Downsizing high voltage cables with RADOX®technology

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White Paper

HUBER+SUHNER

Downsizing HV Cables with RADOX®

- Cost Reduction: downsizing from 95 mm² HV cable in tube to 70 mm² RADOX® HV cable without tube yields approximately 25% lower cost per meter
- Weight & Space Savings: a smaller conductor crosssection plus thinwall RADOX® insulation significantly reduces cable mass and diameter.
- Thermal Efficiency: freeair installation allows better convective cooling, meaning cables run cooler at equal current.
- Advanced Material Technology: electronbeam crosslinked RADOX® insulation tolerates continuous temperatures of up to 150°C, meaning a smaller cable can safely carry the same current without overheating.
- Reliability & Compliance: downsized RADOX® HV cables meet stringent automotive standards (e.g. ISO 19642 Class D, 150 °C) and are proven in service through maximum safety and durability.

Why installation conditions matter: free air vs tubing

How a cable is packaged dramatically affects its currentcarrying capacity. Energized cables can shed heat freely, whereas cables enclosed in a corrugated plastic tube can severely impede heat dissipation. The tube effectively forms a thermal jacket around the cable, raising the conductor's steadystate temperature for any given current.

To avoid any overheating, designers have historicallv oversized the cable. A 95 mm² conductor in a tube was used to handle a current which a 70 mm² cable could safely carry in open air (see Figure 1). This is problematic because the larger cable and protective tubing adds weight and assembly costs. This was long accepted as the price of meeting safety margins in confined installations.

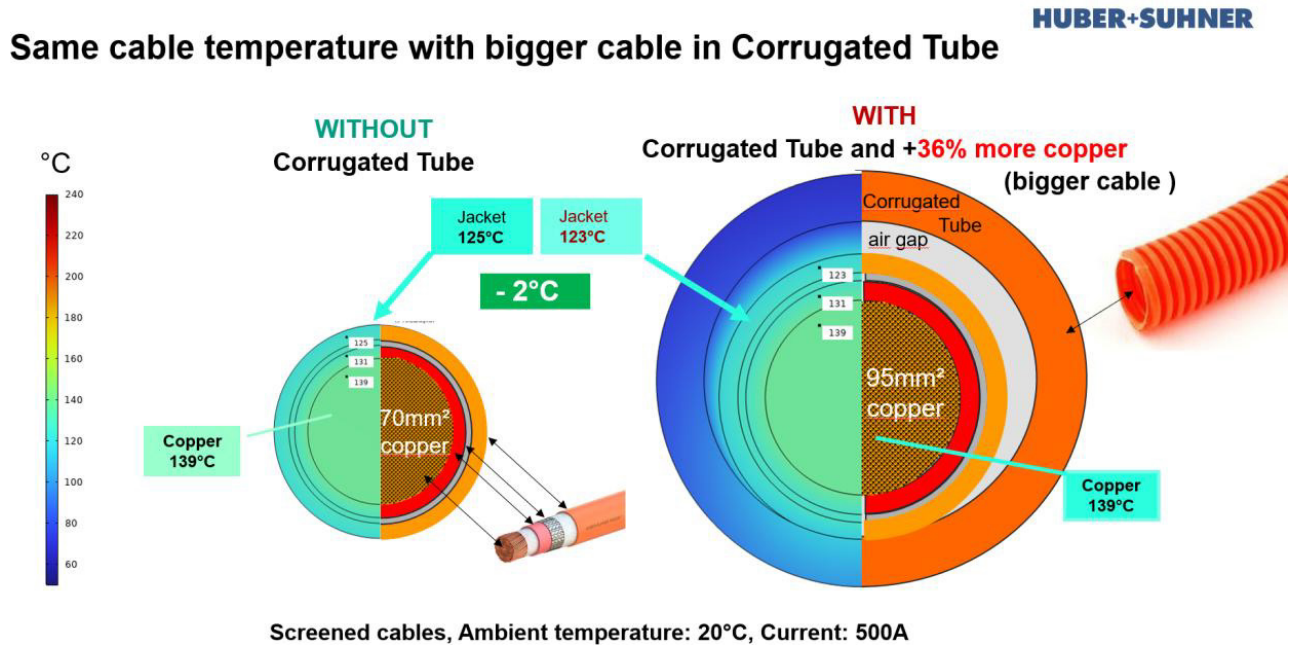

Fig. 1 Radox Cable in Free air vs Cable in Pipe

RADOX® cross-linking: enabling downsizing

RADOX® high voltage (HV) cables use an electron-beam cross-linked polymer for insulation and jacketing. Cross-linking creates an entirely different material class: the cables do not melt at high temperature and can operate up to 150 °C continuously. In effect, RADOX® extends the safe operating range of the cable.

Cross-linked insulation is also stronger and more cut-resistant than conventional thermoplastics, so RADOX® cables can achieve the required electrical strength with a thinner insulation layer. This thin-wall design reduces cable diameter by up to 2.3mm when referenced against a 70mm² cable, according ISO 19642-9 Table A3 and A4. This translates to a 10–20% smaller cross-sectional area of the finished cable.

Crucially, RADOX® cables often don't require additional corrugated tubing for mechanical protection. The rugged insulation itself resists abrasion, fluids, and high temperatures, so it can be routed without a separate conduit in many areas. This takes full advantage of the free-air cooling effect and further reduces the harness weight and volume.

Downsizing in practice: balanced performance and savings

By using smaller RADOX® cables routed in free air, automotive engineers can achieve the same electrical ampacity, voltage rating, and safety as a larger conventional cable in a tube, but with a leaner design.

For instance, replacing a 95 mm² cable and tube with a 70 mm² RADOX® cable without a corrugated tube yields roughly 25–30% in weight savings and approximately 25% in cost reduction per meter.

Simultaneously, the current-carrying capacity remains equivalent, as the RADOX® cable safely withstands higher core temperatures and runs cooler without a heat-trapping sleeve. In short, downsizing is achieved with no compromise in performance or safety, while delivering clear benefits in cost, weight, and design flexibility.

HUBER+SUHNER support capability

HUBER+SUHNER supports customers with end-to-end cable downsizing analyses with application-specific boundary conditions. Our engineering teams model thermal behaviour for real installation scenarios such as free air, conduits, bundling, and ambient profiles as well as validating assumptions through testing where required. This enables robust, standards-compliant decisions on conductor sizing, routing, and material selection early in the design phase.

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