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Fire Safety of External Thermal Insulation Composite Systems (ETICS) for façades with polystyrene (EPS) insulation

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Fachausschuss Vorbeugender Brand-
und Gefahrenschutz
der deutschen Feuerwehren (FA AK VB/G)
c/o Branddirektion München
An der Hauptfeuerwache 8
80331 München

Vereinigung zur Förderung des
deutschen Brandschutzes
Geschäftsstelle
Postfach 4967
48028 Münster

Ltd. BD Dipl.-Ing. (FH) Peter Bachmeier
Phone: 089 2353-40000
Fax: 089 2353-40099
Email: bfm.vb-leitung.kvr@muenchen.de

Präsident Dirk Aschenbrenner
Vizepräsidentin
Dr. Anja Hofmann-Böllinghaus
geschaeftsstelle@vfdb.de

Fires of ETICS with polystyrene (EPS) insulation are a challenge for the fire service as rapid fire spread and enormous smoke production of these systems differ significantly from other systems used for thermal insulation of façades.

German fire services collect fires with ETICS with EPS insulation since 2012. The list of the collected cases is accessible on the homepage of the Frankfurt Fire Service¹. More than 90 cases are listed so far with 11 fatalities and 124 injured persons. Especially remarkable is the fact that fatalities occurred not in the room or floor of fire origin but on floors above the fire origin. Fires in Berlin (2005) as in Cologne (2005) and in Duisburg (2016) spread over the façade to all other floors above. This is significant because fatalities occurred in compartments not related to the room of fire origin.

German building regulations state: Exterior walls and parts of exterior walls as parapets and veneers have to be built in a way that fire spread is limited for sufficient time.² In the cases above this is not fulfilled from our point of view!

The collected fires with ETICS show clearly that fires outside of the building cannot be neglected regarding fire safety of these systems: about two thirds of the fires started outside the building. Especially the extremely rapid fire spread which could be seen in several cases is a situation which cannot be handled by the fire service satisfactorily: with regard to the about ten minutes within the fire service is on scene after emergency call fire spread to more than two floors is likely and cannot be prevented.

The approval of ETICS with EPS insulation was based on a fire test according to E DIN 4102-20. This test simulates a developing fire in a room inside a building. Standardisation work was not continued when German Building authorities (BMK) requested fire tests with ignition sources outside the building in front of the façade system. These large scale tests with approved ETIC systems showed a not tolerable fire performance of these systems with extremely rapid fire spread and enormous heat and smoke production. This result is in accordance with experiences of the fire service.

Based on this result and the collection of fires a new fire test (Sockelbrand) was developed. This test simulates a fire outside the building which represents a realistic fire source – a burning waste container. The burning waste container is represented by a 200 kg wood crib. The Sockelbrand test is the basis of additional constructive measures to enhance the fire safety which has been published by DIBT in 2015³. It is included in the Administrative regulations MVV TB⁴ by DIBt as Technical Regulation A.2.2.1.5 for ETICS with EPS insulation.

Standardisation work for E DIN 4102-20 has been re-installed after the investigations mentioned above were finished. Unfortunately, the fire outside the building

¹ www.feuerwehr-frankfurt.de/index.php/projekte/wdvs

² Paragraf 28, Absatz 1 der Musterbauordnung - MBauO 2012-Änderung 2016-05-13

³ DIBt-Newsletter 3/2015, Konstruktive Ausbildung von Maßnahmen zur Verbesserung des Brandverhaltens von als "schwerentflammbar" einzustufenden Wärmedämmverbundsystemen mit EPS-Dämmstoff

⁴ Muster-Verwaltungsvorschrift Technische Baubestimmungen, 2017, https://www.dibt.de/de/geschaeftsfelder/data/Entwurf_MVVTB_20170531.pdf

(Sockelbrand test) has not been included in that part of DIN 4102 although the German fire safety associations (vfdb, AGBF, DFV) have expressed this wish several times. Part 20 of DIN 4102 represents now the situation about five years ago without the results of the investigations regarding fire outside the building. The fire outside the building shall now build a new part of DIN 4102.

With regard to the European harmonisation process we think that is critical: The European Commission launched a Call for tender in August 2016 with the aim to develop harmonised tests for assessment of fire behavior of façades. The call includes the part 20 of DIN 4102 but not the fire outside the building represented by the Sockelbrand test– as a direct result of the decision to exclude the Sockelbrand test of DIN 4102-20. To maintain our safety level in Germany it is important that the future harmonised system in Europe covers also the fire outside the building (Sockelbrand test). We will continue our work on that topic.

As ETICS are meant to be in place for tenths of years robustness of these systems regarding influences as weathering, ageing and mechanical damages is absolutely necessary from our point of view. This is mentioned in another publication of DIBt with date 18.06.2015⁵ as well. However, our neighbours Austria and France have introduced already measures to ensure more robustness of ETICS with EPS insulation: in both countries mineral wool belts in each floor are mandatory. All investigations so far also show the benefit of mineral wool belts in each floor for fire safety.

Although, this is known for some time now, mineral wool belts in each floor are still not mandatory in Germany.

Management of combustible insulation materials on building sites needs special sensitivity and carefulness regarding storage of large amounts of combustible material when fire safety measures may not yet in place. This is especially important for buildings in use.

For buildings with height of 22 m or more non-combustible façade systems are mandatory in Germany. To ensure our safety level that is important and should be applied to all buildings of special use as well.

⁵ DIBt Merkblatt Empfehlungen zur Sicherstellung der Schutzwirkung von Wärmedämmverbundsystemen (WDVS) aus Polystyrol, 18.06.2015, https://www.dibt.de/de/Fachbereiche/data/Merkblatt_Sicherstellung_der_Schutzwirkung_von_EPS-WDVS_18062015.pdf

As conclusion of the above discussed challenges for fire safety we recommend:

New systems:

- Mineral wool belts in each floor
- Ground floor non-combustible when moveable fire load cannot be prevented or
- Non-combustible housing of moveable fire load

Building sites:

Special sensitivity on building sites regarding the storage of combustible materials – distance to buildings (especially when in use!) or housing of material - is necessary

Systems in use:

Movable fire load as waste containers, waste or vehicles need to have a safety distance to buildings with combustible façade systems or need non-combustible housing. When these measures are not possible, the façade need to be non-combustible on ground floor level.

Damages of combustible façade systems need to be repaired as soon as possible.