

WHITE PAPER ON DISCOLOURED TERMINALS

Effect of Testing on Discolored Terminals

Introduction

Some customers are concerned about a discoloration/ appearance issue on the quick connect series terminals (Insulated and Un-Insulated) hereinafter “discolored parts”. The concern is due to visual defect of the terminals and raises questions surrounding the electrical performance of the discolored parts. This paper explores the discoloration phenomenon and further explains performance impact to the customers

The black spots issue (also called cosmetic issue) is reflected in black spots (light) or a black area (heavy) as shown on the below picture. See Figure 1.



Figure.1

Brass parts of the terminals get discolored when exposed to high humidity and elevated temperature, or when not stored in proper storage conditions (recommended storage conditions are 25 degrees C, 50%~60% RH). TE Connectivity (TE) engineering team conducted series of tests on the discolored parts (both bare and Tin-plated part). See Table.1

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TEST OR EXAMINATION	REQUIREMENTS	PROCEDURES	TEST GROUP		
			A	B	C
			TEST SEQUENCE		
Examination of product	No physical damage	EIA-364-18 Visually and tactually inspect parts for appearance in accordance with applicable Q.I.P (Quality Inspection Procedure) and product drawing for presence of stated defects.	1	1,3	1
Contact resistance	Initial: 3 milliohms (mΩ) maximum Final: 6 milliohms (mΩ) maximum	EIA-364-23 Subject the circuit (including the mated contacts, assembled in housings) to 1A(DC) current. After temperature has stabilized, probe 2 points on the mated tab contact that with one point 75 mm from the wire crimp. Calculate resistance after deducting bulk wire resistance.			2,7
Crimp tensile strength	58(N) minimum for 20AWG 89(N) minimum for 18AWG	UL 310, Para 6.3 Operation Speed: 25.4 mm/min Apply an axial pull force to the crimped wire. Crimp tensile strength is determined when the wire is broken or is pulled off. Exclude insulation crimp.	2		
Thermal shock	No physical damage	EIA-364-32, Test Condition VII Subject mated specimens to 5 cycles between -40°C and 105°C with 30 minute dwell time at temperature extremes and 5 minute (maximum) transition between temperatures.			5
Temperature rise	30 °C (maximum)	UL 310 Measure the temperature rise above ambient created by the energizing current. Measurement must be taken at a place where there is no influence from air convection. Stabilize temperature at a single current level until 3 readings at 5 minute intervals are within 1°C.		2	
Temperature and humidity cycling	No physical damage	EIA-364-31, Condition A, Method II Subject mated contacts to environment at 40±5°C and 90-95% RH for 96 hours. Sample shall be placed in the chamber out of the path of falling water drops. Measurement shall be taken upon completion of exposure period.			4
Salty spay	No physical damage	EIA-364-26, Condition A Subject mated connectors to 5% salt concentration for 96 hours. Measurement is taken after removing the salt. Specimens dried per the specification.			6
Vibration	No physical damage	EIA-364-28, Test Condition I Subject mated connectors to 10-55-10 Hz traversed in 1 minute at 1.52 mm amplitude maximum total excursion, 2 hours each in 2 axial direction			3

Table 1

Test results

Terminals are discolored but their performance continues to meet the requirements of UL310/EIA 364 and the TE performance specification. See following group A, group B, group C test results.

Test group A

1. Tensile strength

	Bare Brass with black spots (Representative PN: 170384-1 20AWG)	Tin plated Brass with black spots (Representative PN: 175020-1 18AWG)
Maximum	134.27 N	220.91 N
Minimum	128.80 N	204.28 N
Average	131.09 N	211.23 N
Requirement	58 N (minimum)	89 N (minimum)

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Conclusion	Meets specification	Meets specification
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Test group B

1. Examination of product

Meets requirements of product drawing. No physical damage.

2. Temperature rise

Meets requirements.

	Bare Brass with black spots (Representative PN: 170384-1 20AWG)	Tin plated Brass with black spots (Representative PN: 175020-1 18AWG)
Maximum	3.3 °C	5.7 °C
Minimum	2.7 °C	5.1 °C
Average	2.9 °C	5.4 °C
Requirement	30 °C (maximum)	30 °C (maximum)
Conclusion	Meets specification	Meets specification

Test group C

1. Examination of product

Meets requirements of product drawing. No physical damage.

2. Contact resistance

Meets requirements

	Bare Brass with black spots (Representative PN: 170384-1 20AWG)	Tin plated Brass with black spots (Representative PN: 175020-1 18AWG)
Maximum	1.17 mΩ	0.96 mΩ
Minimum	0.63 mΩ	0.76 mΩ
Average	0.94 mΩ	0.87 mΩ
Requirement	3 mΩ (maximum)	3 mΩ (maximum)
Conclusion	Meets specification	Meets specification

3. Vibration

Meets requirements. No physical damage or no electrical discontinuity greater than 1 μs.

4. Temperature and humidity cycling

Meets requirements. No physical damage

5. Thermal shock

Meets requirements. No physical damage

6. Salty spray

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Meets requirements. No physical damage

7. Contact resistance

Meets requirements after vibration, temperature and humidity cycling, thermal shock, salty spray

	Bare Brass with black spots (Representative PN: 170384-1 20AWG)	Tin plated Brass with black spots (Representative PN: 175020-1 18AWG)
Maximum	1.26 mΩ	1.42 mΩ
Minimum	0.94 mΩ	0.80 mΩ
Average	1.08 mΩ	1.11 mΩ
Requirement	6 mΩ (maximum)	6 mΩ (maximum)
Conclusion	Meets specification	Meets specification

Conclusion

Both bare and Tin-plated discolored brass terminals meet the requirements of UL310/EIA-364 and the TE performance specification. For more information, please contact your TE sales representative.

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Revision A