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EXPERIMENTAL RESEARCH ON THE FIRE BEHAVIOUR OF STEEL COLUMNS EMBEDDED ON WALLS

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❑ OBJECTIVES

- The aim of this study was to analyse the thermal behaviour of steel columns embedded on one-leaf walls. Fire resistance tests with two different column cross-sections, two orientations of the inertia axis in relation to the fire and two thicknesses of one-leaf building walls, were tested. The experimental results were compared with the ones obtained in the FE program SUPERTEMPCALC.

❑ EXPERIMENTAL PROGRAM

- Columns of cross-sections HEA160 and HEA200, steel S355, embedded on one-leaf brick walls were tested (Fig. 2).
- The columns were placed in the center of a 3D restraining frame. This frame had columns HEA200, 3m tall and beams HEA200, 6m span, steel S355 (Fig. 3).
- The specimens had thermocouples type k in different positions of the cross-section of the columns and on the walls (Fig. 1).
- The evolution of temperatures in the furnace followed the ISO 834 standard fire curve (Fig. 3).

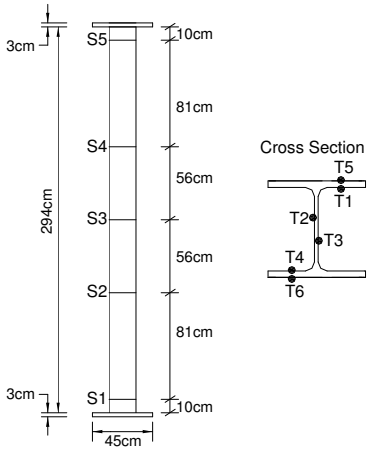


Fig. 1 - Position of the thermocouples

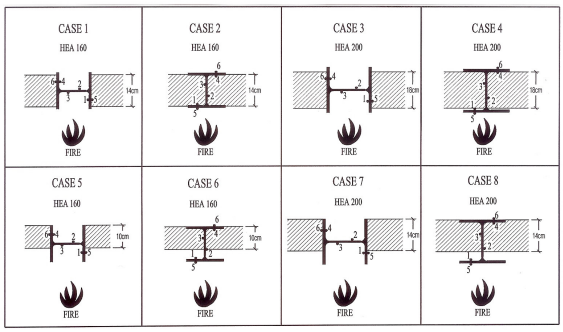


Fig. 2 – Cases study

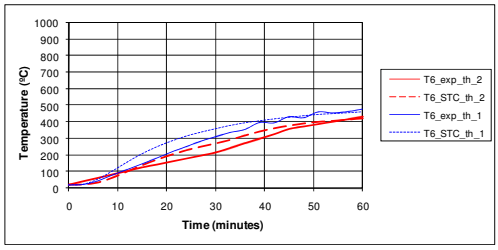
Fig. 3 - Construction of the test model

❑ RESULTS

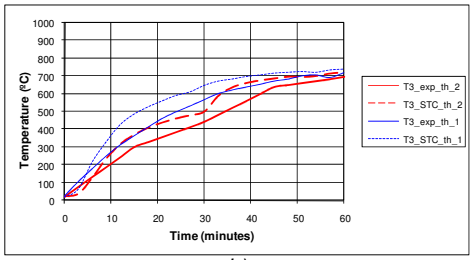
Web parallel to the wall surface:

- The temperature in the flange not exposed to the fire, is higher in the case of the walls of smaller thicknesses (Fig. 4a)).
- In the face of the web exposed to the fire, the temperatures are slightly higher for the thin than for the thick walls (Fig. 4b)).

In graphs, th_2 stands for the thicker walls, and th_1 for thinner walls



a)

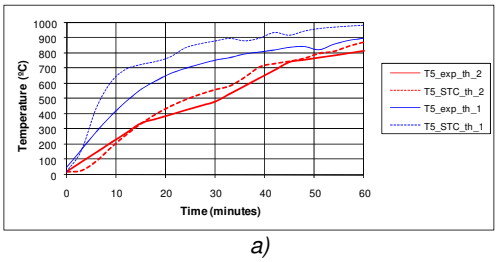


b)

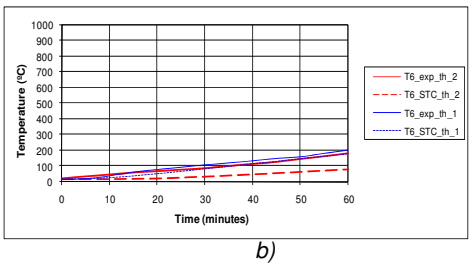
Fig. 4 - HEA 200 with the web parallel to the wall (cases 3 and 7); thermocouple a) T6 ; b) T3

Web perpendicular to the wall surface:

- The temperature in the exposed flange is higher in the case of the thin than in the thick walls (Fig. 5a)).
- In some cases a higher temperature in the unexposed flange was observed with the thicker wall.



a)



b)

Fig. 5 - HEA 200 - web perpendicular to the wall (cases 4 and 8); thermocouples a) T5 ; b) T6

❑ CONCLUSIONS

- For cases with the web parallel to the wall surface it was concluded that the thicker wall plays an important role in reducing the temperatures in the unexposed half of the flange and also in the web.
- For cases with the web perpendicular to the wall surface it was observed, in the unexposed face of the flange, higher temperatures with the thicker wall. On the contrary on the exposed flange the temperatures are much higher with thin walls.

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