

**COATINGS OF PAINT AND VARNISH
HARDNESS TEST (PERSOZ PENDULUM)**

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NO USE RESTRICTION*This is a translation, the French original shall be used in all cases of litigation**Date of translation : 14/04/1997***FOREWORD**

This document is equivalent to the RENAULT document D25 1298. It must not be modified without prior consultation with the Normalisation Services of this Group.

It is in conformity with the agreement reached between this Group and PSA PEUGEOT CITROEN in APRIL 1996.

1. OBJECT AND FIELD OF APPLICATION

The object of this méthode is to measure, with Persoz pendulum, the hardness of protective paint and varnish coatings applied to flat supports, the type of which varies depending on the purpose of the film.

Two processes are used :

- Process A : manual release,
- Process B : automatic release and counting.

2. PRINCIPLE

The test consists of determining the damping of the oscillations of a pendulum resting on the film to be studied by two steel balls, of the same diameter, forming an integral part of the pendulum. This test must be carried out in still air as air movement will significantly falsify the results.

3. EQUIPMENT**3.1. HARDNESS PENDULUM**

See diagram in appendix 1, with a mass of $500 \text{ g} \pm 0,1 \text{ g}$ and a period, measured during a hardness test on a sheet of glass, (carried out as indicated below from a 12° amplitude to a 4° amplitude) equal to $1 \text{ s} \pm 0,001 \text{ s}$.

The two balls by which the pendulum rests on the film must be in stainless steel and show no visible defect. Their diameter must be $8 \text{ mm} \pm 0,005 \text{ mm}$ and the distance separating them is $50 \text{ mm} \pm 1 \text{ mm}$.

When the pendulum is placed at rest on the surface to be studied, its centre of gravity must be $60 \text{ mm} \pm 0,1 \text{ mm}$ below this surface, whilst the point of the needle used to mark the amplitude must be at $400 \text{ mm} \pm 0,2 \text{ mm}$ below this surface.

The median plane of the segment defined by the centres of the balls must be a plane of symmetry.

The aerodynamic properties of the instrument and the rigidity of the support (3.5.) must be such that the duration of the test on the sheet of glass or a mirror (used for calibration), is at least 420 seconds.

3.2. VERTICAL PLANE MIRROR

Mirror on which 3 fine vertical lines are marked carrying the indications 0°, 4°, 12°, arranged as shown in Appendix 2.

3.3. CHRONOMETER FOR PROCESS A

3.4. COUNTING SYSTEM FOR PROCESS B

3.5. RIGID SUPPORT

With levelling screws and a horizontal platform in mild steel at least 5 mm thick on which the test specimen is firmly fixed by means of four screws.

3.6. SPIRIT LEVEL

3.7. CONDITIONED ENCLOSURE

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

3.8. PHOTOELECTRIC CELL

3.9. BOX

With door and transparent top or transparent bell cover.

3.10 MAGNIFYING GLASS

4. PREPARATION OF TEST SPECIMENS

4.1. DIMENSIONS

The dimensions of coated test specimens must be :

- length : 100 mm,
- minimum width : 70 mm
- thickness : 0,7 mm to 1 mm.

4.2. DRYING

The drying conditions for the test specimens are indicated in the documents relating to the products.

4.3. CONDITIONING

Condition the test specimens for at least two hours in the conditioned enclosure (3.7.).

5. METHOD OF OPERATION

Carry out the test in the conditioned enclosure (3.7.).

5.1. PROCESS A

- Place the equipment in the box (3.9.) in order to obtain a calm atmosphere, with no air current to disturb the swing of the pendulum.
- Fix the test specimen to the support (3.5.), the horizontality of which has previously been adjusted to ± 0,5° using the spirit level (3.6.).

- Ensure that the balls of the pendulum (3.1.) are clean, then place the pendulum on the film to be studied.
- Place the mirror (3.2.) parallel to the oscillation plane of the pendulum needle so that the point of the needle is resting opposite the 0° graduation.
- Let the pendulum go without any initial speed from the 12° graduation : at the same time, start the chronometer (3.3.).
- Stop the chronometer when the amplitude of the oscillations reaches 4°.
- To avoid any parallax error in each observation, the tester's eye must be aligned so that he can see his own image precisely behind the line on the mirror. The use of a magnifying glass (3.10) is recommended.
- Carry out three tests, moving the pendulum between two successive tests.

5.2. PROCESS B

- Fix the rigid vertical support (3.5.) to the cast iron triangular stand of the pendulum.
- Position the pendulum rod on the pendulum solenoid.
- Place the triangular stand so that the vertical rod is on the left and the two levelling screws on the right, the horizontal bore on the boss being between the tester and the vertical rod.
- Place the test specimen carrier on the vertical rod, the horizontal plate is on the right of the vertical rod.
- Fix the mirror support rod to the boss which must be approximately 60 mm from the rigid support.
- Connect the counting system to the photoelectric cell (3.8.) by means of the two corresponding connectors, the numbers shown on these must agree.
- Place the test specimen on the rigid support. Tighten by means of the two right hand screws.
- Place the black heel (rectangular part for holding the plate) under the two left hand screws and above the film to be tested.
- Tighten the heel-test specimen assembly with the two left hand screws.
- Adjust the level of the test specimen with the spirit level (3.6.) and the two levelling screws on the rigid support.
- Place the pendulum on the test specimen, the upper square bar against the heel, the point of the needle at approximately 10 mm from the surface of the mirror.
- Adjust the mirror so that the point of the pendulum is against the 12° graduation mark.
- Adjust the slant on the solenoid and the length of the feeler using the knurled screw behind the mirror and the threaded knob placed above the solenoid.
- Carry out a first test with a manual release. If the pendulum does not stop on the zero graduation, move the mirror forward (without touching the pendulum which has just come to rest) until the needle is on the graduation. From this moment, the horizontal adjustment of the mirror must be modified no further.
- Again place the pendulum against the heel. If the point of the pendulum is not on the 12° graduation reference mark, adjust the vertical setting.
- Release it again to check whether the pendulum is on the zero graduation when it comes to rest.

- The pendulum is then ready for measurements to be taken on films applied to supports of constant thickness. Proceed with a new vertical adjustment if a variation in the support thickness has occurred.
- Place the point of the needle so that it is flush with the lower sector of the needle.

5.3. MEASUREMENTS (PROCESS B ONLY)

- Connect the current, with the switch in the "Off" position.
- Adjust the needle so that the luminous ray is intersected by the latter.
- Hold the upper square bar of the pendulum against the heel with one finger of the left hand and switch over to "On". Check that the counter (3.4.) is set to zero, otherwise reset it.
- With the right hand, bring the needle of the pendulum against the solenoid so that it remains stuck.
- Remove the hands from the pendulum and switch over to "Off". The pendulum moves immediately.
- The counting stops automatically when the pendulum no longer goes over the 4° graduation. Read the number of oscillations on the counter. If during the first automatic release a counting frequency of twice the oscillations is noted, re-check the alignment of the needle with the zero graduation, the pendulum being at rest.

6. EXPRESSION OF RESULTS

Express the "pendulum hardness" by the number of seconds obtained by calculating the mean of three successive measurements carried out at various points on the test specimen.

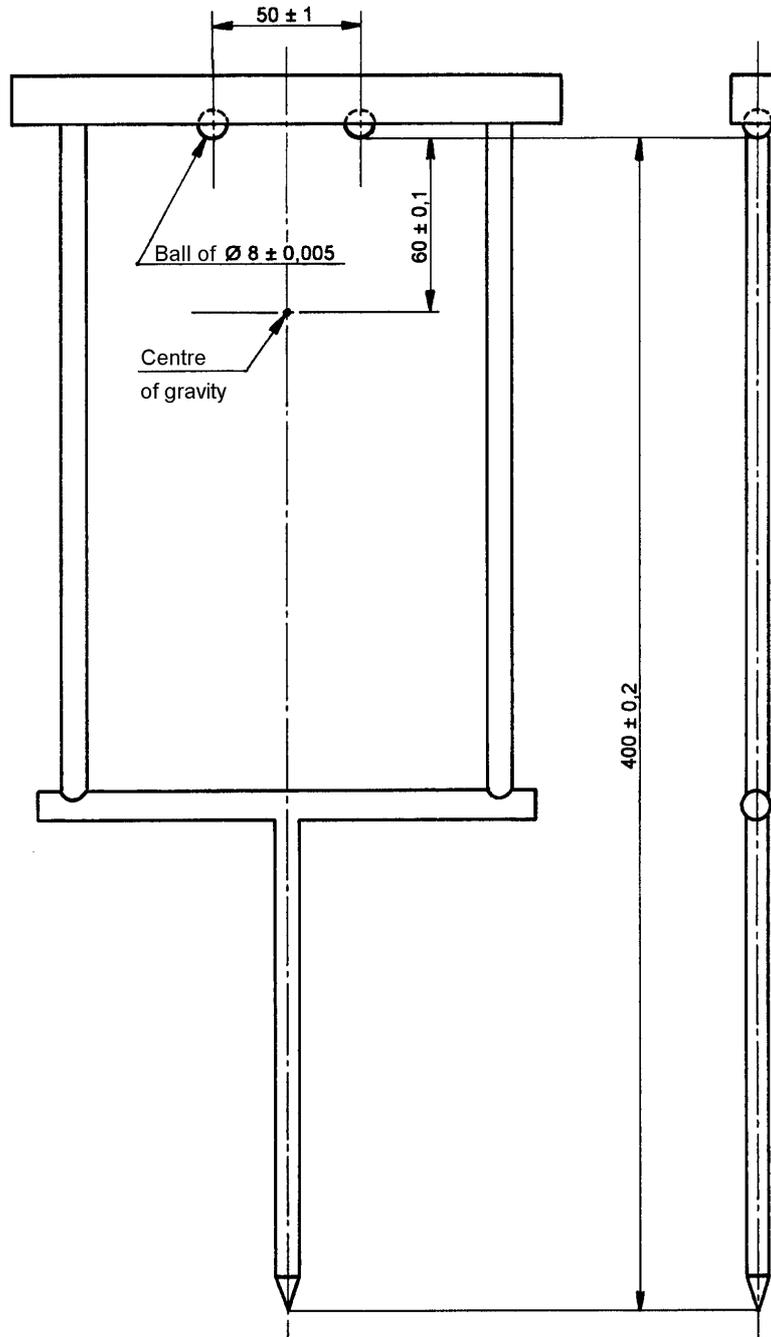
7. TEST REPORT

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

- the reference to this méthode,
- the reference of the material and the name of the supplier,
- the process used,
- the drying or stoving conditions,
- the thickness of the film studied,
- the type of support,
- the operating details not specified in the method as well as any possible incidents likely to have affected the results.

APPENDIX 1

HARDNESS PENDULUM (3.1.)



8. RECORDS AND REFERENCE DOCUMENTS

8.1. RECORDS

8.1.1. CREATION

- OR : 01/09/1979 – CREATION OF THE PSA NORME. REPLACES THE ASSOCIATION NORME No. 1298.

8.1.2. OBJECT OF THE MODIFICATION

- A : 22/07/1996 – 2nd EDITION. COMPLETE REWRITE.
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8.2. REFERENCES DOCUMENTS

8.2.1. PSA DOCUMENTS

8.2.1.1. Normes

8.2.1.2. Others

8.2.2. EXTERNAL DOCUMENTS

8.3. EQUIVALENT TO :

DEXREND251298

8.4. CONFORMS TO:

8.5. KEY-WORDS

DURETE
(Hardness)