

related test method	ENV 13381-4: 2002 Fire protection of steelwork – by applied fire protection materials
subject	Avoidance of buckling of steel test specimens
reference of original query	TC2 N266rev2 Helpdesk 2001-01

Problem

When testing a loaded beam, with exposed lengths greater than the minimum 4m specified in the test method, some laboratories have reported total failure of the beam due to lateral torsional buckling at a steel temperature around 550°C, before the deformation limit had been reached. This sudden distortion of the beam destroyed the protection and the test had to be stopped. This kind of failure was clearly never intended to happen.

Two alternative suggestions for changes to the test method to overcome this problem have been made, namely:

- to reduce the load when half the deflection limit has been reached and continue testing with ever decreasing load until the total deformation limit has been reached.
- to strengthen the top flange of the beam(s) by adding a steel plate on top [10 mm x 180 mm plate suggested].

Recommendation

EGOLF members when testing long loaded steel beams according to ENV 13381-4: 2002 shall follow the instructions given in the following amended clauses in the standard [*the amended text agreed by CEN TC127 WG3) being indicated in italics*]:

5 Test conditions

5.1 General [3rd paragraph]:

The method of testing loaded beams in this part of the test is designed to provide maximum deflection under the influence of load and heating. *Any kind of buckling of the beam shall be prevented by appropriate means.*

5.3 Loading [1st paragraph]

The loaded beam test specimens shall be subjected to a total load which is 60% of the design moment resistance according to ENV 1993-1-1 using the nominal steel strength, *the nominal elastic section modulus and partial safety factor $Y_m = 1.1$.*



The nominal elastic section modulus for IPE 400 is $1160 \times 10^6 \text{ m}^3$ and $1244 \times 10^6 \text{ m}^3$ for IPE 400 with 10 mm flat steel welded to the to the top flange (see Table 1 - note 4)

6.2.1 Loaded beam test sections [5th (new) paragraph]

If the length of the beam is larger than 4.5 m. there is a risk of lateral torsional buckling. In order to prevent lateral torsional buckling laboratories shall reinforce the top flange of loaded beams by welding a 10 x 180 mm flat steel profile to the top flange. This shall also be done to the unloaded beam sections.

Table 1 - Notes

Note 4: If the length of the beam is larger than 4.5 m. there is a risk of lateral torsional buckling. In order to prevent lateral torsional buckling laboratories shall reinforce the top flange of loaded beams by welding a 10 x 180 mm flat steel profile to the top flange. This shall also be done to the unloaded beam sections.