AGRÉMENT SOUTH AFRICA
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Performance criteria: building and walling systems

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Performance criteria for water penetration and damp-proofing

SANS 10021 *The waterproofing of buildings (including damp-proofing and vapour barrier installation)*

Other criteria for building and walling systems

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- Structural assessment of dry-stack masonry
- Structural strength and stability
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General

It is generally accepted that all buildings for human occupation should prevent water (whether from rain or other sources), from penetrating to the inside of the building. However, many buildings have occasional damp patches on the inside surface of the external walls. Medical opinion on the possible danger to health of occasional dampness in buildings varies widely, largely because of the lack of suitable statistical data that relates dampness in buildings to the physical disorders of the occupants.

After considering the available evidence and opinions on the subject, the Board of Agrément South Africa concluded that no dampness should be visible on the inside face of external walls of a building for human habitation under normal weather conditions.

Where applicable, the waterproofing of buildings and the use of damp-proof courses and flashings should be in accordance with SANS 10021.

Water resistance criteria

Various factors play a role

Test samples representative of the relevant building system, as requested by Agrément South Africa, may be subjected to water penetration tests as set out in section 4. The results of such tests will be taken into consideration during the evaluation. However various other factors also play a major role, for example thermal forces, properties of the materials that are used, compatibility of materials, the way the structure is assembled, resistance to damage from impacts such as people colliding with walls during normal use, ageing of the materials, maximum size of structures, construction of joints, the different mechanisms and actions through which water penetration takes place, etc.

The test wall must be representative of what will be constructed in practice, keeping the above factors in mind.

All the factors listed above will be taken into account by Agrément South Africa in determining whether the building system complies with the criteria for water penetration set out below.

SANS 10400 *The application of the National Building Regulations*

Walls of masonry, cast in situ concrete or other types of construction without joints

The criteria for external walls of habitable buildings of masonry or other types of construction without joints (e.g. burnt clay brickwork or conventional hollow concrete blockwork built with mortar), are as follows, which is similar to section KK17 of SANS 10400.

A test wall, when tested in accordance with the unpressurised test method as set out below, should be able to withstand water penetration for at least 20 hours. If water penetrates the wall in less than 20 hours, then the use of the wall will be restricted to certain areas of the country, determined from the table 1.

Parts of the wall may be demolished after the required test period to ascertain whether any moisture has penetrated the interior of the wall, and if so, to determine what the consequences might be.

For this type of wall construction a pressurised test as described is not normally carried out, but in some cases, depending on various factors (page 1), such a test may be necessary.

Non-standardised walling systems or systems with joints

In addition to unpressurised tests, pressurised tests are carried out to take into account the effect of wind-driven rain if the walling system has unfilled joints or if the construction method is in any way non-standardised (eg concrete panels, dry-stack, framework with a cladding system, etc). Wind-driven rain is simulated by subjecting the test wall to a pressurised test.

The test wall is first subjected to an unpressurised test for the period appropriate to the specific area, according to the table, before it is subjected to the pressurised test.

The period of water spraying for the unpressurised test, as set out in the table 1, can be reduced by Agrément South Africa in exceptional cases (for example where non-absorbent materials are evaluated). The judgement of an experienced evaluator is vital to ensuring that all the factors that might have an influence are taken into consideration.

Portions of the wall and any core material may be cut out or demolished and removed from any position after the tests so that any leakage paths into the wall can be traced and the consequences of possible water penetration ascertained.

The results of the pressurised rain penetration tests are interpreted in terms of the likelihood of wind-driven rain in different parts of the country. The likely effects of any water ingress on the construction itself, such as possible corrosion of metallic parts or other possible deterioration of the materials, are also taken into account in the evaluation.

Water penetration test apparatus

The water penetration test apparatus, shown in Figures 1 and 2, consists of a chamber with spray nozzles specially designed and arranged so that a fine spray of water (with almost no kinetic energy) is delivered uniformly in a still atmosphere over a vertical test area at a constant rate sufficient to wet the entire surface of the test wall inside the chamber with a thin film of water. The spraying rate must be between 40 litres m^{-2} h^{-1} and 50 litres m^{-2} h^{-1}, (i.e. equivalent to 50 mm of rain per hour). The chamber is placed against the external side of the test wall and the edges are sealed to the test wall. The chamber can be pressurised during spraying to simulate wind-driven rain.

A manometer should be used to measure the pressure difference between the pressurised cabinet and the atmospheric pressure outside the cabinet.

Table 1: Test period

Mean annual rainfall (mm)	**Hourly mean wind speed** ($m\ s^{-1}$)	**Test period** (hours)
1 000 - 1 400	20 25 30	14 19 20
600 - 1 000	20 25 30	10 15 20
200 - 600	20 25 30	6 11 16
0 - 200	20 25 30	2 7 12

SANS 10160. *The general procedures and loadings to be adopted in the design of buildings*

Notes to table:

For hourly mean wind speed, see SANS 10160, Appendices D and F

Where the actual rainfall is known to exceed 1 400 mm, the figures for the duration of the test may be linearly extrapolated

Test methods

The test wall

The test wall may contain a window, installed as would be the case in practice. The inner surface of the wall may be lime-washed to facilitate the detection of moisture penetration. The wall must be thoroughly air-dry before being tested. The joints between any openable casements or sashes and the window frame are sealed on the external side (inside the rain apparatus) with a suitable adhesive tape. The wall must include at least one joint if the wall is of panel construction or if joints form part of the building system. The wall must be a true reflection of the building as designed and as can be expected to be erected and finished externally in practice.

Water penetration test (unpressurised test)

Where external wall materials are used that, in the opinion of Agrément South Africa, are vulnerable to environmental effects or weathering, the test wall can be left exposed to the elements for a reasonable period prior to testing.

Where external wall materials are used that, in the opinion of Agrément South Africa, may be vulnerable to impact damage, such impacts on the wall will be simulated by means of a soft-body impact test, as described in Agrément South Africa's Performance criteria: Building and walling systems, prior to the water penetration test. This test is carried out on a representative wall specimen, minimum 1,8 m wide and 2,4 m high. The height of swing of the sand bag is 600 mm. Two impacts are delivered to the side of the wall which is most critical, in the opinion of Agrément South Africa.

No visible damage to the wall may result from the impacts. No repairs may be made to the wall after the soft-body impact test.

The water penetration test may be started directly following the soft-body impact test.

The external surface of the test wall is sprayed continuously with water for the minimum period required in terms of the table for the particular area or areas of the country where the building will be erected or until the first signs of dampness appear on the internal face of the wall, if this occurs before the expiry of the full test period. The length of time that the test wall was sprayed is recorded.

Ideally, test walls should always be tested for the maximum period of 20 hours, as this will allow an assessment to be made of the building system's resistance to rain penetration in all the rainfall zones of the country.

Water penetration test with simulation of wind-driven rain (pressurised test)

First the external face of the test wall is subjected to an unpressurised test for the period required for the rainfall area concerned according to the table. If no leaks occur, the wall is immediately sprayed for a further period of 15 minutes maximum with a constant pressure difference of 100 Pa being maintained between the inside and outside of the chamber. If no leaks occur, the spraying is continued for another 10 minutes with a pressure

difference of 200 Pa. No leaks should occur for the full duration of this test.

Rising damp

A continuous damp-proof membrane must be used underneath the entire floor area of all buildings with slab-on-ground floor construction, to prevent any possible problems occurring due to rising damp. A suitable damp-proof membrane (eg Agrément certificated polyethylene sheet, or a sheet in accordance with SANS 952, at least 0,25 mm thick) must be used. This membrane must extend over the foundation plinths to overlap with the damp-proof membrane provided under the walls or extend under the foundation beams where these are integral with the floor slab. The joints between sheets must be lapped for at least 200 mm and effectively sealed in accordance with the manufacturer's recommendations.

SANS 952 *Polyolefin film for damp- and waterproofing in buildings*

Where a building has a suspended timber floor, a continuous damp-proof membrane must be laid over the ground between the foundation walls underneath the timber floor. This will protect the timber floor to a large extent against moisture. Ventilation of the underfloor space must be in accordance with SANS 10043.

SANS 10043: 1973. *The laying of wood floors*

References

SANS 10160 *The general procedures and loadings to be adopted in the design of buildings*

SANS 10021 *The waterproofing of buildings (including damp-proofing and vapour barrier installation)*

SANS 10043 *The laying of wood floors*

SANS 10400 *The application of the National Building Regulations*

SANS 952 *Polyolefin film for damp- and waterproofing in buildings*

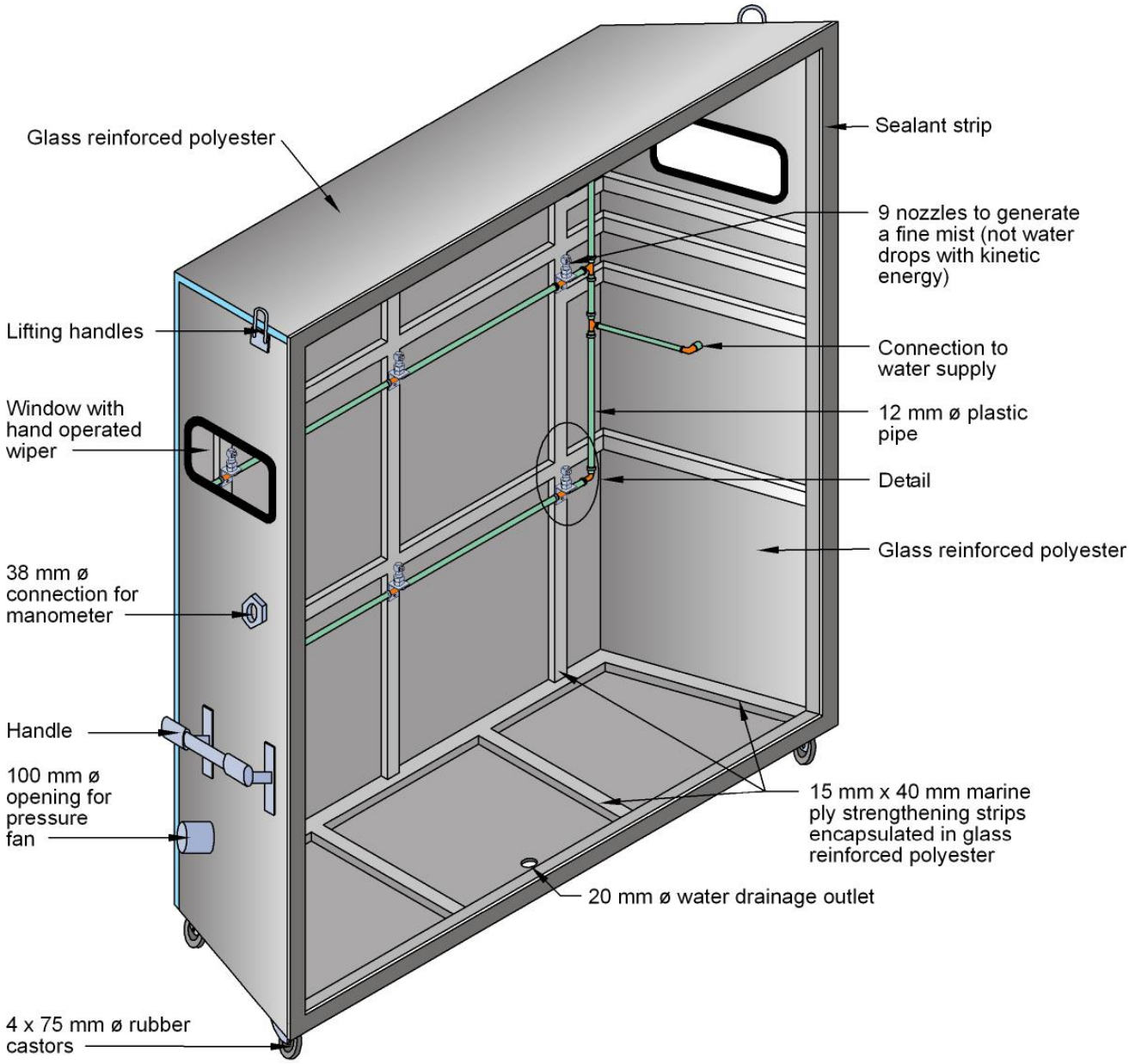
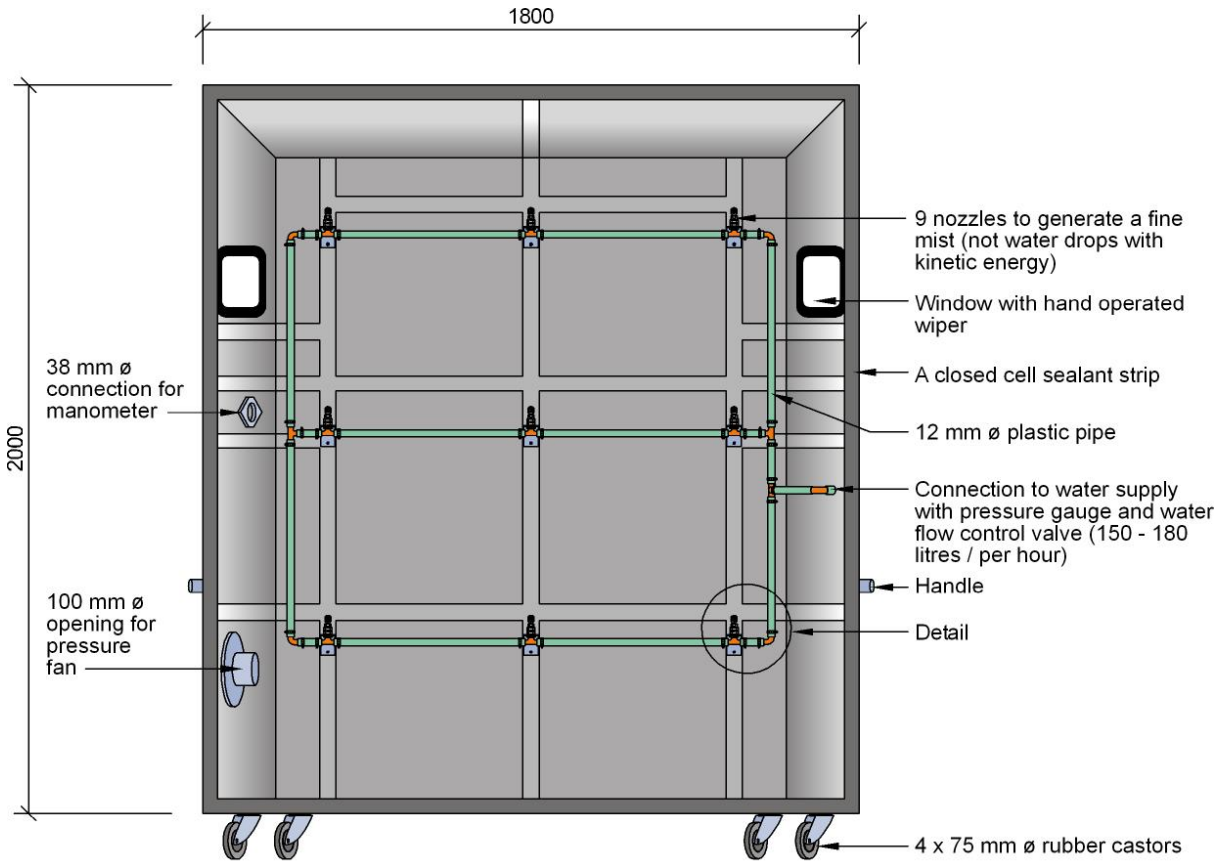


Figure 1: Water penetration test apparatus



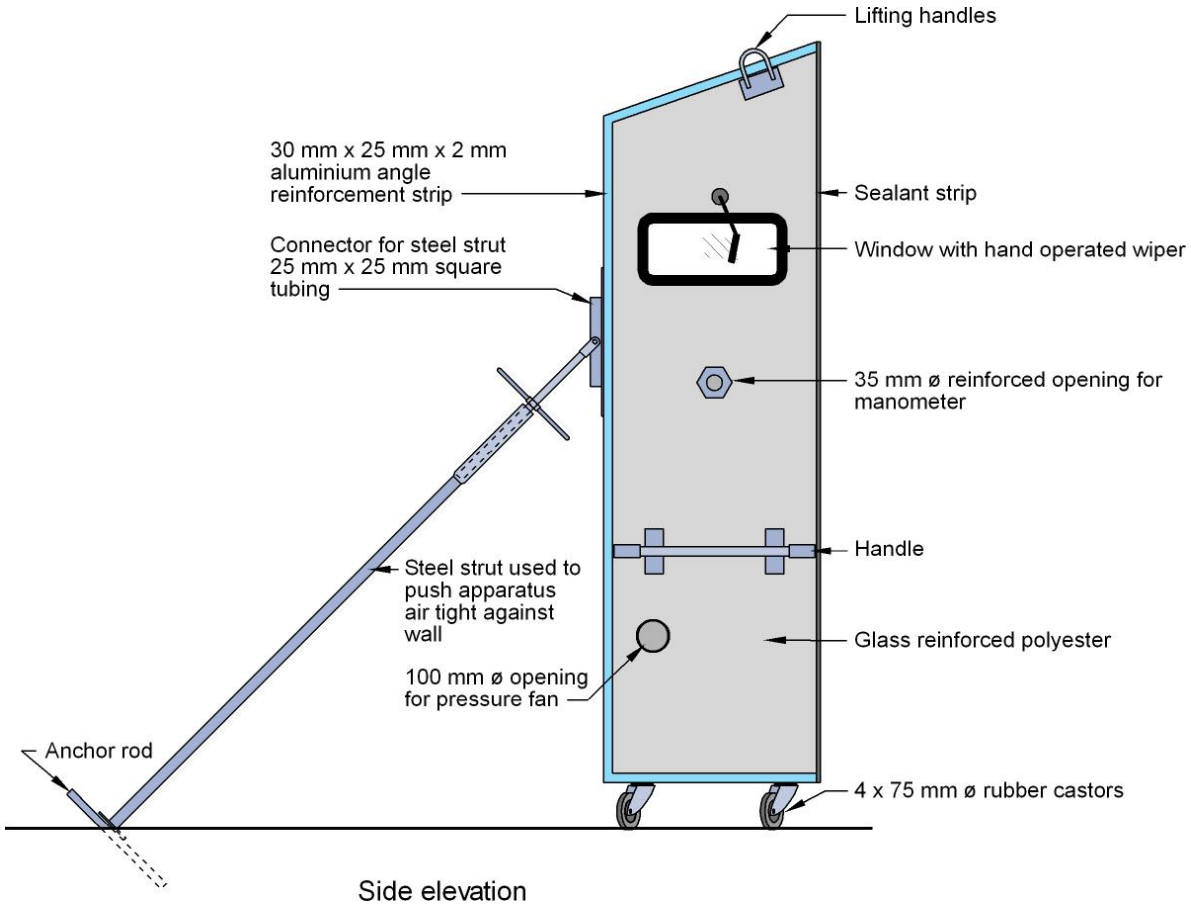


Figure 2: Water penetration test apparatus