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Item 5 (b) of the provisional agenda
Proposals of amendments to ATP:
new proposals

Amendment to annex 1, paragraph 1

Transmitted by the Government of the United Kingdom of Great Britain and Northern Ireland

Introduction

1. Reduction of heat transfer across the walls of an insulated body leads to tighter temperature control by a refrigerating appliance. Chilled product is more sensitive to temperature fluctuations therefore a more uniform temperature distribution decreases the risk of localised warm spots, such as near to the doors at the peripheries of a cargo, which reduces food wastage or spoilage. Along with the positive impacts of food safety reducing the K coefficient of normally insulated equipment brings, there are also several accompanying benefits which align with the goals of the ITC strategy as a whole and these are detailed below.

2. Note that the following information has already been presented to both the CERTE group and WP.11 in 2023 and is repeated below. In response to the comments received from other delegates at the eightieth session of WP.11 and the informal document from the Netherlands we have amended the text for clarity and brevity.

3. Energy efficiency of refrigerated transport, and the cold chain in general, has become of increasing concern since the inception of ATP in 1970. ATP itself is closely based upon an agreement dated January 1962 which never entered into force. The state of art of 1970 is barely recognisable today as there have been significant advances in all fields relevant to ATP since then.

4. In recent years the larger semi-trailer refrigeration systems have mostly been modified to use R452A as the working fluid, rather than R404A which was ubiquitous since R22 was phased out. This change reduces the working fluid's global warming potential (GWP) from 3943 CO_2-equivalent per kg to 1945 (both AR5). The changeover resulted in equipment manufacturers having to test their systems to prove that the overall performance was comparable and part 4.5 of annex 1, appendix 2 was added to the text of the agreement. Annex 1, appendix 2, part 4.5.2 also introduces subclasses of "equivalence" depending on how similar the replacement working fluid (R452A in this case) is to the reference fluid (R404A).

5. By way of example, for a semi-trailer with a 5 kg charge, 5 per cent annual leakage rate, and 95 per cent recuperation rate the change of refrigerant results in approximately 6500 kg·CO_2 equivalent saving over a 12-year lifespan. This is the direct contribution to a system's total environmental warming impact (TEWI) whilst the indirect TEWI contribution makes up everything else, the numbers for which will vary depending on system design, power sources and many other factors. The only constant, in this respect, is the reason a refrigeration system is required in the first place — to overcome heat transmission through the walls of the vehicle whilst perishable foodstuffs are being transported. Although ATP only concerns journeys which cross international borders, the problem of heat transmission is still present to the same degree on the equipment's other trips.

6. Using data available and ATP conditions for frozen and chilled temperature regimes, the average semi-trailer has a CO_2 equivalent of 1.90×10^5 kg over a 12-year lifespan as a result of fuel consumption to remove heat which has been transmitted through the equipment's surfaces.

7. For context, legislation for building thermal efficiency, for those countries that have such regulation, presently require typical values $U < 0.20$ $W \cdot m^{-2} \cdot K^{-1}$ which is with a direct view to lowering energy consumption. Insulated marine containers have $U < 0.32$ $W \cdot m^{-2} \cdot K^{-1}$, and for the majority of their use will often be inside stacks of similar containers therefore having very low amounts of heat transmission from the outside due to low airflow and low solar loading. ATP has two classes, heavily and normally insulated which have K coefficients of 0.40 and 0.70 $W \cdot m^{-2} \cdot K^{-1}$ respectively. Whilst in use the equipment will experience high external airflow and often be exposed to significant solar radiation. Despite this, the K coefficients employed to this day predate ATP and are both found in the 1962 agreement mentioned previously. So far relatively few attempts have been made to make changes to these values despite progress made in other industries.

8. Purely by way of example, reducing the heavily insulated K coefficient from ≤ 0.40 $W \cdot m^{-2} \cdot K^{-1}$ to ≤ 0.39 $W \cdot m^{-2} \cdot K^{-1}$ would translate to a CO_2 equivalent saving of 4755 kg in the example above. Only 2 per cent of the environmental impact is from the refrigerant gas itself with the remaining 98 per cent coming from the requirement to remove heat which has been transmitted through the vehicle's body. For frozen cargoes this is the only source of heat. This proposal does not currently intend to lower the heavily insulated K coefficient but this should be looked at later and reduced accordingly.

9. Further, whilst new technologies are slowly coming to market and the future of diesel driven, either dedicated or via the vehicle power train, being uncertain at the minute, lower K coefficients of the equipment allow for lower appliance effective refrigerating capacity. This is important as appliances are only permitted to be used 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 1.75". Being able to achieve such a rate of heat removal may push transport refrigeration beyond the application of novel systems and may stifle innovation. The only way to reduce the refrigerating/heating capacity required is to lower the acceptance criteria of K coefficients for normally and/or heavily insulated equipment.

10. For smaller vehicles such as panel vans, cooling requirements at both class limits, ie chilled with normal insulation or frozen and heavily insulated, both require around 1 kW of refrigerating capacity. Systems of this size typically have a charge of between 1 and 2 kg of HFC. Hydrocarbon systems have around 50 per cent of the charge size, or between 0.5 and 1.0 kg. Using typical panel van dimensions, the maximum propane (R290) and iso-butane (R600a) charge sizes are 0.35 and 0.39 kg respectively to keep below the LFL in the event of a catastrophic internal leak. Without compromising food safety, the only way to reduce the cooling requirement, and therefore charge size, is by reducing the K coefficient. Whilst secondary loop systems are possible, given the relatively small size of these van systems, the parasitic losses would be heavily detrimental to overall system efficiency with a significant increase in energy consumption.

11. We have previously discussed the K coefficient class limit for normally insulated equipment, most recently at Geneva in 2019 where the working party consensus was in agreement with regards to reducing emissions. At the time it was reasoned that given the

more sensitive nature of chilled cargo than frozen cargo, the heat flux value should be lower for normally insulated than heavily insulated equipment to reduce temperature gradients throughout the refrigerated volume. The proposal aimed to reduce the normally insulated K coefficient requirement to be ≤ 0.65 $W{\cdot}m^{-2}{\cdot}K^{-1}$ which would take heat flux to 19.5 $W{\cdot}m^{-2}$ which is below the corresponding figure for heavily insulated equipment which is 20 $W{\cdot}m^{-2}$. The current K coefficient of ≤ 0.70 $W{\cdot}m^{-2}{\cdot}K^{-1}$ yields a heat flux of 21 $W{\cdot}m^{-2}$. The reduction of the K coefficient for normally insulated equipment is in keeping with the UK's airflow proposal which showed that chilled cargoes require more airflow than their frozen counterparts, despite the typically lower refrigeration requirement. It appears inconsistent that more sensitive cargoes have less stringent requirements given that ATP is supposed to ensure food safety by setting minimum requirements.

12. We do not propose any K coefficient changes for tanks. Tanks ought to be treated separately due to the high specific heat per surface area of liquids. Whilst chilled, solid cargoes are sensitive they typically have a large surface area which has a significant impact on heat exchange. Unlike solid foodstuffs which have air gaps throughout, liquid cargoes are homogenous and have higher specific heat capacity. This means that significantly more energy is required to heat them per unit volume and are less affected by heat ingress.

13. Initially the normally insulated K coefficient should be reduced from ≤ 0.70 $W{\cdot}m^{-2}{\cdot}K^{-1}$ to somewhere in the range of 0.50 ≤ K ≤ 0.65 $W{\cdot}m^{-2}{\cdot}K^{-1}$.

14. Given the above, we initially propose to lower the K coefficient requirement for normally insulated equipment. When discussed during the meeting of the IIR Sub-Commission on refrigerated transport (CERTE meeting) the only issue raised was the possibility of blowing agents changing given the current uncertainty of the F-gas regulations. It is worth noting that any F-gas revision will most likely also affect the refrigeration system's working fluid and it is likely that any changes will reduce either the system efficiency, the system capacity or both. It is in the interest of the cold chain as a whole to ensure that new technologies are not stifled by refrigeration capacity requirements which are entirely dependent upon equipment beyond the control of the manufacturers of such systems.

15. K coefficients used in ATP need to be modernised in light of technological advancements since the time of introduction and also imminent regulation changes for appliances. We propose to make the following changes to Annex 1 of the ATP.

Proposed amendment to annex 1 paragraph 1

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"Insulated equipment. Equipment other than tanks of which …… is assignable to one or other of the following two categories

I_N = Normally insulated equipment:	a K coefficient equal to or less than 0.70 $W{\cdot}m^{-2}{\cdot}K^{-1}$ for bodies that entered into service up to 31 December 2028;
	a K coefficient equal to or less than 0.65 $W{\cdot}m^{-2}{\cdot}K^{-1}$
	For bodies that entered into service from the 1 January 2029;
I_R = Heavily insulated equipment:	a K coefficient equal to or less than 0.40 $W{\cdot}m^{-2}{\cdot}K^{-1}$

For tank bodies 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 tank bodies:	a K coefficient equal to or less than 0.70 $W{\cdot}m^{-2}{\cdot}K^{-1}$

I_R = Heavily insulated tank bodies: a K coefficient equal to or less than 0.40 W·m^{-2}·K^{-1}

Technical impact

16. This change would help to modernise ATP and a positive impact would be that food safety and quality would improve.

Economic impact

17. Whilst the initial purchase price of equipment would probably increase, it should be more than offset by lower running costs of the appliance in service. Fewer operational hours also reduce wear and tear of components leading to more appliance longevity and fewer spare parts being required.

Environmental impact

18. Lower energy use and therefore less overall emissions. Less wear and tear on appliances which reduces the amount of replacement parts needed, therefore fewer items manufactured, along with the associated environmental benefits of this.