



บริษัท กัลฟ์ เจพี เอ็นเอส จำกัด

รายงานการเปลี่ยนแปลงรายละเอียดโครงการ ในรายงานการประเมินผลกระทบสิ่งแวดล้อม  
โครงการโรงไฟฟ้าหนองแซง (ครั้งที่ 6) อำเภอหนองแซง จังหวัดสระบุรี

## ภาคผนวกที่ 2.1

คุณสมบัติของแผงเซลล์แสงอาทิตย์



# THE MOST DEPENDABLE SOLAR PRODUCT

## EAGLE 72HM G5b

525-545 WATT • HALF CELL BIFACIAL

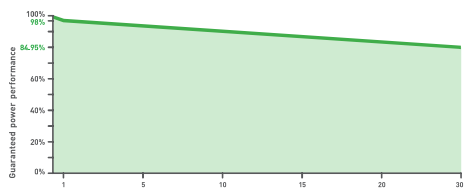
Positive power tolerance of 0~+3%



- NYSE-listed since 2010, Bloomberg Tier 1 manufacturer
- Top performance in the strictest 3<sup>rd</sup> party labs
- Automated manufacturing utilizing artificial intelligence
- Vertically integrated, tight controls on quality
- Premium solar factories in USA, Vietnam, and Malaysia

## LINEAR PERFORMANCE WARRANTY

30-Year Performance Warranty  
12-Year Workmanship Warranty



\*Warranty details available at <https://jinkosolar.us/download-center/#warranty-documents>

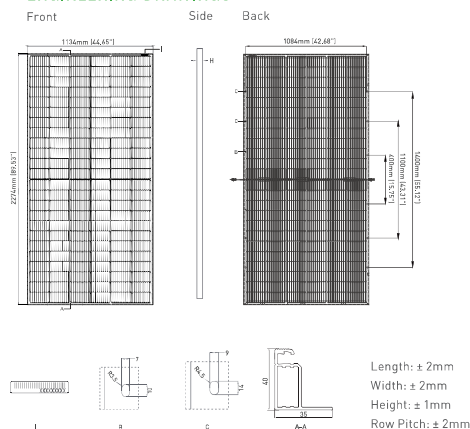
- ISO9001:2015 Quality Standards
- ISO45001:2018 Occupational Health & Safety Standards
- ISO14001:2015 Environmental Standards
- IEC61215, IEC61730 certified products
- UL61730 certified products



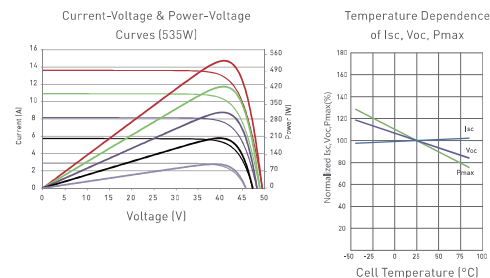
## KEY FEATURES

- Multi Busbar Half Cell Technology**  
High efficiency half cut solar cells deliver high power in a small footprint.
- Bifacial Power Gain**  
Bifacial cell architecture allows backside bonus and more lifetime power yield.
- Light-Weight Design**  
Use of transparent backsheet allows for easy installation and lower BOS cost.
- Thick and Tough**  
Fire Type 1 rated module engineered with a thick frame, 3.2mm front side glass, and thick backsheet for added durability.
- Shade Tolerant**  
Twin array design allows continued performance even with shading by trees or debris.
- Protected Against All Environments**  
Certified to withstand humidity, heat, rain, marine environments, wind, hailstorms, and packed snow.

## ENGINEERING DRAWINGS



## ELECTRICAL PERFORMANCE & TEMPERATURE DEPENDENCE



## ELECTRICAL CHARACTERISTICS

Module Type	JKM525M-72HL4-TV		JKM530M-72HL4-TV		JKM535M-72HL4-TV		JKM540M-72HL4-TV		JKM545M-72HL4-TV	
	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax)	525Wp	391Wp	530Wp	394Wp	535Wp	398Wp	540Wp	402Wp	545Wp	405Wp
Maximum Power Voltage (Vmp)	40.61V	37.74V	40.71V	37.88V	40.81V	37.98V	40.91V	38.08V	41.07V	38.18V
Maximum Power Current (Imp)	12.93A	10.35A	13.02A	10.41A	13.11A	10.48A	13.20A	10.55A	13.27A	10.62A
Open-circuit Voltage (Voc)	49.27V	46.50V	49.35V	46.58V	49.42V	46.65V	49.49V	46.71V	49.65V	46.86V
Short-circuit Current (Isc)	13.64A	11.02A	13.71A	11.07A	13.79A	11.14A	13.87A	11.20A	13.94A	11.26A
Module Efficiency STC (%)	20.36%		20.55%		20.75%		20.94%		21.13%	

\*STC: ☀ Irradiance 1000W/m<sup>2</sup>

NOCT: ☀ Irradiance 800W/m<sup>2</sup>

☁ Cell Temperature 25°C

☁ Ambient Temperature 20°C

☁ AM = 1.5

☁ AM = 1.5

☁ Wind Speed 1m/s

\*Power measurement tolerance: ±3%

The company reserves the final right for explanation on any of the information presented hereby. JKM525-545M-72HL4-TV-F1-US

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Jinko Solar

## MECHANICAL CHARACTERISTICS

No. of Half Cells	144 (2x72)
Dimensions	2274×1134×40mm (89.53×44.65×1.57in)
Weight	29.4kg (64.82lbs)
Front Glass	3.2mm, Anti-Reflection Coating High Transmission, Low Iron, Tempered Glass
Frame	Anodized Aluminum Alloy
Junction Box	IP68 Rated
Output Cables	12 AWG, 1400mm (55.12in) or Customized Length
Fire Type	Type 1
Pressure Rating	5400Pa (Snow) & 2400Pa (Wind)
Hailstone Test	55mm Hailstones at 34m/s

## TEMPERATURE CHARACTERISTICS

Temperature Coefficients of Pmax	-0.35%/°C
Temperature Coefficients of Voc	-0.28%/°C
Temperature Coefficients of Isc	0.048%/°C
Nominal Operating Cell Temperature (NOCT)	45±2°C
Refer. Bifacial Factor	70±5%

## MAXIMUM RATINGS

Operating Temperature (°C)	-40°C ~ +85°C
Maximum System Voltage	1500VDC (UL and IEC)
Maximum Series Fuse Rating	30A

## PACKAGING CONFIGURATION

[Two pallets = One stack]  
27pcs/pallets, 54pcs/stack, 540pcs/40 HQ Container

## BIFACIAL OUTPUT-REAR SIDE POWER GAIN

	Maximum Power (Pmax)	551Wp	557Wp	562Wp	567Wp	572Wp
5%	Module Efficiency (%)	21.38%	21.58%	21.78%	21.99%	22.19%
	Maximum Power (Pmax)	604Wp	610Wp	615Wp	621Wp	623Wp
15%	Module Efficiency (%)	23.41%	23.64%	23.86%	24.08%	24.30%
	Maximum Power (Pmax)	656Wp	663Wp	669Wp	675Wp	681Wp
25%	Module Efficiency (%)	25.45%	25.69%	25.93%	26.18%	26.42%



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## ภาคผนวกที่ 2.2

คุณสมบัติของอุปกรณ์แปลงไฟฟ้า  
กระแสตรงเป็นกระแสลับ (Inverter)

SUN2000-215KTL-H0  
Smart String Inverter



  
9  
MPP Trackers

  
99.0%  
Max. Efficiency

  
String-level  
Management

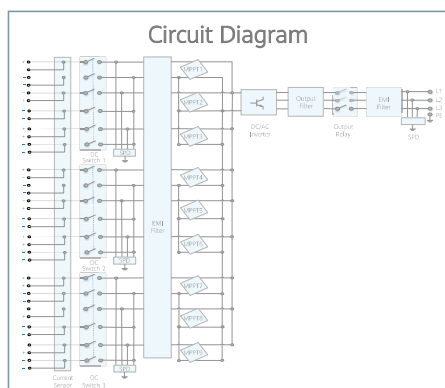
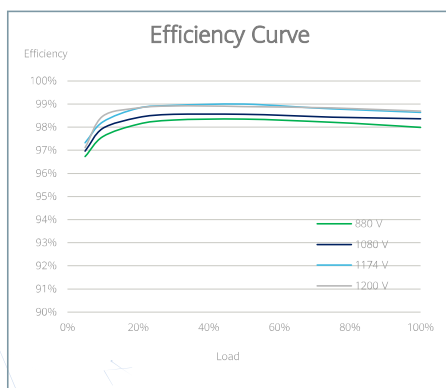
  
Smart I-V Curve  
Diagnosis Supported

  
MBUS  
Supported

  
Fuse Free  
Design

  
Surge Arresters for  
DC & AC

  
IP66  
Protection



SUN2000-215KTL-H0  
Technical Specifications

Efficiency		
Max. Efficiency		≥99.00%
European Efficiency		≥98.60%
Input		
Max. Input Voltage		1,500 V
Max. Current per MPPT		30 A
Max. Short Circuit Current per MPPT		50 A
Start Voltage		550 V
MPPT Operating Voltage Range		500 V ~ 1,500 V
Nominal Input Voltage		1,080 V
Number of Inputs		18
Number of MPP Trackers		9
Output		
Nominal AC Active Power		200,000 W
Max. AC Apparent Power		215,000 VA
Max. AC Active Power (cosφ=1)		215,000 W
Nominal Output Voltage		800 V, 3W + PE
Rated AC Grid Frequency		50 Hz / 60 Hz
Nominal Output Current		144.4 A
Max. Output Current		155.2 A
Adjustable Power Factor Range		0.8 LG ... 0.8 LD
Max. Total Harmonic Distortion		< 1%
Protection		
Input-side Disconnection Device		Yes
Anti-islanding Protection		Yes
AC Overcurrent Protection		Yes
DC Reverse-polarity Protection		Yes
PV-array String Fault Monitoring		Yes
DC Surge Arrester		Type II
AC Surge Arrester		Type II
DC Insulation Resistance Detection		Yes
Residual Current Monitoring Unit		Yes
Communication		
Display		LED Indicators, WLAN + APP
USB		Yes
MBUS		Yes
RS485		Yes
General		
Dimensions (W x H x D)		1,035 x 700 x 365 mm (40.7 x 27.6 x 14.4 inch)
Weight (with mounting plate)		≤86 kg (189.6 lb.)
Operating Temperature Range		-25°C ~ 60°C (-13°F ~ 140°F)
Cooling Method		Smart Air Cooling
Max. Operating Altitude without Derating		4,000 m (13,123 ft.)
Relative Humidity		0 ~ 100%
DC Connector		Staubli MC4 EVO2
AC Connector		Waterproof Connector + OT/DT Terminal
Protection Degree		IP66
Topology		Transformerless





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## ภาคผนวกที่ 2.3

หม้อแปลงไฟฟ้า (Transformer)



**Ekarat Engineering Public Company Limited**  
 U.M Tower Bldg., 29th Floor, 9/291 Ramkhamheang Road,  
 Suanluang Dis., Bangkok 10250  
 Tel. : (662) 719-8777 (auto) Fax. : (662) 719-8757 , 719-8760  
 http://www.ekarat.co.th

ISSUE DATE : 12/7/65

### Transformer Specification

Quote. Ref. :

Customer :

Project :

Rated power	kVA.	3000
Type of transformer		Oil immersed (Hermetically sealed)
Standard		IEC 60076
Cooling System		ONAN
No. of phase		3
Frequency	Hz.	50
Rate of voltage	: Primary V	6600
	: Secondary V	800 / 462
Vector group		Dyn11
Tapping	Type	Off circuit tap changer
	No. of steps	4
	Percentage of tapping	+/- 2 x 2.5 %
Impedance voltage at 75 oC	%	7.00
No - Load current	%	0.80
Ambient temperature	oC	40
Average Temperature rise of winding	oC	65
Average Temperature rise of top oil	oC	60
Noise level not more than	dB	62
No - Load loss	Watt	3600
Load loss at 75 oC	Watt	34500
Total loss	Watt	38100
Efficiency	: 25% of rate power %	99.24
	: 50% of rate power %	99.19
at P.F. = 1	: 75% of rate power %	98.99
	: 100% of rate power %	98.75
Voltage regulation	: at P.F. = 0.8 %	5.18
	: at P.F. = 0.9 %	4.21
	: at P.F. = 1 %	1.39
Impulse withstand	: High voltage winding kV	60
Voltage	: Low voltage winding kV	-
Power frequency	: High voltage winding kV	20
	: Low voltage winding kV	3
Terminal arrangement	H.V. side	Cable
	L.V. side	Cable
Installation on		Concrete foundation



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 http://www.ekarat.co.th

ISSUE DATE : 12/7/65

### Transformer Specification

Quote. Ref. :

Customer :

Project :

Rated power	kVA.	3000
Type of transformer		Oil immersed (Hermetically sealed)
Accessories :		
H.V. bushing with terminal connector		Included
L.V. bushing with terminal connector		Included
Grounding pad or earth terminal		Included
Lifting lug		Included
Oil drain, filter press sampling valve		Included
Name plate		Included
Skid Base		Included
Mechanical pressure relief device		Included
DGPT2		Included (with contact)
Oil level indicator		Included
Cable Box type 1		Included
Testing :		
- Routine test		
Ratio test at each position of tap		Included
Polarity and phase relation test		Included
Resistance measurement		Included
No-load loss and exciting current test		Included
Impedance and load loss test		Included
Applied potential test		Included
Induced potential test		Included
Insulation resistance test		Included
Oil test		Included



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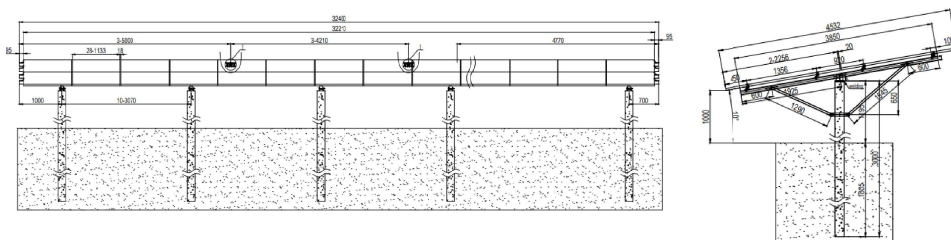
## ภาคผนวกที่ 2.4

อุปกรณ์ติดตั้งแผงเซลล์แสงอาทิตย์ (Solar Mounting)

SolarTerrace I is a highly versatile ground-mounting solution suitable for large-scale utility and commercial installations. The combination of high-quality Zn-MgAl coating steel and hot-dip galvanized (referred to as HDG) steel ensures a robust and reliable solution.

### Main Benefits

- Fast and Simple Installation
- Price Advantage
- Excellent Durability
- Strict Quality Control



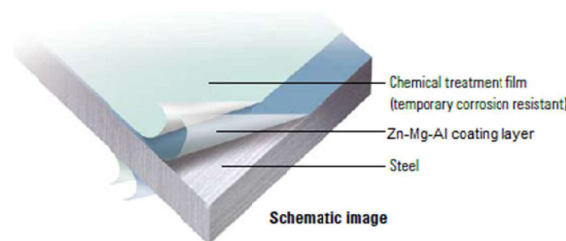
### - Technical Specification -

Module Orientation	Landscape or Portrait
Module Type	Both Framed and Frameless
Wind Load	Customized
Tilt Angle	Customized
Foundation	Ramming/Concrete
Material	Main Structure: Zn-Mg-Al Coating & HDG Steel    Fasteners: HDGS
Standard	AS NZS1170.2-2011   EURCODE 0-9   JISC8955-2017   ASCE 7-10
Warranty	12 years

## Zn-Mg-Al Coating

- What is Zn-Mg-Al coating

Zn-Mg-Al Coating (Magnesium Aluminium alloy Coating product) is a ternary alloy coated steel(Zn- xx%Mg- xx%Al) with high corrosion resistance.



- Advantage of Zn-Mg-Al coating

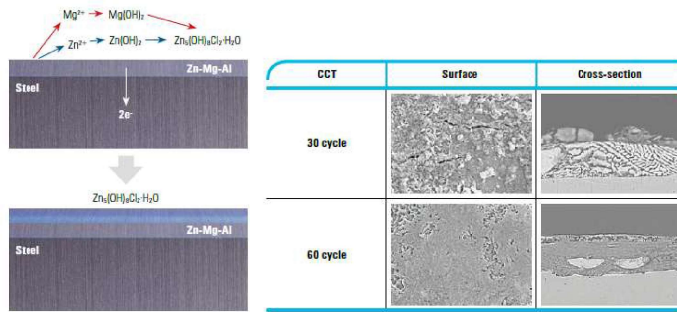
- Excellent Corrosion Resistance
- Self-healing
- Long Service Life
- Easy Processing

- Product characteristics comparison

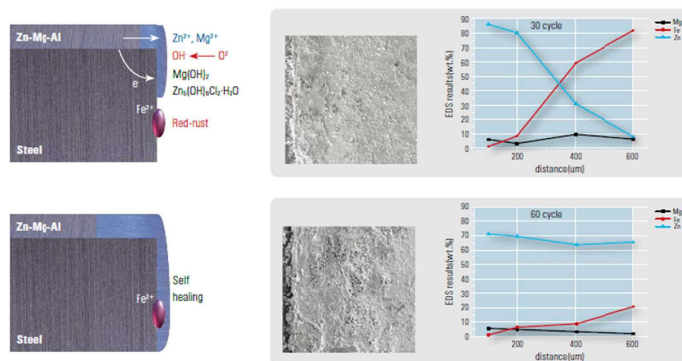
Item	Hot-dip Galvanized Steel mounting structure	Magnesium Aluminum Alloy Coating mounting structure
Corrosive resistance	<ul style="list-style-type: none"><li>- Reliable</li><li>- C3 and below</li><li>- Need painting maintenance</li></ul>	<ul style="list-style-type: none"><li>- Very good, much stronger in corrosive resistance than HDGS</li><li>- C5 and below</li><li>- Self-healing</li><li>- No maintenance needed</li></ul>
Appearance	Fine	Nice appearance, smooth
Lead time	Subject to project	Subject to project
Price	Cost-effective	A little cheaper than Hot-dip Galvanized Steel mounting structure

## - Why Zn-Mg-Al coating has excellent corrosion resistance

The magnesium(Mg) in Zn-Mg-Al coating layer will accelerate the formation of a dense corrosion product called “Simonkolleite ( $\text{Zn}_5(\text{OH})_8\text{Cl}_2 \cdot \text{H}_2\text{O}$ )” which is extremely stable. When simonkolleite is formed on the surface of the coating layer in a film-like-form, it plays a role as a corrosion inhibitor for the base metal.



In addition, the upper coating layer can be dissolved to cover the cross-section and accelerate the growth of a stable corrosion product. However red-rust can be found in the already exposed steel plate, but fortunately, the film of the corrosion products covers the cross-section and serves to prevent corrosion.



## - Comparison to galvanized(GI(H)) / Galvalume in corrosion resistance on flat surfaces(SST)

SST	GI(H)	Galvalume	Zn-Mg-Al coating	
The coating weight on both sides	600g/m <sup>2</sup>	100g/m <sup>2</sup>	200g/m <sup>2</sup>	350g/m <sup>2</sup>
480Hr				
720Hr				
1440Hr				
2400Hr				

## - Comparison to galvanized(GI(H)) / Galvalume in corrosion resistance on flat surfaces(CCT)

CCT	GI(H)				Galvalume	Zn-Mg-Al coating		
The coating weight on both sides	120g/m <sup>2</sup>	200g/m <sup>2</sup>	300g/m <sup>2</sup>	600g/m <sup>2</sup>	100g/m <sup>2</sup>	140g/m <sup>2</sup>	200g/m <sup>2</sup>	275g/m <sup>2</sup>
10 cycle (80Hr)								
70 cycle (560Hr)								
120 cycle (960Hr)								



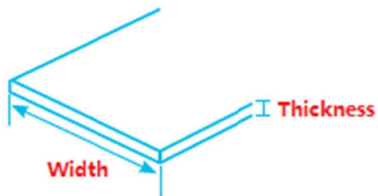
- Technical details of Zn-Mg-Al coating

Coating mass : 60~400g/m<sup>2</sup> (Both Sides)

Post treatment : Cr-Free (NB, NT), Chromate(CL), Cr3+ ECO Chromate(CE)

Sizes in production(CQ) : Thickness 0.4~ 6.0mm / Width 750 ~ 1,650mm

※ Width may vary depending on the thickness





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## ภาคผนวกที่ 2.5

DC Cable

## ÖLFLEX® SOLAR XLR-E

**DB 1023650**  
valid from: 01.07.2016

### 1. Application

ÖLFLEX® SOLAR XLR-E cables are weather-, abrasion- and UV-resistant photovoltaic cables.

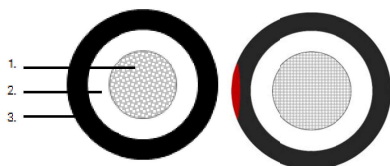
These cross-linked, halogen free and double insulated solar cables are suitable for permanent outdoor use and especially for the interconnection of grounded and ungrounded photovoltaic power systems. They are applicable for the connection of solar panels among themselves and as extension cable between the individual module strings or the DC/AC inverter.

According to EN 50618 applies:

The expected period of use under normal usage conditions as specified in EN 50618 is at least 25 years.

### 2. Cable design

<b>Design</b>	according to EN 50618
<b>Certification</b>	Code designation H1Z2Z2-K, certified according to EN 50618 TÜV Rheinland certificate No. R50345247



1. Conductor: Fine wire strands of non-porous tinned copper wires according to IEC 60228, Class 5
2. Core insulation: Electron beam cross-linked polyolefin co-polymer  
Color: white
3. Outer sheath: Electron beam cross-linked polyolefin co-polymer  
Outer sheath color: black or black with red colored stripe

### 3. Electrical properties

Rated voltage $U_0/U$ acc. IEC	AC 1000/1000 V DC 1500/1500 V
Max. permissible operating voltage	DC 1800 V (according to EN 50618)
Test voltage	AC 6,5 kV
Current carrying capacity	according to EN 50618, Table A.3 & A.4

### 4. Mechanical and thermal properties

Temperature range, conductor temperature fixed installation:	-40°C up to +120°C conductor temperature (according to IEC 60216-2)
Temperature range, ambient temperature fixed installation:	-40°C up to +90°C ambient temperature (according to EN 50618)
Minimum temperature for installation	-25°C (according to EN 50618)
Minimum bending radius	occasional flexing: 15 x cable diameter fixed installation: 5 x cable diameter

Originator: ALTE / PCM approved: HAPF / PDC	Document: DB1023650EN	page 1 of 2
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PD 0019/2-1\_11.09EN

## ÖLFLEX® SOLAR XLR-E

**DB 1023650**  
valid from: 01.07.2016

Weathering/UV-resistance	according to EN 50618 Annex E
Ozone resistance	according to EN 50396
Halogen free	according to IEC 60754-1, IEC 60754-2
Smoke density	according to IEC 61034-2, EN 61034-2
Flame retardant	according to IEC 60332-1-2
Acid and alkaline resistance	according to EN 60811-404 (Oxal-acid and Sodium hydroxide)
EU directives	This cable is conform to the EU directive 2014/35/EU (Low Voltage Directive)

### 5. Installation

H1Z2Z2-K cables are not suitable for the installation underground.  
The cable should be installed according to VDE 0100, part 520, IEC 60364-5-52, EN 50174-1 or comparable standards. Long-term, permanent storage or constant use of the cables in or underwater is not permitted.

According to EN 50618 applies:

Intended for use in PV installations e.g. acc. to HD 60364-7-712.

They are intended for permanent use outdoor and indoor, for free movable, free hanging and fixed installation.

Installation also in conduits and trunkings on, in or under plaster as well as in appliances. Suitable for the application in/at equipment with protective insulation (protection class II).

They are inherently short-circuit and earth fault proof acc. to HD 60364-5-52.

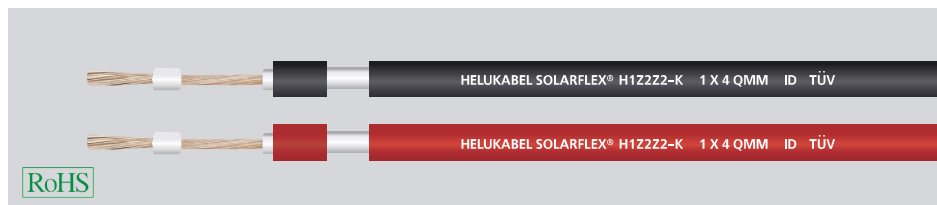
### 6. Versions

Part. No.	Color insulation	Color outer sheath	Conductor cross section [mm²]	Outer diameter approx. [mm]
1023652	white	black	1 x 4	5.4
1023653	white	black	1 x 6	6.0
1023654	white	black	1 x 10	7.2
1023655	white	black	1 x 16	8.7
1023667	white	black with red stripe	1 x 4	5.4
1023668	white	black with red stripe	1 x 6	6.0
1023669	white	black with red stripe	1 x 10	7.2
1023670	white	black with red stripe	1 x 16	8.7

Originator: ALTE / PCM approved: HAPF / PDC	Document: DB1023650EN	page 2 of 2
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PD 0019/2-1\_11.09EN

# SOLARFLEX® H1Z2Z2-K



## Technical data

- **Temperature range**  
-40°C to +90°C  
max. temperature at conductor +120°C
- **Nominal voltage**  
VDE 1000/1000 V AC  
1500 V DC conductor/conductor
- **AC test voltage**  
6500 V AC
- **Minimum bending radius**  
flexing 5x cable Ø  
fixed installation 4x cable Ø
- **Highest permissible Voltage**
  - DC: Conductor/Conductor 1,5 kV
  - AC: Conductor/Conductor 1 kV

## Cable structure

- Tinned copper-conductor, to DIN VDE 0295 cl.5, fine-wire, IEC 60228 cl.5
- Core insulation of cross-linked Polyolefin
- Core identification white
- Outer sheath of cross-linked Polyolefin
- Sheath colour see table below
- with meter marking

## Properties

- Double-insulated
- Ozone resistant acc. to EN 60811-403
- Weather und UV resistant acc. to EN 50618
- Halogen-free acc.to EN 50525-1, Annex B including tests: EN 50267-2-1, -2-2 and EN 60684-2. IEC 62821-1, Annex B including tests: IEC 60754-1,-2 and IEC 60684-2.
- Resistant to acid and bases acc. to EN 60811-404
- Flame retardant to DIN VDE 0482-332-1-2, DIN EN 60332-1-2/ IEC 60332-1 (equivalent DIN VDE 0472 part 804 test method B)
- Smoke density acc.to IEC 61034
- Direct Burial Applied.

## Approvals

- TÜV 2PfG 1169
- RoHS 2011/65/EU
- EN 50618
- IEC 62930

## Application

The SOLARFLEX® H1Z2Z2-K is used for cabling solar modules.

CE= The product is conformed with the EC Low-Voltage Directive 2006/95/EC.

## Note

- Long Term Insulation Resistance
- In Water, 90°C 1000VAC  
acc. to UL 2556 section 6.4.4.2. >3GΩ.m

	No. cores x cross-sec. mm²	Sheath colour	Outer Ø app. mm	Cop. weight kg / km	Weight app. kg / km	AWG-No.
	1 x 4	black	5,4	38,4	60,0	12
	1 x 4	red	5,4	38,4	60,0	12
	1 x 6	black	6,0	57,6	82,0	10
	1 x 6	red	6,0	57,6	82,0	10



บริษัท กัลฟ์ เจพี เอ็นเอส จำกัด

รายงานการเปลี่ยนแปลงรายละเอียดโครงการ ในรายงานการประเมินผลกระทบสิ่งแวดล้อม  
โครงการโรงไฟฟ้าหนองแขง (ครั้งที่ 6) อำเภอหนองแขง จังหวัดสระบุรี

## ภาคผนวกที่ 2.6

AC Cable



# SPECIFICATION

## LOW VOLTAGE POWER CABLE 0.6/1(1.2) KV CU/XLPE/PVC (CV CABLE)

Copper Conductor, Cross-Linked Polyethylene Insulation  
and Polyvinyl Chloride Sheathed Cables

REVISION	ISSUED DATE
03	9 November 2016

## ANNEX A - CABLE DRAWING AND TECHNICAL DATA

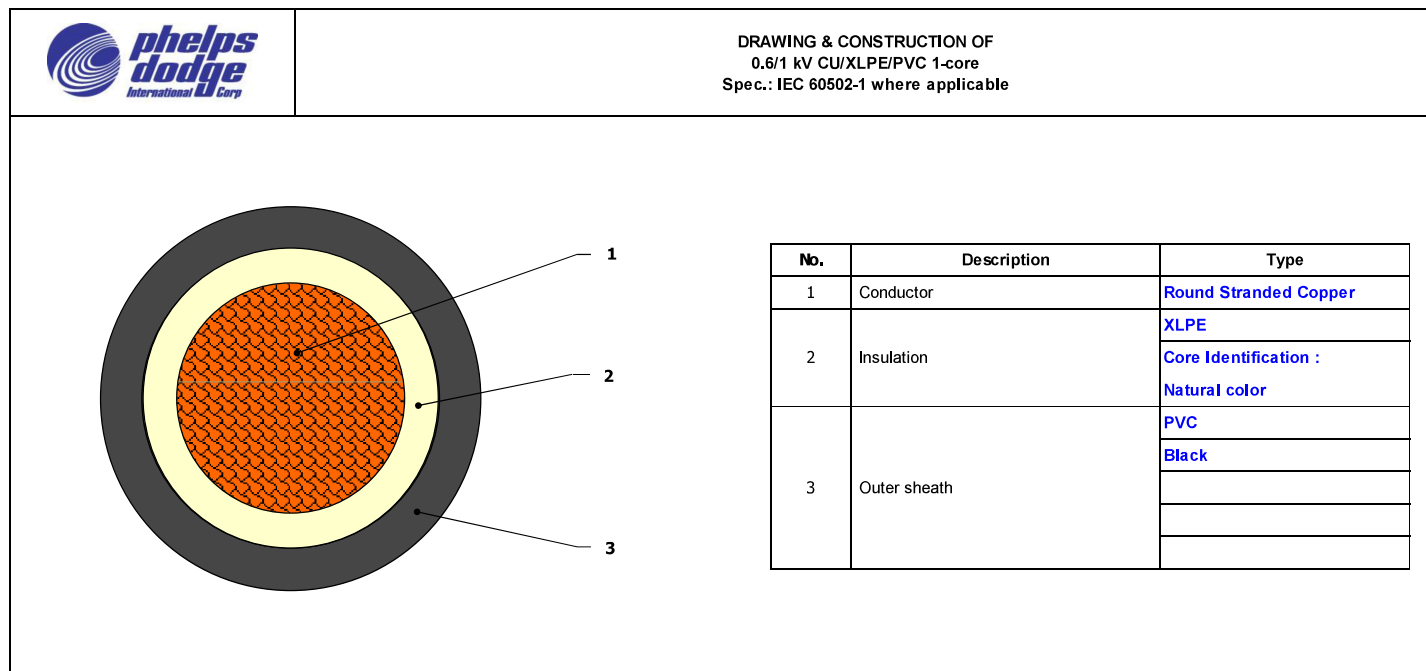


Figure 1 – Cable drawing of 0.6/1 kV CU/XLPE/PVC 1-Core

Spec No.: LV-CV-000

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Rev.: 03 Date: 9 Nov 2016

Phelps Dodge International (Thailand) Limited



Table 1 – Technical data of 0.6/1 kV CU/XLPE/PVC 1-Core

Description	unit	1 x 1.5	1 x 2.5	1 x 4	1 x 6	1 x 10	1 x 16	1 x 25	1 x 35	1 x 50	1 x 70	1 x 95	1 x 120	1 x 150	1 x 185	1 x 240	1 x 300	1 x 400	1 x 500	1 x 630
<b>Conductor material</b>		Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper
Class / Standard		2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228
Diameter of Conductor (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	5.8	7.0	8.0	9.7	11.3	12.8	14.2	15.8	18.2	20.3	23.0	25.9	29.9
<b>Insulation material</b>		XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE
Insulation thickness (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.2	1.4	1.6	1.7	1.8	2.0	2.2	2.4
Diameter over Insulation (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	7.7	8.9	10.1	12.0	13.6	15.3	17.1	19.1	21.8	24.1	27.2	30.5	34.9
<b>Outer sheath material</b>		PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Outer sheath thickness (Nominal)	mm	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.6	1.6	1.7	1.8	1.9	2.0	2.2
Overall diameter (Approx.)	mm	6	7	7	8	8	9	11	12	13	15	17	19	21	23	26	28	32	35	40
Total cable weight (Approx.)	kg/km	50	65	85	105	145	205	305	400	525	740	995	1245	1530	1890	2465	3060	3900	4960	6410
Maximum conductor DC resistance at 20°C	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	0.727	0.524	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601	0.0470	0.0366	0.0283
Minimum Insulation Resistance at 20°C	Mohm-km	1021	842	698	591	514	421	430	367	357	326	284	274	287	294	273	260	256	250	238

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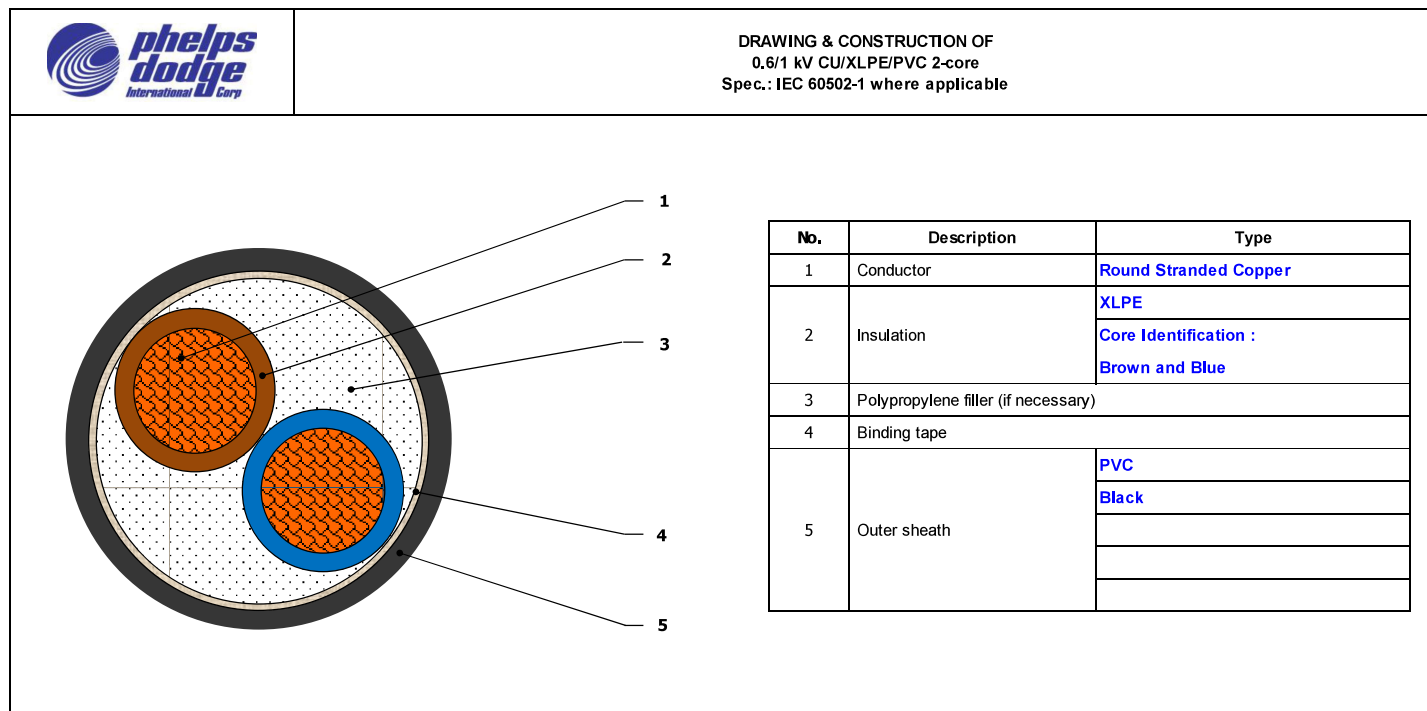


Figure 2 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 2-Core

Table 2 – Technical data of 0.6/1 KV CU/XLPE/PVC 2-Core

Description	unit	2 x 1.5	2 x 2.5	2 x 4	2 x 6	2 x 10	2 x 16	2 x 25	2 x 35	2 x 50	2 x 70	2 x 95	2 x 120	2 x 150	2 x 185	2 x 240	2 x 300
<b>Conductor material</b>		Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper
Class / Standard		2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228
Diameter of Conductor (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	5.8	7.0	8.0	9.7	11.3	12.8	14.2	15.8	18.2	20.3
<b>Insulation material</b>		XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE
Insulation thickness (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.2	1.4	1.6	1.7	1.8
Diameter over Insulation (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	7.7	8.9	10.1	12.0	13.6	15.3	17.1	19.1	21.8	24.1
<b>Outer sheath material</b>		PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Outer sheath thickness (Nominal)	mm	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	2.0	2.2	2.3	2.5	2.6
Overall diameter (Approx.)	mm	10	11	12	13	15	16	20	22	24	28	32	35	39	44	49	54
Total cable weight (Approx.)	kg/km	115	145	190	245	325	460	685	890	1170	1645	2205	2770	3410	4230	5515	6815
Maximum conductor DC resistance at 20°C	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	0.727	0.524	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601
Minimum Insulation Resistance at 20°C	Mohm-km	1021	842	698	591	514	421	430	367	357	326	284	274	287	294	273	260

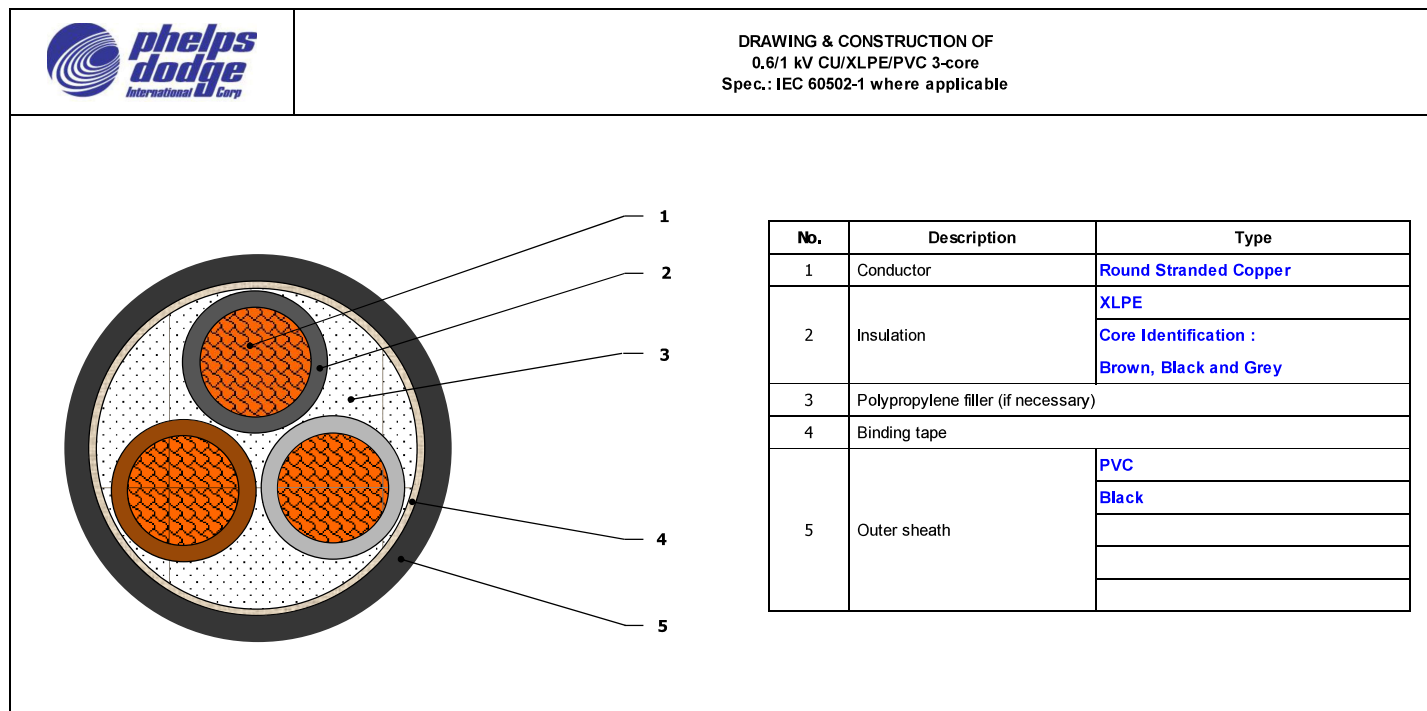


Figure 3 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 3-Core

Table 3 – Technical data of 0.6/1 KV CU/XLPE/PVC 3-Core

Description	unit	3 x 1.5	3 x 2.5	3 x 4	3 x 6	3 x 10	3 x 16	3 x 25	3 x 35	3 x 50	3 x 70	3 x 95	3 x 120	3 x 150	3 x 185	3 x 240	3 x 300
<b>Conductor material</b>		Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper
Class / Standard		2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228
Diameter of Conductor (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	5.8	7.0	8.0	9.7	11.3	12.8	14.2	15.8	18.2	20.3
<b>Insulation material</b>		XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE
Insulation thickness (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.2	1.4	1.6	1.7	1.8
Diameter over Insulation (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	7.7	8.9	10.1	12.0	13.6	15.3	17.1	19.1	21.8	24.1
<b>Outer sheath material</b>		PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Outer sheath thickness (Nominal)	mm	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	2.0	2.1	2.3	2.4	2.6	2.7
Overall diameter (Approx.)	mm	11	12	13	14	15	17	21	23	26	30	34	38	42	47	53	58
Total cable weight (Approx.)	kg/km	135	180	240	310	430	620	925	1220	1615	2310	3095	3900	4800	5960	7785	9645
Maximum conductor DC resistance at 20°C	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	0.727	0.524	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601
Minimum Insulation Resistance at 20°C	Mohm-km	1021	842	698	591	514	421	430	367	357	326	284	274	287	294	273	260

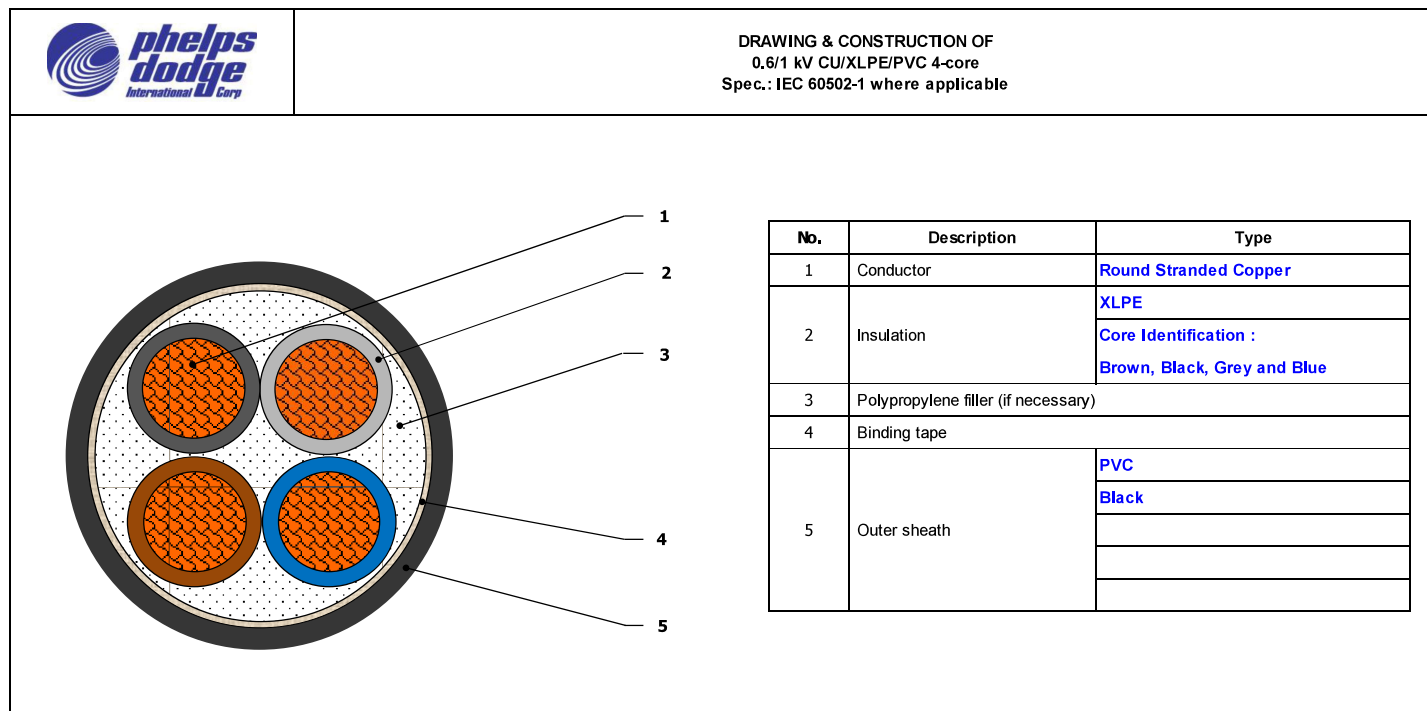


Figure 4 – Cable drawing of 0.6/1 KV CU/XLPE/PVC 4-Core

Table 4 – Technical data of 0.6/1 KV CU/XLPE/PVC 4-Core

Description	unit	4 x 1.5	4 x 2.5	4 x 4	4 x 6	4 x 10	4 x 16	4 x 25	4 x 35	4 x 50	4 x 70	4 x 95	4 x 120	4 x 150	4 x 185	4 x 240	4 x 300
<b>Conductor material</b>		Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper
Class / Standard		2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228
Diameter of Conductor (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	5.8	7.0	8.0	9.7	11.3	12.8	14.2	15.8	18.2	20.3
<b>Insulation material</b>		XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE
Insulation thickness (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.2	1.4	1.6	1.7	1.8
Diameter over Insulation (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	7.7	8.9	10.1	12.0	13.6	15.3	17.1	19.1	21.8	24.1
<b>Outer sheath material</b>		PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Outer sheath thickness (Nominal)	mm	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.0	2.1	2.3	2.4	2.6	2.8	3.0
Overall diameter (Approx.)	mm	12	13	14	15	17	19	23	26	29	34	38	42	47	52	59	65
Total cable weight (Approx.)	kg/km	165	215	295	390	540	790	1190	1575	2090	3015	4050	5120	6280	7825	10225	12700
Maximum conductor DC resistance at 20°C	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	0.727	0.524	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601
Minimum Insulation Resistance at 20°C	Mohm-km	1021	842	698	591	514	421	430	367	357	326	284	274	287	294	273	260



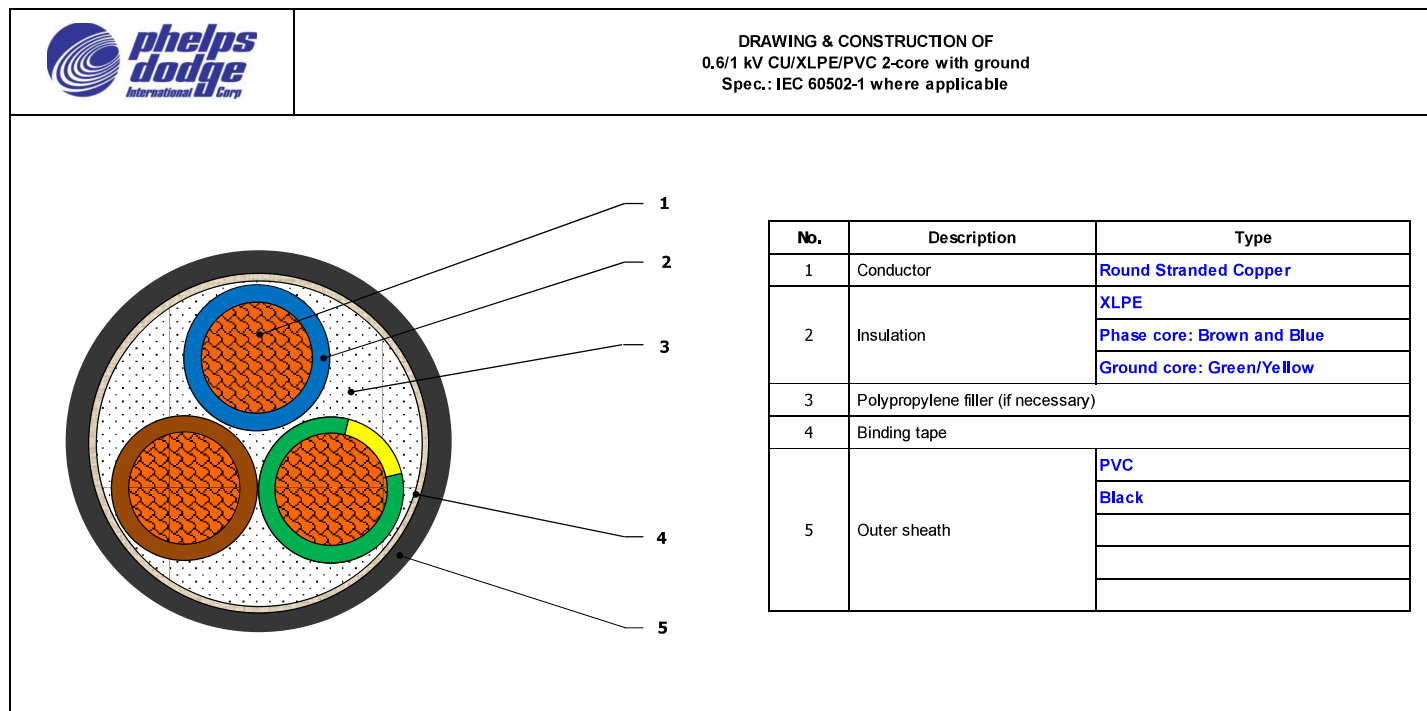


Figure 5 – Cable drawing of 0.6/1 kV CU/XLPE/PVC 2-Core with ground

Table 5 – Technical data of 0.6/1 kV CU/XLPE/PVC 2-Core with ground

Description	unit	2x1.5+1.5	2x2.5+2.5	2x4+4	2x6+6	2x10+10	2x16+16	2x25+16	2x35+16	2x50+25	2x70+35	2x95+50	2x120+70	2x150+95	2x185+95	2x240+120	2x300+150
<b>Conductor material</b>		Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper
Class / Standard		2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228
Diameter of Conductor (Phase) (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	5.8	7.0	8.0	9.7	11.3	12.8	14.2	15.8	18.2	20.3
Diameter of Conductor (Ground) (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	4.6	4.6	5.8	7.0	8.0	9.7	11.3	11.3	12.8	14.2
<b>Insulation material</b>		XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE
Insulation thickness (Phase) (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.2	1.4	1.6	1.7	1.8
Diameter over Insulation (Phase) (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	7.7	8.9	10.1	12.0	13.6	15.3	17.1	19.1	21.8	24.1
Insulation thickness (Ground) (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.1	1.2	1.4
Diameter over Insulation (Ground) (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	6.1	6.1	7.7	8.9	10.1	12.0	13.6	13.6	15.3	17.1
<b>Outer sheath material</b>		PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Outer sheath thickness (Nominal)	mm	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	2.0	2.2	2.3	2.4	2.6
Overall diameter (Approx.)	mm	11	12	13	14	15	17	20	22	25	28	32	36	40	44	49	54
Total cable weight (Approx.)	kg/km	135	180	240	310	430	620	825	1030	1390	1945	2615	3370	4240	5040	6520	8080
Maximum conductor DC resistance at 20°C (Phase)	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	0.727	0.524	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601
Maximum conductor DC resistance at 20°C (Ground)	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	1.15	1.15	0.727	0.524	0.387	0.268	0.193	0.193	0.153	0.124
Minimum Insulation Resistance at 20°C (Phase)	Mohm-km	1021	842	698	591	514	421	430	367	357	326	284	274	287	294	273	260
Minimum Insulation Resistance at 20°C (Ground)	Mohm-km	1021	842	698	591	514	421	421	421	430	367	357	326	284	284	274	287

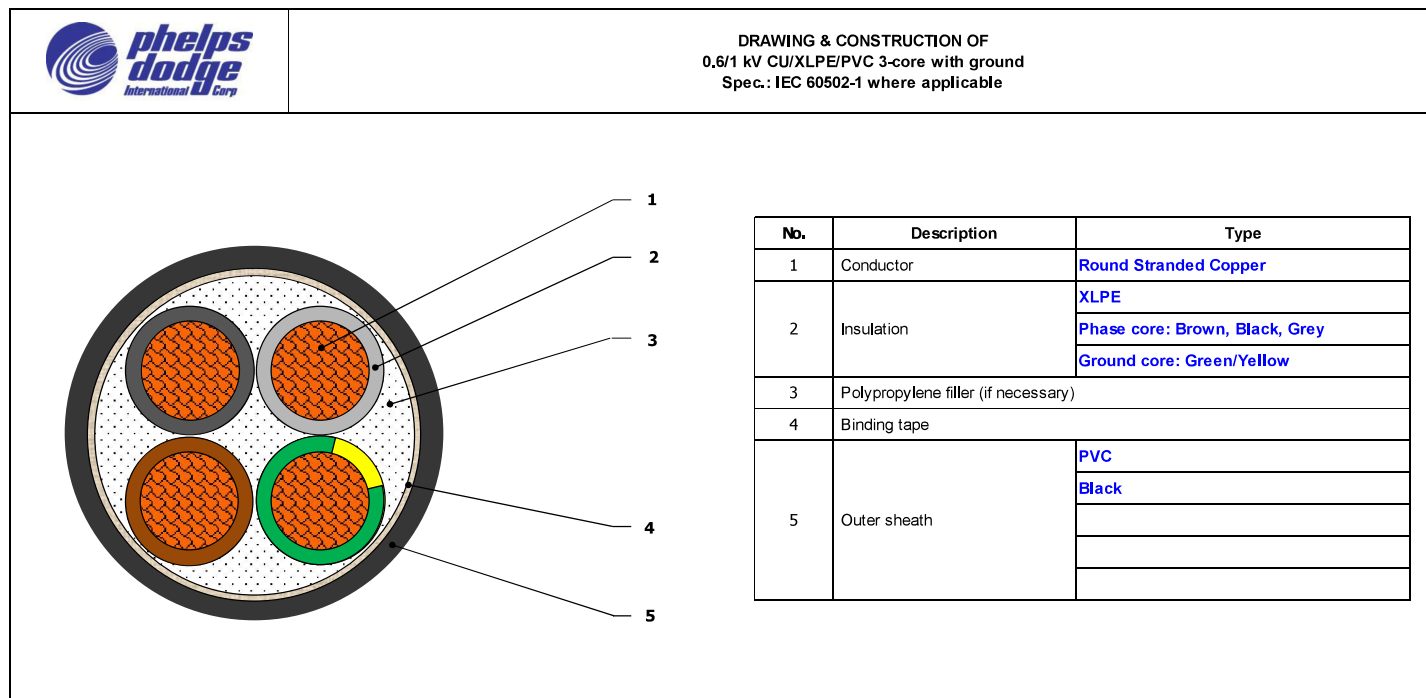


Figure 6 – Cable drawing of 0.6/1 kV CU/XLPE/PVC 3-Core with ground

Table 6 – Technical data of 0.6/1 kV CU/XLPE/PVC 3-Core with ground

Description	unit	3x1.5+1.5	3x2.5+2.5	3x4+4	3x6+6	3x10+10	3x16+16	3x25+16	3x35+16	3x50+25	3x70+35	3x95+50	3x120+70	3x150+95	3x185+95	3x240+120	3x300+150
<b>Conductor material</b>		Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper
Class / Standard		2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228
Diameter of Conductor (Phase) (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	5.8	7.0	8.0	9.7	11.3	12.8	14.2	15.8	18.2	20.3
Diameter of Conductor (Ground) (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	4.6	4.6	5.8	7.0	8.0	9.7	11.3	11.3	12.8	14.2
<b>Insulation material</b>		XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE
Insulation thickness (Phase) (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.2	1.4	1.6	1.7	1.8
Diameter over Insulation (Phase) (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	7.7	8.9	10.1	12.0	13.6	15.3	17.1	19.1	21.8	24.1
Insulation thickness (Ground) (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.2	1.4
Diameter over Insulation (Ground) (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	6.1	6.1	7.7	8.9	10.1	12.0	13.6	13.6	15.3	17.1
<b>Outer sheath material</b>		PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Outer sheath thickness (Nominal)	mm	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	2.1	2.2	2.3	2.5	2.6	2.8
Overall diameter (Approx.)	mm	12	13	14	15	17	19	22	24	27	32	36	40	45	49	55	61
Total cable weight (Approx.)	kg/km	165	215	295	390	540	790	1090	1380	1865	2650	3575	4585	5715	6885	8925	11075
Maximum conductor DC resistance at 20°C (Phase)	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	0.727	0.524	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601
Maximum conductor DC resistance at 20°C (Ground)	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	1.15	1.15	0.727	0.524	0.387	0.268	0.193	0.193	0.153	0.124
Minimum Insulation Resistance at 20°C (Phase)	Mohm-km	1021	842	698	591	514	421	430	367	357	326	284	274	287	294	273	260
Minimum Insulation Resistance at 20°C (Ground)	Mohm-km	1021	842	698	591	514	421	421	421	430	367	357	326	284	284	274	287


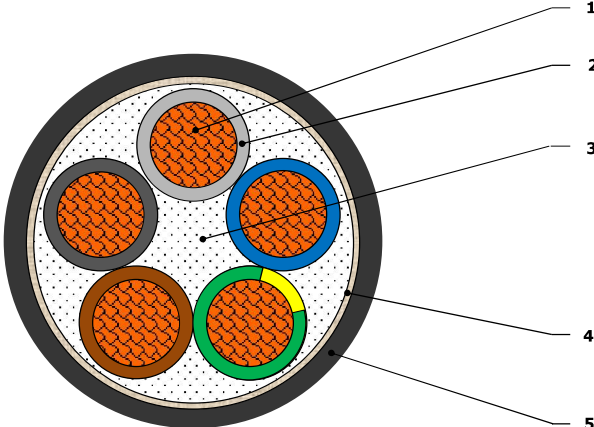
	<div>DRAWING &amp; CONSTRUCTION OF</div> <div>0.6/1 kV CU/XLPE/PVC 4-core with ground</div> <div>Spec.: IEC 60502-1 where applicable</div>																								
	<table><tr><th>No.</th><th>Description</th><th>Type</th></tr><tr><td>1</td><td>Conductor</td><td>Round Stranded Copper</td></tr><tr><td rowspan="3">2</td><td rowspan="3">Insulation</td><td>XLPE</td></tr><tr><td>Phase core: Brown, Black, Grey, Blue</td></tr><tr><td>Ground core: Green/Yellow</td></tr><tr><td>3</td><td colspan="2">Polypropylene filler (if necessary)</td></tr><tr><td>4</td><td colspan="2">Binding tape</td></tr><tr><td rowspan="4">5</td><td rowspan="4">Outer sheath</td><td>PVC</td></tr><tr><td>Black</td></tr><tr><td></td></tr><tr><td></td></tr></table>		No.	Description	Type	1	Conductor	Round Stranded Copper	2	Insulation	XLPE	Phase core: Brown, Black, Grey, Blue	Ground core: Green/Yellow	3	Polypropylene filler (if necessary)		4	Binding tape		5	Outer sheath	PVC	Black		
No.	Description	Type																							
1	Conductor	Round Stranded Copper																							
2	Insulation	XLPE																							
		Phase core: Brown, Black, Grey, Blue																							
		Ground core: Green/Yellow																							
3	Polypropylene filler (if necessary)																								
4	Binding tape																								
5	Outer sheath	PVC																							
		Black																							

Figure 7 – Cable drawing of 0.6/1 kV CU/XLPE/PVC 4-Core with ground

Table 7 – Technical data of 0.6/1 kV CU/XLPE/PVC 4-Core with ground

Description	unit	4x1.5+1.5	4x2.5+2.5	4x4+4	4x6+6	4x10+10	4x16+16	4x25+16	4x35+16	4x50+25	4x70+35	4x95+50	4x120+70	4x150+95	4x185+95	4x240+120	4x300+150
<b>Conductor material</b>		Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper	Copper
Class / Standard		2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228	2/IEC60228
Diameter of Conductor (Phase) (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	5.8	7.0	8.0	9.7	11.3	12.8	14.2	15.8	18.2	20.3
Diameter of Conductor (Ground) (Approx.)	mm	1.6	2.0	2.6	3.1	3.7	4.6	4.6	4.6	5.8	7.0	8.0	9.7	11.3	11.3	12.8	14.2
<b>Insulation material</b>		XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE	XLPE
Insulation thickness (Phase) (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.2	1.4	1.6	1.7	1.8
Diameter over Insulation (Phase) (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	7.7	8.9	10.1	12.0	13.6	15.3	17.1	19.1	21.8	24.1
Insulation thickness (Ground) (Nominal)	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.0	1.1	1.1	1.1	1.1	1.2	1.4
Diameter over Insulation (Ground) (Approx.)	mm	3.1	3.5	4.0	4.6	5.2	6.1	6.1	6.1	7.7	8.9	10.1	12.0	13.6	13.6	15.3	17.1
<b>Outer sheath material</b>		PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC	PVC
Outer sheath thickness (Nominal)	mm	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.9	2.0	2.2	2.3	2.5	2.6	2.9	3.1
Overall diameter (Approx.)	mm	13	14	15	17	18	21	24	27	31	36	40	45	50	55	62	69
Total cable weight (Approx.)	kg/km	195	260	355	475	660	965	1365	1745	2385	3380	4565	5840	7275	8795	11480	14250
Maximum conductor DC resistance at 20°C (Phase)	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	0.727	0.524	0.387	0.268	0.193	0.153	0.124	0.0991	0.0754	0.0601
Maximum conductor DC resistance at 20°C (Ground)	Ohm/km	12.1	7.41	4.61	3.08	1.83	1.15	1.15	1.15	0.727	0.524	0.387	0.268	0.193	0.193	0.153	0.124
Minimum Insulation Resistance at 20°C (Phase)	Mohm-km	1021	842	698	591	514	421	430	367	357	326	284	274	287	294	273	260
Minimum Insulation Resistance at 20°C (Ground)	Mohm-km	1021	842	698	591	514	421	421	421	430	367	357	326	284	284	274	287



SPEC NO.: 3.6/6kV-CU-XL-CT-PE-000

# SPECIFICATION

## MEDIUM VOLTAGE POWER CABLE

3.6/6 (7.2) KV CU/XLPE/CTS/PE

Copper Conductor, Cross-Linked Polyethylene Insulation,  
Copper Tape Shield, PE Sheathed Cable

REVISION	ISSUED DATE
03	2 Feb 2017

## ANNEX A - CABLE DRAWING AND TECHNICAL DATA

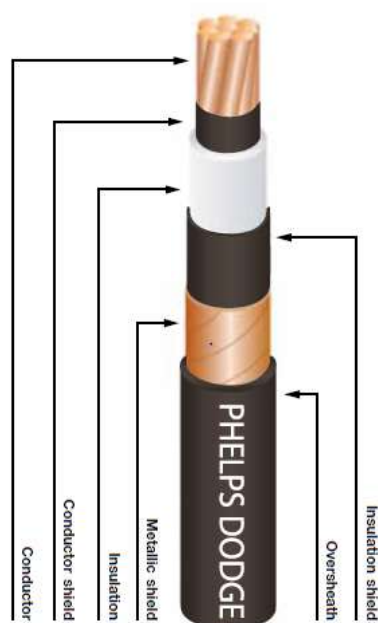


Figure 1 – Cable drawing of 3.6/6(7.2) kV CU/XLPE/CTS/PE Single-core Cable

Phelps Dodge International (Thailand) Limited



Table 1 – Technical data of 3.6/6(7.2) kV CU/XLPE/CTS/PE Single-core Cable

Nominal cross-sectional area mm <sup>2</sup>	Minimum number of wire	Diameter of conductor (approx.) mm	Thickness of insulation mm	Diameter over insulation (approx.) mm	Copper tape shield thickness (approx.) mm	Thickness of oversheath mm	Overall diameter (approx.) mm	Cable weight (approx.) kg / km	Minimum bending radius mm	Standard packing m / reel
35	6	7.0	2.5	13.1	0.07	1.5	18	515	216	1000
50	6	8.0	2.5	14.1	0.07	1.6	19	650	228	1000
70	12	9.7	2.5	15.8	0.07	1.6	21	875	252	1000
95	15	11.3	2.5	17.4	0.07	1.7	22	1140	264	1000
120	18	12.8	2.5	18.9	0.07	1.7	24	1390	288	1000
150	18	14.2	2.5	20.3	0.07	1.8	26	1665	312	1000
185	30	15.8	2.5	21.9	0.07	1.8	27	2020	324	1000
240	34	18.2	2.6	24.5	0.07	1.9	30	2605	360	500
300	34	20.3	2.8	27.0	0.07	2.0	33	3215	396	500
400	53	23.0	3.0	30.2	0.07	2.1	36	4065	432	500
500	53	25.9	3.2	33.7	0.07	2.2	40	5125	480	250
630	53	29.9	3.2	37.7	0.07	2.3	44	6530	528	250
800	53	33.8	3.2	41.6	0.07	2.4	48	8255	576	250
1000	53	39.8	3.2	47.6	0.07	2.6	54	10350	648	250
1200	-	42.9	3.2	50.7	0.07	2.7	58	11970	696	250



**Table 2 - Electrical data of 3.6/6(7.2) kV CU/XLPE/CTS/PE Single-core Cable**

Nominal cross-sectional area mm <sup>2</sup>	Maximum Rdc of conductor at 20°C Ω/km	Minimum insulation resistance at 20°C MΩ-km	Capacitance of cable μF/km	Rac at 90°C		Reactance at 50 Hz		Positive/Negative sequence impedance		Zero sequence impedance Ω/km	Short circuit current capacity for 1 sec.	
				Trefoil Ω/km	Flat* Ω/km	Trefoil Ω/km	Flat* Ω/km	Trefoil Ω/km	Flat* Ω/km		Conductor kA	Shield kA
35	0.524	750	0.295	0.668	0.668	0.115	0.173	0.565 + j0.115	0.565 + j0.173	5.775 + j0.059	5.0	0.5
50	0.387	681	0.325	0.494	0.494	0.111	0.169	0.418 + j0.111	0.418 + j0.169	5.268 + j0.055	7.2	0.5
70	0.268	588	0.376	0.342	0.342	0.104	0.162	0.289 + j0.104	0.289 + j0.162	4.633 + j0.049	10.0	0.7
95	0.193	523	0.423	0.247	0.247	0.100	0.158	0.208 + j0.100	0.208 + j0.158	4.169 + j0.045	13.6	0.7
120	0.153	474	0.467	0.196	0.196	0.096	0.154	0.165 + j0.096	0.165 + j0.154	3.824 + j0.043	17.2	0.7
150	0.124	436	0.507	0.159	0.159	0.094	0.152	0.134 + j0.094	0.134 + j0.152	3.554 + j0.040	21.5	0.7
185	0.0991	399	0.555	0.1280	0.1273	0.091	0.149	0.107 + j0.091	0.107 + j0.149	3.283 + j0.038	26.5	0.7
240	0.0754	367	0.602	0.0984	0.0973	0.089	0.147	0.082 + j0.089	0.082 + j0.147	2.929 + j0.036	34.3	0.7
300	0.0601	359	0.617	0.0795	0.0781	0.087	0.146	0.066 + j0.087	0.066 + j0.146	2.656 + j0.035	42.9	0.9
400	0.0470	341	0.650	0.0637	0.0619	0.086	0.144	0.052 + j0.086	0.052 + j0.144	2.364 + j0.035	57.2	0.9
500	0.0366	327	0.677	0.0514	0.0491	0.085	0.143	0.041 + j0.085	0.041 + j0.143	2.132 + j0.034	71.5	0.9
630	0.0283	289	0.767	0.0421	0.0392	0.082	0.140	0.032 + j0.082	0.032 + j0.140	1.906 + j0.031	90.1	0.9
800	0.0221	259	0.855	0.0356	0.0320	0.080	0.138	0.026 + j0.080	0.026 + j0.138	1.726 + j0.030	114.5	0.9
1000	0.0176	223	0.990	0.0311	0.0270	0.078	0.136	0.022 + j0.078	0.022 + j0.136	1.510 + j0.028	143.1	0.9
1200	0.0151	209	1.060	0.0286	0.0242	0.077	0.135	0.019 + j0.077	0.019 + j0.135	1.418 + j0.027	171.7	0.9

\*For flat laying: distance between center of phase cables is 2xOD<sub>cab</sub>.

**Table 3 – Current Carrying Capacity of 3.6/6(7.2) kV CU/XLPE/CTS/PE Single-core Cable**

Nominal cross-sectional area mm <sup>2</sup>	In Air		Direct Burial		Underground duct (single cable in each duct)	
	Trefoil A	Flat A	Trefoil A	Flat A	Trefoil A	Flat A
35	167	210	168	174	147	152
50	201	252	197	205	174	180
70	253	317	242	251	213	221
95	310	388	289	301	255	265
120	359	450	328	342	290	302
150	411	513	368	384	325	339
185	472	591	415	434	368	384
240	563	704	480	504	428	449
300	649	812	541	570	484	510
400	756	947	613	651	550	583
500	874	1101	692	741	623	668
630	1011	1290	777	845	702	765
800	1146	1487	859	950	781	866
1000	1296	1711	938	1059	856	970
1200	1388	1853	988	1129	905	1039

**Condition:** Ambient air temperature 40 °C, Ground temperature 30 °C, Depth of laying in ground 0.8 m, Thermal resistivity of soil 1.2 K.m/W, Distance between phase cables for flat laying is 2xOD<sub>cab</sub> or 2xOD<sub>duct</sub>, Metallic shield is single point bonded.



บริษัท กัลฟ์ เจพี เอ็นเอส จำกัด

รายงานการเปลี่ยนแปลงรายละเอียดโครงการ ในรายงานการประเมินผลกระทบสิ่งแวดล้อม  
โครงการโรงไฟฟ้าหนองแขง (ครั้งที่ 6) อำเภอหนองแขง จังหวัดสระบุรี

## ภาคผนวกที่ 2.7

ข้อต่อสายไฟสำหรับแผงเซลล์แสงอาทิตย์  
(PV Connectors (MC4))

## MA231 (de\_en) Montageanleitung

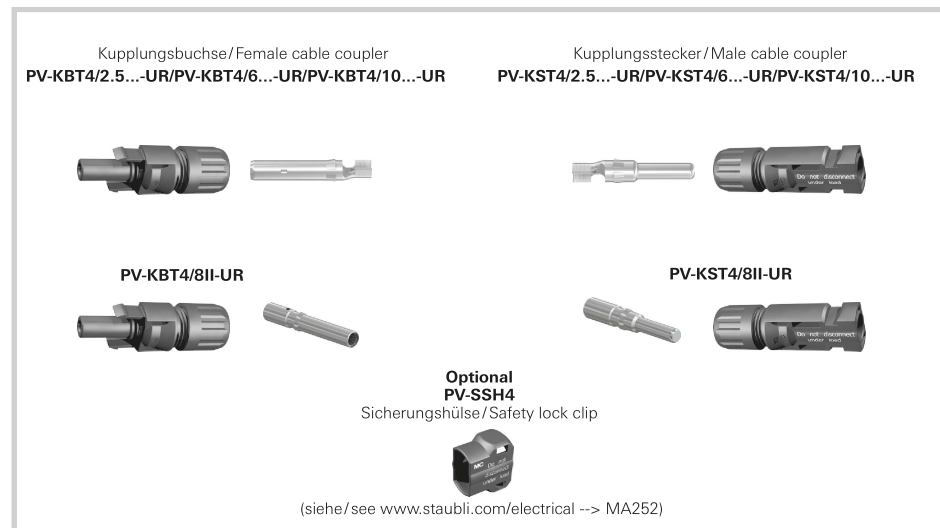
## MA231 (de\_en) Assembly instructions

**PV-Kupplungsstecker PV-KST4/...-UR**  
**PV-Kupplungsbuchse PV-KBT4/...-UR** **MC4**

**PV male cable coupler PV-KST4/...-UR**  
**PV female cable coupler PV-KBT4/...-UR** **MC4**

### Inhalt

Sicherheitshinweise.....	2	Content	
Erforderliches Werkzeug .....	4	Safety Instructions.....	2
Vorbereitung der Leitung.....	5	Tools required .....	4
Crimpen .....	6	Cable preparation .....	5
Montage-Prüfung .....	7	Crimping .....	6
Stecken und Trennen der Kabelkupplung		Assembly check .....	7
ohne Sicherungshülse PV-SSH4 .....	8	Plugging and unplugging the cable coupler	
mit Sicherungshülse PV-SSH4 .....	9	without safety lock clip PV-SSH4 .....	8
Leitungsführung .....	9	with safety lock clip PV-SSH4 .....	9
Technische Daten .....	10	Cable routing .....	9
		Technical data .....	10



## Sicherheitshinweise

Die Montage und Installation der Produkte darf nur durch qualifiziertes und trainiertes Fachpersonal unter Berücksichtigung aller anwendbaren gesetzlichen Sicherheitsbestimmungen und Regelungen erfolgen.  
Stäubli Electrical Connectors (Stäubli) lehnt jegliche Haftung infolge Nichteinhaltung dieser Warnhinweise ab.

Benutzen Sie nur die von Stäubli angegebenen Einzelteile und Werkzeuge. Weichen Sie nicht von den hier beschriebenen Vorgängen zur Vorbereitung und Montage ab, da sonst bei der Selbstkonfektionierung weder die Sicherheit noch die Einhaltung der technischen Daten gewährleistet ist. Ändern Sie das Produkt nicht in irgend einer Weise ab.

Nicht von Stäubli hergestellte Steckverbindungen, die mit Stäubli-Elementen steckbar sind und von den Herstellern manchmal auch als „Stäubli-kompatibel“ bezeichnet werden, entsprechen nicht den Anforderungen für eine sichere, langzeitstabile elektrische Verbindung und dürfen aus Sicherheitsgründen nicht mit Stäubli-Elementen gesteckt werden. Stäubli übernimmt daher keine Haftung, falls diese von Stäubli nicht freigegebenen Steckverbindungen mit Stäubli-Elementen gesteckt werden und deshalb Schäden entstehen.

**⚠ Die hier beschriebenen Arbeiten dürfen nicht an stromführenden oder unter Spannung stehenden Teilen durchgeführt werden.**

**⚠ Der Schutz vor einem elektrischen Schlag muss durch das Endprodukt gegeben sein und vom Anwender sichergestellt werden.**

**⚠ Die Steckverbindungen dürfen nicht unter Last getrennt werden. Das Stecken und Trennen unter Spannung ist zulässig.**

**⚠ Die Steckverbinder sind wasserdicht gemäss IP-Schutzart. Sie sind aber nicht geeignet für einen dauerhaften Gebrauch unter Wasser. Legen Sie die Steckverbinder nicht direkt auf die Dachhaut auf.**

**⚠ Nicht gesteckte Steckverbinder sind mit einer Verschlusskappe (MC4 Artikel Nr. 32.0716 für Buchsen und 32.0717 für Stecker) vor Feuchtigkeit und Schmutz zu schützen. Die Steckverbinder dürfen nicht im verschmutzten Zustand miteinander gesteckt werden.**

**⚠ Die Steckverbindung darf nie einer dauerhaft mechanischen Zugbelastung ausgesetzt sein. Das Kabel sollte mit Kabelbindern befestigt werden.**

**⚠ Stäubli untersagt aus Sicherheitsgründen, weder PVC-Kabel noch unverzinnte Kabel vom Typ H07RN-F zu verwenden.**

**⚠ Die angegebenen Spannungen sind Maximalwerte und beziehen sich lediglich auf die Steckverbinder. Die endgültige Nennspannung wird bestimmt durch die niedrigste maximale Nennspannung der Baugruppe und den einschlägigen Normen, zu denen sie bewertet und zertifiziert wurden.**

**i Weitere technische Daten entnehmen Sie bitte dem Produktkatalog.**

## Erklärung der Symbole

- ⚠** Warnung vor gefährlicher elektrischer Spannung
- ⚠** Warnung vor einer Gefahrenstelle
- i** Nützlicher Hinweis oder Tipp

## Safety Instructions

The products may be assembled and installed only by suitably qualified and trained specialists with due observance of all applicable safety regulations.

Stäubli Electrical Connectors (Stäubli) declines any liability in the event of failure to observe these warnings.

Use only the components and tools specified by Stäubli. Do not deviate from the preparation and assembly procedures described here, since in this event, in the event of self-assembly, no guarantee can be given as to safety or conformity with the technical data. Do not modify the product in any way.

Connectors not made by Stäubli which can be mated with Stäubli products and in some cases are also described as “Stäubli-compatible” do not conform to the requirements for safe electrical connection with long-term stability, and for safety reasons must not be plugged together with Stäubli elements. Stäubli can therefore accept no liability for damage which occurs as a result of mating these connectors which lack Stäubli approval with Stäubli elements.

**⚠ The work described here must not be carried out on live or load-carrying parts.**

**⚠ Protection from electric shock must be assured by the end product and its user.**

**⚠ The plug connections must not be disconnected under load. Plugging and unplugging when live is permitted.**

**⚠ The plug connectors are watertight in accordance with IP protection class. However, they are not suitable for continuous operation under water. Do not place the plug connectors directly on the roof membrane.**

**⚠ Unmated plug connectors must be protected from moisture and dirt or in areas where standing water may occur with a sealing cap (MC4 Article No. 32.0716 for sockets and 32.0717 for plugs). The male and female parts must not be plugged together when soiled.**

**⚠ The plug connection must not be subjected to continuous mechanical tension. The cable should be fixed with an appropriate cable management device.**

**⚠ For safety reasons Stäubli prohibits the use of either PVC cables or untinned cables of type H07RN-F.**

**⚠ Stated voltage ratings are maximum values and pertain only to the cable couplers. The final voltage rating of a cable lead assembly or harness is dictated by the lowest maximum voltage rating of any component contained in the assembly and the relevant standards to which they have been evaluated and certified.**

**i For further technical data please see the product catalogue.**

## Explanation of the symbols

- ⚠** Warning of dangerous voltages
- ⚠** Warning of a hazard area
- i** Useful hint or tip

### Hinweis zur Lagerung

Für die Lagerung der der Steckverbinderkomponenten empfehlen wir eine Lagertemperatur von -30°C bis +60°C bei einer Luftfeuchtigkeit von < 70 %.

Die Komponenten dürfen nicht direktem Regen, kondensierendem Wasser u.ä. ausgesetzt werden. Achten Sie darauf, Einzelteile nicht mit Säuren, Laugen, Gasen, Azeton oder anderen chemischen Substanzen in Berührung zu bringen, die einen Einfluss auf die verwendeten Materialien haben könnten.

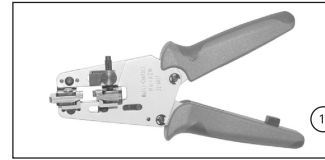
Sofern diese Bedingungen eingehalten werden, beträgt die maximale Lagerzeit 2 Jahre ab Fertigungsdatum.

### Note on storage

We recommend that you store connector components at a temperature between -30°C and +60°C and with a relative humidity of less than 70%.

The components must not be exposed to moisture due to direct rainfall, condensation, etc. Ensure that the individual components do not come into contact with acids, alkalis, gases, acetone, or any other chemical substances that could impact the materials used.

If these conditions are met, the components can be stored for a maximum period of up to two years from the date of manufacture.



### Erforderliches Werkzeug

(ill. 1)  
Abisolierzange **PV-AZM...** inkl.  
eingebauten Abisolier-Messern sowie  
Sechskantschlüssel SW2,5.

Leiterquerschnitt: 1,5/2,5/4/6 mm²  
Typ: **PV-AZM-1.5/6**  
Bestell-Nr. **32.6027-156**

Leiterquerschnitt: 4/6/10 mm²  
Typ: **PV-AZM-4/10**  
Bestell-Nr. **32.6027-410**

(ill. 2)  
Crimpzange **PV-CZM...** inkl. Locator  
und eingebautem Crimpeinsatz.

Crimpbereich:  
1,5/2,5/4 mm² (14/12 AWG)  
Typ: **PV-CZM-18100**  
Bestell-Nr. **32.6020-18100**

Crimpbereich:  
2,5/4/6 mm² (12/10 AWG)  
Typ: **PV-CZM-19100**  
Bestell-Nr. **32.6020-19100**

Crimpbereich: 4/10 mm² (12 AWG)  
Typ: **PV-CZM-20100**  
Bestell-Nr. **32.6020-20100**

Crimpbereich: 12/10/8 AWG  
Typ: **PV-CZM-22100**  
Bestell-Nr. **32.6020-22100**

### Tools required

(ill. 1)  
Stripping pliers **PV-AZM...** or equivalent.

Cable cross section: 1,5/2,5/4/6 mm²  
Type: **PV-AZM-1.5/6**  
Order No. **32.6027-156**

Cable cross section: 4/6/10 mm²  
Type: **PV-AZM-4/10**  
Order No. **32.6027-410**

(ill. 2)  
Crimping pliers **PV-CZM...** incl. Locator and built-in crimping insert.

Crimping range:  
1,5/2,5/4 mm² (14/12 AWG)  
Type: **PV-CZM-18100**  
Order No. **32.6020-18100**

Crimping range:  
2,5/4/6 mm² (12/10 AWG)  
Type: **PV-CZM-19100**  
Order No. **32.6020-19100**

Crimping range: 4/10 mm² (12 AWG)  
Type: **PV-CZM-20100**  
Order No. **32.6020-20100**

Crimping range: 12/10/8 AWG  
Type: **PV-CZM-22100**  
Order No. **32.6020-22100**



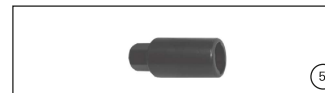
(ill. 3)  
**PV-MS** Montageschlüssel,  
1 Set = 2 Stück  
Bestell-Nr. **32.6024**

(ill. 3)  
Open-end spanner **PV-MS**,  
1 Set = 2 pieces  
Order No. **32.6024**



(ill. 4)  
**PV-WZ-AD/GWD** Steckschlüssel zum  
Anziehen  
Bestell-Nr. **32.6006**

(ill. 4)  
**PV-WZ-AD/GWD** socket wrench  
insert to tighten  
Order No. **32.6006**



(ill. 5)  
**PV-SSE-AD4** Steckschlüssel zum  
Kontern  
Bestell-Nr. **32.6026**

(ill. 5)  
**PV-SSE-AD4** socket wrench insert to  
secure  
Order No. **32.6026**



(ill. 6)  
**PV-PST** Prüfstift  
Bestell-Nr. **32.6028**

(ill. 6)  
Test plug **PV-PST**  
Order No. **32.6028**



(ill. 7)  
SW15 Gabelschlüssel



(ill. 8)  
SW12 Drehmomentschlüssel

### Vorbereitung der Leitung

Anschlussleitungen mit einem Litzenaufbau der Klassen 5 und 6 können angeschlossen werden (IEC). Für UL können Leiter der Klasse B oder höher angeschlossen werden.

#### Achtung:

Verwenden Sie keine blanken oder bereits oxidierten Leiter. Verzinnte Leiter sind vorteilhaft. Sämtliche Solarkabel von Stäubli haben hochwertige, verzinnnte Leiter.

(ill. 9, Tab. 1 + 2)

Kontrollieren Sie die Masse A und b gemäss Illustration 9 und Tabelle 1 und 2.

#### Hinweis:

Bei Verwendung anderer Leitungsdurchmesser als in Tabelle 1 und 2 angegeben sprechen Sie uns bitte an. Wir sind Ihnen gerne behilflich.

(ill. 7)  
Open-end spanner wrench A/F 15 mm

(ill. 8)  
Torque screwdriver A/F 12 mm

### Cable preparation

Cables with a strand construction of classes 5 and 6 can be connected (IEC). For UL cables of class B or higher can be used.

#### Attention:

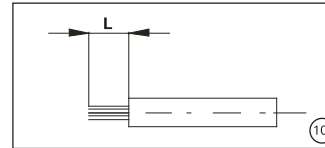
Do not use uncoated (bare) or already oxidised conductors. It is recommended to use tinned conductors. All Stäubli solar cables have high-quality, tinned conductors.

(ill. 9, Tab. 1 + 2)

Check dimensions A and b in accordance with illustration 9 and table 1 and 2.

#### Note:

Other cable combinations that are not mentioned in Tab. 1 or 2 are available. Please contact Stäubli for more information, we are pleased to support you.



Tab. 3

Typ/Type	Masse/Length "L"
PV-K...T4/2,5I	6 – 7,5 mm
PV-K...T4/6I	6 – 7,5 mm
PV-K...T4/10II	6 – 7,5 mm
PV-K...T4/8II	8,5 – 10 mm

(ill. 10)  
Kontrollieren Sie die Masse L gemäss Illustration 10 und Tabelle 3.

#### Achtung:

Schneiden Sie beim Abisolieren keine Einzeldrähte ab!

(ill. 10)  
Check dimensions L in accordance with illustration 10 and table 3.

#### Attention:

Do not cut individual strands when stripping the cable.

#### Hinweis:

Die Bedienung der Abisolierzange PV-AZM... sowie das Auswechseln von Messersätzen entnehmen Sie bitte der Bedienungsanleitung MA267 auf [www.staubli.com/electrical](http://www.staubli.com/electrical)

#### Note:

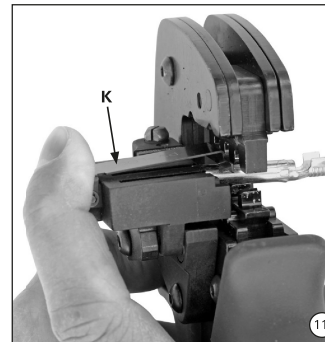
For directions on the operation of stripping pliers PV-AZM... and changing blade sets, see operating instruction MA267 at [www.staubli.com/electrical](http://www.staubli.com/electrical)

### Auswahl von nach TÜV-Rheinland geprüften Steckverbinderkonfigurationen

Tab. 1

A: ø-Bereich der Leitung [mm] A: ø range of the cable [mm]	Leitungsquerschnitt Conductor cross section			
	2,5 mm²	4 mm²	6 mm²	10 mm²
5,0 - 6,0	PV-K...T4/2,5I	PV-K...T4/6I	PV-K...T4/6I	PV-K...T4/10I
5,5 - 7,4	PV-K...T4/2,5X	PV-K...T4/6X	PV-K...T4/6X	PV-K...T4/10X
5,9 - 8,8	PV-K...T4/2,5II	PV-K...T4/6II	PV-K...T4/6II	PV-K...T4/10II
b: Kontrollmaß b: control dimension	~3 mm		~5 mm	~7,2 mm

### Selection of connector configuration proven by TÜV-Rheinland

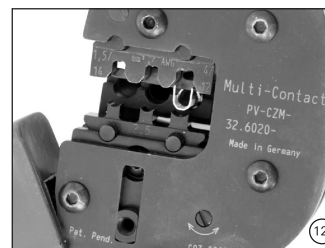


### Crimpen

(ill. 11)  
Öffnen Sie den Klemmbügel (K) und halten Sie ihn fest. Legen Sie den Kontakt in den passenden Querschnittsbereich. Drehen Sie die Crimplaschen nach oben. Lassen Sie den Klemmbügel (K) los. Der Kontakt ist fixiert.

### Crimping

(ill. 11)  
Open the clamp (K) and hold. Place the contact in the appropriate cross-section range. Turn the crimp basket upwards. Release the clamp (K). The contact is fixed.



(ill. 12)  
Drücken Sie die Zange leicht zusammen, bis die Crimplaschen sicher innerhalb der Crimp-Matrize liegen.

(ill. 12)  
Press the pliers gently together until the crimp basket is properly located within the crimping die as shown.

### Auswahl der Steckverbinderkonfiguration bei Verwendung von UL-zertifizierten Leitungen

Tab. 2

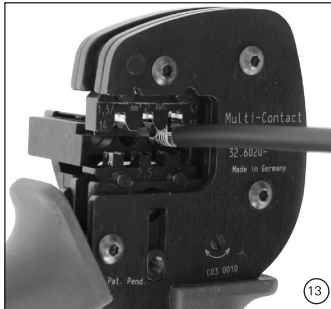
Bemessungsspannung [V] DC Rated voltage [V] DC		Leitungsquerschnitt / Conductor cross section AWG (stranding)			
600 / 1000 / 1500	600				
A: ø-Bereich der Leitung [mm] A: ø range of the cable [mm]					
ZKLA (PV-Wire)	TYLZ (USE-2)	14 (19-49)	12 (7-65)	10 (7-78)	8 (7-168)
5,60 - 6,20	4,83 - 6,20	PV-K...T4/2,5I	PV-K...T4/6I		
6,20 - 7,00	6,20 - 7,00	PV-K...T4/2,5X	PV-K...T4/6X	PV-K...T4/6X	
7,00 - 8,60	7,00 - 8,60	PV-K...T4/2,5II	PV-K...T4/6II	PV-K...T4/6II	
6,05 - 8,40	8,30 - 8,56				PV-K...T4/8II
b: Kontrollmaß b: control dimension		~3 mm	~5 mm		~4,4 mm

#### Hinweis:

Erfüllt das ausgewählte Kabel die Kriterien nach Tabellen 1 und 2 sowie den technischen Daten auf Seite 10, kann dieses als doppelt zertifiziertes Kabel (TUV und UL) verwendet werden.

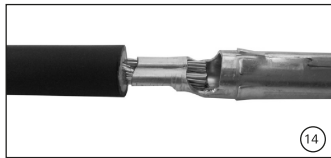
#### Note:

If your chosen cable is suitable for both configurations named in Tab. 1 and 2, you can use it as double certified cable according TUV and UL.



**(ill. 13)**  
Führen Sie das abisolierte Kabel ein, bis die Litzen des Kabels am Klemmbügel anschlagen. Schliessen Sie die Crimpzange ganz.

**(ill. 13)**  
Insert the stripped cable end until the cable strands come up against the locator. Completely close the crimping pliers.



**(ill. 14)**  
Kontrollieren Sie die Verdrumpung bezüglich der Kriterien, die in EN 60352 beschrieben sind.

**(ill. 14)**  
Visually check the crimp according to the criteria written in EN 60352.

**Hinweis:**  
Die Handhabung der Crimpzange entnehmen Sie bitte der Bedienungsanleitung MA251 auf [www.staubli.com/electrical](http://www.staubli.com/electrical)

**Note:**  
For directions on the operation of the crimping tool, please see operating instructions MA251 at [www.staubli.com/electrical](http://www.staubli.com/electrical)

## Montage-Prüfung



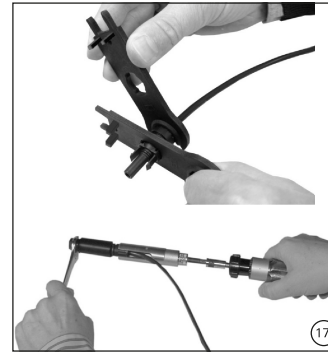
**(ill. 15)**  
Führen Sie den angecrimpten Kontakt von hinten in die Stecker- bzw. Buchsenisolation ein bis zum Einrasten. Prüfen Sie durch leichtes Ziehen an der Leitung, ob das Metallteil richtig eingerastet ist.

**(ill. 15)**  
Insert the crimped-on contact into the insulator of the male or female coupler until it clicks into place. Pull gently on the lead to check that the metal part is correctly engaged.



**(ill. 16)**  
Stecken Sie den Prüfstift mit der entsprechenden Seite in die Buchse bzw. in den Stecker bis zum Anschlag. Bei richtig montiertem Kontakt muss die weiße Markierung am Prüfstift noch sichtbar sein.

**(ill. 16)**  
Insert the appropriate end of the test pin into the male or female coupler as far as it will go. If the contact is correctly located, the white mark on the test pin must still be visible.



**(ill. 17)**  
Ziehen Sie die Leitungsverschraubung mit den Werkzeugen **PV-MS** handfest an, oder ziehen Sie die Leitungsverschraubung mit den Werkzeugen **PV-WZ-AD/GWD** und **PV-SSE-AD4** an.

**In beiden Fällen gilt:**  
Das Anzugsdrehmoment muss auf die konkret verwendeten Solarleitungen abgestimmt werden. Typische Werte liegen im Bereich von 3,4 Nm bis 3,5 Nm <sup>1)</sup>.

<sup>1)</sup> Wir empfehlen den eingesetzten Drehmomentschlüssel vor Montagebeginn zu kalibrieren.

**(ill. 17)**  
Screw the cable gland hand-tight with the tools **PV-MS** then tighten the cable gland with the tools **PV-WZ-AD/GWD** and **PV-SSE-AD4** or PV-MS.

**In both cases:**  
The tightening torque must be appropriate for the solar cables used. Typical values are between 3,4 Nm and 3,5 Nm <sup>1)</sup>.

<sup>1)</sup> We recommend to use a calibrated torque wrench for assembly.

**Hinweis:**  
Die Umgebungstemperatur zur Verarbeitung der Komponenten sollte zwischen -15°C und 35°C liegen

**Note:**  
For assembling of components we recommend an ambient temperature between -15°C and 35°C

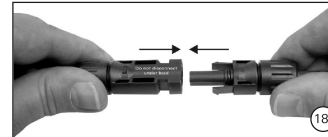
**Hinweis:**  
Verschrauben Sie die Hutmutter nicht auf Block.

**Note:**  
Do not bottom out the capnut.

## Stecken und Trennen der Kabelkupplung ohne Sicherungshülse PV-SSH4

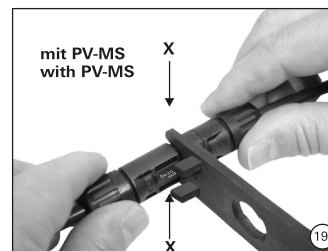
### Stecken

**(ill. 18)**  
Stecken Sie die Kabelkupplung zusammen bis zum Einrasten. Kontrollieren Sie das korrekte Einrasten durch Ziehen an der Kabelkupplung.



### Trennen

**(ill. 19)**  
Zum Trennen der Steckverbindung entriegeln Sie den Schnappverschluss mit dem Werkzeug PV-MS oder PVMS-PLS und ziehen Sie die Steckverbindung auseinander.



## Plugging and unplugging the cable coupler without safety lock clip PV-SSH4

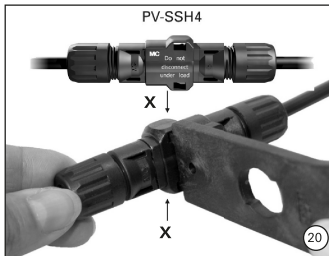
### Plugging

**(ill. 18)**  
Plug the parts of the cable coupler together until they click in place. Check that they have engaged properly by pulling on the cable coupler.

### Unplugging

**(ill. 19)**  
To disconnect the contacts, unlock the snap lock with the tool PV-MS or PVMS-PLS and pull the connector apart.





## Stecken und Trennen der Kabelkupplung mit Sicherungshülse PV-SSH4

### Stecken (ill. 20)

Stecken Sie die Kabelkupplung zusammen bis zum Einrasten. Kontrollieren Sie das korrekte Einrasten durch Ziehen an der Kabelkupplung.

### Trennen

Die Kabelkupplung kann nur noch mit dem Werkzeug PV-MS getrennt werden. Drücken Sie die Einrastlaschen (X) mit dem Werkzeug PV-MS zusammen und ziehen Sie die Kabelkupplung auseinander.

## Leitungsführung

Die Kräfte dürfen keine sichtbare Verformung im Dichtbereich der Isolation aufweisen. Beachten Sie die Spezifikationen des Leitungsherstellers betreffend des Biegeradius. Eine Empfehlung zur Kabelführung direkt am Steckverbinder entnehmen Sie bitte der folgende Skizze.

## Plugging and unplugging the cable coupler with safety lock clip PV-SSH4

### Plugging (ill. 20)

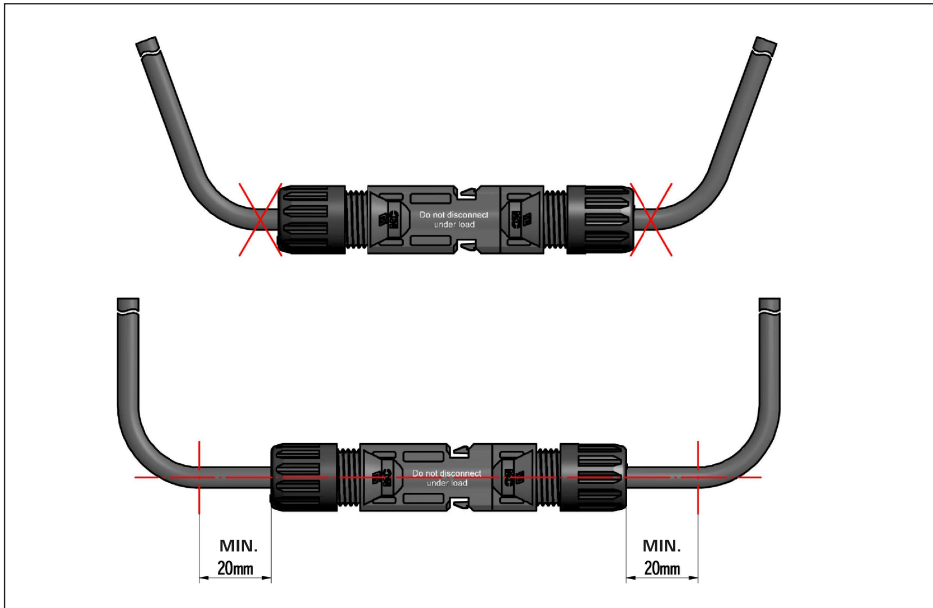
Plug the parts of the cable coupler together until they click in place. Check that they have engaged properly by pulling on the cable coupler.

### Unplugging

The cable coupler can be disconnected only with the tool PV-MS. Press the latches (X) together with the tool PV-MS and pull the halves of the coupler apart.

## Cable routing

Cable management must allow a minimum of 20 mm of cable that exits directly from the cable seal without bending or stress. Refer to cable manufacturers specification for minimum bending radius. Please see picture regarding detailed cable routing.



## Technische Daten

Typenbezeichnung	Type designation	MC4
Steckverbindersystem	Connector system	Ø 4 mm
Bemessungsspannung	Rated voltage	1000 V (EN 50521 / IEC62852) <sup>1)</sup> 1500 V DC (2PFG2330) <sup>1) 2)</sup> 600 V / 1000 V / 1500 V (UL) <sup>3)</sup>
Bemessungsstrom IEC (85 °C)	Rated current IEC (85 °C)	17 A (1,5 mm <sup>2</sup> ) 22,4 A (2,5 mm <sup>2</sup> ) 39 A (4 mm <sup>2</sup> / 6 mm <sup>2</sup> ) 45 A (10 mm <sup>2</sup> )
Bemessungsstrom (UL)	Rated current (UL)	22,5 A (14 AWG) 30 A (12 AWG / 10 AWG) 50 A (8 AWG)
Bemessungsstossspannung	Rated surge voltage	12 kV (1000 V DC (IEC)) 16 kV (1500 V DC (IEC))
Umgebungstemperaturbereich	Ambient temperature range	-40 °C...+85 °C (IEC) -40 °C...+75 °C (UL)
Obere Grenztemperatur	Upper limiting temperature	105 °C (IEC)
Schutzart, gesteckt ungesteckt	Degree of protection, mated unmated	IP65 / IP68 (1 m/1 h) IP2X
Überspannungskat. / Verschmutzungsgrad	Overvoltage category / Pollution degree	CATIII/3
Kontaktwiderstand der Steckverbinder	Contact resistance of plug connectors	0,35 mΩ
Polarität der Steckverbinder	Polarity of the connectors	Buchse / Socket = Plus / positive Stecker / Plug = Minus / negative
Verriegelungssystem	Locking system	Snap-in
Schutzklasse (IEC)	Safety class (IEC)	1000 V DC:II 1500 V DC:0
Kontaktsystem	Contact system	Kontaktlamelle MULTILAM
Anschlussart	Type of termination	Crimpen / Crimping
Hinweis	Warning	Nicht unter Last trennen Do not disconnect under load
Kontaktmaterial	Contact material	Kupfer, verzinkt / Copper, tin plated
Isolationsmaterial	Insulation material	PC/PA
Flammklasse	Flame class	UL94-V0
Salzsprühnebeltest, Schärfeegrad 6	Salt mist spray test, degree of severity 6	IEC 60068-2-52
Ammoniakbeständigkeit (gemäss DLG)	Ammonia resistance (according to DLG)	1500 h, 70 °C / 70 % RH, 750 ppm
TÜV-Rheinland zertifiziert nach IEC 62852	TÜV-Rheinland certified according to IEC 62852	R60111354 <sup>4)</sup>
TÜV-Rheinland zertifiziert nach EN 50521	TÜV-Rheinland certified according to EN 50521	R60028286 <sup>5)</sup>
UL zertifiziert nach UL 6703	UL certified according to UL 6703	E343181
CSA-Zertifiziert nach UL 6703	CSA certified according to UL 6703	250725

Bemessungsspannung [V] DC Rated voltage [V] DC	Verwendbarer Kabeltyp Suitable wires	Hersteller Manufacturer	Kabelquerschnitt [mm <sup>2</sup> ] Cable cross section [mm <sup>2</sup> ]	Zertifikatsnr. Certificate no.
1000	Verwendung mit für 1000 V nach 2PFG 1169/07,08 oder EN50618 zugelassenen Leitungen <sup>6)</sup> Valid with 1000 V wires approved according to 2PFG 1169/07,08 or EN50618 <sup>6)</sup>		1,5 / 2,5 / 4 / 6 / 10	
	FLEX-SOL-XL (Ø 4,70 mm)	Stäubli Electrical Connectors	1,5	R 60024459
	FELX-SOL-EVO-TL (Ø 4,82 mm)	Stäubli Electrical Connectors	4,0	R 50326973
1500	Byson Electronics 7052 (Ø 4,82 mm) nur zugelassen mit für 1500 V nach 2PFG 1990/05.12 oder EN50618 zertifiziertem PV-Kabel <sup>6)</sup> Only with valid 1500 V according to 2PFG 1990/05.12 or EN50618 approved wires <sup>6)</sup>	Byson Electronics	4,0	R 50181294
			1,5 / 2,5 / 4 / 6 / 10	

<sup>2)</sup> 1500 V 2PFG2330: Nur für Zugangsbeschränkte Standorte zugelassen / Only for use in PV-systems with restricted access locations

<sup>3)</sup> Eine Information zu den verwendbaren Kabeldurchmessern finden Sie in Tabelle 2 in dieser Montageanleitung / For usable cable diameter please see table 2 in this assembly instructions.

<sup>4)</sup> Für PV-Anschlussdosen nach IEC62790 müssen Leitungen nach EN50618 verwendet werden / For PV junction boxes according IEC62790 cables according EN50618 must be used

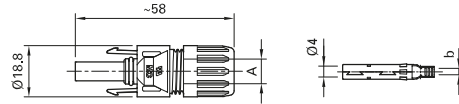
<sup>5)</sup> gültig bis Oktober 2017 / valid till October 2017

<sup>6)</sup> Ab Oktober 2017 nur gültig in Verbindung mit nach EN50618 zertifizierten Kabeln / From October 2017 only valid in connection with cables certified according EN50618

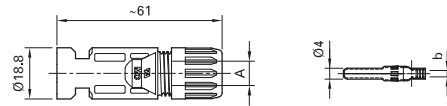
# Female and male cable coupler MC4

Female and male cable coupler as individual part (including insulating part)

PV-KBT4...



PV-KST4...



Order No.	Type	Female cable coupler	Male cable coupler	Ø range of cable gland	Conductor cross section		b (mm)	Approvals			
					A (mm)	mm²		AWG	TÜV	UL®	CSA
32.0010P0001-UR	PV-KBT4/2,5I-UR	x		5-6	2.5	14	3	x	x	x	x
32.0011P0001-UR	PV-KST4/2,5I-UR		x	5-6	2.5	14	3				
32.0140P0001-UR	PV-KBT4/2,5X-UR	x		5.5-7.4	2.5	14	3				
32.0141P0001-UR	PV-KST4/2,5X-UR		x	5.5-7.4	2.5	14	3				
32.0012P0001-UR	PV-KBT4/2,5II-UR	x		5.9-8.8	2.5	14	3				
32.0013P0001-UR	PV-KST4/2,5II-UR		x	5.9-8.8	2.5	14	3				
32.0014P0001-UR	PV-KBT4/6I-UR	x		5-6	4; 6	12; 10	5				
32.0015P0001-UR	PV-KST4/6I-UR		x	5-6	4; 6	12; 10	5				
32.0142P0001-UR	PV-KBT4/6X-UR	x		5.5-7.4	4; 6	12; 10	5				
32.0143P0001-UR	PV-KST4/6X-UR		x	5.5-7.4	4; 6	12; 10	5				
32.0016P0001-UR	PV-KBT4/6II-UR	x		5.9-8.8	4; 6	12; 10	5	x	x	x	x
32.0017P0001-UR	PV-KST4/6II-UR		x	5.9-8.8	4; 6	12; 10	5				
32.0080-UR	PV-KBT4/8II-UR	x		6.05-8.56	–	8	4.4				
32.0081-UR	PV-KST4/8II-UR		x	6.05-8.56	–	8	4.4				
32.0034P0001	PV-KBT4/10II	x		5.9-8.8	10	–	7.2				
32.0035P0001	PV-KST4/10II		x	5.9-8.8	10	–	7.2	x			x

**Note:**

For more detailed information concerning the suitable cable gland range, please consult MA231



Assembly Instructions MA231  
www.staubli.com/electrical



Sealing caps page 53  
Assembly tools page 58





บริษัท กัลฟ์ เจพี เอ็นเอส จำกัด

รายงานการเปลี่ยนแปลงรายละเอียดโครงการ ในรายงานการประเมินผลกระทบสิ่งแวดล้อม  
โครงการโรงไฟฟ้าหนองแขง (ครั้งที่ 6) อำเภอหนองแขง จังหวัดสระบุรี

## ภาคผนวกที่ 2.8

Ring Main Unit (RMU)

# Set Series RM6

Catalog 2021

Gas Insulated Ring Main Unit  
Up to 24 kV

[se.com/rm6](http://se.com/rm6)

Life Is On

Schneider  
Electric

## Range description

RM6 is an indoor gas-insulated switchgear up to 24kV for secondary distribution networks.



RM6 meets the definition of a "sealed pressure system" as laid out by the IEC standard.

RM6 is made up of the following elements:

1. A stainless steel tank filled with SF<sub>6</sub> gas (at 0.23 bar relative pressure), sealed for life and containing the busbar and all live switching components such as the switch disconnector, the earthing switch, the fuse switch combination or the circuit breaker
2. One to four (five optional) cable compartments with interfaces to connect to the network or the transformer
3. User interface with single line diagram, actuators and LV components
4. Manual or motorized operating mechanism compartments
5. Earthing circuit with visible earthing contacts

## General characteristics

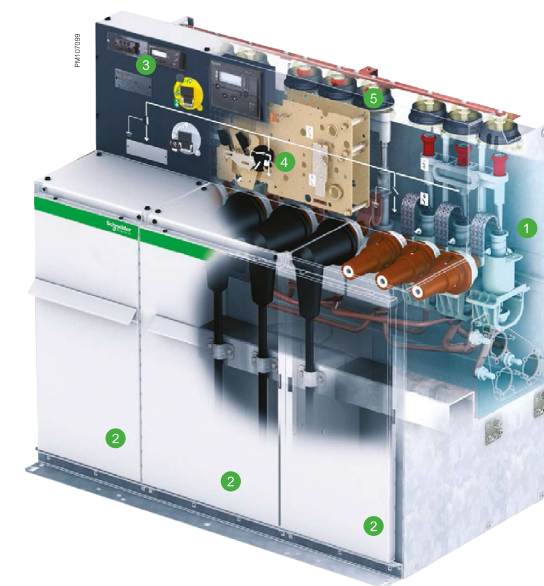
### Electrical characteristics

Rated voltage	Ur (kV)	12	17.5	24
Frequency	f (Hz)	50 or 60		
Insulation level				
Industrial frequency 50Hz 1mn	Insulation (1) Ud (kV rms)	28	38	50
	Isolation (2) Ud (kV rms)	32	45	60
Impulse 1.2/50µs	Insulation (1) Up (kV peak)	75	95	125
	Isolation (2) Up (kV peak)	85	110	145
Tank internal arc withstand	≥ 20 kA (1 sec)			
Seismic Withstand	Severity class 2, acceptance class 2 as per IEC62271-210 (2013)			
Vibration Withstand	NF EN60068.2.6.2 (2008) (3)			

(1) Phase-to-phase, phase-to-earth

(2) Across the isolating distance

(3) Please contact Schneider Electric for details



## General characteristics

### Complete board configuration table

Cubicle	Width (mm)	Depth (mm)	Height (mm)	Weight (kg)
NE-I	472	670	1142	135
NE-B	572	670	1142	135
NE-D	572	670	1142	135
DE-I	532	670	1142	135
DE-B	632	670	1142	135
DE-D	632	670	1142	135
DE-Q	632	670	1142	185
DE-Ic	632	670	1142	145
DE-Bc	632	670	1142	145
DE-Mt	1106	840	1142	420
DE-O	532	670	1142	135
LE-O	502	670	1142	135
RE-O	502	670	1142	135
NE-II	829	670	1142	155
NE-BI	829	670	1142	180
NE-DI	829	670	1142	180
NE-QI	829	670	1142	180
RE-II	859	670	1142	155
NE-III	1186	670	1142	240
NE-IBI	1186	670	1142	250
NE-IDI	1186	670	1142	240
NE-IQI	1186	670	1142	275
RE-III	1216	670	1142	240
RE-IBI	1216	670	1142	250
RE-IDI	1216	670	1142	240
RE-IQI	1216	670	1142	275
DE-III	1246	670	1142	240
DE-IBI	1246	670	1142	250
DE-IDI	1246	670	1142	240
DE-IQI	1246	670	1142	275
NE-III	1619	670	1142	320
NE-IBI	1619	670	1142	330
NE-BIBI	1619	670	1142	340
NE-IIDI	1619	670	1142	330
NE-DIDI	1619	670	1142	340
NE-IIQI	1619	670	1142	355
NE-QIQI	1619	670	1142	390
RE-III	1649	670	1142	320
RE-IBI	1649	670	1142	330
RE-IIDI	1649	670	1142	330
RE-BIBI	1649	670	1142	340
RE-DIDI	1649	670	1142	340
RE-IIQI	1649	670	1142	355
RE-QIQI	1649	670	1142	390
DE-III	1679	670	1142	320
DE-IBI	1679	670	1142	330
DE-IIDI	1679	670	1142	330
DE-IIQI	1679	670	1142	355
NE-I_I_I <sup>(1)</sup>	2000	670	1142	450 to 530 <sup>(2)</sup>
RE-/LE-I_I_I <sup>(1)</sup>	2030	670	1142	455 to 535 <sup>(2)</sup>
DE-I_I_I <sup>(1)</sup>	2060	670	1142	460 to 540 <sup>(2)</sup>

(1) 5 function tanks

(2) Weight depends on the choice of function

## Operating conditions and standards



RM6 performance meets the definition of a "sealed pressure system" as laid down in the IEC recommendations.

The RM6 tank is filled with SF6 at 0.23bar relative pressure and sealed for life after filling. Its tightness, which is systematically checked at the factory, gives the switchgear a high life expectancy.

The RM6 is designed in accordance with the following IEC standards used for general operation conditions for indoor switchgear:

IEC 62271-1 (common specifications for high voltage switchgear and controlgear)

#### Ambient temperature: class -25 °C indoor

- Lower than or equal to 40 °C without derating
- Lower than or equal to 35 °C over 24 hours on average without derating
- Greater than or equal to -25 °C; please contact us for details

#### Altitude:

- Lower than or equal to 1000 m
- Above 1000 m, and up to 2000 m with direct field connectors
- Greater than 2000 m; please contact us for further details

DE-Mt needs voltage derating after 1000 m.

Please consider altitude and temperature when selecting Q function fuses.

Current derating in accordance with ambient temperature		(°C)	40	45	50	55	60
Busbars 630 A	I <sub>r</sub>	(A)	630	575	515	460	425
Busbars 400 A	I <sub>r</sub>	(A)	400	400	400	355	
Functions: I, O, B (with bushing type C)		(A)	630	575	515	460	425
Function D (with bushing type B or C)		(A)	200	200	200	200	200
Function Q		(A)	(3)	(4)	(4)	(4)	(4)

(3) Depends on fuse selection

(4) Please contact us

## Operating conditions and standards



### IEC 62271-200

(AC metal enclosed switchgear and controlgear for rated voltage above 1 kV and up to and including 52 kV)

- Switchgear classification: PM class (metallic partitioning)
- Loss of service continuity: LSC2 class
- Internal arc classification up to A-FLR 20kA 1 sec. (Please refer to section referring to internal arc performance for precise values)

### Switch disconnectors

**IEC 62271-103** (high voltage switches for rated voltage above 1 kV and less than 52 kV)

- Class M1/E3
- 100 CO cycles at rated current and 0.7 p.f.
- 1000 mechanical opening operations.

### Circuit breakers

**200 A feeder** or **630 A line protection**

**IEC 62271-100** (high voltage alternating current circuit breakers)

- Class M1/E2
  - 2000 mechanical opening operations.
  - O-3 min.-CO-3 min.-CO cycle at rated short circuit current

### Other applicable standards

**IEC 62271-100** (high voltage alternating current circuit breakers)

- Switch-fuse combinations: **IEC 62271-105**, alternating current switch-fuse combination.
- Earthing switch: **IEC 62271-102**, alternating current disconnectors and earthing switches.
- Electrical relays: **IEC 60255**.

### RM6 Protection Index

- Tank with HV parts: IP67
- Front face + mechanism: IP3X
- Protection against mechanical impact: IK07

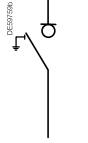
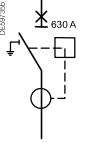
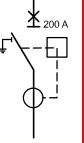
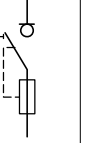
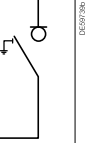
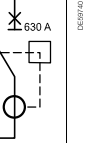

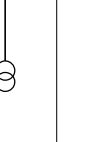
## Functional overview Choice of functional units

### A wide choice of RM6 functions

RM6 benefits from a wide choice of MV functions enabling:

- The connection, power supply and protection of transformers on a radial or open-ring network via 200 A circuit breakers with an independent protection chain, or via combined fuse-switches
- The protection of lines by a 630 A circuit breaker
- MV Metering of private MV/LV substations.

The RM6 functions are described in the table below.

Function	Network switch	Line feeder	Transformer feeder		Network coupling		Cable connection	MV metering
Functional unit	I	B	D	Q	IC	BC	O	Mt
Device	630 A switch	630 A circuit breaker	200 A circuit breaker	Combined fuse-switch	Switch	630 A circuit breaker		
Single line diagrams								



### Scalability of RM6

To support the evolution of your distribution network, RM6 can be extended with a range of functions making it a truly scalable system.

The addition of one or more functional units can be carried out by simply adding modules that are connected to each other via the busbar using dedicated field bushings.

There are different types of extensible RM6:

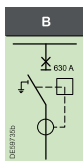
- Right-extensible (-RE type)
- Left-extensible (-LE type)
- Extensible on both sides (-DE type)
- Non-extensible (-NE type)

## Functional overview

### B, D, BC functions

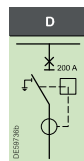
#### B function

- Network points with 630 A disconnecting circuit breaker (line protection feeder)



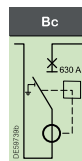
#### D function

- Transformer feeder 200 A with disconnecting circuit breaker



#### DE-Bc function

- Bus coupler by 630 A circuit breaker



Rated voltage			Ur	kV	12	17.5	24										
Rated frequency			Fr	Hz	50 or 60	50 or 60	50 or 60										
Insulation level																	
Industrial frequency 50Hz/1min	Phase-to-phase, phase-to-earth	Ud	kV rms	28	38	50											
	Across isolating distance	Ud	kV rms	32	45	60											
Lightning impulse withstand	Phase-to-phase, phase-to-earth	Up	kV peak	75	95	125											
	Across isolating distance	Up	kV peak	85	110	145											
Rated current			Ir	A	200	630	200	630	200	630	200	630	200	630	200	630	
Rated current busbars			Ir	A	630	630	630	630	630	630	630	630	630	630	630	630	
Short-time withstand current			It	kA rms	25	21(1)	16	20	12.5	16	12.5	16	12.5	16	12.5	16	
			tk	s	1	1 or 3	1	1 or 3	1	1	1	1	1	1	1	1	1
No-load transformer breaking capacity			I3	A	-	16	-	16	-	16	-	16	-	16	-	16	
Short-circuit breaking capacity			Isc	kA	25	21	16	20	12.5	16	12.5	16	12.5	16	12.5	16	
Making capacity			Ima	kA peak	62.5	52.5	40	50	31.25	40	31.25	40	31.25	40	31.25	40	
Operating sequence					O – 3min - CO – 3min - O												
Bushing <sup>(2)</sup>			Type	C	C	BoC	C	A	BoC	A	BoC	A	BoC	A	BoC	A	
Mechanical endurance			Circuit breaker	M1	Number of openings	2000	2000	2000									
			Earthing switch	M0	Number of openings	1000	1000	1000									
Electrical endurance			Circuit breaker	E2	Number of short-circuit breaking operations	3	3	3									
					Number of short-circuit making operations	2	2	2									
			Earthing switch	E2	Number of short-circuit making operations	5	5	5	2	5	5	5	5	5	5	5	5

<sup>(1)</sup> 17.5 kA for DE-Bc

<sup>(2)</sup> No bushing for DE-Bc function



บริษัท กัลฟ์ เจพี เอ็นเอส จำกัด

รายงานการเปลี่ยนแปลงรายละเอียดโครงการ ในรายงานการประเมินผลกระทบสิ่งแวดล้อม  
โครงการโรงไฟฟ้าหนองแขง (ครั้งที่ 6) อำเภอหนองแขง จังหวัดสระบุรี

## ภาคผนวกที่ 2.9

Termination Kits



## SEPARABLE TEE CONNECTORS (FMCTs-400)

### CHARACTERISTICS

For polymeric cable up to 36kV  
non-loadbreak operation

**400 series for 630A (with clamping screw)**

The Prysmian range of FORMFIT® Separable Connectors has a wide range of applications including connection to transformers, switchgear units, motors etc.

Suitable for indoor and outdoor installations, the connector is entirely protected by a watertight conductive envelope connected to earth. The connectors are rated for continuous operation at 630 Amp rms, with 900 Amp rms overload (8 hours per 24 hours).

FORMFIT® 400 series of separable connectors are suitable for use with a wide range of polymeric medium voltage cables, including:

- Single core polymeric insulation (PE, XLPE, EPR etc.)
- **Copper or aluminium conductors (25-300mm<sup>2</sup>)**
- Semi-conducting screen either extruded or taped
- Metallic screen, wire or polylam type
- Insulation voltage up to 36kV (Um)

### FEATURES & BENEFITS

- No need for special tools, heating, taping or filling
- Vertical, angled or inverted position
- No minimum distance between phases
- Energising may take place immediately after the connector is plugged to its individual bushing, dead end plug etc.
- Connectors packed separately



Formerly Pirelli Cables

### DESCRIPTION

#### 1. Clamping screw

Steel silver-plated component, threaded at both ends, for attachment of the mating items: bushing, insulating plug, accessories. A uniform contact pressure is maintained for any combination.

#### 2. Conductor contact

The barrel side, sized for the conductor, is of a compression type. Contact with the clamping screw is through the spade

#### 3. Semi-conducting inner screen

Insert of moulded semi-conducting EPDM, enclosing the connecting components, so that ionisation of any air remaining trapped is prevented.

#### 4. Semi-conducting outer envelope

Jacket made of semi-conducting EPDM. Its design provides relief of electrical stress as does a cable screen. Its connection to the cable screen ensures that the assembly is maintained at earth potential.

#### 5. Insulating body

Moulded from insulating EPDM for integral reconstitution of insulation. It maintains a uniform contact pressure on the cable insulation and the interface of the mating items.

#### 6. Reducer

Composite EPDM moulding allowing connector adaptation to cables of different cross-sections and voltages.

#### 7. Insulating plug

Epoxy component which has a threaded metal insert to accept the clamping screw.

#### 8. Test point

Metallic insert with a hexagonal head. A capacitive voltage divider provides a means of checking that the item is not live before disconnection.

#### 9. Cap

Moulded semi-conducting EPDM part, protects and earths the test point during normal use.

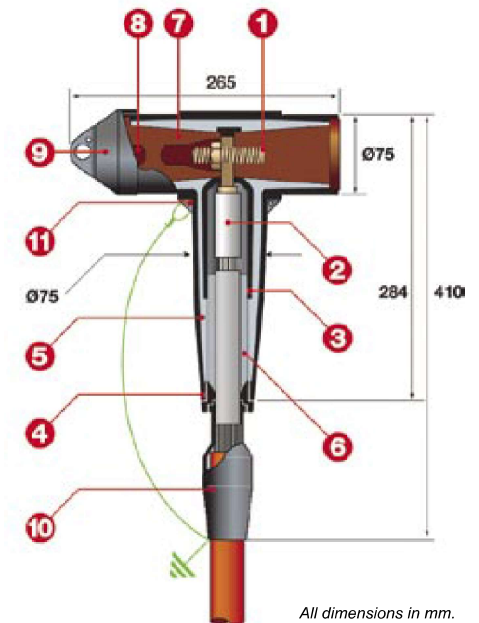
#### 10. Earth cover

Made of moulded EPDM, ensures water tight protection of the earthing device.

#### 11. Earthing Eye

Eye provided for connection of the outer envelope to the cable screen.

FMCTs-400 Separable Tee Connector



All dimensions in mm.



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## SELECTION GUIDE

1. Select from **TABLE A** on the right the kit model corresponding to the diameter over the insulation table.

2. Specify insulation voltage  $U_m$  in kV:  
**12 - 17.5 - 24 - 36**

3. Select from the **TABLE B** (bottom right) the earthing device to suit the cable

4. Select the model of connection end-fitting<sup>(1)</sup> according to:

■ Conductor material **C: Copper**  
**A: Aluminium**

■ Conductor Size **In mm<sup>2</sup>**

<sup>(1)</sup> Can be crimped or indented by usual tools

## EXAMPLE ORDER

## Example #1

Cable 20kV, 95mm<sup>2</sup>, insulation diameter 23.2mm, aluminium conductor, copper tape screen. Assembly on bushing with threaded contact:

**FMCTs-400-C-24-T2-A95**

TABLE A

Separable Tee Connector						
Diameter over insulation mm		Kit Reference	Conductor size mm <sup>2</sup> (for guidance only) Highest Voltage			
MIN	MAX		12kV	17.5kV	24kV	36kV
18.5	20.5	FMCTs-400-Z	70	50	35	
19.9	21.9	FMCTs-400-A	95	70	50	
21.4	23.5	FMCTs-400-B	120	95	70	25
22.9	25.1	FMCTs-400-C	150	120	95	35
24.4	26.6	FMCTs-400-D	185	150	120	50
26.0	28.3	FMCTs-400-E	240	185	150	70
27.8	30.4	FMCTs-400-F	300*	240	185	95
29.8	32.7	FMCTs-400-G		300*	240	120/ 150
31.8	35.3	FMCTs-400-H			300*	185
34.1	38.3	FMCTs-400-J				240

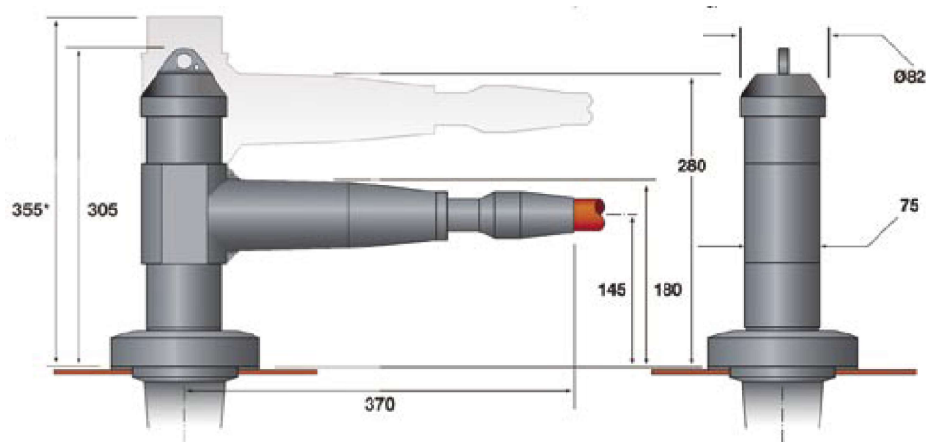
\* Consult us

TABLE B

Earthing Device Reference	Type of Metallic Screen of Cable
T1	polylam
T2	copper tapes
T3	copper wires

## FMCTs-400 Tee Connector

Overall dimensions (mounted on bushing)



All dimensions in mm. \* Minimum dimensions necessary to disconnect.

## SEPARABLE STRAIGHT, ELBOW & TEE CONNECTORS (FMCS-400, FMCE-400 & FMCT-400)

### CHARACTERISTICS

For polymeric cable up to 36kV

Non-loadbreak operation

400 series for 400A (FMCT, clamping pin contact)

The Prysmian range of FORMFIT® Separable Connectors has a wide range of applications including connection to transformers, switchgear units, motors etc.

Suitable for indoor and outdoor installations, the connectors are entirely protected by a watertight conductive envelope connected to earth. The connectors are rated for continuous operation at 400 Amp rms, with 600 Amp rms overload (8 hours per 24 hours).

FORMFIT® 400 series of separable connectors are suitable for use with a wide range of polymeric medium voltage cables, including:

- Single core polymeric insulation (PE, XLPE, EPR etc)
- Copper or aluminium conductors (25-300mm<sup>2</sup>)
- Semi-conducting screen either extruded or taped
- Metallic screen, wire or polylam type
- Insulation voltage up to 36kV (Um)
- Adaptable to MIND paper insulation cables

### FEATURES & BENEFITS

- No need for special tools, heating, taping or filling
- Vertical, angled or inverted position
- No minimum distance between phases
- Energising may take place immediately after the connector is plugged to its individual bushing, dead end plug etc.
- Individual clamping by stainless steel brace
- Connectors packed separately



Formerly Pirelli Cables



### DESCRIPTION

#### 1a. Contact piece

Compressed ferrule with tinned copper contact pin, designed with locking ring. (FMCS)

#### 1b. Contact pin assembly

Composed of a sized conductor fitting and a tinned copper contact pin with a stirrup. After checking proper orientation of the connector, the stirrup is clamped onto the conductor fitting with the hexagonal wrench supplied in the kit. (FMCE)

#### 1c. Contact pin

Copper pin shaped at one end, threaded at the other for attachment of the insulating plug or mating accessory. The central portion is threaded for connection to the conductor contact. A uniform contact pressure is maintained for any combination. (FMCT)

#### 2. Semi-conducting inner screen

Insert of moulded semi-conducting EPDM, enclosing the connecting components, so that ionisation of any air remaining trapped is prevented.

#### 3. Semi-conducting outer envelope

Jacket made of semi-conducting EPDM. Its design provides relief of electrical stress as does a cable screen. Its connection to the cable screen ensures that the assembly is maintained at earth potential.

#### 4. Insulating body

Moulded from insulating EPDM for integral reconstitution of insulation. It maintains a uniform contact pressure on the cable insulation and the bushing interface, producing an excellent moisture seal.

#### 5. Test point

Electrically protected by a cap made of semi-conducting EPDM. A capacitive voltage divider provides a means of checking that the item is not live before disconnection.

#### 6. Reducer

Composite EPDM moulding allowing connector adaptation to cables of different cross-sections and voltages.

#### 7. Locking brace

Stainless steel brace fastening the connector onto its mating bushing or other accessory

#### 8. Earthing Eye

Eye provided for connection of the outer envelope to the cable screen.

#### 9. Earthing cover

Made of moulded EPDM, ensures watertight protection of the earthing device.

#### 10. Conductor contact

The barrel side, sized for the conductor, is of a compression type. Connection to the contact pin is through the spade which is threaded to accept it

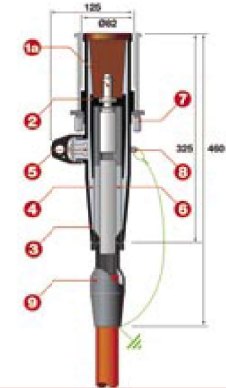
#### 11. Insulating Plug

Epoxy component which has a threaded metal insert to accept the contact pin.

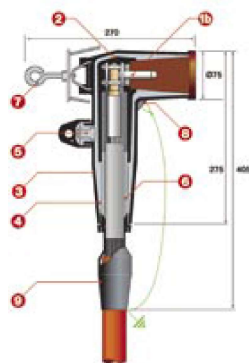
#### 12. Cap

Moulded semi-conducting EPDM part, protects and earths the test point during normal use.

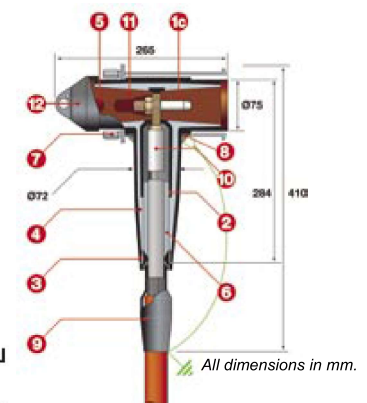
### FMCS-400 Separable Tee Connector



### FMCE-400 Separable Tee Connector



### FMCT-400 Separable Tee Connector



All dimensions in mm.



Formerly Pirelli Cables

## SELECTION GUIDE

1. Select from **TABLE A** on the right the kit model corresponding to the diameter over the insulation table.

2. Specify insulation voltage  $U_m$  in kV:  
**12 - 17.5 - 24-36**

3. Select from the **TABLE B** (bottom right) the earthing device to suit the cable

4. Select the model of connection end-fitting<sup>(1)</sup> according to:

■ Conductor material **C: Copper**  
**A: Aluminium**

■ Conductor Size **In mm<sup>2</sup>**

<sup>(1)</sup> Can be crimped or indented by usual tools

TABLE A

Separable Tee Connector									
Diameter over insulation mm		Kit Reference Elbow	Kit Reference Tee	Kit Reference Straight	Conductor size mm <sup>2</sup> (for guidance only) Highest Voltage				
MIN	MAX				12kV	17.5kV	24kV	36kV	
18.5	20.5	FMCE-400-Z	FMCT-400-Z	FMCS-400-Z	70	50	35		
19.9	21.9	FMCE-400-A	FMCT-400-A	FMCS-400-Z	95	70	50		
21.4	2.5	FMCE-400-B	FMCT-400-B	FMCS-400-Z	120	95	70	25	
22.9	25.1	FMCE-400-C	FMCT-400-C	FMCS-400-Z	150	120	95	35	
24.4	26.6	FMCE-400-D	FMCT-400-D	FMCS-400-Z	185	150	120	50	
26.0	28.3	FMCE-400-E	FMCT-400-E	FMCS-400-Z	240	185	150	70	
27.8	30.4	FMCE-400-F	FMCT-400-F	FMCS-400-Z	300*	240	185	95	
29.8	32.7	FMCE-400-G	FMCT-400-G	FMCS-400-Z		300*	240	120/150	
31.8	35.3	FMCE-400-H	FMCT-400-H	FMCS-400-Z		300*		185	
34.1	38.3	FMCE-400-J	FMCT-400-J	FMCS-400-Z				240	

## EXAMPLE ORDERS

## Example of order for Elbow Connector

Cable 33kV, 95mm<sup>2</sup>, insulation diameter 29.5mm, aluminium conductor, copper wire screen: **FMCE-400-F-36-T3-A95**

## Example of order for Tee Connector

Cable 33kV, 95mm<sup>2</sup>, insulation diameter 23.2mm, aluminium conductor, copper wire screen: **FMCT-400-C-24-T2-A95**

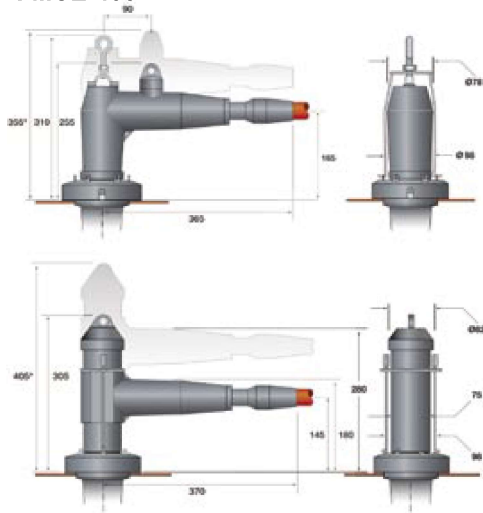
## Example of order for Elbow Connector

Cable 33kV, 95mm<sup>2</sup>, insulation diameter 28.2mm, aluminium conductor, copper wire screen: **FMCS-400-F-36-T3-A95**

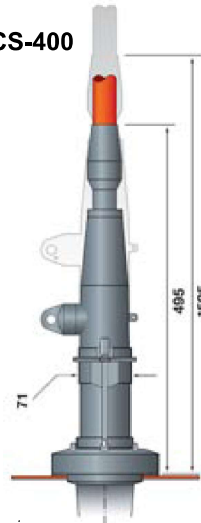
TABLE B

Earthing Device Reference	Type of Metallic Screen of Cable
T1	polylam
T2	copper tapes
T3	copper wires

## FMCE-400



## FMCS-400



All dimensions in mm.

\*Minimum dimensions necessary to disconnect.

**PRYSMIAN**  
CABLES & SYSTEMS

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