

New Messenger Wire – as Strong as Bronze, as Conductive as Cuprum

Cuprum-based alloys with Cd, Mg, Cr, Zr and other metallic additions are used in catenary wiring because of their enhanced durability, strength and resistance to thermal softening. However, while offering various improvements to the wire's mechanical parameters, these additions inhibit the wire's electrical characteristics, significantly increase production costs, and crucially cannot be used on dense traffic lines.

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To overcome these difficulties, Russian engineering company Energoservice began to develop a messenger wire without these alloys. Emphasis during the development phase was placed on identifying a solution which offers high mechanical reliability and only slight temperature-related linear deformations all while being as reliable a conductor of electricity as cuprum. The wire must also be rust resistant and demonstrate enhanced aerodynamic properties, standard diameter values, and be suitable for mass production. Moreover, the price should not be significantly higher than existing solutions, and the product should meet existing standard fittings.

The company's engineering efforts resulted in a copper product of the same diameter as existing wires but which offers both higher impedance (electric impedance of a Ø 14mm wire is $1.1369-1.383 \times 10^{-4}$ Ohm/m) and improved mechanical performance (breaking strength of Ø 14mm wire is 58-60 kgf/mm, a 25-30% improvement).

Energoservice's design increases the service life of the wire by enhancing its swinging amplitude and strength, which reduces the probability of wires breaking following physical damage and material fatigue caused by vibrations and self damping. It also prevents significant accumulation of snow and ice.

Manufacturing is undertaken by Severstal-Metiz and differs from traditional processes by incorporating crimping, shearing, bending, and kinking. This solution produces a strong copper messenger wire (see Figure 1), which by not using alloys, increases its range of applications. This is of particular significance for high-speed rolling stock that require higher current intake leading to more intensive heating of the messenger wire.

The messenger wires used for high-speed lines experience higher tension and intensive heating during operation, which leads to increased wire low-temperature creep. Due to improved performance and less need for replacement, the copper

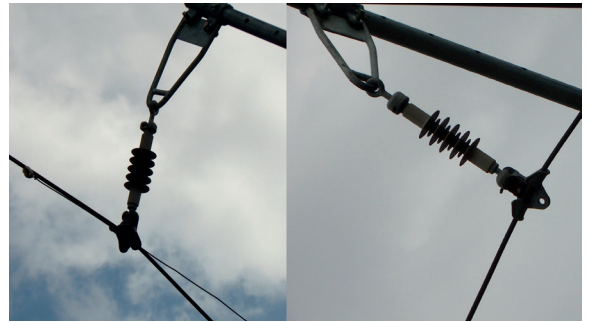


Fig. 1. Messenger wire for rail

messenger solution developed by Energoservice eliminates many of these issues and as a result can offer a return on the initial investment in 10-20 months by energy loss reduction.

The wire has been tested extensively by Russian Railways (RZD). Tests performed include covered thermal softening checks at 155°C and multiple temperature increases to 100°C. Test engineers also carried out arc resistance checks, low-temperature creep checks, heave oscillation (eolian vibration) resistance tests, as well as some other tests used for the first time on a messenger wire.

Pilot tests carried out during several seasons on the South-Ural Railroad, which experiences heavy traffic, also demonstrated the resilience of the wire in severe conditions.

Energoservice has extensive experience in producing efficient engineering solutions for high-strength cables and earthing wires for 35-750 kV overhead power lines. The positive results for the messenger wire are considered the direct consequence of the wire's design rather than the alloys used, and offer significant potential for future applications.

For 20 years, the team of Energoservice, LLC have been developing, testing and deploying innovative products (wires and steel wire ropes) for Russia's leading companies: Norilsk Nickel, RZD, FGC UES, etc. The company's references include the Ostankino Television Tower, deep mine hoistings, and thousands of kilometers of electric mines. Our solutions compete successfully with European products. 