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STUDY OF THE TECHNICAL REQUIREMENTS OF FUNCTIONALITY RETENTION CABLE SYSTEMS

Abstrakt

In order that an electrical fire protection equipment be able to meet the requirements of operational safety, it is always necessary to ensure the supply of electric energy, inevitable for its operation for a period to be determined in accordance with the protection objectives. To ensure this, cable systems must be designed with a track capable of retaining their functionality for a specified duration in case of fire. This paper studies the components of the regulatory and standardization issues required to develop such a track.

Keywords: fire-resistant cable system, functionality retention system, cable, track

MŰKÖDŐKÉPESSÉG-MEGTARTÓ KÁBELRENDSZEREK MŰSZAKI-TECHNIKAI KÖVETELMÉNYEINEK VIZSGÁLATA

Absztrakt

Ahhoz, hogy egy villamos tűzvédelmi berendezés teljesíteni tudja a vele szemben az üzembiztonság terén támasztott követelményeket, mindenkor szükséges, hogy a védelmi célokhoz igazodóan megállapított ideig biztosítva legyen a működtetésükhöz elengedhetetlen villamos energiaellátás. Ennek biztosításához a kábelrendszereket tűz esetén is funkcióját meghatározott ideig megtartani képes nyomvonalon vezetve kell kialakítani. A jelen írás ezen nyomvonalnak kialakításához szükséges szabályozási és szabványossági kérdések összetevőit vizsgálja.

Kulcsszavak: tűzálló kábelrendszer, működőképesség-megtartó rendszer, kábel, nyomvonal

1. BASICS

The widespread use of electricity makes it necessary to study the fire behavior of electrical systems and the resulting fire hazards. Fire damage statistics show that fires occurring due to inadequate care or non-compliance with safety standards in electrical networks account for a significant proportion of fires in facilities, both in terms of their relative frequency and the value of damage.

Electrical failures due to design faults or incorrect construction or deviations from the operating instructions or technical faults can easily lead to life-threatening fires or explosions.

Thus, the uninterrupted provision of the ability to operate and transmit electricity in case of fire forms an essential component of modern fire protection. One of the possibilities for the development of fire safety in electrical networks is the adaptive introduction and application of the results of scientific and technical research. Accordingly, day after day, we encounter more and more new materials and technological processes that have an impact on the role of electrical networks in facilities in case of fires.

In general, it can be said that as a result of development efforts that also take into account modern safety aspects, our built environment and the electricity networks in it are becoming safer and safer. However, there may always be unforeseen circumstances that could lead to hazard sources, whose potential harmful impacts can only be reduced through new, creative and up-to-date preventive measures. [1]

At the same time, electricity networks are not only a key factor in fire safety due to their role in the manifestation of fire hazards. On the contrary, they can endow a system of fire prevention tools that can be utilized as an “ally”, important for fire protection by ensuring the operability of consumers[1] in case of fires, involved in the implementation of active protection. [3]

For this purpose, of course, a security system for fire protection purposes must be used in the buildings, for the operation of which the reliable presence of the power supply system providing the energy supply and signal transmission is essential even in case of fire. It follows that these

[1] "An electricity consumer, who, in case of a fire, must operate for a specified period of time or retain its functionality." [2]

sections of electrical wiring systems must be able to withstand the changes in environmental and material quality resulting from the physical and chemical reactions that can cause structural damages induced by fire. [4]

While maintaining their structural integrity and electrical conductivity related to their primary functions: *"Functionality retaining" wiring systems that meet this criterion are called fire-resistant cable systems."* [2]

The range of systems marketed and certified by the manufacturers significantly exceeds the system design options included in the standard. These products are marketed as certified systems, but the standards referenced during certification do not recognize these technical designs. [5]

The requirements for the design of electrical cable tracks capable of retaining their functionality for a specified period are defined by the system of fire protection regulations in force at any given time. They state that functionality is essential to the design of active or passive fire protection in a building. Underlying this is the principle that consumers in case of fires must be provided with an adequate supply of electricity in order to fulfill their role in protection during an expected fire.

An increased fire hazard does not necessarily mean more or larger fires, more damage, or more malfunctions. However, it requires professional construction work, the search for more up-to-date technical solutions, and the development and introduction of new, more effective fire protection methods and the related system of regulations.

The requirements for the integration of consumers in case fires into the protection system should take into account the extent of the fire risks that may occur in a facility receiving fire response systems in order to retain their functionality for the expected period. The retention of operation is implemented if:

- electricity is available for operation,
- the protection of the supply cables against fire is guaranteed,
- low current cables for control of operation are protected against fire, and

- while maintaining the function of the load-bearing structure, it guarantees the structural integrity of the system structurally connected to it. [2]

In accordance with the present requirements of the National Fire Protection Regulation (hereinafter: OTSZ), issued by MoI Decree 54/2014 (XII.5.), it prescribes the requirement for functionality retention in a timeframe between 15 and 120[2] minutes. This period applies to both the cable track and the structure supporting the track. [6]

The basics of the technical solutions related to this were been laid down in the so-called Fire Protection Technical Guidelines (hereinafter: TvMI). By applying the technical solutions according to them, the relevant requirements of OTSZ are met at the same time, and the level of safety required by OTSZ is achieved. If a standard is applied, equivalence does not need to be demonstrated, even if the designer deviates from TVMI[3].

The relevant Fire Protection Technical Guidelines identified as 7.4:2020.01.22. bear the title "Protection of electrical equipment, lightning protection and against electrostatic charge" (hereinafter: TvMI 7.4). Among the standards valid for the testing of functionality retention systems[4], MSZE 24102:2011 and the source standard are DIN 4102-12:1998.

Based on the characteristics tested in the referenced studies, it can be stated that the relevant fire protection technical-engineering parameters related to the topic can be connected to such basic concepts as functionality, fire-resistance performance, fire protection classification, etc. [9], [10]

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[2] Maximum value see: OTSZ [6] by row 10 of table 1 in Annex 11, accordin to Section IX paragraph 72 (3) (d)
[3] Pursuant to Section 1 paragraph 3/A (3) (a) of Act XXXI of 1996 on Fire Protection [7].
[4] Source: point 2.2.5. of TvMI 7.4 [8]: *"The ability of a fire protection system to retain its functionality for a specified period of time in case of a fire, in accordance with the fire protection concept."*

According to the tests, the functionality retention cables that meet the required qualification criteria therefore include the electrical cables that are able to retain the functionality of the power-supplied system in case of fire for a specified period. In terms of their fire protection properties, it can be stated in general that the cross-section of the conductors of these cables covers the usual electrical cable cross-sections, but their insulation is reinforced. As shown in Figure 1, the copper conductor is typically surrounded by a flame retardant material, which is covered with a vessel insulation made of a halogen-free polymer. There is a halogen-free filling jacket between the vessels, and the outer jacket is also a halogen-free polymer. The color of the cables is typically red or orange. [11]

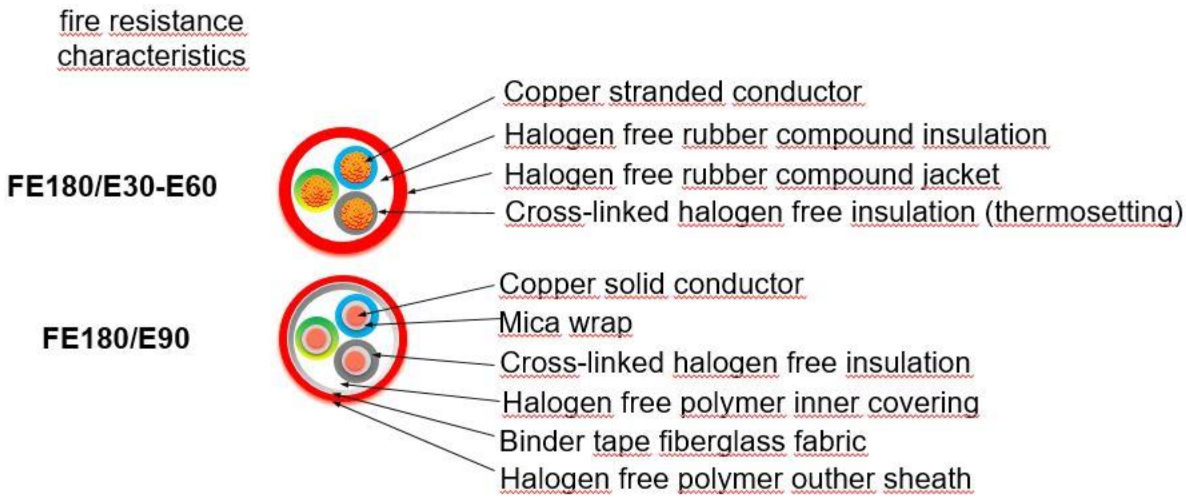

Figure 1: Structural design for fire-resistant cables[5]

The categorization of integrity, i.e., implementation of functionality retention, for cable support tracks was introduced by DIN4102-12. [12]

Depending on the test results, a functionality retention system may have E30, E60 or E90 performance. The letter E indicates integrity. The essence of integrity is that a wall structure is resistant to fire on one of its sides, so that neither heat nor smoke can pass to the other side of this wall structure. However, in our case it indicates the ability of a fire-resistant cable system to retain its functionality. With regard to the related fire-resistance performance indicators, the factor denoting the fire-resistance performance of the load-bearing structures, which indicates

[5] Edited by the author: based on Kruppa, Atilla [2] p. 103.

the ability of the structure to retain its load-bearing capacity under the impacts of fire, has a further emphasis on the load-bearing capacity. This is an important issue, as functionality retention cable systems are fixed to these building structures, and thus maintaining their fire-resistance for a planned duration is an essential condition for fulfilling the function expected of the cable system itself in physical contact therewith. [13]

The DIN4102-12 standard is a standard issued by the German Standards Institution, the Hungarian pre-standard version of which is MSZE24102. MSZE24102 is essentially, but not completely, identical to DIN4102-12. DIN 4102-12 and the standard MSZE 24102 derived from it extend the marking E to fire-resistant cable systems.

Under the concept of retaining functionality, TvMI 7.4 emphasizes that all circumstances must be taken into account when designing the electrical supply of a consumer in case of fire and that the design must be carried out with a system approach. This is also in line with the current OTSZ.

The introduction of the concept[6] of building structures suitable for fixing (fastening) a fire-resistant cable system (hereinafter: TKRA) was a major step forward compared to the previously valid versions of the OTSZ, in which, for the first time, building structures that could be suitable for carrying a fire-resistant track were named.

At present, TKRA structures are/have:

- *"Reinforced concrete walls or slabs at least 10 cm thick.*
- *Reinforced concrete pillars and ceiling beams, bridges.*
- *Walls made of aerated concrete or limestone masonry units at least 10 cm thick.*
- *Brick walls at least 12 cm thick, regardless of the design of the brick.*
- *Timber structures that have been dimensioned for burning rate (charring) in accordance with Eurocode 5.*
- *Metal structures - pillars, gratings, etc. - which, alone or with a fire-retardant coating, have a specified fire-resistance (limit value) performance and to which the fire-resistant cable support structure can be fixed by drilling, nailing, welding or palletizing."* [8]

[6] Source: point 2.2.8. of TvMI 7.4 [8]: *"A building structure or auxiliary structure which is capable of supporting a functionality retention system."*

Among the coating systems that increase the fire-resistance limit, the fire-resistant mortar provides hard protection of the protected surface, which protects the surface in its application quality after applying it and hardening, but after hardening a brittle surface is obtained, which can be extensively damaged.

The fire-retardant paint is liquid in its application quality and reaches its final state after drying. The fire-retardant paint foams against the mortar under the influence of fire and the covering layer of foam protects the surface. [14]

The degree of expansion of the foam determines the degree to which the fire-retardant paint can perform its function. When attaching to a metal structure, frequent destructive fixing (fastening) must be avoided and that if an auxiliary device is mounted on the metal structure, the auxiliary structure must not prevent the foaming paint from foaming or be larger than the extent of the protective layer formed.

Unfortunately, the applicability of fire-resistant cable ducts introduced in TvMI 7.4 is not highlighted to the extent it should deserve. The guidelines recommend it primarily for the protection of the DC side cable of solar panel systems, which is essentially the protection of the space from the fire load caused by the energy connected to the cables and as a functionality retention system element, but its applicability is very limited due to the stipulations. Fire-resistant cable ducts can only be fixed to a TKRA structure with a fastener suitable for the structure. Fire-resistant cable ducts also provide a strong mechanical protection for the cables conducted in them, and it is not necessary for the cables to have functionality retention when using cable ducts. [9]

The use of a fire-resistant cable duct is one of the most optimal methods in technical terms because it has two functions. It is able to protect the operative cable from external influences and is able to protect the space from the fire load caused by the cables conducted in it. When examining the functionality retention systems of consumers in case of fire, it is not considered what physical damage these cables could cause and how much fire load should be expected when conducting them on their tracks. Protecting the exterior from electrical fires is of paramount importance on escape routes and smoke-free stairwells.

2. CONFORMITY OF FIRE-RESISTANT CABLE SYSTEMS

The conformity of fire-resistant cable systems can be determined in accordance with the fire safety strategy of the facility according to their installation. The selection of a cable system capable of meeting the required technical specifications shall in all cases be based on consideration of fire-resistance criteria based on the examination of specific fire engineering aspects. The creditworthy assessment of the required fire-resistance performance can be made based on the fire protection conformity certificate[7] (hereinafter: TMT) obtained after the standard inspection of the given fire-resistance cable system. [15]

The content requirements of TMT are defined by a separate legislation, which names the fire-resistant cable systems and their accessories in the list of products to be procured. [16]

Annex 7.4 D of TvMI states with regard to the certification of fire-resistant cable systems with a Fire Protection Conformity Certificate:

"D.1.1. The implemented fire-resistant cable system shall meet the relevant requirements of OTSZ, if the applied technical solution has a valid Fire Protection Conformity Certificate at the time of elaboration of the relevant construction designs (partial designs) or at the beginning of the commissioning procedure."

Examining the underlying meaning of the above wording in detail, it can be concluded that from the point of view of retaining the functionality of cable systems, they are implemented as a unit consisting of elements with complex fire-fighting capabilities, some components of which have a significant impact on the cable system. By careful analysis of these details, we can distinguish systems with different properties.

[7] Item d) of Section 4 of Act XXXI of 1996 on Fire Protection [7]: *"A document issued by the Hungarian certification body or an organization notified to the European Commission for the performance of a conformity assessment procedure, which proves that the firefighting technical product or the fire- or explosion-hazardous device, machine or equipment complies with the fire protection requirements specified in the fire protection and safety requirements"*

3. INTEGRATED FIRE-RESISTANCE CABLE SYSTEM

A cable system with integrated fire-resistance appears as a chapter in the pre-standard MSZE 24102, but its detailed interpretation is not included in the standard. The previous technical name “cable system with integrated functionality retention” proved to be easier to interpret. [17]

From a technical point of view, the essence of this is that cables with different functions and different fire-resistance limits can be placed on a given qualified cable support system. In this case, the retention limit should be treated as a separate wire, because a cable with a lower fire-resistance limit will not have a “better” fire-resistance from the higher rating of the support structure. However, a cable with a higher limit should not be treated with a lower limit either just because they are conducted on the same track. [18]

So, the performance of the system is determined by the element with the weakest rating in terms of power supply. The performance of the system thus also depends on the fire-resistance class of the support structure, the fire-resistance class of the cable support structures and the fire-resistance class of the cables used. That is, with an E60-rated cable tray system attached to a concrete structure, E90 performance cannot be achieved even if the cable is E90-rated. An E30-rated cable will not be able to operate for 60 minutes in the same support structure, but 30 minutes of functionality is guaranteed. The performance of the fasteners must be verified for the structure to be used, which harmonizes with those specified in OTSZ.

TvMI also determines the fixing (fastening) solutions that are considered regular even if it is not possible to fix them to a TKRA building structure. In this case, the fire authority must also be involved in the approval of the functionality retention system. An exception is made for hanging cable trays or cable ladders on a trapezoidal plate with metal fasteners. If the trapezoidal slab is supported by a reinforced concrete beam, efforts should be made to secure it to the beam. Fastening to a reinforced concrete beam is also considered to be appropriate if the cable tray or cable ladder is fastened to the beam by means of a pallet design. The mechanical stability of the "C" profile rails on which the pallet is fastened must be ensured.

Item D.2.7.3 of TvMI allows fastening to steel structures. Among the fastening methods, it allows the pallet fastening, the fastening and welding with the through screw, or the fastening with the fired threaded nail. For outdoor mounting, it is required to cover the cable trays and cable ladders with a slab.

When fastening a cable with clamps, it is recommended to keep a distance of 20-50 mm between the clamps and the support structure if the surface was treated with a foam-resistant fire protection coating. In the case of a cable system on a metal support surface, it is also necessary to examine the load-bearing capacity of the metal structure. [8]

To illustrate the point, it can be stated that an E30-rated cable conducted on a standard design E60-rated cable ladder is suitable in all cases where the relevant risk class of the structure requires it. However, an E90-rated cable laid on the same cable ladder can perform the function assigned to a maximum E60 fire-resistance performance. In practice, these functionality retention systems are implemented as integrated fire-resistance cable systems.

4. STANDARD FIRE-RESISTANT CABLE SYSTEM

The concept of a standard fire-resistant cable system was first introduced by the German standard DIN 4102-12. According to this, a functionality retention cable system that has been tested in accordance with DIN4102-12 or MSZE 24102 is considered standard. Categories E30 E60 or E90 are classified according to these standards if the system is installed and tested with construction technology that provides the required performance. [19]

Standard fire-resistant cable systems are easy to design and install because MSZE 24102 (DIN 4102-12) clearly defines their design. The purpose of the standardization is also to make it clear that a "Y" cable may be used instead of an "X" cable certified on the standard cable support system of manufacturer "A" if it is appropriately certified, and that "X" cable may be used "B” manufacturer’s standard cable support system even though it has not been certified on it. [9]

	Cable laid on a cable ladder	**Cable laid on a cable tray**	**Cable fixed with individual clamps**	
			With individual clamps	**With individual clamps and cable trough that can be fastened in a profile rail**
Fastening (fixing) distance	1,200 mm	1,200 mm	300 mm	600 mm
Suspension method	Column with screwed or welded bracket, the end of which fastened to the slab with a threaded shank	Column with screwed or welded bracket, the end of which fastened to the slab with a threaded shank		
Dimensions	Ladder width max. 400 mm Side wall height 60 mm Plate thickness 1.5 mm	Tray width max. 300 mm Side wall height 60 mm Plate thickness 1.5 mm Perforation rate (15 ± 5)%	Clamp width (15 ± 5) mm	Clamp width (15 ± 5) mm Trough length 200 mm

Maximum load capacity	20 kg/m	10 kg/m		

Standard fire-resistant cable support designs [9]

The applicability of standard cable support systems is limited in that the design and installation rules specified in the standard cannot be deviated from. As the standards did not follow the manufacturer's developments, the concept of a cable-specific fire-resistant cable system was defined.

5. CABLE-SPECIFIC FIRE-RESISTANT CABLE SYSTEMS

A cable-specific functionality retention system is one in which the system has been tested in accordance with DIN4102-12 or MSZE24102 and is classified as E30, E60 or E90. The structures used to secure the cables were examined along with the cables. [8]

The range of currently available fire-resistant cable fasteners is typically based on cable-specific fastening solutions. Of course, standard fixings are also present, only to a much lesser extent. Most of the metal fastening solutions developed by the manufacturers are not defined in the draft standard MSZE 24102 (DIN 4102-12), therefore it is not interpreted from the side of the standard. In contrast, specific fastening solutions allow for a significantly lower cost design and are therefore much more sought after. With the development of manufacturing technology, it has become possible to reduce the minimum material thickness (e.g., cable tray material thickness) or a completely new fastening solution has been developed, which allows for cost-effective assembly. [20]

The certification of cable-specific functionality retention systems must include all the conditions for certification and the specification of the cables used in the test, due to the non-standard individual fastening design and use. The question arises as to whether, when using a cable-specific system, only the type of cable used for certification can be applied, or can all cables of the same type but of a separate make be used, depending on the type of cable used for certification?

6. RELATIONSHIP BETWEEN CABLE SUPPORT SYSTEMS AND BUILDING STRUCTURE COMPONENTS

MSZE 24102:2011 clearly sets out the requirements for the standard design, with the exception of the type of support structure. The pre-standard takes the conformity of the support structure as given. This standard deficiency shifts the responsibility to the manufacturer to set the minimum expected performance of the support structure at the time of certification. In addition, the standard clearly requires the constructor to declare compliance with the manufacturer's specifications.

"A contractor implementing the solutions ensuring the fire-resistance of a cable system must issue a declaration of conformity for each structure, certifying that the solutions implemented by them comply with the provisions of the test report." [10]

When positioning the functionality retention track, care must be taken to ensure that other structures cannot mechanically damage the track in case of fire. *"The performance of the cable system may not be adversely affected by the surrounding building components during the period of fire-resistance."* [10]

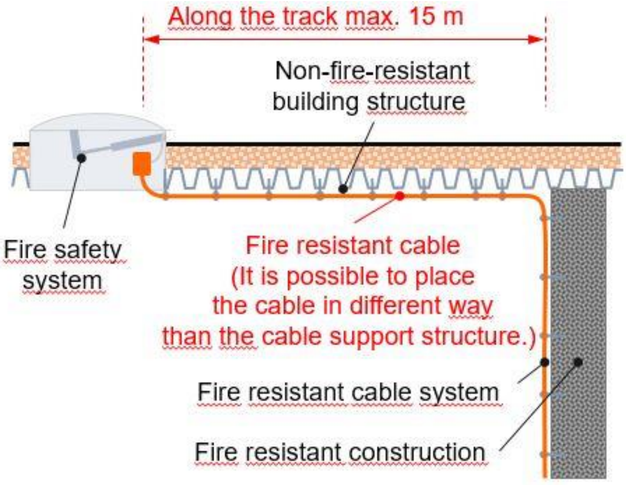

Figure 2: Permissible deviation I[8]

[8] Edited by the author based of Source [8]

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Building structure elements are not defined in detail either, but the most likely interpretation is that it also applies to building structure and other structural elements related to the structure. Based on this, as shown in Figure 2, the installation of a functionality retention track must always be positioned at the highest installation height, above the track, only a system with a higher fire resistance limit can be placed.

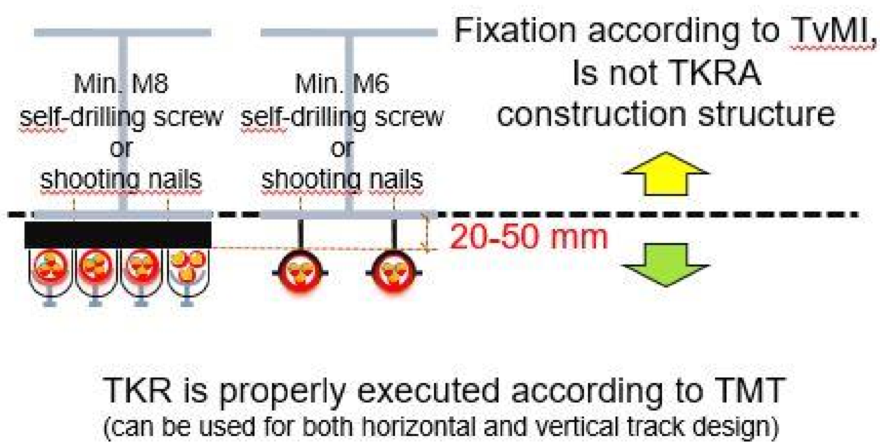

Figure 3: Permissible deviation II[9]

Manufacturers are not prepared to offer regular track fixing for the alternate TKRA and non-TKRA structures outlined in Figure 3, nor are there any so-called fastening aid that would be certified.

With regard to coating systems that increase the fire protection limit value for metal structures in lightweight buildings, manufacturers' recommendations strongly prohibit the use of coatings. In the case of a mixed type of support structure, it is not possible to create a track from one product. The mixed use of the products is not regulated and is subject to individual assessment.

[9] Edited by the author based of Source [8]

7. LEGISLATIVE AND CERTIFICATION DISHARMONIES

For reasons related to the shortcomings of the emerging background of standards, questions may need to be considered for professional consideration in certain aspects of their current certification compliance criteria.

Annex 7.4 D of TvMI:

"D.2.1. A constructed fire-resistant cable system shall meet the relevant requirements of the OTSZ if

a) the construction of a fire-resistant cable system complies with the relevant Fire Protection Certificate of Conformity and Construction Guideline, and

b) a fire-resistant cable system is fixed to TKRA structures using fasteners appropriate to the structure." [8]

Certificates for functionality retention systems refer to the German standard DIN 4102-12: 1998, which does not specify requirements for fastening to a building structure. [21]

"D.2.1.1. A implemented fire-resistant cable system shall meet the relevant requirements of OTSZ even if

(a) the construction of a fire-resistant cable system complies with the relevant Fire Protection Certificate of Conformity and Construction Guideline, and

(b) a fire-resistant cable system is not fastened to TKRA structures, but the technical solution used for fixing complies with point D.2.6. of Annex D." [8]

With this rule, we immediately came into conflict with the certificate and construction instructions of a given product, as well as with the valid OTSZ. Since we can ask the question, how is it possible to install a fire protection system in a building that does not have a TKRA structure? Alternatively, how can a system be expected to have functionality retention whose main load-bearer cannot perform it? Going back to the basic requirement, the minimum operating time an electrical system needs to fulfil is 30 minutes.

The following wording is also worth analyzing.

"D.2.5. Fixing (fastening) of integrated fire-resistance cable systems to TKRA building structures

D.2.5.1. The fastener (screw, dowel) fixing the fire-resistant cable system to the building structure can be used to fasten the fire-resistant cable system if its fire-resistance performance has been verified for the given fastening method (taking into account the material and other characteristics of the building structure).

D.2.6. Fixing of integrated fire-resistance cable systems to non-TKRA building structures

D.2.6.1. If the integrated fire protection cable system is not fastened to a TRKA building structure, unless otherwise possible, a derogation approval procedure must be carried out with the fire protection authority." [8]

Thinking in a greater detail, we can state that TvMI 7.4 defines a rating that has neither a legal nor a standard background. At present, it is not possible to certify fasteners in Hungary, because there is no standard or legislation on fasteners or the fastener-carrier material connection in terms of fire protection. The regulatory approval procedure does not have a raison d'être either, because the designer or contractor cannot offer a technically equivalent alternative due to the above.

Although the best alternative solution can be found in Section 7.4 D.2.6.2 of TvMI, its applicability remains questionable due to the lack of detail in the previous ones.

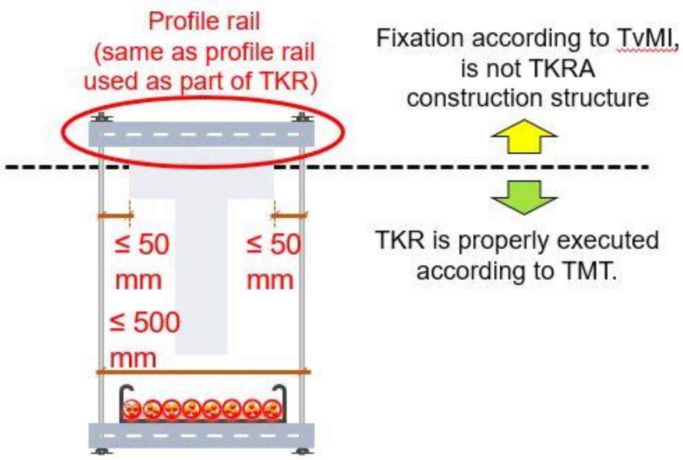

Figure 4: Pallet fastening[10]

[10] Edited by the author based of Source [8]

The pallet fastening shown in Figure 4 could be one of the desired fastening techniques, which in many cases could be a way to go with additional control.

The wording laid down in Section 7.4 D 2.7 of TvMI requires a similarly critical approach.

"A fire-resistant cable system with integrated fire-resistance fastened to a steel structure shall be deemed to be suitable if the standard fire-resistant cable support structure, otherwise properly constructed, can be fastened to the steel structure by a pallet, through-bolt or welding, or by a fired threaded nail (Figures 20A to 20E)."

The literature clearly prohibits the destruction of a coating system that would increase the fire-resistance limit value. Drilling a fire-resistant mortar can damage the coating over a large area, because the mortar simply breaks off the surface, but it is possible to restore it. Prior to applying the fire-resistant paint, the substrate must be carefully prepared, cleaned and degreased. The fire-resistant paint is then applied. A different type of paint is required for flat surfaces and a different type is required for curved surfaces. In the event of an accident, the person or company performing the painting may rightly say that the product was unable to perform its function because the integrity of the system has been violated. Heat is introduced into the drilled metal by the metal elements of the functional structure, thus accelerating the failure due to fire and starting to corrode the steel left without surface protection.

The question is, therefore, why is it necessary to lay down a technical guideline on fastening to non-TKRA systems when there are minimum specified periods of operation of fire protection systems in case of fires? For example, the audible circuit for a fire alarm system must retain the required functionality for at least 30 minutes. The audible alarm for the fire alarm system burns away after 6 minutes at the fire test temperature. [22]

In other words, the question may arise as to whether a fire protection system can be installed on a non-fire-resistant building structure at all. Or approaching the question in an inverse way: what is the raison d'être of a fire protection system operating for a given period of time in a building whose structure cannot provide the minimum required fire-resistance limits of the system?

That is, a logical dissonance arises if the fire-resistance limits of the building structures are from a minimum of 15 minutes, while fire protection systems start from a functionality retention period of 30 minutes. Because logically, fire protection equipment will not be able to provide longer operation in case of a fire than the system on which it is fastened.

As a further technical aspect, if the support structure is connected to the support structure by welding, how can the exact definition of these structural joints and thus the setting of the conformity limits be carried out? After all, as stated earlier, the certifications of functionality retention systems do not deal with fastenings of this design, so, even if the metal structure and the welded auxiliary support are properly painted, it is not possible to state with absolute certainty that the implemented system complies with the certificate. As it is understandable, the visual identification of possible quality differences in the joints formed in this way onsite cannot be considered a technically satisfactory method.

We can state that there are many questions to reconsider on this issue, similar to those detailed above. However, it can be stated that they can be traced primarily to DIN 4102-12:1998. This German standard was last updated in 1998, and manufacturers' offerings and solutions have increased significantly since then. Another problem is that some certification bodies use this standard as a certification basis, on the one hand in countries outside the territorial scope of the standard and on the other hand even for products for which it is completely irrelevant.

8. CONCLUSIONS, SUGGESTIONS

The following conclusions can be drawn in connection with the regulation of functionality retention structures in Hungary:

- The standards on which the certification procedures are based are outdated and do not follow technical developments. Due to the inflexibility of the implementation of the standards, it would be desirable to elaborate a new technical guideline in Hungary, which would only lay down the certification methods and implementation directions related to the functionality retention systems.
- Thanks to an extended certification procedure, fastening systems that are currently available in the categories of heavy-duty fastening systems (e.g., mounting rail systems) could also be included in the certified elements.

- The technical content of the technical guideline in Hungary needs to be clarified with regard to some relevant issues. This includes, for example, that the Technical Guidelines should not provide for exceptions where the national law requires a minimum technical level.
- The national technical guidelines shall harmonize with the technical guidelines for other fire protection systems.
- National legislation must consistently specify the minimum level to be met by a building structure and the fire protection system associated with the building structure.
- It would be desirable to coordinate the fire protection branches in a design guideline program, where the branches can define the boundaries of their own design and the impacts of related fire protection systems in their own territory.
- It would be necessary to make a clear distinction between standard and cable-specific systems. Currently, the standard system has significant additional costs compared to the cable-specific system, but has no tangible advantage.
- It would be desirable to link the design of functionality retention systems to a separate investigation, so that designers can be informed on developments at least in refresher courses.
- It would be necessary for the permissible building structure fastenings to be tested in a real fire test together with the functionality retention systems.

As a solution, it seems appropriate to draw up a standard or series of standards or technical guidelines whose remit covers the entirety of the tracks, including the definition of the materials used. Examples are the MSZ EN 12259 series of standards and the MSZ EN 12845 standard, which deals with the standard background of built-in fire extinguishing equipment, including sprinkler components, and determines the adequacy of design and installation. The proposed standard/technical guideline, in addition to specifying the certification of the constituents to be retained in this context, would set out in the relevant standard/technical guidelines how a constituent certified as required can be built into an integrated system.

Thus, the current regulation is not sufficiently definitive on several technical issues, which, however, open up new space for scientific research. The solutions explored as a result of these issues not only play a role in ensuring safety, but can also advance the issue of fire safety by laying down the basic ideas for initiating a professional discussion.

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