





Customizable Trunk Solution (CTS) For Solar Farm Applications

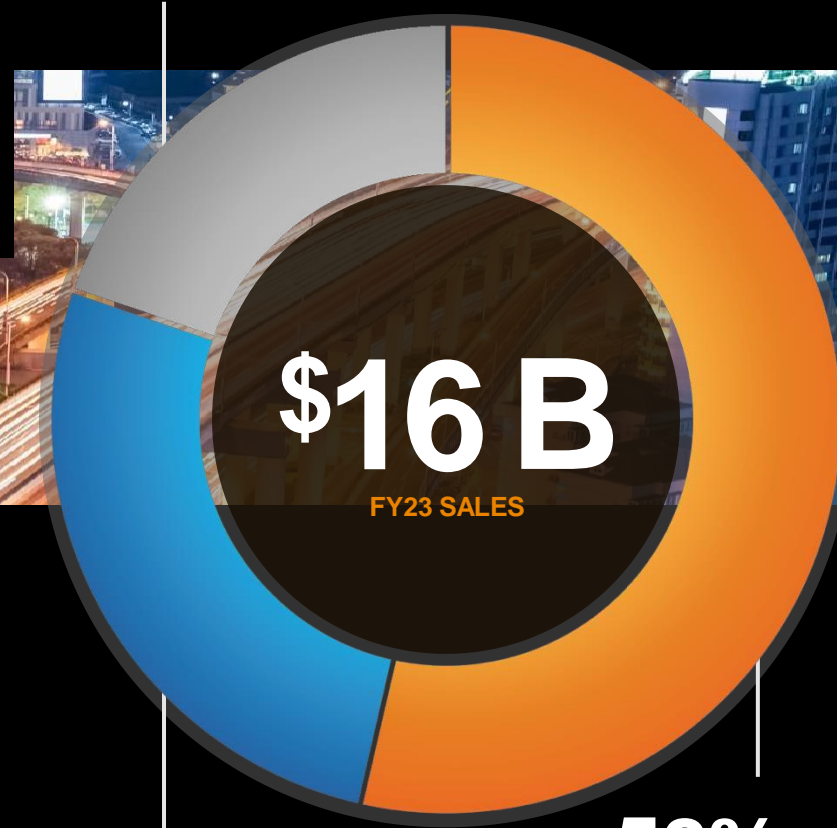
- ✓ Streamlined trunk-bus architecture
- ✓ Flexible and reliable solution
- ✓ Engineering consultant service

EVERY CONNECTION COUNTS



- Energizing the grid
- Reliable solutions
- Cost reduction
- Ease of installation
- Bankability

12% COMMUNICATIONS
Appliances, Data & Devices,



15K+ Patents

CONNECTING THE WORLD

120B

PRODUCTS MANUFACTURED ANNUALLY

30%

INDUSTRIAL

Industrial, Aerospace, Defense & Marine, Medical, Energy

58%

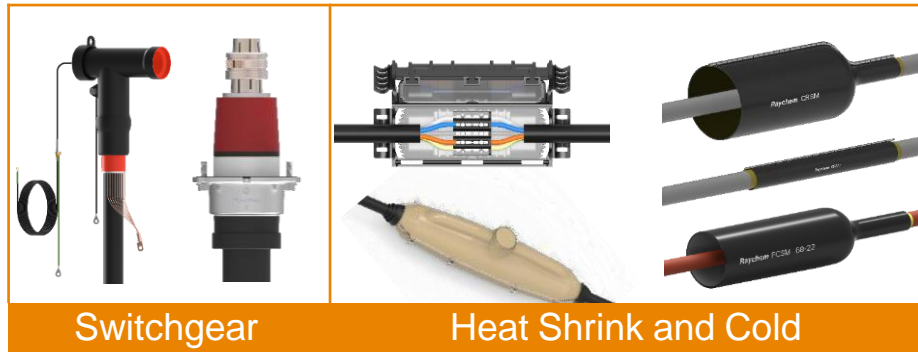
TRANSPORTATION

Automotive, Industrial & Commercial Transportation, Sensors, Application Tooling

Broad Portfolio –PV Panels to Substation

Cable Accessories

- Raychem products feature a variety of insulating and sealing technologies
- Heat shrink, cold applied, gel, resin and casting materials
- Suitable for LV, MV and HV applications
- Ensuring reliability in severe environments



Switchgear

Heat Shrink and Cold



Terminations

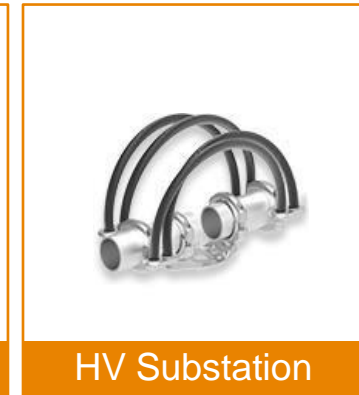
Joints / Splices

Connectors & Fittings

- A wide range of AMP, SIMEL and Utilux solutions
- Offering advanced crimp, shear bolt, wedge pressure, exothermic welding and insulation piercing
- These technologies have revolutionized the industry



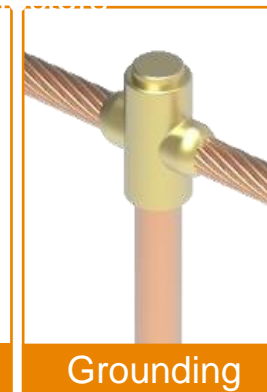
Crimp and Mechanical



HV Substation



Wedge

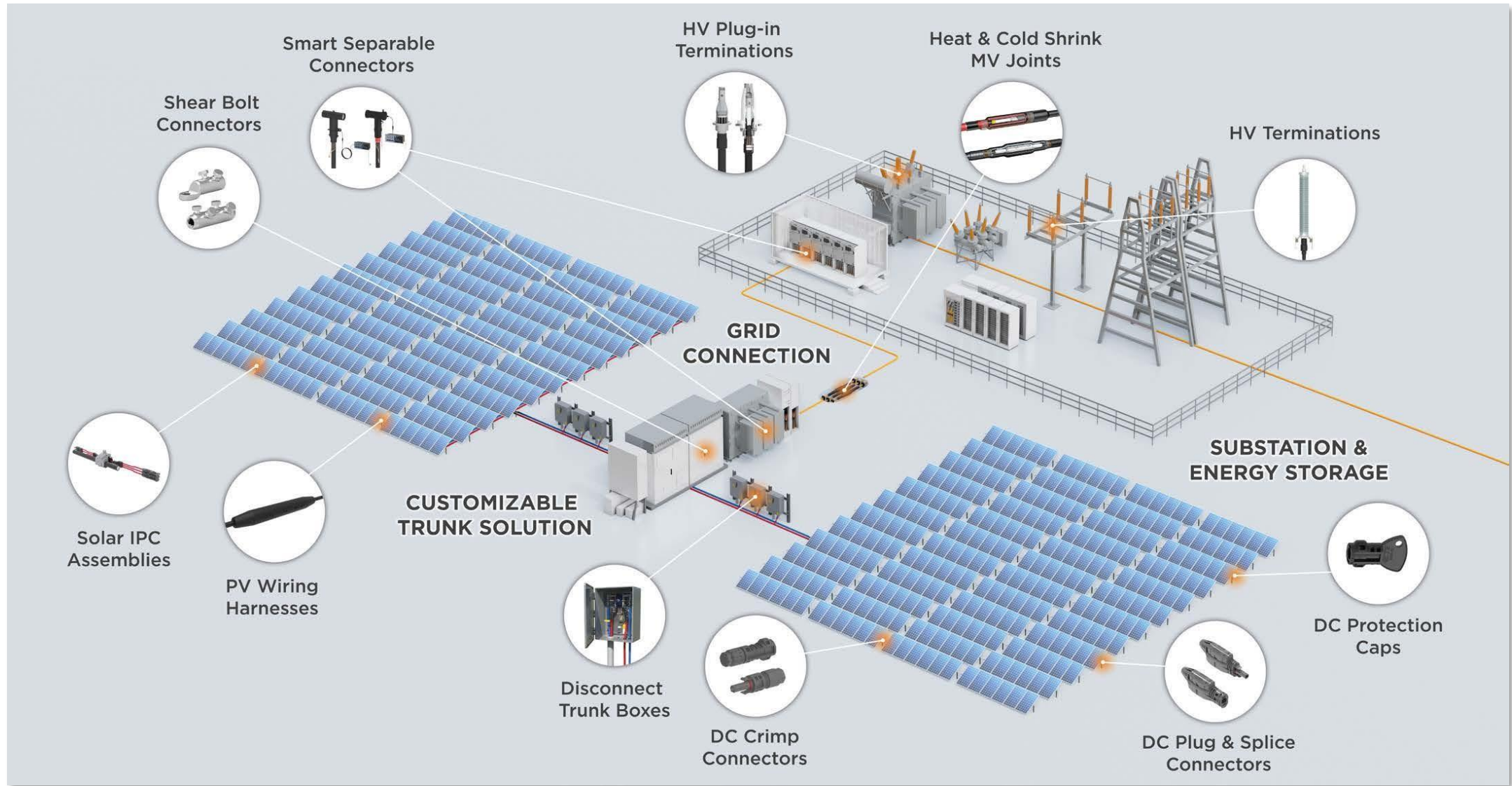


Grounding



Insulation Piercing

TE's Solar Solutions Portfolio Snapshot



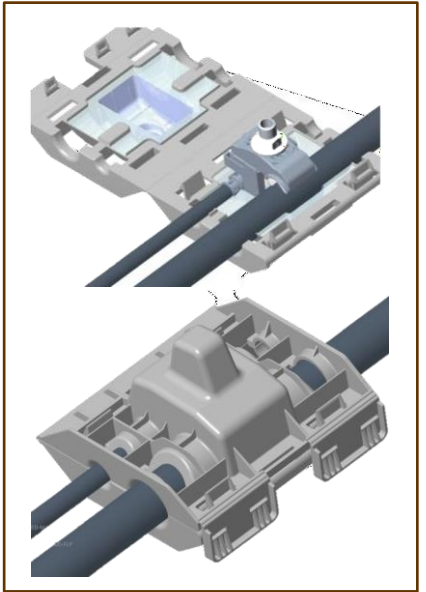
Customizable Trunk Solution (CTS) Reference List

Project Name	Owner/Developer	Location	MW DC
First Solar	Various	Various	2,700
Chicot	NextEra	AR	140
Sanford	NextEra	ME	70
Farmington	NextEra	ME	117
Athos I & II	SB Energy	CA	643
Townsite	Capital Dynamics	NV	300
Atkina	Tokyo Gas & Electric	TX	630
ESM	Advantus (8 Minute Energy)	NV	383
St. James	Energy	LA	35
Pumpkin Seeds	Dominion	VA	80
Route 66	NextEra	NM	75
Buena Vista	NextEra	NM	159
Big Star	RWE Renewables	TX	245
Concho Valley	RWE Renewables	TX	215
Mulligan	Apex Clean Energy	IL	93
Jamison	Ecoplexus	FL	85
Hunter	DESRI (DE Shaw)	CO	101
Madison	Dominion	VA	76
Roseland	Enel Green Power	TX	640
Stampede	Enel Green Power	TX	326
Ganado	Enel Green Power	TX	208
Longbow	Clean Capital	TX	113
Danish Fields	Total	TX	600
Crown & Sol	Buckeye Partners	TX	270
Edison	Strata	VA	3
High Point	Acciona	IL	124
Union	Acciona	OH	407
MT-Sun	Greenbacker	MT	103
Fall River	Greenbacker	SD	100
Lumina I & II	Intersect Power	TX	840
Stagecoach	CPV	GA	100
High Mesa	AES	CO	17
Geer Road I, II, III	AES	NY	20
Mid-Continent	DESRI (DE Shaw)	MI	27
Greenstone	DESRI (DE Shaw)	MI	26
Blue Elk I, II, III, V, VII	DESRI (DE Shaw)	MI	125
Dunns Bridge	NextEra	IN	700
Liberty	Recurrent Energy	TX	62
Sunray	Arava Power	TX	272
Bellfield	Avantus	CA	641
Paulsell	NexEra	CA	33
Savion Martin	Savion	KY	144
Brittlebush	EDP Renewables	AZ	283
Ragsdale	EDP Renewables	MS	137
Wolf Run	EDP Renewables	IL	208
Bayou Galion	Recurrent Energy	LA	127
Estonian	Enel Green Power	TX	260
Sunlight Road	DESRI (DE Shaw)	LA	68
Prairie Mist	Primergy	AR	137
Azalea Springs	EDP Renewables	TX	250
Aspen Road	Brookfield	PA	131
Tag	National Renewable Solutions	NM	170
Shallow Basket	National Renewable Solutions	NM	168
Oak Hill	Vistra	TX	260
TOTAL North America			14+GW

1st Gen IPC: 2016-2019



2nd Gen IPC: 2019-2023



3rd Gen IPC: 2023



14+GW

TE Customizable Trunk Solution (CTS) Line-Up

Reduce overall labor, operational and maintenance costs with our CTS Customizable Trunk Solution. Designed to eliminate combiner boxes and provide plug-and-play flexibility whether installed underground or above.



Solar Insulation Piercing Connectors (SIPC) with Pre-assembled multi-tap UL/cUL 9703 and UL 486A/B

Provide Insulation Piercing Technology for fast connections with no insulation cutback and high-quality sealing. Ranges on Trunk Bus are 500-1000 kCMIL.



PV Wiring Harnesses – Fused and Unfused – UL/cUL 9703

Pre-assembled, customizable plug-and-play design with embedded fuses eliminate need for combiner boxes. Minimizing material within the design.



Trunk Bus Disconnect Boxes or “LBDs” – UL 1741

Protect low voltage systems from surge prior to the inverter connection and minimize cabling. No fuses and clustering are valuable designs.



TE Solar Insulation Piercing Connectors SIPC 1000 with Pre- assembled Multitap

✓ Most Reliable and Tested Solution

EVERY CONNECTION COUNTS



SIPC Features and Technology

Insulation Piercing Technology

Features & Benefits

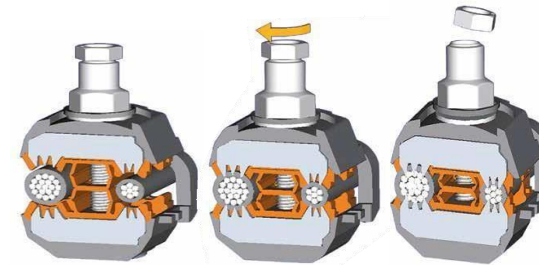
- Quick and easy install
- No need to strip the cables
- Long standing technology
- Simultaneous bolt action main & tap conductors
- Bolt isolated from conductors
- Watertight connection
- Range taking
- **Designed for Life of the project (35+ years)**

Tested and Certified to:

UL / cUL 9703

UL 486A-B

2019-2023 Technology – GS-IPC-500U



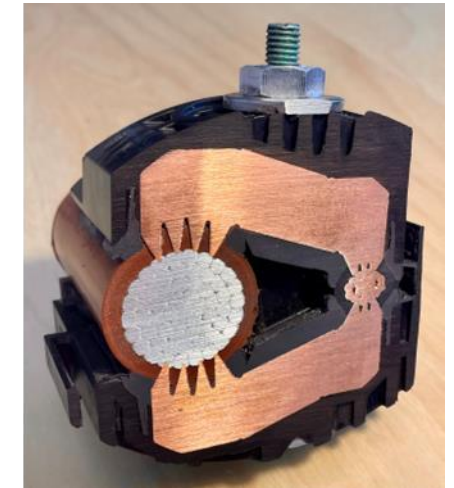
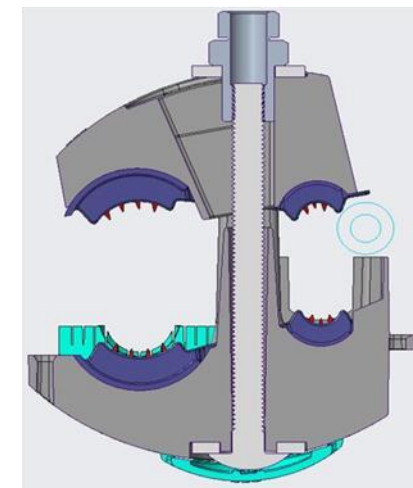
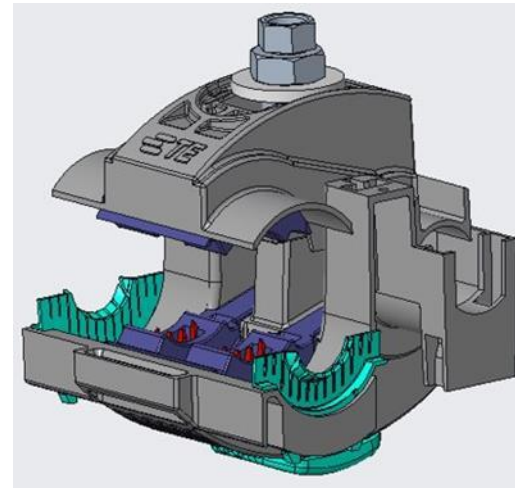
Piercing result on insulation



Clamping result on conductor



SIPC-1000 Technology



SIPC-1000 Harness Component Ratings and Versatility

PARAMETERS	TRUNK RATINGS	NUMBER OF TAPS	TAP PV CONNECTOR SIZE	MAXIMUM AMPACITY PER TAP	MAXIMUM AMPACITY
Maximum Current (at 55°C ambient)	414 A for Al stranded 500 kcmil	2	A= 10 awg	30A	60A
			B= 8 awg	55 A	110 A
			C= 6 awg	65 A	130 A
	642 A for Al Stranded 1000 kcmil	4	A= 10 awg	30 A	130 A
			B= 8 awg	55 A	220 A
			C= 6 awg	65 A	260 A
		6	A= 10 awg	30 A	180 A
			B= 8 awg	55 A	330 A

If #10 -> Total of 60A
If #8 -> Total of 110A
If #6 -> Total of 130A

If #10 -> Total of 130A
If #8 -> Total of 220A
If #6 -> Total of 260A

If #10 -> Total of 180A
If #8 -> Total of 330A

Current ratings are defined on per tap basis. If the harness with 6 8AWG taps is used, up to 330A (or 55A per 8AWG input) can be passing through the connector at an ambient temperature of 55C.

Four 10AWG Taps

Four 8AWG Taps

Four 6AWG Taps

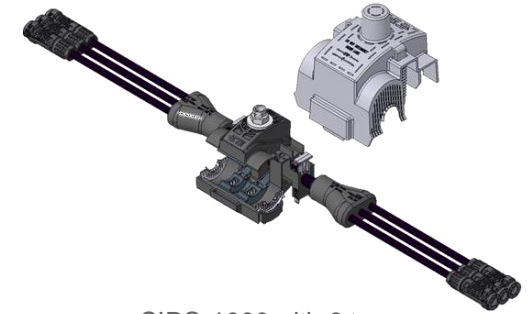
Six 10AWG Taps

Six 8AWG Taps

UL Compliance of TE SIPC-1000 Connector + Harnesses



Products	UL486 A/B Wire Connectors	UL9703 Distributed Generation Wiring Harnesses
SIPC-1000 "Next Gen"	Y	Y
TE Multitap Harness (#10, 8, 6) 2, 4, 6 taps	N/A	Y



SIPC-1000 with 6 taps

- ✓ Long-term Current Cycling – UL486
- ✓ Mechanical Sequence – UL486
- ✓ Static Heating – UL486
- ✓ Material & Flammability Tests
- ✓ Water Spray Sequence
- ✓ Temperature Test (Cont. Current)
- ✓ Dielectric Withstand & Leakage Current
- ✓ Current Overload Test



- ✓ Temperature Cycling Sequence
- ✓ Humidity Cycling Sequence
- ✓ Wet Insulation Resistance & Dielectric Tests
- ✓ Ambient & Cold Temperature Impact Tests
- ✓ Crush Resistance & Strain Relief Tests
- ✓ Push Test
- ✓ Corrosive Atmosphere Test(Bolt)

**TE solar products go through UL certification:
SIPC 1000 connector and harnesses UL File #E519468 for UL 9703
SIPC 1000 connector File #E13288 for UL 486 A&B**



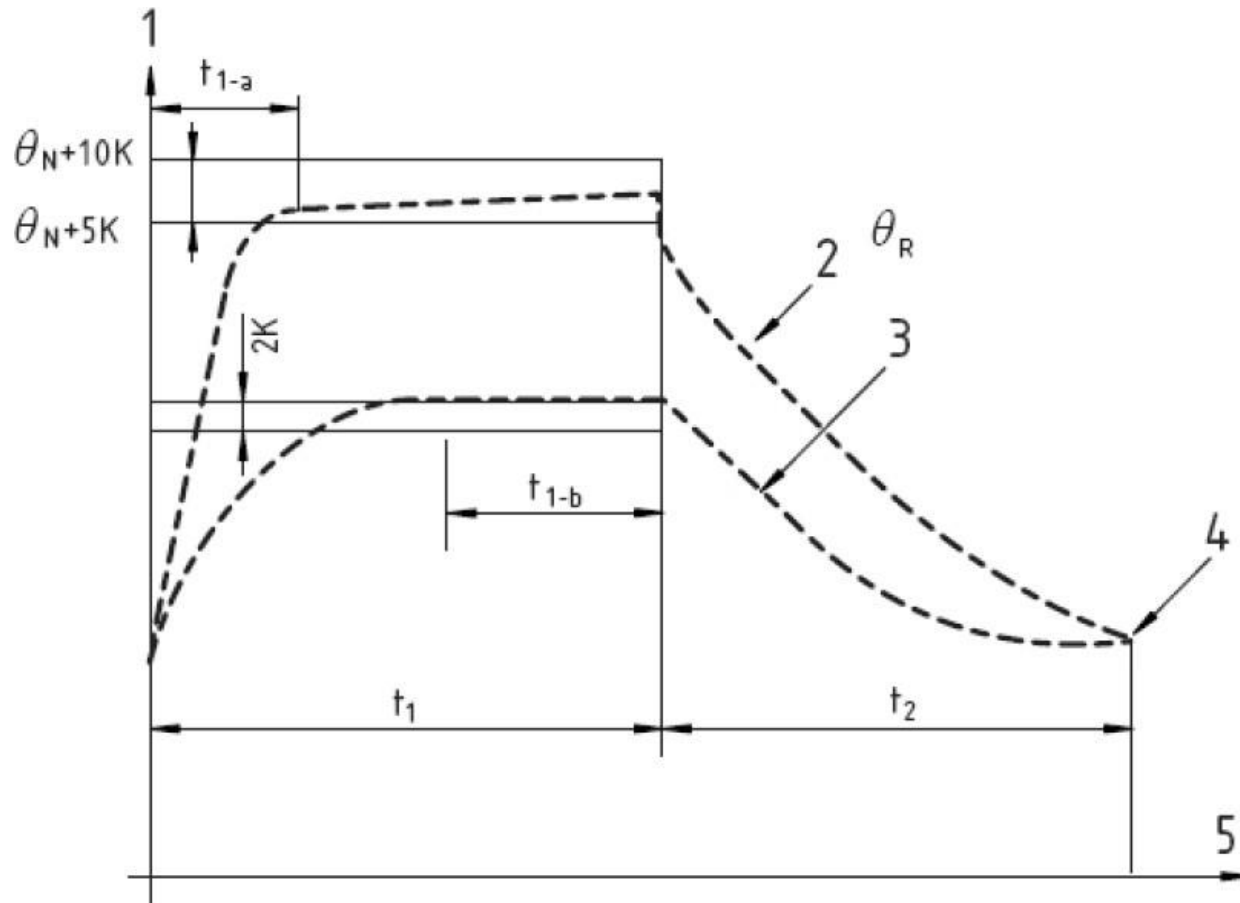
TE: SIPC-1000 Durability Tests per international standard EN50483



Durability Testing	Electrical Qualification	Environmental Qualification	Environmental Qualification
EN50483	1000 cycles (per standard) 2000 cycles (extended internal test)	Climatic Aging Test 1000 hrs (6 x 7 days)	Corrosion Aging Test 1300 hrs (4 x 14 days)
	RT to 100°C(315 A) 16 cycles/day	-25°C to +70°C UV, Humidity, Water Spray	7 Days SO ₂ 7 Days NaCl
Requirement	0 Cycles= "X"Ω 250 Cycles="Y" Ω 0-1000 Cycle= < "2X"Ω 250-1000 Cycle= <"1.15Y"Ω Connector Temp < Conductor	After 1000 hours, DVW(air)= 6kV for 1 min. DVW(H ₂ O)=1kV for 1 min. No deterioration Legible marking	No significant red rust No deterioration Shearhead removable Legible marking
Takeaway:	Stable Resistance ↓ Stable Voltage ↓ Stable SIPC Performance	Watertight Connection ↓ No Corrosion nor safety concern ↓ Stable SIPC Performance	No Corrosion ↓ Stable SIPC Performance

EN50483 measures long-term stability & durability beyond UL requirements

EN50483 – Electrical – 2000 Cycles Test



Electrical Qualification
1000 cycles (per standard) 2000 cycles (extended internal test)
RT to 100°C(315 A) 16 cycles/day
0 Cycles= "X"Ω 250 Cycles="Y" Ω 0-1000 Cycle= < "2X"Ω 250-1000 Cycle= < "1.15Y"Ω Connector Temp < Conductor
Stable Resistance ↓ Stable Voltage ↓ Stable SIPC Performance



EN50483 measures long-term stability & durability beyond UL requirements

Solar Fuse Harness (SFH)

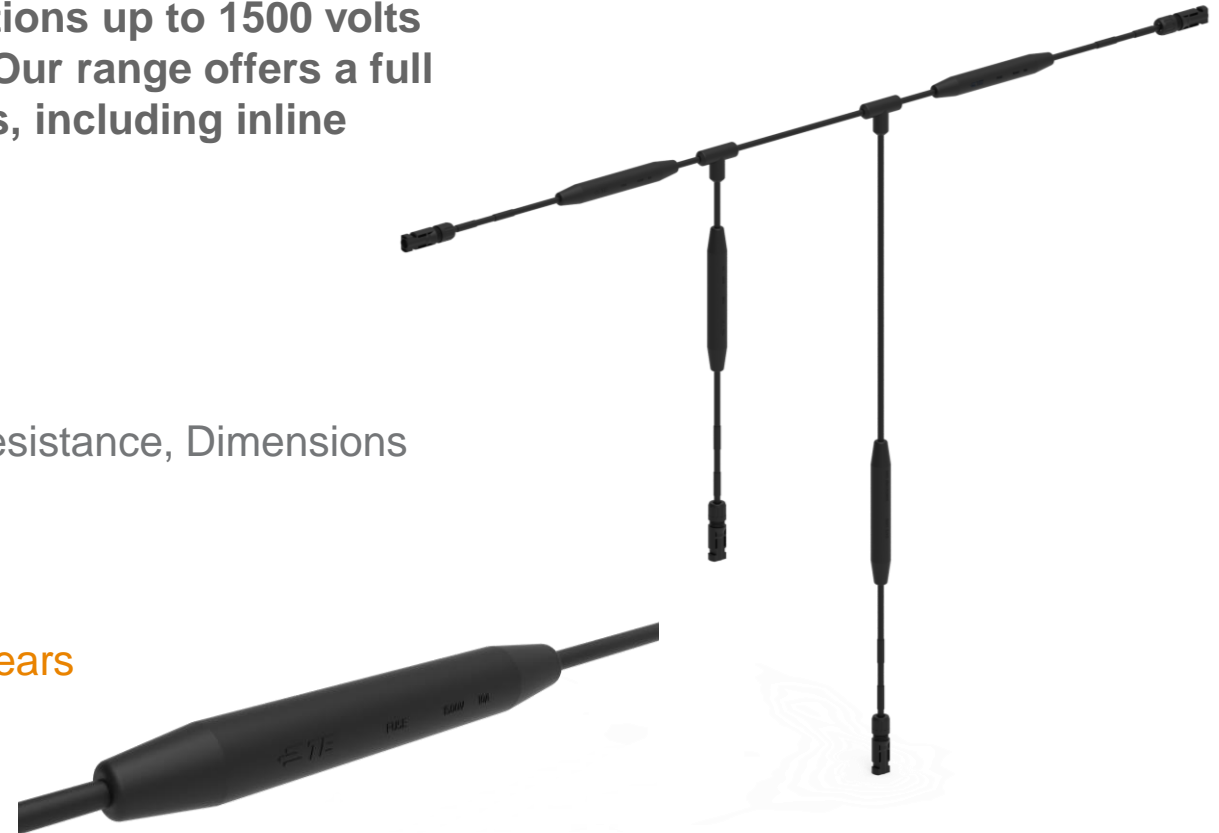
SFH cable assemblies are designed for solar farm applications up to 1500 volts and 60 amps with multiple gauge options (#6 - #12 AWG). Our range offers a full solution of harnesses with a wide variety of configurations, including inline fuses, branching, whips, and string jumpers.

Tested and Certified to:

- UL/cUL 9703
- 100% Prior to shipping - Leakage Current, Continuity, Resistance, Dimensions

Features & Benefits

- Field-proven design – made and tested to perform for **+30 years**
- Designed for 1500V system with 2000V rated cable
- 100% compatibility with panel manufacturers
- Plug & Play solution
- Range of fuse protection fusible – 4 up to 60 A



EASY AND FAST INSTALLATION

Over molded fuse harness assemblies eliminate the need for combiner boxes

LBDs with Shear Bolt Lugs

Pre-integrated TE Shear Bolt Lugs



UP TO

70% INSTALLATION TIME SAVINGS

Factory Direct Lug Install

Shorten install time in field by:

- Eliminating torquing and marking when landed
- No crimping, eliminating deformation of the conductor
- Dry fit torque rating in NEMA 4X rated box eliminates No-Ox

Up to 3 times faster to install, more surface area connected on the conductor without deformation



TE Solar Insulation Piercing Connectors SIPC 1000 with Pre- assembled Multitap

✓ Design Flexibility

EVERY CONNECTION COUNTS



CTS System with SIPC 1000

Advantages of E-W Collection over N-S

Strings connected to DC trunk bus (up to 1000kCMIL/500mm²) using:

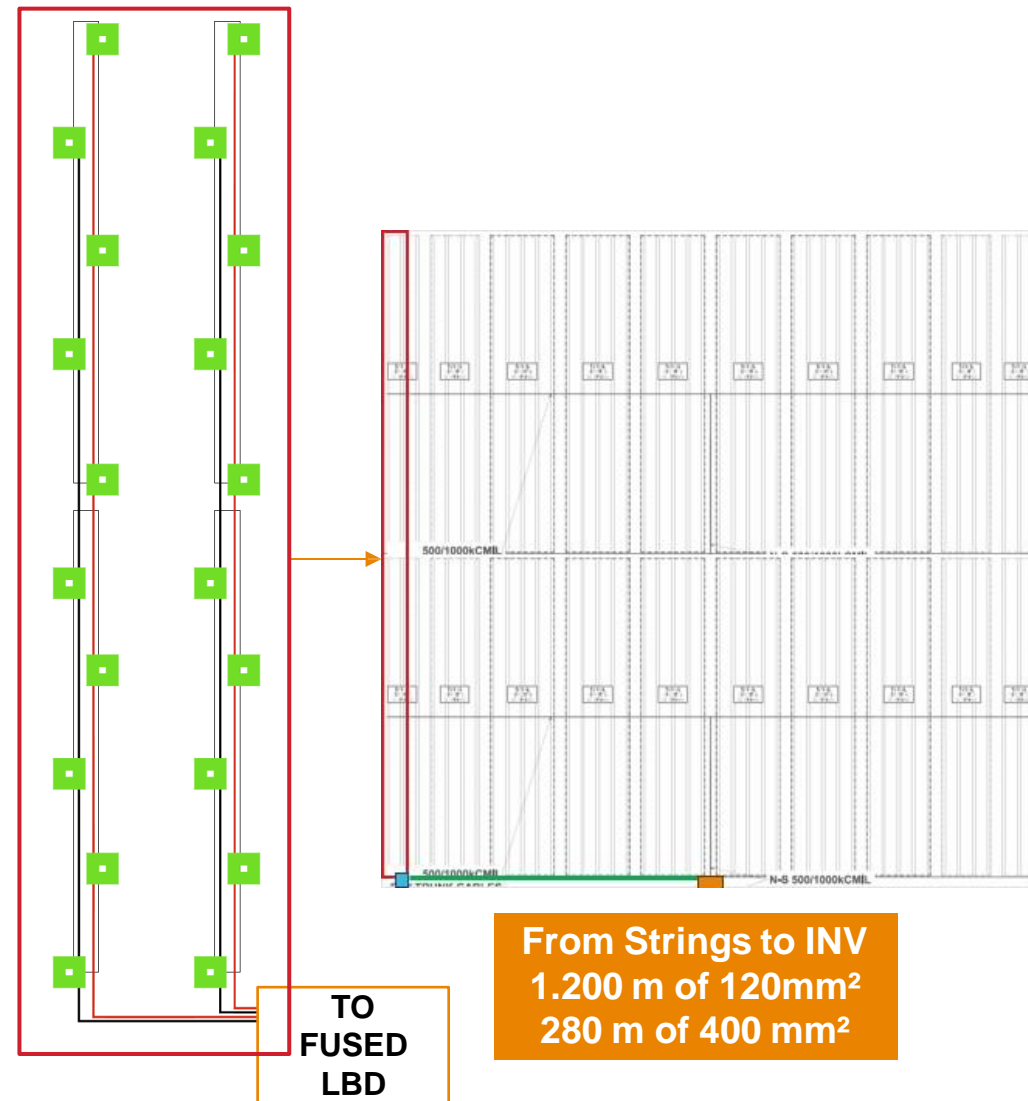
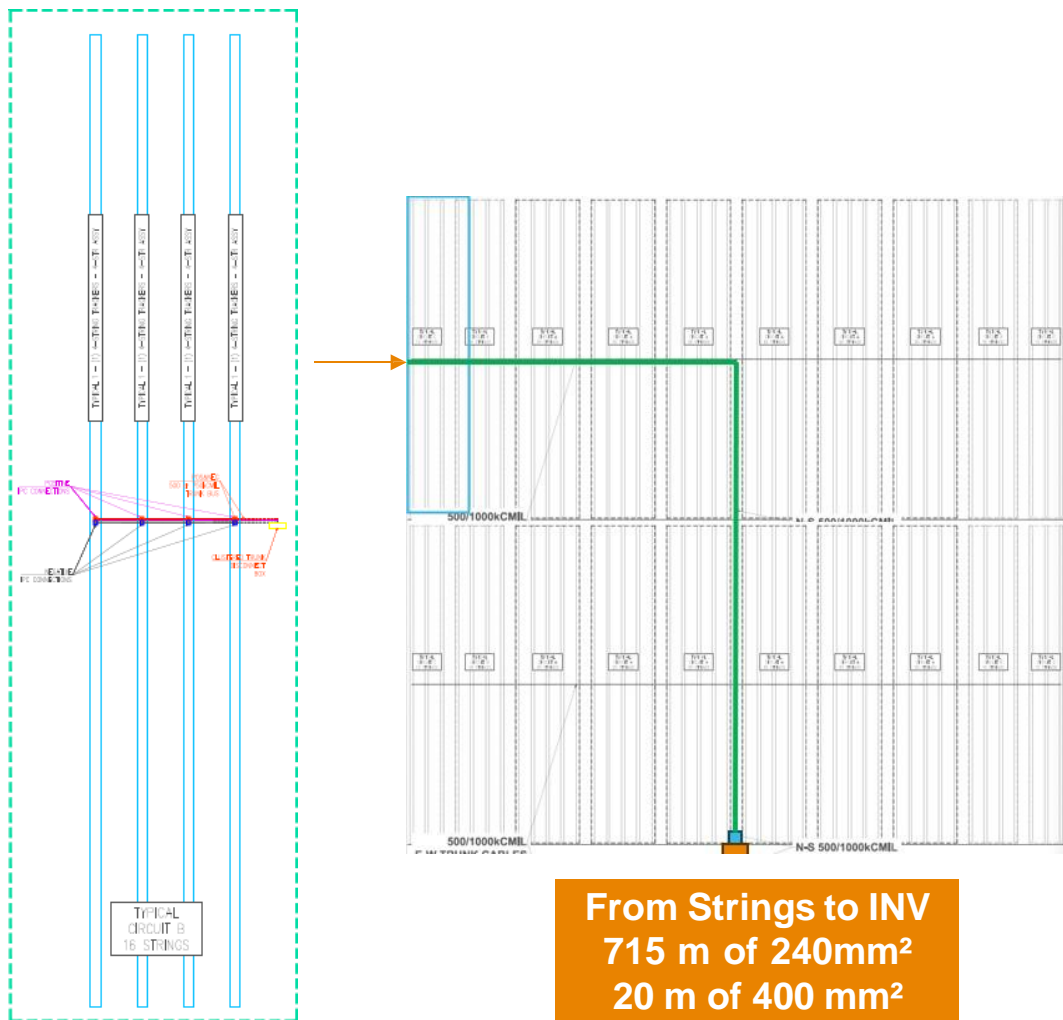
- TE's Fused Harnesses
- TE's SIPC (Solar Insulation Piercing Connector)
- TE's recommendation of strategically cluster the LBDs

- +50% Reduction of Al Wire (meeting VD% requirements)
- More flexible to build larger Circuits
- 1 Input Circuits – NO Fuses @ LBD
- Provides opportunity to Cluster LBDs
- Constructability – Very few diff. Typ Circuits
- Fewer components -> More reliability
- Skip Stringing offers 3X reduction of string wire



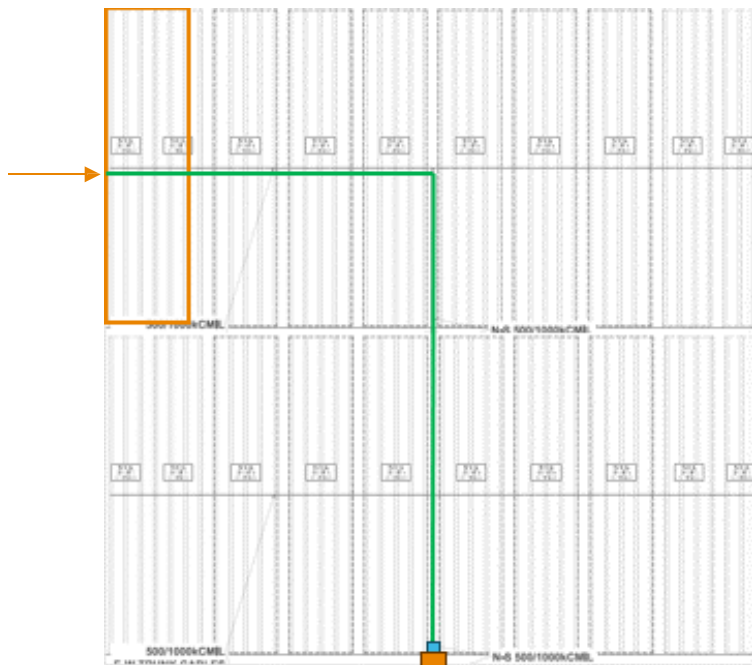
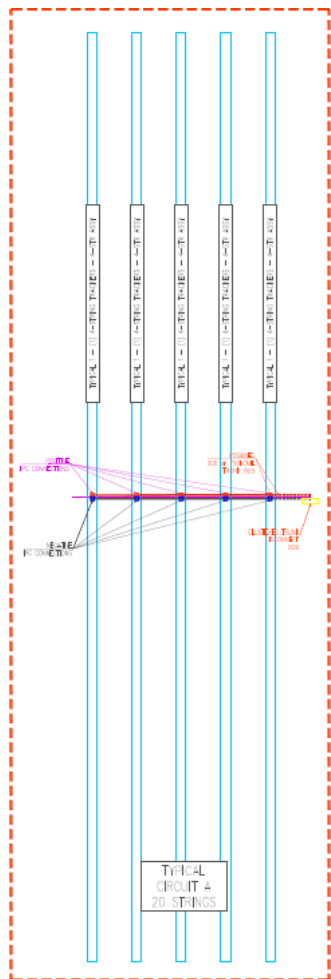
REDUCTION OF ALUMINUM CABLE QUANTITIES

270kW per LBD
 Si-Bifacial +600W; (28) Mod/ String
 (4) 4-String Trackers; (16) Strings/LBD

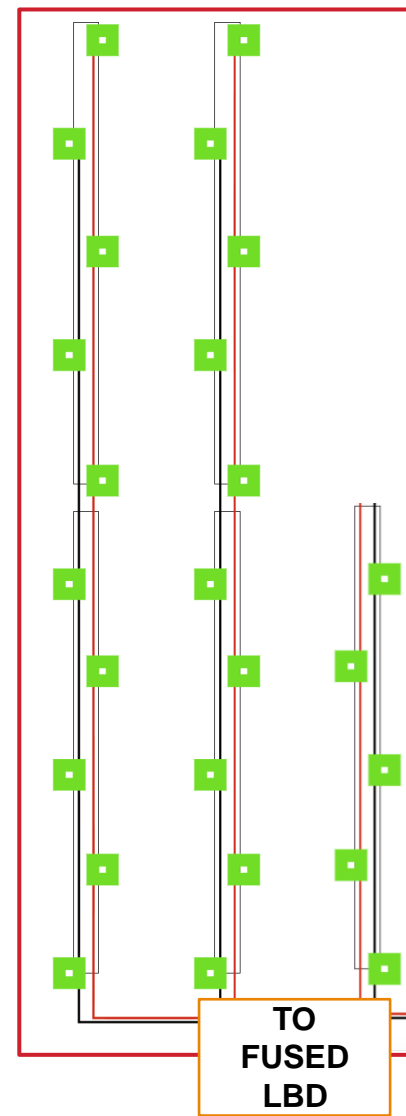


MORE FLEXIBLE TO BUILD LARGER ARRAYS

330kW per LBD
 Si-Bifacial +600W; (28) Mod/ String
 (5) 4-String Trackers; (20) Strings/LBD

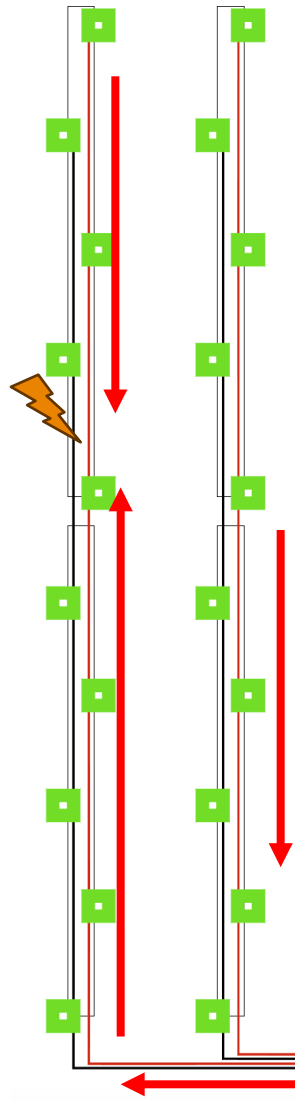


From Strings to INV
 715 m of 240mm²
 20 m of 400 mm²



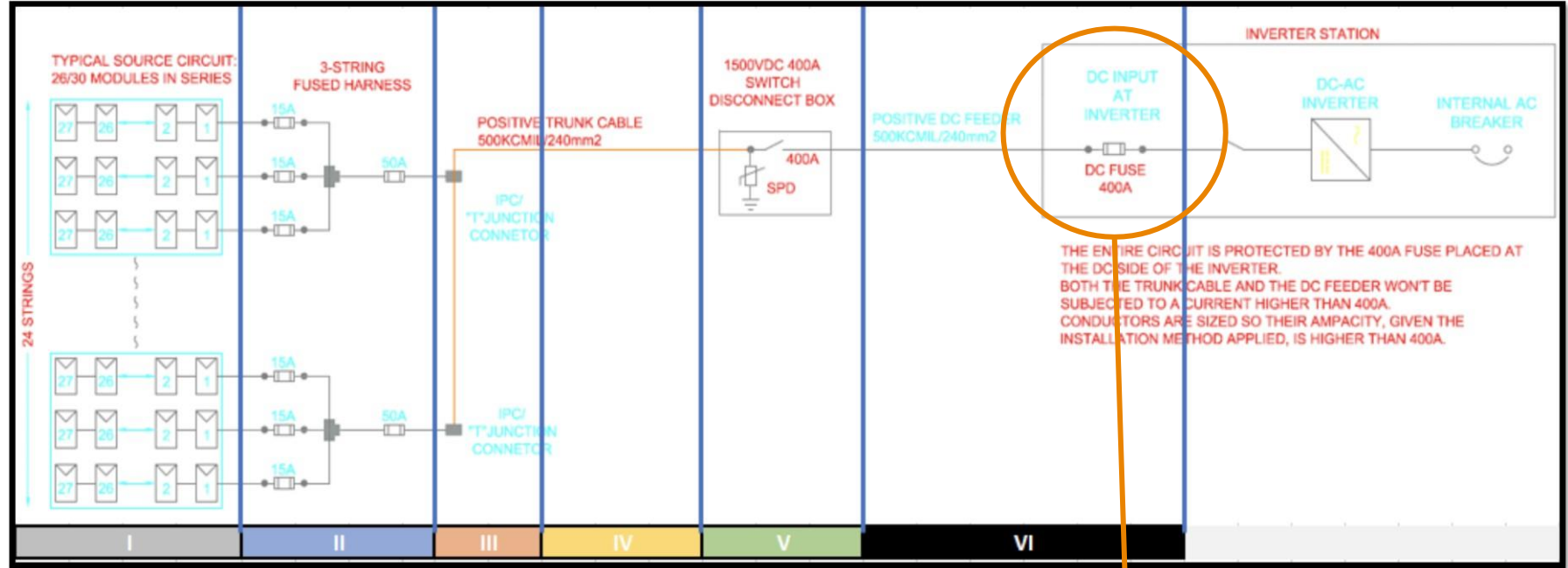
From Strings to INV
 1,500 m of 120mm²
 280 m of 400 mm²

E-W Collection – No fused Inputs @LBD



FUSED LBD

THE CABLE MUST BE SIZED TO HANDLE THE CURRENT OF (2) COLUMNS OR LBD HAS TO BE FUSED



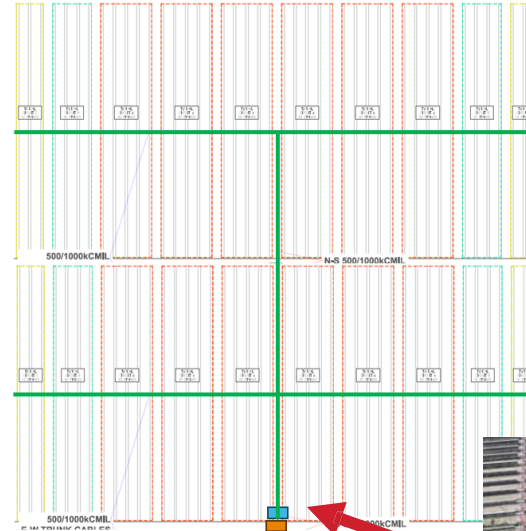
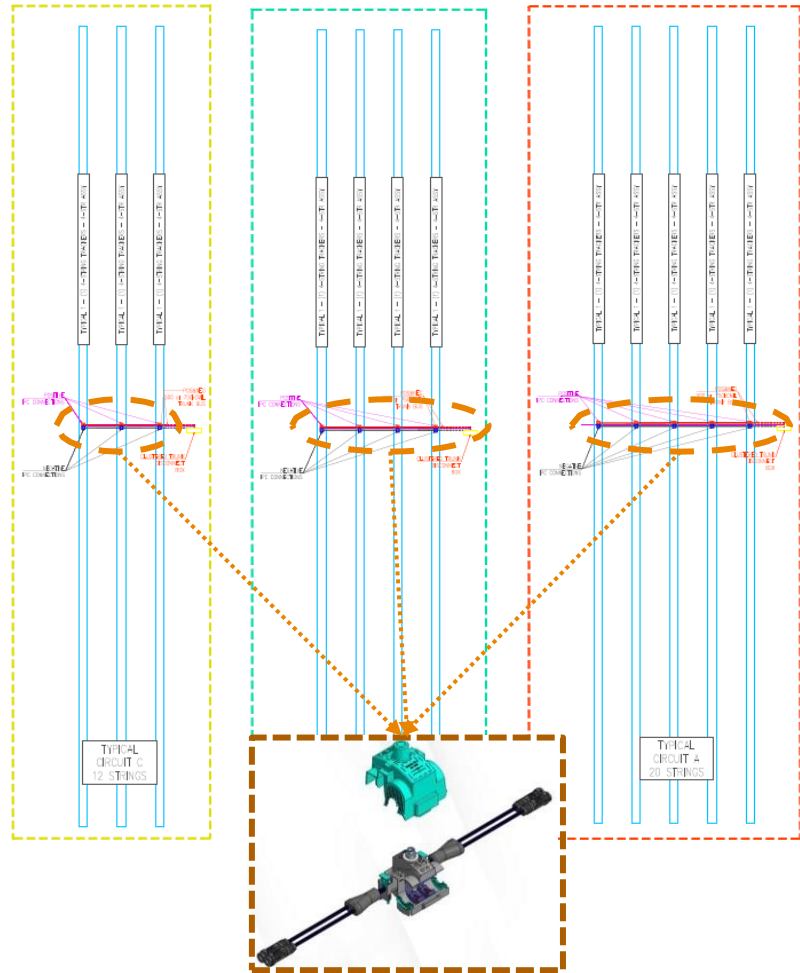
THE ENTIRE CIRCUIT IS PROTECTED BY THE 400A FUSE PLACED AT THE DC SIDE OF THE INVERTER. BOTH THE TRUNK CABLE AND THE DC FEEDER WON'T BE SUBJECTED TO A CURRENT HIGHER THAN 400A. CONDUCTORS ARE SIZED SO THEIR AMPACITY, GIVEN THE INSTALLATION METHOD APPLIED, IS HIGHER THAN 400A.

400A FUSE AT INVERTER PROTECTS FEEDER AND TRUNK CABLE AT THE SAME TIME

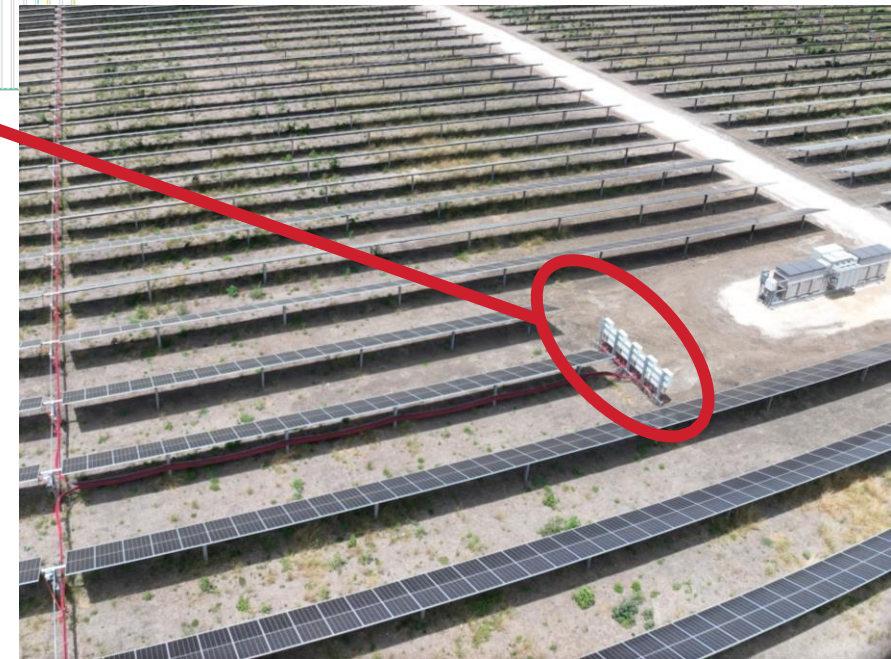
1500V DC FUSES (200) COST \$100, SO THE BOX BECOMES AT LEAST 25% MORE EXPENSIVE

PROVIDES THE ABILITY TO CLUSTER THE LBDs

By collecting with (1) pair of trunk cables per circuit and using TE's SIPC connectors, the project is able to cluster the LBDs at strategic locations across the blocks to minimize aluminum cable costs, installation time (fewer location for piles) while maximizing reliability and O&M safety.



- Minimize All Cable Costs
- Minimize Installation Costs
- Maximize reliability of system
- Maximizing safety for O&M



E-W COLLECTION

N-S COLLECTION



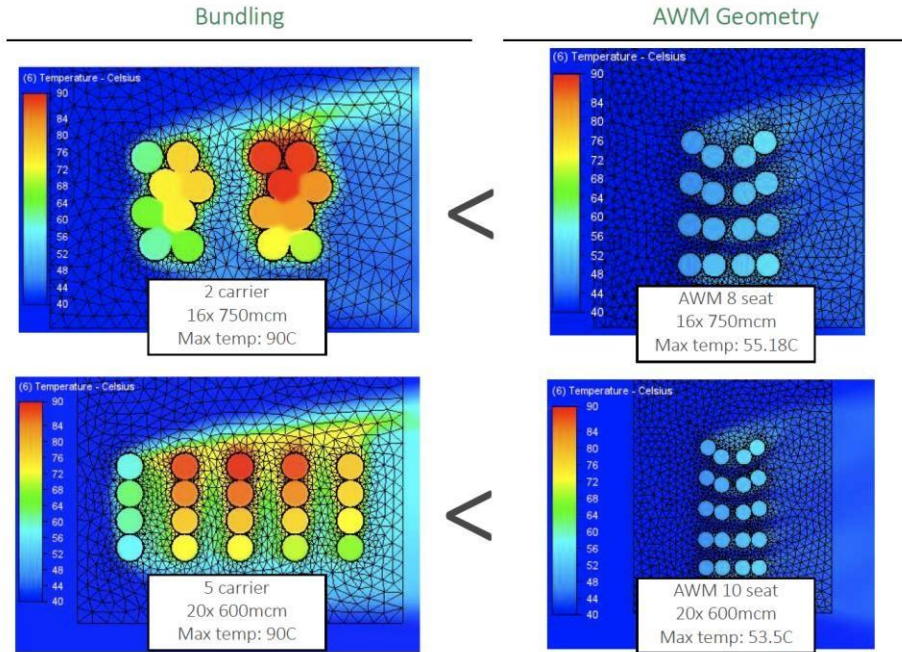
E-W Collection - Bigger cables/ Bigger Arrays/ Lower eBOS

Ampacity is increased greatly when compared to bundles of 4 -10 cables

AWM Hangers are built to manage the cables in a neat, safe, and efficient manner.

As a result, the cables are slightly spaced between each other providing

- Better thermal profile
- Overall lower average and max temperature compared to bundled
- Longer life of cables
- Potential use of a smaller cable
- Potential increase of DC Blocks



Confidential – Please Do Not Distribute

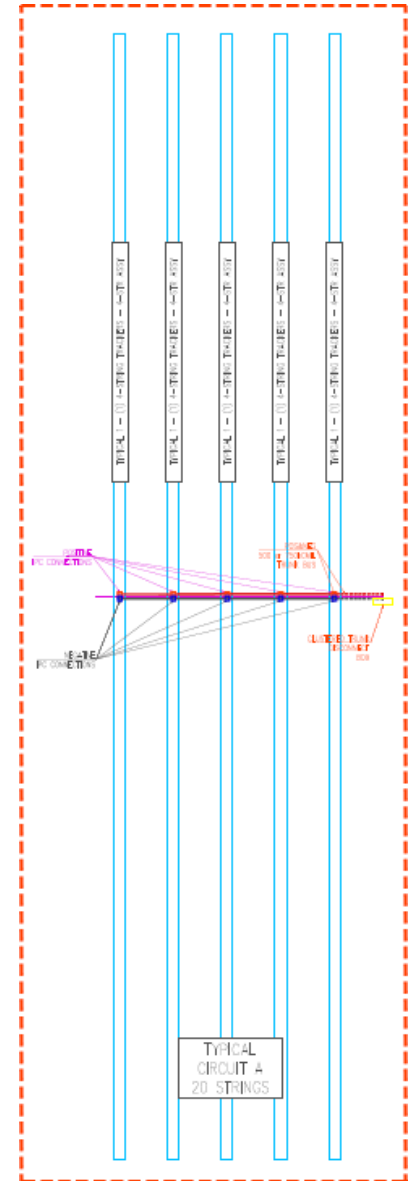


31-0133-01 (8 ckt)					
MCM	30 °C	35 °C	40 °C	45 °C	50 °C
500	477 A	452 A	426 A	400 A	379 A
600	498 A	482 A	455 A	430 A	402 A
750	562 A	533 A	503 A	470 A	443 A

Aboveground @40°C Air		
I project [A]	Ifuse [A]	Icable [A]
385	425	426
Underground @30°C Soil		
I project [A]	Ifuse [A]	Icable [A]
385	425	448

- 300kW per LBD
- Si-Bifacial +650W
- 500A FUSES
- ~ (3) LBDs/MW
- (5) 3-String Track/LBD
- (15) Strings/LBD
- E-W Aboveground
- N-S Aboveground

WITH N-S APPROACH IS MORE DIFFICULT TO FORM BIGGER ARRAYS





TE Solar Insulation Piercing Connectors SIPC 1000 with Pre- assembled Multitap

✓ Product Installation Examples

EVERY CONNECTION COUNTS



Partial Cluster approach



Other Partial Clustered Jobsite Photos



Full Cluster approach

Safety First – Clustering Disconnect Boxes near inverter facilitates rapid shutdown

Road Reduction... 40% fewer roads needed (every 1,400 ft instead of every 525 ft due to clustering)



\$ 6M

LABOR SAVINGS

\$ 5.8M

ROAD COST SAVINGS

+67%

INSTALLATION TIME SAVINGS

Other Full Clustered Jobsite Photos

Highly recommended for safety purposes



SIPC-1000 (+ and -) installed at tracker motor gap





CUSTOMIZABLE TRUNK SOLUTION (CTS) FOR SOLAR FARM APPLICATIONS

✓ Training and Services

EVERY CONNECTION COUNTS



Training and Support



- Installation training provided
- Recommended techniques and best practices

MV & HV Testing Services – Up to 230kV

- VLF AC Withstand Testing
- TD Testing
- PD Testing



Ready to Make Every Connection Count?

Visit [TE.com/solar](https://te.com/solar) to get updates on our product innovations, see our full range of products

Connect on [TE.com/solar-contact](https://te.com/solar-contact) to contact our experts

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SYNTESYS
TECNOLOGICA

Monitoreo Térmico de Activos en Subestaciones y Granjas Solares





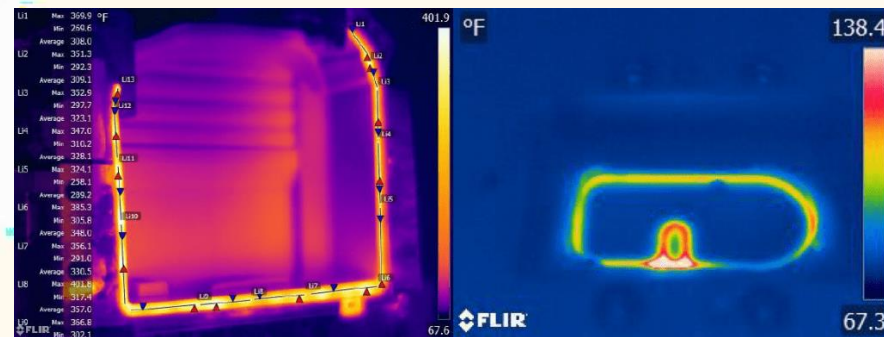
SYNTESYS
TECNOLOGICA

Introducción

Ningún aspecto de la sociedad moderna puede funcionar sin energía, de manera que es esencial que la red de distribución eléctrica esté en pleno funcionamiento para poder mantener nuestra vida cotidiana. Si la maquinaria crítica se avería, se corre el riesgo de perturbar toda la red. El **Sistema de Monitoreo de Activos Críticos** se construye sobre el alto desempeño de las tecnologías basados en la medición por termografía.

¿Qué es la termografía?

La técnica que permite medir temperaturas a distancia y sin contacto físico con el objeto en estudio, captando la intensidad de la radiación infrarroja emitida por los objetos. Esto se realiza a través de cámaras térmicas, que convierten la energía que irradia un objeto en una imagen visible formada a partir de la temperatura superficial del objeto captado.



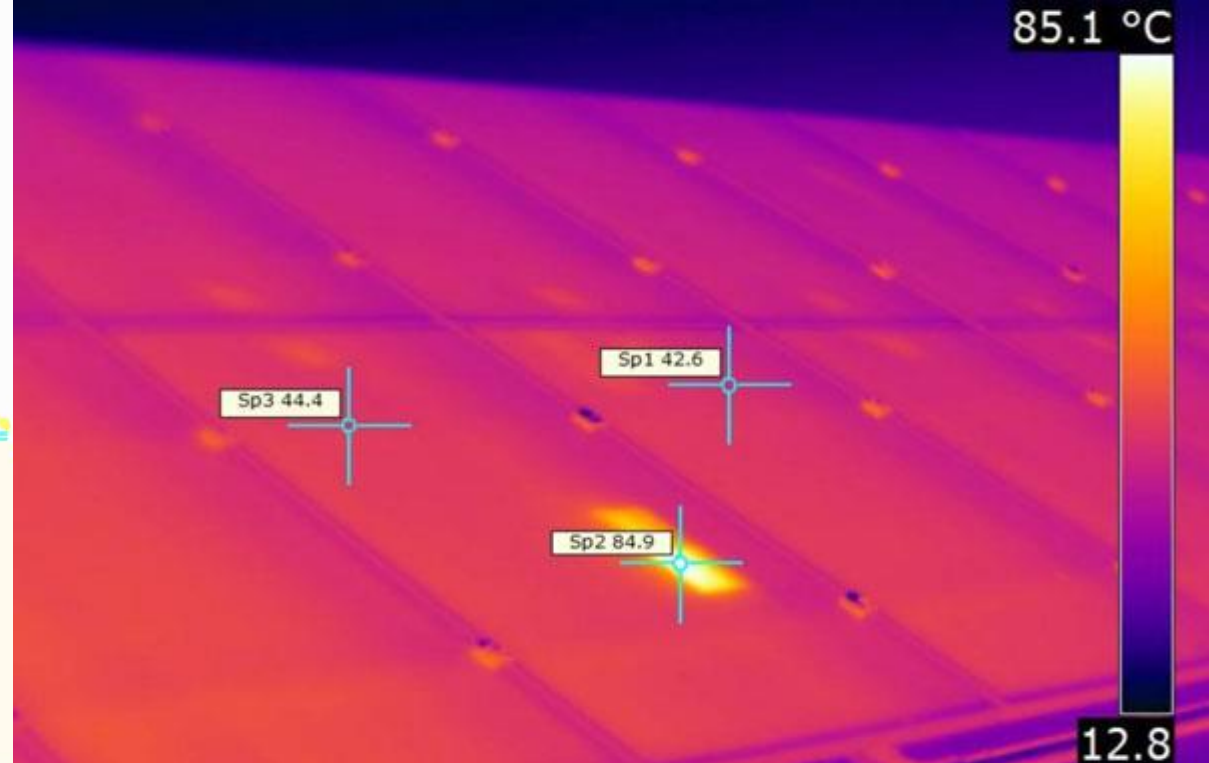
Todos los días estamos expuestos a los rayos infrarrojos. El calor de la luz solar, el fuego o un radiador son formas de infrarrojos. Aunque nuestros ojos no los vean, los nervios de nuestra piel los perciben como calor. Cuanto más caliente es un objeto, más radiación de infrarrojos emite.



¿ Qué es el Monitoreo Térmico?

El monitoreo de la temperatura de los equipos es una de las técnicas más utilizadas por los equipos de mantenimiento para evaluar el estado de las máquinas, ante las variaciones de los parámetros de funcionamiento.

Las características del entorno, como los cambios de temperatura, determinan la viabilidad y los requerimientos de los proyectos. Sin embargo, también pueden condicionar el rendimiento, el nivel de desgaste y la eficiencia de las máquinas industriales.



Tipos de Monitoreo

1. Monitoreo Manual: Involucra la verificación regular de los valores del termómetro mediante intervención humana.



2. Monitoreo Automático: Utiliza sensores digitales y sistemas de monitoreo continuo para registrar continuamente la temperatura, ofreciendo un enfoque más preciso y eficiente.

Beneficios al cliente

- * Equipos con altos protocolos de resistencia a la intemperie, para protección bajo los más adversos ambientes industriales.
- * Ver múltiples partes de equipo en áreas extensas con un solo sistema de Inclinación y Barrido.
- * Destacar con precisión fallas potenciales de equipos con funciones de alarmas configurables a la medida.
- * Programar el mantenimiento preventivo basado en datos, manteniendo bajo control los costos de reparación y reemplazos.
- * Garantizar que la energía sea suministrada a la red sin interrupción por medio del monitoreo continuo.
- * Aumentar la seguridad del personal por medio de capacidades de monitoreo remoto.



SYNTESYS
TECNOLOGICA



Conclusiones

A medida que aumentamos la conciencia sobre los beneficios de la tecnología de monitoreo de condiciones térmicas, resulta más fácil monitorear la infraestructura eléctrica de misión crítica.

Permite a los equipos de monitoreo térmico predecir fallas, proteger equipos eléctricos y optimizar el rendimiento al reducir los costos de mantenimiento.

Dado que los cortes de energía representan una amenaza cada vez más crítica para las organizaciones, la necesidad de soluciones innovadoras de monitoreo térmico para la industria maximiza el tiempo de actividad al predecir las fallas antes de que ocurran.





¿PREGUNTAS?





Algunos de nuestros clientes



Muchas gracias!!!

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