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Proposals of amendments to the ATP :
Pending proposals

Proposal for test and approval of a refrigerated thermal appliance working on liquefied gas separate from the insulated body it will be used on

Transmitted by the Government of the Netherlands

Summary

Executive summary:	From a formal point of view testing of refrigerated thermal appliances working on liquefied gas separated from the insulated body is not foreseen in the ATP. There are no arguments to withhold the advantages of separate testing of these appliances.
Action to be taken:	Inclusion of new provisions.
Related documents:	ECE/TRANS/WP.11/2011/15, INF.3 (67th session), ECE/TRANS/WP.11/2013/17, ECE/TRANS/WP.11/2014/16.

Introduction

1. The rationale in ATP is to test and approve the insulated body in combination with the thermal appliance. An exception is made for mechanically refrigerated thermal appliances in paragraph 3.2.6 of Annex1, Appendix 2 which can be tested and approved separately from the insulated body.

2. Refrigerated thermal appliances working on liquefied gas can, from a technical point of view, also be tested and approved separately. However, Annex 1, Appendix 2, section 3.1 dealing with refrigerated equipment does not allow for this in the same way that it is regulated for mechanically refrigerated equipment in paragraphs 3.2.6 and 3.2.7.

3. An important part of this proposal is that the evaporator and fan combination is the determination factor for maximum capacity and of a type. It is assumed that several evaporators of a type or of different types together will be used in an insulated body. This document contains proposals to allow separate testing of refrigerated units on liquefied gas in Annex1, Appendix 1 and a test procedure for Annex 1, Appendix 2, supported by definitions and a test report. For a test report it need to be considered if model No. 10 should be modified or that a new specific test report should be introduced.

Proposals

Proposal 1

Introduce new definitions in Annex 1 paragraph 3 to read:

"Direct liquefied gas refrigeration unit means a unit that releases liquefied gas inside the insulated body to absorb heat by evaporation."

"Indirect liquefied gas refrigeration unit means a unit that absorbs heat inside the insulated body by evaporation of a liquefied gas in an evaporator. The gas, in gaseous form, is released outside the insulated body."

Proposal 2

Introduce new paragraphs 3.1.7 and 3.1.8 in Annex 1, Appendix 2 to read as follows:

"3.1.7 If a refrigerating appliance of paragraph 3.1.3 (c) with all its accessories has undergone separately, to the satisfaction of the competent authority, the test in section 9 of this appendix to determine its effective refrigerating capacity at the prescribed reference temperatures, the transport equipment may be accepted as refrigerated equipment. 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 1.75.

3.1.8 If the refrigerating appliance 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 3.1.3 to 3.1.5; or

(b) satisfy itself that the effective refrigerating capacity of the new refrigerating appliance 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 refrigerating appliance meets the requirements of paragraph 3.1.7."

Proposal 3

Introduce a new test procedure as section 9 to read:

"9. PROCEDURES FOR MEASURING THE EFFECTIVE REFRIGERATING CAPACITY OF APPLIANCES WORKING ON LIQUEFIED GAS IN MONO TEMPERATURE AND MULTI TEMPERATURE CONFIGURATIONS

9.1 General

The test procedure prescribed in annex 1, appendix 2, section 4, of ATP, shall be followed as far as relevant for refrigerating units working on liquefied gas. Additionally the following particularities shall be taken into account.

This procedure shall apply to direct liquefied gas refrigeration units and indirect liquefied gas refrigeration units.

A unit consists of a tank, a regulating unit and regulator valve, temperature sensors and refrigeration evaporator and its fan(s) or a unit of nozzles.

A unit shall belong to a type if:

- it uses the same gas,
- the evaporator and fan or the section of nozzles have the same capacity,
- the regulating unit, regulator valve and temperature sensors have the same specifications as the unit tested,
- the supply of liquefied gas is identical,
- the capacity of the liquefied gas tank is of the same design with the minimum capacity stated in the test report or larger and
- the length and dimension of the supply line is in conformity with the tested type.

An assembly of two or more evaporator/fan combinations in one housing may be approved as a variation to the type of the approved individual evaporator. In these cases the minimum supply of liquefied gas shall be increased accordingly.

At the request of the manufacturer the test for the effective refrigerating capacity may be replaced by a test for a lower nominal refrigerating capacity. For application of the unit in equipment the nominal capacity shall be used as the effective refrigerating capacity.

The capacity of the liquefied gas tank shall be chosen for a test duration of at least 4 hours without intermediate refilling.

In case the smallest capacity tank in the type approval is of lower capacity than the tank used for the test it shall be verified that the supply of liquefied gas is sufficient for continued use at the effective refrigerating capacity of the unit for at least 1 hour without an unacceptable pressure drop due to cooling down of the tank.

In any case the tank used in the test shall be of the same design type (type of insulation, tank materials, pressure regulator, outlet header, filler valve, shut-off valve, etc.) as the tank(s) included in the type approval and used with the unit on transport equipment.

If the test for the capacity of the tank is performed for another type of refrigerated evaporator/fan the results may be taken into account with reference to this test in the test report.

Where the regulating unit is intended for regulating more than one refrigerating evaporator/fan working combined at the same temperature setting or with different temperature settings it shall be tested with additional evaporators of the same of different capacities simultaneously on individual calorimeter boxes of insulated bodies.

All the elements of the liquefied gas refrigeration unit shall be placed in a thermostatic enclosure at 30 ºC.

9.2 Determination of the effective refrigerating capacity of a refrigerated evaporator/fan or section of nozzles.

The test shall include two mayor parts, a cooling down phase of the calorimeter box or transport equipment and the measurement of the effective refrigerating capacity at -20 ºC and 0 ºC.

The refrigerating capacity at -10 °C shall be calculated by linear interpolation of the capacities at -20 °C and 0 °C.

The duration of the test at each temperature in equilibrium condition shall not be less than 4 hours.

A single additional test of 1 hour shall be conducted with the smallest tank sold with the unit to quantify the impact of its volume on the regulation of refrigerating capacity. The new refrigerating capacity obtained shall not vary by more than 5% from the lower value or compared to the value found with the tank used for the tests of 4 hours or more. In the case of a greater impact, a restriction on the volume of the tank must be included in the official test report.

9.2.3 Checking of the function of the regulating unit in multi temperature configuration.

When the regulation unit is intended for the use in multi temperature operation the proper functioning shall be tested for the maximum number of evaporators or sections of spray nozzles working in independent temperature modes. The test shall be conducted as follows:

For each independent temperature mode an evaporator or section of nozzles shall be placed in an independent calorimeter box or insulated body. Alternatively an multi compartment insulated body representing the number of compartments may be used.

It shall be verified that the temperature may be maintained at 0 C in the compartments while one compartment shall be brought to -20 C. This test shall be performed for all evaporators with an independent temperature setting. If a compartmented insulated body is used a heat source may be used to compensate for the calculated heat loss to the compartment at -20 C.

9.2.4 Test result

The effective refrigerating capacity is that relating to the mean temperature over 15 minutes of air intake temperature (for ‘indirect’ units) or of air temperature inside the body (for ‘direct’ units) that comply with the expected class temperature ±1K.

The information and results shall be given in test report No. zy.

Proposal 4

Introduce a new section 10 concerning the dimensioning and heat requirements of MTMC equipment.

"10. PROCEDURE OF DETERMINATION OF THE REQUIRED EFFECTIVE REFRIGERATION CAPACITY AND DIMENSIONING OF MULTI-COMPARTMENT EQUIPMENT WITH REFRIGERATION UNITS WORKING ON LIQUEFIED GAS

This procedure applies to equipment with multi compartments where different temperature levels are maintained by refrigerating units working on liquefied gas.

Dimensioning and certification shall be carried out as prescribed in annex 1, appendix 2, section 8.3, 'Dimensioning and certification of refrigerated multi-temperature equipment', of ATP, with the following capacity equivalents:

$P_{installed} = P_{nominal}$

Evaporator(s) shall be chosen with a sufficient capacity as required by the compartments. The minimum capacity tank shall be chosen as to have sufficient capacity for the evaporators in mono temp functioning at -20 °C taking into account any pressure drops with continuous cooling.".

Proposal 5

Introduce a new test report zy (see Annex 1 to this report)

Justification

4. There is no technical argument that would make testing of refrigerated appliances working on liquefied gas separate from the insulated body not feasible. The capacity is related to the outflow of gas in the load area for direct injected systems or to the capacity of the evaporator and regulator in indirect systems.

5. Indirect systems in particular are becoming ever more popular because of the silent operation, absence of direct pollution and low weight. Not to be able to use separate testing and approving will result in a test for every type of equipment coming on the market.

6. Proposal 1

The definitions are proposed to clarify the regulation. The wordings will appear in the new section 9 and the new test report. It should be considered if the meaning of "with or without evaporation control" as given in Annex 1 paragraph 2 should be included in the definitions or/and that this wording should be removed in Annex 1, paragraph 2.

7. Proposal 2

The regulation should make it possible for refrigerating units working on liquefied gas to be tested separate from the body they are to be fitted upon. A copy paste from Annex1, Appendix 2 paragraphs 3.2.3 and 3.2.4 for mechanical refrigerated appliances is proposed. The safety factor of 1.75 is maintained to overcome uncertainties by the installation.

8. Proposal 3

The test procedure refers to section 4 of Annex1, Appendix 2 preventing unnecessary repetition as far as possible. An alternative for the wording "as far as relevant" may be a listing of paragraphs and subparagraphs that are not applicable for units working on liquefied gas.

A new aspect is the description of a type. Like for mechanically units the maximum effective capacity is determined by this although the tank can in this case be a limiting factor.

Many items coming from the proposed test procedure in document ECE/TRANS/WP.11/2014/16. However, this procedure is based on section 4.

For multi temperature operations the test for mechanically refrigerated units is not appropriate. The mechanically refrigerated multi temperature units are much more complicated than liquefied gas systems which is mainly regulated by opening a supply valve for a short period to absorb the required amount of heat.

It is assumed that more than one type of evaporator is tested simultaneously and that the function of the regulating unit for multi temperature operation can be conducted as part of the test as a whole. The test of the functioning of the regulator unit is electronic and could be done by simulation. However, as they say proof is in the tasting of the pudding, and a real test can give confidence it functions in reality.

9. Proposal 4

Determining the effective refrigerating capacity of a unit is something different than dimensioning compartments and determining the heat requirements by an insulated body and compartments. To keep the regulation clear this is separated. From a principle point of view, the test of the mechanical refrigerating unit for multi temperature and heat requirements of insulated bodies should be separated as well. Not to overcomplicate things any further this is not addressed for the time being.

10. Proposal 5

A new test report is proposed based on model No 10. (See annex 1 to this report).

Cost:	Costs will be reduced.
Feasibility:	No problems are expected. No transitional period is required.
Enforceability:	No problems are expected.
Environment:	The environment will benefit from reduced testing of units.

Annex 1

Model No. zy

TEST REPORT

Prepared in conformity with the special provisions of the Agreement on the International Carriage of Perishable Foodstuffs and on the Special Equipment to be used for such carriage (ATP)

Test Report No……..

Determination of the effective refrigeration capacity of a refrigeration unit in accordance with section 9 of ATP Annex 1, Appendix 2

Approved testing station

Name : ……
Address : ……..

Refrigeration unit presented
by: ……
……
…..
……
…..
[(a declaration by the manufacturer shall be provided if the applicant is not the manufacturer)]

(a) Technical specifications of the unit

Make /Brand :
Type designation :
Type of liquefied gas
Indirect / Direct injection) :
Serial number or prototype type :
Date of manufacture (month/year) :
(The tested unit shall not have been built more than 1 year prior to ATP tests)

Components:

Indirect[1]
Evaporator:
Make/Brand:
Type:
Heat exchange surface (m^2):

Direct[1]
Nozzles section:
Make/Brand:
Type designation:
Length of section/number of nozzles:

Tubes: (number and diameter)[2].
Make/Brand Fan(s):
Type:
Number of fans: (if different types of fans are used repeat information below for each type)
Fan Pitch: (mm)
Number of blades per fan:
Diameter (mm):
Nominal power (W):
Total nominal output at a pressure of: .. Pa (m^3/h)
Method of drive: drive (description of the electric supply with DC/AC, frequency, etc):

Diameter of tube:

Fan(s)
Number of fans: (if different types of fans are used repeat information below for each type)
Make/Brand Fan(s):
Type:
Fan Pitch: (mm)
Number of blades per fan:
Diameter (mm):

Nominal power (W):

Total nominal output at a pressure of: .. Pa (m^3/h)
Method of drive: drive (description of the electric supply with DC/AC, frequency, etc.):

Regulator valve (if different types of regulators are used repeat information below for each type)

Make/Brand	:
Type	:
Serial number	:

Tank (if different types of regulators are used repeat information below for each type)

Make/Brand	:
Type	:
Serial number	:
Capacity	:
Gas pressure at tank outlet	:
Method of insulation	:
Material of inner tank	:
Material of outer tank	:
Supply of liquefied gas	: (internal pressure, pressure by heat exchanger, pump) [1]

Pressure regulator

Make/Brand	:
Type	:
Serial number	:
Capacity	:
Gas pressure at pressure outlet	:

Supply liquefied gas line(on the test bench)
Diameter :
Length :
Material :
Number of connections :

Defrosting device (Electric/combustion unit)
Make/Brand :
Type :
Supply :
Declared heating capacity :
Regulating unit
Make/Brand:
Type: Hardware version :
Software version :
Serial number :
Power supply :
Possibility for Multi-temp operation: (yes/no)[1]
Number of independent regulated channels(compartments):

(b) Test method and results:

Test method [1]: heat balance method/enthalpy difference method

In a calorimeter box of mean surface area = ... m^2
measured value of the U-coefficient of a box fitted with a refrigeration unit: .....W/°C,
at a mean wall temperature of ……..... °C.

In an item of transport equipment:
measured value of the U-coefficient of an item of transport equipment fitted with a refrigeration unit: ……..…….....W/°C,
at a mean wall temperature of ……..... °C.

Method employed for the correction of the U-coefficient of the body as a function of the mean wall temperature of the body: .....
.....
Maximum errors of determination of:
U-coefficient of the body .....
refrigerating capacity of the unit .....

Corrected cooling
capacity…….W

(c) Checks

Temperature regulator: Setting ……..... Differential ……..°C

Air flow volume leaving the evaporator: ..... value measured ……..m^3/h

at a pressure of ……Pa

Average consumption of liquefied gas at class temperature(s) in equilibrium condition

Minimum capacity tank (the smallest capacity tank is marketed as part of the type)

Regulating unit can be used for Multi temperature operation: (yes/no) [1]
Number of independent regulated channels(compartments):

(d) Remarks

.....
.....
.....

According to the above test results, the refrigerating unit is approved as a type of refrigerating unit valid for a period of not more than six years.

Done at: ……

On: ……
……

Testing Officer

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[1] *Delete where applicable.*
[2] *Value indicated by the manufacturer.*
[3] *Where applicable.*