Protection of steel structures, using so-called intumescent coatings, is an efficient and space saving way to prolong the time before a building, with load bearing steel constructions, collapses in the event of a fire. In addition to the intumescent coating, application of a primer may be required, either to ensure adhesion of the intumescent coating to the steel or to provide corrosion resistance. It is essential to document the performance of the intumescent coating together with the primer to ensure the overall quality of coating system. In the present work, two epoxy primers were used to investigate the potential failure mechanism of a primer applied prior to an intumescent coating. The analysis was carried out using: (1) gas-fired test furnace, (2) a specially designed electrically heated oven, and (3) thermo gravimetric analysis. When tested below an acrylic intumescent coating, exposed to a gas-fired furnace following the ISO834 fire curve (a so-called cellulosic fire), one of the primers selected performed well and the other poorly. From tests in the electrically heated oven, it was found that both primers were sensitive to the film thickness employed and the presence of oxygen. At oxygen-rich conditions, higher primer thicknesses gave weaker performance. In addition, a color change from red to black was observed in nitrogen, while the color remained red in the oxygen-nitrogen mixture. In summary, the results suggest that an adequate choice of primer, primer thickness, and intumescent coating is essential for a good performance of an intumescent coating system. (C) 2014 Elsevier B.V. All rights reserved.