Press Release

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Fine-gaged aluminum wire in Class 5 for all wind-power plant tower types

One for All

From the rotor tip to the tower base, HELUKABEL provides everything needed for the widest range of wind-power plants: Power cables, torsion cables, fiber optic conductors, cables for monitoring and communications, medium voltage and fiber-optic cables for the infrastructure along with all the peripherals for electricity lines. With the new "HELUWIND WK Powerline ALU" series, the company has held a nearly unique selling position for two years, providing numerous advantages for wind-power plant operators.

"The power cablework in a wind-power plant or wind turbine generator system (WTGS) depends on various factors, which are predetermined by the tower structure and the customer" Uwe Schenk, Global Segment Manager Wind explains at HELUKABEL GmbH in Hemmingen. On the one hand, there are various types of towers and these can be classified into steel-tube towers, concrete-tube towers, hybrid towers, pylon towers and wood towers. The hybrid towers are made of steel-reinforced concrete and steel elements and can currently be constructed up to 140 m in height. The cable design is moreover dependent on the plant size. A wind-power plant produces between 1.0 and 7.6 MW, and that power needs to be brought down from the gondola. The power cablework can be made in copper or aluminum. There are two favored groups on the market: One group prefers copper cable because it feels it puts them on the safe side. The other relies on aluminum cable because it is additionally focused on the commercial

aspect. This article demonstrates why aluminum cable is the winner from both points of view.
"We have the full range for individually equipping an entire wind-power plant" Schenk promises. "On top of that, we assist the engineers already in the planning phase. We work out the ideal power cablework with them for the four different types of existing designs." Those are Class 2 copper, Class 5 copper, Class 2 aluminum and Class 5 aluminum. In Class 2, both copper and aluminum are rigid and inflexible. The strand structure of Class 5 is the flexible version. And the company is also flexible in its interface design, which puts HELUKABEL in the position of being able to equip any kind of WTGS.

Copper in the loop, aluminum in the tower.

"Every manufacturer of electric cables and wires has its own philosophy on selecting the correct insulation and conductor material. There are suppliers that recommend aluminum for the torsion application in the WTGS cable loop. But that does not tally with our experience" according to Schenk. Across a planned deployment time of the WTGS of approx. 20 years, demands of up to 15,000 torsion cycles will be placed on the wires in this application. This part of the power cablework, from the generator through the freely suspended loop and through the tower interior wall represents genuine stress for the wires. That is why the wire specialist uses exclusively Class 5 copper wire with a special strand cabling there, which has a much better ability to cope with load. Special, highly abrasion-proof materials are used as the insulation material for the core insulation and sheathing. "After up to now more than 6500 km of installed loop wires, we are very familiar with the trickiest points on the power cablework of a wind-power plant and, for years we have had this application, which I consider to be the Achilles heel, firmly under control" the Segment Chief summarizes.

The conventional construction method of the wind-power plant is the steel tower with three to four segments. This is where the opportunity lies for the tower constructor to preinstall these wires. During onsite assembly, the individual cables can then be connected to each other through compressed joints using so-called crimping technology. During that, up to 80 compressed joints evolve that have to be well executed and well insulated to guarantee permanent functioning later. Connecting the wires in an entire plant like that takes two to three days and is very costly. And this part of the power cablework also has to function correctly across the entire lifetime of the WTGS.

Energy transport in two parts

"If you consider that a crane deployment when assembling wind-power plants carries the cost of about 50,000 euros per day, the installation time needs to be kept as short as possible" Schenk elucidates. For plant constructors who want to reduce this expenditure to the minimum, HELUKABEL provides a solution with which the wires after the loop can be installed in the tower ready to plug-in in one go in just 5 to 6 h. An aluminum design in Class 5, the WK ALU Powerline, has made that possible. For instance it can be flexibly pulled into the tower structure and routed in conduits through the foundation to make the connection to external transformers.
One important aspect when selecting the material is the materials market: "Aluminum makes you relatively independent of the price trend, whereas copper is much more volatile. When the copper price changes, the final customers might have to re-think their entire calculation. With aluminum, they do not have to do so to such a large extent" is how the Segment Chief describes another advantage. In a nutshell, one can speak of cost savings of up to 40% for the electrical power cabling when flexible AL power cables are used as compared with flexible copper cables.

But Schenk also sees the electrotechnical section as the most important point: "Aluminum does not forgive any errors". Cable and connection technology should be matched and tested as one system. The conductor fill factor in the cable lug or compression connector is an important aspect. And in coupling technology, the slight vibrations in a WTGS should also not be neglected. So a pure mechanical pull-out test on the cables and connection technology is no longer sufficient. A reliable statement can only be made when supplemented by an electrical test. Fundamentally, the crimping tool should always be in a technically flawless and maintained condition. "Our philosophy is certainly not to interrupt the power cablework. So we prefer uninterrupted installation into the tower up to the inverter in the tower base" says the Segment Chief. In practical application, that means a prefabricated AL line with ALU/CU compression joints to the loop and an ALU/CU pressure cable lug to the inverter. In keeping with the spirit of plug and play, the wire can be installed through the tower and up to the inverter in one piece.

Special crimping technology secures the conductivity

Standard crimp or screw technology with a finely stranded design of the ALU Powerline cannot be recommended due to the surface of the conductor, which oxidizes more. With conventional crimping technology, the electrical values in large cross-sections would be relatively high and insufficient. That causes excessive heating of the cable lug under load. Due to the higher temperature on the wire, the temperature of the insulation material also rises. This higher stress accelerates the aging process of the line, since contacting aluminum demands the greatest attention.
To work around this problem, for the ALU Powerline HELUKABEL developed its own connection technology with the special C8 crimping technique together with partner companies: This crimp contour makes

the aluminum flow, mechanically rupturing the surface of the wire and making it conductive. That means the contour penetrates very deeply into the stranded bundle, facilitating ideal contacting of all strands even in the bundle core. The company has also tested a screw technology with shear bolts as an option. "Process reliability is really important for us. To ensure that, we had the connection technology tested and certified by TÜV Dortmund in accordance with IEC – DIN EN 61238-1 Class A", Schenk adds. "Apart from that, we also offer a global lending service for the crimping technology, which is being very well received by the market".

Halogen-free and for the American, Canadian region

For this all-inclusive portfolio, the Segment Chief also emphasizes the supply of halogen-free wires, the high temperature range and the numerous certifications for global operational use. "We have the most varied types of insulation materials, even including halogen-free versions. Furthermore, we meet all requirements regarding the climatic conditions of -55° to +145 °C along with international accreditations compliant with UL, CSA, FT4, CE, VDE, TC and WTTC." The combination of UL, CSA and being free of halogen is a nearly unique selling point of WK 135 and WK 137.
That is seldom required but there are applications, especially in the American area, where fire protection plays a very important role. The opinions on that are divided between Europe and the American continent: Whereas the USA and Canada place high importance on not allowing any fire to arise in the first place, the Europeans would rather keep things clean if there is a fire. Disadvantage for the Americans: If a fire does break out, the harmful components of the halogen such as fluorine, chlorine and iodine are released. In connection with moisture, hydrocyanic acid forms which contaminates a structure. So meanwhile

this market is occasionally asking about halogen-free and the trend is increasing.

Images:

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