FIRELAB

TEST METHODS

SANS 10177 test protocol

SANS 10177-1 Fire Testing of Materials, Components and Elements Used in Buildings Part 1: General Introduction to the Methods of Test

Covers the general introduction to and information and explanatory notes in respect of the test methods in **SABS 0177 – 2** to **SABS 0177 – 7**.

Surface Fire Spread, Fire Propagation Properties, Ignitability and Fire Resistance

- SANS 10177 – 2 : Fire Resistance
- SANS 10177 – 3 : Internal finishes
- SANS 10177 – 4 : Floor covering
- SANS 10177 – 5 : Combustibility
- SANS 10177 – 9 : Basic Fire Properties
- SANS 10177 – 10 : Flame Spread
- SANS 10177 – 11 : Classification
- SANS 10177 – 12 : Roof tests

SANS 10177 – 2 Fire Testing of Materials, Components and Elements Used in Buildings

Building Envelopes

- Covers the test methods used for the determination of the fire resistance of elements of buildings. The Fire Resistance (FR) is based on the length of time for which representative test specimens satisfy the criteria in respect of stability, integrity, and insulation.

- The standard method used for the fire resistance test is given in **SANS 10177 – 2.**

- **Apparatus**
  - A 3m x 3m vertical furnace for walling systems (aperture 2.85 x 2.85m)
  - A 6m x 3m horizontal furnace for floor systems and floor slabs (aperture 6 x 3m)
  - A 600mm cubical furnace used to check the feasibility of performing a large scale test, (aperture 650 x 650mm)

- **Test Specimen Preparation**
  - Use the original specimen size as received, if possible, otherwise, the specimen to be tested must have the following dimensions:
  - Wall or partition: nominal height 2.8m, width 2.8m minimum
  - Floor: span 3.9m, width 6.9m (outside furnace dimension)
  - Ceiling system: 3m x 6m
  - Column: height 2.3m max.
  - Beam: max 6m, min 3m
  - The material, fixings, supports and standard of workmanship of the specimen must represent those used in good practice.

- **Stability**
  - **Walls or divisions**
    - A test specimen fails if it collapses in such a way that it cannot fulfill the requirements of its function anymore
    - Consider a horizontal test specimen to have failed when the maximum deflection exceeds L/30
  - **Structural Beams and columns**
    - **Beams**
      - 550 °C maximum
    - **Columns**
      - 450 °C maximum

- **Light-weight steel elements**
  - 375 °C maximum

- **Integrity**
  - A partition or separating element has failed if cracks, holes or other openings appear in the test specimen where flames or hot gases can pass through.

- **Insulation**
  - The insulation of an element has failed if any of the following occurs:
  - If the increase in the average temperature of the unexposed side of a test specimen exceeds the initial temperature by 140 °C.
  - And the maximum temperature at any point on the unexposed side
    - Exceeds the initial temperature by 180 °C
    - Exceeds 220 °C, irrespective of the initial temperature.

SANS 10177 – 2 (Building Envelopes)

Specification for Fire Doors and Fire Shutters

The specifications for fire doors and fire shutters are given in **SANS 1253** intended to provide a FR of 30 minutes or more in order to stop the spread of fire and to limit the spread of smoke. Does not apply to the frame of a fire door or fire shutter not supplied as part of an assembly and is not applicable to the dampers.
The standard method used for testing the fire resistance of fire doors and fire shutters is based on **SANS 10177 – 2**.

- **Preparation of Fire Door or Fire Shutter test sample**
  - The door or shutter assembly must be built into a suitable wall in a similar manner used in practice. Allow masonry construction to dry for 3 days before test.

- **Effective Requirements**
  - No smoke should appear on the unexposed face of the door
  - A tested door or assembly should at least comply with the minimum resistance periods.

- **Fire Resistance Requirements: Stability**
  - The door or shutter will comply with the requirements provided:
    - The door or shutter does not distort out of the frame by more than 25mm, and
    - Continuous flaming on the unexposed side does not exceed 20 s

- **Fire Resistance Requirements: Integrity**
  - The door or shutter will comply with the requirements without the development:
    - Of a straight-through gap with a width not exceeding 10mm along the edges of the door or shutter, and
    - Of straight-through gaps with a width that exceeds 6mm, but does not exceed 10mm in length and of combined length that exceeds the greater of the width or the height of the door along the edges of the door or shutter.

- **Fire Resistance Requirements: Insulation**
  - The door or shutter will comply with the requirements provided:
    - The mean temperature of the unexposed side does not rise higher than 140 °C above ambient temperature, or
    - The temperature at any point of the unexposed side does not rise higher than 180 °C above ambient temperature.

SANS 10177 – 2 (Fire Doors)

SANS 10177 – 2 (Curtain Walls)

SANS 10177 – 3 Fire Testing of Materials, Components and Elements used in Buildings Part 3: Surface Fire Index of Finishing Materials

- The Surface Fire Index is based on the extent of surface spread of flame, density of smoke produced, and the heat contributed by the material of finishing materials applied to vertical surfaces or overhead horizontal surfaces in buildings. It provides a means of assessing and comparing those properties of materials that will determine the behavior of the materials in fire. It is not suitable for un-mounted specimens that are so thin that they burn through or collapse during the test.
- The standard method used for the fire resistance test is given in **SANS 10177 – 3.**
- Finishing materials are classified into classes ranging from class 1 to class 5 depending on their indices and the Surface Fire Index is the mean of these.
- For external surfaces, the Surface Fire Index of finishing materials are calculated from the heat contribution and flame spread, as smoke is not so significant in this case. The same is relevant for cases where the smoke emission index is very high. See Table below.

Classification Table: Surface Fire Index (SFI)

Class	Spread of Flame Index	Heat Contribution Index	Smoke Emission Index	Surface Fire Index (SFI)
1	0.2	0.2	0.15	**0.1**
2	1.0	0.9	0.90	**0.7**
3	2.1	2.1	2.10	**1.7**
4	3.9	3.9	3.90	**3.3**
5	5.0	5.0	5.00	**4.5**

SANS 10177 – 4 Fire Testing of Materials, Components and Elements used in Buildings Part 4: Surface Fire Index of Floor Coverings

- The Surface Fire Index is based on the extent of surface spread of flame, density of smoke produced, and the heat contributed by the material of floor coverings.
- Applies to all types of combustion floor coverings used as a floor finish.
- The standard method used for the fire resistance test is given in **SANS 10177 – 4**
- The same indices as mentioned above are valid for floor coverings as described in **SANS 10177 – 4** and the classification of the five classes above.

SANS 10177 – 5 Fire Testing of Materials, Components and Elements used in buildings Part 5: Non-combustibility at 750 °C of Building Materials

- A material rated as non-combustible does, however, not imply that the material has good fire-resistance properties, or vice versa, and under no circumstances does it imply that it will not burn under any conditions.
- The listed building materials in list 3.1 either single or in combination with one another are presumed to be non-combustible in terms of the non-combustibility test as given in **SANS 10177 – 5.** The moment an organic or combustible material is added to the listed material it renders it as combustible in terms of the test.
- **Fire Resistance Requirements**
- A specimen is considered non-combustible after three successive tests provided:
  - The average temperature of the specimen as well as the furnace does not exceed 800 °C
  - The average duration of the continuous flaming does not exceed 10 s

SANS 10177 – 6 Fire Testing of Materials, Components and Elements used in Buildings Part 6: Non-combustibility at 300 °C of electrical insulation materials

- Covers the determination of non-combustibility properties of rigid or semi-rigid electrical insulation materials used in electrical equipment and appliances. Does not cover materials used for the insulation of cables and similar flexible electrical conductors.

SANS 10177 – 7 Fire Testing of Materials, Components and Elements used in Buildings Part 7: Fire test for fire-check properties of building elements

- The standard method used for the fire testing of materials is given in **SANS 10177 –7**. Based on the the length of time within which a test specimen will satisfy the criteria in respect of stability and integrity, as described in clause 6.
- This part of the code is applicable to external cladding, fire-check glazing assembly and ceiling systems.

SANS 10177 – 9 Basic Fire Properties

- The small-scale test is used to determine the burning characteristics of materials of single sheets when exposed to a luminous flame of 38 mm height.
- The standard test method that is used for small scale testing is the Underwriters Laboratory (UL) 214 test method.

SANS 10177 – 10 Flame Spread Properties

- **External effects**
  - Safety distances and separations
    - Spread from point of origin
    - Spread beyond fire divisions
    - Spread to adjacent buildings
    - Exposure to radiation and resulting effects

- **Internal aspects**
  - Classification of internal finishes
    - Wall finishes
    - Floor finishes
    - Interior design
    - Classification of materials used
    - Limitations

- **Design considerations**
  - Type of material or system
  - Type of building (single or multi-storey)
  - Internal or external
  - Exposure conditions

- **Test Requirements: External**
  - **BS 8414, Part 1** and **2**
  - **ASTM E108**

- **Test Requirements: Internal**
  - **SANS 428**
  - **SANS 10177 Part 3**, **5**, **9**, **10** and **11**

SANS 10177 – 10 (Ceilings)

SANS 10177 – 10 (Ducting)

SANS 10177 – 11 Classification

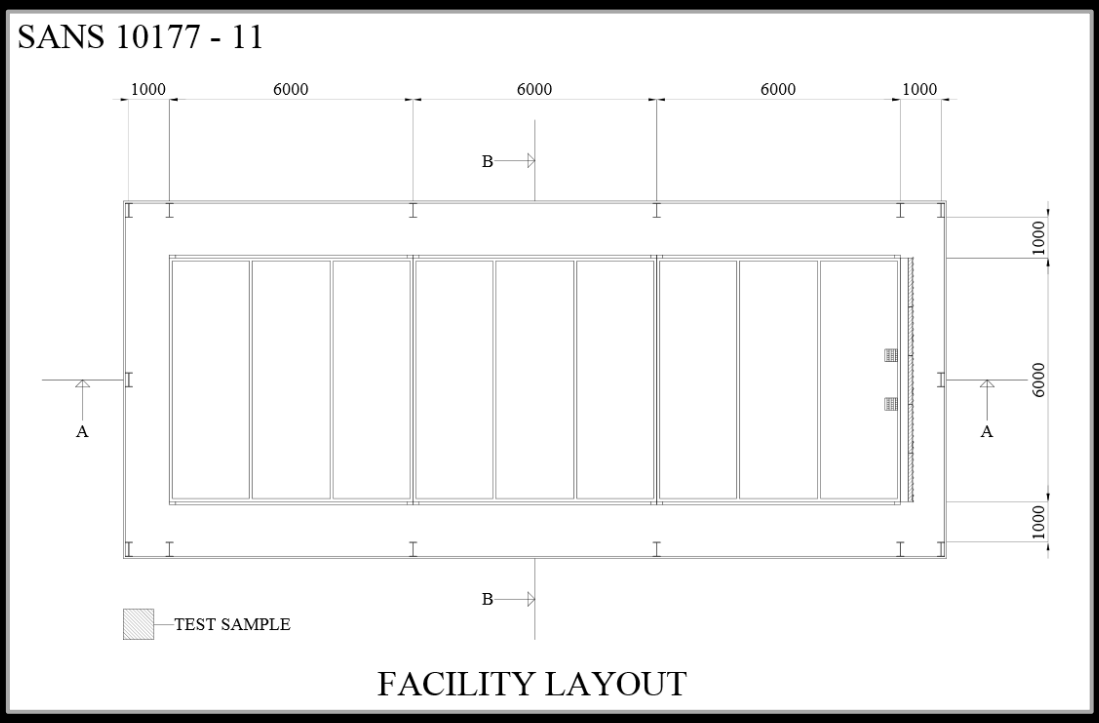
SANS 10177 – 11 (Vertical)

The fire propagation properties associated with the use of this insulation system in a side cladding application were investigated in terms of the relevant section of **SANS 10177 – 11**.

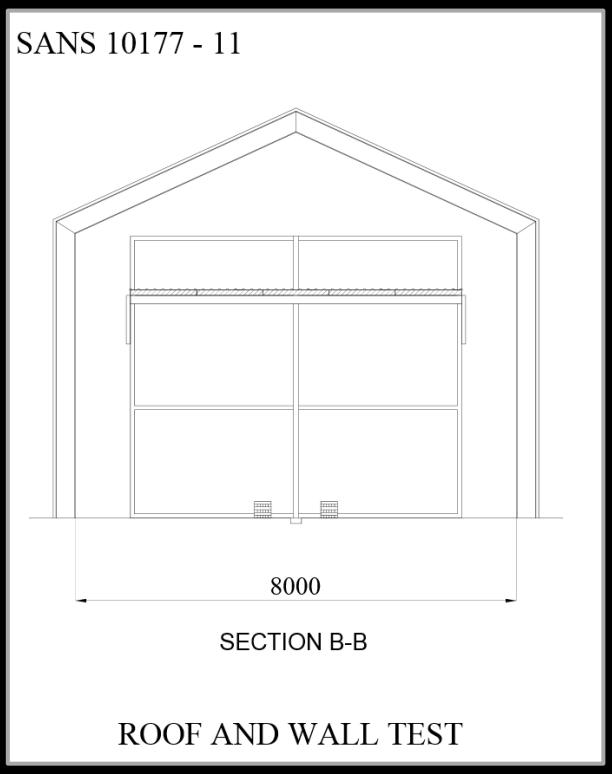
A vertical specimen frame was fitted to the front end of the test installation against the first horizontal hanging frame. The insulation material was installed onto the inside between the horizontal purlins. The fire source was placed 600 mm either side of the center of the vertical frame. A typical installation is shown schematically below.

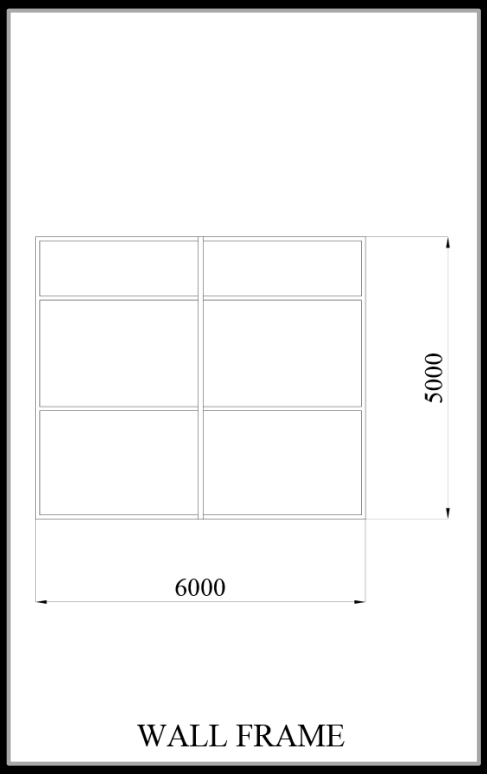
The fire source consisted of two packs of 7.5 kg consisting of 38 mm x 38 mm pine sticks, each 300 mm in length, four per layer and ten layers high.

No temperatures were recorded during this evaluation. The criterion that will be applied when assessing whether the material is suitable for vertical applications is that flame spread onto the roof portion will not be allowed.



SANS 10177 – 11 *facility plan view for vertical test*





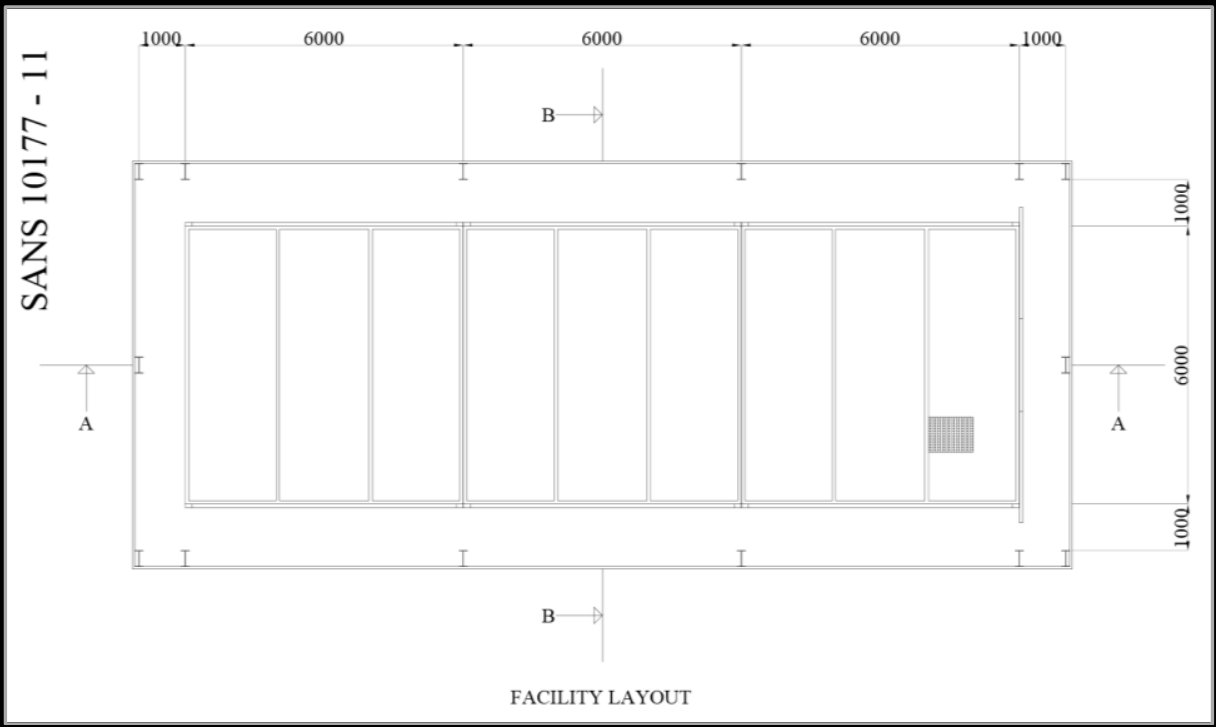
Typical side-cladding installation in ***SANS 10177 – 11*** *facility*

SANS 10177 – 11 (Horizontal)

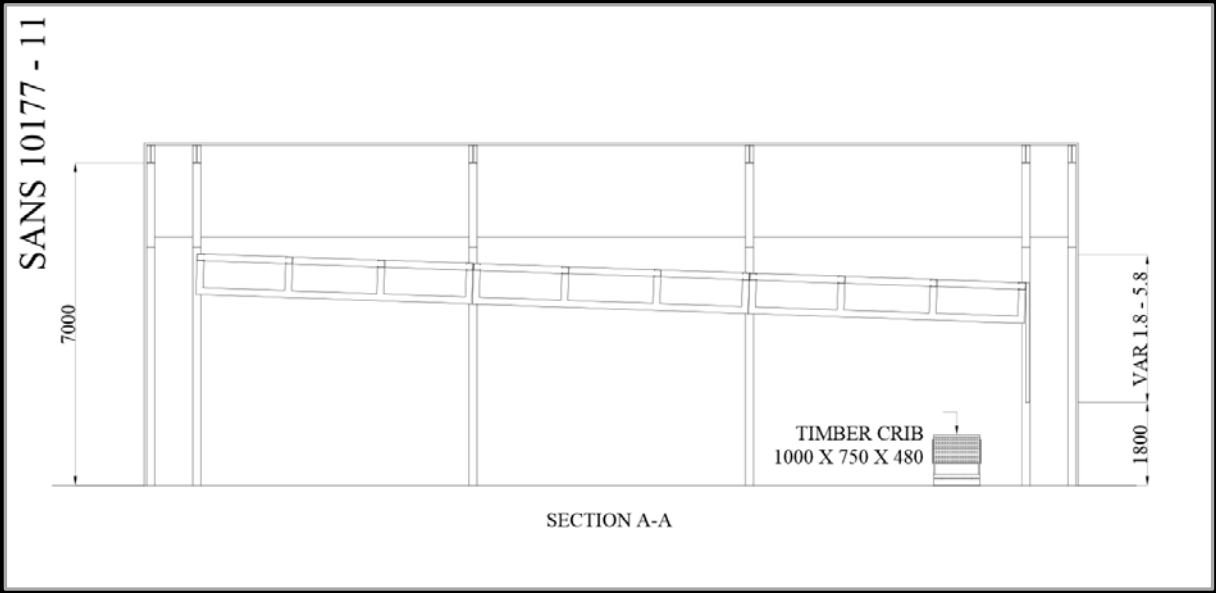
The large-scale fire propagation properties of the system were evaluated by performing a test in the **FIRELAB** large-scale roof insulation test facility. A schematic diagram of the test facility with the specimen frames are shown below.

The ignition source for the under-roof evaluation was constructed from 60 kg dry 38 mm x 38 mm SA Pine sticks stacked in an open-crib configuration to form a 1 000 mm x 750 mm x 480 mm high crib. The pack was ignited with commercial firelighters at each corner, in order to simulate a fire with slow heat build-up. The maximum heat output of the fire source (approximately 2.5 MW based on previous research) occurred after approximately 12 minutes.

This test was performed simulating an under-roof installation without a sprinkler system. This evaluation investigated the fire propagation properties of the insulating material when used as an over-purlin application with the purlins positioned across the width of the test facility. A schematic side view of a typical roof test installation is shown below.



SANS 10177 – Part 11 *test facility with specimen frames*



Typical roof test installation in the ***SANS 10177 – Part 11*** *facility*

SANS 10177 – 12 Roof Tests – Refer to Thatch & Combustible Roofs