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Item 5 (a) and 6 of the provisional agenda
Proposals of amendments to the ATP: pending proposals
ATP Handbook

Interpretation of external surface area measurement for panel vans

Transmitted by the United Kingdom

I. Introduction

1. This topic was originally raised at the 66th session of WP.11 and lead to some misunderstandings over the issues experienced. The problem leads to some van structures receiving lower K values than they otherwise might be entitled to.

2. The existing text of the ATP is not practical for the measurement of the external surface area of insulated vans for all shapes and sizes of vehicle. The smooth contours of a van body make it difficult to establish the most accurate point from which to take measurements. For example, the width of the floor is often different from the ceiling and the front can be narrower than the rear where a side door is installed.

3. Measurement of the external surfaces of a van cannot account for unfilled voids within the structure. Panel voids might also include steel structures that bridge the external heat to the outer edge of the insulated wall panels.

4. The point is illustrated in the diagram below. The grey shading represents the main insulated panel and the black voids represent varying thicknesses of foam infill. The question is whether the external surface should be considered as the outer edge of the grey part or whether it should include the voids and be loosely considered as the external metal surface.

II. Proposed amendment

5. The following text should be added to annex 1, appendix 2, paragraph 1.2 as follows:

"For calculating the mean surface area of the body of a panel van, the competent authorities' appointed experts shall select from one or a combination of the following three methods.

Method A. The manufacturer shall provide drawings and calculations of the inside and outside surfaces.

The surface areas S_e and S_i are determined taking into consideration the projected surface areas of specific design features of the irregularities of its surface such as curves, corrugations, wheel boxes, etc.

Method B. The manufacturer shall provide drawings and the competent authority shall use the calculations according to the schemes and formulae in the ATP Handbook (using either figures 1, 2 or 3 along with figures 4 and 5).

$S_i = (((WI \times LI) + (WI \times LI) + (W_i \times W_i)) \times 2)$

$S_e = (((WE \times LE) + (WE \times LE) + (W_e \times W_e)) \times 2)$

Where:

WI is the Y axis of the internal surface area

LI is the X axis of the internal surface area

W_i is the Z axis of the internal surface area

WE is the Y axis of the external surface area

LE is the X axis of the external surface area

W_e is the Y axis of the external surface area

Method C. If neither of the above is acceptable to the experts, the internal surface shall be measured according to the figures and formulae in method B.

The K value shall then be calculated based on the internal surface area, taking the insulation thickness as nil. From this K value, the average insulation thickness is calculated from the assumption that λ for the insulation has a value of 0.025 W/m·K.

$d = S_i \times \Delta T \times \lambda / W$

Once the thickness of the insulation has been estimated, the external surface area is calculated and the mean surface area is determined. The final K value is derived from successive iteration.

An example of the calculation methods shall be given in the ATP Handbook."

III. Test report

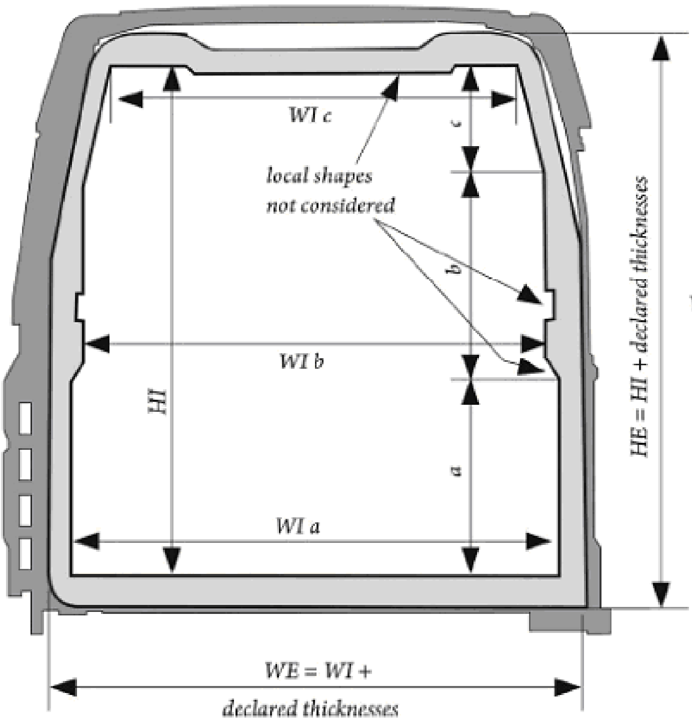
6. To reflect the panel van dimensions in the test report, the maximum internal length and height along with the top and bottom width shall be included in Model No 1 A of the ATP.

7. The external dimensions shall be the internal dimensions with the insulation thickness added.

IV. ATP Handbook

8. It is proposed to include the following drawings in the ATP Handbook with examples.

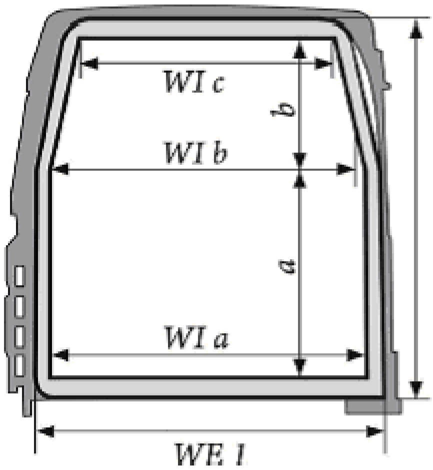
Figure 1



$$WI = \frac{WIa \times a + WIb \times \left(b + \frac{c}{2}\right) + WIc \times \frac{c}{2}}{a + b + c}$$

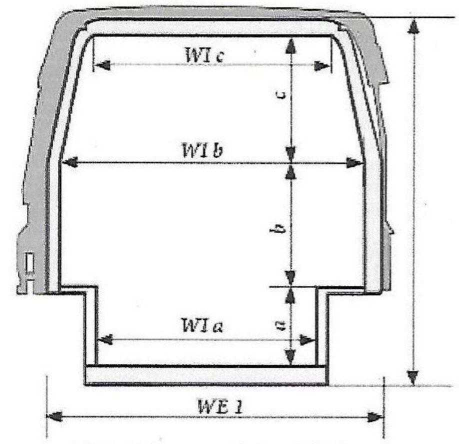
$$\text{Mean declared thicknesses (mm)} < \frac{25}{K}$$

Figure 2



$$WI = \frac{WIa \times \frac{a}{2} + WIb\left(\frac{a}{2} + \frac{b}{2}\right) + WIc\left(\frac{b}{2}\right)}{a + b}$$

Figure 3



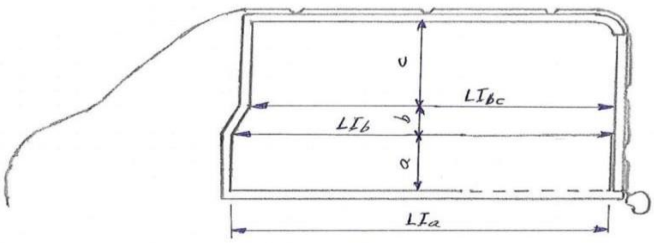
WE = WI + mean declared thicknesses

$$WI = \frac{((WIb x b)+(WIb x c)-((WIb-WIc) x c)+(WIb x a)+(2x((WIb-WIa) x a)))}{(a+b+c)}$$

key

W_{ia}	internal width between the wheel arches
W_{ib}	internal width above the wheel arches
W_{ic}	internal width of the roof
a	internal height of the wheel arches
b	internal height above the wheel arches
c	internal height above the wheel arches where the side wall width ends

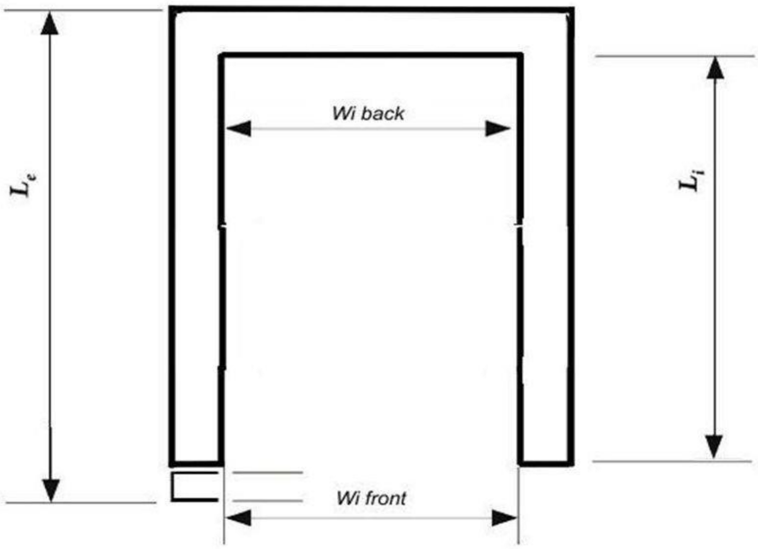
Figure 4



$$LI = \frac{((LIa \times a) + (LIb + LIc)/2 \times b + (LIc \times c))}{(a + b + c)}$$

LE = LI + mean declared thickness

Figure 5



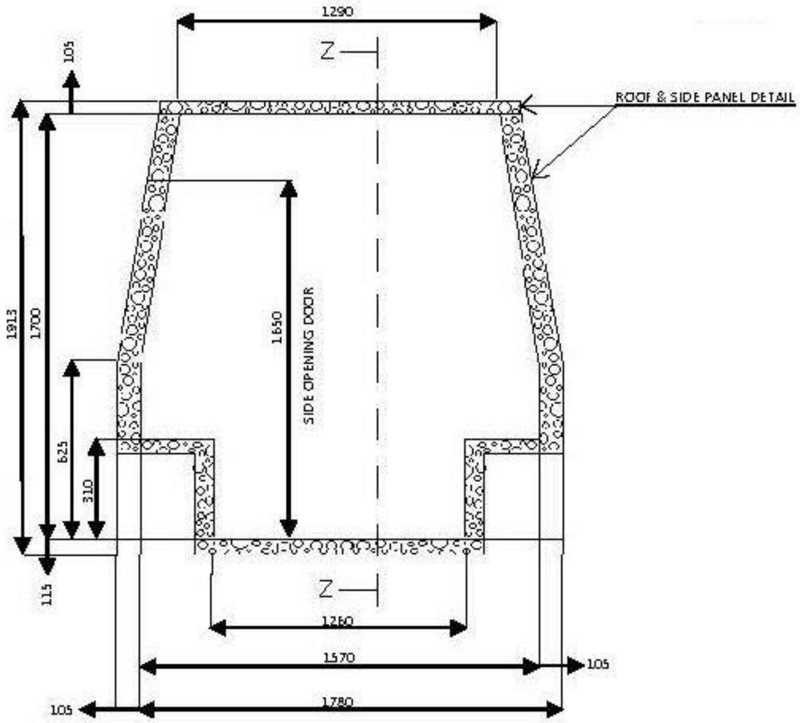
$$Wi = \frac{(Wi\ back + Wi\ front)}{2}$$

We = Wi + mean declared thickness

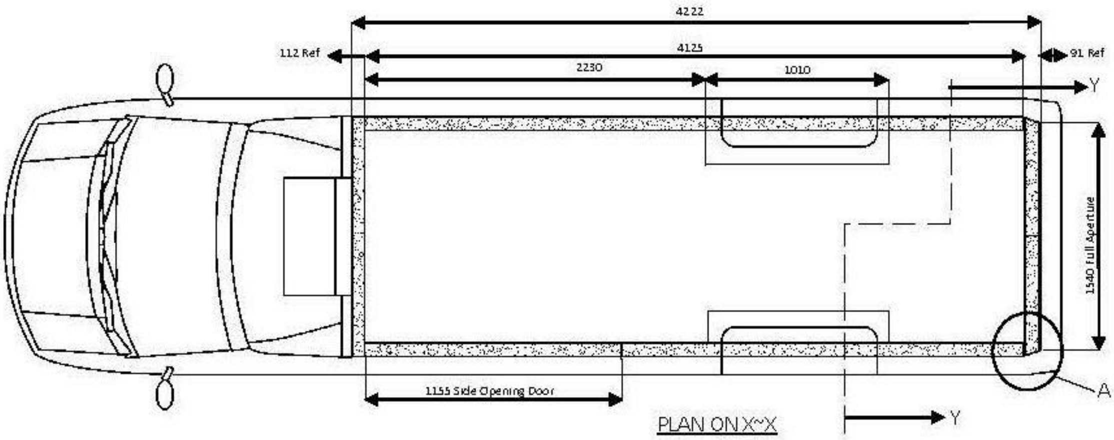
V. Examples

9. Using a van recently tested in the United Kingdom, the three methods are demonstrated using figures 1 to 5 above.

10. The manufacturer in this case was able to supply the drawing of the insulated panel van but was unable to provide calculations of the internal and external surface areas.



1290
105
Z
ROOF & SIDE PANEL DETAIL
1913
1700
1650
SIDE OPENING DOOR
625
310
115
1260
1570
105
105
1780



4222
112 Ref
4125
91 Ref
2230
1010
Y
1540 Full Aperture
A
1155 Side Opening Door
PLAN ON X~X

VI. Using figures 1, 4 and 5

Method A (manufacturer's drawings - excluding wheel arches)

Si	Se	S	W	Delta T	k
29.27	35.11	32.05	300	25	**0.374**

Method B (using described diagrams - excluding wheel arches)

Wia	1.57	Lia	4.125	Wib	1.57
Wib	1.57	Lib	4.125	Wif	1.57
Wic	1.29	Lic	4.125		
a	0.31	a	0.31		
b	0.315	b	0.315		
c	1.075	c	1.075		

WI	1.481471	LI	4.125	Wi	1.57
WE	1.701471	LE	4.328	We	1.78

Method C (using described diagrams and iteration using insulation Lambda 0.025 W/m.k)

Wia	1.57	Lia	4.125	Wib	1.57
Wib	1.57	Lib	4.125	Wif	1.57
Wic	1.29	Lic	4.125		
a	0.31	a	0.31		
b	0.315	b	0.315		
c	1.075	c	1.075		

WI	1.481471	LI	4.125	Wi	1.57
WE	1.4815	LE	4.2474	We	1.692392
WE	1.6120	LE	4.2556	We	1.700568
WE	1.6125	LE	4.2560	We	1.70105

Results

	Si	Se	S	W	Delta T	k
Method A	29.27	35.11	32.05	300	25.00	**0.374**
Method B	29.37	35.79	32.42	300	25.00	**0.370**
Method C	29.37	33.69	31.46	300	25.00	**0.381**

VII. Using figures 2, 4 and 5

Method A (manufacturer's drawings - excluding wheel arches)

Si	Se	S	W	Delta T	k
29.27	35.11	32.05	300	25	**0.374**

Method B (using described diagrams -excluding wheel arches)

Wia	1.57	Lia	4.125	Wib	1.57
Wib	1.57	Lib	4.125	Wif	1.57
Wic	1.29	Lic	4.125		
a	0.625	a	0.31		
b	1.075	b	0.315		
		c	1.075		

WI	1.481471	LI	4.125	Wi	1.57
WE	1.701471	LE	4.328	We	1.78

Method C (using described diagrams and iteration using insulation Lambda 0.025 W/m.k)

Wia	1.57	Lia	4.125	Wib	1.57
Wib	1.57	Lib	4.125	Wif	1.57
Wic	1.29	Lic	4.125		
a	0.625	a	0.31		
b	1.075	b	0.315		
		c	1.075		

WI	1.481471	LI	4.125	Wi	1.57
WE	1.6039	LE	4.2474	We	1.692392
WE	1.6120	LE	4.2556	We	1.700568
WE	1.6125	LE	4.2560	We	1.70105

Results

	Si	Se	S	W	Delta T	k
Method A	29.27	35.11	32.05	300	25.00	**0.374**
Method B	29.37	35.79	32.42	300	25.00	**0.370**
Method C	29.37	33.69	31.46	300	25.00	**0.381**

VIII. Using figures 3, 4 and 5

Method A (manufacturer's drawings - including wheel arches)

Si	Se	S	W	Delta T	k
29.46	35.30	32.25	300	25	**0.372**

Method B (using described diagrams - including wheel arches)

Wia	1.26	Lia	4.125	Wib	1.57
Wib	1.57	Lib	4.125	Wif	1.57
Wic	1.29	Lic	4.125		
a	0.31	a	0.31		
b	0.315	b	0.315		
c	1.075	c	1.075		
WI	1.506	LI	4.125	Wi	1.57
WE	1.726	LE	4.328	We	1.78

Method C (using described diagrams and iteration using insulation Lambda 0.025 W/m.k)

Wia	1.26	Lia	4.125	Wib	1.57
Wib	1.57	Lib	4.125	Wif	1.57
Wic	1.29	Lic	4.125		
a	0.31	a	0.31		
b	0.315	b	0.315		
c	1.075	c	1.075		
WI	1.506	LI	4.125	Wi	1.57
WE	1.6301	LE	4.2491	We	1.694078
WE	1.6381	LE	4.2571	We	1.702136
WE	1.6386	LE	4.2576	We	1.702614

Results

	Si	Se	S	W	Delta T	k
Method A	29.46	35.30	32.25	300	25.00	**0.372**
Method B	29.78	36.22	32.84	300	25.00	**0.365**
Method C	29.78	34.03	31.83	300	25.00	**0.377**

IX. Discussion

11. Method A is shown to give a flattering figure due to the manufacturer's overestimation of the external surface area. Methods B and C give very close K values. A spreadsheet will be submitted in an informal document that gives the method for calculation of the mean insulation surface area from the internal surface area.

12. Below is a summary of the results:

Results excluding wheel arches

	Si	Se	S	W	Delta T	k
Method A	29.27	35.11	32.05	300	25.00	**0.374**
Method B	29.37	35.79	32.42	300	25.00	**0.370**
Method C	29.37	33.69	31.46	300	25.00	**0.381**

Results including wheel arches

	Si	Se	S	W	Delta T	k
Method A	29.46	35.30	32.25	300	25.00	**0.372**
Method B	29.78	36.22	32.84	300	25.00	**0.365**
Method C	29.78	34.03	31.83	300	25.00	**0.377**

X. Impact

13. There may be a financial impact for industry, in that vans overall become slightly more expensive as the less expensive inferior versions are eliminated. As can be seen the iteration method is slightly harsher on the manufacturer than when the precise drawing are available.

14. Improved K values generally reduce carbon emissions. However, in some instances the higher measured K value might result in the necessity for a larger cooling unit, which would increase carbon emissions.

15. The proposal would ensure that measurements made on panel vans are consistent between different experts and testing stations, avoiding unrealistic test results. This would benefit manufacturers / body assemblers who would be reassured that the K value is not dependent on which test station or which expert conducts the test.