

## 4004 Standard of Peel Strength Test

This test specifies the determination of the peel resistance of an adhesive by measuring the peeling force of a bonded assembly of several adherends.

Peel resistance, which can be expressed as force per unit width, is necessary to bring an adhesive joint to the point of failure and/or maintain a specified rate of failure by means of a stress applied in a T-peeling mode with a specified width.

This test applies to the peel resistance of any flexible-to-flexible assembly and flexible-to-rigid assembly, such as plastics-to-plastics, plastics-to-aluminum, plastics-to-paper.

**Apparatus** Tensile-testing machine, or any other machines meets the requirement of this test. This machine shall permit the measurement and recording of the applied force with an accuracy of  $\pm 1\%$ .

**Conditioning** Test specimens shall be placed in  $23\pm 2^\circ\text{C}$  and  $50\pm 5\text{RH}\%$  for at least 4 hours. This condition also applies to the test.

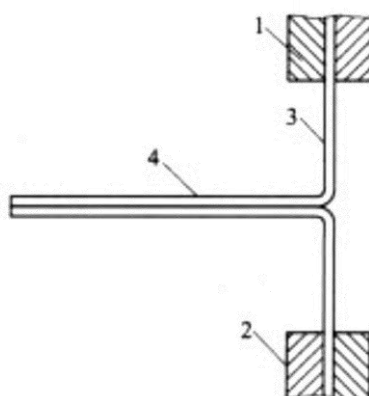
**Test specimens** Test specimens of dimensions shall be cut from bonded laminates with width of  $15.0\text{mm}\pm 0.1\text{mm}$  and length  $\geq 200\text{mm}$ . The direction of specimens shall be both in machine direction and in cross direction. The bonding direction is the machine direction. The number of specimens tested shall be five. If the bonded laminate length is less than 200mm, test specimens of dimensions shall be cut in its real length if test requirements can be meet.

Along the length direction, pre-peel for  $\geq 50\text{mm}$  on the bonded laminates. The unbonded part shall not have apparent damage. If any test specimens are not easy to peel, immerse them into a suitable solvent (i.e. ethyl acetate, acetone) for 20mm in length. Peel after the solvent volatilizes completely.

If the layer cannot be separated from the substrate even by this treatment, the test cannot be carried out. The result is “unable to peel”.

**Procedure** Clamp each leg of the test specimen in the grips of the test machine. The sealed area of the specimen shall be approximately equidistant between the grips. Center the specimen laterally in the grips. Align the specimen in the grips so the seal line is perpendicular to the direction of pull, allowing sufficient slack so the seal is not stressed prior to initiation of the test. Within start of the test, the two unbonded ends of the adherends shall be bent in opposite directions until each end is perpendicular to the bonded assembly, to form a T-shaped specimen (See Figure 1) for clamping in the grips of the test machine. A separation rate of  $300\text{mm}/\text{min}\pm 30\text{mm}/\text{min}$  is generally used. While the test is being conducted, the unbonded part remains unlimited angle in the air. Secure the actual peel length shall be no less than 100mm. If the curve is flat, the minimum peel length shall be no less than 50mm. Report the peel force curve in the

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Fig.1 Specimen Clamping Method

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1. Upper Clamp, 2. Lower Clamp, 3. Peeled Area, 4. Bonded Laminate Area

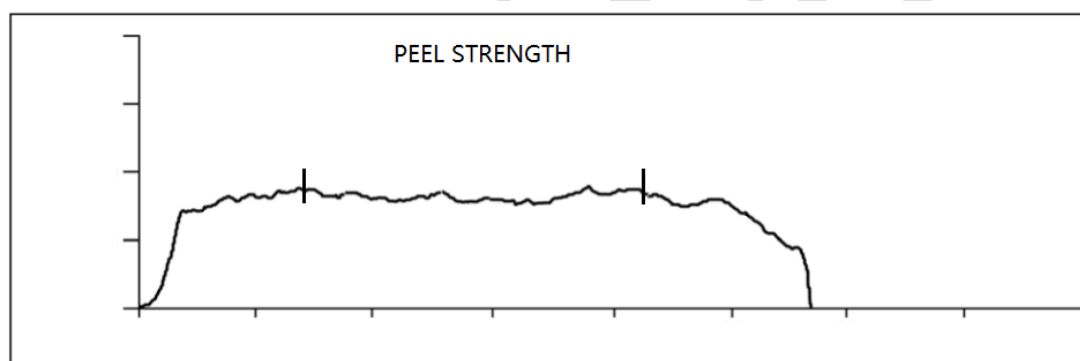
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**Results and conclusions** Fig.2 illustrates the effect of an algorithm that uses data only from the central 50% of the curve to calculate the average. Calculate the average value of peel resistance both in machine direction and in cross direction for each set of test specimens. Peel resistance values to two significant figures. The unit is N/15mm.



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Fig.2 Calculation of Average Peel Strength

Markers on Peel Profile Plot at 25% and 75%

Establish Data Window of Central 50% for Calculation

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Visual determination of mode of specimen failure or “unable to peel”, conclude as Pass.

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