

## Current and Future European Community Emission Requirements

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## **Passenger cars and light duty vehicles (see Annex I)**

Directive 98/69/EC, which amended the base Directive 70/220/EEC, was published in the Official Journal of the European Communities on 28<sup>th</sup> December 1998 (OJ L350, 28.12.1998, p.1).

### **Application dates of emission limits (point (A) of Annex I):**

The applicable emission limits are given in point (a) of Annex I, for which the dates of application are given in the following table.

The directive entered into force on 28<sup>th</sup> December 1998. Since nine months after that date, i.e. 28<sup>th</sup> September 1999, no Member State may, on grounds relating to air pollution by emissions from motor vehicles:

- refuse to grant EC type-approval pursuant to Article 4(1) of Directive 70/156/EEC, or
- refuse to grant national type-approval, or
- prohibit the registration, sale or entry into service of vehicles, pursuant to Article 7 of Directive 70/156/EEC,

if the vehicles comply with the requirements of Directive 70/220/EEC, as amended by this Directive.

<b>Vehicle category</b>	<b>New type-approval date</b>	<b>Directive 98/69/EC reference</b>	<b>All types date</b>	<b>Directive 98/69/EC reference</b>
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#### **Euro 3:**

M except > 2.5 tonnes	1 January 2000	Article 2(2)	1 January 2001	Article 2(3)
M > 2.5 tonnes	1 January 2001	Article 2(2)	1 January 2002	Article 2(3)
N1 weight class I	1 January 2000	Article 2(2)	1 January 2001	Article 2(3)
N1 weight classes II and III	1 January 2001	Article 2(2)	1 January 2002	Article 2(3)

#### **Euro 4:**

M (passenger cars) except > 2.5 tonnes	1 January 2005	Article 2(4)	1 January 2006	Article 2(5)
M (passenger cars) > 2.5 tonnes	1 January 2006	Article 2(4)	1 January 2007	Article 2(5)
N1 (light commercial vehicles) weight class I	1 January 2005	Article 2(4)	1 January 2006	Article 2(5)
N1 (light commercial vehicles) weight classes II and III	1 January 2006	Article 2(4)	1 January 2007	Article 2(5)

*Category M:* Motor vehicles with at least 4 wheels and used for the carriage of passengers.

*Category M1:* Vehicles used for the carriage of passengers and comprising no more than 8 seats in addition to the driver's seat.

*Category M2:* Vehicles used for the carriage of passengers and comprising no more than 8 seats in addition to the driver's seat and a maximum mass not exceeding 5 tonnes.

*Category M3:* Vehicles used for the carriage of passengers and comprising no more than 8 seats in addition to the driver's seat and a maximum mass exceeding 5 tonnes.

<i>Category N:</i>	Motor vehicles with at least 4 wheels and used for the carriage of goods.
<i>Category N1:</i>	Vehicles used for the carriage of goods having a maximum mass not exceeding 3,5 tonnes.
<i>Category N2:</i>	Vehicles used for the carriage of goods having a maximum mass exceeding 3,5 tonnes and not exceeding 12 tonnes.
<i>Category N3:</i>	Vehicles used for the carriage of goods having a maximum mass exceeding 12 tonnes.

### **Additional technical requirements of Directive 98/69/EC:**

<b>Test cycle for tailpipe emissions</b>	Emissions measured over a revised test cycle, i.e. the old dynamometer test cycle minus the first 40 seconds of engine idle where there was no emissions sampling.
<b>Revised weight classifications for light commercial vehicles</b>	Class I $RW \leq 1,305 \text{ kg}$ Class II $1,305 < RW \leq 1,760 \text{ kg}$ Class III $1,760 \text{ kg} < RW$
<b>Cold start test</b>	New test at cold temperature ( $-7^{\circ}\text{C}$ ) with limits of 15 g/km for CO and 1.8 g/km for HC. Measured over the urban part of the test cycle only.  Cold test to be introduced for new type approvals from 1 January 2002.
<b>Evaporative emissions</b>	New procedure with higher and longer temperature excursions to better represent the vehicle heating cycle over a diurnal period. Evaporative limit remains at 2 g/test.
<b>Durability</b>	Remains at 80,000 km or 5 years (whichever is the sooner) for stage 2000 but increases to 100,000 km or 5 years (whichever is the sooner) for stage 2005.
<b>On-board diagnostics</b>	See section on OBD below but the Commission shall also report and make appropriate proposals on extending the scope of OBD to other vehicle systems (covering active and passive safety) and regarding the replacement and retro-fit parts market.
<b>In-use compliance</b>	The emphasis of the revised test is now on the manufacturer to carry out periodic audits of vehicles in service. The authority can check the audit and require confirmatory testing if necessary.  The scope of the audit, the checking of the audit and the statistical procedure for testing vehicles have been examined and the Commission is in the process of making a proposal through technical adaptation.
<b>Extension of approvals to vehicles of category <math>M_2</math> and <math>N_2</math></b>	Commission to study and put forward proposals no later than 2004 to apply in 2005.
<b>Fiscal incentives</b>	Up to 1 January 2001 incentives allowed to be given for vehicles that meet the stage 2000 emission limits. From 1 January 2000 incentives allowed to be given for vehicles that meet the year 2005 emission limits.

**Reference fuels** The Commission has to make a proposal to set the specifications for sulphur, aromatics and oxygen content of petrol and sulphur content of diesel such that they represent the market average of these specifications – this will be applicable for the testing of vehicles to the 2005 emission limits. A Commission proposal will follow in the first half of 2001.

**Auto-Oil II and further study** Issues for the Commission to make further proposals are:

- *Cold start limits for classes II and III* – the Commission has proposed cold test limits for classes II and III which will apply to new types from 1 January 2003. The limits for class II are 27 g/km for CO and 3.2 g/km for HC, while for class III they are 34 g/km for CO and 4.0 g/km for HC;
- *OBD thresholds for 2005/6 for M<sub>1</sub> and N<sub>1</sub> vehicles* – to be proposed in the first half of 2001;
- *Examination of the Type V test, including the possibility of abolishing it;*
- *Improved roadworthiness testing.*

Issues for the Commission to make proposals later are:

- Enhanced durability testing (extending the durability test);
- Fuel quality standards;
- Other possible measures on vehicles and fuels taking into account particulate research and health effects;
- The potential and feasibility of local non-technical measures to reducing vehicle emissions;
- The situation regarding captive fleets and potential for stringent environmental specifications for vehicles in such use;
- Fuel specifications for non-road mobile machinery and agricultural tractors.

#### **Application dates of OBD requirements (point (B) of Annex I):**

The applicable OBD threshold limits are given in point (b) of Annex I. The dates of application for complying with the requirements of the OBD Annex (Annex XI) were defined in Directive 98/69/EC but more recently, Directive 1999/102/EC clarified a number of issues relating to the dates of application of OBD. Directive 98/69/EC was accepted in July 1999 by the Committee for Adaptation to Technical Progress (CATP) and published in the Official Journal of the European Communities on 28<sup>th</sup> December 1999 (OJ L334, 28.12.1999, p.43).

The OBD application dates are as follows, where the paragraph numbers refer to the paragraph numbers in Annex I to Directive 70/220/EEC, as amended by Directive 1999/102/EC:

#### **“8.1. Vehicles with positive-ignition engines**

With effect from 1 January 2000 for new types and from 1 January 2001 for all types, vehicles of category M<sub>1</sub>, except vehicles the maximum mass of which exceeds

2 500 kg, and vehicles of category N<sub>1</sub> class I, must be fitted with an on-board diagnostic (OBD) system for emission control in accordance with Annex XI.

With effect from 1 January 2001 for new types and from 1 January 2002 for all types, vehicles of category N<sub>1</sub> classes II and III and vehicles of category M<sub>1</sub>, the maximum mass of which exceeds 2 500 kg, must be fitted with an OBD system for emission control in accordance with Annex XI.

#### 8.2. **Vehicles with compression-ignition engines**

Vehicles of category M<sub>1</sub>, except

- vehicles designed to carry more than six occupants including the driver,
- vehicles whose maximum mass exceeds 2 500 kg,

from 1 January 2003 for new types and from 1 January 2004 for all types, must be fitted with an on-board diagnostic (OBD) system for emission control in accordance with Annex XI.

Where new types of compression-ignition engined vehicles entering into service prior to this date are fitted with an OBD system, the provisions of sections 6.5.3 to 6.5.3.6 of Annex XI, Appendix 1, are applicable.

#### 8.3. **Vehicles with compression-ignition engines exempt from section 8.2.**

From 1 January 2005 for new types and from 1 January 2006 for all types, vehicles of category M<sub>1</sub> exempted by section 8.2, except vehicles of category M<sub>1</sub> equipped with compression-ignition engines and the maximum mass of which exceeds 2 500 kg, and vehicles in category N<sub>1</sub> class 1 equipped with compression-ignition engines, must be fitted with on-board diagnostic (OBD) systems for emission control in accordance with Annex XI.

From 1 January 2006 for new types and 1 January 2007 for all types, vehicles in category N<sub>1</sub> classes II and III equipped with compression-ignition engines and vehicles of category M<sub>1</sub> equipped with compression-ignition engines and the maximum mass of which exceeds 2 500 kg, must be fitted with on-board diagnostic (OBD) systems for emission control in accordance with Annex XI.

Where compression-ignition engined vehicles entering into service prior to the dates given in this section are fitted with OBD systems, the provisions of sections 6.5.3 to 6.5.3.6 of Annex XI, Appendix 1, are applicable.

#### 8.4. **Vehicles of other Categories**

Vehicles of other categories or vehicles of category M<sub>1</sub> and N<sub>1</sub> not covered by 8.1, 8.2 or 8.3, may be fitted with an OBD system. In this case, sections 6.5.3 to 6.5.3.6 of Annex XI, Appendix 1 are applicable.”

**Directive 1999/102/EC - Technical adaptation in relation to the OBD requirements:**

Directive 1999/102/EC was accepted In July 1999 by the Committee for Adaptation to Technical Progress (CATP) and published in the Official Journal of the European Communities on 28<sup>th</sup> December 1999 (OJ L334, 28.12.1999, p.43).

The amendments deal with OBD and in summary the main amendments:

- clarify the OBD application dates for new types and all types of vehicles equipped with positive-ignition and compression-ignition engines (see section above);
- amend the requirements on tamper protection to allow for electronic system protection in the best possible manner without imposing excessive restrictions on advanced tamper-protection methods while respecting third party access to service, diagnose and repair vehicles equipped with OBD systems;
- amend the requirements on misfire detection to avoid false malfunctions indications when the vehicle is driven over rough roads, during gear-changes or after starting but operation is within the misfire region of the map. This also provides a consistent misfire monitoring strategy with the US regulations. In addition, an amendment is made to avoid permanent malfunction indication due to transient or 'rogue' failures which could be difficult to reproduce in the workshop, e.g. due to wet spark plugs or running out of fuel;
- allow the manufacturer to choose to monitor partial catalyst volume. It is technically beneficial to monitor only the front catalyst since this is the catalyst that is exposed to the most severe temperatures and temperature ranges. The front catalyst would also be the first to suffer plugging or poisoning from the by-products of the combustion of lubricating oil or from fuel additives or contaminants. Where a vehicle is fitted with 3 or 4 catalysts in series, it is likely that the oxygen storage capacity of all catalysts together will be so large that the measurement of catalyst degradation will not be possible until the performance of the catalysts are severely impaired at which point the OBD threshold values may be exceeded. Monitoring only the front catalyst will enable early detection of catalyst degradation;
- clarify the requirements for the storage of distance travelled since a fault has been indicated through the malfunction indicator;
- introduce the concept of OBD deficiencies. OBD calibrations are usually completed at the end of the development programme which may not allow sufficient time for complete validation. Therefore, OBD software errors are frequently discovered just before or even after production has begun. If a software change is required to correct the problem, it may take months to develop, calibrate and validate the correction. To try to rush in invalidated software changes could create additional risk of false malfunction indications etc. Therefore, to follow a precautionary approach during the early life of European OBD and noting the experience of the introduction of OBD in the United States, the Commission proposes to introduce a system whereby two deficiencies may be allowed in the OBD system of a vehicle type. In cases of deficiencies requested at the time of type approval, the authority shall decide, using data provided to him by the manufacturer to support his application, whether such a deficiency request may be granted. In cases of deficiencies discovered on vehicle already in use on the road, the same authority that granted the OBD approval shall rule on the deficiency request. Deficiencies will not be allowed for a complete lack of diagnostic monitoring function.

- require the storage and access of the calibration identification number installed on the vehicle;
- provide for the use of the Controller Area Network (CAN) communication protocol;

In addition, the amendment clarifies the diurnal temperature profile for the calibration of the evaporative emission SHED.

**Directive 2001/1/EC - Dates of application of OBD to vehicles using gas fuels (LPG or NG):**

Directive 2001/1/EC was published in the Official Journal of the European Communities as OJ L35 on 6<sup>th</sup> February 2001, p.34.

This Directive sets the dates from which on-board diagnostic (OBD) systems are mandatory on passenger cars and light commercial vehicles that have positive-ignition engines and which use gas fuels such as liquefied petroleum gas (LPG) or natural gas (NG). Such vehicles may run permanently or part-time on either LPG or NG.

	<b>New types</b>	<b>All types</b>
Vehicles of category M1 ≤ 2500kg and vehicles of category N1 class I .....	1 January 2003	1 January 2006
Vehicles of category M1 > 2500 kg and vehicles of category N1 class II and III.....	1 January 2004	1 January 2007

**Directive 2001/100/EC – Cold start emission limits for category N1 vehicles, classes II and III:**

Directive 2001/100/EC was published in the Official Journal of the European Communities as OJ L16 on 18<sup>th</sup> January 2002, p.32.

This Directive sets the low temperature emission limit values applicable to all new types of light commercial vehicles (category N<sub>1</sub>) of weight class II (greater than 1,305 kg up to and including 1,760 kg) and weight class III (greater than 1,760 kg) that are equipped with positive-ignition engines. The Directive also brings into the scope of the low temperature test new types of passenger cars (category M<sub>1</sub>) equipped with positive-ignition engines that are designed to carry more than six occupants and passenger cars equipped with positive-ignition engines with a maximum mass greater than 2,500 kg but not exceeding 3,500 kg (such passenger cars were previously excluded from the scope of the low temperature test given in Directive 70/220/EEC, as amended by Directive 98/69/EC).

The low temperature emission limits are applicable to these new types of such vehicles from 1 January 2003.

While Directive 70/220/EEC, as amended by Directive 98/69/EC, applied the low temperature test to vehicles equipped with positive-ignition engines, Directive 2001/100/EC now distinguishes between such vehicles that only use petrol or only use a gaseous fuel such as liquefied petroleum gas (LPG) or natural gas (NG) or use both petrol and either LPG or natural gas NG.

In this respect, vehicles that run only on a gaseous fuel (LPG or NG) are exempt from the low temperature test. 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 where the petrol tank cannot contain more than 15 litres of petrol, will be regarded as vehicles that can only run on a gaseous fuel

and will therefore also be exempt from the low temperature test. Vehicles that use petrol and either LPG or NG are tested, for the purpose of the low temperature test, on petrol only.

The actual emission limits for category N1 vehicles, classes II and III and certain types of category M1 vehicles are shown in the table below:

Test temperature 266 K (-7°C)			
Category	Class	Mass of carbon monoxide (CO) L <sub>1</sub> (g/km)	Mass of hydrocarbons (HC) L <sub>2</sub> (g/km)
M <sub>1</sub> <sup>(1)</sup>	-	15	1.8
N <sub>1</sub>	I	15	1.8
N <sub>1</sub> <sup>(2)</sup>	II	24	2.7
	III	30	3.2

<sup>(1)</sup> Except vehicles designed to carry more than six occupants and vehicles the maximum mass of which exceeds 2,500 kg.

<sup>(2)</sup> And those category M<sub>1</sub> vehicles, which are specified in note 1.

The Directive also confirms that the ‘forced method’ was an alternative to the ‘standard method’ of stabilising a vehicle at the cold test temperature of 266 K (-7°C).



## **Heavy duty vehicles (see Annex II)**

### **Summary:**

The proposal to amend Directive 88/77/EEC was adopted by the Commission on the 3<sup>rd</sup> December 1997 and transmitted to the Council and the European Parliament on the 23<sup>rd</sup> March 1998 (reference COM(97)627 final). The European Parliament delivered its opinion in first reading on the 21<sup>st</sup> October 1998 and the Council formulated a political agreement on the 21<sup>st</sup> December 1998. The Council finally adopted its common position on the 22<sup>nd</sup> April 1999. At its plenary on the 16<sup>th</sup> November 1999, the European Parliament voted to accept in full, and without amendment, the Council's common position. The resulting Directive, 1999/96/EC, was published in the Official Journal of the European Communities on 16<sup>th</sup> February 2000 (OJ L44, 16.2.2000, p.1) and entered into force on that date.

### **Content of Directive 1999/96/EC:**

The emission limits for October 2000 (Euro 3) reflect a reduction of 30% over the current levels and include an extension of the scope to also cover gas fuelled engines. The Directive also includes two new test cycles; the European Steady State cycle (ESC) plus the European Load Response test (ELR) and the European Transient Cycle (ETC). For gas engines, specific limits for non-methane hydrocarbons and methane are introduced (as measured on the ETC test) as well as a range of reference fuels for NG and LPG.

The emission limits for October 2005 set much more stringent emission limits for particulates that are intended to push manufacturers into using particulate trap technology but the emission limits for NOx reflect the concern over the development of NOx reduction technology. However, a more stringent NOx limit will be introduced from October 2008 (Euro 5) but subject to a Commission review by the end of 2002 that will take into account the development of technology and accompanied, if necessary, by appropriate proposals).

Regarding the application of the two new test cycles (ESC/ELR and ETC cycles), the Directive requires the following:

“For type approval to row A [Euro 3 - 2000] of the tables in section 6.2.1, the emissions shall be determined on the ESC and ELR tests with conventional diesel engines including those fitted with electronic fuel injection equipment, exhaust gas recirculation (EGR), and/or oxidation catalysts. Diesel engines fitted with advanced exhaust aftertreatment systems including deNOx catalysts and/or particulate traps, shall additionally be tested on the ETC test.

For type approval testing to either row B1 [Euro 4 – 2005], B2 [Euro 5 – 2008] or row C [EEV] of the tables in section 6.2.1 the emission shall be determined on the ESC, ELR and ETC tests.

For gas engines, the gaseous emissions shall be determined on the ETC test.”

As initially proposed by the Commission, the Directive also includes a set of fuel and technology neutral EEV target values that reflect best available technology that may be used by Member States, on a permissive basis, in those areas where there may be an air quality need.

The Commission is also tasked with coming forward with proposals for OBD, durability and in-use conformity testing which will be applicable from October 2005. This will be dealt with in the course of 2001.

**Directive 2001/27/EC – the defeat device Directive:**

In the spring of 2000, a certain manufacturer obtained type-approval to the Euro 3 requirements for two of its heavy-duty engines. The heavy-duty engines were conventional technology and so were tested on the ESC (and ELR) cycles only and the engines met the emission limits on these cycles. These engines were advertised as Euro 3 engines with added benefits in fuel consumption (of around 3% compared to other engines). Since fuel consumption is a major issue for the heavy-duty industry in terms of product competition, several competitors decided to these engines to see how the fuel consumption benefit was being achieved. When tested on the ESC and ELR the engines were shown to be in conformity with the Euro 3 emission limits but when tested on the ETC cycle, the emissions of NO<sub>x</sub> were in excess of 7 g/kWh where the Euro 3 NO<sub>x</sub> limit on the ETC is 5 g/kWh. The ETC is presently the best laboratory representation of European on-road driving so high NO<sub>x</sub> emissions seen on the ETC would also be seen in real use.

Directive 1999/96/EC allows a control strategy to be used (and not classified as a ‘defeat device’) on a temporary basis during engine starting and warming-up and to protect the engine against intermittent operating conditions that could lead to damage. However, further investigations determined that the engine management system was using an ‘irrational emission control strategy’ or a ‘defeat device’ which is specifically forbidden in Directive 1999/96/EC.

It was clear that if one manufacturer used a defeat device then all manufacturers would use similar strategies to compete on fuel consumption. To counter this, the European manufacturers association (ACEA) worked to develop an ‘internal agreement’, or ‘common interpretation’ of the requirements of Directive 1999/96/EC to avoid one manufacturer taking such an advantage. However, the Commission decided to take legislative action to avoid the situation of a couple of years ago in the US where US trucks were found to have good fuel consumption but at the expense of NO<sub>x</sub> emissions which were sometimes eight times higher than they should have been. This led to a lawsuit and a settlement of some \$8 billion between eight manufacturers and the government; stricter legislation also followed.

Consequently, the Commission developed an amendment to Directive 1999/96/EC, which was taken forward through the committee for adaptation to technical progress (CATP). This amendment will improve the definition of what is and what is not allowed in terms of engine control strategies and require the manufacturer to provide detailed information (on a confidential basis between himself and the type-approval authority) of his engine emission control strategies. It will also permit the type-approval authority to impose an additional screening test for NO<sub>x</sub> emissions only on the ETC for those engines that would normally only be tested on the ESC.

Therefore, in mid-November 2000, the CATP managed to agree a package of amendments, primarily dealing with:

- improved control against the use of defeat devices and irrational emission control strategies, which would apply to all new Euro 3 type-approvals from 1<sup>st</sup> October 2001 but also retroactively from 1<sup>st</sup> April 2002 to all existing Euro 3 type-approvals.

The package of amendments also provided for:

- modified ETC statistical criteria for gas engines only (the tolerance bands for engine speed, power and torque by within which the test of an engine over the transient cycle is judged to be acceptable or not was developed using diesel engines. Certain gas engines can not keep within this tolerance band so for gas engines only, the tolerance band was expanded);

- redefined NG and LPG reference fuel specifications (to better reflect the broad range of NG and LPG quality available across the EU);
- extension of the scope of the directive to provide for the type-approval of heavy-duty vehicles using ethanol fuel.

The amending directive was published in the Official Journal of the European Communities as Directive 2001/27/EC (OJ L107, 18<sup>th</sup> April 2001, p.10).

## Two and three-wheeled vehicles

### Directive 97/24/EC:

Emission requirements of motorcycles are governed by the so-called ‘Multi-Directive’ (97/24/EC) of 17 June 1997 regarding certain components and characteristics of two and three-wheeled vehicles. This Directive completed the implementation of the EU type approval system for two and three-wheeled vehicles. Directive 97/24/EC contains emission limit values for mopeds, motorcycles and tricycles and quadricycles, as indicated in the tables below. It is important to note that national type-approvals granted prior to the implementation of this Directive remain valid for a maximum of 4 years, i.e. until 17 June 2003.

#### Mopeds

Stages	Emission limits for type approval and conformity of production		Test cycle
	CO (g/km)	HC + NOx (g/km)	
17 June 1999 (EURO 1)	6 <sup>(1)</sup>	3 <sup>(1)</sup>	UN-ECE Reg.47
17 June 2002 (EURO 2)	1 <sup>(2)</sup>	1.2	UN-ECE Reg.47

<sup>(1)</sup> The limit values for the masses of CO and HC+NOx are multiplied by a factor of 2 in the case of three wheeled mopeds and light quadricycles.

<sup>(2)</sup> The limit value for the mass of CO must be 3.5 g/km in the case of three-wheeled mopeds and light quadricycles.

#### Two-stroke motorcycles and tricycles

Stage	Emission limits for type approval and conformity of production <sup>(1)</sup>			Test cycle
	CO (g/km)	HC (g/km)	NOx (g/km)	
17 June 1999 (EURO 1)	8	4	0.1	UN-ECE Reg.40

<sup>(1)</sup> However, for tricycles and quadricycles, the limit values must be multiplied by a factor of 1.5.

#### Four-stroke motorcycles and tricycles

Stage	Emission limits for type approval and conformity of production <sup>(1)</sup>			Test cycle
	CO (g/km)	HC (g/km)	NOx (g/km)	
17 June 1999 (EURO 1)	13	3	0.3	UN-ECE Reg.40

<sup>(1)</sup> However, for tricycles and quadricycles, the limit values must be multiplied by a factor of 1.5.

**Agreement on future emission limits for motorcycles:**

Agreement was reached in conciliation between the Council and the European Parliament on 19 March 2002 on a package of measures to reduce pollution from two and three-wheel vehicles, amending Directive 97/24/EC. Taking into account associated changes in measuring procedures, the package will result in reductions in emissions from new vehicles of the order of 65-70%, as compared to today's standards.

The following key measures were agreed:

- ◆ A two-step tightening of emission limit values for motorcycles, with the first step taking effect for new type-approvals on 1 April 2003 and with a second step from 1 January 2006. Emission limits will apply to motorcycles in two categories – those with an engine capacity less than 150cm<sup>3</sup> and those greater than or equal to 150cm<sup>3</sup> – which reflects different technological approaches;
- ◆ A single stage of emission limit values for tricycles and quadricycles from 1 April 2003 which will be supplemented by a Commission proposal by the end of 2002 for more stringent emission standards to take effect from 2006;
- ◆ The 2003 emission standards shall be measured over the existing test cycle contained in Directive 94/27/EC but with emissions sampled from 'key-on';
- ◆ For 4-stroke engines, the 2003 stage represents a reduction of some 60% in the emission limits for carbon monoxide and hydrocarbons over the present emission limits. For 2-stroke engines, the 2003 stage represents a reduction of some 30% in the emission limit for carbon monoxide and 70% in the emission limit for hydrocarbons, over the present emission limits. The present NOx limit is already quite low. The NOx limit remains unchanged for 2003 to allow industry more time to concentrate on more drastic NOx reduction measures for 2006;
- ◆ The 2006 stage represents approximately a halving of the 2003 emission limits;
- ◆ The majority of emissions occur while the engine and emission control system is warming-up. Therefore, from 2006, the type-approval test will be conducted from a cold engine start. Motorcycles with an engine capacity less than 150cm<sup>3</sup> will have their emissions measured over six repeats of the elementary urban test cycle applied to passenger cars (UDC) instead of the four repeats that are applicable from 2003. Motorcycles with an engine capacity greater than or equal to 150cm<sup>3</sup> will have their emissions measured over four repeats of the elementary urban test cycle plus an additional high-speed element as applied to passenger cars (UDC+ EUDC);
- ◆ The adaptation of the passenger car test cycle for use with motorcycles will be completed by the end of October 2002 through the Commission's Committee for Adaptation to Technical Progress (CATP);

**Mandatory future emission limits for 2 and 3-wheeled vehicles and quadricycles**

	Class	Mass of carbon monoxide (CO) (g/km)	Mass of hydrocarbons (HC) (g/km)	Mass of oxides of nitrogen (NOx) (g/km)
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Limit values for motorcycles (2-wheel) for type-approval and conformity of production

A (2003)	I (<150cm <sup>3</sup> )	5.5	1.2	0.3
	II (≥ 150cm <sup>3</sup> )	5.5	1.0	0.3
B (2006)	I (<150cm <sup>3</sup> ) (UDC cold) <sup>(1)</sup>	2.0	0.8	0.15
	II (≥ 150cm <sup>3</sup> ) (UDC+EUDC cold) <sup>(2)</sup>	2.0	0.3	0.15

Limit values for tricycles and quadricycles for type-approval and conformity of production (positive-ignition)

A (2003)	All	7.0	1.5	0.4
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Limit values for tricycles and quadricycles for type-approval and conformity of production (compression-ignition)

A (2003)	All	2.0	1.0	0.65
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<sup>(1)</sup> Test cycle = ECE R40 (with emissions measured for all 6 modes – sampling starts at T=0)

<sup>(2)</sup> Test cycle = ECE R40 + EUDC (emissions measured for all modes – sampling starts at T=0), with the maximum speed of 120 km/h.

- ◆ A new dedicated test cycle for motorcycles that has been developed at a technical level in the UN-ECE will be introduced. Since this cycle offers a better control of emissions from motorcycles in the future, especially for motorcycles using new technology, the Commission will, as soon as possible, make a proposal to introduce the new dedicated test cycle for motorcycles in the 2006 stage. This will be complemented by a new set of emission limits that will be established in correlation to those emission limits already agreed for 2006. Hence, in the 2006 stage the manufacturer will have the choice of two type-approval procedures that will be ‘technically equivalent’. However, the Commission will, in its proposal, consider when the new dedicated test cycle will become the sole test procedure for EU type-approval. In addition, the Commission will maintain its efforts to finalise the new dedicated test cycle on a harmonised basis with other parties such as the USA and Japan;

- ◆ A Commission proposal due by the end of 2002 will also deal with:
  - Mandatory emission limits applicable from 2006 to tricycles and quadricycles;
  - technical provisions for durability and conformity of in-service vehicle requirements to ensure that motorcycle emission control equipment remains effective over a period of use of 30,000 km;
  - requirements for the measurement of fuel consumption and CO<sub>2</sub> emissions as part of EU type-approval from 1 January 2006 for new types and 1 January 2007 for all types of two and three-wheel vehicles;
  - particulate emission limits from compression-ignition and two-stroke engines together with the measuring procedures;
  - new emission limits for mopeds, including particulate limits, to be applied from 2006;
  - further proposals concerning inspection & maintenance, on-board diagnostics, control of evaporative emissions and replacement and retro-fit components.
- ◆ The co-legislators agreed on the aim of including two and three-wheel vehicles in the Community strategy for reducing road transport CO<sub>2</sub> emissions as soon as possible;
- ◆ The agreement contains a prohibition on the use of defeat devices and irrational control strategies, as well as provisions on the information to be supplied by the manufacturer that would enable the technical services to check the emission control devices.

### **Motor fuel quality (see Annex III)**

Directive 98/70/EC was published in the Official Journal of the European Communities on 28<sup>th</sup> December 1998 (OJ L350, volume 41, p.58).

<b>1 January 2000 mandatory petrol quality</b>	150 ppm sulphur content, 1% benzene, 42% aromatics. Rest of specifications as point (a) of Annex II. Portugal given derogation to sell petrol with sulphur not exceeding current levels until end 2001.
<b>1 January 2000 mandatory diesel quality</b>	350 ppm sulphur content. Rest of specifications as point (b) of Annex II. Portugal given derogation to sell diesel with sulphur not exceeding current levels until end 2000.
<b>1 January 2005 mandatory petrol quality</b>	See point (c) of Annex II. 50 ppm sulphur content, 35% aromatics.
<b>1 January 2005 mandatory diesel quality</b>	See point (d) of Annex II. 50 ppm sulphur content.
<b>Auto-Oil II</b>	Article 9 accepted to provide the complete 2005 fuel quality specifications in the light of the Auto-Oil II Programme.
<b>Ban of leaded petrol</b>	Leaded petrol banned from 1 January 2000.  Derogations given to Spain, Italy and Greece to continue to sell leaded petrol until end 2001 (French overseas territories until end 2004).  Benzene content in leaded petrol will be 1.0 % .  Small quantities of leaded petrol to a maximum of 0.5% of total sales to be used by old vehicles of a 'characteristic nature' may continue to be marketed.
<b>Cleaner fuels</b>	Member States may require the use of cleaner fuels in specific areas where air quality justifies its use on environmental and health grounds.

### **Commission proposal on motor fuels:**

The Commission was required to complete the 2005 fuel specifications by the end of 1999. However, taking into account initiatives in certain Member States to encourage cleaner fuels, the Commission decided to complete the 2005 fuel specifications on the basis of 50 ppm sulphur content in conjunction with a survey to see what can be done post-2005 to further improve the quality of petrol and diesel fuel.



In May 2000, Commissioner for the Environment, Margot Wallström, launched a 'Call for Evidence' regarding the appropriate level for the sulphur content of petrol and diesel fuels in the EU. The objective of the exercise was to allow stakeholders an input into the debate whether the maximum allowable sulphur content in petrol and diesel motor fuels should be reduced to a level less than the 50 ppm mandated for such fuels from January 2005 through the conclusion of the Auto-Oil I debate. The exercise allowed stakeholders to express their views and to present any relevant data. The views and data were compiled into a summary report and reviewed by an independent panel of three experts whose findings assisted the Commission in deciding on a proposal for future fuel parameters. The final report was made available at the end of October 2000 for consultations with Member States and industry that took place in early December 2000.

The Commission's proposal (COM(2001) 241 final) was adopted on 11<sup>th</sup> May 2001. These are the main points of the proposal (note: the term 'zero sulphur' refers to levels of sulphur less than 10 mg/kg (ppm)):

- **the mandatory introduction of zero sulphur petrol and diesel fuels by no later than 1 January 2005.** Consistent with the entry of new Euro 4 vehicles from 2005. Low sulphur fuels should be available in sufficient quantity and with a balanced geographical coverage in all Member States to permit the free-circulation of Euro 4 vehicles. The introduction of zero sulphur fuels should not compromise the capacity of the refiners to supply the mandated 50 ppm fuels;
- **full market penetration of zero sulphur petrol and diesel by 1 January 2011.** Consistent with the introduction of fuel efficient vehicle technology to offset increased refinery CO2 emissions;
- the deadline of 1 January 2011 will be reviewed by the end of 2006 with respect to diesel fuel only;
- completion of the 2005 fuel specifications based on a maximum sulphur level of 50 ppm (as required in Directive 98/70/EC);
- The proposal also clarifies the situation regarding the currently permissible sulphur content for diesel used in non-road mobile machinery but introduces no new provisions. It also proposes minor changes to the provisions on technical adaptation and alignment with a pending European Standard on fuel quality monitoring. No changes to the non-sulphur parameters have been proposed.

The proposal can be found on the Commission's information web-sites and details of the sulphur review programme can be found on the following web-site:

<http://europa.eu.int/comm/environment/sulphur/index.htm>

### **State of play in Council and European Parliament:**

Three key issues have arisen during the debate in the Council:

- the final date after which the maximum sulphur content of all petrol and diesel sold should be limited to 10 mg/kg;
- whether the quality of diesel used for road vehicles should be extended to apply in non-road mobile machinery applications;
- the possibility to have more stringent environmental specifications for petrol and diesel than those set down in the directive when they are justified by local environmental conditions.

In its first reading, the European Parliament sought to advance the date after which all petrol and diesel sold would be limited to a 10 mg/kg maximum to 1 January 2008 from 1 January 2011 as proposed by the Commission. Regarding diesel used in non-road mobile machinery the European Parliament sought to require that road diesel quality specifications would apply from 1 January 2005.

In the Common Position, the Council agreed to advance the date after which all petrol and diesel sold would be subject to a maximum sulphur content of 10 mg/kg to 1 January 2009. Regarding gas oil used in non-road mobile machinery the Council has left the current situation unchanged whereby a maximum sulphur content of 2000 mg/kg shall continue to apply until 1 January 2008 after which it shall reduce to 1000 mg/kg. However Member States may apply more stringent standards for sulphur content if they so wish. In addition the Commission has been invited to establish the necessary fuel quality consistent with the next stage of emission standards for compression ignition engines used in non-road applications. The current provision in Directive 98/70 whereby a Member State may seek permission to have more stringent environmental specifications for petrol and/or diesel in specific areas within its territory for air quality reasons has now been extended to include risks to groundwater pollution.

The Council has also decided to extend a previous provision in Article 6 of Directive 98/70/EC, which currently allows Member States, subject to a Community control procedure, to require only the marketing of fuel with more stringent environmental specifications in certain parts of a Member States for reasons of atmospheric pollution, to include reasons related to groundwater pollution.

The Common Position was agreed unanimously by the Council. The provisions are broadly in line with the Commission's proposal although the final date after which all petrol and diesel sold in the Community shall be subject to a maximum sulphur content of 10 mg/kg has been advanced by 24 months to 1 January 2009. In the case of diesel, the final date of 1 January 2009 for complete market switchover to 10 mg/kg remains subject to confirmation in a review which will be completed by the Commission no later than 31 December 2005 instead of 31 December 2006, as originally proposed.

The Common Position will not detract from the environmental benefits of the Commission's proposal in the long term. In the near term, depending on technology developments, the earlier date for final market switchover may slightly alter the balance between air quality improvements and reductions of emissions of carbon dioxide. However, this can be taken into account in the review to be completed by the end of 2005. Thus the Commission can accept and support the Common Position.

The European Parliament second reading is now underway and is expected to be adopted at the September Plenary.

**ANNEX I PASSENGER CARS AND LIGHT COMMERCIAL VEHICLES – DIRECTIVE 98/69/EC**

**A. Mandatory tailpipe emission limits:**

Category	Class	Reference mass (RW) (kg)	Limit Values											
			Mass of carbon monoxide (CO)		Mass of hydrocarbons (HC)		Mass of oxides of nitrogen (NOx)		Combined mass of hydrocarbons and oxides of nitrogen (NOx)		Mass of particulates (1) (PM)			
			L1 (g/km)	Diesel	L2 (g/km)	Diesel	L3 (g/km)	Diesel	L2+L3 (g/km)	Diesel	L4 (g/km)	Diesel		
A (2000)	M (2)	All	2.3	0.64	0.20	-	0.15	0.50	-	0.56	0.05			
			Euro 3	N <sub>1</sub> (3)	I	RW ≤ 1305	2.3	0.64	0.20	-	0.15	0.50	-	0.56
	II	1305 < RW ≤ 1760			4.17	0.80	0.25	-	0.18	0.65	-	0.72	0.07	
		III	1760 < RW	5.22	0.95	0.29	-	0.21	0.78	-	0.86	0.10		
B (2005)	M (2)	All	1.0	0.50	0.10	-	0.08	0.25	-	0.30	0.025			
			Euro 4	N <sub>1</sub> (3)	I	RW ≤ 1305	1.0	0.50	0.10	-	0.08	0.25	-	0.30
	II	1305 < RW ≤ 1760			1.81	0.63	0.13	-	0.10	0.33	-	0.39	0.04	
	III	1760 < RW	2.27	0.74	0.16	-	0.11	0.39	-	0.46	0.06			

(1) For compression ignition engines.

(2) Except vehicles the maximum mass of which exceeds 2 500 kg.

(3) And those Category M vehicles, which are specified in note 2.

**B. Mandatory OBD threshold limits:**

Category	Class	Reference mass (RW) (kg)	Mass of carbon monoxide (CO)		Mass of hydrocarbons (HC)		Mass of oxides of nitrogen (NOx)		Mass of particulates (1) (PM)
			L1 (g/km)	L2 (g/km)	L3 (g/km)	L4 (g/km)			
M (2)	All	All	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel	Diesel
			3.2	3.2	0.4	0.4	0.6	1.2	0.18
N <sub>I</sub> (3)	I	RW ≤ 1305	Petrol	Diesel	Petrol	Diesel	Petrol	Diesel	Diesel
			3.2	3.2	0.4	0.4	0.6	1.2	0.18
	II	1305 < RW ≤ 1760	5.8	4.0	0.5	0.5	0.7	1.6	0.23
	III	1760 < RW	7.3	4.8	0.6	0.6	0.8	1.9	0.28

- (1) For compression ignition engines.
- (2) Except vehicles the maximum mass of which exceeds 2 500 kg.
- (3) And those Category M vehicles, which are specified in note 2.
- (4) The Commission proposal referred to in Article 3(1) of this Directive shall contain the threshold limit values for OBD for 2005/6 for M<sub>I</sub> and N<sub>I</sub> vehicles.

**ANNEX II      HEAVY DUTY VEHICLES – DIRECTIVE 1999/96/EC**

**A. Limit values:**

Table 1      Limit values - ESC and ELR tests

Date		Mass of carbon monoxide (CO) g/kWh	Mass of hydrocarbons (HC) g/kWh	Mass of nitrogen oxides (NOx) g/kWh	Mass of particulates (PT) g/kWh	Smoke m <sup>-1</sup>
A 2000	Euro 3	2.1	0.66	5.0	0.10    0.13 (a)	0.8
B1 2005	Euro 4	1.5	0.46	3.5	0.02	0.5
B2 2008	Euro 5	1.5	0.46	2.0	0.02	0.5
C EEV	-	1.5	0.25	2.0	0.02	0.15

(a) For engines having a swept volume of less than 0,75 dm<sup>3</sup> per cylinder and a rated power speed of more than 3000 min<sup>-1</sup>.

Table 2      Limit values - ETC test (b)

Date		Mass of carbon monoxide (CO) g/kWh	Mass of non-methane hydrocarbons (NMHC) g/kWh	Mass of methane (CH <sub>4</sub> ) (c) g/kWh	Mass of nitrogen oxides (NOx) g/kWh	Mass of particulates (PT) (d) g/kWh
A 2000	Euro 3	5.45	0.78	1.6	5.0	0.16    0.21 (a)
B1 2005	Euro 4	4.0	0.55	1.1	3.5	0.03
B2 2005	Euro 5	4.0	0.55	1.1	2.0	0.03
C EEV	-	3.0	0.40	0.65	2.0	0.02

(a) For engines having a swept volume of less than 0,75 dm<sup>3</sup> per cylinder and a rated power speed of more than 3000 min<sup>-1</sup>.

(b) The conditions for verifying the acceptability of the ETC tests (see Annex III, Appendix 2, section 3.9) when measuring the emissions of gas fuelled engines against the limit values applicable in row A shall be re-examined and, where necessary, modified in accordance with the procedure laid down in Article 13 of Directive 70/156/EEC.

(c) For natural gas engines only.

(c) Not applicable for gas fuelled engines at stage A and stages B1 and B2.

**ANNEX III      MOTOR FUELS - DIRECTIVE 98/70/EC**

**A. Petrol 2000:**

Parameter	Unit	Limits (1)		Test Method	Publication
		Minimum	Maximum		
Research octane number, RON		95,0	--	EN 25164	1993
Motor octane number, MON		85,0	--	EN 25163	1993
Reid vapour pressure, summer period (2)	kPa	--	60,0	EN 12	1993
Distillation:					
- evaporated at 100°C	% v/v	46,0	--	EN-ISO 3405	1988
- evaporated at 150°C	% v/v	75,0	--	EN-ISO 3405	1988
Hydrocarbon analysis:					
- olefins	% v/v	--	18,0 (3)	ASTM D 1319	1995
- aromatics	% v/v	--	42,0	ASTM D 1319	1995
- benzene	% v/v	--	1,0	pr. EN 12177	1995 (*)
Oxygen content	% m/m	--	2,7	EN 1601	1996
Oxygenates:					
- Methanol, stabilising agents must be added	% v/v	--	3	EN 1601	1996
- Ethanol, stabilising agents may be necessary	% v/v	--	5	EN 1601	1996
- Iso-propyl alcohol	% v/v	--	10	EN 1601	1996
- Tert-butyl alcohol	% v/v	--	7	EN 1601	1996
- Iso-butyl alcohol	% v/v	--	10	EN 1601	1996
- Ethers containing 5 or more carbon atoms per molecule	% v/v	--	15	EN 1601	1996
Other oxygenates (4)	% v/v	--	10	EN 1601	1996
Sulphur content	mg/kg	--	150	pr. EN ISO/DIS 14596	1996 (*)
Lead content	g/l	--	0,005	EN 237	1996

(\*) The month of publication will be completed in due course.

(1) The values quoted in the specification are "true values". In the establishment of their limit values the terms of ISO 4259 "Petroleum products - Determination and application of precision data in relation to methods of test" have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account (R = reproducibility). The results of individual measurements shall be interpreted on the basis of the criteria described in ISO 4259 (published in 1995).

(2) The summer period shall begin no later than 1 May and shall not end before 30 September. For Member States with arctic conditions the summer period shall begin no later than 1 June and not end before 31 August and the RVP is limited to 70 kPa.

(3) Except for unleaded petrol regular (minimum motor octane number (MON) of 81 and a minimum research octane number (RON) of 91) for which the maximum olefin content shall be 21% v/v. These limits shall not preclude the introduction on to the market of a Member State of another unleaded petrol with lower octane numbers than set out in this Annex.

(4) Other mono-alcohols and ethers with a final distillation point no higher than the final distillation point laid down in national specifications or, where these do not exist, in industrial specifications for motor fuels.

**B. Diesel 2000:**

Parameter	Unit	Limits (1)		Test Method	Publication
		Minimum	Maximum		
Cetane number		51.0	--	EN-ISO 5165	1992
Density at 15°C	kg/m <sup>3</sup>	--	845	EN-ISO 3675	1995
Distillation:					
- 95% point	°C	--	360	EN-ISO 3405	1988
Polycyclic aromatic hydrocarbons	% m/m	--	11	IP 391	1995
Sulphur content (3)	mg/kg	--	350	pr. EN ISO/DIS 14596	1996 (*)

(\*) The month of publication will be completed in due course.

(1) The values quoted in the specification are "true values". In the establishment of their limit values the terms of ISO 4259 "Petroleum products - Determination and application of precision data in relation to methods of test" have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account (R = reproducibility). The results of individual measurements shall be interpreted on the basis of the criteria described in ISO 4259 (published in 1995).

**C. Petrol 2005:**

Parameter	Unit	Limits (1)		Test Method	Publication
		Minimum	Maximum		
Research octane number, RON		95,0		EN 25164	1993
Motor octane number, MON		85,0		EN 25163	1993
Reid vapour pressure, summer period (2)	kPa	--		EN 12	1993
Distillation:					
- evaporated at 100°C	% v/v		--	EN-ISO 3405	1988
- evaporated at 150°C	% v/v		--	EN-ISO 3405	1988
Hydrocarbon analysis:					
- olefins	% v/v	--		ASTM D 1319	1995
- aromatics	% v/v	--	35,0	ASTM D 1319	1995
- benzene	% v/v	--		pr. EN 12177	1995 (*)
Sulphur content	mg/kg	--	50	pr. EN ISO/DIS 14596	1996 (*)
Lead content	g/l	--		EN 237	1996

(\*) The month of publication will be completed in due course.

(1) The values quoted in the specification are "true values". In the establishment of their limit values the terms of ISO 4259 "Petroleum products - Determination and application of precision data in relation to methods of test" have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account (R = reproducibility). The results of individual measurements shall be interpreted on the basis of the criteria described in ISO 4259 (published in 1995).

**D. Diesel 2005:**

Parameter	Unit	Limits (1)		Test Method	Publication
		Minimum	Maximum		
Cetane number			--		
Density at 15°C	kg/m <sup>3</sup>		--		
Distillation:					
- 95% point	°C	--			
Polycyclic aromatic hydrocarbons	% m/m	--			
Sulphur content <sup>(3)</sup>	mg/kg	--	50	pr. EN ISO/DIS 14596	1996 (*)

(\*) The month of publication will be completed in due course.

(1) The values quoted in the specification are "true values". In the establishment of their limit values the terms of ISO 4259 "Petroleum products - Determination and application of precision data in relation to methods of test" have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account (R = reproducibility). The results of individual measurements shall be interpreted on the basis of the criteria described in ISO 4259 (published in 1995).