CYME INTERNATIONAL T&D

TRANSMISSION, DISTRIBUTION & INDUSTRIAL SYSTEMS ANALYSIS

CYMCAP/RTTR, Real-Time Temperature Rating

Numerous underground transmission projects are emerging worldwide. Each project requires a substantial investment of time and money in a market where shortfalls and blackouts are not acceptable anymore.

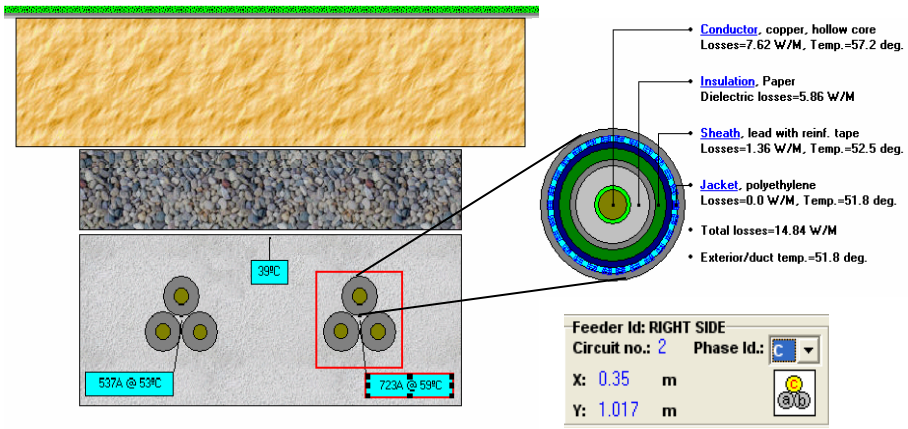
Nowadays, it is a universal practice to use Distributed Temperature Sensing (DTS) systems based on fiber optic technology to monitor the cables temperature all over the run. To supplement this technology, CYME introduces its CYMCAP/RTTR Dynamic or Real Time Temperature cable Rating system to extend the monitoring functionality and predict/forecast the behavior of the installation under emergency situations.

CYMCAP/RTTR is designed to provide both steady state and transient thermal analysis. It is based on the IEC Standards 60287 and/or 60853 or finite elements. This function allows the user to be ready, by looking into the future, when an emergency situation arises.

RTTR Operating Modes

The Real-time Temperature Rating based on CYMCAP has two modes of operation:

- Estimating the conductor temperature from the fiber measured temperature.
- Performing emergency ratings with the transient engine.



CYMCAP Model and results for a multi-layer installation

CYMCAP/RTTR Modeling Capabilities

Virtually every cable construction available in the market can be modeled with CYMCAP: one-core, three-core, sheathed cables, concentric neutrals, armored cables, screens, shields, beddings, servings, jackets, etc. The following installation types can be modeled: duct banks, backfills, directly buried, buried ducts, buried pipes, cables in air (including groups of cables and riser poles) and cables in tunnels. Unique to CYMCAP is its ability to model several materials with different thermal resistivities, for example: stratified soil layers, multiple duct banks and multiple backfills.

Emergency rating

CYMCAP/RTTR provides the following information useful to the cable operator:

- Given the operating temperature and the applied (over) load, the RTTR software predicts the temperature of the cable in the future.
- Given the operating temperature and the applied (over) load, the RTTR gives the time that it will take to the cable to reach a specified emergency temperature.
- Given the operating temperature and a time frame for an over load, the RTTR computes the maximum current that the circuit can carry to reach certain emergency temperature.

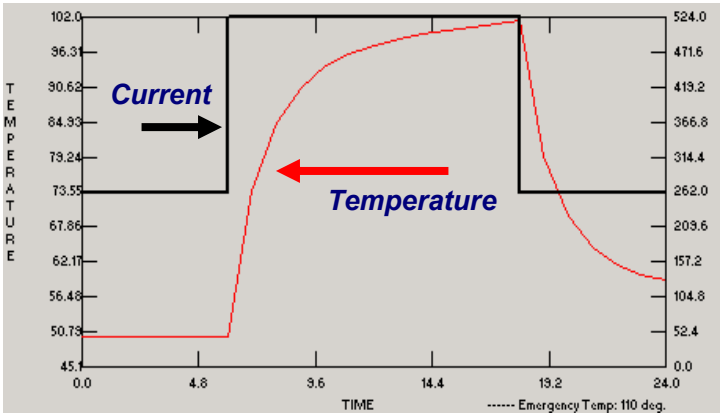
Case	Cable	Current [A]	Temperature [°C]	Time [hours]
1	1	compute	data	data
	2	compute	data	
	...			
	n	compute	data	
2	1	data	compute	data
	2	data	compute	
	...			
	n	data	compute	
3	1	data	data	compute
	2	data	data	compute
	...			
	n	data	data	compute

Computational Procedures

When there are available real-time measurements of both the temperature at the cable surface and the current, CYMCAP/RTTR uses the IEC Standards 60853 to conveniently compute the temperature of the core conductor. When only the temperature at the location of the fiber is available, the temperature of the core can be estimated from the IEC Standards 60287.

Transient Calculations

Cable operating temperature very much depends on the load shape applied to the cable. In other words, the temperature of a cable depends on the intensity of the current and its time variations. Therefore, cables have different ratings, i.e. steady state, cyclic, emergency and short circuit. Since cables installations have thermal inertia, it takes time to heat up the cable and its surroundings. A typical response to a step overload of 100% lasting 12 hours is shown in the figure below. One can appreciate that the temperature of the cable follows in an exponential way the changes in current.



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