

# Validation fire tests on using the adiabatic surface temperature for predicting heat transfer

## Fire protection in buildings

**In this report it is shown how temperature measurements with plate thermometers, PTs, as defined in the international fire resistance furnace test standard ISO 834, can be used for predicting heat transfer and temperature in fire exposed structures.**

To verify the theory, experiments were conducted in a small room with dimensions as given in the Room/Corner standard ISO 9705, i.e., 3.6 m by 2.4 m and 2.4 m high with a door opening. In the tests a steel beam was hanging 20 cm below the ceiling along the centre of the room. A gas burner yielding a constant heat output of 450 kW was placed in one corner, 0.65 m above the floor level. Temperatures were measured in the gas phase with various thermocouples including plate thermometers as well as in the steel beams. The measurements were made on all four sides of the beam at three locations along the beam. As the gas phase temperature and radiation fields were very inhomogeneous the recorded temperatures varied considerably depending on location and direction as well as on time.

In the report it is shown how the so called adiabatic surface temperature, AST, can be calculated from the PT readings. Temperatures in the steel beam at various positions were then calculated with the finite element computer code, Tasef, with heat flux boundary conditions derived from the ASTs. Comparisons between calculated and measured steel temperatures were very good which proves that the PT measurements in combination with the adiabatic surface temperature concept gives an accurate measure of the level of thermal exposure.

### Report

Read more in the SP Report 2009:19. The report can be downloaded from [www.brandforsk.nu](http://www.brandforsk.nu), project number 310-081.

### Contact information

Ulf Wickström, tel. +46 10 516 51 94, e-mail [ulf.wickstrom@sp.se](mailto:ulf.wickstrom@sp.se).