Waterproof silicone adhesive sheet for civil engineering and construction

Catpad™ New Technology Information System of the Japanese Ministry of Land, Infrastructure and Transport and tourism
NETIS Registered TH-140017-VR, TH-190004-A in Japan
Silicone adhesive sheets for innovative applications for refurbishment of the civil engineering and construction applications.

- In waterways and water tanks
- Outstanding waterproofing
- Easy installation
- Long-term durability

At the box culvert junction
Construction example

Waterproof silicone adhesive sheet for civil engineering and construction which combines excellent material properties with ease of application for a long lasting and durable finish.

Bridges

Waterproof cover on the concrete barrier curb of the viaduct (joint gap)

Conventional sealing with polybutadiene resin degrades typically 3 to 5 years. Catpad has a life expectancy of more than 20 years. In addition, primers are not required during repair work which significantly reduced working time.

Before construction

After construction

Maintains flexibility even in winter.

Waterproof cover on the median strip gap

When applied to the median joints on intersecting roads, railways and bridges. Catpad shows superior weather resistance and durability compared to conventional polybutadiene resin, PVC and urethane waterproofing sheet.

Waterproof gap cover between road bridge and pedestrian bridge

The system accommodates the differential movement of the carriageway and the pedestrian bridge maintaining a weather proof seal and preventing water leaks.

Water repellency is maintained 6 years after installation.
Waterproofing between the old column and the new concrete jacketing prevents rainwater penetration into the joint of the concrete jacketing. Long-term seismic resistance can be expected.

Waterproof seal at the joint of a railway viaduct slab track

It can be applied to the concrete surface of the slab track without primer, the ease of application minimizes disruption and allows for application at night. It exhibits excellent durability and fatigue resistance to vibrational movements caused by running railway vehicles.

Waterproof and corrosion protective cover on the steel jacketing of RC column of seismic retrofitting

Catpad can be applied to both the coated steel and mortar without a primer. It will accommodate the combined movement of each substrate resulting from the difference in expansion coefficients of each material for long periods. Changes or an increase in corrosion can be checked by using Catpad Clear.

Waterproof cover of joint in seismic reinforced concrete jacketing of viaduct
Bridges

Anti-corrosion seal against salt damage of wires

When used as a wrapping, prolonged anti-corrosion protection can be expected.

Tunnels

Waterproof seal on the outside joint of the precast box culvert

It can also be buried in soil.

Countermeasures against water leaks and icicles in snow shelters

Adopted to seal joints on metal roofs which experience large expansion and contraction movements, the unique properties of silicone confirm resistance against ultra violet light and extremes in temperature.
Water facilities

**Drainage ditch** (For applications where there is constant water flow, first apply the primer, air dry, then apply the sealant and then apply the Catpad)

Covering the drainage cannal on the slope of a highway

When normally replacing or repairing a U-ditch, heavy equipment such as a crane is required. This is no longer the case when the repairs are carried out using Catpad.

**Construction of drain joint**

When compared to conventional mortar repairs, Catpad requires no mixing and is easy to apply without the need for specialist training. Once installed it has a minimal curing time and can accommodate joint movement.

In response to the revision of the Water Pollution Control Law in Japan (applied in 2015), measures were taken to prevent the leakage of pollutants into the ground.

**Construction of concrete drains in a factory**

**Water tank**

Applying on the bottom and walls of fire cisterns

Full attachment to inner surface of hot spring water storage tank

Sheet edges are covered and sealed with Cat-Tape Clear.

It was effective in preventing water leakage from cracks in the plain concrete fire cisterns.

Example of partial repair of fire cisterns

Small-scale or partial repairs can be performed by municipal officials.

It successfully prevented deterioration and protected the water storage tank from potential damage caused by a hot spring water.
| Roofs, walls, and other general applications |

Application examples related to public facility management areas

A pedestrian bridge (urine marking area)
Rust occurs in areas where pet frequently urinate. Durable rust prevention can be achieved by applying Catpad-Cloth.

Before cover

After cover

After 2 years

Prevention of rust in pedestrian bridge stair area
Catpad-Cloth was applied to the side wall of these steps. It prevented the formation of rust and prevented water from being trapped or stagnating from the flow of rainwater from the upper stages.

Waterproof cover of the street transformer base
Prevents infiltration and freeze-thaw damage of street transformer base buried in snow for more than 3 months in winter.
Leakage seal of domed roof

Catpad manages and accommodate changes in the material substrates due to variation in temperature and the effects of UV enabling a long-term durable applications.

Leakage seal of folded plate roof

Immediately following its application, Catpad is able to accommodate movement and stop water ingress.

Waterproof cover at the coping joint

Water infiltration into metal junctions of buildings as a result of movements from expansion and contraction from freeze-thaw can be prevented.

Insect repellent countermeasures at food factories

It bridges and forms a permanent seal in joints or gaps in food and healthcare factories and buildings where safety and hygiene are important, in addition to waterproofing, it can be used to prevent the ingress of insects, dust and other contaminates.

Repairing aged block walls

Applying Catpad all over the existing block wall surface, waterproofing, freeze-thaw damage prevention, and cleanliness were achieved.
Catpad is a waterproof silicone adhesive sheet used in civil engineering and construction applications. It combines excellent workability and reliability and does not require the use of primer. It has long-term durability when used in a wide range of applications, including bridges, tunnels, roofs, joint intersections, expansion and connection joints.

- Excellent resistance to extreme changes in temperature, stable performance over a wide temperature range of -40°C to 180°C.
- Silicone offers excellent durability and weather resistance.
- Excellent seal and waterproof performance over a long period of time.
- It sticks well to most materials such as metallic and concrete.
- It will not cause corrosion or deterioration of metallic, concrete, etc.
- Excellent flame resistance, no fire spread or carbonization even after more than 5 minutes exposure from a direct flame from a warning flare.
- Excellent workability, matches the shape of the waterproof surface, and can be easily cut on site for repair.
- It is a product with high safety and low environmental impact.

### Various certifications
- New Technology Information System of the Japanese Ministry of Land, Infrastructure and Transport NETIS Registered TH-140017-VR, TH-190004-A
- New Technology Registry 1701015 of Bureau of Construction, the Tokyo Metropolitan Government
- New Technology Registry a-17057 of Civil Engineering Department, Ibaraki Prefectural Government
- Metropolitan Expressway New Technology Information (Bridges) Silicone Adhesive Sheets
- New Technologies Registry 1801014A, 1901008A of Civil Engineering Department, Fukuoka Prefectural Government
- New Technology Registration 20201002 of Construction Department, Hokkaido Government

### General properties

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Catpad</th>
<th>Catpad Clear</th>
<th>Catpad-Cloth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Sheet type</td>
<td>Sheet type</td>
<td>Sheet type</td>
</tr>
<tr>
<td><strong>Roll type</strong></td>
<td>Base layer (silicone rubber) t: 0.8 mm</td>
<td>Base layer (silicone rubber) t: 0.8 mm</td>
<td>Base layer (glass fiber reinforced transparent silicone rubber sheet) t: 0.8 mm</td>
</tr>
<tr>
<td><strong>Adhesive layer (silicone gel)</strong> t: 1.0 mm</td>
<td>Separator film</td>
<td>Separator film</td>
<td>Separator film</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>General type</td>
<td>Transparent type</td>
<td>Glass fiber reinforced type</td>
</tr>
<tr>
<td><strong>Appearance</strong></td>
<td>Gray</td>
<td>Transparent</td>
<td>White transparent</td>
</tr>
<tr>
<td><strong>Reinforcement layer</strong></td>
<td>None</td>
<td>None</td>
<td>Glass fiber</td>
</tr>
<tr>
<td><strong>Standard size mm</strong></td>
<td>Sheet type: 300×1,000, 400×1,000/Roll type: 50×3,000, 100×3,000</td>
<td>Sheet type: 400×1,000</td>
<td></td>
</tr>
<tr>
<td><strong>Thickness mm</strong></td>
<td>1.8</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td><strong>Tackiness</strong></td>
<td>Self-sticking</td>
<td>Self-sticking</td>
<td></td>
</tr>
<tr>
<td><strong>Hardness</strong></td>
<td>Base layer type A 55</td>
<td>Adhesive layer Asker CSR2 60</td>
<td>Adhesive layer Asker CSR2 50</td>
</tr>
<tr>
<td><strong>Adhesive layer</strong></td>
<td>&lt; 15</td>
<td>&lt; 15</td>
<td>&lt; 15</td>
</tr>
<tr>
<td><strong>Tensile strength</strong></td>
<td>10.0</td>
<td>70.0</td>
<td>70.0</td>
</tr>
<tr>
<td><strong>Tear strength</strong></td>
<td>50</td>
<td>250</td>
<td>70.0</td>
</tr>
<tr>
<td><strong>Elongation at break (%)</strong></td>
<td>800</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>Operating temperature range °C</strong></td>
<td>-40 to 180</td>
<td>-40 to 180</td>
<td>-40 to 180</td>
</tr>
<tr>
<td><strong>Breakdown voltage</strong></td>
<td>30 &lt;</td>
<td>20 &lt;</td>
<td>20 &lt;</td>
</tr>
<tr>
<td><strong>Low molecular weight siloxane %</strong></td>
<td>0.83 (Σ D3-D10)</td>
<td>0.27 (Σ D3-D10)</td>
<td></td>
</tr>
</tbody>
</table>

* Measured value of the substrate layer

Maintains water repellency over a long period of time.
Silicone adhesive tape for finishing edges

Cat-Tape™ Clear

Cat-Tape Clear is a putty-like adhesive tape that extends the life expectancy of an application when used to finish the edges and overlapping sections of the Catpad.

- Cat-Tape Clear cures and bonds in 24 hours after application, and bonds strongly to both Catpad sheets and mortar foundation surfaces.
- Caulking gun and masking tape are not required due to the ease of application.
- Can be used to bridge gaps and joints without casing discoloration or staining due to its putty-like consistency.
- Less waste, which is better for the environment.

**Effects of Cat-Tape Clear**

The use of Cat-Tape Clear on the edges and overlapping sections of the Catpad increases the reliability of waterproofing.

- Prevents movement during large deformation.
- Offers protection and prevents dust and contaminates from contacting the adhesive layer.
- Prevents peeling or lifting of the edges due to external forces.

**Test Methods**

Prepare two samples, the first using Catpad without Cat-Tape Clear and the second using both Catpad and Cat-Tape Clear on two mortar plates.

Pull the 50 mm gap to the 75 mm position at a tensile speed of 50 mm/min, and hold for 10 minutes (Autographs manufactured by Shimadzu Corp.). It was further pulled to 100 mm position and held for 10 minutes to confirm the state.

**Test results**

When experiencing an extension of 50 mm to 100 mm (movement of 50 mm) in an application not using Cat-Tape Clear the adhesive layer at the edge of the Catpad becomes exposed. When using the Cat-Tape Clear at the edge the Catpad it remained in its original position and held firmly in place with no exposure of the adhesive layer.

When large movements are expected, the adhesive layer of the Catpad may become exposed, and so the use of Cat-Tape Clear should be considered to prevent this.

**General properties**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Product name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Cat-Tape Clear</td>
</tr>
<tr>
<td>Structure</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>Pink</td>
</tr>
<tr>
<td></td>
<td>Transparent</td>
</tr>
<tr>
<td>Standard size</td>
<td>25 × 3,000 mm</td>
</tr>
<tr>
<td>Test items after curing (silicone rubber)</td>
<td>Measured value</td>
</tr>
<tr>
<td>Hardness Type A</td>
<td>45</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>5.4</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>% 730</td>
</tr>
<tr>
<td>Tear strength Angle type</td>
<td>kN/m 16</td>
</tr>
<tr>
<td>Adhesive (between mortar)*</td>
<td>N/cm 22</td>
</tr>
<tr>
<td>Adhesive (between Catpad)*</td>
<td>N/cm 47</td>
</tr>
<tr>
<td>Adhesive (between Cat-Tape Clear)*</td>
<td>N/cm 65</td>
</tr>
</tbody>
</table>

*180 degree peel, tape width: 10 mm

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**Comparison without Cat-Tape Clear (left) and with Cat-Tape Clear (right) when the gap of 50 mm is pulled to 100 mm**

Without Cat-Tape Clear, the adhesive layer is exposed

With Cat-Tape Clear, the edge is not exposed

**Example of end treatment of a Catpad**

With Cat-Tape Clear, the edge is not exposed

Without Cat-Tape Clear, the adhesive layer is exposed
## Product Lineup and Package

### Catpad
- **Type**
  - **Sheet type**
    - 300×1,000 mm (10 sheets/package)
    - Packing dimensions: D360×W1,110×H60 mm
    - Weight including products: 9 kg
  - **Roll type**
    - 50×3,000 mm (20 pieces/Packing)
    - Packing dimensions: D360×W530×H150 mm
    - Weight including products: 10 kg

### Catpad Clear
- **Type**
  - **Sheet type**
    - 300×1,000 mm (10 sheets/package)
    - Packing dimensions: D470×W1,110×H60 mm
    - Weight including products: 12 kg
  - **Roll type**
    - 50×3,000 mm (20 pieces/Packing)
    - Packing dimensions: D360×W530×H150 mm
    - Weight including products: 10 kg

### Catpad-Cloth
- **Type**
  - **Sheet type**
    - 400×1,000 mm (10 sheets/package)
    - Packing dimensions: D470×W1,110×H60 mm
    - Weight including products: 11 kg
  - **Roll type**
    - 100×3,000 mm (10 pieces/Packing)
    - Packing dimensions: D360×W530×H150 mm
    - Weight including products: 10 kg

### Cat-Tape Clear
- 25×3,000 mm (10 pieces/package)
- Packing dimensions: D200×W340×H180 mm
- Weight including products: 3 kg

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### Packaging

With one wrap in one aluminum moisture-proof pack

### Packing image

NOTE: Packing are subject to change without notice.
Construction guide

Procedure

step 1

Application surface preparation
The application area is cleaned by high powered water jet, shot blasting or by other mechanical means such as a grinder.
※ Ensure that the surfaces are clean, dry and free of dust and other contaminants prior to the application.

step 2

Preparation of Catpad
Dimensions can be adjusted on-site with a cutter. After cutting, remove the separator film. The gap width should be 1/3 or less of the seat width.

step 3

Application of Catpad
Carefully apply the sheet from top to bottom to avoid stretching. After applying, press the sheet by hand or suitable tool. Sheet overlaps should be at least 20 mm. These edges should be finished with Cat-Tape Clear as described in step 4.

step 4

Seal with Cat-Tape Clear
With the pink separator film facing up, press down the product thoroughly with a roller or the fingertips. Then, slowly remove the separator film by pulling in a 180 degree direction. It reacts with moisture in the air to facilitate curing and adhesion. Use up about 30 minutes after opening the package.

Curing and bonding in approximately 24 hours
The Cat-Tape Clear reacts to harden and adhere. Following a curing time of 24 hours, the application is complete. Avoid touching the material during this time. The curing time will increase in a low temperature environment.

● Sealing of step 4 can also be performed with SEALANT MASTER 300-G. The edges seal with sealant over 2 mm thick.
Adhesive strength

Adhesion test
Strong adhesion to a variety of materials.

- **Test results**
  
  Good adhesion was confirmed to all substrates used in the trial with an increase in adhesive strength after a further one week after the initial application.

  ![Adhesive strength graph]

<table>
<thead>
<tr>
<th>Time</th>
<th>Maximum tensile force (N/40 mm)</th>
<th>Displacement at maximum tensile load (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>After 20 min</td>
<td>30.2</td>
<td>42.6</td>
</tr>
<tr>
<td>After 4 days</td>
<td>70.3</td>
<td>80.3</td>
</tr>
<tr>
<td>After 8 days</td>
<td>73.4</td>
<td>85.6</td>
</tr>
</tbody>
</table>

- **Test conditions**
  
  - Test specimens: Catpad length 200 mm x width 25 mm
  - Test methods:
    - It adheres to each surface, and is measured with the autograph testing device which is made by Shimadzu Corp.
    - Peel test according to the adhesive tape test method for JIS C 2107 (test speed: 300 mm/min)

  ![Test conditions diagram]

- **Relation between adhesion and surface roughness (only image)**

  - Ensure that all surfaces is completely dry before the application of Catpad.
  - Full adhesion will not developed if there is contact with water at the adhesion surface before or has fully cured.

  ![Relation diagram]

Lap shear tensile test
Able to accommodate significant movement.

- **Test results**
  
  **Catpad**

  **Single sheet application**

<table>
<thead>
<tr>
<th>Applied surface</th>
<th>Time</th>
<th>Maximum tensile force (N/40 mm)</th>
<th>Displacement at maximum tensile load (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortar</td>
<td>After 20 min</td>
<td>30.2</td>
<td>42.6</td>
</tr>
<tr>
<td></td>
<td>After 4 days</td>
<td>70.3</td>
<td>80.3</td>
</tr>
<tr>
<td></td>
<td>After 8 days</td>
<td>73.4</td>
<td>85.6</td>
</tr>
</tbody>
</table>

  - Displacement value is that recorded at the point of maximum test force. (Not specified values)

  ![Example of overlapping on the joint]

  **Catpad-Cloth**

  **Single sheet application**

<table>
<thead>
<tr>
<th>Applied surface</th>
<th>Time</th>
<th>Maximum tensile force (N/40 mm)</th>
<th>Displacement at maximum tensile load (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortar</td>
<td>After 20 min</td>
<td>64.0</td>
<td>53.0</td>
</tr>
<tr>
<td></td>
<td>After 4 days</td>
<td>92.0</td>
<td>55.0</td>
</tr>
<tr>
<td></td>
<td>After 8 days</td>
<td>88.0</td>
<td>56.0</td>
</tr>
</tbody>
</table>

  - (Not specified values)

  ![Example of overlapping on the joint]

- **Test conditions**
  
  - Test specimens: Catpad and Catpad-Cloth length 60 mm x width 40 mm
  - Substrates: Mortar
  - Test methods:
    - A Catpad or Catpad-Cloth was applied to two hemi-sections of mortar, then lap shear tensile adhesive strength was measured with tensile machine (autograph mfd. by Shimadzu Corp.), starting from a zero span (tensile speed: 50 mm/min).
**Crack-bridging test**  Excellent crack-bridging performance.

- **Test results**
  - Catpad and Catpad-Cloth could follow the displacement more than 40 mm without rupture.

### Displacement at maximum tensile load

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Catpad</th>
<th>Catpad-Cloth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single sheet on joint (mm)</td>
<td>40.8</td>
<td>49.9</td>
</tr>
<tr>
<td>Overlapping application on joint (mm)</td>
<td>55.6</td>
<td>44.7</td>
</tr>
</tbody>
</table>

**Test conditions**
- **Test specimens** Catpad and Catpad-Cloth
- **Substrates** Mortar
- **Test methods**
  - JSCE-K 532-2013: 7. Measured according to the crack following test method for surface coating materials. Two cut mortar test pieces are butted together with zero span between them, and then Catpad or Catpad-Cloth is applied like a bridge across two substrates. The mortar test pieces are then pulled apart horizontally at 5 mm/min, and the product is checked for breakage or separation.
- **Testing laboratory** Japan Paint Inspection and testing Association (JPIA)

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**Adhesion strength test**  Strong adhesion even in the perpendicular direction.

- **Test results**
  - The products showed excellent adhesive strength.

### Adhesion strength test

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Catpad</th>
<th>Catpad-Cloth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesion strength (N/mm²)</td>
<td>0.10</td>
<td>0.09</td>
</tr>
<tr>
<td>Maximum tensile load (N)</td>
<td>155</td>
<td>148</td>
</tr>
<tr>
<td>Breakage point</td>
<td>Break at interface between test substrate and adhesive layer of Catpad</td>
<td>Cohesive failure in adhesive layer of Catpad</td>
</tr>
</tbody>
</table>

**Test conditions**
- **Test specimens** Catpad and Catpad-Cloth
- **Substrates** JSCE-K 531-2013: 6. Adhesion strength test of surface coating, test method compliant test piece of 4.1 Standard condition test specimen (mortar)
- **Test methods** JSCE-K 531-2013: 6. Adhesion strength test of surface coating, and measurement according to the test method of 4.1 Standard condition test specimen. A jig is fixed to the back of a Catpad or Catpad-Cloth sample that is stuck to a mortar test piece. The jig is pulled up vertically at 1500-2000 N/min and the maximum tensile load and adhesive strength are determined. The points of breakage and conditions of the product are also examined.
- **Testing laboratory** Japan Paint Inspection and testing Association (JPIA)

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**Fatigue test**  Stands up to vibration over long periods.

- **Test results**
  - Product showed exceptional fatigue resistance, without any failure or slippage over 20 million cycles.

### Fatigue test

**Test conditions**
- **Test specimens** Catpad and Catpad-Cloth
- **Substrates** A JIS mortar test piece (length 150 mm x width 50 mm, thickness 10 mm) is cut in half longitudinally, then Catpad or Catpad-Cloth is applied such that it bridges two pieces.
- **Test methods** Samples were placed on a fatigue endurance tester and the two blocks were pulled apart from a zero-span position to create a 1.5 mm gap from top to bottom. The blocks were then moved 1.0 mm up and down from the starting point (amplitude: 2.0 mm) at a frequency of 10 Hz for 20 million cycles, and the samples were checked for fatigue failure, slippage and separation.

**Test specimen**
- **Test specimen**
  - Catpad Catpad-Cloth
  - Jig
  - Substrate (mortar)
  - Cut (notch)
Flame resistance

Flame resistance test: Combustion does not spread even when product is in direct contact with the flame of a flare.

### Test progression and results

- **Flare ignition**
  - The flare is ignited and the flame is pressed against the sheet.

- **After 2 minutes**
  - The sheet burns but does not support the passage of flame and remains non-combustible. There is no spread of flame or combustion even after 2 minutes.

- **After 4 minutes**
  - There is deformation of the sheet near the part that is in contact with the flare, but combustion has not spread even after 4 minutes.

- **After 5 minutes 40 seconds**
  - Flare stops burning.

### Appearance of sample after completion of flame resistance test

- **Front**
- **Back (magnified)**

The area that was in direct contact with the flame has been incinerated, but combustion did not spread. This is evidence of the product’s exceptional flame resistance.

### Test conditions

- **Test pieces**: Catpad Cloth
- **Test methods**
  1. Two test blocks (W360 mm x H600 mm x T50 mm, 30 kg in weight) are positioned side by side and separated by a 50 mm gap.
  2. The mortar surface is painted with a urethane paint.
  3. Catpad is applied so as to bridge the gap between the blocks.
  4. The edges are sealed with SEALANT MASTER 300-G.
  5. The flare is ignited, and the flame is brought into contact with the sample where it spans the gap.
  6. The condition of the sample is observed for the 5 minutes (approx.) it takes for the flare to burn out.

### Fire resistance test: The product shows exceptional fire resistance.

### Test progression and results

- **Before ignition**
- **Right after start of combustion**
- **After 7 minutes**
- **After combustion ends**

The area in direct contact with the flame has been incinerated, but combustion has not spread. This is evidence of the product’s exceptional fire resistance.

### Test conditions

- **Test pieces**: Catpad Cloth
- **Test methods**
  1. Two test blocks (W600 mm x H900 mm)
  2. NEXCO Test Methods
  3. Test in accordance with Test Method 738-2011 (Spread of combustion of tunnel retention materials).
  4. Heating time is 10 minutes and the gas used is LPG.
- **Testing laboratory**: Japan Testing Center for Construction Materials (JTCGM)

### Fire resistance performance demonstrated by Catpad-Cloth

- **NEXCO tunnel fire spreading test**: Pass
- **Fire Resistance Performance Test**: Pass
- **4.9 Non-flammability Performance Test Method Gas Hazard Test**: Pass
Dielectric strength test

Product shows excellent dielectric properties and is electrically stable.

**Test methods and results**

- **Test pieces**: Catpad or Catpad-Cloth (100 mm square)
- **Test methods**: The sample is stuck to an aluminum sheet. The sheet is sandwiched between two electrodes (High voltage side: 20 mm (DIA) ball electrode; Low voltage side: aluminum plate electrode). The sample is placed in insulating oil, and the voltage is increased at a rate of 2.0 kV/sec (AC 50 Hz). Measure the applied voltage at which dielectric breakdown occurs.

**Condition of electrodes (image)**

<table>
<thead>
<tr>
<th>Test pieces</th>
<th>Dielectric breakdown voltage kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catpad</td>
<td>33.6</td>
</tr>
<tr>
<td>Catpad-Cloth</td>
<td>26.1</td>
</tr>
</tbody>
</table>

**Test conditions**

- **Test pieces**: Catpad or Catpad-Cloth (100 mm square)
- **Test methods**: 1. A Catpad or Catpad-Cloth sample is stuck to an aluminum sheet. 2. The sheet is sandwiched between two electrodes (High voltage side: 20 mm (DIA) ball electrode; Low voltage side: aluminum plate electrode). The sample is placed in insulating oil, and the voltage is increased at a rate of 2.0 kV/sec (AC 50 Hz). 3. Measure the applied voltage at which dielectric breakdown occurs.
- **Testing laboratory**: Analysis Center, Hitachi Chemical Techno-Service Co., Ltd.

Spark resistance test

Catpad is almost unchanged by direct sparking.

**Test methods and results**

- **Test pieces**: Catpad length 100 mm x width 50 mm
- **Test methods**: It makes a spark from iron round bar by a cutting machine manufactured by Yamabiko corp.

**Condition of electrodes (image)**

After the test, there are iron filling (rust or iron oxide) on the Catpad surface, once they were washed with alcohol no change was evident.

**Test conditions**

- **Test pieces**: Catpad or Catpad-Cloth (100 mm square)
- **Test methods**: 1. A Catpad or Catpad-Cloth sample is stuck to an aluminum sheet. 2. The sheet is sandwiched between two electrodes (High voltage side: 20 mm (DIA) ball electrode; Low voltage side: aluminum plate electrode). The sample is placed in insulating oil, and the voltage is increased at a rate of 2.0 kV/sec (AC 50 Hz). 3. Measure the applied voltage at which dielectric breakdown occurs.
- **Testing laboratory**: Analysis Center, Hitachi Chemical Techno-Service Co., Ltd.

Electrical Characteristics

Push-out test of Catpad-Cloth

The Catpad-Cloth conforms to NEXCO standards (measures against peeling small pieces) and the net-based and gutter-based methods.

**Test progression and results**

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Maximum load (displacement to 50 mm) N</th>
<th>Displacement at maximum load (displacement 10 mm to 50 mm) mm</th>
<th>Maximum load (displacement ≥10 mm) N</th>
<th>Displacement from maximum load (displacement ≥10 mm) mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>651</td>
<td>50</td>
<td>875</td>
<td>82</td>
</tr>
<tr>
<td>Sample 2</td>
<td>706</td>
<td>50</td>
<td>888</td>
<td>78</td>
</tr>
</tbody>
</table>

**Test conditions**

- **Test pieces**: Catpad-Cloth
- **Test methods**: Two sheets of Length 600 mm x width 400 mm and thickness 1.5 mm were prepared. One shall be test sample 1 and one shall be test sample 2. NEXCO Test Methods Seventh Edition Tunnel Related Test Methods (July 2013) Test Methods 734-2011 Measurement according to “Push-out test of a textile sheet glue for preventing the peeling of concrete tunnel.” The test is measured by Model 5582 Instron Japan. Japan Testing Center for Construction Materials (JTCCM)
- **Testing laboratory**: Japan Testing Center for Construction Materials (JTCCM)
Weathering test  Product remains elastic and in good condition even after equivalent of 17 years’ exposure.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Time</th>
<th>Initial</th>
<th>After 1,750 hours (equivalent to 6 years)</th>
<th>After 5,000 hours (equivalent to 17 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile strength</td>
<td>MPa</td>
<td>10.0</td>
<td>10.3</td>
<td>10.5</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>%</td>
<td>800</td>
<td>700</td>
<td>560</td>
</tr>
<tr>
<td>Adhesion</td>
<td>N/50 mm</td>
<td>8.2</td>
<td>10.5</td>
<td>11.1</td>
</tr>
<tr>
<td>Thickness</td>
<td>mm</td>
<td>1.79</td>
<td>1.73</td>
<td>1.74</td>
</tr>
</tbody>
</table>

Test conditions  • Test pieces  Catpad length 150 mm x width 50 mm
• Substrates  Stainless steel (SUS-304)
• Test methods  Place Catpad on stainless steel plate and seal the outer edges. 120 min/1 cycle on a sunshine weather meter, water sprayed for 18 min during light source irradiation. Measured after 1,750 hours (equivalent to 6 years) and 5,000 hours (equivalent to 17 years)

Outdoor exposure test  Helps to prevent rust.

Test results  There was no rust where the Catpad was placed. However, rust appeared on the remaining surface.

Waterproof and anticorrosive properties of Catpad

Salt exposure test  Product helps prevent rust caused by exposure to sea water.

Test results  Even after being left exposed for two years, the area where Catpad was applied showed no rust, whereas rust did occur around the Catpad sample.

Waterproof and anticorrosive properties of Catpad

Water/Saltwater/Alkali/Acid resistance tests  Almost no change in performance was observed.

Test results  There were slight changes in hardness and tensile strength, but changes in weight were minimal, and almost no absorption was observed.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Conditions</th>
<th>Initial</th>
<th>5% NaCl aq</th>
<th>5% NaOH aq</th>
<th>12% HCl aq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>—</td>
<td>No change</td>
<td>No change</td>
<td>No change</td>
<td>No change</td>
</tr>
<tr>
<td>Change in hardness</td>
<td>Point</td>
<td>55</td>
<td>-5</td>
<td>-5</td>
<td>-13</td>
</tr>
<tr>
<td>Change in tensile strength</td>
<td>%</td>
<td>10 MPa</td>
<td>+4</td>
<td>+6</td>
<td>-15</td>
</tr>
<tr>
<td>Weight change</td>
<td>%</td>
<td>—</td>
<td>±0</td>
<td>+0.5</td>
<td>-0.1</td>
</tr>
</tbody>
</table>

Test conditions  • Test specimens  Catpad based on JIS K 6249
• Test methods  Samples of the base material of Catpad were immersed for 1 week in water in above each liquid. The samples were then removed and their physical properties were measured within 15 minutes after removal, in accordance with JIS K 6249.
Handling precautions

1. Take care to prevent contact with solvent and oils, as these substances may degrade the physical properties of the sheets.
2. If sheets tear or come up after construction, these sections can be repaired using Catpad and Cat-tape or Sealant Master 300-G.
3. After application, do not place heavy or sharp objects on top of the sheets.
   After construction, the sheet should not be subjected to strong impacts or walked on.
4. Take care to apply silicone sealant correctly.
   If the sheets are not bonded properly with silicone sealant, water can get in.
5. After construction, bulges may occur because of air trapped between the sheet and the foundation below.
6. This product is not a low-molecular-weight siloxane reduction type.
   Do not use it for electronic applications.
7. Do not place this product directly in contact with food and beverage.
8. When disposing of the product, read the SDS and process it in accordance with the law.
10. Please read the Safety Data Sheet (SDS) before use. SDS can be obtained from our Sales Department.
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This is an edited version of the product data released on Dec. 2021.