

**ADHESIVES  
TENSILE – SHEAR STRENGTH  
(SHIM METHOD)**

Page 1/13

**NO USE RESTRICTION***This is a translation, the French original shall be used in all cases of litigation**Date of translation : 01/01/2001***FOREWORD**

*This document is equivalent to the RENAULT document D41 1108.*

*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 CITROËN in MARCH 1999.*

**1. OBJECT AND FIELD OF APPLICATION**

The object of this méthode is the adhesive and cohesive characterisation of curable or gelling adhesives.

**2. PRINCIPLE**

A parallelepipedic joint of adhesive is applied between two substrates and, if applicable, subjected to stoving.

The test specimen is subjected to a tensile-shear stress in time and temperature conditions determined by the standard documents. The bond is characterised by the stress and type of failure (cohesive or adhesive).

**3. EQUIPMENT****3.1. SUBSTRATES,**

the material of which is defined in the standard documents and geometrically as defined in Appendices 1, 2 and 3. The surface preparation is carried out according to the specifications detailed in the standard documents

**3.2. SET OF SHIMS,**

in poly(tetrafluorethylene) (PTFE) 0,2 mm and 2 mm thick or any other thickness specified in the standard documents.

**3.3. SET OF SHIMS,**

in aluminium or soft iron with a thickness equal to the substrates + adhesive, or re-aligning jaws.

**3.4. SET OF SCREWS,**

of 4 mm with corresponding washers and nuts (or any other device for locking the PTFE shim between the two substrates).

**3.5. TENSILE TEST MACHINE,**

equipped with self-tightening jaws, a dynamometer and with the following characteristics :

- speed of the moving jaws set to 10 mm/min  $\pm$  2 mm/min,
- load scale 10 daN to 1000 daN according to the type of product examined.

**3.5. SPATULA**

or preferably equipment for extruding the products.

**3.7. PARING KNIFE**

**3.8. VENTILATED OVEN**

(adjustable environment up to  $250^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ) for stoving the products, if applicable, according to méthode d'essai D55 1171.

**3.9. CONDITIONED ENCLOSURE**

at  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and  $50\% \pm 5\%$  relative humidity.

**3.10. SPECIFIC RIG**

for glass substrates (see Appendix 5).

**3.11. DEGREASING PRODUCT**

for substrates (except for re-greased sheet metal), heptane for example.

**4. PREPARATION OF TEST SPECIMENS**

The geometry of the adhesive joint depends on the product to be examined. Its thickness, stated in the standard documents, is, except for specific requirements :

- of 0,2 mm (with an overlap of  $12,5 \text{ mm} \pm 0,5 \text{ mm}$ ) for bonding products, (see Appendix 1 or Appendix 2, 3 figure 2),
- of 2 mm (with an overlap of  $20 \text{ mm} \pm 0,5 \text{ mm}$ ) for products with poorer mechanical properties, (see Appendix 1, figure 2 or Appendix 3, figure 3),
- of 2 mm or more according to the standard documents (with an overlap of  $12,5 \text{ mm} \pm 0,5 \text{ mm}$ ) for shimming bonding products (see Appendix 1, figure 3 or Appendix 3, figure 4).
- Provide 3 test specimens per test.

Each test specimen is prepared as follows :

- arrange the “receiving” substrate, screws and shims (3.2) as shown in Appendix 1 (figures 1, 2 and 3) or Appendix 3 (figures 2, 3, 4), or Appendix 2.
- deposit the required quantity of product between the 2 shims (3.2.), the operation is carried out using the spatula (3.6.) or preferably the extrusion equipment so as to avoid any air bubbles being trapped in the joint. The deposited bead must be of a round or triangular shape and still in excess after mating (where this is important),
- place the “bearing” substrate squeezing the product until there is contact with the shims (3.2.) so as to obtain a slight overflow over the whole width of the bonding, taking care of maintaining the substrates parallel.
- Place the washers and nuts, then lock the whole assembly moderately.

The test specimen thus obtained, maintained in horizontal position, is subjected to stoving or drying for the time specified in the standard documents.

After drying or cooling, untighten the nuts and remove the screws and shims (3.2.) by sliding.

## 5. METHOD OF OPERATION

After 24 hours in the conditioned enclosure (3.9.) or after being subjected to one of the ageing processes which may be stipulated in the standard documents, the test specimens must be cleared by means of the paring knife (3.7.) of the possible side overflow of adhesive due to a slight running or swelling during stoving or drying.

The test is carried out in the conditioned enclosure (3.9.) or at any other temperature specified in the standard documents according to the following method of operation :

- fix the test specimen vertically and perfectly central between the dynamometer jaws (3.5) such that the distance between these and the edges of the joint is 50 mm (see Appendix 4). Insert a shim (3.3) on the bonding side between the jaws and the substrate if no specific jaws are used (re-aligning); for example, in the case of 1 mm thick substrates and 0,2 mm thick joints, use a 1,2 mm shim,
- apply a tensile load up to failure,
- read off the dial or recorder the load “F” in daN corresponding to the failure.
- retain all the failed test specimens.

## 6. CALCULATION AND EXPRESSION OF RESULTS

For each test specimen :

**6.1. CALCULATE** the shear breaking stress “R”, expressed in MPa, using the following formula :

$$R = 0,1 \times \frac{F(\text{indaN})}{S(\text{incm}^2)} = \frac{F(\text{inN})}{S(\text{inmm}^2)}$$

The surface “S” is usually 3,125 cm<sup>2</sup> (joints with 12,5 mm overlap) or 5 cm<sup>2</sup> (joints with 20 mm overlap). Ensure that the overlap is 20 mm ± 0,5 mm or 12,5 mm ± 0,5 mm on each test specimen.

Calculate the actual surface of the joint to be taken into account when calculating the shear stress.

Where the overlap length is outside the tolerance, repeat the test.

**6.2. CALCULATE** the mean value of the shear stress for the three test specimens; the variation between the minimum value and the maximum value must be less than 20% the mean value.

If this is not the case, carry out a new determination on three test specimens.

**6.3. INDICATE** the type of break according to the designations in Appendix 5.

**6.4.** Record also the change in the surface of the substrate (corrosion, etc.) when the test specimen has been subjected to an ageing process.

- When the test has been carried out on a tensile test machine that records the load-elongation curves, it might be useful to characterise the flexibility of the sealants used by the elongation at break value. This elongation, expressed in mm, shall be calculated by means of the following formula :

Elongation at break =  $K \Delta x$

$K$  = amplification coefficient of the machine in the travelling direction of the jaws,

$\Delta x$  = difference in mm between the x-axis at break point and the x-axis at the origin of the curve.

- Calculate the mean value of the elongation at break for the three test specimens.

## 7. TEST REPORT

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

- the reference to this méthode,
- the temperature of the tensile-shear test,
- the type and thickness of the substrates,
- the surface preparation of the substrates,
- the thickness of the joint. The result of the shear strength test is highly dependent on the thickness of the joint; indicate the dimension of the joint if it differs (even slightly) from the specified value.
- the times and temperature of polymerisation, stoving or drying carried out and, if applicable, the ageing processes undergone by the test specimens.
- the mean shear stress and type of break observed (see Appendix 6),
- anomalies likely to have influenced the test,
- the operating details not specified in the method as well as any possible incidents likely to have affected the results.

## Appendix 1

## Joint 12,5 mm x 0,2 mm (25 mm wide)

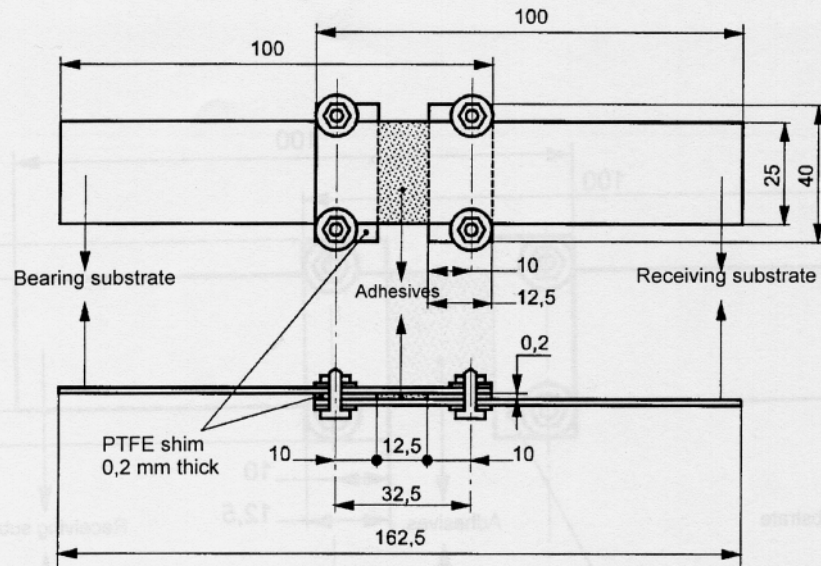


Figure 1

## Joint 20 mm x 2 mm (25 mm wide)

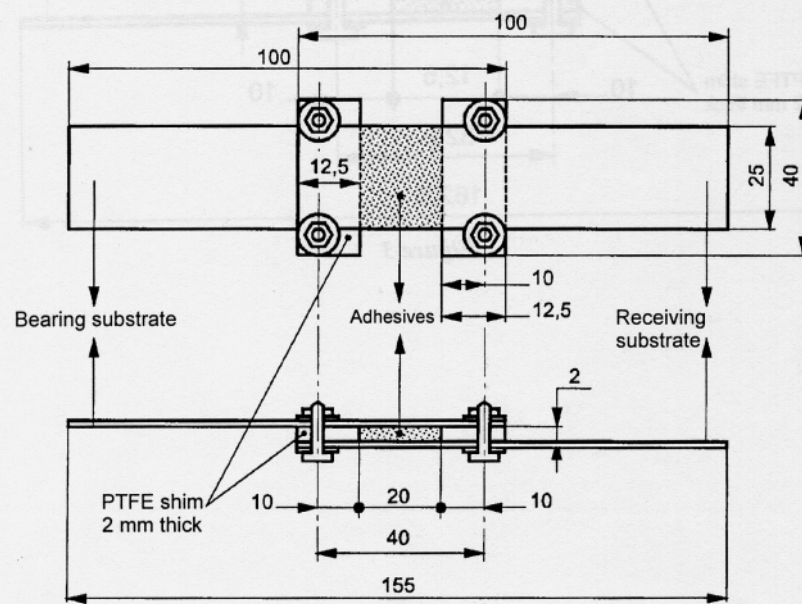
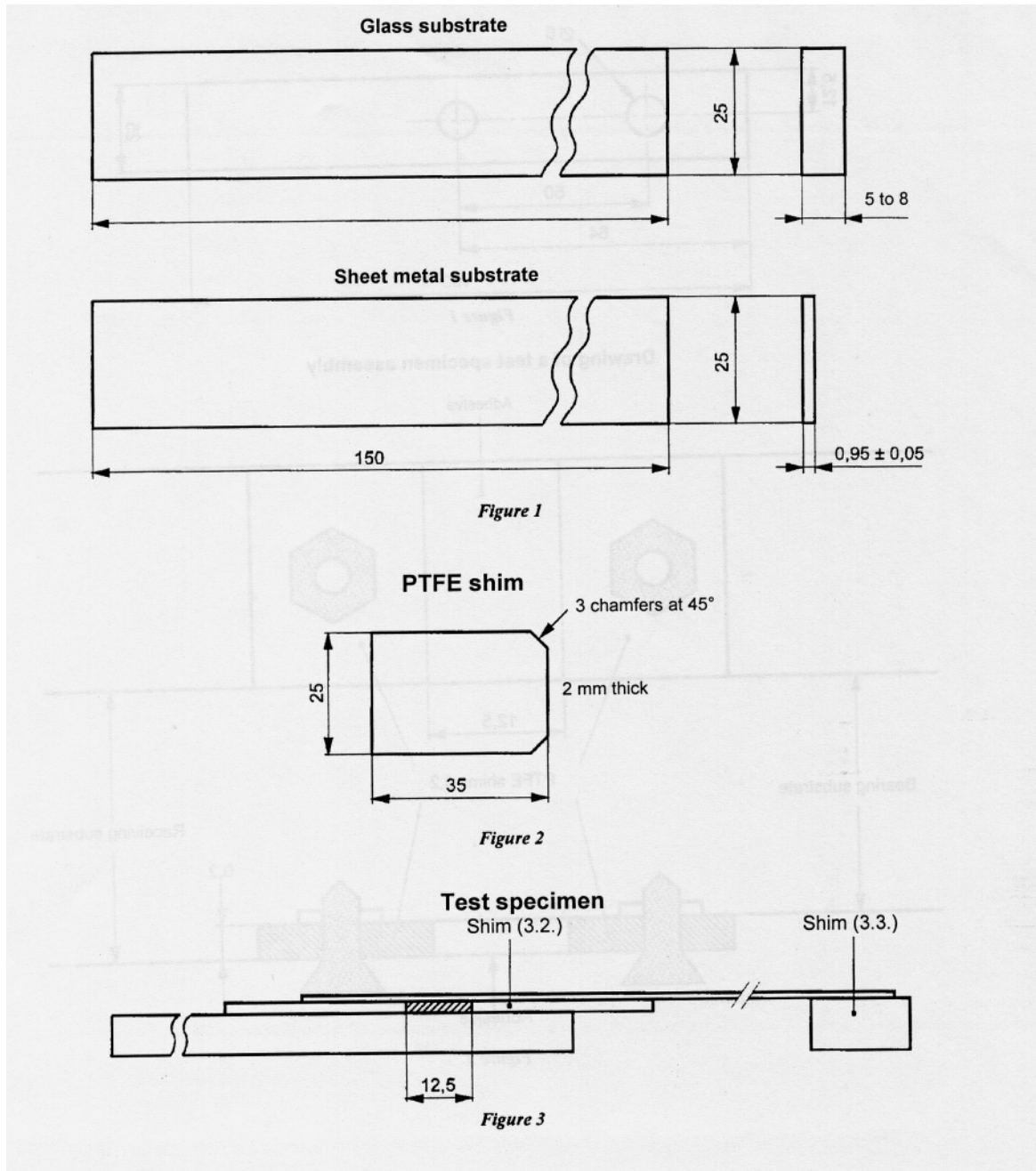


Figure 2



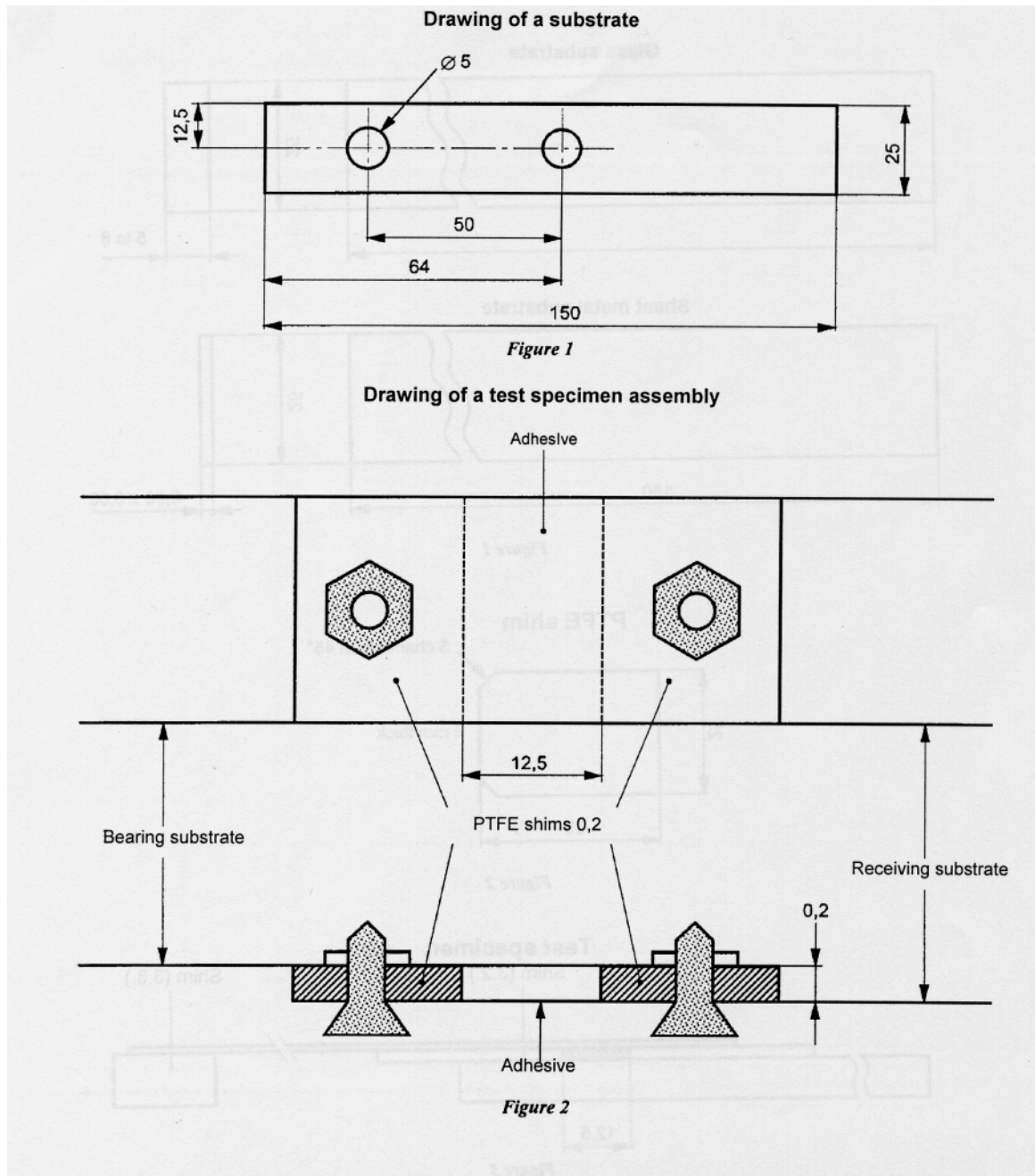
## Appendix 2

## Substrates



## Appendix 3

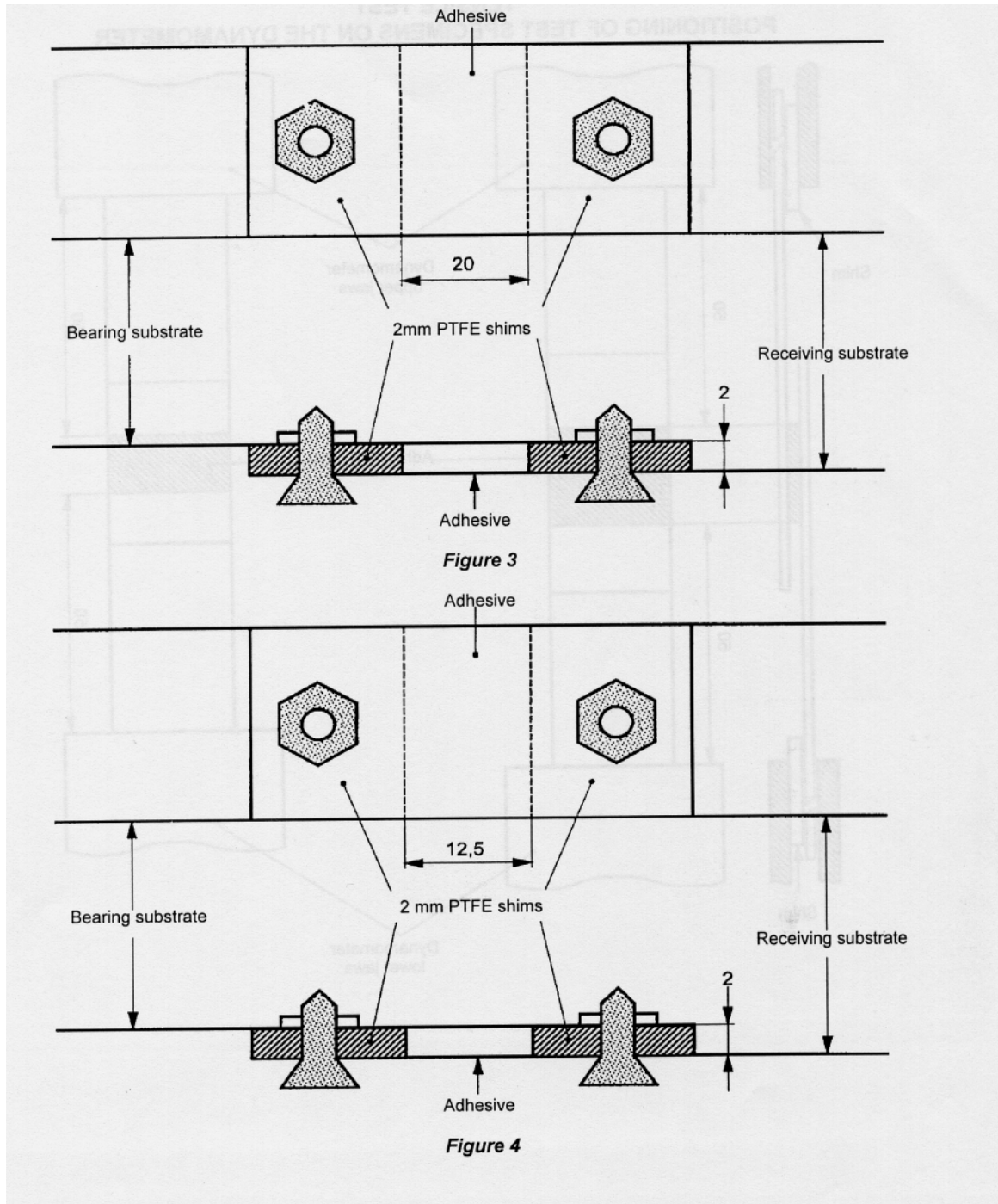
## TEST SPECIMEN SUBSTRATE (3.1.)



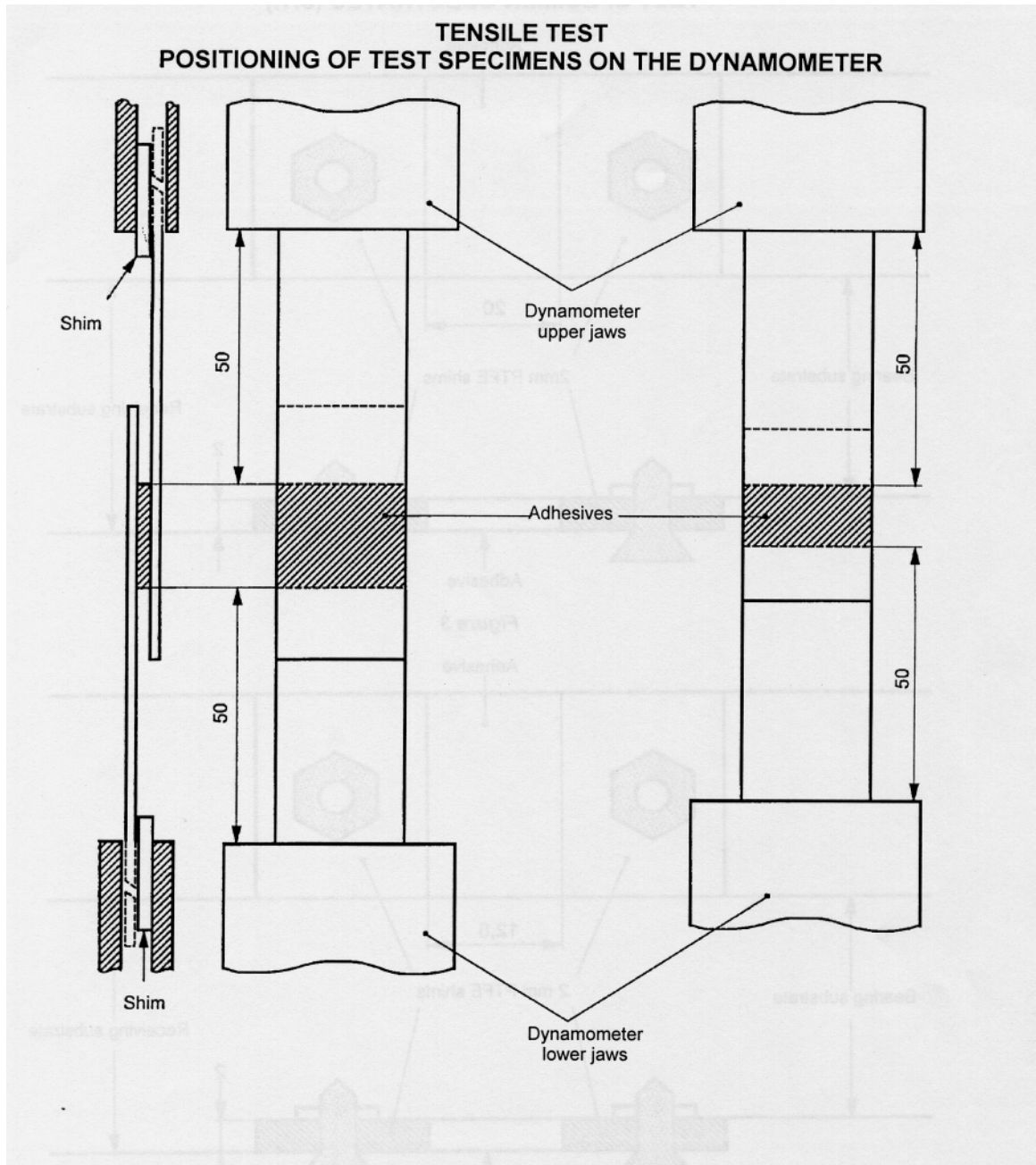


## Appendix 3 (continued)

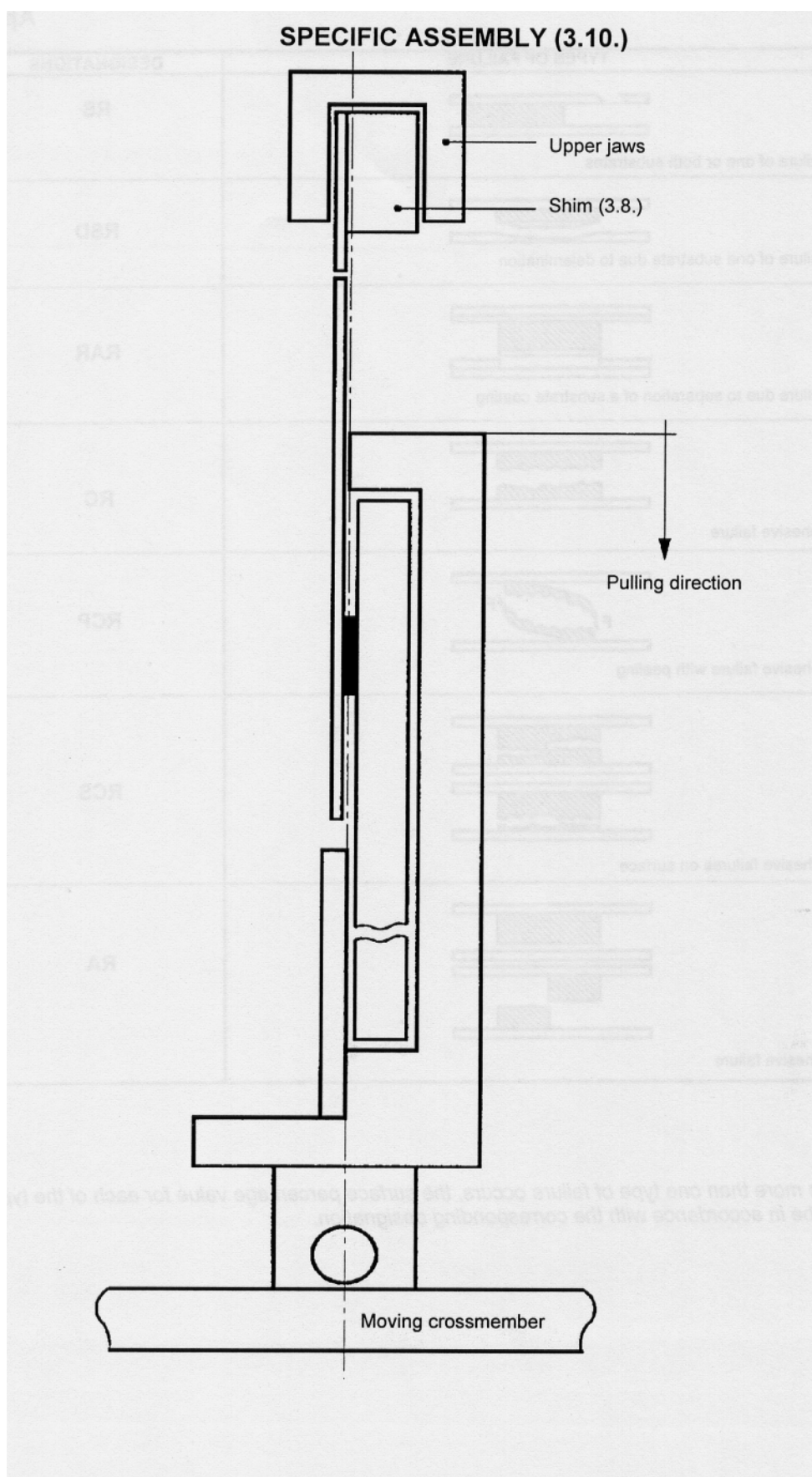
## TEST SPECIMEN SUBSTRATES (3.1.)




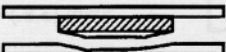
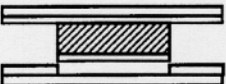
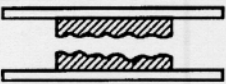
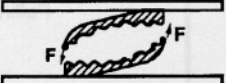
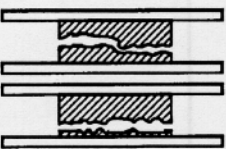
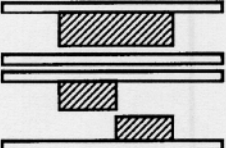
## Appendix 4



## Appendix 5



## Appendix 6

TYPES OF FAILURE		DESIGNATIONS
 Failure of one or both substrates		RS
 Failure of one substrate due to delamination		RSD
 Failure due to separation of a substrate coating		RAR
 Cohesive failure		RC
 Cohesive failure with peeling		RCP
 Cohesive failures on surface		RCS
 Adhesive failure		RA

**Note :** When more than one type of failure occurs, the surface percentage value for each of the types of failure must be in accordance with the corresponding designation.

## 8. RECORDS AND REFERENCE DOCUMENTS

### 8.1. RECORDS

#### 8.1.1. CREATION

- OR : 01/09/1979 – CREATION OF THE NORME.

#### 8.1.2. SUBJECT OF THE MODIFICATION

- F : 15/04/1999 – CHANGE TO THE APPENDIX NUMBERING
- E : 20/01/1998 – MODIFICATIONS TO THE TITLE, TO § 1., AND 3.1. § 3.10, 3.11, AND 6.4  
ADDED APPENDICES 2 AND 4 ADDED

### 8.2. REFERENCE DOCUMENTS

#### 8.2.1. PSA DOCUMENTS

##### 8.2.1.1. Normes D55 1171.

##### 8.2.1.2. Others

#### 8.2.2. EXTERNAL DOCUMENTS

### 8.3. EQUIVALENT TO : REN D41 1108

### 8.4. CONFORMS TO :

### 8.5. KEY WORDS