

## Adhesive Force Measurement with Different Peeling Angles

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### User Benefits

- ◆ The adhesive force can be measured over a range of peeling angles from 10° to 170°.
- ◆ Adhesive force can be measured by peeling at 90° as specified by JIS Z0237.
- ◆ The AGX-V can perform not only peeling tests, but also various other tests such as tensile or compression tests, etc., by changing the jigs.

### Introduction

Adhesive tape has the advantages that it is easy to join two objects together, and it can be peeled off, so it is widely used in industries such as automotive parts, building materials, pharmaceuticals, etc. For example, masking tape is used when painting automobiles and parts with many curves.

It is known that the force (adhesive force) required to peel adhesive tape varies depending on the angle made with the surface to which it is applied. Adhesive tape has various uses and the angle of peeling with respect to the surface on which the tape is applied is not limited to 90° or 180°, so it is necessary to determine the adhesive force for each angle to the surface on which it is applied.

In this test the adhesive force was evaluated with various peeling angles, by reference to the JIS Z 0237 section 10.4.6 for peeling at 90°. The variable angle adhesive tape tensile peeling jigs used in these tests enable measurement of the adhesive force for peeling angles from 10 to 170°.

### Test Specimens

Table 1 shows the test conditions. In these tests, the adhesive force was measured at six angles: 30, 60, 90, 120, 150, and 170°. Masking tape was used for the test specimens, and the adhesive force was calculated from the test force when peeling the tape that was adhering to a test plate. The procedures were as follows.

The test conditions were set by reference to JIS Z 0237 section 10.4.6 for peeling at 90°. In accordance with the standard, the samples were 75 mm or longer, and the range for calculation of the adhesive force was the average value of test force from 50 to 75 mm from the start of peeling.

- Step 1 The test plate was wiped with ethanol to clean it, after which the masking tape was applied. In this case a manual pressure bonding device was used, and the masking tape was bonded using the mass of the roller only. (Fig. 1)
- Step 2 The variable angle adhesive tape peeling jigs were installed in accordance with the required peeling angle, and the test plate was fixed. Fig. 2 shows the 90° case.
- Step 3 One end of the masking tape was gripped with a clamping jig, and by pulling upwards (blue arrow), the masking tape was peeled from the test plate. At this time the test force was measured for calculation of the adhesive force. Note that in Fig. 2, as the clamping jig moved upwards (blue arrow), the test plate was moved in the direction of the red arrow via a pulley, so the peeling angle was always 90°.
- Step 4 The adhesive force was calculated from the following equation.

$$\text{Adhesive force [N/10mm]} = \frac{\text{average test force over displacement range 50 to 75 mm [N]} / \text{sample width [mm]}}{10}$$

Table 1 Test Conditions

Device	: AGX-V Precision Universal Testing Machine 10 kN
Jigs	: Variable angle adhesive tape peeling jigs
Software	: TRAPEZIUM™X-V single peel test conditions
Load cell	: 50 N
Number of test repetitions	: 3 cycles
Speed	: 5.0 mm/sec
Angles	: 30°, 60°, 90°, 120°, 150°, and 170°

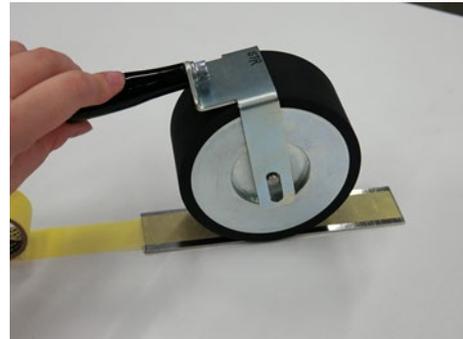


Fig. 1 Manual Pressure Bonding Device

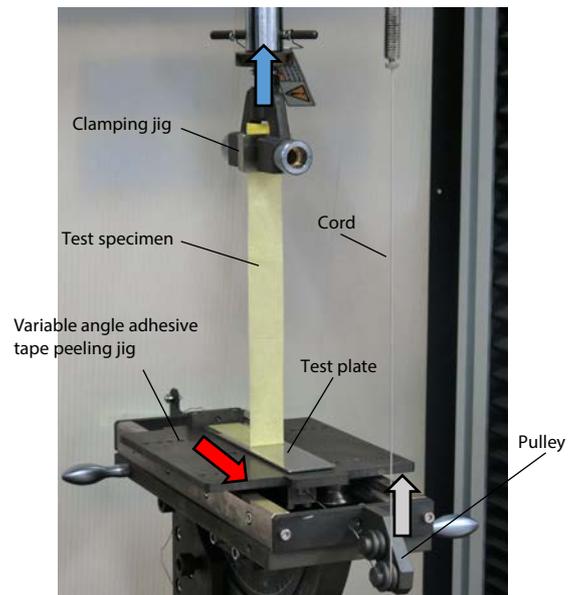


Fig. 2 View of Sample Installed

## Results

Table 2 shows the test results (average values), Fig. 3 shows the adhesive force - peeling angle graph, and Fig. 4 shows the test force - stroke graphs. It can be seen that of the six angles, the adhesive force was highest at a peeling angle of 30°, and was lowest at a peeling angle of 120°. Also the adhesive force reduced as the angle was increased from 30° to 120°, and that the adhesive force increased again as the angle was increased higher than 120°.

Fig. 5 schematically shows the tests at each angle. With the variable angle adhesive tape peeling jigs at the same setting, it is possible to test two angles, for example 60 and 120°, by changing the direction of movement of the peeling jig (red arrow).

Table 2 Test Results (Average Values)

Peeling angle	Adhesive force [N/10 mm]*
30°	2.74
60°	1.10
90°	0.62
120°	0.57
150°	0.64
170°	0.85

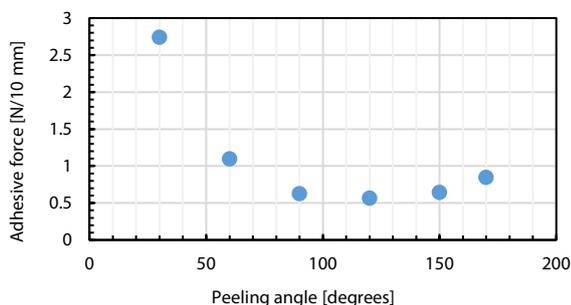


Fig. 3 Peeling Force - Peeling Angle Graph

## Conclusion

The adhesive force of adhesive tape that is widely used in various fields such as automotive parts, building materials, pharmaceuticals, etc., has been evaluated using the AGX-V precision universal testing machine and the variable angle adhesive tape peeling jigs. The results confirmed that the adhesive force varied depending on the angle of the adhesive tape. The function required of adhesive tape varies with its use. The adhesive force required depends on the application, for example in the case of pharmaceuticals peeling must not damage the surface to which the tape is adhering, and for industrial goods the tape must strongly adhere to objects, etc. Evaluation of adhesive force as discussed in this report is useful for selection of adhesive tape and for improvement of functionality.

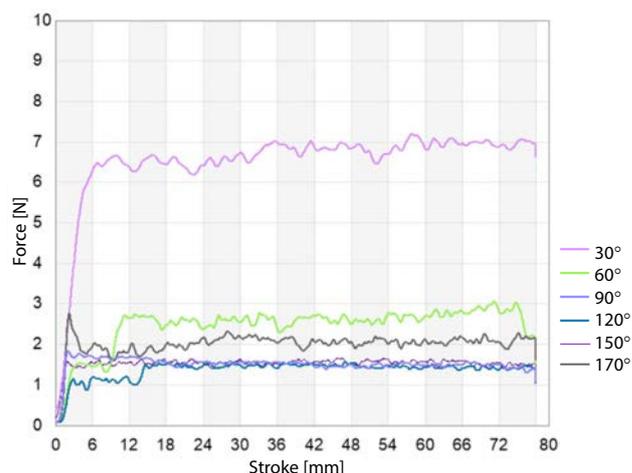


Fig. 4 Force - Stroke Graph

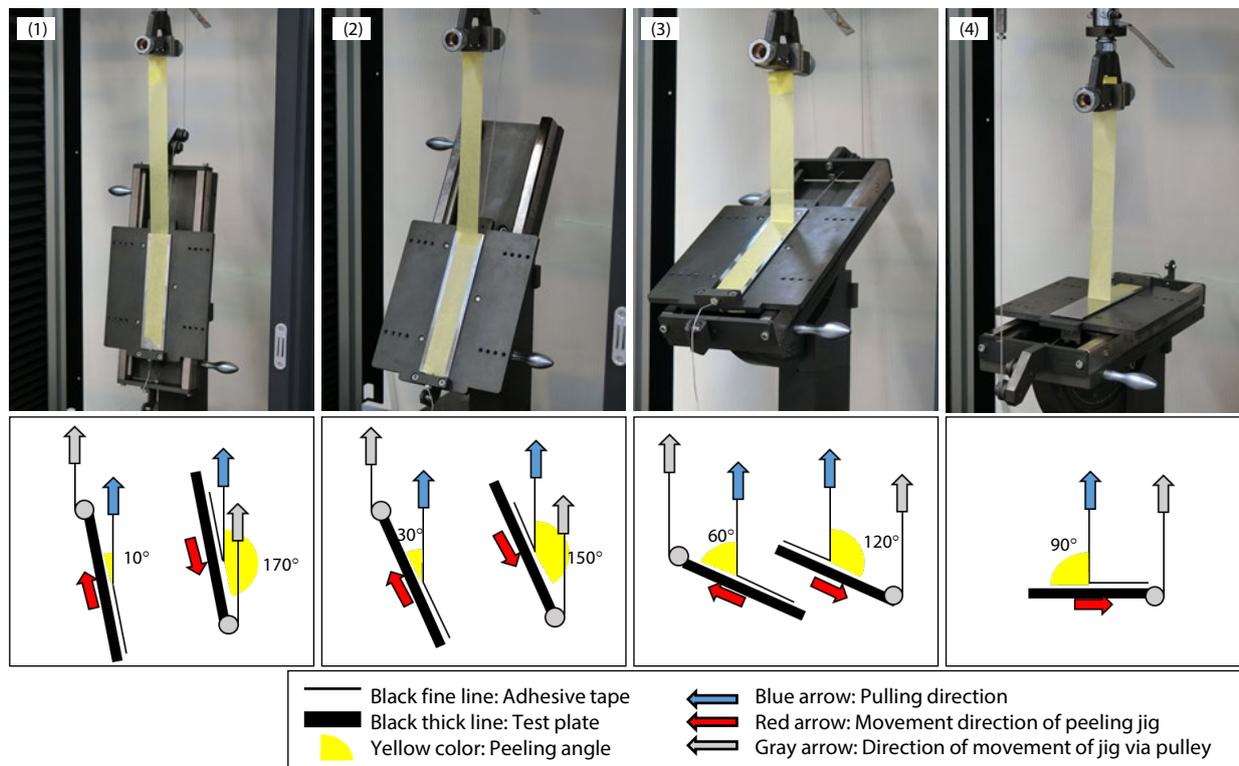


Fig. 5 Schematic View of Tests

(1) 10° and 170° (2) 30° and 150° (3) 60° and 120° (4) 90°

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