Behaviour of galvanized high strength grade 10.9 bolts under fire conditions

In the last decades the structural fire design has changed essentially. In the past the structural integrity of single elements was mostly proven by coating with fire proof material or design tables. The introduction of the “hot” Eurocodes (Part 1-2) gives now the possibility to evaluate even complex systems concerning their structural integrity under fire conditions. For this purpose a calculation can be elaborated according to the Eurocode taking into account the relevant material behaviour. The material behaviour of conventional structural steels and concrete elements is largely known and presented in the Eurocode. The behaviour is defined by stress – strain curves depending on different temperatures. The Eurocode gives even for connection areas a design possibility. The resistance of bolts and welds under fire conditions can be calculated using global reduction factors which are also depending on the current temperature. The global reduction factors for bolts are at the moment valid for all grades. The experience shows that either differing alloying materials or varying treatment methods can lead to a relevant change in the stress – strain curve. These two points have an important influence on the production process of high strength grade 10.9 bolts. Due to this tension and shear tests on specimens and bolts are carried out in order to evaluate the material behaviour under fire conditions. The results will give on one hand the possibility to verify the reduction factors for grade 10.9 bolts given in the Eurocode and on the other hand a more precise understanding of high strength bolts under fire conditions.

Apart from the tests under fire conditions, residual bearing tests after a fire are carried out in order to evaluate the necessary rehabilitation measures. Therefore bolts are heated up to different temperatures, cooled down and finally tested under room temperature.

The presentation will describe the state of the art, the elaborated tests in more depth and show results.

The following pictures show the testing apparatus for specimens.