Fire Eurocodes - The Future?
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Integrated Fire Engineering and Response  
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**Fire Eurocodes - The Future?**  
Wald F., Burgess I., Outinen J., Vila Real P., Horová K.  
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INTRODUCTION

It is current practice in the European Union that safety, including Fire safety, is nationally managed, and the demands made are determined by the specific experiences of each country. While the political motivation for this approach is obvious, and local circumstances vary between countries, it can easily lead to similar processes having to be re-researched and re-invented country by country. In the context of the European Union, safety requirements in the event of fire are based on Directive 305/2011 (9 March 2011) of the European Parliament and Council, setting harmonised conditions for the marketing of construction products and repealing the previous Council Directive 89/106/EEC. The regulation is applied to construction products, as an essential element in construction works. In Annex I of this Directive, the essential requirements for mechanical resistance and stability, and for fire safety, are summarised. The construction works must be designed and built in such a way that, in the event of the outbreak of fire:

- The load-bearing capacity of the construction can be assumed for a specific period of time;
- The generation and spread of fire and smoke within the works are limited;
- The spread of the fire to neighbouring construction works is limited;
- Occupants can leave the works or be rescued by other means;
- The safety of rescue teams is taken into consideration.

The load-bearing capacity of the construction may be modelled on the principles summarised in the parts of the structural Eurocodes which deal with fire. The materials relevant for the proper application of Eurocode fire design are described with worked examples in (Wang et al., 2012) and for steel structures in (Moore et al., 2007) and (Franssen and Vila Real, 2011).

The first part of the material produced in this Work Package was prepared on the basis of the work of WG3 (Integrated Design) and edited by Professor Paulo Vila Real (Portugal) and Dr Jyri Outinen (Finland). The questionnaire was intended to establish current design practice in the member countries with respect to fire safety in buildings (Wald et al., Integrated fire engineering and response - state of the art report, Czech Technical University, Prague, 2011, 239, ISBN 978-80-01-04598-5). Seventeen countries provided responses (Belgium, Croatia, Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Turkey and United Kingdom). Questions concern building regulations, design codes the approvals process, the role of insurance companies, qualification requirements for designers, the conditions for the use of performance based fire engineering design and passive fire protection. The answers have been collated and summarised in this document, so that comparisons can be made. The ways in which designers, regulators and authorities currently deal with application of the ‘fire’ parts of the structural Eurocodes (EN199x-1-2) in different countries, are then listed. The questions in this section, mainly suggested by Dr Florian Block, co-Chair of WG1, were finalised in 2014.

Requirements for the contents of documentation on fire safety design were prepared by Dr Jyri Outinen, on the basis of Table 2 in Performance-based structural fire safety design (Rautaruukki Oyj). This part covers the use of Eurocodes in fulfilling the requirements for fire safety in national regulations.

The third part of this volume summarises a collection of knowledge developed in recent European and national research projects, which suggests that amendments should be made to the ‘fire’ parts of the Eurocodes. It is hoped that these suggestions will help to increase the fire safety of future European buildings. The work is categorised in terms of existing and expected standards, and is intended both to inform the direct development of the Eurocodes, but also to aid the production of Technical Documents which will accompany the next generation of Eurocodes.

The text was kindly reviewed by Prof. Gintaris Kaklauskas, Vilnius Gediminas Technical University, Lithuania.

Luleå, March 2014

Ian Burgess, František Wald
1 Current application of structural fire Eurocodes

In 2011 several questions were prepared to find out which were the current design practice in some European countries regarding fire safety in buildings. Thirteen countries have responded to that questionnaire. In 2014 this questionnaire has been updated by the country members that have answered to the first edition and four new countries have also contributed to the questionnaire. Seventeen countries have responded to the call: Belgium, Croatia, Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Turkey and United Kingdom.

Questions about building regulations, design codes approvals process, insurance companies, qualification requirements for designers, precedence of performance based fire engineering projects and passive fire protection have been made.

The aim was to provide information about the practice in the European countries. Building and design to other countries meet often a variety of problems due to different procedure and acceptance. To help in this matter and also in co-operation between researchers from different countries this questionnaire has been gathered. Although EU should make this kind of interaction easier, the national regulations vary a lot and therefore this kind of information is valuable.

All the answers have been collected and put together in this document so that a comparison could be made between them. The way in which designers, regulators and authorities currently deal with the issues of fire safety in buildings in some European countries, can be checked hereafter.

The following questions, mostly suggested by Dr Florian Block Co-chairman of WP1, have been sent to the members. A comment from Professor Paulo Vila Real and Dr Jyri Outinen has been included.

1. Building Regulations

1.1 Are the Building Regulation Prescriptive / performance based (i.e. is it possible to design from first principles using finite element analysis, CFD, etc to show that the intents of the Building Regulations are met?)

**Comment:** Most of the countries allow for performance based design and the use of advanced calculation methods. Only in Greece, Hungary, Romania and Slovakia the regulations are purely prescriptive and do not allow for the use of advanced calculation methods.

1.2 What are the Building Regulations relevant for fire called and who is the issuing body?

**Comment:** Each country provided a list of their Building Regulation for Fire Safety.

1.3 Is there additional guidance available to interpret the Building Regulations for fire?

**Comment:** Some Countries have guides and FAQ’s. Croatia, France, Greece and Italy do not have this type of information from the authorities.

1.4 Are there different regulations for certain types of buildings (i.e. schools, hospitals, airports, railway stations)?

**Comment:** In all the Countries the regulation covers the most type of buildings
2. Design Codes

2.1 What are the relevant national or international/European standards required to undertake the design of:

- Means of escape
- Smoke management
- Fire resistance of the construction
- Fire fighting
- Fire safety systems (alarm, suppression, …)

Comment: Most of the Countries do not have relevant regulation for Means of escape, Smoke management, Fire fighting and Fire safety systems (alarm, suppression, …), but some guidance are given in the National Regulation for fire safety or some rules are used from NFPA. Only Poland has referred the EN 12101 - Smoke and heat control systems, which also should be used in the other European Countries. All the countries have adopted the structural Eurocodes for checking fire resistance of constructions.

2.2 Is it possible to use Eurocodes or other international fire standards in lieu of the local code?
Comment: All the countries have adopted the structural Eurocodes.

2.3 Are there available the translations of the fire parts of Eurocodes? Which ones?
Comment: For the time being only Greece, Hungary and Italy do not have any translation available.

2.4 Are the national annexes available in internet?
Comment: Only Finland, Greece, Turkey and UK provide the National Annexes in the internet.

3. Approvals process

3.1 What is the normal route to get a project approved?
- Via a public body
- Via a private body
- Self-certified

Comment: The projects are approved in most of the Countries via a public body.

3.2 What is the position of the fire brigade in the process?
Comment: In all the Countries the fire brigade plays an important role in the approval process. In Croatia Fire brigade doesn’t participate in the process of design approval. Exception is the case of approval of fire approach paths for the historical buildings.

3.3 Is there a third party review process common?
Comment: In all the Countries it is not common to have a third party review process.
3.4 Is it necessary to follow an alternative route of approvals for performance based design and what would that route be?

**Comment:** For the Countries where it is possible to use performance based design the project follows the same route as for prescriptive approach, i.e. the authorities must approve the project.

3.5 What is the normal time frame for the approvals process?

**Comment:** Not easy to define. The time depends on the complexity of the project.

3.6 What level of information must be provided to the approving body?

**Comment:** In all the Countries the normal details of a project of fire safety of buildings.

3.7 Are any specific facilitators required to help the engineer in the approvals process?

**Comment:** In most of the countries there are no specific facilitators required to help the engineer in the approvals process, but in Czech Republic, Greece, Hungary, Portugal and Spain the support can be asked to the authorities.

4. Insurance companies

4.1 Are insurance companies involved in the design process?

**Comment:** In most of the countries no, but in Spain requirements of insurance companies are more restrictive that authorities for important projects, for instance; skyscrapers or industrial installations.

4.2 Are insurance companies open to a discussion on fire safety?

**Comment:** In most of the countries insurance companies are not particularly concerned with this matter when establishing insurance premium, they are normally conservatives. Only in Belgium and Finland the insurance companies open to a discussion on fire safety.

5. Qualification requirements for designers and Insurance Companies

5.1 Is it required to hold specific certificates/licenses in the member state to undertake fire safety design and fire engineering?

**Comment:** In some Countries no (Belgium, France, Germany in some federal sates, Greece, Spain, Turkey and UK) and in other yes (Croatia, Czech Republic, Finland, Germany in some federal sates, Hungary, Italy, Poland, Portugal, Romania, Slovakia and Slovenia).

5.2 Are there certain types of buildings for which specific design licenses are required?

**Comment:** In most of the countries no, but in Finland, Poland, Portugal and Spain there are certain types of buildings for which specific design licenses are required.

5.3 Is the licenses holder an individual or an organisation?
Comment: In most of the countries the license is individual. In France and Hungary the license holder is an organization.

5.4 Is a specific insurance required?
Comment: In all the Countries a specific insurance is not required.

6. Precedence of performance based fire engineering projects
6.1 Project details.
Comment: It depends on the Country the amount of the details. Normally are the temperature of the compartment according to the adopted fire scenario, and calculation in agreement with the standards.

6.2 What was performance based?
Comment: In most cases the fire scenario and structural fire behaviour, but also the evacuation time of the building.

6.3 What techniques where used to justify the non-compliance?
Comment: Normally Fire Safety Engineering.

6.4 What approvals route was used?
Comment: Usual route through the authorities.

6.5 Is in your country standardised/recommended format of text of calculation of Performance based fire design?
Comment: In most countries no.

1.1 Building regulations

1.1.1 Prescriptive / performance based rules
Are the Building Regulation Prescriptive / performance based (i.e. is it possible to design from first principles using finite element analysis, CFD, etc to show that the intents of the Building Regulations are met?)

BELGIUM
The regulations are Prescriptive. For industrial buildings: mixture of prescriptive & performance based design and use some calculation methods.

CROATIA
The regulations allow performance based design and use of advanced calculation methods, but these methods have to be discussed with the public authorities for every project.
CZECH REPUBLIC
The regulation allows performance based design and use of advanced calculation methods (technical expertise). Law No. 133/1985 Coll. on fire protection (Section 99): Certified engineer in fire protection can use during the design of fire safety of building approach which is determined by technical standard or another technical document of fire protection.

FINLAND
The regulation allows both: design based on prescriptive rules, performance based design and use of advanced calculation methods.

FRANCE
The building regulation is mostly prescriptive, but allows performance based design and use of advanced calculation methods.

GERMANY
The regulations in exceptionally allow performance based design and use of advanced calculation methods. These methods have to be discussed with the public authorities for every project.

GREECE
The regulation doesn’t allow the use of advanced calculation methods (finite element analysis, CFD, etc.).

HUNGARY
The regulations are really prescriptive.

ITALY
The regulations are basically prescriptive and concern several types of building use. However, the performance based design and advanced calculation methods may be applied either in the lack of prescriptive rules or in the case of “derogation” with respect to prescriptive rules.

POLAND
Generally building regulations are still prescriptive, but they allow performance based design and use of advanced calculation methods.

PORTUGAL
The regulation allows performance based design and use of advanced calculation methods.

ROMANIA
The regulations are prescriptive.

SLOVAKIA
It is not possible to use the engineering access.

SLOVENIA
The regulations are mostly prescriptive. The regulation allows performance based design and use of advanced calculation methods but in this case additional revision of the project is required.

SPAIN
There are excellent codes in Spain based in modern concepts of Fire Engineering in harmony with European regulations. Spanish designers can use advanced models with supervision of local officers.
TURKEY
The regulations are prescriptive. The main regulation is on the fire safety of buildings. It is obliged by law to design and construct buildings according this document. The official title (in Turkish) “Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009” is available online.

UNITED KINGDOM
The regulation allows performance based design and use of advanced calculation methods.

1.1.2 Relevant Building Regulations
What are the Building Regulations relevant for fire called and who is the issuing body?

BELGIUM
Les Normes de Base:
- 7 Juillet 1994. - Arrêté royal fixant les normes de base en matière de prévention contre l'incendie et l'explosion, auxquelles les bâtiments nouveaux doivent satisfaire plus modifications
- Plus a lot of regulations for all sort of building types such as hotels, hospitals, homes for elderly people.

CROATIA
Law on Fire Protection (NN 92/10), Ministry of Internal Affairs
Regulation of resistance to fire and other requirements that buildings must meet in fire (NN 29/13), Ministry of Internal Affairs
- Plus a lot of accompanying regulations which can be found on:
  http://www.arhitekti-hka.hr/hr/zakoni-propisi/popis/zastita/od-pozara/

CZECH REPUBLIC
Law No. 133/1985 Coll., on Fire Protection
This Law includes obligations of state authorities, legal and natural persons on fire protection field (e.g. classification of performed business by fire risk, content evaluation of fire risk).
Decree No. 246/2001 Coll., on stipulation of fire safety conditions and on State fire supervision performance (Decree on fire prevention)
- basic requirements of fire safety
- types of dedicated fire technique, fire protection material means and fire safety equipment
- requirements to Design and installation of fire safety equipment
- type of fire protection documentation
- method of managing the fire protection documentation
- contents and scope of fire safety design etc.
Decree No. 23/2008 Coll., on the technical requirements for the fire protection of buildings
This Decree lays down the technical requirements for fire protection in the design, construction and use of buildings.

FINLAND
The National Building Code of Finland, Series E, especially parts E1 and E2, issued by the Finnish Ministry of the Environment. Link to page with unofficial English translations of said documents:
http://www.ym.fi/fiFI/Maankaytto_ja_rakentaminen/Lainsaadanto_ja_ohjeet/Rakentamismaarayskokoelma/The_National_Building_Code_of_Finland(10420)

Also the Finnish NA’s to the Eurocodes are available on this page.

FRANCE
The principal document is "Le code de la construction et de l'habitation: The Code of the Construction and the buildings".

There are some decrees:
- Décret n° 69-596 of 14-06-1969 which fix the general rules of construction of dwelling buildings
- Décret n°67-1063 of 15-11-1967 which deals with the construction of high rise buildings and their fire protection
- Décret n°54-856 of 13-08-1954 retating to protection against the panic and fire hazards in the establishments receiving of the public.

The issuing body is the Direction of the civil safety of the Ministry for the interior:
http://www.interieur.gouv.fr/sections/a_l_interieur/defense_et_securite_civiles/presentation/ddsc/view

GERMANY
For the reason that Germany is a federal state, every state (bavaria, lower saxony, north-rhine-westphalia, etc.) has its own building regulations. All are based on the Musterbauordnung “MBO” which is a template and could be translated by “Master building regulation”. The general requirements are written down there.

Fire resistance time for different structural members of buildings can be determined by the Eurocodes (parts 1-2).

For industrial buildings according to Musterindustriebaurichtlinie (see below) there are calculation methods listed in DIN 18230.

GREECE
The main regulations are:

HUNGARY
From the Ministry of Local Government:
9/2008. (II. 22.) ÖTM rendelet az Országos Tűzvédelmi Szabályzat kiadásáról

ITALY
- Decree of the Ministry of the Interior, 09/03/2007, “Prestazioni di resistenza al fuoco delle costruzioni nelle attività soggette al corpo nazionale dei vigili del fuoco”.
- Decree of the Ministry of the Interior, 09/05/2007 “Direttive per l’attuazione all’approccio ingegneristico alla sicurezza antincendio”.
- Decree of the Infrastructure Ministry 14/01/2008, “NUOVE NORME TECNICHE PER LE COSTRUZIONI”.
- Decree of Republic President n° 151 01/08/2011, “Regolamento recante semplificazioni della disciplina dei procedimenti relativi alla prevenzione degli incendi, a norma dell’art. 49 comma 4-quater, del decreto – legge 31 maggio 2010, n. 78, convertito, con modificazioni, dalla legge 30 luglio 2010, n. 122”.

Italian
- Decree of the Ministry of the Interior, 07/08/2012, “Disposizioni relative alle modalità di presentazione delle istanze concernenti i procedimenti di prevenzione incendi e alla documentazione da allegare, ai sensi dell’articolo 2, comma 7, del decreto del Presidente della Repubblica 1° Agosto 2011, n.151”.

POLAND
- Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 w sprawie warunków technicznych jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75 z 2002 r, poz. 690 z późn. zm.) – Ministerstwo Infrastruktury (Ministry of Infrastructure)
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 7 czerwca 2010 roku w sprawie ochrony przeciwpożarowej budynków, innych obiektów budowlanych i terenów (Dz. U. Nr 109, poz. 719) – Ministerstwo Spraw Wewnętrznych i Administracji (Ministry of the Interior and Administration).

PORTUGAL
- The law Decreto-Lei n.º 220/2008, de 12 de Novembro, which establishes the juridical rules for buildings fire safety Regime Jurídico da Segurança Contra Incêndio em edifícios (RJ-SCIE);
- Technical regulation for buildings fire safety Regulamento Técnico de Segurança contra Incêndio em Edifícios e Recintos (RT-SCIE), que constitui a Portaria n.º 1532/2008, de 29 de Dezembro de 2008;
- Despacho n.º 2074/2009, de 15 de Janeiro, do Presidente da Autoridade Nacional de Protecção Civil on the technical criteria for determining the modified fire load density.

ROMANIA

SLOVAKIA
- The law n.º 314/2001; The protection for the fires;
- Announcement of Ministry of Interior of the Slovak Republic n. 121/2002; The fire prevention
- Part of government, which prepare juridical decree is ministry of Interior of the Slovak Republic. In the law 314/2001 are the basic duty on the part of protection for the fire and the details solve the Announcements of Ministry of interior of the Slovak Republic with technical contents;
- Fire security of buildings solve the Announcement of MI SR, n. 94/2004, which describe the technical requests on fire protection by the construction of building, so by the using of buildings.

SLOVENIA
- Zakon o varstvu pred požarom (Uradni list RS, št. 3/07 - uradno prečiščeno besedilo, 9/11 in 83/12) (eng: Fire Protection Act)
- Pravilnik o požarni varnosti v stavbah (Uradni list RS, št. 31/04, 10/05, 83/05, 14/07 in 12/13) (eng: Rules on fire safety in buildings)
- Pravilnik o zasnovi in študiji požarne varnosti (Uradni list RS, št. 12/13 in 49/13) (eng: Rules on the concept and study of fire safety)
- Pravilnik o požarnem redu (Uradni list RS, št. 52/07, 34/11 in 101/11) (eng: Rules on Fire Rules)

Issuing body is Ministry of Defense.

SPAIN
We have two relevant codes in Spain;
- The Spanish Technical Building Code (CTE) for residential, commercial and administrative buildings, from Ministry for Housing. It’s a true performance-based code but it has the prescriptive rules too.
  
  CTE - Código Técnico de la Edificación
http://www.codigotecnico.org/web/cte/

- A second code for industrial buildings is the Spanish Security Code against to Fire in Industrial Activities (RSIEI) from Ministry of Industry, Tourism and Trade. It’s a specific legislation for industrial safety.

  RSIEI - Reglamento de Seguridad contra Incendios en los Establecimientos Industriales

http://www.ffii.nova.es/puntoinfomcyt/Archivos/Dis_4539.pdf

TURKEY

There is one regulation on the fire safety of buildings In Turkey. It is obliged by law to design and construct buildings according this document. The issuing body is “Ministry of Environment and Urban Planning of Turkey”.

The official title (in Turkish) “Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009” is available online:


UNITED KINGDOM

- 2010 No. 2214 - Building And Buildings, England And Wales - The Building Regulations 2010
- 2010 No. 2215 - Building And Buildings, England And Wales - The Building (Approved Inspectors etc.) Regulations 2010.

1.1.3 Additional guidance

Is there additional guidance available to interpret the Building Regulations for fire?

BELGIUM

Not answered.

CROATIA

There is no additional guidance.

CZECH REPUBLIC

Fire rescue service of Czech Republic provides some technical notes on fire safety of building.

For example interpretation of laws about fire protection:


FINLAND

Guidance is available in Finnish and Swedish, e.g.

- RIL 221-2003 Paloturvallisuussuunnittelu (guidebook on fire safety engineering design) / In Finnish

FRANCE

No

GERMANY

Yes. For every state building regulation comments and reasons exist.
GREECE
No.

HUNGARY
We have some national pre standards
- 1. MSZE 595-1:2009 Építmények tűzvédelme. 1. rész: Fogalommeghatározások
- 2. MSZE 595-3:2009 Építmények tűzvédelme. 3. rész: Épületszerkezetek tűzállósági követelményei
- 3. MSZE 595-5:2009 Építmények tűzvédelme. 5. rész: Tűzsakaszolás, tűzterjedés elleni védelem
- 4. MSZE 595-6:2009 Építmények tűzvédelme. 6. rész: Kiürítés
- 5. MSZE 595-7:2009 Építmények tűzvédelme. 7. rész: A számított tűzterhelés és a mértékadó tűzidőtartam meghatározása

ITALY
No, in Italy there isn’t a guide available to interpret the Building Regulations for fire. However, the National Body of Fire provides some technical notes (named “Lettere Circolari”) related to several decrees.

POLAND
Some instructions are published by Instytut Techniki Budowlanej (Building Research Institute).

PORTUGAL
ANPC – National Authority of Civil Protection, provides some technical notes on fire safety of buildings: http://www.prociv.pt/Portugues/Pages/Detalhes.aspx?IDItem=41

ROMANIA
A guide is available in order to interpret the normative for fire security of buildings.

SLOVAKIA
The basic requests are described in juristically decree – announcements. Concrete requests specify the Slovak technical standards.

SLOVENIA
Yes, for example:
general guidance on how to reach sufficient fire safety for the building.

SPAIN
Yes, there are some guides and FAQ’s to interpret the practical application of these rules. In several cases this additional information is very relevant.
- CTE http://www.codigotecnico.org/web/cte/faqs/

TURKEY
Additional guidance is provided by two main organizations
TUYAK – Turkish Fire Protection and Education Foundation
TUCSA – Turkish Institute of Steel Construction
By TUCSA:
These organizations adopt European Guidelines. Related documentations are the following:
European Recommendations for the Fire Safety of Steel Structures, ECCS Technical Committee (1983)
Design Manual on the European Recommendations for the Fire Safety of Steel Structures, ECCS Technical Committee (1985)
By TUYAK:
Turkey’s Regulation on Fire Protection, July 2012 (Technical Books Series Number 05)

UNITED KINGDOM

Practical guidance on ways to comply with the functional requirements in the Building Regulations is outlined in a series of 'Approved Documents' published by the Department for Communities and Local Government.

Each document contains:
- general guidance on the performance expected of materials and building work in order to comply with each of the requirements of the Building Regulations; and
- practical examples and solutions on how to achieve compliance for some of the more common building situations.

All of the latest 'Approved Documents' can be downloaded free on the Planning Portal at:
www.planningportal.gov.uk/approveddocuments

1.1.4 Different regulations for certain types of buildings

Are there different regulations for certain types of buildings (i.e. schools, hospitals, airports, railway stations)?

BELGIUM

Yes for every type of buildings there is a different regulation:
- Industrial buildings (part of “les norms de base”)
- Hospitals,
- All sort of different hotels
- All sort of different homes for elderly people,
- Schools,
- Homes for youngsters
- Homes for disabled people
- Homes for childcare
- ...

CROATIA

There are different regulations for certain type of buildings like:
- Regulation on fire protection in warehouses (NN 93/08)
- Regulation on fire protection in hotels (NN 100/99)
- Regulation on the essential requirements for fire protection of power plants and equipment (NN 146/05)
- Regulation on stations supplying vehicles with fuel (NN 93/93, 116/07, 141/08)
- Rules on technical standards for the design, construction, operation and maintenance of gas boilers (ex Yu regulation Sl. SFRJ 10/90, 52/90, accepted as good technical practice)

There is also an important regulation which divides buildings in different groups regarding complexity of fire protection measures:
Regulation on the classification of buildings into groups by the demanding of fire protection measures (NN 56/12)

CZECH REPUBLIC

Decree No. 23/2008 Coll., on the technical requirements for the fire protection of buildings

This Decree specifies basic technical requirements for following types of buildings:

- 1 Family homes and buildings for family recreation
- 2 Apartment buildings
- 3 Hostel buildings
- 4 Health care and social welfare buildings
- 5 Buildings with assembly areas
- 6 Lookout tower buildings
- 7 Garage buildings
- 8 Filling station, servicing and repair buildings
- 9 Buildings used for school and educational establishment activities
- 10 Agricultural buildings
- 11 Production and storage buildings
- 12 Listed buildings
- 13 Building site buildings

FINLAND

Buildings are categorised into three fire classes, P1, P2 and P3, based on the use, size and occupancy of the building. P1 is the highest class and these buildings are usually not allowed to suffer structural collapse due to a fire.

Schools, hospitals, airports etc. are usually Class P1 buildings due to their size and the amount of people using them.

FRANCE

There are some other regulations:

- Arrêté du 31-01-1986, relating to the protection of the apartment buildings against the fire
- Arrêté du 25-06-1980, relating to protection against the panic and fire hazards in the establishments receiving of the public.
- Arrêté du 18-10-1977, relating to protection against the panic and fire hazards in the high rise buildings.

There are different regulations (arêtes) for

- Car parks
- Industrial installation,
- Warehouse,
- Nuclear installations

GERMANY

As mentioned above, every state has its own code in Germany. This is the same for every building type code. The list includes the “template-versions”:

- Musterindustriebaurichtlinie (industrial buildings)
- Mustergaragenverordnung (car parks)
- Musterversammlungsstättenverordnung (meeting halls)
- Musterverkaufsstättenverordnung (shopping centres)
- Musterschulbauordnung (schools)
- Musterbeherbergungsstättenverordnung (hotels)
- Musterkrankenhausbauverordnung (hospitals)
GREECE
Greek Presidential Edict (71/88), Section 1, covers the following utilization-types of buildings:
- Type I   «Dwelling»
- Type II  «Hotels»
- Type III «Schools»
- Type IV «Offices»
- Type V «Shops»
- Type VI «Places of public meetings»
- Type VII «Industrial, workshops and storage»
- Type VIII «Hospitals and nursing homes»
- Type IX «Parking places and fuel stations»

HUNGARY
We use different groups according the fire resistance of the building materials.
- In the first group there are high rise buildings and the middle high rise buildings if there is in a crowd staying room above 13m.
- In the second group there are kindergartens, social homes, closed garages, handicap people staying room if the building is taller than 2 floors, middle high rise buildings, buildings which are not in the first group with the two and three underground floors.
- In the third group there are schools, living buildings which taller than 2 level, community buildings if the top floor is not over 13,65m, more than one floors open garages, handicap people staying room.
- In the fourth group the one floor living and holiday buildings, the one floor community buildings minimum 25 maximum 50 person.
- In the fifth group, maximum ground floor living and holiday buildings maximum 25 person.

ITALY
The Decree of Republic President 01/08/2011 n.151 (Regolamento recante semplificazioni della disciplina dei procedimenti relativi alla prevenzione degli incendi, a norma dell’art. 49 comma 4-quater, del decreto – legge 31 maggio 2010, n. 78, convertito, con modificazioni, dalla legge 30 luglio 2010, n. 122) defines 80 types of building use, which are subjected to the control of the Fire Brigades.

For many building uses the Ministry provides specific Technical Rules of Fire Fighting, generally based on a prescriptive approach.

POLAND
Regulations are general for all kinds of buildings, nevertheless they divide building into three main groups:
- Housing and public utility buildings; involving endangering people (ZL)
- Production plants and warehouses (PM)
- Agricultural (IN)

PORTUGAL
The RJ-SCIE covers the following twelve utilization-types:
- Type I «Dwelling»
- Type II «Car parks»
- Type III «Administrative»
- Type IV «Schools»
- Type V «Hospitals and nursing homes»
- Type VI «Theatres/cinemas and public meetings»
- Type VII «Hotels and restaurants»
- Type VIII «Shopping and transport centres»
- Type IX «Sports and leisure»
- Type X «Museums and art galleries»
- Type XI «Libraries and archives»
- Type XII «Industrial, workshops and storage»

Due to the big dimension in plan and height the building can be classified as “atypical danger”.

ROMANIA

Regulations are general for all kinds of buildings, divided in industrial and civil buildings. A special separate normative is available for underground parkings.

SLOVAKIA

Yes they are specifying in technical decrees:

- Announcements of MI SR n.94/2004 – there are described technical requests on Fire safety by construction and using of the buildings.
- Announcements of MI SR n.96/2004, there are described principles fire protection by manipulation and the storage of flammable liquids, hard fuel oils and flowers and animal fat and oils.
- Announcements of MI SR n.121/2002 – about fire prevention
- Announcements of MI SR n.124/2000- here by the work with the flammable gasses
- Announcements of MI SR n.142/2004 about the fire safety by the construction and using the spaces, where are used pain materials.
- Announcements of MI SR n.258/2007 about demands of fire security by the storage and manipulation with solid flammable materials.

SLOVENIA

Yes, for some type of buildings with high number of possible occupant (i.e. hospitals, sport domes,...) or with higher risk of fire, like chemical companies..., regulations rules from other countries are allowed, Switzerland (VKF rules), German (MBO rules).

SPAIN

The Spanish Technical Building Code (CTE) covers the most types of buildings.

The industrial building or big storage building are covered by the Spanish Security Code against to Fire in Industrial Activities (RSIEI).

Specific activities are out of both codes, for instance; nuclear or mineral extraction.

TURKEY

No. The regulations are for all buildings. But there are the following building categories listed within the Turkish Fire Safety Regulation of Buildings “Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009”

- Residents
- Hotels, Restaurants
- Cooperate buildings
- Offices
- Business type buildings
- Industrial buildings
- Shopping centers
- Storage / Warehouses
- Storages of flammables / Gas stations / Refineries
- Mixed occupation buildings
UNITED KINGDOM
- 2 (a) Institutional
- 2 (a) Other residential: a. in bedrooms; b. in bedrooms corridors; c. elsewhere
- 3 office
- 4 Shop and commercial
- 5 Assembly and recreation: a. building primarily for disabled people; b. areas with seating in rows; c. elsewhere
- 6. Industrial: normal hazard; higher hazard
- 7. Storage and other non-residential: normal hazard; higher hazard
- 2-7 Place of special fire hazard
- 2-7 Plant room or rooftop plant: a. distance within the room; b. escape route not in open air (overall travel distance); c. escape route in open air (overall travel distance)

1.2 Design codes

1.2.1 Relevant national or international/European standards - Means of escape
What are the relevant national or international/European standards required to undertake the design of: means of escape?

BELGIUM
There are no relevant standards on this matter.

CROATIA
There are no relevant Croatian standards issued specifically on this matter. Evacuation is covered by Regulation of resistance to fire and other requirements that buildings must meet in fire (NN 29/13) and by Law of Safety on Works (NN 59/96, 94/96-correct., 114/03, 86/08, 75/09, 143/12)
We also use international standards for this purpose like NFPA (USA), TRVB (Austria).

CZECH REPUBLIC
- CSN 73 0802 - Fire protection of buildings - Non-industrial buildings
- CSN 73 0804 - Fire protection of buildings - Industrial buildings

FINLAND
No information on design standards, but the relevant regulations include:
- Regulations given also in Finnish National Building Code Part E1 Chapter 10 (see link above).

FRANCE
There are no relevant standards on this matter.

GERMANY
Musterbauordnung and regulation for certain type of building.
GREECE
There are no relevant standards on this matter.

HUNGARY
There are no relevant standards on this matter.

ITALY
There are national standards depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

POLAND
- Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 w sprawie warunków technicznych jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75 z 2002 r, poz. 690 z późn. zm.) – Ministerstwo Infrastruktury (Ministry of Infrastructure)
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 7 czerwca 2010 roku w sprawie ochrony przeciwpożarowej budynków, innych obiektów budowlanych i terenów (Dz. U. Nr 109, poz. 719) – Ministerstwo Spraw Wewnętrznych i Administracji. (Ministry of the Interior and Administration).
- PN-92/N-01256/02 Znaki bezpieczeństwa. Ewakuacja.

PORTUGAL

ROMANIA
The regulations for the means of escape are included in the mentioned normative for fire security.

SLOVAKIA
The escape ways, which are saved for the fire and secured with air ventilation.

SLOVENIA
No information on design standards, but relevant regulations for buildings on this issue are given in: Tehnične smernica TSG-1-001:2010, Požarna varnost v stavbah (eng: : Technical guideline: TSG-1-001:2010: Fire safety in buildings)
- i.e. rules on escape routes (distance width), issues concerning emergency lighting and signalling of escape routes are given.

SPAIN
Section SI-3 of CTE is devoted to provision of a safe route(s) for emergency evacuation by horizontal and vertical escape.
Moreover, RSIEI has additional requirements for industrial buildings.

TURKEY
There are no relevant standards on this matter.

UNITED KINGDOM
BS EN’s or Eurocodes primarily but functional regulations so any guidance permissible.
1.2.2 Relevant national or international/European standards - Smoke management

What are the relevant national or international/European standards required to undertake the design of smoke management?

BELGIUM
There is not a general legislation only a these standards:
- NBN S 21-208-1 : 1995 - Protection incendie dans les bâtiments - Conception et calcul des installations d’évacuation de fumées et de chaleur (EFC) - Partie 1 : Grands espaces intérieurs non cloisonnés s'étendant sur un niveau
- NBN S 21-208-2 : 2006 - Protection incendie dans les bâtiments - Conception des systèmes d'évacuation des fumées et de la chaleur (EFC) des bâtiments de parking intérieurs
- NBN S 21-208-2/prA1 : 2010 - Protection incendie dans les bâtiments - Conception des systèmes d'évacuation des fumées et de la chaleur (EFC) des parkings fermé

CROATIA
In Croatia EU norms and standards for smoke management are used (HRN EN 12101-1 to HRN EN 12101-6)

CZECH REPUBLIC
- CSN 73 0802 - Fire protection of buildings - Non-industrial buildings (Annex H – natural smoke and heat exhaust)
- CSN P CEN/TR 12101-5 - Smoke and heat control systems - Part 5: Guidelines on functional recommendations and calculation methods for smoke and heat exhaust ventilation systems

FINLAND
No information on design standards, but the relevant regulations include:
- Regulations given in Finnish National Building Code Part E1 Chapter 11 (see link above).

FRANCE
There are:
- Technical instruction n° 246, relating to receiving smoke clearing in the establishments of the public.
- Technical instruction n° 263 relating to the construction and the receiving smoke clearing of interior free volumes (atriums) in the establishments of the public.

GERMANY
vfdb-guideline, Muster-Versammlungsstättenverordnung, Muster-Industriebaurichtlinie.

GREECE
There are no specific regulations on this matter.

HUNGARY
We use MSZ EN 12101 Smoke and heat control system standard.

ITALY
There are national standards depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

POLAND
- Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 w sprawie warunków technicznych jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75 z 2002 r. poz. 690 z późn. zm.) – Ministerstwo Infrastruktury (Ministry of Infrastructure)
- PN-B-02877-4 Ochrona przeciwpożarowa budynków – Instalacje grawitacyjne do odprowadzania dymu i
ciepła -- Zasady projektowania. (Fire protection of buildings - Installation of gravitational devices for smoke and heat drainage - Design rules
- PN-EN-12101-1 System kontroli rozprzestrzeniania dymu i ciepła – Część 1: Wymagania techniczne dotyczące kurtyn dymowych. (Smoke and heat control systems -- Part 1: Specification for smoke barriers.)
- PN-EN-12101-10 System kontroli rozprzestrzeniania dymu i ciepła – Część 10: Zasilacze (Smoke and heat control systems -- Part 10: Power supplies.)

PORTUGAL
There are no specific regulations on this matter but documents / different rules, for example, the NFPA and APSARD.

ROMANIA
The regulations for the smoke management are included in the mentioned normative for fire security.

SLOVAKIA
Systems for offtake of warm and combustion gasses. The rules are from the producers or from Slovak technical standards 12101. Accepted are technical standards DIN, NFS and the directions VdS.

SLOVENIA
General requirements on smoke management are given in:
- More design options are given:
  - Smernica 405-1/10 Naprave za naravni odvod dima in toplote (NODT), (Technical guidline for natural smoke and heat exhaustion)
  - Smernica 405-2/10 Naravni odvod dima iz stopnišč (NODS), Technical guideline for natural smoke exhaustion from stairways)
- Mainly still regulations from other EU contries are use, especially for mechanical (forced) smoke and heat: Technical guideline, mainly German (DIN) or English (BS).

SPAIN
The article 8th of Section SI-3 of CTE to remit to national standard UNE 23585:2004 and to Euronorme EN 12101-6:2005 for smoke and heat control systems.
- The Annex II of RSIEI has additional requirements and allows using others international standards.

TURKEY
Within the Turkish Fire Safety Regulation of Buildings “Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009”, the Clause 86, 87, 88 give guidelines on smoke management (Chapter 6).

UNITED KINGDOM
BS EN’s or Eurocodes primarily but functional regulations so any guidance permissible.
1.2.3 Relevant national or international/European standards - Fire resistance of the construction

What are the relevant national or international/European standards required to undertake the design of:

Fire resistance of the construction?

BELGIUM

There is a standard for the fire resistance of

- NBN 713-020 Protection contre l’incendie - Comportement au feu des matériaux et éléments de construction - Résistance au feu des éléments de construction
- Part 1.2 (Structural fire design) from Eurocodes.

CROATIA

Requirements on fire resistance:

- Regulation of resistance to fire and other requirements that buildings must meet in fire (NN 29/13
- Part 1.2 (Structural fire design) from Eurocodes, HRN DIN 4102 (till 2019)

CZECH REPUBLIC

Requirements on fire resistance:

- CSN 73 0802 - Fire protection of buildings - Non-industrial buildings
- CSN 73 0804 - Fire protection of buildings - Industrial buildings
- CSN 73 0810 - Fire protection of buildings - General requirements
- Eurocodes:- Part 1.2 (Structural fire design)
- CSN 73 0821 - Fire protection of buildings - Fire resistance of engineering structures

FINLAND

Structural Eurocodes. Parts 1.2 (Structural fire design), National building code of Finland.

FRANCE

Part 1.2 (Structural fire design) from Eurocodes.

GERMANY

Part 1.2 (Structural fire design) from Eurocodes

Greece

National prescriptive rules require a certain standard fire resistance of walls and floors, depending on their use and geometry.

HUNGARY

(Structural fire design) from Eurocodes.

ITALY

The Decree of the Ministry of the Interior, 16/02/2007 ("Classificazione di resistenza al fuoco di prodotti ed elementi costruttivi di opere da costruzione") is applicable to assess the fire resistance of the building. In addition, the Decree allows the use of the Parts 1.2 of the relevant Eurocodes.

POLAND

- Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 w sprawie warunków technicznych jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75 z 2002 r, poz. 690 z późn. zm.) – Ministerstwo Infrastruktury (Ministry of Infrastructure)
- Eurocodes: Part 1.2 (Structural fire design).

Other codes (based on European codes)
1.2.4 Relevant national or international/European standards - Fire fighting
What are the relevant national or international/European standards required to undertake the design of: Firefighting?

BELGIUM
Portable fire extinguishers
The NBN S21-011 to NBN S21-018 range should have been replaced by the NBN EN3-1 to EN3-6. Because the Dutch version of EN3 doesn’t exist, the NBN preserved this range (against all CEN-rules). These standards have become obsolete. In practice, most fire extinguishers are in accordance with the EN3 ranges, of which the last valid standard is the EN3-7: 2004.

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<td>Matériel de sauvetage et de lutte contre l’incendie - Extincteurs d’incendie portatifs - Prescriptions communes applicables à tous les types d’extincteurs</td>
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</table>

CROATIA

All EU norms which covered fire fighting equipment are used in Croatia. There are stipulated in Technical regulation on construction products, group H (NN 33/10, 87/10, 146/10, 81/11, 100/11-correct. 130/12, 81/13). Beside this there are a lot specific regulations related to fire fighting. Main regulation is Law of Fire fighting.

CZECH REPUBLIC

CSN 73 0873 - Fire protection of buildings - Equipment for fire-water supply (Annex B – Fundamentals for analyses fire fighting).

FINLAND

No information on design standards, but the relevant regulations include:
- Regulations given in Finnish National Building Code Part E1 Chapter 11 (see link above).

FRANCE

There are no relevant standards on this matter.

GERMANY

Feuerwehrdienstvorschrift 3 (FwDV 3), Feuerwehrdienstvorschrift 4 (FwDV 4) (fire brigade codes), Fire Protection Law.

GREECE

There are no relevant standards on this matter.

HUNGARY

There are no relevant standards on this matter.
ITALY
There are national standards depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

POLAND
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 7 czerwca 2010 roku w sprawie ochrony przeciwpożarowej budynków, innych obiektów budowlanych i terenów (Dz. U. Nr 109, poz. 719) – Ministerstwo Spraw Wewnętrznych i Administracji (Ministry of the Interior and Administration).
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 24 lipca 2009 r. w sprawie przeciwpożarowego zaopatrzenia w wodę oraz dróg pożarowych (Dz.U. Nr 124, poz. 1030).
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 29 grudnia w sprawie szczegółowych zasad organizacji krajowego systemu ratowniczo-gaśniczego (Dz. U. 111, poz.1311)
- PN-B-02865 Ochrona przeciwpożarowa budynków. Przeciwpożarowe zaopatrzenie wodne. Instalacja wodociągowa przeciwpożarowa.

PORTUGAL
There are no relevant standards on this matter.

ROMANIA
There are national regulations depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

SLOVAKIA
It is solved the adequate conditions for efficient of fire fighting units.

SLOVENIA
In technical guideline:
There are some points considering firefighting issues, mainly accessibility for fire fighting.
And rules:
-Pravilnik o izbiri in namestitvi gasilnih aparatov (Ur.l. RS, št. 67/2005) (Rules on the selection and installation of fire extinguishers)
-Pravilnik o preizkušanju hidrantnih omrežij Ur.l. RS, št. 22/1995) (Rules on the testing of the hydrant network)

SPAIN
Section SI-5 of CTE is devoted to accessibility for fire fighting.

TURKEY
Within the Turkish Fire Safety Regulation of Buildings “Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009”, Chapter 7 gives fire extinguishing systems and management. However, no clearly defined fire fighting guidelines.

UNITED KINGDOM
BS EN's or Eurocodes primarily but functional regulations so any guidance permissible.
1.2.5 Relevant national or international/European standards - Fire safety systems (alarm, suppression, …)

What are the relevant national or international/European standards required to undertake the design of: Fire safety systems (alarm, suppression, …)?

BELGIUM

There are specific standards only some demands in the regulations

- NBN EN 54 part 1,2,3,4,5,7,10,11,12,13,16,17,18, 20, 21, 23, 24, 25; specifies requirements for all component parts of a fire alarm system

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<td>Systèmes de détection d’alarme incendie - Partie 1: Introduction</td>
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<td>NBN EN 54-3: 2007</td>
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<td>FR/EN/DE</td>
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<td>NBN EN 54-4: 2001</td>
<td>Systèmes de détection d’alarme incendie - Partie 4: Dispositifs sonores d’alarme feu</td>
<td>06/2001</td>
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<td>NBN EN 54-6: 2005</td>
<td>Systèmes de détection d’alarme incendie - Partie 6: Dispositifs sonores d’alarme feu</td>
<td>12/2005</td>
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<td>NBN EN 54-8: 2004</td>
<td>Systèmes de détection d’alarme incendie - Partie 8: Équipement d’alimentation électrique</td>
<td>03/2004</td>
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<td>NBN EN 54-10: 2005</td>
<td>Systèmes de détection d’alarme incendie - Partie 10: Détecteurs de fumée - Détecteurs photoélectriques fonctionnant suivant le principe de la diffusion de la lumière de la transmission de la lumière ou de l’ionisation</td>
<td>02/2005</td>
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<td>NBN EN 54-11: 2001</td>
<td>Systèmes de détection d’alarme incendie - Partie 11: Détecteurs de fumée - Détecteurs photoélectriques fonctionnant suivant le principe de la diffusion de la lumière de la transmission de la lumière ou de l’ionisation</td>
<td>02/2001</td>
<td>FR/EN/DE</td>
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<td>NBN EN 54-12: 1993</td>
<td>Systèmes de détection d’alarme incendie - Partie 12: Détecteurs de fumée - Détecteurs photoélectriques fonctionnant suivant le principe de la diffusion de la lumière de la transmission de la lumière ou de l’ionisation</td>
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<td>FR/EN/DE</td>
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<td>NBN EN 54-16: 2005</td>
<td>Systèmes de détection d’alarme incendie - Partie 16: Émetteur central du système d’alarme incendie locaux</td>
<td>09/2005</td>
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<td>NBN EN 54-17: 2005</td>
<td>Systèmes de détection d’alarme incendie - Partie 17: Isolateurs de cour-circuit (+ AC-2007)</td>
<td>09/2005</td>
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<td>NBN EN 54-29: 2005</td>
<td>Systèmes de détection d’alarme incendie - Partie 29: Détecteurs de fumée par diffusion de gaz</td>
<td>08/2005</td>
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NBN EN 12094 Fixed fire fighting systems: part 1, 13 + 16
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<th>Langue</th>
<th>Statut</th>
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<td>NBN EN 10964-1</td>
<td>2003</td>
<td>Installations fixes de lutte contre l’incendie - Eléments constitutifs pour installations d’extinction 2 gaz - Partie 1: Exigences et méthodes d’essai pour dispositifs automatisés de commande et de déclenchement</td>
<td>10/2003</td>
<td>NL/Fr/EN/DE/At</td>
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<td>NBN EN 10964-3</td>
<td>2003</td>
<td>Installations fixes de lutte contre l’infectie - Eléments constitutifs pour installations d’extinction 2 gaz - Partie 2: Exigences et méthodes d’essai pour dispositifs non-techniques de commande et de déclenchement</td>
<td>06/2003</td>
<td>NL/Fr/EN/DE/At</td>
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<td>NBN EN 10964-4</td>
<td>2003</td>
<td>Installations fixes de lutte contre l’infectie - Eléments constitutifs pour installations d’extinction 2 gaz - Partie 3: Exigences et méthodes d’essai pour dispositifs manuels de déclenchement d’urgence</td>
<td>05/2003</td>
<td>NL/Fr/EN/DE/At</td>
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<td>NBN EN 10964-5</td>
<td>2004</td>
<td>Installations fixes de lutte contre l’infectie - Eléments constitutifs pour installations d’extinction 2 gaz - Partie 4: Exigences et méthodes d’essai pour les vannes de dérivation et leurs déclencheurs</td>
<td>29/2004</td>
<td>NL/Fr/EN/DE/At</td>
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<td>NBN EN 10964-6</td>
<td>2006</td>
<td>Installations fixes de lutte contre l’infectie - Eléments constitutifs des installations d’extinction de gaz - Partie 5: Exigences et méthodes d’essai au cours du fonctionnement, de hautes pressions et de leurs déclenchement</td>
<td>10/2006</td>
<td>NL/Fr/EN/DE/At</td>
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<td>NBN EN 10964-7</td>
<td>2001</td>
<td>Installations fixes de lutte contre l’infectie - Eléments constitutifs des installations d’extinction de gaz - Partie 6: Exigences et méthodes d’essai pour dispositifs non-automatiques de basse pression</td>
<td>02/2001</td>
<td>NL/Fr/EN/DE/At</td>
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<td>NBN EN 10964-8</td>
<td>2005</td>
<td>Installations fixes de lutte contre l’infectie - Eléments constitutifs des installations d’extinction de gaz - Partie 7: Exigences et méthodes d’essai pour les dispositifs de système à CO2</td>
<td>03/2005</td>
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</table>

**CROATIA**

All EU norms which covered fire safety systems are used in Croatia. There are stipulated in *Technical regulation on construction products, group H* (NN 33/10, 87/10, 146/10, 81/11, 100/11-correct. 130/12, 81/13)

**CZECH REPUBLIC**

- CSN EN 54 – x (Fire detection and fire alarm systems)
- CSN 73 0875 - Fire protection of buildings – Design of fire detection systems

**FINLAND**

- prNS-INSTA 900-1: Residential sprinkler systems – Part 1: Design, installation and maintenance
- CEA 4001 Sprinkler Systems: Planning and Installation
- A national decree on extuingishing methods is under preparation.
- CEA 4040 Fire Protection Systems - Specifications for automatic fire detection and fire alarm systems - Planning and Installation.
- ST-ohjeisto 1 Paloilmoittimen suunnittelu, asennus, huolto ja kunnossapito 2009 (guidance in Finnish)

**FRANCE**

European standards and the NFPA documents.

**GERMANY**

GREECE
National standards and NFPA documents.

HUNGARY
European standards and the NFPA documents.

ITALY
There are national standards depending on the use of building (within the quoted prescriptive technical rules of fire fighting concerning the specific building use).

POLAND
- Rozporządzenie Ministra Spraw Wewnętrznych i Administracji z dnia 7 czerwca 2010 roku w sprawie ochrony przeciwpożarowej budynków, innych obiektów budowlanych i terenów (Dz. U. Nr 109, poz. 719) – Ministerstwo Spraw Wewnętrznych i Administracji (Ministry of the Interior and Administration).
- PN-EN 54-3 Systemy sygnalizacji pożarowej -- Część 3: Pożarowe urządzenia alarmowe -- Sygnalizatory akustyczne.
- PN-EN 54-4 Systemy sygnalizacji pożarowej -- Część 4: Zasilacze.
- PN-EN 54-5 Systemy sygnalizacji pożarowej -- Część 5: Czujki ciepła -- Czujki punktowe.
- PN-EN 54-7 Systemy sygnalizacji pożarowej -- Część 7: Czujki dymu -- Czujki punktowe działające z wykorzystaniem światła rozproszonego, światła przechodzącego lub jonizacji.
- PN-EN 54-10 Systemy sygnalizacji pożarowej -- Część 10: Czujki plomienia -- Czujki punktowe.
- PN-EN 54-12 Systemy sygnalizacji pożarowej -- Część 12: Czujki dymu -- Czujki liniowe działające z wykorzystaniem wiązki światła przechodzącego.
- PN-EN 54-13 Systemy sygnalizacji pożarowej -- Część 13: Ocena kompatybilności podzespołów systemu.
- PN-EN 54-16 Systemy sygnalizacji pożarowej -- Część 16: Dźwiękowe systemy ostrzegawcze – Centrale.
- PN-EN 54-17 Systemy sygnalizacji pożarowej -- Część 17: Izolatory zwarte.
- PN-EN 54-20 Systemy sygnalizacji pożarowej -- Część 20: Czujki dymu zasysające.
- PN-EN 54-21 Systemy sygnalizacji pożarowej -- Część 21: Urządzenia transmisji alarmów pożarowych i sygnałów uszkodzeniowych.
- PN-EN 54-23 Systemy sygnalizacji pożarowej -- Część 23: Pożarowe urządzenia alarmowe -- Sygnalizatory optyczne.
- PKN-CEN/TS 54-14 Systemy sygnalizacji pożarowej -- Część 14: Wytyczne planowania, projektowania, instalowania, odbioru, eksploatacji i konserwacji.
- PN-EN 50172 Systemy awaryjnego oświetlenia ewakuacyjnego.
- PN-EN 15004-1 Stałe urządzenia gaśnicze -- Urządzenia gaśnicze gazowe -- Część 1: Ogólne wymagania dotyczące projektowania i instalowania.
- PN-EN 60849 Dźwiękowe systemy ostrzegawcze.

PORTUGAL
European standards and the NFPA documents.
There are national regulations depending on the use of building (within the quoted prescriptive technical rules of firefighting concerning the specific building use).

**SLOVAKIA**
European standards.

**SLOVENIA**
European standards and the DIN and NFPA documents.

**SPAIN**
Section SI-4 of CTE is devoted to fire safety systems. More requirements are described in Annex II of Spanish Security Code against to Fire in Industrial Activities (RSIEI) with reference to Euronormes

**TURKEY**
Within the Turkish Fire Safety Regulation of Buildings “Türkiye Binaların Yangından Korunması Hakkında Yönetmelik 2009”, Chapter 5 (Section 4) includes fire alarm systems and Chapter 7 includes fire extinguishing systems.

**UNITED KINGDOM**
BS EN’s or Eurocodes primarily but functional regulations so any guidance permissible

---

**1.2.6 Use of Eurocodes or other international fire standards**

Is it possible to use Eurocodes or other international fire standards in lieu of the local code?

**BELGIUM**
Yes, but you must request a deviation. When documenting your file, you can apply these standards.

**CROATIA**
Yes

**CZECH REPUBLIC**
Yes

**FINLAND**
Yes

**FRANCE**
Yes

**GERMANY**
Yes

**GREECE**
Yes

**HUNGARY**
Yes. In some cases we have to use fire models prove the situation.
ITALY
Yes.
At the present the National annexes have not yet been published; however, some Eurocodes (EN1992-1-2; EN1993-1-2; EN1994-1-2; EN1995-1-2) may be applied assuming the suggested values as NDPs.

POLAND
Yes

PORTUGAL
Yes

ROMANIA
The revision of P118-99 includes the possibility to determine the fire resistance by means of calculation, using the specific Romanian Standards (SR) translated from the Eurocodes, together with the corresponding National Annexes. The new normative for fire safety is planned to be issued in 2014.

SLOVAKIA
Yes

SLOVENIA
Yes

SPAIN
Yes, the Technical Guide of Spanish Security Code against to Fire in Industrial Activities (RSIEI) allows using Eurocode 2, 3, 4, 5, and 6 for checking structural fire resistance.
The rules for structural verification under fire of CTE SI-6 are very similar of the rules of Eurocodes.

TURKEY
Yes. It’s accepted to use the Eurocodes.

UNITED KINGDOM
Yes

1.2.7 Translations of the fire parts of Eurocodes and it National annexes
Are there available the translations of the fire parts of Eurocodes? Which ones?

BELGIUM
NBN EN 1996-1-2: FR – GE
NBN EN 1999-1-2: FR – GE

CROATIA
HRN EN 1991-1-2 – Yes
HRN EN 1992-1-2 – Yes
HRN EN 1993-1-2 – Yes
HRN EN 1994-1-2 – Yes
HRN EN 1995-1-2 – Yes
HRN EN 1996-1-2 – Yes
HRN EN 1999-1-2 – No. Will be available soon

**CZECH REPUBLIC**
CSN EN 1991-1-2 – Yes
CSN EN 1992-1-2 – Yes
CSN EN 1993-1-2 – Yes
CSN EN 1994-1-2 – Yes
CSN EN 1995-1-2 – Yes
CSN EN 1996-1-2 – Yes
CSN EN 1999-1-2 – Yes

**FINLAND**
SFS-EN 1991-1-2 – Yes
SFS-EN 1992-1-2 – Yes
SFS-EN 1993-1-2 – Yes
SFS-EN 1994-1-2 – Yes
SFS-EN 1995-1-2 – Yes
SFS-EN 1996-1-2 – Yes
SFS-EN 1999-1-2 – No

Available for purchase at [http://sales.sfs.fi](http://sales.sfs.fi)

**FRANCE**
NBN EN 1991-1-2 – Yes
NBN EN 1992-1-2 – Yes
NBN EN 1993-1-2 – Yes
NBN EN 1994-1-2 – Yes
NBN EN 1995-1-2 – Yes
NBN EN 1996-1-2 – Yes
NBN EN 1999-1-2 – Yes

**GERMANY**
DIN EN 1991-1-2 – GER
DIN EN 1992-1-2 – GER
DIN EN 1993-1-2 – GER
DIN EN 1994-1-2 – GER
DIN EN 1995-1-2 – GER (is not approved yet)
DIN EN 1996-1-2 – GER
DIN EN 1999-1-2 – GER

**GREECE**
No

**HUNGARY**
No

**ITALY**
No, the translations of the final versions of the Eurocodes are not yet available at the present.
POLAND
PN-EN 1990 – Yes
PN-EN 1991-1-2 – Yes
PN-EN 1992-1-2 – Yes
PN-EN 1993-1-2 – Yes
PN-EN 1994-1-2 – Yes
PN-EN 1995-1-2 – Yes
PN-EN 1996-1-2 – Yes
PN-EN 1999-1-2 – Will be available soon

PORTUGAL
NP EN 1991-1-2 – Yes
NP EN 1992-1-2 – Yes
NP EN 1993-1-2 – Yes
NP EN 1994-1-2 – Yes
NP EN 1995-1-2 – No. Will be available soon
NP EN 1996-1-2 – Yes
NP EN 1999-1-2 – No. Will be available soon

ROMANIA
SR EN 1991-1-2
SR EN 1992-1-2
SR EN 1993-1-2
SR EN 1994-1-2
SR EN 1995-1-2
SR EN 1996-1-2
SR EN 1999-1-2

SLOVAKIA
STN EN 1991-1-2 – Yes
STN EN 1992-1-2 – Yes
STN EN 1993-1-2 – Yes
STN EN 1994-1-2 – Yes
STN EN 1995-1-2 – Yes
STN EN 1996-1-2 – Yes
STN EN 1999-1-2 – Yes

SLOVENIA
SIST EN 1991-1-2
SIST EN 1993-1-2

SPAIN
The Spanish translations of Eurocodes are managed by AENOR (Asociación Española de Normalización) and they are adapted as Spanish standard UNE-EN. These translations UNE-EN are available in paper or electronic format for their acquisition in the official website of AENOR:

http://www.aenor.es/aenor/normas/ctn/fichactn.asp?codigonorm=AEN/CTN%20140&pagina=1

Nowadays, the state of relevant documents is as follows:
UNE-EN 1991-1-2:2004 Available since 14/05/2004
COST Action TU0904  
Integrated Fire Engineering and Response

UNE-EN 1999-1-2 Only ENV available

**TURKEY**  
Yes. They are available on Turkish Standards Institution (TSE) website:

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<th>No</th>
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<th>Date of Approval</th>
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| 1  | TS EN 1992-1-1  
| 1  | TS EN 1992-1-1/AC  
Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings | |
| 2  | TS EN 1994-1-1  
| 3  | TS EN 1994-1-1/AC  
Eurocode 4: Design of composite steel and concrete structures - Part 1-1: General rules and rules for buildings | |
| 4  | TS EN 1998-5  
| 5  | TS EN 14399-8  
High-strength structural bolting assemblies for preloading - Part 8: System HV - Hexagon fit bolt and nut assembly | 13.04.2010 |
| 6  | TS EN 14399-7  
High-strength structural bolting assemblies for preloading - Part 7: System HR - Countersunk head bolt and nut assemblies | 13.04.2010 |
| 7  | TS EN 14399-4  
High-strength structural bolting assemblies for preloading - Part 4: System HV - Hexagon bolt and nut assemblies | 13.04.2010 |

**UNITED KINGDOM**  
N/A
1.2.8 *National annexes to Structural fire Eurocodes*

Are the national annexes available in internet?

**BELGIUM**
No. The national annexes are part of the translations of the Eurocodes. You have to command them via the NBN

**CROATIA**
No. The national annexes are property of the Croatian Standards Institute (HZN). You have to command them via the HZN: [http://www.hzn.hr/](http://www.hzn.hr/)

**CZECH REPUBLIC**
No. The national annexes are part of the Czech translations of the Eurocodes.

**FINLAND**
Yes, at: [http://www.eurocodes.fi/](http://www.eurocodes.fi/)

**FRANCE**
No. The national annexes are part of french office of standardisation AFNOR: [http://www.afnor.org/](http://www.afnor.org/)

**GERMANY**
No

**GREECE**
Yes. Many national annexes are available at the internet site: [http://www.fireservice.gr](http://www.fireservice.gr)

**HUNGARY**
Yes. The fire code is a law so we can use it free.

**ITALY**
Yes, the national annexes were discussed and approved by a National Committee and published with Decree of the Infrastructure Ministry 31 luglio 2012 (*Approvazione delle Appendici nazionali recanti i parametri tecnici per l’applicazione degli Eurocodici*).

**POLAND**
No. The national annexes are part of the Polish translations of the Eurocodes.

**PORTUGAL**
No. The national annexes are part of the Portuguese translations of the Eurocodes.

**ROMANIA**
No. The national annexes are part of Romanian office of standardisation ASRO.

**SLOVAKIA**
No the standards are not available on internet.

**SLOVENIA**
No

**SPAIN**
No
1.3 Approvals process

1.3.1 Route to get a project approved
What is the normal route to get a project approved?

BELGIUM
Via a public body.

CROATIA
Via a public body (Ministry of Internal Affairs).

CZECH REPUBLIC
Via a public body.

FINLAND
Via a public body.

FRANCE
Via a public body. Local fire safety commission and with a favourable opinion of a notified body for not prescriptive fire safety engineering projects.

GERMANY
Via a public body. Via a private body.
In eastern and some northern federal states by inspection engineers.

GREECE
Via a public body.

HUNGARY
Via a public body.
Self-certified. It depends the type of the licence.

ITALY
Via a public body.

POLAND
Via a public body.

PORTUGAL
Via a public body. The National Authority of Civil Protection.

ROMANIA
Via a public body.
SLOVAKIA
Via a public body.

SLOVENIA
Via a public body.

SPAIN
Via a public body. It is usually route. In Spain the local government gives the permission to open the commercial or industrial activity. The local officer analyses the project of fire safety and sometimes he orders a not compulsory report to Fire Service for more complex problems.

Via a private body. It is other possible route. In Spain some local governments use outsourcing to delegate the supervision and control of projects of fire safety by authorized private body.

Self-certified. In the future the local government would authorize the project by a “responsible statement” of designer but only for a small project or activity without risk.

TURKEY
Via the public body.

UNITED KINGDOM
Via a public body.
Via a private body.
Self-certified.

1.3.2 Fire brigade in the process
What is the position of the fire brigade in the process?

BELGIUM
For public buildings you need a report of the fire brigade before you receive a building permission.

CROATIA
Fire brigade doesn’t participate in the process of design approval.
Exception is the case of approval of fire approach paths for the historical buildings.

CZECH REPUBLIC
Fire protection documentation shall be prepared, managed or supplied to State fire supervision body for approval and control.

If the supplied background or documentation shows imperfections with respect to fire safety of buildings, the state fire supervision body stipulates conditions in the approving opinion according to the importance of the imperfections.

FINLAND
The building authority usually consults the relevant fire safety authority (usually employed by the fire brigade) for a statement.

FRANCE
They are consulted in the beginning of the project.
GERMANY
Consulting for the authorities / inspection engineers.

GREECE
Principal role regarding to approval of fire safety design projects, fire inspections etc.

HUNGARY
There are two level in the legislation. In normal situation just the local fire department give the licence. If we need deviation from the code the Civil Defence is the authority having jurisdiction.

ITALY
The degree of Republic President n. 151 dived the place of work activities in three categories, in function fir risk level. For the category C (high risk level) the fire brigades control and approve the projects and issue the “certificate of fire prevention”, instead for the category B (medium fire risk levels) the fire brigades check same projects and approve the Certified Signal of Start Industry (S.C.I.A. – Segnalazione Certificata di Inizio Attività), finally for the category A (low fire risk levels) the fire brigades approve the S.C.I.A. only.

POLAND
Projects must be agreed with a fire expert (fire engineer) appointed after passing the state exam, by the Chief Commandant of the State Fire Service. Before putting building into operation/use it must be checked and officially approved by the fire officer (State Fire Service).

PORTUGAL
Nowadays, due to the responsibility of technicians, is more limited with regard to approval of projects but will continue to play a role in the act of inspections and monitoring.

ROMANIA
The fire brigades control and approve the projects.

SLOVAKIA
Fire brigade is belonging to the process of accreditation.

SLOVENIA
Consulting for the authorities / inspection engineers, but minor influence mostly none.

SPAIN
Fire Service has a position only advisory but its reports have an important role in complex projects of fire safety.

TURKEY
Just as an advisory, the fire brigade could be consulted.

UNITED KINGDOM
Statutory consulters to the building control approvals process

1.3.3 Review by third party
Is there a third party review process common?

BELGIUM
No
CROATIA
No

CZECH REPUBLIC
No

FINLAND
Third-party review is usually required for FSE design.

FRANCE
No

GERMANY
No

GREECE
No

HUNGARY
No

ITALY
No

POLAND
No

PORTUGAL
No

ROMANIA
No

SLOVAKIA
I do not know the answer.

SLOVENIA
Yes, for performance based design.

SPAIN
No

TURKEY
I don’t know for sure but there is no position for the fire brigade in the process.

UNITED KINGDOM
No

1.3.4 Alternative route of approvals for performance based design

Is it necessary to follow an alternative route of approvals for performance based design and what would that route be?
BELGIUM
Yes via a request for deviation.

Only in the regulations of fire protections in industrial buildings is there a possibility to use performance base design methods

CROATIA
No. Validated programs and calculations are accepted.

CZECH REPUBLIC
The legislation has an article that allows engineers to develop projects based on fire safety engineering.

In case of any doubts which scope shall be prepared or managed the fire protection documentation, the decision appertains to the State fire supervision body, which shall decide on the basis of local conditions and after the examination of necessary documents.

FINLAND
No, because all approvals go through the local Building Authority.

FRANCE
No

GERMANY
No

GREECE
No

HUNGARY
This is only possible for buildings to which it is not possible to apply the law. In these cases it is always required the agreement of the OKF The Civil Defence.

ITALY
Yes, the Performance Based Approach may be applied within a Derogation procedure according to the Decree of the Ministry of the Interior 09/05/2007.

POLAND
For new buildings (only) – there is so called “departure from regulation”: an investor applies to the Ministry of Infrastructure via a local building authority; The Ministry issues the final approval (usually after consultation with the State Fire Service).

Existing buildings - so called „substitute solution“: fire expert/fire engineer prepares the expert’s technical report of the substitute solution which must be agreed with the Regional Chief Fire Officer of the State Fire Service.

PORTUGAL
The legislation has an article that allows engineers to develop projects based on fire safety engineering. This is only possible for buildings to which it is not possible to apply the law. In these cases it is always required the agreement of ANPC – National Authority of Civil Protection.

ROMANIA
The revision of P118-99 includes the possibility to determine the fire resistance by means of calculation, using the specific Romanian Standards (SR) translated from the Eurocodes, together with the corresponding
National Annexes. After the issue of the new normative (2014), no alternative route for approvals would be necessary.

**SLOVAKIA**

Our legislation do not adapt the conditions for possibility of proceed building design. For example engineering access. If there are some buildings do not have respect to prescription of Slovak Republic, they are adapted after consultation with other concrete departments.

**SLOVENIA**

No - regulations allow fire engineering as option in part of process, but for some buildings additional review may be asked.

**SPAIN**

In practice the designers use the Prescriptive Rules and only for exceptional projects the Performance-Based Code is allowed but in this case it isn’t necessary to use an alternative route.

**TURKEY**

No.

**UNITED KINGDOM**

No - functional regulations allow fire engineering as normal part of process

### 1.3.5 Time frame for the approvals process

What is the normal time frame for the approvals process?

**BELGIUM**

Not defined.

**CROATIA**

30 days.

**CZECH REPUBLIC**

Time for obtaining opinion issue:
- 30 days (design of common buildings)
- 60 days (design of specific buildings)

**FINLAND**

Not defined.

**FRANCE**

The last fire regulation allows the application of fire safety engineering (performance based design), but in this case a favourable opinion for the study by a notified body is required. The fire scenarios for a performed based design are defined by local fire safety commissions.

**GERMANY**

2-6 months.

**Greece**

Not defined.

**HUNGARY**

Not defined.
ITALY
The approval process, according to D.M. 07/08/2012 is different for the three categories of D.P.R. 151:

Category A: After completing works, the fire safety engineer must present the S.C.I.A. (Certified Signal of Start Industry – Segnalazine Certificate di Inizio Attività), with all technical documentation concerning the building and the project, at the provincial command of the fire brigade. The fire brigade could control some of these documents and they could make an inspection too.

Category B: First to start the works, the fire safety engineer must present the project at the provincial command of the fire brigade; the fire brigade could control some of this project and they may ask for any additions within 30 days. After completing works, the fire safety engineer must present the S.C.I.A. (Certified Signal of Start Industry – Segnalazine Certificate di Inizio Attività), with all technical documentation concerning the building, at the provincial command of the fire brigade. The fire brigade could make an inspection.

Category C: First to start the works, the fire safety engineer must present the project at the provincial command of the fire brigade; the fire brigade control all this project and they may ask for any additions within 30 days. After completing works, the fire safety engineer must present the S.C.I.A. (Certified Signal of Start Industry – Segnalazine Certificate di Inizio Attività), with all technical documentation concerning the building, at the provincial command of the fire brigade. The fire brigade must make an inspection within 60 days; within other 15 day the Fire Prevention Certificate has to be issued. If the fire inspector ensures the lack of security requirements provided by law, during the inspection, he must request the adjustment. In this case, the manager of the industry has 45 days to make changes.

POLAND
Normal time frame - 1 month. In a complex/complicated 2 months are allowed.

PORTUGAL
Not defined.

ROMANIA
Normal time – 30 days.

SLOVAKIA
The standard time is 30 days.

SLOVENIA
By regulation:
30 days
60 days (for special cases)
In practice can be much more.

SPAIN
According to route selected for his approval

TURKEY
I don’t know the answer.

UNITED KINGDOM
Variable dependent on complexity.
1.3.6 Level of information needs
What level of information must be provided to the approving body?

BELGIUM
The project of fire safety of the building.

CROATIA
Complete main design, including Elaborate of Fire Safety.

CZECH REPUBLIC
The project of fire safety of the building.
A preparation of project of fire safety shall be proceeded on the basis of the requirements of specific legislation, normative requirements and requirements of the issued territorial decision.

FINLAND
All relevant information and documentation related to the fire safety of the building.

FRANCE
The project of fire safety of the building.

GERMANY
Detailed information. Fire safety concept and reports of all calculations.

GREECE
The project of fire safety of the building.

HUNGARY
The project of fire safety of the building.

ITALY
The project of fire safety of the building and every technical documentations concerning the building.

POLAND
The expert’s technical report must proves that proposed alternative/substitute solution will provide not lower level of safety than prescriptive requirement.

PORTUGAL
The project of fire safety of the building.

ROMANIA
All relevant information and documentation related to the fire safety of the building.

SLOVAKIA
The project of fire safety of the building.

SLOVENIA
The project of fire safety of the building.

SPAIN
The full project of fire safety of the building, with engineering calculations and certificates of applicator of coatings or paints and its laboratory test
The project of fire safety of the building must be provided. All the requirements by the aforementioned Turkish regulation must be met.

**UNITED KINGDOM**
All areas covered by regulations and approved documents

### 1.3.7 Specific facilitators
Are any specific facilitators required to help the engineer in the approvals process?

**BELGIUM**
No

**CROATIA**
No.

**CZECH REPUBLIC**
Yes, Fire rescue service gives support to the designers.

**FINLAND**
Not defined.

**FRANCE**
No.

**GERMANY**
No

**GREECE**
Yes, Technical chamber of Greece could possibly give support to the designers.

**HUNGARY**
Yes, OKF gives support to the designers.

**ITALY**
Yes, Italian Fire Brigades gives support to the designers.

**POLAND**
No.

**PORTUGAL**
Yes, ANPC gives support to the designers.

**ROMANIA**
No

**SLOVAKIA**
Do not exist.

**SLOVENIA**
No
SPAIN
Usually the dialogue is open with the local officer

TURKEY
I don’t know the answer.

UNITED KINGDOM
No

1.3.8 Product approvals
What are the possible product approvals of fire protection materials and methods (National, ETA or CE marking)?

BELGIUM
National is BENOR ATG
ETA
CE marking.

CROATIA
National and CE marking.
DIN norms till 2019.

CZECH REPUBLIC
Namely CE marking.

FINLAND
- CE marking / ETA for cases where Eurocodes are used
- National product approvals for cases where the National Building Code is used for design / CE-marking or ETAs can sometimes also be used in this case.

FRANCE
CE marking.

GERMANY
National ü-marking or European CE-marking.

GREECE
CE marking.

HUNGARY
CE marking.

ITALY
CE marking.

POLAND
European Certification Process (CE marking)- with requirements of the EU harmonized standards. This procedure is required to issue a declaration of conformity with CPD (construction products) or PPE (personal protective equipment) directives by manufacturer – obligatory for all products used for fire protection.

National:
- Regulation of the Minister of Interior and Administration dated 20th of June, 2007 regarding the list of products which ensure public safety or health care and life protection or property protection and concerning the rules of issue the certificate of admittance for these products to use (O. J. No. 143 pos. 1002),

With requirements of Polish Standards, national technical approvals - this procedure is required to issue the national declaration of conformity and mark products with construction marking by its manufacturer.

**PORTUGAL**
CE marking.

**ROMANIA**
CE marking.

**SLOVAKIA**
Certificate.

**SLOVENIA**
National and CE marking.

**SPAIN**
At the moment, the CE marking is not mandatory in Spain. The national standards tests in Spanish laboratories are required to certificate the fire protection materials and its application.

Nevertheless, there are several protocols for semiautomatic certification of products by the inter-laboratories European network.

After an extended period of transition, there are previsions of more two years for the mandatory CE marking in Spain

**TURKEY**
CE marking is used. Efectis Era Laboratory (in Kocaeli, Turkey) seems to be the only fire resistance lab to provide European Standardization and Certification Tests.

**UNITED KINGDOM**
National and CE marking.

---

**1.4 Insurance companies**

**1.4.1 Involvement of insurance companies**
Are insurance companies involved in the design process?

**BELGIUM**
Indirectly

Some companies give discount when fire protection systems are foreseen.

Some companies ask for specific fire protection systems.
CROATIA
No.

CZECH REPUBLIC
The insurance companies are involved rarely.

FINLAND
Not necessarily, but their views and conditions may have an influence on the design. It would be recommended to be in touch with the insurance companies at an early stage of the project and include them in the design process if necessary.

FRANCE
No.

GERMANY
Usually not.

GREECE
In most cases not.

HUNGARY
No

ITALY
In most cases no.

POLAND
In most cases no.

PORTUGAL
In most cases no.

ROMANIA
Usually not.

SLOVAKIA
No

SLOVENIA
No.

SPAIN
Requirements of insurance companies are more restrictive that the local regulations in important projects, for instance; skyscrapers or industrial installations.

TURKEY
I don’t know the answer.

UNITED KINGDOM
In most cases no.
1.4.2 Discussion with insurance companies
Are insurance companies open to a discussion on fire safety?

BELGIUM
Yes

CROATIA
Not as the regular process.

CZECH REPUBLIC
The insurance companies don’t usually deal with discussion on fire safety. Insurance premium are offered in exceptional cases.

FINLAND
Yes, they usually are.

FRANCE
No.

GERMANY
Often they are conservative.

GREECE
In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium (except for high risk building categories).

HUNGARY
NO!

ITALY
In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium.

POLAND
In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium. They usually run routine fire risk assessment. In an opinion of fire authorities it is not satisfactory.

PORTUGAL
In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium.

ROMANIA
Yes.

SLOVAKIA
In present time are the first steps in this field.

SLOVENIA
They don’t take part in design process.

SPAIN
No. Insurance companies only have an important role in arson investigations.
TURKEY
Yes. They get involved when there is a dispute regarding a fire safety concern of a building between the building owner (or renter) and the contractor (e.g. building a fire barrier or extra fire escape routes etc.)

UNITED KINGDOM
In most cases, insurance companies are not particularly concerned with this matter when establishing insurance premium.

1.5 Qualification requirements for designers

1.5.1 Certificates/licenses requirements
Is it required to hold specific certificates/licenses in the member state to undertake fire safety design and fire engineering?

BELGIUM
Not really but there is a specific master degree
International Master of Science in Fire Safety Engineering

CROATIA
Yes. Fire safety person need to be certified by Ministry of Internal Affairs.

CZECH REPUBLIC
The fire safety design and fire engineering are elaborated only by qualified experts (certified technicians or certified engineers) according to Act No. 360/1992 Coll. on the Professional Practice of Certified Architects and on the Professional Practice of Certified Engineers and Technicians Active in Construction.
The conditions for qualification (certification) are required education, working experience and carry out expert test.

FINLAND
Fire safety engineers need to be certified. The certification process is administered by FISE Ltd. (www.fise.fi) and the requirements include:
- an applicable engineering degree
- sufficient studies in fire physics and relevant engineering topics
- a passed exam
- sufficient work experience in the field.
Design based on prescriptive regulation can usually be carried out by practicing structural engineers.

FRANCE
No, is not required a special certificate for the realization of FSE studies, but in fact the number of the persons involved in these studies is very limited. The most of FSE studies in France are realised by notified bodies.

GERMANY
Since the designer is a person with technical qualification, such as an engineer or an architect, a specific license is generally not necessary. Nevertheless, in some federal states a license is required.
GREECE
Fire safety design projects are mainly edited by civil engineers (passive fire protection) or mechanical/electrical engineers (active fire protection) according to their professional rights.

HUNGARY
Fire experts need an exam. The Civil Defence who give these permit to the fire experts.

ITALY
The designers are required to hold a professional qualification attending the "Specialization Course of Fire Prevention", supported by the Fire Department, according to law n. 818/1984 and Decree of the Ministry of the Interior 05/08/2011 “Procedure e requisiti per l’autorizzazione e l’iscrizione dei professionisti negli elenche del minister dell’Interno di cui all’16 del decreto legislativo del 08/03/2006 n. 139”.

POLAND
Yes, but there are separate licenses for the structural designing and for the assessment of fire protection.

PORTUGAL
In the case of fire safety design for buildings of utilization-type of 3rd and 4th risk category, i.e., for those which have greater complexity, only designers with proven experience by professional association or that have been approved in recognized courses by ANPC can undertake fire safety projects related with the uses mentioned above.

ROMANIA
Civil engineers for passive fire protection and building services engineers for active fire protection, according to their professional rights.

SLOVAKIA
In Slovak Republic is important to have seemly education, specialist preparation and do the exam. After completion of that all conditions the people get the acknowledgment with name "specialist of fire protection, which is limited only for 5 years.

SLOVENIA
Yes. Licences are given by Slovenian Chamber of Engineers (IZS)

SPAIN
No. In Spain the designer is a person with technical academic formation, such engineer or architect.
In practice, there are professional designers for fire safety projects but not a specific license is necessary.
Otherwise, for a local officer or a referee of private body who revises and approves projects is required a specific licence.

TURKEY
No requirement.

UNITED KINGDOM
Currently there is no requirement.

1.5.2 Specific design licenses
Are there certain types of buildings for which specific design licenses are required?
BELGIUM
No

CROATIA
No

CZECH REPUBLIC
No

FINLAND
Yes, see answer directly above.

FRANCE
Actually, only for smoke evacuation of big volumes is delivered a licence by the Ministry of Interior.

GERMANY
No

GREECE
No

HUNGARY
No

ITALY
There are no specific cases.

POLAND
Yes, the regulations specify types of buildings for which a project must be agreed with a fire expert (fire engineer).

PORTUGAL
Yes, for buildings of 3rd and 4th risk category.

ROMANIA
No

SLOVAKIA
The solution of fire safety all buildings solve he specialist of fire protection.

SLOVENIA
No

SPAIN
Yes. The level of the licence allows the control of more complex projects of fire safety for local officers or external referees.

Usually, there are two levels: 1 or 2, function of local government of Spain.

TURKEY
No.

UNITED KINGDOM
No
1.5.3 Licenses holder
Is the licenses holder an individual or an organisation?

BELGIUM
Not answered

CROATIA
The license holder is individual.

CZECH REPUBLIC
The license holder is individual, but under the auspices of the Czech Chamber of Certified Engineers.

FINLAND
The license holder is an individual.

FRANCE
Organisation

GERMANY
The license holder is an individual.

GREECE
The license holder is individual.

HUNGARY
The license holder is organisation.

ITALY
The license holder is individual.

POLAND
The license holder is individual.

PORTUGAL
The license holder is individual.

ROMANIA
N/A

SLOVAKIA
The license holder is personal entity.

SLOVENIA
The license holder is individual.

SPAIN
The license holder is individual (levels 1 or 3).

The private body of control should have an additional licence which has a periodical inspection for its renovation from local government
1.5.4 Specific insurance

Is a specific insurance required?

BELGIUM
Not answered

CROATIA
No. The ordinary professional insurance is enough for individual holders.
For non members of engineer Chambers it is obligatory to have specific insurance.

CZECH REPUBLIC
No

FINLAND
Usually liability insurance is required, or at least recommended.

FRANCE
No

GERMANY
Specific liability insurance is only needed for inspection engineers, not for designers.

GREECE
No.

HUNGARY
No

ITALY
Yes, the Italian engineers must have a professional insurance to practice the profession of engineer.

POLAND
All licensed structural engineers have to be insured.
For a fire expert (fire engineer) it is not obligatory, this is only a good practice but most are insured.

PORTUGAL
No

ROMANIA
No

SLOVAKIA
No. If you like it is solved with Standards.
SLOVENIA
All licensed structural engineers have to be insured. Usually by the company, yet individual insurances are also possible.

SPAIN
No. The ordinary professional insurance is enough for individual holders.

TURKEY
No.

UNITED KINGDOM
No

1.6 Sequence of performance based fire engineering projects

1.6.1 Project details

BELGIUM
There were already some PHD projects in the Ghent University.
And also the master thesis’s of the first session of the International Master of Science in Fire Safety Engineering.

CROATIA
Performance based approach is used for complex buildings with many users (sport halls, malls, airports) but not as the obligation, only as alternative to prescriptive design.

CZECH REPUBLIC
Fire dynamic analysis and design of construction protection.

FINLAND
Salmisaari Wellness Centre, Helsinki, about 20 000 m²
Shopping Center Futurum, Czech Republic
http://www.ruukki.com/References/

FRANCE
The temperature of the fire compartment according the adopted fire scenario.

GERMANY
Performance based fire-prevention concept for industrial livestock farming (pig farming). Since the requirements of the industrial construction regulations cannot be fulfilled because of special terms of use, performance based fire-prevention concepts are recommended.
Confer: Hagen, E.; Upmeyer, J. (2013) Brandschutzkonzepte für Massentierhaltungsanlagen und deren Prüfung (Fire-prevention concepts for industrial livestock farming und their verification). In:
COST Action TU0904
Integrated Fire Engineering and Response


GREECE
Not answered.

HUNGARY
The all properties of the fire compartment are decided by authority having jurisdiction.

ITALY
The definition of fire scenarios and the temperature of the fire compartment according the adopted fire scenario.

POLAND
Fire scenarios, temperatures in particular compartments, fire duration, final safety certificate.

PORTUGAL
The temperature of the fire compartment according the adopted fire scenario.

ROMANIA
Calculation in agreement with Standards.

SLOVAKIA
Calculation in agreement with Standards.

SLOVENIA
Fire dynamic analysis (fire scenarios, duration and size of fire) and design of construction protection.

SPAIN
- Smoke control, temperatures and evacuation.
- Structural resistance of structure.
- Alternative measures of security

TURKEY
No precedence as far as I know.

UNITED KINGDOM
No specific criteria for the use of fire engineering as an alternative to other methods but usually size and complexity are the main reasons

1.6.2 Performance based fire design
What was performance based?

BELGIUM
N/A

CROATIA
The fire scenarios, smoke management and the structural fire behaviour
CZECH REPUBLIC
Use various methods of quantitative analyses (deterministic or combined methods), not only in the area of fire protection of buildings.

FINLAND
Structural fire design of steel structures.

FRANCE
The time evacuation of the building, the stability of the building must be ensured throughout all fire, etc...

GERMANY
Primary and stiffening structures (walls and columns) were built without the requirement of fire resistance-ratings. Based on the determination of the fire load, numerical fire simulations were conducted where the component temperatures were calculated and evaluated.

The fire section area deviated with 20,000 m² from the maximum limit value of 1,600 m². CFD-analyses were conducted to analyse the conditions in the event of fire. In addition the fire load was limited and smoke ventilations were installed.

Exceeding of the length of the escape route (62 m instead of 35 m). This is possible because of the maintenance of the low-smoke layer and the staff who is familiar with the location.

GREECE
Not answered

HUNGARY
The fire scenarios and the structural fire behaviour.

ITALY
The fire scenarios and the structural fire behaviour.

POLAND
Calculation of RSET (required safe escape time) or ASET (available safe escape time); selection of fire protection installations in an individual building - based on the assumed scenario of the fire development (computer simulations - fire models); defining parameters of fire protection installations (e.g. smoke control systems).

The fire scenarios and the structural fire behaviour.

PORTUGAL
The fire scenarios and the structural fire behaviour.

ROMANIA
The structural fire behaviour.

SLOVAKIA
Calculations.

SLOVENIA
Up to now mainly the fire scenarios and the structural fire behaviour.

SPAIN
The fire scenarios
Tenability for life safety, means of escape and structural stability are the main performance criteria.

### 1.6.3 Used techniques

What techniques were used to justify the non-compliance?

**BELGIUM**

N/A

**CROATIA**

N/A

**CZECH REPUBLIC**

In technical standards is defined generally that in these techniques are buildings with extraordinary risk or special risk character in terms of fire safety.

**FINLAND**

FDS simulations based on statistical data on fire loads in different premises. The cooling effect of sprinklers was partly accepted. Ozone software.

**FRANCE**

The difficulties to apply the prescriptive rules

**GERMANY**

Advanced fire simulations and CFD-analyses were conducted where the component temperatures and the conditions in the event of fire were calculated and evaluated.

Since the fire load was limited, it was possible to exceed the fire section area. The exceeded escape route was justified by the maintenance of the low-smoke layers with the help of air-handling systems.

**GREECE**

Not answered.

**HUNGARY**

If the regulation, due to the big dimension in plan and height of the building, is not adequate to be adopted, the building can be classified as “atypical danger” and fire safety engineering can be used.

**ITALY**

The regulations are basically prescriptive and concern several types of building use (DM 12/02/1982).

The performance based design and advanced calculation methods may be applied either in the lack of prescriptive rules or in the case of “derogation” with respect to prescriptive rules. The performance based design has to be developed according to D.M. 09/05/2007.
POLAND
Calculations, an individual assessment, agreements with local fire brigade authorities; a new project on creation of the supporting system for all fire brigades (State Fire Service) has been implemented (special IT tools allowing simple exchange of digital data).

PORTUGAL
If the regulation, due to the big dimension in plan and height of the building, is not adequate to be adopted, the building can be classified as “atypical danger” and fire safety engineering can be used.

ROMANIA
N/A

SLOVAKIA
If it is in conflict with legal prescriptions.

SLOVENIA
Fire engineering can be used along with code-based methods – no specific reasons or techniques required before it can be employed, but usually if code-based methods don’t give sufficient informations or are too strict for modern type buildings.

SPAIN
Fire dynamic analysis techniques and advanced calculation models

TURKEY
N/A.

UNITED KINGDOM
Fire engineering is used along with code-based methods – no specific reasons or techniques required before it can be employed.

1.6.4 Approvals route
What approvals route was used?

BELGIUM
N/A

CROATIA
The fire safety concept must be approve by Fire Authority.

CZECH REPUBLIC
The fire safety project must be approved by Fire rescue service.

FINLAND
Local building and fire authorities together with responsible Fire Consultant, structural designer and steel structure manufacturer. The main simulation was done together with research institutes, VTT, TUT. In Czech Republic, help from CVUT.

FRANCE
The fire safety project must be approved by local fire safety commission.
GERMANY
The fire safety (proof of stability; proof of the fire scenario; etc.) can be approved by an inspection engineer or a certified inspector.

GREECE
Not answered

HUNGARY
The fire safety project must be approved by Civil Defence.

ITALY
The fire safety project must be approved by Regional Fire Brigades.

POLAND
The fire safety project must be approved by entitled fire officer or (depending on a type of building) by Authority of Fire Brigade.

PORTUGAL
The fire safety project must be approved by ANPC – National Authority of Civil Protection.

ROMANIA
Usual route through functional building regulations.

SLOVAKIA
The accreditation does the fire brigade of Slovak Republic.

SLOVENIA
Usual route according to building regulations.

SPAIN
Ordinary route in local government.

TURKEY
N/A.

UNITED KINGDOM
Usual route through functional building regulations.

1.6.5 Asked documentation
Is in your country standardised/recommended format of text of calculation of Performance based fire design?

CROATIA
No.

CZECH REPUBLIC

FINLAND
Not standardized but documentation rules from “Performance based structural fire design”
GERMANY
There are for example some recommendations for the application of natural fire models in: Wathling, K.-D. (2013) Umgang mit Naturbrandnachweisen nach Eurocode im bauaufsichtlichen Verfahren (Dealings with the approval of natural fire models according to the Eurocodes in the construction supervision process). In: Braunschweiger-Brandschutz-Tage 2013, Braunschweig, September 2013. Braunschweig: Dietmar Hosser, S. 159-166.

ITALY
In Italy there is only a guideline for the application of the engineering according to DM 09/05/2007

PORTUGAL
No.

ROMANIA
N/A

SLOVENIA
No

TURKEY
No. There is none.

1.6.6 Location in nationally required documents
How fits performance based fire design to nationally required documents for fire safety of the building?

CROATIA
Performance based design is equal as the prescriptive design according Croatian legislation.

CZECH REPUBLIC
The basic procedure for ensuring fire safety building regulations determine the Technical conditions for the fire protection of buildings No. 23/2008 Coll. § 2 paragraph 1 and 2, a decree establishing the conditions for Fire safety and state fire supervision No. 246/2001 Coll. Fire safety solution that is an integral part of the construction documents and in accordance with Decree No. 499/2006 Coll., which includes cl. e) Evaluation of the proposed structures and fire doors in terms of fire resistance for approval by structural analysis according to European standards.

FINLAND
The fire safety issues, e.g. structural safety, smoke extraction, evacuation, fire distinguishing, should be identified in a Fire safety design done by Fire engineering consultant or specialist. The performance based fire design is allowed and the documentation needed is decided case by case. It is checked by a third-party inspector.

GERMANY
It is possible to develop performance based fire protection concepts in consideration of the state construction laws (Landesbauordnung), whereas each state has its own construction law.

ITALY
In according to article 6 of the D.P.R. 151, the fire safety engineer can use the performance based fire design if he submits the technical documentations and the project with an exception request (Istanza di Deroga); that request must be approved by regional fire brigade.
PORTUGAL
Performance based fire design is allowed by the Portuguese regulation for fire safety in buildings. Normally numerical modelling of fire scenarios and structural behaviour under fire conditions using advanced calculation methods are part of the project of stability of the building submitted to the authorities for approval.

ROMANIA
The revision of the actual normative for fire safety includes the possibility to determine the fire resistance by means of calculation, using the specific Romanian Standards (SR) translated from the Eurocodes, together with the corresponding National Annexes.

TURKEY
N/A.
2 Tasks and deliverables of structural fire safety design

2.1 Background

Performance-based fire safety design is an accepted methodology in European building regulations for the verification of structural resistance in fire conditions. This calculation procedure takes into account the individual characteristics of the building and passive and active fire protection methods. A realistic understanding of the behaviour of structures in fire can be achieved and the overall safety of the building can be verified by using performance-based fire safety design. Through the more profound understanding of phenomena and a more precise analysis of structures in fire, an equal to or higher safety level than with prescriptive fire design is obtained.

Performance-based fire safety design, or natural fire safety design, is generally carried out as shown in Fig. 1. Fire safety is mostly checked by comparing the required fire resistance time $t_{f,req}$ to the calculated fire resistance time $t_{f,d}$ in the same way as in fire design based on the standard fire curve. This leads to the simple equation $t_{f,d} \geq t_{f,req}$, which nevertheless can be used to take into account all the aforementioned factors. However, it should be noted that the required fire resistance time in this equation is not the same value as the real fire resistance time in fire design, but is also determined using a performance-based approach. On the other hand, a similar comparison can be carried out also in the strength domain and temperature domain, see EN1991-1-2 cl. 2.5 Mechanical Analysis.

2.2 List of the requirements set

The characteristics of the building have to be known compartment by compartment before performance-based fire design can be used. In the following table, the main tasks included in structural fire safety design and the corresponding deliverables are listed.

The following lists, Tab. 2.1 the requirements set for the contents of the documentation on fire design, was prepared based nationally approved material on Table 2 in Performance-based structural fire safety design, Rautaruukki Oyj, and Suomen Rakentamismääräyskokoelma.Rakennusten paloturvallisuus. Määräykset ja ohjeet, 2002. This part is completing the use of Eurocodes to approve the asked fire safety in national materials. The similar material was approved for all European countries.

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**Fig. 2.1 Progress of performance-based fire safety design in a simplified form**
Tab. 2.1 Requirements set for the contents of the documentation on fire design

### A. DETERMINATION OF THE USE OF DESIGN DATA OF THE BUILDING

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice of methods and determination of their applicability.</td>
<td>Description of the methods used. The description should state the calculation and testing methods used and their limitations, as well as initial data and made assumptions with explanations. All source references must be clearly stated.</td>
</tr>
<tr>
<td>Determination of acceptability criteria. Acceptability criteria set the limits for the safety of the design solutions. For the time being, these are agreed upon case by case with local authorities.</td>
<td>Structural acceptability criteria with explanations.</td>
</tr>
<tr>
<td>Choice of design standard and modelling methods. The same design standard system has to be used throughout the design process.</td>
<td>Determination of design standards to be used in design. If the design standard system does not include all necessary methods for the analysis of all different factors and other methods are used, the methods have to be validated. The application of all methods in the design has to be described with sufficient accuracy for it to make possible the repetition of the calculations by another party.</td>
</tr>
<tr>
<td>The inclusion of all necessary information regarding fire safety in the service and maintenance documentation of the building.</td>
<td>All necessary information on the use and modifications of use regarding fire safety are included in the service and maintenance documentation of the building. The documentation is updated during the life cycle of the building so that the latest information is always available to the owner and occupier of the building.</td>
</tr>
</tbody>
</table>

### B. FIRE MODELLING

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determination of the geometry of the fire compartment.</td>
<td>The length, width, height and other necessary dimensions of the fire compartment. Small irregularities (e.g. consoles, columns and beams) do not usually have an effect on fire modelling using computer software and can often be ignored during this phase.</td>
</tr>
<tr>
<td>Determination of the surface characteristics confining the fire compartment.</td>
<td>The thermal characteristics (thermal conductivity, specific heat, emissivity, density etc.) of the walls, ceiling and floor of the fire compartment as functions of temperature,</td>
</tr>
<tr>
<td>Openings in the fire compartment.</td>
<td>Locations and dimensions of the openings, such as doors, windows and smoke vents. The opening and closing of openings during the fire. Evaluation of the durability of window panes during the fire. Assumption made on the breakage of windows. It should be noted that the breakage of windows is often difficult to determine accurately, for which reason a sensitivity analysis is necessary. Determination of the opening factor of the fire compartment.</td>
</tr>
</tbody>
</table>
### Performance-based fire design:

Determination of different possible fire scenarios. Performance-based fire design is based on chosen risk scenarios and the corresponding design fires that are set in cooperation with fire authorities before the start of the design project. A certain risk scenario is a description of how, where and when a fire takes place and what are the factors under fire threat.

<table>
<thead>
<tr>
<th>Determination of different possible fire scenarios.</th>
<th>Determination and description of different fire scenarios. This requires sufficient expertise from the designer and experience in the determination of different fire characteristics. A design fire describes how the strength of the fire or the amount of heat energy released by the fire changes over fire duration.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice of fire scenarios for closer analysis.</td>
<td>Critical evaluation of different fire scenarios and the choice of critical fire scenarios for closer inspection. The description of critical fire scenarios and the background for the choices. Explanation on the sufficiency of the chosen scenarios.</td>
</tr>
<tr>
<td>Closer determination of the critical fire scenarios.</td>
<td>The type, size and location of the fire load are determined for all different fire scenarios. The fire load density is not an accurately defined variable, but instead varies statistically according to the purpose of use of the building. A large part of fire load densities given in different reference documents are based on expired data and should be considered with caution. In certain cases it may be necessary to carry out additional verification calculations in order to define the fire loads.</td>
</tr>
<tr>
<td>Consideration of active fire fighting methods.</td>
<td>Effects of active fire fighting methods on structural fire resistance. Active fire fighting methods include appliances and instruments used to extinguish a fire or to prevent its spread by active means, such as fire detectors, first-aid extinguishing equipment and sprinklers. Also fire fighters are counted among active methods, but also the possible displacement of the fire department during the life cycle of the building should be taken into account. The sufficiently effective use of active fire fighting methods and appliances may make it possible to prevent all structural problems during the duration of the fire.</td>
</tr>
<tr>
<td>Consideration of venting.</td>
<td>Location and operation of venting and air-conditioning devices. Can the system be turned off completely or does it turn itself off automatically when signalled by fire detectors? The venting system may have a considerable influence on the availability of oxygen and fire spread.</td>
</tr>
<tr>
<td>Modelling of fire scenarios.</td>
<td>The modelling of each fire scenario that has been deemed critical is carried out with the chosen accuracy using appropriate methods and tools. At least the temperatures and heat fluxes of the gas in the fire compartment have to be given as functions of time and location during the whole duration of the fire. The deliverables shall also include the thickness of the smoke layer at different times and the realised fire heat release rate so that the verification and evaluation of the calculation results is made possible.</td>
</tr>
<tr>
<td>Sensitivity analyses.</td>
<td>Description and explanation of the sensitivity analyses carried out on different affecting factors. The sufficiency of the analyses shall be shown and conclusions made.</td>
</tr>
</tbody>
</table>

## C. CALCULATION OF HEAT TRANSFER FROM FIRE TO STRUCTURES

### Determination of structural geometries.

Dimensions and locations of individual load-carrying structural members.
<table>
<thead>
<tr>
<th>Determination of heat transfer characteristics of the structural materials.</th>
<th>The heat transfer properties of different structural building materials as functions of temperature. Commonly necessary properties include heat conductivity, specific heat, density, surface emissivity and convection factor for the surface.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of passive fire protection.</td>
<td>Definition of all passive fire protection methods and products, if they are used. Examples of passive fire protection products for steel structures include fire boards, fire coatings, sprayed masses and other building materials, such as concrete. The protection provided by the fire protection product shall be determined as function of temperature and/or time on the basis of the thickness and type of the protective layer. Depending on the design case, the resulting passive fire protection is determined only after the basis of the complete fire design process.</td>
</tr>
<tr>
<td>Determination of critical structural members with regard to different fire scenarios.</td>
<td>Critical structural members are determined in the case of each different critical fire scenario. Depending on the design case, these can be situated close to the fire or at a distance from it. The designer may have to analyse several structural members in order to define the critical case.</td>
</tr>
<tr>
<td>Choice of accuracy level of analyses.</td>
<td>Presentation on the accuracy level of the heat transfer analyses: 1D, 2D or 3D. In some cases, or for some building parts, several analyses of different accuracy levels may have to be carried out.</td>
</tr>
<tr>
<td>Heat transfer analyses in different fire scenarios.</td>
<td>Determination of the influence of shadowing effects on the heat transfer to different parts of structural members. Some calculation softwares can carry this out automatically. Detailed report on the calculations taking into account passive and active fire protection methods. Separate report on each critical fire scenario.</td>
</tr>
<tr>
<td>Sensitivity analyses.</td>
<td>Description and explanation on the sensitivity analyses carried out on different affecting factors. The sufficiency of the analyses shall be shown and conclusions made.</td>
</tr>
<tr>
<td>Reporting.</td>
<td>Detailed report on heat transfer, calculations and sensitivity analyses. Conclusions on the complete fire modelling and analysis. Results of the temperature development calculations at the chosen accuracy for different structural members during the whole duration of the fire.</td>
</tr>
</tbody>
</table>

## D. STRUCTURAL ANALYSIS

<table>
<thead>
<tr>
<th>Determination of fire resistance requirements.</th>
<th>Required structural fire resistance time. Limits to the use of the structure.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determination of the properties of structural building materials.</td>
<td>Strength and heat expansion properties as functions of temperature for the load-carrying structural members according to the applicable EN- (or national) standard.</td>
</tr>
<tr>
<td>Specification of design standard system used for the structural analysis.</td>
<td>Accurate and unambiguous determination of design standards and methods used during structural analyses. If the chosen standards system does not include instructions for the consideration of all necessary factors, and a different method is used, the reliability and applicability of this other method has to be established. Design standards belonging to different standardization systems are</td>
</tr>
<tr>
<td>Task</td>
<td>Detailed Description</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Determination of structural analysis model.</td>
<td>The sketching of a simplified structural model. This can be done in a similar way as in normal temperature design. The connections between members and other boundary conditions that may cause forced actions due to heat expansion shall be shown in the structural analysis model. The designer shall decide if the structural members are considered as individual members or if the complete structure is considered. This will also have an effect on the choice of analysis software, and vice versa.</td>
</tr>
<tr>
<td>Determination of actions on structures during the fire situation.</td>
<td>Determination of actions and combinations of actions on structures during the fire situation according to the regulations and instructions given in the applicable design standard.</td>
</tr>
<tr>
<td>Structural analysis.</td>
<td>Stability analysis. The verification of the functioning of the complete structural frame.</td>
</tr>
<tr>
<td></td>
<td>Design analysis in the accidental situation (fire situation).</td>
</tr>
<tr>
<td></td>
<td>Calculation of deflections and deformations.</td>
</tr>
<tr>
<td></td>
<td>Local stability analysis.</td>
</tr>
<tr>
<td></td>
<td>Design of connections.</td>
</tr>
<tr>
<td>Sensitivity analyses.</td>
<td>Description and explanation on the sensitivity analyses carried out on different affecting factors. The sufficiency of the analyses shall be shown and conclusions made.</td>
</tr>
<tr>
<td>Reporting.</td>
<td>Detailed report on analyses of structural behaviour, calculations and sensitivity analyses. Conclusions on the complete structural analysis. Documentation of the behaviour and degrees of utilization of all different structural members at the chosen accuracy.</td>
</tr>
</tbody>
</table>
3 Proposals for improvement of Eurocodes based on local/European projects

The Eurocodes are a set of ten harmonized technical standards developed for the structural design of construction works in the European Union. According to the Eurocode “0” (EN 1990), Eurocodes serve as reference documents to prove compliance of building and civil engineering works with the essential requirements of Council Directive 89/106/EEC (replaced by Regulation (EU) No 305/2011 of 9 March 2011 of the European Parliament and of the Council, laying down harmonised conditions for the marketing of construction products), particularly Essential Requirement N°1 – Mechanical resistance and stability and Essential Requirement N°2 – Safety in case of fire. Regarding essential requirement N°2, Annex I of the Regulation (EU) No 305/2011 states that the construction works must be designed and built in such a way that in the event of an outbreak of fire:

(a) the load-bearing capacity of the construction can be assumed for a specific period of time;
(b) the generation and spread of fire and smoke within the construction works are limited;
(c) the spread of fire to neighbouring construction works is limited;
(d) occupants can leave the construction works or be rescued by other means;
(e) the safety of rescue teams is taken into consideration.

Eurocode 1, where the actions on structures are defined, and all the Eurocodes related with the different structural materials have the so-called Fire Parts (Parts 1-2) listed below:

- Eurocode 1: Actions on structures - Part 1-2: General actions - Actions on structures exposed to fire
- Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design
- Eurocode 3: Design of steel structures - Part 1-2: General rules - Structural fire design
- Eurocode 4: Design of composite steel and concrete structures - Part 1-2: General rules - Structural fire design
- Eurocode 5: Design of timber structures - Part 1-2: General - Structural fire design
- Eurocode 6: Design of masonry structures - Part 1-2: General rules - Structural fire design
- Eurocode 9: Design of aluminium structures - Part 1-2: Structural fire design

In 2007 all the 58 Parts of the Eurocodes have been published and the implementation of the Eurocodes was extended to all European countries. According to the Joint Research Centre (JRC), Institution that supports the implementation, harmonization and further development of the Eurocodes, they are currently at the stage of maintenance and evolution. CEN/TC250 is responsible for the maintenance of the Eurocodes, which involves: correction of errors; technical amendments with regard to urgent matters of health and safety; technical and editorial improvements; resolution of questions of interpretation and; elimination of inconsistencies and misleading statements. Maintenance will be largely based on the feedback from the use of the Eurocodes in the Member States and on requests for revision from industrial organisations or public authorities. Regarding the evolution of the Eurocodes it is expected that new findings related to materials and products, construction techniques and design methods are incorporated in the next generation of the Eurocodes.

In the framework of WP 6 - Thought for Eurocodes upgrade of COST Action TU0904 - Integrated Fire Engineering and Response, the members of the Action were asked to propose new improvements to the next generation of the Eurocodes based on local/European research projects. Ten countries have responded sending 40 proposals. Some of these proposals are completely new formulations and others are proposals for changing the existing formulae or parameters. It is hoped that these proposals presented in the current chapter can contribute to the maintenance and evolution of the Eurocodes. Figure 3.1 shows the number of proposals by country and Figure 3.2 depicts the number of proposal by Eurocode.
From Figure 2 it can be seen that no proposal has been made to the Eurocode 6 (Design of masonry structures) and one proposal was submitted for the new Eurocodes on fibre-reinforced polymer (FRP) composites.

The proposals presented hereafter are of the entire responsibility of the proponents and have been published according the original submission, without any editorial modification.
### 3.1 EN 1991-1-2

#### Proposals for improvement of Eurocodes based on local/European projects

<table>
<thead>
<tr>
<th>Eurocode: EN 1991-1-2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong>: Finland</td>
</tr>
<tr>
<td><strong>Proposers</strong>: Markku Heinisuo, Jyri Outinen</td>
</tr>
<tr>
<td><strong>Subject</strong>: Car fires in car parks</td>
</tr>
<tr>
<td><strong>Clause No.</strong>: New clause E.2.5(5)</td>
</tr>
<tr>
<td><strong>Reasons for improvement</strong>: No information is given for car fires. Car fire is an important scenario in fire. No common rules are given so many different applications are used in real projects for this deeply studied subject. This means high financial risks for contractors.</td>
</tr>
<tr>
<td><strong>Proposed Changes</strong>: The following rate of heat release should be used for one car in car park fires.</td>
</tr>
</tbody>
</table>

![Graph of heat release rate over time](image)

The following fire scenarios should be considered in design.

<table>
<thead>
<tr>
<th>Status of the proposal (Finished/in progress)</th>
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<tr>
<td>Finished</td>
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</table>

<table>
<thead>
<tr>
<th>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</th>
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<tbody>
<tr>
<td>No</td>
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</tbody>
</table>


<table>
<thead>
<tr>
<th>Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)</th>
<th>Yes, European and many local projects, see the references</th>
</tr>
</thead>
</table>
## Proposals for improvement of Eurocodes based on local/European projects

<table>
<thead>
<tr>
<th>Eurocode: EN 1991-1-2</th>
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<table>
<thead>
<tr>
<th>Country</th>
<th>Czech Republic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposers</td>
<td>Kamila Horova, František Wald</td>
</tr>
<tr>
<td>Subject</td>
<td>Definition of use of parametric time-temperature curve</td>
</tr>
<tr>
<td>Clause No.</td>
<td>Annex A (1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reasons for improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature is not homogeneous in horizontal plane across a floor area of a compartment even for compartments smaller than 500 m². Results of numerical study validated to measurements from full-scale fire test proved highly non-uniform temperature even in small fire compartment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change of definition of use in Annex A paragraph (1) is proposed. Limits of use should be based on calculation of presence of flashover. The presence of flashover can be proved by calculation of oxygen balance.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Status of the proposal (Finished/in progress)</th>
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<tbody>
<tr>
<td>In progress</td>
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</table>

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<tr>
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<tbody>
<tr>
<td>LD11039 Travelling fire in multi-storey buildings, Ministry of education and sports, Czech Republic</td>
</tr>
<tr>
<td>National project</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>References (background information)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horova K et al. Temperature heterogeneity during travelling fire on experimental building. Adv Eng Softw (2013), <a href="http://dx.doi.org/10.1016/j.advengsoft.2013.05.001">http://dx.doi.org/10.1016/j.advengsoft.2013.05.001</a></td>
</tr>
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<td>Proposals for improvement of Eurocodes based on local/European projects</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Eurocode:</strong> EN 1991-1-2</td>
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<tr>
<td><strong>Country</strong></td>
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<td><strong>Proposers</strong></td>
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<tr>
<td><strong>Subject</strong></td>
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<tr>
<td><strong>Clause No.</strong></td>
</tr>
<tr>
<td><strong>Reasons for improvement</strong></td>
</tr>
<tr>
<td><strong>Proposed Changes</strong></td>
</tr>
<tr>
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<tr>
<td><strong>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</strong></td>
</tr>
<tr>
<td><strong>Was the proposal studied in the framework of a project?</strong></td>
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<tr>
<td><strong>National project</strong></td>
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## Proposals for improvement of Eurocodes based on local/European projects

**Eurocode: EN 1991-1-2**

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<th>Country</th>
<th>Czech Republic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposers</td>
<td>Kamila Horova, František Wald</td>
</tr>
<tr>
<td>Subject</td>
<td>Fire load densities for different occupancies</td>
</tr>
<tr>
<td>Clause No.</td>
<td>Annex E, Table E.4</td>
</tr>
<tr>
<td>Reasons for improvement</td>
<td>In table E.4 values of 80 % fractile of fire load densities for different occupancies are higher than it was proved in recent studies and experiments in U.S.A., Canada and Finland (mainly for dwellings). Values of 80 % fractile of fire load densities in table E.4 was set higher to be more conservative.</td>
</tr>
<tr>
<td>Proposed Changes</td>
<td>Modification of values of 80 % fractile of fire load densities for different occupancies in tab. E.4 according to latest studies is proposed.</td>
</tr>
<tr>
<td>Status of the proposal (Finished/in progress)</td>
<td>In progress</td>
</tr>
<tr>
<td>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</td>
<td>No</td>
</tr>
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</table>
| Was the proposal studied in the framework of a project? | LD11039 Travelling fire in multi-storey buildings, Ministry of education and sports, Czech Republic  
National project |
| References (background information) | Horova, Kamila. *Heat release rate – the key parametr which defines the fire*, Czech Technical University in Prague, 2012.  
Laasonen, Mauri; Heinisuo, Markku; Outinen, Jyri; Hietaniemi, Jukka. *Systematisation of fire loads in Ruukki’s integrated fire design*, Tampere University of Technology, 2011. |
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<tr>
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<tr>
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<tr>
<td><strong>Proposers</strong></td>
</tr>
<tr>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td><strong>Clause No.</strong></td>
</tr>
</tbody>
</table>

| **Reasons for improvement** | In table E.5 values of the maximum rate of heat release produced by 1 m$^2$ of fire for different occupancies are lower than it was proved in recent studies and experiments in U.S.A., Canada and Finland (mainly for dwellings). Statistical value from table E.5 is about four times lower. |

| **Proposed Changes** | Modification of values of the maximum rate of heat release produced by 1 m$^2$ of fire for different occupancies in tab. E.5 according to latest studies is proposed. |

| **Status of the proposal (Finished/in progress)** | In progress |

| **Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)** | No |

| **Was the proposal studied in the framework of a project?** | LD11039 Travelling fire in multi-storey buildings, Ministry of education and sports, Czech Republic  
National project |

| **References (background information)** | Horova, Kamila. *Heat release rate – the key parameter which defines the fire*, Czech Technical University in Prague, 2012.  
Laasonen, Mauri; Heinisuo, Markku; Outinen, Jyri; Hietaniemi, Jukka. *Systematisation of fire loads in Ruukki’s integrated fire design*, Tampere University of Technology, 2011. |
# Proposals for improvement of Eurocodes based on local/European projects

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<tr>
<th>Eurocode: EN 1991-1-2</th>
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</table>

<table>
<thead>
<tr>
<th>Country</th>
<th>Germany</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Proposers</th>
<th>Christoph Klinzmann</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Subject</th>
<th>Improved safety concept for fire safety design</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Clause No.</th>
<th>Annex E (E.1)</th>
</tr>
</thead>
</table>

| Reasons for improvement | In the original safety concept published in informative Annex E the design value of the heat load density as a basis for design fires considers active fire protection measures via a multiplicative factor. The individual factors remain the same even in case the active fire protection measures are dependent. This is not correct in every case, e.g. in case a plant brigade or a sprinkler system is present in a building, the effect of a public brigade on the resulting HRR cannot be identical to a situation in which such protection measures are not available. |

| Proposed Changes | In a local project, a new safety concept for the German national annex DIN EN 1991-1-2/NA was developed on the basis of full probabilistic analyses. This safety concept could replace the original safety concept in EC1-1-2. |

<table>
<thead>
<tr>
<th>Status of the proposal (Finished/in progress)</th>
<th>Not yet submitted</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</th>
<th>No</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Was the proposal studied in the framework of a project?</th>
<th>Local project, DIBT-Forschungsvorhaben ZP 52-5-4.168-1239/07</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>References (background information)</th>
<th>Albrecht, C., Hosser, D.: “A risk-informed framework for performance-based structural fire protection according to the Eurocode fire parts”; Proceedings of Interflam 2010, Nottingham, UK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Klinzmann, C., Hosser, D.: “Active fire protection measures and probabilistic system analysis as a basis for a national fire safety concept in Germany”</td>
</tr>
</tbody>
</table>

#
### Proposals for improvement of Eurocodes based on local/European projects

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<thead>
<tr>
<th>Eurocode: EN 1991-1-2</th>
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<tr>
<td><strong>Subject</strong></td>
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<tr>
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<tr>
<td><strong>Reasons for improvement</strong></td>
</tr>
<tr>
<td><strong>Proposed Changes</strong></td>
</tr>
<tr>
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<td>-------------------------------------------------------------</td>
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<tr>
<td><strong>Eurocode:</strong> EN 1991-1-2</td>
</tr>
<tr>
<td><strong>Country</strong></td>
</tr>
<tr>
<td><strong>Proposers</strong></td>
</tr>
</tbody>
</table>
| **Subject** | Annex A  
Parametric temperature-time curves |
| **Clause No.** | (A.11 – A.12) parameter \( \Gamma \) in decay phase, i.e. \( t'_{\text{max}} \). |
| **Reasons for improvement** | According to extensive analysis performed by Buchanan [2002] eq. (A.11 – A.12), calculation of the duration of the cooling phase, i.e. reference decay rate, should be modified. |
| **Proposed Changes** | Buchanan (2002) suggests that it is more accurate to modify the reference rate for ventilation factor and thermal insulation in a different way, with the resulting design decay rate by:  
\[
\frac{dT}{dt} = \left( \frac{dT}{dt} \right)_{\text{ref}} \sqrt[\sqrt{0.04}/1900]{b/100} 
\] |
<p>| <strong>Status of the proposal</strong> (Finished/in progress) | / |
| <strong>Is the proposal being considered on the Evolution Group of this part of the Eurocode?</strong> (Yes/No) | / |
| <strong>Was the proposal studied in the framework of a project?</strong> (If yes, reference, title, and Local/European project) | / |</p>
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<tr>
<td><strong>Reasons for improvement</strong></td>
</tr>
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<tr>
<td><strong>Eurocode:</strong> EN 1991-1-2</td>
</tr>
<tr>
<td><strong>Country</strong></td>
</tr>
<tr>
<td><strong>Proposers</strong></td>
</tr>
<tr>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td><strong>Clause No.</strong></td>
</tr>
<tr>
<td><strong>Reasons for improvement</strong></td>
</tr>
<tr>
<td><strong>Proposed Changes</strong></td>
</tr>
<tr>
<td><strong>Status of the proposal (Finished/in progress)</strong></td>
</tr>
<tr>
<td><strong>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</strong></td>
</tr>
<tr>
<td><strong>Was the proposal studied in the framework of a project?</strong></td>
</tr>
</tbody>
</table>
### Proposals for improvement of Eurocodes based on local/European projects

**Eurocode: EN 1991-1-2**

<table>
<thead>
<tr>
<th>Country</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposers</td>
<td>Prof. Dr. Jochen Zehfuss</td>
</tr>
<tr>
<td>Subject</td>
<td>Improved rules for design fires</td>
</tr>
<tr>
<td>Clause No.</td>
<td>Annex A and E</td>
</tr>
<tr>
<td>Reason for improvement</td>
<td>The approaches for design fire published in annex A and E of EC1-1-2 in cases of fire are insufficient. The parametric temperature-time curves for small compartments published in annex A in some cases provide an unrealistic temperature increase and decrease. For fire compartments with large openings and an enclosure with low thermal conductivity the Annex A gives an extremely fast enhancement and decay of the temperature. For fire compartments with small openings and an enclosure with high thermal conductivity, however, an extremely slow decay of the temperature is assumed. The parametric temperature-time curves in annex A only describe the phase of the fully-developed fire without considering the growing phase of the fire. The most critical point is that the parametric temperature-time curves of Eurocode 1-1-2 annex A have no temporal connection with the rate of heat release of Eurocode 1-1-2 annex E. On the other hand Eurocode 1-1-2 offers only poor approaches for the definition of design fires. There are no rules for specification of ventilation openings, considering travelling fires, flash over and fire intervention.</td>
</tr>
</tbody>
</table>

**Proposed Changes**

| Proposed Changes | In a local project, a new method for parametric fire curves was developed which is published in the German national annex DIN EN 1991-1-2/NA. In Germany and other countries pre-normative papers exist with approaches for travelling fires, flash over and fire intervention. |

**Status of the proposal (Finished/in progress)**

| Status of the proposal (Finished/in progress) | finished |

**Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)**

| Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No) | No |

**Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)**

| Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project) | Local project, DIBt-Forschungsvorhaben ZP 52-5-3.83-1041/03 |

**References (background information)**


prINSTA TS 950 Fire safety Engineering – Verification of fire safety design in buildings.
<table>
<thead>
<tr>
<th>Proposals for improvement of Eurocodes based on local/European projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Eurocode:</strong> EN 1991-1-2</td>
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<tr>
<td><strong>Country</strong></td>
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<tr>
<td><strong>Proposers</strong></td>
</tr>
<tr>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td><strong>Clause No.</strong></td>
</tr>
<tr>
<td><strong>Reasons for improvement</strong></td>
</tr>
</tbody>
</table>
| **Proposed Changes** | 1. Reconsider nomenclature. Heat is e.g. normally denoted \( q \) and heat transfer coefficient \( h \).  
2. The emissivity of the fire should always be assumed as unity.  
3. Provisions should be made for using incident radiation as a boundary condition. The radiation temperature needs to be defined in relation to the incident radiation.  
Eq. (3.3) is wrong when the configuration factor \( \phi \) is not unity. It should not influence the emitted radiation. |
| **Status of the proposal (Finished/in progress)** | Topic 1, it is matter of harmonization with nomenclature used in research and practice.  
Topic 2, experimental evidences are provided in references.  
Topic 3 is in progress |
| **Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)** | No |
| **Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)** | References (background information) |

References (background information)


<table>
<thead>
<tr>
<th><strong>Proposals for improvement of Eurocodes based on local/European projects</strong></th>
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</tr>
<tr>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td><strong>Clause No.</strong></td>
</tr>
<tr>
<td><strong>Reasons for improvement</strong></td>
</tr>
<tr>
<td><strong>Proposed Changes</strong></td>
</tr>
<tr>
<td><strong>Status of the proposal (Finished/in progress)</strong></td>
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</tr>
<tr>
<td><strong>Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)</strong></td>
</tr>
<tr>
<td><strong>References (background information)</strong></td>
</tr>
</tbody>
</table>
### 3.2 EN 1992-1-2

#### Proposals for improvement of Eurocodes based on local/European projects

<table>
<thead>
<tr>
<th>Eurocode: EN 1992-1-2</th>
<th>Czech Republic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>Czech Republic</td>
</tr>
<tr>
<td>Proposers</td>
<td>Jan Bednář, František Wald</td>
</tr>
<tr>
<td>Subject</td>
<td>Material properties of steel fibre-concrete at elevated temperature</td>
</tr>
<tr>
<td>Clause No.</td>
<td>3.2.2.2 or new chapter</td>
</tr>
<tr>
<td>Reasons for improvement</td>
<td>Fibre concrete is increasingly used and has properties which can be used for ambient and elevated temperatures. Various certificates and technical regulations are for fibre concrete, but it is not entered in the standards yet.</td>
</tr>
<tr>
<td>Proposed Changes</td>
<td>The description of the stress strain diagram of the fibre concrete and coefficients for change tensile strength and strain at elevated temperature.</td>
</tr>
<tr>
<td>Status of the proposal (Finished/in progress)</td>
<td>In progress</td>
</tr>
<tr>
<td>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</td>
<td>No</td>
</tr>
<tr>
<td>Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)</td>
<td>Gran Agency of Czech Republic No. P105/10/2159 Modelling of Membrane Action of floor slabs exposed to fire National project</td>
</tr>
<tr>
<td>References (background information)</td>
<td>BEDNÁŘ J., WALD F., VODIČKA J., KOHOUTKOVÁ A.; Experiments on membrane action of composite floors with steel fibre reinforced concrete slab exposed to fire; Fire safety Journal; 59; 2013; 111-121. FIKE R., KODUR V.; Enhancing the fire resistance of composite floor assemblies through the use of steel fiber reinforced concrete; Engineering Structures, 33; 2011, 2870-2878.</td>
</tr>
<tr>
<td><strong>Proposals for improvement of Eurocodes based on local/European projects</strong></td>
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<td>-------------------------------------------------</td>
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<tr>
<td><strong>Eurocode:</strong> EN 1992-1-2</td>
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</tr>
<tr>
<td><strong>Country</strong></td>
<td>Czech Republic</td>
</tr>
<tr>
<td><strong>Proposers</strong></td>
<td>Jaroslav Procházka, František Wald, Jan Bednář</td>
</tr>
<tr>
<td><strong>Subject</strong></td>
<td>Fire resistance of lightweight concrete elements</td>
</tr>
<tr>
<td><strong>Clause No.</strong></td>
<td>3.3.1; 3.3.2; 3.3.3; 4.5</td>
</tr>
<tr>
<td><strong>Reasons for improvement</strong></td>
<td>The design of the construction from lightweight concrete is based on the codes for normal concrete. Those methods are appropriate to improve to take into account specific parameters and properties of lightweight concrete.</td>
</tr>
<tr>
<td><strong>Proposed Changes</strong></td>
<td>Description of characteristics of lightweight concrete is proposed to be added into each clause.</td>
</tr>
<tr>
<td><strong>Status of the proposal</strong></td>
<td>Start of investigation</td>
</tr>
<tr>
<td><strong>Is the proposal being considered on the Evolution Group of this part of the Eurocode?</strong></td>
<td>No</td>
</tr>
<tr>
<td><strong>Was the proposal studied in the framework of a project?</strong></td>
<td>No</td>
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</tbody>
</table>
### Proposals for improvement of Eurocodes based on local/European projects

**Eurocode:** EN 1992-1-2

<table>
<thead>
<tr>
<th>Country</th>
<th>Macedonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposers</td>
<td>Meri Cvetkovska, Ljupco Lazarov, Marijana Lazarevska</td>
</tr>
<tr>
<td>Subject</td>
<td>Simplified method for defining fire resistance of centrically and eccentrically loaded RC columns by using fire resistance curves and fuzzy neural networks prognostic model</td>
</tr>
<tr>
<td>Clause No.</td>
<td>Annex B- Simplified calculation methods</td>
</tr>
<tr>
<td>Reasons for improvement</td>
<td>This simplified method should offer quick assessment of the fire resistance of centrically and eccentrically loaded RC columns exposed to fire from all sides or only from one side.</td>
</tr>
<tr>
<td>Proposed Changes</td>
<td></td>
</tr>
<tr>
<td>Status of the proposal (Finished/in progress)</td>
<td>Finished in case when fire exposure is from all sides. For the second case (fire exposure only from one side) the analysis are in progress.</td>
</tr>
<tr>
<td>Is the proposal being considered on the Evolution Group</td>
<td>No</td>
</tr>
</tbody>
</table>
| Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project) | Meri Cvetkovska, “Nonlinear stress strain behavior of RC elements and RC frames exposed to fire”, Doctoral thesis, University Sts Cyril and Methodius, September 2002  
| References (background information) | M.Cvetkovska, L.Lazarov, "Nonlinear Stress Strain Behaviour of RC Columns Exposed to Fire" 2nd International Conference, Lifetime-Oriented Design Concepts, Ruhr-Universitat Bochum, Germany, March 2004  
<table>
<thead>
<tr>
<th><strong>Proposals for improvement of Eurocodes based on local/European projects</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>Eurocode:</strong> EN 1992-1-2</td>
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<tr>
<td><strong>Country</strong></td>
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<td><strong>Proposers</strong></td>
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<tr>
<td><strong>Subject</strong></td>
</tr>
<tr>
<td><strong>Clause No.</strong></td>
</tr>
<tr>
<td><strong>Reasons for improvement</strong></td>
</tr>
</tbody>
</table>
| **Proposed Changes** | When only concrete compressed zone is heated up, the maximal value of $\lambda x$ should be bigger than the one in room temperature. 
When only tensioned reinforcement is heated up, the maximal value of $\lambda x$ should be smaller than the one in room temperature. |
<p>| <strong>Status of the proposal (Finished/in progress)</strong> | Not finished completely yet. |
| <strong>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</strong> | No |
| <strong>Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)</strong> | There was a local internal project realised in Civil Engineering Faculty of Warsaw University of technology |
| <strong>References (background information)</strong> | Not published yet. |</p>
<table>
<thead>
<tr>
<th>Proposals for improvement of Eurocodes based on local/European projects</th>
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<tbody>
<tr>
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<td>Subject</td>
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<tr>
<td>Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)</td>
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<tr>
<td>References (background information)</td>
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</tbody>
</table>
### 3.3 EN 1993-1-2

**Proposals for improvement of Eurocodes based on local/European projects**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Country</strong></td>
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<tr>
<td><strong>Proposers</strong></td>
</tr>
<tr>
<td><strong>Subject</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clause No.</th>
<th>Reasons for improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The EN 1993-1-2, does not consider the combined effect of axial force and bending moment, in structural elements, when the temperature distribution is not uniform within the cross-section, in the design resistance of the cross-section.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The proposal consists of interaction diagrams for H steel sections, with non-uniform temperature distribution, when in contact with walls. The contact with the walls provides huge thermal gradients, which vary with the orientation of the web of the profile, in relation to the walls.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Status of the proposal (Finished/in progress)</th>
<th>Finished</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</td>
<td>No</td>
</tr>
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</table>

| Was the proposal studied in the framework of a project? | PTDC/ECM/65696/2006 - FIRECOLUMN – Fire Resistance of steel and Composite Steel and Concrete Columns with Restrained Thermal Elongation (National Project) |

<table>
<thead>
<tr>
<th>References (background information)</th>
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</table>


## Proposals for improvement of Eurocodes based on local/European projects

**Eurocode: EN 1993-1-2**

<table>
<thead>
<tr>
<th>Country</th>
<th>Portugal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposers</td>
<td>António Correia; João Paulo Rodrigues &amp; Fernando T. Gomes</td>
</tr>
<tr>
<td>Subject</td>
<td>Simplified calculation method for fire Design of steel columns with Restrained Thermal Elongation</td>
</tr>
<tr>
<td>Clause No.</td>
<td>4.2.5</td>
</tr>
<tr>
<td>Reasons for improvement</td>
<td>The simplified calculation method proposed in EN 1993-1-2 for fire design of steel columns, in the time domain and in the temperature domain, involves a great deal of calculation work, due to the great number of parameters involved in the buckling phenomenon at high temperatures. The critical temperature evaluation of a column requires an iterative process.</td>
</tr>
<tr>
<td>Proposed Changes</td>
<td>The proposal of a new simplified calculation method consists of a set of easy-to-use formulae, to assess the critical temperatures and critical times, as a function of the slenderness of the column, and the load level. For each column to be assessed its fire resistance, only one formula is used, so the calculation time is very much reduced comparing with the methods of the EN 1993-1-2.</td>
</tr>
<tr>
<td>Status of the proposal (Finished/in progress)</td>
<td>Finished</td>
</tr>
<tr>
<td>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</td>
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<tr>
<td>Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)</td>
<td>PTDC/ECM/65696/2006 - FIRECOLUMN – Fire Resistance of steel and Composite Steel and Concrete Columns with Restrained Thermal Elongation (National Project)</td>
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</tbody>
</table>

**References (background information)**


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<tr>
<th><strong>Proposals for improvement of Eurocodes based on local/European projects</strong></th>
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<tbody>
<tr>
<td><strong>Eurocode</strong>: EN 1993-1-2</td>
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<tr>
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<tr>
<td><strong>Proposers</strong></td>
</tr>
<tr>
<td><strong>Subject</strong></td>
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<td><strong>Clause No.</strong></td>
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<tr>
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<tr>
<td><strong>Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)</strong></td>
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</table>
### Proposals for improvement of Eurocodes based on local/European projects

**Eurocode:** EN 1993-1-2

<table>
<thead>
<tr>
<th>Country</th>
<th>Finland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposers</td>
<td>Markku Heinisuo</td>
</tr>
<tr>
<td>Subject</td>
<td>Shear resistance of plate in non-uniform elevated temperature</td>
</tr>
<tr>
<td>Clause No.</td>
<td>New NOTE after clause 4.2.1(3)</td>
</tr>
</tbody>
</table>

**Reasons for improvement**

Using maximum temperature and EN rules (EN* in the figure) the design is very safe. Using mean temperature $\theta_{\text{web}}$ and EN rules (EN in the figure) the design is unsafe. Instead of reduction factor $k_{y,0,\text{web}}$ (class 1, 2 and 3 cross-sections) or $k_{p0.2,0,\text{web}}$ (class 4 cross-sections) which are based on mean temperature, a reduction factor $k_{y,0,\text{ref}}$ (class 1, 2 and 3 cross-sections) or $k_{p0.2,0,\text{ref}}$ (class 4 cross-sections) based on the new reference temperature $\theta_{\text{ref}}$ has shown to be relevant (Method B in the figure). Verification was done using a comprehensive non-linear FEM.

**Proposed Changes**

Note. Shear resistance of the plate in non-uniform temperature as shown in the Figure.

![Graph showing shear resistance](image)

The reference temperature is calculated as: $\theta_{\text{ref}} = \theta_{\text{hot}} - d(\theta_{\text{hot}} - \theta_{\text{web}})$ where...
\[ d = k_x^j k_x^j \left[ 0.33 + 0.025 \left( \frac{\theta_{u,tx} - \theta_{u,tx}}{\theta_{u,tx} - \theta_{c,tx}} - 1 \right) \right] \]

and

\[ k_x^j = 1 + 0.00035 \left( f_y - 235 \right), \ 1 \leq k_x^j \leq 1.06 \]
\[ k_x^x = 0.9 + 0.1 \left( \frac{\nu}{f_y} \right), \ 0.95 \leq k_x^x \leq 1.15 \]
\[ k_x^s = 1 + \left( \frac{\theta_{u,tx} - \theta_{u,tx}}{\theta_{c,tx} - \theta_{c,tx}} - 1 \right) \left( \frac{\theta_{c,tx} - 200}{2000} \right), \ 1 \leq k_x^s \leq 1.40 \]

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<tr>
<th>Status of the proposal (Finished/in progress)</th>
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<tbody>
<tr>
<td>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</td>
<td>No</td>
</tr>
<tr>
<td>Was the proposal studied in the framework of a project?</td>
<td>Yes, see references. Local project.</td>
</tr>
</tbody>
</table>
## Proposals for improvement of Eurocodes based on local/European projects

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<td><strong>Subject</strong></td>
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<tr>
<td><strong>Clause No.</strong></td>
</tr>
<tr>
<td><strong>Reasons for improvement</strong></td>
</tr>
<tr>
<td><strong>Proposed Changes</strong></td>
</tr>
<tr>
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</table>
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<td><strong>Clause No.</strong></td>
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<tr>
<td><strong>Reasons for improvement</strong></td>
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<td><strong>Proposed Changes</strong></td>
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<tr>
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<tr>
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</tr>
<tr>
<td><strong>Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)</strong></td>
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</table>
## Proposals for improvement of Eurocodes based on local/European projects

**Eurocode:** EN 1993-1-2

<table>
<thead>
<tr>
<th>Country</th>
<th>Poland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposers</td>
<td>Lesław Kwaśniewski, Piotr Smardz</td>
</tr>
<tr>
<td>Subject</td>
<td>Temperature distribution in steel beams</td>
</tr>
<tr>
<td>Clause No.</td>
<td>4.2.5</td>
</tr>
</tbody>
</table>
| Reasons for improvement | For structural steel elements the calculation of temperature increase in an unprotected member exposed to fire is based on the assumption of uniform temperature field in the element. The formula for temperature increase is therefore based on a single section factor of the structural member (as per item 4.2.5 of EN 1993-1-2).

For certain elements (e.g. large beams with tall webs supporting concrete floors) this assumption does not seem to be realistic.

This approach is also not consistent with calculation methods for composite floor presented in EN 1994-1-2 |
<p>| Proposed Changes | Provide criteria when it is appropriate to assume uniform temperature distribution in a steel member, and when it is more appropriate to split the member notionally into different parts, each having uniform temperature. |
| Status of the proposal (Finished/in progress) | In progress |
| Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No) | |
| Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project) | |
| References (background information) | n/a |</p>
<table>
<thead>
<tr>
<th>Proposals for improvement of Eurocodes based on local/European projects</th>
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<td>Subject</td>
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</tbody>
</table>
| Clause No. | 4.2.5.1 Unprotected internal steelwork  
4.2.5.2 Internal steelwork insulated by fire protection material |
| Reasons for improvement | Calculations of section factor Am/V in columns have some problems in the case of non uniform temperature distribution, for instance the non-uniform heating produces thermal gradients through the cross-section.  
There are two problems, especially in the case of an strong asymmetric distribution of temperature:  
  i. Assumption of uniform temperature distribution can give an unconservative estimate of the column or beam-column capacity, especially in slender beams  
  ii. Displacements out of axis of column -bowing effect- produce distortion or break of the wall and the loss of its integrity (E criterion) |
| Proposed Changes | Some advices for application of general formulae 4.25 and 4.26 in the cases of columns or beam-columns with asymmetric heating from Tables 4.3 and 4.4 of Eurocode EN 1993-1-2. For instance, the addition a new clause or note to warning in the case of columns or beam-columns to calculate the section factor Am/V with asymmetry.  
Otherwise, it may be possible to incorporate new cases of columns or beam-columns with mechanical and thermal double symmetry in these tables 4.3 and 4.4. |
<p>| Status of the proposal | In progress |</p>
<table>
<thead>
<tr>
<th><strong>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</strong></th>
<th>We don't know exactly if the subject will be studied in the Evolution Group of CEN TC 250/SC3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)</strong></td>
<td>No, these subjects are preceded from questions of Fire Brigade of local government of Catalonia to university UPC</td>
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### Proposals for improvement of Eurocodes based on local/European projects

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<td><strong>National project</strong></td>
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## Proposals for improvement of Eurocodes based on local/European projects

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<tbody>
<tr>
<td><strong>Country</strong></td>
<td>Sweden</td>
</tr>
<tr>
<td><strong>Proposers</strong></td>
<td>Ulf Wickström, Milan Veljkovic</td>
</tr>
<tr>
<td><strong>Subject</strong></td>
<td>Thermal properties</td>
</tr>
</tbody>
</table>
| **Clause No.** | 2.2 Actions  
3.4.1.2 Specific heat  
4.2.5.1 Shadow effect |
| **Reasons for improvement** | 2.2 Actions  
The emissivity of a concrete surface is likely to be more than 0.7. It should be 0.9 for all materials unless anything else is proven.  
3.3.2 Specific heat  
The values presented must be looked over. Is the peak at 735 °C really as dominant?  
4.2.5.1 Shadow effect  
The reduction factor 0.9 is has simply no physical reason and should be removed. It cause too low temperatures and thereby compromise safety. |
| **Proposed Changes** | 2.2 Actions  
The emissivity of a concrete surface should be 0.9 for all materials unless anything else is proven.  
4.2.5.1 Shadow effect  
The reduction factor 0.9 should be removed. It cause too low temperatures and thereby compromise safety. |
| **Status of the proposal (Finished/in progress)** | In progress |
| **Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)** | No |
| **Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)** | |
| **References (background information)** | |
### 3.4 EN 1994-1-2

| Proposals for improvement of Eurocodes based on local/European projects |
|---|---|
| **Eurocode:** | EN 1994-1-2 |
| **Country** | Poland |
| **Proposers** | Lesław Kwaśniewski, Piotr Smardz |
| **Subject** | Temperature distribution in steel beams |
| **Clause No.** | 4.3.4.2.2 item (11) |
| **Reasons for improvement** | Item (11) in section 4.3.4.2.2 of EN 1994-1-2 states, that if "the beam depth does not exceed 500 mm, the temperature of the web may be taken as equal to that of the lower flange". For a beam with relatively thin web but significantly thicker bottom flange this approach may underestimate the temperature of the web |
| **Proposed Changes** | Provide criteria additional criteria for the limiting ratio of the web thickness to lower flange thickness |
| **Status of the proposal (Finished/in progress)** | In progress |
| **Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)** | |
| **Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)** | |
| **References (background information)** | n/a |
### Proposals for improvement of Eurocodes based on local/European projects

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<tr>
<th>Country</th>
<th>Portugal</th>
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<tbody>
<tr>
<td>Proposers</td>
<td>João Paulo C. Rodrigues; Tiago Ancelmo de C. Pires &amp; Luis M Laim</td>
</tr>
<tr>
<td>Subject</td>
<td>Improving the simple calculation method for composite columns made of concrete filled circular hollow (CFCH) sections subjected to fire</td>
</tr>
</tbody>
</table>

### Reasons for improvement

- The critical times of the CFCH columns tested in this research were slender than those suggested in EN1994-1-2 and registered in the international literature;
- The most of researches with CFCH columns in fire do not consider the restraining to their thermal elongation;
- The tabulated data (item 4.2.3.4) showed to be slightly unsafe for larger columns in Fire;
- Simplified calculation method (annex H) leads to conservative results, is difficult to be applied in practical cases and unsafe for slender columns.

### Proposed Changes

- Suggest for CFCH columns fire resistance lower than the presented in item 4.2.3.4 of the EN 1994-1-2
- Propose new simplified equations able to predict the fire resistance of CFCH columns with restrained thermal elongation in fire and other parameters which had influence on the behavior of these columns in fire.

### Status of the proposal

- In progress

### Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)
- In part Yes

### Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)
- Yes.
  - FRISCC - RFSR-CT-2012-00025 - Fire Resistance of Innovative and Slender Concrete Filled Tubular Composite Columns fire

### References (background information)

### Proposals for improvement of Eurocodes based on local/European projects

**Eurocode:** EN 1994-1-2

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<tr>
<th><strong>Country</strong></th>
<th>Germany</th>
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<tbody>
<tr>
<td><strong>Proposers</strong></td>
<td>Peter Schaumann; Waldemar Weisheim</td>
</tr>
<tr>
<td><strong>Subject</strong></td>
<td>Structural behaviour of composite columns (simple calculation model)</td>
</tr>
<tr>
<td><strong>Clause No.</strong></td>
<td>4.3.5.1; Annex H</td>
</tr>
<tr>
<td><strong>Reasons for improvement</strong></td>
<td>Results for fire buckling loads based on Clause 4.3.5.1 and Annex H reveal to be on the “unsafe” side for composite columns with a relative slenderness higher than 0.5. (cf. Zhao and Espinós).</td>
</tr>
<tr>
<td><strong>Proposed Changes</strong></td>
<td>Proposal of a new simplified calculation method developed by Bergmann. (Remark: the method is not verified yet).</td>
</tr>
<tr>
<td><strong>Status of the proposal (Finished/in progress)</strong></td>
<td>In progress</td>
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<tr>
<td><strong>Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)</strong></td>
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</table>

**Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)**

The simplified calculation method was developed during a PhD thesis:

Bergmann, M., Zur Bemessung von Hohlprofilverbundstützen im Brandfall (*Design of composite hollow-section columns in fire*), Institut für Konstruktiven Ingenieurbau, Bergische Universität Wuppertal, Diss. 2013.

**References (background information)**

Zhao B.: Slenderness limit for composite columns with concrete filled hollow sections under fire situation. Centre Technique Industriel de la Construction Métallique (CTICM), France 2010.

### 3.5 EN1995-1-2

<table>
<thead>
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<td><strong>Clause No.</strong></td>
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<tr>
<td><strong>Reasons for improvement</strong></td>
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</tbody>
</table>
| **Proposed Changes** | Charring rate for load-bearing floor joists and wall studs in assemblies whose cavities are completely filled with insulation (Annex C)  
After char depth exceeds 25 mm charring rate reduces to the \( \beta_n = k_s \cdot k_n \cdot \beta_0 \) when \( t > t_o \). |
| **Status of the proposal (Finished/in progress)** | finished |
| **Is the proposal being considered on the Evolution Group of this part of the Eurocode? (Yes/No)** | No |
| **Was the proposal studied in the framework of a project? (If yes, reference, title, and Local/European project)** | SGS research project “Behavior of light timber-framed buildings exposed to fire” European Union, OP RDI project No. CZ.1.05/2.1.00/03.0091 – University Centre for Energy Efficient Buildings |
| **References (background information)** | KUKLÍK, P., DUFKOVÁ, M., RADA, V.: “Fire tests of light timber framed buildings” magazine Stavebnictví 01-02/14  
### New Eurocode

**Proposals for improvement of Eurocodes based on local/European projects**

<table>
<thead>
<tr>
<th>Eurocode: New Eurocode in preparation concerning structures that incorporate FRP</th>
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# References


EN 1991-1-2, Eurocode 1, Actions on structures, General actions, Part 1-2, Actions on structures exposed to fire, CEN, Brussels 2002.


