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Working Party on the Transport of Perishable Foodstuffs
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AGREEMENT ON THE INTERNATIONAL CARRIAGE OF PERISHABLE FOODSTUFFS AND ON THE SPECIAL EQUIPMENT TO BE USED (ATP)

Revised text of Annex 1 to ATP

Note from the secretariat

This document is based on the document (TRANS/WP.11/2002/12) which was considered by the Working Party at its last session.

The Working Party adopted the new structure of the Annex 1 (numbering, index and headings and sub-headings) as proposed, but decided to keep the existing text of ATP (also for models of test reports) except for the transitional provisions which had been deleted.

It also accepted the use of "T" for temperature and the replacement of "° C" by "K" at several points in the text.

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Annex l

DEFINITIONS OF AND STANDARDS FOR SPECIAL EQUIPMENT [1/] FOR THE CARRIAGE OF PERISHABLE FOODSTUFFS

1. **Insulated equipment**. Equipment of which the body [2/] is built with insulating walls, doors, floor and roof, by which heat exchanges between the inside and outside of the body can be so limited that the overall coefficient of heat transfer (K coefficient), is such that the equipment is assignable to one or other of the following two categories:

I_N = Normally insulated equipment — specified by a K coefficient equal to or less than 0.70 $W/m^2.K$

I_R = Heavily insulated equipment — specified by :

a K coefficient equal to or less than 0.40 $W/m^2.K$ and by

- side-walls with a thickness of at least 45 mm for transport equipment of a width greater than 2.50 m.

The definition of the K coefficient and a description of the method to be used in measuring it, are given in appendix 2 to this annex.

2. **Refrigerated equipment**. Insulated equipment which, using a source of cold (natural ice, with or without the addition of salt; eutectic plates; dry ice, with or without sublimation control; liquefied gases, with or without evaporation control, etc.) other than a mechanical or "absorption" unit, is capable, with a mean outside temperature of + 30 °C, of lowering the temperature inside the empty body to, and thereafter maintaining it:

At + 7 °C maximum in the case of class A;

At - 10 °C maximum in the case of class B;

At - 20 °C maximum in the case of class C; and

At 0 °C maximum in the case of class D,

1/ *Wagons, semi-trailers, containers, swap-bodies and similar equipment. These provisions shall apply to vehicles of categories N and O as defined in annex 7 of the Consolidated Resolution on construction of vehicles (RE3)*

2/ *In the case of tank equipment, the term "body" means under this definition, the tank itself.*

If such equipment includes one or more compartments, receptacles or tanks for the refrigerant. The said compartments, receptacles or tanks shall:

Be capable of being filled or refilled from the outside; and

Have a capacity in conformity with the provisions of annex l, appendix 2, paragraph 3.1.3.

The K coefficient of refrigerated equipment of classes B and C shall in every case be equal to or less than 0.40 $W/m^2.K$.

3. **Mechanically refrigerated equipment**. Insulated equipment either fitted with its own refrigerating appliance, or served jointly with other units of transport equipment by such an appliance, (fitted with either a mechanical compressor, or an "absorption" device). The appliance shall be capable, with a mean outside temperature of + 30 °C, of lowering the temperature T_i inside the empty body to, and thereafter maintaining it continuously in the following manner at:

In the case of classes A, B and C, any desired practically constant inside temperature T_i in conformity with the standards defined below for the three classes:

Class A. Mechanically refrigerated equipment fitted with a refrigerating appliance such that T_i may be chosen between + 12 °C and 0 °C inclusive.

Class B. Mechanically refrigerated equipment fitted with a refrigerating appliance such that T_i may be chosen between + 12 °C and - 10 °C inclusive.

Class C. Mechanically refrigerated equipment fitted with a refrigerating appliance such that T_i may be chosen between + 12 °C and - 20 °C inclusive.

In the case of classes D, E and F a fixed practically constant inside temperature T_i in conformity with the standards defined below for the three classes:

Class D. Mechanically refrigerated equipment fitted with a refrigerating appliance such that T_i is equal to or less than 0 °C.

Class E. Mechanically refrigerated equipment fitted with a refrigerating appliance such that T_i is equal to or less than - 10 °C.

Class F. Mechanically refrigerated equipment fitted with a refrigerating appliance such that T_i is equal to or less than - 20 °C.

The K coefficient of equipment of classes B, C, E and F shall in every case be equal to or less than 0.40 $W/m^2.K$.

4. **Heated equipment.** Insulated equipment fitted, which is capable of raising the inside temperature of the empty body to, and thereafter maintaining it for not less than 12 hours without renewal of supply at, a practically constant value of not less than + 12 °C when the mean outside temperature, as indicated below is:

- 10 °C in the case of class A heated equipment;

- 20 °C in the case of class B heated equipment;

Heat producing appliances shall have a capacity in conformity with the provisions of annex 1, appendix 2, paragraphs 3.3.1 to 3.3.5.

The K coefficient of equipment of class B shall in every case be equal to or less than 0.40 $W/m^2.K$.

Annex 1, Appendix 1

PROVISIONS RELATING TO THE CHECKING OF INSULATED, REFRIGERATED, MECHANICALLY REFRIGERATED OR HEATED EQUIPMENT FOR COMPLIANCE WITH THE STANDARDS

1. Checks for conformity with the standards prescribed in this annex shall be made:

(a) before equipment enters into service;

(b) periodically, at least once every six years;

(c) whenever required by the competent authority.

Except in the cases provided for in appendix 2, paragraphs 5 to 5.3 and 6 to 6.4, to this annex, the checks shall be made at a testing station designated or approved by the competent authority of the country in which the equipment is registered or recorded, unless, in the case of the check referred to in (a) above, a check has already been made on the equipment itself or on its prototype in a testing station designated or approved by the competent authority of the country in which the equipment was manufactured.

2. The methods and procedures to be used in checking for compliance with the standards are described in appendix 2 to this annex.

3. A certificate of compliance with the standards shall be issued by the competent authority of the country in which the equipment is to be registered and recorded on a form conforming to the model reproduced in appendix 3 to this annex.

In the case of equipment transferred to another country which is a Contracting Party to ATP it shall be accompanied by the following documents so that the competent authority of the country in which the equipment is to be registered or recorded shall issue an ATP certificate:

(a) in all cases, the test report - of the equipment itself or, in the case of serially produced equipment, of the reference equipment;

(b) in all cases, the ATP certificate issued by the competent authority of the country of manufacture or, for equipment in service, the competent authority of the country of registration. This certificate will be treated as a provisional certificate valid, if necessary, for three months;

(c) in the case of serially produced equipment, the technical specification of the equipment to be certified-(this specification shall cover the same items as the

descriptive pages concerning the equipment which appears in the test report).

In the case of equipment transferred after it has been in use, the equipment may be subject to a visual inspection to confirm its identity before the competent authority of the country in which it is to be registered or recorded issues a certificate of compliance. The certificate or a certified true photographic copy thereof shall be carried on the equipment during carriage and be produced whenever so required by the control authorities. However, if a certification plate, as reproduced in appendix 3 to this annex, is fixed to the equipment, the ATP plate shall be recognised as equivalent to an ATP certificate. ATP certification plates shall be removed as soon as the equipment ceased to conform to the standards laid down in this annex.

4. Classification distinguishing marks and particulars shall be affixed to the equipment in conformity with the provisions of appendix 4 to this annex. They shall be removed as soon as the equipment ceases to conform to the standards laid down in this annex.

5. The insulated bodies of "insulated", "refrigerated", "mechanically refrigerated" or "heated" transport equipment and their thermal appliances shall each bear permanent distinguishing marks affixed by the manufacturer and including at least the following particulars:

Country of manufacture or letters used in international road traffic;

Name of manufacturer or company;

Model (figures and/or letters);

Serial number;

Month and year of manufacture.

6. (a) New equipment of a specific type serially produced may be approved by testing one unit of that type. If the unit tested meets class specification, the resulting test report shall be regarded as a Type Approval Certificate. This certificate shall expire at the end of a period of six years.

(b) The competent authority shall take steps to verify that production of other units is in conformity with the approved type. For this purpose it may check by testing sample units drawn at random from the production series.

(c) A unit shall not be regarded as being of the same type as the unit tested unless it satisfies the following minimum conditions:

(i) If it is insulated equipment, in which case the reference equipment may be insulated, refrigerated, mechanically refrigerated or heated equipment,

the construction shall be comparable and, in particular, the insulating material and the method of insulation shall be identical;

the thickness of the insulating material shall be not less than that of the reference equipment;

the interior fittings shall be identical or simplified;

the number of doors and the number of hatches or other openings shall be the same or less; and

the inside surface area of the body shall not be as much as 20% greater or smaller;

(ii) If it is refrigerated equipment, in which case the reference equipment shall be refrigerated equipment,

the conditions set out under (i) above shall be satisfied;

inside circulating fans shall be comparable;

the source of cold shall be identical; and

the reserve of cold per unit of inside surface area shall be greater or equal;

(iii) If it is mechanically refrigerated equipment, in which case the reference equipment shall be either:

(a) mechanically refrigerated equipment,

- the conditions set out in (i) above shall be satisfied; and

- the effective refrigerating capacity of the mechanical refrigeration appliance per unit of inside surface area, under the same temperature conditions, shall be greater or equal; or

(b) insulated equipment to which is complete in every detail but minus its mechanical refrigeration unit which will be fitted at a later date. The resulting aperture will be filled, during the measurement of the K coefficient, with close fitting panels of the same overall thickness and type of insulation as is fitted to the front wall. In which case:

- the conditions set out in (i) above shall be satisfied; and

- the effective refrigerating capacity of the mechanical refrigeration unit fitted to insulated reference equipment shall be as defined in annex 1, appendix 2, paragraph 3.2.6 .

(iv) If it is heated equipment, in which case the reference equipment may be insulated or heated equipment,

- the conditions set out under (i) above shall be satisfied;

- the source of heat shall be identical; and

- the capacity of the heating appliance per unit of inside surface area shall be greater or equal.

(d) If, in the course of the six-year period, the production series exceeds 100 units, the competent authority shall determine the percentage of units to be tested.

Annex l, Appendix 2

METHODS AND PROCEDURES FOR MEASURING AND CHECKING THE INSULATING CAPACITY AND THE EFFICIENCY OF THE COOLING OR HEATING APPLIANCES OF SPECIAL EQUIPMENT FOR THE CARRIAGE OF PERISHABLE FOODSTUFFS

1. DEFINITIONS AND GENERAL PRINCIPLES

1.1. K coefficient. The overall heat transfer coefficient (K coefficient) of the special equipment, is defined by the following formula:

$$K = \frac{W}{S \cdot \Delta T}$$ where W is either the heating power or the cooling capacity, as the case may be, required to maintain a constant absolute temperature difference ΔT between the mean inside temperature T_i and the mean outside temperature T_e during continuous operation, when the mean outside temperature T_e is constant, for a body of mean surface area S.

1.2. The mean surface area S of the body is the geometric mean of the inside surface area S_i and the outside surface area S_e of the body:

$$S = \sqrt{S_i \cdot S_e}$$

In determining the two surface areas S_i and S_e, structural peculiarities and surface irregularities of the body, such as chamfers, wheel-arches and similar features, shall be taken into account and shall be noted under the appropriate heading in test reports; however, if the body is covered with corrugated sheet metal the area considered shall be that of the plane surface occupied, not that of the developed corrugated surface.

Temperature measuring points

1.3. In the case of parallelepipedic bodies, the mean inside temperature of the body T_i is the arithmetic mean of the temperatures measured 10 cm from the walls at the following 12 points:

(a) the eight inside corners of the body; and

(b) the centres of the four inside faces having the largest area.

If the body is not parallelepipedic, the 12 points of measurements shall be distributed as satisfactorily as possible having regard to the shape of the body.

1.4. In the case of parallelepipedic bodies, the mean outside temperature of the body (T_e) is the arithmetic mean of the temperatures measured 10 cm from the walls at the following 12 points:

(a) the eight outside corners of the body; and

(b) the centres of the four outside faces having the largest area.

If the body is not parallelepipedic, the 12 points of measurement shall be distributed as satisfactorily as possible having regard to the shape of the body.

1.5. The mean temperature of the walls of the body is the arithmetic mean of the mean outside temperature of the body and the mean inside temperature of the body:

$$\frac{T_e + T_i}{2}$$

1.6. Temperature measuring instruments protected against radiation shall be placed inside and outside the body at the points specified in paragraphs 1.3 and 1.4 of this appendix.

Steady state period and duration of test

1.7. The mean outside temperatures and the mean inside temperatures of the body, taken over a steady period of not less than 12 hours, shall not vary by more than $\pm$ 0.3 K, and these temperatures shall not vary by more than $\pm$ 1.0 K during the preceding 6 hours.

The difference between the heating power or cooling capacity measured over two periods of not less than 3 hours at the start and at the end of the steady state period, and separated by at least 6 hours, shall be less than 3 %.

The mean values of the temperatures and thermal capacity over at least the last 6 hours of the steady state period will be used in K coefficient calculation.

The mean inside and outside temperatures at the beginning and the end of the calculation period of at least 6 hours shall not differ by more that 0.2 K.

2. INSULATING CAPACITY OF EQUIPMENT

Procedures for measuring the K coefficient

2.1. Equipment other than liquid-foodstuffs tanks

2.1.1. K coefficient shall be measured in continuous operation either by the internal cooling method or by the internal heating method. In either case, the empty body shall be

placed in an insulated chamber.

Test Method

2.1.2. Where the internal cooling method is used, one or more heat exchangers shall be placed inside the body. The surface area of these exchangers shall be such that, if a fluid at a temperature not lower than 0 °C */ passes through them, the mean inside temperature of the body remains below + 10 °C when continuous operation has been established. Where the internal heating method is used, electrical heating appliances (resistors etc.) shall be used. The heat exchangers or electrical heating appliances shall be fitted with fans having a delivery rate sufficient to obtain 40 to 70 air charges per hour related to the empty volume of the tested body, and the air distribution around all inside surfaces of the tested body shall be sufficient to ensure that the maximum difference between the temperatures of any 2 of the 12 points specified in paragraph 1.3 of this appendix does not exceed 2 K when continuous operation has been established.

2.1.3. Heat quantity: The heat dissipated by the electrical resistance fan heaters shall not exceed a flow of $1W/cm^2$ and the heater units shall be protected by a casing of low emissivity.

Test Procedure

2.1.4. Whatever the method employed, the mean temperature of the insulated chamber shall throughout the test be kept uniform, and constant in compliance with paragraph 1.7 of this appendix, to within ± 0.5 °C, at a level such that the temperature difference between the inside of the body and the insulated chamber is 25 °C ± 2 K, the average temperature of the walls of the body being maintained at + 20 °C ± 0.5 K.

2.1.5. During the test, whether by the internal cooling method or by the internal heating method, the mass of air in the chamber shall be made to circulate continuously so that its speed of movement of the air 10 cm from the walls is maintained at between l and 2 metres/second.

2.1.6. The appliances for generating and distributing cold or heat and for measuring the quantity of cold or heat exchanged and the heat equivalent of the air-circulating fans shall be started up. Electrical cable losses between the heat input measuring instrument and the tested body shall be established by a measurement or calculation and subtracted from the total heat input measured.

2.1.7. When continuous operation has been established, the maximum difference between the temperatures at the warmest and at the coldest points on the outside of the body

*/ To prevent frosting.

shall not exceed 2 K.

2.1.8. The mean outside temperature and the mean inside temperature of the body shall each be read not less than four times per hour.

2.2. Liquid-foodstuffs tanks

2.2.1. The method described below applies only to single-compartment or multiple-compartment tank equipment intended solely for the carriage of liquid foodstuffs such as milk. Each compartment of such tanks shall have at least one manhole and one discharge-pipe connecting socket; where there are several compartments they shall be separated from one another by non-insulated vertical partitions.

2.2.2. K coefficients shall be measured in continuous operation by internal heating of the empty tank in an insulated chamber.

Test method

2.2.3. An electrical heating appliance (resistors etc.) shall be placed inside the tank. If the tank has several compartments, an electrical heating appliance shall be placed in each compartment. The electrical heating appliances shall be fitted with fans with a delivery rate sufficient to ensure that the difference between the maximum temperature and the minimum temperature inside each compartment does not exceed 2 K when continuous operation has been established. If the tank comprises several compartments, the difference between the mean temperature in the coldest compartment and the mean temperature in the warmest compartment shall not exceed 2 K, the temperatures being measured as specified in paragraph 2.2.4 of this appendix.

2.2.4. Temperature measuring instruments protected against radiation shall be placed inside and outside the tank 10 cm from the walls, as follows:

(a) If the tank has only one compartment, measurements shall be made at a minimum of 12 points positioned as follows:

The four extremities of two diameters at right angles to one another, one horizontal and the other vertical, near each of the two ends of the tank;

The four extremities of two diameters at right angles to one another, inclined at an angle of 45° to the horizontal, in the axial plane of the tank.

(b) If the tank has several compartments, the points of measurement shall be as follows:

for each of the two end compartments, at least the following:

The extremities of a horizontal diameter near the end and the extremities

of a vertical diameter near the partition;

and for each of the other compartments, at least the following:

The extremities of a diameter inclined at an angle of 45° to the horizontal near one of the partitions and the extremities of a diameter perpendicular to the first and near the other partition.

The mean inside temperature and the mean outside temperature of the tank shall respectively be the arithmetic mean of all the measurements taken inside and all the measurements taken outside the tank. In the case of a tank having several compartments, the mean inside temperature of each compartment shall be the arithmetic mean of the measurements, numbering not less than four, relating to that compartment.

Test procedure

2.2.5. Throughout the test, the mean temperature of the insulated chamber shall be kept uniform, and constant in compliance with paragraph 1.7 of this appendix, at a level such that the difference in temperature between the inside of the tank and that of the insulated chamber is not less than 25 °C $\pm$ 2 K, with the average temperature of the tank walls being maintained at + 20 °C $\pm$ 0.5 K.

2.2.6. The mass of air in the chamber shall be made to circulate continuously so that the speed of movement of the air 10 cm from the walls is maintained at between l and 2 metres/second.

2.2.7. The appliances for heating and circulating the air and for measuring the quantity of heat exchanged and the heat equivalent of the air-circulating fans shall be started up.

2.2.8. When continuous operation has been established, the maximum difference between the temperatures at the warmest and at the coldest points on the outside of the tank shall not exceed 2 K.

2.2.9. The mean outside temperature and the mean inside temperature of the tank shall each be read not less than four times per hour.

2.3. Provisions common to all types of insulated equipment

2.3.1. **Verification of the K coefficient**

Where the purpose of the tests is not to determine the K coefficient but simply to verify that it is below a certain limit, the tests carried out as described in paragraphs 2.1.1. to 2.2.9. of this appendix may be stopped as soon as the measurements made

show that the K coefficient meets the requirements.

2.3.2. **Accuracy of measurements of the K coefficient**

Testing stations shall be provided with the equipment and instruments necessary to ensure that the K coefficient is determined with a maximum margin of error of ± 10% when using the method of internal cooling and ± 5% when using the method of internal heating.

3. EFFECTIVENESS OF THERMAL APPLIANCES OF EQUIPMENT

Procedures for determining the efficiency of thermal appliances of equipment

3.1. Refrigerated equipment

3.1.1. The empty equipment shall be placed in an insulated chamber whose mean temperature shall be kept uniform, and constant to within ± 0.5 K, at + 30 °C. The mass of air in the chamber shall be made to circulate as described in paragraph 2.1.5 of this appendix.

3.1.2. Temperature measuring instruments protected against radiation shall be placed inside and outside the body at the points specified in paragraphs 1.3 and 1.4 of this appendix.

Test procedure

3.1.3. (a) In the case of equipment other than equipment with fixed eutectic plates, and equipment fitted with liquefied gas systems, the maximum weight of refrigerant specified by the manufacturer or which can normally be accommodated shall be loaded into the spaces provided when the mean inside temperature of the body has reached the mean outside temperature of the body (+ 30 °C). Doors, hatches and other openings shall be closed and the inside ventilation appliances (if any) of the equipment shall be started up at maximum capacity. In addition, in the case of new equipment, a heating appliance with a heating capacity equal to 35% of the heat exchanged through the walls in continuous operation shall be started up inside the body when the temperature prescribed for the class to which the equipment is presumed to belong has been reached. No additional refrigerant shall be loaded during the test.

(b) In the case of equipment with fixed eutectic plates, the test shall comprise a preliminary phase of freezing of the eutectic solution. For this purpose, when the mean inside temperature of the body and the temperature of the plates have reached the mean outside temperature (+ 30 °C), the plate-cooling appliance shall be put into operation for 18 consecutive hours after closure of the doors and hatches. If the plate-cooling appliance includes a cyclically-operating mechanism, the total duration of operation of the appliance shall be 24 hours.

In the case of new equipment, as soon as the cooling appliance is stopped, a heating appliance with a heating capacity equal to 35% of the heat exchanged through the walls in continuous operation shall be started up inside the body when the temperature prescribed for the class to which the equipment is presumed to belong has been reached. The solution shall not be subjected to any re-freezing operation during the test.

(c) In the case of equipment fitted with liquefied gas systems, the following test procedure shall be used: when the mean inside temperature of the body has reached the mean outside temperature (+ 30 °C), the receptacles for the liquefied gas shall be filled to the level prescribed by the manufacturer. Then the doors, hatches and other openings shall be closed as in normal operation and the inside ventilation appliances (if any) of the equipment shall be started up at maximum capacity. The thermostat shall be set at a temperature not more than 2 degrees below the limit temperature of the presumed class of the equipment. Cooling of the body then shall be commenced. During the cooling of the body the refrigerant consumed is simultaneously replaced. This replacement shall be effected:

Either for a time corresponding to the interval between the commencement of cooling and the moment when the temperature prescribed for the class to which the equipment is presumed to belong is reached for the first time;

or for a duration of three hours counting from the commencement of cooling, whichever is shorter.

Beyond this period, no additional refrigerant shall be loaded during the test.

In the case of new equipment, a heating appliance with a heating capacity equal to 35% of the heat exchanged through the walls in continuous operation shall be started up inside the body when the class temperature has been reached.

Provisions common to all types of refrigerated equipment

3.1.4. The mean outside temperature and the mean inside temperature of the body shall each be read not less often than once every 30 minutes.

3.1.5. The test shall be continued for 12 hours after the mean inside temperature of the body has reached the lower limit prescribed for the class to which the equipment is presumed to belong (A = + 7 °C; B = - 10 °C; C = - 20 °C; D = 0 °C) or, in the case of equipment with fixed eutectic plates, after stoppage of the cooling appliance.

Criterion of satisfaction

3.1.6. The test shall be deemed satisfactory if the mean inside temperature of the body does not exceed the aforesaid lower limit during the aforesaid period of 12 hours.

3.2. Mechanically refrigerated equipment

Test method

3.2.1. The test shall be carried out in the conditions described in paragraphs 3.1.1 and 3.1.2. of this appendix.

Test procedure

3.2.2. When the mean inside temperature of the body reaches the outside temperature (+ 30 °C), the doors, hatches and other openings shall be closed and the refrigerating appliance and the inside ventilating appliances (if any) shall be started up at maximum capacity. In addition, in the case of new equipment, a heating appliance with a heating capacity equal to 35% of the heat exchanged through the walls in continuous operation shall be started up inside the body when the temperature prescribed for the class to which the equipment is presumed to belong has been reached.

3.2.3. The mean outside temperature and the mean inside temperature of the body shall each be read not less often than once every 30 minutes.

3.2.4. The test shall be continued for 12 hours after the mean inside temperature of the body has reached:

Either the lower limit prescribed for the class to which the equipment is presumed to belong in the case of classes A, B and C (A = 0 °C; B = - 10 °C; C = - 20 °C); or

A level not lower than the upper limit prescribed for the class to which the equipment is presumed to belong in the case of classes D, E, and F (D = 0 °C; E = - 10 °C; F = - 20 °C).

Criterion of satisfaction

3.2.5. The test shall be deemed satisfactory if the refrigerating appliance is able to maintain the prescribed temperature conditions during the said 12-hour periods, with any automatic defrosting of the refrigerating unit not being taken into account.

3.2.6. If the refrigerating appliance with all its accessories has undergone separately, to the satisfaction of the competent authority, a test to determine its effective refrigerating capacity at the prescribed reference temperatures, the transport equipment may be

accepted as mechanically refrigerated equipment without undergoing an efficiency test if the effective refrigerating capacity of the appliance in continuous operation exceeds the heat loss through the walls for the class under consideration, multiplied by the factor l.75.

3.2.7. If the mechanically refrigerating unit is replaced by a unit of a different type, the competent authority may:

(a) require the equipment to undergo the determinations and verifications prescribed in paragraphs 3.1.1. to 3.1.4.; or

(b) satisfy itself that the effective refrigerating capacity of the new mechanically refrigerating unit is, at the temperature prescribed for equipment of the class concerned, at least equal to that of the unit replaced; or

(c) satisfy itself that the effective refrigerating capacity of the new mechanically refrigerating unit meets the requirements of paragraph 3.2.6.

3.3. Heated equipment

Test method

3.3.1. The empty equipment shall be placed in an insulated chamber whose temperature shall be kept uniform and constant at as low a level as possible. The atmosphere of the chamber shall be made to circulate as described in paragraph 2.1.5. of this appendix.

3.3.2. Temperature measuring instruments protected against radiation shall be placed inside and outside the body at the points specified in paragraphs 1.3 and 1.4 of this appendix.

Test procedure

3.3.3. Doors, hatches and other openings shall be closed and the heating equipment and the inside ventilating appliances (if any) shall be started up at maximum capacity.

3.3.4 The mean outside temperature and the mean inside temperature of the body shall each be read not less often than once every 30 minutes.

3.3.5 The test shall be continued for 12 hours after the difference between the mean inside temperature and the mean outside temperature of the body has reached the level corresponding to the conditions prescribed for the class to which the equipment is presumed to belong. In the case of new equipment, the above temperature difference must be increased by 35 per cent.

Criterion of satisfaction

3.3.6. The test shall be deemed satisfactory if the heating appliance is able to maintain the prescribed temperature difference during the 12 hours aforesaid.

4. PROCEDURE FOR MEASURING THE EFFECTIVE REFRIGERATING CAPACITY W_O OF A UNIT WHEN THE EVAPORATOR IS FREE FROM FROST

4.1. General principles

4.1.1. When attached to either a calorimeter box or the insulated body of a unit of transport equipment, and operating continuously, this capacity is:

$$W_o = W_j + U.\ \Delta T$$

where U is the heat leakage of the calorimeter box or insulated body, Watts/°C.

ΔT is the difference between the mean inside temperature T_i and the mean outside temperature T_e of the calorimeter or insulated body (°C),

W_j is the heat dissipated by the fan heater unit to maintain each temperature difference in equilibrium.

4.2. Test method

4.2.1. The refrigeration unit is either fitted to a calorimeter box, or the insulated body of a unit of transport equipment.

In each case, the heat leakage is measured at a single mean wall temperature prior to the capacity test. An arithmetical correction factor, based upon the experience of the testing station, is made to take into account the average temperature of the walls at each thermal equilibrium during the determination of the effective refrigerating capacity.

It is preferable to use a calibrated calorimeter box to obtain maximum accuracy.

Measurements and procedure shall be as described in paragraphs 1.1 to 2.1.8 above; however, it is sufficient to measure U the heat leakage only, the value of this coefficient being defined by the following relationship:

$$U = \frac{W}{\Delta \mathrm{Tm}}$$

where:

W is the heating power (in watts) dissipated by the internal heater and fans;

ΔT_m is the difference between the mean internal temperature T_i and the mean external temperature T_e .

U is the heat flow per degree of difference between the air temperature inside and outside the calorimeter box or unit of transport equipment measured with the refrigeration unit fitted.

The calorimeter box or unit of transport equipment is placed in a test chamber. If a calorimeter box is used, $U.\Delta T$ should be not more than 35% of the total heat flow W_o. The calorimeter box or unit of transport equipment shall be heavily insulated.

4.2.2. **Instrumentation**

Test stations shall be equipped with instruments to measure the U value to an accuracy of $\pm$ 5%. Heat transfer through air leakage should not exceed 5% of the total heat transfer through the calorimeter box or through the insulated body of the unit of transport equipment. The refrigerating capacity shall be determined with an accuracy of $\pm$ 10%.

The instrumentation of the calorimeter box or the insulated body of unit of transport equipment shall conform to paragraphs 1.3 and 1.4 above. The following are to be measured:

(a) Air temperatures: At least four thermometers uniformly distributed at the inlet to the evaporator;

At least four thermometers uniformly distributed at the outlet to the evaporator;

At least four thermometers uniformly distributed at the air inlet(s) to the refrigeration unit;

The thermometers shall be protected against radiation.

(b) Energy consumption: Instruments shall be provided to measure the electrical energy or fuel consumption of the refrigeration unit.

(c) Speed of rotation: Instruments shall be provided to measure the speed of rotation of the compressors and circulating fans or to allow these speeds to be calculated where direct measurement is impractical.

(d) Pressure: High precision pressure gauges (accurate to $\pm$ 1%) shall be fitted to the condenser and evaporator and to the compressor inlet when the evaporator

is fitted with a pressure regulator.

(e) Heat quantity: The heat dissipated by the internal fan heaters fitted with electrical resistances shall not exceed a flow of $1W/cm^2$ and the heater units shall be protected by a casing of low emissivity.

4.2.3. Test conditions

(i) The average air temperature at the inlet(s) to the refrigeration unit shall be maintained at 30 °C ± 0.5 K.

The maximum difference between the temperatures at the warmest and at the coldest points shall not exceed 2 K.

(ii) Inside the calorimeter box or the insulated body of a unit of transport equipment (at the air inlet to the evaporator): there shall be three levels of temperature between -25 °C and +12 °C depending on the characteristics of the unit, one temperature level being at the minimum prescribed for the class requested by the manufacturer with a tolerance of ± 1 K.

The mean inside temperature shall be maintained within a tolerance of ± 0.5 K. During the measurement of refrigerating capacity, the heat dissipated within the calorimeter box or unit of transport equipment shall be maintained at a constant level with a tolerance of ± 1%.

When presenting a refrigeration unit for test, the manufacturer must supply:

- Documents describing the unit to be tested;

- A technical document outlining the parameters that are most important to the functioning of the unit and specifying their allowable range;

- The characteristics of the equipment series tested; and

- A statement as to which prime mover(s) shall be used during testing.

4.3. Test procedure

4.3.1. The test shall be divided into two major parts, the cooling phase and the measurement of the effective refrigerating capacity at three increasing temperature levels.

(a) Cooling phase; the initial temperature of the calorimeter box or transport equipment shall be within ± 3 K of the prescribed ambient temperature. It shall then be lowered to 5 K below the lower limit class temperature.

(b) Measurement of effective refrigerating capacity, at each internal temperature level.

A first test to be carried out, for at least four hours at each level of temperature, under control of the thermostat (of the refrigeration unit) to stabilize the heat transfer between the interior and exterior of the calorimeter box or unit of transport equipment.

A second test shall be carried out without the thermostat in operation in order to determine the maximum refrigerating capacity, with the heating power of the internal heater producing an equilibrium condition at each temperature level as prescribed in paragraph 4.2.3.

The duration of the second test shall be not less than four hours.

Before changing from one temperature level to another, the box or unit shall be manually defrosted.

If the refrigeration unit can be operated by more than one form of energy, the tests shall be repeated accordingly.

If the compressor is driven by the vehicle engine, the test shall be carried out at both the minimum speed and at the nominal speed of rotation of the compressor as specified by the manufacturer.

If the compressor is driven by the vehicle motion, the test shall be carried out at the nominal speed of rotation of the compressor as specified by the manufacturer.

4.3.2. The same procedure shall be followed for the enthalpy method described below, but in this case the heat power dissipated by the evaporator fans at each temperature level must also be measured.

This method may, alternatively, be used to test reference equipment. In this case, the effective refrigerating capacity is measured by multiplying the mass flow (m) of the refrigerant liquid by the difference in enthalpy between the refrigerant vapour leaving the unit (h_o) and the liquid at the inlet to the unit (h_i).

To obtain the effective refrigerating capacity, the heat generated by the evaporator fans (W_f) is deducted. It is difficult to measure W_f if the evaporator fans are driven by an external motor, in this particular case the enthalpy method is not recommended. When the fans are driven by internal electric motors, the electrical power is measured by appropriate instruments with an accuracy of ± 3%, with refrigerant flow measurement being accurate to ± 5%.

The heat balance is given by the formula:

$$W_o = (h_o - h_i)\, m - W_f.$$

Appropriate methods are described in standards ISO 971, BS 3122, DIN, NEN, etc. An electric heater is placed inside the equipment in order to obtain the thermal equilibrium.

4.3.3 **Precautions**

As the tests for effective refrigerating capacity are carried out with the thermostat of the refrigeration unit disconnected, the following precautions must be observed:

if the equipment has a hot gas injection system, it must be inoperative during the test;

with automatic controls of the refrigeration unit which unload individual cylinders (to tune the capacity of the refrigeration unit to motor output the test must be carried out with the number of cylinders appropriate for the temperature.

4.3.4 **Checks**

The following should be verified and the methods used indicated on the test report:

(i) the defrosting system and the thermostat are functioning correctly;

(ii) the rate of air circulation is that specified by the manufacturer.

If the air circulation of a refrigeration unit's evaporator fans are to be measured, methods capable of measuring the total delivery volume must be used. Use of one of the relevant existing standards, i.e. BS 848, ISO 5801, AMCA 210-85, DIN 24163, NFE 36101, NF X10.102, DIN 4796 is recommended;

(iii) the refrigerant used for tests is that specified by the manufacturer.

4.4. Test result

4.4.1. The refrigeration capacity for ATP purposes is that relating to the mean internal temperature as determined from the probes described in paragraph 1.3 above, and not that relating to evaporator inlet or outlet probes.

5. CHECKING THE INSULATING CAPACITY OF EQUIPMENT IN SERVICE

For the purpose of checking the insulating capacity of each piece of equipment in service as prescribed in appendix 1, paragraphs 1 (b) and 1 (c), to this annex, the competent authorities may:

Apply the methods described in paragraphs 2.1.1 to 2.3.2 of this appendix; or

Appoint experts to assess the fitness of the equipment for retention in one or other of the categories of insulated equipment. These experts shall take the following particulars into account and shall base their conclusions on information as indicated below:

5.1. General examination of the equipment

This examination shall take the form of an inspection of the equipment to determine the following:

(i) the general design of the insulating sheathing;

(ii) the method of application of insulation;

(iii) the nature and condition of the walls;

(iv) the condition of the insulated compartment;

(v) the thickness of the walls;

and to make all appropriate observations concerning the effective insulating capacity of the equipment. For this purpose the experts may cause parts of the equipment to be dismantled and require all documents they may need to consult (plans, test reports, specifications, invoices, etc.) to be placed at their disposal.

5.2. Examination for air-tightness (not applicable to tank equipment)

The inspection shall be made by an observer stationed inside the equipment, which shall be placed in a brightly-illuminated area. Any method yielding more accurate results may be used.

5.3. Decisions

(i) If the conclusions regarding the general condition of the body are favourable, the equipment may be kept in service as insulated equipment of its initial class for a further period of not more than three years. If the conclusions of the

expert or experts are not acceptable, the equipment may be kept in service only following a satisfactory measurement of K coefficient according to the procedure described in paragraphs 2.1.1 to 2.3.2 of this appendix; it may then be kept in service for a further period of six years.

(ii) In the case of heavily insulated equipment, if the conclusions of an expert or experts show the body to be unsuitable for keeping in service in its initial class but suitable for continuing in service as normally insulated equipment, then the body may be kept in service in an appropriate class for a further three years. In this case, the distinguishing marks (as in Appendix 4 of this Annex) shall be changed appropriately.

(iii) If the equipment consists of units of serially-produced equipment of a particular type satisfying the requirements of appendix l, paragraph 6, to this annex and belonging to one owner, then in addition to an inspection of each unit of equipment the K coefficient of not less than l% of the number of units involved, may be measured in conformity with the provisions of paragraphs 2.1.1 to 2.3.2 of this appendix. If the results of the examinations and measurements are acceptable, all the equipment in question may be kept in service as insulating equipment of its initial class for a further period of six years.

6 VERIFYING THE EFFECTIVENESS OF THERMAL APPLIANCES OF EQUIPMENT IN SERVICE

To verify as prescribed in appendix l, paragraphs l (b) and l (c), to this annex the effectiveness of the thermal appliance of each item of refrigerated, mechanically refrigerated or heated equipment in service, the competent authorities may:

Apply the methods described in paragraphs 3.1.1 to 3.3.6 of this appendix; or

Appoint experts to apply the following provisions:

6.1. Refrigerated equipment other than equipment with fixed eutectic accumulators

It shall be verified that the inside temperature of the empty equipment, previously brought to the outside temperature, can be brought to the limit temperature of the class to which the equipment belongs, as prescribed in this annex, and maintained below the said limit temperature for a period t

such that $t \geq \frac{12\Delta T}{\Delta T'}$ in which

ΔT is the difference between + 30 °C and the said limit temperature, and ΔT' is the difference between the mean outside temperature during the test and the class limit temperature, the outside temperature being not lower than + 15 °C. If the results are acceptable, the equipment may be kept in service as refrigerated equipment of its initial class for a further period of not more than three years.

6.2. Mechanically refrigerated equipment

Checks shall be made to ensure that, when the outside temperature is not lower than + 15 °C, the inside temperature of the empty equipment, which has been previously equalized to that outside, can be reduced to the required class temperature within a maximum period of 6 hours:

In the case of equipment in classes A, B or C, to the minimum temperature, as prescribed in this annex;

In the case of equipment in classes D, E or F, to the limit temperature, as prescribed in this annex.

If the results are acceptable, the equipment may be kept in service as mechanically refrigerated equipment of its initial class for a further period of not more than three years.

6.3. Heated equipment

It shall be verified that the difference between the inside temperature of the equipment and the outside temperature which governs the class to which the equipment belongs as prescribed in this annex (a difference of 22 K in the case of class A and of 32 K in the case of class B) can be achieved and be maintained for not less than 12 hours. If the results are acceptable, the equipment may be kept in service as heated equipment of its initial class for a further period of not more than three years.

6.4. Provisions common to refrigerated, mechanically refrigerated and heated equipment

(i) If the results are not acceptable, refrigerated, mechanically refrigerated or heated equipment may be kept in service in its initial class only if it passes at a testing station the tests described in paragraphs 3.1.1 to 3.3.6 of this appendix; it may then be kept in service in its initial class for a further period of six years.

(ii) If the equipment consists of units of serially-produced refrigerated, mechanically refrigerated or heated equipment of a particular type satisfying the requirements of appendix l, paragraph 6, to this annex and belonging to one owner, then in addition to an inspection of the thermal appliances to ensure that their general condition appears to be satisfactory, the effectiveness of the cooling or heating appliances of not less than l% of the number of units may be determined at a testing station in conformity with the provisions of paragraphs 3.1.1 to 3.3.6 of this appendix. If the results of the examinations

and of the determination of effectiveness are acceptable, all the equipment in question may be kept in service in its initial class for a further period of six years.

7. TEST REPORTS

A test report of the type appropriate to the equipment tested shall be drawn up for each test in conformity with one or other of the models 1 to 6 hereunder.

[*Note from the secretariat:* *For the models of test reports, see ATP*]

Annex l, Appendix 3

Amend the title A as follows:

"A. FORM OF CERTIFICATE FOR INSULATED, REFRIGERATED, MECHANICALLY REFRIGERATED OR HEATED EQUIPMENT USED FOR THE INTERNATIONAL CARRIAGE OF PERISHABLE FOODSTUFFS BY LAND"

[*Note from the secretariat:* *For the rest of Appendix 3, see ATP*]

Annex l, Appendix 4

Delete the following entries as well as the footnote relating to these entries:

Class B mechanically refrigerated equipment with normal insulation	FNB 1/
Class C mechanically refrigerated equipment with normal insulation	FNC 1/
Class E mechanically refrigerated equipment with normal insulation	FNE1/
Class F mechanically refrigerated equipment with normal insulation	FNF1/

[*Note from the secretariat:* *For the rest of Appendix 4, see ATP*]

1/ See transitional provisions in paragraph 5 of this annex.