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Items 5 (a) of the provisional agenda
Proposal of amendments to the ATP: Pending proposals

Proposal to amend annex 1 appendix 2 paragraph 8.3.2 of ATP

Transmitted by Finland

Introduction

1. An amendment to ATP dealing with multi-temperature equipment entered into force on 23 September 2013.

2. The issue dealt with in this paper was raised by Finland at the 69th session of WP.11 in 2013 (see informal document INF 8). During the 69th session a small group was mandated to deal with the proposal, but the group has not met so far.

3. The proposal was discussed in the International Institute of Refrigeration (IIR) sub-commission on refrigerated transport in June 2014 and on the basis of those discussions and comments, Finland has modified the proposal, bearing in mind that calculating the refrigerating capacity demands of multi-compartment equipment should be simple and practical.

4. Although discussed in the IIR sub-commission, this proposal is not the official position of the sub-commission. Neither is it the official position of the small group which might discuss the proposal after the deadline for WP.11 documents. If necessary, such discussions will be transmitted in an informal paper.

Current situation

5. Calculating the refrigerating capacity demand of transport equipment is based on the formula for the K coefficient, see annex 1, appendix 2, paragraphs 1.1 and 1.2:

$$K = W / S * \Delta T$$

$$<=> \quad W = K * S * \Delta T$$

where the term S means the geometric mean of the inside surface area and the outside surface area of the body in square meters, W is the thermal capacity in Watts to maintain the temperature difference, ΔT is in Kelvins. After multiplying by the factor of 1.75, the formula for calculating the required refrigerating capacity, P, in Watts, is obtained:

$$P \geq 1.75 * K * S * \Delta T$$

6. At the beginning of the new paragraph 8.3.1 of annex 1, appendix 2 of ATP "General procedure" it is stated that "The refrigerating capacity demand of multi-temperature equipment shall be based on the refrigerating capacity demand of mono-temperature equipment as defined in this appendix". As defined in this appendix refers to annex 1, appendix 2, paragraph 3.2.6 where the factor 1.75 is introduced.

7. In accordance with paragraph 8.3.1 there should be no difference between the nominal refrigerating capacity demand of single compartment and multi-compartment transport equipment.

8. However, the new paragraph 8.3.2 introduces the following formula to calculate the refrigerating capacity demand of multi-compartment equipment:

$$P_{nominal} > 1.75 * K_{body} * S_{body} * \Delta T$$

where S_{body} is the internal surface of the full body.

9. In this new formula S (geometric mean surface area) is replaced by S_{body} (internal surface area).

10. This inconsistency means that single compartment and multi-compartment equipment are not treated equally and in practice the required nominal refrigerating capacity for multi-compartment equipment is lower than for single compartment equipment, due to the fact that the internal surface area of the body is smaller than the geometric mean surface area of the body.

10. According to data from the Finnish ATP database (2550 FRC certificates in force in June 2014) the internal surface area is on average 4.4% smaller than the geometric mean surface area. This means that if the internal surface area is used instead of the geometric surface area, the required nominal capacity also has to be on average 4.4% lower. If a K coefficient of 0.40 W/m^2K is used, the difference is on average 200 W. It is also obvious that the relative difference between the two formulas depends on the size of the body as can be seen from the table below.

Internal volume of the body	*Geometric mean surface area, m^2*	*Internal surface area, m^2*	*Difference of surface areas, %*	*Required nominal capacity / Single compartment / K = 0.40, W*	*Required nominal capacity / Multi compartment / K = 0.40, W*	*Difference of required nominal capacities, W*
< 50 m^3	91.1	86.4	-5.2 %	3189	3024	-165
50 to 80 m^3	110.5	105.5	-4.5 %	3868	3693	-175
> 80 m^3	157.8	151.3	-4.1 %	5523	5296	-227
Equipment type						
Lorry, container or swap-body	98.4	93.7	-4.8 %	3444	3280	-164
Trailer or semi-trailer	156.2	149.7	-4.2 %	5467	5249	-218
All	130.1	124.4	-4.4 %	4554	4354	-200

Practical examples

11. Calculating the required nominal capacity for class FRC using the formula:

$P_{nominal} > 1.75 * K_{body} * S_{body} * \Delta T$, where $\Delta T = 50$ K

gives the following results:

Lorry

K=0.36 W/m^2K, internal dimensions in meters 6.25*2.47*2.30 and outside dimensions in meters 6.42*2.59*2.51

Internal surface area 70.99 m^2, outside surface area 78.49 m^2, geometric mean surface area 74.65 m^2

Required nominal capacity if single compartment, S_{body} = 74.65 m^2: 2351 W

Required nominal capacity if multi compartment, S_{body} = 70.99 m^2: 2236 W
(-115 W => -4.9 %)

Semi-trailer

K=0.38 W/m^2K, internal dimensions in meters 13.47*2.50*2.55 and outside dimensions in meters 13.60*2.60*2.70

Internal surface area 148.80 m^2, outside surface area 158.20 m^2, geometric mean surface area 153.43 m^2

Required nominal capacity if single compartment, S_{body} = 153.43 m^2: 5102 W

Required nominal capacity if multi compartment, S_{body} = 148.80 m^2: 4948 W
(-154 W => -3.0 %)

Proposal to correct the inconsistency

12. It is proposed to amend the term S_{body} in paragraph 8.3.2 to mean the geometric mean surface area of the body. See the proposed text at the end of this document.

Technical impact of the proposal

13. Tools for calculating the required refrigerating capacities need to be slightly modified. On the other hand, the same tools could also be used for single compartment equipment.

14. Using multi-compartment equipment as single compartment equipment has to be possible without calculations and checks.

Economic impact of the proposal

15. There will be no remarkable economic impacts because in practice the factor of 1.75 is already greatly exceeded for the vast majority of equipment. The proposal will only apply to equipment manufactured after the amendment has entered into force.

Environmental impact of the proposal

16. There is no foreseeable environmental impact. The slight increase of nominal refrigerating capacity demand of multi-compartment equipment does not in practice mean an increase of overcapacity as the factor 1.75 is already greatly exceeded for the vast majority of equipment.

Conclusion

17. The present text of annex 1, appendix 2 paragraph 8.3.2 gives a message which is not desirable. Although the difference between the internal surface area and the geometric surface area is only a few per cent, the difference is towards the wrong direction. In some special designs the difference may be more than 10%.

Text of the proposal

18. The current text of annex 1, appendix 2, paragraph 8.3.2, line for S_{body} reads as follows:

"S_{body} is the internal surface of the full body".

19. Amend annex 1, appendix 2, paragraph 8.3.2, line for S_{body} to read as follows:

"S_{body} is the geometric mean surface area of the full body".