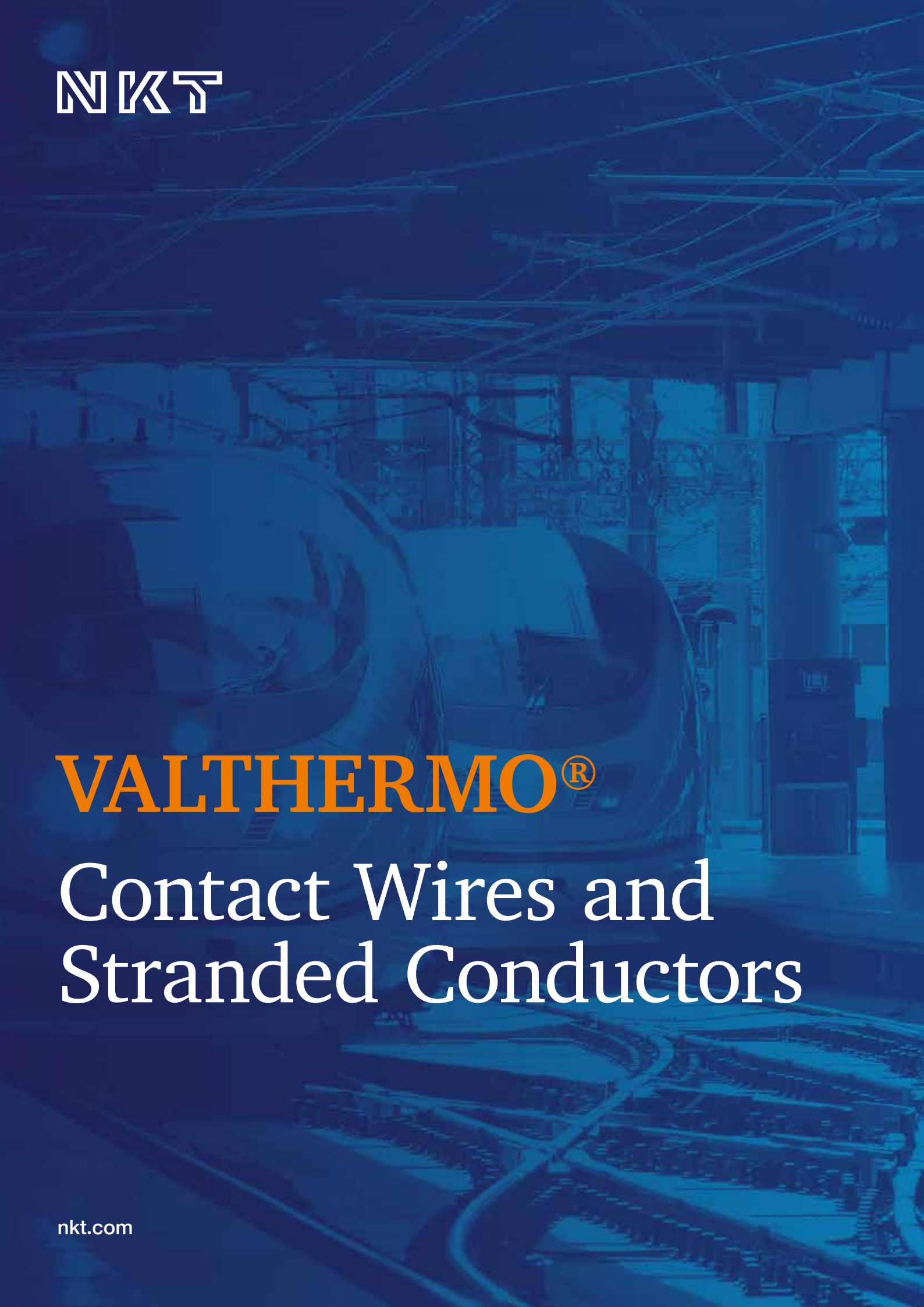
NKT

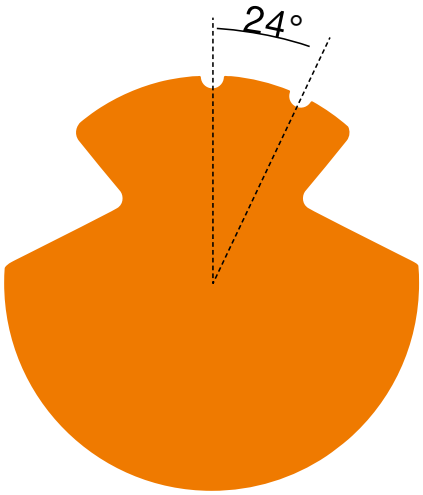


VALTHERMO®

Contact Wires and Stranded Conductors

nkt.com

The economic alternative to Cu- and CuAg Overhead Catenary Systems



VALTHERMO® is the new contact wire material from NKT. Copper and copper-silver contact wires can now be replaced by the VALTHERMO® economic alternative.

Compared with copper contact wires, VALTHERMO® provides **higher wear resistance,** higher thermal resistance and lower creep strain while achieving the same high level of conductivity as copper and copper-silver contact wires.

A wide range of application areas for VALTHERMO®

In the first instance, VALTHERMO® is used as a cost efficient alternative to CuAg0.1 while fully complying with EN 50149. Field test results show that VALTHERMO® contact wires have a longer life expectancy as compared to CuAg0.1, both when used with alternating current and with direct current.

Profile / nominal construction cross section	Tensile strength	Min. breaking load	Breaking elongation	Electrical resistivity	Electrical
mm/mm²	N/mm²	kN	%	10^{-8} Ω x m	% IACS
AC 80	≥ 375	≥ 29.1	3 – 8	≤ 1.777	≥ 97
AC 100	≥ 375	≥ 36.4	3 – 8	≤ 1.777	≥ 97
AC 107	≥ 360	≥ 37.4	3 – 8	≤ 1.777	≥ 97
AC 120	≥ 360	≥ 41.9	3 – 8	≤ 1.777	≥ 97
BC 100	≥ 375	≥ 36.4	3 – 8	≤ 1.777	≥ 97
BC 107	≥ 360	≥ 37.4	3 – 7	≤ 1.777	≥ 97
BC 120	≥ 360	≥ 41.9	3 – 8	≤ 1.777	≥ 97
CF 100	≥ 375	≥ 36.75	2,5 – 7	≤ 1.777	≥ 97
CF 120	≥ 370	≥ 43.5	2,5 – 7	≤ 1.777	≥ 97
BC 150	≥ 360	≥ 52.4	3 – 8	≤ 1.777	≥ 97
19x2.52 95	≥ 460 [1)]	≥ 41.0			≥ 96

[1)]) Single strand (prior to stranding)

Due to more stringent requirements on contact line system availability and power transmission capability, replacing copper contact wires (Cu-ETP) with VALTHERMO® is also strongly recommended.

The permissible constant temperature of 80 °C for Cu-ETP can be increased to a minimum of 100 °C in the case of VALTHERMO® , just as it can be done in the case of CuAg0.1, without any thermal softening.

Thermal resistance as well is significantly higher when subjected to thermal stresses and in particular to local overheating (e.g. with a stationary pantograph).

In the long term, other products made of VALTHERMO®, such as messenger wires, are also the preferred economic alternative when compared to copper or copper-silver cables because of their high thermal resistance and lower creep strain.

In harmony with sustainability objectives: Multiple lifetimes and resource conservation

VALTHERMO® contact wire is a sustainable product: A saving of over 5,500 t CO_2 in manufacture and operation per 100 km of twin-rail track fitted with VALTHERMO® contact wire can be achieved.[1)]

Saving on contact wire changes and reduced wear conserves resources thanks to lower Cu consumption and Cu input into the environment.

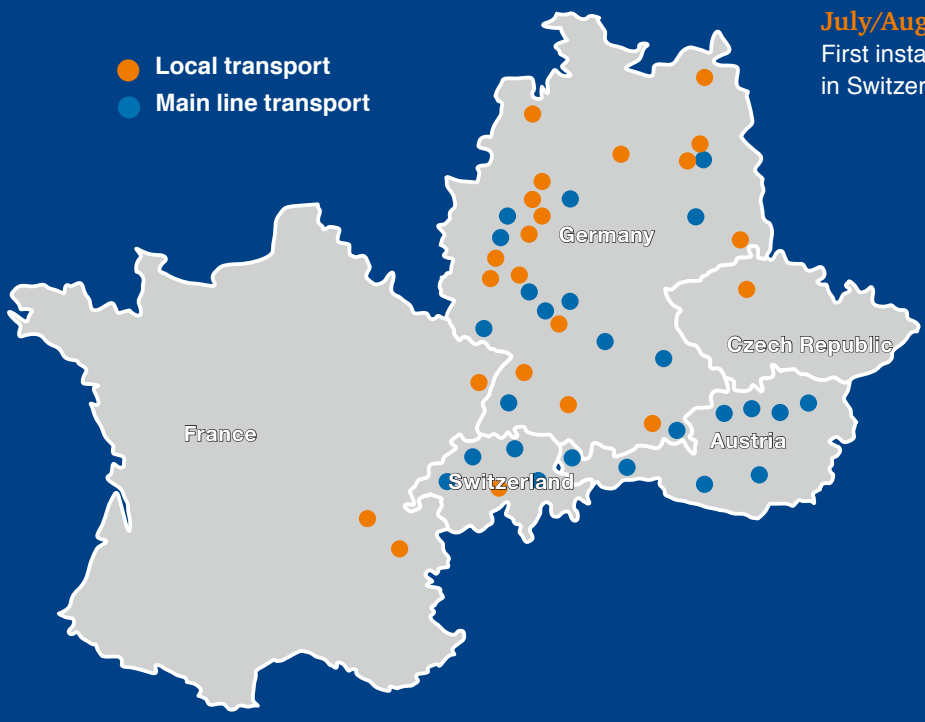
[1)] In comparison to Cu-ETP contact wire. Approximately 62 MWh of energy are required for the manufacture of 100 km of AC-100 contact wire. (Factor of 0.6 kg CO_2 per kWh, information from Environmental Federal Office for Electric Power). In addition to this, considerable CO_2 savings are achieved over the total lifetime of 70 years thanks to wear-related lower cross-section of the contact wire which as a result reduces losses in electricity.

conductivity	Electrical resistance	Torsion	Bending test	Weight	Half-hard point
m/(Ω x mm²)	Ω/km			kg/km	°C
≥ 56.3	≤ 0.229	5	≥ 6	710	≥ 300
≥ 56.3	≤ 0.183	5	≥ 6	890	≥ 300
≥ 56.3	≤ 0.171	5	≥ 6	952	≥ 300
≥ 56.3	≤ 0.153	5	≥ 6	1070	≥ 300
≥ 56.3	≤ 0.183	5	≥ 6	890	≥ 300
≥ 56.3	≤ 0.171	5	≥ 6	952	≥ 300
≥ 56.3	≤ 0.153	5	≥ 6	1070	≥ 300
≥ 56.3	≤ 0.183	≥ 5	≥ 6	889	≥ 300
≥ 56.3	≤ 0.153	≥ 5	≥ 6	1067	≥ 300
≥ 56.3	≤ 0.122	5	≥ 6	1333	≥ 300
≥ 55.7	≤ 0.19	5	≥ 6	859	≥ 250

VALTHERMO® contact wire: in commercial use since 2012

- Order volume of over 600 tonnes – 44 customers in 8 countries
- Direct- and alternating current
- Local and mainline traffic, used in trolley buses
- Agreements on (long-term) framework contracts, projects, maintenance requirements

VALTHERMO® has already and successfully found its way into: Deutsche Bahn and many other rail operators in Germany, Austria, Switzerland and France, among others, have seen the benefits and opted for VALTHERMO®.



April 2012:
First presentation at DB Netz

September 2012:
Field testing in the DB Netz area (VALTHERMO® compared with Cu, CuAg0.1 and CuMg0.2)

October – November 2012:
Elongation measurement as part of field testing

From January 2013:
Component compatibility testing (system-specific)

May 2014:
First comparative wear measurement as part of field testing

August 2014:
Approval by DB Netz, inclusion in the DB Ebs-Zeichnungswerk. Delivery orders from Germany and abroad for AC- and DC railways arrive at NKT!

January 2015:
1st Deutsche Bahn project delivery

September 2016:
VALTHERMO® considered for the DB Innovation Award (VALTHERMO® positioned in the top 10 innovations)

December 2016:
Acceptance in the ÖBB framework contract

March 2017:
1st VALTHERMO® project delivery "down under" (Canberra Light Rail, Australia)

July 2017:
Semitag (Grenoble) changes from Cu-ETP to VALTHERMO® for maintenance

July/August 2017:
First installation of 95 mm^2 VALTHERMO® messenger wire in Switzerland

The most important advantages of VALTHERMO®

In comparison with other materials, the VALTHERMO® contact wire has been in commercial operation with the DB rail network since 2012, and in the meantime also by other rail operators.

This has demonstrated **two major advantages** for VALTHERMO® compared to Cu-ETP contact wire:

- considerably more than **double the service life**
- a **lower creep strain** by a factor of approximately 1:3 to 1:2

That means:

1. **A saving** of one or a number of **contact wire replacements** over the **system's life**.
2. **The cost of adjusting the initial contact wire installations is cut, or even avoided altogether.** VALTHERMO® exhibits exactly the same creep strain as CuAg0.1. The adjustment cost savings mean that VALTHERMO® pays for itself in the very first year. The remaining installation characteristics are the same as for Cu-ETP and CuAg0.1. A survey conducted in April 2017 on the installation properties of VALTHERMO® contact wires confirms that in practice application is comparable to Cu-ETP and has a slight edge over CuAg0.1 contact wire.
3. **Significant economies** in terms of operating and maintenance. An analysis by Dresden University of Technology based on the Net Present Value method demonstrates that a mainline overhead contact wire system can be operated for more than 70 years without replacement. This economic benefit was also confirmed for local transport by Dresden University of Technology in 2015: over a period of 70 years the percentage of the savings resulting from the change in contact wire as compared to Cu-ETP amounts to more than 80% throughout its life cycle – a clear benefit of VALTHERMO®.
4. The longer service life and lower adjustment cost translates into **significantly higher** contact line system **availability.**
5. VALTHERMO® contact wires are **mechanically** *(tensile strength, hardness, modulus of elasticity, torsional characteristics, coefficient of expansion etc.)* and **electrically** *(conductivity, thermal coefficient of electrical resistance)* fully compatible with Cu-ETP and CuAg0.1-contact wires. The clamps and other accessories used for Cu-ETP and CuAg0.1 can also be used unchanged for VALTHERMO®.
6. **VALTHERMO® contact wires** comply with EN 50149. Furthermore, DB have evaluated the field test, have technically approved VALTHERMO® and have adopted it into the Ebs-Zeichnungswerk (set of standard drawings for German railways).

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NKT is signatory of the Europacable Industry Charter: A commitment towards superior quality.