CLEVELAND ELECTRIC LABORATORIES
Thermocouples & Sensing Solutions since 1920

FiberStrike®
by Cleveland Electric Labs
LIGHT CAPTURING MOTION

FIBER OPTICS • INNOVATION •

Real Time Thermal Rating (RTTR)

In order to operate power grids, such as transmission lines and distribution networks, with maximum efficiency and at higher voltages, advanced technology is needed to maximize power load and simultaneously retain high safety standards. One of these advanced technologies is RTTR.

Real Time Thermal Rating (RTTR) or Dynamic Cable Rating (DCR) continuously calculates the conductor temperature of a power grid by taking current load, load history, thermal conditions and other factors into account. At the same time it predicts the maximum permissible load for steady state and emergency situations. Based on industry standards IEC 60287, IEC 60853 and finite element modeling, you can operate your network at the highest possible safe ampacity levels with excellent predictive capabilities.

The RTTR calculation is based on precise thermal models reflecting the soil/ambient conditions along the high voltage power cable. The RTTR module calculates pertinent information such as conductor temperature profiles and emergency ratings in real-time using fast Kalman Filter technology.

RTTR seamlessly integrates into our software package, enabling the identification of critical locations and triggering (pre-)alarms when respective thresholds are reached. RTTR is the ideal tool for comprehensive asset monitoring of HVAC & HVDC underground and submarine cables.

RTTR functionality comprises of:

- ✔ **The calculation of conductor temperature** profiles along power cables from Distributed Temperature Sensing (DTS) and load data
- ✔ **The calculation of steady-state ampacity**, i.e. maximum permissible load
- ✔ **Emergency ratings**, i.e. real-time prediction of maximum conductor temperature, emergency time or emergency current for up to one week

MADE IN THE USA
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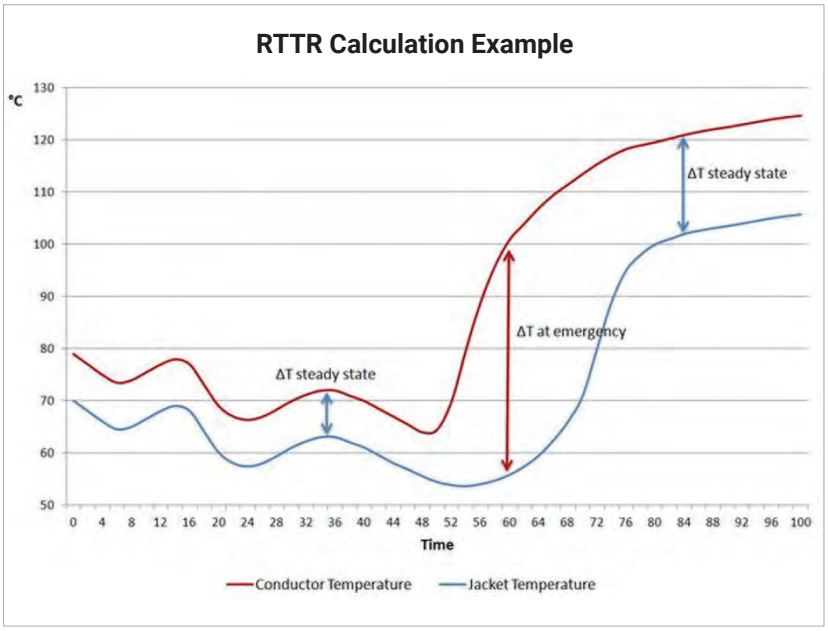
FiberStrike has a proven history providing power cable monitoring solutions including RTTR and has worked together with industry leaders to achieve precise, reliable and validated data. Rating results are fully integrated into our software platform and are easily interfaced into the operator's load dispatch center via standard protocols such as Modbus TCP, IEC 61850 and IEC 60870-104.



The FiberStrike RTTR module is a **state-of-the-art software module** and enables the optimal use of temperature information from monitored power transmission and distribution networks. Thermal rating of AC and DC circuits is supported, enabling the optimized monitoring of all modern onshore and offshore underground power cables (single-core and three-core cables). A wide range of installation configurations for single and multiple circuits is supported including a wide range of sensor positions.

Steady State and Emergency Ratings

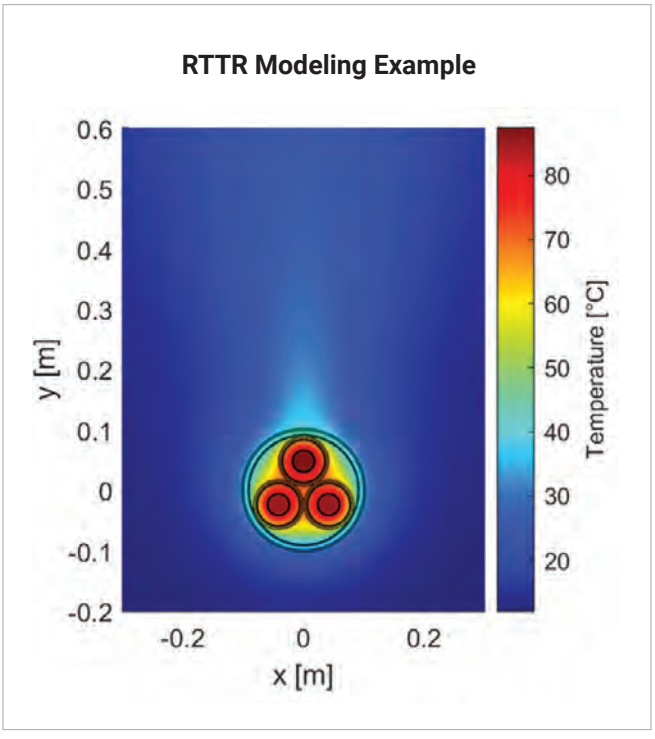
Using continuous temperature measurements of the cable surface (fiber position) and the available load data, RTTR calculates the temperature of the conductor core.

The RTTR engine can predict:

- The temperature of the cable in the future (up to 1 week).
- The time it will take the cable to reach the specified limit.
- The maximum current that the circuit can carry to reach the specified temperature.

RTTR Modeling Capabilities

Virtually all types of cable designs can be modeled in our RTTR such as: single-core, three-core, sheathed cables, subsea composite cables, and concentric neutrals.



Numerous cable-laying conditions can be modeled, such as directly buried, duct banks, thermal backfills, buried ducts and pipes, submerged cables, and many more. The cable phases can be touching or non-touching, single or multiple circuits installation combined. Our RTTR solution can model several materials with individual thermal parameters, for example stratified soil layers, multiple duct banks and thermal backfills. The model range is continually being extended.

Various types of fiber positions verified by **Finite-Elements-Method (FEM) simulations** can be covered:

- Internal sensor, e.g. in cable sheath (position specified by cable layer),
- External sensor cable, attached to power cable or pipe,
- Remote sensor (distant to power cable or pipe),
- Special positions for trefoil touching circuits.

Benefits of RTTR:

- **Prediction of time before maximum temperature is reached.**
- **Identification of dynamic or permanent load pattern and the maximum conductor temperature limit for the cable.**
- **Temperature of the cable at the end of a given period of (over) load for improved safety.**
- **The maximum permissible load of the cable for an emergency situation.**
- **Lower maintenance and operating costs.**

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