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**APPLICATION OF A TEMPERATURE MAINTENANCE
TEST FOR NON-INDEPENDENT MECHANICALLY
REFRIGERATED EQUIPMENT WITH A VIEW TO
RENEWING THE CERTIFICATE OF COMPLIANCE
WITH ATP AT 6 AND 9 YEARS**

(Procedure)

Note by the secretariat

The secretariat reproduces below a proposal submitted by France.

1. Purpose and scope

This procedure describes the conditions for the preparation and application of a temperature maintenance test for single and multi-temperature and single and multi-evaporator non-independent mechanically refrigerated equipment.

The relevant registration is intended for the competent authority for the renewal of the certificate of compliance of the vehicle with ATP at six and nine years. This test shall be carried out by an authorized professional selected by the owner of the vehicle(s) or his agent.

2. Reference

Annex 1 of the amended ATP Agreement.

3. Definitions

cf. Annexes I and II.

4. Principle

The purpose of the test is to obtain a recording of temperature maintenance below the temperature of the class in question.

5. Conditions required for carrying out the test

5.1 Personnel

The professionals carrying out the temperature maintenance test shall be specialized in on-board refrigeration. The tests shall be carried out under the responsibility of an authorized person who will sign the test report.

The list of authorized professionals is updated every six months and may be consulted on G.I.E. CEMAFROID's web site (www.cemafroid.fr).

5.2 Equipment

5.2.1 Environment

The test shall be carried out as far as possible inside a closed building with adequate ventilation, and in any case under cover and sheltered from wind and sun. The environmental conditions shall ensure some degree of stability in the ambient temperature which must not be less than +15° C.

The outside temperature is the mean of all the instant outside temperatures. The instant outside temperature is the mean of the temperatures recorded by the outside sensors at any given moment. The difference between the warmest and the coldest instant temperature shall not exceed 5° C.

Exhaust gases must not interfere with the course of the test.

5.2.2 Measuring instruments

The temperature recorder shall be equipped with at least four sensors, disposed as indicated in 6.2.4.

The recordings shall be printed on paper and plotted; they shall include at least the following:

- Date of the test;
- Identification of the transport equipment tested (identification number of the body and registration number of the vehicle, if appropriate);
- Record of the temperatures for each sensor and the position of the sensors;
- The mean of the air temperatures - at mid-height and in the middle of the sides, and also at the rear of the body;
- Name of the person in charge of the test;
- Identification of the measuring apparatus.

The maximum interval between two measurements is 15 minutes.

The equipment shall comply with the standard NF E 18-150 or its CEN equivalent, and shall be calibrated regularly.

5.3 Documents

The presentation and content of the model forms for the declaration and for the test results shall correspond to the models in annex III.

6. Carrying out the test

6.1 Informing the competent authority

The competent authority shall be informed (e.g. by fax or e-mail) of the date, time and place of the tests and the identification of the equipment tested three working days before the start of the tests.

6.2 Preparation of the test

6.2.1 *Location of the temperature sensors*

The temperature sensors shall be disposed as follows:

- two sensors outside the body, one at the return airflow, the other at the blower of each evaporator;

- one sensor outside the body, in the middle of one side at mid-height;
- one sensor outside the body, in the rear section. This sensor enables the outside temperature to be confirmed.

The outside sensors shall be protected from solar radiation and from any other interfering source of heat.

6.2.2 *Connection and activation of the recorder*

6.2.3 *Blocking the action of defrosting*

It shall be ensured that defrosting will not interfere with the first six hours of the test, for example:

- by disconnecting the defrosting programming clock;
- programming the command system so that the next defrosting will take place after six hours have elapsed; or
- by disconnecting the sensor fixed to the evaporator which permits defrosting by closing the contact.

6.2.4 *The vehicle shall reach the class temperature*

The body shall be dry.

The vehicle shall be brought to within approximately 1° C of the temperature of the class in question (for example, with the electric engine or in road mode):

- Class C: -20° C;
- Class B: -10° C;
- Class A: 0° C.

6.3 **Progress of the test**

The vehicle with the engine idling shall maintain a class temperature for a period of time not less than two hours. During the driving phase of the compressor, the rotation speeds of the engine and the compressor shall be measured. The engine idling speed shall not be more than 100 revolutions per minute at the idling speed indicated by the vehicle constructor.

Subsequently, for data purposes, the electric engine will be activated and must also maintain the temperature for a period of not less than two hours.

6.4 Printing out the recording

The temperature recordings shall be printed out so that they can be attached to the test report (cf. paragraph 8).

7. Interpretation of the tests

When the equipment has several evaporators, the interpretation of the test shall be according to the least favourable evaporator recording.

The result of the test with the “mains” electric engine shall have no effect on the decision handed down.

8. Writing the test report

The presentation and content of the test report shall correspond to the model in annex III. All the entries shall be correctly completed, particularly those concerning the description of the equipment tested.

The temperature recording(s) and the test report shall be handed over to the author of the request for the test for transmission to the competent authority.

Annex I

Definitions¹

Definitions	Remarks
Removable: refers to a thermal appliance which can be entirely or partially removed and put back.	For example, this may be a cooling appliance in which the eutectic plates must be placed in a chill room in order to be deep-frozen (small containers used for general distribution). Equipment with <i>removable</i> or <i>non-independent</i> appliances shall have an additional letter X in their distinguishing marks (annex 1, appendix 4 of ATP).
Non-independent: a refrigerating appliance is said to be non-independent when the energy source is dependent on that for moving the vehicle.	Equipment with <i>removable</i> or non-independent appliances have an additional letter X in their distinguishing marks (annex 1, appendix 4 of ATP).
Movable bulkhead means a rigid or flexible bulkhead which may be connected to the roof or to the side walls of the equipment by fixed rails. Such bulkheads may be moved lengthwise or crosswise for a certain distance, raised to the roof or jointed with the walls.	Flexible bulkheads not connected to the walls can only be used in multi-compartment equipment if they comply strictly with health requirements (body/partition matching, cleanliness).
K coefficient means the overall coefficient of heat transfer which represents the insulating capacity of the equipment.	For a cell with normal insulation (IN): $0.40 < K \leq 0.70 \text{ W/m}^2 \cdot \text{K}$ For a cell with heavy insulation (IR): $K \leq 0.40 \text{ W/m}^2 \cdot \text{K}$
Safety coefficient means the multiplication factor (applied to the heat flow through the walls of the body (Q) for refrigerated appliances), which ensures that the effective refrigerating capacity of the thermal appliance is greater than the thermal losses from the body.	ATP has set the minimum limit of the coefficient at 1.75.

¹ Words in *bold italics* are given definitions.

Definitions	Remarks
<p>Compliance with ATP means that equipment must meet the following conditions in order to comply with ATP:</p> <ul style="list-style-type: none"> - They belong to a series in which a <i>model</i> has undergone a complete test of the equipment (body and unit), or more generally separate tests of the body and the unit. These tests shall be carried out in an ATP-recognized laboratory and certified by the issue of the relevant test report(s). - They are certified by the competent authority; in France, they are inspected on the production site and when approvals are issued or renewed. 	
<p>Thermal appliance means an appliance which produces cold (refrigeration unit, cooling appliance) or heat (heating appliance).</p>	
<p>Appliance finished in the workshop means a body produced by a coach-builder and sent to a concessionary for mounting on a chassis with the possible addition of the <i>thermal appliance</i>.</p>	
<p>Model or prototype means equipment which, after testing in a laboratory recognized by ATP and certification by the issue of a test report, will permit the approval of new equipment mass produced according to the model.</p>	<p>In the case of <i>multi-compartment</i> vehicles, each compartment may or may not be fitted with a thermal appliance. This may concern:</p> <ul style="list-style-type: none"> - units completely separate (refrigeration, cooling or heating); - a <i>multi-evaporator</i> mechanical refrigeration unit.
<p>Kit means a body comprising several elements supplied unassembled and so described in the model certificate.</p>	<p>The assembly is decentralized and must be carried out in accordance with the assembly guide.</p>
<p>Single-temperature means equipment in which all of the insulated body is kept at the same temperature.</p>	<p>The volume thus constituted may or not be divided into compartments by movable or non-movable bulkheads. The cold distribution is ensured by one or more evaporators.</p>

Definitions	Remarks
Multi-evaporator means a refrigerating unit with several evaporators constituting a common section under high pressure (drive, compressor, condenser and automaticity appliances) located outside the body and connected to evaporators placed in one or more different compartments. These may either be of the ventilated type or the flooded type in eutectic plates or tubes.	
Multi-temperature means equipment in which the compartments are kept at temperatures which may be different.	
Thin walled means equipment in which the thickness of the side walls of the insulated body is less than 45 mm.	
Delivery is taken of a vehicle when it has undergone a satisfactory inspection of the requirements for compliance with ATP.	

Annex II

Abbreviations and units

Abbreviation	Meaning	Unit
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Refrigerated equipment and units

IN	normally insulated	/
IR	heavily insulated	/
K	overall coefficient of heat transfer	W/(m ² * K) (watts per square metre and per Kelvin)
P	effective refrigerating capacity indicated by the constructor of the refrigerating appliance	W (watts)

Multi-evaporator refrigeration units

P _{total}	total nominal capacity of the high pressure unit	W
P _{comp}	effective capacity of the evaporator of the unit in the compartment in question (given in the table of effective values in the test report)	W
S _m	mean surface area of the body $S_m = \sqrt{S_i \cdot S_e}$	m ² (square metre)
S _i	inside surface area of the body	m ²
S _e	outside surface area of the body	m ²

Multi-compartment equipment

S _{mtotal}	mean surface area of the whole body	m ²
S _{mcomp}	mean surface area of the compartment in question in its largest dimensions	m ²
Δθ	Temperature difference between the outside temperature of 30° C and the inside temperature (0° C, -10° C or -20° C depending on the class in question)	K (Kelvin)
$\phi = K \cdot S_m \cdot \Delta\theta$	heat flow through the walls of the body	W
$U = K \cdot S_m$	coefficient used to compare the respective heat results of a cooling appliance (to be approved) and the cooling appliance tested in the tunnel	m ² .K

Annex III

<p>Declaration of a temperature-maintenance test for non-independent mechanically refrigerated equipment <i>(the document shall be sent to the competent authority three working days</i> <i>before the start of the test)</i></p>

Company authorized to carry out the test:

Company reference:

Name:
Address:

Date of start of test:

Owner of equipment tested:

<i>Body</i>	<i>Unit</i>
Name:	Name:
Address:	Address:

Results
of the temperature maintenance test of non-independent
mechanically refrigerated equipment

*(delivered to the author of the request for the test,
for transmission to the competent authority)*

Equipment subjected to testing:

Registration number	Category	Make
Body:	Date of initial issue of the certificate of compliance	Unit:
Make:		Make:
Type:	Original K coefficient	Model:
No. of report of reference test:		No. of test report:
Serial number:		Serial number:
Date of manufacture:		Refrigerant:
		Date of manufacture:
		Number of hours of operation:

Special features of the equipment:

		Number	Location	
Bulkhead(s) (specify fixed or removable)				
Evaporator			Type	Location
	No. 1			
	No. 2			
	No. 3			

Test data:

Number of recording graphs attached: Temperature recorder reference:

Idling speed: rpm: Reference revolution counter

Idling speed of compressor in road mode: rpm

Maintenance of temperature at idle in road mode

Evaporator		Temperature	Time
	No. 1		
	No. 2		
	No. 3		

Class in question:

Result of the temperature maintenance test:

In conformity²

Not in conformity²

Speed electric compressor: rpm

The temperature was maintained at ...° C for ... minutes in mains operation mode

Signature:

Name and position of signatory:²

² Delete as appropriate.