

PAINT COATINGS RESISTANCE TO THE ACTION OF MECHANICAL WASH BRUSHES

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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 : 25/11/2003*

1.OBJECT AND FIELD OF APPLICATION

The object of this method is the characterisation of automotive paint coatings to the action of mechanical wash brushes.

It is applicable to coatings, opaque and metallic colours with or without clearcoat, onto sheet metal or plastic substrates.

2.PRINCIPLE

The test consists of subjecting the paint coating to the action of a rotary brush with polyethylene bristles combined with the application of a defined abrasive solution between the brush and the test specimen.

The surface defect obtained in this way, optical mattness due to the accumulation of scratches, is comparable to the defect encountered on vehicles frequently using certain mechanical wash installations.

3.EQUIPMENT

3.1.BRUSH MACHINE,

There are 2 distinct generations of equipment:

- **Generation 1 (G1)** : equipment manufactured by the TOUZART and MATIGNON company.
- **Generation 2 (G2)** : equipment manufactured by the BRAIVE Instruments company.

Installed in the test laboratory, represented according to Appendix 1, comprising of:

3.1.1.BRUSH,

Guided between two circular flanges. This brush consists of 4 tufts, each of which is separated into 3 strands, each strand having the same number of bristles, thus:

- 28 bristles per strand,
- 84 bristles per tuft,
- 336 bristles on the brush.

The fixing head for the 12 strands making up the 4 tufts of the brush is shown in Appendix 2.

Note : The fixing system may differ depending on the generation of equipment, single or sliding hub.

The bristles making up the brush must be polyethylene, of natural colour, white, and with a star shaped profile.

The section of the bristle must conform to the grading defined, according to appendix 3, of length 900 mm, with specific PSA PEUGEOT CITROËN channel.

The infrared spectrum and the differential thermal analysis diagram of a bristle are given in Appendices 4 and 5.

These bristles are supplied by the MBMP BRUSHCAR company.

These bristles must be kept flat, unrolled, away from light in the test laboratory.

The maximum duration for which bristles are kept is 2 years.

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3.1.2.ELECTRIC MOTOR,

Equipped with a speed regulator enabling the brush (3.1.1), by means of a shaft, to be driven at 150 r/min.

3.1.3.TEST SPECIMEN SUPPORT,

Allows the positioning of the test specimen as shown in Appendix 6. The support may also be adapted, if required, for tests on painted plastic parts.

3.1.4.SEALED TRANSPARENT BOX,

To avoid projection of the abrasive solution (5.3.).

Provision must be made for the discharge of the solution from the box.

3.1.5.SUPPLY OF ABRASIVE SOLUTION,

A supply of 1 litre minimum, or 2 litres maximum fitted with a blade stirring system, for maintaining the abrasive particles in suspension, while limiting the formation of foam.

3.1.6.PERISTALTIC PUMP,

With an adjustable flow, allowing the specimen to be supplied with the abrasive solution.

3.1.7.COMPRESSED AIR,

Allowing the droplets of abrasive solution to be dispersed between the bristles of the brush and the test specimen.

The compressed air must be free from oil and dust and may be obtained by means of a distribution network or a compressor.

3.2.FIXTURE OR TUBE FOR CUTTING THE BRUSH BRISTLES,

This fixture for cutting bristles, for first generation machines, reduces the measurement scatters due to different brushes, by cutting out the bristles neatly and evenly.

Note : *The drawings are available from DPTA/DMOV/MXP/PEI.*

The second generation machines are supplied with a cutting tube.

The cutting of bristles must be made with the cutting tool (3.12.).

The length of bristles, measured from the rotation axis to the extremity of the bristle, must be $320 \text{ mm} \pm 2 \text{ mm}$.

3.3.GLOSS METER,

Allowing the measurement of the specular gloss of test specimens according to test method D25 1413.

3.4.CONDITIONED CHAMBER,

At $23^\circ\text{C} \pm 2^\circ\text{C}$ with no hygrometric requirements.

3.5.OVEN,

Regulated to $165^\circ\text{C} \pm 5^\circ\text{C}$.

3.6.BALANCE,

Precise to the nearest tenth of a milligram.

3.7.DESICCATOR**3.8.CHRONOMETER,**

Accurate to the nearest tenth of a second.

3.9.GRADUATED MEASURING CYLINDERS,

Of 50 millilitres and 1 litre.

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3.10.BEAKER,

Of 150 millilitres.

3.11.FLASKS,

In polyethylene minimum 2 litres with stopper, for mixing and storing.

3.12.SHARP CUTTING TOOL,

Such as a razor blade, etc.

3.13.CALIBRATION PLATES,

In black PolyMethyl MethAcrylate (PMMA), thickness 4 mm, dimensions 90 mm x 190 mm.

Note : PMMA cast PERSPEX black 962 in 4 mm thickness, plate of 3050 mm x 2030 mm cut into specimens of 90 mm x 190 mm may be ordered from the SCERT PLASTIQUES company.

3.14.ABSORBENT SURGICAL COTTON WOOL**4. REAGENTS**

All reagents used during testing must be of a recognised analytical quality.

4.1.DE-IONISED WATER**4.2.ALUMINIUM OXIDE SUSPENSION,**

Al_2O_3 , for metallography, quality 24 H, from PROLABO reference 20 994.260.

4.3.DODECYL SODIUM SULPHATE

$\text{C}_{12}\text{H}_{25}\text{NaO}_4\text{S}$, from PROLABO reference 27 926.238.

5.PREPARATION OF SOLUTIONS**5.1.SURFACE-ACTIVE SOLUTION**

Prepare the surface-active solution in the test laboratory, under very light stirring action, while retaining the ratio of 10 grams of dodecyl sodium sulphate (4.3.) to 100 ml of de-ionised water(4.1.).

Note :

- The surface-active solution must not be kept for more than 6 months after preparation,
- This product must be handled under an extractor hood while wearing a mask, as it is an irritant.

5.2.ABRASIVE SOLUTION WITHOUT SURFACE-ACTIVE AGENT

- Stir the aluminium oxide suspension (4.2.) using a magnetic stirrer for bottles, for at least of 30 minutes.
- Measure the dry extract of aluminium oxide suspension (4.2.) according to the method of operation described in Appendix 7.
- The ratio to be met for the preparation of the abrasive solution is 20 grams of aluminium oxide suspension (4.2.) made up to 1 litre with water. The preparation is to be made in a flask (3.11.).
- Keep this solution in the flask (3.11.) in the test laboratory.
- Measure the dry extract of this solution according to the method of operating described in Appendix 7.

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5.3.ABRASIVE SOLUTION WITH SURFACE-ACTIVE AGENT

- Add approximately 3 ml of surface-active solution (5.1.), per litre of abrasive solution without surface-active agent (5.2.).
- Stir the solution using a magnetic stirrer for bottles introduced into the flask (3.11.), adjust the speed to limit the formation of foam, and maintain this action for the duration of the test.

6.PREPARATION OF TEST SPECIMENS

6.1.FORM AND DIMENSIONS

Test specimens, coated with the paint to be examined, must be flat rectangular plates 90 mm x 190 mm in minimum dimensions. Their thickness must be between 0,5 mm and 5 mm.

6.2.CONDITIONING

Prior to the test allow the test specimens to remain in the test laboratory for at least 24 hours.

7.STARTING AND CALIBRATING THE EQUIPMENT

The adjustments indicated in the test method, such as flow rate, brushing time, rotation speed, dry extracts etc..., are there for information to give the operator an indication of configuration.

The equipment is considered to be calibrated when the loss of gloss target is achieved on PMMA plates and is stable.

The adjustments are to be kept for the testing of painted specimens.

7.1.STARTING AND PRE-SETTING THE EQUIPMENT

- Fill the reservoir of the supply system (3.1.5.) with the abrasive solution with surface-active agent (5.3.).
- Start the stirrer (3.1.5.).
- Position a painted test specimen or PMMA plate on the support (3.1.3.) during the setting stage in order to prevent deterioration of the bristles.
- Humidify the bristle assembled on the hub (G1) or sliders (G2), by passing under a supply of de-mineralised water, for a few second, then fit to the brushes to the equipment.
- Start the pump to supply the test specimen with abrasive solution.

Note: In the case of the initial starting of the equipment, an approximate adjustment of the supply flow rate (7.2.) is to be done, otherwise, use the previous test settings for starting the equipment.

- Adjust the flow of compressed air in such a way as to make the abrasive solution droplets "burst" onto the test specimen.
- Start the rotation of the brush at a speed of approximately 150 r/min.
- Leave the brush in its rotating state with a flow of solution for approximately 30 minutes.

7.2.ADJUSTMENT OF THE SUPPLY FLOW RATE

- Assess the flow rate of the solution by checking the time t, in seconds required, to fill the specimen with 50 ml (3.9.).

The supply flow rate, Q, in millilitres per hour, is given by the following equation:

$$Q = (50 \times 3600) / t$$

The value Q must be approximately 350 ml/h.

7.3.CALIBRATION ON PMMA PLATES

- Measure the initial specular gloss $B_{(ini)}$ of the PMMA plate in accordance with test method D25 1413.
- Position the plate on the support (3.1.3.).
- Complete the brushing cycle on the PMMA plate in accordance with § 8.METHOD OF OPERATION, by adjusting the setting parameters in order to obtain the target percentage loss of gloss. For information, the brushing time should be approximately 10 minutes.
- Find and measure the new minimum specular gloss $B_{(ini)}$ in the abraded area, in accordance with test method D25 1413.

The percentage loss of gloss, ΔB , is given by the equation:

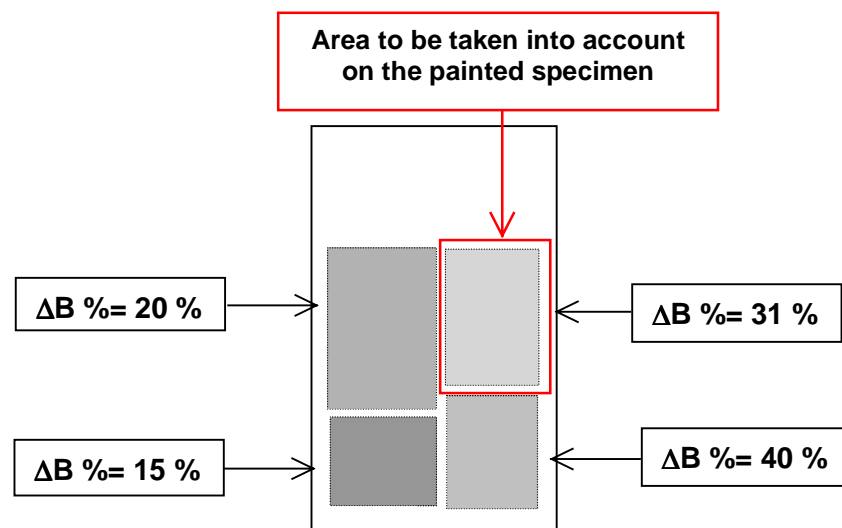
$$\Delta B \% = [(B_{(ini)} - B_{(fin)}) / B_{(ini)}] \times 100$$

The target percentage loss of gloss is $30 \% \pm 5 \%$.

The operation is to be completed on a minimum of 3 PMMA plates. Calibration is considered to conform when the loss of gloss percentage on the 3 PMMA plates is stable.

On the PMMA plate, the identification of different areas of loss of gloss allows the area to be taken into account on the painted test specimen to be determined.

- Example of determination of the area of loss of gloss on PMMA:



Note: Before proceeding with the actual test, record all the calibration results on an inspection document

8.METHOD OF OPERATION

For the duration of the tests, it is advisable to maintain the stock of the abrasive solution with surface-active agent (5.3.), to half its capacity and not to suspend the flow of the solution between two test specimens in order to avoid an excessive sedimentation of the aluminium oxide in the circuit.

- Measure the mean initial specular gloss $B_{(ini)}$ of the test specimen, under the angle defined in the standards documents in accordance with test method D25 1413.
- Position the test specimen on the support (3.1.3.).
- Operate the compressed air system (3.1.7.) and the supply (3.1.6.) of abrasive solution (5.3.).
- Start the rotation of the brush for the length of time defined in § 7.3.CALIBRATION ON PMMA PLATES.
- Remove the test specimen from the support and wash in plenty of water rubbing it lightly with the absorbent surgical cotton wool (3.14.).
- Dry the test specimen using the compressed air (3.1.7.).
- Dry the test specimen thoroughly with absorbent surgical cotton wool (3.14.), with a slow action in order to prevent polishing of the surface.
- After two hours drying in ambient air, measure again the specular gloss $B_{(fin)}$ in the abraded area which corresponds with the area of targetted loss of gloss defined on PMMA during calibration, in accordance with test method D25 1413.
- Check all 5 test specimens, the absence of drift of ΔB by using a PMMA plate.
- At the end of the test, carefully wash the brush (3.1.1.) with plenty of water, and dry with compressed air (3.1.7.).

- Note:**
- *Clean the supply circuit by flushing with de-ionised water (4.1.) at the end of the test run.*
 - *Never re-use a brush which has been dried without being washed.*
 - *The second generation equipment G2 is equipped with a cleaning device which can be used between each test specimen in order to prevent the accumulation of aluminium oxide on the brush.*
 - *Change the bristles of the brush completely every 210 tests corresponding to 35 hours of use, including the adjustment times.*

9.EXPRESSION OF RESULTS

Calculate for each test specimen, the loss of gloss ΔB , expressed in gloss units, according to the following equation:

$$\Delta B = B_{(ini)} - B_{(fin)}$$

In which:

$B_{(ini)}$ = Mean initial gloss value, expressed in gloss units.

$B_{(fin)}$ = Minimum gloss value after an abrasion cycle, expressed in gloss units.

The action of the wash brush is expressed by the specular gloss value after brushing $B_{(fin)}$ and the loss of gloss ΔB .

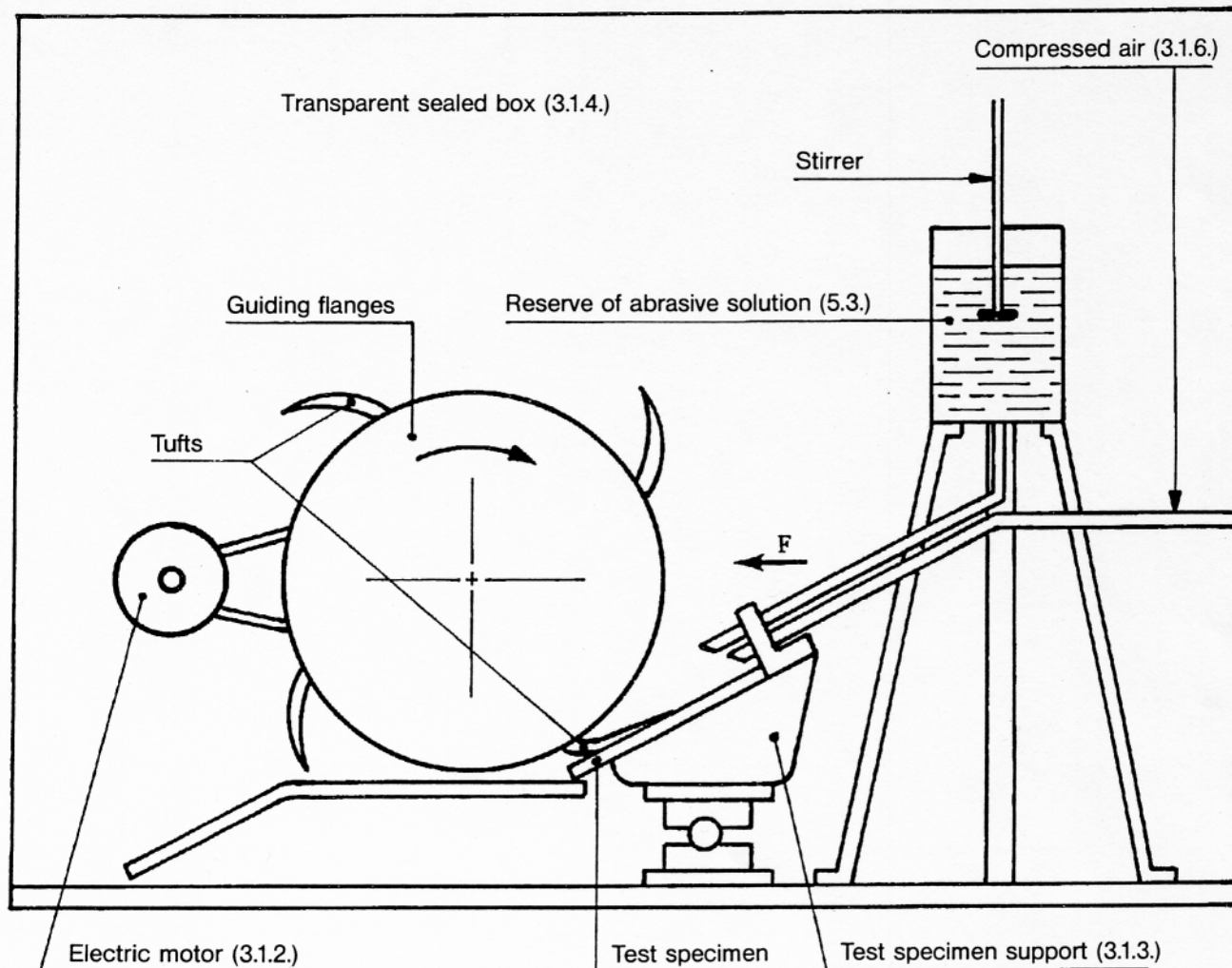
10. TEST REPORT

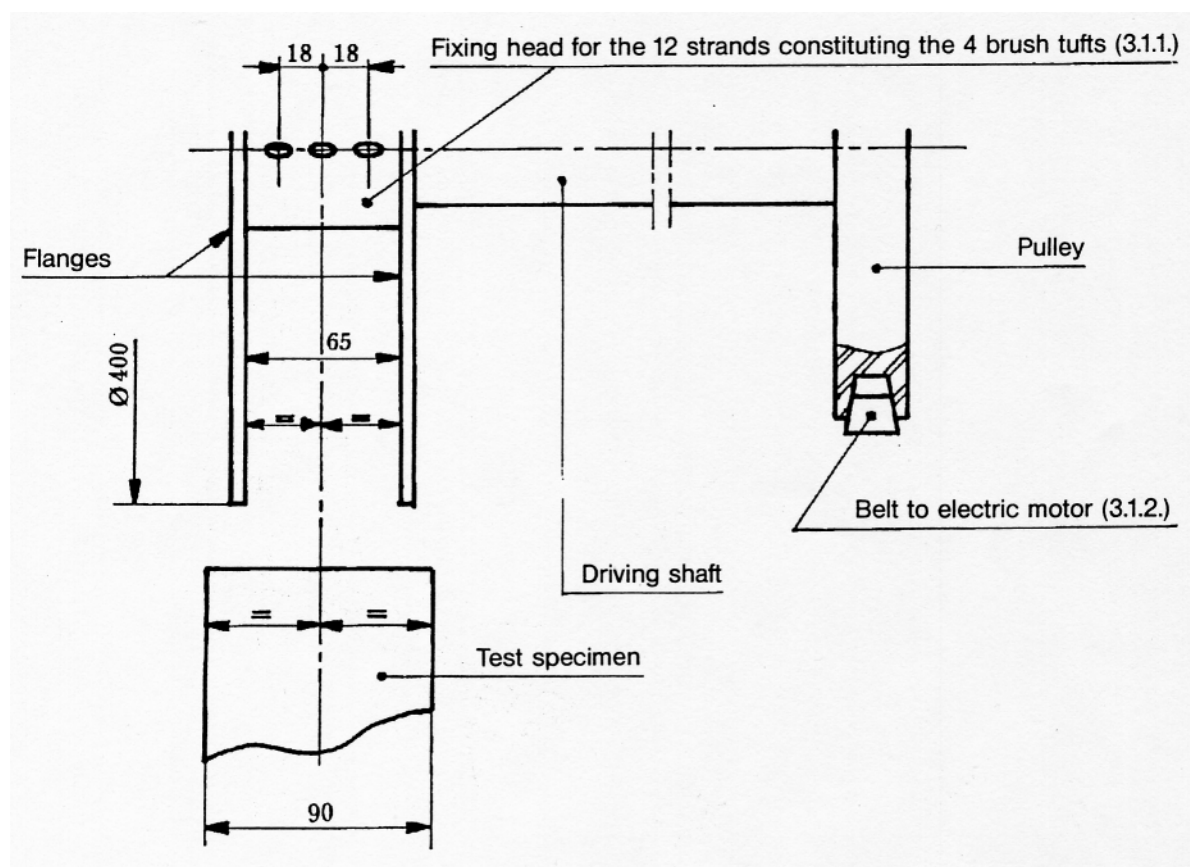
As well as the results obtained, the test report must include:

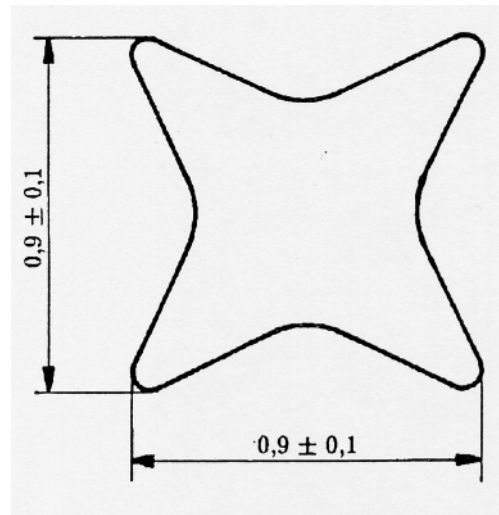
- the reference of this method,
- the reference of the test specimen examined and the name of the supplier,
- if applicable, the treatments to which the test specimens were subjected to prior to the test,
- the results obtained on PMMA,
- the operational details not stated in the method as well as any incidents which may affect the results.

Annexe 1

SCHEMATIC DIAGRAM OF THE BRUSH MACHINE

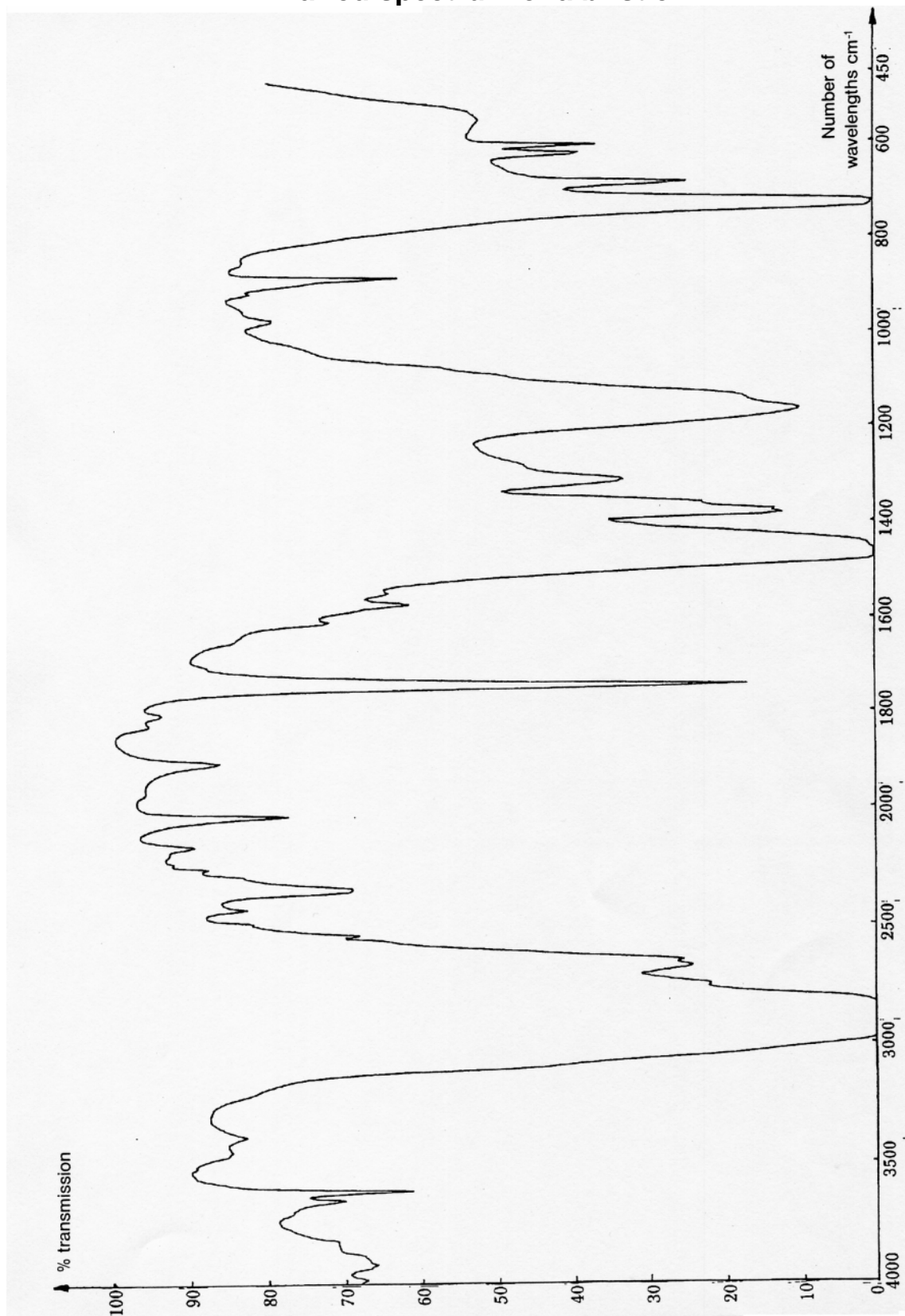


Annexe 2**FIXING HEAD****(View in direction F of Appendix 1)**

Annexe 3**BRISTLE SECTION
(Scale 50)**

Appendix 4

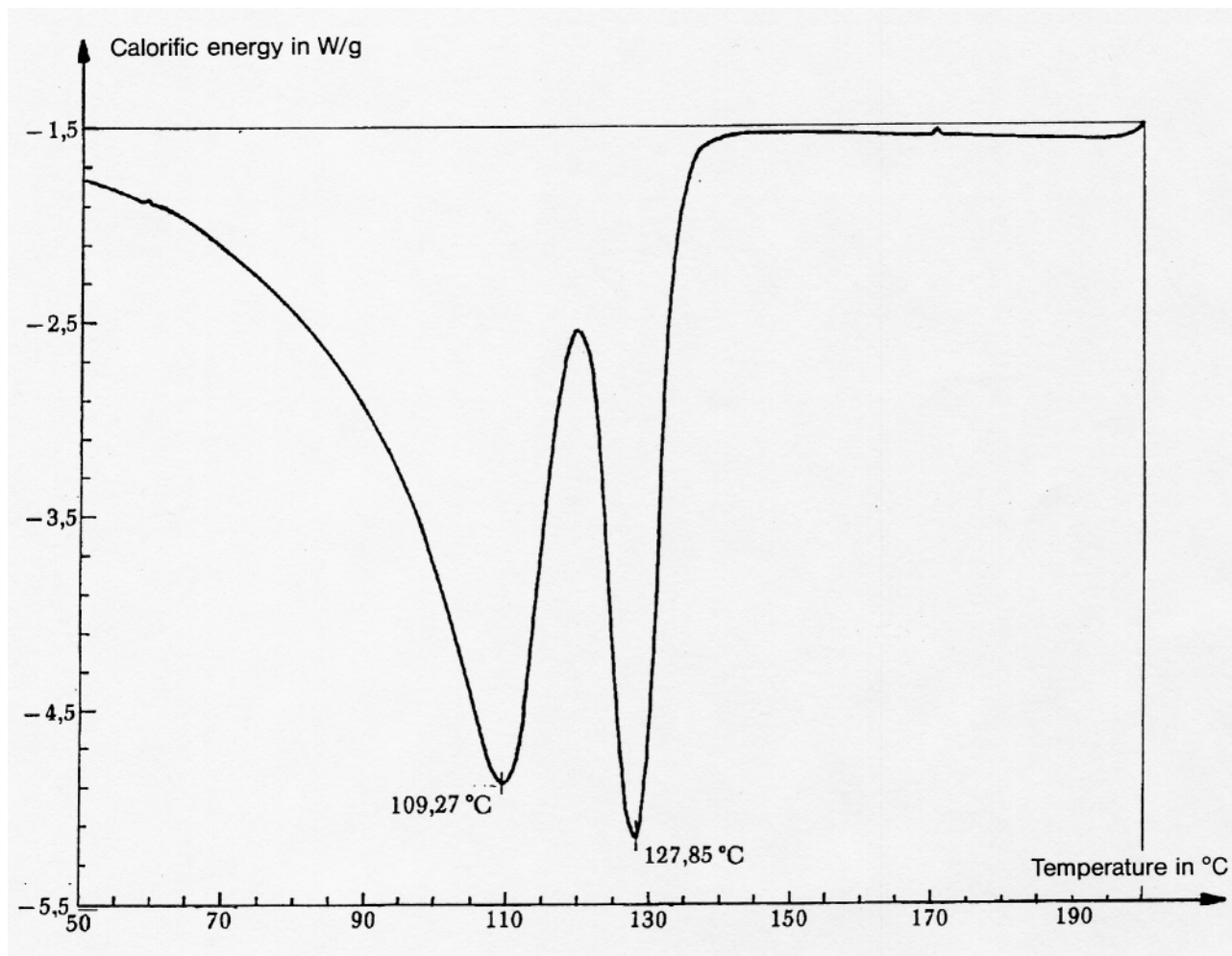
Infra red spectrum of a bristle



Annexe 5

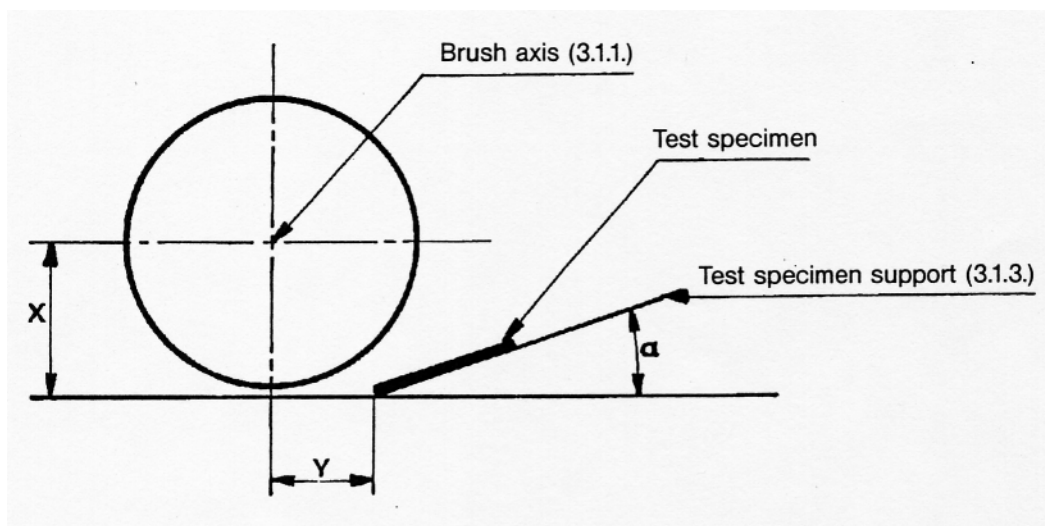
DIAGRAM OF A BRISTLE BY DIFFERENTIAL THERMAL ANALYSIS

(Test specimen weight 1 mg)



Annexe 6

POSITIONING OF THE TEST SPECIMEN



In which :

- $X = 205 \text{ mm} \pm 3 \text{ mm}$
- $Y = 140 \text{ mm} \pm 5 \text{ mm}$
- $\alpha = 20^\circ \pm 1^\circ$

Annexe 7

METHOD OF OPERATION

MEASUREMENT OF THE DRY EXTRACT OF THE ALUMINIUM OXIDE SOLUTION (4.2.)

- Weigh a beaker(3.10.)using the balance(3.6.), let M_1 be its mass in grams.
- Take approximately 20 grams of aluminium oxide suspension(4.2.) previously stirred for a minimum of 30 minutes, in the beaker(3.10.).
- Weigh using the balance(3.6.), the beaker + suspension together (4.2.), let M_2 be its mass in grams.
- Allow the water to evaporate in the oven(3.5.) for at least 4 hours.
- Remove the beaker and allow it to cool in the desiccator (3.7.).
- Weight a second time using the balance(3.6.) the beaker + dry extract together, let M_3 be its mass in grams.

The value of the dry extract, Es, as a percentage of the mass of the aluminium oxide suspension(4.2.), is given by the following equation:

$$Es \% = [(M_3 - M_1) / (M_2 - M_1)] \times 100$$

The value of the dry extract in the aluminium oxide suspension(4.2.) must be between 18 % and 22 % aluminium oxide.

MEASUREMENT OF DRY EXTRACT OF THE ABRASIVE SOLUTION WITH SURFACE-ACTIVE AGENT(5.2.)

- Proceed as for aluminium oxide.

The dry extract value of the abrasive solution without surface-active agent (5.2.) must be between 0,37 % and 0,42 % aluminium oxide.

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11.RECORDS AND REFERENCE DOCUMENTS

11.1.RECORDS

11.1.1.CREATION

- OR : 01/06/1993 – CREATION OF THE NORME.

11.1.2.OBJECT OF THE MODIFICATION

- C : 04/06/2003 – UPDATE OF THE TEST METHOD, AND DELETION OF THE FOREWORD
- B : 13/09/1996 – COMPLETE REWRITE AND ADDITION OF THE FOREWORD

11.2. REFERENCES DOCUMENTS

11.2.1. PSA DOCUMENTS

11.2.1.1. *Normes*

D25 1413 PAINT COATINGS – RUBBERS AND PLASTICS - MEASUREMENT OF GLOSS

11.2.1.2. *Others*

11.2.2.EXTERNAL DOCUMENTS

11.3.EQUIVALENT TO :

11.4.CONFORMS TO:

11.5.KEY-WORDS