

The EPDM Kevlar® insulating tube How is it possible to develop hose assemblies for deionized water that ensure optimum cooling of the converters while providing perfect electrical insulation? Angst+Pfister was contracted by the Swiss Federal Railways (SBB) company to tackle this question.

How is it possible to develop hose assemblies for deionized water that ensure optimum cooling of the converters while providing perfect electrical insulation? Angst+Pfister was contracted by the Swiss Federal Railways (SBB) company to tackle this question. Every electric locomotive is equipped with a converter that generates a three-phase current in two stages as well as a variable frequency for power supply and for regulation of the motor speed. The heat generated by the converter requires a powerful cooling system. The hoses employed in such systems must first of all have excellent dielectric properties. Angst+Pfister has developed a cost-effective solution that ideally meets all these requirements.

Angst+Pfister components for an efficient cooling system A two-stage process takes place in the converter. First, the alternating-current component of the single-phase operating voltage is rectified and impeded by capacitors and an L/C absorption circuit in order to obtain a continuous as possible reference voltage. Then, a variable-frequency,

variable-amplitude three-phase voltage is generated to power the asynchronous traction engines. In order to maintain the ideal temperature in the converter at all times, the GTO thyristor and the restrictor of the absorption circuit must be connected to a powerful cooling system equipped with fluid-handling and sealing technology components from Angst+Pfister. A mixture of deionized water and antifreeze with a conductivity of less than 2 µS is used as the coolant. The permanent voltage differential between the connected components is 2,600 V, and the direct-current voltage to be maintained over a period of eight years is 2,800 V/m. Moreover, the operating temperature can fluctuate between -25 °C and +60 °C.

Cooling hoses that meet the toughest demands As it circulates, the coolant is fed through a total of four tubes to the GTO thyristor carriers and through two tubes at the

feeder cables to the interphase transformer. Transporting the deionized coolant mixture inside the converter, requires the use of dielectric hoses because the significant voltage differential between the connection terminals must be completely absorbed by the tubes' insulating elements. The connecting hoses

must not conduct even the slightest voltage, and they must not be susceptible to any electrical charge differentials themselves. The multi-year deployment of the hose lines places additional high demands on their durability. The connectors attached to these hoses by Angst+Pfister, ideally

meet the required material property specifications. The hose lines also meet the positioning and installation requirements necessitated by the restricted space inside the converter.

The EPDM Kevlar sleeve for excellent electrical insulation.



ICN electrical converter



Special connecting ducts with 90° double bend, covered with shrink tubing sleeve for better electrical insulation



Connection of multiple electrical-converter cooling hoses



Overhaul of ICN trains

EPDM insulating sleeve with Kevlar® insert The solution devised by Angst+Pfister consists of an EPDM tube with a Kevlar® inner lining. This tube has been specifically designed for transporting deionized water because the end pieces in particular are exposed to high electric voltage. EPDM has excellent resistance to ozone and oxygen and can also withstand severe weather conditions without any problems. It therefore possesses the paramount properties for this specific application since the electrical installation itself may produce a certain ozone concentration. The long-term durability of the EPDM tube has proved to be outstanding and ensures the desired longevity of the hose lines. The valuable experience that Angst+Pfister has gained in similar applications proved to be an invaluable competitive advantage and proof of quality in devising this solution (see also the article in Angst+Pfister Magazine no. 5/2008, p. 16 and 17).

Limitless application spectrum The EPDM tube with Kevlar® insert is used to great success in a large number of specific installations. Thanks to its excellent suitability for transporting demineralized water, it is above all used in all types of cooling circuits that require excellent electrical insulation. The array of deployment possibilities is virtually unlimited and ranges from electromagnetic devices and automotive and railway applications to transformers and electrically operated industrial furnaces.

Comprehensive product assortment combined with a wealth of experience The high-grade special tubing is part of Angst+Pfister's extensive fluid-handling and sealing technology product assortment and is available from stock in numerous standard variations. Special variations can be supplied on request. In addition, a full range of connectors and fittings for all types of needs is available to customers. The tubes of course can also be supplied as ready-to-install hose assemblies. Inventiveness and extensive engi-

neering know-how make Angst+Pfister an expert collaboration partner that always has ideal solutions at the ready even for ambitious fluid-handling and sealing technology tasks.

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