

# Managing fire safety in historical buildings

CFPA-E Guideline No 30:2013 F





## **FOREWORD**

The European Fire Protection Associations have decided to produce common guidelines in order to achieve similar interpretation in European countries and to give examples of acceptable solutions, concepts and models. The Confederation of Fire Protection Associations in Europe (CFPA E) has the aim to facilitate and support fire protection activities across Europe.

Nations shares responsibility to preserve historic buildings; i.e., buildings of architectural or historic interest or significance. Together we compete with ravages of time, natural disasters and other perils which eventually destroy buildings. Best practice and techniques can be shared to fight a common enemy.

People are aware of the importance of cultural heritage and have made great achievements for its preservation. Many studies have been made on fires, especially in most important buildings of cultural heritage, and many guidelines have been written. There are new technical options for fire protection, but there are also new risks. Therefore, we must continually check our ability to face these risks, so we can adequately protect these material traces of the history of mankind.

This guideline is intended for owners, managers, caretakers and other responsible for safety of historical buildings. It provides knowledge about basic, simple, low-cost actions, which can be done to protect the historic building from fire. It also indicates routes to more advanced ways of protection. Assistance and cooperation of professionals - rescue services, consultants, safety companies etc. is needed to increase the level of fire safety in historic buildings.

The proposals within this guideline have been produced by the Slovenian Fire Protection Association on the basis of many documents and studies, especially on results of COST (the European Cooperation in the field of Scientific and Technical Research) Action C17: Built Heritage: Fire Loss to Historic Buildings. Working group 4 of this programme worked on property management strategies and has produced excellent practice guidelines.

This guideline has been compiled by the Guidelines Commission and adopted by all fire protection associations in the CFPA E. Where the guidelines and national requirement conflict, national requirements must apply.

Copenhagen, November 2013  
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## 1 Introduction

We care for our cultural heritage and want to protect it. If we are aware of the danger of fire and do not underestimate the possibility of a fire to start in a historic building we visit, use, take care of, we have taken the first step on the path of the protection of the building and its content from fire.

National guidelines prescribe how to protect lives, environment and property from fire. Protecting historic buildings is often more complex. The level of protection should be high without destroying the historical value.

Buildings of cultural heritage were built in other times, under different rules and with no standards of safety. We often use them in different ways than they were used in the time of their construction. Modern installations and equipment is installed in many of them, so they can be used for different purposes. Some were used as residences in their times, with constant presence of people. Now we use them as public places, museums or galleries, i.e. buildings that are visited by groups occasionally. The attitude to the building and familiarity of users is different from what it was in past times.



"Magda's House", Filovci, Slovenia. The living area of the house with a thached roof was converted into a folk museum, residential culture and a small shop with souvenirs, postcards and local products. The stables and barns are an exhibition space for various smaller exhibitions and thematic workshops.  
(<http://magdina-hisa.si/slo/domov/>)



Ponte Vecchio, Florence, Italy. Crowded shops in a historic building.



Steps in Vatican Museums, Rome, Italy. Approx. 5 million of visitors go through Vatican Museums every year.



Narrow access road to the castle courtyard in Český Krumlov, Czech Republic.

On the other hand, nowadays, we have more knowledge about the phenomena of fire and we can use this knowledge to prevent fires from starting. We can use installations and equipment for lighting, cooking and heating which do not cause fire. We are familiar with techniques to prevent fires caused by lightning. We can install systems for the detection of fire, for providing quicker and better information about fire to users of a building and to firefighters, and even for automatic suppression of fire where needed.

A lot of studies have been made about the causes of fire and the most effective measures to prevent fires in historic buildings. Good housekeeping and implementation of simple protection actions are proven as most cost effective. These guidelines offer instructions for caretakers of historic buildings and help to organize fire protection for any kind of historic building.

Further and detailed information is available for every protection measure in many national and international standards, guides and other literature. Some of them are listed at the end of this guideline. It is advisable to engage a fire protection consultant or other expert to design fire protection for complex historic buildings of high importance.

It is advisable to use other publications together with these guidelines when a historic building is used as a museum, accommodation building (hotel, for example), school, hospital or other public building.



## 2 Concept of fire protection in historic buildings

Each historic building is unique. It requires unique and creative solutions of fire protection issues. Some basic recommendations for actions of fire protection management are described in this chapter.

### 2.1 Risk assessment

Risk assessment is the first step of fire protection management, an on-going process with a goal to achieve and support a certain level of fire safety in a historic building. Investment in risk assessment planning made by professionals – a team of fire protection consultants and restoration experts, and preparation of cost-benefit analysis can provide acceptable solutions and save money. Fire protection measures should be based on this risk assessment.

The risk assessment should be kept up to date. It should be reviewed on a regular basis, not less than annually, before and after maintenance works, special events, etc. Usually, trained in-house personnel can check if fire safety is on a required level and ask for help of fire protection consultants, if needed.

### 2.2 Documentation

Comprehensive documentation should be prepared to describe the building and its fire prevention appliances, the changes of use of the building with an eye on fire protection, the organizational structure in place for fire prevention, and the alterations that occur. It should be considered if any changes reduce the level of fire protection in the building. Documentation should be compiled and maintained by in-house personnel who are well versed in the operation and building details.

Information on all fire safety systems and components should be detailed in a **Fire Safety Handbook** or similar document, according to national rules. This Fire Safety Handbook should include floor plans with locations of fire extinguishers, hose reels, hydrant points, gas shut-off valves, wiring diagrams, charts, specification sheets and replacement parts lists. The Fire Safety Handbook should also incorporate the operational, service and maintenance instructions for fire protection systems and equipment, together with details of any modifications or upgrades undertaken on the equipment. Safety procedures for special occasions when higher risk is expected should also be written in the Fire Safety Handbook. Special occasions are special events with fireworks, and/or additional electrical equipment, work where hot works are performed (see 3.1.4), etc.

A **Fire Safety Logbook** or similar document, according to national rules, should be created and used to record information such as:

- Fire training sessions undertaken or delivered, including the duration of the event, the content and the names of those who attended.
- Fire drills undertaken, including time, duration and the names of those who participated. The record should include a "comments" column for noting any particular problems or other observations. If a problem or difficulty has been encountered, details of the remedy should also be provided.



- Inspections or visits by service personnel of fire protection equipment, insurance company visits, fire brigade or other persons should include brief details of any observations made.
- Full details of all fire equipment inspections and fire systems maintenance, including emergency lighting. It is suggested that this information is recorded in the Fire Safety Logbook even when there are separate maintenance logs for equipment such as fire detection or alarm systems.
- Details of any fire incidents, false alarms or other matters of interest together with the responses or remedial action taken.

A **Damage Limitation Plan** should form the basis for all the work to be carried out when fire starts and help from the fire brigade is needed. The Damage Limitation Plan should set out in some detail the organisation's response to the emergency to include such information as:

- A brief description of the premises and the use.
- A sketch plan showing access roads, drives, fire hydrants and other features such as main gas valves and electrical switch rooms.
- Identification of the items that can be removed in an emergency, together with pre-identified safe locations to which the items will be taken.
- Allocation of tasks to employees and others, together with home/mobile phone numbers.
- Duties of managers and supervisors.
- Liaison with the fire and rescue service.
- Names and addresses of resources such as contractors, conservation specialists, etc.

In developing a Damage Limitation Plan a system of categorisation should be established to ensure that clear priorities exist for object removal. This should identify:

- First priority: items of international heritage value which are intimately connected with the building or its previous occupants.
- Second priority: items of national value or which are important to explain the history of the building or its occupants. This should also include items that have a high monetary value.
- Third priority: items which would be difficult or expensive to replace and which contribute to the history of the building.
- Unclassified: items that will be left in place.

The Damage Limitation Plan should be developed and updated with the cooperation of local fire service.

### **2.3 Simple and low cost actions**

Simple and low cost actions should be used first. Good housekeeping (regular cleaning, proper storage and disposal of litter, controlling electrical installations and equipment, cutting the grass around the building, keeping records of incidents, maintenance, etc.) is a low cost measure. Staff, aware of risks, which are trained to help with evacuation and fire fighting, is crucial.

### **2.4 Advanced measures**

If advanced measures like fire detection, fire suppression systems and others are needed they should be maintained in their best condition.



### 3 Basic fire protection measures

Fire protection measures should be defined for each building, case-by-case. Rules of housekeeping and management have to be clearly prescribed and tasks of staff must be followed. Each building should have a specifically appointed person with responsibility and training for fire protection. This person has to carry out regular fire inspections according to a checklist that is specially made for each building. The number of appointed persons and content of checklists have to be defined in the Fire Safety Handbook. Some basic fire protection measures, which should be included in the Fire Safety Handbook are described in this chapter.

#### 3.1 Prevention of fire ignition

Reducing possibilities for a fire to start is a basic protection measure. Most common causes of fires in historic buildings are arson, electrical faults, open fires, smoking materials, candles, heating equipment, lightning, hot works such as welding, cutting, and similar uses during works of renovation, etc.

##### 3.1.1 Arson

Arson is the most frequent cause of fire in historic buildings. Fires can start outdoors and then be transferred into the building.

In many cases, arson can be prevented by relatively simple measures. Make sure that unguarded rooms (for example basements and stairways) are kept locked and that combustible waste is not piled up along the facades or stored in open containers. Make sure that waste containers are not stored below a window or in front of doors - especially on escape routes.

Ensure that external doors are locked and windows are closed when the premises are unoccupied.

For additional information see CFP-E guideline no. 7: Safety distance between waste containers and buildings.



Invitation to arsonists. ([http://www.frug.org/reports/Fire\\_Safety\\_in\\_Historic\\_Town\\_Centres.pdf](http://www.frug.org/reports/Fire_Safety_in_Historic_Town_Centres.pdf))

##### 3.1.2 Electrical installation and equipment

The electrical installation and equipment in historic buildings are often obsolete, decrepit and out of date. Even new electrical installations, heaters, cooker plates and other electrical equipment can



cause fire. Some examples of risk from electrical faults and basic rules to prevent these fires are listed below:

Spotlights with directed beams can cause a fire through sustained heating of surrounding combustible material. Make sure the distance from a spotlight to the combustible material is such that material is not hot or even warm after a longer period of exposure to the direct beam of the spotlight. Spotlights should not be covered.

On November 20, 1992 much of Windsor Castle, the Queen's favourite weekend residence, was destroyed by fire. More than 100 rooms, covering an area of 7,000 square metres, were damaged in the blaze, which is thought to have been started by a spotlight shining on a curtain.  
([http://news.bbc.co.uk/2/hi/special\\_report/31069.stm](http://news.bbc.co.uk/2/hi/special_report/31069.stm))

Fluorescent tubes often flicker until they go out when a component fails. Condensers and glow starters, which are still hot may fall down and ignite combustible material below the light fitting. The following should be checked:

- That there are no blinking or "glowing" fluorescent tubes. Replace ordinary glow starters with safety glow starters.
- That light bulbs, spotlights and other forms of electrical light fittings are positioned in such a manner that they do not encourage people to hang clothing or similar objects on them.
- That electric light fittings are not equipped with overly powerful bulbs.
- That electric light fittings are stable and are properly fixed.

Cooker plates and percolators, which have been switched on and forgotten, have caused many fires. Above all, fires often start in rest rooms or kitchenettes in a staff room. Most fires where kitchenettes are involved start because someone has forgotten to switch off a plate or has by accident turned a knob so that a plate is switched on. Using a kitchenette as a storage space or keeping materials on top of hot plates, may cause them to catch fire. For this reason, such electrical equipment should be fitted with a monitoring system that automatically turns the electricity off.

Other types of electrical equipment, such as copiers can also cause fire. For this reason they should be fitted with a timer that turns off the power after a certain period of time or after working hours. Computers should also be turned off at the end of the working day.

To avoid fire in electrical equipment, it is also important to check:

- That technical space, such as electrical signal box or distribution box, is not used as storage facility.
- That cables are intact and not pinched, and that areas surrounding heat radiating equipment are clean and clear.
- That lids and doors to distribution boxes, controller cabinets and switch bays are closed.
- That distribution boxes and other electrical installations are not exposed to humidity.
- That electrical heating equipment such as electric radiators, coffee makers and sauna heating units are not covered or placed in an unsuitable environment.



- That hot plates are cleared of all combustible materials and knobs cannot accidentally be turned on.
- That hot plates not in use are disconnected.

When restoring or renovating, use electrical products that are CE marked. Through the CE mark, the maker or importer certifies that the product complies with all the fundamental health and safety requirements in directives that are specified in harmonised European standards.

Defective or overloaded electrical installations can cause overheating or a short circuit that may cause a fire. Early detection of such defects can be instrumental in saving human lives or property. Modern thermographic surveys can be used to detect and eliminate hot areas in electrical equipment and circuits. A thermal scan of the electrical panel and components of electrical systems can show problems that can't be seen with the naked eye. The infrared images can reveal hot spots, excessive or unbalanced loads, loose connections, defective breakers, fuses and switches. These types of scans can be used as routine safety checks to prevent problems that could lead to fire. For more information about thermographic surveys, see CFP-A-E Guideline No 3.

### ***3.1.3 Open fires, smoking materials, candles, heating equipment***

Open fires, smoking materials, candles and heating equipment can cause ignition of combustible material by direct contact or thermal radiation. They should be used/lighted only if they are situated properly and surrounded by incombustible material. They should be kept under surveillance.

Torches and candles have to be placed in such a way that they cannot tip over or anything can fall into hot wax (or similar fuel), splash it around and ignite the near-by combustible material.

Fireplaces, stoves, grates and hearths are serious risks. Fireplaces must have proper air supplies to achieve good combustion. The clearance from combustible material must be observed even if non-combustible plaster or other masonry materials protect the combustible material, such as wood furniture or carpets.

Chimneys should be checked regularly to prevent chimney fires. Fire can spread to other parts of the building due to cracked or faulty flues.

Apart from its pleasurable and working environment aspects, smoking is also a fire protection issue. At the places where smoking is permitted, safety ashtrays should be provided. These prevent cigarettes falling down from the ashtray. In this case also the management should decide what rules apply to smoking. In order to lower the risk of fire caused by lit cigarettes, specially designed (smoke free systems) smoking stations with fire resistant ash-handling systems can be installed.

### ***3.1.4 Hot works***

Hot works occurring during renovation and/or maintenance is a common cause of fire that has serious consequences. Hot work is work that develops heat or causes sparking such as cutting, welding, soldering and/or the use of heat guns. Fires are caused by heat transmitted by conduction through metals, spray from grinding or splatter from welding. Fires start when the hot



surface comes into contact with combustible material. Fires often start in concealed spaces. Since the fire is not detected immediately it has time to grow and spread. When it is finally detected, it is often too late.

Dust and cobwebs in the attic, for example, increase the risk of ignition during hot works or lightning strikes. However, combustible dust clouds do not start burning if not ignited by a sufficiently strong heat source. A measure to prevent ignition is regular cleaning of dust or at least before the hot work will take place.

A hot work control procedure should be in place and followed when in the process of renovation, maintenance and other works. Hot work should be performed under strict control and by person/contractor with hot work permit. For more information about fire safety basics for hot work operatives see CFPA-E Guideline No 12.

### 3.2 Prevention of fire spread

The fire triangle illustrates the three elements a fire needs to ignite and spread.

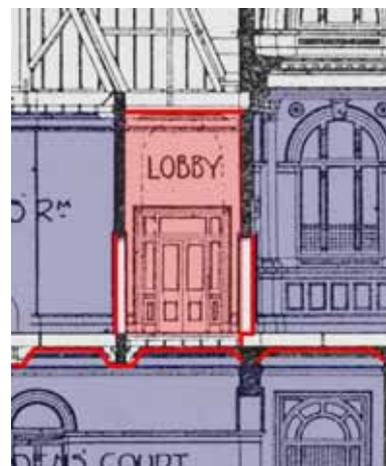
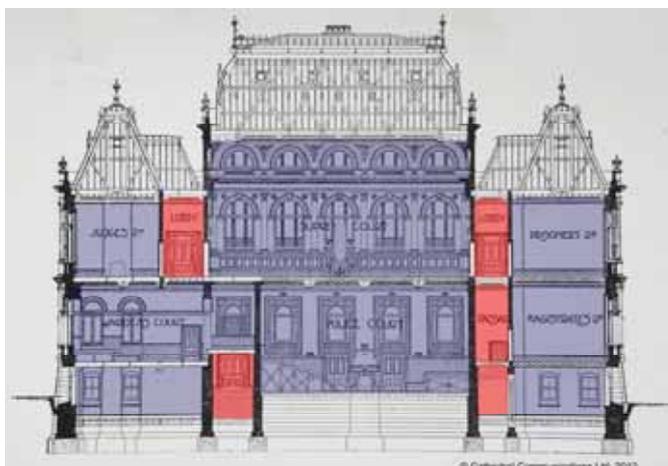


Fire triangle

The fire will be prevented or extinguished by removing any one of the elements in the fire triangle. Air with sufficient amount of oxygen is usually present, especially in drafty historic buildings. If there is enough combustible material, initial fire can grow and cause serious problems.

Regular cleaning, proper storage and disposal of litter, and other rules of good housekeeping are basic actions to prevent fire spread in the room of origin. Fire extinguishers, blankets and other basic equipment should be at hand to allow people to extinguish an initial fire.

Fire compartmentation prevents spreading of fire from the room of origin to other parts of the building for a certain period of time. Historic buildings usually don't have proper fire compartmentation. Other actions are in place to confine the fire until the fire brigade reaches the site and fire-fighting operations begin.



Compartmentation: All openings must be taken into consideration, including those such as underfloor spaces which can be permanently protected, and those like doorways, ducts and pipework which must be sealed in an emergency.

(<http://www.buildingconservation.com/articles/intumescent-products/intumescent-products.htm>)



Door assemblies can be upgraded to provide adequate fire resistance.

Even an ordinary door, when closed, can retain a fire for some time in the room where it began.

In the case of modern structures the spread of fire is usually restricted because of the proper distance between the buildings or fire walls. When speaking of historic buildings, this often cannot be easily achieved.

Care should be taken in the placement of a temporary building near the historic building in question. An assessment should be performed regarding the risk of the spread of fire. The scope of advanced fire safety actions, like installation of detection and extinguishing systems should be defined on the basis of risk assessment and detailed in the Fire Safety Handbook.

### **3.2.1 Manual firefighting equipment**

Employees and visitors can prevent spread of a fire with a fire extinguisher or other suitable manual firefighting equipment. It is essential to choose fire extinguishers that have sufficient extinguishing effectiveness for the expected fire and not give irreversible damage to the building



and its content. Selection of equipment should be guided by assessing the fire risks which might have to be tackled. It is wise to minimise the range of different types of extinguishers, so employees can easily become familiar with a certain fire fighting equipment. Certified fire extinguishers should be chosen. For further information see Research report: Manual Fire Extinguishing Equipment for Protection of Heritage (<http://www.fireriskheritage.net/wp-content/uploads/ManualFireExtinguishingEquipment1.pdf>).

Portable fire extinguishers should be placed in a prominent location and be clearly signposted. The travel distance to a portable extinguisher should not exceed 20 m. The exact placement also depends on where people are present and where the exits and normal travel routes are situated. There should be at least one portable fire extinguisher on each storey. An appropriate site is directly inside a door leading outside, near the stairway, by the receptionist, etc.

For reasonably effective fire protection on a low budget, simple buckets and access to water or sand may be employed in addition to life safety provisions dictated by legislation. Without any dedicated hand held equipment, fires may be tackled by smothering (closing ventilation openings to the room where fire is located), by disconnecting electric power in certain types of electrical fire or by spreading of the burning material. Staff should be informed about these means in addition to the use of extinguishing equipment.

### ***3.2.2 Active fire protection measures***

Fire protection measures like fire detection systems, sprinkler systems and similar can be installed to detect a fire in its early stage and to limit its spread. Installed systems must be in working order and regularly maintained.

Besides the usual there are additional requirements for fire systems in historic buildings. They should be minimally invasive, sensitively integrated and reversible.

Fire detection systems in general are very effective fire safety measures for heritage buildings and museums. Still, we are faced with several challenges of detectors and inherent cable installations. Technologies used for minimizing invasive detector installations have been made. Results are evaluated and recommendations given. The solutions and recommendations generally apply world-wide. For further information see Research report: Minimum Invasive Fire Detection for Protection of Heritage (<http://www.fireriskheritage.net/wp-content/uploads/MinimumInvasiveFireDetection.pdf>).

Sprinkler or water mist systems may seem invasive, but in certain situations a very effective way to deal with a fire before it spreads too much.



The dome of the US Library of Congress – spot the sprinkler!  
(<http://www.buildingconservation.com/articles/firesup/firesup.htm>)



An automatic high-pressure water mist nozzle in Älgårds church. The position of a nozzle is often a compromise between fire protection, cultural historical and aesthetic demands. (An overview of fire protection of Swedish wooden churches, Magnus Arvidson, Brandforsk project 500-061  
[http://www.brandforsk.se/MediaBinaryLoader.axd?MediaArchive\\_FileID=32f260f3-64b1-4f83-9442-ad1a5eed6097&MediaArchive\\_ForceDownload=true](http://www.brandforsk.se/MediaBinaryLoader.axd?MediaArchive_FileID=32f260f3-64b1-4f83-9442-ad1a5eed6097&MediaArchive_ForceDownload=true))

There are others, not usually used or well-known fire protection measures which can be introduced in certain buildings. Protection with inert air systems is often overlooked, but very useful for heritage applications. Inert air prevents ignition, initial smoke and fire spread. Storage rooms and exhibitions may be protected, with sizes ranging from small closets to large volumes. For further information see Research report: Hypoxic Air Venting for Protection of Heritage (<http://www.cowi.no/SiteCollectionDocuments/cowi/no/menu/Rapporter/Hypoxic%20Air%20for%20Protection%20of%20Heritage%20COWI.pdf>).

### 3.3 Evacuation

Protection of cultural heritage buildings should include the protection of human life.

The responsibility of the evacuation lies on management. Firefighters often come too late and can only help if something goes wrong. In-house staff should be trained to organize the evacuation and help people and animals when needed. In cases where evacuation conditions are not optimal, escape alarm and other active fire protection measures can be installed to compensate for the lower level of passive fire protection.

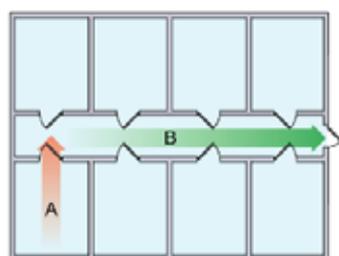


An escape route should lead to a place of safety usually outdoors, at the ground level and with an access to public grounds. The equivalent is an exit to a terrace, courtyard, etc. that can be easily reached from the street.

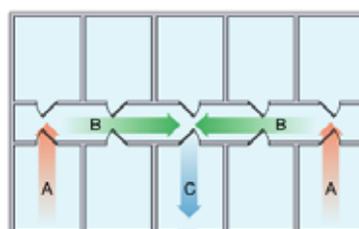
Escape routes in buildings of cultural heritage often do not meet today's safety standards. An assessment of capacities and dimensions of elements, such as doors, corridors, staircases, stairs, ramps, etc. is required. Based on this assessment an escape route may need to be adjusted. In extreme cases a restriction of access to visitors should be put in place. Possible measures are that only guided tours are allowed, to limit the number of visitors, provide additional support for disabled people, etc.

In contemporary buildings, the travel distance of 15 m to the final exit of a building used as a public place is usually accepted by national regulations. If the travel distance to the final exit of a building used as a public place is more than 15 m, the exit from the room shall lead to the escape route leading to at least two different final exits, independent of one another. The travel distance to the final exit should not exceed 45 m. If part of the travel distance to two mutually independent escape routes is shared, the shared distance is to be counted as 1.5 times its actual length ( $(A \times 1.5) + B \leq 45$  m; A is shared travel distance, B is the rest of the distance to the final exit). If stairs form part of the travel distance to an escape route, four times the difference in level is to be added to the travel distance.

Calculation of travel distance:



$$A + B \leq 15 \text{ m}$$



$$A + B + C \leq 15 \text{ m}$$

In historic buildings, especially in large and complex buildings, like castles and cathedrals, travel distances can be longer. In such cases a study has to be done and actions written in a Fire Safety Handbook have to be implemented for the life of a historic building.

In some cases windows may be approved as an alternative escape. For buildings with several storeys, the escape route shall be supplemented with stairs. This applies also when a window is an alternative exit from a room.

Historic buildings can in some cases be constructed with only one escape route. In this instance there must be no unexpected risk that the exit will be blocked by fire. An unexpected risk may also arise if escape is prevented by a fire occurring in nearby buildings. See example below.



Historic building is of two storeys. Upper storey is used as a concert hall. The lower story is used as a workshop, contains flammable materials and creates an elevated fire risk. There shall be at least two mutually independent escape routes with two separate stairs down to ground level.

In case of a doubt in a safe evacuation, fire protection consultant can use software for virtual evacuation to simulate the movement of people. The use of this technology allows experts to estimate time of egress under different situations (normal conditions, very high occupancy, emergency routes blocked by the fire, etc.) and to propose additional/new escape routes and evaluate them before the implementation on site.

### ***3.3.1 Doors on escape routes***

Doors in or to an escape route shall normally open outwards in the direction of escape. Doors should not be locked during opening hours. Where they have to be secure against entry from the outside doors should be easily openable from within the building to prevent people from being stuck in the room.

### ***3.3.2 Alternative ways of escape***

In historic buildings, alternative ways of escape can be accepted and introduced on the basis of a study, taking into account certain limitations. Use of a fixed or freestanding ladder, a stair tower or an evacuation chair can be accepted for the evacuation for a small number of occupants (less than 10). An escape arranged this way could take a long time. Evacuation stewards have to be trained specially to help people evacuate in this way.

Access balconies may be used as a shared portion of otherwise separate escape routes. Escape over a flat roof may be regarded as equivalent to escape via an access balcony.

### ***3.3.3 Escape alarm***

Rooms in a historic building where people are present behind closed doors and which are situated in such a way that it is necessary to pass through a corridor or some other space to reach the escape routes, should be fitted with an alarm that is automatically triggered by a smoke fire detector in the corridor. A restroom should also be fitted with an escape alarm.

### ***3.3.4 Fittings in escape routes***

During working/visiting hours when people are present, the escape shall be possible without the help of a key. Note that this also applies to windows if these form part of the escape strategy.

A pull handle or lever handle can be used as the opening device in escape routes in historic buildings on condition that the door can be opened by only one operation, i.e. without a knob having to be manoeuvred at the same time. Door opening devices should comply with European Standard EN 179. Ordinary escape locks, regardless of design, can never meet the requirement for an approved locking unit, since the escape lock shall at all times be capable of being opened in the direction of escape without a key or some other implement.



An approved locking unit comprises a lock housing, striking plate and, if necessary, door strengthening accessories. All components must be of a standard not lower than lock class three. A multiple tumbler lock may also be part of an approved lock unit.

When there is a requirement for intruder protection locking, at least one additional approved locking unit must therefore be installed in the door environment.

Many historic buildings are fitted with external bars and padlocks. It is in most cases impossible to ensure that these are unlocked by various technical arrangements. It is better to set up a strict locking procedure. For instance, the person who leaves last shall lock all doors and that the person who unlocks the first door must also unlock all the other escape routes.

### ***3.3.5 Guidance signs***

Guidance signs are signs with a green front face and clear white symbols in accordance with the CFP-A-E Guideline 5 2003F: Guidance signs, emergency lightning and general lightning.

If fixed installation of guidance signs is too much of an impact on the cultural and historical value of the building and/or its content, the placement of removable plates during the event when people are in the building can also be an option.

The use of photoluminescent floor marking tapes is also an option in some cases. They can be removed and not cause damage to walls, ceilings, etc. Photoluminescent tape offer glow-in-the-dark identification after the lights go out and could give off light for some time (even up to 6 hours) in darkness. The time of the photoluminescence effect varies from product to product and is declared by the manufacturer.

Solutions with removable guidance signs and/or the use of photoluminescent marking tapes are not recommended or practical if the building is available to the public frequently (every week, for example).

### ***3.3.6 Plan of escape routes***

Copies of plans of escape routes should be displayed in suitable positions. The plan shall show the escape routes, specify how to alert rescue services and other required assistance. When appropriate, the placement of manual alarm buttons and alarm telephones, and the place for assembly after escape should also be included in the plan.

Plans of escape routes are not, however needed for rooms whose size, position and layout are such that there is obviously no need for these to ensure the safety of visitors. It is thus a matter of judgment in each individual case whether such plans are required for the building in question.

It is often advisable to display at least one such plan on each storey. It is best to arrange a common place of assembly for occupants, visitors, etc. This makes it easier to check that everybody has been able to come to the place of assembly.



The fire escape plan provides information of escape routes and other necessary information.

### **3.4 Salvage of items of historic value**

Salvage of items of historic value may require special design of the evacuation routes or special equipment. A damage limitation plan should provide solutions to prevent crowding of routes and congestion of the personnel and rescue teams if evacuation of people and items of historic value is going on at the same time.

## **4 Staff training**

Appointed staff should receive training according their responsibilities, stated in a Fire Safety Handbook. In addition to the training for managers, fire wardens and evacuation stewards, all staff should receive information about fire safety measures. It is useful to include visitors to fire drills from time to time.

In addition to the usual basic fire training, knowledge should be upgraded with special issues regarding emergency procedures, damage limitation actions (moving or extinguishing artefacts, for example), etc.

Evacuation stewards should be trained to help to evacuate school groups, people with small children and/or people with disabilities (impaired mobility, vision, hearing and/or mental impairments), etc.

Staff should also be aware and trained to cope with special or additional risks during maintenance, renovation, special events, reconstruction and other works, etc. Mobile structures like tents, additional electrical equipment, combustible material and similar can be present at such occasions.

## **5 Conditions for effective intervention of the fire brigade**

The intervention of a fire brigade can be much more effective if they are familiar with the premises. Management of a historic building should cooperate with local fire brigade with a goal to ensure that the fire brigade will have necessary equipment and knowledge to fight the fire in the premises and not cause unnecessary water damage to the building and its content during the intervention. Important works of art should be evacuated and the fire brigade can help to do that. It is recommended that the fire brigade be invited to fire drills.



### 5.1 Access roads

Access roads should ensure that effective rescue and firefighting can take place. Access for the rescue service should be planned with the local fire brigade.

Fire hydrants and/or gas stop valves in the carriageway or footway shall not be obstructed. Nor must there be obstruction of manholes for electricity/telecom, water or district heating.

No obstruction of rescue roads and/or hard standings for the lift platform or turntable ladder of the rescue service. Consult the rescue service if there is uncertainty concerning the hard standing.



Access for the rescue service should be planned with local fire brigade.

### 5.2 Water supplies for firefighting

Where there is no public water supply or it is insufficient, an alternative water supply should be provided such as swimming pool, lake, underground cistern, etc.

### 5.3 Firefighting in historic buildings

Firefighters should be trained for firefighting in a historic building. Emergency procedure for each historic building has to be prepared and checked at least yearly to remain up-to-date. Firefighters intervene at other disasters such as floods, storms, etc, which can be a more frequent event than a fire. People learn from different experiences and can always improve the procedures. Disaster plans should include emergency procedures for different causes of the intervention.

Some details in a disaster plan, which should not be overlooked include:

- Water damage can be as devastating as fire in historic buildings. Use of water, as well as other extinguishing agents should be planned in advance with a thought on the damage they present to the building and its artefacts. It is wiser to use small amounts of water to keep the fire in a small compartment or part of the building then to leave fire to spread without having enough and proper extinguishing agent at hand.
- It is useful to have trained salvage teams for certain actions like evacuation of certain artefacts. In these teams, there can be people, employees, volunteers, etc, who are not firefighters. Actions have to be coordinated usually by a fire chief, to prevent injuries, unnecessary losses, etc.
- Fire drills should be performed at different times; at night, during the weekend, early in the morning, during rush hour, when visitors are present or not, etc.



No Vehicle access to Clovelly  
([http://www.frsug.org/reports/Fire Safety in Historic Town Centres.pdf](http://www.frsug.org/reports/Fire_Safety_in_Historic_Town_Centres.pdf))



Remote location of memorial Church of the Holy Spirit with a wooden construction, Javorca, Tolmin, Slovenia. ([http://www.grboslovje.si/novice/article\\_2010\\_06\\_24\\_0005.php](http://www.grboslovje.si/novice/article_2010_06_24_0005.php), <http://www.potmiru.si/slo/cerkev-svetega-duha-na-javorci>)



## 6 Checklist for fire protection actions in historic building

Building:	
Responsible person for fire protection:	Telephone:
Address of site office:	
Other contact person:	

	Yes	No with comments	Initials
The building satisfies security of escape regarding: <ul style="list-style-type: none"> <li>- Travel distance</li> <li>- Guidance signs</li> <li>- Special escape fittings mounted on escape doors</li> <li>- Only stairs as escape routes</li> <li>- Windows used as escape routes</li> <li>- Access balconies used as escape routes</li> <li>- Escape plans are displayed</li> <li>- Windows near escape routes (stairs) have fire classification</li> </ul>			
Are there separate fire compartments			
Protection against spread of fire between buildings <ul style="list-style-type: none"> <li>- Sufficient safety zone</li> <li>- Other measures</li> </ul>			
Electrical and other installation <ul style="list-style-type: none"> <li>- According to up-to-date standards</li> <li>- ...</li> </ul>			
Equipment for fire fighting <ul style="list-style-type: none"> <li>- Portable fire extinguishers</li> <li>- Fire blankets</li> <li>- Other measures</li> </ul>			
Measures taken to provide access for rescue service to the building including freestandin ladder location, free access balcony, etc			
Water supplies for firefighting <ul style="list-style-type: none"> <li>- Public water supply</li> <li>- Alternative water supply</li> </ul>			
Management & maintenance instructions handed over			
Drawings/plans of the building			

Discrepancies/Comments:

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Name

Date

Signature



## 7 Regular inspections

The following checklist may be helpful for inspections. Historic buildings should be inspected regularly. It is up to the owner/manager to determine the frequency. It is best to carry out checks regarding arson the day before a weekend or holiday.

### Checklist for inspections

<b>Escape</b>	<b>Check that</b>
Escape routes	<ul style="list-style-type: none"> <li>- Escape route is not obstructed.</li> <li>- Escape doors are not obstructed. Check also on the outside that they are not obstructed by snow or something else.</li> </ul>
Signs for escape	<ul style="list-style-type: none"> <li>- The sign is in place.</li> <li>- Sign is easy to see from suitable points in the building.</li> <li>- Luminous or illuminated signs are intact and the light is on.</li> <li>- Where emergency power supply is installed, it is in working order.</li> </ul>
<b>Compartment boundary</b>	<b>Check that:</b>
Wall at compartment boundary	<ul style="list-style-type: none"> <li>- There are no holes, leaks, gaps etc. in the wall.</li> <li>- Openings in walls for e.g. pipes, cables, ventilation ducts are sealed.</li> </ul>
Fire resistant glazing, windows	<ul style="list-style-type: none"> <li>- The glass is intact.</li> <li>- Windows are closed.</li> </ul>
For all doors in and to escape routes, regardless of whether or not they have a fire separating function, the following shall be checked	<p><b>Function</b></p> <ul style="list-style-type: none"> <li>- Check that the door can be easily opened without a key, code or card and that it opens at least 900 mm</li> <li>- Check that the escape route is not obstructed by some object</li> <li>- Check that the force needed to open the door does not exceed 130 N (ca 13 kg)</li> </ul> <p><b>Maintenance</b></p> <ul style="list-style-type: none"> <li>- When the door is opened, make a visual inspection of hinges, locks, door handle, frame, fixing of glass (if any), any damage, rating label, function of door handle, etc</li> </ul> <p><b>Door closer</b></p> <ul style="list-style-type: none"> <li>- Open the door ca 10 cm and release it. Check that the door closes completely, and that</li> <li>- The spring bolt engages with the striking plate</li> <li>- Check for oil leaks</li> <li>- Check for damage to the alarm system that affects door closer function</li> <li>- Check the fixing of door closer housing and of the arms</li> <li>- NOTE that split/hold-open arms are not recommended for doors at compartment boundaries</li> </ul> <p><b>Additional locks</b></p> <ul style="list-style-type: none"> <li>- When burglar proof locks are installed, check that the lock is open during working times</li> </ul>
<b>Firefighting equipment</b>	<b>Check that:</b>
Portable extinguishers	<ul style="list-style-type: none"> <li>- Extinguishers are in their intended place</li> <li>- Pressure gauge indicator is in the green field</li> <li>- There are signs for the extinguishers and that they can be seen</li> <li>- The extinguishers have had annual external checks (there must be a sticker on the extinguisher which shows date of last inspection)</li> <li>- The extinguishers are not obstructed and it is readily accessible</li> </ul>
<b>Electrical installations</b>	<b>Check that:</b>
Fluorescent tubes	<ul style="list-style-type: none"> <li>- The tube is not blinking when the light is switched on and it does not blink in normal operation</li> <li>- The tubes are not burned out and/or their ends are not glowing red</li> </ul>
Halogen lights and incandescent lights	<ul style="list-style-type: none"> <li>- There is no combustible material such as curtains near, or in contact with, lights</li> <li>- The fitting is stable and properly fixed</li> <li>- Fittings are not sited so that excessive heating is caused</li> </ul>
Electrical installations	<ul style="list-style-type: none"> <li>- Cables are not damaged or pinched</li> <li>- Wall sockets or switches are not damaged</li> <li>- Combustible materials are not kept nearer than 1 m from a fuse board</li> </ul>



	<ul style="list-style-type: none"> <li>- Electric heaters are not covered</li> <li>- There are no loose cables</li> <li>- Cables are free from harmful amounts of thermally insulating dust</li> </ul>
<b>Gas installations</b>	<b>Check:</b>
Gas piping connections	<ul style="list-style-type: none"> <li>- distance from combustible materials, fresh air supply, fuel storage, etc.</li> <li>- heating device installation</li> </ul>
<b>Other items</b>	<b>Check that</b>
Kitchen and/or staff room	<ul style="list-style-type: none"> <li>- Naked lights are not left unguarded and combustible candle holders are not used. Check also their placing in relation to combustible materials such as curtains, on the TV, etc</li> <li>- Percolators, hotplates etc. have timers</li> <li>- Near cookers there is no combustible material that can fall down or cause a fire in some other way</li> <li>- The tops of cookers are not used as storage places</li> <li>- Fan filters are clean</li> </ul>
Other potential causes of accidents	<ul style="list-style-type: none"> <li>- Skid resistant surfaces on e.g. stairs or in other places where these are needed are in a serviceable state.</li> <li>- There is no smoking other than in authorised places.</li> </ul>
First aid	<ul style="list-style-type: none"> <li>- Existing contents agree with list of contents.</li> </ul>
Cleaning/order	<ul style="list-style-type: none"> <li>- Litter is regularly carried away.</li> <li>- Rubbish or empty packaging is not stored in large quantities or in an unsuitable place indoors or too near the facade of the building on the outside.</li> </ul>
Pallets, containers and storage of combustible materials	<ul style="list-style-type: none"> <li>- Combustible materials, e.g. pallets, waste containers etc. are not placed nearer than 6 m from a facade with openings such as windows, doors or air inlets, unless these are of fire resistant construction.</li> <li>- Single combustible garbage containers if together not more than 600 l are not placed nearer than 4 m from a facade with openings such as windows, doors or air inlets, unless these are of fire resistant construction.</li> </ul>
Arson	<p>Around the outside of buildings</p> <ul style="list-style-type: none"> <li>- Rubbish and empty packaging or other combustible materials are not placed along the facade or under a canopy.</li> <li>- Containers for combustible materials are not kept nearer than 5 m from a building</li> <li>- Store rooms are locked.</li> <li>- There are no ladders or some other equipment that can be used to get up on the roof.</li> <li>- Windows and doors are locked.</li> <li>- External lighting is not damaged.</li> </ul>

## 8 Literature

- COST Action C17 "Built Heritage: Fire Loss to Historic Buildings", Ingval Maxwell, Stewart Kidd ([http://www.cost.eu/domains\\_actions/tud/Actions/C17](http://www.cost.eu/domains_actions/tud/Actions/C17))
- Inform guide – fire safety, Guide for practitioners, Historic Scotland ([http://www.historic-scotland.gov.uk/v1/product\\_detail.htm?productid=1783](http://www.historic-scotland.gov.uk/v1/product_detail.htm?productid=1783))
- Fire protection of Norwegian Cultural Heritage, Einar Karlsen, Directorate for Cultural Heritage (Riksantikvaren), Norway ([http://www.arcchip.cz/w04/w04\\_karlsen.pdf](http://www.arcchip.cz/w04/w04_karlsen.pdf))
- National Trust for Historic Preservation (<http://www.preservationnation.org/>)
- Research report: Minimum Invasive Fire Detection for Protection of Heritage (<http://www.fireriskheritage.net/wp-content/uploads/MinimumInvasiveFireDetection.pdf>)
- Research report: Manual Fire Extinguishing Equipment for Protection of Heritage (<http://www.fireriskheritage.net/wp-content/uploads/ManualFireExtinguishingEquipment1.pdf>)



- Research report: Hypoxic Air Venting for Protection of Heritage  
(<http://www.cowi.no/SiteCollectionDocuments/cowi/no/menu/Rapporter/Hypoxic%20Air%20for%20Protection%20of%20Heritage%20COWI.pdf>)
- An overview of fire protection of Swedish wooden churches, Magnus Arvidson, Brandforsk project 500-061  
([http://www.brandforsk.se/MediaBinaryLoader.axd?MediaArchive\\_FileID=32f260f3-64b1-4f83-9442-ad1a5eed6097&MediaArchive\\_ForceDownload=true](http://www.brandforsk.se/MediaBinaryLoader.axd?MediaArchive_FileID=32f260f3-64b1-4f83-9442-ad1a5eed6097&MediaArchive_ForceDownload=true))
- English Heritage, Fire Safety in Historic Town Centres, Steve Emery  
([http://www.frsug.org/reports/Fire\\_Safety\\_in\\_Historic\\_Town\\_Centres.pdf](http://www.frsug.org/reports/Fire_Safety_in_Historic_Town_Centres.pdf))
- Brandschutz in historischen Gebäuden; Empfehlungen zur Schadenverhütung (VdS 2171), German Insurance Association  
([http://vds.de/fileadmin/vds\\_publicationen/vds\\_2171\\_web.pdf](http://vds.de/fileadmin/vds_publicationen/vds_2171_web.pdf))
- NFPA 914: Code for Fire Protection of Historic Structures, National Fire Protection Association ([www.nfpa.org](http://www.nfpa.org))
- NFPA 909: Code for the Protection of Cultural Resource Properties – Museums, Libraries, and Places of Worship ([www.nfpa.org](http://www.nfpa.org))

## 9 European guidelines

### *Fire*

- Guideline No 1:2002 F - Internal fire protection control
- Guideline No 2:2013 F - Panic & emergency exit devices
- Guideline No 3:2011 F - Certification of thermographers
- Guideline No 4:2010 F - Introduction to qualitative fire risk assessment
- Guideline No 5:2003 F - Guidance signs, emergency lighting and general lighting
- Guideline No 6:2011 F - Fire safety in care homes for the elderly
- Guideline No 7:2011 F - Safety distance between waste containers and buildings
- Guideline No 8:2004 F - Preventing arson – information to young people
- Guideline No 9:2012 F - Fire safety in restaurants
- Guideline No 10:2008 F - Smoke alarms in the home
- Guideline No 11:2005 F - Recommended numbers of fire protection trained staff
- Guideline No 12:2012 F - Fire safety basics for hot work operatives
- Guideline No 13:2006 F - Fire protection documentation
- Guideline No 14:2007 F - Fire protection in information technology facilities
- Guideline No 15:2012 F - Fire safety in guest harbours and marinas
- Guideline No 16:2008 F - Fire protection in offices
- Guideline No 17:2008 F - Fire safety in farm buildings
- Guideline No 18:2013 F - Fire protection on chemical manufacturing sites
- Guideline No 19:2009 F - Fire safety engineering concerning evacuation from buildings
- Guideline No 20:2012 F - Fire safety in camping sites
- Guideline No 21:2012 F - Fire prevention on construction sites
- Guideline No 22:2012 F - Wind turbines – Fire protection guideline
- Guideline No 23:2010 F - Securing the operational readiness of fire control system
- Guideline No 24:2010 F - Fire safe homes
- Guideline No 25:2010 F - Emergency plan



- Guideline No 26:2010 F - Fire protection of temporary buildings on construction sites
- Guideline No 27:2011 F - Fire safety in apartment buildings
- Guideline No 28:2012 F - Fire safety in laboratories
- Guideline No 29:2013 F - Protection of paintings: transport, exhibition and storage
- Guideline No 30:2013 F - Managing Fire Protection of Historic Buildings
- Guideline No 31:2013 F - Protection against self-ignition and explosions in handling and storage of silage and fodder in farms

*Natural hazards*

- Guideline No 1:2012 N - Protection against flood
- Guideline No 2:2013 N - Business Resilience – An introduction to protecting your business
- Guideline No 3:2013 N - Protection of buildings against wind damage
- Guideline No 4:2013 N - Lightning protection

*Security*

- Guideline No 1:2010 S - Arson document
- Guideline No 2:2010 S - Protection of empty buildings
- Guideline No 3:2010 S - Security system for empty buildings
- Guideline No 4:2010 S - Guidance on key holder selections and duties