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► **M2** COUNCIL DIRECTIVE
of 16 December 1980

relating to the carbon dioxide emissions and the fuel consumption of motor vehicles

(80/1268/EEC) ◀

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► <u>M1</u> Commission Directive 89/491/EEC of 17 July 1989	L 238	43	15.8.1989
► <u>M2</u> Commission Directive 93/116/EC of 17 December 1993	L 329	39	30.12.1993
► <u>M3</u> Commission Directive 1999/100/EC of 15 December 1999	L 334	36	28.12.1999
► <u>M4</u> Directive 2004/3/EC of the European Parliament and of the Council of 11 February 2004	L 49	36	19.2.2004

Corrected by:

- **C1** Corrigendum, OJ L 42, 15.2.1994, p. 27 (93/116/EC)
- **C2** Corrigendum, OJ L 163, 4.7.2000, p. 38 (1999/100/EC)

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COUNCIL DIRECTIVE
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relating to the carbon dioxide emissions and the fuel consumption
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(80/1268/EEC)

▼B

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 100 thereof,

Having regard to the proposal from the Commission ⁽¹⁾,

Having regard to the opinion of the European Parliament ⁽²⁾,

Having regard to the opinion of the Economic and Social Committee ⁽³⁾,

Whereas the technical requirements which motor vehicles must satisfy pursuant to certain national laws relate *inter alia* to the method of measuring fuel consumption which must be used to indicate the fuel consumption of a vehicle type;

Whereas those requirements differ from one Member State to another; whereas this results in technical barriers to trade which must be eliminated by all Member States adopting the same requirements either in addition to or in place of their existing rules, in order in particular to allow the EEC type-approval procedure which was the subject of Council Directive 70/156/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers ⁽⁴⁾, as last amended by Directive 80/1267/EEC ⁽⁵⁾, to be introduced in respect of each type of vehicle;

Whereas it is of paramount importance to establish a method of measuring fuel consumption by motor vehicles for inclusion in Community requirements;

Whereas a Community method of measuring fuel consumption is also necessary to ensure, in particular, that customers and users are supplied with objective and precise information;

Whereas the requirements of this Directive apply only to motor vehicles in international motor vehicle classification category M₁ as set out in Directive 70/156/EEC; whereas a method of measuring the fuel consumption of the other categories of motor vehicles will be established as soon as certain technical difficulties can be resolved,

HAS ADOPTED THIS DIRECTIVE:

Article 1

For the purpose of this Directive, 'vehicle' means any motor vehicle intended for use on the road, with or without bodywork, having at least four wheels and a maximum design speed exceeding 25 km/h, with the exception of vehicles which run on rails and of agricultural tractors and machinery.

⁽¹⁾ OJ No C 104, 28. 4. 1980, p. 1.

⁽²⁾ OJ No C 265, 13. 10. 1980, p. 76.

⁽³⁾ OJ No C 182, 21. 7. 1980, p. 3.

⁽⁴⁾ OJ No L 42, 23. 2. 1970, p. 1.

⁽⁵⁾ See page 34 of this Official Journal.

▼M2*Article 2*

No Member State may refuse to grant EC type-approval or national type-approval in respect of a vehicle, or refuse or prohibit the sale, registration, entry into service or use of a vehicle, on grounds relating to its carbon dioxide emissions or its fuel consumption if the emission and consumption figures have been determined in accordance with Annexes I and II and are set out in a document given to the vehicle owner at the time of purchase in the manner and form decided by each Member State.

▼B*Article 3*

Any amendments necessary for adapting the requirements of the Annexes to take account of technical progress shall be adopted in accordance with the procedure laid down in Article 13 of Directive 70/156/EEC.

Article 4

1. Member States shall bring into force the provisions necessary in order to comply with this Directive within 18 months of its notification. They shall forthwith inform the Commission thereof.
2. Member States shall ensure that the texts of the main provisions of national law which they adopt in the field covered by this Directive are communicated to the Commission.

Article 5

This Directive is addressed to the Member States.

▼ M2*ANNEX I***DETERMINATION OF CO₂ EMISSIONS AND FUEL CONSUMPTION****▼ M4**

1. SCOPE

This Directive applies to the measurement of carbon dioxide (CO₂) emissions and fuel consumption of motor vehicles of categories M₁ and N₁.

It does not apply to a type of N₁ vehicle if both:

- the engine type fitted to that type of vehicle has received type-approval pursuant to Directive 88/77/EEC, and
- the total annual worldwide production of N₁ vehicles of the manufacturer is less than 2 000 units.

▼ M2

2. APPLICATION FOR EC TYPE-APPROVAL

- 2.1. The application for EC type-approval pursuant to Article 3 (4) of Directive 70/156/EEC for a vehicle type with regard to CO₂ emissions and fuel consumption shall be submitted by the manufacturer.
- 2.2. A model for the information document is given in Annex II to Directive 70/220/EEC. When already available, the type-approval number will also be reported. When appropriate, copies of other type-approvals with the relevant data are provided to enable extension of approvals in accordance with point 11. At the request of the technical service in charge of the tests or the manufacturer, complementary technical information could be considered for specific vehicles which are particularly fuel efficient.

▼ M4

- 2.3. For the test described in point 6, a vehicle representative of the vehicle type to be approved will be submitted when the technical service responsible for the type-approval tests carries out the tests itself. For M₁ and N₁ vehicles, type-approved with respect to their emissions according to Directive 70/220/EEC, the technical service will check during the test that this vehicle conforms to the limit values applicable to that type, as described in Directive 70/220/EEC.

▼ M2

3. GRANTING OF EC TYPE-APPROVAL

- 3.1. If the relevant requirements are satisfied, EC type-approval pursuant to Article 4 (3) of Directive 70/156/EEC shall be granted.
- 3.2. A model for the EC type-approval certificate is given in Annex II.
- 3.3. An approval number in accordance with Annex VII to Directive 70/156/EEC shall be assigned to each vehicle type approved. The same Member State shall not assign the same number to another vehicle type.

4. GENERAL REQUIREMENTS

▼ M3

- 4.1. The CO₂ emissions are measured during the test cycle simulating the urban and extra-urban driving patterns as described in Appendix 1 of Annex III to Directive 70/220/EEC, as last amended.

▼ M2

- 4.2. The results of the test must be expressed as carbon dioxide emissions in g/km rounded to the nearest whole number.
- 4.3. Fuel consumptions are calculated according to point 7 by the carbon balance method using the measured emissions of CO₂ and the other carbon related emissions (CO and HC). The results will be rounded to the first decimal place.

▼ M34.4. **Test fuel**

4.4.1. Petrol and diesel vehicles

The appropriate reference fuels as defined in Annex IX to Directive 70/220/EEC, as last amended, must be used for testing.

4.4.2. LPG and NG-fuelled vehicles

For LPG and NG, that fuel must be used which is chosen by the manufacturer for the measurement of the net power in accordance with Annex I to Directive 80/1269/EEC. The chosen fuel shall be specified in the communication document as defined in Annex II.

4.4.3. For the purpose of calculation mentioned in 4.3, the following fuel characteristics will be used:

(a) density: measured on the test fuel according to ISO 3675 or an equivalent method; for petrol and diesel the measured density at 15 °C will be used; for LPG and NG, a reference density will be used, as follows:

0,538 kg/l for LPG

0,654 kg/m³ for NG ⁽¹⁾

(b) hydrogen-carbon ratio: fixed values will be used, which are:

1,85 for petrol

1,86 for diesel

2,525 for LPG

4,00 for NG

2,93 for NG (NMHC).

▼ M2

5. TEST CONDITIONS

5.1. **Test vehicle**

5.1.1. The vehicle must be presented in good mechanical condition. It must have been run in and driven at least 3 000 kilometres, but less than 15 000 kilometres, before the test.

5.1.2. The settings of the engine and of the vehicle controls must be those prescribed by the manufacturer. This requirement also applies, in particular to the idle settings, to the cold start device and to the exhaust gas pollutant emission control system.

5.1.3. The laboratory may check that vehicle performance is as specified by the manufacturer and that it is possible to use it in normal driving conditions, particularly cold and hot start.

5.1.4. Before the test, the vehicle must be stored in a room where the temperature remains between 293 and 303 K (20 and 30 °C). This conditioning period will last at least six hours and to a point where the temperature of the engine lube oil and the engine coolant are within ± 2 K of the room temperature. At the request of the manufacturer, the test may be conducted within a maximum of 30 hours after the vehicle has been used at normal temperature.

▼ M3

At the manufacturer's request, positive ignition engined vehicles may be preconditioned according to the procedure prescribed in item 5.2.1 of Annex VI to Directive 70/220/EEC, as last amended. Compression ignition engined vehicles may be preconditioned according to the procedure described in item 5.3 of Annex III to the same Directive.

▼ M2

5.1.5. Only the equipment necessary for the functioning of the vehicle during the test shall be in operation. If there is a manually controlled device on the carburettor inlet for air heating, it must be in the 'summer' position. In general, the auxiliary equipment required for the normal running of the vehicle must be in operation.

5.1.6. If the radiator fan is temperature controlled, it must be operating as it would normally on the vehicle. The passenger compartment

(1) This is the mean value of the G20 and G23 reference fuels at 15 °C.

▼ M2

heating system must not be operating, nor must the air conditioning system, although its compressor must be operating normally.

- 5.1.7. If a pressure charging device is fitted, it must be operating as it would normally.

5.2. **Lubricants**

All lubricants must be those recommended by the manufacturer of the vehicle and must be indicated on the test report.

5.3. **Tyres**

The tyres must be of one of the types specified as original equipment by the vehicle manufacturer, inflated to the pressure recommended for the test load and speeds (adjusted, where necessary, for test-bed operation under test conditions). The pressures used must be indicated in the test report.

6. MEASUREMENT OF CO₂ AND CARBON-RELATED EMISSIONS

▼ M3

6.1. **Test cycle**

The test cycle is described in Appendix 1 of Annex III to Directive 70/220/EEC, as last amended, including both Part I (urban driving) and Part II (extra-urban driving). All driving prescriptions contained in this Appendix will be applied for the CO₂ measurement.

▼ M4

Vehicles which do not attain the acceleration and maximum speed values required in the test cycle must be operated with the accelerator control fully depressed until they once again reach the required operating curve. Deviations from the test cycle must be recorded in the test report.

▼ M2

6.2. **Definition**

6.2.1. Reference mass

Mass of the vehicle in running order less the uniform mass of the driver of 75 kg and increased by a uniform mass of 100 kg.

6.3. **Dynamometer adjustments**

▼ M3

- 6.3.1. The load and inertia adjustments of the dynamometer are determined as defined in Annex III to Directive 70/220/EEC, as last amended.

▼ M2

6.4. **Calculation of emissions**

6.4.1. General provisions

- 6.4.1.1. Emissions of gaseous pollutants are calculated by means of the following equation:

$$M_i = \frac{V_{\text{mix}} \cdot Q_i \cdot C_i \cdot 10^{-6}}{d} \quad (1)$$

where:

- M_i = mass emission of the pollutant i in grams per kilometre;
 V_{mix} = volume of the diluted exhaust gas expressed in litres per test and corrected to standard conditions (273,2 K and 101,33 kPa);
 Q_i = density of the pollutant i in grams per litre at normal temperature and pressure (273,2 K and 101,33 kPa);
 C_i = concentration of the pollutant i in the diluted exhaust gas expressed in ppm and corrected by the amount of the

▼ **M2**

pollutant *i* contained in the dilution air. If C_i is expressed in % volume, 10^{-6} factor is replaced by 10^{-2} ;

d = driven distance during the operating cycle in km.

6.4.1.2. Volume determination

6.4.1.2.1. Calculation of the volume when a variable dilution device with constant flow control by orifice or venturi is used. Record continuously the parameters showing the volumetric flow, and calculate the total volume for the duration of the test.

6.4.1.2.2. Calculation of volume when a positive displacement pump is used. The volume of diluted exhaust gas in systems comprising a positive displacement pump is calculated with the following formula:

$$V = V_o \cdot N$$

where:

V = volume of the diluted exhaust gas expressed in litres per test (prior to correction);

V_o = volume of gas delivered by the positive displacement pump on testing conditions in litres per revolution;

N = number of revolutions per test.

6.4.1.2.3. Correction of the diluted exhaust-gas volume to standard conditions. The diluted exhaust-gas volume is corrected by means of the following formula:

$$V_{\text{mix}} = V \cdot K_1 \cdot \frac{P_p}{T_p} \quad (2)$$

in which:

$$K_1 = \frac{273,2}{101,33} = 2,6961 \quad (K \cdot \text{kPa}^{-1}) \quad (3)$$

where:

P_p = absolute pressure at the inlet to the positive displacement pump in kPa;

T_p = average temperature of the diluted exhaust gas entering the positive displacement pump during the test (K).

6.4.1.3. Calculation of the corrected concentration of pollutants in the sampling bag

$$C_i = C_e - C_d \left(1 - \frac{1}{DF} \right) \quad (4)$$

where:

C_i = concentration of the pollutant *i* in the diluted exhaust gas, expressed in ppm or % volume and corrected by the amount of *i* contained in the dilution air;

C_e = measured concentration of pollutant *i* in the diluted exhaust gas, expressed in ppm, or % volume;

C_d = measured concentration of pollutant *i* in the air used for dilution, expressed in ppm, or % volume;

DF = dilution factor.

▼ **M3**

The dilution factor is calculated as follows:

For petrol and diesel:

$$DF = \frac{13,4}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}})10}$$

For LPG:

$$DF = \frac{11,9}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}})10}$$

For NG:

$$DF = \frac{9,5}{C_{\text{CO}_2} + (C_{\text{HC}} + C_{\text{CO}})10}$$

▼ **M3**

where:

▼ **M2**

C_{CO_2} = concentration of CO_2 in the diluted exhaust gas contained in the sampling bag, expressed in % volume;

C_{HC} = concentration of HC in the diluted exhaust gas contained in the sampling bag, expressed in ppm carbon equivalent;

C_{CO} = concentration of CO in the diluted exhaust gas contained in the sampling bag, expressed in ppm.

6.4.1.4. Example

6.4.1.4.1. Data

6.4.1.4.1.1. Ambient conditions:

ambient temperature: $23\text{ °C} = 296,2\text{ °K}$,

barometric pressure: $P_B = 101,33\text{ kPa}$.

6.4.1.4.1.2. Volume measured and reduced to standard conditions

$$V = 51\,961\text{ l}$$

6.4.1.4.1.3. Analyser readings:

	Diluted exhaust	Dilution air
HC (¹)	92 ppm	3,0 ppm
CO	470 ppm	0 ppm
CO_2	1,6 % volume	0,03 % volume

(¹) In ppm carbon equivalent.

6.4.1.4.2. Calculation

6.4.1.4.2.1. Dilution factor (DF) (see formula 5)

$$DF = \frac{13,4}{C_{CO_2} + (C_{CH} + C_{CO}) \cdot 10^{-4}}$$

$$DF = \frac{13,4}{1,6 + (92 + 470) \cdot 10^{-4}}$$

$$DF = 8,091$$

6.4.1.4.2.2. Calculation of the corrected concentration of pollutants in the sampling bag:

HC mass emissions (see formulae 4 and 1)

$$C_i = C_e - C_d \left(1 - \frac{1}{DF} \right) \quad (4)$$

$$C_{HC} = 92 - 3 \left(1 - \frac{1}{8,091} \right)$$

$$C_{HC} = 89,371\text{ ppm}$$

$$M_{HC} = C_{HC} \cdot V_{mix} \cdot Q_{HC} \cdot \frac{1}{d} \cdot 10^{-6} \quad (1)$$

$$Q_{HC} = 0,619$$

$$M_{HC} = 89,371 \cdot 51\,961 \cdot 0,619 \cdot 10^{-6} \cdot \frac{1}{d}$$

$$M_{HC} = \frac{2,88}{d}\text{ g/km}$$

CO mass emissions (see formula 1)

▼ **M2**

$$M_{CO} = C_{CO} \cdot V_{mix} \cdot Q_{CO} \cdot \frac{1}{d} \cdot 10^{-6} \quad (1)$$

$$Q_{CO} = 1,25$$

$$M_{CO} = 470 \cdot 51\,961 \cdot 1,25 \cdot 10^{-6} \cdot \frac{1}{d}$$

$$M_{CO} = \frac{30,5}{d} \text{ g/km}$$

CO₂ mass emissions (see formula 1)

$$C_i = C_e - C_d \left(1 - \frac{1}{DF} \right) \quad (4)$$

$$C_{CO_2} = 1,6 - 0,03 \left(1 - \frac{1}{8,091} \right)$$

$$C_{CO_2} = 1,573 \text{ \% volume}$$

$$Q_{CO_2} = 1,964$$

$$M_{CO_2} = C_{CO_2} \cdot V_{mix} \cdot Q_{CO_2} \cdot 10^{-2} \cdot \frac{1}{d} \quad (1)$$

$$M_{CO_2} = 1,573 \cdot 51\,961 \cdot 1,964 \cdot 10^{-2} \cdot \frac{1}{d}$$

$$M_{CO_2} = \frac{1\,605,27}{d} \text{ g/km}$$

- 6.4.2. Special provisions relating to vehicles equipped with compression ignition engines

HC measurements for compression-ignition engines

The average HC concentration used in determining the HC mass emissions from compression-ignition engines is calculated with the aid of the following formula:

$$C_e = \frac{\int_{t_1}^{t_2} C_{HC} \cdot dt}{t_2 - t_1} \quad (7)$$

where:

$\int_{t_1}^{t_2} C_{HC} \cdot dt$ = integral of the recording of the heated FID over the test duration ($t_2 - t_1$);

C_e = HC concentration of the diluted exhaust sample as calculated from the integrated HC trace, in ppm carbon equivalent.

6.5. Interpretation of the results

- 6.5.1. The CO₂ value adopted as the type-approval value shall be the value declared by the manufacturer if the value measured by the technical service does not exceed the declared value by more than 4 %. The measured value can be lower without any limitations.

- 6.5.2. If the measured value of CO₂ exceeds the manufacturer's declared CO₂ value by more than 4 %, then another test is run on the same vehicle.

When the average of the two test results does not exceed the manufacturer's declared value by more than 4 %, then the value declared by the manufacturer is taken as the type-approval value.

- 6.5.3. If the average still exceeds the declared value by more than 4 %, a final test is run on the same vehicle.

The average of the three test results is taken as the type-approval value.

▼ M2

7. CALCULATION OF FUEL CONSUMPTIONS

- 7.1. The fuel consumptions are calculated from the emissions of hydrocarbons, carbon monoxide and carbon dioxide calculated in accordance with paragraph 6.

▼ M3

- 7.2. The fuel consumption, expressed in litres per 100 km (in the case of petrol, LPG or diesel) or in m³ per 100 km (in the case of NG), is calculated by means of the following formulae: ⁽¹⁾

- (a) for vehicles with a positive ignition engine fuelled with petrol:

$$\blacktriangleright \text{C2 } FC = (0,1154/D) \times [(0,866 \times \text{THC}) + (0,429 \times \text{CO}) + (0,273 \times \text{CO}_2)] \blacktriangleleft$$

- (b) for vehicles with a positive ignition engine fuelled with LPG:

$$FC_{\text{norm}} = (0,1212/0,538) \times [(0,825 \times \text{THC}) + (0,429 \times \text{CO}) + (0,273 \times \text{CO}_2)]$$

If the composition of the fuel used for the test differs from the composition that is assumed for the calculation of the normalised consumption, on the manufacturer's request a correction factor *cf* may be applied as follows:

$$FC_{\text{norm}} = (0,1212/0,538) \times cf \times [(0,825 \times \text{THC}) + (0,429 \times \text{CO}) + (0,273 \times \text{CO}_2)]$$

The correction factor *cf*, which may be applied, is determined as follows:

$$cf = 0,825 + 0,0693 \times n_{\text{actual}}$$

where:

$$n_{\text{actual}} = \text{the actual H/C ratio of the fuel used}$$

- (c) for vehicles with a positive ignition engine fuelled with NG:

$$FC_{\text{norm}} = (0,1336/0,654) \times [(0,749 \times \text{THC}) + (0,429 \times \text{CO}) + (0,273 \times \text{CO}_2)]$$

- (d) for vehicles with a compression ignition engine:

$$FC = (0,1155/D) \times [(0,866 \times \text{THC}) + (0,429 \times \text{CO}) + (0,273 \times \text{CO}_2)]$$

In these formulae:

FC = the fuel consumption in litre per 100 km (in the case of petrol, LPG or diesel) or in m³ per 100 km (in the case of NG)

THC = the measured emission of total hydrocarbons in g/km

CO = the measured emission of carbon monoxide in g/km

CO₂ = the measured emission of carbon dioxide in g/km

D = the density of the test fuel at 15 °C.

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8. AMENDMENTS TO APPROVALS

- 8.1. In the case of amendments to approvals granted pursuant to this Directive the provisions of Article 5 of Directive 70/156/EEC shall apply.

9. CONFORMITY OF PRODUCTION FOR CO₂ EMISSIONS

- 9.1. As a general rule, measures to ensure the conformity of production with regard to CO₂ emissions from vehicles is checked on the basis of the description in the type-approval certificate set out in Annex II to this Directive and in accordance with the provisions of Article 10 of Directive 70/156/EEC.

If the authority is not satisfied with the auditing procedure of the manufacturer, then points 2.4.2 and 2.4.3 of Annex X to Directive 70/156/EEC shall apply.

⁽¹⁾ Repeat for petrol and gaseous fuel in the case of a vehicle that can run either on petrol or on a gaseous fuel. Vehicles that can be fuelled with both petrol and a gaseous fuel, but where the petrol system is fitted for emergency purposes or starting only and of which the petrol tank cannot contain more than 15 litres of petrol will be regarded for the test as vehicles which can only run a gaseous fuel.

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9.1.1. If a vehicle type has had one or several extensions, the tests will be carried out on the vehicle(s) described in the information package which accompanied the first type-approval application.

9.1.1.1. Conformity of the vehicle for the CO₂ test.

9.1.1.1.1. Three vehicles are randomly taken in the series and are tested as described in paragraph 6 of this Annex.

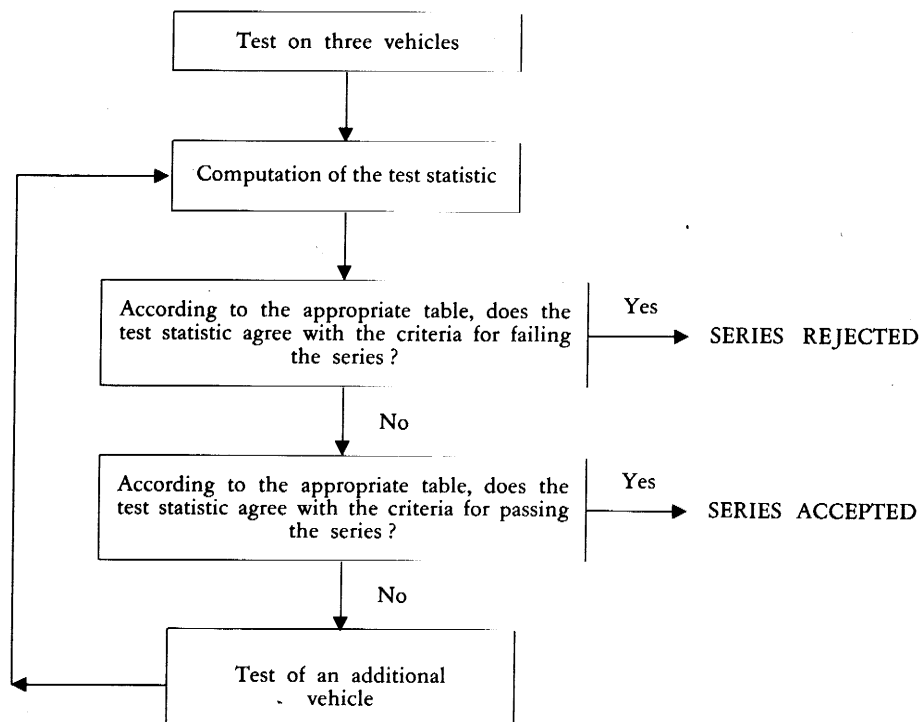
9.1.1.1.2. If the authority is satisfied with the production standard deviation given by the manufacturer, according to Annex X to Directive 70/156/EEC, the tests are carried out according to point 9.2 of this Annex.

If the authority is not satisfied with the production standard deviation given by the manufacturer according to Annex X to Directive 70/156/EEC, the tests are carried out according to point 9.3 of this Annex.

9.1.1.1.3. The production of a series is regarded as conforming or non-conforming, on the basis of tests on the three sampled vehicles, once a pass or fail decision is reached for CO₂, according to the test criteria applied in the appropriate table.

If no pass decision and/or no fail decision is reached for CO₂, a test is carried out on an additional vehicle (see Figure I/8).

FIGURE I/8



9.1.1.2. Notwithstanding the requirements of point 5.1.1 of this Annex, the tests will be carried out on vehicles which have not travelled any distance.

9.1.1.2.1. However, at the request of the manufacturer, the tests will be carried out on vehicles which have been run-in a maximum of 15 000 km.

In this case, the running-in procedure will be conducted by the manufacturer who shall undertake not to make any adjustments to those vehicles.

9.1.1.2.2. If the manufacturer asks to conduct a running-in procedure ('x' km, where $x \leq 15\,000$ km), it may be carried out as follows:

- the emission of CO₂ will be measured at zero and at 'x' km on the first tested vehicle (which can be the type-approval vehicle),
- the evolution coefficient of the emission between zero and 'x' km will be calculated as follows:

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$$EC = \frac{\text{Emissions 'x' km}}{\text{Emissions zero km}}$$

It may be less than one,

- the following vehicles will not be subjected to the running-in procedure, but their zero km emissions will be modified by the evolution coefficient, EC.

In this case, the values to be taken will be:

- the value at 'x' km for the first vehicle,
- the values at zero km multiplied by the evolution coefficient for the following vehicles.

- 9.1.1.2.3. As an alternative to this procedure, the car manufacturer can use a fixed evolution coefficient EC of 0,92 and multiply all values of CO₂ measured at zero km by this factor.

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- 9.1.1.2.4. The reference fuels described in Annex IX and Annex IXa to Directive 70/220/EEC, as last amended, shall be used for testing.

▼ **M2**

- 9.2. Conformity of production when manufacturer's statistical data is available

- 9.2.1. The following sections describe the procedure to be used to verify the CO₂ conformity of production requirements when the manufacturer's production standard deviation is satisfactory.

- 9.2.2. With a minimum sample size of three the sampling procedure is set so that the probability of a lot passing a test with 40 % of the production defective is 0,95 (producer's risk = 5 %), while the probability of a lot being accepted with 65 % of the production defective is 0,1 (consumer's risk = 10 %).

- 9.2.3. The following procedure is used (see Figure I/8).

Let L be the natural logarithm of the CO₂ type-approval value:

x_i = the natural logarithm of the measurement for the i-th vehicle of the sample;

s = an estimate of the production standard deviation (after taking the natural logarithm of the measurements);

n = the current sample number.

- 9.2.4. Compute for the sample, the test statistic quantifying the sum of the standardized deviations to the limit and defined as:

$$\frac{1}{s} \sum_{i=1}^n (L - x_i)$$

- 9.2.5. Then:

- if the test statistic is greater than the pass decision number for the sample size given in Table I/ - /9.2.5, a pass decision is reached,
- if the test statistic is less than the fail decision number for the sample size given in Table I/ - /9.2.5, a fail decision is reached,
- otherwise, an additional vehicle is tested according to point 6 of this Annex and the procedure is applied to the sample with one unit more.

TABLE I/ - /9.2.5

Sample size (cumulative number of vehicles tested)	Pass Decision No	Fail Decision No
(a)	(b)	(c)
3	3,327	- 4,724
4	3,261	- 4,790
5	3,195	- 4,856
6	3,129	- 4,922
7	3,063	- 4,988
8	2,997	- 5,054
9	2,931	- 5,120
10	2,865	- 5,185

▼ M2

Sample size (cumulative number of vehicles tested)	Pass Decision No	Fail Decision No
11	2,799	- 5,251
12	2,733	- 5,317
13	2,667	- 5,383
14	2,601	- 5,449
15	2,535	- 5,515
16	2,469	- 5,581
17	2,403	- 5,647
18	2,337	- 5,713
19	2,271	- 5,779
20	2,205	- 5,845
21	2,139	- 5,911
22	2,073	- 5,977
23	2,007	- 6,043
24	1,941	- 6,109
25	1,875	- 6,175
26	1,809	- 6,241
27	1,743	- 6,307
28	1,677	- 6,373
29	1,611	- 6,439
30	1,545	- 6,505
31	1,479	- 6,571
32	- 2,112	- 2,112

- 9.3. Conformity of production when manufacturer's statistical data is unsatisfactory or unavailable.
- 9.3.1. The following sections describe the procedure to be used to verify the CO₂ conformity of production requirements when the manufacturer's evidence of production standard deviation is either unsatisfactory or unavailable.
- 9.3.2. With a minimum sample size of three the sampling procedure is set so that the probability of a lot passing a test with 40 % of the production defective is 0,95 (producer's risk = 5 %), while the probability of a lot being accepted with 65 % of the production defective is 0,1 (consumer's risk = 10 %).
- 9.3.3. The measurement of CO₂ is considered to be log normally distributed and should first be transformed by taking the natural logarithms. Let m₀ and m denote the minimum and maximum sample sizes respectively (m₀ = 3 and m = 32) and let n denote the current sample number.
- 9.3.4. If the natural logarithms of the measurements in the series are x₁, x₂, ..., x_j and L is the natural logarithm of the CO₂ type-approval value, then define:

$$d_j = x_j - L$$

$$\bar{d}_n = \frac{1}{n} \sum_{j=1}^n d_j$$

and:

$$V_n^2 = \frac{1}{n} \sum_{j=1}^n (d_j - \bar{d}_n)^2$$

- 9.3.5. Table I/ - /9.3.5 shows values of the pass (A_n) and fail (B_n) decision numbers against current sample number. The test statistic is the ratio \bar{d}_n/V_n and shall be used to determine whether the series has passed or failed as follows:

for m₀ ≤ n ≤ m:

- pass the series if $\bar{d}_n/V_n \leq A_n$,
- fail the series if $\bar{d}_n/V_n \geq B_n$,
- take another measurement if $A_n < \bar{d}_n/V_n < B_n$.

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9.3.6. Remarks

The following recursive formulae are useful for computing successive values of the test statistic:

$$\bar{d}_n = \left(1 - \frac{1}{n}\right) \bar{d}_{n-1} + \frac{1}{n} d_n$$

$$V_n^2 = \left(1 - \frac{1}{n}\right) V_{n-1}^2 + \frac{(\bar{d}_n - d_n)^2}{n-1}$$

$$(n = 2, 3, \dots; \bar{d}_1 = d_1; V_1 = 0)$$

TABLE I/ - /9.3.5

Sample size (cumulative number of vehicles tested) n	Pass Decision No A _n	Fail Decision No B _n
(a)	(b)	(c)
3	- 0,80381	16,64743
4	- 0,76339	7,68627
5	- 0,72982	4,67136
6	- 0,69962	3,25573
7	- 0,67129	2,45431
8	- 0,64406	1,94369
9	- 0,6175	1,59105
10	- 0,59135	1,33295
11	- 0,56542	1,13566
12	- 0,5396	0,9797
13	- 0,51379	0,85307
14	- 0,48791	0,74801
15	- 0,46191	0,65928
16	- 0,43573	0,58321
17	- 0,40933	0,51718
18	- 0,38266	0,45922
19	- 0,3557	0,40788
20	- 0,3284	0,36203
21	- 0,30072	0,32078
22	- 0,27263	0,28343
23	- 0,2441	0,24943
24	- 0,21509	0,21831
25	- 0,18557	0,1897
26	- 0,1555	0,16328
27	- 0,12483	0,1388
28	- 0,09354	0,11603
29	- 0,06159	0,0948
30	- 0,02892	0,07493
31	► C1 0,00449 ◀	0,05629
32	► C1 0,03876 ◀	0,03876

10. SPECIAL PROVISIONS

- 10.1. In the future, vehicles with special fuel efficient technologies may be offered which could be submitted to complementary testing programmes. These would be specified at a later stage which can be claimed by the manufacturer in order to demonstrate the advantages of the solution.

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11. EXTENSION OF APPROVAL

- 11.1. The type-approval can be extended to vehicles from the same type or from a different type differing with regard to the following characteristics of Annex II, if the CO₂ emissions measured by the technical service do not exceed the type-approval value by more

▼ **M4**

than 4 % for vehicles of category M_1 and 6 % for vehicles of category N_1 :

- reference mass,
- maximum authorised mass,
- type of bodywork:
 - for M_1 : saloon, hatchback, station wagon, coupé, convertible, multipurpose vehicle
 - for N_1 : lorry, van,
- overall gear ratios,
- engine equipment and accessories.

11.2. Extension of approval of vehicles of category N_1 within a family:

11.2.1. For vehicles of category N_1 that are approved as members of a vehicle family using the procedure in Annex I, point 12.2, the type-approval can be extended to vehicles from within the same family only if the technical service estimates that the fuel consumption of the new vehicle does not exceed the fuel consumption of the vehicle on which the family's fuel consumption is based.

Approvals may also be extended to vehicles which:

- are up to 110 kg heavier than the family member tested, provided that they are within 220 kg of the lightest member of the family,
- have a lower overall transmission ratio than the family member tested due solely to a change in tyre sizes and
- conform with the family in all other respects.

11.2.2. For vehicles of category N_1 that are approved as members of a vehicle family using the procedure in Annex I, point 12.3, the type-approval can be extended to vehicles from within the same family without additional testing only if the technical service estimates that the fuel consumption of the new vehicle falls within the limits made up of those two vehicles in the family that have the lowest and the highest fuel consumption, respectively.

12. APPROVAL OF VEHICLES OF CATEGORY N_1 WITHIN A FAMILY

Vehicles of category N_1 can be approved within a family as defined in 12.1 using one of the two alternative methods described in 12.2 and 12.3.

12.1. N_1 vehicles may be grouped together into a family for the purposes of this Directive if the following parameters are identical or within the specified limits:

12.1.1. Identical parameters are:

- manufacturer and type as defined in Annex II, section I, point 0.2,
- engine capacity,
- emission control system type,
- fuel system type as defined in Annex II, point 1.5.2.

12.1.2. The following parameters have to be within the following limits:

- transmission overall ratios (no more than 8 % higher than the lowest) as defined in Annex II, point 1.6.3,
- reference mass (no more than 220 kg lighter than the heaviest),
- frontal area (no more than 15 % smaller than the largest),
- engine power (no more than 10 % less than the highest value).

12.2. A vehicle family, as defined in 12.1, can be approved with CO_2 emission and fuel consumption data that are common to all members of the family. The technical service must select for testing the member of the family which the service considers to have the highest CO_2 emission. The measurements are performed as described in point 6, and the results according to the method described in 6.5 are used as type-approval values that are common to all members of the family.

▼ M4

- 12.3. Vehicles that are grouped in a family as defined in 12.1 can be approved with individual CO₂ emission and fuel consumption data for each of the family members. The technical service selects for testing the two vehicles, which the service considers to have the highest and the lowest CO₂ emissions respectively. The measurements are performed as described in point 6. If the manufacturer's data for these two vehicles falls within the tolerance limits described in 6.5, the CO₂ emissions declared by the manufacturer for all members of the vehicle family can be used as type-approval values. If the manufacturer's data do not fall within the tolerance limits, the results according to the method described in 6.5 are used as type-approval values and the technical service shall select an appropriate number of other family members for additional tests.

▼M2*ANNEX II***MODEL**

(maximum format: A4 (210 × 297 mm))

EC TYPE-APPROVAL CERTIFICATE

STAMP OF ADMINISTRATION

Communication concerning the :

- type approval ⁽¹⁾
- extension of type approval ⁽¹⁾
- refusal of type approval ⁽¹⁾
- withdrawal of type approval ⁽¹⁾

of a type of vehicle / component / separate technical unit ⁽¹⁾ with regard to Directive 80/1268/EEC, as last amended by Directive 93/116/EC.

Type-approval number :

Reason for extension :

Section I

- 0.1. Make (trade name of manufacturer) :
- 0.2. Type and general commercial description(s) :
- 0.3. Means of identification of type, if marked on the vehicle/component/separate technical unit ⁽¹⁾ ⁽²⁾ :
- 0.3.1. Location of that marking :
- 0.4. Category of vehicle ⁽³⁾ :
- 0.5. Name and address of manufacturer :
- 0.6. In the case of components and separate technical units, location and method of affixing of the EC type-approval mark :
- 0.7. Address(es) of assembly plant(s) :

Section II

1. Additional information (where applicable) : see addendum
2. Technical service responsible for carrying out the tests :
3. Date of test report :
4. No of test report :
5. Remarks (if any) : see addendum
6. Place :
7. Date :
8. Signature :
9. The index to the information package lodged with the approval authority, which may be obtained on request, is attached.

▼ **M2**►⁽³⁾ *Addendum*

to EC type-approval certificate No :

concerning the type-approval of a vehicle ⁽¹⁾ with regard to Directive 80/1268/EEC (CO₂ emissions and fuel consumption) as last amended by Directive 2004/3/EC. ◀

1. Additional information
 - 1.1. Mass of the vehicle in running order :
 - 1.2. Maximum mass :
 - ⁽⁶⁾ 1.3. Type of bodywork :
 - 1.3.1. for M₁: saloon, hatchback, station wagon, coupé, convertible, multipurpose vehicle⁽¹⁾
 - 1.3.2. for N₁: lorry, van ◀
 - 1.4. Drive wheels : front, rear, 4 x 4 ⁽¹⁾
 - 1.5. Engine :
 - 1.5.1. Engine displacement :
 - 1.5.2. Fuel supply system : carburettor/injection ⁽¹⁾
 - 1.5.3. Fuel recommended by the manufacturer :
 - 1.5.4. Maximum power : kW at min⁻¹
 - 1.5.5. Pressure charging device : yes/no ⁽¹⁾
 - 1.5.6. Ignition system : diesel/conventional or electronic ignition ⁽¹⁾
 - 1.6. Transmission :
 - 1.6.1. Type of gearbox : manual/automatic ⁽¹⁾
 - 1.6.2. Number of gear ratios :
 - 1.6.3. Total gear ratios (including the rolling circumferences of the tyres under load): road speeds per 1 000 min⁻¹ km/h

First gear :	Fourth gear :
Second gear :	Fifth gear :
Third gear :	Overdrive :
 - 1.6.4. Final drive ratio :
 - 1.6.5. Tyres :

Type :	Dimensions :
Rolling circumference under load :	
 - ⁽⁶⁾ 1.7. Type-approval values ◀⁽⁴⁾
 - 1.7.1. CO₂ mass emissions
 - 1.7.1.1. CO₂ mass emissions (urban conditions): g/km
 - 1.7.1.2. CO₂ mass emissions (extra-urban conditions): g/km
 - 1.7.1.3. CO₂ mass emissions (combined): g/km
 - 1.7.2. Fuel consumptions
 - 1.7.2.1. Fuel consumption (urban conditions): l/100 km ⁽²⁾
 - 1.7.2.2. Fuel consumption (extra-urban conditions): l/100 km ⁽²⁾
 - 1.7.2.3. Fuel consumption (combined): l/100 km ⁽²⁾ ◀
 2. Remarks :
- (¹) Delete where not applicable.
- (²) If the means of identification of type contains characters not relevant to describe the vehicle, component or separate technical unit types covered by this type-approval certificate, such characters shall be represented in the documentation by the symbol '?' (e.g. ABC??123??).
- (³) As defined in Annex II A to Directive 70/156/EEC.
- ⁽⁴⁾ Repeat for petrol and gaseous fuel in the case of a vehicle that can run either on petrol or on a gaseous fuel. Vehicles that can be fuelled with both petrol and a gaseous fuel, but where the petrol system is fitted for emergency purposes or starting only and of which the petrol tank cannot contain more than 15 litres of petrol will be regarded for the test as vehicles which can only run a gaseous fuel.
- (⁵) For vehicles fuelled with NG, the unit "l/100 km" is replaced by "m³/100 km". ◀
- ⁽⁶⁾ For vehicles that are approved within a family according to Annex I, point 12, this Addendum must be supplied for each individual member of the vehicle family. ◀