



Test Method of Sealant for Vehicle

KES T - L027

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1. Purpose

The purpose of this standard is to insure proper quality and to improve quality level by standardizing the sealant test method.

2. Scope of Application

This standard shall be applied to the test method of sealant used for water and dust proof of vehicles.

3. General Condition for Testing

- (1) The temperature and the humidity of test room shall be $23 \pm 2^\circ\text{C}$ RH $50 \pm 5\%$.

Under unavoidable circumstances, however, use the standard temperature state third class ($20 \pm 5^\circ\text{C}$) and the standard humidity state third class ($65 \pm 20\%$). In this case, be sure to record the temperature and the humidity in the test result.

- (2) Specimen status

The specimen should be such a one that 12 hours have passed since fabrication, and be kept in the test room state for more than an hour before testing.

4. Method for Sample Selection

Select specified amount of specimen from the lot which has been confirmed to have the same quality and put them in a sealed vessel not to evaporate. use them after stirring enough to make uniform state.

5. Sample and Specimen Preparation

Keep the sample and specimen with the state of 3 clause for enough time.

6. Type of Specimen Material and Surface Treatment

For specimen material in principle, use 1.0mm cold rolled steel plate of class 1 specified in KES B-A001(Cold rolled steel plate and strip), and for surface treatment, polish with No. 240 specified in KS L 6003(Polishing paper) and then cleanse with toluene or acetone.

However, the specimen material and the surface treatment method can be changed in

agreement between companys concerned.

7. Specimen Heating Condition

As for specimen heating condition, follow the Table 1 below.

However, it can be changed in agreement between persons concerned.

Table 1

Specimen	Temp. °C	min
Body assembly process	$170 \pm 2^{\circ}\text{C}$	30
Painting process	$140 \pm 2^{\circ}\text{C}$	30

8. Test Result Record

Record the test condition and the breakdown state in the test result.

Cf : Inner breakdown of sealant(agglomerate breakdown)

Af : Adhesion surface breakdown(adhesion breakdown)

Bf : Specimen material breakdown(material breakdown)

9. Testing Method

9.1 Appearance

9.1.1 Purpose

This test is to inspect uniformity, gel, inclusion of foreign materials and color of sealant.

9.1.2 Testing Apparatus

(1) Glass plate : Use common glass of $200 \times 200\text{mm}$.

(2) Spatula : Use stainless steel material of 15~20mm wide, 1~2 thick, and 200~250mm long.

9.1.3 Testinf method

After blending sample well and plastering it with a spatula on the glass plate which has been cleansed with 20~30g solvent, inspect uniformity, gel, inclusion of foreign materials, color, etc.

9.1.4 Indication

Record the state on the test result if the specimen disorder has occurred.

9.2 Specific gravity testing method A

9.2.1 Purpose

This test is to measure the specific gravity of sealant by using aluminum vessel for specific gravity measurement.

9.2.2 Test apparatus

(1) Chemical balance :

Use one with 1mg sensitivity.

(2) Aluminum plate for the specific gravity measurement :

See Figure 1. Material KS D 6701(Aluminum and aluminum alloy plate) A1P1 - 1/2H

(3) Beaker :

Should be big enough to have aluminum plate for specific gravity measurement inside.

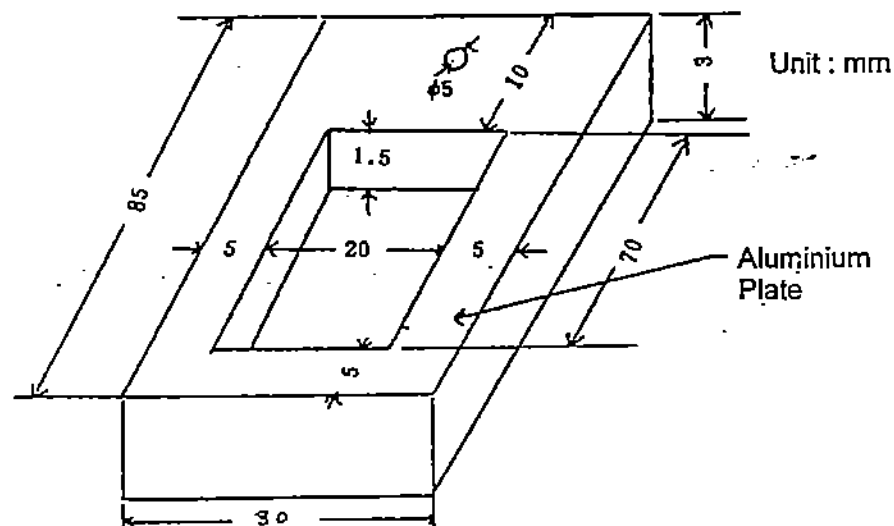


Figure 1 Aluminum plate for specific gravity measurement

9.2.3 Measurement method

Record the aluminum plate weight in the air and in the water and then dry the plate on cloth. Plaster the sample into the groove of the aluminum plate for specific gravity measurement to prevent air, and then measure the weight while in distilled water of $20 \pm 2^\circ\text{C}$ to calculate the

specific gravity with the following expression.

$$\text{Specific gravity } D = \frac{W4 - W2}{(W4 - W2) - (W3 - W1)}$$

where W1 : weight of aluminum plate under water (g)

W2 : weight of aluminum plate in air (g)

W3 : weight of aluminum plate plus sample under water(g)

W4 : weight of aluminum plate plus sample in air(g)

9.2.4 Result-in value

Record the averaged result value by measuring for three specimens.

9.3 Specific gravity testing method B

(1) Test apparatus

Specific gravity cup :

Made from brass and coated with chrome, it is shaped circular and its lid has been engraved and has a hole to discharge in the groove.

At $20 \pm 2^\circ\text{C}$, water the cup and put the lid on. And then wipe out water pushed out and measure the weight. Weight of water shall be $100 \pm 0.5\text{g}$ of its volume and the cup weight should not exceed 200g.

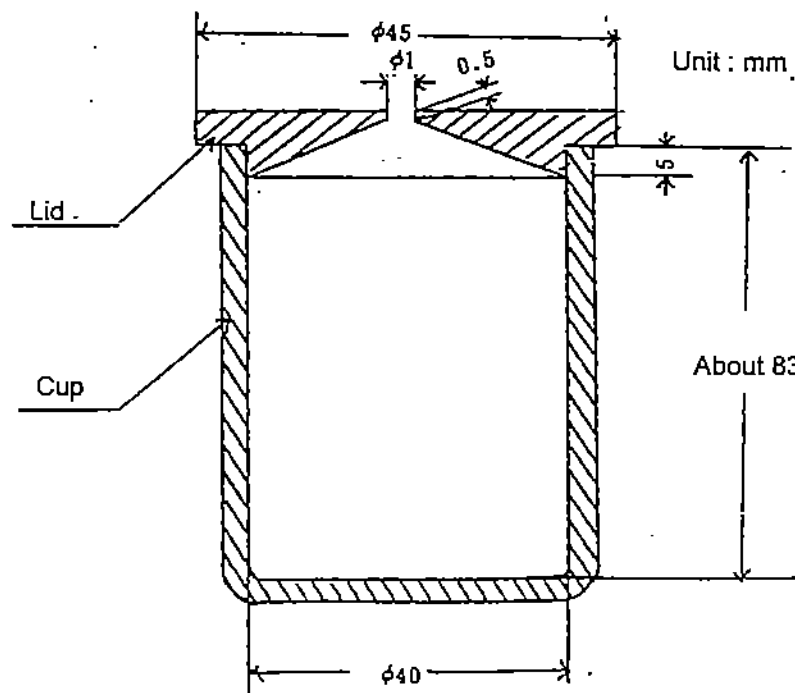


Figure 2 Specific gravity cup

(2) Measurement method

Keep the specimen for 3 hours at $20 \pm 2^\circ\text{C}$. Then put it fully in the cup watching the bubble shall not enter and cover the lid. Wipe out water pushed out from the hole and measure the weight.

Measuring the sample weight and multiplying 0.01 on the value, report it as the specific gravity of the sample.

Non-volatile ratio

This test is for measuring non-volatile ratio of sealant after heating or drying.

9.4.1 Test apparatus

(1) Dryer :

Use one with hot blast circulation type, which can maintain fixed temperature.

(2) Weighing method :

Use one with lid whose inner diameter is about 50mm, and depth is about 30mm.

(3) Chemical balance :

Use the one specified in 9.2.2 (1).

(4) Desiccator :

Use one with silica gel as dryer.

(5) Aluminum foil dish :

Use aluminum foil dish formed circular along the inner wall of the weighing bottle 50mm.

9.4.2 Measurement method

Measure the weight of weighing bottle and aluminum foil.

Quickly pick 1.5g of the sample into the aluminum foil dish which has been formed circular along the inner wall of the weighing bottle 50mm, close the lid and measure the weight. After open the lid leaving indoors for 30 to 60 minutes, dry it in the dryer kept at $105 \pm 2^\circ\text{C}$ for three hours. Cool it in the desiccator and then close the lid measuring its weight and calculate non-volatile ratio according to the following expression.

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9.7.2 Specimen preparation

For forming sealant, measure by piling the sample over 20mm. (See Figure 3)

3)

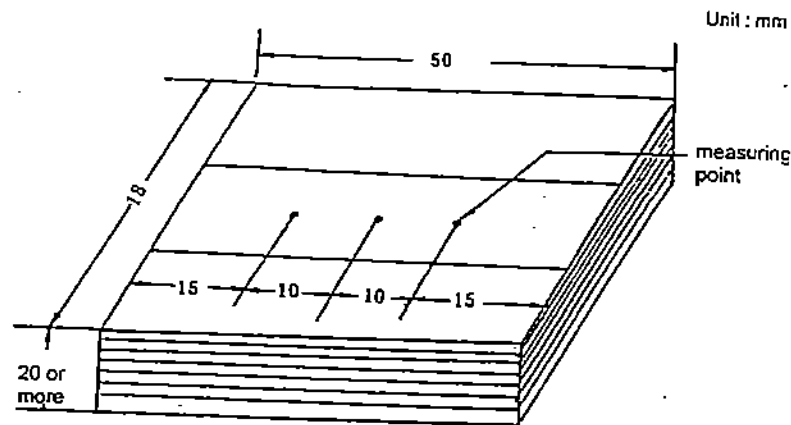


Figure 3

9.7.3 Measurement method

Fill the accompanying vessel of the penetrating meter with the sample by using spatula (be careful so that bubbles shall not enter), and extract the included air by patting the vessel 2 to 3 times. By using spatula, remove rest of the sample in the vessel and put the vessel on the penetrating meter stopper attaching the cone head with the center portion of the sample surface. Confirm the center and the graduations face and press the keeper to let in the cone for 5 seconds by its own weight. And then quietly attaching the lock for penetrating measurement with top of the apparatus, read the scale.

In principle, use one with 0 to 360 graduations range.

9.7.4 Record

For the test result, record the average value over the three samples.

Storage stability

This test shall be performed in order to measure storage stability by change rate of the sealant viscosity and penetrating.

9.8.1 Test apparatus

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(1) Vessel :

Use the one specified in 9.4.2 (2).

(2) Thermostatic tank : Should be controllable to $45 \pm 2^\circ\text{C}$.

9.8.2 Measurement method

(1) Forming sealant

Put the sample on liner paper leaving 70 ± 2 hours at $40 \pm 2^\circ\text{C}$, and then put it out leaving at normal temperature for 60 minutes, measure penetrating according to 9.7.3.

$$\text{Change rate} = \frac{\text{penetrating after leaving alone} - \text{penetrating before testing}}{\text{penetrating before testing}} \times 100$$

(2) Unsettled sealant

Put the sample in the about 500ml vessel to seal, and leave it 70 hours at $45 \pm 2^\circ\text{C}$ and then leave it at normal temperature for 60 minutes. Next, observe any abnormality like gel or separation, and measure the viscosity according to the clause 9.5 to calculate the change rate with the following expression.

$$\text{Change rate(\%)} = \frac{\text{viscosity after leaving alone} - \text{initial viscosity}}{\text{initial viscosity}} \times 100$$

9.9 flash point

This test is for measuring the flash point of sealant.

9.9.1 Test apparatus

- (1) For the expected flash point of 80°C or over : Use KS M 2010(Flash point testing method for crude oil and petroleum products) Cleveland open type.
- (2) For the expected flash point of 80°C or below: Use KS M 2010 Tag closed type.

9.9.2 Measurement method

(1) For the expected flash point of 80°C or over

Fill the cup with the sample up to the marked line attaching a thermometer, and raise the temperature by 14 to 17°C per minute

indoors with no wind. When the specimen temperature approaches the expected flash point, pass the flame above the sample each time the temperature rises by 2°C to check if it flashes. When it flashes, record the sample temperature.

- (2) For the expected flash point of 80°C or below

Put about 50ml of sample in the vessel and close the sealing lid.

Heat the sample so that its temperature rises by about 0.5°C per 30 ± 3 seconds. When the temperature reaches about 6°C below the expected flash point, put the sample flame in the vessel for a while and put it out soon. At this point, if complete flashing is confirmed, record the sample temperature.

9.9.3 Record

Record the average value over three measurement.

9.10 Fluidity

This test is for measuring the sealant fluidity.

9.10.1 Test apparatus

- (1) Fluidity testing plate : Follow Figure 4.
- (2) Stop watch

9.10.2 Measurement method

- (1) Specimen fabrication :

Coat the plate with the sample as in Figure 4, like letter "L" of 5 mm thick and 10mm long.

- (2) Fluidity at normal temperature :

Set up the specimen inclined to 70 degree right after fabrication like Figure 4 and measure the fluidity after 10 minutes.

- (3) Fluidity at heating :

Set up the specimen inclined to 70 degree after fabrication like Figure 5 and measure the fluidity after 10 minutes in a dryer.

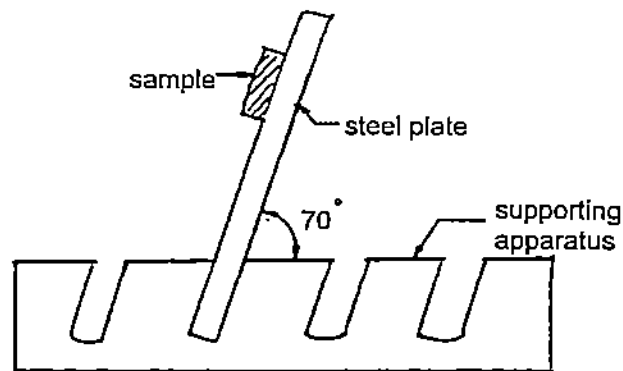


Figure 4

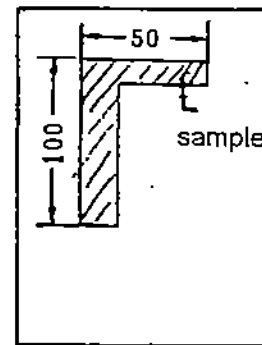


Figure 5

9.11 Combustion durability

This test is for measuring the combustion durability of sealant used in welding.

9.11.1 Test apparatus

Bunsen burner : Use the one with 11mm inner radius.

9.11.2 Specimen fabrication

- (1) Forming sealant : Attach the sample with about 150mm horizontal on the steel plate oil surface (0.8mm thick, 100×300mm) and stick it by reciprocating the roll once.
- (2) Unsettled sealant : Coat the steel plate oil surface with the sample as in Figure 6.

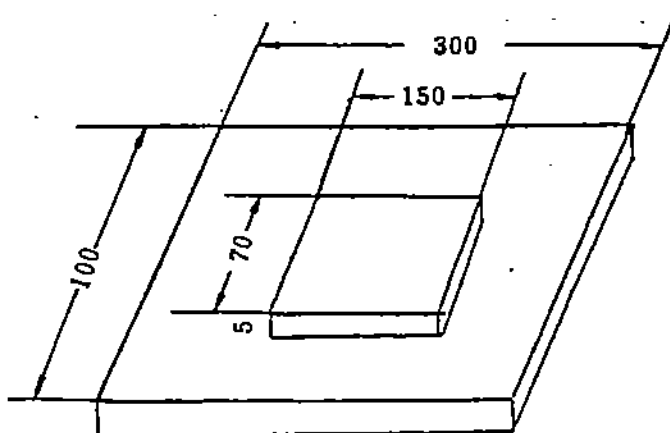


Figure 6

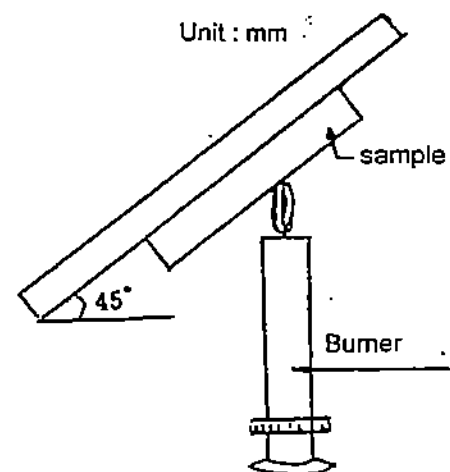


Figure 7

9.11.3 Measurement method

Leave the specimen for 30 minutes at normal temperature after fabrication. Move the burner flame to the completed specimen so as to slightly touch middle of the specimen. Leave the specimen 10 seconds at this state, and take apart the flame recording the vertical combustion duration time in seconds. When it doesn't burn for 2 seconds, draw the flame near the specimen again. Repeat this manipulation 5 times and record counts the flame goes out within 2 seconds.

9.12 Flow back property

This test is performed to inspect stripping off condition of the sealant near spot welding.

(1) Test apparatus

Drill : Should be able to make a hole 8mm diameter on two steel plates.

(2) Specimen fabrication

Attach the specimen on the center of steel plate oil surface (0.8mm thick, 50×100mm) as a circular plate 15mm of diameter and 2mm thick, and overlap another steel plate oil surface. Weld a point on the center by spot-welding and use this in the test.

(3) Measurement method

Gently make a hole on the spot welding center of the specimen by a drill and separate the two steel plates to observe the stripping-off state near spot welding

9.13 Self Leveling property

This test is performed to inspect self leveling property of the unsettled sealant.

9.13.1 Test apparatus

(1) Spread : This should be one made of aluminum as in Figure 8.

(2) Teeth shape spread : This should be one made of aluminum plate as in Figure 9.

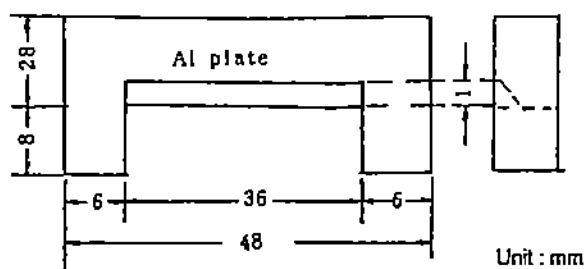


Figure 8

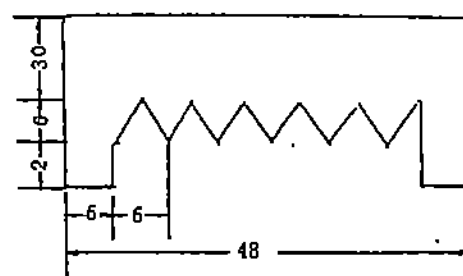
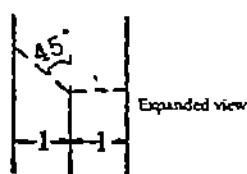


Figure 9



9.13.2 Specimen fabrication

Spreading the sample on Electronic deposition painting steel plate(0.8mm thick, 100×300 mm) uniformly, use this in the test.

9.13.3 Measurement method

Impress teeth shape mark on the specimen with teeth shape spread leave it alone for 10 minutes, and heat with the specified condition and again leave it 60 minutes at normal temperature. Then, paint Top coat with spray gun and leave 10 minutes at normal temperature. Heat again with the specified condition and leave it at normal temperature, then observing flatness of the film and any color changes.

9.14 Hardness

This test is to measure the hardness after sealant hardening.

9.14.1 Test apparatus

(1) Spring type hardness tester :

Use the one specified in KS M 6518(Physical testing method of vulcanized rubber) or equivalent.

(2) Vessel :

Use metallic vessel like the one in Figure 10.

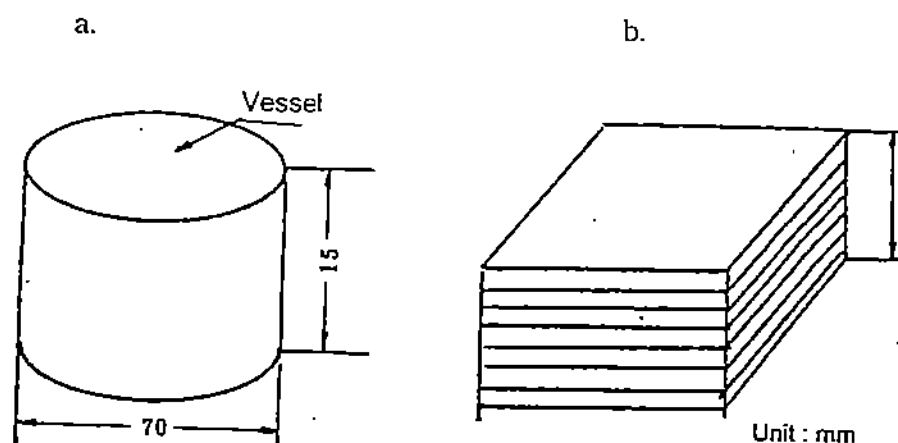


Figure 10

9.14.2 Specimen fabrication

(1) Heat hardening sealant, foam type sealant :

Put the sample in the vessel shown in Figure 10-a, watching bubbles shall not enter. Heating under specified condition and leaving 60 minutes at a normal temperature, use this for testing.

(2) Solvent volatile hardening sealant :

Coat the liner paper with the sample 2mm thick and 50mm×50mm wide leaving it alone 70 ± 2 hours, and then use this for testing by overlapping 12mm thick or more as shown in Figure 10-b.

9.14.3 Measurement method

Locate the specimen horizontal, and press the pressure-pin setting up vertically on the specimen. Then read the scale to measure the hardness. Here, the pressure-pin is classified by the following usage.

Type A : foam type sealant, solvent volatile hardening sealant

Type C : heat hardening sealant

9.14.4 Record

Record the result values and the pressure-pin shape.

9.15 Absorption rate

This test shall be applied to measure the absorption rate of sealant.

- (1) Heat foam hardening type forming sealant : Put the sample on center of the aluminum plate whose weight is known, as in Figure 11, and leave it

as it is for 10 minutes. And then heat it under specified condition and leave as it is 60 minutes at a normal temperature. Then measure the weight and submerge it in water of $10 \pm 1^\circ\text{C}$ for 22 hours. Take it out and quickly wipe out water on it with filter paper. Measure its weight and calculate the absorption rate with the following expression.

$$\text{absorption rate} = \frac{\text{sample weight after absorption} - \text{sample weight before absorption}}{\text{sample weight before absorption}} \times 100$$

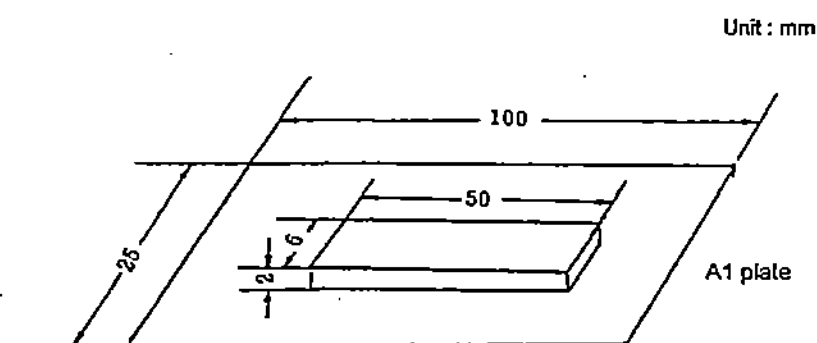


Figure 11

(2) heat foam hardening type unsettled sealant :

Follow 9.15.1 (1).

Here, submerging time is 20 hours and the specimen shape looks like Figure 12.

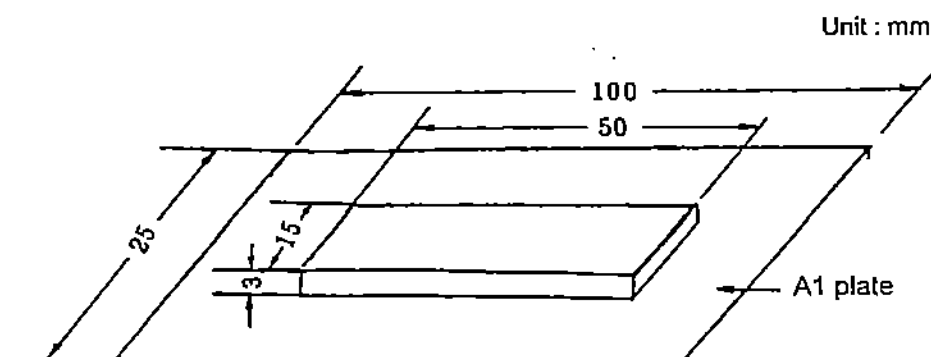


Figure 12

- (3) For solvent volatile acid hardening type unsettled sealant and non-hardening type unsettled sealant.

Follow 9.15.1 (1).

Before testing, leave the specimen 70 hours at a normal temperature during fabrication process and then use this. The specimen shape shall look like Figure 12.

9.16 Swelling rate

This test shall be performed to measure the swelling rate of sealant for rubber materials.

9.16.1 Measurement method

(1) Forming sealant

Prepare soft rubber(25×50mm) and measure its mass in air and in 20 ±1°C water. Stick the sample on both sides of the soft rubber watching bubbles shall not enter, and then leave it at a normal temperature for 22 hours. Take the sample off the soft rubber and clean it with the specified solvent. Then measure the soft rubber mass in air and in water, and calculate the swelling rate with the following expression.

$$\text{Swelling rate (\%)} = \frac{(m_3 - m_4) - (m_1 - m_2)}{m_1 - m_2} \times 100$$

where m_1 : soft rubber mass before testing

m_2 : soft rubber mass in water before testing

m_3 : soft rubber mass after testing

m_4 : soft rubber mass in water after testing

(2) Unsettled sealant

Prepare soft rubber(25×50mm) and measure its mass in air and in 20 ±1°C water. Put the sample in vessel, and rotating soft rubber in the sample, submerge it watching bubbles shall not enter. Leave it at a normal temperature for 22 hours and then take it out wiping out the attached sample. Measuring the soft rubber mass in air and