Assessment report: Study of horizontal fire spread in flat roofs

Kingspan Therma TR26 FM

SP Fire Research AS

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ABSTRACT
Three tests on insulated flat roofs were performed at SP Fire Research .

The mission of this assessment report is to evaluate the performance of Kingspan Therma TR26 FM when used as insulation on flat roofs in terms of the requirements given in the Norwegian building regulations (TEK10) and the corresponding guidance (VTEK10).

The assessment is solely based on the obtained test results and is only valid for Kingspan Therma FM range as described in chapter 1.2 and not for other/similar materials, products or other producers.

A background, assessment and conclusion is included in this report.

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Contents

1 Background

1.1 Fire tests

Three tests on insulated flat roofs were performed at SP Fire Research. An overview is presented in the table below:

Table 1 List of fire tests and corresponding information.

Test no.	Test report no.	Issued date	Insulation material	Insulation thickness	Comment
1	F16 20239:1	2016-10-05	Kingspan Therma TR26 FM	300 mm	
2	F16 20239:2	2016-10-05	Kingspan Therma TR26 FM	300 mm	There were two penetration holes through the entire roof construction with no filling.
3	F16 20239:3	2016-10-05	Kingspan Therma TR26 FM	100 mm	

The test setup and constructional details are given for each test specimen in the individual test reports.

1.2 Objective and limitations

The mission of this assessment report is to evaluate the performance of Kingspan Therma TR26 FM when used as insulation on flat roofs in terms of the requirements given in the Norwegian building regulations (TEK10) and the corresponding guidance (VTEK10).

The assessment is solely based on the obtained test results and is only valid for the following products and not for other/similar materials, products or other producers:

- Kingspan Therma TR26 FM
  - Flat board, faced on both sides with low emissivity composite foil facing
- Kingspan Therma TR27 FM
  - Flat board, faced on both sides with a coated glass tissue facing
- Kingspan Therma TT46 FM
  - Tapered board, faced on both sides with low emissivity composite foil facing
- Kingspan Therma TT47 FM
  - Tapered board, faced on both sides with a coated glass tissue facing

The products listed above are all made with the same PIR core material.

1.3 Building codes

The Norwegian building regulations (TEK10) states the following in Part 3, § 11-9. Fire capabilities of materials and products – second paragraph:

Products and materials shall not have characteristics that make an unacceptable contribution to the development of a fire. Weight shall be given to the possibility of ignition, speed of heat transfer, smoke production, development of burning drops and time to flashover.

The guidance to the Norwegian building regulations, VTEK10, states the following in the corresponding paragraph – section 6 (our translation):

For buildings in fire class 1 and 2 insulation not meeting the A2-s1,d0 [non-combustible/limited combustibility] criteria can be used in roof constructions which have documented load bearing capabilities during a fire (classified R in agreement to § 11-4) and meeting the A2-s1,d0 [non-combustible/limited combustibility] criteria. Unless the loadbearing roof construction is protecting the combustible insulation by itself against heat exposure from below (e.g. concrete elements), the combustible insulation must be placed on top of an insulation – with a sufficient thickness to insulate against heat exposure from below – meeting the A2-s1,d0 criteria. The combustible insulation must also be protected on the upper side with materials meeting the A2-s1,d0 criteria which prevents ignition and fire spread in the insulation. As an alternative to protecting the upper side the insulation can be sectioned into areas up to a maximum of 400 m^2.

2 Observations

The fire tests with Kingspan Therma TR26 FM (test 1-3 in Table 1) showed the following characteristics:

- The insulation located above the fire chamber was damaged. Damage is in this context regarded as charring. The damages varied with the thickness of the insulation – thicker insulation showed less damage.
- In test 3 with 100 mm Kingspan Therma TR26 FM the fire spread to the unexposed face from both the insulation material and roofing membrane. The initial ignition of the roofing membrane occurred above a joint in the insulation material.
- There was very limited horizontal fire spread observed away from the area located above the fire chamber. The maximum fire spread distance values are approximately 500 mm.
- Self-sustaining flames were observed in the Kingspan Therma TR26 FM after the external flame source had burnt out. However, the flames were relatively small in size (100 – 150 mm in height) and progressed slowly and ceased without any means of extinguishing any remaining flames in the test specimen. The results indicate that the risk of an escalating fire in the insulation material is low, the small flames can in some cases with a relative high insulation thickness (300 mm) continue for several hours (~2h).
- The roof membrane used in the tests in Table 1 is a layer of Protan SE 1.2 mm, B_{ROOF} (t2) certified with Kingspan Therma TR26 FM as a substrate, PVC roofing membrane that was placed on top of the insulation.

3 Assessment

Unless it is not specified the following recommendations for "Kingspan Therma TR26 FM" is also applicable to the products listed in section 1.2 Objective and limitations.

Based on the observations and results from the fire tests in Table 1 it is SP Fire Research's opinion that Kingspan Therma TR26 FM can be used without being placed on top of an insulation meeting the A2-s1,d0 criteria in [profiled steel deck] roof constructions. The fire safety will also be acceptable without sectioning the roof into areas of maximum 400 m^2 as described in the guidelines to the Norwegian building regulations. If Kingspan Therma TR26 FM is to be used in sections larger than 400 m^2, it is SP Fire Research's opinion that Kingspan Therma TR26 FM do not need to be covered with an insulation meeting the A2-s1,d0 criteria.

In order to prevent flames to penetrate through a joint the Kingspan Therma TR26 FM insulation the boards shall be applied in at least two layers with staggered joints. In cases where there is only a single layer of Kingspan Therma TR26 FM the insulation boards shall have rebate joints.

SP Fire Research recommends that any roof membrane used on top of Kingspan Therma TR26/TT46 FM must be classified as B_{ROOF} (t2) based on tests with Kingspan Therma TR26 FM as a substrate. Any roof membrane used on top of Kingspan Therma TR27/TT47 FM must be classified as B_{ROOF} (t2) based on tests with Kingspan Therma TR27 FM as a substrate.

It is also SP Fire Research's opinion that Kingspan Therma TR26 FM can be used towards parapets and section walls above roof level made of or covered with non-combustible material(s) without replacing a 0.6 m section with insulation meeting the A2-s1,d0 criteria. If the section wall does not extend above roof level a section of Kingspan Therma TR26 FM must be replaced with a material meeting the A2-s1,d0 criteria in the width of the section wall.

It is also SP Fire Research's opinion that Kingspan Therma TR26 FM can be used towards and around penetrations and windows without replacing a 0.6 m section with insulation meeting the A2-s1,d0 criteria.

In cases where the roof has adjacent walls with combustible materials on the façade it is recommended to add a 0.6 m wide section of 20 mm PROMATECT®-H Calcium Silicate Board below the Kingspan Therma TR26 FM.

It is recommended that when using profiled steel plates in roofs the profiles shall be filled with a non-combustible material (A2,s1,d0) on both sides of the profiled steel plate above all fire walls.

In roofs where different insulation materials meet or are joined it is SP Fire Research's opinion that Kingspan Therma TR26 FM and the other materials shall be separated with a section of insulation meeting the A2-s1,d0 criteria with a width of 0.6 m. e.g. a roof which is going to be partly refurbished.

These statements are based on the observations from the tests in Table 1. Even though flames in the Kingspan Therma TR26 FM could be observed for some time after the external fire source had burnt out, the flames in the material were relatively small and eventually faded out without causing a dramatic fire spread.

The observations made from the tests showed that the risk for escalating horizontal fire spread was low. The tests indicate that any fire in the Kingspan Therma TR26 FM (when exposed from below while being on top of a profiled steel deck roof construction) will most likely be located above the area exposed to fire. A slow and limited fire spread should be taken into account in cases that are not described above.

SP Technical Research Institute of Sweden

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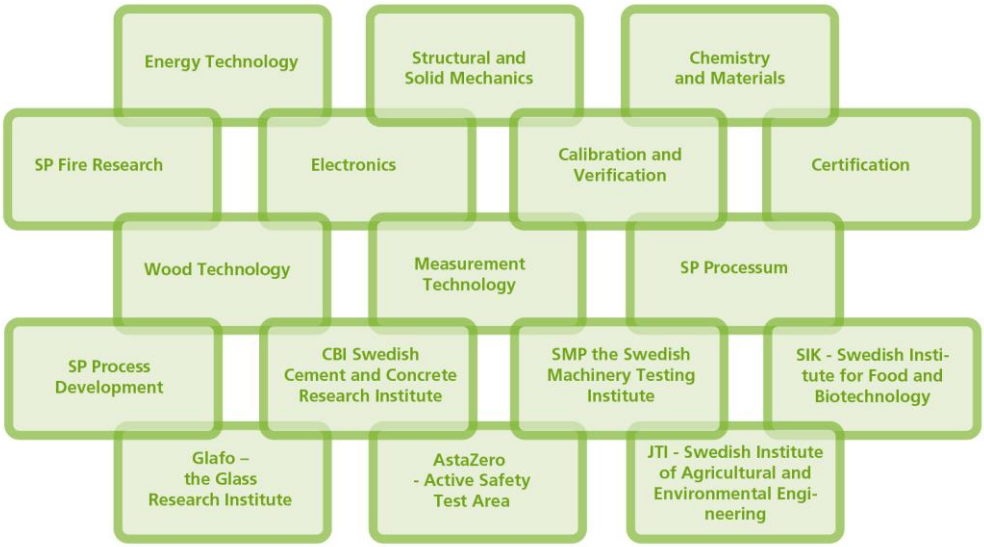

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