

METHODES D'ESSAI MATIERES

**PRODUCTS APPLIED TO BODY-IN-WHITE
OR PAINT COATED BODY, PLASTICS
ACCELERATED AGEING**

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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: 19/07/2004***1.OBJECT AND FIELD OF APPLICATION**

The object of this method is to describe standard conditions of exposure to various environmental conditions: climatic or chemical, single, in combination or cyclic, in order to determine their effect on certain given characteristics .

It applies to products applied to body-in-white or paint coated bodies corresponding to a bonding, sealing, damping, anti-chip, anti-corrosion, protection functions, and plastics.

It is not, however, possible to establish a direct relationship between test results and performance over time under service conditions. On the other hand, in certain applications, the benefit of experience may allow a correlation to be established between a test and service life duration.

2.PRINCIPLE

To define the ageing conditions from which shall be selected those which shall reproduce the optimum natural exposures, either from a temperature, humidity, corrosion point of view, or from a potential presence of liquid point of view, for each application.

3.EQUIPMENT**3.1.CONDITIONED ENCLOSURE**

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

3.2.DRY HEAT ENCLOSURE

Ventilated, adjustable between 20 and 200 °C to an accuracy of \pm 2 °C.

3.3.ADJUSTABLE ENCLOSURE

for relative humidity and temperature, fitted with:

- a device for measuring the degree of relative humidity to within 5 %,
- a device for measuring the temperature to within 1 °C .

3.4.COLD ENCLOSURE

Adjustable down to - 40 °C \pm 3 °C.

3.5.CLIMATIC ENCLOSURE

An automatic temperature and humidity control device, capable of creating repetitive climatic cycles as per the diagram in Appendix 4.

3.6.ENCLOSURE FOR IMMERSION IN WATER**3.7.GLASS JARS**

"Jam" type sealed with a leaktight rubber seal.

3.8.LOW DENSITY POLYETHYLENE BAGS

120 μ m \pm 10 μ m thick and with a gram per square metre capacity of 100 g/m² \pm 10 g/m².

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3.9.SOLDERING GUN FOR POLYETHYLENE

3.10.COTTON WOOL

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4. REAGENTS

4.1. DISTILLED OR DE-IONISED WATER

With sodium lauryl sulphate added at a concentration of 10 g/litre, of analytical quality.

4.2. DISTILLED OR DE-IONISED WATER

With resistivity of $\geq 100\,000\ \Omega\cdot\text{cm}$.

4.3. ASTM NO. 1 OIL

4.4. IRM 902 OIL

4.5. IRM 903 OIL

4.6. COOLANT

50/50 mixture of ethylene glycol and de-ionised water (4.2).

4.7. AFNOR C LIQUID

50/50 mixture of 2,2,4- trimethyl pentane (isooctane) and toluene.

5. PREPARATION OF TEST SPECIMENS

Prepare the test pieces as per the instructions from the various test methods specified for each product to be examined. Then place them in the conditioned enclosure (3.1) for at least 24 hours prior to subjecting them to the various ageing conditions.

6. METHOD OF OPERATION

6.1 Determine the characteristics chosen in accordance with the method of operation for the corresponding test method, after conditioning and before exposure.

6.2 Expose the test pieces to the environmental conditions for the ageing method chosen and as defined in Appendices 1 and 2.

- Atmospheric conditions, see Appendix 1.
Exposure in their unprepared state or prepared as per the instructions in Appendix 3 for the humid cataplasma.
- In liquids, exposure in jars (3.7) 4/5 filled and hermetically sealed.
Use a new jar for each product.

6.3 Determine the characteristics chosen in accordance with the method of operation of the corresponding test method, after exposure to the environmental conditions, and followed by conditioning in the enclosure (3.1), of:

- at least 2 hours and no more than 4 hours in the case of humid test specimens,
- at least 24 hours for others.

If necessary, and before establishing (a) new type(s) of ageing not indicated in this method, consult the French standard NF EN 29142.

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7.EXPRESSION OF RESULTS

In addition to the test results obtained in this way, record any changes visible during the ageing test, and before, during and after the destructive test, in addition to any observations made on test specimens prior to ageing. The aim is to not attribute manufacturing defects in test specimens to the standard ageing conditions.

For verification purposes, it is desirable to keep a batch of reference test pieces in a conditioned enclosure (3.1).

In the case of measurable characteristics, the results obtained shall be expressed:

- either as an absolute value,
- or as a relative variation against the initial value.

In the case of non-measurable characteristics, specify the type of changes observed, such as a break between substrate and adhesive, loss of cohesion in the adhesive seal during partial or total corrosion of the substrate under the adhesive, etc.

Note: *It may be useful to verify that the variations in the characteristic measured are purely a result of the accelerated ageing test . To do this, using the following 3 values:*

A = value of the characteristic measured before the accelerated ageing test,

B = value of the characteristic measured on the reference test specimen subjected to intrinsic ageing at 23 °C ± 2 °C and 50 % ± 5 % relative humidity ,

C = value of the characteristic after the accelerated ageing test.

calculate:

$$\frac{A - B}{A} \times 100 \quad \text{If not zero, determine the characteristics of intrinsic ageing}$$

$$\frac{A - C}{A} \times 100 \quad \text{Determine the characteristics of full ageing (under standard conditions and intrinsic ageing).}$$

$$\frac{B - C}{A} \times 100 \quad \text{Determine the characteristics of ageing under standard conditions.}$$

8.TEST REPORT

In addition to the results obtained, the test report shall indicate:

- the reference number of this method,
- the type of ageing used and benchmarked in Appendices 1 and 2, and the exposure periods,
- the results of the observations indicated in paragraphs 6.3 and 7,
- the operating details not specified in the method as well as any incidents which may have affected the results.

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Appendix 1 (1/2)

| Type of ageing | | | | | | | Information supplied in the documents |
|----------------|-----------------------------|--------------------------------------|------------------------|----------------|---------|------|---------------------------------------|
| Ref. No. | Enclosures used | Ambience | Relative humidity in % | Temperature | Times | | |
| | | | | | Hours | Days | |
| P | 3.2 | Dry heat | - | 70 °C | 24 | 1 | D47 1165 - A -1 |
| | | | | | 72 | 3 | D47 1165 - A -3 |
| | | | | | 168 | 7 | D47 1165 - A -7 |
| | | | | | 336 | 14 | D47 1165 - A -14 |
| | | | | | 504 | 21 | D47 1165 - A -21 |
| B | 3.2 | Dry heat | - | 100 °C | 24 | 1 | D47 1165 - B -1 |
| | | | | | 72 | 3 | D47 1165 - B -3 |
| | | | | | 168 | 7 | D47 1165 - B -7 |
| | | | | | 336 | 14 | D47 1165 - B -14 |
| | | | | | 504 | 21 | D47 1165 - B -21 |
| C | 3.4 | Cold | - | 20 °C | 24 | 1 | D47 1165 - C -1 |
| | | | | | 72 | 3 | D47 1165 - C -3 |
| | | | | | 168 | 7 | D47 1165 - C -7 |
| | | | | | 336 | 14 | D47 1165 - C -14 |
| | | | | | 504 | 21 | D47 1165 - C -21 |
| D | 3.2 | Dry heat | - | 85 °C | 24 | 1 | D47 1165 - D -1 |
| | | | | | 72 | 3 | D47 1165 - D -3 |
| | | | | | 168 | 7 | D47 1165 - D -7 |
| | | | | | 336 | 14 | D47 1165 - D -14 |
| | | | | | 504 | 21 | D47 1165 - D -21 |
| E | 3.4 | Cold | - | 30 °C | 24 | 1 | D47 1165 - E -1 |
| | | | | | 72 | 3 | D47 1165 - E -3 |
| | | | | | 168 | 7 | D47 1165 - E -7 |
| | | | | | 336 | 14 | D47 1165 - E -14 |
| | | | | | 504 | 21 | D47 1165 - E -21 |
| H | 3.8 + 3.2 + 3.4 | Humid cataplasms as per Appendix 3 | - | - | 24 + 2 | 1 | D47 1165 - H -1 |
| | | | | | 72 + 2 | 3 | D47 1165 - H -3 |
| | | | | | 168 + 2 | 7 | D47 1165 - H -7 |
| | | | | | 336 + 2 | 14 | D47 1165 - H -14 |
| | | | | | 504 + 2 | 21 | D47 1165 - H -21 |
| J | 3.2 + 3.6 + 3.4 | Successive action of: Dry heat | - | 100 °C | 4 | - | D47 1165-J |
| | | - Moisture: Total immersion in water | | 23 °C | + 4 | | |
| | | Cold as per Appendix 5: | | 20 °C | + 16 | | |
| K | 3.5 | Climatic as per Appendix 4: | ≥ 95 | 70 °C 30 °C | 24 | 1 | D47 1165 - K -1 |
| | | | | | 72 | 3 | D47 1165 - K -3 |
| | | | | | 168 | 7 | D47 1165 - K -7 |
| | | | | | 336 | 14 | D47 1165 - K -14 |
| | | | | | 504 | 21 | D47 1165 - K -21 |
| M | 3.5 | Climatic as per Appendix 4: | ≥ 95 | 80 °C 40 °C | 24 | 1 | D47 1165 - M -1 |
| | | | | | 72 | 3 | D47 1165 - M -3 |
| | | | | | 168 | 7 | D47 1165 - M -7 |
| | | | | | 336 | 14 | D47 1165 - M -14 |
| | | | | | 504 | 21 | D47 1165 - M -21 |
| N | 3.3 | Humid | ≥ 95 | 40 °C | 24 | 1 | D47 1165 - N -1 |
| | | | | | 72 | 3 | D47 1165 - N -3 |
| | | | | | 168 | 7 | D47 1165 - N -7 |
| | | | | | 336 | 14 | D47 1165 - N -14 |
| | | | | | 504 | 21 | D47 1165 - N -21 |
| T | 3.3 | Humid | ≥ 95 | 55 °C | 24 | 1 | D47 1165 - R -1 |
| | | | | | 72 | 3 | D47 1165 - R -3 |
| | | | | | 168 | 7 | D47 1165 - R -7 |
| | | | | | 336 | 14 | D47 1165 - R -14 |
| | | | | | 504 | 21 | D47 1165 - R -21 |
| V | 3.3 + 3.2 | Humid | ≥ 95 | 85 °C | 96 | - | D47 1165-V |
| | | | - | 85 °C | 240 | | |

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Appendix 1 (2/2)

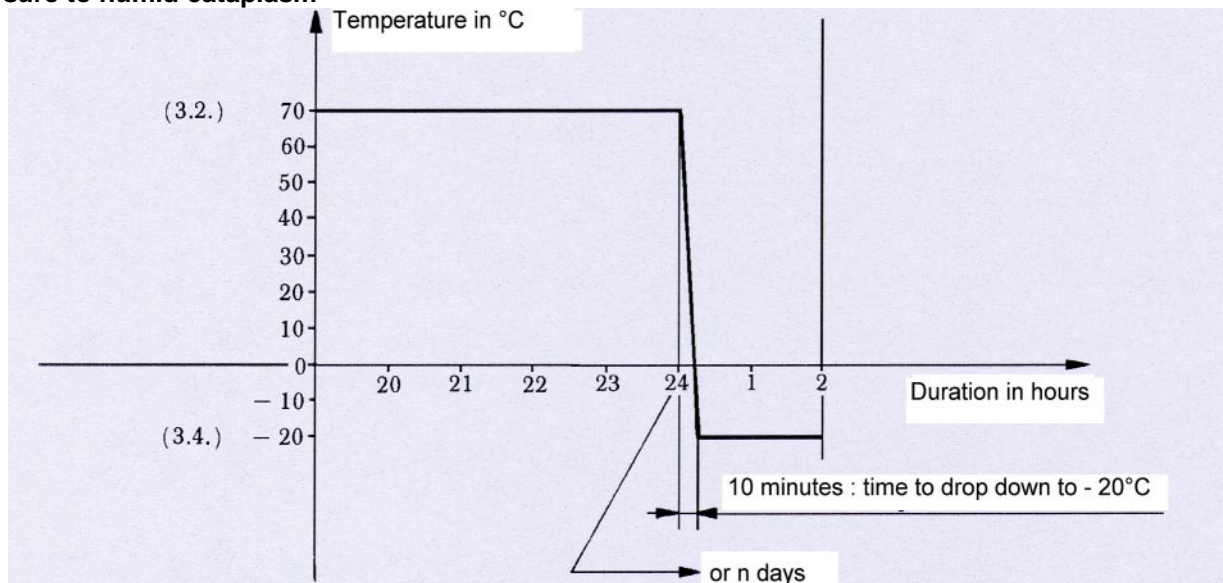
| Nature of the ageing | | | | | | | Information supplied in the documents |
|----------------------|--------------------|----------|---------------------------|-------------|-------|------|---|
| Ref. No. | Enclosures used | Ambience | Relative Humidity in % | Temperature | Times | | |
| | | | | | Hours | Days | |
| W | 3.3 | Humid | ≥ 95 | 85 °C | 24 | 1 | D47 1165 - W -1 |
| | | | | | 72 | 3 | D47 1165 - W -3 |
| | | | | | 168 | 7 | D47 1165 - W -7 |
| | | | | | 336 | 14 | D47 1165 - W -14 |
| | | | | | 504 | 21 | D47 1165 - W -21 |
| X | 3.3 | Humid | ≥ 95 | 35 °C | 504 | 21 | D47 1165 - X -21 |

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Appendix 2

| Type of ageing | | | | | | | | Information supplied in the documents |
|----------------|-----------------|--|---------|-----------------------|-------------|-------|------|---------------------------------------|
| Ref. No. | Enclosures used | Ambience | Liquids | Type | Temperature | Times | | |
| | | | | | | Hours | Days | |
| FA | 3.5 + 3.7 | Cyclical total immersion as per Appendix 4 | 4.5 | IRM 903I oil | 100 °C | 24 | 1 | D47 1165 - FA -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 - FA -3 |
| | | | | | | 168 | 7 | D47 1165 - FA -7 |
| | | | | | | 336 | 14 | D47 1165 - FA -14 |
| | | | | | | 504 | 21 | D47 1165 - FA -21 |
| FB | 3.5 + 3.7 | Cyclical total immersion as per Appendix 4 | 4.5 | IRM 903 oil | 130 °C | 24 | 1 | D47 1165 - FB -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 - FB -3 |
| | | | | | | 168 | 7 | D47 1165 - FB -7 |
| | | | | | | 336 | 14 | D47 1165 - FB -14 |
| | | | | | | 504 | 21 | D47 1165 - FB -21 |
| FC | 3.5 + 3.7 | Cyclical total immersion as per Appendix 4 | 4.5 | IRM 903I oil | 150 °C | 24 | 1 | D47 1165 - FC -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 - FC -3 |
| | | | | | | 168 | 7 | D47 1165 - FC -7 |
| | | | | | | 336 | 14 | D47 1165 - FC -14 |
| | | | | | | 504 | 21 | D47 1165 - FC -21 |
| FD | 3.2 + 3.7 | Total immersion | 4.3 | ASTM No 1I oil | 100 °C | 24 | 1 | D47 1165 - FD -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 - FD -3 |
| | | | | | | 168 | 7 | D47 1165 - FD -7 |
| | | | | | | 336 | 14 | D47 1165 - FD -14 |
| | | | | | | 504 | 21 | D47 1165 - FD -21 |
| FE | 3.2 + 3.7 | Total immersion | 4.3 | ASTM no 1 oil | 130 °C | 24 | 1 | D47 1165 - FE -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 - FE -3 |
| | | | | | | 168 | 7 | D47 1165 - FE -7 |
| | | | | | | 336 | 14 | D47 1165 - FE -14 |
| | | | | | | 504 | 21 | D47 1165 - FE -21 |
| FF | 3.2 + 3.7 | Total immersion | 4.6 | Ethylene glycol | 100 °C | 24 | 1 | D47 1165 - FF -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 - FF -3 |
| | | | | | | 168 | 7 | D47 1165 - FF -7 |
| | | | | | | 336 | 14 | D47 1165 - FF -14 |
| | | | | | | 504 | 21 | D47 1165 - FF -21 |
| FH | 3.5 + 3.7 | Cyclical total immersion as per Appendix 4 | 4.4 | IRM 902 oil | 70 °C | 24 | 1 | D47 1165 - FH -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 - FH -3 |
| | | | | | | 168 | 7 | D47 1165 - FH -7 |
| | | | | | | 336 | 14 | D47 1165 - FH -14 |
| | | | | | | 504 | 21 | D47 1165 - FH -21 |
| FJ | 3.5 + 3.7 | Cyclical total immersion as per Appendix 4 | 4.4 | IRM 902 oil | 150 °C | 24 | 1 | D47 1165 -FJ -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 -FJ -3 |
| | | | | | | 168 | 7 | D47 1165 -FJ -7 |
| | | | | | | 336 | 14 | D47 1165 -FJ -14 |
| | | | | | | 504 | 21 | D47 1165 -FJ -21 |
| FK | 3.5 + 3.7 | Cyclical total immersion as per Appendix 4 | 4.7 | AFNOR C liquid | 55 °C | 24 | 1 | D47 1165 - FK -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 - FK -3 |
| | | | | | | 168 | 7 | D47 1165 - FK -7 |
| | | | | | | 336 | 14 | D47 1165 - FK -14 |
| | | | | | | 504 | 21 | D47 1165 - FK -21 |
| FL | 3.2 + 3.7 | Total immersion | 4.1 | Water + wetting agent | 55 °C | 24 | 1 | D47 1165 - FL -1 |
| | | | | | 30 °C | 72 | 3 | D47 1165 - FL -3 |
| | | | | | | 168 | 7 | D47 1165 - FL -7 |
| | | | | | | 336 | 14 | D47 1165 - FL -14 |
| | | | | | | 504 | 21 | D47 1165 - FL -21 |

Appendix 3 (1/2)

- CONDITION H**Exposure to humid cataplasms**

This exposure requires two enclosures: One dry heat enclosure (3.2) and one cold enclosure (3.4), cotton wool (3.10), weldable bags made from polyethylene (3.8), de-ionised water (4.2).

Preparation of humid cataplasms

- Cut out and weigh a strip of cotton wool (3.10) measuring 180 x 500 mm and with a mass of $45 \text{ g} \pm 5 \text{ g}$.
Note: the strip of cotton used must have the characteristics indicated above. In the case of large parts, only the area to be tested needs to be covered with the cotton.
- Place the first test specimen(s) on the first third of the length of the cotton wool.
- Fold back the second third of the strip of cotton wool on the test specimen(s).
- Deposit the second test specimen or the other test specimens and cover with the third 1/3 of the strip of cotton wool.
- Introduce the assembly into a polyethylene bag (3.8).
- Add a mass of de-ionised water (4.2) equal to 10 times that of the cotton wool taking care to distribute it uniformly.
- Remove as much air as possible by smoothing out the bag by hand.
- Close the polyethylene bag by welding it using the soldering gun (3.9).
- To ensure a perfect seal, the assembly is placed in a second bag which must be soldered in the same way.

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Exposure conditions of the cataplasms

- Keep the cataplasms for the period(s) previously determined in the enclosure (3.2), maintained at the temperature of $70\text{ °C} \pm 2\text{ °C}$.
- Remove it, and immediately, take out the test specimen(s) from the bag and the cotton wool.
- Place this/these test piece(s) for two hours in the enclosure (3.4) maintained at the temperature of $-20\text{ °C} \pm 2\text{ °C}$.
- Then place it (them) in the conditioned enclosure (3.1) for at least 2 hours but no more than 4 hours, before determining the characteristic chosen.

Note: Any bag to be found unsealed must lead to the rejection of the test specimens contained. If ageing of 14 days or more is performed, the cataplasms shall be completely re-formed using the method indicated above (using fresh cotton wool and bags) every 14 days.

Appendix 4

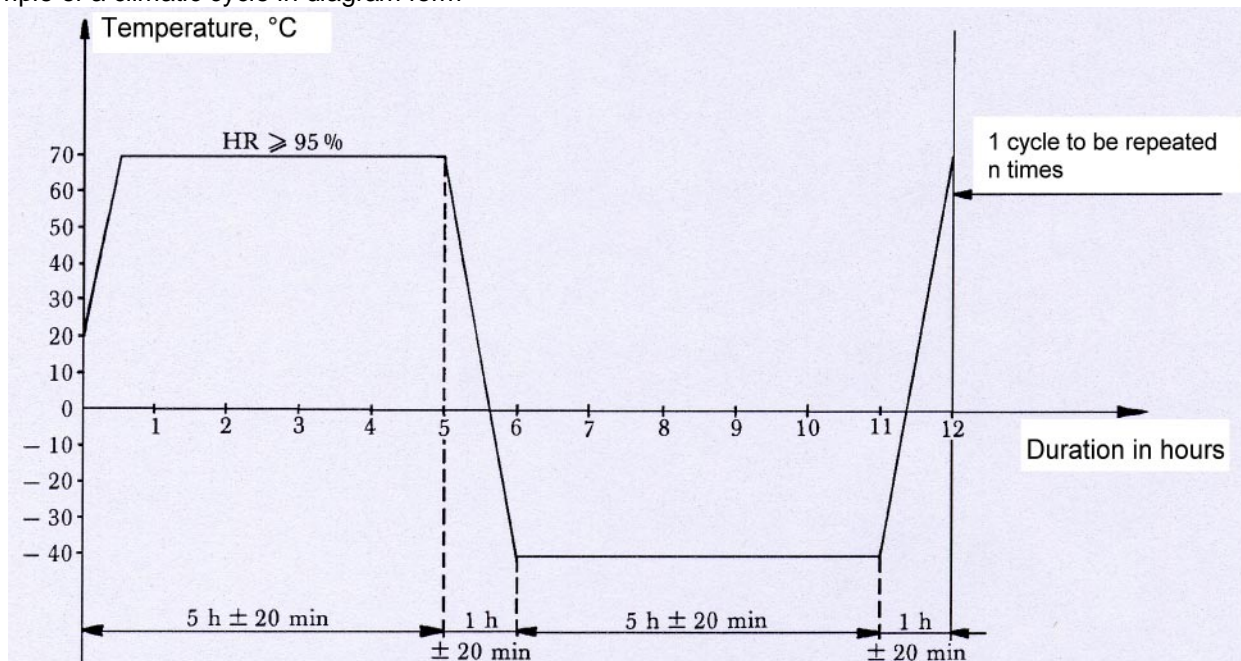
- CONDITIONS K - M

Humid heat and cold test cycles

- CONDITIONS FA - FB - FC - FH - FJ - FK

Hot and cold test cycles

Example of a climatic cycle in diagram form



This cycle requires an enclosure (3.5) that can be programmed to automatically change from hot to cold and vice versa, capable of meeting the changeover times within the tolerances laid down.

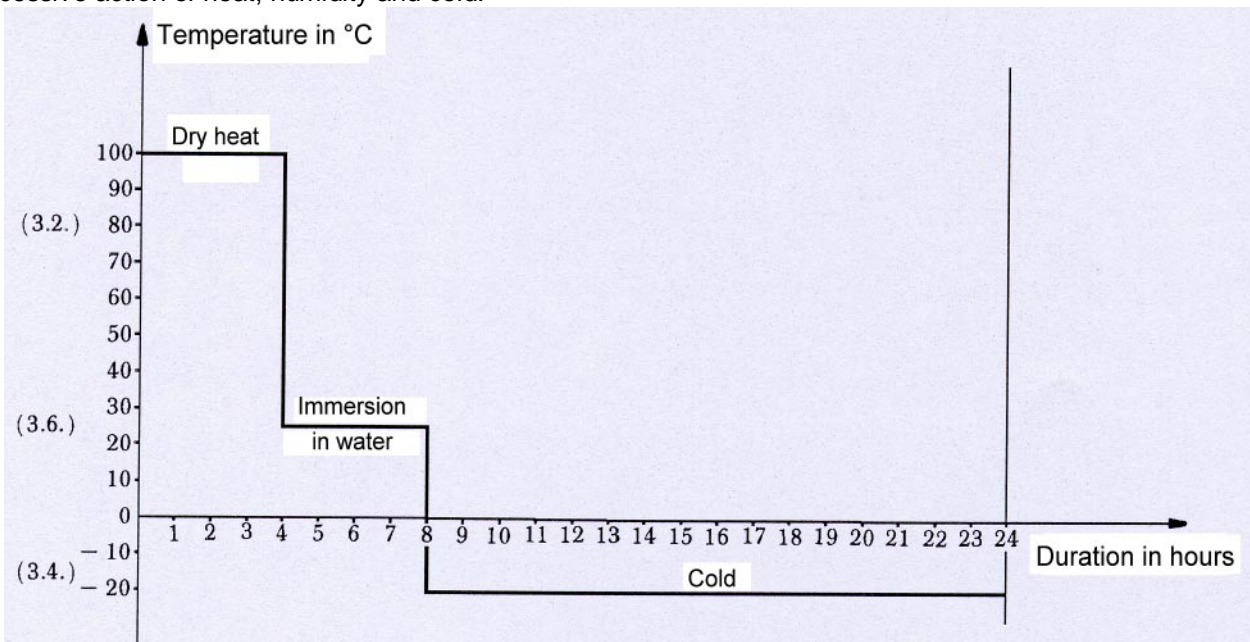
It comprises:

- a period of 5 hours \pm 20 minutes at a temperature of $70\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and a relative humidity of $\geq 95\%$ (this humidity is not compulsory in the case of conditions FA - FB, etc.),
- changing from hot to cold within 1 hour \pm 20 minutes,
- a period of 5 hours \pm 20 minutes at a temperature of $-40\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$,
- changing from cold to hot within 1 hour \pm 20 minutes,
- conditioning at $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and $50\% \pm 5\%$ relative humidity for 24 hours prior to determining the characteristic chosen.

Appendix 5

- CONDITION J

Successive action of heat, humidity and cold.



This cycle requires 3 enclosures: one dry heat enclosure (3.2), one enclosure for immersion in water (3.6) and one cold enclosure (3.4).

It comprises:

- a period of 4 hours in the enclosure (3.2) maintained at a temperature of $100\text{ °C} \pm 2\text{ °C}$,
- changing within 3 minutes from enclosure (3.2) to enclosure (3.6) maintained at $23\text{ °C} \pm 2\text{ °C}$ and totally immersed in water,
- a period of 4 hours in the enclosure (3.6),
- changing within 3 minutes from enclosure (3.6) to enclosure (3.4) maintained at a temperature of $20\text{ °C} \pm 2\text{ °C}$ and totally immersed in water,
- remaining for 16 hours in the enclosure (3.4),
- conditioning at $23\text{ °C} \pm 2\text{ °C}$ and $50\% \pm 5\%$ relative humidity for 24 hours prior to determining the characteristic chosen.

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9.RECORDS AND REFERENCE DOCUMENTS

9.1.RECORDS

9.1.1.CREATION

- OR : 01/02/1980 – CREATION OF THE PSA NORME. REPLACES THE ASSOCIATION NORME No. 1165.

9.1.2.SUBJECT OF THE MODIFICATION

- F : 07/02/1997 – MODIFICATION TO THE TITLE, PARAGRAPH 1 AND ADDITION OF AGEING CONDITIONS V-W-X, AND DELETION OF FOREWORD.
- G : 17/02/1997 – MODIFICATIONS TO PARAGRAPHS 4.3, 4.4 AND APPENDICES 2, 3(1/2).

9.2.REFERENCE DOCUMENTS

9.2.1.PSA DOCUMENTS

9.2.1.1.Standards

9.2.1.2.Others

9.2.2.EXTERNAL DOCUMENTS

AFNOR standard: NF EN 29142 (10/1993 - CLASSIFICATION NUMBER T 76-109)

9.3.EQUIVALENT TO:

9.4.CONFORMS TO:

9.5.KEY WORDS

DAMPING, ANTI-CORROSION, ANTI-CHIPPING, SEALING, BONDING, PROTECTION