

# DIRECT (NON-ITERATIVE) CALCULATION OF THE CRITICAL TEMPERATURE OF STEEL MEMBERS SUBJECT TO STABILITY LOSS IN FIRE

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This paper introduces a calculation method for critical temperature of a steel member subject to stability loss in fire.

In EN 1993-1-2, the critical temperature of a steel member may be calculated directly using equation 4.22, but only when stability phenomena and deformation criteria do not need to be taken into account. In most cases, however, stability must be taken into account. In these cases, EN 1993-1-2 does not give any means of calculating critical temperature directly. The common procedure is iterative: guessing a temperature, calculating the member resistance in this temperature, comparing it to actions, and making a better informed guess of the critical temperature until accurate enough value has been found.

The method described in this paper allows direct calculation for a very good approximation of the critical temperature, so that multiple iterations are not needed. It is suitable for stability checks for a single action, such as buckling under axial loading or shear buckling under plain shear force. For stability checks under combined actions, such as buckling due to combined bending and axial compression, iterative method remains preferable.

A literature review related to the subject is also conducted, as well as comparison between approximate results derived with the direct method and accurate results derived with the iterative method.

The method presented here provides simplicity and efficiency to the hand calculation procedure, and may also enable faster programming and easier maintenance to any spreadsheets or other computer code used to solve stability problems of steel structures in fire. All equations have graphical representations that link with the graphs in EN 1993-1-2, so an intuitive graphic method may also be used to make rough estimates of the critical temperature.