Solar Cables

Power cables for
Rooftop installations

Top Cable

Rooftop PV installations

Rooftop PV systems provide a clean and increasingly affordable option for building owners and occupants to produce their electricity. For this reason, Rooftop Solar installation market is growing exponentially on a global scale. This trend is expected to continue going forward in the coming years, as building designers and engineers are considering solar rooftop installations more frequently on new buildings.

The choice of a solar cable does not only depend on whether it is manufactured according to standards. Manufacturing according to standards does not mean using the right materials, nor does it mean that the cable will afterwards fulfil the purpose for which it was intended.

Out of the 28 pages of the reference solar standard EN 50618 (excluding index), 12 are for tests and trials to be carried out on the cable. Certifying a cable not only implies manufacturing according to a standard but also that an external certifying body carries out all these tests so that it can control the quality of the final product manufactured and ensure its functionality.

Also, a **CPR certificate is required for local buildings** and in most cases, not only an E_{ca} declaration type is the one allowed to get legal permission to connect the solar modules to the distribution panels.


Top Cable

TOPSOLAR® PV H1Z2Z2-K

TÜV solar PV cable.

ACCORDING TO: EN 50618 / IEC 62930 / UTE C 32-502

100% Green Energy Cable Production

Cca

APPLICATION

The TOPSOLAR® PV H1Z2Z2-K cable, which is TÜV certified according to EN 50618 and AENOR certified according to IEC 62930, it is suitable for both fixed and mobile solar installations (solar farms, rooftop solar installations and floating plants).
It is a highly flexible cable compatible with all major connectors and specially designed for the connection of photovoltaic panels.
This versatile single-conductor cable is designed to meet the varying needs of the solar industry.
Suitable for wet, damp and humid locations.

- Solar PV installations string cable.

CONSTRUCTION

Conductor
Electrolytic annealed tinned copper, class 5 (flexible) according to IEC 60228 and EN 60228.

Insulation
Halogen free cross-linked rubber according to table B1 in Annex B of EN 50618 and IEC 62930.

Outer sheath
Halogen free cross-linked flexible rubber according to table B1 in Annex B of EN 50618 and IEC 62930.
Red or black colour.

CHARACTERISTICS

Electrical performance
Low voltage: 1,5 (1,8) kV DC.
1,0/1,0 kV AC.

Thermal performance
Maximum conductor temperature: 90°C (120°C during 20.000 h).
Maximum short-circuit temperature: 250°C (max. 5 s).
Minimum service temperature: -40°C (fixed and protected installations).

Fire performance
Flame non-propagation according to EN 60332-1-2 / IEC 60332-1-2.
Fire non-propagation according to EN 50399.
Reaction to fire CPR: C_{ca}-s1b, d2, a1 according to EN 50575.
Low smoke halogen free according to EN 60754-1 / IEC 60754-1.
Low corrosive gases emission according to EN 60754-2 / IEC 60754-2.
Low smoke emission according to EN 61034 / IEC 61034:
Light transmittance > 60%.

Mechanical performance
Minimum bending radius:
4x cable diameter (cable diameter ≤ 8 mm)
5x cable diameter (8 < cable diameter ≤ 12 mm)
6x cable diameter (cable diameter > 12 mm).
Impact resistance: AG2 Medium severity.

Environmental performance
Chemical & Oil resistance: Excellent.
Grease & mineral oils resistance: Excellent.
Ozone resistant according to EN 50618.
UV Resistant according to EN 50618 and IEC 62930.
Water resistance: AD8 Submersion.

Installation conditions
Open Air.
Buried.
In conduit.

STANDARDS / COMPLIANCE

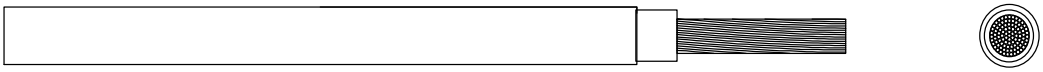
According to
EN 50618/ IEC 62930 / UTE C 32-502

Standards and approvals
TÜV Rheinland (from 2.5 to 25mm² in Black and Red) / RETIE / AENOR/ RoHS / CE / UKCA

CPR (Construction Products Regulation)
C_{ca}-s1b, d2, a1

TOPSOLAR® PV H1Z2Z2-K

DIMENSIONS & ADMISSIBLE INTENSITIES



Cross-Section (mm^2)	Diameter (mm)	Weight (kg/km)	Single cable free in air (A)	Single cable on surfaces (A)	To cables adjacent on surface (A)	Voltage drop (V/A · km)
1 x 1,5	4,5	35	30	29	24	38,1
1 x 2,5	5,0	45	41	39	33	22,8
1 x 4	5,4	60	55	52	44	14,3
1 x 6	6,0	80	70	67	57	9,49
1 x 10	7,0	120	98	93	79	5,46
1 x 16	8,2	180	132	125	107	3,47
1 x 25	10,2	280	176	167	142	2,23
1 x 35	11,5	375	218	207	176	1,58
1 x 50	13,3	525	276	262	221	1,10
1 x 70	15,0	720	347	330	278	0,772
1 x 95	17,0	930	416	395	333	0,585
1 x 120	18,7	1.175	488	464	390	0,457
1 x 150	21,0	1.475	566	538	453	0,368
1 x 185	23,5	1.805	644	612	515	0,301
1 x 240	26,3	2.345	775	736	620	0,228
1 x 300 *	29,3	2.935	879	834	715	0,182
1 x 500 **	38,0	4.935	-	-	-	0,108

* Cable outside of the standard EN 50618.
** Cable outside of the standard EN 50618 and IEC 62930.

The tolerances on the nominal outer diameters are:
Cables with outer diameter d ≤ 7 mm. → -0,1 +0,2 mm
Cables with outer diameter 7 < d < 10 mm. → -0,1 +0,3 mm
Cables with outer diameter d ≥ 10 mm. → -0,2 +0,4 mm

Current-carrying capacities, in amperes, are according to EN 50618 (ambient temperature of 60 °C).
In all cases are supposed a direct current circuit.
Voltage drop is calculated with conductor temperature of 120 °C.

CORRECTION FACTORS FOR AIR TEMPERATURE

Air Temp. (ºC)	Up to 60	70	80	90
Factor	**1**	0,92	0,84	0,75

For groups reduction factors according to IEC 60364-5-52, Table A.52-17 shall apply.

TOXFREE® ZH OUTDOOR
H07Z1-K (AS) type 2 CuSn

Flexible and halogen free earthing connections.

ACCORDING TO: EN 50525-3-31 / UNE 211002

100% Green Energy Cable Production

B2ca

APPLICATION

Toxfree® ZH Outdoor H07Z1-K is a LSHF safety cable specially engineered for earthing connections in outdoor installations. The tinned copper and the special UV resistant compound make the cable resistant against corrosion and UV rays' degradation.

CONSTRUCTION

Conductor
Electrolytic annealed tinned copper, class 5 (flexible) according to IEC 60228 and EN 60228.

Insulation
UV resistant polyolefin, type TI7 according to EN 50363-7.
The standard identification of insulated conductors is the following:
Green/Yellow RAL 6018/1021
Other colours available on request.

CHARACTERISTICS

Electrical performance
Low voltage: 450/750 V.

Thermal performance
Maximum conductor temperature: 70°C.
Maximum short-circuit temperature: 160°C (max. 5 s).
Minimum service temperature: -40°C (fixed and protected installations).

Fire performance
Flame non-propagation according to EN 60332-1 / IEC 60332-1.
Fire non-propagation according to EN 60332-3-24 / IEC 60332-3-24 and EN 50399.
Reaction to fire CPR: $B2_{ca}$-s1a, d1, a1, according to EN 50575.
Low Smoke Halogen-Free according to EN 60754-1 / IEC 60754-1.
Low corrosive gases emission according to EN 60754-2 / IEC 60754-2.
Low smoke emission according to EN 61034 / IEC 61034:
Light transmittance > 80%.

Mechanical performance
Minimum bending radius: 5x cable diameter.

Environmental performance
Chemical & Oil resistance: Excellent.
Grease & mineral oils resistance: Excellent.
UV Resistant according to EN 50618.
Ozone resistant according to EN 50618.

STANDARDS / COMPLIANCE

According to
EN 50525-3-31 / UNE 211002

Standards and approvals
HAR / AENOR / BUREAU VERITAS / RoHS / CE

CPR (Construction Products Regulation)
$B2_{ca}$-s1a, d1, a1

TOXFREE® ZH OUTDOOR
H07Z1-K (AS) type 2 CuSn

DIMENSIONS & ADMISSIBLE INTENSITIES

Cross-section (mm^2)	Diameter (mm)	Weight (kg/km)	In conduit 2 cond. (A) [1]	In conduit 3 cond. (A) [1]	Voltage drop (V/A · km) [2]
1 x 4	4,1	45	32	28	12,2
1 x 6	4,7	65	41	36	8,11
1 x 10	6,0	105	57	50	4,66
1 x 16	7,0	160	76	68	2,97
1 x 25	8,8	250	101	89	1,90
1 x 35	9,9	335	125	110	1,35
1 x 50	11,7	480	151	134	0,94
1 x 70	13,2	660	192	171	0,66

[1] Reference method B1 for two and three loaded conductors installed in conduit on a wall according to IEC60364-5-52 in open air at 30°C ambient temperature.
[2] At 70°C conductor temperature, cos φ= 1 and single-phase circuit.

SHORT-CIRCUIT CURRENT-CARRYING CAPACITIES

Time (s)	0,1	0,2	0,3	0,5	1	1,5	2	2,5	3
A/mm^2	364	257	210	163	115	94	81	73	66

CORRECTION FACTORS FOR AIR TEMPERATURE

Air T. (°C)	20	25	30	35	40	45	50	55	60
Factor	1,12	1,06	1	0,94	0,87	0,79	0,71	0,61	0,50


Top Cable
OFICINES

DECLARATION OF PERFORMANCE
DECLARACIÓN DE PRESTACIONES

DoP Nr/ nº: **TC054** Rev.1

–

Code of the product-type / *Código de producto tipo:*
TOPSOLAR PV C H1Z2Z2-K

Identification of the product / *Identificación del producto de construcción:*
H1Z2Z2-K full range according to EN 50618

Intended use/s: / *Uso/s previsto/s:*
Supply of electricity in buildings and other civil engineering works with the objective of limiting the generation and spread of fire and smoke. Power Cables.

Suministro de electricidad en edificios y otras obras de ingeniería civil con el objetivo de limitar la generación y propagación de fuego y humo. Cables de potencia.

Manufacturer / *Fabricante:*

TOP CABLE S.A.
Leonardo da Vinci, 1
08191 Rubí (Barcelona) SPAIN
Tel. +34 93 588 09 11
Fax: +34 93 588 04 11
Email: ventas@topcable.com

Authorized representative: / *Representante autorizado:* N/A
System/s of AVCP: / *Sistema/s de EVCP:* System 1+ / Sistema 1+
Harmonized standard: / *Norma armonizada:* EN 50575:2014 and EN 50575:2014/A1: 2016
Notified body/ies: / *Organismo/s notificado/s:* AENOR – 0099

Notified product certification body issued the Certificate of Constancy of Performances for characteristics of reaction to fire.

Organismo notificado de certificación de producto que ha emitido el Certificado de Constancia de las Prestaciones para las características de reacción al fuego.

Declared performances: / *Prestaciones declaradas:*

Essential characteristics / Características esenciales	Performance / Prestaciones
Reaction to fire / Reacción al fuego	**C_{ca} - s1b, d2, a1**
Dangerous substances / sustancias peligrosas	NPD (Non Performance declaration / Prestación no determinada)

The performance of the product identified above is in conformity with the set of declared performances. This declaration of performance is issued, in accordance with Regulation (EU) No 305/2011, under the sole responsibility of the manufacturer identified above.

Las prestaciones del producto identificado anteriormente son conformes con el conjunto de prestaciones declaradas. La presente declaración de prestaciones se emite, de conformidad con el Reglamento (UE) nº 305/2011, bajo la responsabilidad exclusiva del fabricante arriba identificado.

Signed for and on behalf of the manufacturer by / *Firmado por y en nombre del fabricante por:*

Felipe DIAZ RUBIO,
Technical Department

Rubí (Barcelona) Spain, 30/04/2020

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Zertifikat *Certificate*

TÜVRheinland®

Zertifikat Nr. *Certificate No.*
R 60113828

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0001

Ihr Zeichen *Client Reference*	Unser Zeichen *Our Reference*	Ausstellungsdatum *Date of Issue* (day/mo/yr)
	0010--21243325 001	13.10.2016

Genehmigungsinhaber *License Holder*
TOP CABLE S.A.
P.A.E. Can Sant Joan
Leonardo da Vinci 1
08191 Rubi - Barcelona
Spain

Fertigungsstätte *Manufacturing Plant*
AKAN Cables S.L.
P.L. Plans de la Sala,Parcela 11
08650 Barcelona
Spain

Prüfzeichen *Test Mark*

TÜVRheinland CERTIFIED
Type Approved
Safety
Regular Production
Surveillance
www.tuv.com
ID 1111210601

Geprüft nach *Tested acc. to*
EN 50618:2014

Zertifiziertes Produkt (Geräteidentifikation)
Certified Product (Product Identification)

Lizenzentgelte - Einheit
License Fee - Unit

PV-Cables

Identification:	TOPSOLAR PV H1Z2Z2-K	16
Code designation:	H1Z2Z2-K	
Rated diameter:	2,5 mm²; 4,0 mm²; 6,0 mm²; 10,0 mm²; 16,0 mm²; 25,0 mm²	
Rated voltage:	AC U0/U 1,0/1,0 kV	
Rated voltage:	DC 1500 V (conductor-conductor and conductor-earth)	
Max. permitted voltage:	DC 1,8 kV	
Light transmission:	82,1 %	
Ambient temperature:	-40 °C to +90 °C	
max. Core temperature:	+120 °C @ 20.000 h	
Material of Insulation:	Halogene Free thermosetting rubber	
Material of Sheath:	Halogene Free thermosetting rubber	
Colour of Sheath:	black	

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Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es bestätigt die Konformität des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzliche Anforderungen in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzlich betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht.
This certificate is based on our Testing and Certification Regulation and states the conformity of the product with the standards and testing requirements as indicated above. Any additional requirements in countries where the product is going to be marketed have to be considered additionally. The manufacturing of the certified product is subject to surveillance.

Zertifizierungsstelle

TÜVRheinland LGA Products GmbH Zertifizierungsstelle

Guido Volberg

TÜV Rheinland LGA Products GmbH, Tillystraße 2, 90431 Nürnberg
Tel.: +49 221 806-1371 e-mail: cert-validity@de.tuv.com
Fax: +49 221 806-3935 http://www.tuv.com/safety

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Zertifikat *Certificate*

TÜVRheinland®

Zertifikat Nr. *Certificate No.*
R 60113828

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0002

Ihr Zeichen *Client Reference*	Unser Zeichen *Our Reference*	Ausstellungsdatum *Date of Issue* (day/mo/yr)
	0010--21243325 002	29.11.2016

Genehmigungsinhaber *License Holder*
TOP CABLE S.A.
P.A.E. Can Sant Joan
Leonardo da Vinci 1
08191 Rubi - Barcelona
Spain

Fertigungsstätte *Manufacturing Plant*
AKAN Cables S.L.
P.L. Plans de la Sala,Parcela 11
08650 Barcelona
Spain

Prüfzeichen *Test Mark*
TÜVRheinland CERTIFIED
Type Approved
Safety
Regular Production Surveillance
www.tuv.com
ID 1111210601

Geprüft nach *Tested acc. to*
EN 50618:2014

Zertifiziertes Produkt (Geräteidentifikation) *Certified Product (Product Identification)*

Lizenzentgelte - Einheit *License Fee - Unit*

PV-Cables

as page 0001
Amendment

additional Colour of sheath: RED

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde und es bestätigt die Konformität des Produktes mit den oben genannten Standards und Prüfgrundlagen. Zusätzliche Anforderungen in Ländern, in denen das Produkt in Verkehr gebracht werden soll, müssen zusätzlich betrachtet werden. Die Herstellung des zertifizierten Produktes wird überwacht.
This certificate is based on our Testing and Certification Regulation and states the conformity of the product with the standards and testing requirements as indicated above. Any additional requirements in countries where the product is going to be marketed have to be considered additionally. The manufacturing of the certified product is subject to surveillance.

Zertifizierungsstelle

TÜV Rheinland LGA Products GmbH · Zertifizierungsstelle · TÜVRheinland

Guido Volberg

TÜV Rheinland LGA Products GmbH, Tillystraße 2, 90431 Nürnberg
Tel.: +49 221 806-1371 e-mail: cert-validity@de.tuv.com
Fax: +49 221 806-3935 http://www.tuv.com/safety

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High-performance cables for **PV generation**

Worldwide environmental concerns are accelerating the growth of solar power generation. Cables used in solar generation differ from those used in industrial installations in the sense that they must be designed to withstand harsh environmental conditions like rain, long-term exposure to ozone and sunlight, extreme temperature fluctuations and direct ultraviolet (UV) rays.

Building a quality, safe and profitable solar PV plant with a good return on investment (RoI) is the most important objective of investors, project owners and also developers. **Cables only represent around 4-5% of a solar project cost, but it can have a significant impact on the power output.** Cabling is often not considered to be a critical factor, however improper design and/or poor cable selection can lead to safety hazards, reduced power output, and other performance issues that may jeopardize the overall lifetime of a PV system.

On the contrary, a proper cable selection and management are vital to the health of the PV system as it contributes to minimize maintenance, optimize safety and enable longer-lasting PV systems.

To maintain longevity performance and reliability of the PV system, solar cables must have been specifically engineered to optimize efficiency and minimize line losses. All cables in PV installations should be developed to resist UV, ozone, sand abrasion and water absorption, as well as provide excellent flexibility for extreme low weather conditions and deformation resistance during prolonged exposure at high temperatures. Regardless of their size, all PV installations require high-quality cables that provide excellent mechanical properties and superior sunlight resistance for outdoor installations, easy handling and, depending on the installation type (PV farm or PV floating farm) extra flexibility as well as maximum water performance.

Cable certification is paramount to ensuring the economic viability of PV power systems. The industry has seen a variety of cable designs and practices, many of which may not necessarily support long-term solar needs. In recent years, manufacturers in the photovoltaic industry have upgraded their technology, increasing the operating voltage up to 1500V in DC.


Top Cable

Cables especially engineered to meet the **most exigent solar requirements**

Top Cable has specifically engineered superior electric performance PV cables that resist to UV rays, ozone, sand abrasion and water absorption, as well as provide excellent flexibility for extreme weather conditions during prolonged exposure at sunlight.

The company is continuously developing new cable solutions for new incoming markets to meet its customers' most demanding needs in solar power generation. The solar plants are conceived, designed and manufactured to have 25 years durability and recent Tribunal considers a useful life of 35 years. Of course some minor investment will be needed from the beginning to reach a 35 years lifetime.

For solar tracking panels, our **Topsolar® H1Z2Z2-K cables** have been designed with a rubber cross-linked insulation and outer sheath that makes the cable extremely flexible, as the panels will be moving along with the sun. These cables also meet the most stringent global standards for halogen-free, fire-retardant, and low-corrosive gas emissions, are AD8, direct burial and TÜV certified according to EN 50618 and IEC 62930.

Top Cable has developed an **Aluminium cable** specifically engineered for all types of underground and open-air solar installations, that provides extra durability and prevents the premature ageing of the cable, providing longevity performance and reliability of the PV investment.

In order to connect the PV installation to substations and the power grid we have developed a complete range of **high-performance Medium Voltage cables**.

Planning and designing a **PV Plant**

When planning and designing a PV plant certain factors need to be considered, including the size of the solar array, its geographical location, and other site-specific considerations.

1. PV Plant with string box

In a large solar photovoltaic installation using central inverter and combiner/string box, multiple solar modules are connected in series in a string to build the voltage up to proper levels. Then the power is transmitted in DC from string box that combines the output of multiple strings of PV modules for connection to the central inverter.

- The solar cable must be certified according to EN 50618.
- The aluminium cable must be UV Resistant, directly buried and the cable must support voltage test according to EN 50618.

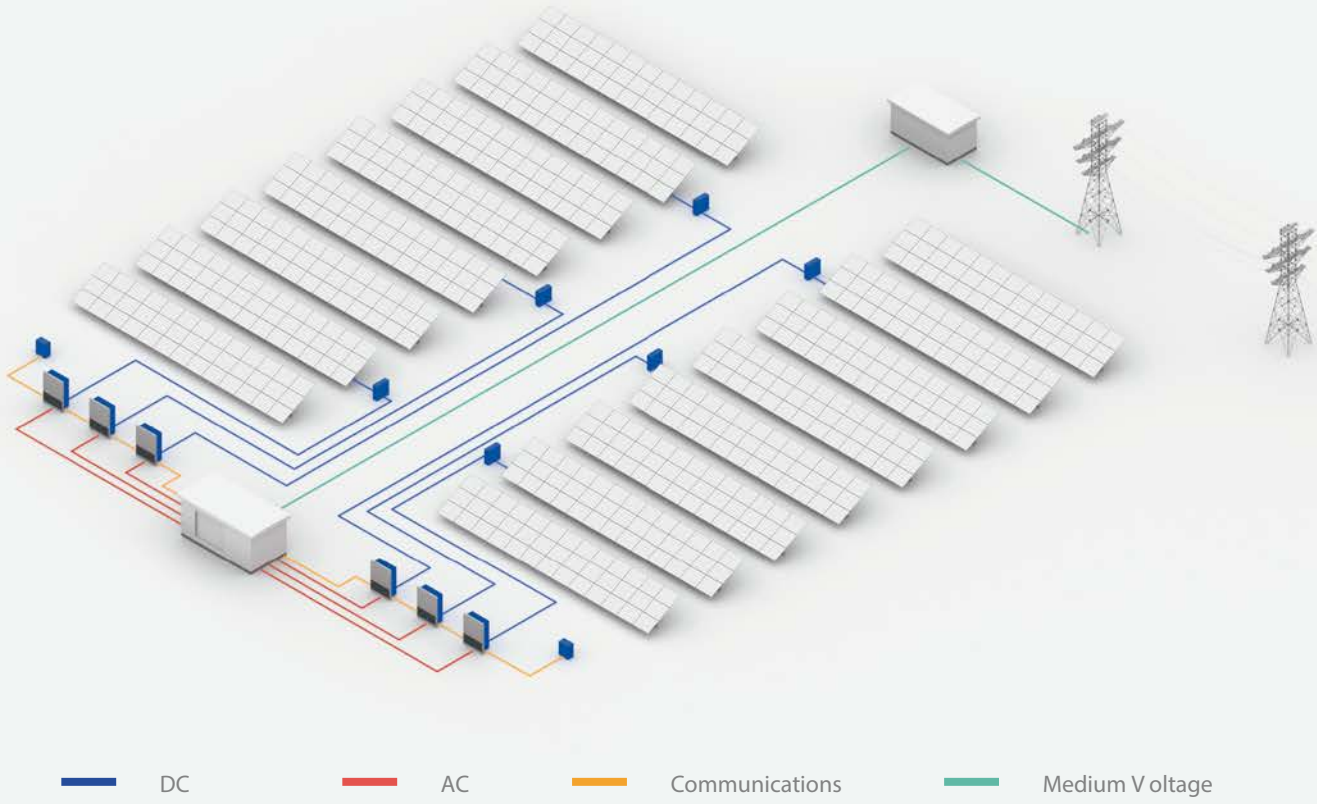
2. PV Plant with string inverter

An increasing number of ground-mount PV systems are built using String Inverter technology. The preference of string inverters over central inverters continues to grow because of the benefits of the modular power electronics design.

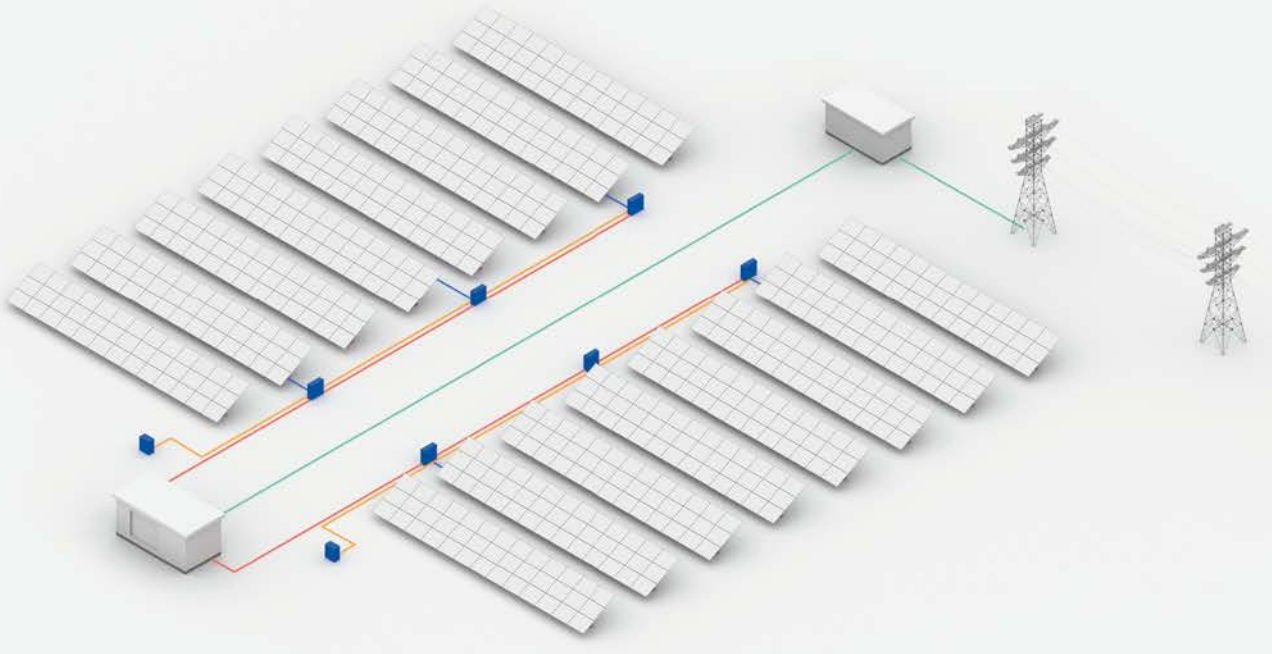
As the previous installation, multiple solar modules are connected in series in a string to build the voltage up to proper levels. Then the power is transmitted in AC from string inverter that combines the output of multiple strings of PV modules for connection to the power station.

- The solar cable must be certified according to EN 50618.
- The aluminium cable must be UV Resistant, directly buried and support voltage test 1,8/3 kV according to IEC 60502-1.

1. PV Plant with string box



2. PV Plant with string inverter



Top Cable

Topsolar®: A complete range of cables for solar installations

At Top Cable you will find a reliable manufacturer and supplier for all power cables required on PV installations. Our comprehensive range of solar cables covers from cable selection or design, project management with our technical expertise to logistics and after-sales service support.

Top Cable is committed to manufacturing products under the highest quality standards and in offering an excellent service to its customers worldwide, highlighting:

- Total traceability in our product range.
- Cables specifically designed for solar installations.
- Worldwide recognized certificates.
- Full product range up to 66kV.
- CPR certified cables.
- After-sales service support.
- Large solar cable stock.

Solar cables engineered to meet the most exigent **safety requirements.**

Top Cable

Top Cable, an **international manufacturer** of industrial and power cables

Top Cable is a recognized manufacturer of electric cables, always meeting the highest expectations that contractors, developers, grid operators, panel manufacturers and integrators demand when designing a solar installation. The company has supplied cables to worldwide solar installations from residential installations to large scale rooftops, floating solar projects or ground farms.

All Top Cable's manufacturing plants are based around Barcelona, Spain. The organization is a medium-sized, family-owned company manufacturing electric cables on an international scale, with offices and warehouses located around the globe. Therefore, we guarantee customer proximity on a global level.

Customers around the world appreciate Top Cable as a technically leading manufacturer of solar cables of outstanding quality. Customers receive their solar deliveries on schedule from the company's main logistics centre located in Barcelona.

Large PV cable stocks are available there to ensure short lead times and shipment flexibility. Top Cable also manages several solar cable stocks across their worldwide offices and wharehouses to avoid out-of-stock situations in the supply chain.

Our PV cables are TÜV certified, meeting the most stringent solar specifications. Check other National Electric Code requirements and PV certificates with your Top Cable technical sales expert.


TOP CABLE

Innovation

Our R&D Centre and laboratories were established to provide research work and to enable us to constantly provide high-performance cables that are suited for multiple applications in various industries.

Being conscious of the importance of optimal costing, Top Cable has opted for the integration of our processes, through focusing each of our production centres into a specialized production unit, while coordinating with one another to optimize common resources.

Our technical staff are professionally trained and assure the highest quality in the cable production process.

Top Cable | Solar Cables

Leonardo Da Vinci nr.1
08191 Rubí (Barcelona) Spain
Tel + 34 93 586 21 68
+ 34 93 586 21 69
sales@topcable.com
www.topcable.com

Top Cable