Swiss Hail Impact Protection Register (HSR)

CFIA Test Specification No. 20 Sandwich panels

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www.hagelregister.ch

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20 Sandwich panel

20.1 General information

The test specifications for the "Sandwich panel" component category includes additional, component-specific provisions for the standard test, which are not governed by the general test specifications. At a minimum, a sandwich panel consists of a core and two face layers (i.e., facings). Facing materials are metals, fibre-reinforced polymers, fibre-reinforced cements, wood, or polymers. The individual layers are permanently connected to each other either by a factory process or by a manual process at the job site.

Typically, sandwich panels have a board- or plate-like form with facings made from metal-plastic plates, fibre-plastic panels, fibre-cement boards and wood-based panels. Cores of sandwich panels are often composed of a thermal insulation material; these types of cores consist of cellular polymeric materials such as polyurethane (PUR), polyisocyanurate (PIR), polyvinylchloride (PVC), phenolic resins (PF), and polystyrene (PS).

Resistance against hail impact is dependent on the facings, adhesion at the facing-core interface, and the core itself. Also a coating on the facings can influence the hail-resistance performance. Because of the different facings, sandwich panels can be subdivided into the following types:

- Metal based sandwich panel
- Polymer based sandwich panel
- Cement based sandwich panel
- Wood based sandwich panel

The following testing specifications always apply to all metal based, polymer based, cement based and wood based sandwich panel, unless reference to a different treatment type is made in any subsection.

20.2 Intended use

Sandwich panel may be used on the façade and on the roof.

20.3 Test specimen

The test specimen consists of 3 panels forming a T-joint (Fig. 1). The panels are joined together using original fasteners and installed according to the actual procedures used in practice. The specimen has a minimum length of 1200 mm and a minimum width of 1000 mm.

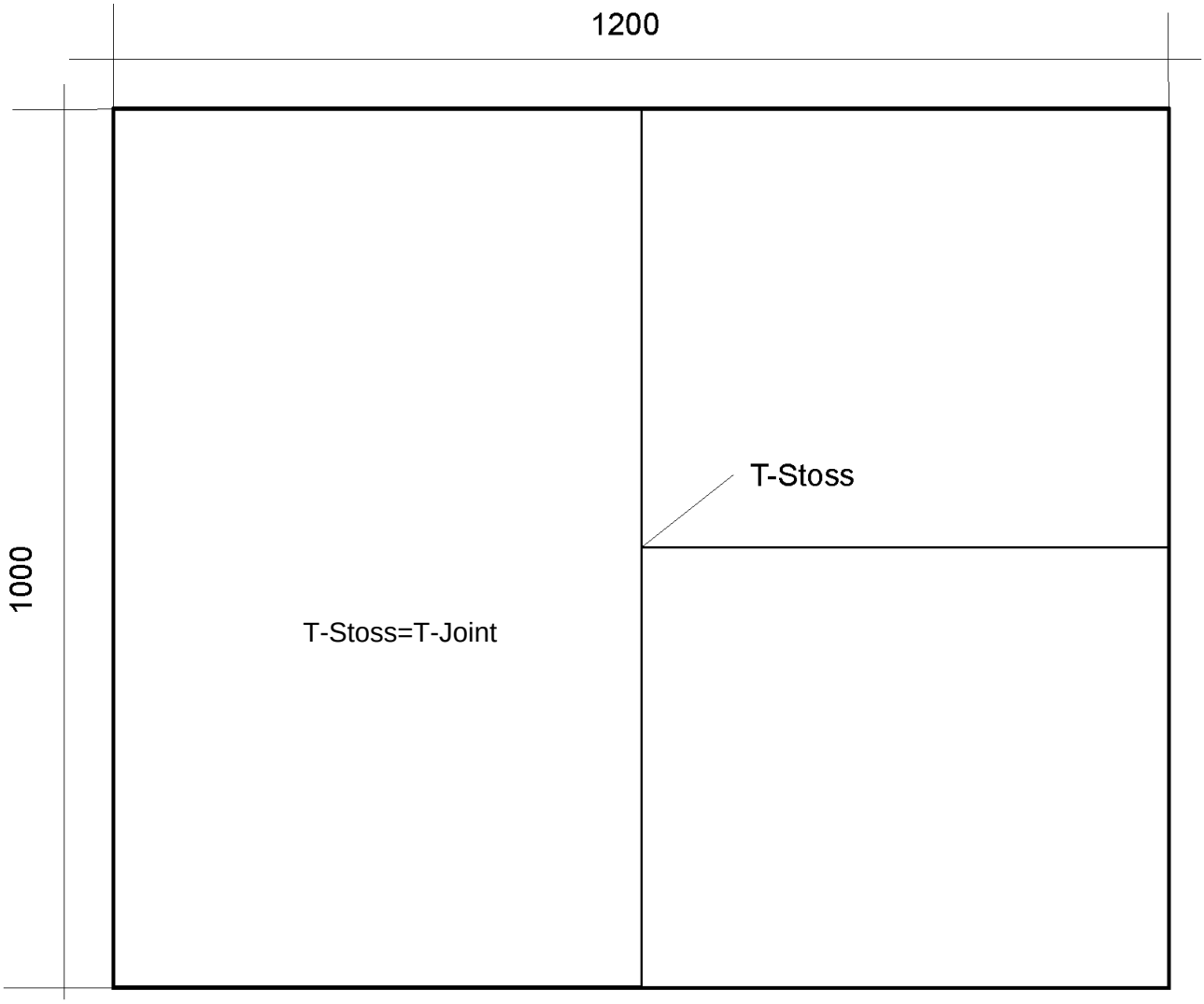

Figure 1 Lay-out of the test specimen (dimensions in millimetres)

20.4 Test set-up

The test specimen is positioned on the support and secured to it.

20.5 Specimen storage prior to testing (conditioning)

The test sample must be stored in the test climate for at least 3 days.

20.5.1 Metal based sandwich panel

The test specimen must be stored in the test environment for at least 3 days immediately prior to testing.

20.5.2 Polymer based sandwich panel

The test specimen must be stored in the test environment for at least 3 days immediately prior to testing.

20.5.3 Cement based sandwich panel

The test specimen must be at least 28 days old and be stored in the test environment for at least 3 days immediately prior to testing.

20.5.4 Wood based sandwich panel

The test specimen must be stored for at least 7 days at a room temperature of 20° C and a relative humidity of 65% ± 5% immediately prior to testing.

20.6 Specimen treatement before testing

The surface is cooled with ice flakes for 3 minutes before projectiles are fired.

20.6.1 Metal based sandwich panel

In general no treatment is necessary, except for such specimens with polymeric core materials. In such cases the specimens are treated according to 20.6.2.

20.6.2 Polymer based sandwich panel

The surface is cooled with ice chips for 3 minutes before projectiles are fired.

20.6.3 Cement based sandwich panel

The sandwich facing that is exposed to the weather is wetted using a damp sponge three times at intervals of 30 s.

20.6.4 Wood based sandwich panel

The wood surface that is exposed to the weather is wetted using a damp sponge three times at intervals of 30 s.

20.7 Target area and angle of impact

The test specimen is impacted at 3 locations (Fig. 2):

- Center zone: the center zone is hit at a minimum distance of 150 mm between two target locations.
- Edge zone: the distance from the edge is 1/5 of projectile diameter. The distance between two shots is 150 mm. The corners must be tested.
- Joint zone: the zone is 50 mm wide. The T-joint (meeting point of the three panels) must be hit.
- Several tests can be performed on one test specimen, but only if the distance between the impacted locations is at least 150 mm. The impact angle is 45° for façade panels and 90° for roof panels.

– Any other vulnerabilities must be tested also (refer to part A).

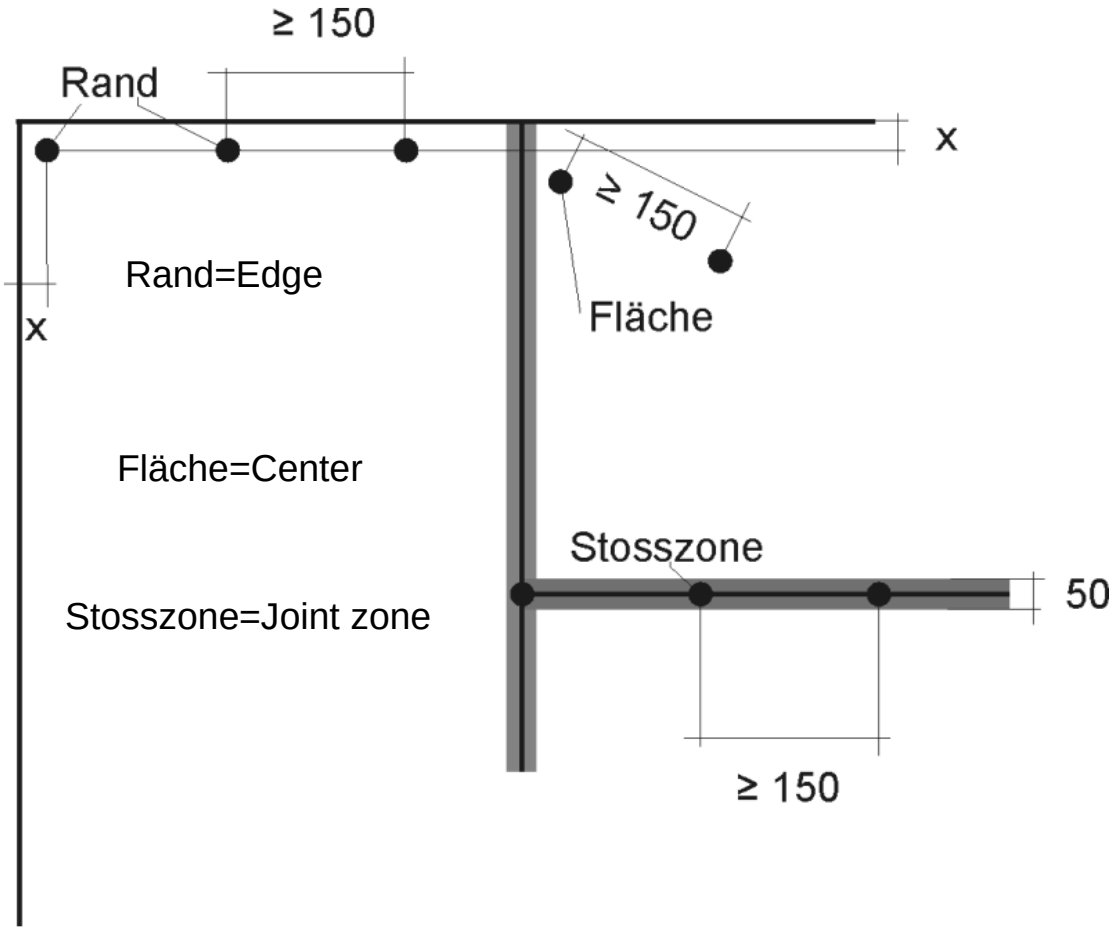

Figure 2 Outline of target locations on the sandwich panel specimen (dimensions in millimetres, x = 1/5 diameter of projectile)

20.8 Component function

The specimen is tested for watertightness and appearance. If the joint between the sections in the joint zone need to be watertight, it is tested as well.

20.9 Damage criterion

Watertightness function: If the facings are free of cracks and fracture, the specimen is considered watertight. Also the facings should not delaminate from the core. If a crack or fracture or the facing delaminates from the core, the specimen is considered to be damaged with respect to watertightness. The joint is considered to be watertight as long as no continuous separation can be detected. If a continuous separation can be detected, the specimen is considered to be damaged.

Appearance function: The appearance of the specimen is considered to be undamaged if no indentation, chipping/spalling, or material elongation beyond the elastic limit is visible. If any indentation, chipping/spalling or material elongation beyond the elastic limit is visible, the specimen appearance is considered to be damaged.

20.10 Measuring methods

Watertightness function: Watertightness is visually checked by the naked eye for cracks, fractures, or openings in the target zones (test specimen - tester distance of no more than 0.5 m). If no crack, no fracture or no leaks in the target zones are visible, the zones must be tested by the vacuum test according to EN 13583. Delamination of facings is detected by a surface tapping technique (“woodpecker test”) or in case of doubt by cutting open the specimen.

Appearance function: Appearance is visually checked at all light conditions and at all possible angles at a distance of 5 m from the test specimen.

20.11 Existing standards and regulations (not exhaustive)