aitex

textile
research
institute

REACTION TO FIRE LABORATORY

AITEX – Textile Reseach Institute is a private non-profit making association established in 1985, whose main objective is to improve the companies competitiveness, promoting modernisation actions, new technologies introduction and improvement of the company and products quality.

AITEX belongs to the Spanish Federation of Innovation and Technology entities (FEDIT), to the net of Technological institutes of the Valencian Community (REDIT) and to a lot of national and international entities.

REACTION TO FIRE LABORATORY

AITEX disposes, amongst others, of a Fire Behaviour Laboratory.This Laboratory offers services about the fire behaviour of all sort of materials.

AITEX is the Notify Body Nº 0161 for the appliance of the European Directive 89/106/EEC relative to construction products for the Reaction to Fire Classification of construction materials.

Is one of the Spanish Laboratories accredited by ENAC, according to the standard UNE ISO/IEC 17025, for the classification of construction materials according to the standard UNE EN 13501-1 and by the Industry Ministry for the appliance of the European Directive 89/106/EEC of construction materials.

The institute, is member of A.E.L.A.F (Asociación Española de Laboratorios de Fuego) and member of the Technical Committee AEN/ CTN 23 Construction Materials, in the Reaction to Fire subcommittee. In European level is member of EGOLF (European Group of Organisations for Fire Testing, Inspection and Certification) and participate in the WG4 (Reaction to Fire) and WG7 (Classification) from CEN TC 127: Fire Safety in Buildings.

TEST SERVICES FOR MANY TEXTILE USES

An essential point of the reaction to fire and fire behaviour tests is that test methods reproduce materials end use conditions depending on its application, being essential parameters evaluated to guarantee the product safety (ease of ignition, flame spread, heat release, smoke emission, etc).

HOME TEXTILES

- **UPHOLSTERED FURNITURE**

  •**UNE-EN 1021-1:2006 "**Assessment of the ignitability of upholstered furniture. Part I: Ignition source: smouldering cigarette".

  • **UNE-EN 1021-2:2006** "Assessment of the ignitability of upholstered furniture. Part 2: Ignition source: match flame equivalent".

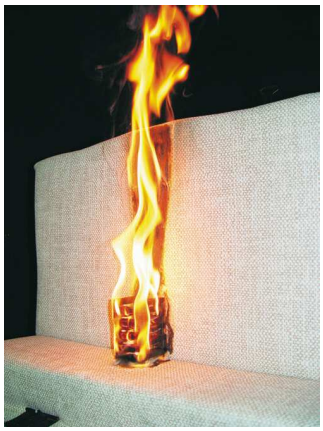
Those tests evaluate the behaviour of the assembly.

Relevant factors:

- Sort of substrate
- Interlining
- Ageing
- Duration of ignition.
- Duration of smoke release
- Charring spread

➢ Other upholstery standards:

- **BS 5852** "Methods of test for assessment of the ignitability of upholstered seating by smouldering and flaming ignition sources: cigarette / flame / cribs". – Included at British Furniture & Furnishings (Fire) Safety Regulations, as well as on the hazard risk assessment specific standard BS 7176.

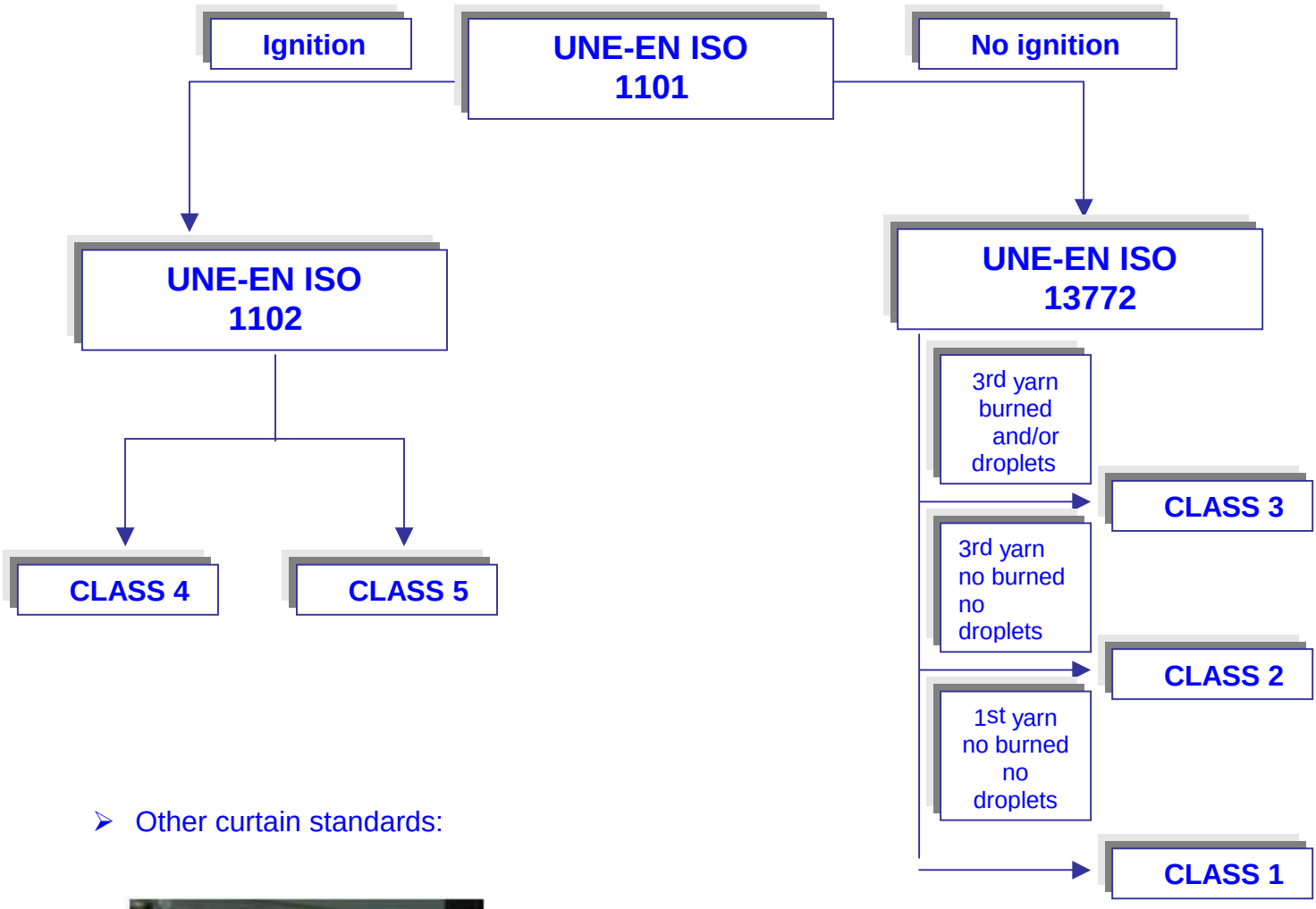


- **IMO: Resolution A.652(16)** "Resolution about procedures of FIRE exposition tests for upholstered furniture" issued by the International Maritime Organisation (IMO)

- **CURTAINS AND DRAPES**

UNE-EN 13773:2003 - "Classification of the fire behaviour of vertically suspended textile elements"

UNE-EN 1101:1996 – Ignitability assessment
UNE-EN 13772:2003 – Flame spread evaluation including radiation source
UNE-EN 1102:1996 – Flame spread evaluation excluding radiation source



➢ Other curtain standards:

- **BS 5867-2: 1980** "British General Flammability Requirements"

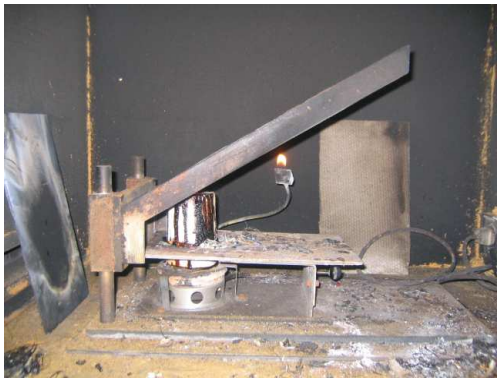
- **IMO: Resolution A.471(XII) / A.563(14)** "Test procedures to evaluate the fire bahaviour of vertically suspended textiles, issued by the International Maritime Organisation (IMO)".

- **SHEETS, MATTRESS COVERS, BLANKETS, DUVETS AND PILLOWS**

  - **UNE-EN ISO 12952** "Fire behaviour of bedding items".

  - IMO : Resolución A.688(17) "Test procedures to evaluate the fire behaviour of bedding items".

- **AWNINGS**, according to **UNE-EN 14115:2002** Fire behaviour of materials used in marquees, large tents and related products



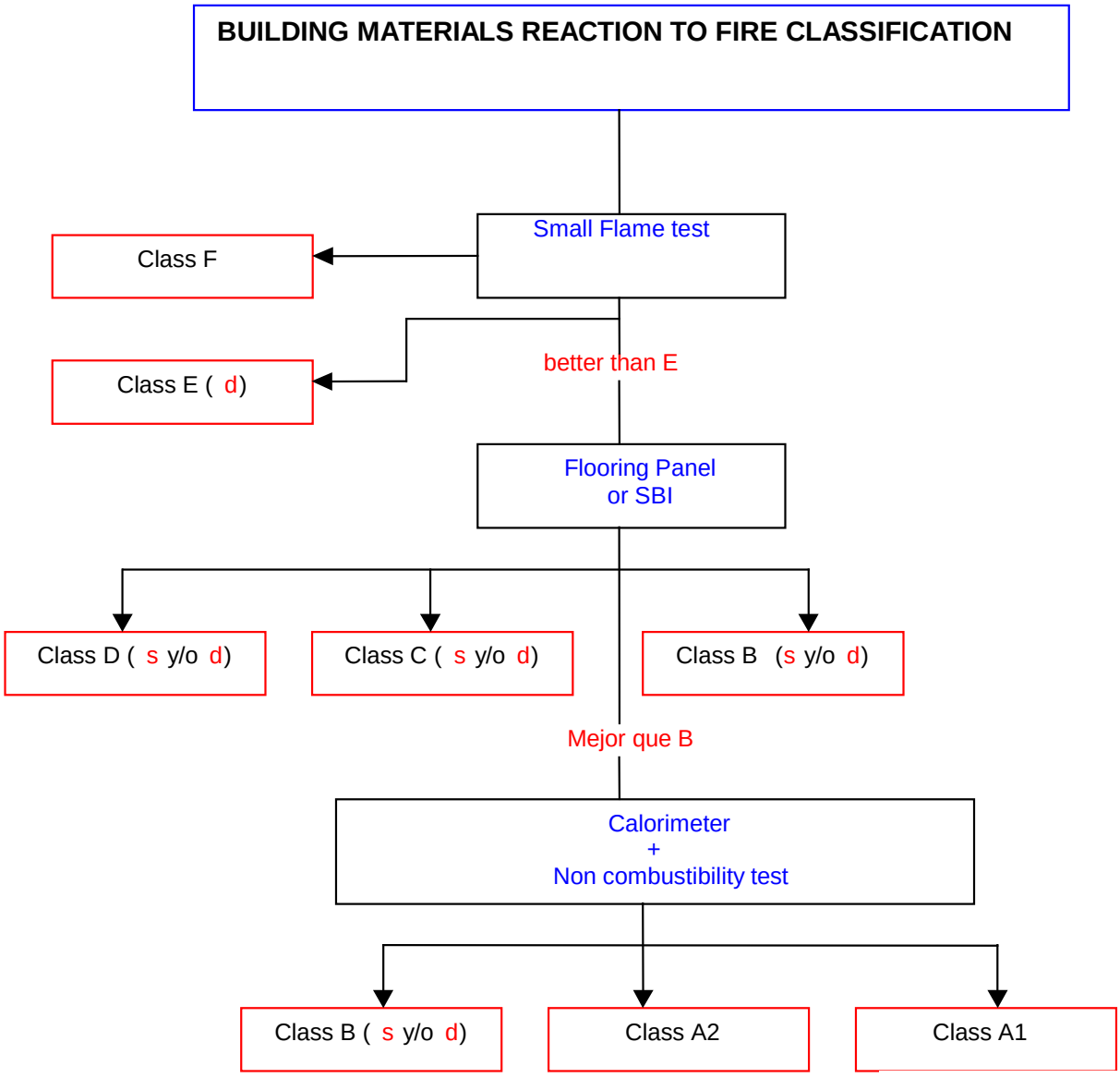
- **MATTRESSES**

  - **UNE-EN 597:1995** "Ignitability evaluation of mattresses and bed bases".

  - **BS 6807:2006** "Ignitability of mattresses, bed bases and divans using primary and secondary ignition sources".

CONSTRUCTION PRODUCTS AND MATERIALS

According to the European standard EN 13501-1, different test methods procedures have to be applied to classify the reaction to fire of a construction product or material. Those test procedures depend on the material end use conditions (floorings or walls and ceilings). A rough guide of the classiffication flow diagram Could be as follows:



A very important aspecto on this sector is to check is there is a harmonised product standard for the product to test, where CE marking bases and test specific remarks to be considered for tests are included.

SMALL FLAME IGNITABILITY TEST (UNE-EN ISO 11925-2)

This test procedure evaluate de ease of ignition and initial flame spread of products exposed to a small flame, as well as the falling of dangerous flaming droplets. Reaction to fire of building materials is by this way evaluated considering first stages of a fire scenario (fire seats) and its contribution to the initial evolution.

SINGLE BURNING ITEM TEST - SBI (UNE-EN 13823)

This test method evaluates the potential contribution to a fire development of wall coverings and ceilings, simulating a fire scenario where a single item is fully burning on a room corner, next to the testing material.

Equipment measures the thermal contribution (heat release) and the dark smokes emission, used for the evaluation of vision deficiency during evacuations. Alternatively, it is also evaluated the melting behaviour by checking the falling of flaming droplets beyond the burning area that could be hazardous of new fire seats cause. Considering all those features, classification given by this test methods is formed by three parameters: HEAT, SMOKES and BURNING DROPLETS.

FLOORING RADIANT PANEL TEST (UNE-EN ISO 9239-1)

This test method evaluates the potential contribution to a fire development of a floor covering, by a radiant heat attack which simulates a developed fire radiation over the surface material.

Measurement is based on the critical radiation flux where flames extinguish along the floor covering specimen surface. Furthermore, the dark smokes emission, used for the evaluation of vision deficiency during evacuations is also measured. Considering this two results, classification given by this test methods is formed by two parameters: FLAME SPREAD and SMOKES.

NON COMBUSTIBILTY TEST (UNE-EN ISO 1182)

This test procedure is used to define products which do not contribute to a fire, or contribute in a negligible way, independently to its final en use conditions.

Test method consist on introduce material test specimens into a cone furnace steady at 750 ºC, and observe the temperature increase, sustained flaming, and mass loss after test.

HEAT OF COMBUSTION TEST (UNE-EN ISO 1716)

This test measures the potential heat release of a product when it is completely burned., independently to its end use conditions. It allows the higher heating value (HHV) and lower heating value (LHV) .

Higher heating value **HHV** (MJ/Kg) ➡ Heat of combustion of a material when there is a complete combustion and the produced water has fully condensed in specific conditions

Lower heating value **LHV** (MJ/Kg) ➡ Heat of combustion of a material when there is a complete combustion and the produced water is in vapour phase in specific conditions

MATERIALS USED IN PUBLIC TRANSPORT VEHICLES

Public transport sector is clearly divided in subsections formed by specific vehicles families, which have different regulations, test methods and criteria depending on the related risks and considerations taken by competent bodies in each case. In a general way, following groups could be considered:

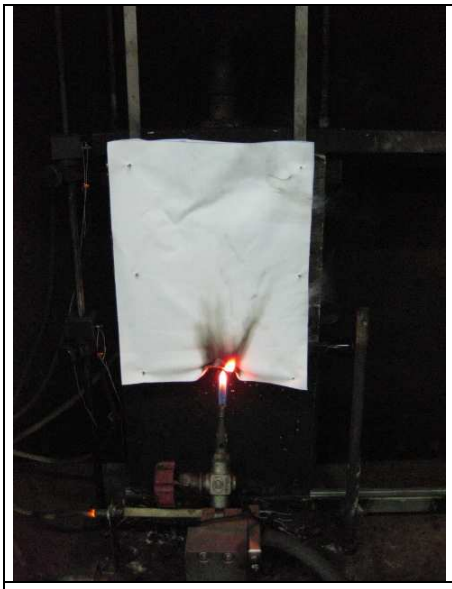
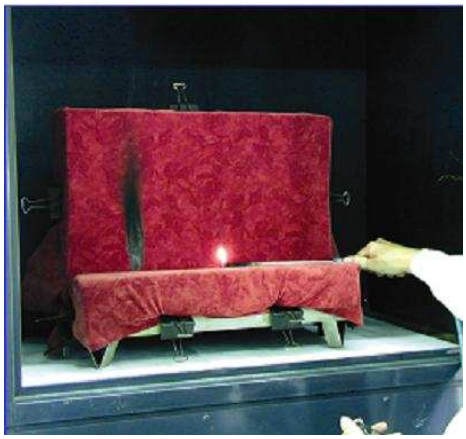
Road vehicles: cars, trucks and buses.

Every material contained inside a road vehicle receptacle shall have a limited flame spread behaviour. All test methods and criteria required by main constructors are besed in International standards as ISO 3795 or the American FMVSS 302.

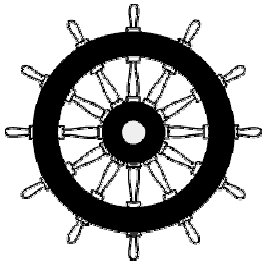
Those test methods evaluate the flame spread rate of horizontally positioned specimens, alter a 15 seconds attack of a 38 mm height flame. Acceptability limit is, mainly, 100 mm/min rate.

Ships and vessels.

Naval sector is regulated by International Maritime Organisation (IMO) directives, which published a fire tests procedure code that describe test methods and criteria depending on the material use and conditions, in order to safeguard people safety in case of fire. In a general view, as it happens in building and construction, each test method reproduce the real exposures of each material on its final end use conditions, evaluating its potential related hazard (ignitability, flame spread, smoke production, etc.). Main peculiarity regarding building sector is, due to the evacuation limitations, regulations ask for materials which produce low toxic smokes during combustions for human beings.

		
IMO Res. A.563 (14) Curtains and drapes	IMO Res. A.652 (16) Upholstered furniture	IMO Res. A.688 (17) Bedding items
		
IMO Res. A.653 (16) IMO Res. A.687 (17) Coverings	ISO 5659-2 + Smokes density and toxicity analysis	ISO 1716 ISO 1182 Non combustible materials

Similar to the CE marking, the marine equipment Directive establish evaluation of conformity procedures and production factory controls to indentify products with the WheelMark.



Railway vehicles.

Despite this sector has been historically controlled by the related national entities and test methods and criteria where taken from other sector regulations, there has been developed the European harmonised standard (prEN 45545). Main idea is to list main test methods depending relevant parameters and to establish a checklist containing limit values depending on operational risk level considering vehicle design.

Aeronautic vehicles.

Aeronautic sector is strongly determined by the constructors codes and requirements. Basic requirement based on FAR 25.853 should be mentioned, which evaluates the ignitability, burned area and falling of flaming droplets after a bunsen burner application into the bottom edge of a vertically oriented specimen.

OTHER TEST METHODS BY THE LABORATORY

- **FIRE BLANKETS EFFECTIVENESS (EN 1869:1997)**

This test method is used to evaluate and distinguish effectiveness of fie blankets used for small fires extinguishment. Standard method is divided in four parts: packaging design, product operability, electrical behaviour (to evaluate risks in electrical fires) and extinguishment effectiveness.

The fire test consists in heat up a tray containing vegetal oil until its ignition and cover then fire with the blanket and observe its action during the following 15 minutes.

On the other hand, the electrical test is performed to prove that blankets could be used safely in electrical fires or fires next to electrical sources. Test method consists in measure the electrical resistance in several blanket points using a rectangular shape electrode and a ohmmeter. Criteria would be fulfilled when all measures are higher than 1 MΩ.

- **LOI: LIMIT OXYGEN INDEX (EN 4589-2)**

This test method is used to measure the minimal amount of oxygen necessary to keep a material ignited. It is a Commonly used technique for the general fire behaviour evaluation, specially for plastics.

Procedure is based on the chemical combustion principle, where aside from a combustible (material) and the energy enough to Bering the reaction (ignition source), oxygen is required to allow the combustion reaction. Test consists in tentative repetitions using different oxygen concentrations at test enclosures (chimney), until limit point where downwards there isn't combustions and upwards material ignites easily.

Taking into consideration that there is a 21% of oxygen at atmosphere, any material having a LOI value higher than 21 would have a good fire behaviour, whilst materials having a lower material would burn easily in normal conditions.

All this features make this test very interesting for new materials and finishings development, where fire behaviour is a parameter to consider

- **SMOKE ANALYSIS**

Aside the potential hazard of vision possibilities decrement during people evacuation of places in case of fire, it has been proved that fatal risk by asphyxia or toxic fumes inhalation is an aspect to take into account with the same attention or higher than the burning risk. Looking to those premises and considering that in those cases evacuation is much more difficult than building places, the public transport sector has taken into account to regulate the produced smokes composition during fires.

Naval sector as well as the railway one, consider the qualitative and quantitative determination of smoke components at regulations and requirements in order to ensure that materials are not potentially hezardous for human beings during fires. Both sectors describe a test based on espectral analysis using FTIR techniques.

It consist in pass through the FTIR gas analyser the accumulated smokes on a airtight chamber (UNE-EN ISO 5659-2), where it evaluated the presence of the nine components considered most harmful for human beings: CO, CO_2, HF, HCl, HBr, HCN, SO_2, NO y NO_2.

- CONE CALORIMETER (ISO 5660-1)

This small scale test, used normally with experimental and research purposes, studies the thermal contribution that a material could have in a developed fire,

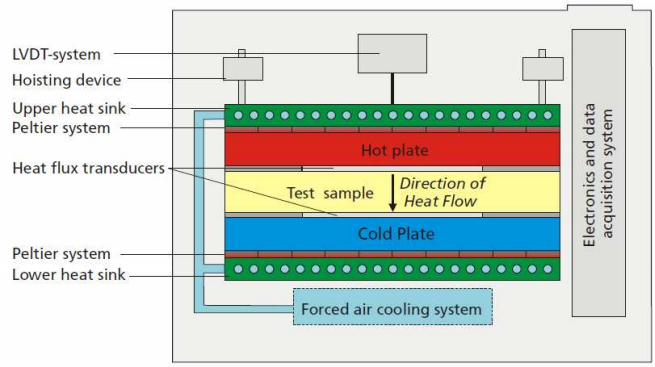
Thje apparatus versatility, toguether with measuring the same heat release parameters than the SBI test (see construction products tests) using the same oxygen consumption technique, make this test method the perfect one to develop new materials minimising costs and material consume.

- THERMAL CONDUCTIVITY OF INSULATING MATERIALS

The incorporation of this thermal property using a heat flow meter allows laboratory to offer one more test required at harmonised product standards where main procedures and rules for CE marking are based.

This test is performed for the termal conductivity or λ value of construction insulating materials determination. This value is required at many harmonised product standards and used for energetic efficiency calculations, recommended or required by some nacional building regulations.

Test consists to place the insulating material between two plates at different temperatures, and measure the resistance conjectured by material to the heat flow going from the hot plate to the cold one.



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