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

Degrees Celsius and Kelvin

Transmitted by the Government of Spain

Introduction

1. In the ATP agreement the temperature has been expressed in two different units, ºC and K. Both have been used differently over the years, and apparently no uniform criteria exists. Currently most references to specific temperatures (e.g. temperatures for specific products, temperatures for special equipment) are given in ºC, but in many cases references to temperature intervals are given in K.

2. The degree kelvin, (K) is part of the International System of Units, formed by the seven base units, which are the second, meter, kilogram, ampere, kelvin, mole, and candela. Originally the kelvin was defined as the fraction 1/273.16 of the thermodynamic temperature of the triple point of water (exactly 0.01 °C or 32.018 °F). On 16 November 2018, a new definition was adopted, in terms of a fixed value of the Boltzmann constant. These new set of definitions (affecting not only the kelvin but also other base units) defines the Kelvin in a way that is not dependent of the conditions on Earth, without changing its value. For legal metrology purposes, the new definition officially came into force on 20 May 2019.

3. The degree Celsius (ºC) is a derived unit used by the International System of Units introduced in 1743 and defined basing assigning 0 °C for the freezing point of water and 100 °C for the boiling point of water at 1atm pressure. By international agreement, since 1954 the unit *degree Celsius* and the Celsius scale are defined by absolute zero and the triple point of Vienna Standard Mean Ocean Water, a specially purified water. This definition also precisely relates the Celsius scale to the Kelvin scale, which defines the SI base units as absolute zero, the lowest temperature possible, is defined as being exactly 0 K and −273.15 °C. The temperature of the triple point of water is defined as exactly 273.16 K (0.01 °C). This means that a temperature difference of one degree Celsius and that of one kelvin are exactly the same.

4. In the corrections made to the ATP agreement applicable since 8 November de 2018 (see document ECE/TRANS/WP11/237) the degrees, measured in K, were partially substituted by ºC in Annex1, Appendix 2, paragraphs 2.1.4, 2.2.5, 3.1.1, 4.2.3 (i) and 4.3.1(a).

5. Nevertheless, in the rest of the ATP text the temperatures are expressed partially in K and partially in ºC. It would be a welcomed simplification to use always the same unit for the text of ATP.

6. As specific temperature references are more familiar to most users in ºC than in K, it would be interesting to use this unit in the text of ATP.

7. Introducing consistently ºC into the whole text, would:

- Identify clearly all the references to temperatures, measured in the same unit always;
- Avoid the possibility of confusing K as used for the coefficient K from the temperatures measured in K;
- Use the more familiar unit for all involved actors.

8. Therefore, it would be interesting to modify all references to degrees Kelvin, if possible, and refer to the values in ºC.

Analysis

9. At the last session, the representative of Spain made this proposal in informal document INF.9 and was invited by the Working Party to present this working document.

10. In this document, it is proposed to modify all of the uses of K and introduce ºC, except for the units of the coefficient K. Nevertheless, as the formula corresponding to the definition of the overall heat transfer coefficient K is defined as $K = \frac{W}{S \cdot \Delta T}$ and in this definition a temperature difference is used, this coefficient K can be measured both as $(K) = \frac{W}{m^2 \cdot K}$ or as $(K) = \frac{W}{m^2 \cdot ^\circ C}$ indistinctly.

Proposal

11. It is proposed to substitute K by ºC in all the cases where it appears. Deleted text is shown ~~stricken through~~ and new text in **bold**, except in the test report models in annex 1, appendix 2, where the changes to be made are shown:

Annex 1

1. Insulated equipment:

   Under I_N "… a K coefficient equal to or less than $0{,}70 \frac{W}{m^2 \cdot \text{~~K~~} ^\circ C}$"

   Under I_R "… a K coefficient equal to or less than $0{,}40 \frac{W}{m^2 \cdot \text{~~K~~} ^\circ C}$ and …"

2. Refrigerated equipment, last paragraph:
   "… equal to or less than $0{,}40 \frac{W}{m^2 \cdot \text{~~K~~} ^\circ C}$"

3. Mechanically refrigerated equipment, Class F:
   "… equal to or less than $0{,}40 \frac{W}{m^2 \cdot \text{~~K~~} ^\circ C}$"

4. Heated equipment, , last paragraph:
   "… equal to or less than $0{,}40 \frac{W}{m^2 \cdot \text{~~K~~} ^\circ C}$"

5. Mechanically refrigerated and heated equipment, second last paragraph:
   "… equal to or less than $0{,}40 \frac{W}{m^2 \cdot \text{~~K~~} ^\circ C}$"

Annex 1 - Appendix 2

1.2: Method C:

"… for the insulation has a value of 0,025 $\frac{W}{m \cdot \sout{K}\ ^\circ C}$ "

1.7: first paragraph:

"… more than ± 0.3 ~~K~~ **ºC**".
"… by more than ± 1.0 ~~K~~ **ºC**".

1.7: fourth paragraph:
"… by more than ± 0.2 ~~K~~ **ºC**."

2.1.2: first paragraph:
"… do not exceed 2 ~~K~~ **ºC**."

2.1.7: "… shall not exceed 2 ~~K~~ **ºC**."

2.2.3: "… does not exceed 3~~K~~ **ºC** when …"

"… shall not exceed 2 ~~K~~ **ºC** …"

2.2.8: "… shall not exceed 2 ~~K~~ **ºC**."

4.1.1: "… or insulated body (~~K~~ **ºC**)"

4.2.2 a): "… shall be ± 0.2 ~~K~~ **ºC**."

4.2.3 i): "…shall not exceed 2 ~~K~~ **ºC**."…"with a tolerance of ± 1 ~~K~~ **ºC**."

4.2.3: paragraph after ii):

"… with a tolerance of ± 0.5 ~~K~~ **ºC**."

6.3: "… (a difference of 22 K ºC in the case of class A, 32 K ºC in the case of class B, 42 K ºC in the case of class C and 52 K ºC in the case of class D) …"

6.4 (ii): "… a difference of 22 K ºC in the case of classes A, E and I, of 32 K ºC in the case of classes B, F and J, of 42 K ºC in the case of classes C, G and K, and of 52 K ºC in the case of classes D, H and L), …"

7.3.1: second paragraph:

"… less than or equal to 0,40 $\frac{W}{m^2 \cdot \sout{K}\ ^\circ C}$ for the outer …"

7.3.2: first paragraph:
"… value ≤ 0,40 $\frac{W}{m^2 \cdot \sout{K}\ ^\circ C}$."

7.3.7: table heading:
"K Coefficient – [W/m² · ~~K~~ ºC]"

8: Test report model 1A, last line:
Change "$\frac{W}{m^2 \cdot K}$"for " $\frac{W}{m^2 \cdot ^\circ C}$" one time.

8: Test report model 2A:
Change "K" for "ºC" 6 times.
Change "$\frac{W}{m^2 \cdot K}$"for " $\frac{W}{m^2 \cdot ^\circ C}$" one time.

8: Test report model 2B:
Change "K" for "ºC" 6 times.
Change "$\frac{W}{m^2 \cdot K}$"for " $\frac{W}{m^2 \cdot ^\circ C}$" one time.

8: Test report model 3:
Change "$\frac{W}{m^2 \cdot K}$"for "$\frac{W}{m^2 \cdot ^\circ C}$" one time.

8: Test report model 4A:
Change "K" for "ºC" 3 times.

8: Test report model 4B:
Change “K” for “ºC” 3 times.

8: Test report model 4C:
Change “K” for “ºC” 3 times.

8: Test report model 5:
Change “K” for “ºC” 3 times.

8: Test report model 6:
Change “K” for “ºC” 2 times.

8: Test report model 7:
Change “K” for “ºC” 3 times.

Justification

1. The proposed amendments would imply that the temperature in the ATP agreement is expressed always in ºC. This would simplify the use of the text.

2. All occasions when the temperature is currently expressed in K have been revised. When used in formulas, no change in the results of the formulas will take place because of changing from K to ºC, as the temperature difference is used in all of these cases (same numerical value in ºC and K).