



HIGH PERFORMANCE WOOD COMPOSITES

SILVADEC
PC.37.269 – MD/FD/2003.357-1296
Bordeaux, 20 October 2003

MATERIAUX/0001/03
20 October 2003

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3.1.1.2 Sampling

The tests have been carried out on:

- 6 new test tubes
- 6 test tubes having undergone accelerated aging (ultra violet rays for 2 x 3 weeks)
- 6 test tubes having undergone cyclical aging in accordance with EN321 (called V313)
- 3 control test tubes of sap wood of Norwegian Pine

3.1.2 Results

- Control test tubes of sap wood of Norwegian Pine : 3 quoted 4 (out of 3)
- New test tubes with STRANDEX 2 out of 6 quoted 1, the rest quoted 0
- Test tubes UV aged: 4 out of 6 quoted 1, the rest quoted 0
- Test tubes V313 aged: 6 out of 6 quoted 1

3.1.3 Conclusion

We consider that the material is protected from attack by Saintonge termites if, at the most one test tube (out of 6) has a quotation of 2.

In this case, no test tube, no matter in what state (new or aged), reached this level of deterioration.

With a wood content of approximately 60% we estimate that protection against the Saintonge Termite is assured not only in the initial state but also after surface deterioration, which can appear over time.

Concerning insects with xylophagous larvae, we have not accounted for a possible sensitivity:

- In the Capricorn of houses (*Hylotupes bajulus*) is reputed to attack only solid wood
- Death Watch Beetle (*Anobium punctatum*) which is not known to cause significant economic damage to wood based composite panels



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3.2 Resistance to Lignivores Fungi

Two types of resistance to fungi have been evaluated: those in risk class 3 and those in risk class 4.

In both cases, the tests have been carried out using new test tubes and UV aged test tubes (2 x 3 weeks exposed to RDA accelerated aging coils) and heat moisture (test called V313 at a rate of two 3 week cycles according to NF EN 321).

3.2.1 Risk Class 3

The tests for resistance to Fungi implemented a testing method adapted from the Norm project N34 by the work group 23 part of technical committee 38 of the CEN.

3.2.1.1 Test Principal

We exposed test-tubes of material to be tested under ideal³ conditions for fungi to develop.

These were selected according to the wood essence used in the manufacture of the composite. After a given period we determined the loss of relative mass starting from the loss of mass of the test-tubes in relation to their initial mass.

3.2.1.2 Results

The average of the loss of relative mass and the loss of mass at 95% exclusion are laid out in the table below. The Durability Classification has also been added in relation to the fungic agent for each condition.

³ The quality of the conditions for development of fungi stocks is controlled by a set of control test tubes of sapwood of Norwegian Pine and Beech. The quality of virulence is demonstrated by a minimal level of loss of relative mass from these control test-tubes.

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Table of the losses of relative mass (%) Averages (values 95% of exclusion)				
Conditions of Test tubes	Coniophora Puteana	Gloeophyllum trabeum	Poria placenta	Coriolus versicolor
Initial State	2.57 (2.89)	2.51 (2.84)	2.45 (2.71)	2.55 (2.82)
Post RDA (UV)	2.69 (2.97)	2.56 (2.78)	2.57 (2.75)	2.58 (2.78)
Post V313	2.32 (2.57)	2.30 (2.49)	2.24 (2.42)	2.21 (2.32)
Durability Classification (derived from the median loss of mass)				
Initial State	1	1	1	1
Post RDA (UV)	1	1	1	1
Post V313	1	1	1	1
Class 1 supposes a median loss of mass of 5% at most				

3.2.1.3 Comments:

We note that:

- The level of loss of mass is very weak
- The dispersion of results is very weak (coefficient of variation is always less than 7%)
- This weak dispersion means that the loss of relative mass at 95% exclusion is less than 3% (calculation according to the law of normal distribution or according to GALTON's law – this law in general is better adapted to more clearly dispersed properties).

Note:

Even when noting the loss of mass at 95% exclusion to the effective mass of wood in the composite (61%), the loss of relative mass at 95% exclusion stays less than 5%.



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3.2.1.4 Conclusion:

The main conclusion is that with the median loss of relative mass being lower than 5%, the STRANDEX product has a durability of Class 1 (very durable) with respect to all the fungi that it was exposed to both in its initial state as well as after each preliminary conventional ageing test. This very durable characteristic at least for wood contents of 61% at least therefore makes the product suitable for use in classes of risk 1, 2 and 3 as understood by the Norm NF EN 335. STRANDEX material is therefore capable of sustaining any biological threat for internal, semi-external and external wood finishes.

3.2.2 Class of Risk 4

The tests for resistance to soft rotting fungi implemented a testing method adapted from the Norm project N35 by the work group 23 part of technical committee 38 of the CEN.

3.2.2.1 Test Principal:

For 40 weeks we exposed the test tubes of material in a reference soil and in optimal moisture conditions to encourage rotting. The test tubes of Beech and sap wood of Norwegian Pine are both used to evaluate the virulence of the fungi in action

At the end of the period, we evaluate the loss of relative mass of the test tubes (the same procedure as for the fungi in the class of risk 3)

3.2.2.2 Results:

The average of the loss of relative mass and the loss of mass at 95% exclusion are detailed in the table below. The Durability Classification has also been added in relation to the fungic agent for each condition.



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Table of the losses of relative mass (%) Averages (values 95% of exclusion)		
Conditions of Test tubes	Soft Rotting Fungi	Durability Classification of material
Initial State	1.37 (1.70)	1
Post RDA (UV)	1.79 (2.58)	1
Post V313	1.68 (2.14)	1
Class 1 supposes a median loss of mass of 5% at most The loss of mass at 95% of exclusion has been calculated using GALTON's Law		

3.2.2.3 Comments:

We note that:

- the loss of mass is very weak
- the dispersion is stronger than for the fungi in Class 3 (the coefficient of variation is more than 12% and even exceeds 21% for the UV test tubes). The values at 95% exclusion are rather lower than those obtained with the Risk Class 3 Risk fungi.

Note:

Even by bringing back the loss of mass to 95% on the effective wood mass (61%), the value at 95% of exclusion remains lower than 5%

3.2.2.4 Conclusion:

The main conclusion is that with the median loss of relative mass being lower than 5%, the STRANDEX product has a durability of Class 1 (very durable) with respect to all the rotting fungi that it was exposed to both in its initial state as well as after each preliminary conventional ageing test. This very durable characteristic at least for wood contents of 61% or less therefore makes the product suitable for use in Risk Class 4 as understood by the Norm NF EN 335. STRANDEX material is therefore capable of sustaining any biological threat for wood finishes in contact with the ground. However, taking into account the newness of the material, we would recommend a drained ground surface.



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4 – GENERAL CONCLUSION ON APTITUDE FOR USE

4.1 Mechanical and physical properties

4.1.1 Flexural Strength

The tests carried out give an indication of flexural strength performance and are intended to be used as a base for the processing control. Concerning flexural strength we note 3 points:

- an average breaking force of flexural strength of 23 N/mm²
- an average modulus of elasticity of 4500 N/mm²

Note: The samples tested do not make it possible to determine calculation values that are sufficiently reliable to calculate load bearing behaviour.

Moreover, for this type of use, the behaviour of STRANDEX under different temperature conditions must be taken into account (embrittlement to the cold and an important loss of rigidity and resistance under heat: at 60°C approximately one third for resistance and about a half for rigidity).

On the other hand, we note a stable flexural strength in relation to UV exposure and a combination of heat and humidity (at least for a thickness of 15mm).

For structural use, more suitable tests should be undertaken to evaluate performance to sudden impact of loads. These would be:

- **for the material: tests in accordance with NF EN 789 and NF EN 1058**
- **For profiles used as floor boards: test in accordance with NF EN 1533 and even NF EN 1195 (tests on life size models)**

Finally, if use under load over a long period is required, specific evaluation of creep according to XP ENV 1156 should be carried out. Indeed, for a material derived from wood tests show that the finer the particles, the greater the creep. In these conditions and without further behavioural knowledge (for example continuous and bearing primary structures) Strandex should not be used for the moment.



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4.1.2 Density

A Density of 1200 kg/m² means the material resists well to screws and other inserts (as long as they have been inserted appropriately)

4.1.3 Moisture Stability

Swelling and resumption of mass is very weak. This probably accounts for the good test results in relation to Fungi. (see later)
As for the dimensional variations when flat at 3mm/m they are between 30 and 85% of the relative humidity of air

4.1.4 Hardness

With a characteristic value of almost 60 N/mm², the BRINELL hardness is at a level superior to oak wood.

4.1.5 Abrasion Resistance

It is the same as that of Oak.

4.1.6 Reaction to Fire

At 15mm, the reaction to fire corresponds to Class M3.

4.2 Durability

4.2.1 Termites:

Following the usual tests the STRANDEX material appeared to be resistant to Saintonge Termites. The tests also tend to show that it should be resistant to other urban xylophages insects.

Note: The absence of any significant attack during the tests does not signify that a barrier in STRANDEX can not be crossed by the parasite if it is in the way of another material that it is seeking out.

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4.2.2 Lignivores Fungi:

Whether in their initial state or after accelerated aging (UV and a combination of heat and humidity – the cyclical test V313 in accordance with NF EN 321) the loss of mass results are those of a very durable wood (Class 1 in accordance with NF EN 350), both for Class 3 and Class 4 Lignivore Fungi.

The material can therefore be used in all risk classes as defined by NF EN 335. They are:

- 1 (dry environment)
- 2 (humid environment)
- 3 (outside environment)
- 4 (contact with the ground)

Note: For this Class we recommend that the ground surface is drained. Indeed, one should always seek the best environment for products made of wood or wood derivatives.

4.3 Final Conclusion

The range of tests was carried out on **Strandex** profiles with a declared wood content of 61%. We can calculate that the results obtained are valid around this value. Even if it does seem probable that all of the performances will not have the same sensitivity to the wood content, complementary tests linking wood content to performance are needed to calculate the performance variation according to the wood content of the wood composite.

In addition, the results showed an extremely weak dispersion of amplitude; that can be partly explained by the source of a single manufacturing batch and only a continuous processing control will make it possible to determine the real amplitude.

Lastly, as this is a new product we highly recommend that this continuous processing control is undertaken by a third party. Indeed this step would unquestionably reassure those using **Strandex** products.

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