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Doors with specific fire resistance class

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Abstract

Fire doorsets have a major role in the fulfillment of the rules of buildings fire safety. This paper discusses the main issues related to the fire resistance of fire doors - requirements, test methodology and way of classification of for this type of elements. Comparison of thermal insulation of fire doorsets test specimens depending on the type of structure and side of fire exposure was presented. Temperature rises have been compared on unexposed surface of timber, aluminum and steel doorset leaves in case of the fire acting from the hinge side and the side opposite the hinges.

Keywords: fire doors, fire resistance, thermal insulation, fire integrity, smoke control, radiation, fire insulation, temperature comparison.

Fire doorsets have a major role in the fulfillment of the rules of buildings fire safety.This paper discusses the main issues related to the fire resistance of glazed aluminum curtain walls - requirements in accordance with the provisions of Polish law, test methodology and way of classification of for this type of elements. Comparison of thermal insulation of fire doorsets test specimens depending on the type of structure and side of fire exposure was presented. Temperature rises have been compared on unexposed surface of timber, aluminum and steel doorset leaves in case of the fire acting from the hinge side and the side opposite the hinges.

1. Introduction

Fire doors are used as closures for openings in horizontal fire separations found usually in public buildings, such as hospitals, cinemas, schools and shopping malls, high-rise buildings [1] or special-purpose structures, such as tunnels [5]. This type of buildings and structures must be built so as to make possible efficient and safe evacuation

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of occupants in the event of a fire. Fire doors play a key role in the fulfilment of this requirement [2]. In fire conditions, they are to form a barrier to fire, smoke and heat. Therefore, this type of elements should be appropriately fire-rated with respect to tightness and the fire integrity, fire insulation and smoke control. This article will discuss main aspects of heat flow stopping, i.e. fire insulation.

2. Technical solutions

Worldwide, there are many manufacturers of fire doors, and thus there is a great diversity in products of this type. Although each manufacturer uses its own individual design solutions, some common can be found in most cases. The basic issue is the material used to make the door – here wooden and metal (most often aluminium or steel) doors can be distinguished. Doors can also be classified according toe their method of opening (hinged, sliding, roll-up, etc.) or the number of door leaves (single leaf, double leaf, etc.). A special group are, however, glazed closures, with special fire glazing. This article discusses only the construction of the most commonly used door types, i.e. solid wood and glazed doors, seamless steel doors, profile steel and profile aluminium doors [6]. Example profile cross-sections are presented in fig. 1

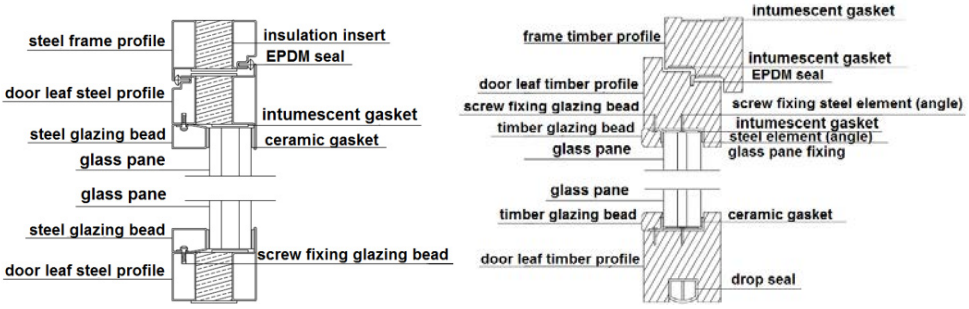

Fig. 1. Sample steel and timber profile cross-sections [8].

3. Fire resistance classification and tests

Fire resistance class of doors cannot be calculated or assessed based on comparisons. The sole method allowing to obtain a realistic and clear classification of a specific element is the fire resistance testing. According to standard EN 13501-2:2007+A1:2009, the classifications of fire resistance doors shall be developed based on the tests carried out in accordance with standard EN 1634-1: 2014 (fire integrity assessment (E), fire insulation assessment (I), and radiation assessment (W)), and the tests carried out in accordance with standard EN 14600:2005 (self-closing feature assessment (C)).

The following fire resistance classes are defined:

Table 1. Fire resistance classes of doors [7].

class									
E	15	20	30	45	60	90	120	180	240
EI_1	15	20	30	45	60	90	120	180	240
EI_2	15	20	30	45	60	90	120	180	240
W		20	30		60				

(**E** – fire integrity, **I** – fire insulation, **W** – radiation)

The tested piece is heated in accordance to the standard temperature/time curve. This relationship is the model of a fully developed fire in a room, and is determined with formula (1).

$$T = 345\, log_{10}(8t + 1) + 20 \quad (1)$$