NT METHOD

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CORROSION TEST FOR FIRE RETARDANT TREATED WOODEN PRODUCTS

Key words: Fire retardant wood, corrosion, test method

1 SCOPE

This test method specifies the procedure for determining the corrosion hazard on metals and metal fasteners from fire retardant treated wooden products after exposure in an accelerated laboratory environment.

2 FIELD OF APPLICATION

The corrosion on metals and metal fasteners in contact with fire retardant treated wood is normally higher than in contact with untreated wood if the fire retardants are hygroscopic. This test will tell within 6 months if the fire retardant wood is more corrosive than untreated wood in environment with high relative humidity (RH).

The same test can be carried out outdoors, but the exposure time must then be increased to at least one year.

3 REFERENCES

This draft Nordtest standard is a modified version of a non standardized method used for corrosion test of metals in connection with pressure-treated wood exposed outdoors. The modification is primarily based on the accelerated environment.

4 DEFINITIONS

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5 SAMPLING, SAMPLE HANDLING AND PREPARATION

5.1 Wood samples

The wood species in the samples must be the same as approved for the fire retardants in a standardized national fire test classification according to a national, European or other standardised system. If several wood species are approved, the species that have the highest retention shall be chosen, e.g. pine.

The wooden test specimens shall be planed and have sharp edges even if the approval is for profiled panels.

The test specimens shall be treated to the approved retention, and then dried to the moisture content like the end-use dryness for the product. If the fire approval includes priming or other surface treatment, the samples shall be treated accordingly before the metal fasteners are applied in the wood specimens.

An appropriate size of the wooden samples are 22 x 95 x (L) mm.

\[ L = \text{the length of the samples and a recommended length is: } 30 \text{ mm multiplied by the number of fasteners to be tested multiplied by 2 (number of parallels)} \]
add 30 mm. For 5 fasteners the length of the wooden specimens shall be \[(30 \times 5 \times 2) + 30\] mm = 330 mm. See Figure 1.

5.2 Metal fasteners
The following metal fasteners shall always be included:
1. Mild steel
2. Zinc plated steel
3. Hot dip galvanized steel
4. Stainless steel A2
5. Aluminium
Additional metal fasteners may be added.

6 TEST METHOD
6.1 Principle
The test is based on exposure of the samples in a humid environment of 90 % RH (relative humidity) and 27 °C. The corrosion is normally assessed visually, but can also be evaluated by weight loss of metal from the fasteners (optional).

6.2 Equipment
A conditioning room with air circulation and instruments to control the temperature within 27 ± 2 °C and RH 90 ± 5 %.

6.3 Pre-treatment of the metal fasteners (optional)
If determination of the weight loss of metal is chosen, all the fasteners have to be washed in ethanol and weighed before they are applied to the wood specimens.

6.4 Sample set-up
12 fasteners of the same metal are applied in each fire retardant product and in one untreated reference of the same wood species as the treated wood. The space between each fastener shall be at least 30 mm. One specimen can contain two or more parallels, see Figure 1. In each test 12 parallel metal fasteners shall be tested at accelerated exposure.

Figure 1. Wooden specimen with 2 parallels of fasteners 1–5.

6.5 Assessment
6.5.1 General
The samples shall be assessed after 1, 3 and 6 months. At each time interval four parallels of each metal are assessed. The assessment is normally visual. The metal loss may be determined by treating the metal fasteners in a pickling solution to remove the corrosion products and then be weighed (optional).

6.5.2 Visual assessment of the corrosion attack
The rating of the corrosion attack is described in Table 1.

Table 1. Visual assessment of the corrosion.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No attack</td>
<td>&lt;5 % of surface attacked</td>
</tr>
<tr>
<td>1</td>
<td>Insignificant attack</td>
<td>5-50 % of surface attacked</td>
</tr>
<tr>
<td>2</td>
<td>Slight attack</td>
<td>50-95 % of surface attacked</td>
</tr>
<tr>
<td>3</td>
<td>Serious attack</td>
<td>&gt;95 % of surface attacked</td>
</tr>
</tbody>
</table>

If the corrosion attack is only in the coating or both in the coating and the fasteners basic metal, the same rating is used. Then the overall rating of the attack is calculated by the following Equation (1):

\[
\text{Weighted rating} = \frac{\text{rating surface coating} + 3 \times \text{rating basic material}}{4}
\]

6.5.3 Calculation of the metal loss (optional)
Metal loss can be calculated and expressed either as metal loss per surface unit (g/cm²), or as the depth of corrosion (µm).

The fasteners then have to be treated in a pickling solution to remove the corrosion products, before they were weighed. The treatment is carried out as follows:
1. Five minutes pickling in an ultrasonic bath
2. Two minutes cleaning in hot water in an ultrasonic bath
3. Ten seconds rinsing in hot running water
4. Drying with clean paper tissue
5. Dipping for 30 seconds in 96% ethanol
6. Drying with clean paper tissue
7. Storage for at least one hour in a desiccator. To equalize the temperature, this is done in the same room as the weighing.

The following pickling solutions can be used depending of the metal:

<table>
<thead>
<tr>
<th>Metal</th>
<th>Temperature</th>
<th>Pickling solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>25 °C</td>
<td>Clark’s solution: Concentrated hydrochlorics acid with an additive of 20 g/l antimony oxide and 20 g/l stannic chloride</td>
</tr>
<tr>
<td>Aluminium</td>
<td>80 °C</td>
<td>Aluminium 80 °C Chromic acid 20 g/l and phosphoric acid 50 ml/l de-ionized water</td>
</tr>
</tbody>
</table>

After pickling the fasteners are weighed. The weight loss is calculated as the difference between the original weight (prior to exposure in the test) and the weight after pickling and divided by the fastener’s surface area. The loss is given as g/cm².

6.6 Applicability
The results will be useful in determining any limitations selecting metals when the fire retardant wood is used outdoors or indoors in a atmosphere with high humidity. The repeatability and reproducibility of the method have to be determined. Since the assessment is visually, there should be a photographic rating of fasteners.

6.7 Uncertainty
There is insufficient data available to give the methods uncertainty.

7 TEST REPORT
The test report shall contain:
- The name of the contractor
- The fire retardant(s) that are tested
- The wood species used
- The metal fasteners tested
- The corrosion rating of the fasteners after 1, 3 and 6 months
- (Optional: The metal loss of the fasteners after 1, 3 and 6 months)
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