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中国认可  
国际互认  
检测  
TESTING  
CNAS L0207

报告编号  
Reference No

CT20-04840

# 检测报告

## Test Report

样品名称 Name of sample	铝合金绞线 All aluminum alloy conductor
样品型号 Type of sample	AAAC
委托方 Consigner	郑州市乐美电线电缆有限公司 ZHENGZHOU LEMEI WIRE AND CABLE CO., LTD
试验类型 Kind of test	委托试验 Commission test



国家电线电缆质量监督检验中心  
CHINA NATIONAL CENTRE FOR QUALITY  
SUPERVISION AND TEST OF ELECTRIC WIRE AND CABLE



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# 国家电线电缆质量监督检验中心检测报告

China National Centre for Quality Supervision and Test of Electric Wire and Cable  
Test Report

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试验类型 Kind of test		委托试验 Commission test		报告编号 Reference No.		CT20-04840	
样品名称 Name of sample		铝合金绞线 All aluminum alloy conductor					
型号规格 Type and Size		AAAC 1×150mm <sup>2</sup>		检测日期 Date of test		2020-08-11 ~ 2020-10-10	
委托方 Consigner	名称 Name	郑州市乐美电线电缆有限公司 ZHENGZHOU LEMEI WIRE AND CABLE CO., LTD					
	地址 Address	河南省巩义市产业集聚区 Industrial Agglomeration Area of Gongyi City, Henan Province, China					
	电话号码 Tel.	186 9599 8251	邮政编码 P.C.	451283	单位编号 Unit No.	451184	
生产单位 Manufacturer	名称 Name	郑州市乐美电线电缆有限公司 ZHENGZHOU LEMEI WIRE AND CABLE CO., LTD					
	地址 Address	河南省巩义市产业集聚区 Industrial Agglomeration Area of Gongyi City, Henan Province, China					
	电话号码 Tel.	186 9599 8251	邮政编码 P.C.	451283	单位编号 Unit No.	451184	
来样方式 Delivering mode		送样 Supplied by consigner	接收状态 Sample state at receiving	正常 Normal	收样日期 Receiving date	2020-07-31	
检测依据 Test standard		1. IEC 61089:1991+A1:1997 圆线同心绞架空导线 IEC 61089:1991+A1:1997 Round wire concentric lay overhead electrical stranded conductors 2. AS 3822-2002 架空裸导体试验方法 第6.3条 线膨胀系数 AS 3822-2002 Test methods for bare overhead conductors — Clause 6.3 Coefficient of thermal elongation 3. IEC 60287-1-1:2014 电缆载流量计算 第1-1部分: 载流量公式(100%负荷因数)和损耗计算一般规定 IEC 60287-1-1:2014 Electric cables- Calculation of the current rating-Part 1-1: Current rating equations (100% load factor) and calculation of losses-General					
判定依据 Verdict standard		委托方提供的技术参数 Technical requirement supplied by consigner					
检测结论 Conclusion		该样品“绞线单位长度质量”、“绞线线膨胀系数”、“绞线弹性模量及应力-应变曲线”和“绞线载流量测试及计算”提供检测结果,其余所测项目符合委托方提供的技术参数要求。 The “Mass per unit length”, “Temperature coefficient of linear expansion”, “Elasticity modulus & stress-strain curve” and “Test and calculation of the current carrying capacity” of the conductor items tested for the sample are provided with test results., and other items comply with the requirements of the technical requirement supplied by consigner.					
备注 Note		样品名称及型号规格由委托方提供并负责。 The consigner supplied name, type and size of the sample and is responsible for them.					
主检 Tested by	王红梅 Wang HongMei	审核 Checked by	王煦 Wang Xu	批准 Approved by	范玉军 Fan YuJun		
日期 Date	2020.10.10	日期 Date	2020.10.10	日期 Date	2020-10-10		



型号和规格 Type and size		AAAC 1×150mm <sup>2</sup>		报告编号 Reference No.	CT20-04840
序号 No.	检测项目 Test Items	单位 Unit	技术要求 Requirements	检测结果 Test Results	单项评定 Verdict
1	表面质量 Surface quality		绞线应光洁, 不应有裂纹、毛刺、开裂、夹杂等与良好工业品不相称的任何缺陷。 The stranded wire shall be smooth and free from any defects such as cracks, burrs, cracks, inclusions, etc. that are not commensurate with good industrial products.	通过 Pass	P
2	绞制 Lay				
2.1	绞向 Direction of lay		相邻层绞线方向相反, 最外层绞线方向向右。 The stranded direction of adjacent layers should be opposite. The stranded direction of outermost layer should be to the right.	相反, 右向 Reverse, right-hand.	P
2.2	节径比 Lay Ratio				
2.2.1	内层 Inner layer		10~17	16.7	P
2.2.2	邻外层 Adjacent outer layer		10~16	13.9	P
2.2.3	外层 Outer layer		10~14	12.4	P
3	铝合金线根数 Number of Al alloy wires	根 No.	37	37	P
4	铝合金线性能 (绞后) Properties of Al alloy wires (stranded)				
4.1	断后伸长率 (L <sub>0</sub> =250 mm) Elongation after fracture (L <sub>0</sub> =250 mm)	%	≥3.0	3.8	P
4.2	卷绕 (1d, 8 圈) Bending (1d, 8 turns)		不断裂 No cracking.	未断裂 No cracking.	P
4.3	20℃时直流电阻率 DC resistivity at 20℃				
4.3.1	中心线 Core wire	Ω·mm <sup>2</sup> /m	≤0.032841	0.03112	P
4.3.2	内层 Inner layer	Ω·mm <sup>2</sup> /m	≤0.032841	0.03152	P
4.3.3	邻外层 Adjacent outer layer	Ω·mm <sup>2</sup> /m	≤0.032841	0.03155 0.03157	P

注: “单项评定”符号含义: P: 检测结果符合要求; F: 检测结果不符合要求; N: 检测结果不要求判定。  
Note: “P” means this item does meet the requirement, “F” means this item does not meet the requirement, “N” means this item does not require to the verdict.

型号和规格 Type and size		AAAC 1×150mm <sup>2</sup>		报告编号 Reference No.	CT20-04840	
序号 No.	检测项目 Test Items	单位 Unit	技术要求 Requirements	检测结果 Test Results		单项评定 Verdict
4.3.4	外层 Outer layer	Ω·mm <sup>2</sup> /m	≤0.032841	0.03113	0.03124	P
4.4	导电率(平均值) Conductivity (Average)	%IACS	≥52.5	55.0		P
5	绞线单位长度质量 Mass per unit length of the conductor	kg/km	/	404		N
6	绞线 20°C 直流电阻 DC resistance of the conductor at 20°C	Ω/km	≤0.2275	0.2155		P
7	绞线膨胀系数 Temperature coefficient of linear expansion of the conductor		/	见附录一 Shown in appendix one		N
8	绞线弹性模量及应力-应变 曲线 Elasticity modulus & stress- strain curve of the conductor		/	见附录二 Shown in appendix two		N
9	绞线载流量测试及计算 Test and calculation of the current carrying capacity of the conductor		/	见附录三 Shown in appendix three		N
			以下空白 End of Report			

注：“单项评定”符号含义：P：检测结果符合要求；F：检测结果不符合要求；N：检测结果不要求判定。  
Note: “P” means this item does meet the requirement, “F” means this item does not meet the requirement, “N” means this item does not require to the verdict.

# 铝合金绞线 线膨胀系数

TEMPERATURE COEFFICIENT OF LINEAR EXPANSION OF  
ALL ALUMINUM ALLOY CONDUCTOR

## 检测报告

## Test Report

### 一. 试件信息:

Sample:

委托单位: 郑州市乐美电线电缆有限公司

Consigner: ZHENGZHOU LEMEI WIRE AND CABLE CO., LTD

型号规格: AAAC 1×150mm<sup>2</sup>

Type and size: AAAC 1×150mm<sup>2</sup>

结构: 铝合金线 37/2.25

Structure: Al alloy wire 37/2.25

标称外径: 15.75 mm

Diameter: 15.75 mm

计算总截面积: 147.1 mm<sup>2</sup>

Total cross sectional area: 147.1 mm<sup>2</sup>

额定拉断力 (RTS): 41.06 kN

Rated Tensile Strength (RTS) : 41.06 kN

### 二. 试验依据:

Test stranded:

AS 3822-2002 架空裸导体试验方法 第6.3条 线膨胀系数

AS 3822-2002 Test methods for bare overhead conductors —Clause 6.3

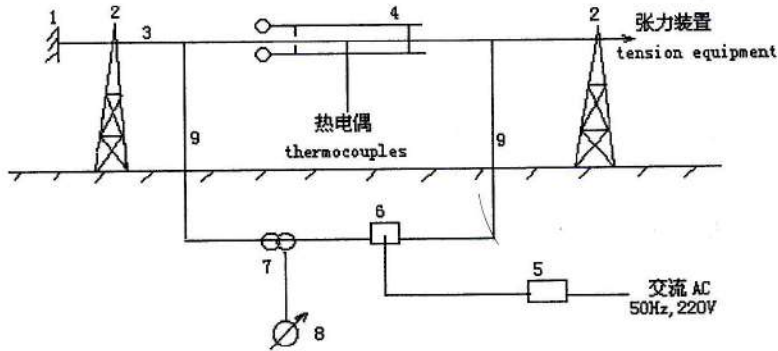
Coefficient of thermal elongation

三. 设备布置及试验条件:

Test preparation and condition:

1. 试验设备及布置, 见图 1-1。

Test equipment and test preparation, the layout of specimen is as Fig.1-1



- |                                       |                     |                     |                       |         |
|---------------------------------------|---------------------|---------------------|-----------------------|---------|
| ① 固定端                                 | ② 铁塔                | ③ 被测试绞线             | ④ 伸长仪                 | ⑤ 调压器   |
| fixed head                            | steel tower         | stranded conductors | elongation meter      | booster |
| ⑥ 大电流低压变压器                            | ⑦ 电流互感器             | ⑧ 电流表               | ⑨ 连接铜排                |         |
| heavy current low voltage transformer | current transformer | current-meter       | connecting copper bar |         |

图 1-1 线膨胀试验布置图

Fig.1-1 Layout of temperature coefficient of linear expansion test

2. 试验条件

Test condition

- 试样加热区长度: 10 m  
The conductor length of heated partition: 10 m
- 试样张力: 4.11 kN (10% RTS)  
Test tension: 4.11 kN (10% RTS)
- 加热方法: 施加低压大电流 (交流)  
The means of heating: load low voltage heavy current (AC)
- 试验室温:  $(24.0 \pm 2.0) ^\circ\text{C}$   
Room temperature:  $(24.0 \pm 2.0) ^\circ\text{C}$
- 加热温度范围: 室温  $\sim 100 ^\circ\text{C}$   
Test temperature: Room temperature  $\sim 100 ^\circ\text{C}$
- 测试的有效长度: 2000 mm  
Gauge length: 2000 mm
- 温度测试: 采用 4 根热电偶测温, 取平均值  
Temperature measure: with 4 thermocouples, get average.



四. 试验方法:

Test method:

1. 在测试前, 将试件施加 4.11 kN (10% RTS) 的张力, 并在整个测试过程中保持此张力。

Before the test, increase load to 4.11 kN (10% RTS), and keep this tension in the whole duration.

2. 接通电源对试件加热, 通过调节调压器, 使试件温度在室温 ~ 100 °C 范围内达到平衡后进行测试, 每 10 °C 记录一组数值。

Then, heat the specimen by power, record the data of elongation and temperature when the specimen meet the thermal balance state from room temperature to 100 °C, a set of test results will be recorded at interval of every 10 °C.

3. 试验值经回归处理后, 求取绞线在室温 ~ 100 °C 范围内的平均线膨胀系数。

After regression process of testing values, solving equations for getting the average linear expansion coefficient of the stranded conductor in the range of room temperature to 100 °C.

五. 试验结果:

Test result:

该绞线实测线膨胀系数为:  $22.9 \times 10^{-6}$  (1/°C)。

The testing temperature coefficient of linear expansion of specimen is:  $22.9 \times 10^{-6}$ .

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——End of report——

铝合金绞线  
弹性模量及应力-应变曲线  
ELASTICITY MODULUS & STRESS-STRAIN CURVE  
OF ALL ALUMINUM ALLOY CONDUCTOR  
检测报告  
Test Report

一、试件信息:

Sample:

委托单位: 郑州市乐美电线电缆有限公司

Consigner: ZHENGZHOU LEMEI WIRE AND CABLE CO., LTD

型号规格: AAAC 1×150mm<sup>2</sup>

Type and size: AAAC 1×150mm<sup>2</sup>

结构: 铝合金线 37/2.25

Structure: Al alloy wire 37/2.25

标称外径: 15.75 mm

Diameter: 15.75 mm

计算总截面积: 147.1 mm<sup>2</sup>

Total cross sectional area: 147.1 mm<sup>2</sup>

额定拉断力 (RTS): 41.06 kN

Rated Tensile Strength (RTS) : 41.06 kN

二、试验依据:

Test standard:

IEC 61089:1991+A1:1997 附录 B 应力-应变试验方法

IEC 61089:1991+A1:1997 Appendix B Stress-Strain Testing Method



三、试验条件:

Testing conditions:

1. 试验设备: 500 kN 液电卧式拉力试验机。

Testing Equipment: 500 kN hydraulic-electric horizontal tensile machine.

2. 试验条件:

Testing conditions:

试样根数: 1 根

Quantity of specimens: 1 piece

试样有效长度: 10 m

Effective length of specimen: 10 m

试样端头处理: 环氧树脂浇注

Treatment of specimen ends: cast with epoxy resin

引伸仪长度: 2000 mm

Length of stretching device: 2000 mm

测试精度: 应力为 $\pm 1\%$

应变为 $\pm 0.01\text{ mm}/2000\text{ mm}$

Test accuracy: Stress:  $\pm 1\%$

Strain:  $\pm 0.01\text{ mm}/2000\text{ mm}$

四、试验结果:

Test result:

1. 试样的最终弹性模量为 61.5 GPa;

The final modulus of elasticity of the specimen is 61.5 GPa;

2. 本绞线的应力-应变曲线见图 1-1。

The stress-strain curve of the specimen is shown as the Fig. 1-1.

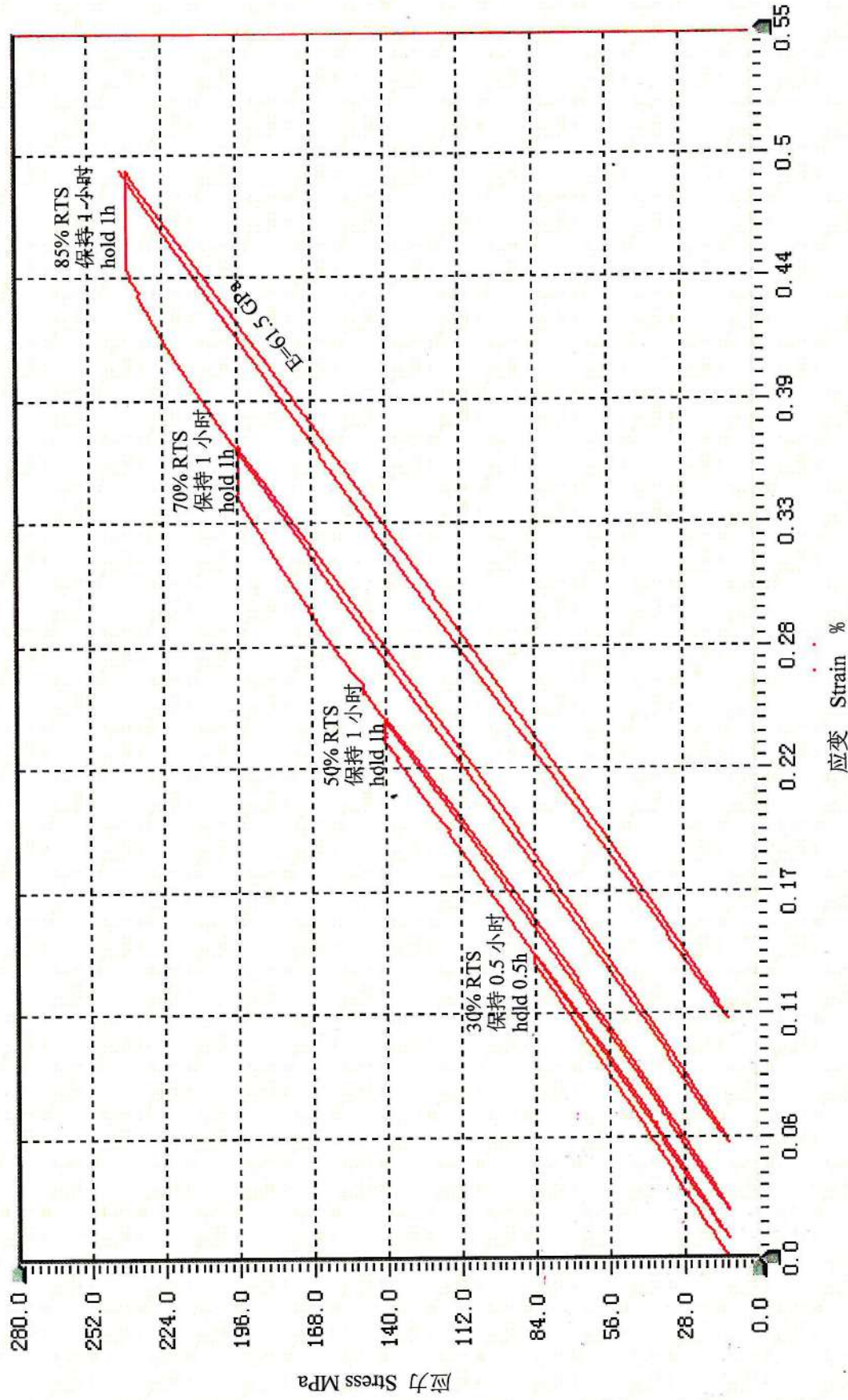


图 1-1 应力-应变曲线

Fig. 1-1 Stress-strain curve

铝合金绞线  
载流量测试及计算  
TEST AND CALCULATION OF CURRENT CARRYING  
CAPACITY OF ALL ALUMINUM ALLOY CONDUCTOR  
检测报告  
Test Report

一、 试样信息:

Sample:

委托单位: 郑州市乐美电线电缆有限公司

Consigner: ZHENGZHOU LEMEI WIRE AND CABLE CO., LTD

型号规格: AAAC 1×150mm<sup>2</sup>

Type and size: AAAC 1×150mm<sup>2</sup>

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计算总截面积: 147.1 mm<sup>2</sup>

Total cross sectional area: 147.1 mm<sup>2</sup>

额定拉断力 (RTS): 41.06 kN

Rated Tensile Strength (RTS) : 41.06 kN

二、 试验依据:

Test standard:

IEC 60287-1-1:2006+AMD1:2014 电缆载流量计算 第 1-1 部分: 载流量公式(100%负荷因数)和损耗计算 一般规定

IEC 60287-1-1:2006+AMD1:2014 Electric cables - Calculation of the current rating - Part 1-1: Current rating equations (100 % load factor) and calculation of losses - General



三、试验设备及试验条件:

Test equipment and conditions

1. 试验条件: 试验是在无风、无日照和自然对流条件下进行

Test condition: no wind、no solar and free convection

试样加热区长度: 10 m

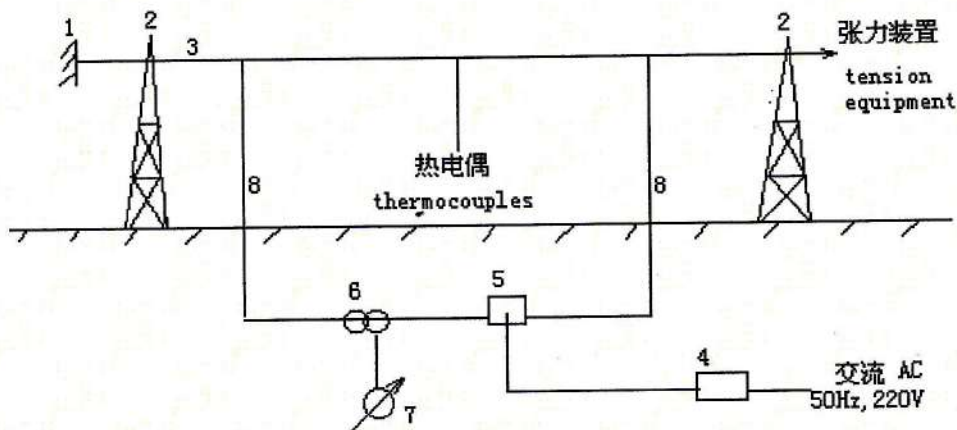
The conductor length of heated partition: 10 m

试样温度测试: 采用 4 根热电偶测温, 取平均值

Specimen temperature test: measure the temperature with 4 thermocouples, get average.

2. 试验设备及布置, 见下图 3-1

Test equipment and test preparation, the layout of specimen is as Fig.3-1



- |                                       |                     |                     |                       |
|---------------------------------------|---------------------|---------------------|-----------------------|
| ① 固定端                                 | ② 铁塔                | ③ 被测试绞线             | ④ 调压器                 |
| Fixed head                            | Steel tower         | stranded conductors | booster               |
| ⑤ 大电流低压变压器                            | ⑥ 电流互感器             | ⑦ 电流表               | ⑧ 连接铜排                |
| heavy current low voltage transformer | current transformer | current-meter       | connecting copper bar |

图 3-1 载流量试验布置图

Fig.3-1 Layout of current carrying capacity test

3. 试验结果:

Test result:

表 3-1 无风、无日照和自然对流条件下载流量试验数据

Table 3-1 The current carrying capacity with no wind, no solar and free convection

绞线温度 °C Conductor temperature	环境温度 °C Ambient temperature	载流量 A Current carrying capacity
51.7	23.9	244
61.6	24.1	282
70.6	24.1	320
80.8	24.1	354
90.9	24.2	385
100.0	24.2	415

四、载流量的理论计算（两种计算参数）

Calculational current carrying capacity (two kinds of parameter)

1. 国内常用计算参数

Usual parameter in China

风速	0.5 m/s
Speed of cross wind	0.5 m/s
日照强度	1000 W/m <sup>2</sup>
Intensity of solar radiation	1000 W/m <sup>2</sup>
绞线表面吸收系数	0.9
Solar absorption coefficient	0.9
绞线辐射系数	0.9
Emissivity with respect to black body	0.9
环境温度	(20~45) °C
Ambient temperature	(20~45) °C
绞线工作温度	(70~100) °C

Operating temperature (70~100) °C

根据国内常用计算参数，载流量计算结果列于表 3-2

The result of current carrying capacity on usual parameter in China is shown in Table 3-2

below

表 3-2 在国内常用计算参数下的载流量

Table 3-2 The current carrying capacity on usual parameter in China

绞线温度 Conductor temperature °C	不同环境温度下的计算载流量 The current carrying capacity at different ambient temperature / A						直流电阻 DC Resistance of strand Ω/km	交流电阻 AC Resistance of strand Ω/km	交直流 电阻比 Ratio of AC to DC resistance
	20°C	25°C	30°C	35°C	40°C	45°C			
70	445	415	384	349	311	267	0.2529	0.2532	1.0014
80	492	466	439	410	379	345	0.2604	0.2607	1.0013
90	533	510	486	461	435	406	0.2678	0.2682	1.0013
100	570	549	527	505	482	457	0.2753	0.2757	1.0012

2. IEC 60287-1-1:2006+AMD1:2014 推荐的计算参数

IEC 60287-1-1:2006+AMD1:2014 commendatory parameter

风速 1.0 m/s

Speed of cross wind 1.0 m/s

日照强度 900 W/m<sup>2</sup>

Intensity of solar radiation 900 W/m<sup>2</sup>

绞线表面吸收系数 0.5

Solar absorption coefficient 0.5

绞线辐射系数 0.6

Emissivity with respect to black body 0.6

环境温度 (20~45) °C

Ambient temperature (20~45) °C

绞线工作温度 (70~100) °C



Operating temperature (70~100) °C

根据 IEC 60287-1-1:2006+AMD1:2014 推荐的计算参数, 载流量计算结果列于表 3-3

The result of current carrying capacity on IEC 60287-1-1:2006+AMD1:2014 commendatory parameter is shown in Table 3-3 below

表 3-3 在 IEC 60287-1-1:2006+AMD1:2014 推荐的计算参数下载流量

Table 3-3 The current carrying capacity on IEC 60287-1-1:2006+AMD1:2014 commendatory parameter

绞线温度 Conductor temperature °C	不同环境温度下的计算载流量 The current carrying capacity at different ambient temperature / A						直流电阻 DC Resistance of strand Ω/km	交流电阻 AC Resistance of strand Ω/km	交直流 电阻比 Ratio of AC to DC resistance
	20°C	25°C	30°C	35°C	40°C	45°C			
70	539	508	474	439	401	359	0.2529	0.2532	1.0014
80	584	557	527	497	464	430	0.2604	0.2607	1.0013
90	624	599	573	545	517	487	0.2678	0.2682	1.0013
100	659	636	612	587	562	535	0.2753	0.2757	1.0012

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