3.2. Wind tunnel criteria

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3.2.4. Solid blockage ratio

The vehicle blockage ratio ε sb expressed as the quotient of the vehicle frontal area and the area of the nozzle outlet as calculated using the following equation, shall not exceed 0,35.

$$ε\_{sb}=\frac{A\_{f}}{A\_{nozzle}}$$

where:

εsb is the vehicle blockage ratio;

Af  is the frontal area of the vehicle, m2;

Anozzle is the nozzle outlet area, m2.

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6. Wind tunnel method

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6.2. Approval of the facilities by the approval authority

The results of the wind tunnel method shall be compared to those obtained using the coastdown method to demonstrate qualification of the facilities and included in all relevant test reports.

6.2.1. Three vehicles shall be selected by the approval authority. The vehicles shall cover the range of vehicles (e.g. size, weight) planned to be measured with the facilities concerned.

6.2.2. Two separate coastdown tests shall be performed with each of the three vehicles according to paragraph 4.3. of this Sub-Annex, and the resulting road load coefficients, f0 , f1 and f2, shall be determined according to that paragraph and corrected according to paragraph 4.5.5. of this Sub-Annex. The coastdown test result of a test vehicle shall be the arithmetic average of the road load coefficients of its two separate coastdown tests. If more than two coastdown tests are necessary to fulfil the approval of facilities' criteria, all valid tests shall be averaged.

6.2.3. Measurement with the wind tunnel method according to paragraphs 6.3. to 6.7. inclusive of this Sub-Annex shall be performed on the same three vehicles as selected in paragraph 6.2.1. of this Sub- Annex and in the same conditions, and the resulting road load coefficients, f0 , f1 and f2, shall be determined.

If the manufacturer chooses to use one or more of the available alternative procedures within the wind tunnel method (i.e. paragraph 6.5.2.1. on preconditioning, paragraphs 6.5.2.2. and 6.5.2.3. on the procedure, and paragraph 6.5.2.3.3. on dynamometer setting), these procedures shall also be used also for the approval of the facilities.

6.2.4. Approval criteria

The facility or combination of facilities used shall be approved if both of the following two criteria are fulfilled:

(a) The difference in cycle energy, expressed as εk, between the wind tunnel method and the coastdown method shall be within ± 0,05 for each of the three vehicles k according to the following equation:

$$ε\_{k}=\frac{E\_{k,WTM}}{E\_{k,coastdown}}-1$$

where:

εk is the difference in cycle energy over a complete Class 3 WLTC for vehicle k between the wind tunnel method and the coastdown method, per cent;

Ek,WTM is the cycle energy over a complete Class 3 WLTC for vehicle k, calculated with the road load derived from the wind tunnel method (WTM) calculated according to paragraph 5 of Sub-Annex 7, J;

Ek,coastdown is the cycle energy over a complete Class 3 WLTC for vehicle k, calculated with the road load derived from the coastdown method calculated according to paragraph 5. of Sub-Annex 7, J.; and

(b) The arithmetic average x of the three differences shall be within 0,02.

$$\overbar{X}=\left|\frac{ε\_{1}+ε\_{2}+ε\_{3}}{3}\right|$$

The approval shall be recorded by the approval authority including measurement data and the facilities concerned.

The facility may be used for road load determination for a maximum of two years after the approval has been granted.

Each combination of roller chassis dynamometer or moving belt and wind tunnel shall be approved separately.

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6.4.1. Wind tunnel criteria

 The wind tunnel design, test methods and the corrections shall provide a value of
(CD × Af) representative of the on-road (CD × Af) value and with a precision of ± 0,015 m2.

For all (CD × Af) measurements, the wind tunnel criteria listed in paragraph 3.2. of this Sub-Annex shall be met with the following modifications:

(a) The solid blockage ratio described in paragraph 3.2.4. of this Sub-Annex shall be less than 25 per cent. However, a wind tunnel with a solid blockage ratio described in paragraph 3.2.4. of this Sub-Annex of between 25 per cent and 35 per cent may be used when the approval checks described in paragraphs 6.2.1. to 6.2.3. of this Sub-Annex are repeated on 3 vehicles, each with a frontal area greater than 25 per cent of the nozzle area, and the approval criteria described in paragraph 6.2.4. of this Sub-Annex are met. In this case the largest permissible blockage ratio is that of the vehicle with the largest frontal area of those used for these approval checks;

(b) The belt surface contacting any tyre shall exceed the length of that tyre's contact area by at least 20 per cent and shall be at least as wide as that contact patch;

(c) The standard deviation of total air pressure at the nozzle outlet described in paragraph 3.2.8. of this Sub-Annex shall be less than 1 per cent;

(d) The restraint system blockage ratio described in paragraph 3.2.10. of this Sub-Annex shall be less than 3 per cent.