Quality and Testing Specifications for Production Control for Terrace Decking made from Wood-Polymer Composites

(Version 2014-08-01)

1 The Quality Association for Wood-based Products[1]

The „Qualitätsgemeinschaft Holzwerkstoffe e.V.“ (Quality Association for Wood-based Products, registered association), Giessen, Germany, awards the "Quality Mark for Wood-based Products" to products fulfilling its quality criteria. Such products are non-hazardous to health and technically safe. Thus, industry and commerce come by an instrument which they can use as a favourable argument in view of customers who are aware of health and safety hazards.

The quality criteria fixed by the Quality Association for Wood-based Products are compulsory for its members. It is thus being assured that the products manufactured by the members of this Association are of a high quality, durable, safe, and non-hazardous to human health and the environment.

All quality requirements are confirmed by testing at independent testing laboratories. The technical prerequisites of the materials are scrutinized and documented according to clearly defined procedures, taking account of the intended use.

Only wood-based panels having passed all the tests will be awarded the Quality Mark.

2 Scope

The Quality Association awards the Quality Mark for Wood-based Panels to producers of decking profiles made from wood-polymer composites (EN 15534-1 and EN 15534-2). Such manufacturers have proven to fulfil the following quality requirements:

2.1 Decking profiles made from wood-polymer composites

In order to obtain the Quality Mark for Wood-based Products, the following properties shall be documented:

[1] The „Qualitätsgemeinschaft Holzwerkstoffe e.V.“ carries out third-party supervision of high-quality wood-based products. It carries out selected tests and supervision on behalf of the testing laboratory EPH, which is accredited and notified according to the European Construction Products Regulation (Notified Body, N° 0766).

a. The content of wood of the product shall be at least 50 % by weight (dry) and shall originate exclusively from certified sustainably managed forests. Untreated recycled wood (of the category A I according to the “Recycled Wood Ordinance”) may be used, recycled wood of the categories A II to A IV is not permitted. Other natural fibres may be constituent parts of the products.

b. The polymer or polymer mixture used in the product shall consist of 100 % freshly made synthetic resin, or from a pure grade of resin originating from the residues of an earlier industrial production. Pure grades of recycled polymers of the same polymer type, which are free of impurities, may also be added. Direct recycling of residues from the production of wood-polymer composites is permitted.

c. WPC materials are recyclable materials which can be recovered by a recovery procedure in order to economize raw materials and to minimize emissions of dangerous substances. It is therefore additionally permitted to use recovered mill material from the manufacturers own profile systems which have been taken back from the market (cut-offs or dismantled deckings).

d. The physical characteristics described in paragraph 3 shall be considered as minimum requirements.

2.2 Verification of Raw Material Properties

The characteristics stated under (2.1 a.) and (2.1 b.) have to be proved by external supervision (4.2), as follows:

a. The producer uses roundwood or chips furnished by another supplier. In this context, the following proofs have to be furnished:

- FSC- or PEFC-certificate of the supplied roundwood by the forest authority or
- FSC- or PEFC-certification of the chips by the chip supplier.
- Where non-ligneous natural fibres are used (e.g. rice husks, cereal hulls), proof has to be furnished of a controlled cultivation which conserves the natural resources.

b. Proof has to be furnished that the thermoplastic components used contain only “permitted materials” according to 2.1. For this purpose, the recipe

components used have to be declared to the third party supervision authority. Additionally, proof of the quality and quantity of materials used has to be furnished on the basis of the purchase documents.

Furthermore, the third party supervision authority shall inspect the premises of the manufacturer, in order to check out the plausibility of the submitted documentation.

3 Supervision of physical and mechanical properties

Within the scope of third party supervision by an external authority, the physical and mechanical properties listed below are evaluated for the purpose of the **initial inspection**:

- bending properties (3.1)
- immersion in boiling water (boil test) (3.2)
- slip resistance (3.3)
- bending performance under long-term loading (3.4)
- performance under cyclic climatic stress (3.5)
- performance under falling ball test (3.6)
- linear thermal expansion coefficient (3.7)
- weathering resistance (3.8)
- immersion in cold water (3.9)
- dimensional accuracy (3.10)

The supervision authority shall draw necessary the test pieces directly at the premises of the producer. For slip resistance, one test result shall be determined, for bending properties, five test results are required and for all other properties, three test results. Individual test results are compared to the threshold values given. Additionally, the arithmetic mean of the quoted test results is determined and compared to the threshold values of the mean value in question.

The profiles shall have issued from the production line at least 24 h, maximum 4 weeks prior to testing. During this period, the profiles shall be stored at room climate (18°-24°C/40-60 % relative humidity).

One year after the initial inspection, the following intervals shall be observed with respect to third-party supervision:

Bending properties (3.1), immersion in boiling water (boil test, 3.2), performance under the falling ball test (3.6), immersion in cold water (3.9) and dimensional accuracy (3.19) shall be inspected annually.

Slip resistance (3.3), bending performance under long-term loading (3.4), performance under cyclic climatic stress (3.5), linear thermal expansion coefficient (3.7) and weathering resistance (3.8) shall be tested every two years.

The testing authority shall draw the test pieces necessary at the premises of the producer once again.

A complete set of tests shall be carried out if the material composition changes significantly, i.e.:

- Change of the content of wood by more than 5 %
- Change/replacement of the natural (non-ligneous) fibres by more than 5 %
- Change of the polymer type used.

In this case, the user of the quality mark shall submit an updated data sheet to the Quality Association.

Within the scope of the Factory Production Control (FPC) carried out by the producer at least the bending properties (3.1), boil test (3.2), cold water immersion (3.9) and dimensional accuracy (3.10) shall be evaluated. Except for cold water immersion, samples for each test shall be withdrawn at least once per shift (≤ 12 h), respectively, in the case of multiple tools, per production line. The individual test results are compared to the threshold values quoted.

For cold water immersion, at least 3 profiles per product per month are tested. The individual test results are compared to the threshold values quoted.

The profiles shall have issued from the production line at least 24 h, maximum 2 weeks prior to testing. During this period, the profiles shall be stored at room climate (18°-24°C/40-60 % relative humidity).

3.1 Bending properties

The profiles are subjected to a three-point-bending test according to EN 310. The distance of the supports shall be determined in accordance with the maximum distance of the support rails as recommended by the producer (clearance between the supporting rails). Where different specifications are given, the highest value shall be taken into account. The length of the test piece shall be equal to the distance between the supports plus 100 mm. In the case of profiled products where forces may be transmitted between neighbouring profiles (e.g. tongue- and groove profiles), for the purposes of this test, three profiles may be jointed together as prescribed and submitted to the test. The load shall, however, only be applied to the central profile. The profiles shall not be fixed to the supports. The supports shall be oscillating rollers as specified by EN 310 and shall support all profiles submitted to the test.

The profiles shall be tested at least 24 h after production, respectively 2 weeks after production at the latest. During this time, the profiles shall be stored at room climate (18°-24°C/40-60 % r.h.).

According to EN 15534-1, the test pieces are loaded with an initial load of 50 N. During the tests, the modulus of rupture and the deflection at a load of 500 N additional to the initial load shall be recorded.

If the profile may be used with both faces up (e.g. with different ribbing), the third party supervision authority shall determine during the initial inspection or by evaluation of the factory production control records which face results in the lowest performances. This loading direction will be used for loading in all future tests for the purposes of factory production control and third-party supervision. If the performances are independent of the faces, the testing authority shall determine the reference loading direction for future testing.

Threshold values

- The average modulus of rupture may not be lower than 3300 N, individual values may not fall below 3300 N.
- The average deflection at a load of 500 N may not exceed 1,9 mm, individual values max not exceed 2,0 mm.

3.2 Immersion in boiling water (boil test)

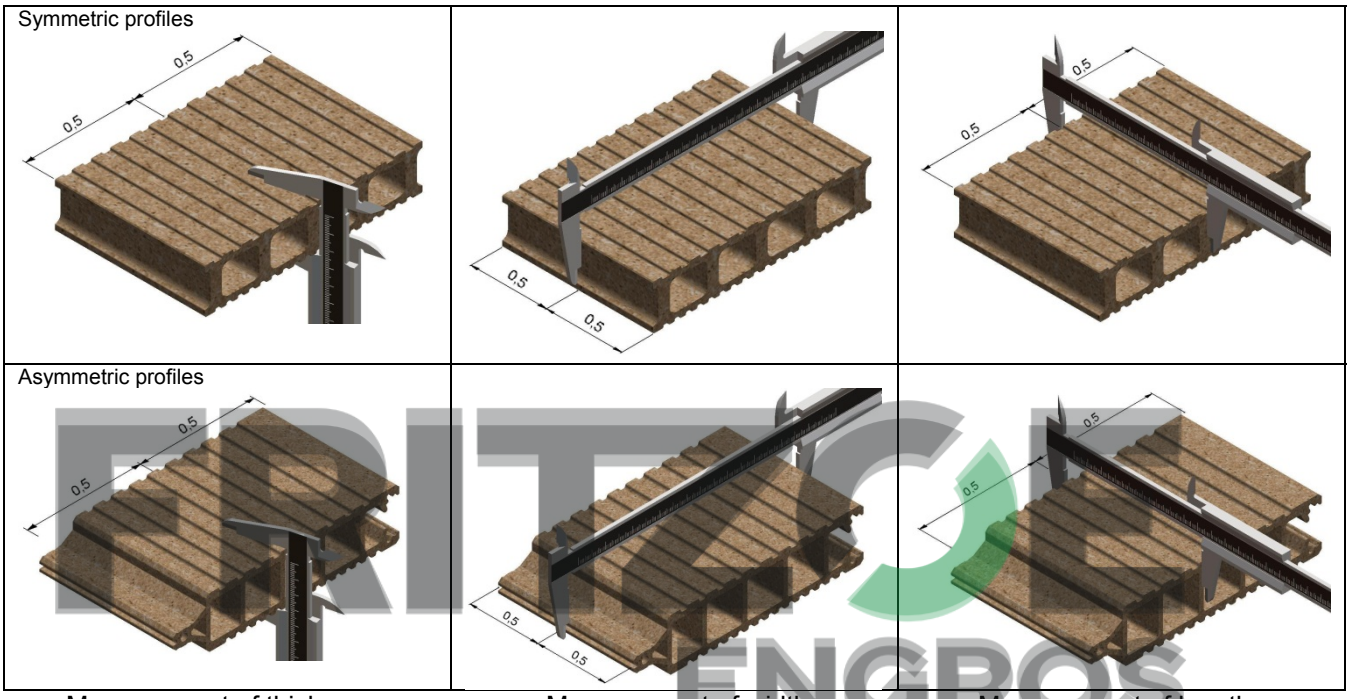
By analogy with EN 1087-1 profiles are stored in boiling water during 5 h. In deviation from EN 1087-1 the test pieces are submerged after the water has reached the boiling point. After 5 h immersion in boiling water, the test pieces are immediately submerged in cold water (18°-22°C) during 15 minutes. Afterwards, the test pieces are removed from the water, surplus water is taken off (e.g. by blowing off) and stored at room climate (18°-24°C/40-60 % r.h.). Within 120 minutes (latest) after removal from the water, the properties stated below shall be determined.

Thickness and width of the test pieces before testing are equal to the dimensions of the profile. The length of the test pieces (parallel to the direction of production) shall be 100 mm.

For the purposes of testing, the swelling in thickness, length and width of the test pieces shall be measured with a sliding calliper or an equivalent measuring instrument. These values are expressed as percentage of the initial dimensions of the test pieces. Additionally, the water uptake of the test pieces is determined as percentage of the initial mass of the test pieces.

The measuring points for the determination of swelling are shown in Figure **1**. The measuring points shall be fixed centrally with respect to the axis of symmetry of the profile, independent of whether there is a rib or a cavity below the measuring point.

Measurement of thickness shall be carried out on the cross section. The measuring instrument shall be applied at a distance of 5-15 mm from the end of the profile and shall be supported over a length of at least 10 mm. The measuring instrument shall be selected in such a way that swelling of the edges is not taken into account. (cf. Figure 2).



Measurement of thickness | Measurement of width | Measurement of length

Figure 1: Measuring points for the determination of swelling characteristics.

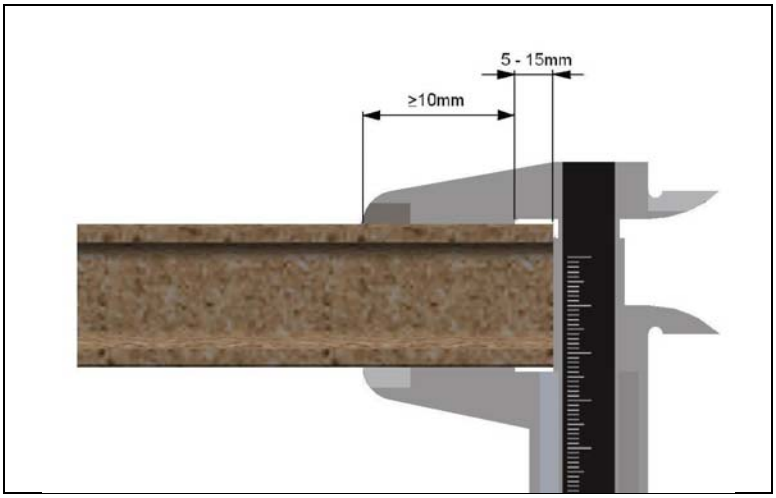


Figure 2: Detail regarding measurement of thickness

Threshold values:

- The average values of swelling may not exceed 4,5 % in thickness, 0,8 % in width and 0,5 % in length.

- The average value of water uptake may not exceed 7 %, individual values may not exceed 8 %.

3.3 Slip resistance

The slip resistance of surfaces can be determined using the FLOOR SLIDE CONTROL 2000 testing apparatus.

A „synthetic sole“ shall be used as gliding block. The surfaces shall be wetted evenly by means of a sponge soaked with testing liquid according to EN 15534-1.

If the profiles have two faces between which the customer may choose (e.g. with different ribbings), both faces have to be tested. If the structure shows a clearly-defined direction, the direction with the lowest slip resistance values shall be decisive for the test results.

Threshold value:

- A minimum slip value μ of 0,43 (slip class "safe") shall be achieved.

Alternatively, slip resistance may also be determined according to DIN 51097 (wet barefoot area). The test pieces shall be evenly wetted with the testing liquid according to prEN 15534-1.

Threshold value:

- The tested profiles shall fulfil the requirements of the highest rating group “C” (average angle of inclination ≥ 20°) according to DIN 51097.

3.4 Bending performance under long term loading

The profiles are submitted to three-point bending under long term loading by according to EN 15534-1. The distance of the supports shall be determined in accordance with the maximum distance of the support rails as recommended by the producer (clearance between the supporting rails). The length of the test piece shall be equal to the distance between the supports plus 100 mm. In the case of profiled products where forces may be transmitted between neighbouring profiles (e.g. tongue- and groove profiles), for the purposes of this test, three profiles may be jointed together as prescribed and submitted to the test. The load shall, however, only be applied to the central profile. The profiles shall not be

fixed to the supports. The supports shall be oscillating rollers as specified by EN 310.

Prior to testing, the test pieces shall be conditioned during at least 1 hour without load in the testing apparatus. The load applied shall be 85 kg (about 25 % of minimum modulus of rupture), the test duration shall be 168 h (7 days), and the testing climate shall be 50°C/50 % r.h.

The deflection Δs is calculated as the difference between the deflection at the end of the test and the deflection observed 1 min after application of the load.

Residual deflection Δs_r is calculated as the difference between the deflections observed 24h after removal of the load and prior to application of the load.

Only the direction (face) which has been determined during the bending tests (3.1) as being the relevant direction (face) shall be tested.

Threshold values:

- The average difference Δs may not exceed 9,5 mm, individual values may not exceed 10 mm.
- The average difference Δs_r may not exceed 4,5 mm, individual values may not exceed 5 mm.

3.5 Performance under cyclic climatic stress

By analogy to EN 321, the profiles are exposed to a cyclic climatic stress. Afterwards, modulus of rupture is determined according to 3.1. The size of the test pieces for cyclic testing is as described in 3.1.
The reference test pieces for testing without cyclic stress and the test pieces for cyclic testing shall be withdrawn from the production immediately after each other.

Only the direction (face) which has been determined during the bending tests (3.1) as being the relevant direction (face) shall be tested.

The first cycle of climatic stress shall be carried out as follows:
- 28 days immersion in cold water;
- 24 h freezing;
- 72 h drying;

Two further storage cycles shall be carried out as specified below:
- 72 h cold water immersion;
- 24 h freezing;
- 72 h drying;

The test pieces shall be taken from one place of storage to the next one without any delay.

After cyclic testing and before the bending tests, the test pieces shall be stored at room climate for 24-48 h.

The mean moduli of rupture before and after cyclic testing are compared with each other and the reduction of modulus of rupture is expressed in percent.

Threshold values:

- The mean reduction of modulus of rupture shall not exceed 18 %, individual values of reduction of modulus of rupture shall not exceed 20 %.

3.6 Performance under falling ball test

The profiles are submitted to a falling ball test according to EN 477. For this test, the profiles are impacted from a defined height with a striking pin with a mass of 1000 ± 5 g and a striking ball surface of 25 ± 0,5 mm radius The profile to be tested shall have a length of 300 mm and shall be put onto two defined supports set at a centre distance of 200 mm (cf. EN 477). Thickness and width of the test pieces are equal to the dimensions of the profile.

The height of fall of the pin shall be of 700 ±5 mm above the surface of the profile to be tested. Testing temperature shall be 18°-24°C at 40-60 % relative humidity.

If both faces of the profiles may be used, both shall be tested. If not, only the service face shall be tested.

For each service face, tests shall be carried out on the surface of 3 profiles each as well as on the longitudinal edges of 3 profiles each (i.e. 9 tests in total per service face).

Testing of surfaces:
The impact position of the pin on the profile shall correspond to the point with the lowest breaking strength. For cavity profiles, this is normally the central point with the highest distance between ribs.

If there are any uncertainties in this context, the correct position shall be determined by preliminary testing.

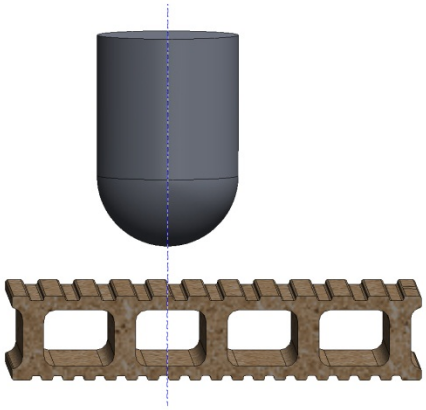


Figure 2: Example of falling ball testing on a profile surface

Testing of the longitudinal edges:
Each longitudinal edge shall be tested. The impact position shall be determined in such a way that the circumference of the pin shall be flush with the outer edge of the profile surface (service face).

In the case of profiled products where forces may be transmitted between neighbouring profiles (e.g. tongue- and groove profiles), for the purposes of this test, two profiles shall be jointed together as prescribed and submitted to the test. The test is carried out on the joint.

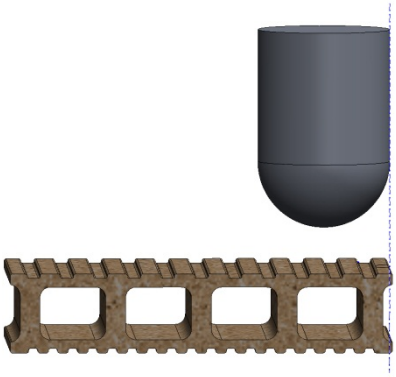


Figure 3: Example of falling ball testing on a longitudinal edge, outer surface of the pin flush with the outer edge of the profile surface

Determination of deterioration:

Measurements shall be carried out 5 ±2 min. after impact testing.
The impact area is inspected with the aid of a magnifying glass (factor 10).
Lighting should correspond to EN 20105-A02 (‘Surfaces to be compared to each

other should be lighted up by daylight shining in from the North at an angle of 45° or an artificial light source with a luminance intensity of at least 600 lx).

The longest perceptible surface crack is measured to an accuracy of 0,5 mm (linear distance between end points of the crack). The orientation of the crack is unimportant.

The maximum depth of the residual ball impact indentation is measured with a suitable measuring instrument (e.g. a vernier calliper) to an accuracy of 0,1 mm in relation to the level of the surrounding texture which has remained intact.

Threshold values:

Cavity profile

- None of the test piece surfaces may show any cracks exceeding 10 mm in length.
- The maximum depth of residual indentation may not exceed 0,5 mm.

Solid profile

- The maximum depth of residual indentation may not exceed 0,5 mm.

3.7 Linear thermal expansion coefficient

By analogy to ISO 11359-2 or DIN 53752 three profiles of 400 mm length are drawn from the production. These test pieces are subsequently stored in an oven at 60 °C for at least 48 h. After storage in the oven, the length of the profiles is measured with a sliding calliper; this shall be done within 15 minutes of removal of the test pieces from the oven. The dimensions are determined again after the test pieces have been stored at -20 °C for at least 48 h.

The linear thermal length expansion coefficient is determined from the difference of the respective length of the profile and the difference between storage temperatures according to the following equation:

Alpha = Delta L / (Delta T x initial length) [K^{-1}]

Theshold value:

- The maximum linear thermal length expansion coefficient shall not exceed a value of 4 x 10^{-5} [K^{-1}]

3.8 Weathering resistance

According to EN ISO 4892-2 the profiles are exposed to artificial weathering in a Xenon arc testing apparatus. The testing cycle shall correspond to method A, testing cycle 1 (not protected by glass, 102 min. radiation, 18 min. spraying).

One test each shall be carried out per service face and colour.

Total weathering time in the testing apparatus shall be 300 h.

The test pieces shall be removed from the apparatus during the drying cycle.

The determination of brightness and hue is carried out with colorimeters. The colour differences ΔE, ΔL, Δa and Δb are determined according to ISO 7724 Part 1-3 as the difference between the measurements taken prior to and after 300 h of artificial weathering.

When using colorimeters for colorimetry, the following points should be taken into account: The measuring geometry of the colorimeter used should be of 45°/0° or of 8°/d, including a gloss trap. The measuring orifice shall have a diameter of at least 6 mm. Five measuring points shall be evenly distributed over the surface exposed to weathering, and the average shall be calculated from the measurements taken.

The measuring geometry and the measuring orifice of the colorimeter used shall be recorded.

Threshold value:

- The total deviation ΔE may not exceed a value of 10.

3.9 Cold water immersion

By analogy to EN 317 the profiles are immersed in cold water (temperature 20±2°C) during 28 days. Afterwards, the test pieces are removed from the water, surplus water is taken off (e.g. by blowing off) and stored at room climate (18°-24°C/40-60 % r.h.). Within 120 minutes (latest) after removal from the water, the properties stated below shall be determined.

Thickness and width of the test pieces before testing are equal to the dimensions of the profile. The length of the test pieces (parallel to the direction of production) shall be 100 mm.

For the purposes of testing, the swelling in thickness, length and width of the test pieces shall be measured with a sliding calliper or an equivalent measuring instrument. These values are expressed as percentage of the initial dimensions of the test pieces. Additionally, the water uptake of the test pieces is determined as percentage of the initial mass of the test pieces.

The measuring points for the determination of swelling are shown in Figure **1**5. The measuring points shall be fixed centrally with respect to the axis of symmetry of the profile, independent of whether there is a rib or a cavity below the measuring point.

Measurement of thickness shall be carried out on the cross section. The measuring instrument shall be applied at a distance of 5-15 mm from the end of the profile and shall be supported over a length of at least 10 mm. The measuring instrument shall be selected in such a way that swelling of the edges is not taken into account. (cf. Figure 2).

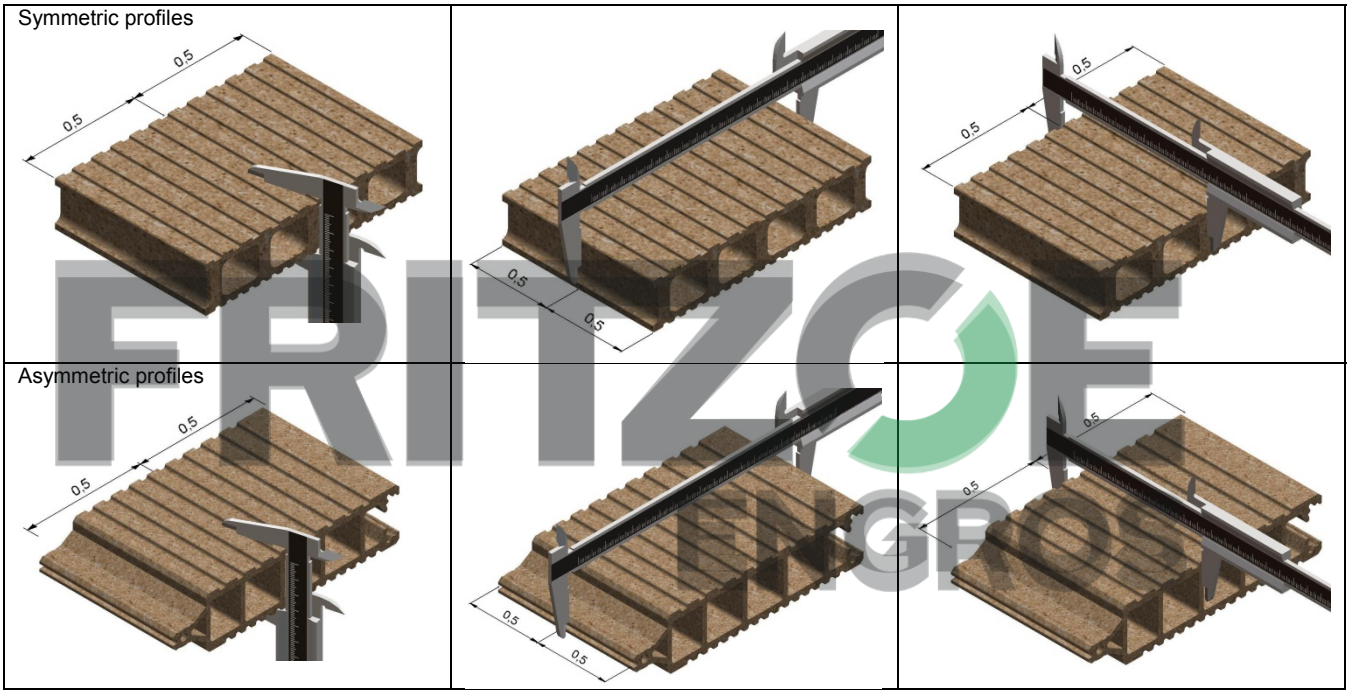


Figure 5: Measuring points for the determination of swelling characteristics.

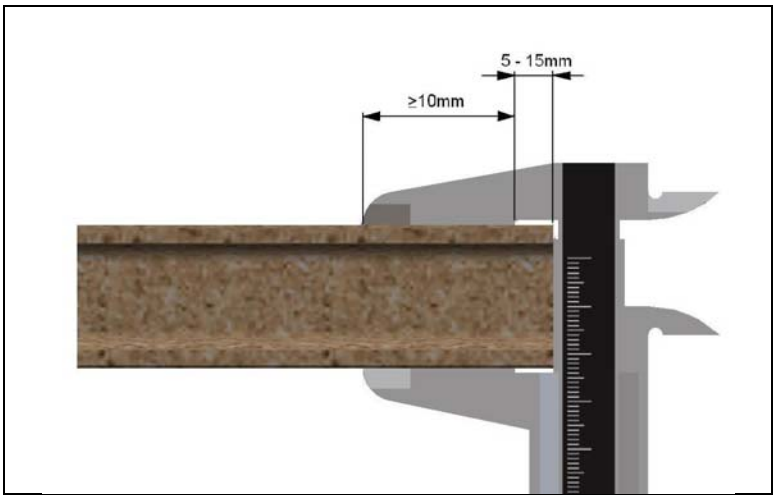


Figure 6: Detail regarding measurement of thickness

Threshold values:

- Individual values: The maximum values of water uptake may not exceed 9 %, of swelling in length 0,45 %, of swelling in width 1 % and of swelling in thickness 4,5 %.
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- Average values: The maximum values of water uptake may not exceed 7 %, of swelling in length 0,40 %, of swelling in thickness 4,0 % %, and of swelling in width 0,8 %

3.10 Dimensional accuracy

Measurements regarding longitudinal dimensions, profile width and thickness, deviation from straightness and warp are taken on the test pieces according to EN 15534-1.

Threshold value:

- The tolerances specified by the manufacturer shall be adhered to.

4 Third-party supervision

4.1 Initial inspection / FPC

Each factory applying to the Quality Association for the Quality Mark is subject to an initial inspection. During the initial inspection, the Quality Association for Wood-based Products will check out the personal and technical circumstances of the applicant. The manufacturer must be able to produce wood-polymer decking profiles according to the present Quality and Testing Requirements of the Quality Association for Wood-based Products. Furthermore, the applicant must prove that he is able to carry out the required Factory Production Control (FPC).

4.2 Third-party supervision

Regular third-party supervision by the quality association is carried out once per year. For all products bearing the quality mark, sampling of test pieces and an inspection of the production premises is carried out annually respectively, every two years (as defined in Clause 3) for the purpose of an independent (neutral) evaluation of the wood-polymer products.

Supervision is carried out by the Quality Association. The Association may entrust suitable neutral experts or testing authorities with the supervision. Strict confidentiality of the information gathered shall be ensured by the Quality Association.

The costs shall be borne by the user of the Quality Mark.

4.3 Repeated inspection

Should the supervisor detect any shortcomings regarding the quality control carried out by the user of the Quality Mark during his inspection visit, the Quality Supervision Committee of the Quality Association may order a repeated inspection. The scope, contents and date of the repeated inspection shall be determined by the Quality Supervision Committee.

If the manufacturer fails to pass the repeated inspection, it shall be considered that he no longer fulfils the quality requirements. The Quality Supervision Committee shall then schedule the further proceedings for the withdrawal of the Quality Mark.

The costs of the repeated inspection shall be borne by the user of the Quality Mark.

5 Marking

5.1 Obligation of Marking

Technical Data Sheets shall be provided for each decking profile made from wood polymer composites subject to these quality requirements and for which the manufacturer has been awarded the Quality Mark. Such technical data sheets shall contain the following, unmistakable information:

Producer, Product name (brand), registration number, type of synthetic polymer used, Type and content of cellulose used according to EN 15534-4, profile thickness and width.

Example: Hansen, Novodeck, QG/2011/Z054, PP-W6/R10, 22 x 145 mm

The products shall also be marked with this description.

5.2 Quality Mark

Decking profiles made from wood polymer composites which have proven to fulfil the requirements set out in paragraphs 2 and 3 may be marked with the Quality Mark represented hereinafter, if the producer has been awarded the Mark by the Quality Association on the basis of a valid licence agreement.

Pattern I: WPC-products using 100 % wood fibres

Wood-polymer composite from certified production

- **Wood** from sustainably managed forests
- **Industrial polymer** (pure grades)

Pattern II: WPC-products using wood and other natural fibres (e.g. rice husks)

Wood-polymer composite from certified production

- **Wood** from sustainably managed forests
- **Rice husks** from controlled cultivation
- **Industrial polymer** (pure grades)

The proportions as well as the defined colours of the logo as well as of the wording shall remain unchanged. Further information is given in the licence agreement.

For products having identical material compositions, dimensions, wall thicknesses and structures, a common certificate may be issued.

6 Amendments

Amendments of these Quality and Testing Specifications shall receive written approval by at least ¾ of the members of the Quality Association. The Managing Board of the Association will fix an adequate deadline for the implementation of such amendments after the members of the Association have been notified thereof.