



Solar Simulator

Solar Simulator Finland Ltd.

Executive Summary

Public

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Ref. no.: AlmedahlsPohjonenex280308TO.pdf

Uranus Comparative UV Radiation Analysis

Customer:



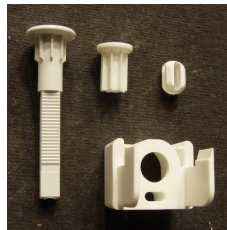
Almedahls Oy
Lasse Pohjonen
FI-20780 Kaarina

Contract:

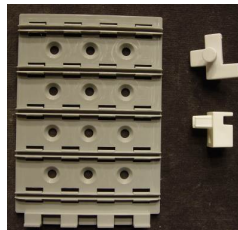
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Target:

Ball chain (ball diam. 3 mm)
4 pcs Tilt axles to chainwheel
4 pcs Top chainwheels
4 pcs Ball chain connectors
4 pcs End caps for headrail
1 pc of Paneltrack fixplate
5 pcs of Paneltrack sliders
5 pcs of Paneltrack cordguide plugs



Tilt axle, Top chainwheel, Ball chain connector, End cap for headrail



Paneltrack fixplate, Paneltrack slider and Paneltrack cordguide plug



Ball chain



COLOUR



MECHANICAL

Ball chain, tilt axle, top chainwheel, ball chain connector and end caps for headrail are parts used in the Integrated Venetian blinds.

Ball chain is cut into 5 sets of 5 pcs of 40 cm long ball chains.

Testing time:

The start of the test: 31st of January, 2008
The end of the test: 13th of March, 2008
Total test time 1000 hours



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Purpose of the test:

To test the withstand of the parts of the Integrated Venetian blind and parts of the paneltrack to UV radiation. The mechanical tests consisting of the tensile strength test will be done to the Ball chain.

Test method:

The strain of the test is made through the use of UV-radiation. The test cycle is continuous UV-radiation.

Total test time is 1000 hours. A set of ball chains is taken away from the test at an interval of 250 test hours. After the whole test for these samples will be made mechanical tests.

The intensity of UV-radiation is 90 W/m^2 . The black plate temperature is $40^\circ\text{C} \pm 2^\circ\text{C}$.

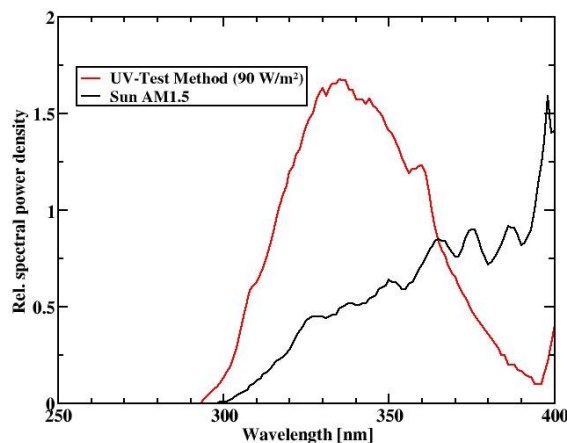
Validation of test method:

The spectrum of the used UV-radiation is near the UV-radiation received from the real sun. The total UV-radiation energy received by the samples during the 1000 test hours corresponds to about 3 years of UV-energy received through a south facing window in Southern Finland. The results of the mechanical tests to the ball chain describe possible changes in the used materials.

The test conditions are according to the standard SFS-EN ISO 4892-3.

Actions done:

The spectra of the UV-lamp used and that of the sun are in the figure.



The samples were attached to the test stand. The non-radiated sides of the samples are marked with a black spot as seen in the picture on the left. Paneltrack sliders were tested so that they were sideways towards the UV-radiation as seen in the picture in the middle. The UV-radiation in this



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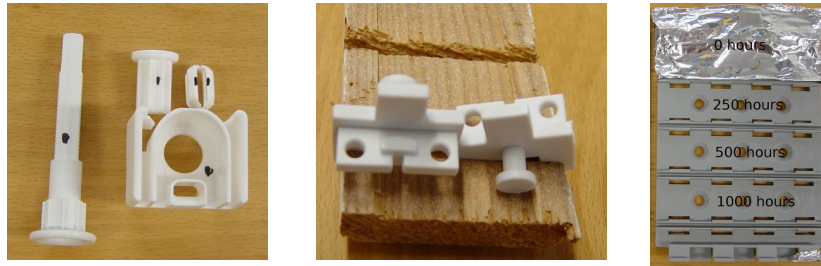
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case came to the samples from upwards. Paneltrack fixplate was covered with a radiation shield which was partly removed during the test so that parts of the sample received UV-radiation for 1000, 500, 250 and 0 test hours.



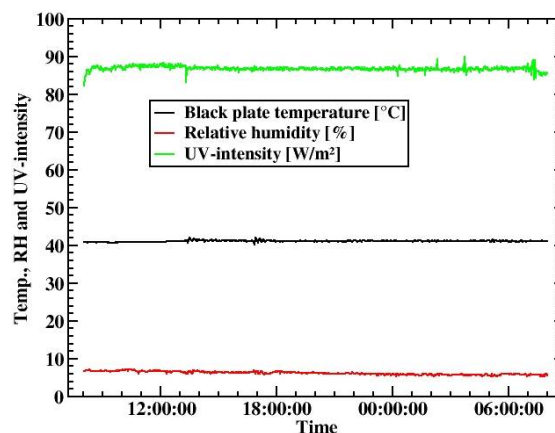
The ball chains were attached to wooden test stands as seen in the picture where there are four sets of ball chain samples. The length of the ball chain samples is 40 cm. Five sets were made from five pieces of ball chains. One set of ball chains was removed from the test after every 250 test hours.



These samples were stored in darkness in room temperature before testing the retention of tensile strength and ultimate elongation of the samples.

The mean intensity of the UV-radiation during the test was $90 \text{ W/m}^2 \pm 5 \text{ W/m}^2$ at the samples. During 1000 test hours the samples received totally an UV-energy of 90 kWh/m^2 .

The black plate temperature was $40^\circ\text{C} \pm 3^\circ\text{C}$ during the UV-radiation cycle. The black plate temperature, UV-intensity and relative humidity in the test chamber during a 24 hour test cycle are in the figure.





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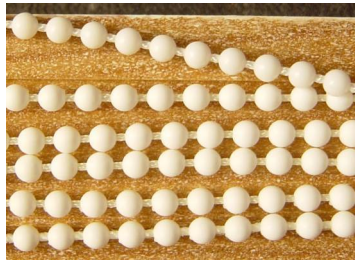
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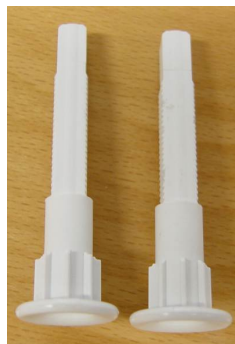
The Grey Scale values of the samples were determined on a visual checking board. The samples were illuminated with a D65 light. The light was incident upon the surface at an angle of 45° and the direction of viewing was perpendicular to the surfaces. The fastness grade (the Grey Scale value) was observed by comparing the radiated part of the sample to the unirradiated part of the sample or to a reference sample. Value 5 indicates no contrast change and value 1 indicates a very large contrast change. Normally the approval value is 5 or 4/5.



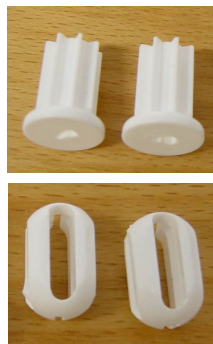
The colour of the Ball chain changed very little during the test. In the picture there are the reference ball chain (uppermost) and five 1000 hours UV-tested ball chain samples. However, the gloss of the balls of the ball chains diminished during the test and after 250 test hours the balls were quite matt-finished.

The colours of the other parts of the Integrated Venetian blind did not change either noticeably during the test. The colour of the Paneltrack fixplate changed to a little yellowish tone during the test.

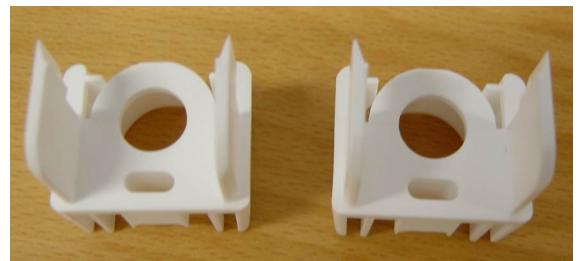
In the pictures there are the reference samples on the left and 1000 hours UV-tested samples on the right.



Tilt axles to chainwheels



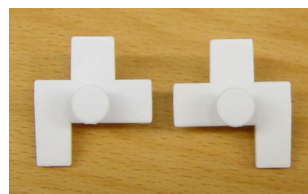
Top chainwheels (upper)
Ball chain connectors



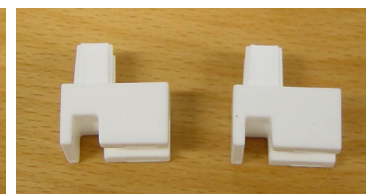
End caps for headrails



Paneltrack fixplates



Paneltrack sliders



Paneltrack cordguide plugs



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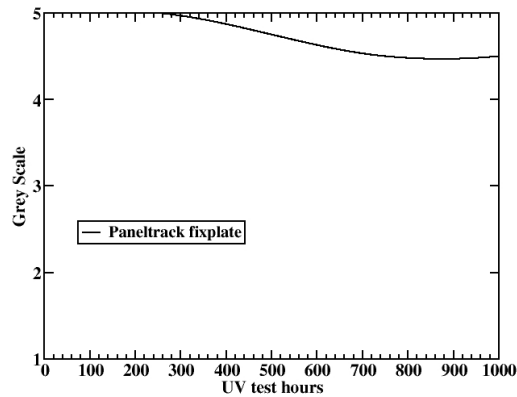
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The smoothed Grey Scale curve of Paneltrack fixplate as a function of test hours is figured.

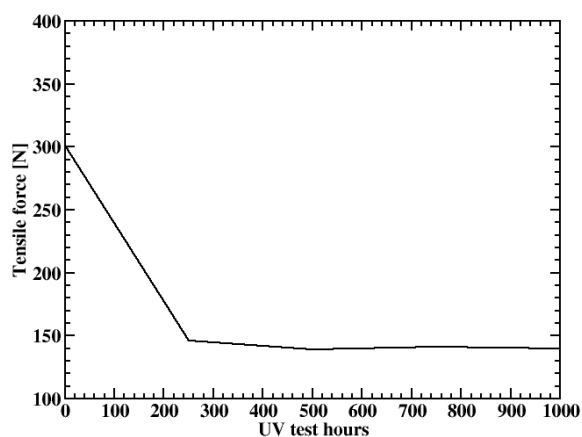


Radiation correspondence

The mean UV radiation energy in Southern Finland during one year is 54 kWh/m² onto a horizontal surface and 47 kWh/m² onto a south facing vertical surface. Thus at this test the total UV-energy of 90 kWh/m² corresponds to 1.7 years of UV-energy onto a horizontal surface outside in Southern Finland and 1.9 years of UV-energy onto a south facing vertical surface outside in Southern Finland. About 65 % of the UV-energy goes through a window. Thus the 90 kWh/m² of UV-energy corresponds inside a south facing window to about 3 years.

● Luna 2: Mechanical Analysis

The tensile force for the reference ball chain, 250 h, 500 h, 750 h and 1000 h UV-tested ball chains were measured. The result describes the force with which the chain breaks in two.



The force with which the chain breaks goes to half of the original value during the first 250 test hours and stays at that level until the end of the test.



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Conclusions:

The Grey scale values of the tested samples after the test are tabulated. In the same table there are also passed/failed verdicts for the samples based on visual observations. The mechanical test was done for the ball chain.

Sample	Grey Scale	Visual Approval	Mechanical Approval
Ball chain	5	Passed	Passed
Tilt axle to chainwheel	5	Passed	-
Top chainwheel	5	Passed	-
Ball chain connector	5	Passed	-
End cap for headrail	5	Passed	-
Paneltrack fixplate	4/5	Passed	-
Paneltrack slider	5	Passed	-
Paneltrack cordguide plug	5	Passed	-

Remarks:

Actions, operations and reporting are in accordance with IEC/ISO 17025 'General requirements for the competence of testing laboratories'.

Signatures:

Littoinen, 18th of April, 2008

Timo Oksa



COLOUR



MECHANICAL