

## Derating factors for multiple circuits of low and medium voltage cable installations

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Electrical engineers who design and supply internal circuits in new buildings often use ampacity tables provided by cable manufacturers. This approach is usually sufficient; however, in certain conditions additional ampacity study needs to be conducted. The aforementioned conditions are applicable to installations where multiple circuits are laid close to each other which can often be observed in modern data centers. Characteristic behavior of such circuits is relatively high power requirement and almost unity load factor. Although the power loss of individual cable chosen on the basis of generic ampacity tables seems to be low, the impact of multiple tens of cables can be easily underestimated leading to overheating and in effect decreasing of the reliability of such facility. As previously mentioned, one of the solutions is to conduct ampacity study for each installation which is impractical and not cost effective. Second approach is to develop de-rating tables for high number (beyond 20) of cables directly buried or installed in conduits. These tables or formulas, if implemented as a standard, will provide guidance for designing such installations.

The IEC standards for low and medium voltage cables as well as some published works by Siemens address the issue of derating factors for multi-circuit installations. There is no information given how these factors were obtained and verified.

This paper presents the results of calculations performed towards obtaining tables for certain configurations of cables where the engineer can apply the de-rating factor for multiple installations. The approach used in the calculations applies the finite element method (FEM) permitting to overcome the limitations of the analytical methods. In order to validate the approach several simplified FEM models are verified with analytical ones.

In summary, the paper will provide the details of the calculations, key factors and a discussion of developing further guidelines.