

GLUES AND ADHESIVES PEELING AT RIGHT ANGLES

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This is a translation, the French original shall be used in all cases of litigation

Date of translation : 11/10/2000

FOREWORD

*This document is equivalent to the RENAULT document D51 1485. It must not be modified without prior consultation with the Normalisation Department of this Group.
It is in conformity with the agreement reached between this Group and PSA PEUGEOT CITROEN in July 1997.*

1. OBJECT AND FIELD OF APPLICATION

The object of this méthode is to assess the cohesive failure by peeling and the characterisation between a rigid substrate and a flexible cover.

Three processes may be used :

- Process A : for hot or ambient temperature curable adhesives applied to any rigid substrate.
- Process B : for adhesives in solution (aqueous or organic) or in emulsion.
- Process C : for pre-deposited adhesives onto the substrate or the cover during manufacture (for example an adhesive sheet protected by anti-adhesive sheet).

For B and C processes, the flexible cover may be a textile, a rubber or plastic coated textile, a rubber sheet, a plastic sheet, a double sided adhesive tape, etc. The flat rigid substrate may be in any type of material, such as degreased or painted steel sheet, plastic, etc.

2. PRINCIPLE

The test consists of measuring the force required to cause detachment by peeling at an angle of 90° :

- of the adhesive tape applied to a rigid substrate (process A),
- of the flexible cover of the rigid substrate (processes B and C).

3. EQUIPMENT AND REAGENT

3.1. TENSILE TEST MACHINE

Non inertia type tensile test machine with a sensitivity range capable of providing the measurement from 1 newton to 1000 newtons loads. The lower moving jaw must fit the fixture fixing for the right angle peeling test described in paragraph 3.2. and the upper jaw must enable the adhesive tape to be clamped at the end. The travelling speed of the moving jaw is set to 100 mm/min \pm 10 mm/min, unless otherwise specified. The machine must be equipped with a recorder giving the development of the load in terms of the travel of the moving jaw.

3.2. FIXTURE

Suitable for the right angle peeling test, in conformity with appendix 1 and allowing by the servo control displacement of the test specimen and movement of the moving jaw, to maintain the peeling angle close to 90°.

Note : *The right angle peeling device described in this method does not provide a constant angle when the flexible cover is subjected to a noticeable extension under the load required for detachment (in the case of knitted textiles, coated knitted textiles, very flexible sheets, adhesive tapes). In this case, it is recommended to reinforce the flexible cover with the adhesive tape (3.9.).*

3.3. CONDITIONED CHAMBER

At 23°C ± 2°C and 50% ± 5% relative humidity.

3.4. SUBSTRATE

Of dimensions : 200 mm x 100 mm and minimum thickness 0,9 mm.

3.5. FLEXIBLE COVER

Of dimensions : 250 mm x 50 mm the width of which may be less than 50 mm providing that it remains at least equal to 10 mm.

3.6. TEMPLATE 2 MILLIMETRE THICK

Or any other dimension defined in the standard documents for depositing a layer of adhesive, see appendix 2.

3.7. TEMPLATE 4 MILLIMETRE THICK

For the possible calibration of the second deposited layer of adhesive, see appendix 2.

3.8. METAL REINFORCEMENT

Of dimensions : 200 mm x 25 mm x 0,2 mm and meshing equal to 0,5 mm.

3.9. REINFORCED OR NON REINFORCED ADHESIVE TAPE**3.10. CUTTING TOOL****3.11. FILMOGRAPH**

CH. BRAIVE S3 type, with a 250 µm opening and application width greater than 55 mm for liquid adhesives.

3.12. DEVICE FOR APPLYING PRESSURE

For applying a pressure of 0,02 MPa on the test specimen or any other pressure stipulated in the standard documents.

3.13. SPACER PLATES

Of dimensions : 190 mm x 50 mm or any other dimensions required by the fixture, of even thickness between 3 mm and 6 mm, cut out of a semi-flexible cellular material such as spongy rubber, expanded vinyl polychloride or polyurethane foam with a lift of P_{50} close to 200 N/dm², reinforced with a rigid plate.

3.14. CHRONOMETER**3.15. SOLVENT**

Heptane or any other solvent conforming to the current legislation.

4. PROCESS A

4.1. PREPARATION OF TEST SPECIMENS

Prepare three test specimens for each test condition in the conditioned chamber (3.3).

- Apply, to one end of the substrate (3.4.) previously degreased with the solvent (3.15.) a strip of non reinforced adhesive tape (3.9). This arrangement enables to obtain one end of the adhesive tape not adhering to the substrate (3.4.), see appendix 3.
- Deposit one layer of adhesive along the centre of the substrate (3.4.).
- Spread the adhesive with the template (3.6.) so as to obtain an even layer of 200 mm x 25 mm x 2 mm.
- If applicable, apply the reinforcement (3.8.) to the previous layer ensuring that it is permeable to the adhesive layer.
- Apply to the assembly obtained, a second layer of calibrated adhesive with the template (3.7.) in order to finally obtain an adhesive layer of 200 mm x 25 mm x 4 mm.
Note : *The test specimens produced in this way may possibly be subjected to the stoving operation defined in the documents and to possible ageing processes.*
- Before carrying out the peeling test with the cutting tool (3.10.), rough out the test specimens over their full length and detach the adhesive from the substrate (3.4.) over the first millimetres of glued adhesive.

4.2. METHOD OF OPERATION

- Set the tensile test machine (3.1.) to the appropriate sensitivity, determined if necessary by a prior test.
- Fix the fixture (3.2.) to the lower jaw of the machine.
- Fix the adhesive free “tab” to the upper jaw of the machine.
- Bring down the lower jaw until the tab fixed to the upper jaw is subjected to a slight tension.
- Operate the tensile test machine (3.1.) and record the peeling load “F” expressed in newtons in terms of the travel of the moving jaw.

5. PROCESS B

5.1. PREPARATION OF THE TEST SPECIMENS

Prepare three test specimens for each test condition in the conditioned chamber (3.3.) while observing the following conditions :

- Apply a liquid adhesive layer evenly onto the substrate (3.4.) with the filmograph (3.11.) at the speed of 500 mm/min. Start the chronometer (3.14.) after applying the liquid adhesive.
- After a time which, unless otherwise specified in the standard documents, must be equal to half the product open time, that is $\frac{1}{2} t_1$, determined according to méthode d'essai D55 1384, align the flexible cover (3.5.) with the substrate (3.4.) while observing the arrangement in appendix 4.
- Apply immediately a pressure of 0,02 MPa with the device (3.12.) (unless otherwise prescribed in the standard documents) for $10 \text{ s} \pm 1 \text{ s}$ after interleaving a plate (3.13.) between the surface of the test specimen and the positioning device in order to obtain an even distribution of the pressure.
- Unless otherwise specified in the documents, the test specimen is positioned in the conditioned chamber (3.3.) for $22 \text{ h} \pm 2 \text{ h}$.
- If applicable, subject the test specimen to the ageing test specified in the standard documents.

Note :

- *When the flatness of the rigid substrate does not allow a correct application of the adhesive with the filmograph, or when the conditions of application in the workshop must be reproduced, use a brush or a spraying gun providing that the thickness of the liquid adhesive is as even as possible and close to that deposited by the filmograph.*
- *The mean thickness of the liquid adhesive applied may be assessed by weighing an additional plate, by weighing of this plate after drying in the conditions used for the measurement of the dry extract (see méthode d'essai D55 1486) and by measurement of the surface S covered by the liquid adhesive. The thickness "e" of the liquid adhesive, expressed in micrometres (μm) is obtained by means of the following formula :*

$$e = \frac{(10^2 \times \Delta m)}{(S \times d \times E)}$$

in which : Δm = difference in mass of glue before and after drying, expressed in grams (g),

S = surface of liquid adhesive, expressed in square centimetres (cm^2),

d = volume mass in g/cm^3 ,

E = percentage of mass variation, expressed according to méthode d'essai D55 1486.

6. PROCESS C

6.1. PREPARATION OF TEST SPECIMENS

Prepare, in the conditioned chamber (3.3.), three test specimens for each test condition while observing the following conditions.

- Remove, if required, the adhesive protective film.
- Align the flexible cover with the rigid substrate while observing the arrangement in appendix 4.
- Apply pressure and proceed with the preparation of the test specimen as indicated in paragraph 5.1.

Note : *For the assembly of several materials from the supplier or the plant, there is no need for alignment.*

7. METHOD OF OPERATION FOR PROCESSES B AND C

- Set the tensile test machine (3.1.) to a suitable sensitivity, determined if required by means of a previous test.
- Fix the fixture (3.2.) to the lower jaw of the machine.
- Stick to the test specimen, at the back of the support plate, a strip of reinforced adhesive tape (3.9.) which must be extended by approximately 50 mm from the side of the flexible cover tab. Fold onto itself this part of the adhesive tape (see appendix 4)
- Place the test specimen into the fixture (3.2.).
- Detach a strip of 10 mm to 50 mm from the flexible cover and fix the free tab to the upper jaw of the machine.
- Slide the test specimen into the fixture (3.2.) until the limit of detached area is in the jaw axis.
- Bring down the lower jaw until the tab fixed to the upper jaw is subjected to a slight tension.
- Fix the slave control cord to the support plate by pushing the hook into the adhesive tape so that the cord is subjected to a slight tension.
- Start the machine and record the peeling load "F" in newtons in terms of the travel of the moving jaw.

8. REMINDER OF NORMAL TEST CONDITIONS

TEST CONDITIONS	Process A	Process B	Process C
Width of the strip (mm)	25	> 55	50 (10 minimum)
Method of application of the adhesive	gun + template	filmograph	already placed
Thickness of the liquid adhesive	2 or 4 mm	250 µm	according to the part
Pre-drying time before alignment (seconds)		$\frac{1}{2} t_1$	0
Alignment pressure (MPa)		0,02	according to standard document specifications
Alignment time (seconds)		10	
Drying time and conditioning before test (hours)	according to product	22 h \pm 2	22 h \pm 2
Tensile speed (mm/min)	according to product	100	100

9. EXPRESSION OF RESULTS

For each test specimen, determine the mean peeling load in newtons, over a length of 100 mm after eliminating the section of the load-travel curve (x-axis for travel and y-axis for loads) corresponding to the first peeled 25 mm :

- either by using an integrating device for the planimetry of the curve,
- or by trying to balance graphically the projecting and inset surfaces (see appendix 5) from either side of a parallel to the x-axis.

The intersection of this parallel with the y-axis provides the mean value of the peeling force. Calculate the mean value from the resistance values thus determined on the 3 test specimens. The results are given by the mean peeling load expressed in newtons per centimetre of product width, the difference between the minimum value and the maximum value must be lower than 20% the mean value.

If not, carry out a new determination on 3 test specimens.

Note the type of break obtained by referring to appendix 6.

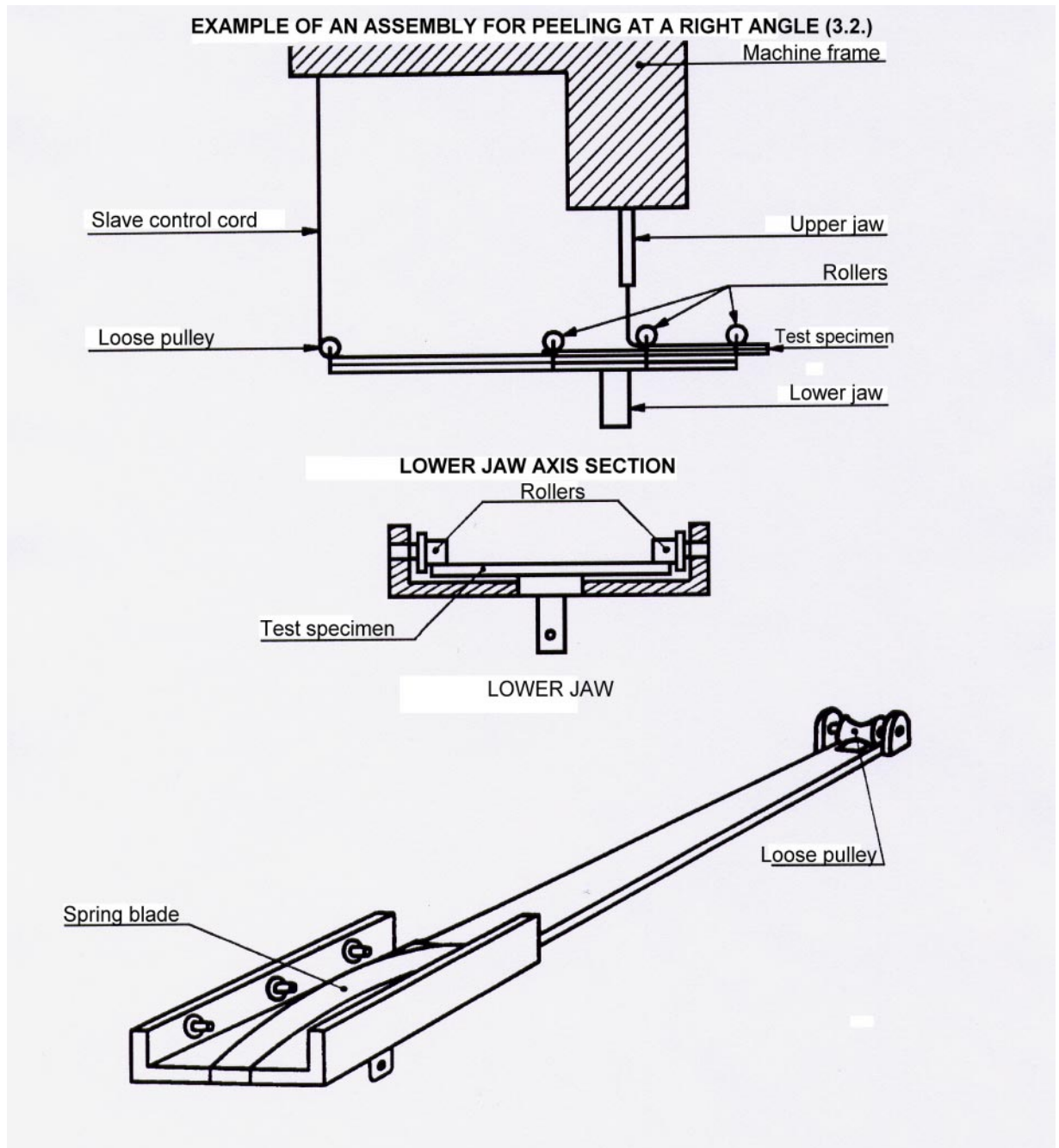
Note : *Mention if the adhesive remains, or not, systematically on one substrate and if the flexible cover is subjected to a distortion during the tension.*

10. TEST REPORT

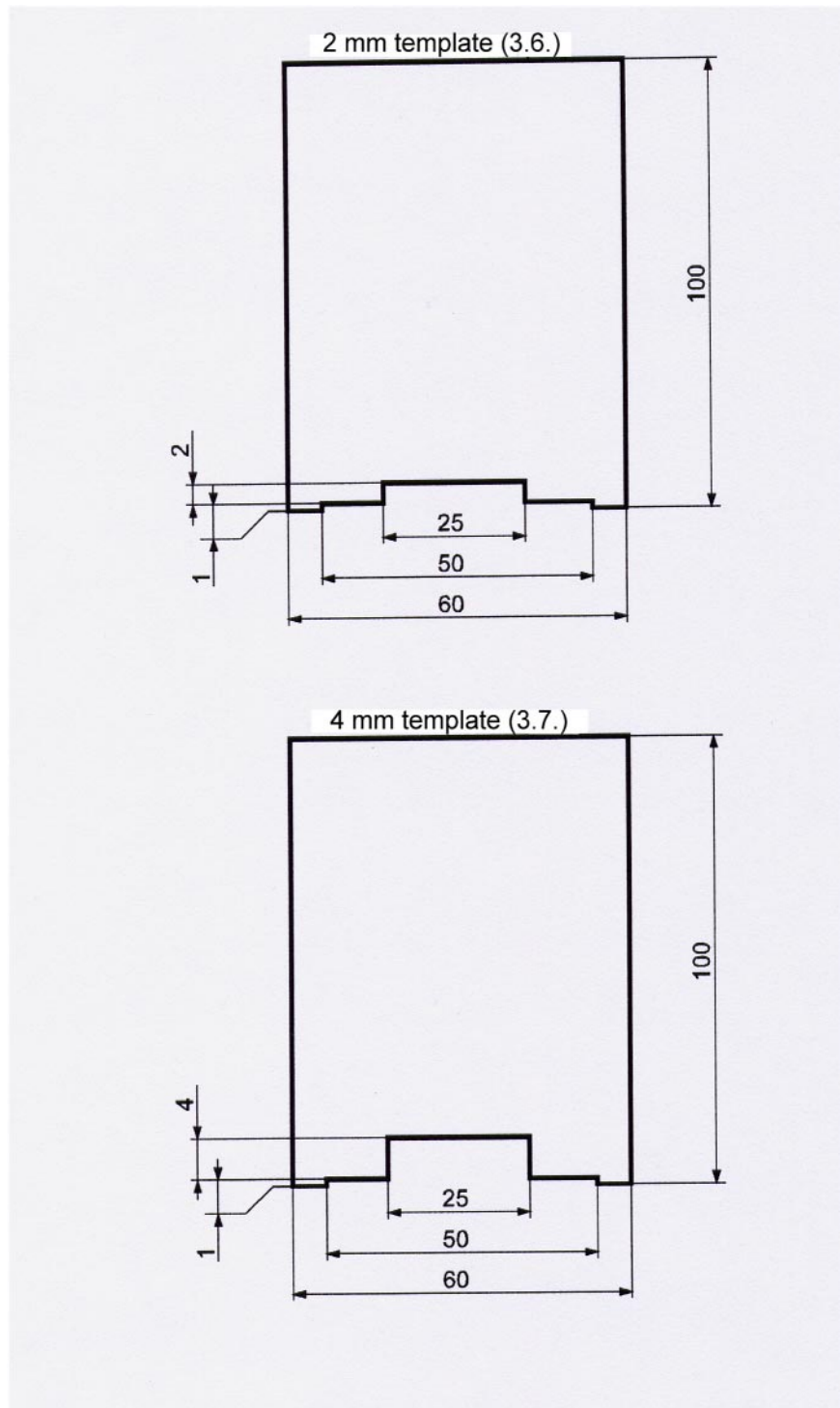
As well as the results obtained, the test report must indicate :

- the reference to this méthode,
- the full references of the product tested, its presentation and the name of the supplier,
- the type of substrates used,
- the alignment pressure,
- the stoving temperature of the test specimens,
- the drying and conditioning time of the test specimens before the test,
- the type of ageing undergone by the test specimens,
- the operating details not specified in the method as well as any possible incidents likely to have affected the results.

Appendix 1

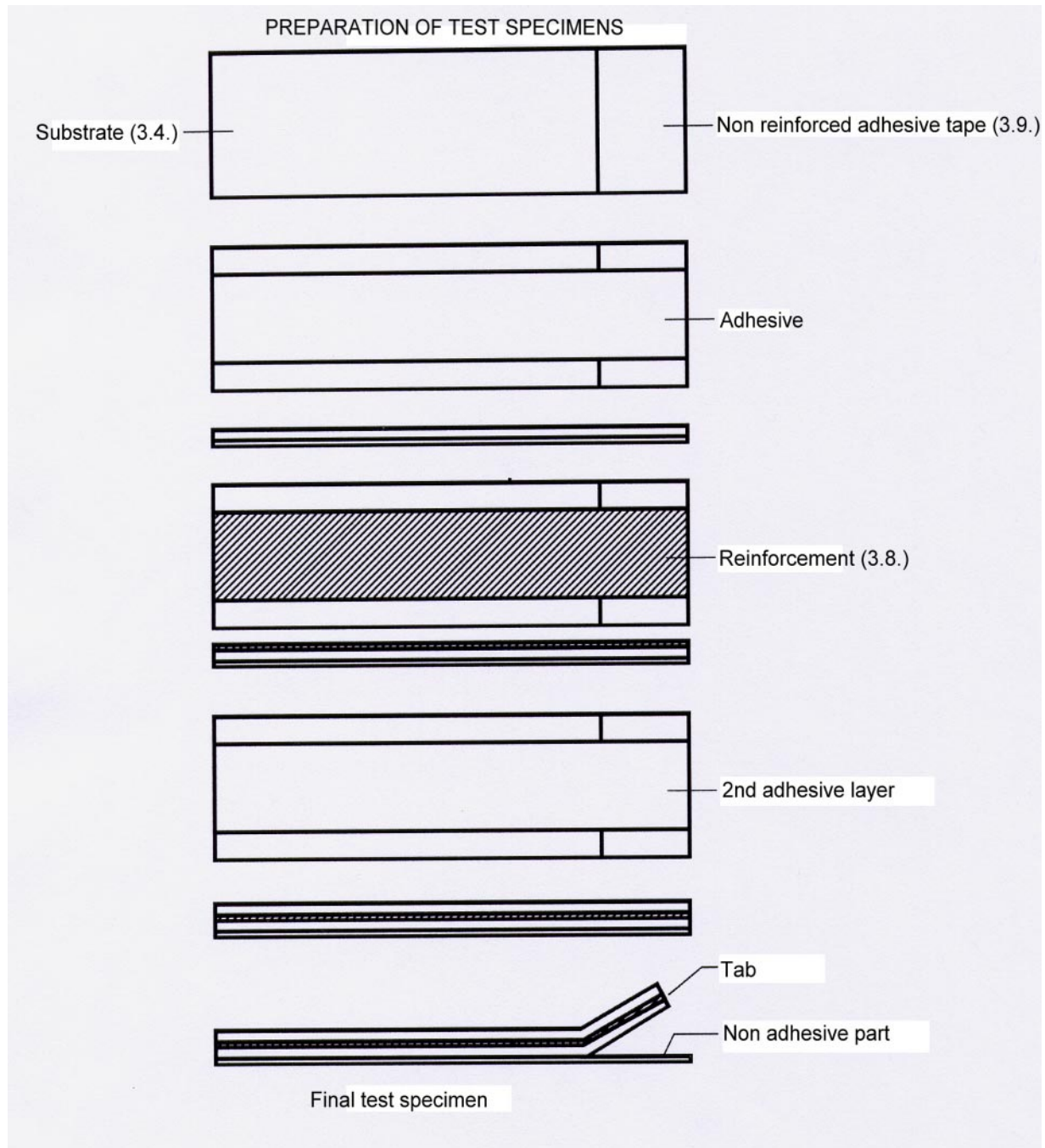


Appendix 2



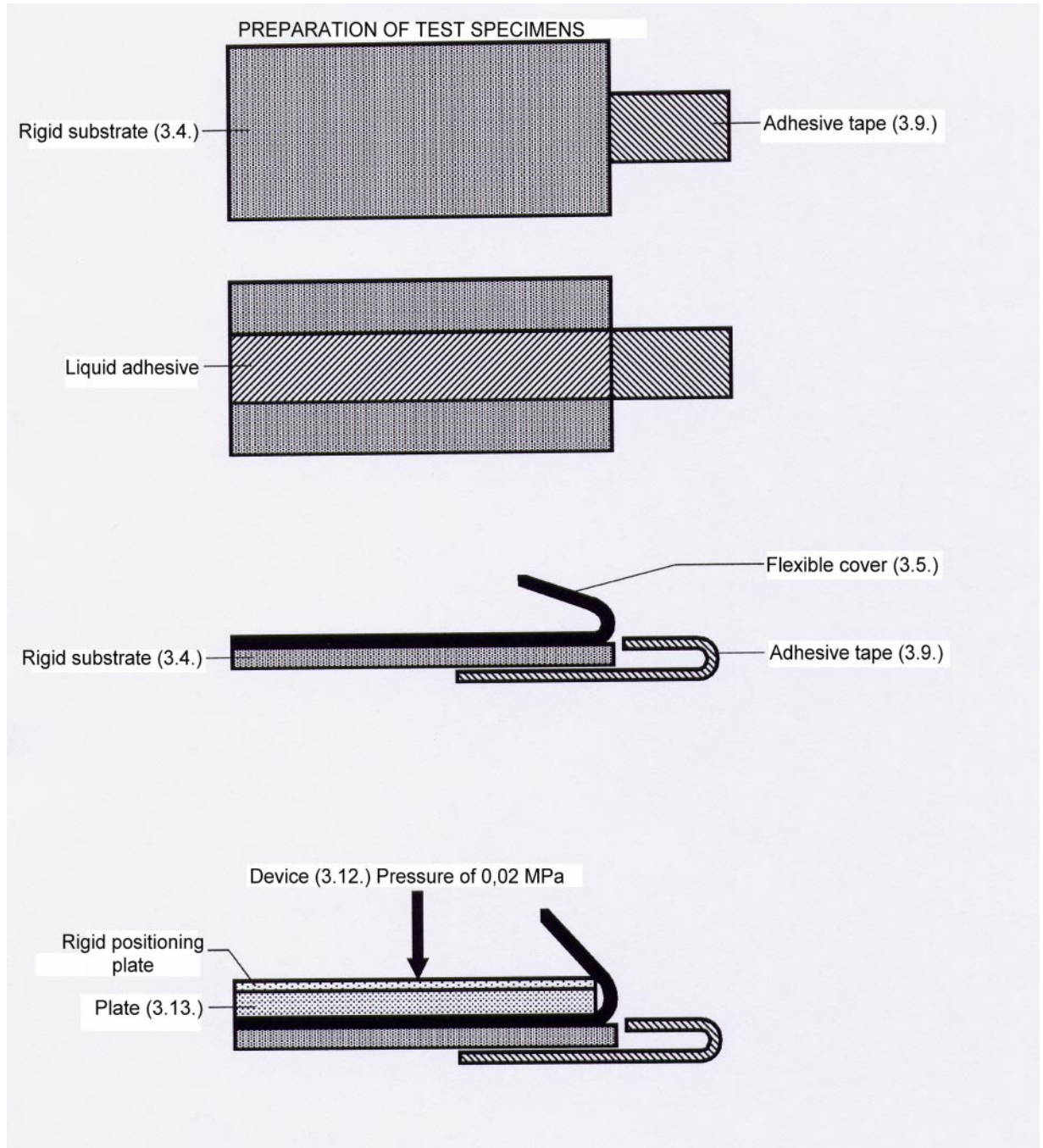
Appendix 3

PROCESS A

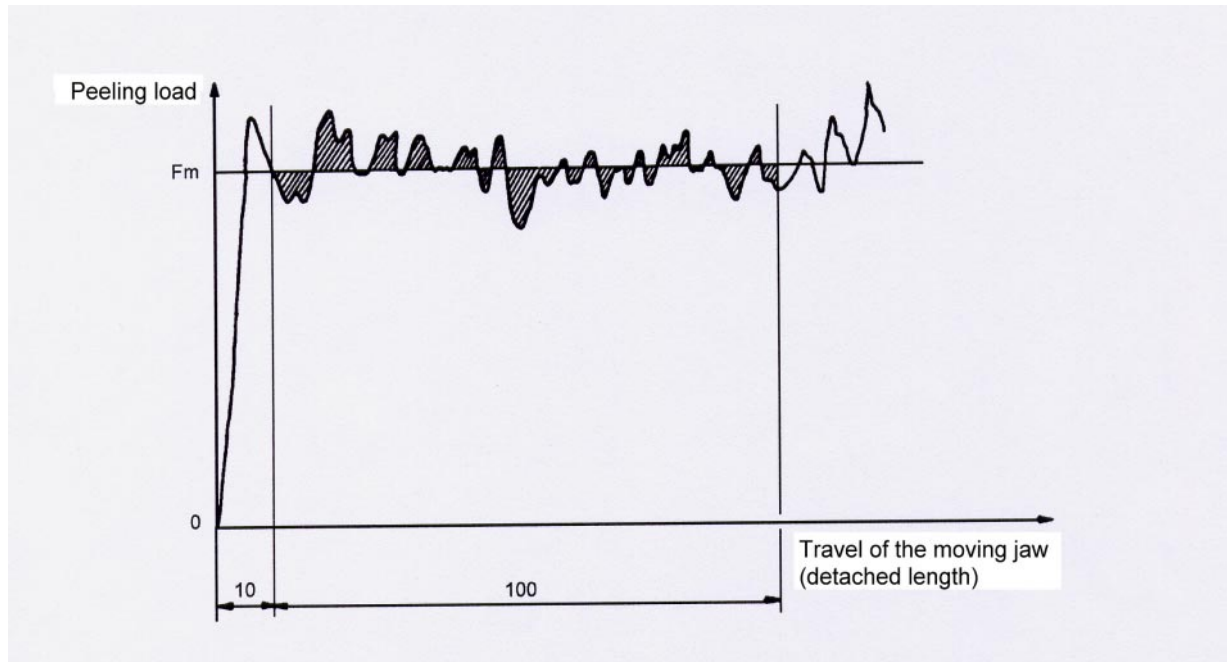


Appendix 4

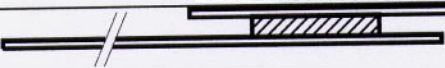
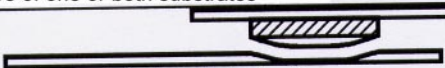

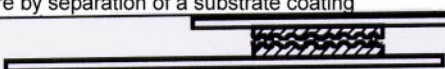
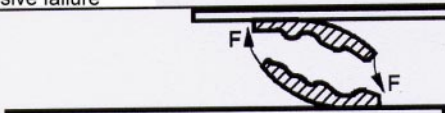
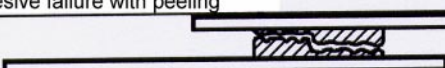
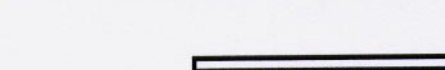
PROCESS B



Appendix 5

EXAMPLE OF CURVE OBTAINED AND GRAPHIC EVALUATION OF
THE MEAN PEELING FORCE

Appendix 6

TYPES OF FAILURE	DESIGNATION
 Failure of one or both substrates	RS
 Failure of one substrate by delamination	RSD
 Failure by separation of a substrate coating	RAR
 Cohesive failure	RC
 Cohesive failure with peeling	RCP
 Cohesive failure at the surface	RCS
 Failure to adhere	RA

Note : When more than one type of failure occurs, the surface percentage value for each of the types of failure must follow the corresponding designation.

11. RECORDS AND REFERENCE DOCUMENTS

11.1. RECORDS

11.1.1. CREATION

OR : 01/07/1985 – CREATION OF THE NORME.

11.1.2. SUBJECT OF THE MODIFICATION

- A : 20/12/1996 – INTRODUCED INTO IDEM (*French only*).
- B : 02/09/1997 – COMPLETE REWRITE OF THE NORME.

11.2. REFERENCE DOCUMENTS

11.2.1. PSA DOCUMENTS

11.2.1.1 Normes

D55 1384, D55 1486.

11.2.1.2. Others

11.2.2. EXTERNAL DOCUMENTS

11.3. EQUIVALENT TO :

REN1485

11.4. CONFORMS TO :

11.5. KEY-WORDS