Proposal for Supplement 7 to Regulation No. 85

The purpose of this proposal is to avoid a duplicated correction of the measured engine power from supercharged and turbocharged engines fitted with a system which allows compensation for ambient conditions such as temperature and altitude.
This idea is based on amendment in Annex XX added in (EU) No 136/2014.

I.   Proposal

Annex 5, insert 5.4.3. shown in __bold__:

"5.4.   Determination of correction factor α_a and α_d[1]

5.4.1.   Naturally aspirated or pressure-charged positive-ignition engine factor α_a

The correction factor α_a is obtained by applying the formula:

$$\alpha_a = \left(\frac{99}{P_s}\right)^{1.2} \cdot \left(\frac{T}{298}\right)^{0.6} \quad {\scriptstyle 2}$$

Where

P_s is the total dry atmospheric pressure in kilopascals (kPa); that is to say, the total barometric pressure minus water vapour pressure

T is the absolute temperature in kelvins (K) of the air drawn in by the engine.

Conditions to be complied with in the laboratory

For a test to be valid, the correction factor α_a must be such that $0.93 \leq \alpha_a \leq 1.07$

If these limits are exceeded, the corrected value obtained shall be given and the test conditions (temperature and pressure) precisely stated in the test report.

5.4.2.   Diesel engines - Factor α_d

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[1]   The tests may be carried out in air-conditioned test rooms where the atmospheric conditions may be controlled.

[2]   In the case of engines fitted with automatic air temperature control, if the device is such that at full load at 25 °C no heated air is added, the test shall be carried out with the device fully closed. If the device is still operating at 25 °C then the test is made with the device operating normally and the exponent of the temperature term in the correction factor shall be taken as zero (no temperature correction).

The power correction factor (α_d) for diesel engines at constant fuel rate is obtained by applying the formula:

Where $\alpha_d = (f_a)\ f_m$

f_a is the atmospheric factor

f_m is the characteristic parameter for each type of engine and adjustment

5.4.2.1.   Atmospheric factor f_a

This factor indicates the effects of environmental conditions (pressure, temperature and humidity) on the air drawn in by the engine. The atmospheric factor formula differs according to the type of engine.

5.4.2.1.1.   Naturally aspirated and mechanically supercharged engines

$$f_a = \left(\frac{99}{P_s}\right)\cdot\left(\frac{T}{298}\right)^{0.7}$$

5.4.2.1.2.   Turbocharged engines with or without cooling of inlet air

$$f_a = \left(\frac{99}{P_s}\right)^{0.7}\cdot\left(\frac{T}{298}\right)^{1.5}$$

5.4.2.2.   Engine factor f_m

f_m is a function of q_c (fuel flow corrected) as follows:

$f_m = 0.036\ q_c - 1.14$

Where: $q_c = q/r$

Where:

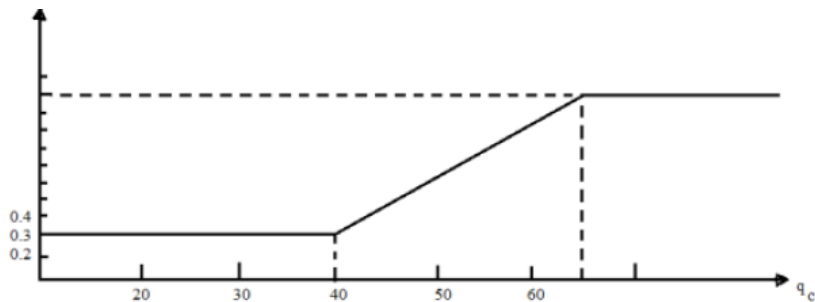q is the fuel flow in milligram per cycle per litre of total swept volume (mg/(l.cycle))

r is the pressure ratio of compressor outlet and compressor inlet

(r = 1 for naturally aspirated engines)

This formula is valid for a value interval of q_c included between 40 mg/(l.cycle) and 65 mg/(l.cycle.)

For q_c values lower than 40 mg/(l.cycle), a constant value of f_m equal to 0.3 (f_m= 0.3) will be taken.

For qc values higher than 65 mg/(l.cycle), a constant value of f_m equal to 1.2 (f_m = 1.2) will be taken (see figure):

5.4.2.3. Conditions to be complied with in the laboratory

For a test to be valid; the correction factor αd must be such that $0.9 \leq \alpha_d \leq 1.1$
If these limits are exceeded, the corrected value obtained shall be given and the test conditions (temperature and pressure) precisely stated in the test report.

5.4.3. **When a turbo-charged engine is fitted with a system which allows compensating the ambient conditions temperature and altitude, at the request of the manufacturer, the correction factor α_a or α_d shall be set to the value of 1.**"

II. Justification

The correction factor may lead to a duplicated correction for supercharged and turbocharged engines equipped with a self-correction ability, resulting in a test result that differs from the actual engine power. This proposal aims to obtain a more accurate test result by accepting no corrections for these engines.

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