PU Europe

Factsheet

n° 24C | November 2015

Fire performance of thermal insulation products in end-use conditions

Room fire test of an insulated internal plasterboard wall

Executive summary

Ensuring fire safe buildings are one of the major priorities for the PU industry. PU Europe strongly believes that discussions should not be limited to the reaction to fire of individual construction products as this is a poor indicator for the fire safety of complete buildings. In this sense, ANPE launched a test programme, co-sponsored by PU Europe, comparing the performance of combustible and non-combustible thermal insulation products in real-life scenarios, i.e. in typical end-use conditions. This factsheet summarises the results for insulated internal lining build-ups. This technical solution is particularly suitable for buildings where external insulation is not possible or where there is the need to operate on individual units/building structures.

The tests were conducted and supervised by a notified body (L.S. Fire Testing Institute) using the Room Corner Test – RCT (ISO 9705) and comparing build-ups with largely similar U-values. Because of its high thermal performance, the PU build-up was considerably thinner than the stone wool solution.

Despite the different classifications – A2 s1 d0 for the stone wool composite board and B s1 d0 for the PU composite board – the behaviour of the two samples did not differ substantially. Neither build-up led to flashover. The classes assigned to the composite products in relation to table 1 of EN13501-1 were as follows:

- PU composite board: B
- SW composite board: B

Glossary

- ANPE: Associazione Nazionale Poliuretano Espanso rigido (Italian association for PU rigid foam)
- PIR: Polyisocyanurate
- PU: Polyurethane (PUR/PIR)
- RCT: Room Corner Test
- THR: Total Heat Release
- RHR: Rate of Heat Release
- SW: Stone wool
- TSP: Total Smoke Production

Tested materials

A PU board and a stone wool board were tested.

Fixing accessories and finishing

- **Wall mounting:** Adhesive spot distributed. Grouting of the joints made in two layers with interposition of a micro-perforated tape reinforcement.
- **Ceiling mounting:** U-shaped hooks and C metal profiles set at intervals of 50 cm; fixing the boards with phosphate screws; grouting of the joints and of screw heads made with two layers with interposition of a micro-perforated tape reinforcement.
- **Curing time:** In addition to the assembly of samples and the execution of the test, 10 days were necessary to ensure that the adhesives were fully dry and were operating well.

PU board
The tested 70 mm thick PU board was

made of a PIR core (Euroclass: E) faced on both sides with a fibreglass facing and adhered on one side to a 9.5 mm thick plasterboard panel.

Stone wool board
The tested 100 mm thick SW board was made of a double density stone wool core (Euroclass: A2 s1 d0) adhered on one side to a 10 mm thick plasterboard panel.

	PU board	Stone wool board
Declared thermal conductivity (λD) (W/mK)	0.028 (thickness from 20 to 70 mm)	0.035
Thickness applied for testing (mm)	70	100+10
Thermal resistance (m^2K/W)*	2.50	2.87
Fire performance/Euroclass	B s1 d0	A2 s1 d0

Product characteristics
** Differences are due to the availability of the products in the market*

Test method

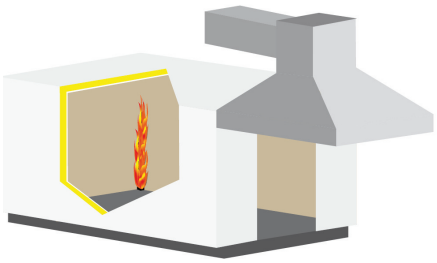
"The test was performed by installing prefabricated composite boards on the walls and ceiling of the chamber [...]".

To evaluate the fire performance of products in end-use conditions, full-scale tests were performed, submitting the sample build-ups to the RCT as described in ISO 9705. The RCT evaluates the behaviour of products during both the ignition and the fire development. This test is representative of the product's reaction to fire, and its behaviour during a fully developed fire.

The test was performed by installing prefabricated composite boards on the walls and ceiling of the chamber using auxiliary materials and procedures recognised as good practices.

This method reproduces a scenario of a fire in the corner of a room measuring 2.4 m x 3.6 m x 2.4 m high.

The burner, fuelled with propane, is placed in the corner opposite the gateway and the samples are submitted to the following



ISO 9705 - Room Corner Test: equipment and test method

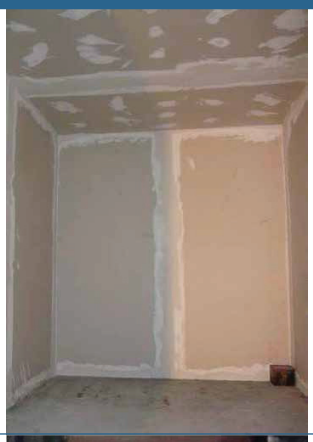
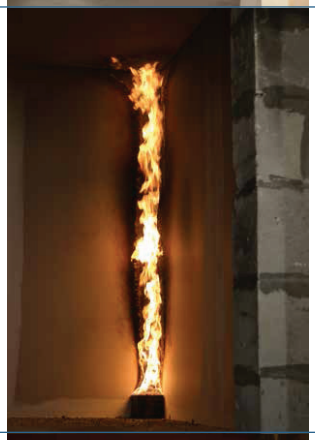
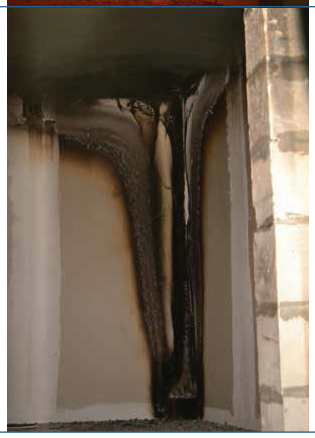
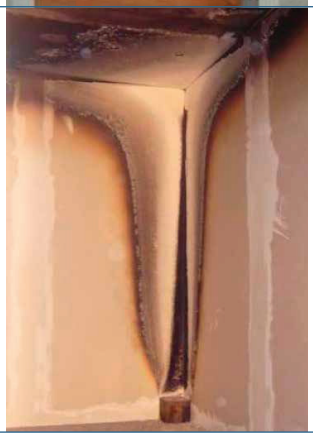
thermal attacks:

- 100 kW for the first 10 minutes – to simulate a fire in the first stage (ignition and development);
- 300 kW for the next 10 minutes – to simulate a fire which is fully developed.

The test is passed if flashover is not reached.

Test results

"[...], the fire performance of the two build-ups does not differ substantially".

Plasterboard panel system with PU Euroclass B s1 d0	**Plasterboard panel system with SW** Euroclass A2 s1 d0
	
	
	
	

Photos taken before, during and after the tests on two samples. In both tests, flashover was not observed

Despite the different classifications – A1 for the board in stone wool and E for the PU board – the fire performance of the two build-ups did not differ substantially.

In the first phase of the test in particular, in which fire ignition and development was simulated, THR, RHR and TSP curves were almost the same in both materials.

Only in the second phase, simulating a developed fire when the thermal attack reached 300 kW, a modest increase in the value of RHR and THR for the PU sample was observed, as well as a slight increase in the value for smoke production.

The two build-ups self-extinguished. Damaged areas appeared comparable and in both cases there was a negligible detachment of the plasterboard ceiling.

The classes assigned to the build-ups according to table 1 of EN13501-1 were as follows:

- PU composite board: B
- SW composite board: B

Conclusions

"[...] all build-ups have to be tested [...] no matter whether they use combustible or non-combustible insulation".

- The reaction to fire performance of individual insulation products did not provide a complete picture of how these products perform in end-use applications and, even less so, how insulated buildings perform in a fire. In fact, the test showed that internal lining build-ups with combustible insulation can achieve a performance which is similar to that of build-ups with non-combustible insulation.
- Several build-ups with non-combustible insulation are "deemed to satisfy" in certain countries without any need to test. If there is a need for a build-up fire requirement, it is recommended that all build-ups have to be tested in these countries no matter whether they use combustible or non-combustible insulation.

Disclaimer

While all the information and recommendations in this publication are to the best of our knowledge, information and belief accurate at the date of publication, nothing herein is to be construed as a warranty, express or otherwise.

References

- *Fire behaviour in end use conditions - Research project 2014,* ANPE, L.S. Fire Testing Institute
- ISO 9705: *Fire tests – Full-scale room test for surface products*
- EN13501-1: *Fire classification of construction products and building elements. Classification using test data from reaction to fire tests*