WLTP-08-24e

Wind Tunnel Method (OIT #10 and #18)

Requirements for the flatbelt

Flatbelt Dynamometer

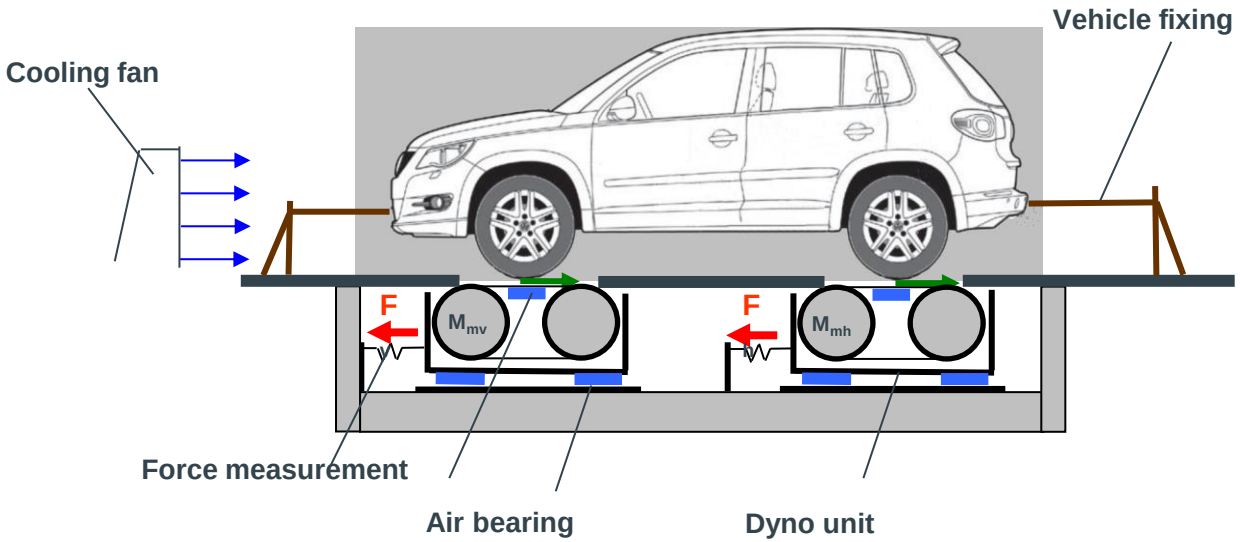
- Realistic measurements of the whole mechanical drag of a car under defined climate terms and conditions.
- To receive the complete road load of the car, the aerodynamic drag is added to the mechanical drag from the flatbelt.

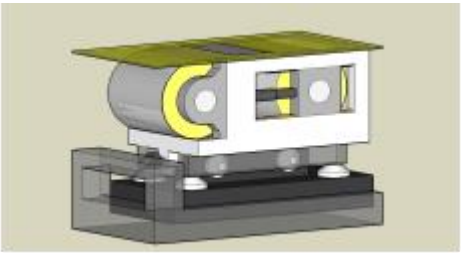
$F_{vehicle} = F_{mechanical} + F_{air}$

F_{air} = calculated from wind tunnel Measurement

$F_{mechanical}$ = measured on flatbelt

Explanation of the Measuring Principle





Belt Unit with air bearing

- Each belt unit is mounted drag free against the environment by air bearings.
- The reaction forces of the car is measured over the whole unit against the environment.

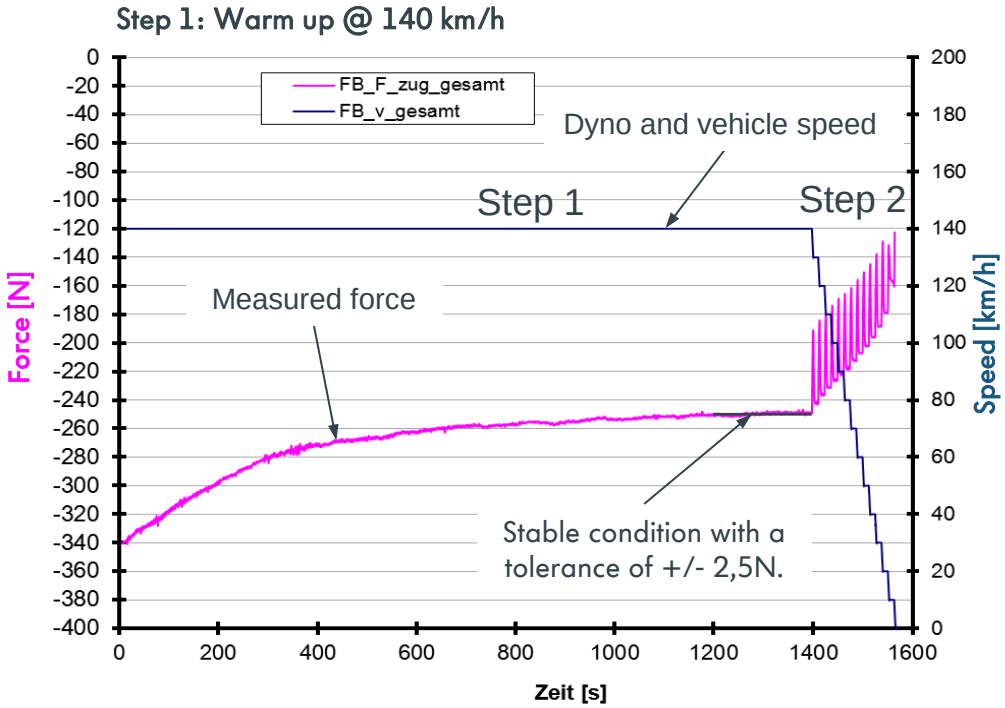
Requirements:

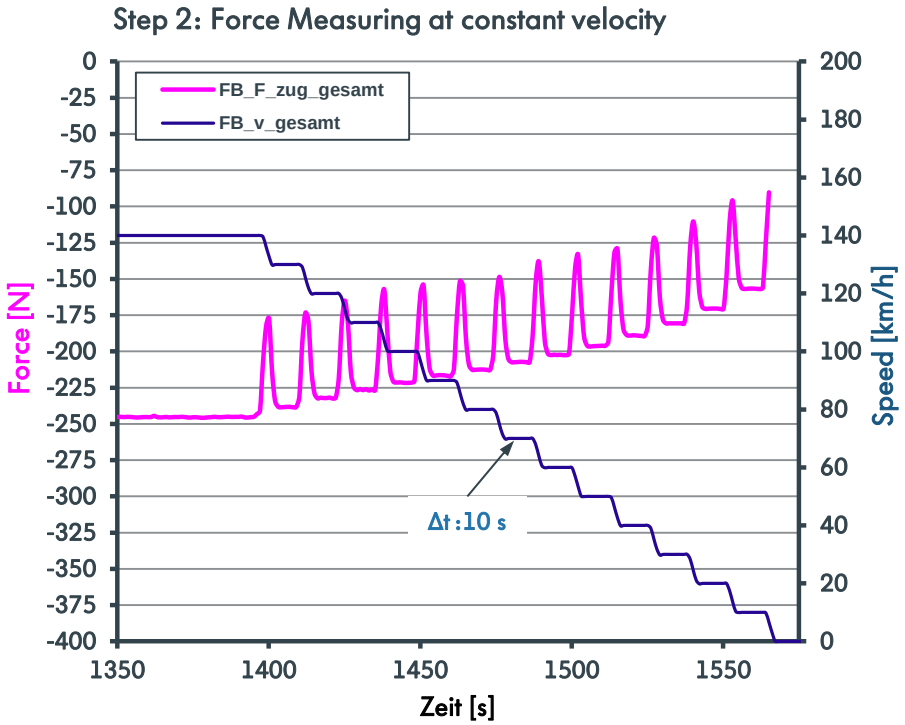
→ Only the reaction force for rotating the wheels shall be measured

→ No external forces shall be included in the result (e.g. air force of the cooling fan, vehicle restraints, aerodynamic reaction forces of the flatbelt, etc.)
Only exception: Wind tunnel facilities with integrated flatbelts for measuring running resistance. Here, the measurement of the whole road load by one test is possible (these facilities do not exist today).

→ The measurement shall be done in the same conditions like on the road (engine on, idling speed, neutral gear “N”)

Explanation of the Measuring Principle





Requirement:

→ Brake conditioning: See description for the coast down on the road (see 4.2.4.1.1.).

→ Vehicle warm up:

a) See description for the coast down on the road (active driving, see 4.2.4.1).

b) On manufacture's request: By driving the flatbelt with the vehicle installed at [110] per cent of the maximum speed of the applicable WLTC for at least 1200 s until the change of measured force over a period of 200 s is smaller than [5 N] (see step 1).

→ Force measuring (see step 2): stepping down at constant speed with [Δv =10km/h] for at least [10 s]. After a stabilization of [4 s], measure the average force at the constant reference speed for at least [6 s].

Calculating Road Load Coefficients

Aerodynamic force:

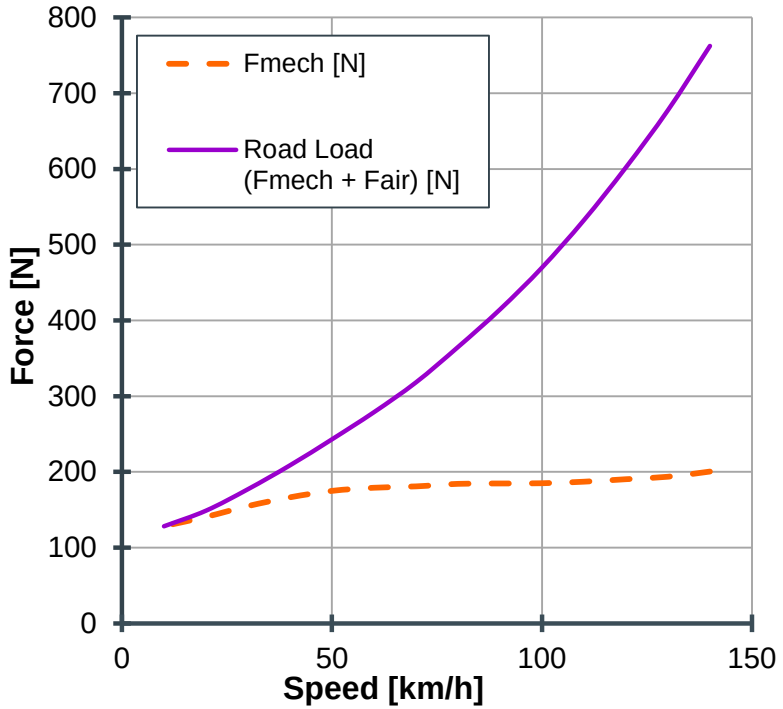
$$F_{Aj} = (c_d * A_f)_j * \frac{\rho_0}{2} * \frac{v_j^2}{3.6^2}$$

Mechanical force (measured on flatbelt):

$$\sum mechanical\ drag\ from\ each\ wheel$$

Total road load:

$$\sum mechanical\ drag + aerodynamic\ drag$$



Road Load Coefficients

f_0 [N]	117,3
f_1 [N/(km/h)]	1,32
f_2 [N/(km/h)²]	0,0224

Requirement:

- → Measuring cd x A in wind tunnel as defined in 6.4.
- → Calculate the aerodynamic force (see 6.7.2.)
- → Adding the aerodynamic force by calculation to the measured force from the flat belt to receive the total road load of the car
- → Calculate the road load coefficients f_0, f_1, f_2 with a least squares regression analysis and use these parameters as target coefficients in paragraph 8.1.1.