



HVA HD400 MULTIPLE CORE 2POS & 3POS PLUG CONNECTOR
SPECIFICATION

HVA HD400 两位&三位高压多芯线连接器产品规范



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1. SCOPE 适用范围

1.1 Content 内容

TE Connectivity's touch-proof HVA HD400 Multiple Core 2P & 3P Plug connector is designed to meet LV215 specifications, for six kinds of metric wire size (2*2.5mm², 3*2.5mm², 2*4mm², 3*4mm², 2*6mm², 3*6mm² acc. to ISO 6722 class D).

With a 180° cable outlet incorporates the sealed connector system two 4mm Power contacts and an integrated High Voltage Interlock (HVIL) System. The HVA HD400 connector is available for 6 different keying or polarizing configurations and incorporates 360° conductive EMI shields to reduce radiated emissions in the application. The housings are molded in orange to denote a high voltage system.

泰科电子的 HVA HD400 两位&三位防触摸高压多芯线母端连接器，设计符合 LV215 标准，适用符合 6 种公制线径（符合 ISO 6722 class D 的 2*2.5mm², 3*2.5mm², 2*4mm², 3*4mm², 2*6mm², 3*6mm²）。密封连接系统采用 180°出线，两路或三路 4mm 电源连接和一个高压互锁系统。HVA HD400 连接器有六种不同的键位，并采用 360 度导电 EMI 屏蔽以减少应用中的辐射。外壳体采用橙色警示色代表高压系统。

This specification covers the performance, test and quality requirements for TE Connectivity HVA HD400 Multiple Core 2P & 3P Plug connector assembly. (Hereinafter referred to as HVA HD400).

本规范适用于泰科电子 HVA HD400 两位&三位高压多芯线母端连接器(以下简称 HVA HD400) 的性能，测试和质量要求。

1.2 Qualification 鉴定

When tests are performed, the following specifications and standards shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

本测试规范依照下面的规范及标准执行。所有的检验应依照合适的检验计划及产品图纸执行。

2. APPLICABLE DOCUMENTS 适用文件

2.1 Usable document 使用文件

In the event of conflict between the requirements of this specification and the drawing, the product drawing shall take precedent.

In the event of conflict between the requirement of this specification and the referenced documents, this specification shall take precedent.

在本规范的要求与图纸发生冲突时，以产品图纸为准。

在本规范的要求与参考文件发生冲突时，以本规范为准。

2.2 TE specifications 泰科电子规范

TEC-109-1: General requirements for Test Specifications / 测试通用规范

2.3 Other specifications 其他规范

Table 1: Customer drawings / 客户图纸

Header side (Include interface) / 公端(包括应用面板)	
2371113	2POS& 3POS, 4MM, HEADER HSG, ASSY
2349180	DIA. 4MM MALE PIN

1418754	TAB CONTACT 1.2MM
Plug side / 母端	
2349177	DIA. 4MM SOCKET TERMINAL
2392519	2POS & 3POS,4MM, SOC OUTER HSG ASSY, SEALED
2392553	INNER FERRULE
2392554	OUT FERRULE
2392556	SINGLE WIRE SEAL
2392558	CABLE CLIP
2392559	REAR COVER
2392560	SPACER
2392563	INNER HOUSING
2392564	FIXTURE
2392567	TPA ASSY

2.4 Specifications 规范

Table 2: TE-specifications / 泰科规范

Specifications	Description
108-32306	Product Specification 4MM contact system
108-18782	Product Specification MCON1.2 Contact system
108-160599	Product Specification HVA HD400 Multiple Core 2P & 3P Plug connector
114-160038	Application Specification 4MM contact system
114-18464	Application Specification MCON1.2 Contact system
114-160337	Application Specification HVA HD400 Multiple Core 2P & 3P Plug connector
114-160095	Application Specification HVA HD400 2POS & 3POS Header

2.5 Other Specifications 其他规范

Table 3: Other Specifications / 其它规范

Doc number	Edition	Standard: Title, Author
DIN 40050-9	1993-05	Degrees of protection (IP-Code) - Protection of electrical equipment against foreign objects, water and access
ISO 20653	2006-08	Road vehicles – Degrees of protection (IP Code) - Protection of electrical equipment against foreign objects, water and access

ISO 16750-3	2001-01	Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Mechanical loads
SAE J 1742	2005-12	Connections for High Voltage On-Board Road Vehicle, Electrical Wiring Harnesses Test Methods and General Performance Requirements
LV 214	2010-03	Test specification for motor vehicle connectors
LV 215	2013-03	Electrical/Electronic Requirements of HV Connectors
LV 215	2016-11	Electrical/Electronic Requirements of HV Connectors
USCAR-2-6	2013-02	Performance Specification for Automotive Electrical Connector Systems
DIN EN 60664-1	2008-01	Isolation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests

3. REQUIREMENT 要求

3.1 Design and Construction 设计和结构

Products must meet the design, construction and physical dimensions specified in the applicable product drawings.

产品必须满足产品图纸上的设计，结构和尺寸要求。

3.2 Material 材料

Description of the material sees the related product drawings.

材料描述见相关产品图纸。

3.3 Test parameters and tolerances 测试参数与公差

Table 4: Test parameters and tolerances

Requirement 要求	Tolerance 公差
Ambient temperature 环境温度	23°C ± 5°C
Relative humidity 相对湿度	45% to 75%
Atmospheric pressure 大气压力	100kPa ± 10kPa

3.4 Ratings 等级

Table 5: Product Ratings / 产品等级

Description	Range
Max. Voltage according to DIN EN 60664-1	≤ 1000VDC
Voltage class acc. ISO 6469-3	B

Dielectric withstand voltage	3000VAC
Insulation resistance acc. ISO 6469-3, SAE J 1742	> 200MΩ
Isolation Group I acc. DIN EN 60664-1	CTI ≥ 600
Pollution degree acc. DIN EN 60664-1	2
Ambient temperature	-40°C to 140°C
Degrees of protection (IP-Code) against access acc. ISO 20653 (Unmated condition)	IPXXB
Degrees of protection (IP-Code) against foreign objects and water acc. ISO 20653 (Mated condition)	IP6K9K IPX8: 1M depth, 48H
Color of plastic housing	Orange (RAL 2003)
Durability mating cycle	Ag : 50 cycle SnAg : 20 cycle

3.5 General Performance and Test description 通用性能和试验描述

The product is designed to meet the electrical, mechanical and environmental performance requirements specified in table 6 and table 7. All testes must be performed at the test condition of the TE test specification TEC-109-1 unless otherwise specified.

产品应能满足表 6 和表 7 中的电气，机械和环境等性能要求。所有试验均需按照 TE 规范 TEC-109-1 中的测试条件进行，除非另有说明。

3.6 Tests requirement and method summary 测试要求及方法

Mainly test procedures are shown as table below, please check LV215 / Nov. 2016, LV214 / March 2010 for more details.

主要步骤如下表所示,更多细节请查询 LV215 (2016.10), LV214 (2010.03).

Table 6: Test Requirements and Procedures Summary / 测试要求及方法

Test Description	Requirement	Procedure
PG0 INSPECTION OF RECEIVING INSPECTION		
E 0.1 Visual inspection	No Defect	LV215-2
E 0.2 Contact resistance	Contact (total resistance including crimp connection): - Contact ≤ 1.17mΩ (2.5mm²) - Contact ≤ 0.72mΩ (4mm²) - Contact ≤ 0.68mΩ (6mm²) - HVIL ≤ 15mΩ - Shield cable – aggregate ≤ 10mΩ	LV215-2

E 0.3 Insulation resistance	• Every HV potential to each other • Every HV potential to shielding • Every HV potential to HVIL $R > 200 \text{ M}\Omega$ at $V = 1000 \text{ V DC}$, $t = 60 \text{ s}$ • Shielding to HVIL $R > 100 \text{ M}\Omega$ at $V = 500 \text{ V DC}$, $t = 60 \text{ s}$	LV215-2
E 0.4 Dielectric strength	• Every HV potential to each other • Every HV potential to shielding • Every HV potential to HVIL Leakage current $< 10 \text{ mA}$ at $V=3000 \text{ V AC}$, $t=60 \text{ s}$	LV215-2
PG 4 CONTACT OVERLAPPING		
E 4.1 Contact engagement length	Values see appendix 5.3	Theoretical study
PG 6 INTERACTION BETWEEN CONTACT AND HOUSING		
E 6.1 Deflection of contacts in the housing cavity	No damage during joining	Theoretical study
B 6.1 Drop test	Drop test from 1m height; No damages or impairments of function	LV215-2
PG7 HANDING AND FUNCTIONAL RELIABILITY OF THE HOUSINGS		
E 7.1 Error-proof design of housings	Coding/Polarization test load: 150N	LV215-2
E 7.2 Retention force of the housing latch/lock	Retention force of the housing latch mechanism/housing interlock: $> 100 \text{ N}$	LV215-2
E 7.3 Functionality of CPA	Actuation force to close: 5-30N Actuation force to open: 5-30N CPA efficiency: $> 80 \text{ N}$	LV215-2
E 7.4 Insertion force or actuation force for insertion and extraction aids	Insertion or actuation force: • $\leq 75 \text{ N}$ (2POS) • $\leq 100 \text{ N}$ (3POS)	LV215-2
PG 8 MATING AND RETENTION FORCE OF CONTACT PARTS		
E 8.1 Inner housing insertion forces in outer housing	Document data	LV215-2
E 8.2 Inner housing holding force from outer housing	Inner housing holding force $> 200 \text{ N}$	LV215-2

PG 11 MATING CYCLES		
B 11.1 Mating cycles	Connector with HVIL 50 cycles is for Ag plating terminal. 20 cycles is for SnAg plating terminal. Insertion and actuation force: • $\leq 75\text{N}$ (2POS) • $\leq 100\text{N}$ (3POS)	LV215-2
PG 13 HOUSING INFLUENCE ON THE DERATING		
E 13.2 Derating with housing	Dependent on application and cable type different values are possible Max. temperature at contacts 150°C Derating see appendix 5.1	LV215-2
PG 17 DYNAMIC LOAD		
B 17.2 Dynamic Load Broad-band random	Severity 3: "Applications close to the engine"; Details see appendix 5.2 Resistances after testing • Contact $\leq 1.36\text{m}\Omega$ (6mm^2) • HVIL-contact $\leq 15\text{m}\Omega$ • Shielding cable – header shield $< 7\text{m}\Omega$	LV215-2
PG 18C DICING SALT LOAD		
B 18.2 Salt spray, cyclic	Resistances after salt spray test, not sealed • Contact $\leq 2.34\text{m}\Omega$ (2.5mm^2) • Contact $\leq 1.44\text{m}\Omega$ (4mm^2) • Contact $\leq 1.36\text{m}\Omega$ (6mm^2) • HVIL-contact $\leq 15\text{m}\Omega$ • Shielding cable – aggregate $< 10\text{m}\Omega$	LV215-2
B23.1 Immersion with vacuum	Each pressure states -10 kPa, holding time 5 min -50 kPa, holding time 5 min	LV215-2
E 0.3 Insulation resistance	Resistance after testing, • Every HV potential to each other • Every HV potential to shielding • Every HV potential to HVIL $R > 200\text{ M}\Omega$ at $V = 1000\text{ V DC}$, $t = 60\text{ s}$ • Shielding to HVIL $R > 100\text{ M}\Omega$ at $V = 500\text{ V DC}$, $t = 60\text{ s}$	LV215-2

PG19 ENVIRONMENTAL SIMULATION		
B 19.1 Temperature shock	Duration: 144 cycles Temperature: - 40°C /140°C per 15min	LV215-2
B 19.2 Temperature cycle	Duration: 20 cycles Temperature: - 40°C /140°C per 3h	LV215-2
B 19.3 Aging in dry heat	Duration: 120h Temperature: 140°C	LV215-2
B 19.5 Humid heat, cyclic	Relative humidity: 95% constant Duration: 10cycles of 24h each Temperatures: 25°C / 55°C	LV215-2
E 0.3 Insulation resistance	$R \geq 50\text{M}\Omega$ at $V = 1000\text{ V DC}$, $t = 60\text{ s}$	LV215-2
E 0.2 Contact resistance	After testing - Contact $\leq 2.34\text{m}\Omega$ (2.5mm^2) - Contact $\leq 1.44\text{m}\Omega$ (4mm^2) - Contact $\leq 1.36\text{m}\Omega$ (6mm^2) - HVIL- contact $< 15\text{m}\Omega$ - Shielding cable – header shield $< 7\text{m}\Omega$	LV215-2
PG 20 CLIMATIC LOAD OF HOUSINGS		
B 20.1 Dry heat	Dry heat 120h / 140°C	LV215-2
B 20.2 Damp heat	- Duration: 10days, Temperature: 40°C Relative humidity: 95% - Insulation resistance after testing Every HV potential to each other Every HV potential to shielding Every HV potential to HVIL $R > 200\text{ M}\Omega$ at $V = 1000\text{ V DC}$, $t = 60\text{ s}$ Shielding to HVIL $R > 100\text{ M}\Omega$ at $V = 500\text{ V DC}$, $t = 60\text{ s}$	LV215-2
B 20.3 Climatic cold	Climatic cold 48h / -40°C Extracting and inserting at -20°C	LV215-2
B 20.1 Dry heat	Dry heat 48h / 80°C	LV215-2
B 6.1 Drop test after aging	Drop test from 1m height; No damages or impairments of function	LV215-2

PG 21 LONG-TERM AGING		
B 21.1 Long-term aging in dry heat	1000h at 140°C; Resistances after aging: - Contact $\leq 2.34\text{m}\Omega$ (2.5mm²) - Contact $\leq 1.44\text{m}\Omega$ (4mm²) - Contact $\leq 1.36\text{m}\Omega$ (6mm²) - HVIL-Contact $\leq 15\text{m}\Omega$ - Shielding cable – aggregate < 10mΩ	LV215-2
PG 22B CHEMICAL RESISTANCE		
B 22.1B Resistance to chemicals	The DUTs must be exposed to the media (No Biodiesel and No battery) and aged for 48 h at the required aging temperature. Insulation resistance > 100M Ω	LV215-2
PG 23 WATER - TIGHTNESS		
B 19.3 Aging in dry heat	120h at 140°C	LV215-2
B 19.1 Temperature shock	Duration: 144 cycles Temperature: -40°C / +140°C per 15min	LV215-2
B 23.1 Immersion with pressure difference	The specified hold times apply once the required pressure values (1.-4.) are maintained. Medium: Low surface-tension 5% NaCl solution 1. Normal pressure 2. -10 kPa, holding time 5min 3. -50 kPa, holding time 5min 4. Normal pressure Pressure change: 10 kPa/min	LV215-2
B 23.2 Cable movement during Immersion with pressure difference	Movement profile: a) Deflection of the cable bundle by 100mm (final position) at 100mm from the SWS. b) Hold for 10s. c) Deflection to the opposite final position. d) Hold for 10s.	LV215-2
B 23.3 Thermal shock test	30min. in 120°C air; 15min in 0°C Water. 5 cycles	LV215-2
B 23.4 High pressure spray	Severity: IP X9K Test duration per side: 15s Distance from DUT to nozzle: 10-15cm Pressure: 80 bar Temperature: 80°C	LV215-2

E 0.3 Insulation resistance	Resistance after testing, • Every HV potential to each other • Every HV potential to shielding • Every HV potential to HVIL R > 200 MΩ at V = 1000 V DC, t = 60 s • Shielding to HVIL R > 100 MΩ at V = 500 V DC, t = 60 s	LV215-2								
PG49B Water tightness after dust load										
B49 Imperviousness to dust	Test duration: 20 cycles 20 minutes each	ISO 20653								
B23.1 Immersion with pressure difference	The specified hold times apply once the required pressure values (1.-4.) are maintained. Medium: Low surface-tension 5% NaCl solution 1. Normal pressure 2. -10 kPa, holding time 5min 3. -50 kPa, holding time 5min 4. Normal pressure Pressure change: 10 kPa/min	LV215-2								
E0.3	Insulation resistance after testing • Every HV potential to each other • Every HV potential to shielding • Every HV potential to HVIL R > 200 MΩ at V = 1000 V DC, t = 60 s • Shielding to HVIL R > 100 MΩ at V = 500 V DC, t = 60 s	LV215-2								
PG 50 EMC – ELECTROMAGNETIC COMPATIBILITY										
PG 50 EMC- Electromagnetic compatibility	<table><tr><td>Frequency</td><td>Delta-Transfer impedance</td></tr><tr><td>DC</td><td>< 10mΩ</td></tr><tr><td>2MHz</td><td>< 10mΩ</td></tr><tr><td>30MHz</td><td>< 50mΩ</td></tr></table>	Frequency	Delta-Transfer impedance	DC	< 10mΩ	2MHz	< 10mΩ	30MHz	< 50mΩ	LV 215-2
Frequency	Delta-Transfer impedance									
DC	< 10mΩ									
2MHz	< 10mΩ									
30MHz	< 50mΩ									
PG 51 IP PROTECTION OPEN CONNECTOR										
PG51 Protection open connector	IP-Protection IPXXB, un-mated (VDE test finger Ø12mm) IP-Protection IPXXD, mated	ISO 20653								

3.7 Additional Test Procedures and Test Results 附加的测试方法和结果

Table 7: Additional test requirements

Test Description	Requirement	Procedure
A1 Cable clip Insertion force and Retention force further connector parts	Cable clip insertion force $\leq 75\text{N}$ Cable clip retention force $\geq 110\text{N}$	USCAR-2, Section 5.4.5
A2 Degree of protection test / pressure washer test IPX8	Depth: 1m, duration time: 48H	ISO 20653
A3 Ferrule retention force	For $2 \times 2.5\text{mm}^2$, $3 \times 2.5\text{mm}^2 \geq 150\text{N}$ For $2 \times 4\text{mm}^2$, $3 \times 4\text{mm}^2 \geq 200\text{N}$ For $2 \times 6\text{mm}^2$, $3 \times 6\text{mm}^2 \geq 300\text{N}$	TE-Spec. 109-18212

4. QUALITY 质量

4.1 Qualification test 鉴定

Samples must be in accordance with drawings and be taken in a random way in the production in progress.

样件必须与产品图纸一致，并且是生产过程中随机选取的。

4.2 Requalification test 重新鉴定

If changes significantly affecting form, fit, or function are made to the product or to the manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by product engineering.

如果产品或者制造过程中有显著影响外观，装配和功能的设变，质保需要协调按照原先工程部定义的测试顺序，重新验证全部或者部分测试项目。

4.3 Acceptance 验收

Acceptance is based on verification that the product meets the requirements of section 3.6. Failures attributed to equipment, test setup, or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken, and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmitted.

归咎于测试设备，样件安装或者操作员的失误的失效不应判定产品不合格。当产品失效发生时，需要有纠正措施以及重新提交样件进行验证。在重新验证前，需确认已有纠正措施。

4.4 Quality conformance inspection 质量合格检验

The applicable TE Connectivity quality inspection plan will specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification

TE Connectivity 的质量检验计划将指定适用的质量标准。尺寸和功能要求，应按照适用的产品图纸和本规范。

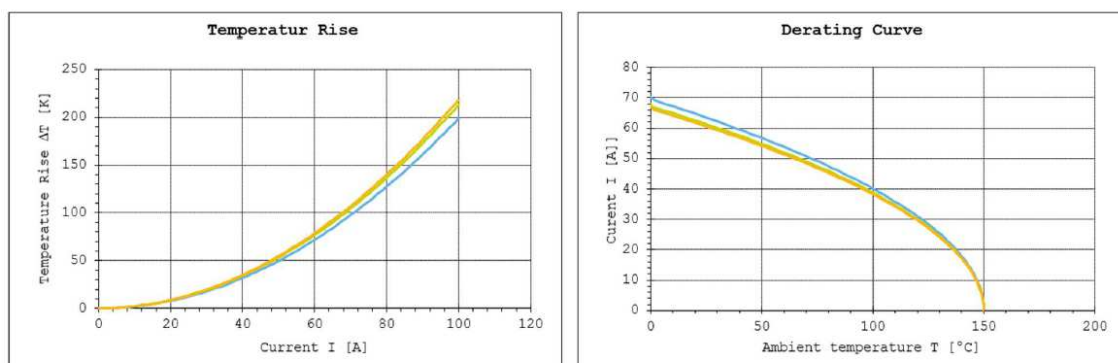
5. APPENDIX 附件

5.1 Derating inside housing 成品温升降额曲线

Derating and temperature rise, derating inside housing (80% characteristic)

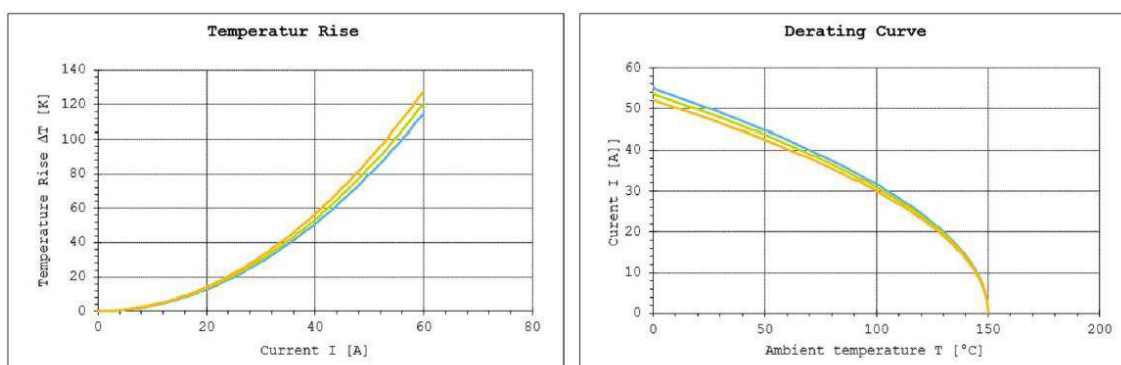
- Current at contact and shield:

➤ Curve G1 3Pos – 6mm²



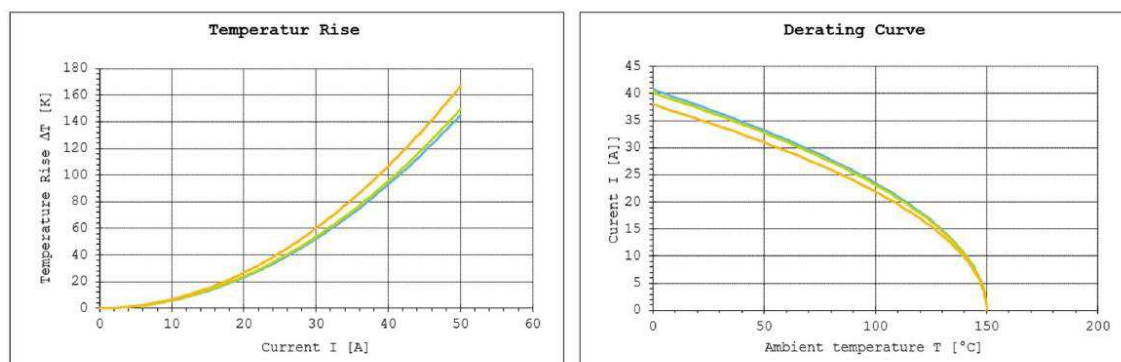
Remark: — Shielding I = 0A — Shielding I = 10A — Shielding I = 20A

➤ Curve G2 3Pos – 4mm²



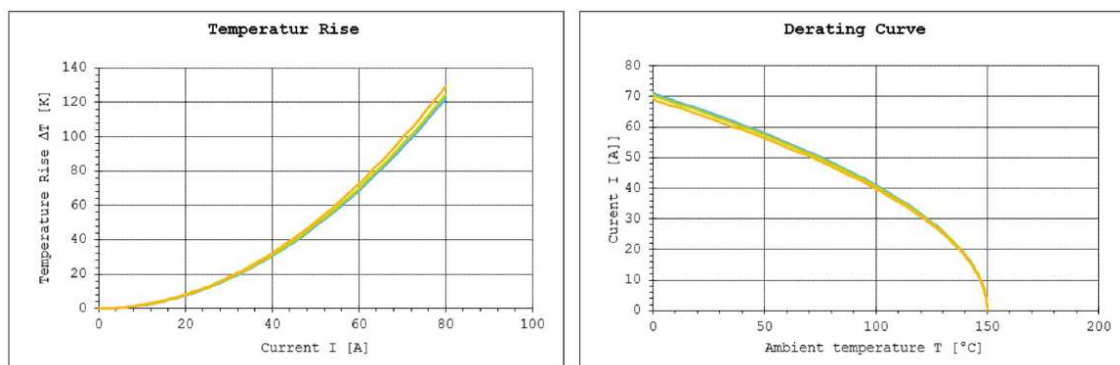
Remark: — Shielding I = 0A — Shielding I = 10A — Shielding I = 20A

➤ Curve G3 3Pos – 2.5mm²



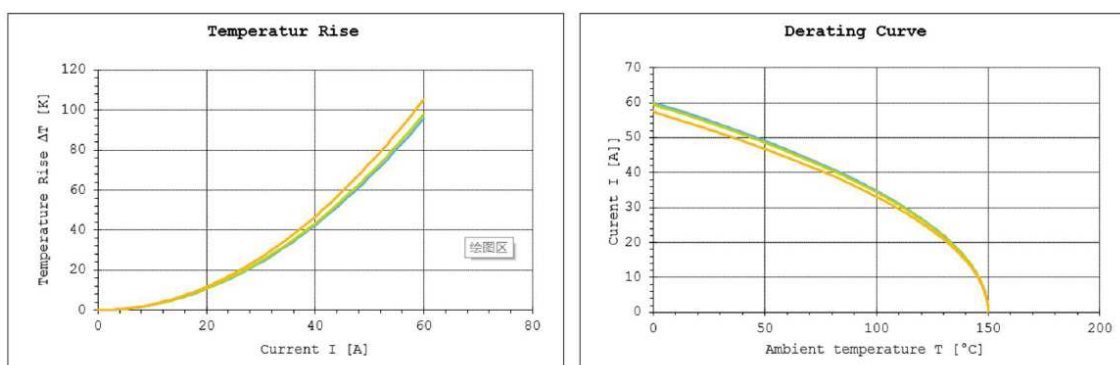
Remark: — Shielding I = 0A — Shielding I = 10A — Shielding I = 20A

➤ **Curve G4 2Pos – 6mm²**



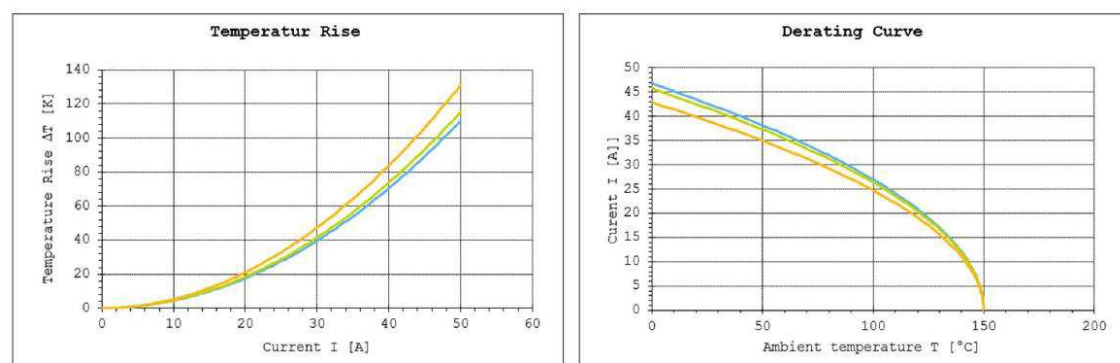
Remark: — Shielding I = 0A — Shielding I = 10A — Shielding I = 20A

➤ **Curve G5 2Pos – 4mm²**



Remark: — Shielding I = 0A — Shielding I = 10A — Shielding I = 20A

➤ **Curve G6 2Pos – 2.5mm²**



Remark: — Shielding I = 0A — Shielding I = 10A — Shielding I = 20A

5.2 Dynamic load (LV215 S3 T4) 振动性能 (LV215 S3 T4)

Dynamic load acc. LV215 (released 2016-09)

Design of vibration device (see figure1)

H&S RADOX shield cable 3*6mm² shield cable, cable length 500mm

Wire fastening distance is 200mm+250mm

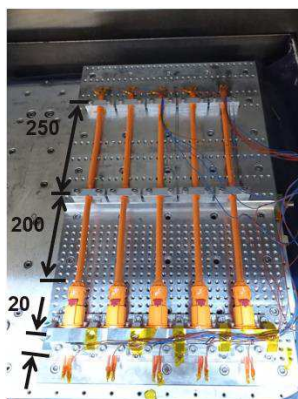


Figure 1: Vibration device (exemplary view)

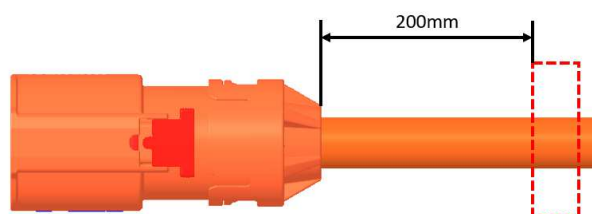
5.3 Contact engagement length 端子接触长度

A	Contact overlap – Power contact	电源端子	≥ 1mm
B	Contact overlap – HVIL contact	高压互锁端子	≥ 1mm
C	Contact overlap – Shield contact	屏蔽接触	≥ 1mm

5.4 Strain Relief 应力释放

System is validated with strain relief at 200mm. Each application has to be evaluated independently with regards to the external influences on the system. Having strain relief, which moves with the connector body, close to the end of the connector will have a positive influence on the performance of the connector. Have strain relief further from the end of the connector or that moves independent of the connector body will have a negative influence on the performance of the connectors.

系统通过 200mm 的应变消除进行验证。每个应用都必须独立评估对系统的外部影响。随连接器主体移动的压力释放，接近连接器的末端将对连接器的性能产生积极影响。应变释放离连接器的末端更远或者连接器主体晃动将对连接器的性能产生负面影响。



REV	DESCRIPTION CHANGE	RESPONSIBLE	DATE
A	New document	Z.C	10NOV2022
A1	Modify the mating cycles	S.W	07OCT2023