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Construction rules of the Swedish National Board of Housing, Building, and Planning (regulations and general recommendations)

5 Fire protection

This section contains regulations and general recommendations for Chapter 8(9) of the PBL and Chapter 3(8) of the PBF. The section also contains general recommendations for Chapter 10(6) of the PBL. (*BFS 2011:xx*).

General recommendation

Rules on analytical dimensioning are found in the Board of Housing, Building, and Planning's general recommendations on analytical dimensioning of buildings' fire protection.

Rules on buildings' bearing capacity in the event of fire are found in section C, Chapter 1.1.2 of the National Board of Housing, Building, and Planning's regulations and general recommendations (2011:10) on the application of European construction standards (eurocodes), ECS. (*BFS 2011:XX*).

5:1 General preconditions

Buildings shall be designed with such fire protection that fire safety is satisfactory. The design of fire protection shall presume that fire may occur.

Fire protection shall be designed with adequate robustness such that none or no major parts of the protection are disabled by individual events or stresses. (*BFS 2011:xx*).

General recommendation

Some examples of events and stresses referred to in the second paragraph of the regulation are functional disturbances that may affect several protective systems or faults in individual protective systems that are of great importance to fire protection.

5:11 Dimensioning

The fire protection of buildings shall be projected, designed, and verified using simplified or analytical dimensioning. (*BFS 2011:xx*).

General recommendation

General recommendations on verification are found in section 2:32. (*BFS 2011:xx*).

5:111 Simplified dimensioning

Simplified dimensioning means that the builder complies with the regulations through the solutions and methods indicated in the general recommendations in sections 5:2–5:7.

(*BFS 2011:xx*).

General recommendation

The control panel should include a check of whether only methods and solutions according to simplified dimensioning are applied. (*BFS 2011:xx*).

If an automatic extinguishing system is to satisfy the requirements of more than two regulations, analytical dimensioning shall be applied. For those activities for which there are requirements on an automatic extinguishing system in the regulation, analytical dimensioning shall be applied if the extinguishing system is to satisfy the requirements of more than one regulation. The general recommendations that meet the regulations referred to in sections 5:331, 5:336, 5:531, 5:5332, 5:534, 5:542, 5:548, 5:552, and 5:732 and in section C, Chapter 1.1.2.6 of the National Board of Housing, Building, and Planning's regulations and general recommendations (2011:XX) on the application of European construction standards (eurocodes), ECS.

5:112 Analytical dimensioning

Analytical dimensioning means that the builder complies with one or more of the regulations in this section in another way than through simplified dimensioning.

Verification of the building's fire protection shall be carried out through

- qualitative assessment,
- scenario analysis,
- quantitative risk analysis,

or equivalent methods. Methods may also be combined.

The method of verification shall be chosen for the specific object with consideration taken to the complexity of fire protection.

Qualitative assessment may be used as the method of verification if the deviations from simplified dimensioning are limited. The same applies if the effect of the design of fire safety is well known and if the design complies with the regulations by a good margin.

Fire protection in buildings of building class Br0 shall be verified using analytical dimensioning. (*BFS 2011:xx*).

General recommendation

Verification should be carried out as indicated in the National Board of Housing, Building, and Planning's general recommendation (2011:XX) on analytical dimensioning of the fire protection of buildings.
(*BFS 2011:xx*).

5:12 Documentation

Documentation of fire protection shall be instituted. It shall indicate what the prerequisites for the structural technical fire protection are and how the erected building's fire protection is designed and verification of whether

the fire protection meets the requirements in this section and in section C of the National Board of Housing, Building, and Planning's regulations and general recommendations (2011:XX) on the application of European construction standards (eurocodes), ECS.

The requirement on the documentation of fire protection does not apply to complementary buildings that are a maximum of 14 m². (BFS 2011:xx).

General recommendation

The documentation should account for the design of the buildings and its components regarding fire protection in accordance with section 5, bearing capacity in the event of fire in accordance with section C of the National Board of Housing, Building, and Planning's regulations and general recommendations (2011:XX) on the application of European construction standards (eurocodes), ECS, and a plan for operations and maintenance according to section 2:5.

If fire protection has been adapted with consideration taken to the capability of the rescue service according to 5:13, this should be stated.

The documentation should also describe such prerequisites that may entail limitations on how the building is used. Such prerequisites are, for example, the number of persons for which the premises are dimensioned and for which fire load the fire protection is dimensioned. That to which is referred in this section regarding fire load is clarified in the National Board of Housing, Building, and Planning's *Handbok om brandbelastning*.

Rules on systematic efforts for fire protection are published by *Myndigheten för samhällsskydd och beredskap* (the Swedish Civil Contingencies Agency) (BFS 2011:xx).

5:13¹ Importance of the effort of the rescue service

If the rescue service has a sufficiently fast response time and sufficient capability, evacuation through windows with the help of the rescue service in accordance with 5:323 may be applied. (BFS 2011:xx).

General recommendation

Response time refers to the time from when an alarm has been received by the rescue service until rescue efforts have begun.

Judgement of the response time and capability of the rescue service may be based on the municipal action plan instituted in accordance with Chapter 3(8) of the Act on protection against accidents (2003:778), (BFS 2011:xx)

5:2 Fire technical classes and other preconditions

General recommendation

In section 5, floor refers to a floor, a cellar, or an attic.

Floor refers to a floor of the building.

Cellar refers to the floor of each part of a cellar that is delimited with consecutive tiers of beams and exterior walls.

Attic refers to the floor of an attic.

Cellars or attics can at the same time be floors.

5:21 Activity classes

Spaces in buildings shall be divided into activity classes (AC) based on the intended activity. (BFS 2011:xx).

¹ Most recent formulation BFS 2005:17.

General recommendation

Classification depends on

- to what extent the persons have knowledge of the building and the possibilities of evacuating it,
- whether the persons to the greater extent are able to evacuate by themselves,
- whether the persons may be expected to be awake, and
- whether an increased risk of the occurrence of fire exists or where a fire may develop very quickly and extensively.

The same building can be divided into several activity classes.

(BFS 2011:xx).

5:211 Activity class 1 – Industry, office, etc.

This activity class encompasses spaces occupied by persons who may be expected to have good knowledge of the area, who have the ability to take themselves to safety on their own, and who may be expected to be awake. (BFS 2011:xx).

General recommendation

Examples of premises that are encompassed by the regulation are industrial buildings, storerooms, and offices. (BFS 2011:xx).

5:212 Activity class 2 – Assembly rooms, etc.

This activity class encompasses assembly rooms and other premises occupied by persons who may not be expected to have good knowledge of the area, who have the ability to take themselves to safety on their own, and who may be expected to be awake. Assembly room refers to any premises or any group of premises within a fire cell that is intended for a larger number of persons.

Spaces shall be divided into the activity classes 2A, 2B, or 2C.

Activity class 2A refers to premises for a maximum of 150 persons.

Activity class 2B refers to an assembly room for more than 150 persons.

Activity class 2C refers to an assembly room intended for more than 150 persons and where alcohol is served to any but a limited extent. (BFS 2011:xx).

General recommendation

Examples of premises that may belong to activity class 2A or 2B are schools, shops, healthcare centres, conference facilities, auditoriums, cinemas, lecture halls, restaurants, travel terminals, sports halls, department stores, retail trade facilities, and premises for theatre, concerts, dance, studies, and leisure activities. Examples of premises that may belong to activity class 2C are discotheques, larger pubs, night clubs, and similar. (BFS 2011:xx).

5:213 Activity class 3 – Residences

This activity class encompasses residences occupied by persons who may be expected to have good knowledge of the area, who have the ability to take themselves to safety on their own and who may not be expected to be awake. (BFS 2011:xx).

General recommendation

Activity class 3 encompasses residences in multi-residence buildings and one-family houses, “trygghetsboende” (security housing), senior housing, family day nurseries, and leisure homes and similar. (BFS 2011:xx).

5:214 Activity class 4 – Hotels, etc.

This activity class encompasses spaces occupied by persons who may not be expected to have good knowledge of the area, who have the ability to take themselves to safety on their own and who may not be expected to be awake. (BFS 2011:xx).

General recommendation

Examples of activities encompassed by this regulation are hotels, youth hostels, bed and breakfasts, and other types of temporary accommodation. (BFS 2011:xx).

5:215 Activity class 5 – Healthcare environments, etc.

This activity class encompasses spaces occupied by persons who have limited or not ability to take themselves to safety on their own.

Spaces shall be divided into the activity classes 5A, 5B, 5C, or 5D.

Activity class 5A encompasses spaces solely intended for daily activities and that comply with the first paragraph of the regulation. (BFS 2011:xx).

General recommendation

Examples of spaces that are included in activity class 5A are preschools or daily activities in accordance with the Swedish Social Services Act (2001:453). (BFS 2011:xx).

Activity class 5B encompasses need-tested special housing for persons

- with a physical or mental illness,
- with a functional impairment,
- with impaired development,
- with dementia or
- whose ability to take him or herself to safety on their own is in any

other way impaired. (BFS 2011:xx).

General recommendation

Need-testing can be carried out in accordance with legislation such as the Swedish Social Services Act (SoL) or the Swedish Act concerning Support and Service for Persons with Certain Functional Impairments (LSS).

Activity class 5B also encompasses open wards with need-testing in accordance with the Care of Abusers (Special Provisions) Act (1988:870) (LVM), the Care of Young Persons Act (1990:52) (LVU) or the Act on the Execution of Closed Institutional Youth Care (1988:603) (LSU).

(BFS 2011:xx).

Activity class 5C encompasses premises for healthcare and medical care. (BFS 2011:xx).

General recommendation

An example of premises referred to in this regulation is hospitals. (BFS 2011:xx).

Activity class 5D encompasses premises intended for persons who are kept locked in. (BFS 2011:xx).

General recommendation

Examples of premises encompassed by this regulation are jails, corrective facilities, and activities where persons may be deprived of liberty in accordance with the Swedish Communicable Diseases Act (2004:168), the Swedish Forensic Medical Care Act (1991:1129) or the Swedish Compulsory Mental Care Act (1991:1128). Activity class 5D also encompasses closed wards with need-testing in accordance with the Care of Abusers (Special Provisions) Act (1988:870) (LVM), the Care of Young Persons Act (1990:52) (LVU) or the Act on the Execution of Closed Institutional Youth Care (1988:603) (LSU). (BFS 2011:xx).

5:216 Activity class 6

Activity class 6 encompasses premises with an increased risk of the occurrence of fire or where a fire may develop very quickly and extensively. (BFS 2011:xx).

General recommendation

Premises that are encompassed by this regulation are primarily ones where flammable materials are produced and processed on a more than minor scale or where flammable dust may collect. Examples of such premises are mills, paper industry, textile industry, production buildings for agriculture, and spaces for the professional processing of wood.

Rules on the handling of inflammable and explosive goods are issued by *Myndigheten för samhällsskydd och beredskap* (the Swedish Civil Contingencies Agency). (BFS 2011:xx).

5:22 Building classes

Buildings shall be divided into building classes, Br, based on the need of protection.

- Buildings with a very great need of protection shall be designed in accordance with building class Br0.
- Buildings with a great need of protection shall be designed in accordance with building class Br1.
- Buildings with a moderate need of protection shall be designed in accordance with building class Br2.
- Buildings with a little need of protection shall be designed in accordance with building class Br3.

In judging the need of protection, consideration shall be taken to the probable development of a fire, potential consequences of a fire, and the complexity of the building. (BFS 2011:xx).

General recommendation

In classification, factors that are related to evacuation and the consequence of the collapse of the building shall be considered.

Buildings of more than 16 floors, larger buildings in activity class 5C, spaces in activity class 5D, and buildings with certain types of assembly rooms should be designed in accordance with building class Br0.

Certain types of assembly rooms refers to:

- Assembly rooms in activity class 2B that are not on the ground floor and that are intended for more than 1 000 persons.
- Assembly rooms in activity class 2C that are on the ground floor and that are intended for more than 600 persons.

– Assembly rooms in activity class 2C that are not on the ground floor and that are intended for more than 300 persons.

Buildings of three or more floors should be designed in accordance with building class Br1. Single-family houses of a maximum of three floors may however be designed in accordance with at least building class Br2.

The following buildings of two floors should be designed in accordance with building class Br1:

- Buildings intended for activity classes 4 or 5.
- Buildings with assembly rooms in activity classes 2B or 2C on the second floor.

The following buildings of two floors should be designed in accordance with at least building class Br2:

- Buildings intended for more than two residential flats and where there are residential or work rooms in the attic.
- Buildings with assembly rooms in activity classes 2B or 2C on the ground floor.
- Buildings that have a constructed area greater than 200 m² and that are not divided into fire sections of no greater than this size by fire walls of a fire technical class in accordance with section 5:562.

Buildings with one floor should be designed in accordance with at least building class Br2 if they contain:

- assembly rooms in activity classes 2B or 2C on or under the ground floor,
- residences and premises in activity classes 5B, 5C or 5D

Other buildings may be designed in accordance with building class Br3.

When classifying a building, a mezzanine floor in a building should be counted as a floor of its own if the area of the mezzanine floor constitutes more than 50 % of the floor area of the floor below. The area should however not be less than 100 m² for buildings in building class Br1 and Br2 or 200 m² for buildings in building class Br3. For storerooms or industries in activity class 1 in buildings in building class Br3, an area of a maximum of 500 m² can be accepted. (*BFS 2011:xx*).

5:23 Building sections, classes, and definitions

5:231 Class denominations

Building sections are classified depending on their function in the following classes:

- R bearing capacity
- RE bearing capacity and integrity (tightness)
- REI bearing capacity, integrity, and insulation
- E integrity
- EI integrity and insulation
- EI₁ or EI₂ integrity and insulation for fire partition windows (that can only be opened with tools, keys or similar) or for fire doors.
- EW integrity and limited radiation

The denominations are followed by a time requirement: 15, 30, 45, 60, 90, 120, 180, 240 or 360 minutes. The classes can be combined with the supplementary denominations:

- M mechanical impact
- C doors with closing devices in one of the classes C1–C5
- S_a or S_m tightness for combustion gas for doors. (*BFS 2011:xx*).

General recommendation

The significance of fire classes is indicated in SS-EN 13501 parts 1–5.

Examples of class denominations: R 120, RE 60, REI 30, EI₁ 30, EI₂15/EW30, EI 30, EI 60-C, E 15, and REI 60-M.

Rules on construction products with certified properties are provided in section 1:4 (*BFS 2011:xx*).

In addition, the following class denominations are used for materials, coverings, and surface layers. Denominations with index L refer to materials for piping.

- A1, A2, B, C, D, E
- A1_L, A2_L, B_L, C_L, D_L, E_L

Fire technical class A1 is the highest requirement and cannot be combined with any supplementary class. Classes A2, B, C, D are always combined with one of the following supplementary classes:

- s1 the building section may emit a very limited amount of combustion gases
- s2 the building section may emit a limited amount of combustion gases
- s3 no requirement on limited production of combustion gases
- d0 burning drops or particles may not issue from the building section
- d1 burning drops or particles may issue in a limited amount
- d2 no requirement on limitation of burning drops and particles.

Fire technical class E is the lowest class and is combined with supplementary class d2 if no drop requirement is met. (*BFS 2011:xx*).

General recommendation

Examples of class denominations: A1, A2-s1,d0, B-s1,d0, D-s2,d0, D_L-s3,d0. (*BFS 2011:xx*).

Floor covering A1_{fl}, A2_{fl}, B_{fl}, C_{fl}, D_{fl}, E_{fl}.

Class A1_{fl} is the highest requirement and cannot be combined with any supplementary class. Classes A2_{fl}, B_{fl}, C_{fl}, D_{fl} are always combined with one of the following supplementary classes:

- s1 the floor material may emit a limited amount of combustion gases.
- s3 no requirement on limited production of combustion gases.

Class E_{fl} is the lowest class and is not combined with any supplementary class. (*BFS 2011:xx*).

General recommendation

Examples of class denominations: A1_{fl}, C_{fl}-s1, D_{fl}-s1. (*BFS 2011:xx*).

- Roof covering class B_{ROOF} (t2).
- Covering of fire technical class K₂10/B-s1,d0.

The class denomination and applicable supplementary classes shall as a minimum correspond to the requirements indicated in this statute in order to meet the requirements and be permitted in each respective application. (*BFS 2011:xx*).

5:2311 Doors

General recommendation

Doors with a requirement of fire resistance in class EI XX can be designed in accordance with at least class EI₂ 15/EW XX in accordance with SS-EN 13501-2 and where XX represents the time in minutes to which the fire resistance corresponds.

For doors in class A2-s1,d0, the requirement on insulation, I, may be considered met if the increase in temperature on the side away from the fire is on the average a maximum of 280 °C and a maximum of 330 °C at individual spots.

For lift door, fire resistance up to 120 minutes in class E or EI can be verified using SS-EN 81-58. (BFS 2011:xx).

5:232 Partitioning construction

Partitioning construction refers to a construction such as tiers of beams and walls—including lead-throughs and similar and connections to adjacent building parts—that resist all or part of the progression of a fire. A partitioning construction shall meet relevant requirements of integrity and insulation.

The requirement that the dispersion of fire and combustion gas be limited shall be applied with consideration taken to which fire progressions may be expected and the building's need of protection.

General recommendation

Partitioning constructions should be determined and classified using the classes (E or EI) that are indicated in section 5:231. (BFS 2011:xx).

5:233 Fire load

Fire load refers to energy per floor area (MJ/m²) in a given area. Fire load is determined for the total amount of energy that can be burnt in the case of a complete fire progression in relation to the floor area of the space in question.

The dimensioning value of fire load shall be that value that fits in 80 % of the observed values in a representative statistical material.

General recommendation

Fire load should be calculated in accordance with the National Board of Housing, Building, and Planning's *Handbok om brandbelastning*, choosing characteristic values in accordance with table 2. The space should correspond to a fire cell.

5:24 General structural technical concepts

5:241 Air locks and fire safety locks

Air locks connect spaces where special requirements are placed on protection against the dispersion of fire and combustion gases. The air lock shall be big enough that it can be passed with only one door open at a time. If the air lock forms part of a fire cell boundary, the fire classified door shall be self-closing.

Fire safety locks connect spaces with particularly high requirements on protection against the dispersion of fire and combustion gases. The fire safety lock shall be designed as a fire cell of its own. The fire safety lock

shall be big enough that it can be passed with only one door open at a time. (*BFS 2011:xx*).

General recommendation

The tightness of doors in the fire cell boundary should comply with fire technical class S_m .

The ceiling and walls in fire safety locks should be designed in accordance with at least fire technical class B-s1,d0 attached to material of class A2-s1,d0 or covering of class $K_210/B-s1,d0$. The floor covering should be in accordance with at least class D_{fl-s1} . The fire safety lock should be separated from adjacent spaces in accordance with at least class EI 60. The fire safety lock should have doors in accordance with at least class EI 60- CS_m . (*BFS 2011:xx*).

5:242 Fire cell

Fire cell refers to a separate part of a building in which a fire during all or part of the progression of a fire may develop without spreading to other parts of the building or to other buildings. The fire cell shall be partitioned from the rest of the building by enclosing walls and tiers of beams or equivalent, such that evacuation of the building is secured and such that persons in adjacent fire cells or buildings are protected during all or part of the progression of a fire. (*BFS 2011:xx*).

5:243 Fire section

Fire section refers to a separate part of a building in which a fire may develop without spreading to other parts of the building or to other buildings. The fire section shall be partitioned from the rest of the building by fire walls and tiers of beams or equivalent, such that the dispersion of fire in and between buildings is limited. (*BFS 2011:xx*).

5:244 Fire wall

Fire walls shall, with sufficient reliability, be able to limit a fire without efforts by rescue personnel.

The wall shall resist probable mechanical impact in the event of fire and be designed such that it easily can be located by the rescue service.

Building parts, installations, and connections placed at, beside or in a fire wall shall be designed such that they cannot impair the function of the fire wall.

The fire wall between buildings shall possess such stability and bearing capacity that buildings on either side can collapse without the properties of the fire wall being significantly impaired.

Fire walls may be shared in joined buildings. In joined buildings of different buildings classes, the fire wall shall be designed in accordance with the same fire technical class that applies to the building with the higher fire technical class. (*BFS 2011:xx*).

General recommendation:

A fire wall shall be designed in accordance with fire technical class REI XX-M where XX follows from relevant requirements in section 5:5. The fire wall can, for example, be located by the connection to the roof being clearly marked. (*BFS 2011:xx*).

5:245 Tr1 stairwell

Tr1 stairwells shall be designed with a partitioning construction such that the dispersion of fire and combustion gases to the stairwell is limited.

(BFS 2011:xx).

General recommendation

The partitioning construction should be designed in accordance with at least class EI 60.

The stairwell should only be connected to other spaces by a fire safety lock that is open to the out-of-doors. The lift shaft may however be placed in the stairwell as part of the same fire cell as the stairwell. Neither the stairwell, the lift shaft, nor the fire safety lock should be connected to a floor that is located below the floor that is used for evacuation to the out-of-doors.

Doors between the stairwell and the fire safety lock should be designed in accordance with at least fire technical class E 30-S_mC. Doors between a residence or premises and the fire safety lock should be designed in accordance with at least fire technical class EI 60-S_mC. If the fire safety lock bounds on a connection, hall or similar space in its own fire cell, doors may be designed in accordance with at least fire technical class EI 30-S_mC. (BFS 2011:xx).

5:246 Tr2 stairwell

Tr2 stairwells shall be designed with a partitioning construction such that the dispersion of fire and combustion gases to the stairwell is limited.

General recommendation

The partitioning construction should be designed in accordance with at least class EI 60.

Doors to Tr2 stairwells should be designed in accordance with at least class EI 60-S_mC. If the stairwell serves a building with a maximum of eight floors, EI 30-S_mC is sufficient.

The stairwell should only be connected by way of a space in its own fire cell with residences in activity class 3, offices in activity class 1, and comparable spaces occupied by persons on a more than temporary basis. Other spaces than residences in activity class 3, offices in activity class 1, and comparable spaces occupied by persons on a more than temporary basis should only be connected with the stairwell by way of a fire safety lock. Such spaces should have access to at least one more access route for rescue efforts.

A lift shaft can be placed in the stairwell as part of the same fire cell.

Tr2 stairwells that constitute the only evacuation route should not be connected with the cellar in accordance with the requirements in 5:722. This also applies to lift shafts that form part of the same fire cell as the stairwell.

Attics, occupied only temporarily by persons, may be directly connected with Tr2 stairwells by way of doors in at least class EI 60-S_mC.

(BFS 2011:xx).

5:247 Evacuation route and safe location

An evacuation route shall be an exit to a safe location. An evacuation route may also be a space in a building that leads from a fire cell to such an exit.

(BFS 2011:xx).

General recommendation

Safe location refers to a place out-of-doors where fire and combustion gases cannot affect evacuating persons. A safe location can, for example, be a

street out-of-doors or a terrace, courtyard or similar provided that the street can be reached out-of-doors from it.

An evacuation route may include doors and connecting routes such as halls or stairs within their own fire cells, access balconies or similar spaces out-of-doors. (BFS 2011:xx).

5:248 Evacuation site

Evacuation site refers to a space in an adjacent fire cell that is located in connection with an evacuation route where persons with impaired capability of movement or orientation can await continued evacuation. The evacuation site may also be a part of the evacuation route if the evacuation site is placed in connection with the spaces that are served by the evacuation route.

The evacuation site shall be able to hold persons with impaired capability of movement or orientation. The evacuation site shall be usable and accessible to the persons referred to in section 3:1 and be accessible without a key or similar.

The evacuation site shall be situated on the same floor as the space it serves. Two-way communication shall be possible from the evacuation site. It shall be possible to maintain the function of the communication system in the event of an interruption of power and it shall have protection against interruption of power due to fire. (BFS 2011:xx).

General recommendation

The design of the communication system should meet at least the corresponding requirements for interruption of power and error signals as automatic fire alarms in accordance with section 5:2511. Equipment for communication from the evacuation site should be placed with its centre 0.8 m from the floor.

Communication to the evacuation site should take place in connection with the alarm system's central equipment, fire defence table or equivalent.

Doors to evacuation sites should be equipped with door closing devices. (BFS 2011:xx).

5:249 Separate boiler room

Separate boiler room refers to such boiler rooms that are specially designed with protection against the development and dispersion of fire and combustion gases. (BFS 2011:xx).

General recommendation:

Separate boiler rooms and fuel storage in direct connection to a separate boiler room should be designed as a fire cell of their own. (BFS 2011:xx).

5:25 Fire technical installations

5:251 Alarm systems

5:2511 Automatic fire alarms

Automatic fire alarms shall be installed when this is a prerequisite for the design of fire protection. The system shall be designed with such properties that it, with a high degree of reliability, is able to detect a fire and issue a signal to the functions that are dependent on the alarm. The system shall be designed with a sufficient degree of coverage and shall activate quickly

enough to ensure the intended function. The system shall be designed such that corrosion, thermic impact or other factors in the building's environment do not affect reliability.

The facility's function should be able to be maintained in the event of interruption of power and it shall be equipped with protection against interruption of power due to fire in the spaces that are not covered by the automatic fire alarm.

If the automatic fire alarm is a prerequisite for fire protection in all or part of a building, the detection system shall cover these areas.

(*BFS 2011:xx*).

General recommendation

The reliability and capability of automatic fire alarms can be verified in accordance with section 3 of the Fire Protection Association's publication *Regler för automatisk brandlarmsanläggning*, SBF 110:6. The components of an automatic fire alarm can be verified in accordance with the SS-EN 54 series of standards with properties adapted to intended use. The components of a fire alarm in accordance with SS-EN 54-21 should be designed as type 1.

Examples of such properties as are referred to in the regulation are the capability to detect different types of fires, the design of the detection system, the placement of detectors depending on the area of coverage and how the detection system is activated. Examples of functions that may be dependent on the alarm are door closing devices, dampers or fans in air treatment installations, evacuation alarms, and combustion gas ventilation.

Detection should, when possible, take place with the aid of smoke detectors.

The automatic fire alarm should automatically issue error signals in the event of faults in the wire network or power supply. An error signal should be designed such that it can be detected by persons in the building or at another location. (*BFS 2011:xx*).

5:2512 Evacuation alarm

Evacuation alarms shall be installed when this is a prerequisite for the design of fire protection. The evacuation alarm shall be designed based on the need of information such that persons occupying the building can be reached by information on suitable actions during evacuation.

Spaces in public premises that may be used by persons with impaired hearing without direct contact with other persons shall be equipped with complementary alarm devices so that the hearing-impaired and the deaf may be reached by warning signals in the event of fire or other danger.

For acoustic alarms, audibility shall be such that signals or messages can be perceived in the relevant parts of the building.

It shall be possible to maintain the function of the facility in the event of an interruption of power and it shall have protection against interruption of power due to fire. (*BFS 2011:xx*).

General recommendation

Evacuation alarms can be activated manually or by automatic fire alarms. The evacuation alarm should issue signals directly both when activated with a manual alarm button or by an automatic fire alarm.

The design of the evacuation alarm based on the need of information should be carried out in accordance with that which is indicated in section

5:35, for example with regard to when a spoken message or simpler signal can be used.

An example of spaces in public premises that should be equipped with complementary alarm devices is hygiene spaces. Complementary devices refers for example to optical devices.

The volume of an evacuation alarm should be adapted to the surrounding volume of sound in the premises. Evacuation alarms used in residences in activity class 3 or premises for sleeping persons in activity classes 4 and 5 should be placed such that volume of sound in a place for sleeping persons is at least 75 dB(A). The volume of sound for other premises should not be less than 65 dB(A) in places occupied more than temporarily by persons. The volume of sound should also be at least 10 dB(A) above the normal surrounding background level and should not be less than 115 dB(A) at a distance of one metre from the alarm device.

Evacuation alarms with spoken messages can be verified in accordance with SS-EN 54-16 and SS-EN 54-24. Audibility can be verified in accordance with prEN 50849. For a spoken message, an STI value of at least 0.55 should be attained. The level of acoustic pressure should be at least 70 dB, but no less than 15 dB over the surroundings. A spoken evacuation message should be preceded by a distinctive audio signal. The message should be adapted to the premises in question and the activities carried out in it. The spoken message should clearly provide information on the situation and be repeated until the alarm has been reset. A proposal for a message may have the following wording:

1. Signal character 1 (immediate danger) in accordance with SS 31711 is emitted for 5 seconds.
2. "Important message. There is a fire situation in the building. Please leave the building through the nearest exit. Follow the instructions given by the management. Proceed to the out-of-doors and do not block the exits."
3. Signal character 1 (immediate danger) in accordance with SS 31711 is emitted for 5 seconds.
4. "Important message. There is a fire situation in the building. Please leave the building through the nearest exit. Follow the instructions given by the management and proceed to the outside. Do not block the exits."
5. The message is repeated from item 1.

Acoustic or optical alarm devices can be verified using SS-EN 54-3 or 54-23.

An evacuation signal should continue until the alarm has been reset. All alarm devices should be equipped with a sign that indicates the significance of the signal and a suggestion for suitable action. An example of text may be "evacuation alarm – leave the building immediately when the alarm sounds/ashes". The sign should be designed with white text on a red background and be legible from standing level below or beside the alarm device.

Evacuation alarms should be able to emit an evacuation signal for at least 30 minutes after an interruption of power of 24 hours. The evacuation alarm should automatically issue error signals in the event of faults in the wire network or power supply. An error signal should be designed such that it can be detected by persons in the building or at another location.

The design of alarm buttons for the manual activation of evacuation alarms can be verified in accordance with SS-EN 54-11. Such alarm buttons should be equipped with safety covers. Alarm buttons should be placed a maximum of 1.60 m above the floor. (BFS 2011:xx).

5:2513 *Smoke detectors*

Smoke detectors shall be installed when this is a prerequisite for the design of fire protection. Smoke detectors shall be designed and placed such that they, with a high degree of reliability, have the capability to detect and warn in the event of fire. Smoke detectors shall also be designed with a sufficiently fast activation time such that they give early warning.

Smoke detectors shall be designed such that corrosion, thermic impact or other factors in the building's environment do not affect reliability. (BFS 2011:xx).

General recommendation

The design of smoke detectors can be verified in accordance with SS-EN 14604. Smoke detectors should be equipped with alarm indicators.

Examples of properties that are important to reliability are the possibility of detecting different types of combustion, whether the power supply is secured in the event of an interruption of power, a placement that ensures sufficiently fast activation time, and a good degree of coverage.

In order to achieve a good degree of coverage, at least one smoke detector should be placed on every floor that contains spaces occupied more than temporarily. Smoke detectors should be placed in, or outside of, each room for sleeping persons. In the occurrence of stairs, smoke detectors should also be placed in the space directly above the stairs. (BFS 2011:xx).

5:252 Automatic extinguishing system

If an automatic extinguishing system is a prerequisite for the design of fire protection, it shall be designed such that it, with high reliability, has the capability of extinguishing or controlling a fire during the intended time. The system shall activate quickly enough and be designed with a sufficient degree of coverage to ensure the intended function. The system shall have such properties as are required to ensure that activation can take place with great reliability. The system shall be designed such that corrosion, thermic impact or other factors in the building's environment do not affect reliability. Systems using extinguishing media that may have toxic properties shall be designed such that satisfactory personal safety is maintained.

The facility shall have protection against its function being disturbed due to fire. (BFS 2011:xx).

General recommendation

Examples of factors that may affect reliability are type of water source, pressure, water flow, action surface, type of triggering mechanism, design of valves, maintenance, and number, type, and placement of sprinkler heads.

An example of that to which is referred in the second paragraph of the regulation may be the interruption of power due to fire.

Rules on water and drains are found in section 6:6. (BFS 2011:xx).

5:2521 Automatic water sprinkler plant

General recommendation

The reliability and capability of automatic water sprinkler plants can be verified in accordance with SS-EN 12845 and the SS-EN 12259 series of standards. For spaces in activity class 5C, the water source should be comprised of an improved, doubled or combined water inlet in accordance with 9.6.2-9.6.4 in SS-EN 12845.

The reliability and capability of water spraying and deluge systems can be verified in accordance with SIS-CEN TS 14816. Other systems can be verified in accordance with SBF 120. (*BFS 2011:xx*).

5:2522 Residential sprinklers

General recommendation

The reliability and capability of residential sprinklers intended for residences in activity class 3 and activity class 5B can be verified in accordance with SS 883001 and SS 883002 with sprinkler systems according to the following:

1. For buildings with a maximum of two floors, sprinkler systems of type 1 should be applied.
2. For buildings with a maximum of eight floors, sprinkler systems of type 2 should be applied.
3. For buildings of more than eight floors and for spaces in activity class 5B, sprinkler systems of type 3 should be applied.

The components of a system for residential sprinklers can be designed in accordance with the SS EN-12259 series of standards with properties adapted to intended use. (*BFS 2011:xx*).

5:253 Combustion gas ventilation

If a system for combustion gas ventilation is a prerequisite for the function of fire protection, the system shall be designed such that it, with great reliability, can control combustion gases during the intended time. The system shall have a sufficiently fast activation time and sufficient capacity to ensure that fire protection will be satisfactory. In dimensioning combustion gas ventilation, consideration shall be taken to snow load and wind load. Openings and other devices shall be designed such that routes for incoming air and outgoing air are secured based on the conditions that may arise in the event of a fire. It shall be possible to maintain the function of the facility when power is being supplied to the building and it shall have protection against interruption of power due to fire. (*BFS 2011:xx*).

General recommendation

Combustion gas ventilation can be applied in order, for example, to limit the collection of combustion gases and their temperature and to improve the possibility of rescue efforts.

Systems for combustion gas ventilation can be verified in accordance with the SS-EN 12101 series of standards.

5:254 Door closing devices

Door closing devices shall be installed when this is a prerequisite for the design of fire protection. The system shall be designed such that it, with great reliability, ensures that the fire cell boundaries maintain their function. (*BFS 2011:xx*).

General recommendation

Door closing devices should be designed in accordance with at least fire technical class C1. For doors that can be propped open and that are covered by the requirement, door closing devices should be activated automatically in the event of fire.

Rules concerning doors are found in section 5:534.

Rules on available and usable doors that should be easy to open are found in section 3:143. (*BFS 2011:xx*).

5:256 Ventilation technical fire protection

5:2561 Dampers

If dampers are a prerequisite for the design of fire protection, they shall be designed such that they, with great reliability, give protection against the dispersion of fire and combustion gases in the ventilation system equivalent to the partitioning capability that applies to the fire cell boundary. Dampers shall be able to resist the temperature to which they are exposed and the dampers shall be activated within the time required for the intended function to be achieved.

The dampers shall as needed be equipped with protection against the interruption of power due to fire. (*BFS 2011:xx*).

General recommendation

Dampers can be verified in accordance with SS-EN 15650.

The activation of dampers should be done by smoke detectors that are placed in an appropriate location. The design of the smoke detector can be verified in accordance with SS-EN 54-7. (*BFS 2011:xx*).

5:2562 Fans in operation in the event of fire

Fans in operation in the event of fire refers to a protective method that means that fans in a ventilation system are used to control combustion gases or limit the dispersion of fire and combustion gases between fire cells.

If fans in operation in the event of fire are a prerequisite for the design of fire protection, they shall be dimensioned such that they with great reliability fulfil the intended function. The system shall be equipped with protection against the interruption of power due to fire. (*BFS 2011:xx*).

General recommendation

Cables for the supply of power should be designed with protection corresponding to the requirement on the partitioning construction in the building. (*BFS 2011:xx*).

5:257 Pressurisation of spaces

If pressurisation of spaces is a prerequisite for the design of fire protection, the system shall, with great reliability, be designed such that combustion gases are not dispersed to the space. (*BFS 2011:xx*).

General recommendation

The design of systems for pressurisation can be verified with SS-EN 12101-6. The system should be designed to function for at least 30 minutes provided the supply of power to the building functions. The system should be dimensioned to resist the temperature to which it may be expected to be exposed during this time. (*BFS 2011:xx*).

5:3 Possibility of evacuation in the event of fire

5:31 General

Buildings shall be designed such that satisfactory evacuation is possible in the event of fire. Satisfactory evacuation refers to persons who evacuate,

with sufficient safety, who are not exposed to falling building parts, high temperature, high heat radiation, toxic combustion gases or poor visibility that hinder evacuation to a safe location. (*BFS 2011:xx*).

5:32 Access to evacuation route

5:321 General

If not otherwise indicated in section 5:322, spaces occupied by persons more than temporarily shall be designed with access to at least two mutually independent evacuation routes.

If the residence or premises have more than one floor, there shall be at least one evacuation route for each floor. Smaller mezzanine floors may however be designed without an exit to an evacuation route from the mezzanine floor provided that evacuation nonetheless can take place in a satisfactory manner. (*BFS 2011:xx*).

General recommendation

Evacuation routes should be located so far from each other that evacuation can take place even if one evacuation route is blocked by the fire. In order for evacuation routes to be considered independent of each other, the distance between them should be at least 5 m. Examples of spaces occupied more than temporarily are

- common spaces such as laundries and hobby rooms in multi-residence buildings
- garages over 50 m²

Examples of spaces occupied temporarily and more than temporarily are also provided in section 1:6.

One of the evacuation routes may be accessible through an adjacent fire cell on the same floor if the evacuation route is accessible without a key or other tool. This does not, however, apply if any of the evacuation routes only consists of a window or a balcony. For assembly room sin activity classes 2B or 2C, the adjacent fire cell should contain the main entrance. For activity class 5C, both evacuation routes may be accessible through a horizontal passageway to adjacent premises in activity class 5C.

A hall within its own fire cell, an access balcony or equivalent in direct connection to the space it serves—except for assembly rooms in activity classes 2B or 2C—comprise a common part of otherwise separate evacuation routes. Such halls should be partitioned into units of a maximum length of 60 m. The partitions should be designed in accordance with at least fire technical class E 15, with doors in accordance with fire technical class E 15-C.

In the context of evacuation, a smaller mezzanine floor refers to a floor within the fire cell that constitutes a small part of the underlying floor that is not divided into smaller rooms and that is only fitted with a railing or equivalent. A smaller mezzanine floor constitutes a maximum of 50 % of the floor area of the underlying floor, but no more than 25 m². Smaller mezzanine floors shall be equipped with smoke detectors. (*BFS 2011:xx*).

In buildings with more than eight but a maximum of sixteen floors, residences and premises shall be designed with access to at least one Tr2 stairwell. In buildings with more than sixteen floors, residences and premises shall be designed with access to at least one Tr1 stairwell.

General recommendation:

In buildings of more than sixteen floors, other stairwells should be at least Tr2. (BFS 2011:xx).

5:322 A single evacuation route

A door to a safe location may be the only evacuation route from spaces on the ground floor for

1. spaces in activity class 1 if the possibility of evacuation can be considered satisfactory and if only a limited number of persons are expected to occupy the spaces.

2. smaller premises and residences in activity class 2A, 3, and 4 that are readily overviewed and that are expected to be occupied by a limited number of persons.

(BFS 2011:xx).

General recommendation

What is referred to in 1 is that walking distance should be 30 m and that the number of persons does not exceed 50.

What is referred to in 2 is premises with a maximum walking distance of 15 m to an evacuation route, that the evacuation route is visible from the main part of the premises or residence, and that the number of persons does not exceed 30. (BFS 2011:xx).

If conditions for satisfactory evacuation exist, a Tr1 stairwell may constitute the only evacuation route from residences in activity class 3 and from premises in activity class 1.

If conditions for satisfactory evacuation exist, a Tr2 stairwell may constitute the only evacuation route in premises in activity class 1 in buildings of a maximum of eight floors and from residences in activity class 3 in buildings of a maximum of sixteen floors.

General recommendation

Evacuation is assumed to take place satisfactorily if walking distance is a maximum of 30 m and that the number of persons in each fire cell does not exceed 50.

A Tr1 stairwell may constitute the only evacuation route in buildings of up to sixteen floors.

5:323 Evacuation through windows

Windows for evacuation shall be designed such that evacuation can take place in a satisfactory manner.

General recommendation

Windows intended for evacuation should be side-hung or rotate around a vertical axle and openable without a key or other tool. Windows that rotate around a horizontal axle can be used if they open outwards and remain in an open position. Windows should have a free opening of at least 0.50 metres in width and at least 0.60 metres in height. For windows that rotate around a horizontal axle, the free measurement should be calculated below the axle. The sum of the width and the height should be at least 1.50 m. The bottom edge of the opening should be a maximum of 1.2 m above the floor. If the distance between the floor and the bottom edge exceeds 1.2 m, a platform or similar should be mounted on the inside.

In spaces in activity class 1, schools in activity class 2A and residences in activity class 3, one of the evacuation routes may be replaced by access to a window. The bottom edge of the window may be a maximum of 2.0 m above ground level outside and if there is otherwise a possibility of evacuation in a satisfactory manner.

Evacuation from residences in activity class 3 in Br2 and Br3 buildings may also take place in accordance with section 5:353.

General recommendation

In office premises in activity class 1, classrooms in activity class 2A, and residences in activity class 3, satisfactory evacuation is expected to be able to take place through windows if each premises or residence is designed for the evacuation of a maximum of 50 persons. Each window intended for evacuation should be counted as an evacuation route for a maximum of 30 persons.

Evacuation from a window with the aid of the rescue service may be counted as one of the evacuation routes for buildings in activity classes 1 or 3, provided that a maximum of 15 persons evacuate using this route from the fire cell. This is assuming that the rescue service has a sufficiently quick response time and sufficient capability. A place dimensioned for the set-up of the rescue service's equipment shall be available. (BFS 2011:xx).

General recommendation

The possibility of evacuation with the aid of the rescue service should only be used in buildings where the bottom edge of the opening is a maximum of 23 m above ground level.

In the judgement of the rescue service's capability and the dimensioning of the set-up location, consideration should be taken of the factors that affect the possibility of being able to carry out evacuation efficiently.

Rules concerning the set-up location are found in section 5:721.

A sufficiently quick response time for the rescue service is normally a maximum of 10 minutes. For free-standing multi-residence buildings in activity class 3 with a maximum of three floors, a sufficiently quick response time may be 20 minutes. Sufficient capability refers to such staffing and equipment that evacuation can be carried out in a satisfactory manner.

Fire cells in premises in activity class 1 that are expected to be evacuated with the aid of the rescue service through a window should not be bigger than 200 m².

Residences in activity class 3 in buildings in class Br1 whose upper floor is only designed for evacuation through a window with the aid of the rescue service should be partitioned from the underlying floor in at least fire technical class E 30. Partitioning need not be carried out as a fire cell boundary. (BFS 2011:xx).

5:33 Design and passableness

5:331 Walking distance to the evacuation route

General recommendation

Walking distance to the nearest evacuation route or to another fire cell should not exceed the distances in Table 5.331. Distances to an evacuation route should be measured for the least favourable case. A walking route is

considered congruent provided it does not need to be branched off to lead to different evacuation routes.

In a space that is protected by an automatic extinguishing system, walking distances can be increased by one-third. In an assembly room in activity class 2C that is protected by an automatic water sprinkling plant, walking distance can be calculated as for assembly rooms in activity class 2B.

If evacuation takes place through a window, the permissible walking distance to the window shall be reduced to one-third.

In measuring walking distance to an evacuation route, the following shall be considered:

- The route should be measured by assuming that the changes in direction during movement are perpendicular, Figure 5.331a.
- If the walking route to two evacuation routes that are independent of each other are partially or entirely congruent, the common part shall be counted as 2 times the actual length. In residences in activity class 3, offices in activity class 1 and garages, however, the common part shall only be counted as 1.5 times the actual length. These factors do not apply to a single evacuation route.
- If stairs form part of the walking route to an evacuation route, the stairs are calculated as corresponding to a horizontal walking distance that is four times the difference in levels. This does not, however, apply to stairs on bleachers and gradines in an assembly room in activity class 2, where instead the actual walking distance in the gradient of the stairs is counted.

Table 5:331. Maximum walking distance to nearest evacuation route.

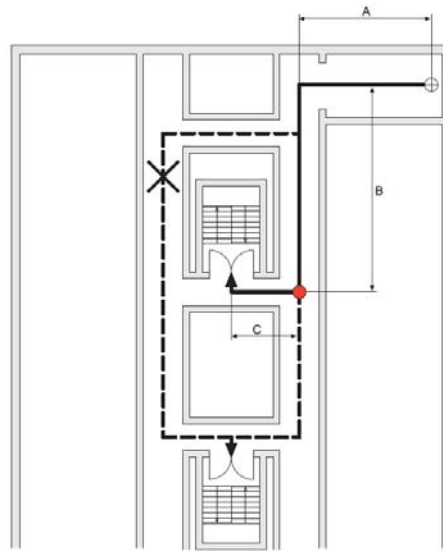
Preconditions	Example	Distance
If passableness and overview are good and fire load is a maximum of 250 MJ/m ² , at the same time that the risk of fire is small. Activity does not entail risk of too rapid dispersion of fire.	Certain premises within activity class 1 such as concrete goods factories, mechanical workshops, and breweries.	60 m
If the density of persons is low at the same time that persons affected mainly can be expected to possess good knowledge of the premises.	In garages and certain premises in activity class 1 such as office, storeroom, handicraft, and industrial buildings. Residences in activity class 3 and in activity class 5B.	45 m
If the density of persons is high or affected persons cannot be expected to evacuate by themselves or cannot be expected to have good knowledge of the premises, or if activity entails risk of quick dispersion of fire.	Premises in activity classes 2A and 2B. Certain premises in activity class 1 such as wooden or plastic goods factories and high storerooms in industry. Activity class 4. Premises in activity classes 5A, 5C, and 5D.	30 m
If there is a particular risk of the occurrence of fire or is great numbers of persons may be expected to be under	Premises in activity class 6. Assembly rooms in activity class 2C.	15 m

- = place where a person must choose an evacuation route
- ⊕ = starting point for longest walking distance

Walking distance G to nearest stairwell.
Calculation done for the least favourable case = solid line.

$$G = 2 * x (A + B) + C$$

- 1.5 for AC1, AC3, and garage



Example, calculation of walking distance.

Figure 5.331a-b. Calculation of walking distance to nearest evacuation route.

(BFS 2011:xx).

5:332 Walking distance within the evacuation route

Evacuation routes shall be designed such that the risk of persons becoming shut in by fire and combustion gases is limited. (BFS 2011:xx).

General recommendation

Walking distance within an evacuation route to,

1. the nearest stairs that lead to another floor or
2. an exit that leads to a safe location

should not exceed 30 m.

In evacuation routes where it is only possible to evacuate in one direction, walking distance should not exceed the distances indicated in Table 5.332.

In calculating walking distance within an evacuation route, no factor for congruent walking distance need be considered.

Table 5:332. Walking distance within certain evacuation routes

Activity	Maximum walking distance when evacuation is only possible in one direction
In stair halls, hallways or equivalent for activity classes 1, 2, and 3, 5B	10 m
In access balconies for activity classes 1 or 3, 5B in buildings with access balconies	15 m
In stair halls, hallways or equivalent for activity classes 4 or 5A and 5C	7 m
All activity classes if it is only possible to walk in one direction, e.g. when there are only doors in	30 m

each end of a hallway. (BFS 2011:xx).	
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5:333 Dimensioning number of persons

General recommendation

The dimensioning of evacuation routes and routes to evacuation routes should be based on the maximum number of persons that may be expected to occupy the premises. The distribution of the persons in the premises and how this may vary should be considered. Data from Table 5.333 can be used to dimension the density of persons.

Table 5:333. Dimensioning density of persons

Activity	Density of persons, persons/m ² net area
Activity class 1	
Office	0.1
Activity class 2	
Library*	0.1
Dancing hall	2.5
Classroom	0.5
Conference room*	0.7
Church	1.0
Shopping centre, department store, shop	0.5
Museum, art gallery	0.25
Pub, bar	3.0
Restaurant*	number of seats or 1.0
Assembly room for seated only but without fixed seats	1.7
Assembly room for standing and seated	2.5
Assembly room with fixed seats	number of seats

* For these activities, determination of the net can be done by subtracting the area for unfixed fittings. (BFS 2011:xx).

5:334 Design of evacuation routes

General recommendation

Evacuation routes should have a free width of at least 0.90 m. Railings and similar may encroach by a maximum of 0.10 m per side of the evacuation route. Evacuation routes should have a free height of at least 2.00 m. Door openings should have a free width of at least 0.80 m.

When two or more evacuation routes open onto a common part inside the building, the evacuation route from the common space should have a width or equivalent capacity corresponding at least to the sum of the widths of the evacuation routes that open onto the common space. This applies providing that evacuation from the premises takes place at the same time and then requires higher capacity compared to if one room evacuates at a time.

The distance between a door and a stairs or ramp should be at least 0.8 m.

If each floor constitutes a fire cell of its own, the stairs that constitute the evacuation route should be dimensioned for the floor that requires the broadest evacuation route. If several floors will be using the evacuation

route at the same time, the width should be adapted such that the stairs can handle the greater number of persons.

Escalators should not form part of a route to an evacuation route or of an evacuation route.

Spiral stairs should not be used as an evacuation route from premises where persons have difficulty in walking on stairs, such as spaces in activity class 5B and 5C. Spiral stairs should furthermore not be used as an evacuation route from assembly rooms in activity class 2B and 2C.

Stairs with treads of grating should not be used for more than three floors.

Rules for the design of communication spaces and ramps are found in section 3:142.

In premises for a greater number of persons, measure shall be taken such that high density of persons is avoided at the exit. (*BFS 2011:xx*).

General recommendation

Evacuation routes that serve more than 150 persons should have a free width of at least 1.20 m. The door leaf should encroach on the width of the door no more than 0.05 m. The total free width of all evacuation routes should be at least 1.00 m per 150 persons. If one of the evacuation routes is blocked, the other ones should have such a width that 1.00 m corresponds to 300 persons.

Assembly rooms in activity classes 2B and 2C should have at least three evacuation routes if they are untended for more than 600 persons and at least four if they are intended for more than 1000 persons.

5:335 Doors

Doors that will be used for evacuation shall open outwards in the direction of evacuation and be easy to identify as exits. Doors opening inwards may only be used if the formation of queues cannot be expected to occur in front of the door. Other variants of doors may be used if they can provide corresponding safety as side-hung doors. (*BFS 2011:xx*).

General recommendation

The doors should be placed such that they when open do not hinder evacuation for other persons.

The formation of queues is not expected to occur in

- residences in activity class 3 and residential rooms in activity class 4,
- premises for a maximum of 30 persons where the persons have knowledge of the surroundings, e.g. classrooms in activity class 2A, smaller offices and engineering industry in activity class 1 and entrance doors in residential buildings in activity class 3,
- premises for a maximum of 30 persons where the persons cannot be expected to have knowledge of the surroundings and walking distance to the evacuation route is a maximum of 15 m, e.g. conference rooms in activity class 1 or 2A, shops, banks, and dining premises in activity class 2A.

Automatically controlled horizontal or vertical sliding doors can be used if they also open in the event of the interruption of power or if they can be opened by pushing the door leaves outwards.

A manual horizontal sliding door can be used in the same situations as a door that opens inwards. In cases where the door requires any kind of mechanical assistance to be operated, this function must also work in the event of an interruption of power.

Rotating doors can be used if free passage with a minimum width in accordance with 5:334 can be achieved through automatic opening in the event of the interruption of power or if it is possible to open the door by pushing the door leaves outwards.

Doors that are to be used for evacuation shall be easy to open and pass through. Exceptions are given for spaces in activity 5D.

General recommendation

Doors should open without any greater previous knowledge of how this is to be done. If needed, it should be made clearly apparent how the door can be opened. Locked doors with delayed opening should not be used.

Doors should be able to be opened using a lever handle that is pushed downwards or by the door being opened outwards. Fittings for opening should be placed with their centre between 0.80 and 1.20 m above the floor. The greatest force needed to open a door should be adapted to the type of opening device used.

- For lever handles, the vertical force should be less than 70 N. This applies for example to lever handles designed in accordance with SS-EN 179. The force need to push the door open should be less than 150 N.

- For push pads, opening force should be less than 150 N. This applies for example for push pads designed in accordance with SS-EN 179.

- For larger opening devices, for example entire door leaves or panic evacuation fittings, a greater opening force can be accepted, but no greater than 220 N for the opening function and no greater than 150 N for the continued opening of the door. This applies for example to panic evacuation fittings designed in accordance with SS-EN 1125.

Knobs can be used to unlock an otherwise locked door in premises for a maximum of 50 persons. Knobs that are used to also open the door (and also control the fall of the lever) should be avoided, as these are difficult to use. If a cap that covers the knob is used, the cap should be designed such that it can easily be forced by hand.

In some activities, in addition to activity class 2B and 2C, buttons for electrical opening can be used. In such cases, the button should be placed beside the door's normal lever handle and be so big that it can be immediately identified as an opening button. The opening button should be placed with its centre between 0.80 and 1.20 m above the floor. The opening button should be clearly marked with a sign that is at least 0.10 m x 0.15 m and is lit when persons are expected to use the door, i.e. also in the event of evacuation. The sign should display a suitable figure, e.g. a stylised key, and the text "Emergency opening" or similar. The door should be able to be opened also in the event of an interruption of power.

Sliding doors should not be opened only using an electrical push button.

Locked doors that only open with a signal from an automatic fire alarm should not be used, since evacuation may become necessary for a reason other than fire.

Premises, for example in activity classes 1 and 2, where doors intended for evacuation are kept locked at certain times, can have electrical control of all doors being unlocked during the time that person occupy the premises. In order for satisfactory evacuation to be able to take place, this control should be coordinated with some function that is important to operation, for example the main lighting. Interruption of power or other faults should not disable this control.

Doors in evacuation routes that serve spaces in activity class 4, 5A, and 5C should be equipped with devices that make it possible for persons to return after passing through. This does not apply to guest rooms in activity class 4. This possibility should also exist when the evacuation route is

reached through a passageway to an evacuation route in other premises and for doors within an evacuation route. Doors that lead to a safe location in the out-of-doors need not be equipped with such a device.

Rules on protection against slipping and tripping are found in section 8:22.

Rules on available and usable doors are found in section 3:143.
(BFS 2011:xx).

Doors that are to be used for evacuation and that can only be opened with a key can be used in spaces in activity classes 1 and 3 if the doors serve a small number of persons that may be expected to have access to the key. (BFS 2011:xx).

General recommendation

A small number of persons refers to a maximum of ten persons.
(BFS 2011:xx).

5:336 Evacuation site

Public premises that are to be available and usable in accordance with section 3:1 to persons with impaired capability of movement or orientation shall be equipped with at least two independent evacuation sites. If the premises have more than one floor, there shall be at least one evacuation site for each floor. If the premises in accordance with section 5:322 only have a single evacuation route, the premises may be designed with one evacuation site. The evacuation site shall be located in an adjacent fire cell and be connected to or located in an evacuation route. There should be room for at least one outdoor wheelchair that occupies an area of 1.30 m x 0.70 m in the evacuation site.

An evacuation route that is available and usable and that leads horizontally to a safe location need not be equipped with an evacuation site.

Public premises that are equipped with automatic extinguishing systems need not be equipped with evacuation sites.

Further requirements are indicated in section 5:352. (BFS 2011:xx).

General recommendation

Rules on evacuation sites are also published by the Swedish Work Environment Authority.

5:337 Lifts

General recommendation

Rules on lifts and other lifting devices are found in section 3:144 and in the regulations and general recommendations of the National Board of Housing, Building, and Planning on lifts and certain other motorised devices (BFS 1994:25).

Rules on evacuation lifts are found in the National Board of Housing, Building, and Planning's general recommendation 2010:XX, Guide to analytical dimensioning of construction technical fire protection.
(BFS 2011:xx).

5:34 Fire technical installations

5:341 Guide markings

Guide markings refer to signs or similar that during evacuation provide guidance so that evacuation is not hindered by difficulties in being oriented in the building.

There shall be guide markings in spaces in which orientation is difficult. Requirements on guide markings are also found in sections 5:351, 5:352, 5:354, and 5:357. Where requirements on guide markings exist, the lighting or backlighting of guide markings shall have a secured supply of power corresponding to emergency lighting in accordance with section 5:343.

For the spaces where requirements on guide marking apply, there shall be signs or similar near the doors and windows that are intended for evacuation. Signs shall be designed as green disks with clear white symbols and be easy to notice.

(BFS 2011:xx).

General recommendation

Areas that are difficult to orientate oneself in may be larger premises where it is not apparent where the evacuation routes are located or that do not permit daylight to enter, e.g. garages bigger than 50 m² and cellars.

An example of when it is not apparent where the evacuation routes are located may be an office where the premises are designed with parallel hallways within the fire cell. Signs should be placed at changes in direction, bifurcations or similar, e.g. in stairs that continue past the floor where evacuation takes place to the out-of-doors. The signs should be placed such that a person only need move a short distance to see a sign, see Figure 5.341 a–c. Signs should be placed such that it is clear where the evacuation routes are, e.g. over a door opening or hanging from the ceiling

There should be signs in premises when evacuation takes place through another fire cell.

For signs to be noticeable, they should consist of green disks with clear white symbols that are lit or backlit. Signs should be lit or backlit both in normal cases and in the event of an interruption of power. Signs should be mounted in fittings together with the light source.

Signs should be of such a size and luminance that they are clearly visible from the location in question and under the lighting conditions in question and have guide markings designed in accordance with the Work Environment Authority's rules on signs.

The route to an evacuation site and an available and usable evacuation route that leads to a safe location should be complemented with guide markings that contain a symbol for persons with an impaired capacity for movement.

The height of the sign (the height of the green field) can be calculated using the following formula:

Height [m] = Viewing distance [m]/constant

It is assumed that the sign's width is greater than the height. The constant has the following values:

- Lit sign: 100
- Backlit sign: 200

The lowest height of a sign should be 0.10 m. In assembly rooms in activity classes 2B and 2C such as department stores and larger shops, the lowest sign height should be 0.20 m.

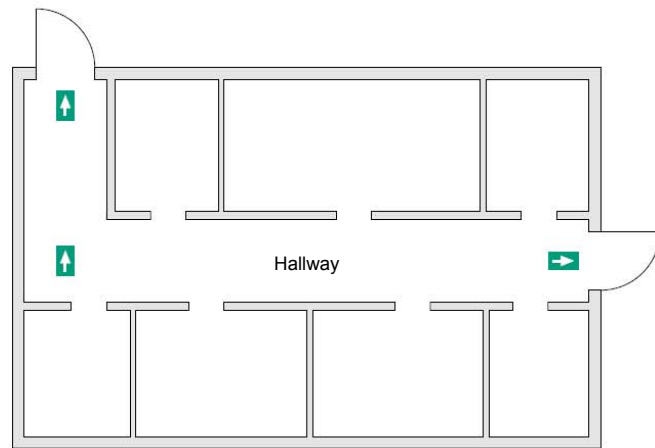
Luminance for a sign should be adapted such that the sign is clearly visible in the premises in which it is used. For backlit signs in premises such

as offices and schools, 80 cd/m² on the most poorly lit part of the white surfaces, approximately corresponding to at least 11 cd/m² on the most poorly lit part of the green surface, may serve as a starting point for judgement. The value applies if the illuminance in the room is between 500–1500 lux. Higher luminance may be motivated in premises that permit daylight to enter where illuminance may be higher. A guiding value may be that the contrast between the average luminance of the surroundings and the sign may be about 1:20 for well-lit premises.

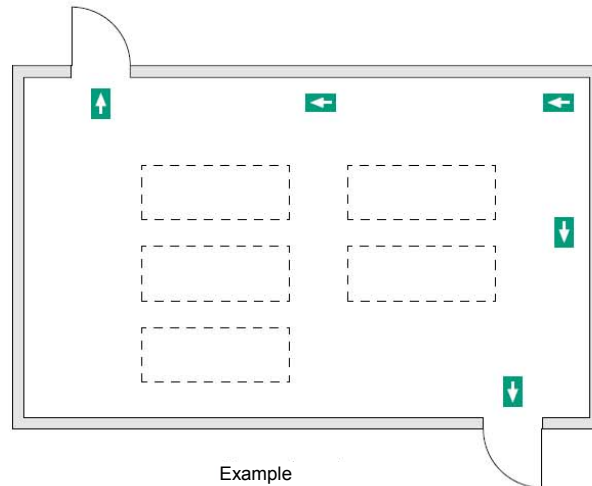
In darker parts of a building, lower luminance in the sign may nonetheless provide equivalent guidance. The luminance of signs can be lowered to a minimum of 2 cd/m² when the lighting in the premises is low, e.g. in a theatre or cinema during a performance. The limit value of 2 cd/m² applies to the most poorly lit part of the sign, normally on the green surface. Illuminance should return to the normal level when the evacuation alarm is activated and when the lighting in the premises is lit. The signs should otherwise follow the recommendation in SS-EN 1838 on evacuation signs.

Rules on the design of signage in workplaces are found at the Work Environment Authority.

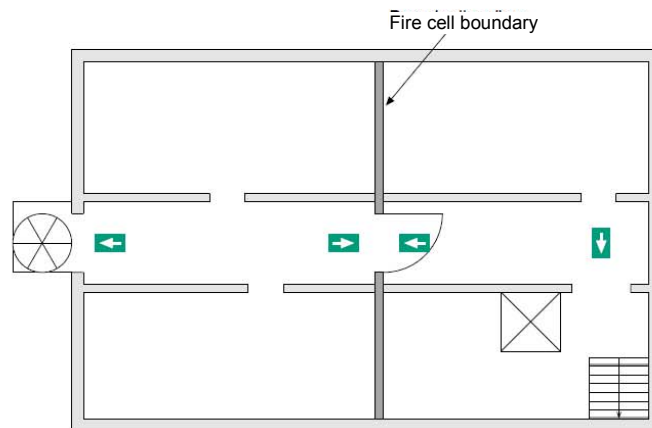
EU-ANMÄLÄ



Example hotel



Example department store



Example evacuation
via other fire cell

Figure 5.341 a–c. Examples of location of guide markings in offices and department stores.

(BFS 2011:xx).

5:342 General lighting

Evacuation routes shall be equipped with general lighting that functions with satisfactory reliability. (BFS 2011:xx).

General recommendation

In buildings with more than two floors, two light points in a row in stairwells and hallways should not go out due to the same reason. This can, for example, be addressed by connecting them to different group fuses and ground fault breakers.

Average illuminance should not be less than 100 lux in the evacuation route.

Electric cables for lighting in Tr1 or Tr2 stairwells with adjoining hallways and similar spaces should be protected against direct impact from fire for at least 30 minutes in those parts of the building that are served by the stairwell. (BFS 2011:xx).

5:343 Emergency lighting

In a building or part of a building where emergency lighting is prescribed, emergency lighting shall enable evacuation also in the event of interruption of power.

In the event of fire, emergency lighting shall fill its function in those parts of the building that are not immediately adjacent to the fire. In the event of interruption of power, emergency lighting shall provide the intended lighting for at least 60 minutes.

There shall be emergency lighting in all stairwells that are evacuation routes in buildings of more than eight floors.

Requirements on emergency lighting are also found in sections 5:352, 5:354, 5:356, and 5:357. (BFS 2011:xx).

General recommendation

Interruption of power also refers to an interruption caused by fire.

Emergency lighting can be designed in accordance with the recommendations for lighting of evacuation routes in SS-EN 1838.

Illuminance should not be lower than 1 lux along the centreline of the evacuation route. In order to reduce the risk for falling, illuminance in stairs should be at least 5 lux in the walking line.

Emergency lighting should attain 50 % of the required illuminance within 5 seconds and the required level of lighting within 60 seconds.

Electric cables for emergency lighting should be placed protected in fire technical class EI 30 or have equivalent fire resistance. Emergency lighting should not go out in other parts of the building than the fire cell where the fire is burning if the cables are affected by the fire. (BFS 2011:xx).

5:35 Special requirements for the different activity classes

5:351 Activity class 2A

Premises belonging to activity class 2A shall be equipped with guide markings. Smaller premises that offer an easy overview may be designed without the requirement of guide markings.

General recommendation

Premises can be designed without guide markings if walking distance to an evacuation route is no more than 15 m and the evacuation routes are visible from the main part of the premises.

5:352 Activity class 2B and 2C

Evacuation routes from assembly rooms shall be dimensioned for the maximum number of persons that may occupy the premises.
(BFS 2011:xx).

General recommendation

In assembly rooms or in antechambers to these, there should be signs that indicate the maximum number of persons that may occupy the premises at the same time.

In dimensioning evacuation sites, at least 1 % of the maximum number of persons should be assumed to be in need of using an evacuation site. The dimensioning of evacuation sites should be done such that these together can accommodate those persons that are in need of an evacuation site and with consideration taken to the fact that one of the evacuation sites might be blocked by fire.

Rules concerning accessible and usable doors are contained in section 3:143.

The seats in an assembly room should be arranged in rows in one or more bench fields so that evacuation can take place easily.

Rows of benches should not be wider than 40 seats if evacuation can take place in two directions, otherwise not wider than 10 seats. The free passage measurement in front of a row of benches should be at least 0.45 m. Chairs in an auditorium, theatre, cinema or equivalent should be fixed to the floor. (BFS 2011:xx).

It shall be possible to open doors in or to an evacuation route by pushing the door or with an easily operated lever handle. (BFS 2011:xx).

General recommendation

It should be possible to open doors for evacuation from assembly rooms by pushing outwards or by pushing a lever handle downward. It should be possible to perform this operation with one hand. The operation should also result in both door leaves opening if two-leaf doors are used. If both door leaves cannot be opened with such an operation, the passive half-door should be fitted with fittings in accordance with SS-EN 1125.

Doors for evacuation should be designed with a simple lever handle, e.g. a fitting in accordance with SS-EN 179. Doors in assembly rooms intended for more than 1000 persons should be designed with fittings in accordance with SS-EN 1125. (BFS 2011:xx).

Assembly rooms shall be equipped with devices for warning in the event of fire and, if needed, a device for the early detection of fire.

General recommendation

Assembly rooms should be equipped with evacuation alarms. Evacuation alarms in assembly rooms in activity class 2C should be activated by an automatic fire alarm and it should be possible for them to be activated manually. Assembly rooms in activity class 2B can be equipped with an only manually activated evacuation alarm.

Spoken messages should be used as evacuation alarms, since this normally gives quick initiation of evacuation from the building. Simpler evacuation alarms, e.g. bells or sirens, can be used in assembly rooms in

activity class 2B that are intended for a maximum of 300 persons or that contain a cinema hall, theatre, auditorium or equivalent.

In assembly rooms that can be expected to have weak or no lighting, lighting should be lit automatically on an evacuation alarm. In assembly rooms with a high volume of sound, music and similar should be turned off automatically on an evacuation alarm.

Assembly rooms shall be equipped with guide markings for evacuation.

Assembly rooms shall be equipped with general lighting and emergency lighting. Evacuation routes from assembly rooms shall be equipped with emergency lighting. Emergency lighting shall be installed immediately outside of exits to the out-of-doors.

Exterior evacuation routes from assembly rooms shall be lighted in their entire length and equipped with emergency lighting.

General recommendation

Stairs in the assembly room should also have emergency lighting.

Illuminance shall correspond to at least 5 lux in stairs. (BFS 2011:xx).

5:353 Activity class 3

Residences in activity class 3 shall be equipped with devices for early detection and warning in the event of fire. It shall be possible to be perceived in those spaces occupied by persons more than temporarily.

It shall be possible to evacuate residential rooms in activity class 3 in buildings in activity class Br2 or Br3 without the aid of the rescue service. (BFS 2011:xx).

General recommendation

Devices for early detection and warning in the event of fire should consist of smoke detectors.

Evacuation routes from residential rooms referred to in the first paragraph of the regulation can be arranged according to one of the following alternatives:

- a) Exit to an evacuation route, e.g. stairs outside the residence.
- b) Exit directly to a safe location or to an outside stairs or fixed ladder designed in accordance with SS831340 that leads to a safe location.
- c) Windows that can be opened, with the bottom edge of the opening no higher than 5.0 m above ground level.
- d) Through another adjacent room on the same floor that complies with that which is indicated in a), b) or c) in the first paragraph. Alternative d) only applies if the adjacent room is separate from or can easily be partitioned from the underlying floor. (BFS 2011:xx).

5:354 Activity class 4

Spaces in activity class 4 shall be equipped with devices for early detection and warning in the event of fire. (BFS 2011:xx).

General recommendation

In buildings of several floors that are intended for at least nine guests or with at least five guest rooms, spaces in activity class 4 should be equipped with evacuation alarms that can be activated manually and with automatic fire alarms. There should be alarm buttons on every floor that are located in easily accessible places and in the reception area.

Buildings of one floor that have an exit directly to the out-of-doors from each guest room should be equipped with smoke detectors and manually activated evacuation alarms.

Buildings intended for fewer than nine guests and fewer than five guest rooms should be equipped with smoke detectors. Smoke detectors should be placed in each guest room. (BFS 2011:xx).

Spaces in activity class 4 shall be equipped with guide markings for evacuation. Evacuation routes shall be equipped with emergency lighting. There shall be notices with an evacuation plan in each guest room. (BFS 2011:xx).

General recommendation

The evacuation plan should be placed directly adjacent to a door to an evacuation route. The evacuation plan should describe the meaning and nature of the evacuation alarm, what the hotel guest is expected to do and be complemented by a drawing that shows the building's evacuation routes. In buildings with at least nine guests or with at least five guest rooms, evacuation plans should be designed in accordance with SS 2875. (BFS 2011:xx).

5:355 Activity class 5A

Spaces in activity class 5A shall be equipped with devices for early detection and warning in the event of fire.

General recommendation

Devices for early detection and warning in the event of fire can consist of smoke detectors. Smoke detectors should be placed such that they cover the entire activity. Each smoke detector can be expected to have a coverage area of a maximum of 60 m². (BFS 2011:xx).

5:356 Activity class 5B

Spaces in activity class 5B shall be equipped with devices for early detection and warning in the event of fire.

The evacuation routes from spaces in activity class 5B shall be equipped with emergency lighting. (BFS 2011:xx).

General recommendation

Devices for early detection and warning in the event of fire should consist of evacuation alarms that can be activated manually and by automatic fire alarms. The evacuation alarm should otherwise be adapted to the conditions for staff intervention and the residents' health. This may e.g. involve the use of vibration alarms, light signals or sirens adapted for persons with impaired hearing. (BFS 2011:xx).

5:357 Activity class 5C

Spaces in activity class 5C shall be equipped with devices for early detection in the event of fire.

Routes to evacuation routes may pass through an adjacent fire cell. It shall be possible for passage between fire cells to take place without combustion gases spreading to the part not exposed to fire.

The evacuation routes from spaces in activity class 5C shall be equipped with emergency lighting.

There shall be guide markings in buildings in activity class 5C. (BFS 2011:xx).

General recommendation

Devices for early detection in the event of fire should consist of smoke detectors.

There should be an air lock to enable passage between fire cells.
(BFS 2011:xx).

5:358 Separate meeting rooms, etc.

General recommendation

In a room in activity class 1, 2A, 2B, and 5C where persons may stay behind closed doors that is located such that an evacuation route only can be reached by passing through a hallway or other space there is a risk of being shut in in the event of fire. To meet the requirement on satisfactory evacuation, evacuation alarms that are activated by an automatic fire alarm should be installed if:

- the rooms accommodates more than 30 persons or
- the room accommodates more than ten persons and walking distance to the nearest evacuation route is over 10 m.

The requirement does not apply to spaces occupied only temporarily.

5:4 Protection against the occurrence of fire

5:41 General

Buildings and fixed installations shall be designed with satisfactory protection against the occurrence of fire.

The surface temperature of nearby building parts and fixed fittings of combustible material may not be so high that the material can ignite.
(BFS 2011:xx).

General recommendation

Satisfactory protection against the occurrence of fire can be achieved by high temperature, heat radiation, and spark formation not causing ignition in nearby building parts or fixed fittings.

Building parts and fixed fittings should be designed such that the properties that are necessary are not consumed or deteriorate with regard to the temperature to which they may be expected to be exposed. Examples of such properties may be partitioning capability or protection against ignition.

The requirement in the second paragraph of the regulation is met if the temperature on the surface of nearby building parts and fixed fittings of combustible material does not exceed 85°C. Other temperatures can be used if the material's properties are well-known and documented.

In design, consideration should be taken to the fact that the temperature can rise during lengthy, continuous operation or if the fixed installation is built in. When installation parts are upholstered, material that may attain temperatures in excess of 85°C if built in should be material that is at least A2-s1,d0.

Fixed electrical installations are regulated by the Swedish National Electrical Safety Board. (BFS 2011:xx).

5:42 Heating devices, etc.

5:421 General

Heating devices shall, in addition to that to which is referred in section 5:41, be designed such that protection against other hazards is limited. (BFS 2011:xx).

General recommendation

Examples of heating devices may be fireplaces, stoves, sauna heaters, heating panels, and similar.

Other hazards refers to chimney fire, incomplete combustion, and flue gas leakage from fireplaces, stoking devices, heating installations, and flue and exhaust gas ducts. (BFS 2011:xx).

A fireplace connected to a chimney or a flue or exhaust gas duct shall be designed such that the system constitutes a fireproof, well-functioning whole.

General recommendation

The choice of chimney and duct should be made with consideration taken to the fireplace's properties, such as the temperature of flue and exhaust gases. Consideration should also be taken to the effect of continuous firing during a long period, which can affect the resistant properties of the duct.

Rules concerning emission to the surroundings are found in Section 6:7.

5:422 Fireplaces

5:4221 General

General recommendation

Fireplaces and connecting ducts can meet the requirement in accordance with section 5:41, protection against the effect of heat, by having the requisite protective distance, protection against radiation or a combination of both.

Fireplaces should be supplied with sufficient combustion air such that combustion does not occur with an uncontrolled air deficiency.

What the requisite protective distance is depends, among other things, on the size of the radiating surface, temperature, and emissivity. The requisite distance can be calculated as follows:

1. For an uninsulated fireplace that does not have a water jacket or for an uninsulated flue and exhaust gas duct, the requisite protective distance to combustible building parts is set to 0.5 m.
2. Combustible building parts can be protected by radiation protection of material of at least fire technical class A2-s1,d0 and by sufficient extension vertically and laterally and placed with a distance to combustible building parts or to the fireplace.
3. For fireplaces, depending on type, the requisite distance can be verified using SS-EN 13229 or SS-EN 13240.

Guidance for the verification of chimneys is provided in SS-EN 15287-1 or SS-EN 15287-2.(BFS 2011:xx).

5:4222 Loads

Fireplaces and connecting ducts shall possess sufficient strength to withstand the loads that occur. Fireplaces, stoking devices, and similar shall be placed on surfaces with sufficient bearing capacity. The foundation and surface shall be designed such that the downward

dispersion of fire is limited and untightness due to settling does not occur in connected ducts and piping. (BFS 2011:xx).

General recommendation

The surface of fireplaces should be designed in at least fire technical class R60 except in single-family houses. In single-family houses, the surface should be designed in at least fire technical class R15. (BFS 2011:xx).

5:4223 Fireplace floor

Fireplaces for burning solid or liquid fuel shall be equipped with protection against the downward dispersion of fire such that ignition of the floor cannot take place due to spilling, embers or sparks. (BFS 2011:xx).

General recommendation

Protection against the downward dispersion of fire is provided if the floor covering or the fireplace floor is constructed in at least fire technical class A2-s1,d0.

If there is free space under the fireplace or the bottom of the fireplace, the fireplace floor should also include this space.

The fireplace floor for furnaces fuelled with solid fuel should be at least 2 m in front of the side with the fireplace opening and at least 1 m outside of the other parts. In the case of smaller, closed fireplaces, the fireplace floor should extend at least 0.3 m in front of the fireplace and to at least 0.1 m on each side of the fireplace or have an addition of at least 0.2 m on each side of the opening. For larger closed fireplaces (for example tile stoves), lateral extension can however be limited to the width of the fireplace opening with an addition of at least 0.2 m on each side of the opening. For open fireplaces, the fireplace floor should be arranged such that the horizontal distance from the hearth's centre to unprotected combustible floor is at least 1.0 m. From a larger open hearth, the fireplace floor should also extend at least 0.3 m in front of the fireplace. If the bottom of the fireplace is higher than 0.4 m above the floor, the distance should be increased by half of the projecting height measurement.

The fireplace floor for the fireplace in premises in spaces in activity class 3 can consist of 0.7 mm steel plate. For such part of a fireplace floor that lies under the fireplace, sheet metal may only be used if there is an at least 50 mm free, ventilated space between the fireplace and the fireplace floor and if temperature conditions otherwise permit.

For other activities, the fireplace floor can consist of at least 50 mm concrete, brick or other material that meets the requirement on A2-s1,d0 and partitioning function EI 30. (BFS 2011:xx).

5:423 Ash space

In other buildings than single-family houses, there shall be a space for the storing of soot and ash adjacent to a separate boiler room with a fireplace for burning solid or liquid fuel, where ash can be stored in a safe manner. Safe manner refers to the space being separate, so that ash or other glowing material cannot ignite or pyrolise in or next to the ash storage. (BFS 2011:xx).

General recommendation

The space can consist of a separate room or a space out-of-doors.

The space should be dimensioned such that ash may be expected to have temperatures of up to 200°C and an energy content equivalent to 4 MJ/kg.

The space can meet the requirements of the regulation through partitioning in fire technical class EI 15, with doors in at least fire technical

class EI 15-C. The material in the partition shall be in at least class A2-s1,d0. (BFS 2011:xx).

5:424 Stoking devices

A stoking device shall be constructed with satisfactory safety with regard to fire and against the dispersion of fire to fuel storage. (BFS 2011:xx).

General recommendation

The stoking device should be equipped with at least two mutually independent systems for protection against the backward dispersion of fire through the stoking device to the fuel storage. (BFS 2011:xx).

5:425 Chimneys

5:4251 General

Chimneys and flue and exhaust gas ducts shall be placed and designed such that nearby building parts and fixed installations cannot be ignited.

Chimneys and flue and exhaust gas ducts, including insulation and the surrounding shaft, may not have an exterior temperature exceeding 100°C when the connected device is operated at the highest power. (BFS 2011:xx).

General recommendation

The design of chimneys can be verified in accordance with SS-EN 1443 and SS-EN 15287-1 or SS-EN 15287-2. (BFS 2011:xx).

Flue and exhaust gas ducts shall be designed with consideration taken to throughput. The cross-sectional area of a duct that functions through natural draught shall be designed with consideration taken to the fireplace to which the duct connects, the fireplace's heating capacity, the fuel that will be used, and the height of the duct. (BFS 2011:xx).

General recommendation

The cross-section of a flue and exhaust gas duct for a fireplace can be calculated in accordance with SS-EN 13384-1.

Verification can be done through the series of standards SS-EN 13384-1, SS-EN 13384-2 or SS-EN 13384-3. (BFS 2011:xx).

5:4252 Loads

In design, consideration shall be taken to the chimney's dead weight, outer load, and temperature impact on the properties of the building materials. (BFS 2011:xx).

General recommendation

Outer load on the chimney may be caused by wind and snow load and dynamic load from wind. Consideration can be taken to wind impact at a load of 1.5 kN/m². (BFS 2011:xx).

5:4254 Height

Chimneys and flue and exhaust gas ducts shall be such a height that the risk of fire is limited. Design shall be carried out with consideration taken to connected fireplaces, stoking devices, and type of fuel. (BFS 2011:xx).

General recommendation

Rules on the height of chimneys are also found in section 6:743. (BFS 2011:xx).

5:4255 Vertical orientation

The deviation of chimneys and flue and exhaust gas ducts from a vertical orientation may not affect fire safety or the function of the chimney. (BFS 2011:xx).

General recommendation

Flue and exhaust gas ducts should be designed such that consideration is taken to the effect of heat movements. (BFS 2011:xx).

5:4256 Materials' properties and resistance

Walls in chimneys and flue and exhaust gas ducts shall be designed such that their function is not impaired. Consideration shall in particular be taken to temperature variations, impact of the climate, corrosive flue gases, moisture, and the use of chimney-sweeping tools.

Insert pipes shall be designed such that the pipe or adjacent building parts are not damaged. (BFS 2011:xx).

General recommendation

Suitable material qualities are indicated in SS-EN 15287-1, Annexes A, D, and E and SS-EN 15287-2, Annexes A, D, and E. If an insert pipe is mounted in the duct, this should be done in its entire length.

Consideration shall be taken to the risk of moisture and corrosion in a duct with regard to fuel and flue gas temperature. In corrosive conditions, corrosion-resistant materials should be used. Corrosive conditions involve, for example, flue gas temperature in the flue being lower than the acid dew point and the fuel having a sulphur content of over 0.1 % or containing chlorides.

Chimneys and flue and exhaust gas ducts should be frost-resistant. (BFS 2011:xx).

5:4257 Tightness

Chimneys and flue and exhaust gas ducts shall be so tight that the danger of fire, the risk of poisoning, and other nuisances do not occur. (BFS 2011:xx).

General recommendation

Tightness can be checked by leakage measurement or smoke pressure testing.

Tightness can be achieved through construction in accordance with the gas tightness classes in Table 5 in SS-EN 1443, section 6.4.1. Calculation of air leakage is done using the duct's inner surface. The tightness of joints can be achieved using temperature-resistant seals that are durable over time.

Smoke pressure testing should also be performed so that tightness for the entire chimney and flue and exhaust gas duct is examined. (BFS 2011:xx).

5:4258 Chimney fires

Flue and exhaust gas ducts that are connected to fireplaces intended for soot-generating fuels shall be designed with satisfactory protection against the development of fire due to chimney fires. (BFS 2011:xx).

General recommendation

The requirement can be met using flue and exhaust gas ducts that retain their properties after a chimney fire or by enclosing flue and exhaust gas ducts in a chimney shaft. Doors, connections, and other installations that form part of the duct are also subject to the requirement.

Flue and exhaust gas ducts in fire technical class G(x) with requisite protective distance x to combustible material can be designed without a chimney shaft. The tightness of the chimney after chimney fire testing should meet the requirements on tightness in accordance with 5:4257.

The chimney shaft should be designed in material that does not itself contribute to the development of a fire and that retains a fire technically partitioning function with respect to other spaces. Chimney shafts that enclose flue and exhaust gas ducts can be designed in materials of A2-s1,d0 and with shaft walls in at least fire technical class EI 15. Chimney shafts constructed this way meet the requirement on protection against chimney fires.

Rules on protection against burn injuries are found in section 8:4.
(BFS 2011:xx).

5:426 Connection to flue and exhaust gas duct

Exhaust gases and flue gases from fixed installations shall not give rise to an increased risk of fire, increased risk of poisoning or other nuisances.

Exhaust gases shall be led through exhaust a gas duct or a flue gas duct. Flue gases shall be led through a flue gas duct.

Fixed installations for gaseous or liquid fuel with a nominal output of 12 kW need not be connected to an exhaust gas duct or a flue gas duct if it is installed in a space whose volume is greater than 7 m³, where ventilation is adequate and where combustion does not give rise to increased risk of fire, increased risk of poisoning or other nuisances. (BFS 2011:xx).

General recommendation

Fixed installations refers, for example, to heating devices and stoves.

Fireplaces for solid or liquid fuel should be connected to a flue gas duct. Fireplaces intended for gas should be connected to an exhaust gas duct.

The function of flue and exhaust gas ducts can be calculated and verified in accordance with SS-EN 13384-1. Gas devices should be connected to an exhaust gas duct if combustion intentionally takes place with an air deficit or a sooty flame.

Whether combustion gives rise to increased risk of fire or increased risk of poisoning depends on the amount of combustion products and their properties.

Rules on air are also found in section 6:2. (BFS 2011:xx).

Flue and exhaust gas ducts that are connected to more than one fireplace shall be designed such that the risk of fire and other nuisances does not increase. (BFS 2011:xx).

General recommendation

If several fireplaces are connected to the same duct, consideration should be taken of the risks of condensation, the dispersion of fire, smoking from a fireplace that is not used, and the function of the fireplaces when used simultaneously. This also applies to exhaust gas ducts from fuel-driven motors. The function of flue and exhaust gas ducts that are connected to more than one fireplace can be calculated and verified in accordance with SS-EN 13384-2.

Fireplaces in the same boiler room can be connected to the same duct with the same limitations as apply for the duct with regard to maximum temperature, nominal output, and whether flue gases can be led out of the building in a reliable way. (BFS 2011:xx).

5:427 Separate boiler room

General recommendation:

A boiler or several boilers for solid or liquid fuel, whose aggregate nominal output exceeds 60 kW should be installed in a separate boiler room. A separate boiler room should only be connected by way of an air lock with evacuation routes from residences in activity class 3 and offices in activity class 1 that do not comprise an integrated part of industrial activities or similar. (BFS 2011:xx).

5:428 Cleaning out and inspection

Fireplaces and flue and exhaust gas ducts shall be accessible for cleaning out, checking, and inspection without difficulty. Clean-out doors shall be designed in materials that do not ignite and that withstand temperature variations and corrosion. (BFS 2011:xx).

General recommendation

It should be possible to clean out combustion chambers, ash rooms, connection ducts, and flue and exhaust gas ducts with normal chimney-sweeping tools.

Clean-out doors should close tightly and be designed in materials in at least class A2-s1,d0. As needed, clean-out doors should be bolted in order to avoid that they open in the event of overpressure in the duct.

There should be no clean-out doors in spaces occupied by persons more than temporarily or in garages. If clean-out doors are placed in spaces occupied by persons more than temporarily or where explosive gases may form, consideration should be taken to tightness, surface temperature, protection against involuntary opening and child safety.

Rules on operational spaces are also found in section 3:4. (BFS 2011:xx).

5:43 Cooking devices

Stoves and other cooking devices shall be placed such that satisfactory protection against the occurrence of fire is achieved. (BFS 2011:xx).

General recommendation

Satisfactory protection against the occurrence of fire can be achieved through a vertical protective distance from the top of an electrical stove to combustible material or a stove fan that is at least 0.5 m. For gas stoves, the distance should, however, be at least 0.65 m. (BFS 2011:xx).

5:44 Garages

Garages shall be designed such that the risk of fire or explosion due to the occurrence of combustible or explosive gases is limited (BFS 2011:xx).

General recommendation

Heating in garages shall not be done with an open flame, an open incandescent spiral or any other device that can cause fire or an explosion.

Clean-out doors in garages should be designed such that they are tight and the temperature of the doors is limited. (BFS 2011:xx).

5:5 Protection against the development and dispersion of fire and combustion gas within buildings

5:51 General

General recommendation

Fire classified surface layers and coverings, division in fire cells, fire sectioning, and fire technical installations are examples of protective measures that may limit the development and dispersion of fire and combustion gas within a building. (*BFS 2011:xx*).

5:52 Materials, surface layers, and coverings

5:521 Walls, roofs, floors, and fittings

Materials in roofs, walls, floors, and fittings shall have such properties or form part of building parts in such a way that they:

- are difficult to ignite,
- do not contribute to the rapid dispersion of fire,
- do not rapidly develop great amounts of heat or combustion gas,
- are not deformed by minor impact of fire so that danger may arise,
- do not fall down or are otherwise changed so that the risk of personal injury increases,
- do not melt and drip outside of the immediate vicinity of the seat of the fire.

The level of requirement on materials depends on the amount of heat and combustion gas that can be allowed to develop in the building. (*BFS 2011:xx*).

General recommendation

Materials with a lower fire technical class than D-s2,d0 should be protected against fire impact during the initial phase of the fire such that protection against fire corresponding to that of surface layers in fire technical class D-s2,d0 is achieved. In residences in activity class 3 and premises in activity classes 4 and 5, such materials in building parts should be protected by a covering in fire technical class K₂10/B-s1. Examples of materials that should be protected are combustible insulation, board material or similar in a lower fire technical class than D-s2,d0.

Except for evacuation routes and special premises in accordance with 5:522 and 5:523, the following surface layers should be chosen:

- In buildings in building class Br1, roof surfaces should have surface layers of fire technical class B-s1,d0, attached to materials of A2-s1,d0 or on covering in fire technical class K₂10/B-s1,d0. Wall surfaces should have a surface layer of at least fire technical class C-s2,d0.
- In buildings in building class Br2, roof surfaces should have surface layers of at least fire technical class C-s2,d0, attached to materials of A2-s1,d0 or on covering in fire technical class K₂10/B-s1,d0. Wall surfaces should have a surface layer of at least fire technical class D-s2,d0.
- In buildings in building class Br, roof and wall surfaces should have surface layers of at least fire technical class D-s2,d0.
- In tent buildings with a single layer of fabric material, roof and wall surfaces should have surface layers of at least fire technical class E.

For smaller building parts, surface layers can be designed in a lower fire technical class, but not lower than fire technical class D-s2,d0. Smaller building parts are such building parts whose total enclosed area is less than 20 % of the connected roof or wall. Examples of such smaller building parts may be door leaves, door and window frames, ceiling and floor mouldings, and beams. This does not, however, apply to pipe insulation.

The same applies to rooms in cases where the surface layer does not affect evacuation safety in the building. The same applies to pipe insulation in such rooms. These may be smaller rooms of a maximum of 15 m², for example hygiene rooms or saunas. Lift cages can be designed with a surface layer in fire technical class D-s2,d0 if the lift shaft is placed in a fire cell of its own. (BFS 2011:xx).

5:522 Walls and roofs in evacuation routes

In evacuation routes, walls and roofs shall be designed such that the development of a fire in the premises is not significantly contributed to by the roofs' and walls' surface layer. (BFS 2011:xx).

General recommendation

In buildings in class Br1 and Br2, roof surfaces and interior wall surfaces in evacuation routes should have surface layers of at least fire technical class B-s1,d0. The surface layer should be attached to material in fire technical class A2-s1,d0 or on covering in at least fire technical class K₂10/B-s1,d0.

In buildings in class Br3, roof surfaces and interior wall surfaces should have surface layers according to the following:

- a) Evacuation routes in activity class 4 and 5C should have surface layers of class B-s1,d0 on roof surfaces and at least class C-s2,d0 on interior wall surfaces. The surface layer should be attached to material of A2-s1,d0 or on covering in class K₂10/B-s1,d0.
- b) Evacuation routes that are common to two or more residential flats or offices should have surface layers of class B-s1,d0 on roof surfaces and of at least class C-s2,d0 on interior wall surfaces.
- c) Evacuation routes from premises in activity class 6 should have roof and wall surfaces with surface layers of class B-s1,d0 attached to material of A2-s1,d0 or on covering in class K₂10/B-s1,d0. (BFS 2011:xx).

5:523 Special premises

Roofs and walls in

- assembly rooms in activity classes 2B and 2C,
- premises in activity class 5C,
- premises in activity class 6,
- separate boiler rooms,
- fire safety locks,
- garages and
- large-scale kitchens

shall be designed such that their surface layers only will contribute negligibly to the development of a fire. (BFS 2011:xx).

General recommendation

Roof and wall surfaces should have surface layers of at least class B-s1,d0. The surface layer should be attached to material in class A2-s1,d0 or on covering in at least class K₂10/B-s1,d0.

Interior wall surfaces in spaces in activity class 5C and large-scale kitchens can be designed with surface layers of class C-s2,d0 attached to material of A2-s1,d0 or covering in class K₂10/B-s1,d0. Interior roof

surfaces should have surface layers of class B-s1,d0 attached to material of A2-s1,d0 or covering in class K₂10/B-s1,d0. (BFS 2011:xx).

5:524 Floor coverings

The floor covering in

- evacuation routes in buildings in class Br1,
- evacuation routes from assembly rooms in activity class 2B and 2C,
- fire safety locks

shall be constructed with material with a limited tendency to disperse fire and develop combustion gases. (BFS 2011:xx).

General recommendation

Floor coverings should be designed in at least class C_{fl}-s1. (BFS 2011:xx).

The floor covering in

- assembly rooms in activity class 2B and 2C,
- premises in activity class 6 and

shall be constructed with material with a moderate tendency to disperse fire and develop combustion gases.

General recommendation

Floor coverings should be designed in at least class D_{fl}-s1. (BFS 2011:xx).

Floor coverings in separate boiler rooms shall be made from material that cannot ignite. (BFS 2011:xx).

General recommendation

Floor coverings in separate boiler rooms should be designed in at least class A1_{fl}. (BFS 2011:xx).

5:525 Pipe insulation

General recommendation

If the total exposed enclosed area in pipe installations is more than 20 % of the adjacent wall or roof surface, the pipe insulation should meet class A2_L-s1,d0 or the requirement on surface layers for adjacent surfaces of walls, the roof, and the floor.

If the total exposed enclosed area of the pipe installations is less than 20 % of the adjacent wall or roof surface, the pipe insulation should meet at least the following classes:

- B_L-s1,d0 where surrounding surfaces have the requirement of B-s1,d0.
- C_L-s3,d0 where surrounding surfaces have the requirement of C-s2,d0.
- D_L-s3,d0 where surrounding surfaces have the requirement of D-s2,d0. (BFS 2011:xx).

5:526 Air treatment installations

General recommendation

Material in air treatment installations should be of class A2-s1,d0. For the following system parts, a lower fire technical class is accepted:

Table 5:526. Properties for air treatment installations

Minor details such as filter material, seals, fan belts, and electrical installations.	No requirement (class F)
Ducts in single-residence houses	Class E
Ducts, except kitchen flues, in other	Corresponding requirement on

buildings than single-residence houses.	surface layers as applies to the connecting wall or roof surface. Exception applies for both inside and outside of the duct.
Ducts in shafts and machinery rooms if these can be designed such that fire cannot be dispersed to or from shafts or machinery rooms during the time corresponding to the fire resistance for fire cell boundaries in the building in question.	Class E
Ducts in outdoor air devices in outer walls within the room with which the outer wall bounds.	No requirement (class F)
Air devices except stove hoods in large-scale kitchens.	Class E
Outdoor air devices and transmitted air devices in residences.	No requirement (class F)

5:53 Division into fire cells

Buildings shall be divided into fire cells to such an extent that sufficient time for evacuation is provided and that the consequences of fire are limited.

For smaller buildings with an activity where the consequences of a fire are minor, no fire cells are necessary.

Division into fire cells may be entirely or partially replaced by fire technical installations. (*BFS 2011:xx*).

General recommendation

Spaces in different activity classes should be located in separate fire cells. As an alternative, all spaces in different activity classes in the fire cell can be designed such that the requirements on fire protection that apply to each activity conducted are met.

Evacuation routes and stairwells should comprise fire cells of their own. Other spaces that should comprise fire cells of their own are indicated in section 5:54.

Spaces in buildings with activity that involves the great probability of the occurrence of fire and where this may carry great consequences for safety at evacuation should be divided into fire cells of their own. Such spaces may be premises where hot works are carried out, garages, separate boiler rooms, large-scale kitchens, refuse rooms, and similar.

Fire cells should separate rooms with great fire load (>1600 MJ/m²) or premises in activity class 6 from other spaces.

The same fire cell should not—excepting residences in activity class 3, stairwells, shafts, and open garages—include spaces extending over more than two floors.

Rules on fire technical installations are found in section 05:25. (*BFS 2011:xx*).

When buildings are divided into fire cells, these shall be designed such that satisfactory protection against the dispersion of fire and combustion gases is achieved. The design of the fire cell shall limit the dispersion of fire and

combustion gases to an adjacent fire cell during a given time.
(BFS 2011:xx).

General recommendation

Special consideration shall be taken of lead-throughs, storage spaces, and joints so that the fire cell retains its partitioning function. *(BFS 2011:xx)*

5:531 Buildings in class Br1

For buildings in class Br1, the dispersion of fire and combustion gases between fire cells shall be limited by partitioning constructions.
(BFS 2011:xx).

General recommendation

Partitioning constructions in buildings in class Br1 should be designed in at least the fire technical class indicated in Table 5:531.

Dimensioning fire load should be determined in accordance with the National Board of Housing, Building, and Planning's *Handbok om Brandbelastning*. *(BFS 2011:xx).*

Table 5.531 Fire cell partitioning building parts in a building in class Br1

Building part	Fire technical class at fire load f (MJ/m ²)		
	$f \leq 800$	$f \leq 1600$	$f > 1600$
Partitioning construction in general and tiers of beams above cellar	EI 60	EI 120 (EI 60*)	EI 240 (EI 120*)

* For buildings that are to be protected with an automatic water sprinkler plant.

5:532 Buildings in class Br2 and Br3

For buildings in class Br2 and Br3, the dispersion of fire and combustion gases between fire cells shall be limited by partitioning constructions.
(BFS 2011:xx).

General recommendation

Partitioning constructions should be constructed in at least class EI 30. Requirements on partitioning constructions are also found in section 5:54.
(BFS 2011:xx).

5:533 Air treatment installations

Air treatment installations shall be located, designed, and hung such that protection against the dispersion of fire and combustion gases between fire cells is retained.

Consideration shall be taken to the risk of the dispersion of fire due to heat transfer through air treatment installations to combustible materials in other fire cells. The installations shall be designed such that all parts needed to retain protection can withstand the increase in temperature to which they may be expected to be exposed. *(BFS 2011:xx).*

General recommendation

Satisfactory protection against the dispersion of fire and combustible gases through the air treatment installations between fire cells can be achieved by designing the installations, including suspension, ventilation ducts, and lead-throughs such that they are able to maintain the fire cell boundary

during the intended time. The installations should be designed with resistance against fire that starts in either fire cell. In designing, consideration should be taken to the risk of the dispersion of fire and combustion gases through the air treatment installations.

Consideration should be taken to the risk of the dispersion of fire due to heat transfer through ventilation ducts by insulating the ducts when fire cells are breached.

If the air treatment installations are not separate for each fire cell, ventilation ducts should be equipped with dampers with a partitioning capability corresponding to that of the fire cell boundary in question. The dampers should be designed such that their function can be maintained based on the stress to which they may be expected to be exposed. (BFS 2011:xx).

5:5331 Installation shafts

Installation shafts shall be designed such that the fire cell boundaries are maintained. Consideration shall be taken to the risk of the dispersion of fire through heat transfer from ventilation ducts to combustible material. (BFS 2011:xx).

General recommendation

Installation shafts should be installed in fire cells of their own or partitioned in each tier of beams that comprises a fire cell boundary.

The partitioning capability of ventilation ducts should, together with the partitioning of the installation shaft, ensure that the fire cell boundary is maintained. Within a partitioned shaft, ventilation ducts should be partitioned in at least class EI 15 from combustible building parts or fittings such as pipes, insulation, bolts, and wiring. (BFS 2011:xx).

5:5332 Kitchen flues

Kitchen flues with appurtenant parts shall be designed with protection against the dispersion of fire and combustion gases within and between fire cells. Protection shall limit the risk of the dispersion of fire to adjacent building parts or fittings and such that fire cell boundaries are maintained. (BFS 2011:xx).

General recommendation

Fire protection for kitchen flues in large-scale kitchens should be adapted to the risk of combustible deposits forming in the flue. If there is a risk of great amounts of deposits forming in the kitchen flue, it should meet the requirements in accordance with ISO 6944-2, both for fire inside and fire outside the flue.

Large-scale kitchens where there is no risk that major deposits form in the kitchen flue may be such kitchens that are only used for heating and boiling and kitchens that are only used to a limited extent.

Large-scale kitchens can, as an alternative to that which is indicated in the first paragraph of the recommendation, be designed with

- filtering systems that reduce the risk of the formation of deposits or
- automatic extinguishing systems that with sufficient capability limit the risk of dispersion of fire in the deposits.

Kitchen flues from large-scale kitchens should in their entire length be made from at least fire technical class EI 60 in buildings in building class Br1. For buildings in building class Br2 and Br, that which is required for other partitioning constructions applies, but no lower than fire technical class EI 30.

Kitchen flues may however be uninsulated within the fire cell if there is an at least 100 mm wide air gap between the flue and combustible building parts. Kitchen flues may also be uninsulated if they are located on the outside and the distance to combustible material is at least 0.5 metres. The distance can be reduced to 0.25 m if there is radiation protection between the flue and combustible material. Radiation protection should be made in at least fire technical class A2-s1,d0 with resistant properties.

In kitchens in residences and other spaces with a household stove or oven, the kitchen flue should be made in at least fire technical class EI 15. As an alternative to E 15, the kitchen flue can be made in at least fire technical class E 15 and with a protective distance to combustible material of at least 30 mm. Connection devices to kitchen flues should be designed with material in at least fire technical class E. Flues and connection devices can be placed against combustible material when passing through shelves or cabinet sides. Also the top and other smaller parts of the outer casing of stove fans can be placed against combustible material. (*BFS 2011:xx*).

5:534 Doors, covers, and entrance doors

Doors, covers, and entrance doors in a partitioning construction shall be designed such that fire cell boundaries are maintained.

General recommendation

Doors should be designed in the same fire technical class for the fire cell boundary that is indicated in section 5:531 and 5:532.

Doors that connect to an evacuation route can be designed in at least fire technical class EI 30-S_a.

Spaces that are equipped with an automatic water sprinkling plant or that have a fire load lower than 250 MJ/m² can be designed with half the fire technical class for the building part in question and with a requirement on insulation, but in at least class E 30.

Doors to stairwells, with the exception of lift doors, should be tight, including at the bottom edge of the door. Such doors can be designed with a combustion gas tightness of S_m.

Doors to and in evacuation routes that cannot be expected to be closed should be equipped with door closing devices. Doors that can be expected to be closed are for residences in activity class 3, lift machine rooms, and technical spaces.

That which is indicated for doors also applies to covers and entrance doors.

Rules on the door closing devices are also found in section 5:254. (*BFS 2011:xx*).

5:535 Attic and false ceiling spaces

Attic and false ceiling spaces shall be designed such that protection against the dispersion of fire between fire cells is maintained and such that the extensive dispersion of fire is limited. False ceiling spaces that extend over several fire cells shall be partitioned to the same extent and at least in the same fire technical class as are required for the fire cell partitioning walls. (*BFS 2011:xx*).

General recommendation

Attic spaces should be divided into fire cells of a maximum of 400 m² with fire cell boundaries in at least class EI 30. Additionally, attic spaces should be divided into parts of a maximum of 1200 m² with fire cell boundaries in at least class EI 60. In order to maintain protection against the dispersion of fire between fire cells, special consideration should be taken to the need of

protection against the dispersion of fire in the attic and to the roof construction's bearing capacity in the event of fire.

The risk of the dispersion of fire from windows to an attic via the eaves should be limited, e.g. by the eaves being made with partitioning capacity corresponding to the fire cell requirement. (BFS 2011:xx).

5:536 Protection against the dispersion of fire from adjacent roofs

Protection against the dispersion of fire to a fire cell that is higher than an adjacent roof shall be maintained. (BFS 2011:xx).

General recommendation:

Protection can, for example, be maintained through a combination of protective distance, partitioning construction, protection against radiation, and incombustible roof covering. Examples of acceptable solutions may be that

- The outer wall of the higher fire cell, including windows, is given fire resistance up to a height of five metres above the adjacent roof that corresponds to the requirement on a partition construction. For windows that comprise less than 20 % of the surface in question, fire technical class EW 30 can however be accepted.
- The adjacent roof at a distance of less than eight metres from the outer wall is given fire resistance corresponding to REI 60.
- An automatic water sprinkler plant is installed in lower spaces. (BFS 2011:xx).

5:537 Glass balconies, access balconies, and patios

Protection against the dispersion of fire and combustion gases between fire cells shall be maintained when glass is used to enclose spaces that connect to the fire cell, such as balconies, access balconies, and patios. (BFS 2011:xx).

General recommendation

Protection against the dispersion of fire and combustion gases should consist of a fire technical partitioning construction, protective distance or a combination of both.

Protection against the dispersion of fire and combustion gases between adjacent and overlying spaces as mentioned above, or in windows in other fire cells, should be equivalent to partitioning in at least class E 30. Protection should extend to the surfaces that face each other in parallel, e.g. top against bottom or side against side. The surfaces are considered parallel if the angle between them is less than 60°.

A partitioning construction can be combined with or be replaced by protective distance. For protection by distance alone, protective distance between parallel horizontal surfaces that are unprotected should be at least 3 m and between parallel vertical surfaces at least 0.5 m. (BFS 2011:xx).

5:54 Special preconditions

5:541 Activity class 1

General recommendation

Offices in activity class 1 should comprise fire cells of their own.

5:542 Activity class 2B and 2C

General recommendation

Assembly rooms in activity class 2B and 2C should comprise fire cells of their own.

In assembly rooms in activity classes 2B and 2C with a larger theatre stage or equivalent, the stage should, without consideration taken to the stage opening, be designed as a fire cell of its own. The stage opening should be screened off by a fire protective curtain. The curtain should be complemented with a curtain sprinkler if the stage is bigger than 120 m². Bigger theatre stages in assembly rooms in activity class 2B and 2C that are equipped with an automatic extinguishing system need not be placed in a fire cell of their own. (BFS 2011:xx).

5:543 Activity class 3

In activity class 3, the dispersion of fire and combustion gases shall be limited between residential flats by a partitioning construction.

General recommendation

Residential flats should comprise fire cells of their own and the partitioning construction between the residential flats should be designed in at least class EI 60. (BFS 2011:xx).

5:544 Activity class 4

In activity class 4, the dispersion of fire and combustion gases shall be limited between each guest room or suite by a partitioning construction. (BFS 2011:xx).

General recommendation

Guest rooms and suites should comprise fire cells of their own and the partitioning construction should be designed in at least class EI 60. (BFS 2011:xx).

5:545 Activity class 5A

In activity class 5A, the dispersion of fire and combustion gases shall be limited if the building contains more than two sections or functional units. (BFS 2011:xx).

General recommendation

Buildings that contain activity class 5A should be divided into fire cells such that a maximum of two sections or functional units form part of the same fire cell. Partitioning constructions should be designed in at least fire technical class E 30. (BFS 2011:xx).

5:546 Activity class 5B

In activity class 5B, the dispersion of fire and combustion gases shall be limited between residential flats by a partitioning construction. Spaces in activity class 5B shall be equipped with automatic extinguishing systems.

Doors to flats may be designed without door closing devices if connecting spaces are divided by a partitioning construction such that each such space connects to a maximum of eight flats. (BFS 2011:xx).

General recommendation

Residential flats should comprise fire cells of their own and the partitioning construction should be designed in at least class EI 60.

Automatic extinguishing systems can be designed as residential sprinklers in accordance with section 5:2522.

Connecting spaces can e.g. be hallways including day rooms and kitchens. Partitioning constructions between connecting spaces should be

designed in at least fire technical class E15 with doors in class E 15-C.
(BFS 2011:xx).

5:547 Activity class 5C

Spaces in activity class 5C shall be equipped with automatic extinguishing systems. In activity class 5C, the dispersion of fire and combustion gases between each ward, operation room or other functional unit shall be limited by a partitioning construction. (BFS 2011:xx).

General recommendation

Buildings in activity class 5C should be equipped with an automatic water sprinkler plant in accordance with section 5:2521.

Wards, operation rooms, and other functional units should comprise fire cells of their own. (BFS 2011:xx).

5:548 Premises in activity class 6, etc.

Premises in activity class 6 shall be designed with a partitioning construction such that the dispersion of fire and combustion gases to another fire cell is limited.

Premises in activity class 6 may only be connected to an assembly room in activity class 2B and 2C by way of an air lock. (BFS 2011:xx).

General recommendation

Partitioning constructions should be designed in at least fire technical class EI 60. (BFS 2011:xx).

In premises in activity class 6 and other premises with a high probability of the occurrence of fire, special measures shall be taken if the premises are connected to an evacuation route that serves several premises.
(BFS 2011:xx).

General recommendation

Examples of other premises are large-scale kitchens and garages that are larger than 50 m². Special measures may be the installation of an automatic extinguishing system or a fire safety lock. (BFS 2011:xx).

5:549 Lifts

Lift shafts shall be designed such that protection against the dispersion of fire and combustion gases between fire cells is maintained. (BFS 2011:xx).

General recommendation

Protection can be maintained by designing the lift shaft as a fire cell of its own. Lift shafts that are equipped with lift doors with fire resistance verified in accordance with SS-EN 81-58 should be designed with ventilation for combustion gases.

Protection against the dispersion of fire and combustion gases from or through a lift shaft to other fire cells can also be limited by creating a fire cell of its own and with an air lock between the lift and adjacent fire cells.

The lift shaft can, as an alternative, be placed in the same fire cell as the stairwell.

Lift machines and pulley wheels can be placed in the same fire cell as the lift shaft. Lift machine cabinets with low fire load can be placed in the lift shaft or stairwell.

Electrical cables for lift machinery for a lift allowed to carry passengers, which in the event of the interruption of power do not automatically proceed to the nearest stopping floor, should be placed separately in class EI 30 or

equivalent. The latter applies within the fire cells that are served by the lift with the exception of the lift shaft. (BFS 2011:xx).

5:55 Outer walls

Façade coverings may in the event of fire only develop heat and smoke to a limited extent. (BFS 2011:xx).

General recommendation

Limited extent refers to the fact that possibility of satisfactory evacuation and fire extinguishing is maintained.

Rules on protection against the dispersion of fire between buildings are found in section 5:6. (BFS 2011:xx).

5:551 Outer walls in buildings in class Br1

Outer walls in buildings in class Br1 shall be designed such that

1. the partitioning function is maintained between fire cells,
2. the dispersion of fire inside the wall is limited,
3. the risk of the dispersion of fire along the surface of the façade is limited,
4. the risk of personal injury as a result of falling parts of the outer wall is limited. (2011:xx).

General recommendation

Outer wall constructions, which when tested in accordance with SS-EN 13501-2 with a fire impact in accordance with chapter 4.2 (standard fire curve) meet applicable parts of the requirements in section 5:531 on partitioning functions, meet the requirements in item 1 of the regulation.

Outer walls that only contain material of at least class A2-s1,d0 or that are partitioned in such a way that a fire inside the wall is prevented from spreading beyond a partitioning construction meet the requirements in item 2 of the regulation on protection against the dispersion of fire inside the wall.

Outer walls meet the requirements in item 3 of the regulation if they are made in at least class A2-s1,d0. As an alternative, the requirements can be met by covering the outside of the outer wall with material in at least class D-s2,d2 if one of the following conditions is met:

- the building has a maximum of two floors,
- the covering, regardless of the height of the building, only covers the bottom floor of the building
- the building has a maximum of eight floors and is equipped with an automatic extinguishing system and the outer wall in the bottom floor is made of material in at least A2-s1,d0.
- the building has a maximum of eight floors and combustible material of at least class D-s2,d2 cover a limited part of the façade surface.

Outer walls should be designed such that the requirement in item 4 is met so that the risk of falling building parts such as broken glass, smaller pieces of plaster, and similar is limited.

Outer wall constructions that pass testing in accordance with SP FIRE 105, 5th edition with the below conditions meet items 1, 2, 3, and 4 of the regulation.

For outer walls in buildings with a maximum of eight floors, if it is shown in testing that:

- a) no larger parts of the façade fall, e.g. large pieces of plaster, plates or sheets of glass, which can cause danger to evacuating persons or rescue staff,

b) the dispersion of fire in the surface layer and inside the wall are limited to the bottom edge of a window two floors above the room of the fire and

c) no outside flames occur that can ignite the eaves above the window two floors above the room of the fire. An equivalent criterion is that the gas temperature immediately below the eaves does not exceed 500°C during a continuous period of over 2 minutes or 450°C for more than 10 minutes.

For outer walls in buildings with more than eight floors, in testing, in addition to criteria a–c, the outer wall shall not increase the risk of the dispersion of fire to another fire cell on another floor above the room of the fire. As an equivalent criterion in testing in accordance with SP FIRE 105, 5th edition, the total heat flow in towards the façade in the centre of the window in the floor above the room of the fire shall not exceed 80 kW/m². (BFS 2011:xx).

5:552 Outer walls in buildings in class Br2 and Br3

Outer walls in buildings in class Br2 and Br3 shall be designed such that the dispersion of fire along the surface of the façade is limited. (BFS 2011:xx).

General recommendation

Façade coverings should meet the requirements for class D-s2,d2. (BFS 2011:xx).

5:553 Windows in outer walls

Windows that belong to different fire cells in the same building and that face each other or are placed above each other vertically shall be designed and placed such that the dispersion of fire between the fire cells is limited. Fire classified windows may only be able to be opened with tools, keys or similar. (BFS 2011:xx).

General recommendation

Windows, glass surfaces or equivalent that are located in relation to each other such that direct heat radiation from fire can take place from one window to another are encompassed by the requirements of the regulation.

Examples of designs that meet the requirements of the regulation on protection against the dispersion of fire are found in Table 5:553. Heat radiation is assumed to take place perpendicularly and diagonally out from the window at up to a 135° angle from the surface of the window. If the angle in the inner corner is less than 60°, then that angle that which is indicated for opposite parallel outer walls applies. (BFS 2011:xx).

Table 5.553 Examples of a design of windows in outer walls that face each other or are placed above each other vertically. This applies between fire cells with requirements corresponding to EI60 or lower.

Relative position	Distance (m) between windows	Design, outer walls
Windows in opposite (parallel) outer walls	< 5.0	One window in class E 30 or both in E 15
	≥ 5.0	–
Other windows in inner corners	< 2.0	One window in class E 15
	≥ 2.0	–
Windows placed above each other vertically	< 1.2	E 30

	≥ 1.2	-
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(BFS 2011:xx).

5:56 Protection against extensive dispersion of fire

5:561 General

Large buildings shall be designed such that the extensive dispersion of fire in the building is limited. (BFS 2011:xx).

General recommendation

In order to limit the extensive dispersion of fire in large buildings, these should be designed with fire cells, fire sections, fire technical installations, or combinations of these. In judging the risk of the dispersion of fire, consideration should be taken to fire load.

An example of suitable design is dividing the building into fire cells of a maximum of 1250 m² or into fire sections in accordance with Table 5:561. If fire load is a maximum of 250 MJ/m², the space can be designed without any special protection against the extensive dispersion of fire.

Table 5.561 Fire sectioning of large buildings.

Protective system	Maximum size (net area*) of fire section at fire load f (MJ/m ²)	
	f ≤ 800	f > 800
No automatic fire alarm or automatic extinguishing system	2500 m ²	1250 m ²
Automatic fire alarm	5000 m ²	2500 m ²
Automatic water sprinkler plant	Unlimited	Unlimited

* Net area is determined based on all floors that form part of the fire cell or fire section.

Horizontal section boundaries can be designed as fire cell boundaries with the corresponding requirements in accordance with 5:562, but without the requirement on protection against mechanical impact (M). (BFS 2011:xx).

5:562 Fire wall

General recommendation

Fire walls should be designed in a fire technical class in accordance with Table 5.562 and break through combustible layers in the roof in order to limit the risk of the dispersion of fire past the fire wall.

If different spaces have different requirements on protection against the dispersion of fire, the higher requirement should apply.

Doors in fire walls should be designed in accordance with at least fire technical class EI₂-C.

Table 5.562 Fire technical class for fire wall.

Building class	Fire technical class at fire load f (MJ/m ²)		
	f ≤ 800	f ≤ 1600	f > 1600
1. Br1	REI 90-M	REI 120-M	REI 240-M
2. Br2, Br3	REI 60-M	REI 90-M	REI 120-M

| (BFS 2011:xx).

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5:6 Protection against the dispersion of fire between buildings

The regulations in section 5:61 do not apply to complementary buildings that have a constructed area of a maximum of 15 m². (*BFS 2011:xx*).

5:61 General

Buildings shall be designed with satisfactory protection against the dispersion of fire between buildings. (*BFS 2011:xx*).

General recommendation

Satisfactory protection is achieved if buildings are built with a distance exceeding 8 m.

Satisfactory protection is achieved if the dispersion of fire between buildings is limited by protection corresponding to the highest requirement for fire cells or fire walls in each building. Buildings that are built together with more than two floors should be separated by a fire wall.

If there is a glass balcony, the distance should be calculated from the outer edge of the balcony plate. Other projecting details, e.g. eaves and balconies, which project more than 0.5 m should be considered in the calculation of the distance between buildings.

Rules on outer walls are found in section 5:55. (*BFS 2011:xx*).

5:611 Single-family houses, etc.

General recommendation

The distance between single-family houses, between complementary buildings or between complementary buildings and single-family houses can be less than 8 m if they are built according to Table 5.611. This also applies to buildings with a maximum of two floors and that only contain activity class 1 or 3.

Single-family houses of one floor and an attic or single-family houses with two floors should be divided into groups of a maximum total constructed area of 800 m². The area of roof balconies, carports, and similar are not counted in the constructed area mentioned. Each group of single-family houses should be partitioned with fire walls in at least class REI 60-M or with a distance between the groups of at least eight metres.

Table 5:611. Combination, outer walls, and protective distances

Protection against dispersion of fire between single-family houses	
Combination of outer walls and protective distances	
Construction of one building's outer wall	Minimum relative distance
EI 60 (incl. doors) without window openings	-
Protection against dispersion of fire between single-family houses, between complementary buildings* or between complementary buildings* and single-family houses	
Combination of outer walls and protective distances	
Construction of both buildings' opposing outer walls	Minimum relative distance
EI 30 (incl. doors) without window openings	-
EI 30 (incl. doors) with max 1 m ²	2 m

unclassified window area	
EI 30 with max 4 m ² unclassified window area	5 m
EI 30 (incl. doors) without limitations on window openings	7 m

* For complementary buildings, it is sufficient that one of the walls is constructed in accordance with the above.

Outer walls can be considered to be opposing if direct heat radiation can take place from one outer wall to the other. Direct heat radiation is assumed to be able to take place perpendicularly and diagonally out from the wall up to a 135° angle from the wall

(BFS 2011:xx).

5:62 Roof covering

The roof covering of buildings shall be designed such that ignition is made difficult, the dispersion of fire is limited, and it can only make a limited contribution to the fire. (BFS 2011:xx).

General recommendation

Ignition made difficult refers, for example, to protection against spot fires or sparks.

Roof coverings should be designed with material of class A2-s1,d0 or with material of at least class B_{ROOF} (t2) on underlying material of class A2-s1,d0.

Combustible roof covering in at least class B_{ROOF} (t2) can be used on combustible surfaces in buildings that are situated at least 8 m from each other or in single-family houses.

Combustible covering on combustible surfaces should not occur in buildings, except single-family houses, within 8 m from a chimney connected to a boiler burning solid fuels.

In single-family houses, material of at least class E can be used as roof covering on roofs above patios, screen roofs or similar.

Rules on protection against the dispersion of fire from adjacent roofs are found in section 5:536 and this applies also between buildings.

(BFS 2011:xx).

5:7 Possibility of rescue efforts

5:71 General

Buildings shall be designed such that rescue efforts are possible to carry out with satisfactory safety. (BFS 2011:xx).

General recommendation

Rescue efforts can be both interior and exterior. Rescue efforts can be carried out by a rescue service, the staff of the activity itself or others.

The possibility of rescue efforts with the satisfactory safety of the rescue service means that the building is designed such that the rescue service is able to enter a building and that sufficient installations for the facilitation of extinguishing and rescue efforts exist. (BFS 2011:xx).

5:72 Accessibility for rescue efforts

Buildings shall be accessible for rescue efforts. (BFS 2011:xx).

5:721 Rescue route

If the street grid or equivalent does not offer accessibility, a special rescue route shall be arranged providing good accessibility. The rescue route shall be signposted and have parking spaces for the requisite vehicles. (BFS 2011:xx).

General recommendation

The rescue route and parking site should be designed with regard to, for example, free height, slope of the ground, width, turning radius, and bearing capacity such that the larger vehicles of the rescue service can operate. Bearing capacity should correspond to that of the street grid. Rules on the bearing capacity of tiers of joists are found in section C, Chapter 1.1.1.11 of the National Board of Housing, Building, and Planning's regulations and general recommendations (2011:10) on the application of European construction standards (eurocodes), ECS.

The distance between the rescue service's parking site and the approach point for the building should be less than 50 m.

If evacuation is assumed to be done via a mechanical ladder or a tipper lorry, the distance from the street, rescue route or parking site to the building wall should be a maximum of 9 m. Other conditions may be indicated in the municipality's action programme.

Outside of windows where a portable ladder is intended to be used, the ground should be adapted for evacuation. (BFS 2011:xx).

5:722 Access route

An access route for internal rescue efforts shall exist on each floor.

General recommendation:

An access route may consist of an evacuation route.

The access route to an attic can consist of hatches in the outer roof. If the rescue service cannot be expected to reach the outer roof with its own equipment, a fire technically partitioned access route should be arranged. Exterior access routes should be designed in accordance with applicable parts of the requirements in section 8:24. Interior access routes should be partitioned from attics in accordance with the requirements on partitioning constructions. Interior access routes to an outer roof can be arranged from a stairwell or a roof balcony from which the roof can easily be reached.

For cellars of two or more cellar floors and for cellars that are connected to Tr2 stairwells, the access route to the cellar should enable rescue efforts without the evacuation routes from residences or premises being put in open connection with the cellar. Each cellar floor should in such cases be partitioned from the access routes such that the efforts of rescue staff are secured. (BFS 2011:xx).

The length of access routes shall be limited on each floor in activity class 5A, 5B, and 5C.

General recommendation:

The distance between the nearest stairwell or similar approach point and the most distant part of a space should not exceed 50 m within activity class 5A, 5B, and 5C with consideration of the rescue staff's possibility to operate. (BFS 2011:xx).

5:73 Accessibility for extinguishing and rescue efforts

5:731 Extinguishing equipment

There shall be extinguishing equipment where fire can be expected to disperse rapidly or attain very great intensity. (*BFS 2011:xx*).

General recommendation

There should be indoor fire hydrants in industrial facilities and storerooms in activity class 1 if fire load exceeds 800 MJ/m² and in premises in activity class 6.

Indoor fire hydrants should be designed in accordance with SS-EN 671-1. (*BFS 2011:xx*).

5:732 Combustion gas ventilation

In buildings in class Br1, stairwells shall be equipped with combustion gas ventilation or equivalent.

There shall furthermore be combustion gas ventilation or equivalent in each fire cell in an attic that is used as a storage space in buildings of more than four floors.

Combustion gas ventilation or equivalent shall be designed such that interior rescue efforts are facilitated. (*BFS 2011:xx*).

General recommendation

Combustion gas ventilation may be a smoke hatch or a mechanical fan.

Operating devices for the activation of smoke hatches, mechanical fans, or equivalent in stairwells should be placed in the bottom floor and should be designed to be able to be activated by the rescue service. If a smoke hatch is installed in a stairwell, the free area should be at least 1 m² in buildings of a maximum of eight floors.

In stairwells, a solution corresponding to combustion gas ventilation may be windows that can be opened on at least every other floor. There should also be windows on the topmost floor. It should be possible to open all windows with a fire department key designed in accordance with SS 3654.

In attics, a solution corresponding to combustion gas ventilation may also be other openings such as windows or hatches that are easily opened from the outside or that are easy to break. Openings in attics should have an area corresponding to at least 1 % of the storage spaces' floor area and be evenly distributed.

Combustion gas ventilation or equivalent should be designed such that accumulation of combustion gases is limited and pressure relief is achieved. (*BFS 2011:xx*).

Cellars in a building in class Br1 shall be equipped with combustion gas ventilation or equivalent. (*BFS 2011:xx*).

General recommendation

In cellars, a solution that corresponds to combustion gas ventilation may also be other openings such as windows or other openings onto the out-of-doors. These should exist to such an extent that stairwells need not be used for the ventilation of combustion gases.

In buildings with more than one cellar floor, there should be separate combustion gas ventilation for each cellar floor. In these cases, it should be possible to operate combustion gas ventilation from the bottom floor and its control device should be equipped with a sign.

Openings should have an area corresponding to at least 0.5 % of the net area of the fire cell in the case of a fire load that is a maximum of 800 MJ/m². If the fire cell is equipped with an automatic water sprinkler

plant, 0.1 % can be considered sufficient. The latter also applies in the case of a higher fire load than 800 MJ/m².

Rules on the design of signage are found at the Work Environment Authority. (BFS 2011:xx).

5:733 Delivery conduits

In buildings with a construction height of over 24 m, delivery conduits for extinguishing water shall be arranged in stairwells. (BFS 2011:xx).

General recommendation

Operating pressure at the outlet for the delivery conduit should be between 0.8 MPa and 1.2 MPa. Delivery conduits should be dimensioned such that at least two fire engine pipes can be connected with a flow of 300 l/min for each pipe.

For buildings with a construction height over 40 m, delivery conduits should be pressurised.

Delivery conduits should be designed in accordance with SS 3112 and it should be possible to open locked hatches with a fire department key designed in accordance with SS 3654. Inlets and outlets should be marked with signs. Rules on signage are found at the Work Environment Authority.

There should be outlets in the stairwell starting with the floor number three and on at least every other subsequent floor. The distance between the outlet for a delivery conduit and the most distant part of a space should not exceed 50 m with consideration of the rescue staff's possibility to operate. (BFS 2011:xx).

5:734 Rescue lifts

In buildings of more than ten floors, there shall be at least one rescue lift. The lift may only be connected to other spaces by way of a fire safety lock. The lift shaft of the rescue lift shall constitute a fire cell of its own. (BFS 2011:xx).

General recommendation

The rescue lift can be designed in accordance with SS-EN 81-72. The fire cells that are required in accordance with SS-EN 81-72 should be designed in the class that corresponds to that which applies to other fire cell partitioning parts. At least two rescue lifts should be installed if the floor's area exceeds 900 m².

The lift that is designed as a rescue lift should be the one that in accordance with 3:144 can accommodate a stretcher.

Rules on lifts and other lifting devices are found in section 3:144 and in the regulations and general recommendations of the National Board of Housing, Building, and Planning on lifts and certain other motorised devices, (BFS 2011:12). (BFS 2011:xx).

8:7 Protection against poisoning

Connections between premises where poisonous gases may occur and premises occupied by persons more than temporarily may only be provided if satisfactory measures have been taken to limit the risk of personal injury due to poisoning. (BFS 2008:6).

General recommendation

Examples of premises where poisonous gases may occur are garages in multi-residence buildings and storage spaces for certain fuels.

The connection should be tight and equipped with a door closing device.
Rules on partitioning in certain cases of premises containing hazardous substances are also published by the Work Environment Authority.
(BFS 2008:6).

In residential flats and other equivalent spaces occupied by children, safe storage of chemical-technical compounds, medicines, and similar shall be provided. (BFS 2008:6).

General recommendation

The spaces should be equipped with safety fittings or otherwise be made difficult for children to access. There should be a space, located, for example, high in a cleaning closet, that can be locked for the storage of medicines and hazardous chemical-technical compounds such as machine dishwashing agents, heavy duty cleaners, and petroleum products. For the storage of less harmful compounds such as mild detergents, there should be a counter cabinet with safety fittings or a cabinet that is located at least 1.4 metres above the floor. (BFS 2008:6).

In a garage with a net area of more than 50 m², clearly visible signs shall be provided that warn of the risk of carbon monoxide poisoning.
(BFS 2008:6).

General recommendation

The sign should indicate that it is prohibited to idle vehicles. (BFS 2008:6).