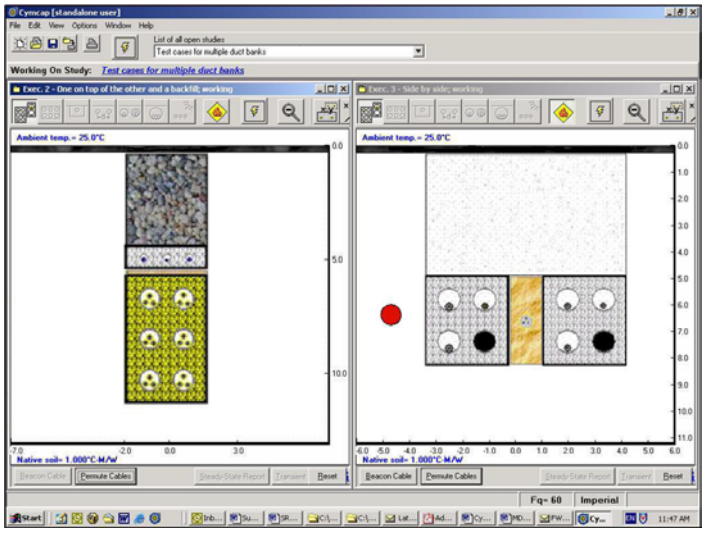
TRANSMISSION, INDUSTRIAL AND DISTRIBUTION SYSTEMS ANALYSIS

Multiple Duct Banks | Duct Bank Optimizer | Short Circuit Ratings | Cables in Tunnels | Magnetic Fields | And more...

CYMCAP/MDB, Multiple Duct Banks

The Multiple Duct Banks module (MDB) is the extension to CYMCAP designed to determine the steady state ampacity of cables installed in several neighboring duct banks and/or backfills with different thermal resistivity. The module presents a unique solution combining standard and non-standard calculation methods. The module computes the values of T_4 (the external to the cable thermal resistance) using finite elements and then the ampacity (or operating temperature) of the cable system is obtained using the IEC standardized solution method.



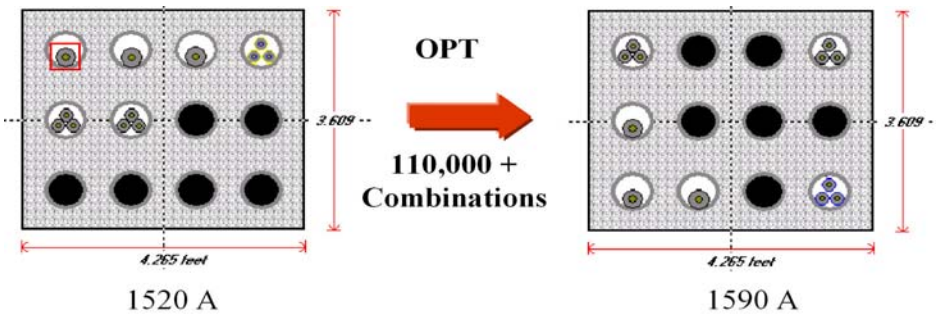
CYMCAP/MDB features many modeling facilities. The following capabilities can be highlighted:

- Modeling up to eleven rectangular areas with different thermal resistivity.
- Modeling up to three duct banks in a single installation.
- Modeling one heat source or sink in the installation.
- Computation of the steady state ampacity or temperature.

CYMCAP/OPT, Duct Bank Optimizer

The duct bank optimizer is an add-on module to CYMCAP that allows the user to determine the optimal placement of several circuits within a duct bank. More specifically, the module can recommend the various circuit disposition within the duct bank in order that:

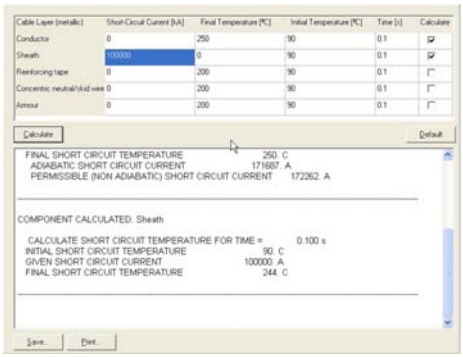
- The duct bank overall ampacity, i.e. the sum of the ampacities for all circuits, is maximized.
- The duct bank overall ampacity, i.e. the sum of the ampacities for all circuits, is minimized.
- The ampacity of any given circuit is maximized.
- The ampacity of any given circuit is minimized.



For a 3 by 4 duct bank with three trefoils and one three-phase circuit (one phase per conduit), there are over 110,000 possible combinations. CYMCAP elaborated mathematical algorithm prevents the repetitive calculation of equivalent cases, therefore the solution is obtained very efficiently. The condition illustrated on the right hand side, above, shows the cable locations for maximum ampacity.

CYMCAP/SCR, Short Circuit Cable Rating

The Short Circuit Cable Rating (/SCR) add-on module to CYMCAP is dedicated to the rating of cables for short circuit currents. The implemented method is described in the IEC Standard 949 (1988) "Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects". CYMCAP computes both adiabatic and non-adiabatic ratings. CYMCAP /SCR offers two possibilities according to the known input data:

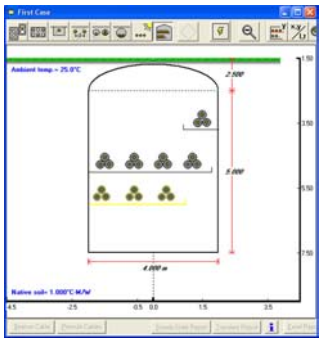


- Compute the maximum short-circuit current that a cable component can carry given the short circuit time together with the initial and final temperatures.
- Compute the final temperature that a given cable component will reach for a specified short circuit current and initial temperature.

The short circuit rating can be computed for up to the five metallic layers in the CYMCAP model: (1) Conductor, (2) Sheath, (3) Sheath reinforcement, (4) Concentric neutral / Skid wires, (5) Armour.

Cables in Tunnels

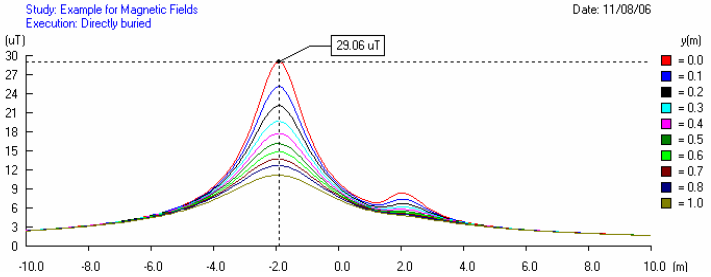
The optional Cables in Tunnels Module allows the user to determine the temperature, steady state, cyclic and transient ampacity of cables installed in unventilated tunnels. Note that only equally loaded cables having the same type and loading are considered. This add-on module supports a large variety of cable arrangements for single core (flat formations or trefoils) and three-core cables. The cables can be laid down on a floor, hanging from supports clamped on a wall, installed in ladder racks or in cable trays. Major features are:



- Modeling of a large variety of installation methods: laying on a floor; hanging from a wall; in ladder-type racks; or in cable trays.
- Cables and groups of cables can be single-core or three-core. Single-core cables can be arranged in flat formations (vertically or horizontally) or in trefoil.
- Computation of the steady state ampacity or temperature. Cyclic loading using daily, weekly and yearly load factors. Computation of emergency ratings.

Magnetic Fields

The Magnetic Fields Module (EMF) is an optional add-on that can be connected to CYMCAP. Although this module is not directly related to cable thermal rating, it offers convenience to the CYMCAP users. After an ampacity or a temperature steady state simulation the module computes the magnetic flux density at any point on or above the ground of an underground cable installation. The output is a plot (or a table) of magnetic flux density versus position. Modeling features include:



- Infinite-length thin-wire two-dimensional approach.
- Consideration of time-varying currents producing an elliptically polarized rotating magnetic vector.
- The currents in a three-phase circuit can be unbalanced (in magnitude and phase).
- All media is assumed homogenous, isotropic and linear.
- The induced currents are neglected.

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