



**RAL**

GÜTEZEICHEN



... for fire-tested fastening

Gütegemeinschaft Rohrbefestigung

Safety. Reliability. Transparency.

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## Pipe supports in the case of fire

### Problem

A modern building contains extensive technical installations as part of the building services such as drinking water, waste water, rain water, heating and ventilation equipment. In some cases, there are great installation densities, especially where pipe routes have been laid, in often very tight mounting situations above suspended ceilings.

These create great problems especially in emergency exits and escapes, as the fire safety characteristics of the suspended ceiling must be guaranteed, despite the overlying pipe routes. This is only possible if the fire safety features of the pipes, and especially the pipe supports used, are known and predictable. Proof thereof is indispensable.

The new regulation, RAL-GZ 656 was conceived for this purpose.

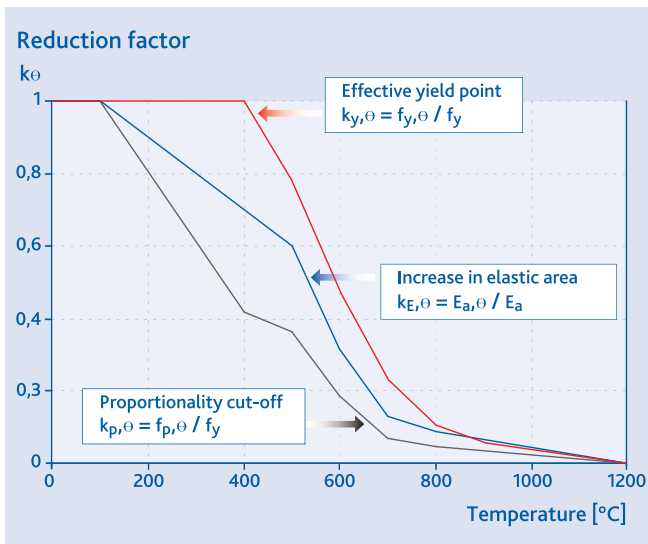


So, how can the fire behaviour of pipe supports be evaluated?



## Steel does not burn, but fails nevertheless.

The mechanical capability of all steel constructions decreases with increasing temperature. This is a direct consequence of the change in material properties at high temperatures. So the solidity and elasticity of steel decreases at 800°C (represents 30 mins burning time) to approximately 10 % of the set point.

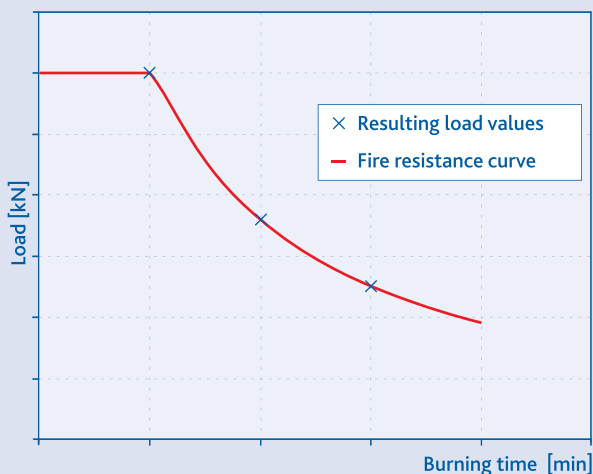


Reduction factors according to DIN EN 1993-1-2 (Eurocode 3)

Pipe clamps also lose a great deal of load capacity with increasing temperature. Because steel is a good heat conductor and pipe clamps are delicate building elements, the temperature of the construction elements quickly follows that of the immediate environment.

Thus there is a permitted load weight, which a clamp can carry, for each temperature. Because every temperature can be assigned a specific burning time, with use of the standard temperature curve, according to DIN 4102 or EN 1363, as the case may be, it is possible to put the allowable load capacity of a pipe clamp over the burning time. This curve is called the **fire resistance curve**.

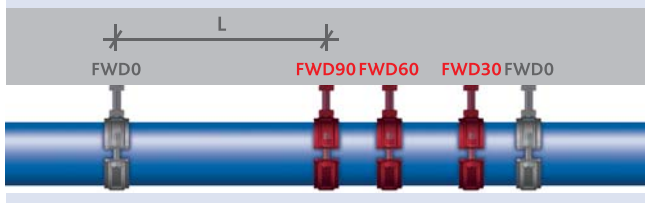
### Fire resistance curve $F_{\text{permitted,fl}}(t)$



Fire resistance curve

The fire resistance curve indicates the permitted load a pipe clamp can hold at any given fire resistance duration. The sustainability is restricted by the load permitted according to RAL-GZ 655, in the lower temperature area. For this reason, determining of mechanical properties at room temperature according to RAL-GZ 655 is of the utmost importance, also to evaluate the behaviour of the building component in the case of fire. The permitted load sinks with increasing temperature. This means that the higher the fire resistance duration should be, the smaller the mounting distances.

### Mounting distances

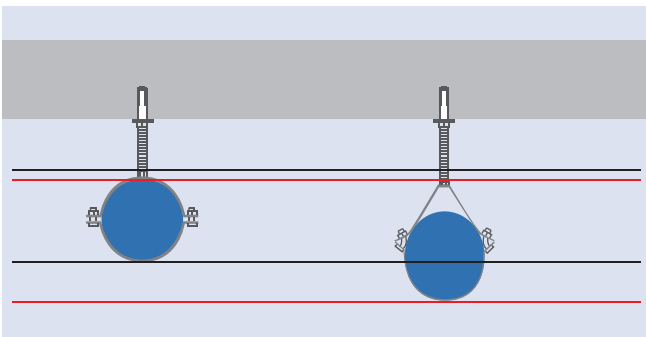


Reduction of mounting distances with increasing fire resistance time

## Steel loses its shape before it fails.

The yield strength and elastic modulus of steel decrease with increasing temperature. Thus an increasing temperature gives rise to greater elasticity and plastic strain in the pipe clamps. Predetermining this failure is no triviality.

For example, if pipes are laid above a fire-protection suspended ceiling, it has to be assured that this ceiling will not be hit by falling construction elements. It is also vital to ensure that the pipes do not sink so far as to touch the ceiling. Otherwise the fire-protected characteristics of the ceiling can no longer be guaranteed. For this reason, it is very important to be informed of the deformation behaviour of the pipe clamps in the case of fire. This deformation depends on the type of pipe clamp, the load involved and the burning time (temperature).



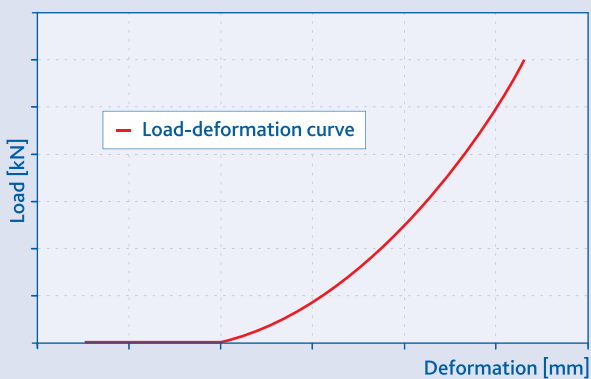
Deforming and sinking of a pipe clamp as a consequence of fire (schematic illustration)



Because the deformation depends on the load, the probable deformation can be reduced by reducing the load. This is of especially great advantage in very tightly constructed areas.

The product data necessary for such a case can be ascertained by way of a load-deformation curve. Thus, an appropriate mounting distance can be found for a fire resistance duration of 30 minutes with a desired maximum lowering of the pipes.

#### Determining load-deformation curve for up to 30 minutes burning time



Load-deformation curve up to 30 minutes burning time

## Previous practice in evaluating fire behaviour of pipe supports

Up to now the behaviour of pipe supports under the influence of fire was only possible based on individual evaluation processes. Every manufacturer, who wanted to determine his products' performance, did so on the basis of his own evaluation procedures, which differed from manufacturer to manufacturer, and from test institute to test institute. A direct comparison of values was therefore not possible. Moreover, most of the procedures were restricted in their suitability to make safe, comparable projections as to the deformation behaviour of the pipe clamps. Because of the complex behaviour of one building element such as pipe clamps, a mathematical solution to the problem is normally not feasible.

## The new RAL-GZ 656 „Fire-tested pipe supports“

The new technical regulation RAL-GZ 656 was developed together with major testing institutes and manufacturers. It is the first comprehensive evaluation model for the fire behaviour of pipe clamps, which is recognised independently of manufacturer, and spanning all test





institutes. It contains rules for carrying out and evaluating fire tests on pipe clamps. With the help of these regulations, it is now possible to determine the fire resistance curve and the load-deformation curve of a pipe clamp. Thus allowing a totally new quality of fire protection planning, which has never been available to planners up to now.

## RAL-GZ 655 “pipe supports”

The proven and recognised technical regulation RAL-GZ 655 „pipe supports“, through its refined methods of determining the mechanical load capacities of pipe clamps, offers a sure basis for further fire-protection evaluation. Without the knowledge of the basic mechanical behaviour of a pipe clamp, no useful evaluation, based on the new regulation RAL-GZ 655, is possible.

## The quality mark “fire-tested pipe supports”

The quality mark “fire-tested pipe supports” can be awarded on application to products, which completely satisfy the high requirements expected of fire-tested pipe supports. This always involves a neutral, independent evaluation of the mechanical product characteristics according to RAL-GZ 655, as well as the carrying out and evaluation of fire tests according to RAL-GZ 656. Furthermore, these products are subject to continuous external monitoring.





## Planning requires safety

For a planner, safety is an indispensable, basic consideration, especially when planning demanding building projects. Reliability and comparability of technical data is of special importance. As is the certainty that all data is based on recognised technical regulations. The quality mark "fire-tested pipe supports" offers this certainty.

## RAL Quality assurance in construction

The RAL quality mark stands for constantly neutrally tested and proven quality in construction. Current information on RAL quality associations involved in all aspects of construction can be found under: [www.ral-guetezeichen.de](http://www.ral-guetezeichen.de).

## RAL quality mark pipe supports & fire-tested pipe supports

The RAL quality mark "pipe supports" and „fire-tested pipe supports“ denote pipe clamps, brackets, mounting rails and equipment, whose technical performance and quality has been proven in comprehensive, neutral tests. The resulting safety is an advantage for all those involved in construction.

## Neutral, independent and competent test centres

According to RAL-GZ 655 and RAL-GZ 656 the determining of technical data must be confirmed by an approved, independent test institute. Thus, the technical data for quality assured pipe supports is not the same as simple information given by the manufacturer, but is evaluated by independent, neutral test centres.

To ensure a uniform product quality, these quality-assured pipe supports are regularly monitored by a neutral body. In this case, the quality association works exclusively with renowned, internationally highly regarded test institutes.

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