
**Fire-resistance tests — Elements of
building construction —**

Part 13:

**Requirements for the testing and
assessment of applied fire protection
to steel beams with web openings**

Essais de résistance au feu — Éléments de construction —

*Partie 13: Exigences pour les essais et l'évaluation de la protection
contre l'incendie appliquée aux poutres en acier avec ouvertures
dans l'âme*

ISO 834-13:2019

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Foreword

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A list of all parts in the ISO 834 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Background

Recent developments in steel construction have seen the introduction of cellular beams consisting of openings of various sizes and shapes cut in the web of the steel section. These offer a number of advantages over conventional beams without openings such as lighter/less steel required to provide the same structural performance and the ability to accommodate services within the depth of the section.

An opening in the web of a beam may be circular or rectangular but in reality can be any shape. Cellular beams may have a mixture of opening shapes and in some cases there may only be a single isolated opening.

Cellular beams can be fabricated from either hot rolled sections or welded steel plate. In the case of structural sections this involves cutting around the centre line of the web along the beams length and then welding the two halves together. Assymetric beams can be fabricated by welding together the two halves of different size sections. In the case of plate girders, asymmetry can also be achieved by using different plate thicknesses for the top and bottom flanges.

Beams with web openings behave differently to solid beams in that additional failure modes at the fire limit state (FLS) are possible as a result of the proximity of openings and web slenderness. Solid beams generally fail in bending but a beam with web openings can fail in one of several mechanisms which include:

- buckling of the web-post,
- shear at an opening,
- Vierendeel bending around the opening.

These failure modes generally occur at lower temperatures than for a solid beam at similar utilisation factors and therefore require greater thicknesses of fire protection.

Overview of structural geometry

A beam with circular web openings is illustrated in [Figure 1](#). The figure also shows some of the important dimensions that will affect beam's performance in fire.