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Fire Resistance Parameters for Glazed Non-Load-Bearing Curtain Walling Structures. Extended Application

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Abstract

This article provides a development of the new state standard of the Russian Federation 55988-2014 "Building structures. Extended application of results from fire resistance tests for glazed non-loadbearing curtain walling structures". This standard is harmonized with the current European standard EN 15254-4: 2008 + A1: 2011 "Extended application of results from fire resistance tests – Non-loadbearing walls Part 4: Glazed constructions" and modified (not made identical) in relation to it, as there are significant differences in Russia and Europe concerning the systems of rationing the fire resistance of non-loadbearing glazed walls.

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Keywords: Building constructions, glazed constructions, extended application of results, fire resistance.

1. Introduction

Nowadays we are witnessing a fast growth in the design and construction of buildings and various constructions including transparent non-load-bearing walling structures - facades with the help of modern power effective decisions for transparent designs [1 – 6].

In the Russian Federation according to Art. 35 of the Technical regulations about the requirements of fire safety [7], the limits of fire resistance of construction designs are defined under the conditions of standard tests. The fire resistance limit of a design for filling apertures in fire-prevention barriers is reached when the integrity (E) and insulating abilities (I) are lost and the limiting density of a thermal stream (W) and (or) smoke-and-gas tightness (S) are achieved. The methods for defining the fire resistance limits of construction designs and the signs of limiting conditions are regulated by the fire safety normative documents. The current Russian standards concerning the methods of fire tests do not address specific design solutions for exterior curtain walls with glazed elements and associated possible scenarios of fire, as well as the orientation of the thermal effect on such a structure [8 – 13].

In the European Union countries the classification of non-bearing external walls with translucent elements is implemented according to item 7.5.3 EN 13501-2 [14], where the following parameters are adopted as normalized limiting conditions: E - integrity; I - thermal insulating capacity according to the temperature on the not warmed party; W - thermal insulating capacity according to the size of a critical thermal stream (15 kW/m2 at a distance of 1 m from the not warmed surface of the sample). Rationing is carried out according to the fire resistance limits E, EI or EW and is defined by the conditions of the real application

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of the designs, as well as the fire protection regulations in each of the European countries. Thus, in the European classification the designations of the limits of fire resistance E, EW or EI are applied to translucent designs, while in the Russian one these are E or EIW [15 – 18].

2. Review

One of the problems in the Russian system of fire-prevention rationing of translucent designs in the external non-bearing walls is that in [7] there is no accurate definition of the cumulative parameters of fire resistance for elements of such designs. Therefore, in table 23 [7] the translucent fire-prevention barriers with translucent filling of more than 25 percent are normalized in accordance with the fire resistance limit of EIW 45 (for a barrier of type I) and EIW 15 for a barrier of type II.

In table 21 [7] for buildings of degree I of fire resistance for external non-bearing walls the fire resistance limit is normalized as E, whereas the list of all the fire resistance parameters for designs in terms of reaching limiting conditions is provided in Art. 35 [7].

According to GOST R 53308-2009 "Designs construction. Translucent protecting designs and filling of apertures. A test method on fire resistance" [19], a limiting condition only as the loss of integrity E is used for rationing the fire resistance limits of translucent protecting designs, namely for non-bearing external (front) walls and windows.

The valid standards of the Russian Federation concerning the methods of fire tests do not take into account the special features of constructive solutions for external non-bearing hinged walls with glazed designs and the related possible scenarios of the development of a fire and the orientation of the thermal impact on the design.

In this regard, the application of the existing standards and methods for fire resistance of the designs of translucent facades does not ensure an adequate assessment of the fire resistance indicators, as well as the creation of an objective database for fire-prevention rationing, which currently regards the requirements for the non-bearing designs with partial or full leaning and the hinged non-bearing designs as equal.

There is a number of normative documents establishing a method designed to define the possibility of extending the fire resistance test results received in the course of the standard test procedure to the designs with certain changes, and these documents are used in the international standard practice for some types of fire-resistant designs. Thus, according to certain rules, the actual limits of fire resistance of a modified design are predicted and confirmed, which allows producers to reduce the cost of large-scale fire tests for final products, i.e. separate construction designs [20, 21].

Within the framework of the European norms this methodology (the so-called method of extended application - "Extended application of results") extends to the results of fire tests of various construction designs and items, and products for fire and technical purposes [22] and includes an assessment of the test results based on the interpolation between the test data or the extrapolations from the test results , and also some established rules according to which the results received during standard tests can be extended to this or that change.

The method of the extended application of test results for construction designs and materials is widely present in the European system of rationing in the field of fire safety and it is reflected in the following normative documents:

- EN/TS 15117:2005. Guidance on direct and extended application [22];
- EN 15725:2010. Extended application reports on the fire performance of construction products and building elements [23];
- series documents of EN 15080. Extended application of results from fire resistance tests [24, 25];
- series documents of EN 15269. Extended application of test results for fire resistance and/or smoke control for door, shutter and openable window assemblies, including their elements of building hardware [26 – 29];
- EN 15254-4:2008. Extended application of results from fire resistance tests series - Non-load-bearing walls [30];
- EN 15882-3:2009. Extended applications of results from fire resistance tests for service installations [31].
- Generally, the method of extended application consists in the following:
- identification of an earlier tested design according to the normative document taken as a basis for the application of a method (base test);
- definition of the possibility of change for each factor (parameter) separately according to rules of the corresponding standard for extended application;
- establishment of the new classification parameters for the changed design.

In Russia the method of extended application is not used systematically for rationing in the field of fire safety. There are separate standards, for example GOST R 53307-2009 [32] which lists the possible extension of test results received for fire-protective doors and gates to other types of designs in case of various quantities of additional elements, deviations in sizes and admissions etc.; GOST R 53299-2009 [33] according to which the test results of the fire resistance limits of an air line can be extended to air lines of a similar design of rectangular and round section under certain conditions.

The reason why this method did not find wide application in the Russian Federation is the absence of the necessary procedures and rules in the domestic regulatory base, as well as the differences in the European and Russian norms concerning the defined parameters. However, it is becoming more and more relevant to use the method for extending the fire resistance test results to