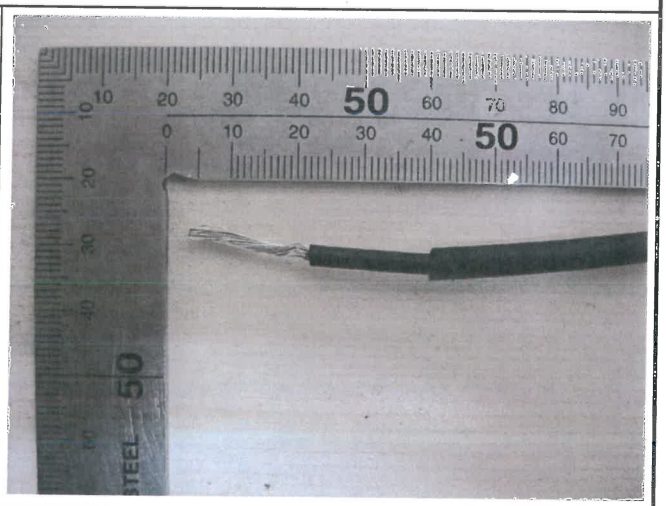
Prüfbericht-Nr.: *Test Report No.:*	**50104079 001**	**Auftrags-Nr.:** *Order No.:*	154229135	Seite 1 von 21 *Page 1 of 21*
Kunden-Referenz-Nr.: *Client Reference No.:*	N/A	**Auftragsdatum:** *Order date:*	27.02.2017	
Auftraggeber: *Client:*	Hangzhou Easy Electric Wire and Cable Co.,Ltd No.7 Long Tan Road , Future Technology Park, Hangzhou, Zhejiang, P.R. China			
Prüfgegenstand: *Test item:*	Electric Cables for Photovoltaic Systems			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	H1Z2Z2-K 1X1,5...240mm2			
Auftrags-Inhalt: *Order content:*	TÜV mark approval			
Prüfgrundlage: *Test specification:*	EN 50618:2014 Kabel und Leitungen - Leitungen für Photovoltaic Systeme *Electric cables for photovoltaik systems*			

Wareneingangsdatum: *Date of receipt:*	12.03.2017
Prüfmuster-Nr.: *Test sample No.:*	CTL17-018-(1~2) CTL17-019-(1~3)
Prüfzeitraum: *Testing period:*	14.03.2017 – 18.09.2017
Ort der Prüfung: *Place of testing:*	See Other below for details
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (Shanghai) Co., Ltd.
Prüfergebnis*: *Test result*:*	Pass



geprüft von / *tested by*:

Datum / *Date*	Name / Stellung / *Name / Position*	Unterschrift / *Signature*
23.10.2017	Jixu Jing / PE	

kontrolliert von / *reviewed by*:

Datum / *Date*	Name / Stellung / *Name / Position*	Unterschrift / *Signature*
23.10.2017	Jill Zhou / Reviewer	

Sonstiges / *Other*:
Place of testing: Shanghai National Center of Testing and Inspection for Electric Cable and Wire Co., Ltd., 1000 Jungong Road, Shanghai 200093, P.R. China

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar	5 = mangelhaft N/T = nicht getestet
Legend:	*1 = very good* *P(ass) = passed a.m. test specification(s)*	*2 = good*	*3 = satisfactory* *F(ail) = failed a.m. test specification(s)*	*4 = sufficient* *N/A = not applicable*	*5 = poor* *N/T = not tested*

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.

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Liste der verwendeten Prüfmittel
List of used test equipment

Prüfmittel *Test equipment*	**Prüfmittel-Nr. / ID-Nr.** *Equipment No. / ID-No.*	**Nächste Kalibrierung** *Next calibration*
See attachment 1		

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Produktbeschreibung
Product description

	Characteristics of cable					
	Code designation		H1Z2Z2-K			
	Trademark		**QIFAN**			
	Rated Voltage AC		U_0/U AC: 1/1 kV			
	Rated voltage DC		1,5 kV DC (conductor-conductor and conductor-earth)			
	Cross section:	[mm²]	**1,5**	**185**		
	Outer dimension:	[mm]	4,9	26,4		
	Meas. wall thickness insulation:	[mm]	0,7	1,8		
	Min. wall thickness insulation:	[mm]	**0,7**	**1,6**		
	Meas. wall thickness sheath:	[mm]	0,9	2,0		
	Min. wall thickness sheath:	[mm]	**0,8**	**1,6**		
	Min. wall thickness compl. Insulation:	[mm]	1,43	3,36		
	Standard		EN 50618:2014			
	Lower ambient temperature		-40 °C			
	Upper ambient temperature		+90 °C			
	Max temperature at conductor		+120°C @ 20.000 h (see enclosed Arrhenius curve)			
	Material separation layer between conductor and insulation		—			
	Material insulation		XLPE			
	Material separation layer between insulation and sheath		—			
	Material sheath		XLPE			
	Extrusion type		Tandem Extrusion			

Remarks:

All tests according to EN 50618:2014 in this report were performed to the complete cable H1Z2Z2-K 1X1,5mm² with 300m.

All tests except Ref. No. 1.4 in Table B.1 were performed to the complete cable H1Z2Z2-K 1X185mm² with 100m.

Test of Ref. No. 15 in Table 2 was performed to the complete cables H1Z2Z2-K 1X2,5...6mm² with 30m of each.

This test report contains 21 pages and an attachment 1 with 2 pages for testing equipment list.

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
5.1	**CONDUCTOR**		
5.1.1	**Material**		
	Number of cores:	1	P ☒ F ☐ N/A ☐ N/T ☐
	Single wires are of copper and tinned:	tinned copper wire	P ☒ F ☐ N/A ☐ N/T ☐
	Compliance with class 5 acc. to IEC 60228 *SEE TABLE 5.1.5*	class 5 conductors	P ☒ F ☐ N/A ☐ N/T ☐
	There are no visible gaps in the continuous layer, when examined with normal or corrected vision.	no visible gaps	P ☒ F ☐ N/A ☐ N/T ☐
5.1.2	**CONSTRUCTION**		
	The class of the conductor must be class 5 in accordance to EN 60228		P ☒ F ☐ N/A ☐ N/T ☐
	The maximum diameter of the wires in the conductor are be in accordance to EN 60228		P ☒ F ☐ N/A ☐ N/T ☐
5.1.3	**SEPERATOR BETWEEN CONDUCTOR AND INSULATION**		
	Separation layer of halogen free material between insulation and conductor		P ☐ F ☐ N/A ☒ N/T ☐
5.1.4	**CHECK OF CONSTRUCTION**		
	The construction must be checked in accordance of the requirements of 5.1.1, 5.1.2 and 5.1.3 including the requirements of EN 60228 for class 5 conductor	checked	
5.1.5	**ELECTRICAL RESISTANCE**		

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
	The resistor of each conductor at 20°C must be in accordance with the requirements of EN 60228 for class 5 conductor		P ☒ F ☐ N/A ☐ N/T ☐
	Compliance must be checked by the test of clause 5 of EN 50395		P ☒ F ☐ N/A ☐ N/T ☐
5.2	**INSULATION**		
5.2.1	**MATERIAL**		
	The insulation must be crosslinked and fulfil the requirements of table B.1 in Annex B	XLPE in black	P ☒ F ☐ N/A ☐ N/T ☐
5.2.2	**APPLICATION TO THE CONDUCTOR**		
	Insulation extruded, smooth and consistently applied and possible to remove without damage to the insulation itself, to the conductor or to the tin coating.		P ☒ F ☐ N/A ☐ N/T ☐
	Compliance must be checked by inspection and by manual test		P ☒ F ☐ N/A ☐ N/T ☐
5.2.3	**THICKNESS**		
	For each piece of insulation, the average of the measured values, rounded to 0,1 mm have be not less than the specified value for each size of table 1		P ☒ F ☐ N/A ☐ N/T ☐
	The smallest value must not fall below 90% of the specified value by more than 0,1 mm. Compliance must be checked using by test of clause 4.1 of EN 50396		P ☒ F ☐ N/A ☐ N/T ☐
5.3	**SHEATH**		
	The sheath must be crosslinked and fulfil the requirements of table B.1 in Annex B	XLPE in black	P ☒ F ☐ N/A ☐ N/T ☐

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
5.3.2	**APPLICATION**		
	The sheath must be applied homogeneously by extrusion and halogen free material. The application of the sheath must give the finished cable a practically circular shape		P ☒ F ☐ N/A ☐ N/T ☐
	Separation layer of halogen free material between insulation and sheath		P ☐ F ☐ N/A ☒ N/T ☐
5.3.3	**THICKNESS**		
	For each piece of insulation, the average of the measured values, rounded to 0,1 mm must be less than the specified value for each size of table 1		P ☒ F ☐ N/A ☐ N/T ☐
	The smallest value must not fall below 85% of the specified value by more than 0,1 mm. Compliance must be checked using by test of clause 4.1 of EN 50396		P ☒ F ☐ N/A ☐ N/T ☐
5.3.4	**COLOUR**		
	The colour of the sheath must be black, unless otherwise agreed between manufacturer and customer. The colour must be throughout for whole sheath.	black sheath	P ☒ F ☐ N/A ☐ N/T ☐
6	**MARKING**		
6.1	**GENERAL**		
	The marking at the sheath must be by printing, embossing or indenting.	by printing	P ☒ F ☐ N/A ☐ N/T ☐
6.2	**INDICATION OF ORIGIN**		
	Cables are marked with		
	a) manufacturer's name or Trademark or identification number	QIFAN	P ☒ F ☐ N/A ☐ N/T ☐

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
6.3	b) Code designation	H1Z2Z2-K	P ☒ F ☐ N/A ☐ N/T ☐
6.4	c) Nominal cross-sectional area of conductor	1,5...240mm2	P ☒ F ☐ N/A ☐ N/T ☐
6.5	**CONTINUITY OF MARKING**		
	Spacing between the end of marking and the begin of the following identical marking does not exceed 550mm	=<550mm	P ☒ F ☐ N/A ☐ N/T ☐
6.6	The name CENELEC, in full or abbreviated, does not be marked on, or in, the cables		P ☐ F ☐ N/A ☒ N/T ☐
6.7.1	Marking is still legible after test of cl. 5.1 of EN 50396		P ☒ F ☐ N/A ☐ N/T ☐
6.7.2	All markings are legible.		P ☒ F ☐ N/A ☐ N/T ☐
Table 2	**TEST FOR CABLES TO EN 50618**		
1	**ELECTRICAL TEST**		
1.1.1	Conductor resistance *SEE CLAUSE 5.1.5 AND TABLE 5.1.5*		P ☒ F ☐ N/A ☐ N/T ☐
1.2	No breakdown at high voltage test with		
	- AC 6,5kV, or	no breakdown	P ☒ F ☐ N/A ☐ N/T ☐
	- DC 15kV		P ☐ F ☐ N/A ☒ N/T ☐

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
1.4	Insulation resistance		
1.4.1.2	- during test in water at 20°C Min. as stated in table 1 of this standard: [MOhm*km] *see table 8.1*		P ☒ F ☐ N/A ☐ N/T ☐
1.4.2	- during test in water at 90°C Min. as stated in table 1 of this standard: [MOhm*km] *see table 8.1*		P ☒ F ☐ N/A ☐ N/T ☐
1.5.1	During long term resistance of insulation to D.C. a stable progress has been identified, no breakdown of the test voltage: [V d.c.]	no breakdown	P ☒ F ☐ N/A ☐ N/T ☐
1.5.2	After long term resistance test no damage or cracks of the insulation have been visible.	no damage and visible cracks	P ☒ F ☐ N/A ☐ N/T ☐
1.6.2	Surface resistance of sheath min 10 GOhm: [Ohm]	1X1,5: 60GOhm 1X185: 80GOhm	P ☒ F ☐ N/A ☐ N/T ☐
2	**CONSTRUCTIONAL AND DIMENSIONAL TEST**		
2.1 **2.1.1**	Conductor Maximum diameter of the conductor in accordance to EN 60228 clause 6.1 *SEE table 5.1.5*		P ☒ F ☐ N/A ☐ N/T ☐
2.1.2	Checking continuity of tin to clause 5.1.1 No visible gaps occurred	no visible gaps	P ☒ F ☐ N/A ☐ N/T ☐
2.2	Wall thickness of insulation Not less than stated in clause 5.2.3 of this standard *SEE TABLE 5.2.3*		P ☒ F ☐ N/A ☐ N/T ☐
2.3	Wall thickness of sheath Not less than stated in clause 5.3.3 of this standard *SEE TABLE 5.3.3*		P ☒ F ☐ N/A ☐ N/T ☐
	Measurement of overall dimensions Not less than stated in table 1 of this standard *SEE TABLE 5.3.4*		P ☒ F ☐ N/A ☐ N/T ☐

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Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
	Mean value *SEE TABLE 7.3.3*		P ☒ F ☐ N/A ☐ N/T ☐
2.4	Ovality max. 15% Not less than stated in clause 7.3.3 of this standard *SEE TABLE 7.3.3*		P ☒ F ☐ N/A ☐ N/T ☐
2.5 **2.5.1**	Sheath colour Visual examination as stated in clause 7.3.1 of this standard	black	P ☒ F ☐ N/A ☐ N/T ☐
2.6 **2.6.1**	Sheath marking Visual examination and measurement as stated in clause 7.3.2 of this standard		P ☒ F ☐ N/A ☐ N/T ☐
3	Insulation material as stated in table B.1 of this standard		P ☒ F ☐ N/A ☐ N/T ☐
4	Sheath material as stated in table B.1 of this standard		P ☒ F ☐ N/A ☐ N/T ☐
5	**COMPATIBILITY TEST ACCORDING TO EN 60811-401**		
5.1	Test conditions: Duration of test 168 h Temperature 135 ± 2 °C		
5.2	Result in accordance to Table B.1 Lfd. No.: 1.7 of this standard *SEE RESULT OF TABLE B1 No. 1.7*		P ☒ F ☐ N/A ☐ N/T ☐
6	**COLD IMPACT TEST ACCORDING TO EN 60811-506**		
6.1	Test conditions as stated in annex C of this standard -40°C	-40° C, 16h. mass of hammer: 1,5: 1000g, 185:2000g height: 1,5:100mm, 185:200mm	
6.2	After the test no cracks are visible	no visible cracks	P ☒ F ☐ N/A ☐ N/T ☐
7	**COLD BENDING TEST ACCORDING TO EN 60811-504 (Cable diameter ≤ 12,5 mm)**		

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
7.1	Test conditions: Conditioning duration 16 h: Temperature -40 ± 2°C: Diameter of mandrel: [mm]	-40°C, 16h diameter of mandrel: 1X1,5: 24mm	
7.2	After the test no cracks are visible	no visible cracks	P ☒ F ☐ N/A ☐ N/T ☐
8	**COLD ELONGATION TEST ACCORDING TO EN 60811-505 (Cable diameter > 12,5 mm)**		
8.1	Test conditions: Conditioning duration 16 h Temperature -40 ± 2°C	H1Z2Z2-K 1X185: -40°C, 16h	
	Elongation at break min 30%: [%]	insulation: 83 sheath: 93	P ☒ F ☐ N/A ☐ N/T ☐
9	**OZONE RESISTANCE ON COMPLETE CABLE**		
9.1	Method A: Temperature 25 ± 2°C Duration 24 h Ozone concentration (by volume) (250-300)*10E-4 %	diameter of mandrel: 1X1,5: 9,8mm 1X185: 52,9mm	P ☒ F ☐ N/A ☐ N/T ☐
9.2	Method B: Temperature 40 ± 2°C Relative humidity 55 ± 5 % Duration 72 h Ozone concentration (by volume) (150-250)*10E-6 %		P ☐ F ☐ N/A ☒ N/T ☐
9.3	After the test no cracks are visible	no visible crack	P ☒ F ☐ N/A ☐ N/T ☐
10	**WEATHERING / UV RESISTANCE TEST (see annex E)**		
10.1	Temperature during drying 65± 3 °C Relative humidity 65 % Power at wavelength betw. 300 to 400 nm 60 ± 2 W/m² Duration spraying/ drying 18 / 102 Min Duration 720 h After test conditioning the exposed five specimens at ambient temperature for 16h		P ☒ F ☐ N/A ☐ N/T ☐

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
10.2	Variation of tensile strength ≥ 70% Variation of elongation at break ≥ 70% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
11	DYNAMIC PENETRATION TEST (annex D) *see table 7.4*		P ☒ F ☐ N/A ☐ N/T ☐
12	**DAMP HEAT TEST**		
12.1	Temperature 90 °C Duration 1000 h Relative humidity min. 85 % Reconditioning period 16 to 24 h		
12.2	Variation of tensile strength max. - 30% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
	Variation of elongation at break max. - 30% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
13	**SHRINKAGE**		
13.1	Length of cable before test [mm] Length of cable after test: [mm]	1X1,5: 300; 1X185: 300 1X1,5: 298; 1X185: 298,5	
13.2	Shrinkage after test max 2%: [%]	1X1,5: 1 1X185: 1	P ☒ F ☐ N/A ☐ N/T ☐
14	**TEST UNDER FIRE CONDITIONS**		
14.1	Length of sample 600 ± 25 mm Temperature during conditioning 23 ± 5 °C Relative humidity during conditioning 50 ±20 % Duration of conditioning 16 h Overall diameter of test sample: [mm] Duration of flame application, depending on the diameter of the test sample 60 s	overall diameter: 1X1,5: 4,7mm 1X185: 26,4mm	
	Distance from the lower edge of the top support to the upper onset of charring > 50 mm: [mm]	1X1,5: 451mm 1X185: 446mm	P ☒ F ☐ N/A ☐ N/T ☐

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
	Charring does not extend downwards to a point greater than 540 mm from the lower edge of the top support: [mm]	1X1,5: 492mm 1X185: 498mm	P ☒ F ☐ N/A ☐ N/T ☐
15	**SMOKE EMISSION OF COMPLETE CABLE ACCORDING TO EN 61034-2**		
15.1	Test result light transmittance, min 60%: [%]	1X1,5: 95 1X2,5: 94 1X4: 90 1X185: 83	P ☒ F ☐ N/A ☐ N/T ☐
16	**ASSESSMENT OF HALOGEN ACCORDING TO 50525-1 ANNEX B**		
16.1	Determination of halogen		P ☒ F ☐ N/A ☐ N/T ☐
	Chloride, fluoride and bromide have been determined during test acc. to annex C (If yes, continue with phase 1)		P ☒ F ☐ N/A ☐ N/T ☐
	Phase 1		
	ph-value min. 4,3: [ph]	1X1,5: 5,4 for insulation 5,3 for sheath 1X185: 5,2 for insulation 5,2 for sheath	P ☒ F ☐ N/A ☐ N/T ☐
	If ph-value min. 4,3 conductivity must be measured: [µS/mm]	1X1,5: 0 for insulation 0 for sheath 1X185: 0 for insulation 0 for sheath	P ☒ F ☐ N/A ☐ N/T ☐
	If conductivity is > 2,5 µS/mm but < 10 µS/mm continue with phase 2, if conductivity is max. 2,5 µS/mm material is acceptable without phase 2		P ☐ F ☐ N/A ☒ N/T ☐
	Phase 2		
	Chlorine- and bromine content max. 0,5% (continue with phase 3): [%]	1X1,5: =<0,5 for both insulation and sheath 1X185: =<0,5 for both insulation and sheath	P ☒ F ☐ N/A ☐ N/T ☐
	Phase 3		

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
	Flouride content max. 0,5%: [%]	1X1,5: =<0,02 for both insulation and sheath 1X185: =<0,02 for both insulation and sheath	P ☒ F ☐ N/A ☐ N/T ☐
Table B.1	**REQUIREMENTS FOR INSULATION AND SHEATHING MATERIALS**		
1	**MECHANICAL CHARACTERISTICS**		
1.1	**Mechanical properties before ageing**		
1.1.1	Determined median values for tensile strengt		
	- for insulation min. 8,0N/mm² *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
	- for sheath min. 8,0N/mm² *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
1.1.2	Determined median values for elongation at break		
	- for insulation min. 125% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
	- for sheath min 125% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
1.2	**MECHANICAL PROPERTIES AFTER AGEING IN OVEN (150°C/168H)**		
1.2.1	Test temperature: 150 ± 2°C *Test duration: 168h*		
1.2.2	Determined median values for tensile strength		
	- for insulation variation max. - 30% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
	- for sheath variation max. - 30% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
1.2.3	Determined median values for elongation at break		
1.2.3	- for insulation variation max. - 30% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
	- for sheath variation max. - 30% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
1.3	**HOT SET TEST IN OVEN ACCORDING TO EN 60811-507 (250°C / 15 MIN / 20N/cm2)**		
1.3.2	Elongation under load max. 100%: [%]	H1Z2Z2-K 1X1,5: insulation: 53; sheath: 45 H1Z2Z2-K 1X185: insulation: 25; sheath: 33	P ☒ F ☐ N/A ☐ N/T ☐
	Permanent elongation after cooling max. 25%: [%]	H1Z2Z2-K 1X1,5: insulation: 10; sheath: 10 H1Z2Z2-K 1X185: insulation: 3; sheath: 3	P ☒ F ☐ N/A ☐ N/T ☐
1.4	**THERMAL ENDURANCE TEST ACCORDING TO EN 60216 PARTS 1 AND 2**		
	The determined Arrhenius curve resulting from the test results of test according to IEC 60216-2 shows a thermal endurance of min. 20.000h at a temperature of 120°C. *SEE ENCLOSURED ARRHENIUS-CALCULATION SHEET*	specimens obtained from the complete cable of H1Z2Z2-K 1X1,5	P ☒ F ☐ N/A ☐ N/T ☐
1.5	**COLD ELONGATION TEST ACCORDING TO EN 60811-505**		
1.5.1	Test conditions see EN 60811-505		
1.5.2	Elongation of break min. 30%: [%]		P ☐ F ☐ N/A ☒ N/T ☐
1.6	**SHEATH RESISTANCE AGAINST ACID AND ALKALINE SOLUTION ACCORDING TO EN 60811-404**		

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
1.6.1	Acid: N-Oxal-acid Alkaline solution: N-sodium hydroxide solution Temperature 23 C° Duration 168 h		
1.6.2	max. Variation of tensile strength ± 30% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
1.6.3	Min. Elongation at break > 100% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
1.7	**COMPATIBILITY TEST ACCORDING TO EN 60811-401**		
1.7.1	Test conditions: Temperature 135 ± 2°C Duration of treatment 168 h		
1.7.2	Variation of tensile strength insulation max. ± 30% Variation of tensile strength sheath max. - 30% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐
1.7.3	Variation of elongation at break insulation max. ± 30% Variation of elongation at break sheath max. - 30% *SEE TABLE B.1*		P ☒ F ☐ N/A ☐ N/T ☐

Absatz *Clause*	**EN 50618:2014** Anforderungen - Prüfungen / *Requirements - Tests*	Messergebnisse - Bemerkungen *Measuring results - Remarks*	Bewertung *Evaluation*
		blank page	

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H1Z2Z2-K 1X1,5 mm^2

Table B.1 MECHANICAL CHARACTERISTICS							
Samples of insulation ..... ☐ test plate ☒ sleeve probe						black	
Samples of sheath ..... ☐ test plate ☒ sleeve probe						black	
INSULATION							
	Values of tensile strength [N/mm²]:					Median [N/mm²]	Variation [%]
Before ageing	18,6	18,9	18,8	18,7	18,3	+19	-
After ageing in oven	20,0	20,6	20,2	20,3	19,8	20,2	+8
After damp heat test	-	-	-	-	-	-	-
After test of mutual influence	19,4	19,5	19,7	19,6	19,4	19,5	+4
	Values of elongation at break [%]:					Median %	Variation %
Before ageing	240	230	220	230	230	230	-
After ageing in oven	220	210	200	190	210	210	-9
After damp heat test	-	-	-	-	-	-	-
After test of mutual influence	230	220	210	220	220	220	-4
During cold elongation test	-	-	-	-	-	-	-
SHEATH							
	Values of tensile strength [N/mm²]:					Median [N/mm²]	Variation [%]
Before ageing	15,1	15,0	15,2	15,1	14,8	15,1	-
After ageing in oven	17,5	18,8	19,0	18,7	18,4	18,7	+24
After damp heat test	15,8	16,0	16,2	16,4	16,5	16,2	+7
After storing in acid	14,1	13,9	13,8	14,5	14,0	14,0	-7
After storing in alkaline	14,6	14,4	14,3	14,0	13,7	14,3	-5
After storing UV Weathering	13,5	12,7	13,4	13,1	12,5	13,1	-13
After test of mutual influence	17,1	17,3	16,9	16,8	17,4	17,1	+13
	Values of elongation at break [%]:					Median [%]	Variation [%]
Before ageing	210	200	190	200	200	200	-
After ageing in oven	170	160	150	170	160	160	-20
After damp heat test	190	170	180	180	180	180	-10
After storing in acid	200	180	190	190	200	190	-5
After storing in alkaline	200	190	180	190	190	190	-5
After storing UV Weathering	190	180	170	180	180	180	-10
After test of mutual influence	190	180	170	180	180	180	-10
During cold elongation test	-	-	-	-	-	-	-

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H1Z2Z2-K 1X185mm^2

Table B.1 MECHANICAL CHARACTERISTICS							
Samples of insulation ..... ☒test plate ☐ sleeve probe						black	
Samples of sheath ..... ☒test plate ☐ sleeve probe						black	
INSULATION							
	Values of tensile strength [N/mm²]:					Median [N/mm²]	Variation [%]
Before ageing	18,0	17,0	17,6	18,4	17,8	17,8	-
After ageing in oven	18,2	18,4	18,5	18,5	18,7	18,5	+4
After damp heat test	-	-	-	-	-	-	-
After test of mutual influence	18,0	18,2	17,8	18,4	18,2	18,2	+2
	Values of elongation at break [%]:					Median %	Variation %
Before ageing	190	180	180	190	190	190	-
After ageing in oven	180	170	160	170	170	170	-11
After damp heat test	-	-	-	-	-	-	-
After test of mutual influence	190	180	170	180	180	180	-5
During cold elongation test	-	-	-	-	-	-	-
SHEATH							
	Values of tensile strength [N/mm²]:					Median [N/mm²]	Variation [%]
Before ageing	15,8	16,0	15,4	15,7	14,6	15,7	-
After ageing in oven	17,0	16,8	17,4	17,2	17,1	17,1	+9
After damp heat test	16,4	16,0	17,0	16,5	16,7	16,5	+5
After storing in acid	14,2	14,7	15,3	15,1	14,6	14,7	-6
After storing in alkaline	15,3	15,0	14,9	14,0	14,5	14,9	-5
After storing UV Weathering	13,3	14,0	14,4	14,7	13,6	14,0	-11
After test of mutual influence	16,6	16,7	15,9	16,4	16,1	16,4	+5
	Values of elongation at break [%]:					Median [%]	Variation [%]
Before ageing	180	170	160	170	170	170	-
After ageing in oven	160	150	140	150	150	150	-12
After damp heat test	170	160	150	160	160	160	-6
After storing in acid	170	150	160	140	160	160	-6
After storing in alkaline	160	170	150	150	160	160	-6
After storing UV Weathering	160	140	150	150	130	150	-12
After test of mutual influence	170	160	150	160	160	160	-6
During cold elongation test	-	-	-	-	-	-	-

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Table 5.1.5 COMPLIANCE OF CONDUCTOR WITH CLASS 5 OF IEC 60228				
	Diameter of single wires		Resistance of conductor	
	Max. [mm]	Measured [mm]	Max. [Ω /km]	Measured [Ω/km]
H1Z2Z2-K 1X1,5mm^2	**0,26**	0,20	**13,7**	11,6
H1Z2Z2-K 1X185mm^2	**0,51**	0,41	**0,108**	0,0955

Table 8.1 INSULATION RESISTANCE VALUE				
Cross section	Insulation resistance at 20°C		Insulation resistance at 90°C	
mm²	Min. MΩ /km	Measured MΩ /km	Min. MΩ /km	Measured MΩ /km
1,5	**860**	3305	**0,860**	1,2
185	**200**	0,0955	**0,200**	762

Table 5.2.3 WALL THICKNESS OF INSULATION									
Values of measured wall thickness not less than stated in clause 5.2.3 of this standard (smallest value shall be highlighted) [mm]							Average value [mm]	Minimum thickness of insulation [mm]	Smallest measured value not less than tm ≥ 0,9t_s - 0,1 mm
1X1,5mm^2	-	-	-	-	-	-	0,7	0,61	**0,53**
1X185mm^2	-	-	-	-	-	-	1,8	1,62	**1,34**

Table 5.3.3 WALL THICKNESS OF SHEATH									
Values of measured wall thickness not less than stated in clause 5.3.3 of this standard (smallest value shall be highlighted) [mm]							Average value [mm]	Minimum thickness of sheath [mm]	Smallest measured value not less than tm ≥ 0,85t_s - 0,1 mm
1X1,5mm^2	-	-	-	-	-	-	0,9	0,82	**0,58**
1X185mm^2	-	-	-	-	-	-	2,0	1,74	**1,26**

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Table 7.3.3 MEAN VALUES AND OVALITY OF CABLE									
Values of measured ovality not less than stated in clause 7.3.3 of this standard									
	Sample 1		Sample 2		Sample 3		Average value [mm]	Manufac-turer spec. [mm]	Ovality [%]
	Value 1 [mm]	Value 2 [mm]	Value 1 [mm]	Value 2 [mm]	Value 1 [mm]	Value 2 [mm]			
1X1,5mm^2	-	-	-	-	-	-	4,9	-	3
1X185mm^2	-	-	-	-	-	-	26,4	-	6

Table 7.4 Dynamic penetration test (Annex D)								
Nominal cross-sectional area of conductor: [mm²]	**1,5**	**185**						
Rated diameter of conductor according to table 2 of IEC 60719 (D_n): [mm]	1,50	17,5						
Minimum value of force (150 * $\sqrt{D_n}$): [N]	**184**	**627**						
Determined mean value of force: [N]	575	1400						

1.4 **Thermal endurance properties**
Testing method according to EN 60216-2

Test conditions
Temperature Index : 120
Selected exposure temperatures : 185°C, 165°C, 145°C
Elongation at break : 50 %

Test sample	Time to end-point at exposure temperature 185°C hour	**Specified time (min.) h**	Time to end-point at exposure temperature 165°C hour	Time to end-point at exposure temperature 145°C hour	**Specified time (min.) h**	Obtained absolute temperature K	**Absolute temperature (min.) K**	
insulation	124	**100**	946	5875	**5000**	407	**393**	P
sheath	124	**100**	900	5253	**5000**	406	**393**	P

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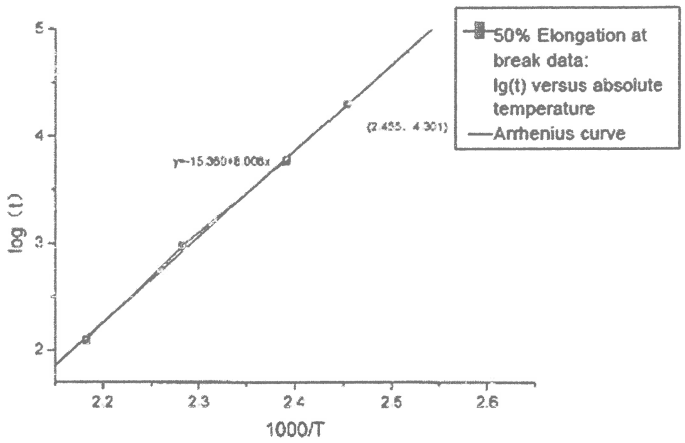
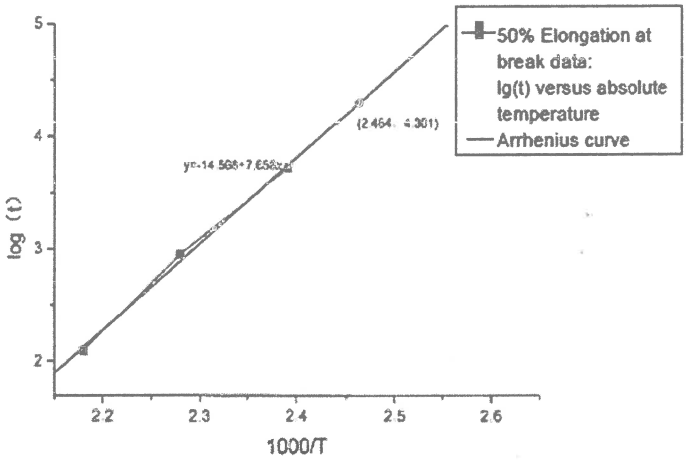
Thermal endurance graph for insulation material



Remark: The value of t is equal to 20,000 h at lg(t)=4,30

Thermal endurance graph for sheath material



Remark: The value of t is equal to 20,000 h at lg(t)=4,30

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Equipment List

No. of equipment	Name of equipment	Next calibration date
JL0218	Seven Multi Multi-fuction tester	2018-02-08
JL0311	DDSL-308 Conductivity meter	2017-12-26
JL0319	MICRO OHMMETER	2018-06-21
JL0338	JSL-500N tensile-testing machine	2018-06-22
JL0403	ZX-01C Ozone resistance test box	2017-11-09
JL0475	Damp heat test chamber	2018-08-08
JL0535	CMT4204 electronic universal test machine	2017-12-22
JL0617	ZC-90A Insulation resistance measurement apparatus	2017-10-09
JL0987	Digital Micrometer	2018-06-04
ZJ03011	WD270B low temperature testing box	2018-08-21
ZJ03014	DJ-201 Low temperature bending apparatus	2018-11-17
ZJ03015	LS-II low tempreature tension apparatus	2018-07-25
ZJ0380F	PH value tester	2017-09-20
ZJ0403	YDJ5/50 50KV YDJ5/50 50KV A.C. Dielectric strength tester	2018-02-16
ZJ0439	RL100 thermal ageing oven	2017-11-16
ZJ0440	RL100 thermal ageing oven	2017-11-28
ZJ0461	HVDC 502-10 D.C. Dielectric strength tester	2018-01-05
ZJ0473	Low temperature impact apparatus	2019-03-15
ZJ0475	Test system of smoke emission of complete cable	2018-03-23
ZJ0493	SL-1 HCl and acidity measuring instruments	2018-04-24
ZJ0550	RYS Hot set test apparatus	2019-04-20
ZJ6114	CHX-40 thermal ageing oven	2018-05-08
ZJ6116	CHX-40 thermal ageing oven	2018-05-10
ZJ6117	CHX-40 thermal ageing oven	2018-05-09
ZJ6118	C CHX-40 thermal ageing oven	2018-05-08
ZJ6178	WCDMS cable dimension measurement system	2018-01-15
ZJ6180	SH65C Xenon TEST Chamber	2018-03-27
ZJ6187	Test for a single vertical insulated cable system	2018-06-22
ZJ6239	RL45 thermal ageing oven	2018-05-16

18.04.20

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Appendix

List of key test equipment

Reference No.: CTL17-019

No. of equipment	Name of equipment	Next calibration date
JL0987	Digital Micrometer	2017-06-05
ZJ0330	Test system of smoke emission of complete cable	2018-03-22
ZJ6178	WCDMS cable dimension measurement system	2018-01-15
	End of list	

30-05-17