	3,2
50	0,17	0,71	0,141	0,641	3,0	0,852	198	4,6
70	0,20	0,80	0,132	0,443	3,0	0,570	243	6,5
95	0,22	0,89	0,125	0,320	3,0	0,412	296	8,8
120	0,24	0,96	0,120	0,253	3,0	0,328	338	11,1
150	0,25	1,03	0,117	0,206	3,0	0,268	387	13,8
185	0,28	1,12	0,112	0,164	3,0	0,213	441	17,0
240	0,30	1,23	0,108	0,125	3,0	0,163	517	22,1
300	0,33	1,34	0,105	0,100	3,0	0,132	586	27,6
400	0,37	1,48	0,101	0,0778	3,0	0,103	677	36,8
500	0,40	1,62	0,098	0,0605	3,0	0,081	775	46,0
630	0,44	1,80	0,095	0,0469	3,0	0,064	882	58,0
3x1x25	0,15	0,56	0,155	1,200	3,0	1,540	136	2,3
3x1x35	0,16	0,65	0,147	0,868	3,0	1,115	160	3,2
3x1x50	0,17	0,71	0,141	0,641	3,0	0,825	198	4,6
3x1x70	0,20	0,80	0,132	0,443	3,0	0,570	243	6,5
3x1x95	0,22	0,89	0,125	0,320	3,0	0,412	296	8,8
3x1x120	0,24	0,96	0,120	0,253	3,0	0,328	338	11,1
3x1x150	0,25	1,03	0,117	0,206	3,0	0,268	387	13,8
3x1x185	0,28	1,12	0,112	0,164	3,0	0,213	441	17,0
3x1x240	0,30	1,23	0,108	0,125	3,0	0,163	517	22,1
3x1x300	0,33	1,34	0,105	0,100	3,0	0,132	586	27,6
3x1x400	0,37	1,48	0,101	0,0778	3,0	0,103	677	36,8
3x1x500	0,40	1,62	0,098	0,0605	3,0	0,081	775	46,0

Per i cavi con isolamento in G7 le portate di corrente sono da ritenersi più basse di 4-6 A.

For cables with insulation G7 current rating are to be considered more low 4-6 A.

Accessori Consigliati/Recommended accessories

Accessori per cavi con tensione di esercizio/Cables accessories with voltage 12/20 kV

Sezione nominale conduttore Nominal section conductor	Terminazione termorestringente da interno unipolare Xxxxxxx	Terminazione termorestringente da esterno unipolare Xxxxxxx	Giunto termorestringente unipolare Xxxxxxx
35	24TTMI1-50C12	24TTME1-50C12	24GTS1-50C
50	24TTMI1-50C12	24TTME1-50C12	24GTS1-50C
70	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
95	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
120	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
150	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
185	24TTMI1-185C12	24TTME1-185C12	24GTS1-185E2AC
240	24TTMI1-300C16	24TTME1-300C16	24GTS1-185E2AC
300	24TTMI1-300C16	24TTME1-300C16	24GTS1-300C
400	24TTMI1-630C16	24TTME1-630C16	24GTS1-630C
500	24TTMI1-630C16	24TTME1-630C16	24GTS1-630C
630	24TTMI1-630C16	24TTME1-630C16	24GTS1-630C

N.B. Per i cavi tripolari utilizzare tre confezioni unipolari della sezione corrispondente.



ARE4H1RX - Elica visibile - 18/30 kV

18/30 kV Dati dimensionali - size characteristics

Formazione	Ø nominale conduttore	Spessore isolante	Spessore guaina	Ø nominale cavo	Peso nominale cavo	Raggio minimo di curvatura
Size	Nominal conduct. Ø	Insulation thickness	Sheath thickness	Nominal cable Ø	Nominal cable weight	Minimum bending radius
n° x mm²	mm	mm	mm	mm	kg/km	mm
35	7,0	8,0	1,9	36,0	920	430
50	8,1	8,0	2,0	37,5	990	460
70	9,9	8,0	2,0	39,5	1140	480
95	11,5	8,0	2,1	41,1	1265	500
120	12,9	8,0	2,1	42,5	1380	530
150	14,2	8,0	2,2	44,2	1510	550
185	15,9	8,0	2,2	45,8	1665	570
240	18,3	8,0	2,3	49,0	1940	610
300	20,7	8,0	2,4	51,5	2245	640
400	23,5	8,0	2,5	57,6	2625	690
500	26,5	8,0	2,6	57,7	3065	730
630	30,1	8,0	2,7	63,4	3860	810
3x1x35	7,0	8,0	1,9	77,8	2766	430
3x1x50	8,1	8,0	2,0	81,0	2976	560
3x1x70	9,9	8,0	2,0	85,3	3427	480
3x1x95	11,5	8,0	2,1	88,8	3803	500
3x1x120	12,9	8,0	2,1	91,8	4148	530
3x1x150	14,2	8,0	2,2	95,5	4539	550
3x1x185	15,9	8,0	2,2	98,9	5005	570
3x1x240	18,3	8,0	2,3	105,8	5832	610
3x1x300	20,7	8,0	2,4	111,2	6748	640

Per i cavi con isolamento in G7 i dati dimensionali sono da ritenersi identici.
 For cables with insulation G7 dimensional data are to be considered identical.

ARE4H1RX - Elica visibile - 18/30 kV

18/30 kV Caratteristiche elettriche - electrical characteristics

Formazione	Capacità nominale	Corrente capacitiva nominale a tensione U_0	Reattanza di fase a 50 HZ	Resistenza massima in CC del conduttore a 20°C	Resistenza massima in CC dello schermo a 20°C	Resistenza massima in CA del conduttore a 90°C	Portata di corrente	Corrente di corto circuito del conduttore
Size	Nominal capacity	Nominal capacitive current at voltage U_0	Reactance phase 50HZ	Conductor max electrical resist. CC at 20°C	Screen max electrical resist. CC at 20°C	Conductor max electrical resist. CA at 20°C	Current rating A	Short circuit current conductor (1s)
n° x mm ²	mm	A/Km	Ω/Km	Ω/Km	Ω/Km	Ω/Km	in aria a 30° C interrato a 20° C Underground at 20° C Rt=1m°C/W	kA
35	0,13	0,74	0,153	0,868	3,0	1,115	160	3,2
50	0,13	0,83	0,149	0,641	3,0	0,825	198	4,6
70	0,15	0,92	0,140	0,443	3,0	0,570	243	6,5
95	0,16	1,01	0,132	0,320	3,0	0,412	289	8,8
120	0,18	1,10	0,127	0,253	3,0	0,328	334	11,1
150	0,19	1,16	0,123	0,206	3,0	0,268	373	13,8
185	0,21	1,22	0,119	0,164	3,0	0,213	426	17,0
240	0,22	1,37	0,115	0,125	3,0	0,163	494	22,1
300	0,24	1,49	0,111	0,100	3,0	0,132	555	27,6
400	0,27	1,64	0,107	0,0778	3,0	0,103	630	36,8
500	0,29	1,79	0,103	0,0605	3,0	0,081	714	46,0
630	0,32	1,96	0,100	0,0469	3,0	0,064	793	58,0
3x1x35	0,13	0,74	0,153	0,868	3,0	1,115	160	3,2
3x1x50	0,13	0,83	0,149	0,641	3,0	0,825	198	4,6
3x1x70	0,15	0,92	0,140	0,443	3,0	0,570	243	6,5
3x1x95	0,16	1,01	0,132	0,320	3,0	0,412	289	8,8
3x1x120	0,18	1,10	0,127	0,253	3,0	0,328	334	11,1
3x1x150	0,19	1,16	0,123	0,206	3,0	0,268	373	13,8
3x1x185	0,21	1,22	0,119	0,164	3,0	0,213	426	17,0
3x1x240	0,22	1,37	0,115	0,125	3,0	0,163	494	22,1
3x1x300	0,24	1,49	0,111	0,100	3,0	0,132	555	27,6

Per i cavi con isolamento in G7 le portate di corrente sono da ritenersi più basse di 4-6 A.

For cables with insulation G7 current rating are to be considered more low 4-6 A.

Accessori Consigliati/Recommended accessories

Accessori per cavi con tensione di esercizio/Cables accessories with voltage 18/30 kV

Sezione nominale conduttore Nominal section conductor	Terminazione termorestringente da interno unipolare Xxxxxx	Terminazione termorestringente da esterno unipolare Xxxxxx	Giunto termorestringente unipolare Xxxxxx
35	36TTMI1-70C12	36TTME1-70C12	36GTS1-95C
50	36TTMI1-70C12	36TTME1-70C12	36GTS1-95C
70	36TTMI1-70C12	36TTME1-70C12	36GTS1-95C
95	36TTMI1-240C12	36TTME1-240C12	36GTS1-95C
120	36TTMI1-240C12	36TTME1-240C12	36GTS1-240C
150	36TTMI1-240C12	36TTME1-240C12	36GTS1-240C
185	36TTMI1-240C12	36TTME1-240C12	36GTS1-240C
240	36TTMI1-240C16	36TTME1-240C12	36GTS1-240C
300	36TTMI1-300C16	36TTME1-300C16	36GTS1-300C
400	36TTMI1-630C16	36TTME1-630C16	36GTS1-630C
500	36TTMI1-630C16	36TTME1-630C16	36GTS1-630C
630	36TTMI1-630C16	36TTME1-630C16	36GTS1-630C

N.B. Per i cavi tripolari utilizzare tre confezioni unipolari della sezione corrispondente.

