



缆慧检测



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检测
TESTING
CNAS L9930

Report No.: TN20-0912E

Sample No.: CN19-4675

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Contract No.: ISTCW19-2282

Test Report

Consigner SHENZHEN WOER HEAT-SHRINKABLE MATERIAL CO., LTD.
Wall Industrial Park, Lanjing North Road, Longtian Street, Pingshan District, SHENZHEN

Sample Name Copper Connecting Tube

Type and Size GT-G-10mm²

Kind of test Type test

Sample Received Date December 26th, 2019

Test Duration December 26th, 2019 – April 9th, 2020

Test Conclusion
1. The samples have been subjected to the series tests in accordance with GB/T 9327—2008. The results comply with the type tests requirements (Class A) of GB/T 9327—2008.
2. The surface and dimension of the sample has been tested according to GB/T 14315—2008. The results comply with the requirements of GB/T 14315—2008.

Authorized by
Shanghai Intelligent Service and Technology Co., Ltd.

李骥 Li Ji

Issue date 2020-04-21

Testing Engineer: 贾欣 Jia Xin

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GT-G-10mm ²

1 Sample Description

Manufacturer	SHENZHEN WOER HEAT-SHRINKABLE MATERIAL CO., LTD. Wall Industrial Park, Lanjing North Road, Longtian Street, Pingshan District, SHENZHEN
Type and Size	GT-G-10mm ²
Quantity	10 sets
Marking	/
Color	/
Source	Sent by the consigner
Status	Normal appearance

2 Testing and Verdict Standards

2.1 Testing Standards

- 1) GB/T 9327—2008 Compression and mechanical connectors for power cables for rated voltages up to 35kV ($U_m=40.5kV$)—Test methods and requirements
- 2) GB/T 14315—2008 Compression type terminal lugs and ferrules with copper or aluminum for power cables conductors

2.2 Verdict Standards

- 1) GB/T 9327—2008 Compression and mechanical connectors for power cables for rated voltages up to 35kV ($U_m=40.5kV$)—Test methods and requirements
- 2) GB/T 14315—2008 Compression type terminal lugs and ferrules with copper or aluminum for power cables conductors

3 Other Information

3.1 Description of the testing party

This report is the English version of test report of TN20-0912, the Chinese version shall prevail if any inconsistencies between Chinese version and English version.

3.2 Illustration

- 1) The sample's name, type and manufacturer are provided by the consigner.
- 2) The short-circuit test is subcontracted, because this test is not included in our testing scope approved by CNAS and CMA. The subcontractor is Machinery Industry High-voltage Transmission and Distribution Equipment Quality Inspection & Testing Center. The certificate number of CNAS for the center is CNAS L2550 and the qualification certificate number of CMA for the center is 160008223396, the short-circuit test report number is No.20200034B.
- 3) The short-circuit test was carried out with Sample No. CN19-4671 at the same time.

3.3 Testing Location

The following testing items are tested at No.458, Haixiang Road, Fengxian Area, Shanghai, China, except the subcontracted testing item.

- Heat cycle tests and electrical resistance measurements in electrical test;
- Surface and dimension check.

3.4 Symbol definition

Requirement: / not required by standard

Verdict: P complying with requirement/Pass

F not complying with requirement/Fail

N not required

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4 Test Item

4.1 Electrical Test

4.1.1 The 1st electrical resistance measurement (before the 1st heat cycle test)

According to GB/T 9327—2008, clause 6.3.3.

Test method: GB/T 9327—2008 clause 6.2

Test parameters

Ambient temperature: 17 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.645	/	/	/	/	/	/
- Connecting tube	mΩ	/	0.606	0.596	0.591	0.594	0.600	0.614
	mΩ	/	0.0731	0.0667	0.0639	0.0564	0.0636	0.0851

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- before the 1st heat cycle	/	/	0.726	0.651	0.635	0.542	0.632	0.831	N
Initial scatter δ									
- initial scatter	/	≤0.30			0.24				P

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4.1.2 The 1st heat cycle test

According to GB/T 9327—2008, clause 6.3.1.

Test method: GB/T 9327—2008, clause 6.3.1

Test parameters

Ambient temperature: 11 °C

Required reference conductor temperature (°C)	Reference conductor temperature (°C)	Heat current for steady reference conductor temperature (A)	Median connecting terminal temperature (°C)
120~140	127	119	100

Test Results	The test is finished successfully. The 1st heat cycle temperature curve is shown in Figure 1.
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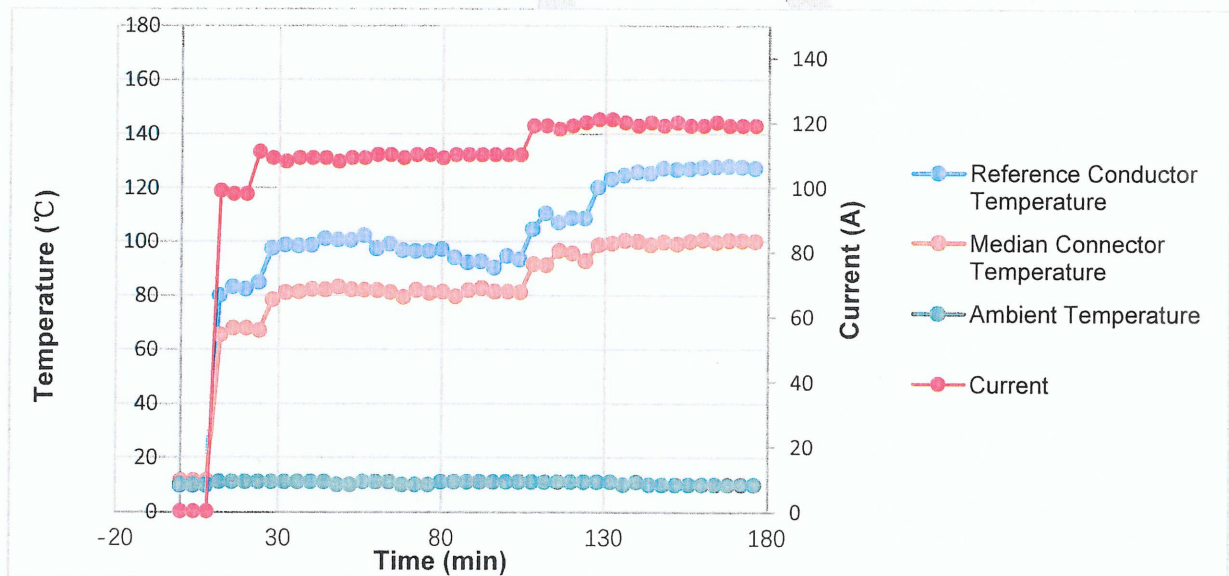


Figure 1 1st heat cycle temperature curve

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4.1.3 The 2nd heat cycle test

According to GB/T 9327—2008, clause 6.3.2.

Test method: GB/T 9327—2008, clause 6.3.2

Test parameters

Ambient temperature: 11 °C

Required reference conductor steady temperature (°C)	Heat current for steady reference conductor temperature (A)	Reference conductor temperature (°C)	Median connecting terminal		Heat cycle time	
			Steady temperature (°C)	Steady time (min)	Heating time (min)	Cooling time (min)
127~133	119	127~130	100~102	10	24	8

Test Results	The test is finished successfully. The 2nd heat cycle temperature curve is shown in Figure 2.
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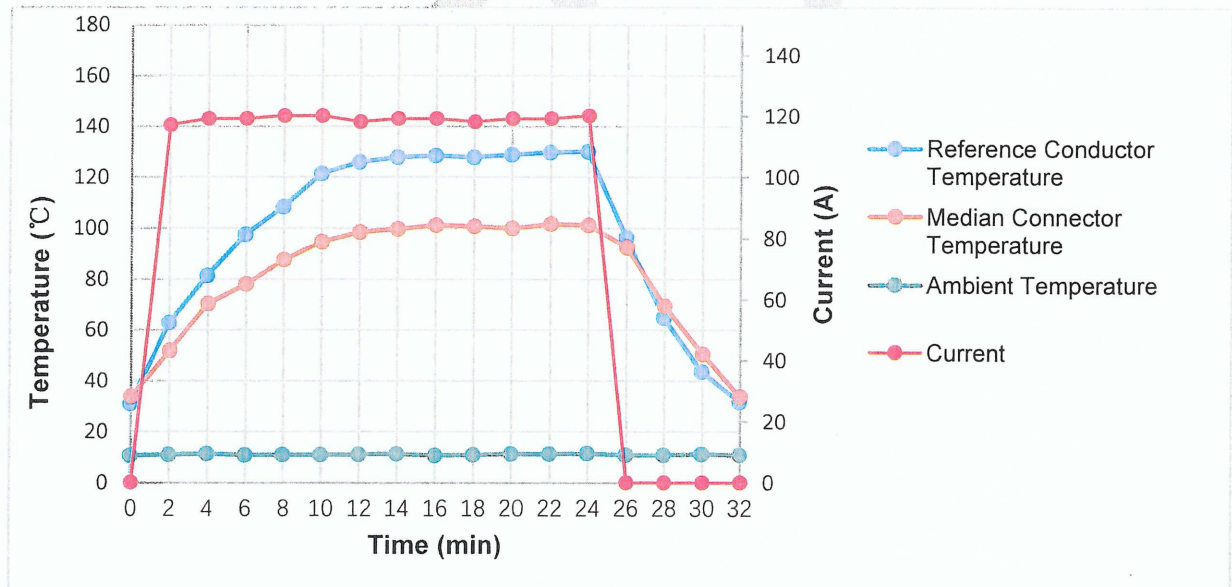


Figure 2 2nd heat cycle temperature curve

The following heat cycle according to the heating current and time.

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4.1.4 The 2nd electrical resistance measurement (after the 200th heat cycle, before short-circuit)

According to GB/T 9327—2008, clause 6.3.3.

Test method: GB/T 9327—2008 clause 6.2

Test parameters

Ambient temperature: 19 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.644	/	/	/	/	/	/
	mΩ	/	0.607	0.595	0.589	0.600	0.592	0.618
- Connecting tube	mΩ	/	0.0750	0.0669	0.0623	0.0625	0.0566	0.0892

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 200th heat cycle (before short-circuit)	/	/	0.746	0.655	0.620	0.602	0.563	0.872	N
Resistance factor ration λ									
- Resistance factor ration λ ₁	/	≤2.0	1.0	1.0	1.0	1.1	0.9	1.0	P

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4.1.5 Short-circuit test

According to GB/T 9327—2008, clause 6.3.4.

Test method: GB/T 9327—2008, clause 6.3.4

Test parameters

Ambient temperature: 16 °C

Required short-circuit current: 1.86(kA) Duration: 1(s)		Short-circuit	Short-circuit current valid value (kA)	Duration (s)
Current applied	Short-circuit mode	1st	1.88	1.00
Conductor and Connecting Tubes	1 phase	2nd	1.88	1.01
		3rd	1.88	1.01
		4th	1.88	1.01
		5th	1.88	1.01
		6th	1.88	1.01

Test Item	Requirement	Test Result	Verdict
Short-circuit test	/	There is no any sign of damage or deformation for the samples. The waveform and duration of short-circuit are shown in subcontractor test report.	N

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4.1.6 The 3rd electrical resistance measurement (after the 200th heat cycle, after short-circuit test)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 15 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.653	/	/	/	/	/	/
	mΩ	/	0.622	0.606	0.602	0.603	0.597	0.627
- Connecting tube	mΩ	/	0.0831	0.0703	0.0687	0.0587	0.0540	0.0917

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 200th heat cycle (after short-circuit)	/	/	0.816	0.679	0.675	0.557	0.530	0.885	N
Resistance factor ration λ									
- Resistance factor ration λ ₂	/	≤2.0	1.1	1.0	1.1	1.0	0.8	1.0	P

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4.1.7 The 4th electrical resistance measurement (after 250th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 16 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.647	/	/	/	/	/	/
	mΩ	/	0.617	0.600	0.598	0.605	0.604	0.628
- Connecting tube	mΩ	/	0.0836	0.0695	0.0693	0.0657	0.0669	0.0981

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 250th heat cycle	/	/	0.829	0.678	0.687	0.630	0.663	0.956	N
Resistance factor ration λ									
- Resistance factor ration λ ₃	/	≤2.0	1.1	1.0	1.1	1.2	1.0	1.1	P

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4.1.8 The 5th electrical resistance measurement (after the 325th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 16 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.651	/	/	/	/	/	/
	mΩ	/	0.622	0.603	0.605	0.608	0.607	0.635
- Connecting tube	mΩ	/	0.0841	0.0687	0.0724	0.0655	0.0662	0.101

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 325th heat cycle	/	/	0.828	0.665	0.713	0.623	0.652	0.976	N
Resistance factor ration λ									
- Resistance factor ration λ ₄	/	≤2.0	1.1	1.0	1.1	1.2	1.0	1.1	P

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4.1.9 The 6th electrical resistance measurement (after the 400th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 18 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.644	/	/	/	/	/	
	mΩ	/	0.614	0.596	0.593	0.598	0.596	
- Connecting tube	mΩ	/	0.0825	0.0680	0.0671	0.0611	0.0612	
							0.0969	

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 400th heat cycle	/	/	0.821	0.666	0.668	0.588	0.609	0.949	N
Resistance factor ratio λ									
- Resistance factor ratio λ ₅	/	≤2.0	1.1	1.0	1.1	1.1	1.0	1.1	P

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4.1.10 The 7th electrical resistance measurement (after the 475th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 16 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.649	/	/	/	/	/	/
- Connecting tube	mΩ	/	0.618	0.602	0.601	0.602	0.603	0.629
	mΩ	/	0.0823	0.0694	0.0709	0.0616	0.0634	0.0973

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 475th heat cycle	/	/	0.813	0.674	0.701	0.589	0.627	0.945	N
Resistance factor ratio λ									
- Resistance factor ratio λ ₆	/	≤2.0	1.1	1.0	1.1	1.1	1.0	1.1	P

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4.1.11 The 8th electrical resistance measurement (after the 550th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 17 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.645	/	/	/	/	/	/
	mΩ	/	0.616	0.599	0.597	0.599	0.602	0.623
- Connecting tube	mΩ	/	0.0833	0.0699	0.0695	0.0610	0.0656	0.0942

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 550th heat cycle	/	/	0.827	0.683	0.690	0.586	0.652	0.921	N
Resistance factor ration λ									
- Resistance factor ration λ ₇	/	≤2.0	1.1	1.0	1.1	1.1	1.0	1.1	P

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4.1.12 The 9th electrical resistance measurement (after the 625th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 18 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.643	/	/	/	/	/	/
	mΩ	/	0.615	0.598	0.596	0.599	0.600	0.625
- Connecting tube	mΩ	/	0.0836	0.0709	0.0697	0.0625	0.0656	0.0975

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 625th heat cycle	/	/	0.834	0.695	0.695	0.602	0.654	0.955	N
Resistance factor ration λ									
- Resistance factor ration λ ₈	/	≤2.0	1.1	1.1	1.1	1.1	1.0	1.1	P

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4.1.13 The 10th electrical resistance measurement (after the 700th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 17 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.646	/	/	/	/	/	
	mΩ	/	0.614	0.600	0.597	0.602	0.624	
- Connecting tube	mΩ	/	0.0810	0.0704	0.0692	0.0637	0.0655	
							0.0938	

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 700th heat cycle	/	/	0.804	0.687	0.687	0.611	0.650	0.915	N
Resistance factor ration λ									
- Resistance factor ration λ ₉	/	≤2.0	1.1	1.1	1.1	1.1	1.0	1.1	P

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4.1.14 The 11th electrical resistance measurement (after the 775th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 17 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.650	/	/	/	/	/	
	mΩ	/	0.617	0.606	0.597	0.602	0.623	
- Connecting tube	mΩ	/	0.0808	0.0727	0.0653	0.0604	0.0624	
							0.0902	

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 775th heat cycle	/	/	0.797	0.705	0.644	0.576	0.615	0.875	N
Resistance factor ration λ									
- Resistance factor ration λ ₁₀	/	≤2.0	1.1	1.1	1.0	1.1	1.0	1.1	P

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4.1.15 The 12th electrical resistance measurement (after the 850th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 18 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.650	/	/	/	/	/	/
	mΩ	/	0.623	0.607	0.600	0.605	0.603	0.628
- Connecting tube	mΩ	/	0.0872	0.0745	0.0686	0.0638	0.0632	0.0950

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 850th heat cycle	/	/	0.861	0.723	0.677	0.609	0.624	0.922	N
Resistance factor ratio λ									
- Resistance factor ratio λ ₁₁	/	≤2.0	1.2	1.1	1.1	1.1	1.0	1.1	P

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4.1.16 The 13th electrical resistance measurement (after the 925th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 17 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.648	/	/	/	/	/	/
- Connecting tube	mΩ	/	0.619	0.602	0.603	0.602	0.603	0.630
	mΩ	/	0.0845	0.0703	0.0731	0.0621	0.0648	0.0987

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 925th heat cycle	/	/	0.837	0.685	0.724	0.595	0.641	0.960	N
Resistance factor ratio λ									
- Resistance factor ratio λ ₁₂	/	≤2.0	1.2	1.1	1.1	1.1	1.0	1.2	P

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4.1.17 The 14th electrical resistance measurement (after the 1000th heat cycle)

According to GB/T 9327—2008 clause 6.3.3.

Test method: GB/T 9327—2008, clause 6.2

Test parameters

Ambient temperature: 17 °C

Measurement Item	Unit	Measurement Results						
		Reference conductor	Connecting Tube					
			1#	2#	3#	4#	5#	6#
Electrical resistance (20°C)								
- Between the two equalizers	mΩ	0.649	/	/	/	/	/	/
- Connecting tube	mΩ	/	0.623	0.600	0.601	0.603	0.607	0.626
	mΩ	/	0.0871	0.0683	0.0710	0.0622	0.0679	0.0936

Test Item	Unit	Requirement	Test Results						Verdict
			1#	2#	3#	4#	5#	6#	
Resistance factor k									
- After the 1000th heat cycle	/	/	0.861	0.663	0.701	0.594	0.671	0.868	N
Resistance factor ratio λ									
- Resistance factor ratio λ ₁₃	/	≤2.0	1.2	1.0	1.1	1.1	1.1	1.1	P
Mean scatter β									
- Mean scatter	/	≤0.30			0.29				P
Change in resistance factor D									
- Change in resistance factor	/	≤0.15	0.08	0.09	0.07	0.09	0.07	0.11	P
Maximum temperature θ_{max}									
- Reference conductor θ _{ref}	°C	127~133	132	133	131	133	131	131	P
- Connecting terminal maximum temperature θ _{max}	°C	≤θ _{ref}	118	104	104	104	105	105	P

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3 samples experienced with 1000 heat cycles were tested for mechanical tests.

4.2 Mechanical test

According to GB/T 9327—2008 clause 7.

Test method: GB/T 9327—2008, clause 7.1

Test parameters

Total tensile force: 600 N

Load rate: ≤ 10 N/(s·mm²)

Duration: 1 min

Test Item	Requirement	Test Result	Verdict
Mechanical tests	No slipping shall occur during the last minute of the test.	There is no slipping for the 3 samples in the tests.	P

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4.3 Surface and dimension check

4.3.1 Surface check

According to GB/T 14315—2008 Table 10, No.1.

Test method: GB/T 14315—2008, Table 10

Test parameter

Ambient temperature: 18 °C

Test Item	Requirement	Test Result	Verdict
Surface check	Sample surface shall be bright, clean and smooth. There shall be no burr formation, crack, sharp edge, overlap. The cladding layer shall be well-distributed, no desquamated. There shall be no sharp angle and edge roll on both sides of the connecting tube.	By visual checking, the surface is smooth, there is no burr, or crack, or sharp edge, or overlap. The cladding layer is no desquamated. There is no sharp angle, or edge roll on the both sides of the connecting tube.	N

4.3.2 Dimension check

According to GB/T 14315—2008 Table 10, No.2.

Test method: GB/T 14315—2008, Table 10

Test parameter

Ambient temperature: 18 °C

Test Item	Unit	Requirement	Test Result	Verdict
Dimension check				
- d	mm	5 ^{+0.30} _{-0.30}	5.23	P
- D	mm	8 ⁰ _{-0.12}	7.92	P
- L	mm	≥50	50	P
- L1	mm	/	0.6	N

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Appendix A: Conductor structure for the tests and installation information
Appendix A.1 Conductor structure

Nominal section area	Material	Type	Outer diameter	Nominal diameter for single wire	The number of single wires	Structure
10mm ²	Cu	Circle, stranded	Φ4.0	Φ1.32	7	2 layers, 1+6

Appendix A.2 Parameters of the pressure clamp

Tube type & size	Clamp type	Working pressure	Stamper type & size	Diagonal line length	Shape of stamper
GT-G-10mm ²	EZ-400	120kN	Cu10	6.0mm	Hexagon confining pressure

Appendix A.3 Distance between the compressions

There are four compression in the center part of the connecting tube. The distance is 1mm between the impressions. The distance between the last compression and the tube end is 1mm.

Appendix B: Samples length

Item	Length (mm)						
	Reference conductor	Connecting Tube					
		1#	2#	3#	4#	5#	6#
Between two equalizers	372	/	/	/	/	/	/
Equalizer—Terminal end (I _a)	/	153	151	150	154	155	152
Equalizer—Terminal end (I _b)	/	154	154	154	156	154	153
Terminal end—Terminal top (I _j)	/	58	59	58	60	58	59

- The End -