

Influence of the preparation of aluminium conductors for the assembly of medium voltage mechanical connectors on the quality of the electrical connection

Christian REINHOLD, Mirnes AGANBEGOVIĆ, Volker MARKGRAF and Ralf SCHELL

Nexans Power Accessories Germany GmbH, Ferdinand-Porsche-Straße 12, 95028 Hof (Germany)

christian.reinhold@nexans.com, mirnes.aganbegovic@nexans.com, volker.markgraf@nexans.com, ralf.schell@nexans.com

ABSTRACT

Cable networks require electrical connections providing service for approx. 30 to 40 years of lifetime. Therefore, different accessories are used. The heart of such accessories is always the connection of the current carrying metallic conductors. In order to achieve the connection, different kind of ferrules and lugs are used. State of the art are compression and bolted mechanical connectors. In combination with the different types of conductors different ways of conductor preparation before the shear-off are common. Especially on aluminium conductors special treatments are performed before shear-off, or they are treated with special grease, that is usually inside the lug or connector.

Due to this fact the question occurred, what is the best way to prepare an aluminium stranded conductor before installing in a connector or lug. Why is there a difference between an aluminium and a copper conductor in preparation. Is it really necessary to prepare an aluminium conductor in a different way than a copper conductor and in case it is, what would be the best way to do it.

The aim of this work is to give an answer to these questions and to give a suitable recommendation for an appropriate cable preparation. Therefore, different ways of the cable preparation are investigated and compared. In particular, untreated conductors are compared to brushed and grinded ones by their electrical and thermal behaviour according to the requirements given by the standard IEC 61238.

KEYWORDS

Electrical connection, mechanical screw connector, aluminium conductor, cable preparation, connection quality, cable connector, cable joint, medium voltage connection

INTRODUCTION

Nexans Power Accessories Germany GmbH is one of the leading companies in the world in the electrical connection technology for ferrules and lugs. As a part of the worldwide operating Nexans group, mechanical lugs and connectors manufactured on the site in Hof (Bavaria, Germany) are installed in cable accessories in all over the world.

The high quality, that is guaranteed by the trademark GPH® and the long term experience of more than 60 years in the development, production and testing of electrical contact technology for overhead lines and cables, has also lead to several recommendations for the installation techniques of these connectors and lugs. Especially for the installation on aluminium stranded conductors, the way of the installation

has a high impact on the quality and stability of the interface. Under normal conditions aluminium tends to develop a very thin but very hard and high insulating oxide layer over time.



Fig. 1: Aluminium stranded conductor

One of the basic recommendations acc. installation, is to brush the aluminium conductor with a metal brush before installation. The influence of the brushing will be shown in this work. Another method of preparing the aluminium conductors investigated in this work is grinding the individual wires.

THEORETICAL BASICS

The most common method to connect two cable conductors electrically and mechanically is to crimp or compress a tubular high-conducting metallic connector on the ends of the conductors or by using a mechanical connector with shear-off screws (Fig. 2).



Fig. 2: Mechanical connectors and lugs

The contact inside a stranded conductor consists of different contact layers, which number is depending on the number of layers of wires in the conductor. The number of layers depends on the cross-section of the cable conductor. Thus, big cross-sections have a higher number of contacts inside the conductor than small cross-sections.

The first contact layer is the contact between the screw-tip and the outer layer of wires. The second layer is the contact between the outer layer of wires and the wire layer underneath (see Fig. 3). These contact layers occur between every layer of conductor wires. The final contact layer is connecting the outer layer of wires of the conductor with the connector body.