Fire Protection Guidelines

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The Fire Protection Guidelines (FPG) from Sikla provide employees, planners and processors with the security they need to design effective fire protection fastening solutions.

The fire protection requirements are based on the provisions of the constitution which guarantee the general safety and integrity of the public.

Fire protection requirements are generally divided into

- **Preventive fire protection** (for buildings, systems, insurance regulations)
- **Defensive fire protection (fire fighting)**
- **Organisational fire protection (company fire protection regulations).**

The essential safety requirements are based on the legal provisions of the **Model Building Code (MBO)** for fire protection and are legally binding requirements in each federal state set out in the **State Building Code (LBO)**. The Model Building Code shall be applied to pipe systems in the broadest sense because these construction types are based on building products.

Reference is made in the State Building Code (LBO) to the **LETB (List of Technical Building Regulations)** which provides an overview of the technical regulations and standards to be applied to every federal state. These are guidelines and standards primarily regarding fire protection, thermal insulation and noise protection which shall be applied in the planning, implementation of installations as well as design of a fire protection concept. The LETB includes both national standards (DIN) as well as European standards (DIN EN), for example the relevant **Eurocodes** (DIN EN 1990; 1991; 1993).

Besides compliance with the legal provisions, there are other guidelines, e.g.

- **the Model Pipe System Guidelines (MLAR)**
- **the Model Ventilation System Guidelines (M-LüAR),**

in which other requirements for special areas are set out and explained in more detail in other publications by a group of authors under the leadership of Mr. Dipl.-ing. Manfred Lippe based on examples, e.g.

- **the comment on MLAR and the comment on M-LüAR.**

The German standard DIN 4102-4 and European standard DIN EN 13501-1 also apply in terms of the basic **classification of building materials according to their fire behaviour**.

Product-specific test results were calculated and analysed by the **Pipe Fastening Association (RAL)** and by the **Material Testing Institutes (MPA)**. These results have been included in the current catalogue details.

This cooperation has enabled us at an early stage to calculate fastening designs under defined requirements as well as conduct a scientific analysis of load and deformation values on specific components from fire tests.

Expert reports from renowned testing institutes were conducted to inspect in various practical fastening situations in the event of a fire and analyse them professionally, in particular by the IBS [12] for ventilation and smoke extraction systems.

The documentation provides the processor with further information to ensure and improve the safe and effective construction of buildings and to mitigate known risks and hazards by complying with fire-related boundary conditions. The information summarised in Chapter 12 (Use) applies in terms of the **application** of these fire protection guidelines for processing specific projects.

The importance attached to fire protection in **Europe** varies depending on the particular country. This is reflected in specific national application documents (NAD) for European standards as well as in different building practices.

In this respect, specific national regulations, which deviate from the standards, may apply which do not stipulate compliance to the information presented here and allow for different safety objectives.

Model Building Code (MBO) [15]

§ 2 defines the classification of structural systems in accordance with building classes (1 to 5).

Specific evacuation and rescue concepts are assigned to each building classification which means the design of ceilings and walls is linked to specific requirements as far as the fire resistance is concerned to identify suitable evacuation and rescue options and to create specific fire zones.

Fire-fighting rescue equipment is to be provided for evacuation from building category 3 upwards.

§ 3 describes the requirements to guarantee public safety and order.

§ 14 specifies the key protection objectives

“Structural installations shall be built, altered and maintained in such a way that

- the risk of a fire breaking out is prevented
- the spread of fire and smoke (fire propagation) is prevented
- humans and animals can be rescued safely in the event of a fire
- and the fire can be extinguished effectively.”

§ 33 ff defines requirements concerning (evacuation and) rescue routes.

Rescue routes must lead to the outside and, if common and recreational rooms are available, an alternative must also be provided (second rescue route required).

Rescue routes are usually divided into horizontal sections (required corridors) and vertical sections (required staircases) depending on the direction of the routes.

§ 40 explains that pipe systems in (evacuation and) escape routes are only permissible if they can be used for a sufficient amount of time in the event of a fire.
Furthermore, this also means:
(evacuation and) rescue routes should/must be free of fire loads.

§ 41 explains that ventilation systems must be fireproof.

Ventilation lines, their claddings and insulation material must be made of non-combustible materials. Combustible materials are only permissible if there is no risk whatsoever of a fire breaking out and spreading in the ventilation line.

§ 42 Furnaces and fire places include, for example heating plants etc., special-purpose rooms.

Special regulations, for example Fireplace Regulations, apply to special rooms (e.g. rooms with furnaces) which, depending on the type of furnace and type and scope of heating material used, are subject to specific requirements regarding the construction and design of adjacent parts (ceilings, walls) and their openings (doors and windows).

However, the Model Building Code also permits

- **deviations** in accordance with **§ 16** of the certificate of usability (for building types)
- **deviations** in accordance with **§ 21** of the certificate of usability (for building products)
- **alleviations** in accordance with **§ 51** (e.g. for special-purpose buildings)
- **deviations** in accordance with **§ 67** (e.g., for building projects involving normal type and use and special-purpose buildings)
- **deviations** in accordance with **§ 85 (a)** of the Technical Building Provisions (pursuant to amended version 2016) if the general requirements … can be met to exactly the same degree using another solution.

Classification of building materials and parts in accordance with their fire behaviour

national (Germany)
DIN 4102 [4]

Fire behaviour of building materials and parts

Test rating including B2 in accordance with DIN 4102-1 and DIN 4102-4 and DIN 4102-15

A	A1	100% non-combustible	without any combustible parts
	A2	100% non-combustible	with combustible parts (harmless smoke development)
B	B1	difficult to ignite	additives in the event of fire problematic
	B2	normal combustibility	With additives, without burning droplets
	B3	easily ignited	Cannot be used alone in accordance with the Model Building Code; can only be used in combination if at least B2 is achieved

European
DIN EN 13501-1 [7] and tests in accordance with DIN EN 13501-2

Classification of building products and construction types according to fire behaviour (tests according to DIN EN 1363-1 ff)

A1	non-combustible	Test in accordance with DIN EN ISO 1182; no contribution to fire
A2	non-combustible	A2, s1, d0 negligible contribution to fire
A2	flame-retardant	A2, s>1 and/or d>0, but negligible contribution to fire
B	flame-retardant	SBI test bench, very limited contribution to fire
C (similar to B1)	flame-retardant	SBI test bench, limited release of energy
D	Normal flammability	Tolerable release of energy
E (similar to B2)	Normal flammability	Test in accordance with DIN EN ISO 11925-2; acceptable fire behaviour
F	Highly flammable	Unsuitable fire behaviour

s = smoke emission level	s1 = smoke emission absent or weak
	s2 = smoke emission of average intensity
	s3 = smoke emission of high intensity
d = flaming droplets and/ or particles production	d0 = no dripping in 600 s
	d1 = no continuous dripping over more than 10 s
	d2 = no performance detected

Description of fire resistance

E	Integrity (leak tightness)
I	Insulation (side not exposed to fire max. 180 K increase in temperature)
M	Mechanical stress (impact)
R	Resistance; load-bearing capacity; sustainability; stability
S	Limit the smoke permeability (leak tightness)

Overview and information on current amendments to standards

European standards
DIN EN 1363-1 / new edition 2012-10 [5]
Fire resistance tests - Part 1: General Requirements

This standard outlines the boundary conditions for fire tests which are used to calculate the fire resistance of components.

Amendments to this regulation are referred to in the national preface (letters “a” to “h”). The load capacity criteria has been reformulated since version 1999-10:

Section 11.1 outlines that failure occurs if either the deflection speed or the load-bearing capacity is exceeded with an unchanged application of load during the fire test.

The deflection speed criteria is not applicable within the first 10 minutes.

The load-bearing capacity is fulfilled if the permissible limit value of deflection D is exceeded for load-bearing parts.

$$D = \frac{L^2}{400d}\ mm$$

D = deflection in mm
L = free profile length between 2 anchorage points in mm
d = profile height in mm

At this point in the test, the analysis can be aborted if the values leave the permissible range. A calculation may not produce any higher results to secure the applicability of the algorithms.

These limiting criteria have already been programmed into our software so that solutions are only displayed as permissible if they do not exceed these criteria.

This ensures that profiles generally retain their structure within the required fire resistance rating even in the event of a fire and no visual signs of failure appear, such as a funicular polygon.

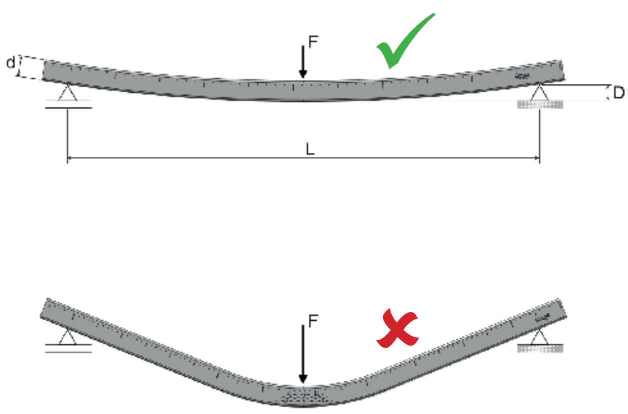


Figure 2.1: Deformation resulting in a funicular polygon indicates failure

National standards (D)
DIN 4102-4 / new edition 2016-05 [4]
Fire behaviour of building materials and building components Part 4:
Synopsis and application of classified building materials, components and special components

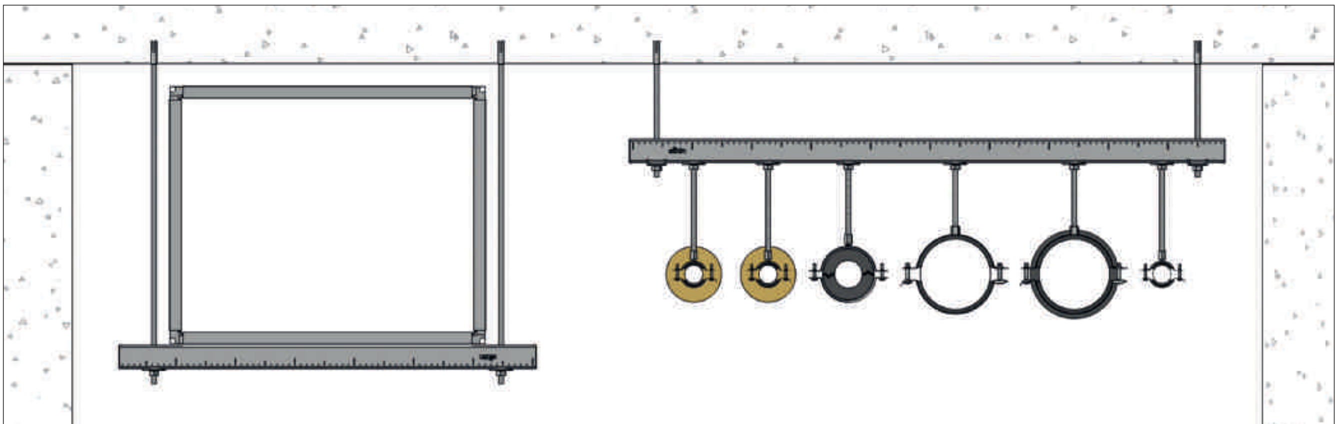
The design of steel components in accordance with DIN EN 1993 (Eurocode 3) is described in section 7.1.

A cold-state design of steel parts is to be conducted in accordance with DIN EN 1993-1-1 while a hot-state design in accordance with DIN EN 1993-1-2.

The load-bearing capacity of cladded and non-cladded steel components and steel structures and partial structures can be calculated under any fire load.

In contrast to the earlier version, an attempt has been made to align this current version to the European standards and reference has been made to the calculation method applied.

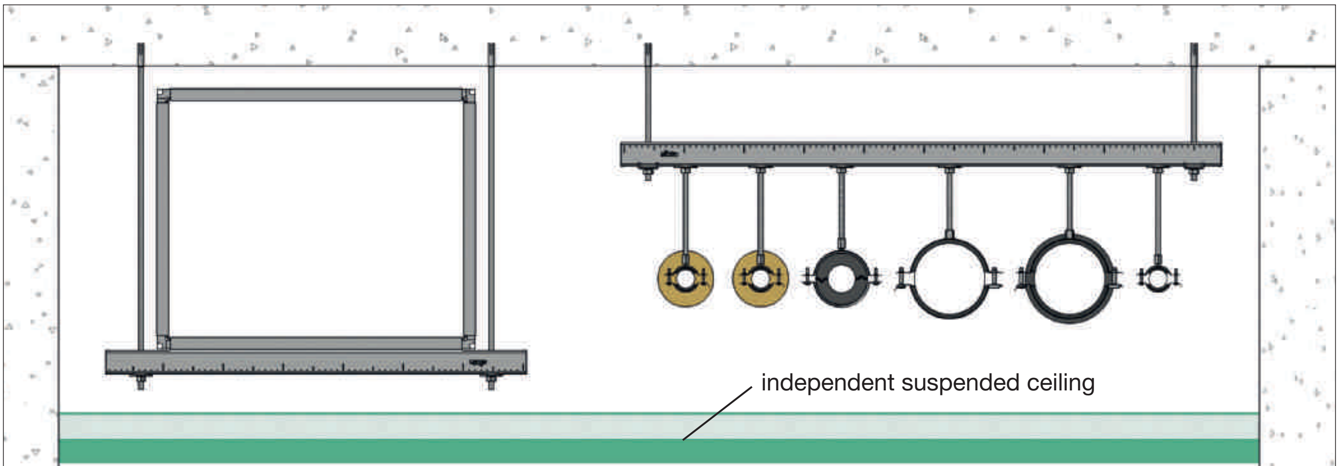
Model Pipe System Guidelines / Examples for pipe systems in escape routes



Open pipe systems can be fitted in the relevant corridors, provided that the pipes, their support and fastening systems as well as the insulated material are made of non-combustible building material. The same applies to pipelines for combustible/oxidizing media.

Support and fastening systems are designed in accordance with the structural requirements.

When fitting combustible lines (e.g. electrical lines) or lines with combustible insulating material (e.g. pipelines with synthetic rubber), additional fire protection measures must be taken.
The following are feasible in accordance with the Model Pipe System Guidelines:
Installation shafts or ducts, suspended ceilings, underfloor ducts or system floors.
Fire load encapsulation is possible for individual, combustible pipelines or pipelines with combustible insulating material (see page 9.6).



The independent suspended ceiling may not be loaded within the required fire resistance duration by falling components or warpage components caused by the exposure to heat in the event of a fire.
The support and fastening systems of the pipes above the independent suspended ceilings are therefore to be designed to meet fire protection regulations. Furthermore, minimum spacings between the pipe systems and the suspended ceiling construction must be observed. These are usually based on the certificate of usability for the suspended ceiling.

The fitting of pipelines for combustible/oxidizing media within these cavities is only possible to a limited extent (DVGW-TRGI specifications must be observed).

Model Ventilation System Guidelines [18] / Ventilation Systems / Ventilation Pipes / Smoke Protection

The **Model Ventilation System Guidelines** [18] regulate the fire protection of ventilation systems for the fire protection requirements set out in the § 41 Model Building Code [15]. These include

- air-conditioning systems
- hot-air heating as well as
- ambient air systems.

Therefore, the Model Ventilation System Guidelines [18] **apply** in

- buildings with > 2 utilisation units
- buildings with utilisation units of a total > 400 m²
- buildings with common and recreational rooms with an upper edge floor > 7m and
- all special-purpose buildings.

The Model Ventilation System Guidelines [18] **do not apply** for

- pneumatic delivery systems
- air-operated conveyor systems (transport of chips or similar).

Ventilation systems comprise of ventilation lines and all the components and equipment required for functioning.

Ventilation lines comprise of ventilation pipes, ventilation ducts, shut-off devices to prevent the spread of fire and/ or smoke (fire protection flaps / smoke protection flaps) and from their connections, **fastenings, insulations** etc.

Pursuant to § 41 (2) Model Building Code [15], ventilation pipes including their cladding and insulating material comprise of non-combustible building materials. Combustible materials are only permissible if there is no risk of a contribution to a fire breaking out or spreading.

Flame-retardant building materials are permissible for ventilation lines if they are fitted exclusively within a fire zone and do not contribute to the spreading of fire.

Ventilation lines may only pass through space-enclosing components for which fire resistance is specified if there is no risk of the spread of fire for a sufficiently long time or if preventive measures have been taken.

Section 5.2 of the Model Ventilation System Guidelines [18] provides special information on the routing of lines/ pipes:
When exposed to fire, ventilation lines may not exert any significant forces on supporting or fire resistant parts of the building structure. The relevant expansion possibilities must be provided, see Figure 2.3 on page 2.6.

Fire resistant line sections must be fastened to components with a suitable fire resistance rating.

Particularly above independent suspended ceilings with the required fire resistance, ventilation lines must be fastened in such a way that they cannot fall in the event of a fire.

The Model Ventilation System Guidelines [18] describe in detail using illustrations **shaft and bulkhead solutions**, which are explained in even greater detail in the corresponding comment [19].

Among other topics, the following issues were **added** in edition **2016** of the Model Ventilation System Guidelines [18]:

- Fire resistance of ventilation lines with potential risks in the event of penetrations
- Use of fire protection flaps for laboratory ventilation
- Prevention of major structural loads by the expansion of pipes in the event of fire.

Fastenings to protect the function of fire protection flaps [12]

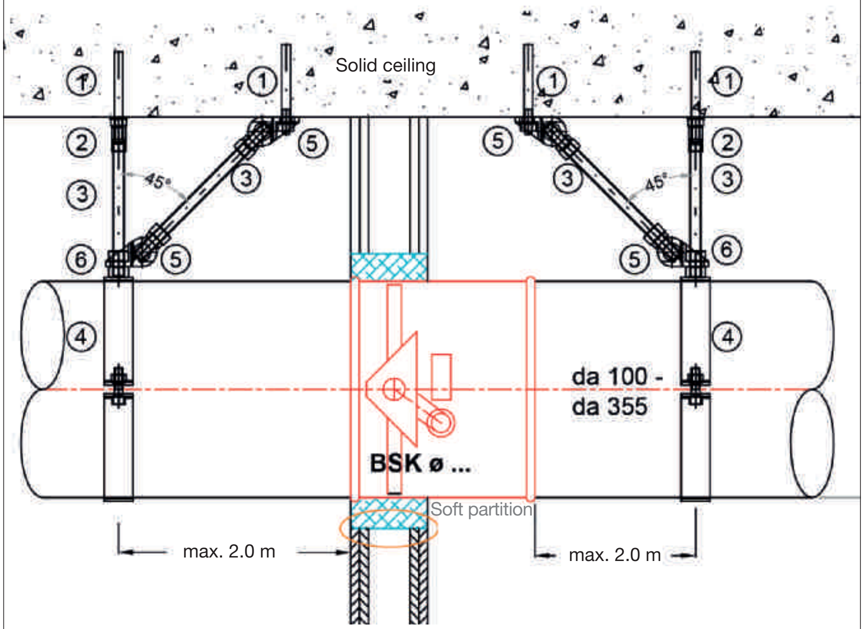


Figure 2.2: Rigid safety of fire protection flaps [12]

Fastenings of ventilation lines with round and/or square fire protection flaps or fire/smoke control flaps must be designed in such a way that their function is guaranteed in the event of a fire.

In the expert report from the IBS [12], rigid and flexible fastening solutions are therefore described which prevent an unintentional moving of these safety devices and ensure their correct functioning.

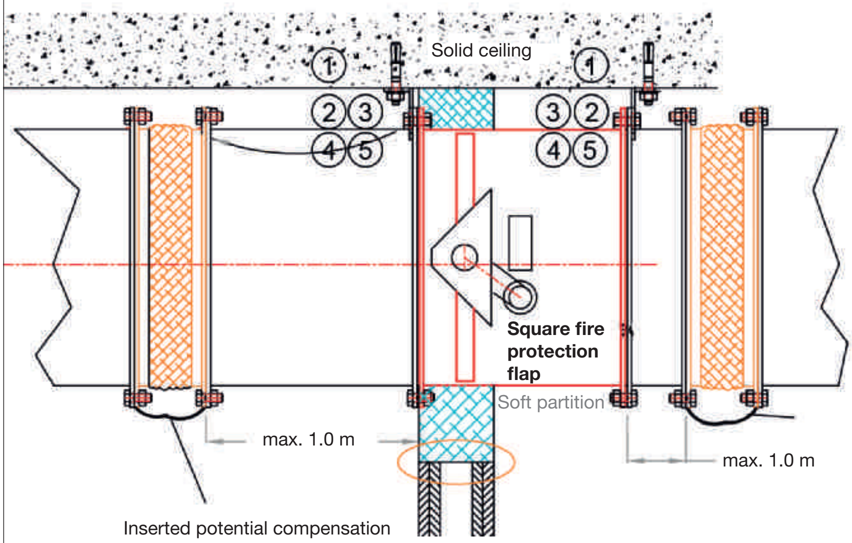


Figure 2.3: Flexible safety of fire protection flaps [12]

Expansion compensation is especially required if a ventilation line, which expands in the event of a fire, could impair the functioning of the safety devices.
The example shows such a case where the position of the safety flaps is secured by adjacent anchors or by decoupling.

IBS Institut für Brandschutztechnik und Sicherheitsforschung

Fire triangle and fire progress

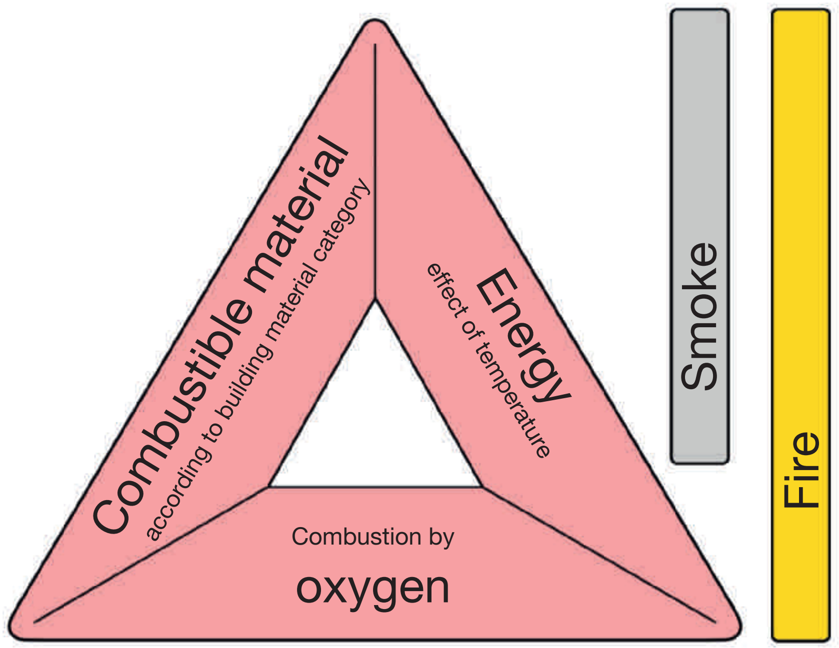


Figure 3.1: Fire triangle, see [10]

A fire needs three different elements to ignite:

- combustible material
- energy and
- oxygen.

A fire can be prevented or extinguished by removing any one of the elements in the fire triangle:

- by reducing the amount of combustible materials
- by removing energy (cooling by sprinklers and/or removal of toxic fumes with RWA)
- by removing / smothering the oxygen

In this way, one of the three basic elements is removed until the fire is extinguished.
At the same time, the fire is also prevented from spreading.
Since over 90% of fire victims die of exposure to toxic fumes, a primary objective is to mitigate the breaking out and spreading of smoke.

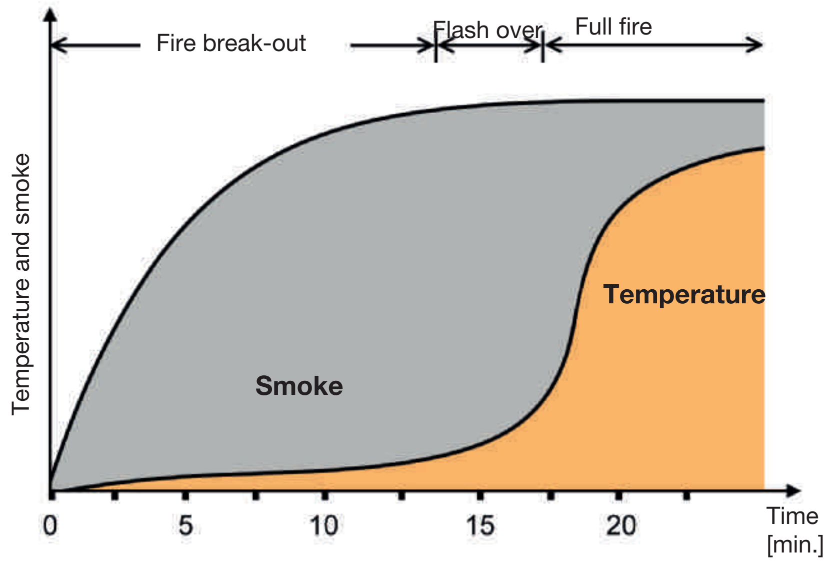


Figure 3.2: Percentage of smoke in the event of a fire, see [10]

Life-threatening smoke spreads in the first few minutes after a fire starts.

Fire then occurs with an increase in temperature and exposure to oxygen.

A particularly dangerous moment is when the existing fumes auto-ignite with increasing temperatures.

After this flash over, the blazing fire phase occurs.

If the sprinkler system is activated in the first phase, this system or the arriving fire services can prevent a blazing fire from occurring or bring it under control to mitigate the damage.

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Fire rating (standard temperature curve)

Each fire progresses and spreads according to its own parameters depending on its environment:
These special circumstances include in particular

- Fire loading (magnitude, spread, replenishment)
- Extinguishing options (sprinkler system) and
- The time until the fire services arrive.

However, the impact of a fire should still be simulated by a generally applicable model; the effects should be more on the conservative side, where possible.

To record comparable values on fire resistance, the progress of fire is therefore usually plotted by the standard temperature curve.
This procedure is described both in DIN 4102-2 as well as in DIN EN 1363-1.
The temperature curve corresponds to the international standard curve in accordance with ISO 834.

The temperature in the fire room is calculated by a logarithmic equation as a factor of time:

$$T - T_0 = 345 \cdot lg\,(8 \cdot t + 1) \quad [K]$$

Sensors in the fire room are used to control the burning to plot the actual temperature curve within a permissible tolerance.

Key points are the temperatures after 30 min. and after 90 min. in the furnace at a room temperature of To = 20 °C at the start of the test.

Duration	Gas temperature
0 min.	20 °C
30 min.	842 °C
90 min.	1006 °C

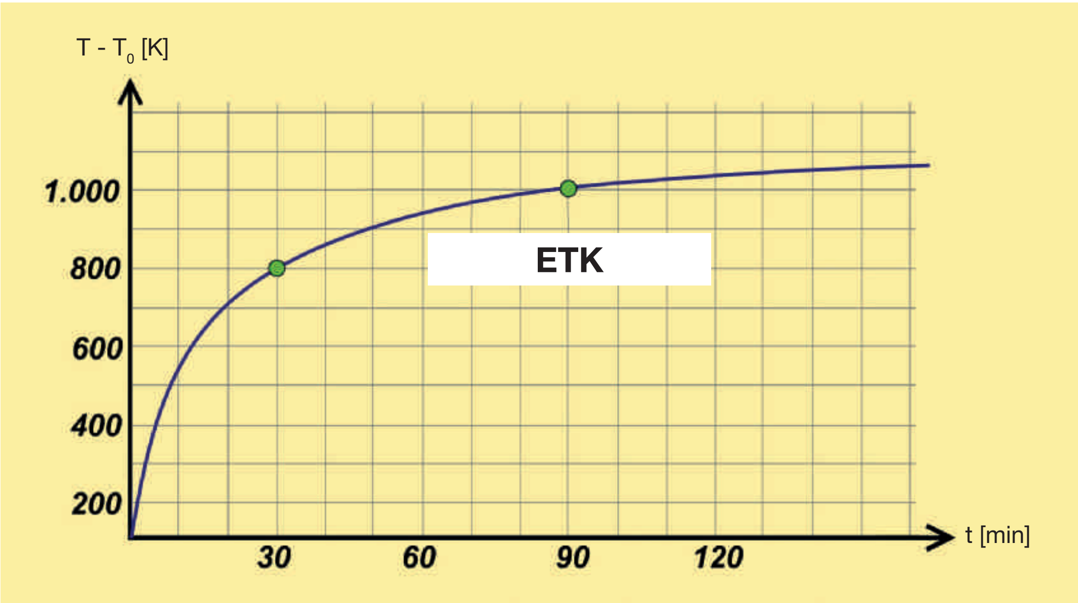


Figure 3.3: Standard temperature curve [9]

Other fire scenarios (tunnel fire and natural fire)

Tunnel fire curve / Additional Technical Regulations and Guidelines

A tunnel fire describes an extreme situation of

- Burning vehicles including fuel when heat dissipation is restricted.

As part of the Additional Technical Regulations and Guidelines, e.g. for the construction of road tunnels, special requirements are defined that shall be applied under these conditions for a engineering design.

The lack of fire loading distribution and the increasing lack of oxygen eventually cause a continual drop in temperature from the 30th minute.

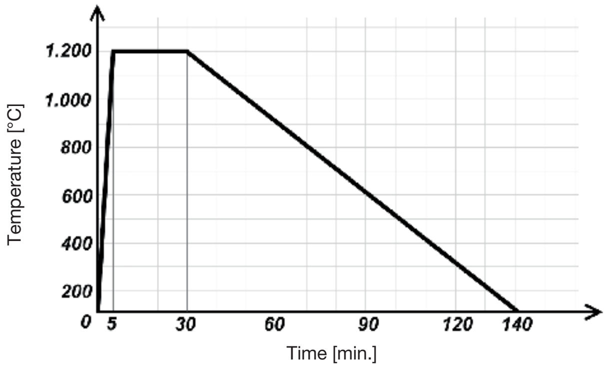


Figure 3.4: Tunnel fire curve in accordance with ZTV [25]

Natural fire model

Today, natural fire curves are only used as an exception. As a result of specific boundary conditions to be monitored regarding

- Actual fire load
- Initial extinguishing measures (sprinkler system and fire-fighting services)
- Evacuation times
- Presence of smoke

a more efficient design can often be realised in comparison to the unit-temperature time curve.

In particular for special-purpose buildings, the use of natural fire curves can provide interesting alternative solutions for the future which need to be checked for each particular case.

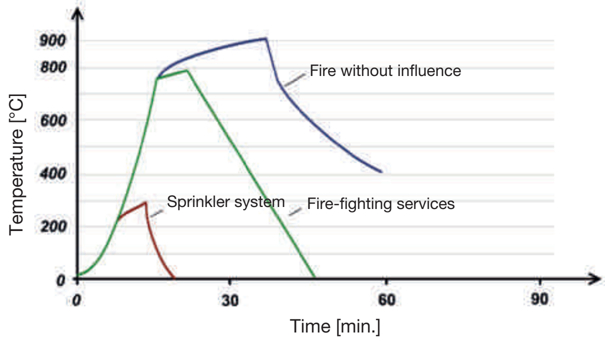


Figure 3.5: Natural fire model / see VFDB guidelines [24]

If it starts to burn… be on the safe side

If a fire should break out above an independent suspended ceiling, this will usually have been caused by exceptional and unintentional circumstances.

The spread of fire could be caused by heat convection, heat conduction and heat radiation, e.g. by a short circuit. In a bulkhead zone above the classified ceiling, you should not expect a supply of fuel or a supply of oxygen.

Due to these circumstances, this fire will struggle to develop (according to the fire triangle) and it can be assumed that this fire would not continue to spread in accordance with the standard temperature curve in this situation in practice.

Fire behaviour of structural steel / reduction factors

The strength values of steel belong to the material's key properties.
From a physical perspective, it is an indisputable fact that these material characteristics reduce to 0 between room temperature and melting point.

In DIN EN 1993-1-2: 2010-12 (Eurocode 3), the reduced values for the hot-state design are indicated as the temperature factor for the

- effective yield point
- proportional limit (elastic behaviour) and for the
- curve gradient in the elastic elongation (electric module).

The specific reduction factors are specified using a diagram (see Figure below) as well as using the tables of figures depending on the stationary temperature. Linear interpolation between specified values is permitted. In this way, the residual load capacity can be calculated on the hot-state design curve for the event of a fire.

The monitored parameters are in close correlation: A drop in the yield point will reduce the load capacity and a lower electric module is indirectly proportional to an increase in deformation. An application of load above the plastic limit load torque causes failure, which is visible as a funicular polygon for a traverse.

When exposed to fire for 90 min., a construction's resistance will be reduced by a factor of 20, in other words to approx. 5 % which is generally not an economically viable solution for the pipe span. In these cases, it is instead common to reinforce (e.g., by 4 times) the construction (on the resistance side) and to reduce the normal span to 1/5 at room temperature which also results in a factor of 20 but in this case provides an "economically viable" solution. On the basis of DIN 4104-4 [4] Sec. 11.2.6.3, the pipe span should not exceed 1.5 m in the event of a fire.

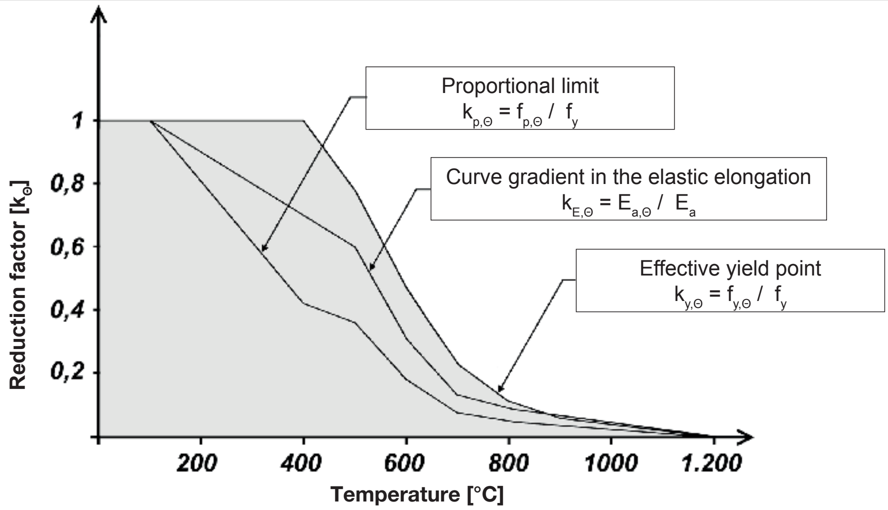


Figure 4.1: Reduction factors for carbon steel [6]

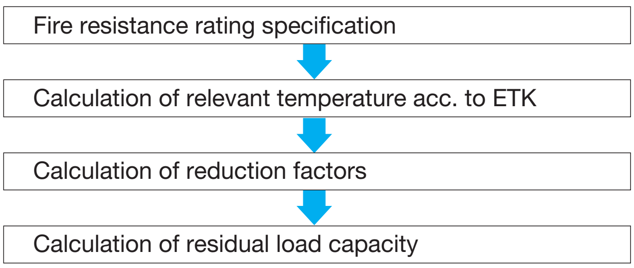
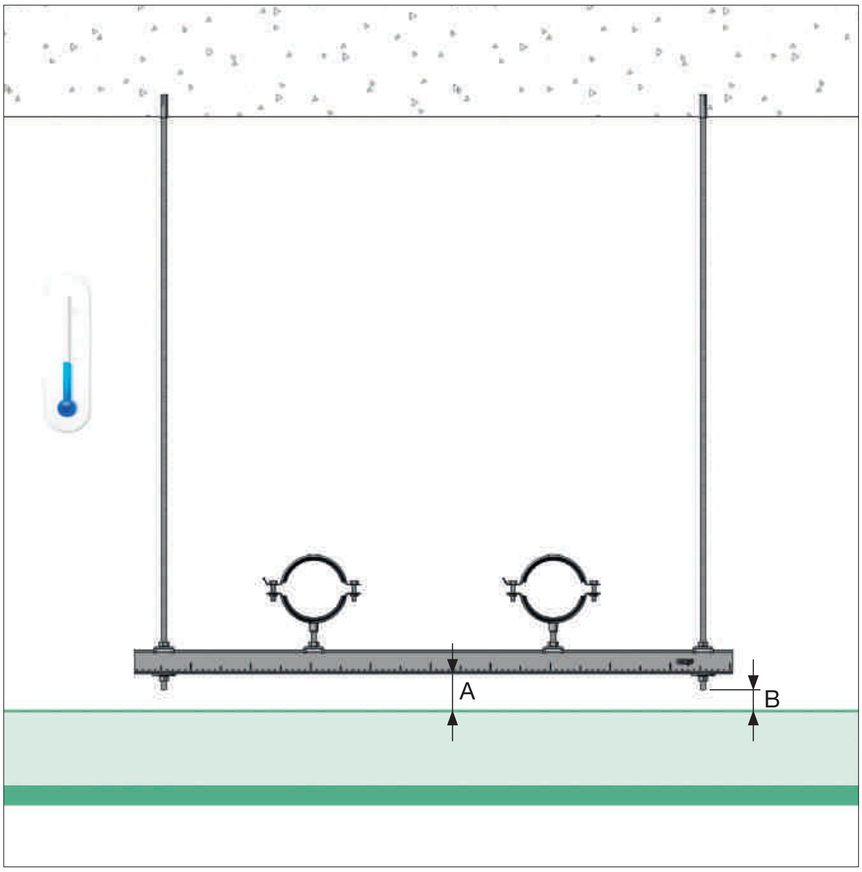


Figure 4.2: Hot-state design procedure / Sikla

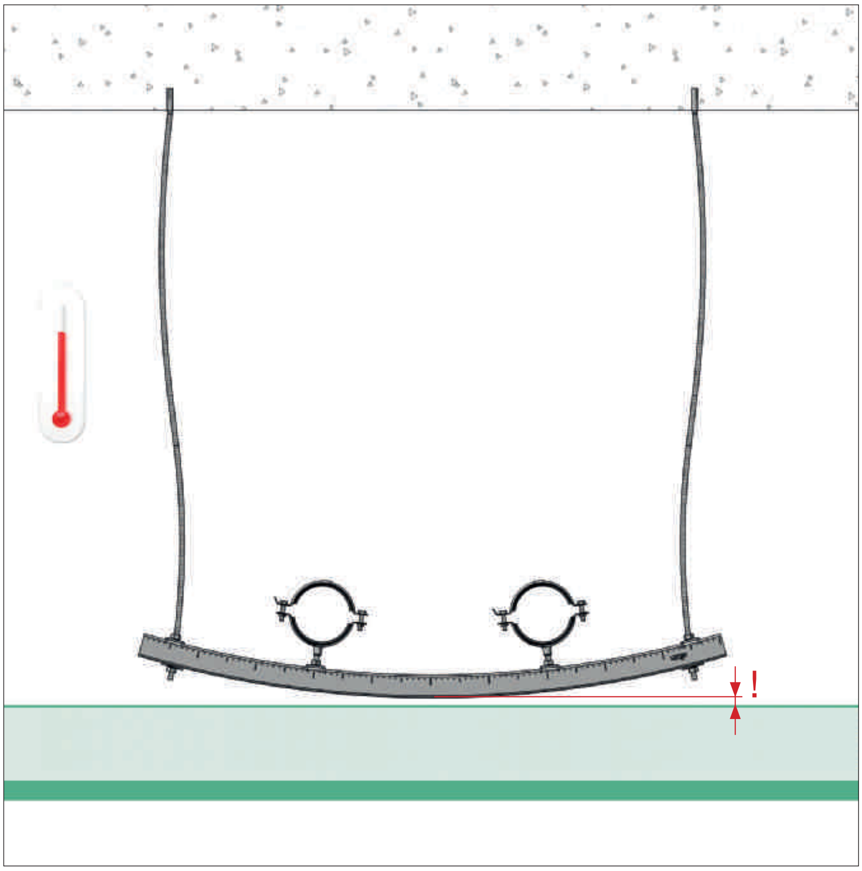
Minimum distance of pipe brackets above independent suspended ceilings



Assembly situation under normal conditions at room temperature

Note:
▶ *The support and fastening systems of the pipes above classified suspended ceilings are therefore to be designed to meet the fire resistance rating of the ceilings.*

min. (A; B) ≥ 50 mm



Assembly situation under fire conditions

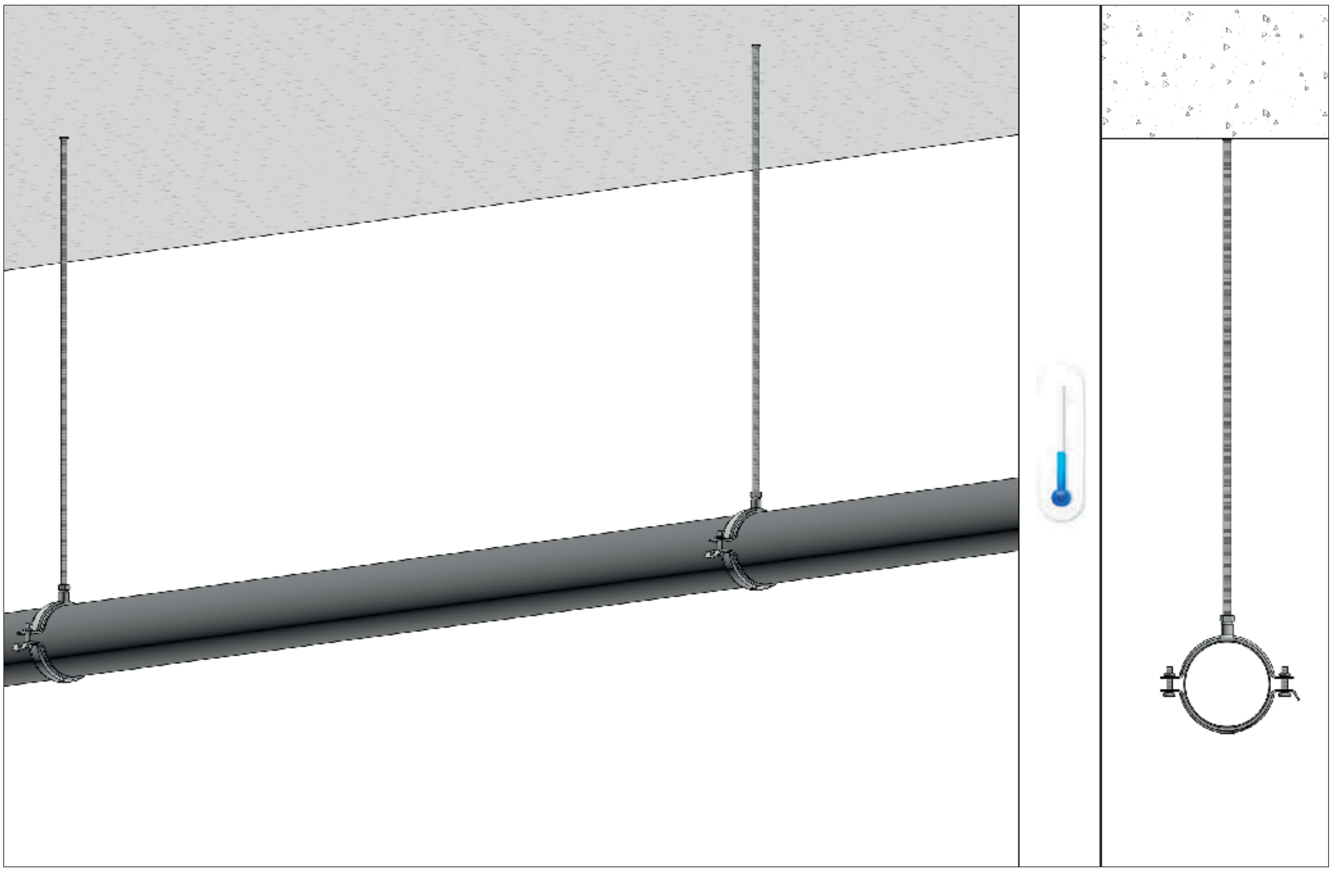
An adequate distance between the fastening construction and the upper edge of the classified suspended ceiling must be ensured to prevent them being damaged or destroyed.

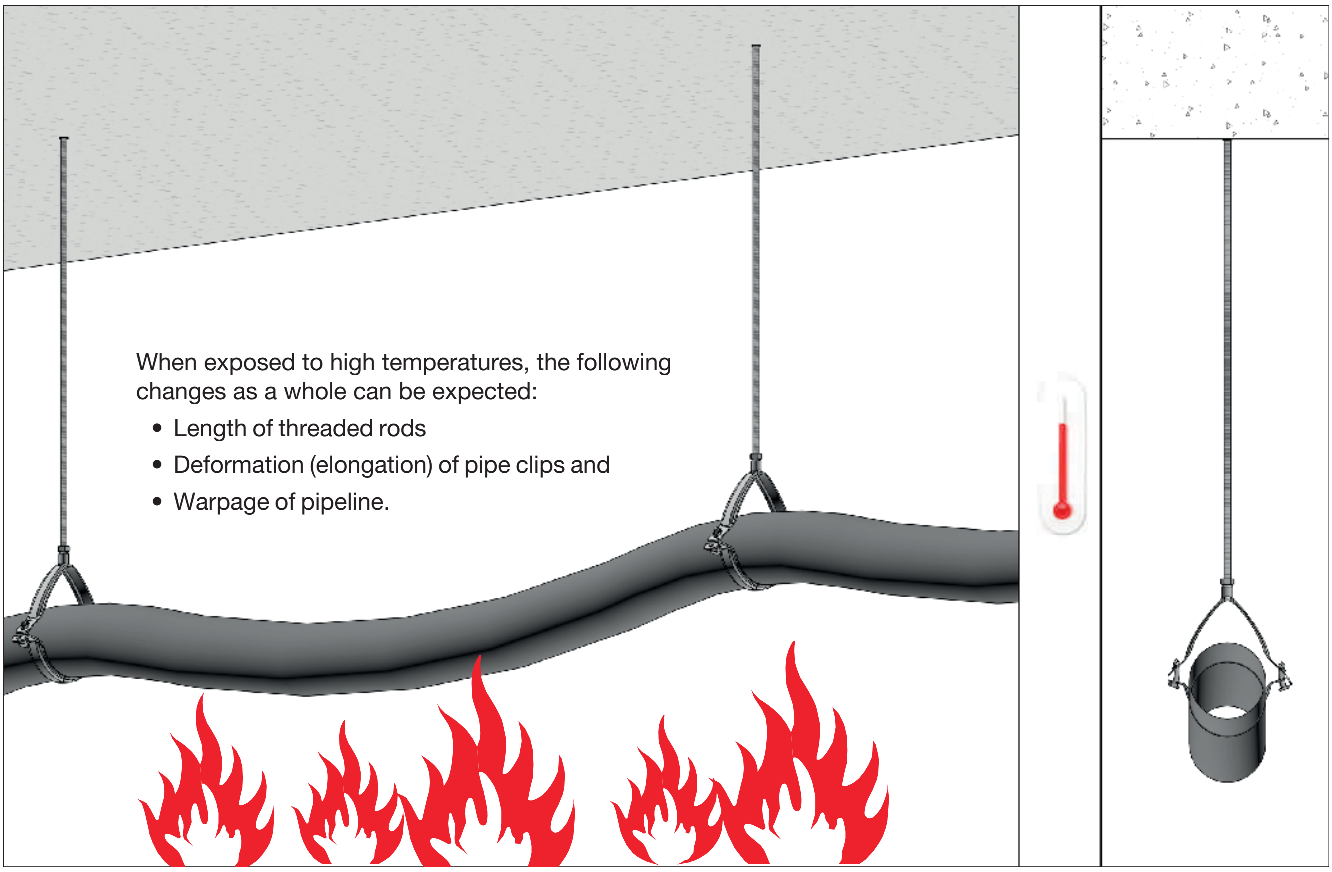
Note:
▶ *Minimum distances are based on the certificate of usability (general test certificate/general building approval) of the ceiling manufacturer.*

According to the recommendations in the comment of the Model Pipe System Guidelines [17], this should be 50 mm at least.

A larger distance (even above 100 mm) may often be necessary especially with suspended pipelines.

Deformation of a pipeline with exposure to temperature





Fastening rules for pipes with exposure to temperature

To **certify the structural safety** of a pipeline, the first step is to calculate the distribution of load in the individual fastenings and then examine for each fastening point a load chain based on their resistance values.

R_{AN} = characteristic load of anchor
R_{ROD} = characteristic load of threaded rod
R_{CLIP} = characteristic load of pipe clip

In their interaction, each element of this load chain must provide the required resistance.
Each individual value must be considerably higher than the pipeline weight at the fastening point in order to take any irregularities into consideration when fitting the pipes:

$$min.\ (R_{AN}\ ;\ R_{ROD}\ ;\ R_{CLIP})\ >\ G'(pipe)\ \cdot\ PS$$

G' (pipe) = weight of filled, insulated pipeline for each m
PS = pipe span

To estimate the **usability** of a pipeline in the event of fire, the warpage of the pipeline should also be considered if the pipe is not fitted with special fire protection features, e.g. insulated with Rockwool 800.

Individual suspensions of non-insulated pipelines especially can be subject to major unexpected total deformation d_{tot} as these pipelines consist of several different components:

$$d_{TOT} = d_{ROD} + d_{CLIP} + d_{Pipe}$$

d_{ROD} = expansion of threaded rod
d_{CLIP} = expansion of pipe clip
d_{PIPE} = reduction of pipeline

The expansion of a threaded rod d_{ROD} can be calculated and is approx. 13 mm / (m · 1000 K).
The expansion of the surrounding pipe parts d_{CLIP} can be found in the catalogue specifications (from page 6.2 onwards) and is based on the test reports.
It is far more difficult to predict the reduction of the pipeline d_{PIPE} and should therefore be minimised indirectly by taking measures such as

- Shorter distances (< 1 m) and/or
- Non-combustible pipe insulation (rock wool) and/or
- Intermediate suspensions with cross beams

.

Note: Recommendation for pipe sections
▶ *If the pipelines are elevated and fastened on horizontal profiles, the profile height of the support rail and the height of the connection elements create additional clearance for the pipeline to potentially bend.*

Behaviour of fastening products in the event of fire

The expansion of a threaded rod can basically be calculated in the event of fire.

In accordance with the stipulated fire resistance rating, the increase in temperature is recorded from the unit-temperature time curve [9] and multiplied with the (integral) coefficient of linear thermal expansion.

The following rough estimation applies

$$d_{z,ROD} = L_{ROD} \cdot 0.013\ mm / (m \cdot K)$$

With a fire resistance rating (FRR) 90, it can be assumed that a 1 m threaded rod expands by approx. 13 mm in the structural safety range, a figure reflected by the tables in various fire tests.

Unlike with the threaded rod (the elongation of which depends on a temperature change and its length can be calculated), constant deformation values are used especially for pipe clips which were calculated during an allocated test time of 120 min. in fire tests.

These values (see Table from page 6.2) can also be applied to shorter fire resistance rating times and in these cases are on the safe side.

After calculating all the expected deformations in the event of fire, an additional safety distance of 50 mm should also be taken into account (depending on the protection objective) to maintain the functioning of the independent suspended ceiling in the event of asymmetric deformation behaviour and other irregularities.

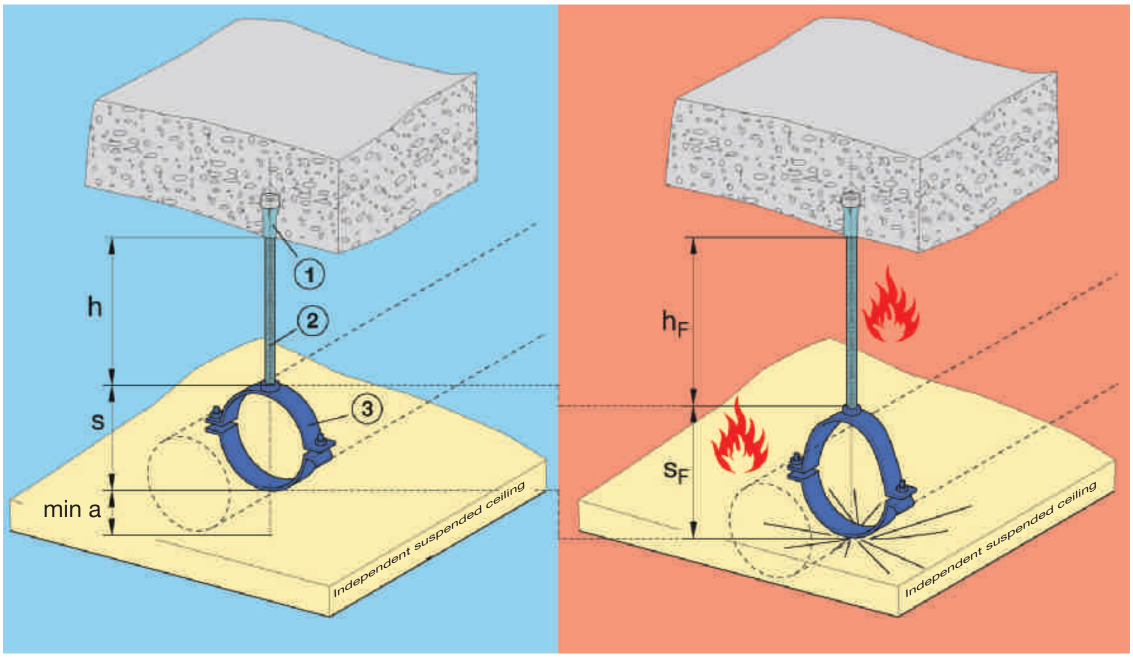


Figure 6.1: Pipe fastenings above an independent suspended ceiling in the event of fire / Sikla

Working loads and max. tensile load in the event of a fire (1)

Fire resistance rating				without	**FRR 30**	**FRR 60**	**FRR 90**	**FRR 120**	
Time exposed to fire		t	min.	0	30	60	90	120	
Max. temperature		T	° C	20	842	945	1006	1069	
Reduction factor (a)		ky, Θ	--	1.000	0.089	0.051	0.039	0.030	
Reduced yield point (b)		fy, Θ	N/mm²	235.0	20.9	12.0	9.2	7.1	
Concrete anchor AN ES				ETA - 10/0258 (2017-08-02)					
M 8 x 30	110467	F (c, d, e)	kN	1.70	0.90	0.90	0.90	0.50	
M 8 x 40	110468	F (c, d, e)	kN	2.00	1.50	1.50	0.90	0.50	
M 10 x 40	110469	F (c, d, e)	kN	2.00	1.50	1.50	1.50	1.00	
M 12 x 50	110470	F (c, d, e)	kN	2.40	1.50	1.50	1.50	1.20	
M 16 x 65	110471	F (c, d, e)	kN	6.30	4.00	4.00	3.70	2.40	
Wedge anchor AN BZ plus				ETA - 10/0259 (09/06/2017)					
M 8	114137	F (d, f, h)	kN	2.40	1.25	1.10	0.80	0.70	
M 10	114143	F (d, f, h)	kN	4.30	2.25	1.90	1.40	1.20	
M 12	114149	F (d, f, h)	kN	7.60	4.00	3.00	2.40	2.20	
M 16	114156	F (d, f, h)	kN	11.90	6.25	5.60	4.40	4.00	
Compound anchor VMZ				ETA 0260	MFPA GS3.2/17-340-2 (to 2023-02-04)				
M 8 / 50	190721	F (d)	kN	6.10	1.04	0.47	---	---	
M10 / 60	190748	F (d)	kN	8.00	2.50	1.45	0.39	---	
M12 / 80	190775	F (d)	kN	12.30	5.80	3.80	1.81	0.81	
M16 / 125	190793	F (d)	kN	24.00	7.62	5.81	4.01	3.11	
Nail anchor AN N				ETA - 13/0048 (issued 2018-01-30)					
M 8 / M10	112152	F (d, e)	kN	2.14	0.60	0.60	0.60	0.50	
Section nail PN 27				ETA - 06/0259 (issued 08/12/2016)					
6 x 35	196298	F (d)	kN	2.40	0.80	0.70	0.60	0.40	
Hanger bolt anchor MMS-ST				ETA - 05/0010 (issued 21/01/2015)					
7.5 x 80	157825	F (d)	kN	2.00	1.50	1.10	0.80	0.50	
10 x 100	157898	F (d)	kN	3.70	2.70	2.00	1.50	1.00	
Hanger bolt anchor TSM-ST				ETA - 16/0656 (issued 30/09/2016)					
6 x 55	115725	F (d)	kN	3.60	0.90	0.80	0.60	0.40	
Cut anchor AN Easy				DIBt Z-21.1-1785 (issued 2016-08-24)					
M 8	110463	F (d, i)	kN	2.00	0.90	0.90	0.70	0.40	
M10	110465	F (d, i)	kN	3.00	1.20	1.20	1.20	1.00	
M12	110466	F (d, i)	kN	3.00	1.20	1.20	1.20	1.20	
Block PBH 41				PB 901 9945 000/La					
M8-**M12** for s(AR) = 2.0 mm	199008	F	kN	5.80	0.85	0.43	0.25	---	
M8-**M12** for s(AR) ≥ 2.5 mm	199008	F	kN	5.80	1.00	0.54	0.35	0.25	
Stable D-3G with E. + silicone				RAL-GZ 655 and RAL-GZ 656					dz [mm]
14 - 23		F (M10)	kN	1.80	0.38	0.20	0.14	---	49
24 - 65		F (M10)	kN	2.00	0.50	0.25	0.17	0.12	44
67 - 115		F (M10)	kN	2.00	1.00	0.65	0.50	0.40	96
124 - 162		F (M12)	kN	2.90	2.20	1.20	0.85	0.60	96
165 - 305		F (M12)	kN	8.00	2.40	1.40	1.00	0.85	104

Working loads and max. tensile load in the event of a fire (2)

Ratio S					RAL-GZ 655 and RAL-GZ 656					dz [mm]
12 - 35			F (M10)	kN	0.80	0.27	0.08	0.02	---	42
38 - 80			F (M10)	kN	1.30	0.45	0.14	0.07	0.04	41
83 - 90			F (M10)	kN	1.30	0.46	0.17	0.08	0.03	45
108 - 170			F (M10)	kN	2.20	0.57	0.31	0.20	0.15	62

Ratio LS					RAL-GZ 655 and RAL-GZ 656					dz [mm]
12 - 84			F (M10)	kN	0.60	0.27	0.12	0.07	0.04	35
83 - 90			F (M10)	kN	0.95	0.30	0.11	0.08	0.03	45
108 - 114			F (M10)	kN	1.15	0.51	0.26	0.17	0.13	46

Sliding element GLE J					PB 2101/785/16-CM and PB 900 8374 000/La/Ei				
M10		126861	F	kN	3.50	1.10	0.60	0.40	0.30
M12		126870	F	kN	6.00	1.30	1.00	0.50	0.30
M16		126889	F	kN	6.00	1.30	1.00	0.50	0.30

Sliding set GS 2G					PB 900 8374 000/La/Ei and PB 901 9945 000/La				
GS 2G2		110584	F	kN	0.60	0.60	0.43	0.28	0.20
GS 2G2-PL		110585	F	kN	0.60	0.60	0.43	0.28	0.20

Sliding set GS H3G					PB 901 9945 000/La and PB 900 8374 000/La/Ei				
GS H3G2		110588	F	kN	5.00	1.00	0.54	0.36	0.26
GS H3G2-PL		110589	F	kN	5.00	1.00	0.54	0.36	0.26

Universal fitting UG					PB 2100/243/17- CM				
M 8		198636	F	kN	5.80	0.60	0.45	0.34	0.26
M10		198643	F	kN	8.00	0.60	0.60	0.54	0.42
M12		158075	F	kN	13.00	1.60	1.03	0.79	0.61
M16		158084	F	kN	13.00	1.60	1.60	1.47	1.13

Threaded rods 4.6 / 4.8					DIN EN 1993-1-2: 2010-12 (Eurocode 3)				
M 8		124559	F (g)	kN	5.80	0.78	0.45	0.34	0.26
M10		124568	F (g)	kN	9.30	1.24	0.71	0.54	0.42
M12		143192	F (g)	kN	13.50	1.80	1.03	0.79	0.61
M16		110817	F (g)	kN	25.10	3.35	1.92	1.47	1.13

Threaded rods 4.6 / 4.8					DIN 4102-4: 2016-05				
M 8		124559	F (k)	kN	5.80	0.33	0.33	0.22	0.22
M10		124568	F (k)	kN	9.30	0.52	0.52	0.35	0.35
M12		143192	F (k)	kN	13.50	0.76	0.76	0.51	0.51
M16		110817	F (k)	kN	25.10	1.41	1.41	0.94	0.94

Notes:

a) for ferritic concrete steel acc. to test report no. 9009798000 from MPA Stuttgart (OGI)
b) for fy = 235 N/mm²
c) for galvanized versions (fire load for connection from 5.6) or stainless steel A4
d) for C 20/25 without taking into account the reduced axis or edge distances in the cracked concrete
e) for multiple fastenings of non-structural systems in the cracked concrete
f) fire loads for version A4 and higher (see catalogue)
g) loads for threaded rod under fire stress in accordance with DIN EN 1993-1-2: 2006-10
h) for standard anchorage depth at t_{fix} = 50 mm
i) for concrete ≥ C45/55 and thickness ≥ 40 mm
k) loads for threaded rod under fire stress in accordance with DIN 4102-4: 2016-05

All load specifications are regarded as tensile loads.

Product tests in accordance with RAL-GZ 656

The independent testing of pipe clips under fire conditions is subject to the stringent quality and test specifications RAL-GZ 655 “Pipe fastening” as the basis for a fire testing and analysis in compliance with RAL-GZ 656 “Fire-certified pipe fastening”.

Several products are inserted into clamps (in accordance with clearly specified assembly instructions), are then tested in room temperature conditions and the results are statistically analysed.

If the products pass the tests at room temperature, several fire tests are then conducted to produce results at a specific number of defined measurement points which are then subject to an engineering analysis based on regression curves and necessary safety assessments.

Bestehendes Gütezeichen RAL-GZ 655

The fire resistances of parts are calculated in the result with regard to their tensile load at a fire resistance rating of 30; 60; 90; 120 min. and the largest deformation d_z in mm (values listed from page 6.2).

Clearly defined and identical test conditions help the user to feasibly compare the technical characteristics of these products.
To constantly maintain the expected quality standards, it is important to comply with specifications when conducting in-house production checks and independent third-party monitoring.

Figure 6.2: Pipe clip fire test / Sikla

The maximum deformation d_z applies to a fire resistance rating of 120 min. and is also applicable to all shorter resistance times.

Figure 6.3: Stable D-3G pipe clip before and after the fire test / Sikla

Profiles / defining boundary conditions

Load-bearing capacity (LBC)

The load-bearing capacity of sections in the event of fire is regarded as adequate (pursuant to the new version of DIN EN 1363-1 : 2012-10 for “Fire resistance tests”) if the warpage has reached the following limit $d_{perm,LBC}$.

$$d_{perm,LBC} = \frac{L_f^2}{400 \cdot h}$$

Serviceability (S)

The usability refers to a limited warpage $d_{perm,S}$, which is permissible from a visual perspective and ensures the strength of the profile cross section over the stressed free length L_f :

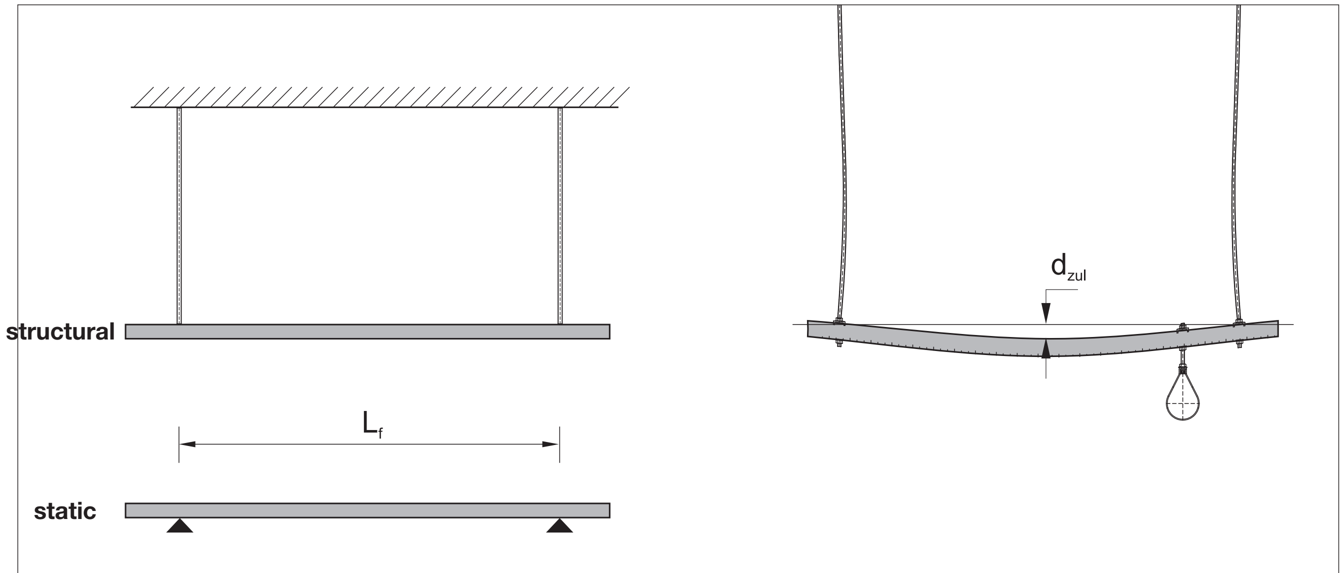
$$d_{perm,S} = \frac{L_f}{20}$$

If both criteria are linked, the maximum recommended span L_f in the event of fire produces the theoretical value $L_{f,theor}$

$$d_{perm,LBC} = d_{perm,U}$$

$$\frac{L_f^2}{400 \cdot h} = \frac{L_f}{20}$$

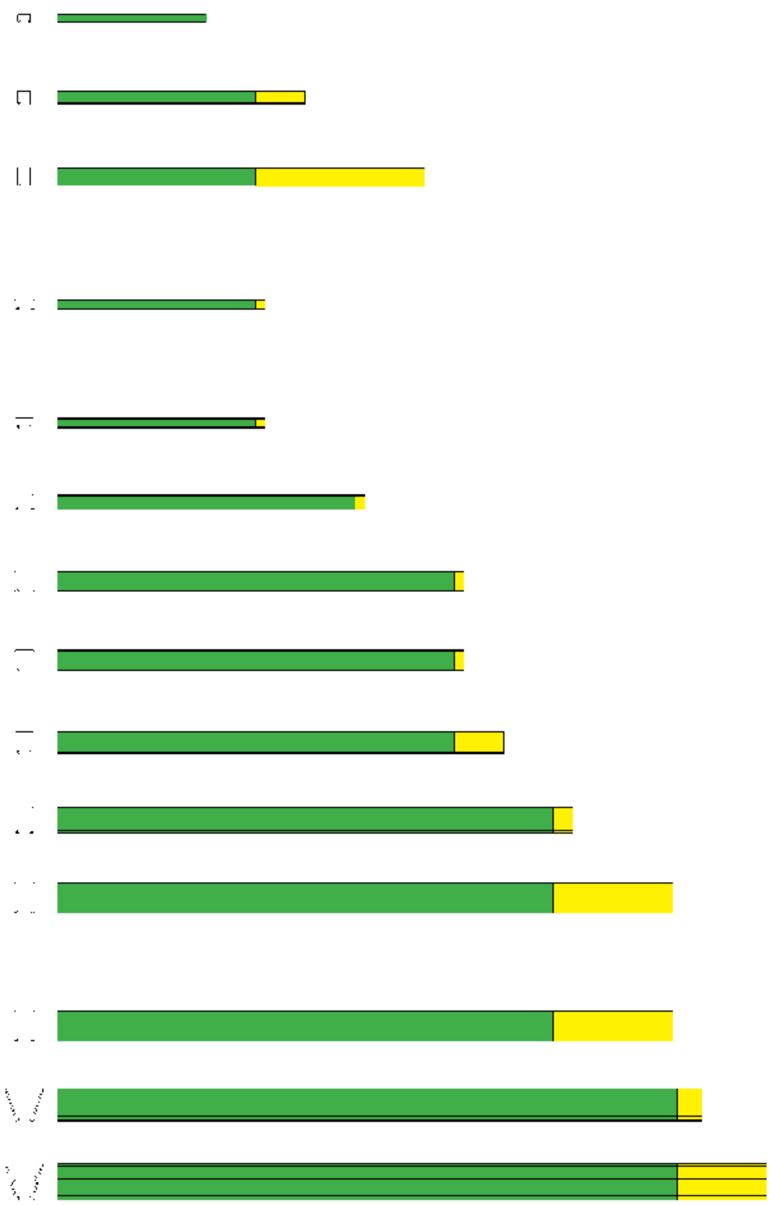
$$L_{f,\,theor} = 20 \cdot h$$



Model at room temperature

Model in the event of a fire

Sections / table for free lengths L_f



Channel (MS) Type	$L_{f,recommend}$ [mm]	$L_{f, theor}$ [mm]
27/15/1,25	300	300 [1]
27/25/1,25	400	500 [1]
27/37/1,25	400	740 [1]
41/21/1,5	400	420 [1]
41/21/2,0	400	420 [2]
41/31/2,0	600	620 [2]
41/41/2,0	800	820 [2]
41/41/2,5	800	820 [2]
41/45/2,5	800	900 [2]
41/52/2,5	1000	1040 [2]
41/62/2,5	1000	1240 [2]
41/62/3,0	1000	1240 [2]
41-75/65/3,0	1250	1300 [2]
41-75/75/3,0	1250	1500 [2]

[1] The use of these profiles requires the additional assessment of the concrete application conditions by an expert/specialist planner for fire protection for buildings.

[2] Profiles from a wall thickness of 2.0 mm may be designed by trained employees (awarded with the SiPlan training certificate, block 2 with focus on “hot-state design”) in accordance with DIN EN 1363-1 : 2012-10 for fire resistance tests in accordance with DIN EN 1993-1-2 : 2010-12 for structural fire design in the event of fire.

Based on the calculated theoretical free length $L_{f, theor}$, recommended values $L_{f, recommend}$ were calculated taking fire protection considerations into account. The following always applies

$L_{f, recommend} \leq L_{f, theor}$

Basic principles

1. Traditional calculation of load values for the event of fire

The first calculation methods were included in earlier versions of DIN 4102 for tension-type elements (threaded rods) with the tensile stress values used since approx. **1970**:

Permissible tensile stress	FRR 30	FRR 60	FRR 90	FRR 120
In accordance with DIN 4102	9 N/mm²	9 N/mm²	6 N/mm²	6 N/mm²

Identical values for FRR 30 and FRR 60 as well as for FRR 90 and FRR 120 underline that FRR 30 and FRR 90 provide more security.
Until **2000**, tests were almost exclusively conducted in materials testing institutes to certify the fire resistance of building products.
The application of engineering methods was first in the test stage and was only rolled out at the same time as the software development for the calculation of steel structures with and without cladding.

2. Eurocode 3 DIN EN 1993-1-2 in the event of a fire

In 2005, the first European standard was published for the hot-state design:
DIN EN 1993-1-2 Design of steel structures - Part 1-2: “General rules - Structural fire design”

The scope is extended to cover thin-walled profiles (up to 3 mm).
In 2010, a revised version of this standard [7] was published with a national annex.

3. Sikla received test report from MPA Stuttgart

At the end of 2005, Sikla received from the MPA Stuttgart (Independent Material Testing Institute in Stuttgart) test report no. 900 9788 000 for the computational analysis of suspended steel cross beams made of C profiles for the event of fire. The applicability of calculations for channels exposed to tension was certified by this test report and the calculations were then programmed into the SiPlan planning software. Based on the findings and experience of MPA Stuttgart, an additional magnification factor is to be taken into account when calculating the deformation.

4. New findings of RAL Quality Association for pipe fastenings

Tests conducted in 2015 by the RAL fire protection work group revealed that in certain situations larger deformations than those calculated according to EC 3 can occur. In a publication from TAB [23] this phenomenon is described in detail and the author points out that this standard should only be applied to lightweight, cold-profiled, thin-walled profiles by employees with expert knowledge and extensive application and product know-how. Furthermore, attention was also drawn to the fact that individual preliminary tests by manufacturers indicated a higher load-bearing capacity than the computational capacity expected which provided an indisputable argument for the use of the reduced tensile stress values as described in another trade article of the RAL Quality Association published in the magazine FeuerTrutz 2017/1 [11].

5. Sikla adopts new findings

In 2016, new findings were analysed and, as a result, a deformation allowance was calculated and incorporated in SiPlan to enable the calculation of considerably larger deformations than was previously possible with the application of EC 3 alone. Based on the new load-bearing capacity criterion set out in DIN EN 1363-1, the calculations are limited to the range where no failure is expected.
Only those cases which are regarded as “viable solutions” are calculated.
In contrast, deformations such as funicular polygons are caused by local cross sectional changes and therefore do not belong in the solution category but in the “failure” category.

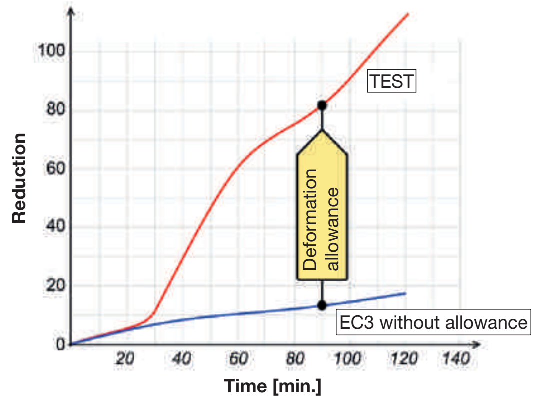


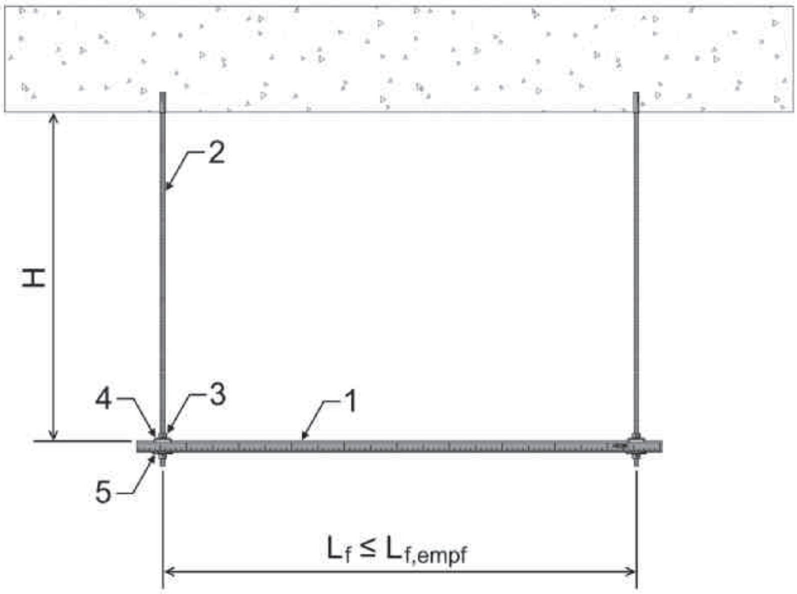
Figure 8.1: Deformation allowance between test values and allowance-free EC3 calculation for assembly rails by Sikla

Due to these newly acquired findings, the recommendation to use the computational method for channels from a wall thickness of 2 mm in elevated lengths depending on the cross section is limited to a free length L_f from 400 mm to a max. 1250 mm with a wall thickness of 3 mm (see page 7.2).

For this reason, it shall be used for intermediate suspensions and max. deformations of up to L/20 in order to sensibly limit the applicability of this computational method to a controllable range until research results indicate a wider and more economically viable range of application.

Exceptions for channels with a thinner wall thickness are only possible under certain conditions and required specialist knowledge.

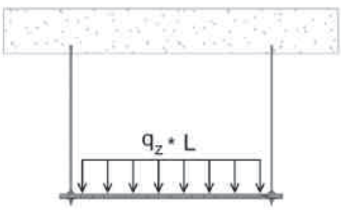
Fire resistance loads values for suspended channels: MS 41/21/2.0



Parts list

Item	Art. no.	Number	Designation
1	193686	1	MS 41/21/2,0
2	124568	2	Threaded rod GST M10
3	137546	4	Hexagonal nut M10
4	178247	2	Retaining bracket HK 41/10
5	105590	2	Washer US 10/40

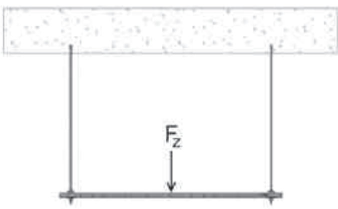
Max. $q_{z, perm}$: Distributed linear load



Fire resistance rating	L_f					
	200 mm		300 mm		400 mm	
	Max. q_z * L [kN]	Reduction δ_{max} [mm]	Max. q_z * L [kN]	Reduction δ_{max} [mm]	Max. q_z * L [kN]	Reduction δ_{max} [mm]
FRR 30	0.93	10.0	0.61	14.0	0.46	19.0
FRR 60	0.53	11.0	0.35	17.0	0.26	24.0
FRR 90	0.40	11.0	0.26	16.0	0.19	23.0
FRR 120	0.31	12.0	0.20	16.0	0.15	23.0

H = 500 mm

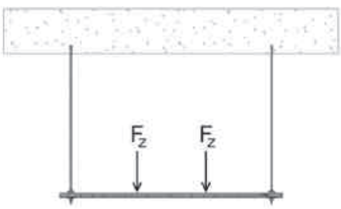
Max. $F_{z, perm}$: Individual load – centric



Fire resistance rating	L_f					
	200 mm		300 mm		400 mm	
	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.46	10.0	0.30	14.0	0.23	19.0
FRR 60	0.26	11.0	0.17	16.0	0.13	24.0
FRR 90	0.20	11.0	0.13	16.0	0.09	22.0
FRR 120	0.15	11.0	0.10	16.0	0.07	22.0

H = 500 mm

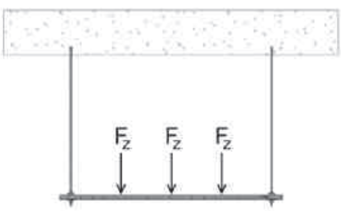
Max. $F_{z, perm}$: 2 individual loads – symmetric



Fire resistance rating	L_f					
	200 mm		300 mm		400 mm	
	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.34	10.0	0.23	14.0	0.17	19.0
FRR 60	0.19	11.0	0.13	16.0	0.09	23.0
FRR 90	0.15	11.0	0.10	16.0	0.07	23.0
FRR 120	0.11	11.0	0.07	16.0	0.05	21.0

H = 500 mm

Max. $F_{z, perm}$: 3 individual loads – symmetric



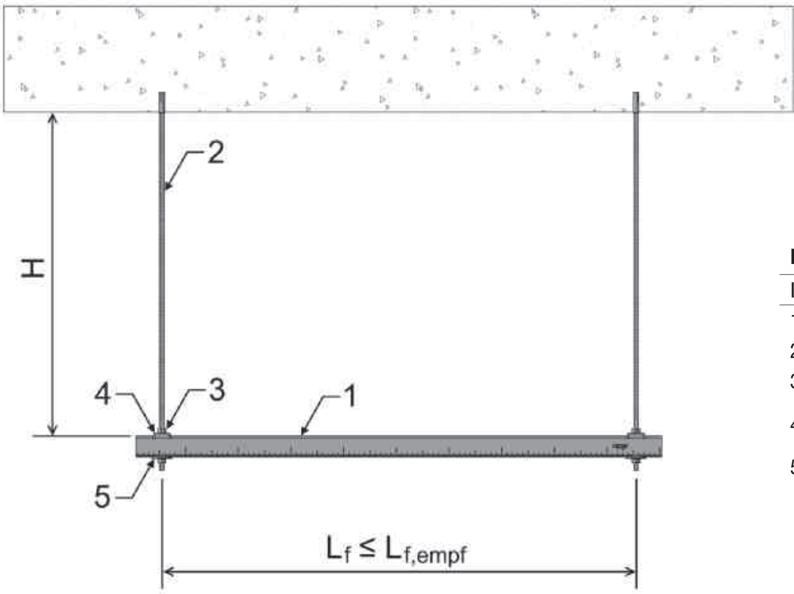
Fire resistance rating	L_f					
	200 mm		300 mm		400 mm	
	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.23	10.0	0.15	14.0	0.11	19.0
FRR 60	0.13	11.0	0.08	16.0	0.06	23.0
FRR 90	0.10	11.0	0.06	16.0	0.04	20.0
FRR 120	0.07	11.0	0.05	16.0	0.03	20.0

H = 500 mm

The indicated reduction is based on the expansion of the threaded rods and warpage of the profile; the value contains a deformation allowance in accordance with the current research results.

06/2018

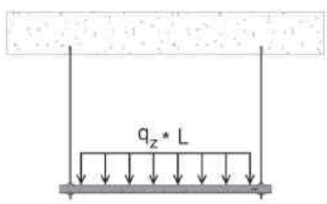
Fire resistance loads values for suspended channels: MS 41/41/2.0



Parts list

Item	Art. no.	Number	Designation
1	193723	1	MS 41/41/2,0
2	124568	2	Threaded rod GST M10
3	137546	4	Hexagonal nut M10
4	178247	2	Retaining bracket HK 41/10
5	105590	2	Washer US 10/40

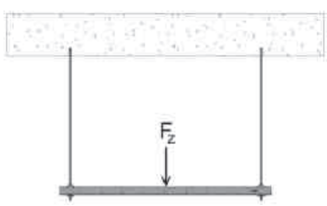
Max. $q_{z, perm}$: Distributed linear load



Fire resistance rating	L_f 200 mm: Max. q_z * L [kN]	200 mm: Reduction δ_{max} [mm]	400 mm: Max. q_z * L [kN]	400 mm: Reduction δ_{max} [mm]	600 mm: Max. q_z * L [kN]	600 mm: Reduction δ_{max} [mm]	800 mm: Max. qz * L [kN]	800 mm: Reduction δ_{max} [mm]
FRR 30	2.47	8.0	1.31	13.0	0.87	21.0	0.64	32.0
FRR 60	1.41	9.0	0.75	15.0	0.49	26.0	0.36	41.0
FRR 90	1.07	9.0	0.56	15.0	0.37	25.0	0.27	39.0
FRR 120	0.83	9.0	0.44	15.0	0.28	25.0	0.20	38.0

H = 500 mm

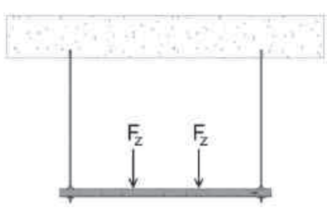
Max. $F_{z, perm}$: Individual load – centric



Fire resistance rating	L_f 200 mm: Max. F_z [kN]	200 mm: Reduction δ_{max} [mm]	400 mm: Max. F_z [kN]	400 mm: Reduction δ_{max} [mm]	600 mm: Max. F_z [kN]	600 mm: Reduction δ_{max} [mm]	800 mm: Max. F_z [kN]	800 mm: Reduction δ_{max} [mm]
FRR 30	1.32	8.0	0.66	13.0	0.43	21.0	0.32	32.0
FRR 60	0.75	9.0	0.37	15.0	0.24	26.0	0.18	41.0
FRR 90	0.57	9.0	0.28	15.0	0.18	25.0	0.13	39.0
FRR 120	0.44	9.0	0.22	15.0	0.14	24.0	0.10	38.0

H = 500 mm

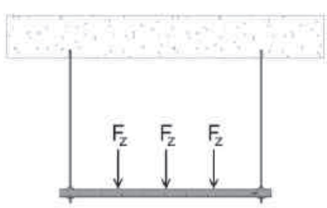
Max. $F_{z, perm}$: 2 individual loads – symmetric



Fire resistance rating	L_f 200 mm: Max. F_z [kN]	200 mm: Reduction δ_{max} [mm]	400 mm: Max. F_z [kN]	400 mm: Reduction δ_{max} [mm]	600 mm: Max. F_z [kN]	600 mm: Reduction δ_{max} [mm]	800 mm: Max. F_z [kN]	800 mm: Reduction δ_{max} [mm]
FRR 30	0.98	8.0	0.49	13.0	0.32	21.0	0.24	32.0
FRR 60	0.56	9.0	0.28	15.0	0.18	26.0	0.13	40.0
FRR 90	0.42	9.0	0.21	15.0	0.13	25.0	0.10	39.0
FRR 120	0.33	9.0	0.16	15.0	0.10	25.0	0.07	38.0

H = 500 mm

Max. $F_{z, perm}$: 3 individual loads – symmetric

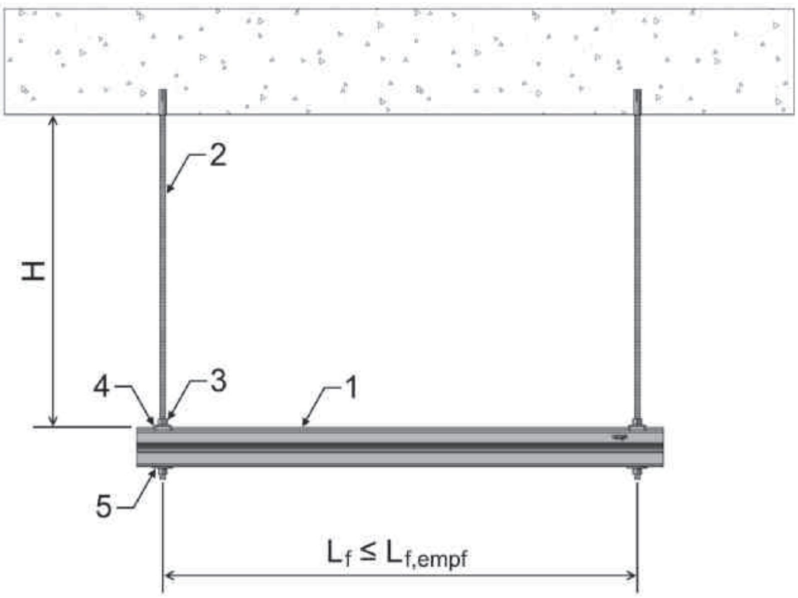


Fire resistance rating	L_f 200 mm: Max. F_z [kN]	200 mm: Reduction δ_{max} [mm]	400 mm: Max. F_z [kN]	400 mm: Reduction δ_{max} [mm]	600 mm: Max. F_z [kN]	600 mm: Reduction δ_{max} [mm]	800 mm: Max. F_z [kN]	800 mm: Reduction δ_{max} [mm]
FRR 30	0.66	8.0	0.32	13.0	0.21	21.0	0.16	32.0
FRR 60	0.37	9.0	0.18	15.0	0.12	26.0	0.09	41.0
FRR 90	0.28	9.0	0.14	15.0	0.09	25.0	0.06	39.0
FRR 120	0.22	9.0	0.11	15.0	0.07	25.0	0.05	38.0

H = 500 mm

The indicated reduction is based on the expansion of the threaded rods and warpage of the profile; the value contains a deformation allowance in accordance with the current research results.

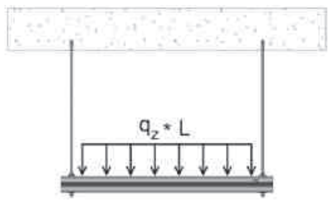
Fire resistance loads values for suspended channels: MS 41-75/75/3.0



Parts list

Item	Art. no.	Number	Designation
1	173999	1	MS 41-75/75/3.0
2	143192	2	Threaded rod GST M12
3	114228	4	Hexagonal nut M12
4	178256	2	Retaining bracket HK 41/12
5	105606	2	Washer US 12/40

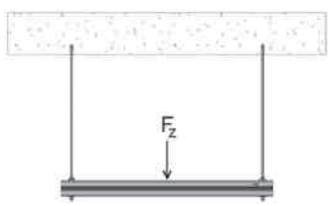
Max. $q_{z, perm}$: Distributed linear load



Fire resistance rating	L_f 500 mm		750 mm		1,000 mm		1,250 mm	
	Max. q_z * L [kN]	Reduction δ_{max} [mm]	Max. q_z * L [kN]	Reduction δ_{max} [mm]	Max. q_z * L [kN]	Reduction δ_{max} [mm]	Max. qz * L [kN]	Reduction δ_{max} [mm]
FRR 30	3.56	10.0	3.37	19.0	2.50	29.0	1.97	42.0
FRR 60	2.02	12.0	1.91	23.0	1.42	37.0	1.10	54.0
FRR 90	1.54	12.0	1.43	23.0	1.05	35.0	0.81	51.0
FRR 120	1.18	12.0	1.11	23.0	0.81	35.0	0.62	50.0

H = 500 mm

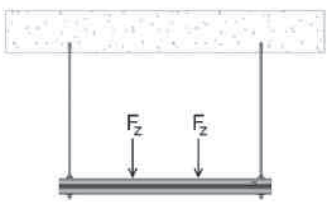
Max. $F_{z, perm}$: Individual load – centric



Fire resistance rating	L_f 500 mm		750 mm		1,000 mm		1,250 mm	
	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	2.55	12.0	1.68	19.0	1.25	29.0	0.98	42.0
FRR 60	1.46	14.0	0.95	23.0	0.70	37.0	0.55	54.0
FRR 90	1.10	14.0	0.71	23.0	0.52	35.0	0.40	51.0
FRR 120	0.85	14.0	0.55	22.0	0.40	34.0	0.31	50.0

H = 500 mm

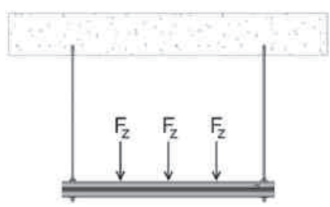
Max. $F_{z, perm}$: 2 individual loads – symmetric



Fire resistance rating	L_f 500 mm		750 mm		1,000 mm		1,250 mm	
	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	1.78	11.0	1.26	19.0	0.93	29.0	0.74	43.0
FRR 60	1.01	13.0	0.70	23.0	0.53	37.0	0.41	54.0
FRR 90	0.77	13.0	0.53	23.0	0.39	35.0	0.30	51.0
FRR 120	0.59	13.0	0.41	22.0	0.30	34.0	0.23	50.0

H = 500 mm

Max. $F_{z, perm}$: 3 individual loads – symmetric

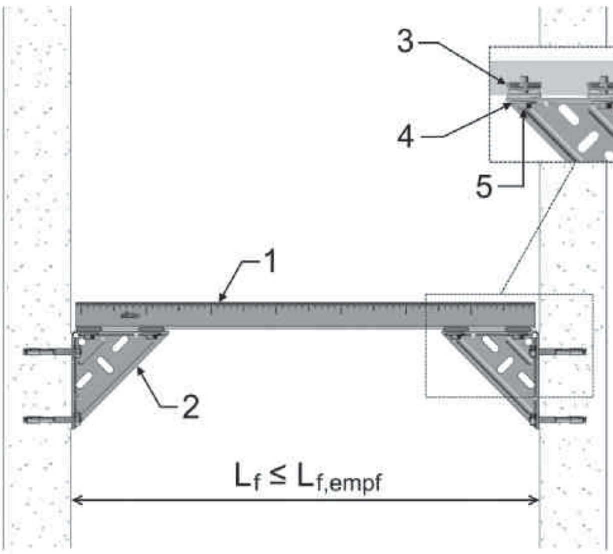


Fire resistance rating	L_f 500 mm		750 mm		1,000 mm		1,250 mm	
	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	1.18	11.0	0.84	19.0	0.58	28.0	0.48	42.0
FRR 60	0.67	13.0	0.47	23.0	0.35	37.0	0.27	53.0
FRR 90	0.51	13.0	0.36	23.0	0.26	35.0	0.20	50.0
FRR 120	0.38	13.0	0.27	22.0	0.20	34.0	0.15	49.0

H = 500 mm

The indicated reduction is based on the expansion of the threaded rods and warpage of the profile; the value contains a deformation allowance in accordance with the current research results.

Fire resistance load values for channel as cross beam to angle bracket: MS 41/41/2.0



Parts list

Item	Art. no.	Number	Designation
1	193723	1	MS 41/41/2,0
2	-	2	Angle bracket WK, type see load table

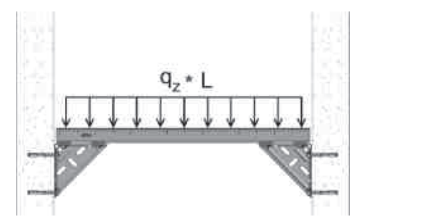
WK 100/100-40

Item	Art. no.	Number	Designation
3	198995	4	Block PBH 41-M10
4	125365	4	U washer DIN 9021-10
5	138626	4	Hexagonal head screw M10 x 30

from WK 150/150

Item	Art. no.	Number	Designation
3	199008	4	Block PBH 41-M12
4	156462	4	U washer 12/30
5	138477	4	Hexagonal head screw M12 x 30

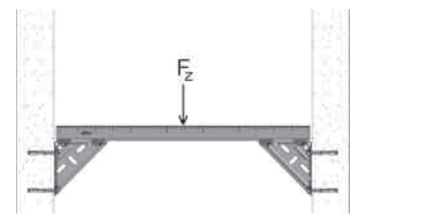
Max. $q_{z, perm}$: Distributed linear load



Fire resistance rating	Angle bracket WK (art. no.)					
	100/100-40 (163921)		150/150 (155513)		200/200 (118170)	
	Max. $q_z * L$ [kN]	Reduction δ_{max} [mm]	Max. $q_z * L$ [kN]	Reduction δ_{max} [mm]	Max. $q_z * L$ [kN]	Reduction δ_{max} [mm]
FRR 30	0.34	13.0	0.70	16.0	0.70	12.0
FRR 60	0.18	15.0	0.39	20.0	0.39	15.0
FRR 90	0.13	15.0	0.29	19.0	0.29	14.0
FRR 120	0.10	15.0	0.22	19.0	0.22	14.0

L_f = 800 mm

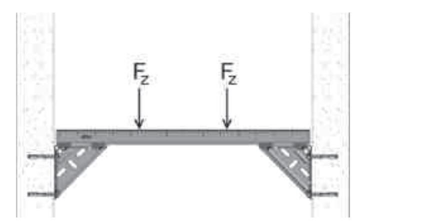
Max. $F_{z, perm}$: Individual load – centric



Fire resistance rating	Angle bracket WK (art. no.)					
	100/100-40 (163921)		150/150 (155513)		200/200 (118170)	
	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.34	23.0	0.40	22.0	0.44	19.0
FRR 60	0.18	28.0	0.22	28.0	0.25	24.0
FRR 90	0.13	27.0	0.17	26.0	0.19	23.0
FRR 120	0.10	26.0	0.13	26.0	0.14	22.0

L_f = 800 mm

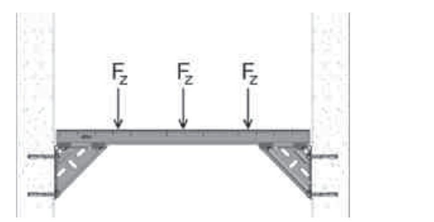
Max. $F_{z, perm}$: 2 individual loads – symmetric



Fire resistance rating	Angle bracket WK (art. no.)					
	100/100-40 (163921)		150/150 (155513)		200/200 (118170)	
	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.17	16.0	0.34	22.0	0.34	17.0
FRR 60	0.09	20.0	0.19	28.0	0.19	21.0
FRR 90	0.06	19.0	0.14	26.0	0.14	20.0
FRR 120	0.05	19.0	0.11	26.0	0.11	20.0

L_f = 800 mm

Max. $F_{z, perm}$: 3 individual loads – symmetric



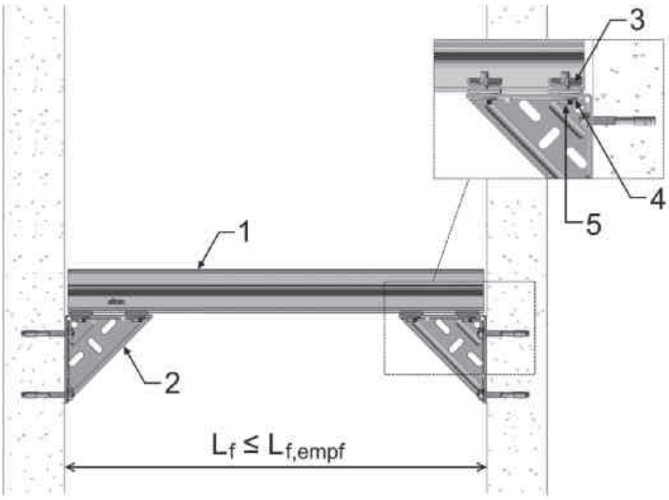
Fire resistance rating	Angle bracket WK (art. no.)					
	100/100-40 (163921)		150/150 (155513)		200/200 (118170)	
	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.11	16.0	0.22	22.0	0.23	17.0
FRR 60	0.06	20.0	0.12	28.0	0.13	21.0
FRR 90	0.04	19.0	0.09	26.0	0.09	20.0
FRR 120	0.03	19.0	0.07	26.0	0.07	20.0

L_f = 800 mm

The indicated reduction is based on the deformation of the angle bracket and warpage of the profile; the value contains a deformation allowance in accordance with the current research results.

Note: The brackets can be assembled above the channel.

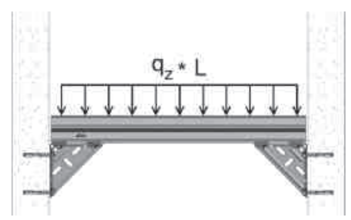
Fire resistance load values for channel as cross beam to angle bracket: MS 41-75/75/3.0



Parts list

Item	Art. no.	Number	Designation
1	173999	1	MS 41-75/75/3.0
2	-	2	Angle bracket WK, type see load table
3	199008	4	Block PBH 41-M12
4	156462	4	U washer 12/30
5	138477	4	Hexagonal head screw M12 x 30

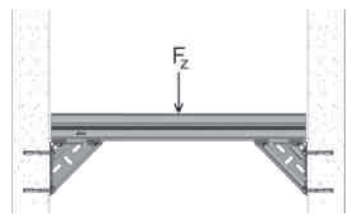
Max. $q_{z, perm}$: Distributed linear load



Fire resistance rating	Angle bracket WK (art. no.) 150/150 (155513) Max. q_z * L [kN]	150/150 (155513) Reduction $δ_{max}$ [mm]	200/200 (118170) Max. q_z * L [kN]	200/200 (118170) Reduction $δ_{max}$ [mm]	300/200 (118046) Max. q_z * L [kN]	300/200 (118046) Reduction $δ_{max}$ [mm]
FRR 30	0.64	11.0	0.64	10.0	1.71	26.0
FRR 60	0.34	14.0	0.34	12.0	0.95	33.0
FRR 90	0.24	13.0	0.24	12.0	0.71	32.0
FRR 120	0.17	13.0	0.17	11.0	0.54	31.0

L_f = 1,250 mm

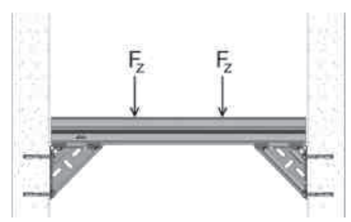
Max. $F_{z, perm}$: Individual load – centric



Fire resistance rating	Angle bracket WK (art. no.) 150/150 (155513) Max. F_z [kN]	150/150 (155513) Reduction $δ_{max}$ [mm]	200/200 (118170) Max. F_z [kN]	200/200 (118170) Reduction $δ_{max}$ [mm]	300/200 (118046) Max. F_z [kN]	300/200 (118046) Reduction $δ_{max}$ [mm]
FRR 30	0.64	19.0	0.64	17.0	1.11	34.0
FRR 60	0.34	23.0	0.34	20.0	0.62	43.0
FRR 90	0.24	22.0	0.24	19.0	0.46	41.0
FRR 120	0.17	20.0	0.17	18.0	0.35	40.0

L_f = 1,250 mm

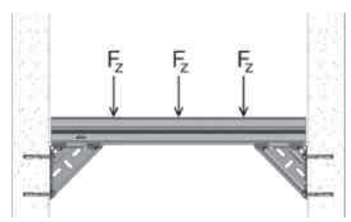
Max. $F_{z, perm}$: 2 individual loads – symmetric



Fire resistance rating	Angle bracket WK (art. no.) 150/150 (155513) Max. F_z [kN]	150/150 (155513) Reduction $δ_{max}$ [mm]	200/200 (118170) Max. F_z [kN]	200/200 (118170) Reduction $δ_{max}$ [mm]	300/200 (118046) Max. F_z [kN]	300/200 (118046) Reduction $δ_{max}$ [mm]
FRR 30	0.32	14.0	0.32	12.0	0.85	34.0
FRR 60	0.17	17.0	0.17	14.0	0.47	42.0
FRR 90	0.12	16.0	0.12	14.0	0.35	40.0
FRR 120	0.08	16.0	0.08	13.0	0.27	40.0

L_f = 1,250 mm

Max. $F_{z, perm}$: 3 individual loads – symmetric



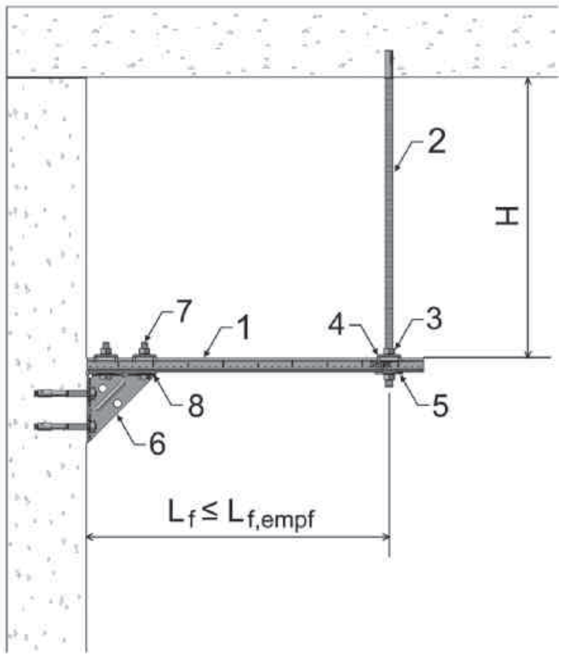
Fire resistance rating	Angle bracket WK (art. no.) 150/150 (155513) Max. F_z [kN]	150/150 (155513) Reduction $δ_{max}$ [mm]	200/200 (118170) Max. F_z [kN]	200/200 (118170) Reduction $δ_{max}$ [mm]	300/200 (118046) Max. F_z [kN]	300/200 (118046) Reduction $δ_{max}$ [mm]
FRR 30	0.21	14.0	0.21	12.0	0.57	34.0
FRR 60	0.11	16.0	0.11	14.0	0.31	42.0
FRR 90	0.08	16.0	0.08	14.0	0.23	40.0
FRR 120	0.05	15.0	0.05	13.0	0.18	40.0

L_f = 1,250 mm

The indicated reduction is based on the deformation of the angle bracket and warpage of the profile; the value contains a deformation allowance in accordance with the current research results.

Note: The brackets can be assembled above the channel.

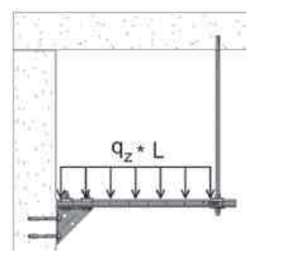
Fire resistance load values for cantilever type channels with end suspension: MS 41/21/2.0



Parts list

Item	Art. no.	Number	Designation
1	193686	1	MS 41/21/2.0
2	124568	1	Threaded rod GST M10
3	137546	4	Hexagonal nut M10
4	178247	3	Retaining bracket HK 41/10
5	105590	1	U washer 10/40
6	163921	1	Angle bracket WK 100/100-40
7	138635	2	Hexagonal head screw M10 x 60
8	125365	2	U washer 10/9021

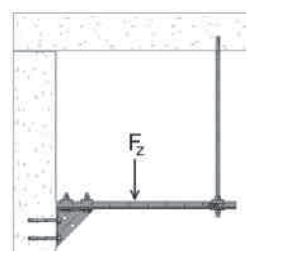
Max. $q_{z,\,perm}$: Distributed linear load



Fire resistance rating	Max. $q_z * L$ [kN]	Reduction δ_{max} [mm]
FRR 30	0.30	10.0
FRR 60	0.17	12.0
FRR 90	0.13	13.0
FRR 120	0.10	13.0

H = 500 mm; L_f = 400 mm

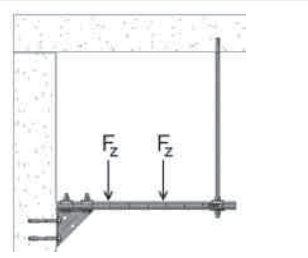
Max. $F_{z,\,perm}$: Individual load – centric



Fire resistance rating	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.27	16.0
FRR 60	0.15	19.0
FRR 90	0.11	18.0
FRR 120	0.09	19.0

H = 500 mm; L_f = 400 mm

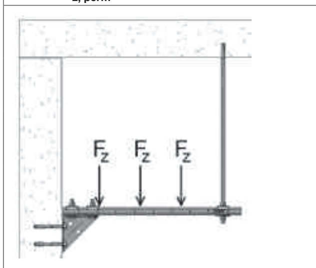
Max. $F_{z,\,perm}$: 2 individual loads – symmetric



Fire resistance rating	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.15	13.0
FRR 60	0.08	15.0
FRR 90	0.06	15.0
FRR 120	0.05	16.0

H = 500 mm; L_f = 400 mm

Max. $F_{z,\,perm}$: 3 individual loads – symmetric

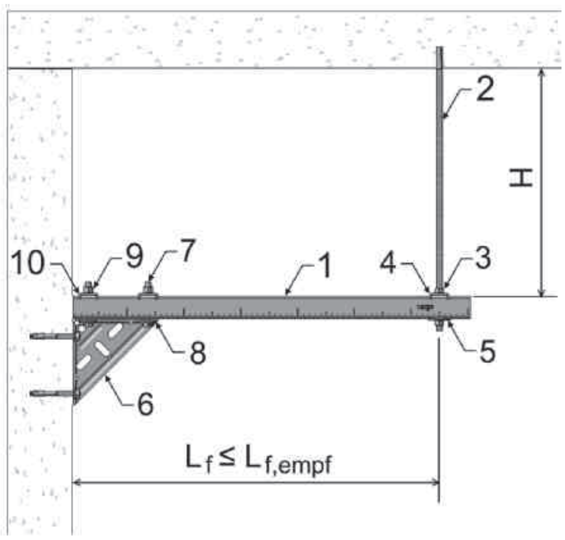


Fire resistance rating	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.11	12.0
FRR 60	0.05	14.0
FRR 90	0.04	14.0
FRR 120	0.03	14.0

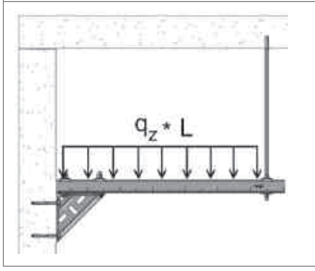
H = 500 mm; L_f = 400 mm

The indicated reduction is based on the deformation of the bracket, the expansion of the threaded rod and the warpage of the profile; the value contains a deformation allowance in accordance with the current research results.

Fire resistance load values for cantilever type channels with end suspension: MS 41/41/2.0



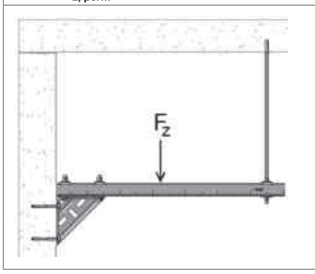
Max. $q_{z, perm}$: Distributed linear load



Fire resistance rating	Max. q_z * L [kN]	Reduction $δ_{max}$ [mm]
FRR 30	0.63	22.0
FRR 60	0.35	28.0
FRR 90	0.26	26.0
FRR 120	0.20	26.0

H = 500 mm; L_f = 800 mm

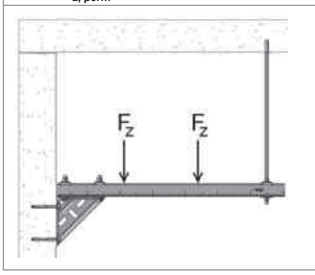
Max. $F_{z, perm}$: Individual load – centric



Fire resistance rating	Max. F_z [kN]	Reduction $δ_{max}$ [mm]
FRR 30	0.36	27.0
FRR 60	0.20	33.0
FRR 90	0.15	32.0
FRR 120	0.11	30.0

H = 500 mm; L_f = 800 mm

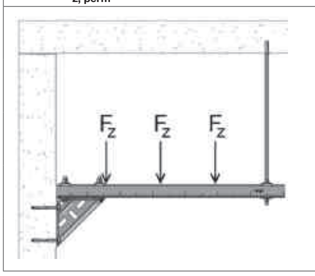
Max. $F_{z, perm}$: 2 individual loads – symmetric



Fire resistance rating	Max. F_z [kN]	Reduction $δ_{max}$ [mm]
FRR 30	0.27	27.0
FRR 60	0.15	33.0
FRR 90	0.11	31.0
FRR 120	0.08	30.0

H = 500 mm; L_f = 800 mm

Max. $F_{z, perm}$: 3 individual loads – symmetric



Fire resistance rating	Max. F_z [kN]	Reduction $δ_{max}$ [mm]
FRR 30	0.19	27.0
FRR 60	0.10	32.0
FRR 90	0.08	32.0
FRR 120	0.06	31.0

H = 500 mm; L_f = 800 mm

Parts list

Item	Art. no.	Number	Designation
1	193723	1	MS 41/41/2.0
2	124568	1	Threaded rod GST M10
3	137546	2	Hexagonal nut M10
4	178247	1	Retaining bracket HK 41/10
5	105590	1	U washer 10/40
6	155513	1	Angle bracket WK 150/150
7	138705	2	Hexagonal head screw M12 x 80
8	156462	2	U washer 12/30
9	114228	2	Hexagonal nut M12
10	178256	2	Retaining bracket HK 41/12

The indicated reduction is based on the deformation of the bracket, the expansion of the threaded rod and the warpage of the profile; the value contains a deformation allowance in accordance with the current research results.

06/2018

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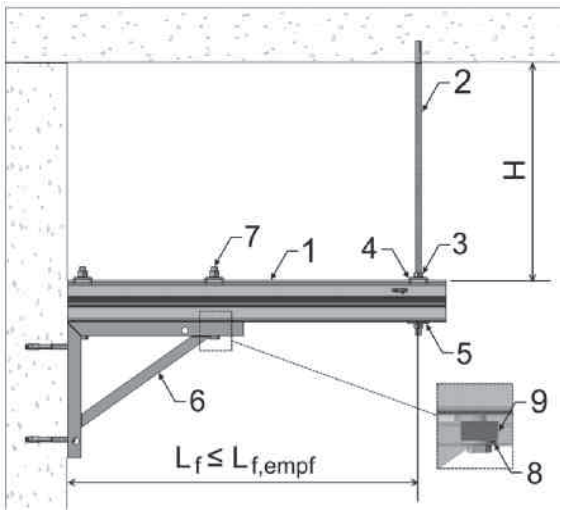
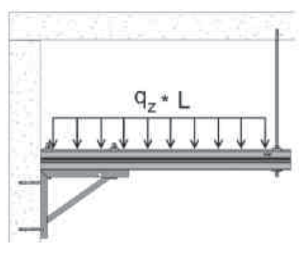
Fire resistance load values for cantilever type channels with end suspension: MS 41-75/75/3.0



Parts list

Item	Art. no.	Number	Designation
1	173999	1	MS 41-75/75/3.0
2	143192	1	Threaded rod GST M12
3	114228	4	Hexagonal nut M12
4	178256	3	Retaining bracket HK 41/12
5	105606	1	U washer 12/40
6	118046	1	Angle bracket WK 300/200
7	114750	2	Hexagonal head screw M12 x 120
8	156462	2	U washer 12/30
9	114848	2	Spacer DIS So-WK

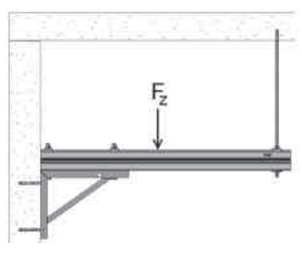
Max. $q_{z, perm}$: Distributed linear load



Fire resistance rating	Max. q_z * L [kN]	Reduction δ_{max} [mm]
FRR 30	1.65	32.0
FRR 60	0.91	40.0
FRR 90	0.68	39.0
FRR 120	0.51	38.0

H = 500 mm; L_f = 1,250 mm

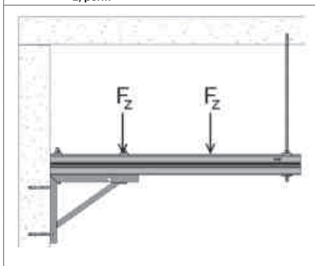
Max. $F_{z, perm}$: Individual load – centric



Fire resistance rating	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	1.03	40.0
FRR 60	0.57	50.0
FRR 90	0.42	47.0
FRR 120	0.32	46.0

H = 500 mm; L_f = 1,250 mm

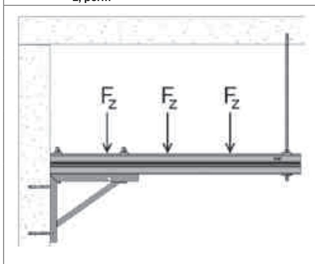
Max. $F_{z, perm}$: 2 individual loads – symmetric



Fire resistance rating	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.77	40.0
FRR 60	0.43	50.0
FRR 90	0.32	48.0
FRR 120	0.24	46.0

H = 500 mm; L_f = 1,250 mm

Max. $F_{z, perm}$: 3 individual loads – symmetric



Fire resistance rating	Max. F_z [kN]	Reduction δ_{max} [mm]
FRR 30	0.52	40.0
FRR 60	0.29	50.0
FRR 90	0.21	47.0
FRR 120	0.16	46.0

H = 500 mm; L_f = 1,250 mm

The indicated reduction is based on the deformation of the bracket, the expansion of the threaded rod and the warpage of the profile; the value contains a deformation allowance in accordance with the current research results.

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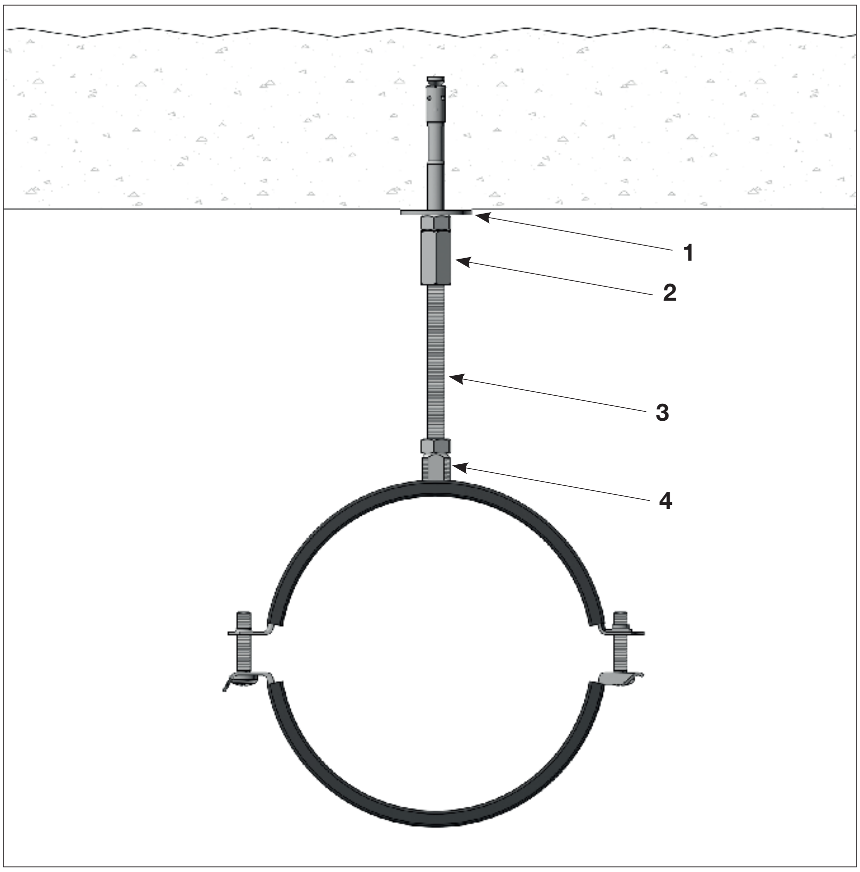
Fastening of pipe clamps without/with redundancy / individual and multiple fastenings



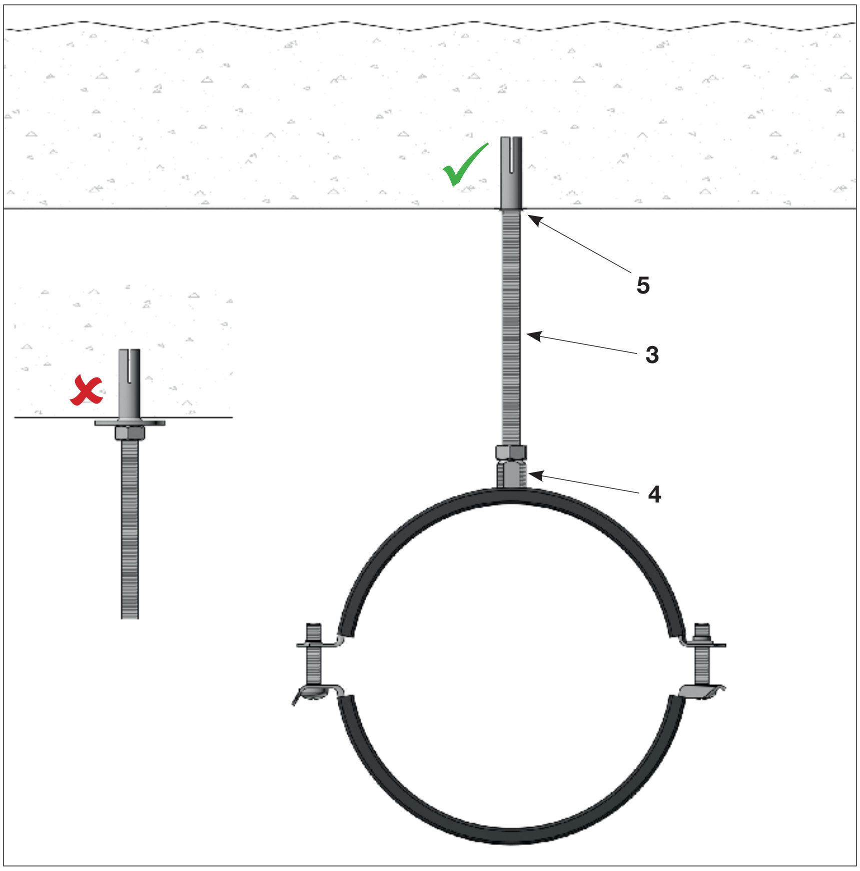
Individual fastening

for pipelines for non-combustible liquids and gases.
The pipe manufacturer's specifications must be observed.

Components

1 wedge anchor AN BZ plus
2 extension socket AD
3 threaded rod
4 pipe clamp from page 6.2

Other suitable anchors, see overview from page of 6.2.



Multiple fastening (redundancy)

for pipelines for non-combustible liquids / gases. The pipe manufacturer's specifications must be observed.

Components

3 threaded rod
4 pipe clip from page 6.2
5 concrete anchor AN ES

Basic principles:

With requirements on the fire resistance rating (F30 to F120), components are selected in accordance with the table for max. tensile load in the event of fire, from page 6.2. On the basis of DIN 4102 T4, Section 11.2.6.3, a maximum span of 1.50 m is recommended. In accordance with this principle, spiral ducts can be fastened with air-conditioning systems.

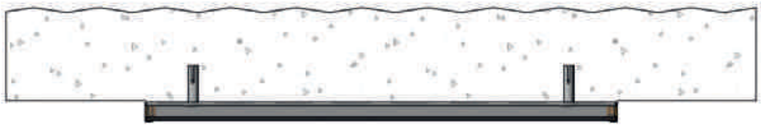
Note:

▶ *No nut is included in the anchor's approval. If a nut is used, it may only be tightened loosely by hand.*

06/2018

Ceiling anchorage of channels

Anchorage in the rail base



It is not recommended to anchor in the rail base because the load-bearing capacity is designed according to the entire rail cross-section.

Screwed-through solutions are therefore recommended for ceiling anchorage.

Anchorage with push-through installation (concrete anchor AN ES)

Tightening torque:
M10 = 15 Nm
M12 = 35 Nm
≥ 50 mm

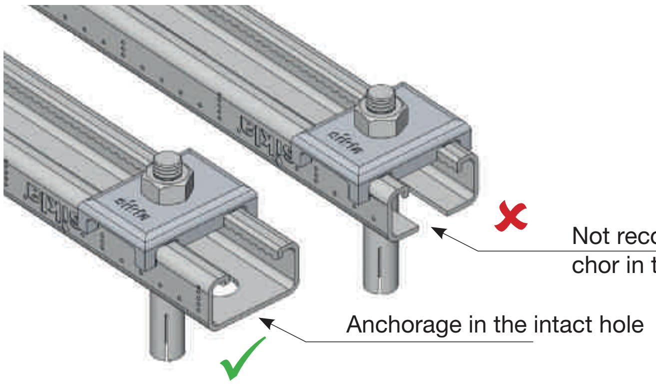
Anchorage with push-through installation (wedge anchor BZ plus)

Tightening torque:
M10 = 25 Nm
M12 = 45 Nm
≥ 50 mm

Anchorage with push-through installation (hanger bolt anchor AN - ES)

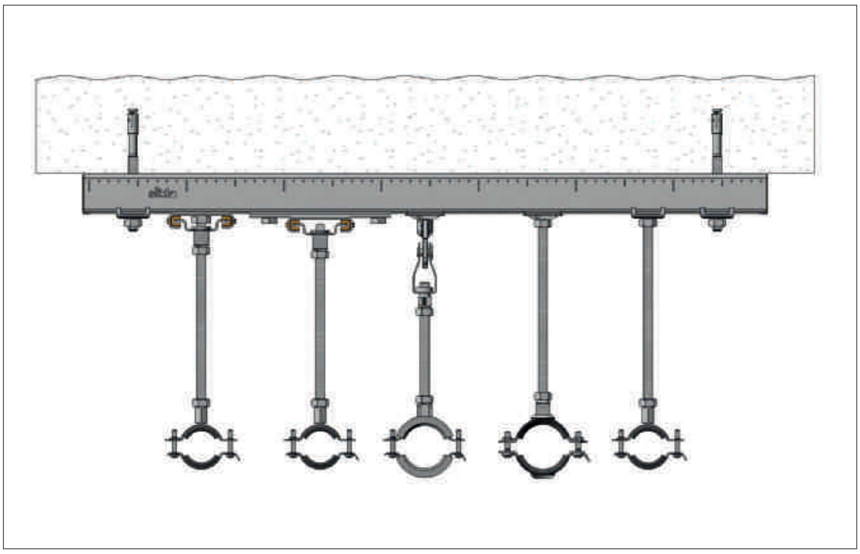
Tightening torque:
M10 = 40 Nm

≥ 50 mm



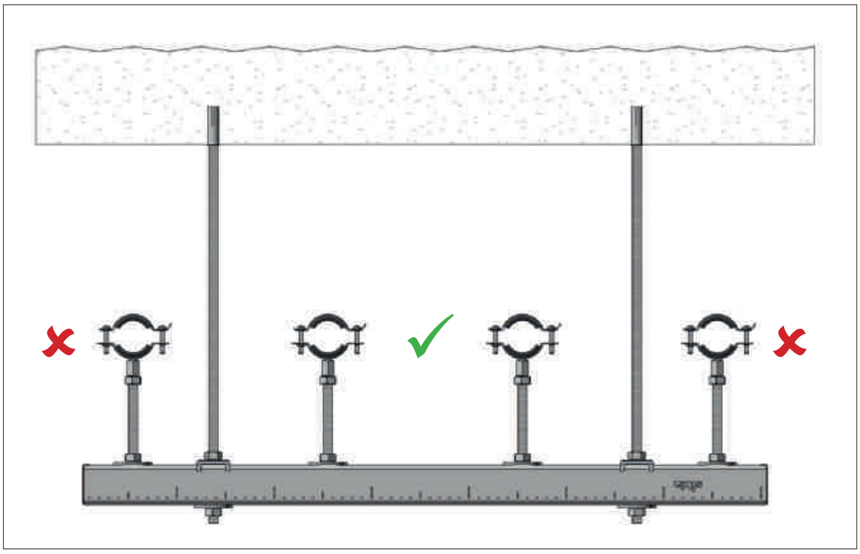
General instructions on anchorage:
Retaining brackets all around the profile are to be used for the push-through installation of the anchors.

Pipe trusses for HVAC pipe routes



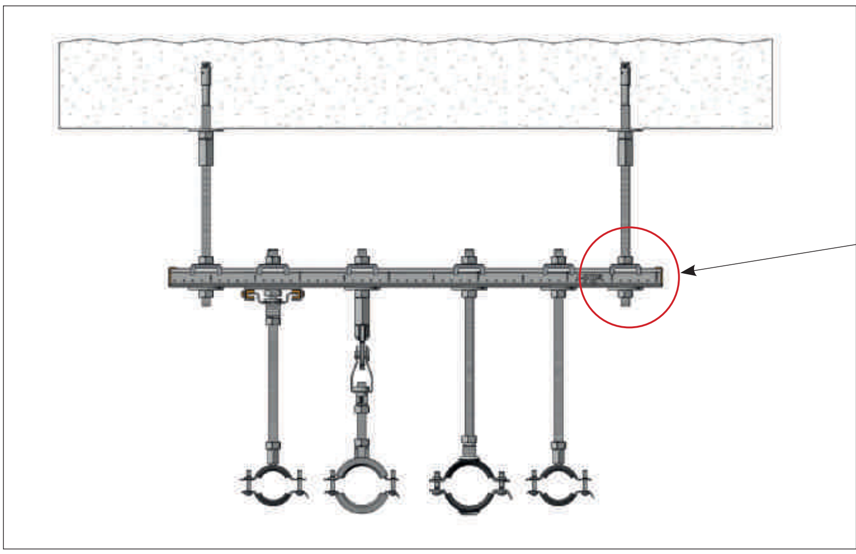
Channel with direct ceiling fastening

To fasten the pipes on assembly rails, it is recommended to use products according to their maximum tensile loads in the event of fire from page 6.2.



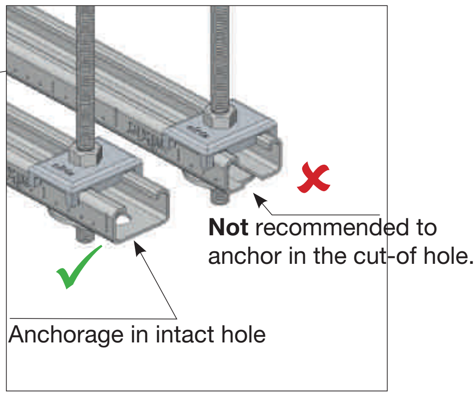
Channels MS as suspended cross member

Loads applied to an assembly rail outside the structural fastenings are impermissible as they are to be treated like single-arm projections.

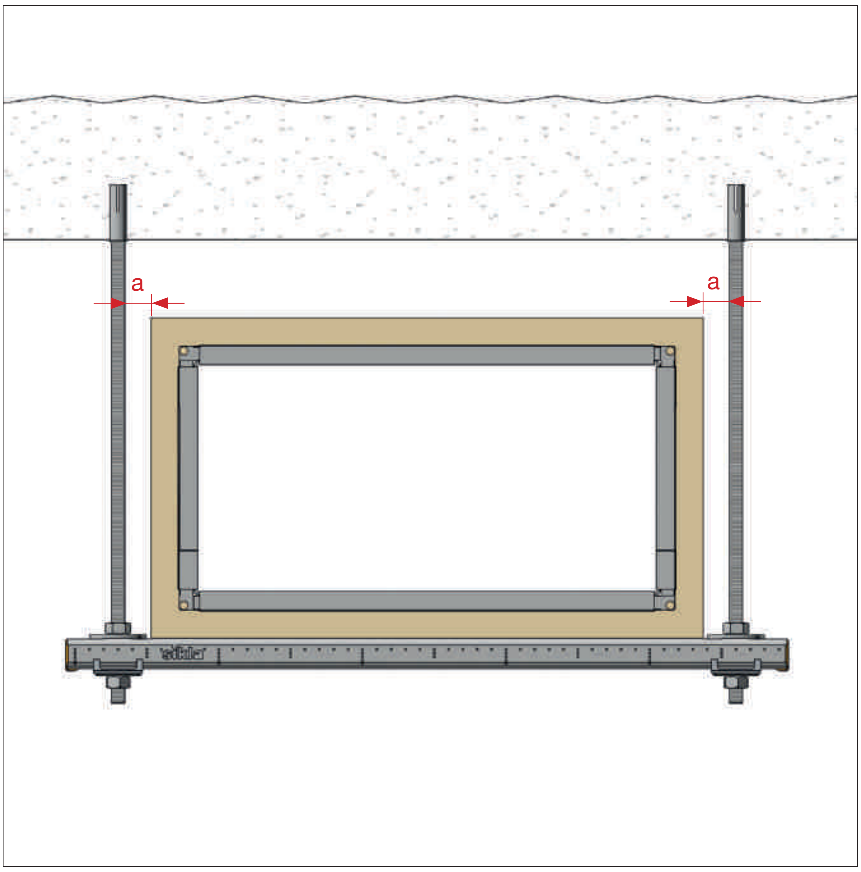


Channels MS as suspended cross member

should not be fastened in the cut-out holes but in the closed holes.



Fastening of ventilation ducts / spiral ducts

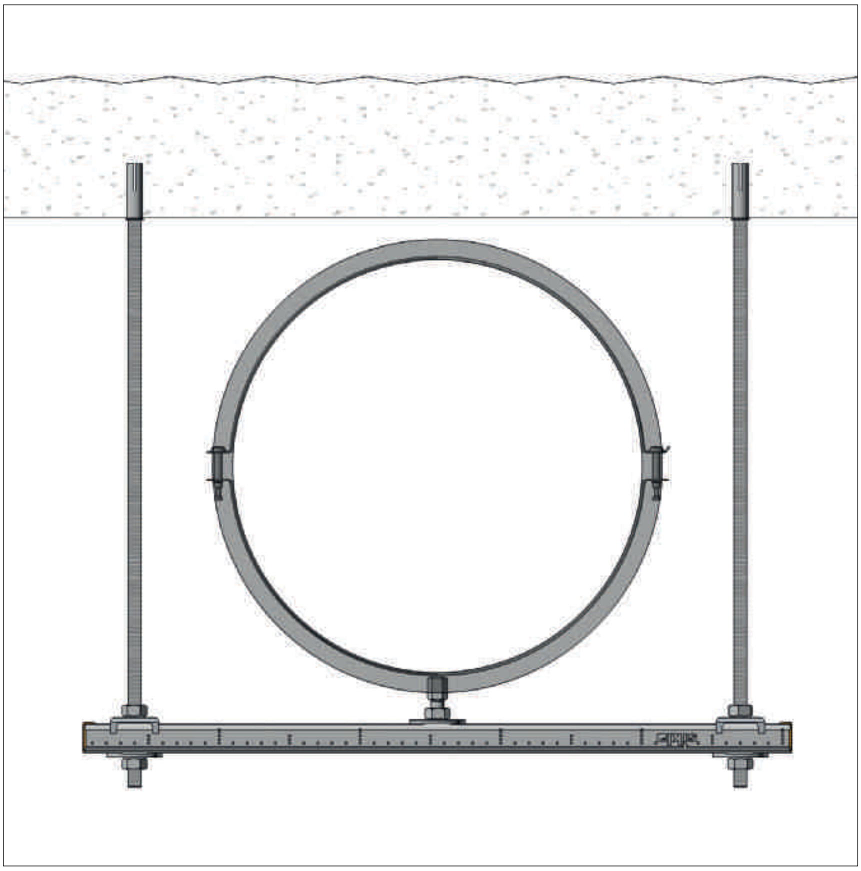


Duct bracket

Ventilation ducts are to be fastened on assembly rails. Legitimation of assembly rails according to Euroc-ode 3 and manufacturer's recom-mendations.

Recommendation for span 1,50 m based on Section 11.2.6.3 of DIN 4102 - 4: 2016-05

For distance a - 50 mm is recom-mended.



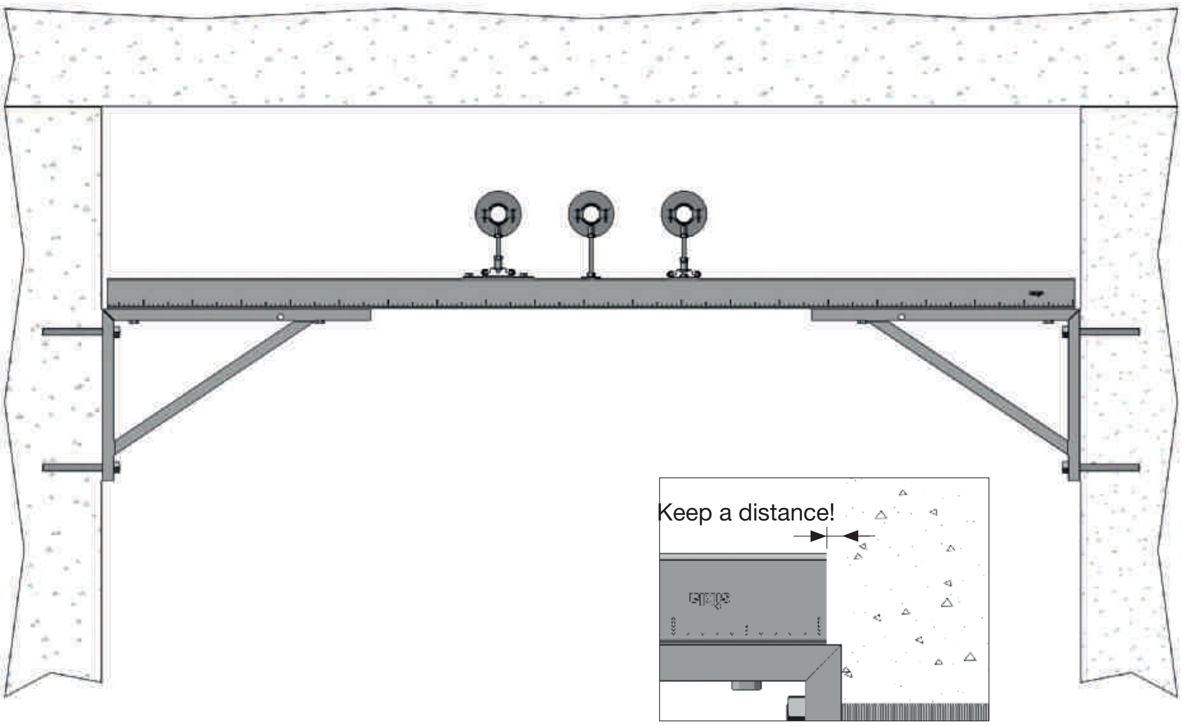
Pipe bracket

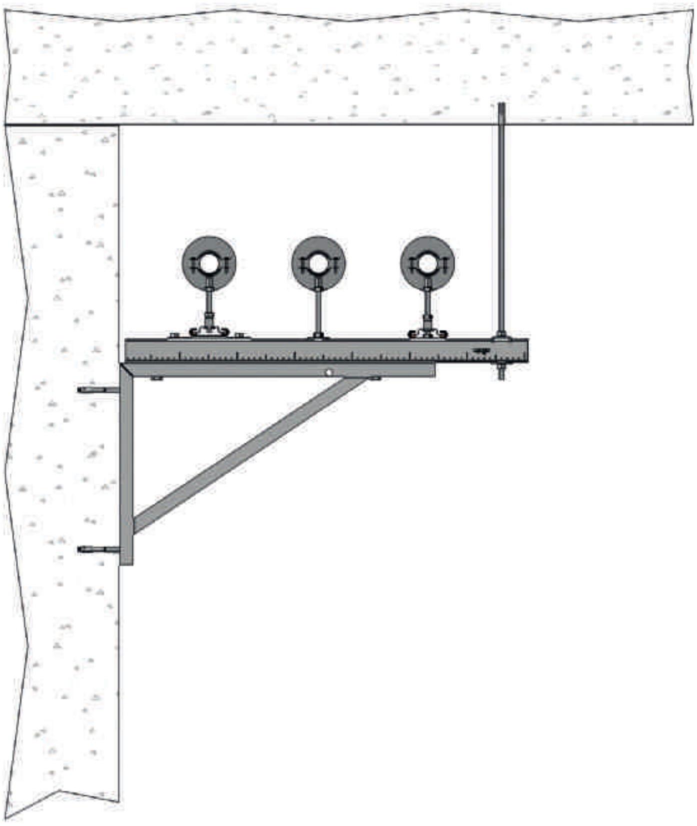
Spiral ducts with ventilation clips should only be assembled in a raised position. Suspended bracket versions are to be designed with pipe clips, the service loads of which in the event of fire are listed in Section 6.

Recommendation for span 1,50 m based on Section 11.2.6.3 of DIN 4102 - 4: 2016-05

Wall fastening of channels MS

To prevent the distortion of horizontal profiles when heated in the event of fire, a 10 mm/m distance from the wall is generally recommended.





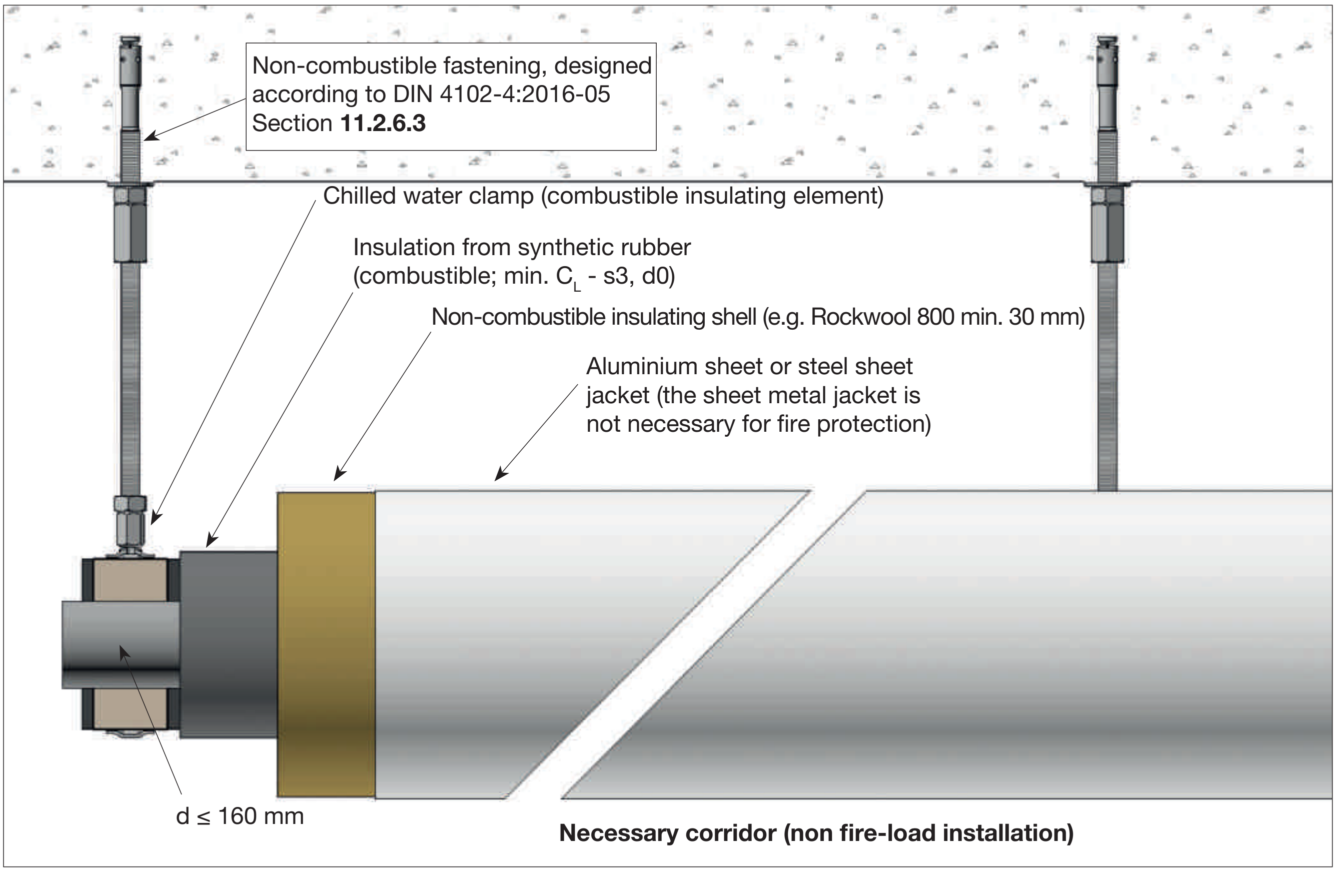
Double-sided wall fastening with brackets

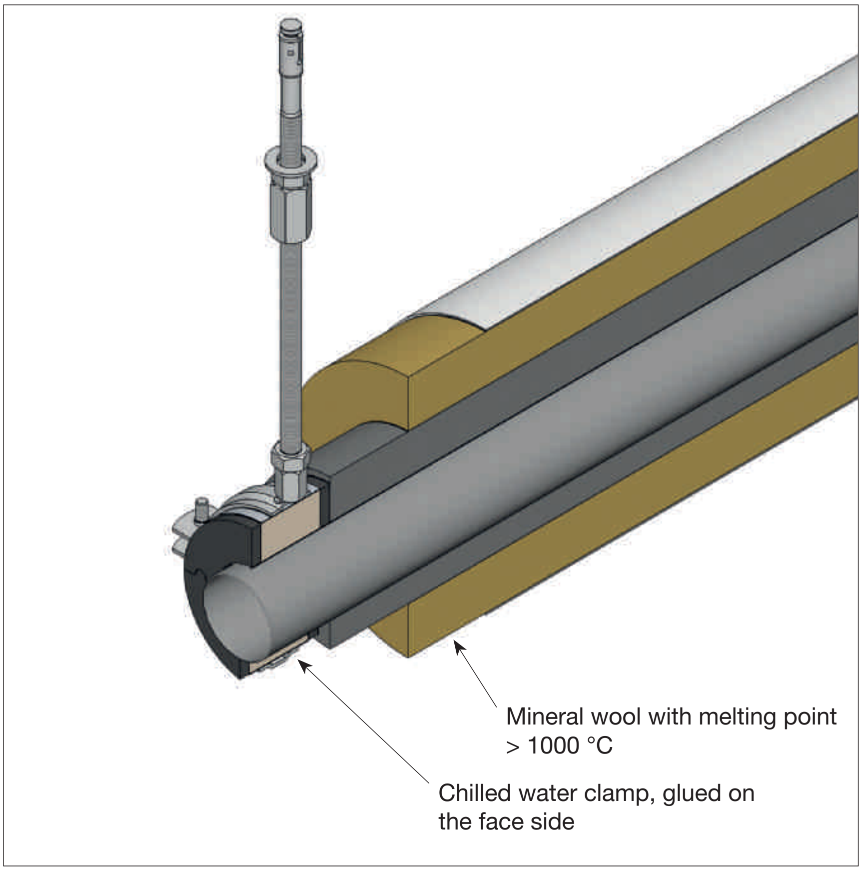
To prevent a distortion caused by heat elongation which can result in a premature failure of the channel (MS), the ends of the assembly rail should be assembled at a distance to the wall.

Single-sided wall fastening with bracket

Protect the cantilever arm from bending by using an additional fastening on the ceiling.

Pipe fastening for chilled water pipes with fire protection encapsulation





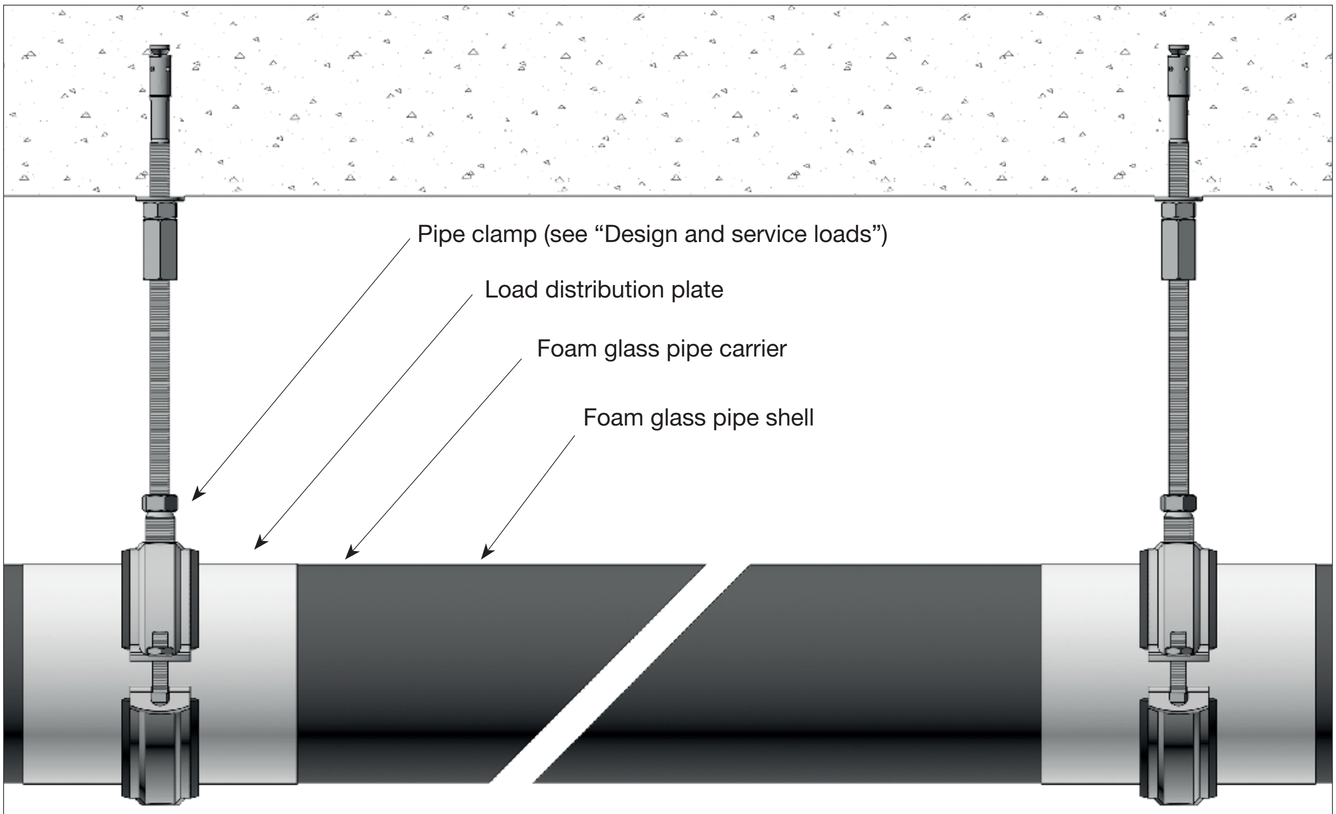
Individual / multiple fastening for chilled water pipes

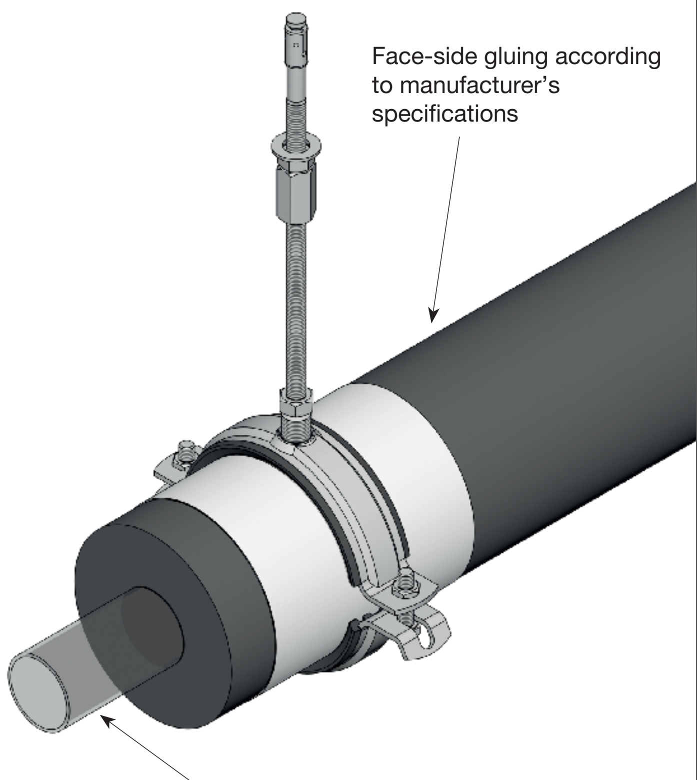
If pipes in necessary corridors are jacketed with combustible insulating material, these can be jacketed with a mineral wool pipe shell Rockwool 800 with at least 30 mm insulation thickness. According to the expert report GA 3335/1111-Mer from the MPA in Braunschweig*, this design is to be evaluated as equivalent to the measures described in the Model Pipe System Guidelines in Section 3.3.2..
The pipe fastening is designed in accordance with DIN 4102-4:2016-05 Section **11.2.6.3**.

Larger pipe dimensions (da > 160 mm) require thicker insulating shells or other appropriate measures.

* Expert report GA 3335/1111-Mer at: www.rockwool.de

Pipe fastening for chilled water pipes with foam glass pipe shells





Single/multiple fastening for chilled water pipes

Pipe brackets with requirements on the fire resistance rating and specifications for non-fire load fitting in necessary corridors.

Pipe clip distance according to manufacturer's specifications.
The certificate of usability from the insulating material manufacturer must be observed.

Note:

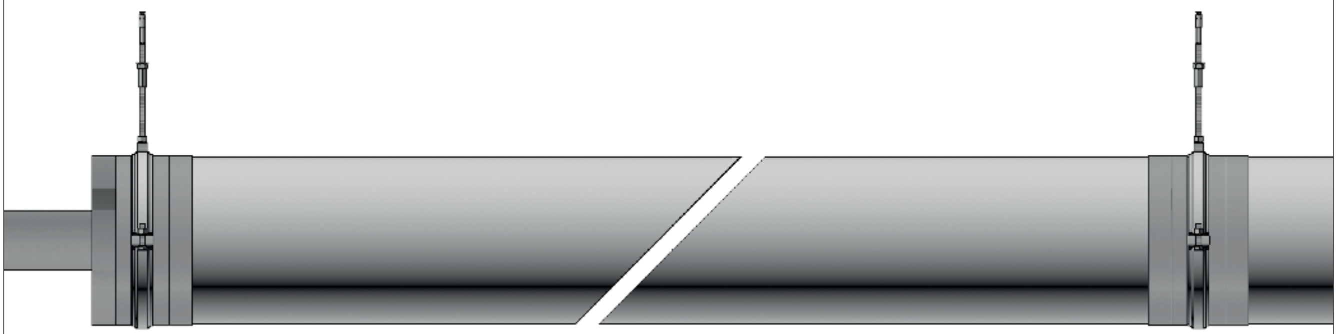
▶ *Certified pipe clips, anchors and threaded rods in accordance with DIN 4102-4:2016-05 Section 11.2.6.3 must be used in case of requirements on the fire resistance rating. For this purpose, a maximum span of 1.50 m is recommended.*

Note:

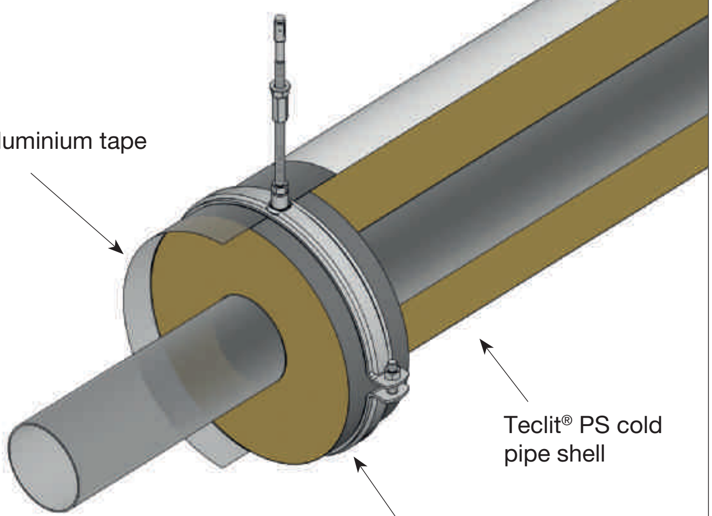
▶ *The pipe fastenings can be assembled independently of the continuing insulation.*

Pipe fastening for chilled water pipes with Teclit® System

Non-combustible insulation system for chilled water pipes



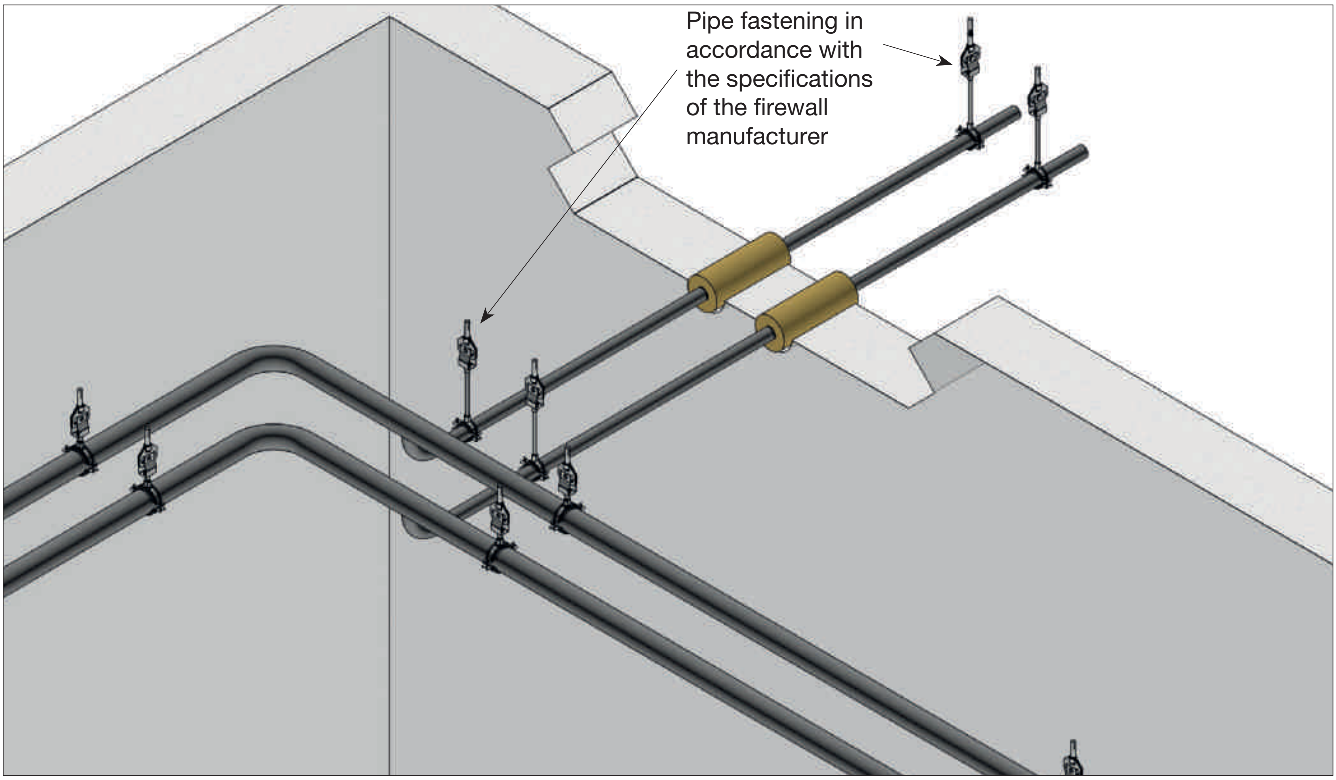
* Expert report GA 3335/1111-Mer at:
www.rockwool.de

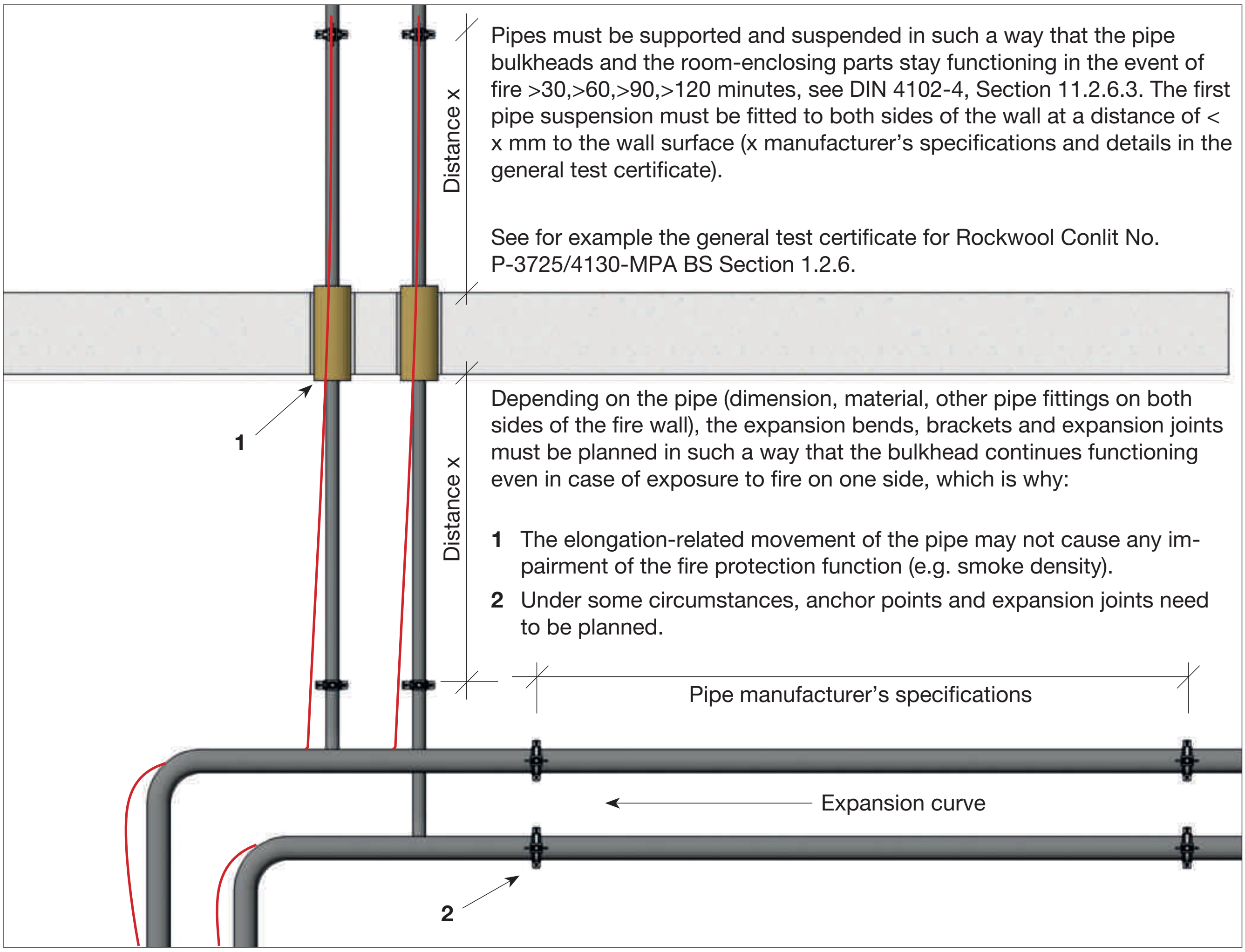


Non-combustible insulation system for chilled water pipes

To fulfil the requirements of a non fire-load fitting in the necessary corridors, chilled water pipes can be insulated with the Teclit®System from Rockwool.
In this case, the Teclit® Hanger is used to fasten the pipes.
The hanger comprises inside of a pressure-resistant insulating core made of non-combustible mineral wool with a glass-fibre reinforced aluminium lining. The Teclit PS Cold pipe shell insulates the pipe. It is important that all components are sealed impermeably at their joints with the Teclit aluminium tape.
On combustible pipes, the system can also be used for fire load encapsulation in accordance with the expert report GA 3335/1111-Mer from the MPA Braunschweig*.
In this case, the pipe fastening is designed in accordance with DIN 4102-4:2016-05 Section 11.2.6.3.

Fire protection wall duct





Pipes must be supported and suspended in such a way that the pipe bulkheads and the room-enclosing parts stay functioning in the event of fire >30,>60,>90,>120 minutes, see DIN 4102-4, Section 11.2.6.3. The first pipe suspension must be fitted to both sides of the wall at a distance of < x mm to the wall surface (x manufacturer's specifications and details in the general test certificate).

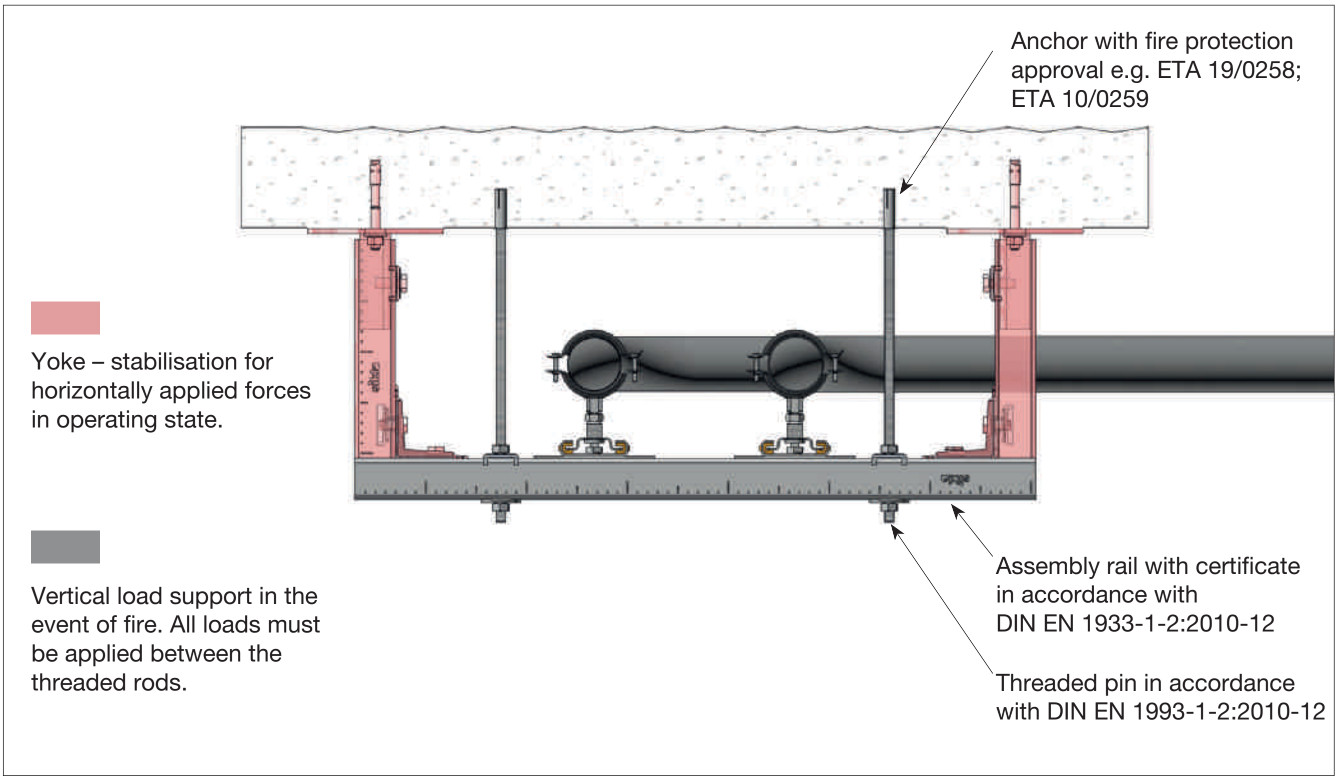
See for example the general test certificate for Rockwool Conlit No. P-3725/4130-MPA BS Section 1.2.6.

Depending on the pipe (dimension, material, other pipe fittings on both sides of the fire wall), the expansion bends, brackets and expansion joints must be planned in such a way that the bulkhead continues functioning even in case of exposure to fire on one side, which is why:

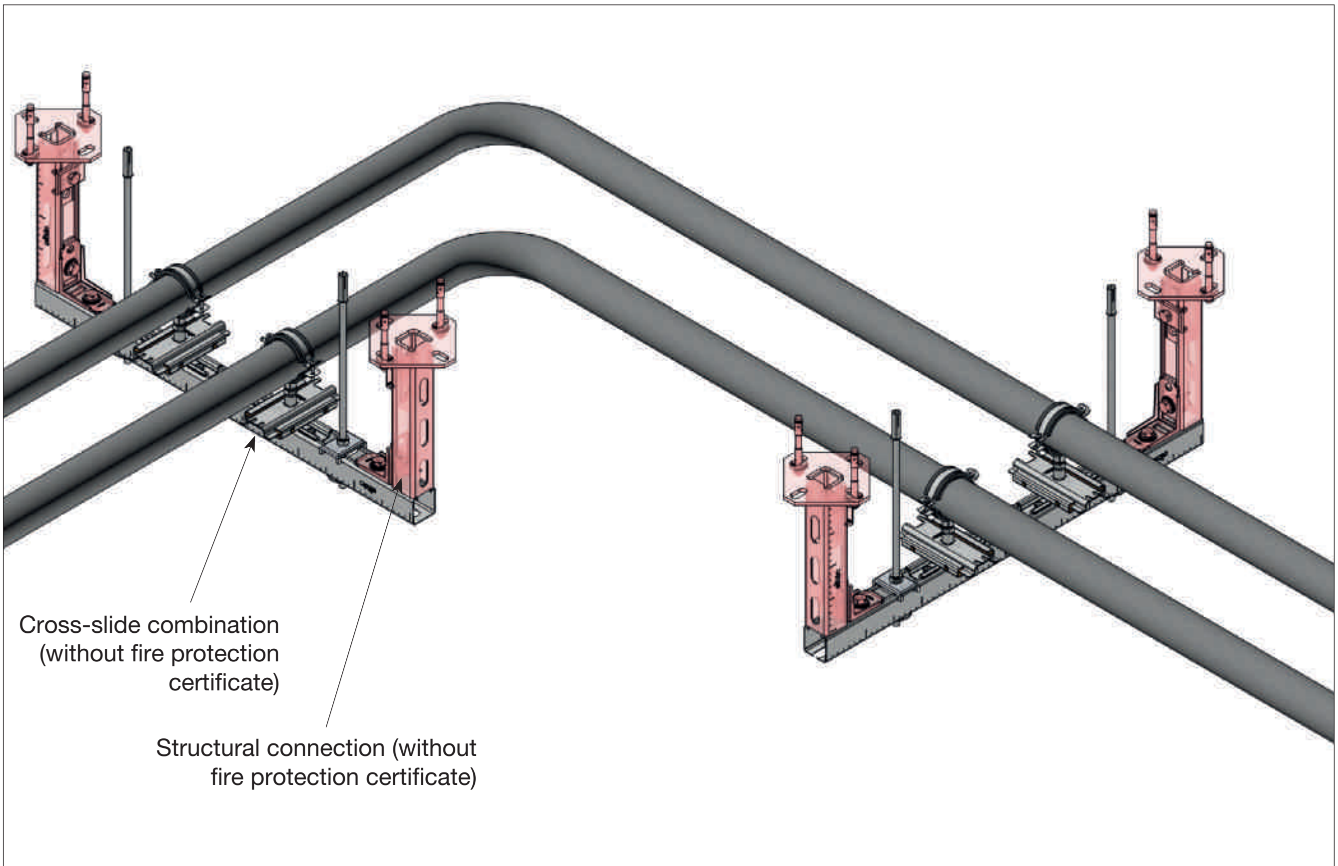
1 The elongation-related movement of the pipe may not cause any impairment of the fire protection function (e.g. smoke density).
2 Under some circumstances, anchor points and expansion joints need to be planned.

06/2018

U-type bracket with fire protection requirements



With route modules with defined fire resistance rating requirements, with which a simple suspension with threaded rods is not sufficient from a structural perspective, it is possible to upgrade the fire protection with certificate. In this case, the supporting horizontal profile, threaded rods and anchors are assessed.



abP	**General test certificate**
abZ	**General building approval**
Building Rules Lists	have been published regularly over the previous years by the DIBt and include technical regulations for building products and building types, divided into the lists A; B; C (regulated; non-regulated; other building products and building types). It is planned to replace the building rules lists with the VVTB which are to be introduced in the federal states in Germany
Building material class	refers to the combustibility of the material in terms of its contribution to the fire propagation: - smoke formation - flame formation - heat development - spreading of source of fire - flaming droplets
FAS	**Fire alarm system in accordance with DIN 14675 / DIN EN 54 ff**
Fire compartment	**covers a maximum 1600 m² because the 40 m distance of fire walls should not be exceeded (justified exceptions for special-purpose buildings are permissible)**
Spread of fire	**caused by heat convection / heat conduction / heat radiation**
Fire protection concept	Complex planning services, e.g. for special-purpose buildings to meet the required protection objectives for specific concrete and deviating boundary conditions.
ETA	European Technical Assessment (formerly European Technical Approval)
Fire resistance **Fire resistance rating** **FRR**	Specification of a component / building type with a specific (FRR 30; FRR 60; FRR 90; FRR 120) Time interval in min. concerning the component's behaviour in the event of fire
Fire-resistant	Fire resistance rating ≥ 90 min. highly fire resistant ≥ 120 min.
Fire-retardant	Fire resistance rating ≥ 30 min. highly fire-retardant ≥ 60 min.
hEN	Harmonised European (product) standards always have a national annex which lists the mandatory properties
Declaration of performance	Mandatory document CE-labeled products with specifications on mandatory properties

Utilisation unit	**Isolated fire protection unit, characterised by specific use or specific user with common rooms**
HSV	Heat and smoke vent
Rescue route	Umbrella term for corridors and staircases and other areas used by persons to get to safety in the event of fire and which are used by the fire rescue services and other emergency services for evacuation.
PS	**Pipe span**
SBI test bench	Single burning item test bench
Special-purpose building regulations	for high-rise buildings, restaurants, youth hostels, mobile constructions, care homes, hospitals, garages, assembly facilities, industrial buildings, sport facilities, camping sites, prisons, amusement parks, etc.

[1] **CPR** European Construction Products Regulation, applicable since 01.07.2013

[2] **DIBt** German Institute for Structural Engineering, Berlin

[3] **DIN** German Institute for Standardisation, Berlin

[4] **DIN** **4102-4 :** 2016-05
Fire Behaviour of Building Materials and Structural Elements Part 4: Synopsis and application of classified building materials, components and special components DIN, distributed exclusively by the Beuth publishers, Berlin

[5] **DIN EN** **1363-1 :** 2012-10
Fire resistance tests - Part 1: DIN general requirements, distributed exclusively by the Beuth publishers, Berlin

[6] **DIN EN** **1993-1-2 :** 2010-12 (Eurocode 3)
Design of steel structures, Part 1-2: General rules – General rules - Structural fire design, distributed exclusively by the Beuth publishers, Berlin

[7] **DIN EN** **13501-1 :** 2010-01
Fire classification of construction products and building elements, Part 1: Classification using data from reaction to fire tests DIN, distributed exclusively by the Beuth publishers, Berlin

[8] **ETA** European Technical Assessment

[9] **UTC** Standard fire test curve in accordance with DIN 4102; DIN EN 1363-1 and ISO 834

[10] **FeuerTrutz** Brandschutzatlas (Fire Protection Atlas), Version 3/2018

[11] **FeuerTrutz** Eurocode 3: Uncertainties regarding fire behaviour of assembly rails, published by the RAL Quality Association, FeuerTrutz Magazine 2017/1

[12] **IBS** Institute for Fire Protection Technology and Security Research, Linz Expert Report No. 316080801-1 from 04.09.2017 Fire protection assessment for fastening systems of fire protection flaps and fire/smoke control flaps

[13] **LBO** State Building Code, for each federal state based on the Model Building Code (MBO)

[14] **LETB** List (directory) of technical building provisions published by the DIBt, version dated 13.03.2017

[15] **MBO** Model Building Code 2016, agreed on by the Conference of Ministers of Construction held on 13.05.2016 (based on the MBO 2002 version)

[16] **MLAR** Model Pipe System Guidelines on fire protection requirements for pipe systems published by the DIBt, version dated 10.02.2015 revision of edition 2 from 11.10.2016

[17] Comment on MLAR, (4th edition 2011), 5th edition to be published in Autumn 2018, recommendations for use and practical examples from the authors Lippe, Czepuck, Möller, Reintsema published by the Heizungs-journal Verlags GmbH

[18] **M-LüAR** Model Ventilation System Guidelines on fire protection requirements for ventilation systems published by the DIBt, version dated 29.09.2005 revision of edition 1 from 10.02.2016 with modifications from 11.12.2015

[19] Comment on M-LüAR, 2nd edition from May 2016 with recommendations on the practical implementation of ventilation system guidelines from the authors Lippe, Czepuck, Esser and Vogelsang published by the FEUER-TRUTZ publishers

[20] **MPA** Federal Institute for Materials Research and Testing (certified institutes for independent testing) Nando = New Approach Notified and Designated Organisations

[21] **M-VVTB** Model administrative act for technical building provisions, draft version of DIBt, status 11.12.2017

[22] **RAL** Quality association for pipe fastenings, at Landsberg am Lech, Germany: Awards quality labels after neutral, equivalent testing

[23] **tab** Trade article on fire behaviour of pipe fastenings. Results from basic trials with assembly rails, published in the trade journal ‘tab’, 2015-09

[24] **vfdb** Association for the Promotion of German Fire Protection, guidelines on engineering methods in fire protection, 2013 Author: Hosser, Dietmar

[25] **ZTV** Additional technical contract conditions and guidelines, e.g. for the construction of road tunnels

These fire protection guidelines provide a summary of the latest technology and information on suitable fire protection fastening solutions based on explanations, diagrams and tables.

Due to advancing technical developments, the user must check the validity of the assumptions made when applying data to current projects and compare them using concrete boundary conditions.

The explanations apply exclusively to products distributed by Sikla by complying with the relevant assembly instructions.

The current data, which can be found on our homepage, applies to load specifications as well as the current status of indicated anchor approvals.

For this reason, Sikla cannot accept any guarantee for the accuracy of the information and specifications provided.

In particular, the user (who is ultimately responsible for implementing the solution) should consult with the fire protection concept officer or other experts.

When a new version of these fire protection guidelines are published, this edition loses its validity. More information can be found on our homepage at https://www.sikla.de under Downloads, “Brochures”.

Notes