



eltherm Heating Systems for Railway Transportation





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1. eltherm GmbH

eltherm GmbH – Burbach DE

Internet: www.eltherm.com

Founded in 1991

About 130 employees (growing constantly)

Innovation by Investment

Investments:

> 5 Mio. € within the last 5 years

Huikeshoven BV – Hengelo NL

Internet: www.huikeshoven.nl

Founded in 1929, distributor for Eltherm since 2006.



1. eltherm GmbH

- eltherm GmbH is an international operating company specialising in the field of electrical heat tracing systems. With more than 40 years of technology know-how, continuous demand for the highest quality and flexibility, this owner-managed company has grown significantly since its humble beginning.
- The clear commitment to the production site in Germany strongly emphasizes the philosophy of eltherm, which is to supply its customers with electrical heat tracing system solutions individually customized to their requirements on the highest level.
- Having its own production site for heating cables and accessories, it has enhanced the engineering society in eltherm so as to become one of the leading manufacturers for electrical heat tracing systems worldwide.
- Besides frost protection and temperature maintenance up to 900°C, eltherm is the competent partner for complete system solutions like heating whole chemical or other industrial plants. eltherm proved its potential and expertise in different applications for industries like oil and gas, power plant building, automotive and food industries.



1. eltherm GmbH

Subsidiaries and/or trade partners all over the world

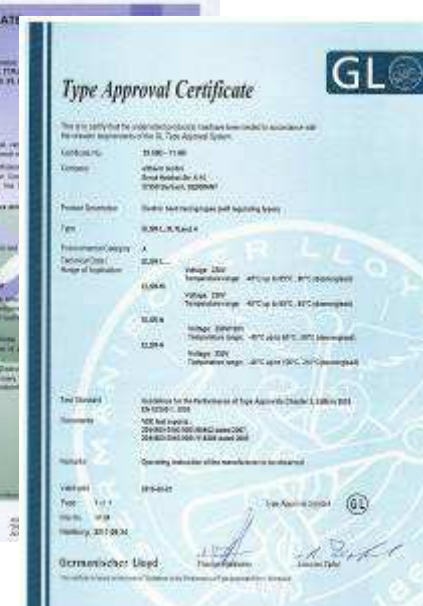
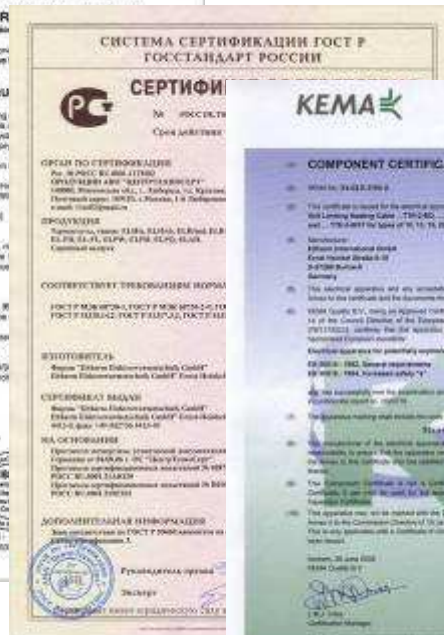
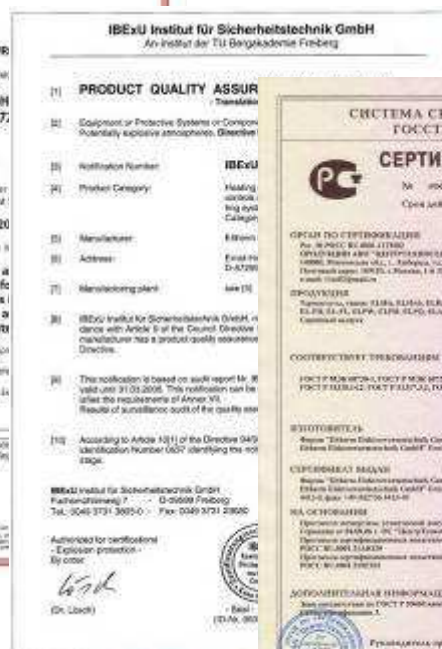


Subsidiaries and/or Channel Business Partners
around the world for maximum customer focus.

www.eltherm.com



1. eltherm GmbH



All eltherm products are certified according to the latest standards.



2. eltherm heating systems for railway transportation

The past winters, especially 2010/2011, have shown:
For a proper and secure railway transportation, frost protection and therefore heating plays a more and more important role.

The eltherm GmbH took the challenge to find the best solution for each frost problem within the Railway transportation.

No matter if rail heating, point heating or any other heating problem in the field of railway transportation, the eltherm engineers develop the most suitable system.





3. Purpose of rail heating

In areas with frequent and long frost periods, any surface exposed to open air is likely to be covered by snow and / or ice. I.g. with the Metrosystem of Alstom, ice or snow covered track running surfaces reduce the friction between the rubber wheels and the track and thus restrict control over the train.

For trouble free train operation during winter seasons, rail heating is recommended to keep the track surface free of ice and snow.



a. Basic design considerations

When using electric trace heating on rails, it is recommended that:

- the number of tracings on the rail is kept to a minimum by
 - choosing a cable of high possible output
 - placing it at the most efficient position of the rail
 - ensuring a maximum heat transfer to the rail
- the number of total supply points is kept to a minimum by installing maximum possible circuit length of the cable
- the number of total cable terminations and splices is kept to a minimum, again by installing maximum possible circuit length of the cable

All of those considerations are directly linked to a cost effective installation and maintenance and to a reliable operation of the heating cable.

With regard to a cost effective operation of the heating system, suitable controls are required.



a. Basic design considerations

Local conditions may however rise the need for higher loads. The required heat loads are depending mainly on the predicted snowfall rate for the specific area and the expected minimum ambient temperature.

The installed load depends also on the feasibility of inappropriate weather conditions and the demanded availability of the track part.





b. Why not parallel heating cables on the track?

Though included in the eltherm product range, eltherm intentionally did not choose parallel heating cable designs for rail applications. The main reasons for this are:

- parallel heating cable is subject to voltage drop
- parallel heating cable can partly fail while surveillance is almost impossible

Those statements are true for both designs of parallel heating cable, the “constant wattage” and the “self-regulating” design.

For instance, parallel constant wattage heating cable have a large number of contact points between heating and bus wire. Each of them poses a certain risk of failure. In a rail heating project, the number of contact points is likely to be some 10,000 or more and therefore it is expectable that some will fail by production process means. Bending the cable when mounting will increase this risk..

b. Why not parallel heating cable?

Self-regulating heating cable may have low power or even “dead” sections due to variations in the carbon content of the conductive (heat generating) part of the cable, too. This also depends on the quality of the contact between conductive part of the cable and the conductors. This contact can also be affected when mounting the cable.

Self-regulating cable also make a special “power up” management and equipment necessary because to the huge inrush currents involved.

Why is a partly failure of the heating cable critical to railway applications?

In contrary to a pipe with flowing heated goods, partly failure of the heating cable is critical on a rail because

it will definitely cause cold zones on the rail and thus lead to ice build-up.

b. Why not parallel heating cable?

Even though parallel heating cables are not suitable for heating of rails on track, they are the best choice for other trace heating tasks in the field of railway traffic, just because of their special characteristics and opportunities.

Constant wattage cables are a good solution for point heating systems. Self-regulating heating cables are quite suitable for most other tasks around the train itself.

Of course each application has its own challenges. So our eltherm engineers always develop the best solution for the actual application and make sure that you receive a reliably operating and suitable system.

c. The eltherm Rail Heating System EL-RAIL

eltherm El-Rail is instead a series cable and therefore has the benefit of extremely long heating circuits without any cold spot along the cable and without any power loss due to voltage drop.

The further benefits of the eltherm proposal are based mainly on the unique design of the El-Rail heating cable.

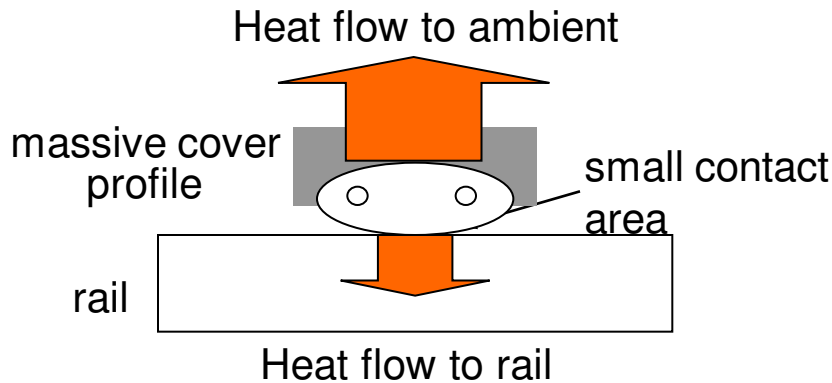
Because of its flat shape, it provides an exceptional large surface for contact with the rail, thus delivering a maximum possible heat transfer to the rail. The thermally insulated eltherm cover profile will enhance this effect even further.

Especially when compared to standard, oval shaped parallel heating cables, those advantages become obvious:

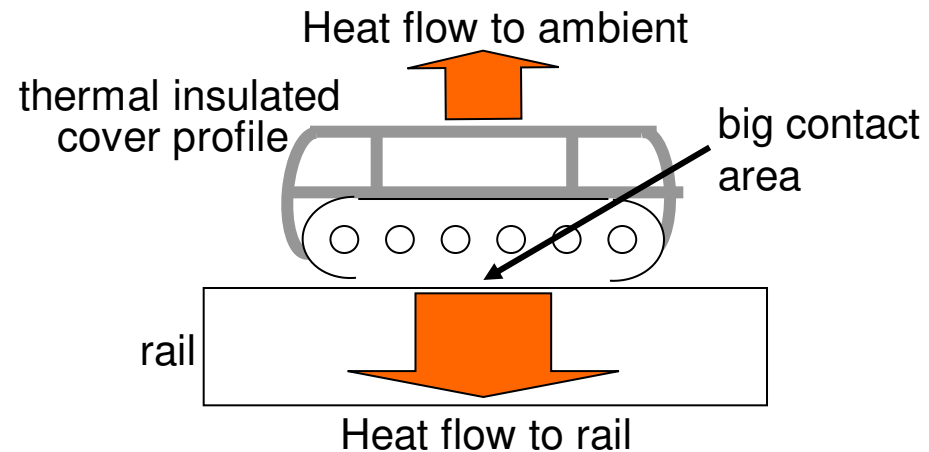


c. The eltherm Rail Heating System EL-RAIL

1a) Heat Flow parallel heating cable
(constant wattage or self-regulating)



1b) EL-RAIL

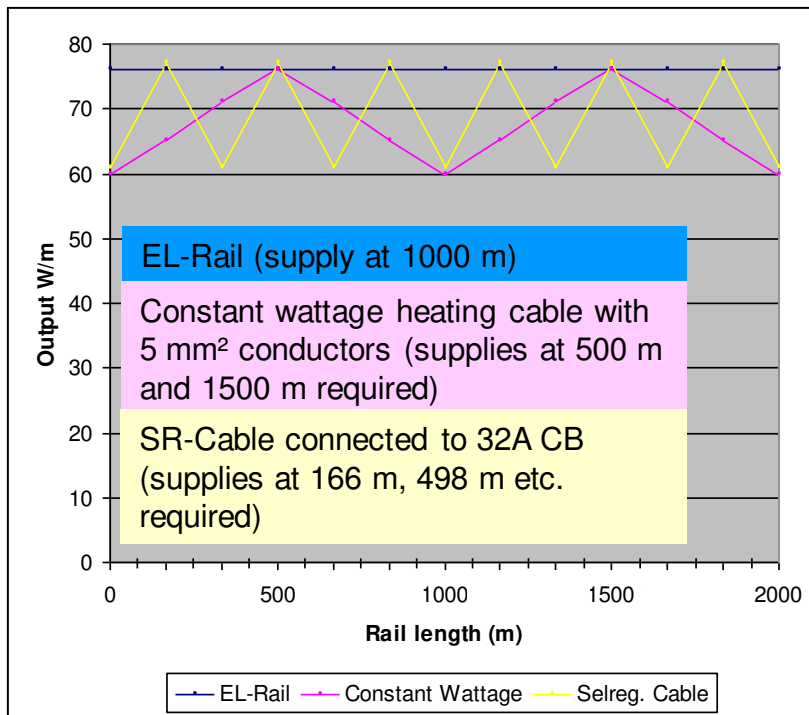


Sum of heat flows is identical for example a) and b) at a given total output



c. The eltherm Rail Heating System EL-RAIL

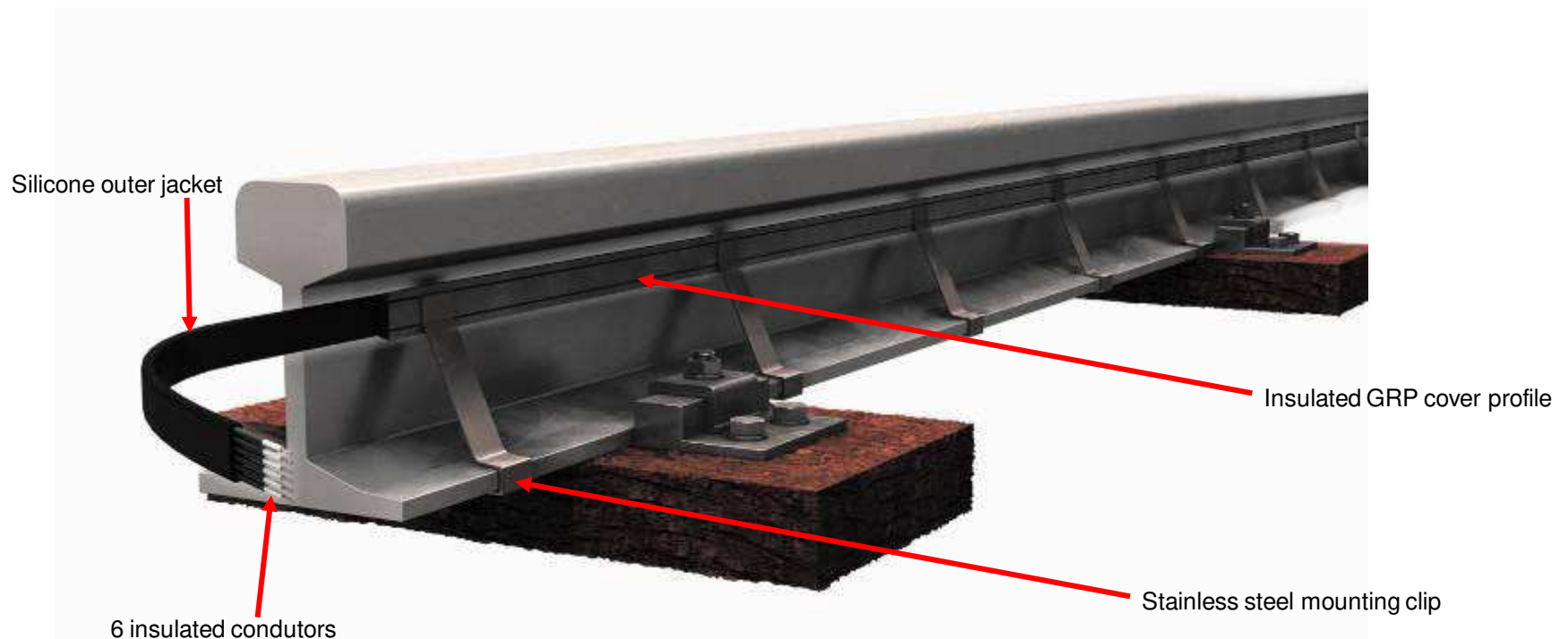
2. Distribution of nominal output along rail



Heat distribution on the rail will be proportional to distribution of nominal output. However, resulting rail surface temperature depends heavily upon the achieved heat flow towards the rail.



c. The eltherm Rail Heating System EL-RAIL



c. The eltherm Rail Heating System EL-RAIL



Effectiveness shown by infra-red camera



Orpington, UK in December 2010

d. Benefits at a glance

- No additional power supply points for the heating cable required because of circuit lengths up to 1150 m.
- Evenly distributed heat along the entire rail because voltage drop in EI-Rail cable is 0%.
- No risk of cold zones on the rail caused by low power or dead cable sections.
- Excellent thermal efficiency due to
 - thermal insulating cover profile which directs heat flow towards the rail.
 - good contact between heating cable and rail provided by unique large flat cable surface, rigid cover profile and spring steel fitting clips.

That means:

Compared to oval shaped cable of smaller dimensions and at a given power rating, EI-Rail cable will achieve higher surface temperatures on top of the rail.

d. Benefits at a glance

- No special effort for the handling of inrush currents necessary.
- PTFE electric insulation provides superior temperature withstand properties along with an unequalled flexibility, thus providing extra electrical safety in case of Voltage peaks (EI-Rail cable passes 20000V factory spark test).
- EI-Rail cable has self-stabilising properties due to its copper conductors with PTC behaviour. This will automatically restrict the thermal effects of possible Voltage peaks, thus providing additional safety against overheating.

d. Benefits at a glance

- Quick and easy installation due to unique and custom-made fitting clips.
- Low maintenance costs due to
 - minimum number of power distribution panels, junction boxes and cold end connections.
 - protected position of the heating cable directly underneath the running surface of the rail and additional protective cover profile.
- All materials are by mechanical properties suitable for heavy duty use and are resistant against oil, glycol, herbicides and UV radiation. The PTFE insulation layer provides additional safety against extremely aggressive media like acids etc.

e. Datasheets

EL-RAIL Rail Heating Cable

The eltherm EL-RAIL is a flat cable, combining six PTFE insulated series heating conductors in a silicone over-jacket. Superior properties of the heating system, low installation and operation costs and professional support from eltherm make the EL-RAIL to a first choice in rail heating applications.

Cable specifications:

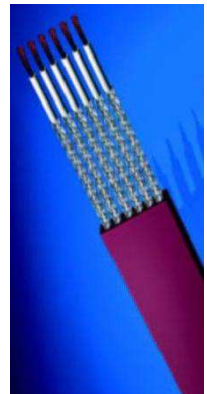
Insulation Class: 2
First insulation: 0.8 mm PTFE
Second insulation: 2.5 mm Silicon
(Insulation based on VDE 0253 standard/
/ EN 62395-1)

Available resistances: upon request

Dimensions: 8 x 34mm
Min. bending radius: 50 mm
Weight: approx. 400g/m

Max. circuit length at 150W/m
800m / 1000VAC or 250m / 230VAC
(supply from both sides)

400m / 1000VAC or 125m / 230VAC
(supply from one side)

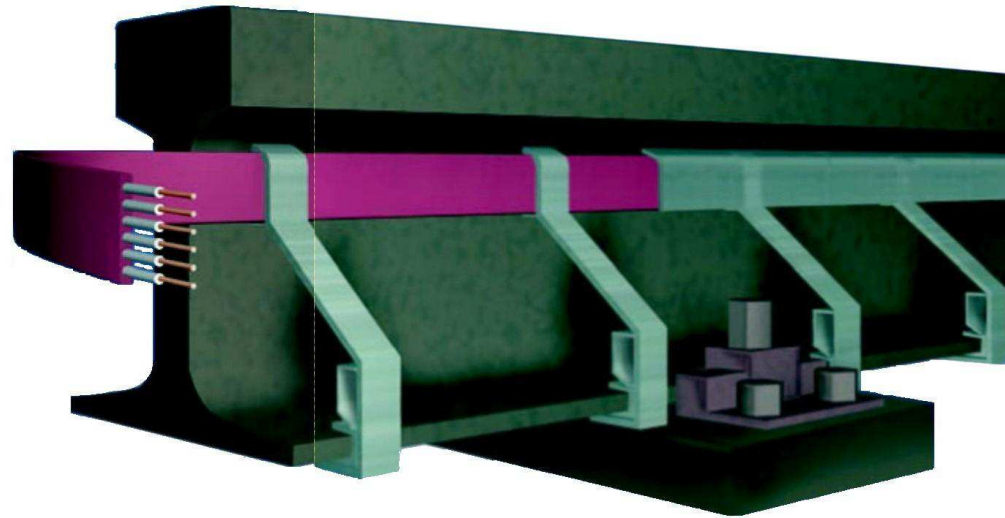




e. Datasheets

Braid (optional)	tinned copper
Max. loading	150 W/m
Max. voltage	1,000VDC
Max. current	30 A per conductor
Max. temp. operated:	50 C
Max. temp. de-energized:	150 C
Min. installation temp.:	-40 C
Ohm values:	according to site conditions

Resistant against UV rays, Glycol, mineral oil and herbicides

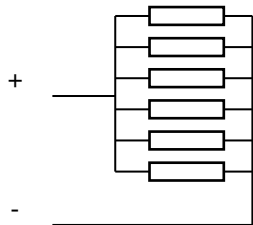




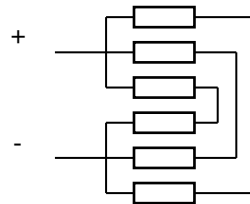
e. Datasheets

Possible Connections:

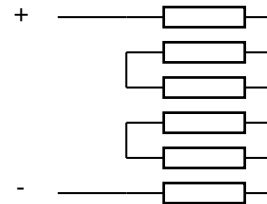
6 parallel



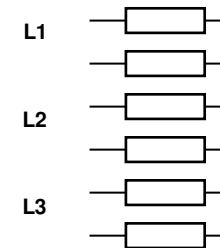
3 parallel 2 series



6 series



Star

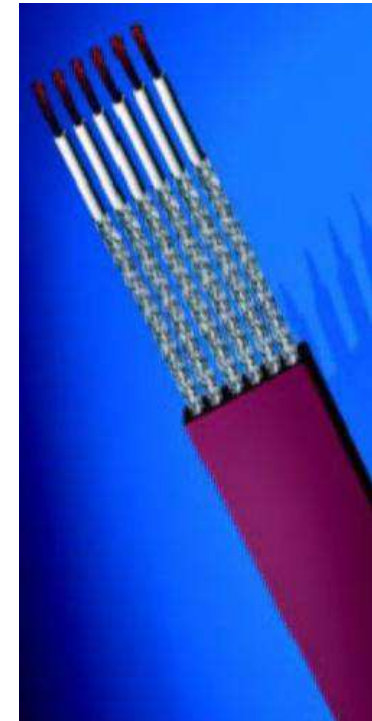




e. Datasheets

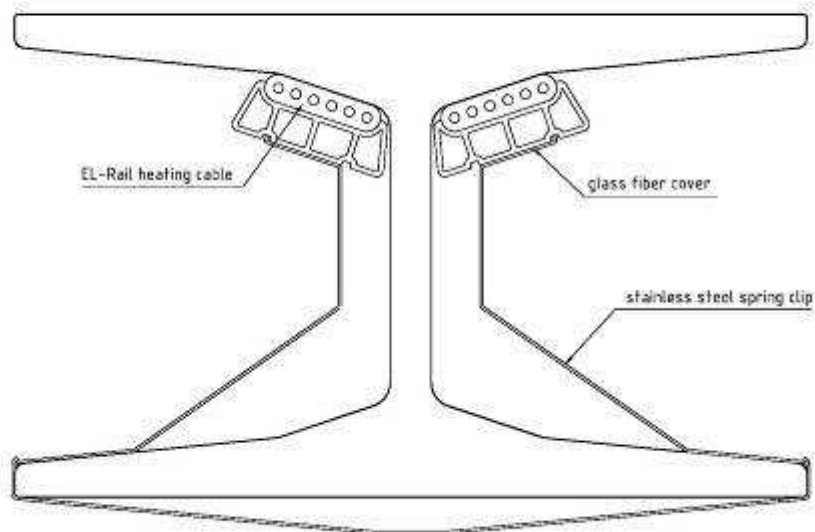
Benefits:

- Heating circuits up to 1,200 m at ~70 W/m
- Optimal heat distribution and heat transfer due to a big heat transfer surface
- Constant power output of max. 150 W/m
- Low cost of installation termination and mounting material caused by single heat tracer solution
- Low end termination costs
- High quality, mechanical and chemical resistance due to additional PTFE insulation of bus wires
- High efficiency with heat insulating covering profile
- Perfected mounting system
- Voltage 230 V to 1,000 V, heating cable withstands 5 kV tests

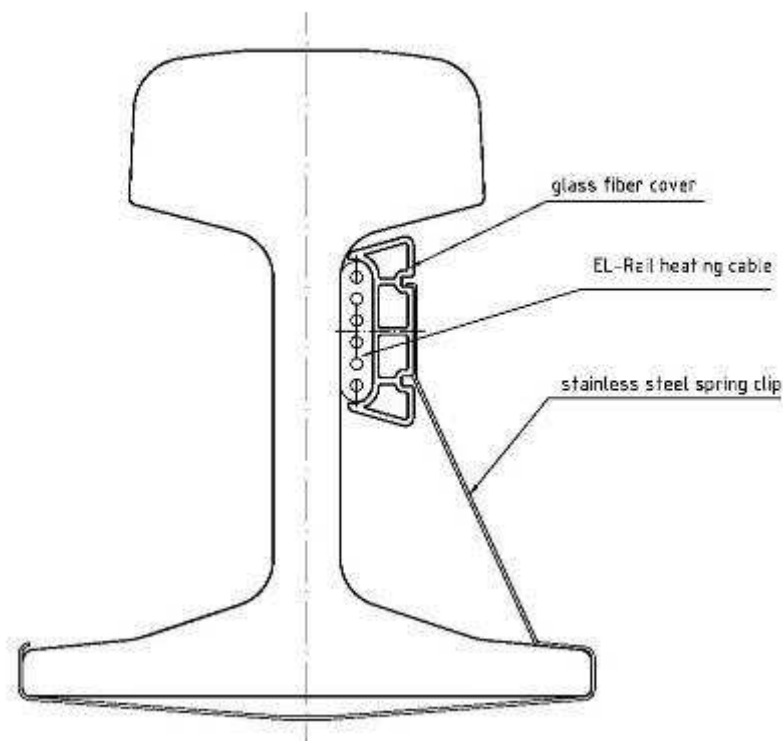


Installation Drawings

Heating cable installation on running rail



Heating cable installation on profile U50



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4. The eltherm point heating system EL-Point

- The eltherm engineers develop for each application in the railway transportation the best solution.
- For rail heating on the track the series cable has proven to be the best choice.
- For point heating the eltherm constant wattage cables have shown to be the ideal solution. eltherm designed a special cable which is most suitable for this application.

a. Advantages of the eltherm point heating system EL-Point

- Reduced stock and easy handling
 - only one product is needed for all turnout geometries
 - heating cable can be taken off reel and cut to length
- Optimised heat transfer from heating cable to point rails
 - flexible heating cable adapts in the best possible way to the point rail, thus minimising gaps
 - thermal insulating cover profile reduces heat loss to ambient and directs heat flow towards the point rail
 - large, dark rail surface is thus turned into a radiator – the high heat radiation ratio clears the gap between stock rail and moving rail effectively from snow and ice
 - high efficiency due to high heat radiation ratio and partial thermal insulation of rail surface by cover profile



a. Advantages of the eltherm point heating system EL-Point

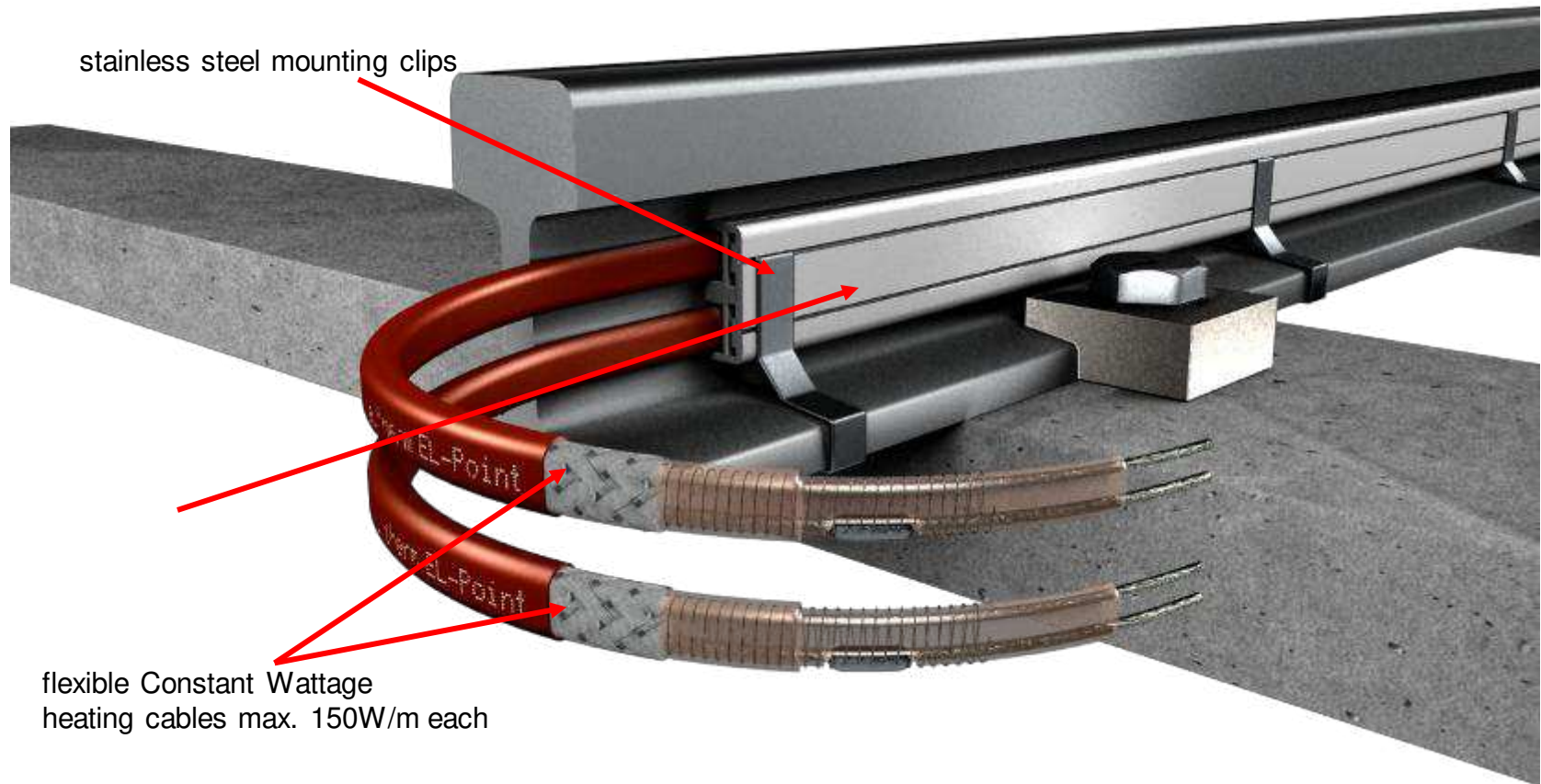
- Fast and easy mounting
 - due to radiation effect, installation on the outside of the stock rail is possible –easy cutting and onsite termination
 - no risk of short circuit of rails due to fluoropolymeric heating cable surface and cover profiles, thereby easy installation on existing track circuits
 - heating cable comes pre-terminated with plugs and / or cold lead if required
 - cutting to length automatically creates cold length of 500 mm for splicing or connecting to junction box
- Low maintenance requirements
 - moisture problems are avoided by use of polymeric electrical insulation and jacket
 - easy access to the heating cable due to position on the outside of the stock rail whilst still optimal protection by rigid cover profile
- No risk of blocked signalling rail-circuits because of non-conductive outer material

Technical Details

- cut to length constant wattage heating cable (W x H approx. 16 x 7 mm, distance between contact points approx. 500 mm)
- versions from 50V up to 750V
- thermally insulating GRP cover profile (W x H approx. 40 x 11 mm, length approx. 2000 mm)
- stainless steel fitting clips
- up to 2 heating cables per cover profile
- power output from 120 W/m (one heating cable per cover) to approx 300 W/m (two heating cables per cover)
- all components UV-resistant and resistant against oil, grease, herbicides, salt and de-icing fluids
- optional: Flexo plugs pre-fitted to heating cable or intermediate cold lead



b. Design of the eltherm point heating system EL-Point



stainless steel mounting clips

flexible Constant Wattage
heating cables max. 150W/m each

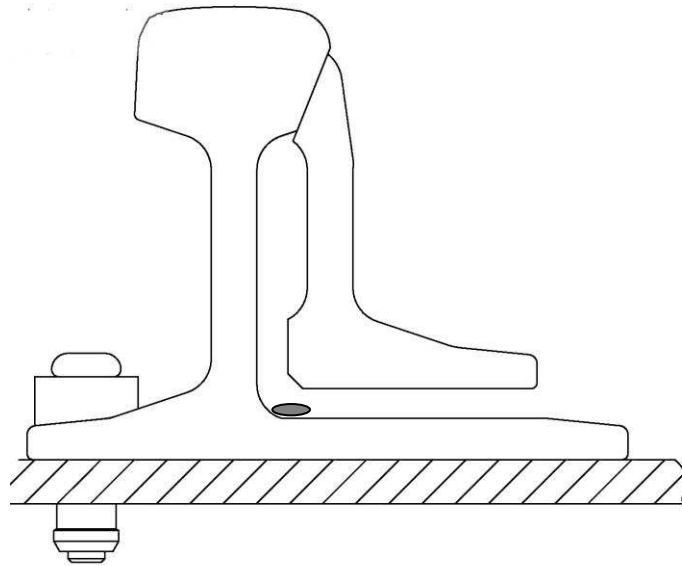
optional: pre-fitted plugs with or without intermediate cold lead

www.eltherm.com

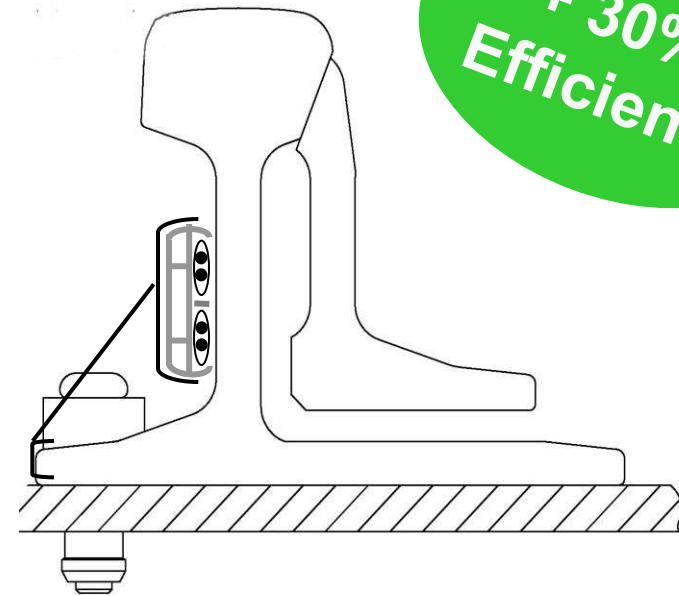


Performance: EL-Point in comparison with standard flat heating element

Standard point heating with flat heating



eltherm EL-Point

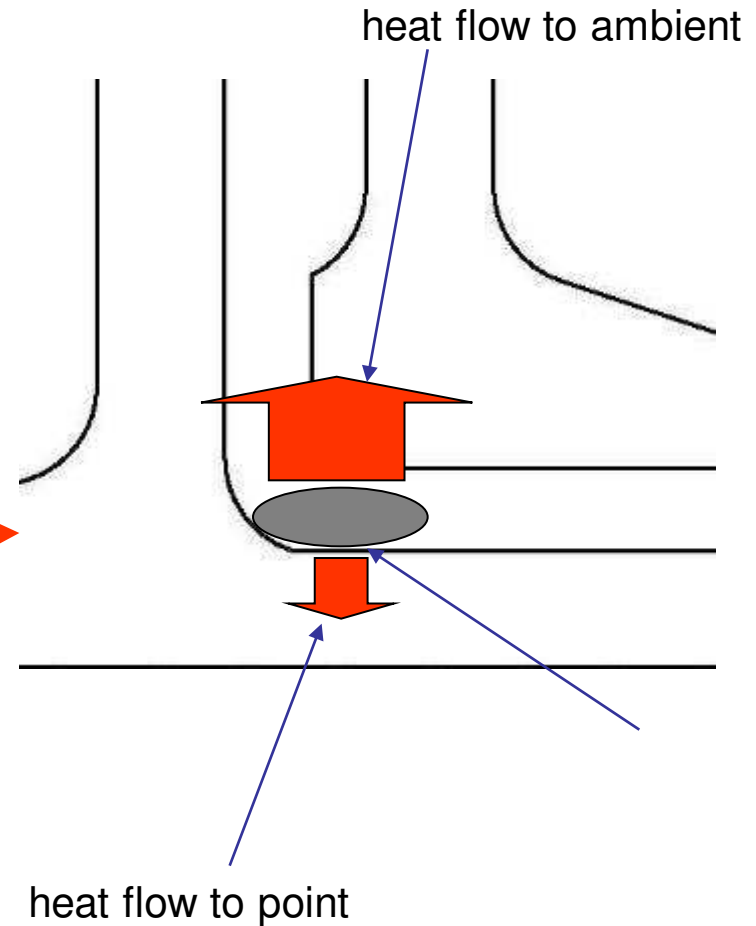
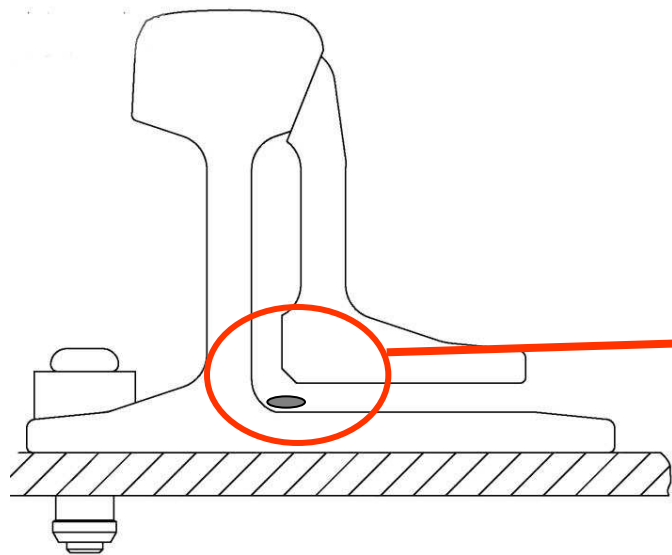


**+ 30%
Efficiency**



Performance: EL-Point in comparison with
standard flat heating element

Standard point heating with flat heating element

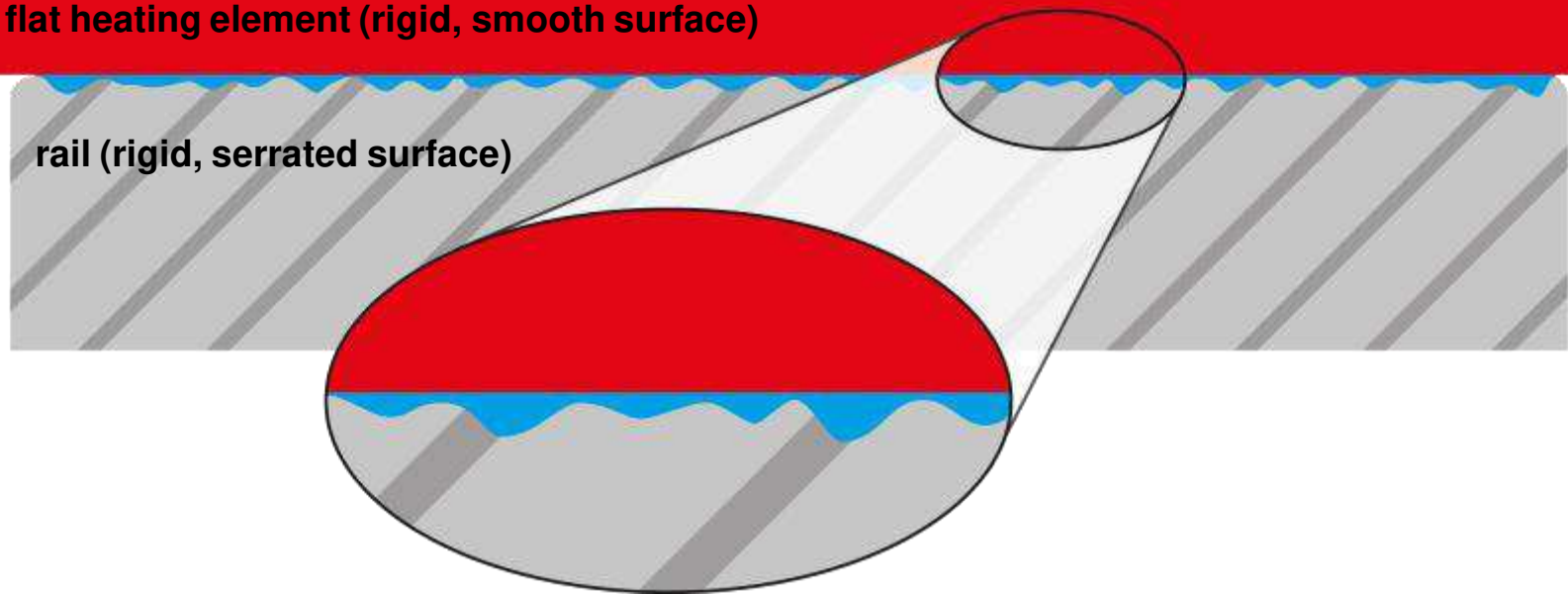




Performance: EL-Point in comparison with
standard flat heating element

Standard point heating with flat heating element

flat heating element (rigid, smooth surface)



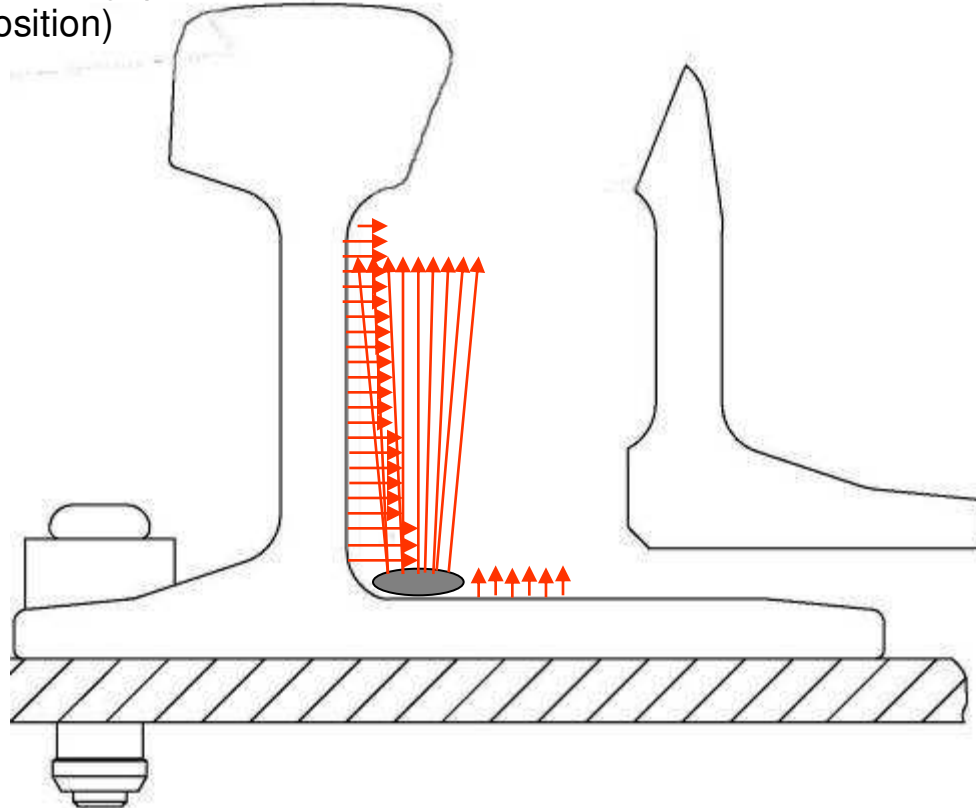
rail (rigid, serrated surface)

Between the rail and heating element surface, a number of small gaps occur because of the irregularities in the rail surface and the inflexibility of the heating element. The result is a comparatively poor heat transfer into the rail and thus a comparatively low rail temperature.



Performance: EL-Point in comparison with standard flat heating element

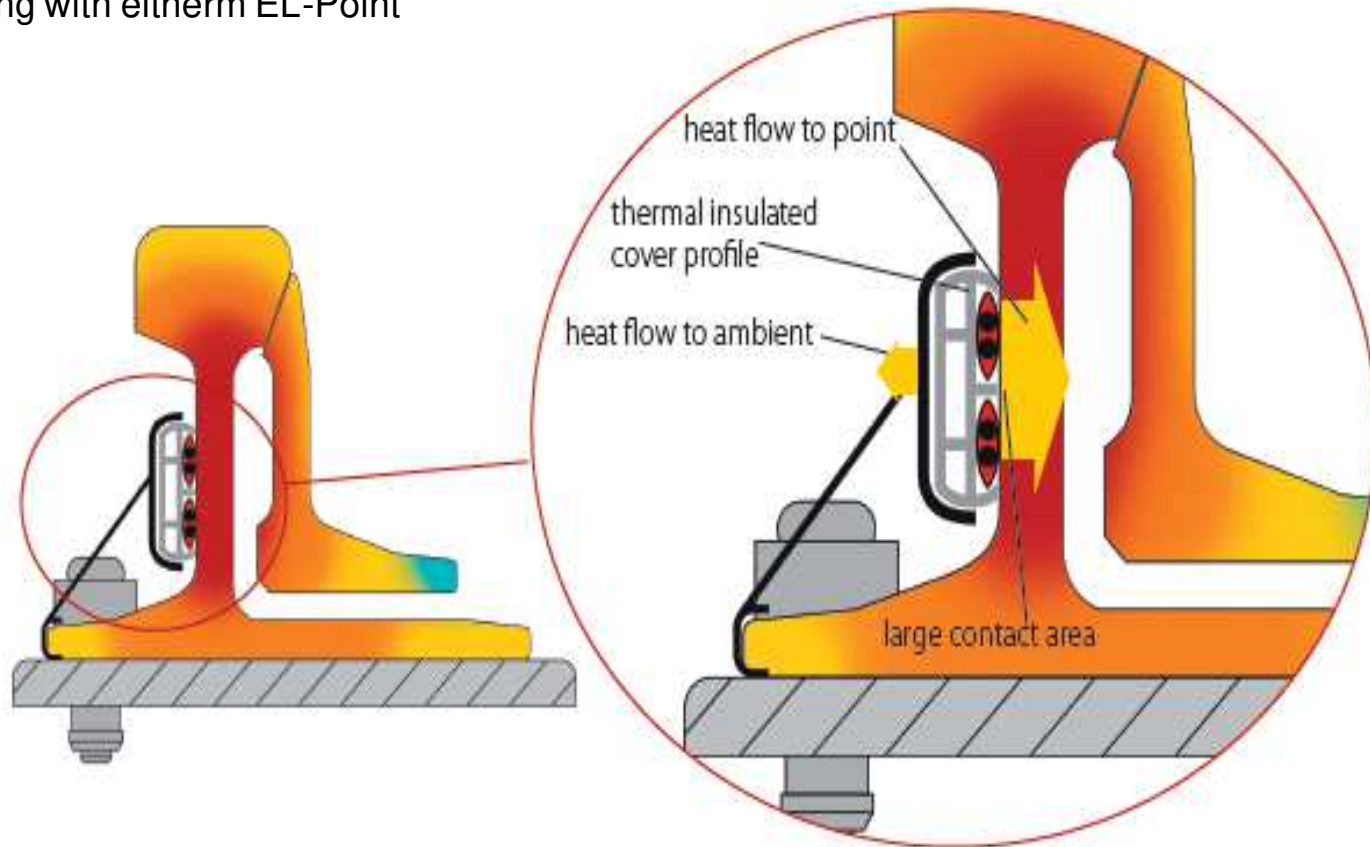
Standard point heating with flat heating element:
resulting heat radiation in gap between stock rail and moving rail (open position)





Performance: EL-Point in comparison with standard flat heating element

Point heating with eltherm EL-Point



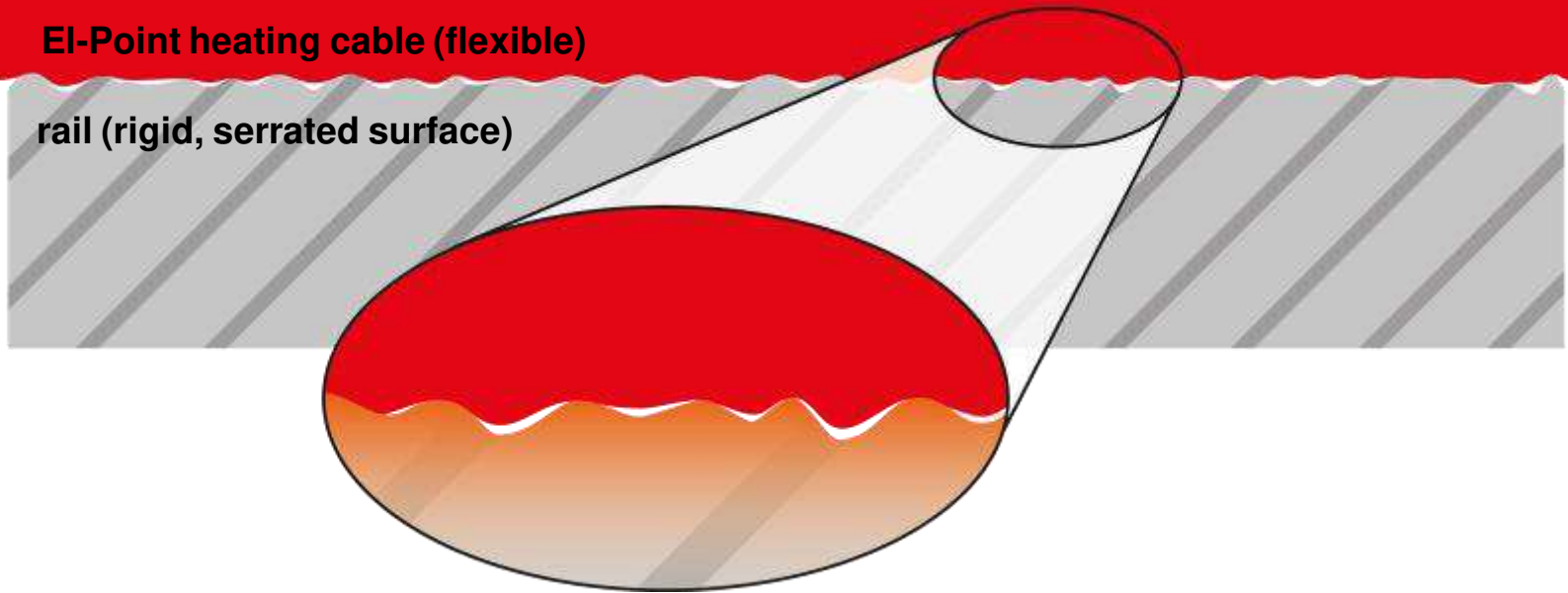


Performance: EL-Point in comparison with
standard flat heating element

Point heating with eltherm EL-Pont

EL-Point heating cable (flexible)

rail (rigid, serrated surface)

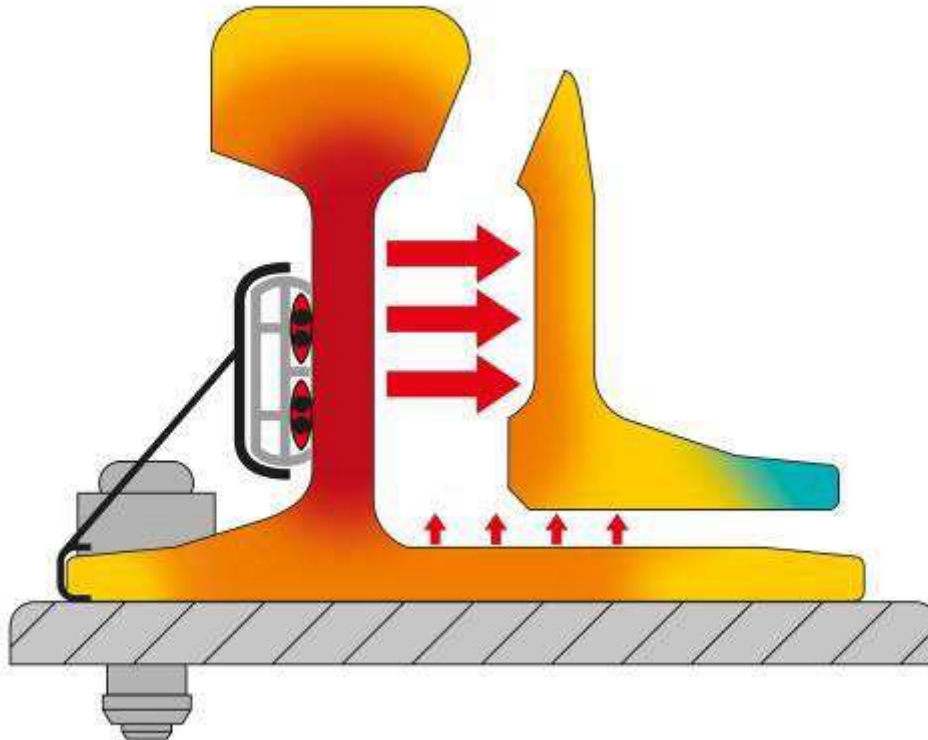


Due to its flexibility, the heating cable can equalise most of the
rails irregularities. Thus the heat transfer into the rail is
enhanced and results in a higher rail temperature.



Performance: EL-Point in comparison with standard flat heating element

Point heating with EL-Point system:
resulting heat radiation in gap between stock rail
and moving rail (open position)





5. References

Site: Bahnhof Michaelstein (Rübelandbahn),
Germany

Owner: Fels Netz GmbH

Year of installation: 2012

Scope of supply: 4 Points including switch blade
stock rail, throw bar heater, point mechanism,
Including control system with eltherm power
stepping logic for a maximum efficiency
Loading W/m: variable 150 - 300 W/m





5. References

Site: Copenhagen-Ørestad Tram Depot,
Denmark

Owner: Metro Copenhagen

Year of installation: 2011

Scope of supply: 1 Point including
switch blade, stock rail

Loading W/m: 300 W/m



5. References

Site: UK, Kent / Sussex

Owner: Network Rail

Year of installation: 2010/2011

Length of third rail heated: 56,000 m

Loading W/m: 150



5. References

Network Rail UK





5. References

Site: Switzerland, Lausanne, Metro m2
Owner: tl
Year of installation: 2006/2007
Total amount of heating cable: 14,000 m
Length of rail heated: 1,200 m
Two tracks with 6 cables each
Loading W/m: 130



5. References

Metro Lausanne





5. References

Site: Sweden, Eaodespänn,
Cleaning station

Owner: Stockholm Tunnelbann

Year of installation: 2004

Length of rail heated: 200 m

Loading per m: 130 W/m





5. References

Site: Germany, Görlitz, centrifugal force test rail,

Owner: Brunel Railmotive

Year of installation: 2008

Length of rail heated: 50 m

Loading W/m: 130



5. References

centrifugal force test rail





Prepared by:

eltherm GmbH
Ernst-Heinkel-Str. 6-10
57299 Burbach, Germany
Phone: +49 (0) 27 36 – 44 13-0
Fax: +49 (0) 27 36 – 44 13-50
E-Mail: info@eltherm.com
Internet: www.eltherm.com

Huikeshoven BV
Robijnstraat 6
NL-7554 TB Hengelo
(088)-8898850

info@huikeshoven.nl
www.huikeshoven.nl

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