

Melting-Fuse Description

Buildings must be more energy efficient, healthier and safer. To become more energy efficient, better insulation is a must. Better insulation is expressed by installing more thermal insulation in floors, façades and roofs. Materials with a high heat resistance are most commonly considered for thermal insulation. The materials do not all offer the same fire protection. The most fire-safe materials unfortunately have a moderate thermal resistance, so that for insulation with fire-safe materials, much more must be installed. Better insulation is expressed by the thermal insulation and by fitting construction components together better, which controls the air flowing through the building shell. The higher the air flow, the lower the loss of hot air and thus energy. A good controlled air flow in the building shell may be necessary so that construction elements do not become too damp. This applies namely to the outermost layer of the shell. When this is airtight, as is the case with glass and metal, condensation occurring on the layer must be avoided through ventilation. In structural terms, this is “a ventilated cavity” with which space behind the surface is meant that is in an open connection with the outside air.

Ventilation, thermal insulation and fire safety are all related pillars. Fire is the result of three main elements: fuel, oxygen and an ignition. Flammable insulation in combination with air flow makes a façade or roof structure actively contribute to the spread of the fire if a fire breaks out. Flammable insulation in combination with air flow makes a façade or roof structure with a ventilated cavity actively contribute to the spread of the fire if a fire breaks out. Above all in tall buildings with multiple floors, this is a notorious phenomenon in which multiple victims are not rare. Therefore, the recommendation per floor and per building compartment is to install fire-resistant barriers in the building shell. Generally, the barriers are made of inflammable materials, filled with thermal foam substances. These barriers are not only difficult intersections in structure with regard to design, they are also often also difficult to create.

A common solution for creating fire-resistant barriers is the installation of a block of mineral wool filled with a strip of fire retardant foam tape. The mineral wool is fire resistant up to high temperatures at sufficient density.

The fire retardant foam tape expands at high temperatures such that it closes off the free space. The mineral wool retains its structure when exposed to heat. The fire retardant foam material does however lose its cohesion and it flows out under hot air flows. The application of fire retardant foam tape in a

ventilated cavity is therefore very critical. If the cavity is too narrow, this will not ventilate enough and the outermost layer may become too damp over time and thus may be damaged. Materials with which the outermost layer of the substructure is attached may corrode, which causes the outermost façade parts to come loose. An unacceptable situation for a high-rise building. If the cavity is too wide, however, the fire retardant foam material will blow away too quickly, and the barrier will not be fire-resistant enough. In this, one must consider that in the event of fire, the air flow in the cavity will reach much higher speeds than otherwise, as in a chimney.

A second disadvantage, the installation of a fire-resistant barrier of mineral wool is difficult. This is because the fixation must also be fire-resistant. In current applications, a block of mineral wool is inserted via a “blind” fixation, for example. The fixation of the mineral wool barrier thus almost always deviates from the fixation of the other insulation. The mineral wool insulation must be fully aligned with the insulation, which must be installed earlier. You may guess that this is difficult on a construction site.

A third disadvantage is that in the event of fire, the components may become deformed through exposure to heat. A block of mineral wool itself will not burn, but the closing off of the cavity to prevent the fire spreading, will take place much more slowly because of deformation of above all the outermost parts of the façade. Even the foaming material will dissipate much faster, through which the barrier will only hold out for a short time or in a limited manner.

The desire of the implementing parties is also to have a solution that fits into the construction process and results in a reliable, durable and implementable barrier, whereby the size of the ventilation space in the cavity is guaranteed as well as, in the event of fire, closing-off of the cavity to combat the spread of the fire.

To solve this problem, the following application has been thought out and worked out, in fact, the invention, the fuse. The fuse is characterized by, after the detailed definition in dimensions and composition of a quantity of mineral wool (such as mineral wool), whereby this is compressed by generating a vacuum or applying vacuum techniques, this then in the form of a certain melt-proof gasket is installed, such as placing this in a cassette specifically developed for this. The technique of compression guarantees the orientation and maintenance of the fibre wool and with it the elasticity of

the wool. The elasticity causes the wool to return to the original form after melting of the gasket or otherwise for it to be free to expand.

The technique of compression guarantees the orientation and maintenance of the fibre wool and with it the durable elasticity of the wool. The durable elasticity causes the wool to return to the original form even after dozens of years after melting of the gasket or otherwise for it to be free to expand.

By containing the compressed or vacuumed mineral wool in the desired dimensions in a gasket with a fuse, it will expand when melting. At higher temperatures, such as in the event of fire, the gasket itself will melt or break open and the gasket actually works as a “fuse” for the expansion of the mineral wool needed in the event of fire. After (part) of the “fuse” melts (a part of the package, such as a part of the cassette), the mineral wool expands in the desired direction and closes off the cavity. As an example, one of these objectives, namely preventing the spread of fire in high-rise buildings with ventilated façades is explained below.

The maintenance of the vacuum and thus the compromised status by sealing the wool is limited or very expensive. There is vacuum insulation whereby the vacuum is guaranteed for years and whereby the air seal is created by metal or glass. For a fire-retardant barrier which is not visible in a façade and is often installed at great height and nearly inaccessible, that is not reliable enough. The compressed or vacuumed mineral wool is therefore placed in a pre-defined form (the invention), such as a cassette, such that the mineral wool still always expands if the form disappears, such as a part of the cassette. The disappearance of the form occurs when the fuse buckles, such as a (side) wall of the cassette. The form with the compressed or vacuumed mineral wool is designed in a dimension that matches the dimensions of the insulation material used in the façade.

In this way, the construction process and the size of the cavity are followed through in the detail. As extra safety, a strip of fire retardant foam tape is included. When this expands after the compressed or vacuumed mineral wool has expanded, it will not fly away with the flow of hot air because the expanded mineral wool seals the cavity. This technique of installation has the great advantage that the connection, which is not always precise due to the building process, is filled to be completely fire-retardant through the expansion of both the inflammable mineral wool and the fire retardant foam material.

The fuse can be installed in multiple forms by implementing the solution, here are four non-limiting examples:

1. Between the compressed or vacuumed mineral wool and the outer façade, a plastic air-permeable spacer may be installed that ensures ventilation. The spacer is first to melt during a fire, after which the compressed or vacuumed mineral wool expands as desired.

2. But this fuse can also be realized in another way, by, for example, sealing it in with the compression or vacuuming of the mineral wool. The spacer is first to melt during a fire, after which the compressed or vacuumed mineral wool expands as desired. This fuse can also be installed after sealing, whereby when installing the fuse, the mineral wool in the container can expand by the dimensions that it must have for application in the cavity.

3. Or if one uses a specially developed container, such as a cassette, a part of this container will melt away in a fire, after which the compressed or vacuumed mineral wool will expand and stay in place through the construction of the container (in this, pins/screws can be stuck/screwed through the mineral wool) and then close off the opening.

4. A combination of the aforementioned designs.

Finally, in all cases, the installed strip of fire retardant foam tape will ensure that there is no spread of the fire.

The invention will be explained in more detail using the drawings with example designs (not limited to these).

The following are shown:

Fig. 1 schematic presentation of a (residential) building with fire compartments

Fig. 2 schematic presentation of a ventilated cavity at the location of a story floor

Fig. 3 schematic presentation of a barrier with fuse in the design with a container/cassette

Fig. 4 schematic presentation of the function of a barrier with fuse

Fig. 5 schematic presentation of a barrier with fuse in the design with an internal fuse

Fig. 6 schematic presentation of a barrier with fuse in the design with an air-permeable spacer

When a building is divided into compartments there are in practice more spaces in the façade, floor or roof where a barrier against fire is required and a cavity must be conserved, these can all be provided with the current invention, the fuse. The fuse works in two parts, first it holds the compressed or vacuumed mineral wool in the desired location, without this prematurely expanding and thus interrupting the necessary air flow (which leads to damp problems). The second form of fuse is designed for the fact that this melts first in the event of fire, after which the compressed or vacuumed mineral

wool expands and seals the cavity. With the examples shown in the figures (not limiting), one seeks to create insight into the solution that can be conceived and is a limited selection of all of the spaces present in a structural shell, where air must flow through.

5 Figure 1 sketches out a residential building (1) with indication of a residence that must be constructed as a compartment (2) in terms of fire safety. In the event of fire in a compartment, this will be contained as long as possible to that compartment. All structural elements and connections between elements (3) must have sufficient resistant to the spread and transfer of fire. Fire resistant barriers are a solution for this in the connections. In this, the connections to the façade must be ventilated and are thus
10 equipped with flammable insulation.

 Figure 2 shows a schematic cross-section of the connection between a story floor (4) and a ventilated façade. The façade is made up of an interior sheet (5) and a façade (9). The thermal insulation (6) is installed between the interior sheet and the façade. Moisture can condense behind the façade and
15 to prevent this, the space between the insulation (6) and the façade (9), the cavity (7) must be continually ventilated with outside air. In the event of fire in one compartment, the fire may spread to another compartment may take place via the cavity. A fire resistant barrier (8) must prevent that. But when the barrier does not seal the cavity during a fire, the flames can creep up to the following floor between the barrier and the façade. Considering that the cavity acts as a chimney over the entire height of the building
20 in the event of fire, and the thermal insulation (6) also burns, the fire can spread around it in a very short time and can “climb” up very fast via the cavity.

 Figure 3 shows an example design of the invention, a fire-resistant barrier with expanding wool (8). In a container developed for this, such as a cassette (12), there is inflammable insulation material
25 installed (10) with a thickness adjusted to the thermal insulation used in the façade. This also includes compressed or vacuumed mineral wool (11). The cassette serves as a container and also as a fuse. During a fire, - whether or not part of - the cassette melts away, after which the compressed or vacuumed mineral wool will expand. In this, the fire retardant foam tape (13) is pressed against the façade, through which there is no or limited air flow and the fire retardant foam material better blocks the fire without falling
30 apart / be blown away. The design of the cassette includes attachment points (14), so that it is very easy to install on the interior sheet.

A design of the invention not shown differs from figure 3 in the following. The expanding wool (8) is equipped with a reinforcement material that guarantees that the expanding wool (8) keeps its position when an underlying construction has fallen away through fire. The reinforcement material extends out into the interior of the wool (8). The reinforcement material extends out in the inflammable insulation material (10) and/or in the mineral wool (11). The reinforcement material contains a bracket attached in the wool (8). The bracket is attached to the cassette (12). It will be clear that all suitable reinforcement materials can be considered.

Figure 4 shows what happens during a fire when the compressed or vacuumed mineral wool is installed with a fuse. After the fuse melts, the mineral wool (11) which is in the same position at the level of the storey floor (4), expanded and occludes the cavity (7) fully to the façade (9). The flames (15) can now not climb through the cavity, because the combination of the mineral wool (11), such as rock wool, with the fire retardant foam tape (13) functions as a fire-resistant barrier.

Figure 5 shows an example of another manner of fuse. In this case, there is no container, but the fuse (16) is integrated into the compressed or vacuumed mineral wool. The fuse is installed between 2 plates (17), keeps this in place and thus holds the compressed or vacuumed mineral wool under tension and in shape. During a fire, the fuse (16) melts, after which the combination of, for example, stone wool (11) and fire retardant foam tape (13) expands and performs the intended role.

Lastly in figure 6 another alternative is shown. Here the fuse is installed in the form of an air-permeable spacer (18) that is perforated or allows air to flow through in another way (as a result of the design used, perhaps containing air vents), which melts first during a fire, after which the combination of the compressed or vacuumed mineral wool and fire retardant foam tape expands and performs its intended role.