

**ANTI-CHIP PRODUCTS
PLASTICS – RUBBERS
RESISTANCE TO SHOT BLASTING**

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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 : 27/01/2003***1. OBJECT AND FIELD OF APPLICATION**

The object of this method is to evaluate the resistance of protective coatings applied to vehicles in the areas exposed to chipping.

It therefore applies essentially to curable and non-curable anti-chip products. It may also be used to characterise the resistance to chipping of materials such as plastics and rubbers.

Finally, it allows the quality of an anti-chip coating, applied to a part, to be assessed.

2. PRINCIPLE

The product to be examined, applied to the substrate specified in the documents (or the part coated in the anti-chip product) is subjected to a blast of pellets.

The resistance to chipping is generally identified by the time necessary to pierce the layer of protective product and by the surface uncovered after a determined time of additional exposure.

It can also be identified by the loss in mass or by the variation in a significant characteristic after a given period of blasting.

3. EQUIPMENT**3.1. SUBSTRATES,**

with minimum dimensions of 120 mm x 200 mm defined in the standard documents.

3.2. ASSEMBLY,

for the preparation of test specimens for obtaining a film of the product with a thickness as uniform as possible such as filmograph, minimum opening gauge 50 mm x 100 mm.

3.3 PULVERISATION EQUIPMENT,

suitable for the application conditions.

3.4. VENTILATED OVEN,

temperature adjustable up to 250°C to within 2°C, conforming to the conditions in méthode d'essai D55 1171.

3.5. CHRONOMETER**3.6. SHOT BLASTING MACHINE,**

see Appendices 1,2,3,4 and 5.

3.7. CAST STEEL PELLETS,

rendered angular by crushing of spherical pellets, type GP 14 Wheelabrator Alleward.

3.8. CALIBRATION PLATES,

1 mm \pm 0,05 mm thick, injection moulded, of high density polyethylene, reference RIGIDEX HD 6070EA , Supplier BP Chemicals, available from DPTA/DMOV/MXP/PEI/ACFP – Belchamp.

3.9. SURFACE AREA MEASURING EQUIPMENT SUCH AS PLANIMETER**3.10. CONDITIONED ENCLOSURE**

standardised at 24°C \pm 4°C.

3.11. DIGITAL MICROMETER,

with contact for measuring the thickness of the product being tested over a surface area of approximately 0,5 cm² at a pressure of 0,22 MPa \pm 0,01 MPa and with an accuracy of \pm 2 μ m.

3.12. TRANSFER ADHESIVE,

of 0,1 mm maximum thickness.

Example : adhesive transfer film Scotchmark Y9568 from 3M completely suitable.

4. METHOD OF OPERATION**4.1. PREPARATION OF THE TEST SPECIMENS****4.1.1. PASTE TYPE ANTI-CHIP PRODUCTS**

Produce a preliminary series of test specimens in order to determine the quantity of fresh product necessary to obtain a layer of the required thickness.

Apply the product to be examined to the substrate (3.1.), using either the filmograph or a spatula, smoothing it to the thickness given by the gauge, or by pulverisation.

Proceed with drying or baking of the product in conformity with the details in the standard documents.

Measuring prior to all ageing :

- After conditioning in the enclosure (3.10.), carry out the measurements of thickness E at the subsequent impact point using the micrometer (3.11.)

$$E = e_1 - e_2$$

in which :

e_1 = thickness of the substrate (3.1.) + thickness of the layer of product layer (actual value, not rounded up),

e_2 = thickness of the substrate (3.1.) (actual value, not rounded up).

- prepare the required number of test specimens necessary, proceeding as above, if necessary making the corrections to get closer or encompass the required thickness.

4.1.2. PLASTIC OR RUBBER SLABS

The test specimen is made up by assembling a slab of the material to be examined, preferably 1 mm \pm 0,1 mm thick and a steel sheet serving as a substrate.

These two sheets are assembled either by mechanical means or by a suitable adhesive.

Example : a thin layer of cyanoacrylic adhesive, double sided adhesive film, etc.

4.1.3. TESTS ON PARTS

The test specimen consists of a part or a portion of a part (for example in the case of a tube) fixed, if necessary, to a support plate.

4.2. CALIBRATION OF THE SHOT BLASTING MACHINE

- Position the standard test specimen (3.8.) on the specified assembly inside the booth, according to Appendices 1 and 3, after gluing it, glossy face outwards, over all its surface using the adhesive (3.12.) onto a steel sheet. The glued test specimen is subjected to a pressure of $25 \text{ MPa} \pm 0,5 \text{ MPa}$ for 1 minute.
- Close the shot blasting machine, ensuring that the pressure inside the machine is in equilibrium with the atmospheric pressure.
- Regulate the air pressure to the usual figure, actuate the air inlet valve and start the chronometer (3.5.).

Note : *In the absence of previous data, the first calibration may be carried out at a pressure of 3 bars.*

- The calibration plate (3.8.) must be perforated under the following conditions :
 - after 180 seconds ± 10 seconds,
 - with a pellet flow rate of $2,6 \text{ kg/min.} \pm 0,05 \text{ kg/min.}$
 - with an impact pattern corresponding to that defined in Appendix 5.

If this is not the case, increase or decrease the air pressure and/or the pellet flow rate until these values are obtained. Confirm the setting by carrying out a second check.

- Carry out a new calibration each hour during the operation and modify the test pressure, if necessary.
- Change the pellets every 10 hours of operation. Each time a new load is introduced, lap the pellets for one hour on bare steel sheet.

4.3. SHOT BLASTING OF TEST SPECIMENS

- Successively position each test specimen, previously conditioned in the conditioned enclosure (3.10.), for a minimum time of 2 hours, on the assembly specified in the interior of the booth. This assembly consists of a rigid anvil which holds the test specimen to avoid any vibrations under the impact of the shot blasting.
- Then proceed as in § 4.2. – Closing the shot blasting machine, introduction of air, starting the chronometer and introduction of the pellets.
- Record time, t at the appearance of the substrate and allow the machine to run for 60 seconds.
- Remove the test specimen from the assembly and measure the uncovered surface with the equipment (3.9.).
- Carry out this procedure on new test specimens or test specimens which have previously been subjected to all ageing specified in the documents.

Note : *In the case of a test on slabs thicker than 1 mm. or on plastic parts, it may be preferable not to wait for piercing as far as the steel sheet and to identify the test result by loss of mass after a shot blasting time of 300 seconds or the variation of a characteristic, for example, burst pressure for a tube, after this period of time, see § 5.2.*

5. EXPRESSION OF RESULTS

5.1. PASTE TYPE ANTI-CHIP PRODUCTS

5.1.1. If the thickness, measured in the conditions of § 4.1.1., is equal to that specified in the standard documents, the resistance to shot blasting is expressed by the arithmetic mean of the 3 results obtained for time, t , expressed in minutes and seconds, and in the form of grading in terms of the surface uncovered after 60 additional seconds, as indicated in the table below.

Grading	Surface S uncovered after 60 seconds
0	$S < 1 \text{ cm}^2$
1	$1 \text{ cm}^2 < S \leq 2 \text{ cm}^2$
2	$2 \text{ cm}^2 < S \leq 3 \text{ cm}^2$
3	$3 \text{ cm}^2 < S \leq 4 \text{ cm}^2$
4	$4 \text{ cm}^2 < S \leq 5 \text{ cm}^2$
5	$5 \text{ cm}^2 < S \leq 6 \text{ cm}^2$
6	$6 \text{ cm}^2 < S \leq 7 \text{ cm}^2$
7	$7 \text{ cm}^2 < S$ or peeling

5.1.2. If the thickness measured in the conditions of § 4.1.1. is different from that specified in the standard documents, the test specified in § 4.3. is still undertaken and the resistance to shot blasting is expressed by value t , deduced graphically from the t' values actually obtained from the test specimens subjected to the test according to Appendix 6.

Whatever the case, the thickness of the coatings actually measured in the new condition must not vary by more than 10% from the nominal thickness required.

5.2. PLASTICS AND RUBBERS

As far as possible, the thickness of the sample must be 1 mm.

When the thickness of the test specimens is only $\pm 0,1$ mm different, indicate the time, t necessary in seconds to obtain the piercing.

If the thickness is greater than 1 mm., indicate the weight in grams of material removed after a shot blasting time of 300 seconds. If the test specimen is pierced in this time, indicate the time, t in seconds.

In the case of tests on parts, indicate the modification of characteristics in relation to the shot blasting time.

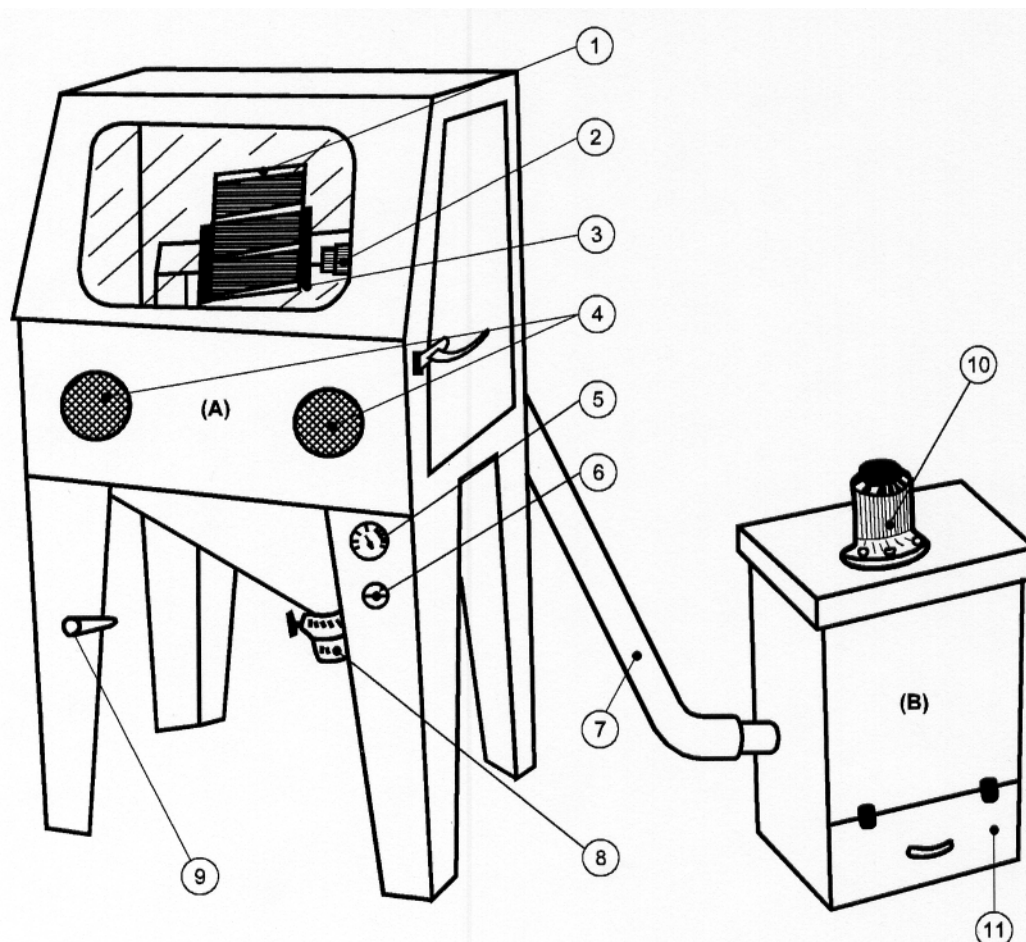
6. TEST REPORT

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

- the reference to this méthode,
- the exact thickness, if it is different from that specified in § 5.1. and 5.2.
- if the thickness of the test specimen is subject to variation at the end of the ageing, refer to the initial thickness measured in the new condition.
- the operating details not specified in the méthode as well as possible incidents likely to have affected the results, in particular the drying and stoving conditions.

Appendix 1

SHOT BLASTING MACHINE



BOOTH (A)

- ① Test specimen
- ② Blasting nozzle
- ③ Test specimen substrate
- ④ Air intake
- ⑤ Manometer
- ⑥ Relief valve
- ⑦ Flexible hose
- ⑧ Recycling tube fixing
- ⑨ Air inlet control

SUCTION MACHINE (B)

- ⑩ Suction motor
- ⑪ Dust collecting drawer

Appendix 2

SHOT BLASTING MACHINE

DESCRIPTION

Machine composed of two parts :

- the booth **(A)**, see Appendix 1,
- the suction machine **(B)**, see Appendix 1.

OPERATING PRINCIPLE

25 kg of pellets are introduced into the booth using the perforated base on which the assembly for positioning the test specimen and the shot blasting nozzle rests (see appendix 3).

After being set in motion, by operating the inlet control, the pellets circulate in a closed circuit. They fall to the base of the booth, which is in the shape of a funnel, from where they are taken and lifted up to the nozzle, to be propelled onto the test specimen.

The flow of pellets is regulated by adjusting the connection ⁸ in such a way as to obtain a regular flow, see Appendix 1.

The air pressure is regulated using the manometer and the relief valve ⁶, see Appendix 1.

The suction system **(B)** for dust permits a continuous cleaning of the pellets. It must be in operation during the test.

Note : *It is very important, before each startup time, to clean the filters by turning the crank handle located on one side of the suction machine **(B)**.*

OVERALL DIMENSIONS OF THE SHOT BLASTING MACHINE

Height 1380 mm
Width 1100 mm
Depth 760 mm

EFFECTIVE DIMENSIONS OF BOOTH

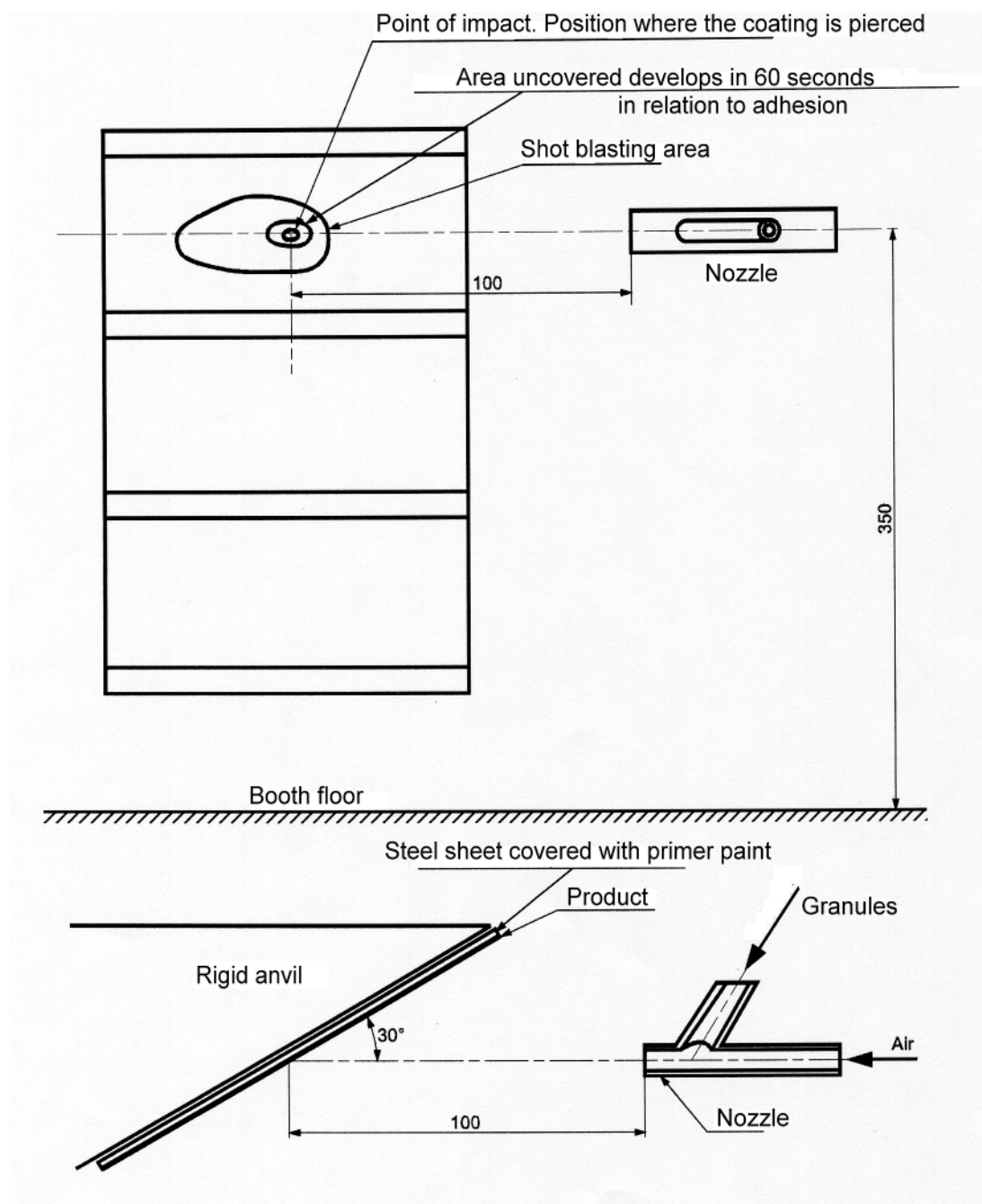
Height 600 mm
Width 710 mm
Depth 540 mm

NOZZLE

Must be in conformity, for these essential dimensions, with the diagram in Appendix 4, and in particular :

- Diameter of the barrel : 10 mm \pm 0,1 mm.
- Diameter of the air injector : 4 mm.
- Length of barrel, including the venturi section : 111 mm.
- Distance between the injector and the end of the barrel : 115 mm.
- Distance of 4 mm, injector position in chamber, to be checked, tolerance \pm 0,2 mm.

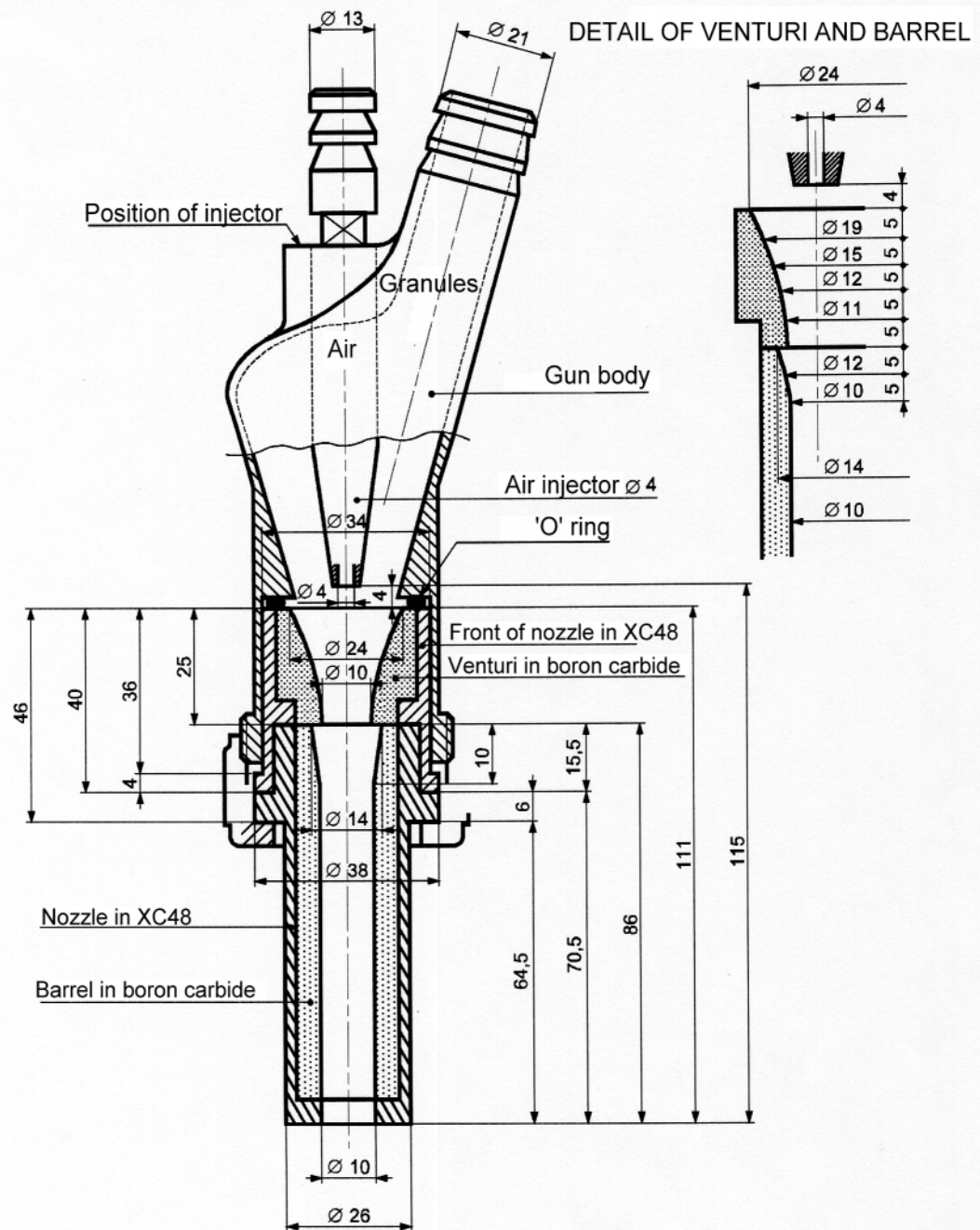
Appendix 3

**POSITIONING OF THE TEST SPECIMEN
AND THE SHOT BLASTING NOZZLE INSIDE THE BOOTH**

Appendix 4

SHOT BLASTING GUN

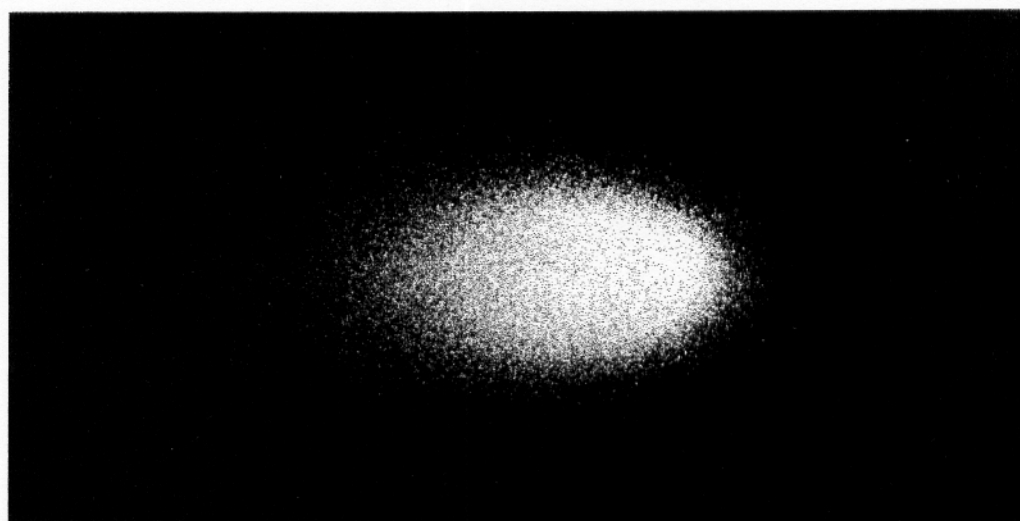
Air flow at 5 bars with injector dia 4 : 55 cubic metres/h



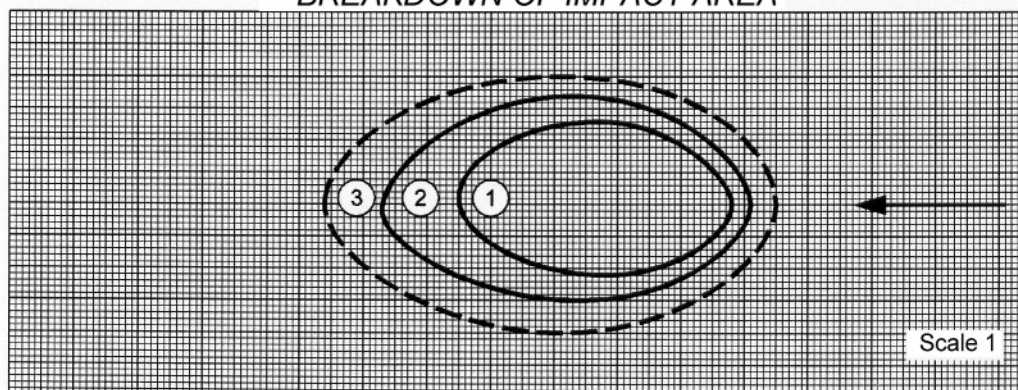
Appendix 5

IMPACT PATTERN

In the previous setting conditions, shot blasting for one minute of a substrate coated with recoverable primer paint (example : PPG type 742962) with a thickness of 15 μm and 20 μm baked at 10 + 15 min at 185°C, nominal stoving, must give the following impact pattern.



BREAKDOWN OF IMPACT AREA



- ① Total area uncovered
- ② Partial area uncovered
- ③ Total dispersion area

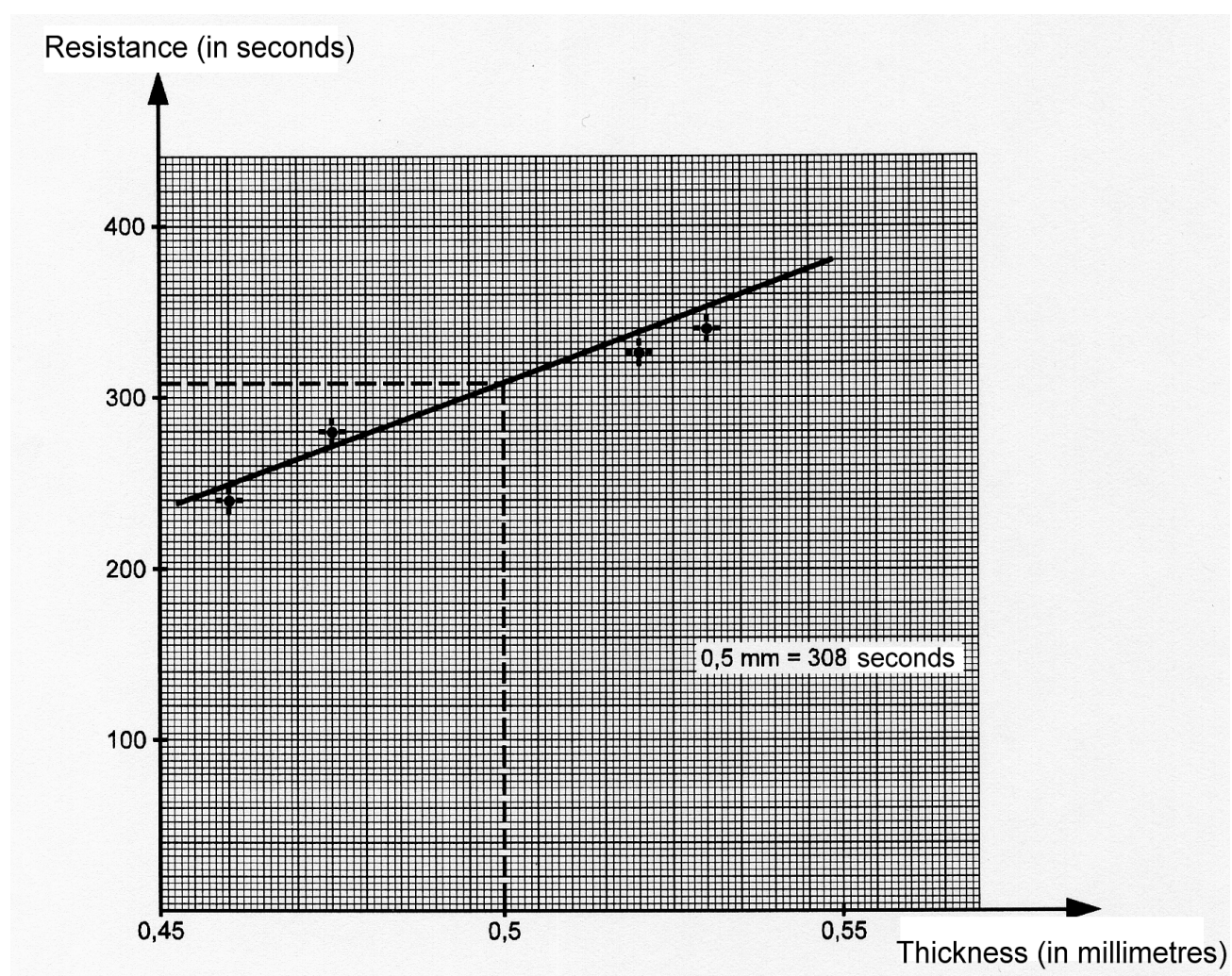
The total area uncovered must be between 7 cm^2 and 7,7 cm^2 , i.e. 10% error.

Appendix 6

EXAMPLE OF ANALYSIS OF RESISTANCE VALUES TO SHOT BLASTING
OBTAINED FROM PASTE TYPE COATINGSUsing the following values t' :

Thickness in mm. :	0,460	0,475	0,520	0,530
t' in seconds :	240	280	325	340

- Trace the curve below.
- From the nominal thickness specified (0,5 mm for example), find time taken, t .



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7. RECORDS AND REFERENCE DOCUMENTS

7.1. RECORDS

7.1.1. CREATION

- OR : 01/09/1984 – CREATION OF THE PSA NORME. REPLACES THE ASSOCIATION NORME N° 1428.

7.1.2. SUBJECT OF THE MODIFICATION

- B : 05/07/2002 – CHANGES TO § 3. EQUIPMENT AND § 4. METHOD OF OPERATION.
- A : 27/03/1997 - INTRODUCED INTO IDEM (*French only*).

7.2. REFERENCE DOCUMENTS

7.2.1.PSA DOCUMENTS

7.2.1.1 Normes

D55 1171 GLUES, MASTICS AND PAINTS – STOVING CONDITIONS IN THE LABORATORY

7.2.1.2. Others

7.2.2. EXTERNAL DOCUMENTS

7.3. EQUIVALENT TO :

7.4. CONFORMS TO :

7.5. KEY-WORDS