TEST REPORT

Your Ref: - Date: 27 Mar 2006

Our Ref: 54S061301/ED Page: 1 of 7

DID: 6885 1414 Fax: 6779 3903

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SUBJECT:
Testing of sealant

TESTED FOR:
PFE Technologies Pte Ltd
9 Gul Street 4
Singapore 629238

Attn: Mr Edward Woo

SAMPLE DESCRIPTION:
The following items were received as shown:

<table>
<thead>
<tr>
<th>Sample/Substrate</th>
<th>Volume</th>
<th>Quantity</th>
<th>Date Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peresael Polyurethane Sealant'</td>
<td>600 ml</td>
<td>2 cartridges</td>
<td>6 Oct 2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 cartridges</td>
<td>27 Oct 2005</td>
</tr>
</tbody>
</table>

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TEST METHODS:


Staining And Colour Change

   - Test cycle: 8 hours UV exposure at 55°C and 4 hours condensation at 45°C
   - Exposure duration: 100 hours
   - No. of determination: 1 for staining test; 1 for colour change test; 1 as control

Extrudability

   - Apparatus: Pycnometer and caulk gun
   - Test pressure: 40 psi
   - No. of determination: 1

Flow Properties

   - Method: Test method for 'Type II' sealant
   - Test conditions:
     a) 4.4°C in environmental chamber for 4 hours
     b) 50°C in oven for 4 hours
   - No. of determinations: 2 for vertical and horizontal displacement

Hardness

   - Test Conditions:
     a) 23°C and 70% relative humidity for 7 days
     b) 38°C and 95% relative humidity for 7 days
     c) 23°C and 70% relative humidity for 7 days
   - No. of determinations: 2 (3 points per test piece)

Tack-Free Time

   - No. of determinations: 2
Cyclic Adhesion & Cohesion


Test Conditions:
- a) 23°C and 65% relative humidity for 7 days
- b) 38°C and 90% relative humidity for 7 days
- c) 23°C and 65% relative humidity for 7 days
- d) Immersion in distilled water at 23°C for 7 days
- e) Drying in oven at 70°C for 7 days

Cyclic Test Conditions:
Stage A-1 0 cycles of joint movements:
- a) The joint width was compressed from 12.7mm to 11.1mm at 3.2 mm/h
- b) It was extended from 11.1mm to 14.3mm at 3.2 mm/h
- c) It was compressed again from 14.3mm to 12.7mm at 3.2 mm/h

Stage B-1 0 cycles of joint movements:
- a) The joint width was compressed to 11.1mm and conditioned at 70°C for 16 to 20 hours
- b) After ageing, the test specimens were cooled to 23°C for 2 to 3 hours
- c) The joint width was extended to 14.3mm at -26°C and 3.2 mm/h
- d) The specimens were removed and allowed to condition to room temperature

No. of determinations: 3

Effects Of Heat Ageing


Test Conditions:
- a) 23°C for 28 days
- b) 70°C for 21 days

No. of determinations: 3 (1 as control)

Effects Of Accelerated Weathering


Test cycle: 8 hours UV exposure at 55°C and 4 hours condensation at 55°C
Lamp designation: Fluorescent UVA 340 mm
Exposure duration: 250 hours
No. of determinations: 3 (1 as control)
Bend test apparatus: Steel mandrel
Test condition: -26°C for 24 hours
No. of determinations: 3
Adhesion-In-Peel


Test Conditions:
- a) 23°C and 70% relative humidity for 7 days
- b) 38°C and 90% relative humidity for 7 days
- c) 23°C and 70% relative humidity for 7 days
- d) Immersion in water at 23°C for 7 days

Substrate:
- a) Mortar
- b) Glass
- c) Aluminium

Crosshead speed: 50.8 mm/min
No. of determinations: 4 per substrate

Material Identification / Verification

10. Material Identification / Verification By Fourier Transform Infra-Red Spectrometric Analysis (FTIR)

CONDITIONING:

Unless otherwise specified, all test specimens were tested at 23 ± 2°C and 65 ± 5% relative humidity.

TEST RESULTS:

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1. Staining And Colour Change</td>
<td>No staining and no colour change</td>
<td>The sealant shall not cause any visible staining on the top surface of a white cement mortar base</td>
</tr>
<tr>
<td>2. Extrudability</td>
<td>40.3 mll/min</td>
<td>Type S (single component), grade NS (non-sag or gunnable sealant) shall have an extrusion rate time of not &lt; 10 mll/min</td>
</tr>
<tr>
<td>3. Rheological (Flow) Properties</td>
<td>Vertical displacement: 0 mm sag Horizontal displacement: No deformation</td>
<td>Grade NS (non-sag) or gunnable sealant shall have flow characteristics such that it does not sag &gt; 4.8 mm in vertical displacement and shall show no deformation in horizontal displacement (refers to Types II and IV sealants)</td>
</tr>
<tr>
<td>4. Indentation Hardness</td>
<td></td>
<td>T (traffic) sealant shall have a hardness reading of not &lt; 25 or &gt; 50 after being properly cured</td>
</tr>
<tr>
<td>Test piece 1, average</td>
<td>43</td>
<td>NT (non-traffic) sealant shall have a hardness reading of not &lt; 15 or &gt; 50 after being properly cured</td>
</tr>
<tr>
<td>Test piece 2, average</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>5. Tack-Free Time</td>
<td>1 hour, no transfer of test specimens to the polyethylene film</td>
<td>There shall be no transfer of the sealant to the polyethylene film when tested at 72 hours</td>
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</table>
TEST RESULTS:

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<tbody>
<tr>
<td>6. Adhesion &amp; Cohesion Under Cyclic Movement</td>
<td>No bond failure</td>
<td>The total loss in bond and cohesion areas among the three specimens tested for each surface shall not be &gt;9 cm² with mortar substrates</td>
</tr>
<tr>
<td>7. Effects Of Heat Ageing On Weight Loss, Cracking And Chalking, average</td>
<td>2.3% No cracking and chalking</td>
<td>The sealant shall not lose &gt;7% of its original weight or show any cracking and chalking.</td>
</tr>
<tr>
<td>8. Effects Of Accelerated Weathering</td>
<td>No cracks after UV exposure and bend test</td>
<td>The sealant shall show no cracks after the specified UV exposure and shall show no cracks after exposure at cold temperature and the bend test</td>
</tr>
<tr>
<td>9. Adhesion-In-Peel, average</td>
<td></td>
<td>The peel strength for each individual test shall not be &lt;22.2 N (5 lbf) and the sealant shall show no &gt;25% adhesive bond loss for each individual test</td>
</tr>
<tr>
<td>(a) Mortar</td>
<td>63.1 N (14.2 lbf)</td>
<td></td>
</tr>
<tr>
<td>(b) Glass</td>
<td>191.7 N (43.2 lbf)</td>
<td></td>
</tr>
<tr>
<td>(c) Aluminium</td>
<td>144.4 N (32.5 lbf)</td>
<td></td>
</tr>
<tr>
<td>10. Material identification / Verification By FTIR</td>
<td>Polyurethane-based material (refer to figure 1)</td>
<td></td>
</tr>
</tbody>
</table>

REMARKS:

The test conditions for staining and colour change tests and effects of accelerated weathering test were adopted from ASTM G154 : 2000a Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Non-Metallic Materials.
Figure 1: IR spectrum of 'Pereseal Polyurethane Sealant'
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May 2005