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**OVERVIEW OF THE NEW RULEBOOK ON TESTING FIRE
RESISTANCE, EXTERNAL FIRE PERFORMANCES AND REACTION
TO FIRE IN THE REPUBLIC OF SERBIA**

Abstract

The growing expansion of construction and import of new, as well as existing materials from around the world, has led to a large number of tests materials and elements of constructions in the Republic of Serbia. Most of these materials and building constructions have test certificates obtained in foreign laboratories, which mostly refer to European standards. The currently valid Rulebook on mandatory attestation of elements of standard building structures for fire resistance and on working conditions that must be met by organizations of associated labour authorized to attest these products from 1990 requires testing of each product, or structural element, according to the domestic SRPS standards. The condition for accessing the European Union requires the harmonization of regulations related to the testing of construction products. Therefore, the IMS Institute, the Ministry of Interior - Sector for Emergency Situations and the Ministry of Construction of the Republic of Serbia have written a new draft Rulebook on Technical Requirements for construction products for which performance characteristics are important: reaction to fire, fire resistance and external fire performance. The plan is to publish the Rulebook, as valid, at the beginning of 2022, with a transitional period for implementation of two years. The paper presents a overview of the new Rulebook.

Keywords

the new rulebook, reaction to fire, fire resistance, behaviour of external fire, classification.

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1. INTRODUCTION

Ordinances in the field of design of building structures for the fire resistance prescribe detailed measures in terms of fire resistance of structural elements as well as all materials used. They define fire resistance as the ability of structural elements or the structure as a whole to maintain integrity, stability and thermal insulation properties during a standard fire. The fire resistance of materials is determined by time tests, expressed in minutes and divided into categories, and depending on the standard of the country in which the test is performed, it is expressed by fire resistance times of 15, 20, 30, 45, 60, 90, 120 and 180 minutes. The time of fire resistance of structural elements depends on the geometry of the elements, its position, and function in the structure, the material from which it was made, the intensity and type of load, the type and purpose of the building, and the manner and type of fire exposure [3]. All defined requirements stated in the regulations were performed on the basis of experimental tests. Experimental tests for fire resistance are performed in special laboratories in which the elements of building structures are exposed to standard fire and every detail of the behavior of the structural elements is recorded. As an alternative to expensive laboratory tests, numerical methods for calculating fire resistance have been developed, which give the designer results on the safety side.

Experimental tests of fire resistance are for the standard development of fire, as well as for each element of the building structure prescribed by the appropriate standard. Each country adopts standards according to which it will test the elements of building constructions. The European Union has adopted the so-called European standards that apply in all member states, and within the European Union, each tested element of construction, in any laboratory, with the issued classification report can be used during the construction of the facility. In Serbia, every element of building construction, whether from national manufacturers, or imported from abroad, must have a test report according to domestic SRPS standards required by the Rulebook on mandatory certification of elements of standard building structures for fire resistance and working conditions that must meet organizations of associated labor authorized to attest those 1990 products [1]. In Serbia, the only accredited laboratory for this type of testing is located within the IMS Institute, called the Laboratory for Thermal Technique and Fire Protection. The main differences in testing according to national and European standards are that European standards require a larger number of measuring points, measurement of deformations on samples, as well as the classification of construction elements and materials. IMS Institute, Ministry of Interior - Sector for Emergency Situations and the Ministry of Construction of the Republic of Serbia have written a new draft rulebook on Technical Requirements for construction products for which the performance of essential characteristics: fire response, fire resistance and external fire performance to harmonize regulations relate to the testing of construction products in our country and in the European Union [2]. According to this Rulebook, every material in the Republic of Serbia would be tested in domestic laboratories according to European standards and a classification report would be issued for it, in addition to the test report. For construction elements for which domestic laboratories are not able to perform tests, reports from foreign accredited laboratories will be recognized, and the Classification Report will be issued by a domestic, accredited laboratory, appointed by the ministry.

2. THE NEW RULEBOOK ON THE MANNER OF EXPRESSION OF PERFORMANCE OF CONSTRUCTION PRODUCTS OF BUILDING ELEMENTS IN CONNECTION WITH ESSENTIAL CHARACTERISTICS: REACTION TO FIRE, FIRE RESISTANCE AND EXTERNAL FIRE BEHAVIOR

The new Rulebook [2], which should enter into force at the beginning of 2022, will completely replace the old Rulebook on mandatory attestation of standard construction products from 1990. [1] The transitional period of validity of attestations and certificates issued according to the old regulations is two years, after which all these samples will be tested according to the new regulations. It is envisaged that the Rulebook regulates in more detail the manner of expressing the performance of construction products and building elements (hereinafter referred to as construction products) in connection with important characteristics: fire reaction, fire resistance and external fire behavior, as well as conditions to be met by legal entity which evaluates the performance of construction products.

According to the new Rulebook [2], all elements of the building structure should be tested according to European EN standards and a classification report with a validity period of 5 years is issued for them. The method and criteria of testing are changing, and classes of tested material are being adopted.

Construction products for which it is necessary to obtain a fire reaction class for performance in relation to essential characteristics are classified into the following categories:

- Construction products;
- Floor coverings;
- Products for thermal insulation of pipes;
- Power, control and communication cables.

Construction products for which it is necessary to provide a fire resistance class for performance related to essential characteristics, are classified into the following categories:

- Load-bearing elements that do not have a fire separation function;
- Load-bearing elements that have the function of fire separation;
- Products and systems for protection of building elements or parts of building elements;
- Non-bearing elements or parts of the building with or without glazing, service installations and fastening elements;
- Wall and ceiling coverings in the function of contributing to fire resistance;
- Service installations;
- Smoke control systems.

Construction products, for which it is necessary to obtain a class of external fire behavior for performance in relation to essential characteristics, are classified into the following categories:

- Roofs and
- Roof coverings.

Testing of essential characteristics of construction products, according to appropriate methods, is carried out by the laboratory for testing essential characteristics of construction

products: fire reactions, fire resistance and behavior in external fire, appointed by the competent ministry.

Sampling of the construction product for testing the reaction to fire/fire resistance/behavior in case of external fire shall be performed by the ordering party or the designated laboratory, depending on the manner prescribed by the technical specification. The client is obliged to submit technical documentation before the examination in order to convince the employees in the laboratory of the authenticity of the documentation and the submitted sample.

Performance in relation to the essential characteristics of construction products is expressed by class [2]. The class for the tested product is determined on the basis of the results obtained by testing (hereinafter the term "classification" will be used). Table 1 lists the standards used to classify products depending on the type of test. Determining the class of construction products is carried out by a laboratory appointed by the competent ministry. In the absence of a laboratory designated for appropriate methods for testing the essential characteristics of fire response, fire resistance and external fire behavior, the classification is performed by a laboratory appointed for at least two methods of testing the essential characteristics of fire response and resistance to fire, i.e. for one method in the field of external fire behavior.

The Laboratory issues a Classification Report which gives the class of the tested product, as well as the extended field of application of the test results. As products of the same composition are made in different dimensions, with different finishes, as well as with materials procured from different suppliers, in order to avoid testing any variation, the concept of extended field of application is introduced. The extended field of application gives changes that have been proven not to affect the value of fire resistance obtained by testing.

The period of validity of the classification report is expected to be 5 years. In case of any changes, during the production of the sample that was tested in the laboratory, the classification report ceases to be valid.

Table 1: Test standards for reaction to fire / fire resistance / external fire behavior

Standard index	Name of Standard	Classification Standard
REACTION TO FIRE		
SRPS EN 13823	Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item	SRPS EN 13501-1
SRPS EN ISO 1182	Reaction to fire tests for building products - Non-combustibility test	SRPS EN 13501-1
SRPS EN ISO 11925-2	Reaction to fire tests - Ignitability of building products subjected to direct impingement of flame - Part 2: Single flame source test	SRPS EN 13501-1
SRPS EN ISO 1716	Reaction to fire tests for building products - Determination of the heat of combustion	SRPS EN 13501-1
SRPS EN ISO 9239-1	Reaction to fire tests for floorings - Part 1: Determination of the burning behavior	SRPS EN 13501-1

	using a radiant heat source	
FIRE RESISTANCE		
SRPS EN 13381-1	Test methods for determining the contribution to the fire resistance of structural members - Part 1: Horizontal protective membranes	SRPS EN 13501-2
SRPS EN 13381-4	Test methods for determining the contribution to the fire resistance of structural members - Part 4: Applied passive protection to steel members	SRPS EN 13501-2
SRPS EN 13381-6	Test methods for determining the contribution to the fire resistance of structural members - Part 6: Applied protection to concrete filled hollow steel columns	SRPS EN 13501-2
SRPS EN 13381-8	Test methods for determining the contribution to the fire resistance of structural members – Part 8: Applied reactive protection to steel members	SRPS EN 13501-2
SRPS EN 1364-1	Fire resistance tests for non load bearing elements - Part 1: Walls	SRPS EN 13501-2
SRPS EN 1364-2	Fire resistance tests for non load bearing elements - Part 2: Ceilings	SRPS EN 13501-2
SRPS EN 1364-3	Fire resistance tests for non load bearing elements - Part 3: Curtain walling - Full configuration (complete assembly)	SRPS EN 13501-2
SRPS EN 1364-4	Fire resistance tests for non load bearing elements - Part 4: Curtain walling - Part configuration	SRPS EN 13501-2
SRPS EN 1365-2	Fire resistance tests for load bearing elements - Part 2: Floors and roofs	SRPS EN 13501-2
SRPS EN 1365-3	Fire resistance tests for load bearing elements - Part 3: Beams	SRPS EN 13501-2
SRPS EN 1365-4	Fire resistance tests for load bearing elements - Part 4: Columns	SRPS EN 13501-2
SRPS EN 1366-1	Fire resistance tests for service installations - Part 1: Ducts	SRPS EN 13501-2
SRPS EN 1366-2	Fire resistance tests for service installations - Part 2: Fire dampers	SRPE EN 13501-3
SRPS EN 1366-3	Fire resistance tests for service installations - Part 3: Penetration seals	SRPS EN 13501-2
SRPS EN 1366-4	Fire resistance tests for service installations - Part 4: Linear joint seals	SRPS EN 13501-2
SRPS EN 1366-5	Fire resistance tests for service installations - Part 5: Service ducts and shafts	SRPS EN 13501-2
SRPS EN 1366-6	Fire resistance tests for service installations	SRPS EN

	- Part 6: Raised access and hollow core floors	13501-2	
SRPS EN 1366-7	Fire resistance tests for service installations - Part 7: Conveyor systems and their closures	SRPS 13501-2	EN
SRPS EN 1366-8	Fire resistance tests for service installations - Part 8: Smoke extraction ducts	SRPS 13501-2	EN
SRPS EN 1366-9	Fire resistance tests for service installations - Part 9: Single compartment smoke extraction ducts	SRPS 13501-2	EN
SRPS EN 1366-10	Fire resistance tests for service installations - Part 10: Smoke control dampers	SRPE 13501-4	EN
SRPS EN 14135	Coverings - Determination of fire protection ability		
SRPS EN 1634-1	Fire resistance and smoke control tests for door, shutter and open able window assemblies and elements of building hardware - Part 1: Fire resistance tests for doors, shutters and open able windows	SRPS 13501-2	EN
SRPS EN 1634-2	Fire resistance and smoke control tests for door, shutter and open able window assemblies and elements of building hardware - Part 2: Fire resistance characterization test for elements of building hardware	SRPS 13501-2	EN
SRPS EN 1634-3	Fire resistance and smoke control tests for door and shutter assemblies, open able windows and elements of building hardware - Part 3: Smoke control test for door and shutter assemblies	SRPS 13501-2	EN
SRPS ENV 13381-2	Test methods for determining the contribution to the fire resistance of structural members - Part 2: Vertical protective membranes	SRPS 13501-2	EN
SRPS ENV 13381-3	Test methods for determining the contribution to the fire resistance of structural members - Part 3: Applied protection to concrete members	SRPS 13501-2	EN
SRPS ENV 13381-5	Test methods for determining the contribution to the fire resistance of structural members - Part 5: Applied protection to concrete/profiled sheet steel composite members	SRPS 13501-2	EN
SRPS ENV 13381-7	Test methods for determining the contribution to the fire resistance of structural members - Part 7: Applied protection to timber members	SRPS 13501-2	EN

External fire behavior		
SRPS CEN/TS 1187	Test methods for external fire exposure to roofs	SRPS EN 13501-5

The Annex 2 of the new Rulebook talks about construction products that should not be tested because they are made of materials that are proven non-combustible. Those materials are class A1 and A1fl. Products that are not subject to testing are given in Table 2.

Construction products made by gluing one or more materials listed in Table 2 are classified in class A1 and A1fl without testing if they contain less than 0.1% by weight or volume of glue (whichever is the worst case). In order for the material to receive class A1 and A1fl, it must not contain more than 1% by weight or volume (whichever is the worst case) of homogeneously distributed, organic material. Also, if the materials listed in Table 2 are coated with an inorganic layer, are still classified as A1 and A1fl, which means that testing is not necessary.

Table 2: Materials not subject to test procedure

Product	
Expanded clay	Gypsum and gypsum-based plasters
Expanded perlite	Mortar with inorganic binders
Expanded vermiculite	Clay elements
Mineral wool	Elements of calcium silicate
Foam glass	Natural stone and slate products
Concrete	Plaster elements
Aggregate concrete (dense and light mineral aggregates, except integral thermal insulation)	Terrazzo
Autoclaved aerated concrete	Glass
Fiber-reinforced cement	Glass ceramics
Cement	Ceramics
Lime wash	Zinc and zinc alloys
Mineral aggregates	Aluminum and aluminum alloys
Iron, steel and stainless steel	Lead
Copper and copper alloys	

3. CONCLUSION

In this paper, the new Rulebook of technical requirements for construction products for which the performance of essential characteristics is expressed: fire reaction, fire resistance and performance in external fire were presented. In the beginning of 2022. year, the Rulebook is expected to enter into force, which ceases to be valid on the mandatory certification of elements of standard building structures for the fire resistance and working conditions that must be met by organizations of associated labor authorized to certify these products from 1990. The new Rulebook completely abolishes testing of elements of building structures and materials according to national SRPS standards and implies that all tests are performed in

accordance with European EN standards that follow European trends. The EN standards requires the preparation of a classification report which defines the class of reaction/resistance to fire and extended field of application of the obtained results and this is the main difference between Testing according to EN standards and testing according to SRPS standards. The classification report has a validity period of 5 years. The new Rulebook prescribed that every domestic, foreign or new product must be tested in an accredited laboratory in the Republic of Serbia before installation. In the case that there is no accredited laboratory for this type of testing in the country, the test reports of foreign laboratories will be recognized and the classification report will be issued by a domestic, accredited laboratory.

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LITERATURE

- [1] Rulebook on mandatory attestation of elements of standard building structures for fire resistance and on working conditions that must be met by organizations of associated labor authorized to attest these products
- [2] Rulebook: Technical Requirements for construction products for which the performance of essential characteristics: fire response, fire resistance and external fire performance
- [3] Dr. Sanin Džidić „Otpornost betonskih konstrukcija na požar“, International Burch University Sarajevo 2015.