

The simple method of computing the time-temperature response of protected steel members that has been recommended by the European Convention for Constructional Steelwork (ECCS) is presented in this paper. The method is a one-dimensional heat flow approach that explicitly accounts for the thickness and thermal properties of the insulation as well as the area and perimeter of the steel section.

Two different cases are recognized. In the simpler, the heat required to increase the temperature of the insulation is small and can be ignored. This will be the case for sprayed mineral fiber fire protection. In other cases, a large amount of heat is absorbed by the insulation and it must explicitly be taken into account. This will be true for gypsum plaster, concrete, or masonry fire protection.

A time-step approach is used, in which thermal equilibrium is considered during each of several short time intervals. This leads to repetitive calculations in a format ideally suited to use in a spreadsheet program in a microcomputer. The time-temperature course of the fire is explicitly taken into account, and the fire may follow the ASTM E-119 curve or any other curve.

Three examples are presented, and comparisons of measured and computed fire endurance are made, with reasonably good agreement found.