International Journal of Engineering and Information Systems (IJEAIS)
ISSN: 2643-640X
Vol.5 Issue 5, May – 2021, Pages: 42-44

Use of Composite Wires and Cables in the Power Supply System

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Annotation: *The article provides information on the possibility of increasing energy efficiency and reducing economic costs when using composite core aluminum conductor wires and cables instead of traditional aluminum conductors in the power supply system.*

Keywords: composite core, coefficient of thermal expansion, composite metal, conductivity, strength, ASSS, ACCR.

INTRODUCTION

Increasing the current capacity requires a huge amount of money. Given the increasing power consumption, it is necessary to increase the cross-sectional area of the power line cable. At the same time, the weight of the overall network increases, which increases the demand for insulators and supports. The demand for supports and insulators makes it possible to replace them with more durable and modern bases and insulators. In contrast to the above and a more complex concept, this is the route of the power transmission line. The choice of route is hampered by the construction of high-voltage power transmission lines (residential areas, national parks, zoos, etc.). Summarizing all the points given, it can be said that the wires used should have high strength and light weight.

Methods

Below we review wires and cables developed by Composite Technology Corp.'s (CTC, Irvine, Calif).

1. ASSS various composite wires and cables. The probability of burning of a standard steel core during peak electrical loading is very high and it is required not to exceed the established norm in order to prevent this. Composite core wires currently produced and manufactured are less prone to heat damage than steel core wires due to their small coefficient of thermal expansion. Replacing the steel core wire with a composite material wire increases the capacity of the power transmission line. According to modern wire manufacturers, it is possible to double the value of the current in the absence of any damage to the wire.

The feature of the composite material is that it has high strength in terms of weight and low suspension, which in turn leads to an increase in the spacing of the supports and reduces the number of supports by 16%. Composite Core Aluminum Conductor Wire (Aluminum Conductor Composite Core - ACCC) manufactured by Composite Technology Corp.'s consists of an artificial core of carbon fiber and fiberglass.

During the manufacturing process, the core is shaped into a cylinder and wrapped through a fiberglass shell. The process of obtaining fiberglass material is one of the most complex processes. Essential oil or other heat-resistant fiberglass material is heated to a temperature of 130-1500S and shaped. The fibers are also impregnated with a high-temperature-resistant synthetic liquid. The layer of glass plastic is used for two purposes: -

- it separates the carbon fiber from the aluminum conductor against galvanic corrosion;
- it increases the strength and flexibility of the core, while ensuring that the coal fiber stays in place.

The core has a defined size, the diameter corresponds to the standard dimensions and ranges from 12.7 mm to 69.85 mm. Alternatively, 300 A to 3500 A wires are prepared and used. During the test, a 9.5 mm core wire was obtained and was able to withstand a load of 18,567 kg at ambient temperature when given a high voltage. The results show that ASSS systems can operate continuously at 1800S and in some cases even at 2000S without breakdown. The coefficient of thermal expansion of steel core wire is much higher than other wires. The coefficient of thermal expansion of the core of the ASSS conductor is standardized at 1.6 x 10-6 0C, while the coefficient of thermal expansion of the steel core conductor is 11.5 x 10-60C. The cost of an ASSS conductor is about 3 times more expensive than traditional used wires for 1 km, but it is economically justified during use. When a composite core wire is pulled in multi-chain lines, the steel core allows twice as much power to be transmitted as a wire of the same weight and voltage.

Figure 1. An overview of the ACCC

In Fujian Province, China, a composite core steel wire has been installed on a 60 km line. During the application, 150 bases had to be installed. This is due to the presence of excess weight. Instead, other supports were removed from the 17 supports when the ASSS was installed, which reduced material costs and significantly reduced the overall cost of the project.

2. ASSR various wires and cables. The method of preparation of Composite Reinforced Aluminum Conductor (ACCR) cable is contrasted with ASSS cable. A composite metal was used as the core of this wire, and a high temperature resistant aluminum zirconium alloy (Al-Zr) was used around it. The ASSR composite core and outer sheath in various wires ensures the strength of the AL-Zr wire and increases the conductivity of the wire.

The composite core is composed of high-frequency aluminum-ceramic fiber (Al_2O_3). Each core is made up of 25,000 pieces of Al_2O_3 fiber, which is part of the shell. The core diameter is 1.9 mm to 2.9 mm for alignment with standard wires with a steel core of 21.84 mm to 28.19 mm.

Al-Zr is wrapped in a heat-resistant shell in the alloy and it can operate at 210 0S, while consumers can operate without changing the characteristics of the parameters up to 240 0S when in the peak state. Composite core wire is about 9 times stronger and up to 3 times stiffer than conventional aluminum wire.

The composite core is half lighter than the corresponding steel core, the electrical conductivity is much higher, and the coefficient of thermal expansion is 50% lower than that of a steel core of the same size. The use of composite core wire not only increases the capacity of the power transmission line, but also reduces the economic costs in reconstruction, reducing the power consumption of the power transmission line due to the high-conductivity composite core.

Summarizing the above points, the following suggestions can be made to increase the reliability of the power transmission line of the railway power supply system.

When designing:

-application of new technologies and materials using technical calculations, increases the reliability and durability of power transmission lines;

- the use of new multi-column supports leads to the long service life of the new line, and the rapid recovery of supports after damage further increases reliability;
- It is expedient to cover the bases with a combined shell during repair and restoration works;
- modern concretes should be used for foundations;
- use of climate protection (vibration damper, ice limiter, etc.);
- use of fittings with high electromechanical characteristics and reliability;
- use of the most modern and tested, optimal, high-reliability wires.

During construction:

- establishment of technical control in the production and prevention of deviations that reduce the durability and reliability of the power supply system.

In use:

-increasing the level of diagnosis;

Reconstruction and repair of power transmission lines used for more than 30 years;

- see the restoration of dilapidated areas as an important issue;

-use of modern repair elements of the power transmission line of the railway power supply system. In reconstruction and repair:

-implementation in accordance with technical requirements;

-application of modern technologies and materials;

- take into account changes in operating conditions;

- office work with the use of special mechanisms and tools.

Conclusion

The power supply system should use new, modern, wide-ranging electrical equipment to increase the reliability of the power transmission line. At present, the use of the above-mentioned cables in power transmission lines is cost-effective and provides a long service life to the power supply system.

References

1. Asatov E.A., Tojiboev A.A. Fundamentals of reliability theory and diagnostics. Tashkent 2004.-348 p.
2. Increasing the reliability of air lines 35-750 kV. Novosti Elektrotekhniki, Journal №5 (47), 2007
3. Boltayev O.T., Bayanov I.N., Akhmedova F.A. Galvanic effects of the gravitational network and measures to protect against it. International journal of trends in computer science ISSN: 2348-5205. Volume 2 Issue 1 2021. pp. 3-11.
4. Boltayev O.T., Akhmedova F.A. Induced voltage from traction networks and methods of reducing its influence on adjacent communication lines. International Journal on . Volume 4, Issue 4, April 2021. pp. 265-271.