Commission Regulation (EU) No 65/2012 of 24 January 2012 implementing Regulation (EC) No 661/2009 of the European Parliament and of the Council as regards gear shift indicators and amending Directive 2007/46/EC of the European Parliament and of the Council (Text with EEA relevance)

ANNEX I

**SPECIAL REQUIREMENTS FOR VEHICLES
EQUIPPED WITH GEAR SHIFT INDICATORS (GSI)**

4.   **The fuel economy impact of GSI recommended gear shift points shall be determined according to the following procedure:**

4.1.   *Determination of vehicle speeds at which GSI recommends shifting up gears*

This test is to be performed on a warmed up vehicle on a chassis dynamometer according to the speed profile described in Appendix 1 to this Annex. The advice of the GSI is followed for shifting up gears and the vehicle speeds, for which the GSI recommends shifting, are recorded. The test is repeated 3 times.

V^n_{GSI} shall denote the average speed at which the GSI recommends shifting up from gear n (n = 1, 2, …, #g) into gear n + 1, determined from the 3 tests, where #g shall denote the vehicle's number of forward gears. For this purpose only GSI shift instructions in the phase before the maximum speed is reached are taken into account and any GSI instruction during the deceleration is ignored.

For the purposes of the following calculations V^0_{GSI} is set to 0 km/h and $V^{\#g}_{GSI}$ is set to 140 km/h or the maximum vehicle speed, whichever is smaller. Where the vehicle cannot attain 140 km/h, the vehicle shall be driven at its maximum speed until it rejoins the speed profile in Figure I.1.

Alternatively, the recommended GSI shift speeds may be analytically determined by the manufacturer based on the GSI algorithm contained in the extended documentation package provided according to point 3.1.

4.2.   *Standard gear shift points*

V^n_{std} shall denote the speed at which a typical driver is assumed to shift up from gear n into gear n + 1 without GSI recommendation. Based on the gear shift points defined in the type 1 emission test[1] the following standard gear shift speeds are defined:

V^0_{std}	= 0 km/h;
V^1_{std}	= 15 km/h;
V^2_{std}	= 35 km/h;
V^3_{std}	= 50 km/h;
V^4_{std}	= 70 km/h;
V^5_{std}	= 90 km/h;
V^6_{std}	= 110 km/h;
V^7_{std}	= 130 km/h;
V^8_{std}	= $V^{\#g}_{GSI}$;

V^n_{min} shall denote the minimum vehicle speed the vehicle can be driven in the gear n without stalling of the engine and V^n_{max} the maximum vehicle speed the vehicle can be driven in the gear n without creating damage to the engine.

If V^n_{std} derived from this list is smaller than V^{n+1}_{min}, then V^n_{std} is set to be V^{n+1}_{min}. If V^n_{std} derived from this list is greater than V^n_{max}, then V^n_{std} is set to be V^n_{max} (n = 1, 2, …, #g − 1).

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If $V^{\#g}_{std}$ determined by this procedure is smaller than $V^{\#g}_{GSI}$, it shall be set to $V^{\#g}_{GSI}$.

4.3.   *Fuel consumption speed curves*

The manufacturer shall supply the type-approval authority with the functional dependence of the vehicle's fuel consumption on the steady vehicle speed when driving with gear n according to the following rules.

FC^n_i shall denote the fuel consumption in terms of kg/h (kilograms per hour) when the vehicle is driven with the constant vehicle speed $v_i = i \times 5$ km/h $- 2,5$ km/h (where i is a positive integer number) in the gear n. These data shall be provided by the manufacturer for each gear n (n = 1, 2, …, #g) and $v^n_{min} \leq v_i \leq v^n_{max}$. These fuel consumption values shall be determined under identical ambient conditions corresponding to a realistic driving situation that may be defined by the vehicle manufacturer, either by a physical test or by an appropriate calculation model agreed between the approval authority and the manufacturer.

4.4.   *Vehicle speed distribution*

The following distribution should be used for the probability P_i that the vehicle drives with a speed v, where $v_i - 2,5$ km/h $< v \leq v_i + 2,5$ km/h (i = 1, …, 28):

i	P_i
1	4,610535879
2	5,083909299
3	4,86818148
4	5,128313511
5	5,233189418
6	5,548597362
7	5,768706442
8	5,881761847
9	6,105763476
10	6,098904359
11	5,533164348
12	4,761325003
13	4,077325232
14	3,533825909
15	2,968643201
16	2,61326375
17	2,275220718
18	2,014651418
19	1,873070659
20	1,838715054

21	1,982122053
22	2,124757402
23	2,226658166
24	2,137249569
25	1,76902642
26	1,665033625
27	1,671035353
28	0,607049046

Where the maximum speed of the vehicle corresponds to step i and i < 28, the values of P_{i+1} to P_{28} shall be added to P_i.

4.5.   *Determination of the model fuel consumption*

FC_{GSI} shall denote the fuel consumption of the vehicle when the driver follows the advice of the GSI:

$FC^{GSI}_i = FC^n_i$, where $V^{n-1}_{GSI} \leq v_i < V^n_{GSI}$ (for n = 1, …, #g) and $FC^{GSI}_i = 0$ if $v_i \geq V^{\#g}_{GSI}$

$$FC_{GSI} = \Sigma_{28}^{i=1} P_i \times FC^i_{GSI}/100$$

FC_{std} shall denote the fuel consumption of the vehicle when standard gear shift points are used:

$FC^{std}_i = FC^n_i$, where $V^{n-1}_{std} \leq v_i < V^n_{std}$ (for n = 1, …, #g) and $FC^{std}_i = 0$ if $v_i \geq V^{\#g}_{GSI}$

$$FC_{std} = \Sigma_{28}^{i=1} P_i \times FC^i_{std}/100$$

The relative saving of fuel consumption by following the advice of the GSI of the model is calculated as:

$FC_{rel.\ Save} = (1 - FC_{GSI}/FC_{std}) \times 100\ \%$

4.6.   *Data records*

The following information shall be recorded:

—   the values of V^n_{GSI} as determined according to point 4.1,

—   the values FC^n_i of the fuel consumption speed curve as communicated by the manufacturer according to point 4.3,

—   the values FC_{GSI}, FC_{std} and $FC_{rel.\ Save}$ as calculated according to point 4.5.

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(**1**)   Defined in Annex 4a of UNECE Regulation No 83, 05 series of amendments.