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Report
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Climate testing of multi-layered parquet

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Extent of testing

Climate testing of a multi-layered parquet was performed.

Climate testing

The testing was divided into two climate periods:

- Climate period 1: Two weeks in a climate with relative humidity (RH) of app. 65 % at a temperature of app. 20 °C (late summer climate).
- Climate period 2: Four weeks in a climate of app. 15 % RH and 22 °C (dry winter climate).

Moisture content, cupping, width changes and possible cracks were registered continuously. Cupping was measured using a measuring gauge and is presented in percent across the width of the elements. This was measured in the middle of each board. The width was measured using a sliding calliper, in the same spot as the measuring of cup. Moisture content was measured according to the oven-dry method. This is done by weighing the test specimens before they are placed in an oven with a temperature of 103 ± 2 °C. When constant mass is achieved at the end of the test, the specimens are measured again, and the moisture content (given in weight %) is calculated according to the following formula:

$$\text{Moisture content} = \frac{m_u - m_0}{m_0} \cdot 100\ \%$$

Where: m_u = the test specimens' initial mass.
m_0 = the test specimens' mass after drying.

Identification of samples

Two packages of multi-layered parquet marked Woodline was sent to Norsk Treteknisk Institutt by Tremiljø Prosjekt AS. The parquet is a one strip parquet with a reported production width of 145 mm.

Five elements from each package, in all ten elements, are used in this test.

Result

Mean values and standard deviation for moisture content, width, cupping and cracks are shown in the following tables. Single values are also shown in Appendix 1.

Results

Results at delivery

Table 1. Moisture content [%] at delivery.

Mean value	7.7
Standard deviation	0.2

Table 2. Width [mm] at delivery.

Mean value	145.1
Standard deviation	0.0

Table 3. Cupping [%] at delivery.

Mean value	0.0
Standard deviation	0.0

Results after the 1. climate period ("late summer climate")

Table 4. Moisture content [%] after the 1. climate period.

Mean value	9.9
Standard deviation	0.1

Table 5. Change in width [mm] from delivery until after the 1. climate period.

Mean value	0.2
Standard deviation	0.1

Table 6. Cupping [%] after the 1. climate period.

Mean value	0.1
Standard deviation	0.1

Results after the 2. climate period ("dry winter climate")

Table 7. Moisture content [%] after 2. climate period.

Mean value	5.6
Standard deviation	0.1

Table 8. Change in width [mm] from delivery until after 2. climate period.

Mean value	-0.3
Standard deviation	0.0

Table 9. Cupping [%] after 2. climate period.

Mean value	-0.2
Standard deviation	0.0

Width movement

The change in width was measured from the end of the 1. climate period until the end of the 2. climate period. Percent width movement per one percent change in moisture content is calculated and shown in Table 10.

Table 10. Width movement in % per 1 % change in moisture content from 1. climate period to 2. climate period.

Mean value	0.08
Standard deviation	0.01

Crack in boards

A continuous visual inspection of the test specimens in the dry climate was performed in order to detect any damages in the top layer. Moisture content was registered when the first crack inside an element occurred.

Table 11. Number of elements with cracks inside strips and moisture content [%] at 1. crack inside strips.

Number of elements	2
Mean value	5.8
Standard deviation	0.1

Mean value and standard deviation must be used with discretion, as it is based on only two elements.

Discussion

Moisture content

Wood is a hygroscopic material and will adjust to an equilibrium moisture content (EMC) depending on the temperature and relative humidity (RH) in its surroundings. In a normal eastern Norwegian climate, the lowest EMC will occur during winter when the temperature outside is at its lowest, while the highest EMC will occur during summer. RH indoors will typically vary from under 20 % and up to 60 %. The moisture content in wood will adjust to the EMC indoors and vary according to this, but due to slowness in the moisture diffusion, the EMC will lag accordingly. The lowest wood moisture content indoors will therefore be in February/March, while the highest will be in August/September. In a normal eastern Norwegian indoor climate this will mean a wood moisture content down towards 5 % and up towards 11 %. If one requires that the floor shall have a lowest possible amount of shrinkage or swelling after installation, the parquet should be dried to a moisture content just below the mean value of the expected moisture content occurring. This will mean app. 7.5 %. If floor heating shall be used, an even lower moisture content should be considered. As long as the distance to walls and other fixed installations is sufficient, one can on a general basis say that it is better with a too low delivery moisture content than a too high one.

This test shows that the tested parquet from Woodline has a moisture content at delivery of 7.5 % - 8.0 %. This is a sensible moisture content level for a parquet that shall be used in Norway.

Width and width movement

The natural shrinking and swelling of wood, due to moisture variations, will lead to movement in the floor. Solid oak has a mean width movement of app. 0.22 % per % moisture change, and one may assume that a multi-layered parquet has a movement of app. 1/3 of this, which equals about 0.07 %. This movement will cause cracks between boards. SINTEF Building and Infrastructure specify in their Design Guides 541.505, *Installation of parquet*, that one should not accept cracks larger than 0.3 mm in an installed parquet floor.

Width movement from delivery until after the 2. climate period shows that cracks between elements in average will be at 0.2-0.3 mm.

Average percentage width movement per percent wood moisture content, from the end of the 1. climate period to the end of the 2. climate period, is estimated. This indicates what size of cracks can be expected between elements.

The test shows that the parquet has an average width movement of 0.08 % per % moisture change. This is a normal level for a multi-layered parquet with oak in the top layer.

Cupping

Cupping can manifest itself as concave cupping or as convex cupping. Concave cupping is by far the most common cause for complaints, and occurs during winter when the parquet dries.

NS-EN 13489:2002, Wood flooring – Multi-layer parquet elements, states a requirement of 0.2 % at delivery. In a Nordic dry climate one often will experience some cupping of elements, but this will usually disappear during summer/fall.

The tested parquet fulfils the requirements for cupping at delivery, and also after the dry climate period.

A negative sign indicates concave cupping, while a positive sign indicates convex cupping.

Cracks

Regarding number of boards with cracks within elements, the tested parquet displays cracks in two out of ten elements during the dry climate period. Both these cracks occur at a relatively low moisture content of 5.8 % and 5.9 %.

Conclusion

The conclusion is only based on the testing of the received elements.

The tested parquet has a moisture content at delivery of 7.5 % - 8.0 %. This is a sensible moisture content level for a parquet that shall be used in Norway.

The tested parquet fulfils the requirements for cupping at delivery, and also after the dry climate period.

The test shows that the parquet has an average width movement of 0.08 % per % moisture change. This is a normal level for a multi-layered parquet with oak in the top layer.

The climate test shows that this parquet should be suited for use in a normal Norwegian climate.

