

KS

KOREAN INDUSTRIAL STANDARD

Testing methods for sealants of sealing and grazing
in buildings

KS F 2621 : 2000

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Testing Methods for Sealants of Sealing and Grazing in Buildings

1. Application Scope

This standard provides testing method requirements for sealants for sealing and grazing in buildings (hereinafter to be called "sealant") that is used to insert between joints and glasses in buildings.

2. Reference Standards

The following standards constitute a part of this standard as reference, and the latest versions shall govern.

- KS B 5305** Bourdon tube pressure gauge
- KS D 6701** Aluminum and Aluminum Alloy Panel
- KS D 6759** Extruded Aluminum and Aluminum Alloy
- KS D 8301** Anodizing of Aluminum and Aluminum Alloy
- KS F 2274** Testing Method for Accelerated Exposure of Synthetic Resin for Buildings
- KS F 4910** Sealant for Buildings
- KS F 2012** Float Plate Glass and Polished Plate Glass
- KS L 2317** Chemical Volumeter for Glass
- KS L 5210** Portland Cement
- KS M 6518** Physical Testing Method of Gum

3. Definition Definitions on the terminologies used in this standard shall conform to **Appendix 1** of **KS F 4019**.

4. Test

4.1 Slump Test

4.1.1 Testing Equipment The following testing equipments shall be used to perform the slump test:

a) **Grooved Container** As shown in Fig. 1, the grooved container made of aluminum alloy ⁽¹⁾ or corrosion-resistant metal, the length of the container shall be $150 \pm 0.2 \text{ mm}$, its both ends shall be open and one of the sides of the bottom area shall be $50 \pm 0.5 \text{ mm}$, satisfying either of the following size of section:

1) Width $10 \pm 0.2 \text{ mm}$. Depth $10 \pm 0.2 \text{ mm}$

2) Width $20 \pm 0.2 \text{ mm}$. Depth $10 \pm 0.2 \text{ mm}$

Note ⁽¹⁾ Aluminum alloy specified in the KS D 6701 or anodized aluminum alloy specified in the KS D 8301.

b) **Polyethylene Sheet** Polyethylene sheets used for the test shall be less than 0.5mm thick whose width is as big as it can cover the inside bottom of the grooved container.

c) **Air-circulation Type Pyrostat** Air-circulation type pyrostat used for the test shall be adjustable the temperature to $50 \pm 2^\circ\text{C}$ and $70 \pm 2^\circ\text{C}$.

d) **Pyrostat** Pyrostat used for the test shall be adjustable the temperature to $5 \pm 2^\circ\text{C}$.

e) **Ruler** Rulers used for the test shall be as precise as to measure up to mm.

4.1.2 Preparation of the Specimen Three specimens shall be prepared for each testing temperature. Lay 1 pc of polyethylene sheet on the inside bottom of each grooved container ⁽²⁾ and fold out the top of the sheet. Fill the specimen which has been stored at $235 \pm 2^\circ\text{C}$ for 24 hours inside the container. The following cares shall be taken while filling the specimen inside the container:

a) Prevent air from entering the container.

b) Fill the specimen by pushing it to inside area of the container.

c) Make the surface of the specimen even so that it can be equally leveled to the top and both ends of the container.

Note ⁽²⁾: Containers shall be thoroughly cleaned and dried.

4.1.3 Testing Methods Test shall be performed according to the following methods:

a) Test may be performed at 5°C , 50°C or 70°C . Test may be performed with respect to the vertical side or horizontal size of slump according to the temperature.

b) **Slump (vertical)** When a specimen is prepared, hang it perpendicularly as shown in Fig. 1 and store it at the test temperature for 24 hours. Measure the length of the specimen melted from the lower part of the groove of the container to the front end of the melted specimen with a ruler.

c) **Slump (horizontal)** When a specimen is prepared, put the specimen horizontally and store it at the test temperature for 24 hours as shown in Fig. 2. Measure the specimen discharged from the end of the grooved container to the horizontal direction with a ruler.

d) Slump (mm) shall be indicated with average value, rounding off the fractions to integer.

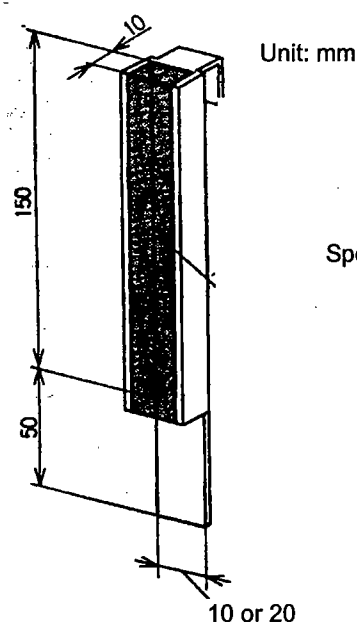


Fig. 1 Slump (vertical)

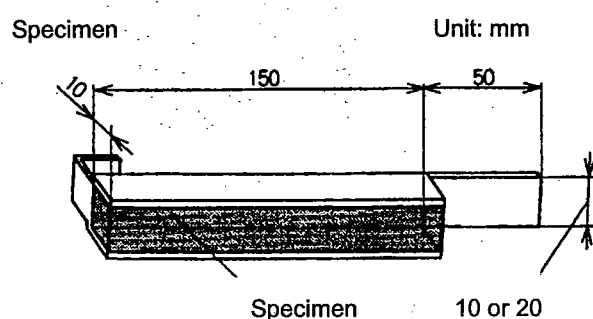


Fig. 2 Slump (horizontal)

4.2 Elastic Recovery Test

4.2.1 **Testing Equipment** Testing equipment for elastic recovery test are as follows:

a) **Grooved substrate** Grooved substrate shall be made of aluminum alloy ⁽³⁾ and its section shall be 12 x 12mm with its thickness of 2mm and length of 70mm as shown in Fig. 3. The grooved substrate shall be cleaned with methyl ethyl keton (MEK) and dried with clean cotton cloth.

Note⁽³⁾ Aluminum alloy that is specified in the KS D 6759 or anodized aluminum alloy specified in the KS D 8301.

b) **Spacer for Preparation of Specimen⁽⁴⁾** Spacer shall be as big as 12 x 12 x 10mm. No sealant shall be attached to it.

Note ⁽⁴⁾ Surface shall be deformed if the materials of spacer are easily adhered to the specimens.

c) **Spacer for Maintaining Strain** Spacers for maintaining strain are categorized as follows:

1) **Extension Spacer** That which can extend specimens to 125%, 160% and 200% of the width of joints as shown in Table 1 (a).

2) **Shearing Strain Spacer** That which can maintain the specimen by adding 30% of shearing strain of the width of joints to the longitudinal direction as shown in **Table 1 (b)**.

Table 1 (a) Extension Ratio and Width of Joint at the Extension

Extension Ratio (l/l_0)%	Width of Joints at the Extension (l_1)mm
125	15.0
160	19.2
200	24.0

* Width of joints in the beginning is 12.0mm.

Table 1 (b) Shearing Strain Ratio and Amount of Shearing Strain

Shearing Strain Ratio (l_s/l_0) %	Amount of Shearing Strain (l_s)mm
30	3.6

* Width of joints in the beginning is 12.0mm.

d) **Deforming Agent** Poly-tetra-fluor-ethylene film used for preparation of the specimen.

e) **Glass Plate** That whose surface is finished with talc powder.

f) **Vernier Calipers** That which can measure minimum 0.1mm.

g) **Tension Tester** That which can control the tension velocity to 5-6mm/min.

h) **Air-circulation Type Pyrostat** That which can control the temperature to $70 \pm 2^\circ\text{C}$.

i) **Water Tank** That which can thoroughly immerse the specimens.

4.2.2 Preparation of Specimen Prepare each 3 specimens for the following two cases: extension of the width of joints; and shearing strain. As shown in **Fig. 3**, make $(12 \pm 0.3) \times (12 \pm 0.3) \times (50 \pm 0.6)$ mm space for each specimen with 2 grooved substrate and 2 specimen-making spacer as shown in **Fig. 3**. Fill the specimen which has been stored at $23 \pm 2^\circ\text{C}$ for 24 hours in the specimen-making spacer and grooved substrate.

unit: mm

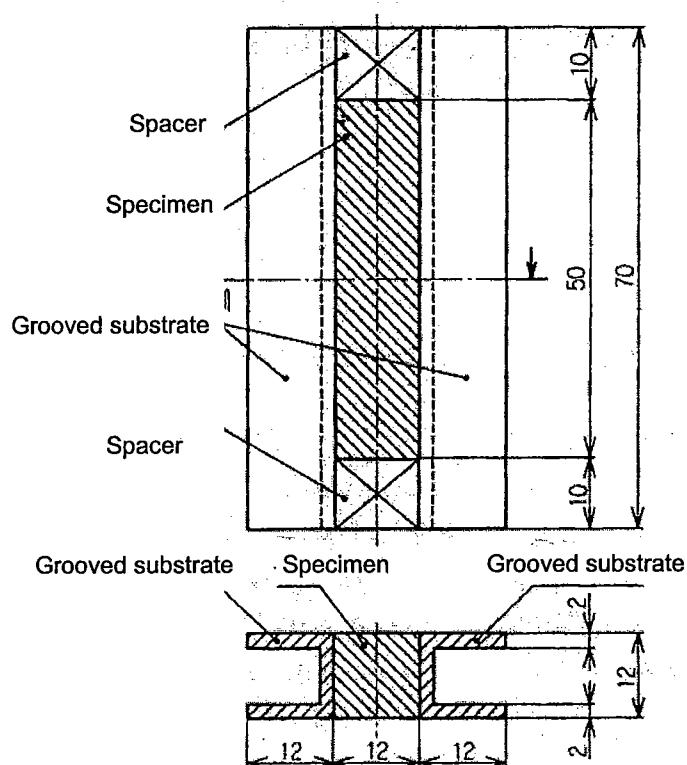


Fig. 3 Specimen for Elastic Recovery Test

Care shall be taken for the following items at the filling of specimen.

- a) Prevent air from entering substrate surface
- b) Fill the specimen by pushing it to inside area of the container.
- c) Make the surface of the specimen even so that it can be equally leveled to the top of the specimen-making spacer and grooved.

Lay the specimen with a manner as shown in Fig. 4 and immediately remove the deformer from the specimen so that the specimen may be easily hardened and dried. Leave the specimen-making spacer as the way it is installed.

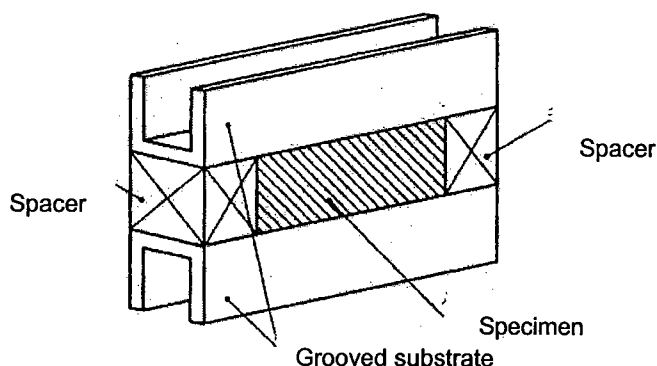


Fig. 4 Specimen Installation Method during Curing for Hardening

4.2.3 Curing for Specimen Specimens may be cured with either curing condition A or curing condition B after the consultation between the vendor and customer. After curing, store the specimens at $23\pm 2^{\circ}\text{C}$. $(50\pm 5\%)$ RH for 24 hours.

a) **Curing Condition A** Store the specimens at $23\pm 2^{\circ}\text{C}$. $(50\pm 5\%)$ RH for 28 days.

b) **Curing Condition B⁽⁵⁾** After curing according to the curing condition A, repeat the following cycle 3 times.

The cycle may be performed in order of 3), 4), 1) and 2).

1) Store the specimens at $70\pm 2^{\circ}\text{C}$ for 3 days.

2) Immerse the specimens in the $23\pm 2^{\circ}\text{C}$ clean water for 1 day.

3) Store specimens in the $70\pm 2^{\circ}\text{C}$ water for 2 days.

4) Immerse the specimens in the $23\pm 2^{\circ}\text{C}$ water for 1 day.

Note⁽⁵⁾ The curing condition A is to check the effect by heat and water, but not to assess the durability of the sealant.

4.2.4 Testing Methods Specimens shall be tested according to the following methods:

a) Test shall be performed at $23\pm 2^{\circ}\text{C}$. $(50\pm 5\%)$ RH.

b) Take out the specimen-making spacer from the specimen and measure the width of joint (l_0) between the both ends of the specimen with a vernier calipers. Install the specimen on the tension tester and extend it with 5-6mm/min velocity until it is extended to 125%, 160% and 200% of the width of the joint. The width of the joint at the time of extension is l_1 .

Incase of shearing strain, allow the specimen crisscrossed by 30% of the width of joint to the longitudinal direction of the specimen without changing the width of joint, and the strain volume from this will be l_1 .

The extension ratio and the width (l_1) of joint at the time of extension with respect to the initial width (l_0)

12.0mm of joint of the specimen shall be specified in **Table 1 (a)** and shearing strain ratio and shearing strain volume (l_s) shall be specified in **Table 1(b)**.

- c) Maintain the width of joint at the time of extension or strain volume at the time of shearing strain for 24 hours, using the extension spacer or shearing strain spacer. Take out the extension spacer or shearing strain spacer and put the specimens on the glass plate whose surface is finished with talc powder as shown in **Fig. 5**. Wait for 1 hour, then measure the width (l_2) of joint at the time of elastic recovery or the shearing strain volume ($l_{s,2}$) at the both ends of the specimen.

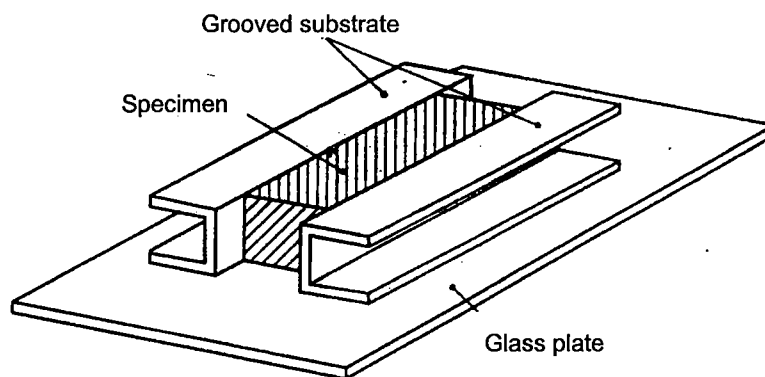


Fig. 5 Method of Placing Specimen for Measurement

- d) Calculate the elastic recovery (%) for 3 specimens and calculate according to the following equations, rounding off fractions to integer.

$$Re = \frac{l_1 - l_2}{l_1 - l_0} \times 100 \quad \text{Or, } Re = \frac{l_s - l_{s,2}}{l_s} \times 100$$

Where, Re : Elastic recovery (%)

l_0 : Initial width of joint (mm)

l_1 : Width of joint at the time of extension (mm)

l_2 : Width of joint at the time of recovery (mm)

l_s : Strain volume at the time of shearing strain (mm)

$l_{s,2}$: Shearing strain volume at the time of recovery (mm)

4.3 Tension Characteristic Test

4.3.1 Test Equipment Equipments to be used for the test are as follows:

- a) **Substrate and Specimen** Of the aluminum plate (1), mortar plate (6) and glass plate (7) as shown in **Fig. 6** and **7**, one of these may be taken as substrate. It is also allowed to use the substrate specified in the item **4.14.1 e)** and the specimens specified in the item **4.14.2**. Surfaces of substrate shall be thoroughly cleaned with the method specified below:

Unit: mm

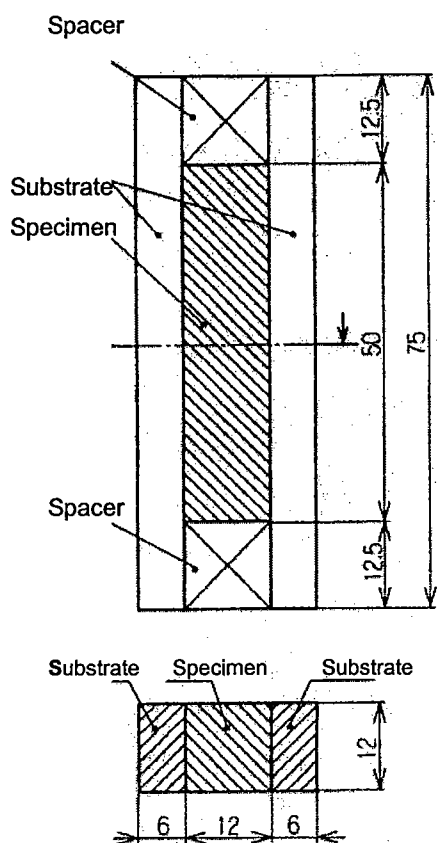


Fig. 6 Aluminum and Glass Specimens

Unit: mm

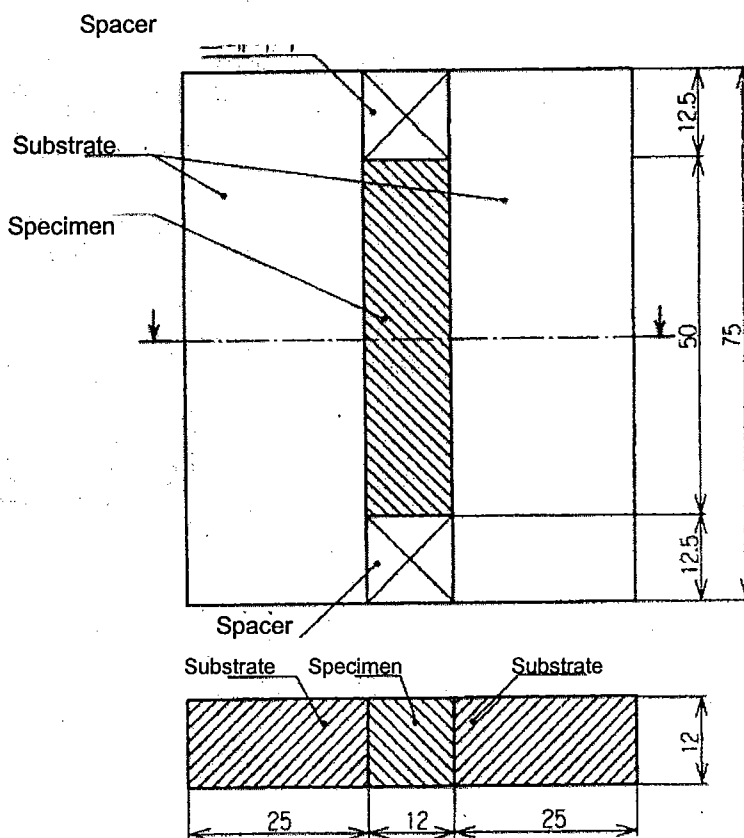


Fig. 7 Mortar Specimen

- 1) **Aluminum Plate** Clean the aluminum plate with methyl ethyl keton (MEK) and dry with clean cotton cloth.
- 2) **Mortar Plate** Grind the surface of substrate with a grinder and remove the dirt or dust with a brush.
- 3) **Glass Plate** Clean the glass plate with methyl ethyl keton (MEK) and dry with clean cotton cloth.

Note (6) : Mortar plate shall be formed by placing Portland cement specified in the **KS L 5201** inside the frame (steel or wooden). Take out the mortar from the frame after 24 hours and cure it at room temperature for 13 days and store it at $23 \pm 2^\circ\text{C}$, $(50 \pm 5)\% \text{RH}$ for more than 14 days. The substrate surface shall be the bottom or cutting area at the time when the specimen is formed.

(7) : That which is specified in the **KS L 2012**.

Remarks: If high modulus specimen is to be tested, it is recommended to reinforce the glass plate.

- b) Specimen-making Spacer⁽⁴⁾** The size of specimen-making spacer shall be $12 \times 12 \times 12.5 \text{ mm}$ and it shall be properly structured so that the specimen may not be adhered to it.

- c) **Deformer** Deformers shall conform to the item 4.2.1 d).
- d) **Tension Tester** Tension tester shall conform to the item 4.2.1 g), having tension test pyrostat that can set the temperature to $-20\pm 2^{\circ}\text{C}$.
- e) **Low-temperature Pyrostat** That which can adjust temperature to $-20\pm 2^{\circ}\text{C}$.
- f) **Air-circulation Type Pyrostat** That which is specified in the item 4.2.1 h).
- g) **Water Tank** That which is specified in the item 4.2.1 i).

4.3.2 Preparation of Specimen Prepare 3 specimens for each test temperature. As shown in Fig. 6 and 7, each specimen is assembled with 2 substrate and 2 specimen-making spacers. Make $(12\pm 0.3) \times (12\pm 0.3) \times 50\pm 0.6\text{mm}$ and put the specimen on the deformer. When necessary, a primer specified by the sealant manufacturer may be used. Fill the specimen which has been stored at $23\pm 2^{\circ}\text{C}$ for 24 hours between the substrate and specimen-making spacer.

Care shall be taken for items 4.2.3 a) and b). Grooved substrate shall be called. Place the specimen as shown in Fig. 8 and immediately remove the deformer so that the specimen may be easily hardened and dried, attaching the specimen-making spacer.

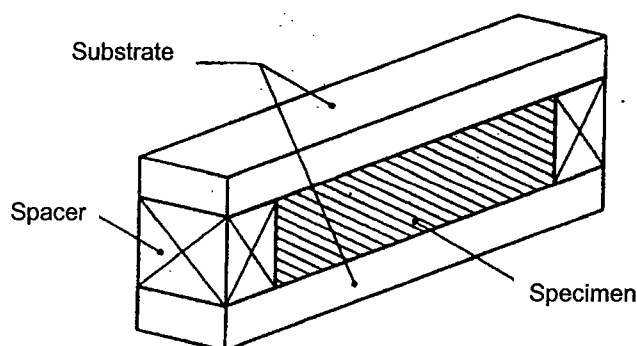


Fig. 8 Method of Setting Specimen During Hardening and Curing

4.3.3 Specimen Curing Specimen shall be cured as indicated on the above item 4.2.3.

4.3.4 Testing Method Testing methods are as follows:

- a) Test shall be performed at $23\pm 2^{\circ}\text{C}$ and $-20\pm 2^{\circ}\text{C}$. If test is to be performed at -20°C , the specimen shall be stored at $-20\pm 2^{\circ}\text{C}$ for more than 4 hours before the test.
- b) Take out the specimen-making spacer from the specimen and attach the specimen on the extension tester. Extend the specimen with 5-6mm/min velocity until the specimen is destructed and record the stress and strain curves.
- c) The tensile stress (N/mm^2) during the specific extension shall be taken as average value, rounding off