Preventive fire protection in buildings
Insulation work /
Guidelines for execution
Part 2: Buildings

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Foreword

The Association of Austrian Insulation Contractors has drafted a directive as guideline for execution, intended as an assistance to all concerned. This initiative took place under the supervision of the Federal Ministry for Labour and Economy and in co-operation with the Austrian Fire Protection Association and the Institute for Fire Protection Technology and Safety Research.

The paper addresses:	architects	civil engineers
	builders	fire brigades
	building contractors	fire protection experts
	technical offices	contracting companies
	administrative authorities	insurances

who deal with – in whichever form – with "preventive fire protection in buildings". It is considered necessary to interpret the methods of execution of fire protection in buildings, since in this new millennium human beings must more then ever be protected against the dangers of fire.

This execution directive is supposed to demonstrate what sort of workmanship and materials are required for the construction of fire protective measurements, so that they can be used as aids in invitations to tender, and to allow for an examination of the work after its completion as well as during its execution.

Additionally it is of importance to use only authorised companies for these tasks since the protection of life and sanity of human beings and material values are at stake.

Contents

General

Design and execution must follow the most recent technical regulations, laid down in the relevant ÖNORMEN and ENNORMEN, the technical directives (TRVB), but also in execution manuals of individual system providers, authorised by notified testing institutes.
Design and execution not obeying these guidelines may lead to both penal investigations and legal liabilities in case of damage, which can also set insurances free of their liability, respectively lead to compensation demands by the insurance provider.

For the execution of all construction work associated with the "preventive fire protection in buildings", the observation of the following preconditions is indispensable:

⇒ The building components, e. g. ceilings, steel building components must be so positioned that the space required for the application of fire protective systems is available.

⇒ Additional measurements must not lead to a decrease of the overall fire resistance (e. g. installation of electrical plugs in a partition wall).

⇒ Additional demands over and above the standards / directives must already be mentioned in the invitation to tender.

⇒ The acceptance by an officially notified testing institute or an accredited expert must already be laid down in the invitation to tender.

⇒ Additionally, exact information about the properties and dimensions of building components to be protected must be given in the invitation to tender.

⇒ Relevant standards and directives shall be observed, e. g. OIB directives in preparation (see point 4).

⇒ In case the terms in EN come into force, they shall be used analogously.

⇒ Marking requirements according to standards and directives.

⇒ Periodic checks and a documentation of the fire protective measurements by an authorised person, an expert or by the executing company are recommended.

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1. Terminology

(Definitions according to ÖNORM B 2212)

1.1. Preventive fire protection in buildings
Total of building technology precautions for the prevention of fire and conflagration growth and the facilitating of fire fighting.

1.2. Fire protection section
Part of a building limited and defined by combustion-stopping measurements (see TRVB).

1.3. Fire-resistant (extremely fire-resistant)
Property of a building component, which is maintained for at least 90 minutes (180 minutes) according to the requirements of ÖNORM B 3800 part 2 and part 4.

1.4. Fire shield
Building component of non-combustible materials as a protection against flash fire and thermal radiation.

1.5. Fire-growth-delaying (extremely fire-growth-delaying)
Property of a building component, maintained for at least 30 minutes (60 minutes) according the relevant requirements of ÖNORM B 3800 part 2 and part 4.

1.6. Fire bulkhead
Lateral wall of at least fire-delaying quality for the compartmentalisation of a long room.

1.7. Fire closure
Closure of openings in walls or ceilings with or without passage of installations in the appropriate fire resistance class.

1.8. Fire apron
Suspended wall in the upper part of a room in at least fire-delaying quality to delay the spread of smoke or fire.

1.9. Fire bridge (according ÖNORM F 1000)
Combustible building, building component or stock pile or otherwise combustible materials, bridging a fire protection wall (according to ÖNORM B 3800 part 3), a protective zone or a fire protective stripe so that the fire can expand towards other fire protection sectors.

1.10. Fire protective closure
Cladding of a building component in one or several layers which increases the fire resistance period considerably.

1.11. Fire protection door
Fire protection closure which meets the conditions of ÖNORM B 3850 or EN 1634 part 1 regarding its fire resistance and its execution.

1.12. Fire resistance period
Period during which a building component offers adequate resistance to the effects of fire according to the requirements of ÖNORM 3800 part 2.

1.13. Fire resistance class
The fire resistance class is marked in capitals and in minutes. I. a. F 30, W 30, G 30 means a fire resistance period of 30 minutes (see also ÖNORM B 3800, part 2, 3 and 4).

1.14. Fire protective coating
Coating applied to the surface of a building component to increase the fire resistance period of the component.

1.15. Flash protection agent
Agent for the treatment of combustible materials (e. g. coating or immersion) to improve their fire behaviour classification (see ÖNORM B 3805).

1.16. Insulation thickness / Layer thickness
Sum of the effective thicknesses of insulation materials.

1.17. ETK (standardised temperature curve)
Standardised temperature curve used to prove the fire resistance class in a combustion chamber according to ÖNORM B 3800 part 2 in the fire test (diagram: time / temperature).

1.18. Fire protective glazing
Fire protective closure made of glass, meeting the requirements of ÖNORM 3800 part 3 regarding its execution and its fire resistance period.

1.19. Ceiling
Statically load-bearing construction, forming a horizontal limit of a room.

1.20. Suspended ceiling
Statically not load-bearing construction which meets the required fire protection in connection with the load-bearing ceiling.

1.20.1. Directly fastened suspended ceiling
Suspended ceiling fixed directly to the load-bearing ceiling.

1.20.2. Suspended ceiling
Suspended ceiling, suspended from the load-bearing ceiling by the means of sub-constructions.

1.21. Independent suspended ceiling
Suspended ceiling meeting the fire protection requirements on its own.

1.22. Steel building component
Elements made of steel, e. g. open or closed profiles, combined into a load-bearing construction.

1.23. Light wall
Not load-bearing, room-limiting elements meeting fire protection requirements.

1.24. Wooden component
Elements made of wood, combined into a load-bearing construction.

1.25. Floor construction
Additional cladding elements immediately applied to the floor to be protected to meet the fire protection requirements for above.

1.26. Double floor
Independent floor construction meeting the fire protection requirements (from one or both sides).

2. Materials

Materials to be used must meet the requirements of tested systems. For other materials a special proof by an authorised testing institute must be presented.
Sub-constructions, supports, coatings, fastening means, etc. must be of dimensions sufficient to meet the requirements of the appropriate testing certificates.
They must be corrosion-protected for the respective application purpose.

2.1. Fire protective materials (examples)

2.1.1. Agents forming insulation layers (expanding)

2.1.2. Rolls, mats, boards, slabs, pipe sections and form pieces made of:

⇒ Wood-wool insulation boards, porous closing boards and multi-layer wood-wool insulation boards with mineral wool core
⇒ Mineral wool, Euroclasses A1 and A2 according to ONORM EN 13501-1 (hitherto combustibility class A, non-combustible according to ONORM B 3800 part 1). For mineral wool which is directly exposed to the flame in case of fire, the proof must be provided that it possess a melting point of above 1000 °C according to DIN 4102-17. Apparent density requirements, according to manufacturer information
⇒ Building materials from expanded vermiculite with inorganic additives and binders
⇒ silicate building materials (e. g. fibre-, calcium silicate) with mineral binders
⇒ gypsum-fibre boards
⇒ gypsum boards
⇒ mineral-fibre ceiling boards
⇒ metal cartridges with internal or external insulation material
⇒ wood chip boards
⇒ fire-protection glass

2.1.3. Fire-protection mortars (on plaster substrates) consisting of:

⇒ Cement mortar
⇒ Lime / cement, gypsum / lime-mortar or gypsum mortar
⇒ Mortar compounds on the basis of vermiculite with cement components
⇒ Cement-bonded mortar compounds of light minerals

2.1.4. Mineral fibre spraying plaster bonded with various inorganic materials

2.1.5. Fire-protection auxiliary components made of:

⇒ Expanding materials in the form of mastic, stripes or boards
⇒ Ceiling compounds in B1 classification
⇒ Fire-resistant adhesives, employment range ≥ 1000 °C

2.2. Steel

Fixings, distance and support constructions must at least have the quality grading ST 320 according to ÖNORM EN 10025

2.3. Claddings / Finishing coatings

Additional casings, respectively finishing coatings must not negatively influence the properties of the fire-protection cladding.

2.4. Fasteners

⇒ Screws, clamps and nails must be appropriate to the purpose
⇒ Welding pins shall be used according to the information given by the manufacturer
⇒ Galvanised wire must have a minimum diameter of 2 x 1,2 mm or 1 x 2 mm and consists of tempered material

⇒ Dowels must not consist of plastic (unless the system is appropriately tested)
⇒ Eyes or clamp wires shall be galvanised and possess a minimum diameter of 3,6 mm
⇒ Nonius hangers must be galvanised and possess a minimum diameter of 0,7 mm and a minimum cross-section of 7.5 mm^2

3. Systems

The technical possibilities shall be certified through standards or test certificates.

This information reflects the current state of technology.
No liability for completeness can be accepted.
Definitions according to ÖNORM F 1000.

Materials and examples of application

Area of application / Materials	Suspended ceilings	Independent suspended ceilings	Inner-roof claddings	Steel components	Wood components	Concrete components	Walls	Joints	Attic completion
Mineral wool	X	X	X	X	X	X		X	(X)
Gypsum boards	X	X	X	X	X	X	X		X
Wood-wool insulation boards	X	X	X	X	X	X	X		X
Vermiculite boards	X	X	X	X	X	X	X		X
Calcium-silicate boards	X	X	X	X	X	X	X		X
Metal cartridges	X	X	X						(X)
Mineral-fibre ceiling boards	X	(X)	(X)						(X)
Fire-protection finishers				X					
Fire-protection glass							(X)		
Fire-protection sealants								X	

X = applicable
(X) = dependent on the system (see test certificate)

3.1. Suspended ceilings

Preliminary remarks:
Ceiling constructions must be regarded as a complete construction (rough ceiling and suspended ceiling) when gauging their fire resistance class.
Fire-protection ceilings serve the division of different horizontal fire sections and are supposed to prevent an average temperature above 140 °C and a maximum temperature above 180 °C as well as smoke and flames on the lee of the fire.

Distinctions are made:

3.1.1. Directly fastened suspended ceilings

Directly fastened suspended ceilings which are immediately fixed on the load-bearing ceiling and fulfil the fire resistance only in combination with the rough ceiling.

3.1.2. Lower suspended ceilings

Lower suspended ceilings which are fixed to the load-bearing ceiling by a sub-construction and fulfil the fire resistance requirement only in combination with the rough ceiling. The ceiling cavity is not load-bearing and no combustible materials must be stored or inserted there.

3.1.3. Independent suspended ceilings

Independent suspended ceilings which meet the fire resistance requirement independently on both sides. In case of a fire load out of the ceiling cavity, it must be ascertained that all suspending building elements meet the required fire resistance. All other components in the ceiling cavity must be so protected, constructed respectively suspended that no additional mechanical load may come to bear on the fire-protected suspended ceiling. This means first and foremost that the building elements must be fixed with appropriately dimensioned and officially certified fire-protection dowels and that the maximum tension load of the suspending construction is limited to 6 N/mm^2.

Fire-resistance classes / Standards:

Fire-resistance classes:	F30 – F90 EI30 – EI90	according to ÖNORM B 3800-2, according to ONORM EN 13501-2, EN 1364-2, EN 13964

Currently, the following materials are used for suspended ceilings:

⇒ Mineral wool
⇒ Gypsum boards
⇒ Wood-wool insulation boards
⇒ Vermiculite boards
⇒ Metal cartridges
⇒ Fire-protection finishers
⇒ Fire-protection glass
⇒ Fire-protection sealants

<u>Preparatory work:</u>

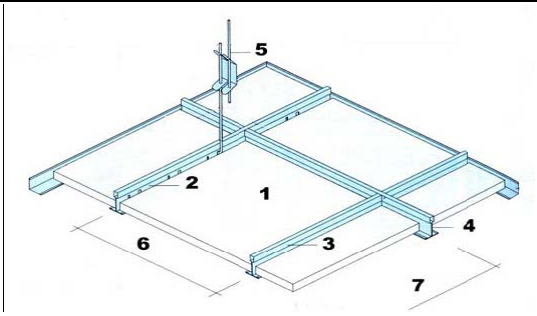
⇒ Visual control of the rough ceiling, respectively the bordering components
⇒ Checking of the substrate for sufficient strength and flatness
⇒ Additional measures at the bordering walls to make sure of a tight connection

<u>Main work:</u>

⇒ Mounting of the lateral connection angles with the appropriate division stripes observing the fixing distances required by the system
⇒ Mounting of the sub-construction observing the distances required by the system (no binding wire is acceptable!)
⇒ Ceiling fittings must be supported and suspended as required by the system
⇒ Insulation layer / cavity insulation (as far as needed)
⇒ Fastening of the boards with quick building screws, clamps, nails, dowels with the distances required by the system or hanging respectively mounting of the boards in case of multi-layer and tapered seam construction
⇒ Joint respectively seam execution in each layer of boards using adhesives respectively plaster (with or without reinforcement stripes)
⇒ Execution of expansion respectively movement joints as required

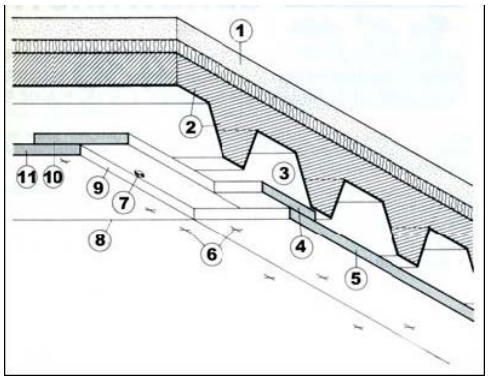
<u>Recommendations:</u>

⇒ Trowelling of all corner protection rails
⇒ Closures around penetrating pipes and cables



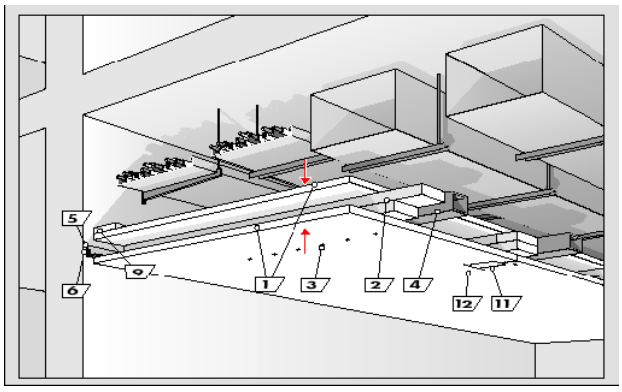
Suspended ceiling

1	Fire-protection board
2	Load-bearing profile
3	Lateral profile
4	Lateral profile
5	Suspension
6	Dimension of grid
7	Dimension of grid



Directly fastened suspended ceiling

1	Floor sub-construction
2	Concrete filling according to static
3	Steel profile sheet
4	Support of joint
5	Fire-protection board
6	Fastening means
7	Steel dowel with screw
8	Board joint
9	Board joint
10	Support of joint
11	Fire-protection board



Independent suspended ceiling

1	Fire-protection boards
2	Supporting – Fire-protection boards
3	ABC spax screw
4	Cavity profile
5	Connection angle
6	Metal dowel
9	Supporting – Fire-protection board
11	Reinforcing stripes
12	Joint sealant

3.2. Roofs

Preliminary remarks:
The fire resistance of the support construction and the coverage or the inner cladding must meet the demanded protection goal, so that the area-sealing effect and the load-bearing capacity for the fire resistance period is ascertained.
The fire behaviour of the insulation material and the cladding influence the fire resistance period of the roof construction.

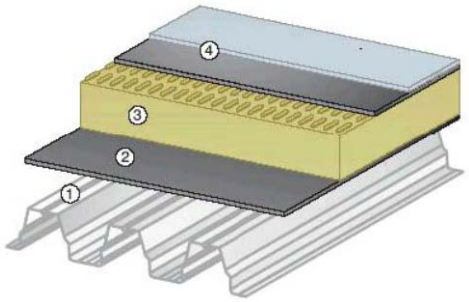
3.2.1. Massive roofs

Roof constructions made of in-situ concrete or factory-made systems are called massive-built roofs. In most cases, this construction itself meets the fire protection requirements. In case this is not so, appropriate additional measures such as cladding with boards or sprayed plasters must be taken.

3.2.2. Light-weight construction roofs

Frame constructions, insulated or not, on supporting elements (e. g. wood or steel) with a cover of profiled sheet or sealing webs are called light-weight construction.

In case a dividing building component with the fire-resistance period demanded is not constructed over the roof, the entire construction including its supporting construction in the first statistic field must be executed in the same fire-resistance class as the dividing building component on both sides.



Light weight construction roof

1 Profiled sheet
2 Vapour barrier
3 Insulating layer
4 Sealing webs

Fire-resistance classes / Standards:

Fire-resistance classes:	(R)EI30 – (R)EI90	according to ÖNORM EN 13501-2
	F30 – F90	according to ONORM B 3800-2

Currently, the following materials are used for claddings with or without sub-construction:

⇒ Mineral wool
⇒ Gypsum boards
⇒ Wood-wool insulation boards
⇒ Vermiculite boards
⇒ Metal cartridges
⇒ Fire-protection finishers
⇒ Fire-protection glass
⇒ Fire-protection sealants

Preparatory work:

⇒ Demand of a proof of sufficient load-bearing capacity
⇒ Visual control of the existing roof construction
⇒ Additional measures on the bordering building components to get connections required by the system

Main work:

⇒ Mounting of the sub-construction required by the system
⇒ Application of insulation materials and vapour barriers
⇒ Mounting of the cladding as required by the system (tapered joints in case of multi-layer construction with the required length of the fastening means)
⇒ Execution of joints and seams as required by the system
⇒ Execution of expansion respectively moving joints
⇒ Support and mounting of the built-in installations as required by the system

Recommendations:

⇒ Closures around penetrating pipes and cables

3.3. Steel building components

Preliminary remarks:
Load-bearing steel building components must be protected against thermal attack according to the fire-resistance period demanded, to ensure that these building components do not approach a critical temperature of 500 °C in case of a fire and thus loose their load-bearing capacity.
The cladding respectively coating layer thickness is decided for each profile individually according to the profile factor (U/A).
In steel constructions with different profiles and in case of mixed construction (skeleton framing) and box-formed cladding, the weakest profile (largest U/A value) is decisive for the coating thickness.
The possible directions of flame attack (from one side, two sides, three sides or four sides) shall be heeded when calculating the U/A factor.
Beams and girders with identical U/A factors may have product-related different cladding or coating layer thicknesses.

Calculation of the profile factor:
Perimeter of the surface under flame attack (U) / cross-section area of the steel component (A)

The calculation of the profile factor (U/A) is according to the table on page 22.

Fire-resistance classes / Standards:

Fire-resistance classes:	F30 – F180	according to ÖNORM 3800 parts 2 and 4
	R30 – R180	according to EN 1365 parts 3 and 4

Execution techniques for the protection of steel building components:

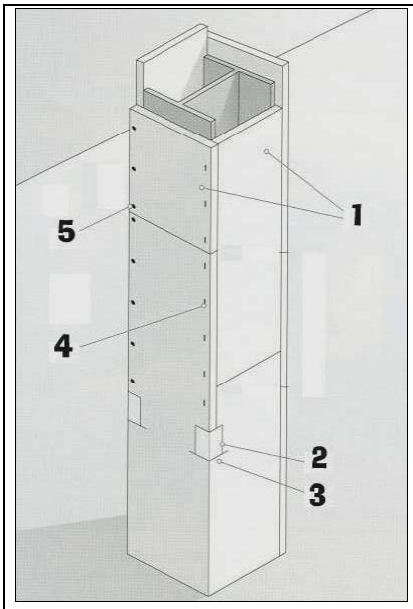
3.3.1. Board claddings

Currently, the following materials are used:
⇒ Gypsum boards
⇒ Silicate boards
⇒ Vermiculite boards
⇒ Cement-bonded boards
⇒ Mineral wool
⇒ Wood-wool insulation boards

Preparatory work:
⇒ Visual control of the corrosion protection applied
⇒ Calculation of the profile factor (U/A)
⇒ Removal of supply lines and/or combustible materials from the components to be protected

Main work:
⇒ If needed, application of sub-construction, anchored appropriately in the ground
⇒ Application of the cladding required by the system and its shock protection (gluing, trowelling, supporting or sealing)
⇒ Insertion of cavity fillers required by the system
⇒ Wood-wool insulation boards: full-surface plastering is required

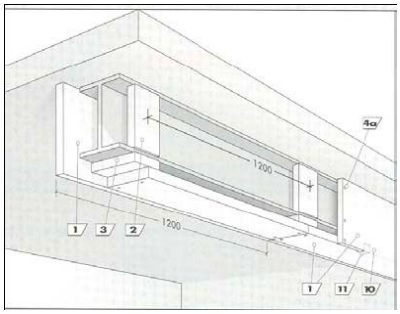
Recommendations:
⇒ Application of protective claddings or protective coatings



Steel girder claddings

1 Fire-protection board
2 Edge protection*
3 Joint filler*
4 Spax screw
5 Clamp

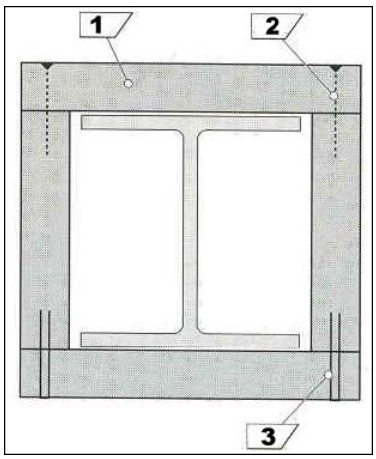
* not required for fire protection



Steel beam cladding

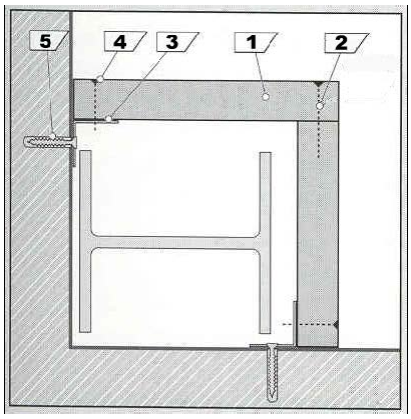
1 Fire-protection board
2 Application stripe
3 Supporting stripe
4a Spax screw
11 Joint filler*
10 Edge protection*

* not required for fire protection



Four-sided board cladding

1 Fire-protection boards
2 Fastening screws
or
3 Fastening clamps



Two-sided board cladding

1 Fire-protection board
2 Fastening screw
3 Steel-sheet angle
4 Fastening screw
5 Metal dowel

3.3.2. Fire-protection plaster

Preliminary remarks:
As sprayed plasters, compounds of inorganic binders (e. g. cement, expanded silicate) with fillers (e. g. mineral wool) are in use. These compounds are delivered ready to apply and are applied to the surfaces to be coated with the help of spraying machines, adding water.

The sprayed plaster may be applied directly onto the construction, following the profile or in box form onto a plaster support (e. g. wire mesh).
Surface hardeners appropriate to the system increase the abrasion resistance and the mechanical durability. For mineral-fibre plasters, fibre abrasion through air circulation is prevented by those measures. Additional paint layers are possible in case of elevated optical requirements.

Precondition is an anti-corrosion layer which must be checked for adhesion capacity and compatibility with the sprayed plaster to be used. In case the surface to be protected is unsuitable, a suitable plaster support must be used.
Fire-protection plasters shall only be used indoors respectively in protected external environments.

Currently, the following materials are used:
⇒ Cement mortar
⇒ Lime/cement, gypsum/lime mortar or gypsum mortar
⇒ Mortar compounds on the basis of vermiculite with cement mixture
⇒ Cement-bound light-weight mortar compounds

Preparatory work:
⇒ Calculation of the plaster thickness dependent upon the fire-resistance period required and the building component (steel beam, steel girder)
⇒ Visual control of the existing surface (corrosion protection)
⇒ Checking the protection against the influence of weather

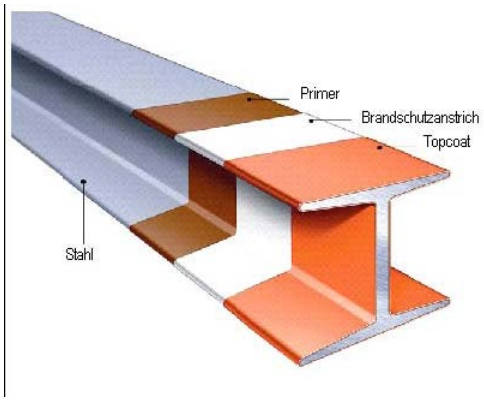
Main work:
⇒ If needed, cleaning of the surface (free of fat, solvents, acids and dust)
⇒ Preparation of a surface compatible to the system (e. g. primer, yield-stress metal, fire mesh)
⇒ System-compatible application of the fire-protection plaster, heeding the drying times
⇒ If needed, application of surface hardeners and/or additional paint coats
⇒ Labelling according to ÖNORM B 2230 part 4 Annex B

Recommendation:
⇒ When applying a fire-protection plaster in protected external environments, an appropriate weather protection (driving rain) must nevertheless be used and respective preparations must be made respectively recommended.

3.3.3. Fire-protection coatings

Preliminary remarks:
Fire-protection coatings are normally executed with agents forming insulation layers. The materials are delivered ready to use and may be applied dependent upon their purpose through painting, rolling or spraying, directly onto the prepared steel surfaces following their profiles (see ÖNORM B 2230 part 4).
The application of materials forming insulation layers is not admissible below 5 °C (ambient temperature and building-component temperature) and also not below the dew-point temperature.

Currently, the following agents forming insulation layers are used:
⇒ Insulation layer formers for indoors, based on water
⇒ Insulation layer formers for indoors, based on solvents
⇒ Insulation layer formers for outdoors, based on solvents



Steel fire-protection coatings

1	Steel profile
2	Anti-corrosion coating
3	Fire-protection coating
4	Paint finish*

* not strictly required

Preparatory work:
⇒ Calculation of the minimum dry layer thickness, observing the required fire-resistance period, the profile factor applicable (U/A value), the type of the profile, open or closed, and the type of building component (girder, beam, framework)
⇒ Visual control of the existing surface to be protected (corrosion protection)
⇒ Checking the protection against the influence of weather during the application (enclosure)

Main work:
⇒ If needed, cleaning of the surface (free of fat and dust, all not firmly adhered particles must be totally removed)
⇒ Preparation of a surface compatible to the system (anti-corrosion primer, primer on galvanised surfaces)
⇒ Application of the fire-protection coating in a system-compatible way, observing the minimum drying times required between the individual stages of work
⇒ Application of the system-compatible protective coating
⇒ Labelling according to ÖNORM B 2230 part 4 Annex B

Recommendations:
⇒ Periodic visual check must be executed dependent upon the service conditions. Repair work only using the originally applied fire-protection coating
⇒ No additional paint coats (with the exception of system-compatible coating materials) may be applied on fire-protection coatings in later stages
⇒ Optical protection claddings must not prevent the insulation layer former to expand in case of fire and they must keep the appropriate minimum distance to the fire-protection coating (dependent upon fire-protection class)

PROFILFAKTOR U/A

BERECHNUNG DES PROFILFAKTORS U/A
Beispiele von unbekleideten oder bekleideten Stahlprofilen

ZEILE	KONSTRUKTIONSMERKMALE b,h,a,d bzw. t.....[cm] Profilumfang.....[cm] Profilfläche A.....[cm²] BRANDBEANSPRUCHUNG	PROFILFAKTOR U/A [m⁻¹]
1	FLACHSTAHL	$\frac{2}{t}\cdot 10^2$
2	FLANSCH	$\frac{2}{t}\cdot 10^2$
3	WINKEL	$\frac{2}{t}\cdot 10^2$
4	DOPPEL-WINKEL	$\frac{2\cdot b + 2\cdot h}{A}\cdot 10^2$
5	HOHLPROFILE oder STUTZEN	$\frac{1}{t}\cdot 10^2$
6	RUNDSTAHL	$\frac{4}{d}\cdot 10^2$
7	TRÄGER oder STUTZE	$\frac{2\cdot b + 2\cdot h}{A}\cdot 10^2$
8	TRÄGER oder STUTZE	$\frac{2\cdot b + 2\cdot h}{A}\cdot 10^2$
9	TRÄGER Profilumfang	$\frac{\text{Profilumfang}}{A}\cdot 10^2$ oder $\frac{2}{t}\cdot 10^2$
10	TRÄGER Profilumfang	$\frac{\text{Profilumfang}}{A}\cdot 10^2$ oder $\frac{2}{t}\cdot 10^2$ Der größere Wert ist maßgebend !

ZEILE	KONSTRUKTIONSMERKMALE b,h,a,d bzw. t.....[cm] Profilumfang.....[cm] Profilfläche A.....[cm²] BRANDBEANSPRUCHUNG	PROFILFAKTOR U/A [m⁻¹]
11	TRÄGER oder STUTZE	$\frac{2\cdot b + 2\cdot h}{A}\cdot 10^2$
12	FLANSCH MAUERWERK oder BETON	$\frac{1}{t}\cdot 10^2$
13	WINKEL	$\frac{2\cdot b + 2\cdot h}{A}\cdot 10^2$
14	TRÄGER oder STUTZE	$\frac{2\cdot b + 2\cdot h}{A}\cdot 10^2$
15	HOHLPROFIL oder STUTZE	$\frac{4\cdot d}{A}\cdot 10^2$
16	VIERKANTSTAHL	$\frac{4}{a}\cdot 10^2$
17	TRÄGER	$\frac{b + 2\cdot h}{A}\cdot 10^2$
18	TRÄGER	$\frac{b + 2\cdot h}{A}\cdot 10^2$
19	TRÄGER Profilumfang	$\frac{\text{Profilumfang} - b}{A}\cdot 10^2$ oder $\frac{2}{t}\cdot 10^2$
20	TRÄGER Profilumfang	$\frac{\text{Profilumfang} - b}{A}\cdot 10^2$ oder $\frac{2}{t}\cdot 10^2$ Der größere Wert ist maßgebend ! ($2A \cdot 10^2$ kann auch bei Trägerhöhen h > 600mm maßgebend werden.)

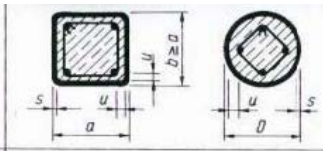
3.3.4. Concrete fillings

Preliminary remarks:
Under fire load, external unclad steel profiles loose their load-bearing capacity already after a short period. To prevent an early failure through bending of steel profiles, their supporting cores must be equipped with a appropriate strength.

The use of greater wall thicknesses or higher-value steel for the structural tubing does not carry any advantage especially for higher fire-protection requirements. The tabulated values for structural tubing beams, therefore, have only been determined for the steel quality St 37. An effective increase of the load-bearing capacity under fire attack is obtained through a concrete steel cladding of the concrete core.

The additional protection must be fixed in its position through stirrups and distancers. The structural tubing must have holes according to DIN 4102, part 4, chapter 6.3.2.2 in a maximum distance of 5 m and always at the head and base point. The cross-section of the openings shall have a minimum of 6 cm^2. These openings must be cleared of hardened concrete and serve in the case of fire as vapour pressure release.

Table from DIN 18806-1

Zeile		Feuerwiderstandsklasse-Benennung[1]				
		F 30-A	F 60-A	F 90-A	F 120-A	F 180-A
1	Mindestquerschnittsabmessungen bei gewähltem Ausnutzungsfaktor $\alpha = 0{,}3$					
1.1	Mindestdicke d bzw. -durchmesser D in mm	160	200	220	260	400
1.2	zugehöriges Mindestbewehrungsverhältnis $A_s/(A_s + A_c)$ in %	0	1,5	3,0	6,0	6,0
1.3	zugehöriger Mindestachsabstand u der Längsbewehrung in mm	[2]	30	40	50	60
2	Mindestquerschnittsabmessungen bei gewähltem Ausnutzungsfaktor $\alpha = 0{,}7$					
2.1	Mindestdicke d bzw. -durchmesser D in mm	260	260	400	450	500
2.2	zugehöriges Mindestbewehrungsverhältnis $A_s/(A_s + A_c)$ in %	0	3,0	6,0	6,0	6,0
2.3	zugehöriger Mindestachsabstand u der Längsbewehrung in mm	[2]	40	40	50	60
3	Mindestquerschnittsabmessungen bei gewähltem Ausnutzungsfaktor $\alpha = 1{,}0$					
3.1	Mindestdicke d bzw. -durchmesser D in mm	260	450	550	–	–
3.2	zugehöriges Mindestbewehrungsverhältnis $A_s/(A_s + A_c)$ in %	3,0	6,0	6,0	–	–
3.3	zugehöriger Mindestachsabstand u der Längsbewehrung in mm	25	30	40	–	–

[1] Sofern eine brandschutztechnische Bemessung nicht möglich ist, sind die betreffenden Flächen mit „–" gekennzeichnet.
[2] Betondeckung nach DIN 18806 Teil 1

3.4. Wood building components

Preliminary remarks:
Load-bearing wood building components must be protected against thermal attack according to the fire-resistance period demanded, so that these components are not heated to a temperature above the ignition temperature of roughly 140 °C in case of fire, so that no ignition of the wooden building components and a weakening of the cross-section, respectively a fire growth inside the construction occurs.
The possibility to use combustible building materials, especially in F90 constructions, is reserved for the legal regulations in the federal states (Bautechnikgesetz, Bautechnikverordnungen and TRVBs).
The ignitability of surfaces is regulated in ÖNORM B 3806 and in TRVBs.

Fire-resistance classes / Standards:

Fire-resistance classes:	F30 – F90	according to ÖNORM 3800 parts 2 and 4
	R/EI/REI 30 – 90	according to EN 13501 part 2

3.4.1. Not load-bearing walls
For the application areas partition walls and partition walls in flats, the criteria of 3.6 apply (with the exception of duct walls).

3.4.2. Load-bearing walls
Unlike the situation with not load-bearing walls, the load-bearing capacity of the wooden construction itself must be ascertained additionally to the fire-protection demands of the room partition. To achieve this, the wooden construction must normally be protected on either side according to the fire-protection requirements.
The thickness of cladding respectively coverage are determined after proven constructions or after the information in ÖNORM B 3800 part 4.

3.4.3. Suspended ceiling
In the room above a suspended ceiling of a wooden construction, no additional fire loads (e. g. combustible insulation materials, cables) must be placed. Apart from this, the criteria according 3.1 apply.

3.4.4. Load-bearing ceilings
Differently from the suspended ceilings, the load-bearing capacity of the wooden construction itself must be ascertained in these constructions apart from the fire-protection requirements of the room partition. To achieve this, the wooden construction is normally to be protected from either side according to fire-protection requirements, where in the upper area, the floor composition may be taken into consideration.
The thicknesses of claddings respectively coatings are determined according to proven constructions or according to the information in ÖNORM B3800 part 4.

3.4.5. Wooden walers, rafters, beams and girders (load-bearing components)
The cladding respectively coating thicknesses are determined according to proven constructions or according to the information in ÖNORM B 3800 part 4. Apart from this, the criteria according to 3.4.2 apply.
The use of a flame-proving agent for wood only leads to an improvement of the combustibility class (e. g. old B2 increases to B1; new D increases to C), but not to an improvement of the fire-resistance class (e. g. REI60 [F60] remains REI60 [F60]).

3.5 Concrete building components

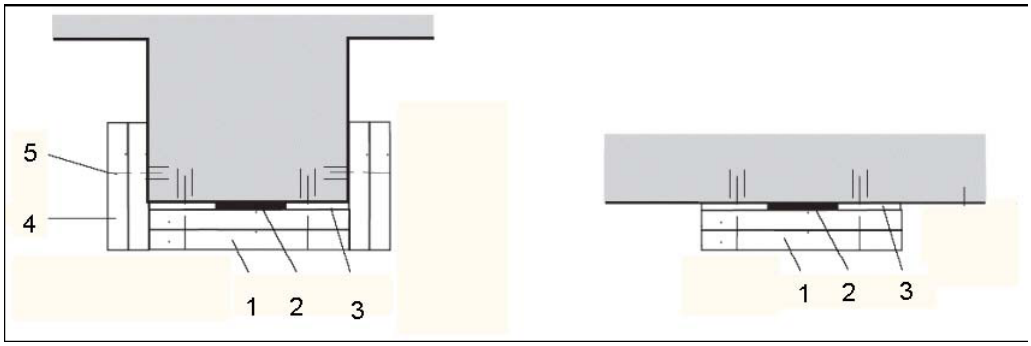
Preliminary remarks:
The behaviour of concrete in the case of fire is very complex. When concrete is heated, physical processes and chemical and mineralogical transpositions take place both in the concrete stone as well as in the additives.
Concrete is non-combustible, therefore does not extend a fire. It does not develop heat and therefore does not contribute to the increase of fire load, does not form smoke and toxical gases.
In case of fire, concrete has a bad thermal conductivity and protects the reinforcement, provided the concrete coverage is sufficient against detrimental thermal influence.
With increasing temperature, concrete strength decreases, however, the dimensional stability does not notably decrease. The compression strength of standard concrete only marginally decreases up to 200 °C, above 300 °C, however, very fast. At 500 °C, it is down to one half of its original strength.
For CFK lamellas (carbon-fibre-reinforced plastics), reinforced concrete components generally have different failure temperatures (roughly 80 °C). This must be heeded when choosing the coverage thickness.

Types of failure for steel concrete components under fire load:

⇒ Exhaustion of the load-bearing capacity
⇒ Exceeding the admissible temperature at the lee of fire

Fire-resistance classes / Standards:

Fire-resistance classes:	F30 – F180	according to ÖNORM 3800 parts 2 and 4
	R30 – R180	according to EN 1365 parts 3 and 4
	REI30 – REI180	according to EN 1365 parts 3 and 4



Cladding with concrete building components (CFK lamellas)

1	Fire-protection board
2	CFK lamella
3	Fire-protection board
4	Fire-protection board
5	Fastening means

Improvement of concrete building components with insufficient fire-resistance classes according to ÖNORM B 3800 part 4, Table 4.20.

Cladding for concrete building components with insufficient fire-protection classification to increse the fire-resistance period

Boards and Tables	According to ÖNORM	Apparent density ρ (kg/m^3)	Minimum thickness of cladding to achieve the following fire-resistance classes in a solid construction (cm)		
			F30	F60	F90[1)]
Minerally bonded wood-wool insulation boards, one-sided with gypsum-lime plaster, minimum thickness 10 mm	B 6021	≥ 350	2,5[4)]	5,0[4)]	
Minerally bonded wood-wool insulation boards, with inner-side sealing with mineral bonding agents	B 6021	≥ 500	3,5	5,0	10,0
Minerally bonded wood-fibre insulation boards, one-sided with gypsum-lime plaster, minimum thickness 10 mm	B 6022	≥ 400	2,5[4)]	5,0[4)]	
GKB, GKBI (gypsum-cardboard building boards)	B 3410		1,8[3)]		
GKF, GKFI (gypsum-cardboard fire-protection boards)	B 3410		1,25[3)]	2x1,25[3)]	3x1,5[3)]
Concrete boards with light inorganic additives[2)]		≤ 1300	3,0	3,5	4,0
Light-weight concrete boards Cellular concrete boards		≤ 1300	4,0	4,5	5,0
Mineral-wool boards	EB 13162	≥ 140	4,0	6,0	8,0
Mineral-wool boards	EN 13162	≥ 120	6,0	8,0	10,0

1) According to ÖNORM B 3800-2 the use of combustible building materials is only at the discretion of Bundesländer regulations.

2) Light-weight organic additives stands for expanded silicates, such as expanded vermiculite and expanded vulcanic perlite.

3) When applying gypsum-cardboard boards according to ÖNORM B 3415 – application rules.

4) The thickness quoted applies for wood-wool, respectively wood-fibre insulation boards without plaster.

Plasters and screeds	According to ÖNORM	Apparent density ρ (kg/m^3)	Minimum thickness of cladding to achieve the following fire-resistance classes in a solid construction (cm)		
			F30	F60	F90[1)]
Concrete-plaster mortar	B 3340		2,0	4,0	6,0
Lime-cement-plaster mortar	B 3340		1,5	3,0	4,5
Gypsum-lime mortar	B 3371		1,5	3,0	4,5
Gypsum mortar	B 3371		1,5	3,0	4,5
Light-weight plaster mortar	B 3340	≤ 1500	1,5	2,5	3,5
Gypsum light-weight mortar	B 3371	≤ 1500	1,5	2,5	3,5
Gypsum ready-made plaster mortar	B 3414	≤ 1500	1,5	2,5	3,5
Mineral-fibre-spray mortar	B 2230-4	≤ 1500	1,5	1,5/2,5	2,5/3,5
Expanded-silicate-spray mortar	B 2230-4	≤ 1500	2,0	2,0/3,0	3,0/4,0
Screed			3,0	5,0	7,0

Requirement:
The supporting construction is equipped with an suitable plaster primer.

3.6 Walls

Preliminary remarks:
Below, not load-bearing partition walls (ÖNORM B 3358 parts 1 and 6) will be treated which are predominantly only need to support their own weight and the weight on consoles and which must meet fire-protection requirements.
Fire-protection walls prevent for a limited period both the transgression of flame and smoke and the temperature increase on the lee of fire to more than an average of 140 °C and a maximum of 180 °C.

Distinction is made:

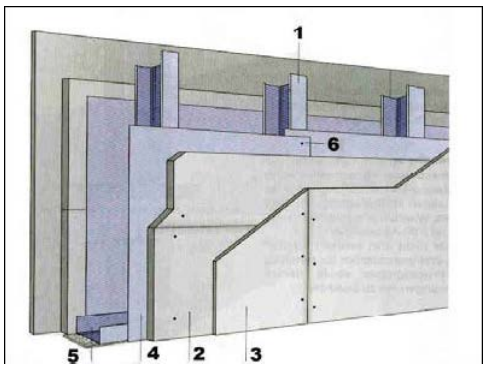
⇒ Not load-bearing walls with fire-protection requirements according to ÖNORM B 2800-2 and -4, EN 1364-1
⇒ Not load-bearing fire-protection walls with additional mechanical requirements according to ÖNORM B 3800-3 or EN 1363-2
⇒ Not load-bearing duct walls (e. g. partitions against installation ducts and elevator ducts)

Fire-resistance classes / Standards:

Fire-resistance classes:	F30 – F90	according to ÖNORM 3800 parts 2 and 4
	EI30 – EI90	according to EN 13501-2

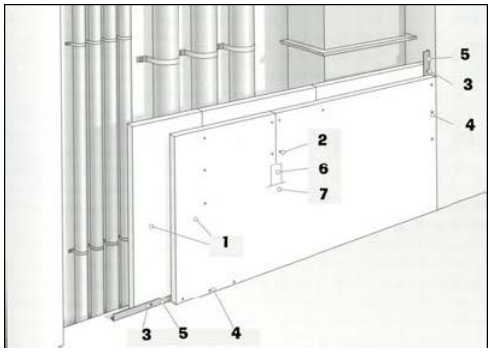
Currently, the following materials are used for partition walls:

⇒ Gypsum boards
⇒ Silicate boards
⇒ Vermiculite boards
⇒ Cement-bonded boards
⇒ Wood-wool boards
⇒ Fire-protection glass
⇒ Wood-derived boards (e. g. MDF, OSB etc.)
⇒ Board system not standardised



Gypsum-board fire wall

1	CW profile
2	Gypsum-board fire-protection slab
3	Gypsum-board fire-protection slab
4	Steel-sheet inlay
5	UW profile
6	Fastening means



Slot wall

1	Fire-protection boards
2 – 4	Fastening means
5	Steel-sheet angle*
6	Joint sealing band
7	Joint filler

* Fastening with steel dowel

Preparatory work:

⇒ Visual check of neighbouring components
⇒ Checking the sub-construction for sufficient solidity and planeness
⇒ Additional building measures to achieve a tight connection

Main work:

⇒ Erection of the sub-construction required with the appropriate partition stripes observing the system-related fastening distances
⇒ Insulation material lining / cavity insulation as far as required
⇒ Fastening the boards with building screws, clamps, nails in system-related distances
⇒ Execution of joints, respectively butts in each layer of boards with adhesive, respectively droweling (with or without reinforcing stripes)
⇒ Appropriate execution of expansion, respectively moving joints

Recommendations:

⇒ Droweling of the required corner-protection rails, respectively mounting of collision protections
⇒ Cavity wall jacks must be backed by mineral wool and must not be positioned opposite each other
⇒ Execution of flannings for fire-protective bulkheads
⇒ Bulkheads for penetrating pipes and cables
⇒ Partitions for fire-protection sections must extend over the roof, respectively other measures

3.7 Building-component joints

Preliminary remarks:
Building-component joints, connecting different fire compartments, must be sealed with fire-protective means according to the fire-resistance class of the adjacent building component.
Care must be taken that continuous building-component joints in the entire area must be sealed, not only in ceilings and floors, but also in walls or with existing pillars (double pillar).
Dependent upon the combustibility of the filling compound, the joints must be executed differently.
Building-component joints that have been sealed for fire-protective reasons do not automatically meet sound-protection requirements, water tightness etc. In case additional requirements are demanded, e. g. movement, this must be taken into consideration when selecting the system.

Fire-resistance classes / Standards:

Fire-resistance classes:	F30 – F180	according to ÖNORM 3800-2
	EI30 – EI180	according to EN 13501-2

Currently, the following systems have been tested and are in use:
⇒ Laminates
⇒ Sealing compounds
⇒ Mineral wool with intumescent paint or sealing compound
⇒ Fire-protective foams

Preparatory work:
⇒ Visual control of adjacent building components
⇒ Cleaning of joint flanning

Main work:
⇒ Removal of filling materials in the depth required for the system
⇒ Preparation of the substrate
⇒ Application of the fire-protection filling compound

Recommendations:
⇒ Covering of joints with suitable covering profiles, e. g. of steel sheet as a protection against mechanical damage
⇒ Repeated checks regarding joint movements

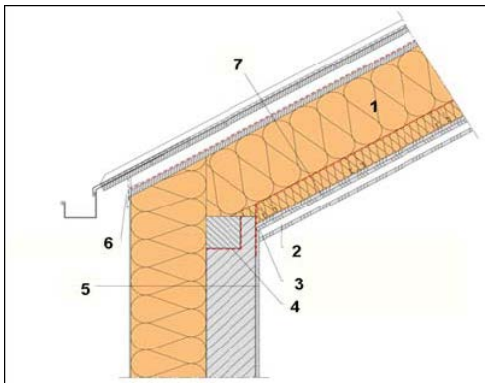
3.8. Loft expansion

Preliminary remarks:
The loft expansion is a combination of suspended ceiling (3.1. and 3.2.), roof (3.3.), steel building components (3.4.), wood building components (3.5.), concrete building components (3.6.), wall (3.7.) and cladding of the roof deviation.
This chapter deals exclusively with the cladding of roof deviations.
Roof constructions must be protected against influence of temperature according to the demanded fire-resistance period, so that building components do not loose their room-closing effect and their load-bearing capacity in case of fire.
Roof constructions normally consist of a support construction, a one- or multi-layer insulation and an inner cladding with fire-protectoion boards.

Fire-resistance classes / Standards:

Fire-resistance classes:	F30 – F90	according to ÖNORM 3800-2
	REI30 – REI90	according to EN 1365-2

Currently, the following materials for roof deviations are used:
⇒ Gypsum boards
⇒ Silicate boards
⇒ Vermiculite boards
⇒ Mineral wool
⇒ Wood-wool insulation boards



Roof deviation

1	insulation
2	cavity for installations
3	joint, air-tight sealed
4	dividing layer
5	inner plaster
6	bug-protection grid
7	fire-protection board

Preparatory work:

⇒ Visual control of support construction (e. g. roof-frame work) and roof coverage for tightness and sufficient solidity
⇒ Additional measures at partition walls to achieve a tight connection

Main work:

⇒ Mounting of the lateral connection angles with appropriate divison stripes under observance of the system-related fastening distances
⇒ Mounting of the system-related sub-construction
⇒ Application of insulation materials
⇒ Application of vapour retarder including the glueing of butts and the system-related connection with neighbouring building components, such as e. g. chimneys, skylights, roof windows
⇒ Application of boards with screws, clamps, nails in the system-related distance, in case of multi-layer application staggering the joints
⇒ Execution of joints and butts in the board layer with additives, respectively droweling with or without reinforcing stripes dependent upon the system
⇒ With open cellular boards, e. g. wood-wool insulation boards, the visual sight must be executed conform to the system (e. g. plastering)
⇒ Possibly execution of expansion and movement joints
⇒ Fittings must be supported and fastened as is required by the system

Recommendations:

⇒ Trowelling of required corner-protection rails
⇒ Fire-protective closure of penetrating pipes and cables

3.9 Fire-protection connections (mobile)

Preliminary remarks:
Mobile fire-protection connections are designed to prevent the penetration of fire and smoke through openings for pedestrian or vehicle traffic in walls of at least the same fire-resistance class.
Attention must be paid to the required automatic closing installation according to ÖNORM B 3850.
Since 1st January 2004, the ÜA designation is compulsory.
This must be in permanent form through an imbossed pattern, through a sign board or through a plate on the door leaf seam near the lock on the side of the band or on a band-facing corner of the opening area.

No. E-14.1.1.-03.1427 Ckecked according to ÖNORM
MANUFACTURER
certified by B 3850

ISC-Linz **T 30-2** Type SVF 301-2

Fire-resistance classes / Standards:

Fire-resistance classes:	T30 – T90	according to ÖNORM 3850
	EI30-C – EI90-C	according to EN 13501-2

Distinctions are made:
⇒ Fire-protective closures according to ÖNORM B 3850 (turning vane, pendulum doors or gates; one or two wing variance)
⇒ Smoke-protection closures according to ÖNORM B 3851 (turning vane, pendulum doors or gates; one or two wing variance)
⇒ Fire-protection closures according to ÖNORM 3852 (automatically closing vertical-, vertical lift-, tip-, roll-, push- and folding doors and gates)
⇒ Attic closures according to ÖNORM B 3860

Instruction:
Fire-protection closures according to ÖNORM B 3855 have been replaced by fire-protection closures according to ÖNORM B 3850.

Unlike fire-protection doors T30 (EI30-C), the smoke closures R30 (E30-C) have no limitations regarding the height of the temperature on the fire lee side.

Smoke-protection closures (S_{200}) are no fire-protection closures since they meet the smoke-protection requirements only up to a temperature of 200 °C.

When applying fire-protection closures, attention must be paid that only doors or gates may be used that have been tested in the system (door frame, door skin, lock and all fittings). The use of “fire-protection frames” without system test is prohibited. Additionally, attention must be paid that the cavity in the fitting is executed in the fashion in which it has been tested.

One-wing $EI_2$30 fire-protection door

Two-wing $EI_2$60 fire-protection door with panic fitting according EN 1125

One-wing fire-protection push gate with escape door and electrical drive to open the gate

3.1.1 Suspended ceilings – Criteria for choice

(Tested systems for the execution of suspended ceilings)

Systems / Materials / Criteria for choice	Mineral wool	Gypsum boards	Silicate boards	Vermiculite boards	Wood-wood boards *2	Metal ceilings
Connection light-weight frame wall *1	X	X	X	X	X	X
Connection light-weight frame wall *1	X	X	X	X	X	X
External application (protected area)	X	X	X	X	X	X
Ball-throwing safety		(x)	(x)	(x)	(x)	(x)
Paintability	X	X	X	X	X	X
Revision openings	X	X	X	X	X	X
Fire-resistance period	(x)	(x)	(x)	(x)	(x)	(x)

x = applicable
(x) = dependent upon the construction (see test certificate, assessment and application directives released by accredited testing institutes)

*1 = special execution for frame partitions, taking care of the lateral wall / ceiling connection
*2 = HWMSDP = wood-wool multi-layer insulation board

3.1.2 Suspended ceilings – Accompanying visual test

(Tested systems for the execution of suspended ceilings)

Systems / Materials / Test criteria	Mineral wool	Gypsum boards	Silicate boards	Vermiculite boards	Wood-wood boards *2	Metal ceilings
Sub-construction (grid dimensions and hangers)	X	X	X	X	X	X
Fittings (lamps, fire alarms and the like)	X	X	X	X	X	X
Properties of layers (thickness and type)	X	X	X	X	X	X
Connection to light-weight frame wall *1	X	X	X	X	X	X
Connection to light-weight frame wall *1	X	X	X	X	X	X
External application (protected area)	X	X	X	X	X	X
Revision openings (function and construction)	X	X	X	X	X	X
Trowelling or glueing of all layers		X	X	X	X	

x = applicable

*1 = special execution for frame partitions, taking care of the lateral wall / ceiling connection
*2 = HWMSDP = wood-wool multi-layer insulation board

3.2.1 Roofs – Criteria for choice

(Tested systems for the execution of roofs)

Products / Constructions Criteria for choice	Mineral wool	Gypsum boards	Silicate boards	Vermiculite boards	Wood-wood boards
Sub-construction (grid dimensions and hangers)	X	X	X	X	X
Properties of layers (thickness and type)	X	X	X	X	X
Connection light-weight frame wall *1	X	X	X	X	X
Trowelling and glueing of all layers		X	X	X	X
Combustible insulation materials	(X)	(X)	(X)	(X)	(X)

x = applicable
(x) = dependent upon the construction (see test certificate, assessment and application directives released by accredited testing institutes)

*1 = special execution for frame partitions, taking care of the lateral wall / ceiling connection

3.2.2 Roofs – Accompanying visual test

(Tested systems for the steel construction)

Products / Constructions / Testing criteria	Mineral wool	Gypsum boards	Silicate boards	Vermiculite boards	Wood-wood boards
Sub-construction (grid dimensions and hangers)	X	X	X	X	X
Properties of layers (thickness and type)	X	X	X	X	X
Connection light-weight frame wall *1	X	X	X	X	X
Trowelling or glueing of all layers	X	X	X	X	X

x = applicable

*1 = special execution for frame wall, taking care of the lateral wall / ceiling connection

3.3.1 Fire protection steel building components – Accompanying visual test

(Tested systems for steel construction)

Systems / Materials / Criteria for choice	Steel fire-protection painting	Wood-wool insulation board *1	Sprayed plaster	Gypsum boards	Vermiculite boards	Silicate boards	Mineral wool	Concrete fillings
Layer thickness (U/A factor)	x	x	x	x	x	x	x	x*2
Type of profile (open or closed profile)	(x)							(x)
Type of building component (support, beam)	x	x	x	x	x	x	x	x
Preparation / corrosion protection	x	x	x	x	x	x	x	x
Moisture resistance	(x)		x	(x)	(x)	(x)	(x)	x
External application	(x)	(x)	(x)	(x)	(x)	(x)	(x)	x
UV resistance	x	x	x	x	x	x	x	x
Paintability	(x)	x	x	x	x	x	x	x
Claddings / coatings *1	x	x	x	x	x	x	x	x
Ball throwing safety	x	(x)	x	(x)	(x)	(x)	(x)	x
Connection bands dependent U/A factor < 90	(x)				x	x	x	
Sheet-profile ceilings and walls		x	x	x	x	x	x	(x)
Knotted connections	(x)	x	x	x	x	x	x	x
Profile following coatings	x	x	x	x	x	x	x	
Clean room suitability	(x)		(x)	(x)	(x)	(x)		(x)
Building physical insulation properties		x					x	
Adhesion to substrate required	x		x					x
Attention to longitudinal expansion		x		x	x	x	(x)	

x = applicable
(x) = dependent upon the construction (see test certificate, assessment and application directives released by accredited testing institutes)

*1 = cladding or coating must not affect the fire protection
*2 = for concrete fillings the appropriate concrete thickness

3.3.2 Fire protection steel building components – Criteria for choice

(Tested systems for the execution of roofs)

Systems / Materials / Test criteria	Steel fire-protection painting	Wood-wool insulation board *1	Sprayed plaster	Gypsum boards	Vermiculite boards	Silicate boards	Mineral wool	Concrete fillings
Material layer thickness (U/A factor)	x	x	x	x	x	x	x	x*2
Component type (support, beam; open or closed profile)	x	x	x	x	x	x	x	x
Preparation / corrosion protection	x	x	x	x	x	x	x	x
Screws or clamps (dimensioning, distances)		x		x	x	x	x	
Substrates for joints / multi-layer – staggering of joints		x		x	x	x	x	
Additional measures for penetrating pipes or cables		(x)	(x)	(x)	(x)	(x)	(x)	(x)
Additional measures for claddings and coatings	x	(x)	(x)	(x)	(x)	(x)		
Glueing or trowelling of all joints		(x)		x	(x)	(x)	(x)	
Minimum distance for claddings	x							
Ventilation openings								x
Tightness / covering of joints		x	x	x	x	x	x	
Compatibility of individual compoments	x	x	x	x	x	x	x	x
External influence through other building parts or components	x	x	x	x	x	x	x	
Protective measures against mechanical damage	x	x	x	x	x	x	x	
Compatibility of connection details – room dividing elements	x	x	x	x	x	x	x	
Visual control of non-coated areas	x	x	x	x	x	x	x	x
Additional measures to allow expansion steel / cladding		x	x	x	x	x	x	

x = applicable
(x) = dependent upon the construction (see test certificate, assessment and application directives released by accredited testing institutes)

*1 HWMSDP = wood-wool multi-layer insulation board
*2 for concrete fillings, the appropriate concrete thickness (evaluation by expert required)

3.4.1 Wood building components – Criteria for choice

(Tested systems for wood building components)

Products / Constructions / Criteria for choice	Mineral wool	Gypsum boards	Silicate boards	Vermiculite boards	Wood-wool insulation boards
Layer thickness	x	x	x	x	x
Component type (support or beam)	x	x	x	x	x
Paintability	x	x	x	x	x
Protective measures against mechanical damage	x	x	x	x	x
Connection details of room dividing elements *1	x	x		x	x
Glueing or trowelling of joints		x		x	x

x = applicable

*1 paying attention to the lateral wall and ceiling connection

3.4.2 Wood building components – Accompanying visual test

(Classified compositions of wood building components)

Products / Constructions / Test criteria	Mineral wool	Gypsum boards	Silicate boards	Vermiculite boards	Wood-wool insulation boards
Screws or clamps (dimensioning, distances)	x	x	x	x	x
Substrate for joints / multi-layer – staggering of joints	x	x	x	x	x
Glueing, trowelling of joints		x		x	x
Protective measures against mechanical damage	x	x	x	x	x
Connection details of room dividing elements *1	x	x	x	x	x

x = applicable

3.6.1 Walls – Criteria for choice

(Tested systems for frame walls)

Systems / Materials / Criteria for choice	Gypsum cardboard boards	Gypsum fibre boards	Silicate boards	Vermiculite boards	Cement-bonded boards	Wood-wool boards	GK special con-structions	Fire protection glass	Wood material boards
Length unlimited	x	x	x	x	x	x	x	x	x
Distance of expansion joints	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Maximum construction height 5 m	x	x	x	x	x	x	x	(x)	(x)
Maximum construction height > 5 m	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Thermal insulation (build-ing physics)	x	x	x	x	x	x	x	x	x
Required sound reduc-tion index	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Size of revision openings	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Clean room suitability	(x)	(x)	(x)	(x)	(x)	(x)	(x)	x	
Shaft walls	x	x	x	x	x	x	x		
Bent walls	x	x	(x)	(x)		x	x		x
Moisture resistance	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Ball throwing safety	(x)	(x)	(x)	(x)	(x)	(x)	(x)	x	(x)
Fire resistance F30 to F90	x	x	x	x	x	x *1	x	x	x *1
Fire resistance F90S (walls with mechanical requirements)	x	x	x	x		x	x		
Thermal radiation	x	x	x	x	x	x	x	(x)	x

x = applicable

(x) = dependent upon the construction (see test certificate, assessment and application directives released by accredited testing institutes)

*1 = F90 dependent upon regional regulations

3.6.2 Walls – Accompanying visual test

(Tested systems for frame walls)

Systems / Constructions / Test criteria	Gypsum boards	Silicate boards	Vermiculite boards	Cement-bonded boards	Wood-wool insulation boards	Fire-protection glass	Wood material boards
Wall, ceiling and floor connection	x	x	x	x	x	x	x
Fire-protection classification of surrounding components							
System-conform edge execution							
Distance and dimensioning of sub-construction fastenings							
Type and distance of sub-construction							
Maximum wall height							
Insulation inlay (type, thickness, apparent density, full surface, closed joints …)							
Cladding: type of boards, thickness, arrangement							
Execution of joints (butt, staggered joint, groove and feather)							
Substrate of joints							
Staggering of joints with multi layers							
Glueing or trowelling of joints							
Distance and dimensioning of fastening means (screws, clamps)							
Additional measures for penetrations by cables, pipes, etc.							
Additional measures for expansion joints and moving connections							
Additional measures for fittings							
Additional measures for openings							

x = applicable

3.7.1 Expansion joints – Criteria for choice

(Tested systems for fire-protection joints)

Products / Constructions Criteria for choice	Fire-protection sealing compoungs	Fire-protection foam	Fire-protection expansion bands	Mineral wool with DB*1	Fire-protection ropes and tresses
Size limitations (width and depth)	x	x	x	x	x
Paintability	(x)		x	(x)	x
Condensation resistance	(x)	x	(x)		
External application	(x)		(x)		(x)
Clean-room suitability	(x)		(x)		(x)
Adherence to substrate required	x	x		x	
Fire resistance class:					
EI90 (F90)	x	x	x	x	x
EI 180 (F180)	(x)		(x)		(x)

x = applicable
(x) = dependent upon the construction (see test certificate, assessment and application directives released by accredited testing institutes)

*1 = DB (insulation-layer former)

3.7.2 Building joints – Accompanying visual test

(Tested systems for fire-protection joints)

Products / Constructions Test criteria	Fire-protection sealing compoungs	Fire-protection foam	Fire-protection expansion bands	Mineral wool with DB*1	Fire-protection ropes and tresses
Size limitations (width and depth)	x	x	x	x	x
Paintability				x	
Condensation resistance	(x)	x	(x)		
External application	x		x		
Adherence to substrate	x	x		x	

x = applicable
(x) = dependent upon the construction (see test certificate, assessment and application directives released by accredited testing institutes)

*1 = DB (insulation-layer former)

3.8.1 Loft completion – Criteria for choice

(Tested systems for loft completion)

Products / Constructions Criteria for choice	Mineral wool	Gypsum boards	Silicate boards	Vermiculite boards	Wood-wool insulation boards	Metal ceilings	Independent ceilings
Sub-construction (grid dimensions and hangers)	x	x	x	x	x	x	x
Fittings with additional measures (lamps, fire alarms and the like)	x	x	x	x	x	x	x
Layer composition and dimensioning (e. g. thick-ness)	x	x	x	x	x	x	x
Trowelling or glueing of all layers		x			(x)		(x)
Surface properties (structure)	x	x	x	x	x	x	x
Connection light-weight frame wall *1	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Connection light-weight shaft wall *	(x)	(x)	(x)	(x)	(x)	(x)	(x)
External application (protected area)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
Revision openings (function and composition)	(x)	(x)	(x)	(x)	(x)	(x)	(x)

x = applicable
(x) = dependent upon the construction (see test certificate, assessment and application directives released by accredited testing institutes)

*1 = special execution for frame wall, paying attention to lateral wall and ceiling connection

3.8.2 Loft completion – Accompanying visual test

(Tested systems for loft completion)

Products / Constructions Test criteria	Mineral wool	Gypsum boards	Silicate boards	Vermiculite boards	Wood-wool insulation boards	Metal ceilings	Independent ceilings
Sub-construction (grid dimensions, hangers)	x	x	x	x	x	x	x
Type, distance and dimensioning of fastening means (screws, clamps, etc.)	x	x	x	x	x	x	x
Fittings with additional measures (lamps, fire alarms and the like)	x	x	x	x	x	x	x
Layer composition and dimensioning (e. g. thick-ness)	x	x	x	x	x	x	x
Trowelling or glueing of all layers		x			(x)		(x)
Connection light-weight frame wall *1	x	x	x	x	x	x	x
Connection light-weight shaft wall *	x	x	x	x	x	x	x
External application (protected area)	x	x	x	x	x	x	x
Revision openings (function and composition)	x	x	x	x	x	x	x
Additional measures for penetrations of cables, pipes, etc.	x	x	x	x	x	x	x
Additional measures for expansion joints and mov-ing connections	x	x	x	x	x	x	x

x = applicable
(x) = dependent upon the construction (see test certificate, assessment and application directives released by accredited testing institutes)

*1 = special execution for frame wall, paying attention to lateral wall and ceiling connection

4. Relevant standards and directives

Standards (ÖNORM, DIN standard, EN standard)
Technical directives for preventive fire protection (TRVB)
OIB directives and ÖN directives

4.1.1 ONORMEN

A 2050

B 2110

B 2230-4

B 2260-1

B 2260-2

B 3415

B 3416

B 3800-1

B 3800-2

B 3800-3

B 3800-4

B 3850

B 3852

B 3855

B 3858

B 3860

B 7260-1

4.1.2 DIN standards

4102-9

4102-6

4.1.3 EN standards

13501-2

13964

13964-2

4.2 Technical directives for preventive fire protection (TRVB)

B 108 91

N 115

N 142

N 106 90

N 130 77

N 132 78

N 135 79

N 138 00

N 143 95

O 120 88

S 125 97

4.3 OIB directives and ÖN directives

OIB directive 2

OIB directive 2.1

OIB directive 2.2

ONR 22000

Equivalence tables

Transition of European classes of fire resistance of building materials (building components) to Austrian fire-resistance classes (extract from ÖNORM B 3807).

Proof of fire-resistance class:
The fire resistance of building materials (building components) according to ÖNORM EN 13501-2, -3 and -4 shall be proven according to the relevant European test standard by a test report of an accredited test institute. A classification according to ÖNORM EN series EN 13501 can not be replaced on the basis of a test report according to the hitherto relevant Austrian standards. The appropriate transition regulations shall be heeded.

Table 2

Building components	Fire delaying		Highly fire delaying		Fire resistant		Highly fire resistant		Test according ÖNORM	
	ÖNORM EN 13501-2, -3, -4	ÖNORM	ÖNORM EN 13501-2, -3, -4	ÖNORM	ÖNORM EN 13501-2, -3, -4	ÖNORM	ÖNORM EN 13501-2, -3, -4	ÖNORM		
Not load-bearing walls with G-glazing	E 30	-	E 60	-	E 90	-	-	-	EN 1364-1	-
Suspended ceilings with fire resistance	EI 30 (a √ b)	-	EI 60 (a √ b)	-	EI 90 (a √ b)	-	-	-	EN 1364-2	-
Roofs without insulation	RE 30	-	RE 60	-	RE 90	-	-	-	EN 1365-2	-
Staircases	R 30	-	R 60	-	R 90	-	-	-	EN 1365-5	-
Gap-sealing systems	EI 30	-	EI 60	-	EI 90	-	EI 180	-	EN 1366-4	-
Installation ducts and shafts	EI 30 (a √ b)	-	EI 60 (a √ b)	-	EI 90 (a √ b)	-	-	-	EN 1366-5	-
Double floors	REI_f 30	-	-	-	-	-	-	-	EN 1366-6	-
RWA pipes	E_{600} 30 $_{single}$ (h_0) EI 30 $_{multi}$ (h_0)	-	E_{600} 60 $_{single}$ (h_0) EI 60 $_{multi}$ (h_0)	-	E_{600} 90 $_{single}$ (h_0) EI 90 $_{multi}$ (h_0)	-	-	-	EN 1366-8	-
Smoke skirts	D 30	-	-	-	-	-	-	-	EN 12101-1	-

ÖNORM B 3807, Table 1 – Building components

Table 1: Building components for which an equivalent fire resistance classification exists (building component equipments' table)

Building components	Fire delaying		Highly fire delaying		Fire resistant		Highly fire resistant		Test according ÖNORM	
	ÖNORM EN 13501-2, resp. -3	ÖNORM (see last column)	ÖNORM EN 13501-2, resp. -3	ÖNORM (see last column)	ÖNORM EN 13501-2, resp. -3	ÖNORM (see last column)	ÖNORM EN 13501-2, resp. -3	ÖNORM		
Not load-bearing walls	EI 30	F 30	EI 60	F 60	EI 90	F 90	EI 180	F 180	EN 1364-1	B 3800-2
Not load-bearing fire partitions	-	-	-	-	EI 90	F 90	EI 180	F 180	EN 1364-1	B 3800-2
	-	-	-	-	EI-M 90	F 90 S	EI 180	F 180 S	EN 1364-1	B 3800-3
Not load-bearing outer walls and apron facades [1]	EI 30 (i √ o)	W 30	EI 60 (i √ o)	W 60	EI 90 (i √ o)	W 90	-	-	EN 1364-3, -4	B 3800-3
Load-bearing walls	REI 30	F 30	REI 60	F 60	REI 90	F 90	REI 180	F 180	EN 1365-1	B 3800-2
Load-bearing fire partitions		-			REI 90	F 90	REI 180	F 180	EN 1365-1	B 3800-2
		-			REI-M 90	F 90 S	REI-M 180	F 180 S	EN 1365-1	B 3800-3
Ceilings and roofs	REI 30	F 30	REI 60	F 60	REI 90	F 90	REI 180	F 180	EN 1365-2	B 3800-2
Bars	R 30	F 30	R 60	F 60	R 90	F 90	R 180	F 180	EN 1365-2	B 3800-2
Supports	R 30	F 30	R 60	F 60	R 90	F 90	R 180	F 180	EN 1365-3	B 3800-2
Ceiling claddings [2]	REI 30	F 30	REI 60	F 60	REI 90	F 90	REI 180	F 180	ENV 13381-1, -5	B 3800-2
Linings for walls [2]	REI 30 / EI 30	F 30	REI 60 / EI 60	F 60	REI 90 / EI 90	F 90	REI 180/EI 180	F 180	ENV 13381-2	B 3800-2
Bar and support coatings, claddings [2]	R 30	F 30	R 60	F 60	R 90	F 90	R 180	F 180	ENV 13381-3, -4, -6, - 7	B 3800-2
Ventilation pipes horizontal	EI 30 h_0 i √ o)	L 30	EI 60 h_0 i √ o)	L 60	EI 90 h_0 i √ o)	L 90	-	-	EN 1366-1	M 7626
Ventilation pipes vertical	EI 30 v_e i √ o)	L 30	EI 60 v_e i √ o)	L 60	EI 90 v_e i √ o)	L 90	-	-	EN 1366-1	M 7626
Fire protection stoppers	-	-	EI [3] 60 / E 60 (v_e h_0 i √ o)	K 60	EI [3] 90 / E 90 (v_e h_0 i √ o)	K 90	-	-	EN 1366-2	M 7625
Bulkheads	EI 30 (IncSlow)	S 30	EI 60 (IncSlow)	S 60	EI 90 (IncSlow)	S 90	-	-	EN 1366-3	B 3836
Bulkheads at conveyor installations [4]	EI_2-(C) 30	T 30	EI_2-(C) 60	T 60	EI_2-(C) 90	T 90	-	-	EN 1366-7	B 3800-3
G-glazing	E 30	G 30	E 60	G 60	E 90	G 90	-	-	EN 1364-1	B 3800-3
F-glazing	EI 30	F 30	EI 60	F 60	EI 90	F 90	-	-	EN 1364-1	B 3800-3
Doors and gates [5]	EI_2 30 C	T 30	EI_2 60 C	T 60	EI_2 90 C	T 90	-	-	EN 1634-1	B 3850/52
Smoke sealings [5]	E 30 C	R 30	-	-	-	-	-	-	EN 1634-1	B 3850
Loft sealings	EI_2 30	T 30	EI_2 60	T 60	-	-	-	-	EN 1634-1	B 3860

[1] This classification relates only to the total system of an external building component, however, not to the respective coatings. For these, equivalent tests are in preparation.

[2] The classification applies to the protected building component.

[3] For EI considerable higher performance characteristics result compared to K. See also introduction in ÖNORM M 7625.

[4] Footnote [5] applies literally.

[5] The performance criteria "self-sealing potential C" is a property which is not tested under fire stress. This is why EN 13916 and EN 14013 describe these criteria for doors and gates as "supporting standards". The ÖNORMEN B 3850 and B 3852, therefore, demand the test of this self-sealing potential also at the specimen. Therefore, the resulting classification is only described through addition of the letter "C" and does not possess an index, indicating the number of opening cycles in the test. The number of opening cycles is described in the Austrian production standard.

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