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To the BU Industrial Cabinet Solutions

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19 March 2020

Confirmation on behalf of the Business Unit Industrial Cabinet Solutions

Dear Sir or Madam

The standard DIN 46228-4 “End sleeves - Part 4: Tubular end-sleeves with plastic sleeve“ was revised and a new edition was published on 01 March 2020. In comparison with the previous revision dated 01 September 1990, the specifications regarding the material of the copper sleeves were extended.

With immediate effect, compliance with the standard now requires a tensile strength of the copper tube of at least $R_m = 250 \text{ N/mm}^2$ and a maximum hardness of 105 HV.

With this document we confirm that the PHOENIX CONTACT ferrules with plastic sleeve (product family: „AI ...“), ferrules without plastic sleeve (product family: „A ...“) and TWIN ferrules (product family: „AI-TWIN 2x...“) comply with the requirements of the extended standard.

Personally liable partner:
Phoenix Contact Verwaltungs GmbH
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Kom. Ges. Amtsgericht Lemgo HRA 3746

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Explanation:

Compliance with the material characteristics is essential for the functionality of the crimp connection between the ferrule and the electrical conductor. The following characteristics need to be considered:

1. Geometry and dimensions
2. Mechanical strength
3. Electrical conductance

Ferrules with excessive hardness have a negative influence on the deformation process. With identical crimping force, harder ferrules achieve a lower degree of compression. If the crimping is not carried out completely, this can lead to problems regarding compliance with the characteristics listed above. Possible consequences might be:

1. The overall dimension of the crimp connection exceeds the dimensional specifications for the clamping spaces stated in DIN EN 60947-1.
2. The specifications for the conductor extraction force are not complied with. A durable connection between ferrule and electrical conductor is not guaranteed.
3. The contact resistance values between ferrule and electrical conductor are increased, possibly leading to unintended heat development or even loss of contact.

In order to achieve the required material characteristics, PHOENIX CONTACT ferrules are subjected to temperature curing. So-called soft annealing reduces the material hardness. This additional procedure therefore supports the deformation process. A reduction of the crimping force is obtained, which leads to an increase in the mechanical strength (conductor extraction forces) and an improvement of the electrical conductance by reducing the resistance.

Tests have shown that the plastic deformation in the fusion process already starts at a 40% lower force level, compared to an uncured ferrule (see Fig. 1).

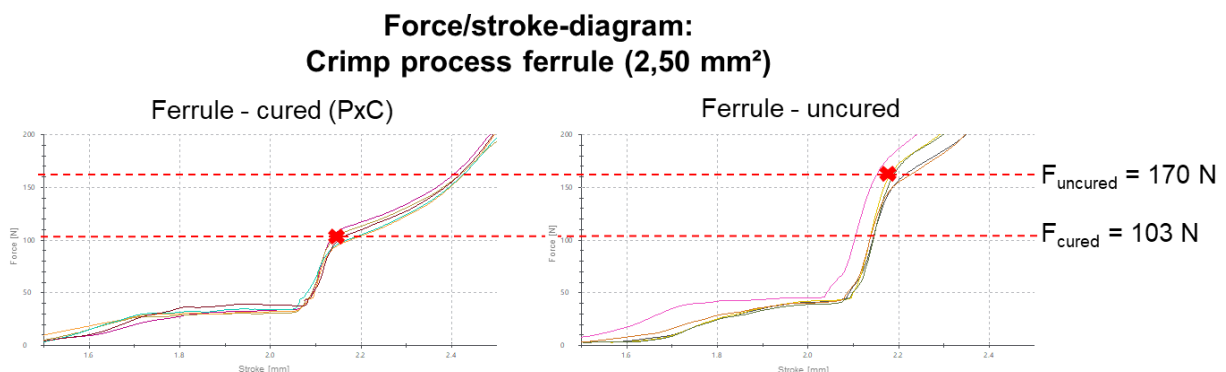


Fig. 1: Force/stroke diagram: Crimping of a cured (left) and an uncured ferrule (right).

Yours faithfully

PHOENIX CONTACT GmbH & Co. KG

i. A.

A handwritten signature in blue ink, appearing to read 'M. Peter'.

Dr. Michael Peter
Director Development and Quality Laboratory
Business Unit MI

i. A.

A handwritten signature in blue ink, appearing to read 'C. Dalmer'.

Christian Dalmer, M.Sc.
Development Laboratory
Business Unit MI

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