

VolTron 1000 Connector

1. Introduction

1.1 Purpose

This test has been performed representatively for the entire VolTron 1000 connector family for use in high voltage application. Tested with the smallest (2-pin) and the largest (6-pin) variant according to 108-94917 Rev. B.

Two types of male parts, the angled and straight as well as female parts have been tested, including both black and orange encoding. And the female connectors are assembled with cable AWG22.

1.2 Scope

This test covered the electrical, mechanical and environmental performance of all VolTron 1000 Connector. The qualification test was performed from 2024/08/06 to 2024/11/14.

1.3 Conclusion

Based on the test results, the parts in the sample list meet the performance requirements of Product Specification, 108-94917 Rev B.

1.4 Product information

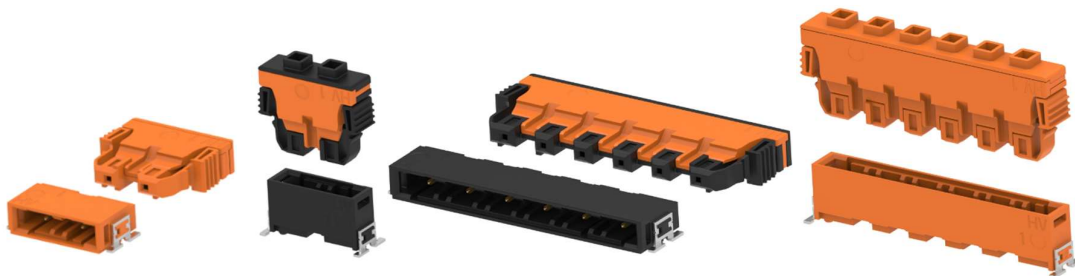


Fig.1 VolTron Product family

The product family of VolTron, as below table shown.

Part No.	Description	Wire
524191-E 544950-E	Female connector 2-pin black encoding, 6.2 SRC-A crimp	464763-E AWG22 (7x0.25)
524192-E 544951-E	Female connector 2-pin orange encoding, 6.2 SRC-A crimp	464763-E AWG22 (7x0.25)
524197-E 544956-E	Female connector 5-pin black encoding, 6.2 SRC-A crimp	464763-E AWG22 (7x0.25)
524198-E 544957-E	Female connector 5-pin orange encoding, 6.2 SRC-A crimp	464763-E AWG22 (7x0.25)

524200-E 544958-E	Female connector 6-pin black encoding, 6.2 SRC-A crimp	464763-E AWG22 (7x0.25)
524201-E 544959-E	Female connector 6-pin orange encoding, 6.2 SRC-A crimp	464763-E AWG22 (7x0.25)
524226-E	Male connector 2-pin black encoding, 6.2 SRC-A SMT angled	N/A
524227-E	Male connector 2-pin orange encoding, 6.2 SRC-A SMT angled	N/A
524232-E	Male connector 5-pin black encoding, 6.2 SRC-A SMT angled	N/A
524233-E	Male connector 5-pin orange encoding, 6.2 SRC-A SMT angled	N/A
524235-E	Male connector 6-pin black encoding, 6.2 SRC-A SMT angled	N/A
524236-E	Male connector 6-pin orange encoding, 6.2 SRC-A SMT angled	N/A
524255-E	Male connector 2-pin black encoding, 6.2 SRC-P SMT straight	N/A
524256-E	Male connector 2-pin orange encoding, 6.2 SRC-P SMT straight	N/A
524261-E	Male connector 5-pin black encoding, 6.2 SRC-P SMT straight	N/A
524262-E	Male connector 5-pin orange encoding, 6.2 SRC-P SMT straight	N/A
524264-E	Male connector 6-pin black encoding, 6.2 SRC-P SMT straight	N/A
524265-E	Male connector 6-pin orange encoding, 6.2 SRC-P SMT straight	N/A

Note: Crimped contact 464763-E and 464762-E are same, with different packing of quantity.

2. Test Group

All of test items as below table shown, detail shown in specification 108-94917 Rev. B

Test Group & items	
Performed Test or Analysis: - TG 0 Inspection of as-received condition - USCAR 32 Dielectric strength - TG 1 Dimension - TG 4 Contact overlap (Theoretical proof) - TG 5 Mechanical and thermal relaxation behavior - TG 6 interaction between contact and housing - TG 7 Handling and functional reliability of the housings - TG 8 Insertion and holding forces of the contact parts in the contact housing - TG 9 Pin insertion angle/mis-use proofing (Theoretical proof) - TG 10 Contact: conductor pull-out strength - TG 11 Contacts: insertion and removal forces, number of mating cycles - TG 13 Housing influence on the derating - TG 14 Thermal time constant - TG 15 Electrical stress testing - TG 17 Dynamic loading - TG 19 Environmental simulation - TG 20 Climate load of the housing - TG 21 Long-term temperature aging - TG 22A Resistance to chemicals	

3. Test Result

Overview of all performed tests and result as below table shown.

Test Group	Requirement	Performed	Result	
			2-pin	6-pin
TG 0	Inspection of as-received condition	yes	passed	passed
USCAR 32	Dielectric strength	yes	passed	passed
TG 1	Dimensions	yes	passed	passed
TG 4	Contact overlap (Theoretical proof)	Theoretical	passed	passed
TG 5	Mechanical and thermal relaxation behavior	yes	passed	passed
TG 6	Interaction between contact and housing	yes	passed	passed
TG 7	Handling and functional reliability of the housings	yes	passed	passed
TG 8	Insertion and holding forces of the contacts parts in the contact housing	yes	passed	passed
TG 9	Pin insertion angle/misuse-proofing (scoop-proofing)	Theoretical	passed	passed
TG 10	Contacts: conductor pull-out strength	yes	passed	passed
TG 11	Contacts: insertion and removal forces, number and of mating cycles	yes	passed	passed
TG 13	Housing influence on the derating	yes	passed	passed
TG14	Thermal time constant		passed	passed
TG 15	Electrical stress testing	yes	passed	passed
TG 17	Dynamic loading	yes	passed	passed
TG 19	Environmental simulation	yes	passed	passed
TG 20	Climate load of the housing	yes	passed	passed
TG 21	Long-term temperature aging	yes	passed	passed
TG 22A	Resistance to chemicals	yes	passed	passed

4. Test Data

The test performed based on LV214 & USCAR-37, detail as the below table shown.

Group	Sequence	Test item	Requirements	Test data	Result
TG0	1	Contact resistance	100 mA Max. and 20 mV Max. monitor contact resistance: $R = R_C + 2 \times R_{CA} : 15 \text{ m}\Omega \text{ Max.}$	2.5m Ω Max	Pass
	2	Insulation resistance	V = 500 V, t = 60 s, insulation resistance: 100 M Ω Min. V = 1000 V, t = 60 s, insulation resistance: 200 M Ω Min.	46.71 G Ω Min.	Pass
	3	Dielectric strength	Neither creeping discharge nor flashover shall occur. leakage current < 10mA 2150 V DC, 60 s -VW80303 4800 V DC, 60 s -USCAR37	0.01 mA Max.	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG1	1	Dimension	Comply with drawings and specification	-	-

Group	Sequence	Test item	Requirements	Test data	Result
TG4	1	Contact overlap	Primary- and secondary locking: Contact overlap $\geq 1 \text{ mm}$ (Theoretical CAD)	See Fig.2	For Reference

Group	Sequence	Test item	Requirements	Test data	Result
TG5	1	Mechanical and thermal relaxation behavior	Document the normal force	See Fig.3	For Reference

Group	Sequence	Test item	Requirements	Test data	Result
TG6	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Function of the primary lock/latch	The primary locking must latch with an audible click and checked by pulling ($\leq 10\text{N}$)	Audible click. Pulling force $\leq 10 \text{ N}$	Pass
	3	Function of the secondary lock/latch	Only lock the secondary locking device after all contacts are correctly positioned and locked in the contact housing cavity.	Second lock closed after contact insert to correct position	Pass
	4	Drop test	The secondary locking latching position must not open. after drop test	latching position was not open	Pass
	5	Actuation force for secondary lock	Dis-engage the secondary locking device from the housing, at Rate $\leq 50 \text{ mm/min}$: $F_O = 10\sim 50\text{N}$	2-pin: 10~17N 6-pin: 20~30N	Pass
			Engage the secondary locking device from the housing, at Rate $\leq 50\text{mm/min}$: $F_C < 75 \text{ N}$	2-pin: 7N Max 6-pin: 12N Max	

Group	Sequence	Test item	Requirements	Test data	Result
TG7	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Distinctiveness of the unequipped contact housing	Apply mis-mating force (80 N) without damage to the connector at Rate $\leq$ 50mm/min	No physical damage	Pass
	3	Holding force of the contact housing latching/locking	Maximum force on the first displacement millimeter. 2-pin: $F > 60$ N 6-pin: $F > 80$ N	2-pin: 78~114 N 6-pin: 82~125 N	Pass
	4	Insertion force for insertion and extraction aids	Insertion/extraction force of fully equipped contact housings: ≤ 75 N	2-pin: $F_{in} = 6\sim 15$ N $F_{ex} = 1\sim 2$ N 6-pin: $F_{in} = 12\sim 22$ N $F_{ex} = 3\sim 7$ N	Pass
	5	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG8	1	Insertion and holding forces of the contact parts in the contact housing	Contact insertion force: $F_{in} \leq 6.0$ N	2pin: 4.5N Max 6pin: 5.6N Max	Pass
	2		Pull out strength, primary locking device only: $F_{primary} > 30$ N	2pin: 34N Min 6pin: 34N Min	Pass
	3		Pull out strength, secondary locking device only: $F_{secondary} > 30$ N	2pin: 40N Min 6pin: 45N Min	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG9	1	Pin insertion angle/misuse-proofing (scoop-proofing)	Theoretical CAD	Detail as fig.3	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG10	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Conductor pull-out strength	Rate = 100 mm/min pull-out strength ≥ 50 N	75.5 ~ 84.0 N	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG11	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Contact opening dimension	Meets requirements of product drawing	Meet	Pass
	3	Insertion and extraction force	Measure the force of the contact insert and extract from the housing	Insertion force: 1.00~1.7 N Extraction force: 0.5~1.2 N	Pass
	4	Number of cycles	100 mating cycle	-	-
	5	Contact opening dimension	Meets requirements of product drawing	Meet	Pass
	6	Insertion and extraction force,	the insertion force changes compared to the initial value: $\leq 25\%$	Insertion force: 0.9~1.8 N Extraction force: 0.4~1.5 N Insertion force change rate: 21% Max	Pass
	7	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG13	1	Derating, with housing	Monitor the contact electrical temperature between the PIN and terminal and calculate the derating current when the current gradually increases to the required temperature point	2-pin derating curve: 10.8 A at 80 °C 6PIN derating curve: 9.3 A at 80 °C Detail see Fig. 4	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG14	1	Thermal time constant	N times (x1;x2,x3;x4;x5)	See diagram thermal time constant, Fig.5	For Reference

Group	Sequence	Test item	Requirements	Test data	Result
TG15	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Durability	inserted and extracted 2 times	No physical damage	Pass
	3	Contact opening dimension	Meets requirements of product drawing (drawing conformity)	Meet	Pass
	4	Volume resistance	100 mA Max. and 20 mV Max. monitor contact resistance: $R = R_C + 2 \times R_{CA} : 15 \text{ m}\Omega \text{ Max.}$	3mΩ Max	Pass
	5	Derating	Ambient temperature $\leq 150 \text{ }^{\circ}\text{C}$ to draw a derating curve Current at 80 °C (from TG13) Condition: W/O housing	-	-
	6	Current cycle	Number of cycles: 60 Power curve: Sequence 5 $T_{\text{max}}: 150 \text{ }^{\circ}\text{C}$	-	-
	7	Damp heat, cyclic	Number of cycles: 21 d (1 d = 1 cycle) Relative humidity: 95% $T_L = 25 \text{ }^{\circ}\text{C}, T_U = 55 \text{ }^{\circ}\text{C}$	-	-
	8	Current cycle	Number of cycles: 60 Current at 80 °C (from TG13) $T_{\text{max}}: 150 \text{ }^{\circ}\text{C}$	-	-
	9	Volume resistance	100 mA Max. and 20 mV Max. monitor contact resistance: $R = R_C + 2 \times R_{CA} : 15 \text{ m}\Omega \text{ Max.}$	3.5 mΩ Max	Pass
	10	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG17	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Volume resistance	100 mA Max. and 20 mV Max. monitor contact resistance: $R = R_C + 2 \times R_{CA} : 15 \text{ m}\Omega \text{ Max.}$	2.5 m Ω Max	Pass
	3	Resonance	Dynamic load, sinusoidal Dwell time: 1 oct./min Acceleration: 10m/s ² Frequency: 5Hz-2000Hz-5Hz	No obvious damage or deformation	Pass
	4	Random vibration Severity 2	Test direction: X Y Z axis Test duration: 20 h per axis, RMS value of acceleration: 27.8 m/s ² Current interruption: <1 000 ns.	Current interruption: <1 000 ns.	Pass
	5	Examination of product	No physical damage	No obvious damage or deformation	Pass
	6	Mechanical shock	Acceleration velocity: 30 g Waveform: half sine Duration: 6 ms Number of shocks: 1 000 times per axis, total: 6 000 Current interruption: <1 000 ns.	Current interruption: <1 000 ns.	Pass
	7	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	8	Volume resistance	100 mA Max. and 20 mV Max. monitor contact resistance: $R = R_C + 2 \times R_{CA} : 15 \text{ m}\Omega \text{ Max.}$	3.3m Ω Max	Pass
	9	Resonance	Dynamic load, sinusoidal Dwell time: 1 oct./min Acceleration: 10m/s ² Frequency: 5Hz-2000Hz-5Hz	No obvious damage or deformation	Pass

Group	Sequence	Test item	Requirements	Test Data	Result
TG19	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Volume resistance	100 mA Max. and 20 mV Max. monitor contact resistance: $R = R_C + 2 \times R_{CA} : 15 \text{ m}\Omega \text{ Max.}$	4.6 m Ω Max	Pass
	3	Durability	The DUTs are inserted and extracted: 50cycles	-	-
	4	Temperature shock	Duration: 144 cycles Temperature: -40 °C / T _{max} 150 °C per 15 min Acclimatization period: 10s Max.	-	-
	5	Temperature change	Duration: 20 cycles Temperature: -40 °C / T _{max} 150 °C per 3 h Time for temperature change: 2 h Max.	-	-
	6	Aging in dry heat	Duration: 120 h Temperature: 150 °C	-	-
	7	Industrial climate	Industrial climate including: 0.2 ppm SO ₂ , 0.01 ppm H ₂ S, 0.2 ppm NO ₂ , 0.01 ppm Cl ₂ Volumetric flow rate: 1 m ³ /h At 25 °C and 75% relative humidity for 21d	-	-

	8	Damp heat, cyclic	Number of cycles: 10 cycles per 24 h Relative humidity: 95% constant $T_L = 25\text{ }^{\circ}\text{C}$, $T_U = 55\text{ }^{\circ}\text{C}$	-	-
	9	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	10	Dynamic load	Broadband noise 6 h per axis RMS value of acceleration: 13.9 m/s^2	-	-
	11	Individual shock	Acceleration: 30 g Individual shock duration: 6 ms, sinusoidal half-wave Number of shocks: 50 per spatial axis	-	-
	12	Durability	One-time extraction and insertion	-	-
	13	Volume resistance	100 mA Max. and 20 mV Max. monitor contact resistance: $R = R_C + 2 \times R_{CA} : 15\text{ m}\Omega$ Max.	6.3 m Ω Max	Pass
	14	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG20	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Insulation resistance	$V = 500\text{ V}$, $t = 60\text{ s}$, $R_{\text{isol}}: 100\text{ M}\Omega$ Min.	$R_{\text{isol}} > 50\text{ G}\Omega$	Pass
	3	Dry heat	Duration: 120 h Temperature: $150\text{ }^{\circ}\text{C}$	No obvious damage or deformation	Pass
	4	Damp heat, constant	Duration: 10 d Temperature: $40\text{ }^{\circ}\text{C}$ Relative humidity: 95%	-	-
	5	Insulation resistance	$V = 500\text{ V}$, $t = 60\text{ s}$, $R_{\text{isol}}: 100\text{ M}\Omega$ Min.	$R_{\text{isol}} > 50\text{ G}\Omega$	Pass
	6	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	7	Low-temperature	Duration: 48 h Temperature: $40\text{ }^{\circ}\text{C}$	-	-
	8	Extracting and inserting	Extracting and inserting at $-20\text{ }^{\circ}\text{C}$ No obvious damage to appearance	No obvious damage or deformation	Pass
	9	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	10	Dry heat	Duration: 48 h Temperature: $80\text{ }^{\circ}\text{C}$	-	-
	11	Drop test in unplugged state	Rotation speed: 3 rpm Number of rotations: 30 No function-impairing damage Locks must not open	No functional damage Lock was not opened	Pass
	12	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass

Group	Sequence	Test item	Requirements	Test data	Result
TG21	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Volume resistance	100 mA Max. and 20 mV Max. monitor contact resistance: $R = R_C + 2 \times R_{CA} : 15 \text{ m}\Omega \text{ Max.}$	3.7 m Ω Max	Pass
	3	Dry heat	Duration: 1 000 h Temperature: $T_{\text{max}} 150 \text{ }^{\circ}\text{C}$ Subsequent aging: 48 h at RT	No obvious damage or deformation	Pass
	4	Volume resistance	100 mA Max. and 20 mV Max. monitor contact resistance: $R = R_C + 2 \times R_{CA} : 15 \text{ m}\Omega \text{ Max.}$	3.4 m Ω Max	Pass
	5	Cycling	Number of cycles: 5	No obvious damage or deformation	Pass
	6	Drop test	Rotation speed: 3rpm Number of rotations: 30 No functional impairment on the housings after test	Secondary locking device is not open	Pass
	7	Contact retention forces	$F_{\text{Hold}} \geq 55 \text{ N}$	60N Min	Pass
	8	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass

Group	Sequence	Test item	Requirements	Test data	Result
22A	1	Examination of product	Meets requirements of product drawing (drawing conformity)	No obvious damage or deformation	Pass
	2	Insulation resistance	$V = 500 \text{ V}$, $t = 60 \text{ s}$, $R_{\text{Isol}}: 100 \text{ M}\Omega \text{ Min.}$	$R_{\text{Isol}}: > 50 \text{ G}\Omega$	Pass
	3	Resistance to chemicals	Chemical list: - Cold-cleaning agent/cockpit cleaning agent - Penetrating oil - Washer fluid antifreeze, undiluted - Isopropanol - Lubricating grease.	No obvious damage or deformation	Pass
	4	Insulation resistance	$V = 500 \text{ V}$, $t = 60 \text{ s}$, $R_{\text{Isol}}: 100 \text{ M}\Omega \text{ Min.}$	$R_{\text{Isol}}: > 50 \text{ G}\Omega$	Pass

Appendix

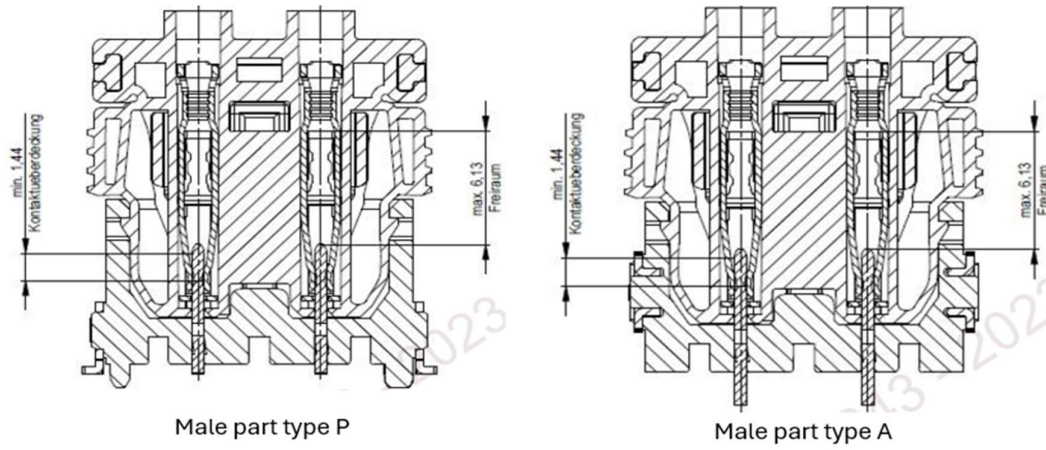


Fig.2 Contact overlap

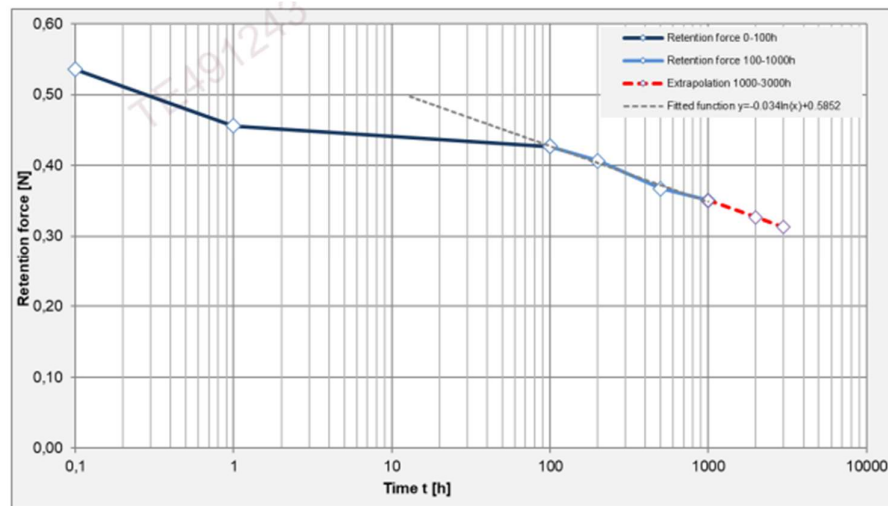


Fig.3 Normal force vs times

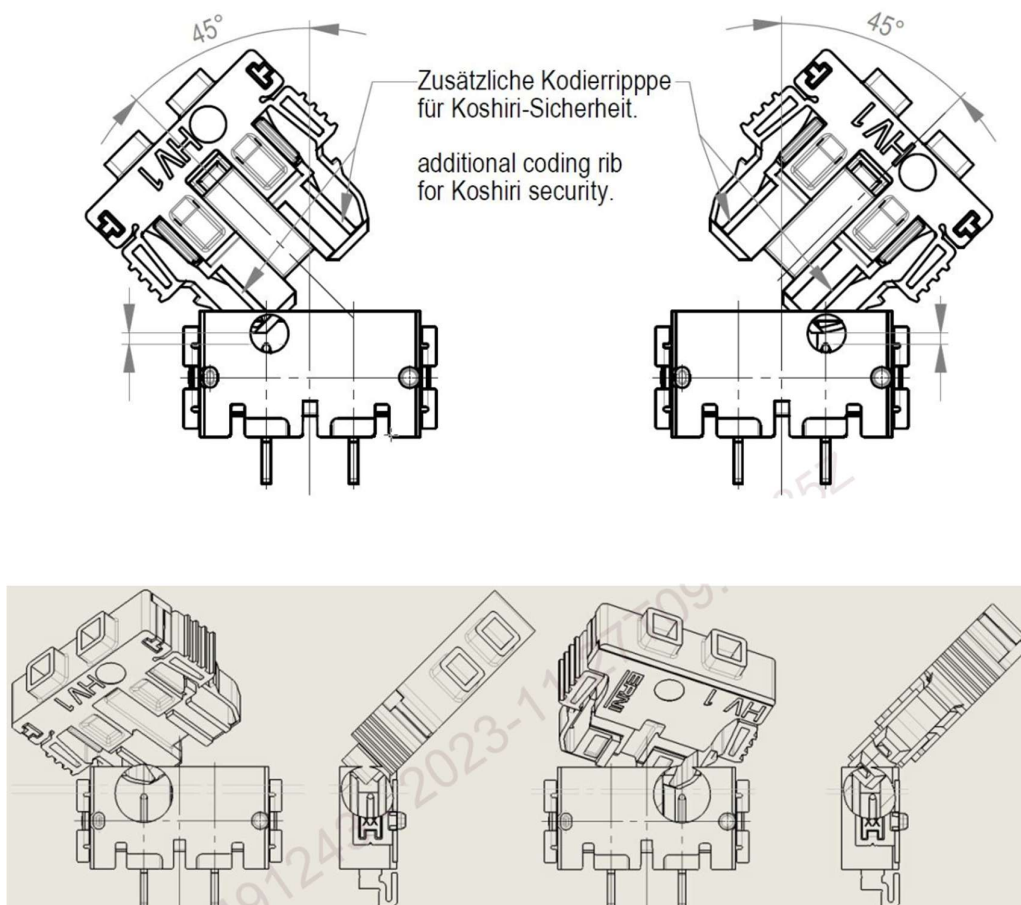


Fig.4 Pin insert inclination under 45° , maximum angle for Koshiri Safety, angled

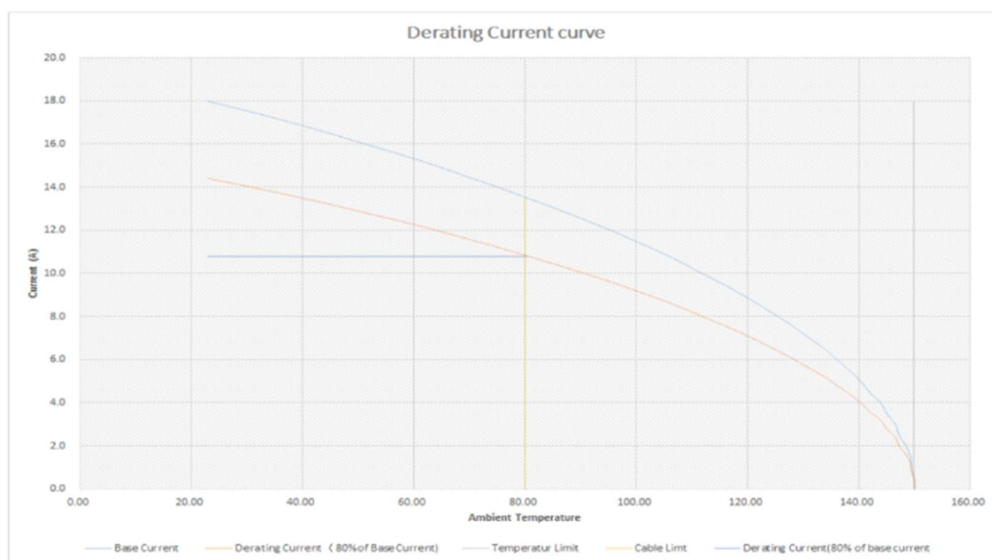


Fig.4-1 Derating curve 2-pin: 10.8A (angled/straight)

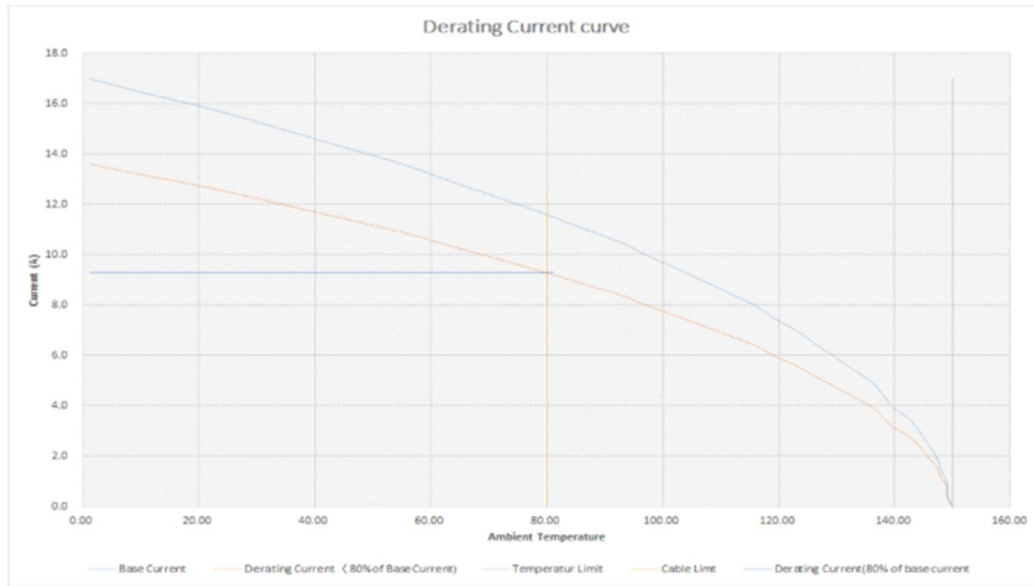


Fig.4-2 Derating curve 6-pin: 9.3A (angled/straight)

TG14 Thermal time constant (following VW 75174 :2018-10)

VolTron 1000 2pin with male 90° and female 180°

plating: male (Au / PdNi / Ni)

plating: female (Au / PdNi / Ni)

cable: Electroair KZ 06 AWG22

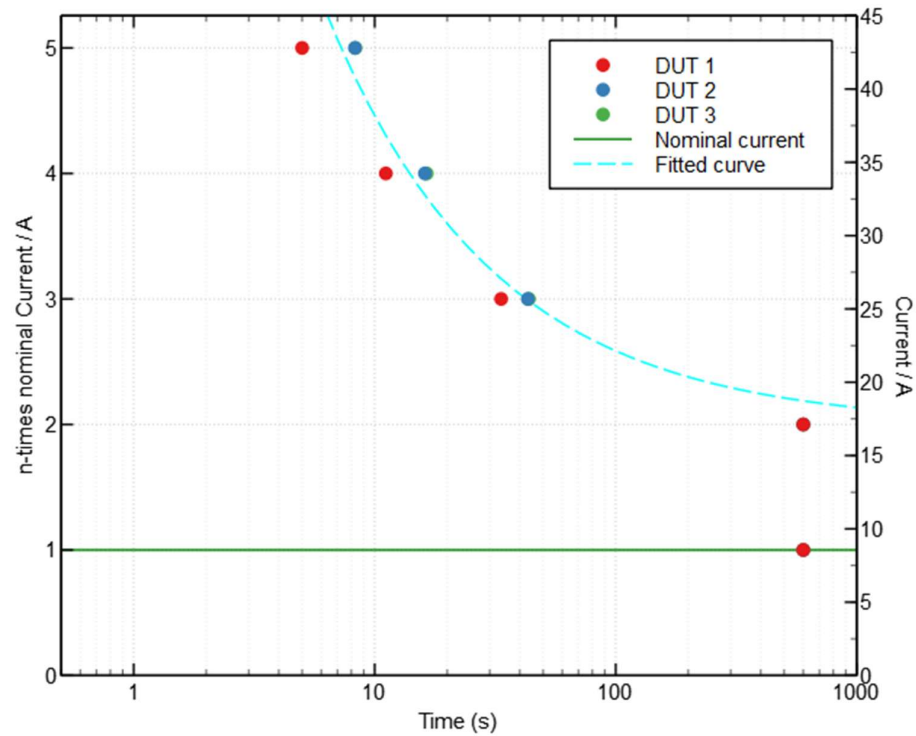


Fig.5 Thermal time constant