

Solarlok 2.0 Family

1. SCOPE

1.1. Content

This specification covers the performance, tests and quality standards for the Solarlok 2.0 connector family (see figure 1, 2 & 3) which allows the electrical connection of photovoltaic (PV) panels.

The Solarlok 2.0 male and female connectors are marked polarity symbol (+ respectively -).
The connector allows for 2.5 mm² (14 AWG), 4.0 mm² (12 AWG) and 6.0 mm² (10 AWG) cable according to see §3.2.



Figure 2: Solarlok 2.0 - PV4-S PIN
SLK-PI-1-BL-XX
(PN 2315176-1)

Figure 2: Solarlok 2.0 - PV4-S Socket
SLK-SK-1-BL-XX
(PN 2308033-1)

Figure 3: Solarlok Splice
SLK-ID-a-BL-XX
(PN 2336077-1)

1.2. Qualification

When tests are performed on the subject product line, procedures specified in §3.4 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

License holder: Tyco Electronics Austria GmbH, Schrackstrasse 1, 3830 Waidhofen/Thaya, Austria.

1.3. Qualification Test Results

Product have passed successful qualification according to the revision A1 of this specification.
Qualification according to this revision is pending.

2. APPLICABLE DOCUMENTS AND FORMS

The following documents and forms constitute a part of this specification to the extent specified herein. Unless otherwise indicated, the latest edition of the document applies.

2.1. TE Documents

- 114-133104 Application Specification
- 501-19266 Qualification Solarlok 2.0 Test Report according 108-133104, revision A
- 501-19269 Qualification Solarlok Splice Test Report according 108-133104, revision A1
- C-2315176-1 Customer drawing Male connector
- C-2308033-1 Customer drawing Female connector
- C-2336077-1 Customer drawing Splice

2.2. Industry Documents

- UL 6703 (March 2, 2017)
- UL 746C (February 5, 2018)
- UL 486A+486B (January 11, 2013)
- UL 1703 (October 12, 2015)
- IEC 62852:2014 + A1 2020
- IEC 60998-1 (2002-12)
- IEC 60998-2-2 (2002-12)
- IEC 60998-2-3 (2002-12)
- IEC 60512 series
- CE

2.3. Reference Document

- 109-197 Test Specification (TE Test Specification vs EIA and IEC Test Methods)
- E353372-20190215 UL certificate number according to UL6703, Solarlok 2.0
- E13288-20200117 UL certificate number according to UL6703, Solarlok Splice
- R60152499.0001 TÜV Rheinland certificate number according to IEC62852:2014, Solarlok 2.0 (Single cable entry holes with PV4-S interface)
- Pending TÜV Rheinland certificate number according to IEC62852:2014, Solarlok Splice (multiple cable entry holes)
- Pending TÜV Rheinland certificate number according to IEC62852:2014, Solarlok T-Splice (multiple cable entry holes)

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction, materials and physical dimensions specified on the applicable product drawing.

3.2. Ratings:

Part number	Name	Wire range*	Model code	Voltage	Current	Temperature
2308033-1	Solarlok 2.0 Socket Connector	2.5 mm ² to 6 mm ² 14 AWG to 10 AWG	SLK-SK-A-BL- XX	1500 V dc (IEC and UL)	IEC: 25 A for 2.5 mm ² 30 A for 4.0 mm ² 35 A for 6.0 mm ² UL: 15 A for 14 AWG 20 A for 12 AWG 30 A for 10 AWG	-40 °C to 85 °C (ambient for IEC and UL)
2315176-1	Solarlok 2.0 Pin Connector	2.5 mm ² to 6 mm ² 14 AWG to 10 AWG	SLK-PI-A-BL-XX			
2336077-1	Solarlok Splice	2.5 mm ² to 6 mm ² 14 AWG to 10 AWG	SLK-ID-A-BL-XX			

*For UL cable with an outside diameter of 5.5 mm to 7.2 mm are permissible if complying with: EN 50618 & IEC62930 and / or UL 4703, UL 44, UL 854, UL 1581 & UL 2556 with at least more than 40 strands.

*For TÜV Rheinland the following cables have been approved in combination with the Solarlok 2.0:

- TE Connectivity, cable PN 2328394-x, 2.5 mm² (14 AWG), TÜV Rheinland cert.: R 50504531 & R 50504536. Type designation: SLKC1B2.
- TE Connectivity, cable PN 2270245-x, 4 mm² (12 AWG), TÜV Rheinland cert.: R 50504531 & R 50504536. Type designation: SLKC1B4.

- TE Connectivity, cable PN 2270260-x, 4 mm² (12 AWG), TÜV Rheinland cert.: R 50504531 & R 50504536. Type designation: SLKC0B4.
- TE Connectivity, cable PN 2328400-x, 6 mm² (10 AWG), TÜV Rheinland cert.: R 50504531 & R 50504536. Type designation: SLKC1B6.
- TE Connectivity, cable PN 2270215-x, 4 mm² (12 AWG), TÜV Rheinland cert.: R 50504538 & R 50504540. Type designation: SLKC1A4.
- TE Connectivity, cable PN 2270259-x, 4 mm² (12 AWG), TÜV Rheinland cert.: R 50504538 & R 50504540. Type designation: SLKC0A4.
- Kunshan Byson Electronics Co., Ltd., cable PN 6351D, 2,5 mm² (10 AWG), TÜV Rheinland cert R50404890 & R50357489.
- Kunshan Byson Electronics Co., Ltd., cable PN 6352D, 4 mm² (10 AWG), TÜV Rheinland cert R50404890 & R50357489.
- Kunshan Byson Electronics Co., Ltd., cable PN 6353D, 6 mm² (10 AWG), TÜV Rheinland cert R50404890 & R50357489.
- Changshu JHOSIN Communication Technology Co., Ltd., cable PN DPN4012A09_REV.A/6, 4 mm² (10 AWG), TÜV Rheinland cert R50413335 & R50325448.

Caution: when using cable SLKC0A4 or SLKC0B4 (rate for 1000 V dc), the system and Solarlok 2.0 and Splice are de-rated to 1000 V dc to match the cables (or any other limiting lower Voltage rated part in the system).

Insulation voltage rating	8 kV ac
Impulse voltage rating	16 kV (1.2 / 50 µs)
Pollution degree:	1 (inside the connector sealed by Power gel) 3 (at cable entrance)
IP rating:	IP 65, IP66, IP67 and IP68 (1 m for 24 h).
Maximum ambient temperature	85 °C
Maximum operating temperature:	105 °C (85 °C (max ambient) + ΔT _{max} (20 °C))
Minimum operating temperature	-40 °C
Type of terminals	IDC (Insulation Displacement Contact)
Solarlok 2.0	mateable and unmateable connectors
Solarlok Splice	On time use connector
Protection class:	II
DO NOT DISCONNECT THE CONNECTOR UNDERLOAD	

3.3. Model code:

Example: SLK-PI-A-BL-XX				
SLK = Solarlok connector	PI = IDC to PV4-S Pin	A = 1 amount in package	BL = Black	FD = F1200 D Diode
	SK = IDC to PV4-S Socket	A = 5 amount in package		SX = SL 1515 (X Diode value)
	ID = IDC on both sides (splice)	A = 9 amount in package	CL = Clear	FX = Fuse (X fuse value)
	IF = IDC to Fuse or Diode to IDC			XX = No fuse or Diode
	TS = IDC to inline IDC T-splitter			

Note: NO diode or fuse version of the Solarlok connectors mention in this specification is approved by TÜV Rheinland, UL or TE Connectivity internal testing.

3.4. Test Requirements and Procedures Summary

Unless otherwise specified, all tests shall be performed at ambient environmental conditions by a TE Connectivity laboratory. Testing below do not represent testing at TÜV Rheinland or UL, those testing's are done according applicable norms.

TEST DESCRIPTION	REQUIREMENT	PROCEDURE
Initial examination of product	Meets requirements of product drawing.	
Final examination of product	Meets visual requirements.	
ELECTRICAL		
Contact Resistance	Max 1.5 mΩ initial (3 time 0.5 mΩ, IDC-PV4-IDC) excluding bulk resistance. After testing max 5 mΩ.	IEC 60512-2b Test current:1 A At the end of the termination
Temperature Rise (IEC)	Max $\Delta T \leq 20$ °C Temperature shall now exceed maximum operating temperature	IEC 62852+A1 §6.3.4 - length of test cable = 500mm±50 mm - Current: 25 A for 2.5 mm ² (14 AWG) 30 A for 4.0 mm ² (12 AWG) 35 A for 6.0 mm ² (10 AWG) -Calculated for ambient temperature of 85 °C. - the test shall be continued until a constant temperature is obtained
Current cycling (UL)	Max $\Delta T \leq 125$ °C	UL 486A-486B §7.2 27 A for 2.5 mm ² (14 AWG) 60 A for 6.0 mm ² (10 AWG) The stability factor must be calculating and within ±10 °C (UL 486C §7.2)
Dielectric Strength 1 (IEC)	No flashover or breakdown of voltage. Leakage current < 0.05 mA (from @1500 V UL 1703 §21, for IEC it is 2 mA @ 8kV)	IEC 62852+A1 §6.3.8b / IEC 60512-4-1 @8 kV ac (2 kV + 4 times rating Voltage) for 1 minute.
Dielectric Strength 2 (IEC)	No flashover or breakdown of voltage.	IEC 60512-4-1 @12 kV ac for 1 minute.
Wet Insulation Resistance Test (IEC)	There shall not be dielectric breakdown or surface tracking as result of applied dc voltage Maximum leakage current: 1 mA	IEC 62790 §5.3.16 @1500 V dc

	Insulation resistance shall be not less than 400 MΩ	
MECHANICAL		
Impact (UL)	No damage likely to impair function Max contact resistance: 5 mΩ.	UL 1703 §30 @ 25 °C Dropping metal sphere Ø51 mm, 535 gr from 1295 mm height on 4 sides. For impact point see §3.5
Impact low temperature (UL)	No damage likely to impair function Max contact resistance: 5 mΩ.	UL 1703 §30 @ -40 ± 2 °C Dropping metal sphere Ø51 mm, 535 gr from 1295 mm height on 4 sides. For impact point see §3.5
Bending (flexing) (IEC)	No damage likely to impair function Insulation shall show no sign of abrasion Max contact resistance: 5 mΩ. No interruption of the test current.	IEC 62852+A1 § 6.3.6 20 N weight hanging on cable while connector is clamped and moved 45 ° on either side of the vertical. Rated current is passed through it. 100 cycles
Secureness (UL)	No damage likely to impair function Insulation shall show no sign of abrasion Permissible displacement 3 mm Max contact resistance: 5 mΩ.	UL 486A-486B §9.3.2 2.5 mm ² (14 AWG) 1.4 kg 4 mm ² (12 AWG) 2.3 kg 6 mm ² (10 AWG) 2.3 kg
Pullout (UL)	No damage likely to impair function Insulation shall show no sign of abrasion Permissible displacement 3 mm Max contact resistance: 5 mΩ.	UL 486A-486B §7.4.2, §9.3.4 (1 minute) 14 AWG: 223 N 12 AWG: 312 N 10 AWG: 356 N
Cable Clamp (torsion, IEC)	No damage likely to impair function Max contact resistance: 5 mΩ. Permissible angle ±30 ° (diameter 4 to 12 mm) Permissible angle ±45 ° (diameter >12 to 33 mm)	IEC 60512 17d Cable diameter 4-9: 0.1 Nm
Strain Relief Test (UL)	Without damage to the connector, or separation of the two mating connectors.	UL1703 §22.2 Shall withstand for 1 min a force of 89 N applied in 4 directions (90 °) permitted by the construction, either directly or through any wire or cable attached to the mating connector, See §3.6 for visualization.
Crush Resistance Test (UL)	Without resulting in any of the following: Reduction of spacing below the min. acceptable values Making bare live parts or internal wiring accessible to contact	UL 746C §21 Compression is applied by flat surface 104 by 254 mm with a force of 454 N (45.5 kg as note in UL 746C).

	Such breakage, cracking, rupture, and the like as to produce an adverse effect on the insulation Producing any other condition that would increase the likelihood of electric shock or fire or both, during use of the equipment	
Insertion	Insertion force ≤ 110 N (typical 80 N)	IEC 62852+A1 §6.3.13 Speed 50mm/s
Effectiveness of connector coupling device (IEC)	>80 N	IEC 62852+A1 §6.3.14 & IEC 60512-15f 10 N/s de-mating rate
Separation test	150 N $< F_{sep}$ for separating the connectors. Insulation shall show no sign of abrasion. Permissible displacement 3 mm	Pull on the cables. 10 N/s de-mating rate

ENVIRONMENTAL

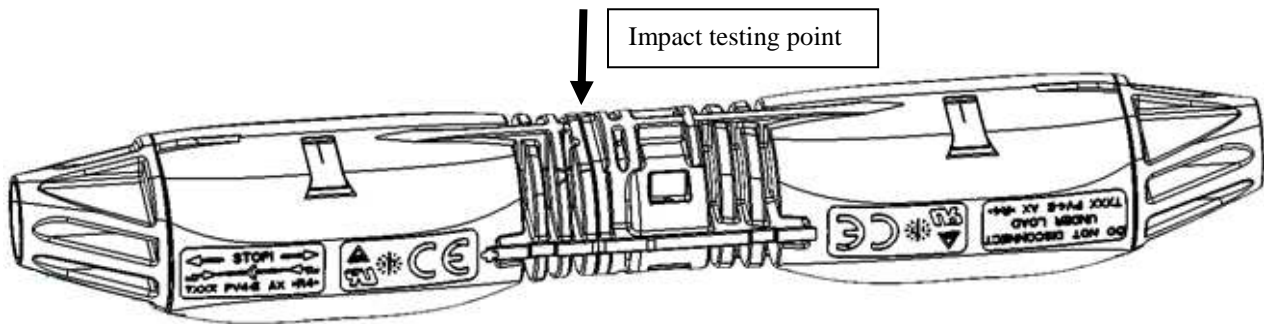
IP 66 (this includes IP 65)		IEC 60529
IP 68 (this includes IP 67)		IEC 605291 1 Meter for 24 hours
Change of Temperature (IEC)	No damage likely to impair function Not lose of continuity Max contact resistance: 5 m Ω .	IEC 62852 §6.3.11 30 minutes 85 °C 30 minutes -40 °C Transfer duration ≤ 3 minutes 200 cycles Rate current applied through the current carrying contacts. Followed by dielectric and wet insulation
Damp heat (IEC)	No damage likely to impair function Max contact resistance: 5 m Ω .	IEC 62852+A1 §6.3.12 Temperature 85 ± 2 °C Relative humidity: 85 % \pm 5% Test duration 1000 hours
Dry Heat	No damage likely to impair function Max contact resistance: 5 m Ω .	60512-11i Temperature 105 ± 2 °C Test duration 1000 hours
Humidity (UL)	No damage likely to impair function No corrosion to metal parts Not lose of continuity Max contact resistance: 5 m Ω .	UL 1703 §36 (10 cycles) Cycle: see figure 36.1
Mold Stress-Relief Distortion (UL)		UL 746C §29 (§61.1a) 95 °C for 7 hours.
Corrosion	No damage likely to impair function	IEC 62852+A1 §6.3.9 test 2

	<p>No corrosion to metal parts Not lose of continuity Max contact resistance: 5 mΩ.</p>	
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i **NOTE**
 Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2.

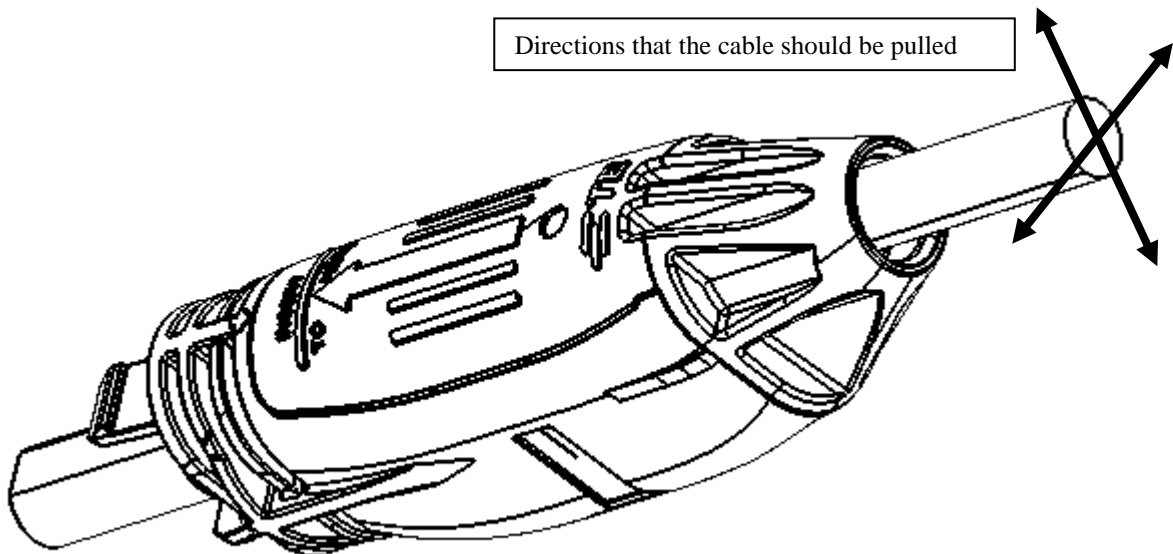
3.5. Impact

Here below the position for the impact testing, the intermating section is considered the weakest point in the construction.



3.6. Strain Relief Test

Please see below the directions the cable shall pulled for testing.



3.7. Product Qualification and Requalification Test Sequence

TEST OR EXAMINATION	TEST GROUP (a)						
	A	B	C	D	E	F	G
	TEST SEQUENCE (b)						
Initial examination	1	1	1	1	1	1	1
Final examination	18	10	14	6	8	8	14
Contact Resistance	2, 4, 6, 8, 10, 12, 14, 17	2, 4, 6, 9	2, 4, 8, 11, 13	2, 4	2, 5, 7	2, 7	2, 7, 11
Temperature Rise	5	3					
Current cycling				3			
Dielectric Strength 1 (IEC)	16	8 (@8 kV)	3, 6			3, 5 (@5 kV)	3, 5, 9 (@5 kV)
Dielectric Strength 2 (IEC)			10				
Wet Insulation Resistance Test (IEC)	3		7			6	6, 10
Impact (UL)	13						
Impact low temperature (UL)	15						
Bending (flexing) (IEC)		7					
Secureness (UL)	7						
Pullout (UL)	9						
Cable Clamp (torsion, IEC)	11						
Strain Relief Test (UL)					4		
Crush Resistance Test (UL)					6		
Insertion force							12
Effectiveness of connector coupling device (IEC)							13
Separation test				5			
IP 65 (IP 66)							4
IP 68 (IP 67)							8
Change of Temperature (IEC)			5				
Damp heat (IEC)			9				
Dry heat (IEC)		5					
Humidity (UL)						4	
Mold Stress-Relief Distortion (UL)					3		
Corrosion (IEC)			12				

i NOTE

- (a) Numbers indicate sequence in which tests are performed.
- (b) Qualification Solarlok 2.0 will be done on all groups on 5 sample of the 2.5 mm² (14 AWG) and the 6 mm² (10 AWG), group A also on the 4 mm². Cable length 1.5 m.
- (c) For adding additional cable to the approved list, they need to be tested against test group A, B, C, F & G.
- (d) Solarlok 2.0 Splice verification testing will be done on group: A (all cable diameters), B (6 mm²), E (2.5 mm²) & G (6 mm² & 2.5 mm²), 5 samples per group.
- (e) Qualification Solarlok 2.0 Splice will be done on groups A, C, D, E and G on 5 sample with cable length 1.5 m.
 - 1. *Group A: 5 samples with 6 mm² (10 AWG), 4 mm² (12 AWG) & 2.5 mm² (14 AWG) 6 mm².*
 - 2. *Group C: 5 samples with 6 mm² & 2.5 mm² cable.*
 - 3. *Group D: 5 samples with 6 mm² cable. Step 5 can be excluded from the test sequence.*
 - 4. *Group E: 5 samples with 2.5 mm² cable.*
 - 5. *Group G: 5 samples with 6 mm² & 2.5 mm² cable. Step 12 & 13 can be excluded from the test sequence.*