

Directive 2005/55/EC of the European Parliament and of the Council of 28 September 2005 on the approximation of the laws of the Member States relating to the measures to be taken against the emission of gaseous and particulate pollutants from compression-ignition engines for use in vehicles, and the emission of gaseous pollutants from positive-ignition engines fuelled with natural gas or liquefied petroleum gas for use in vehicles (Text with EEA relevance) (repealed)

Article 1	Definitions
Article 2	Obligations of the Member States
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ANNEX I

SCOPE, DEFINITIONS AND ABBREVIATIONS, APPLICATION FOR EC TYPE-APPROVAL, SPECIFICATIONS AND TESTS AND CONFORMITY OF PRODUCTION

1. SCOPE
2. DEFINITIONS AND ABBREVIATIONS
 - 2.1. 'test cycle' means a sequence of test points each with...
 - 2.2. 'approval of an engine (engine family)' means the approval of...
 - 2.3. 'diesel engine' means an engine which works on the compression-ignition...
 - 2.4. 'gas engine' means an engine which is fuelled with natural...
 - 2.5. 'engine type' means a category of engines which do not...
 - 2.6. 'engine family' means a manufacturers grouping of engines which, through...
 - 2.7. 'parent engine' means an engine selected from an engine family...
 - 2.8. 'gaseous pollutants' means carbon monoxide, hydrocarbons (assuming a ratio of...
 - 2.9. 'particulate pollutants' means any material collected on a specified filter...
 - 2.10. 'smoke' means particles suspended in the exhaust stream of a...
 - 2.11. 'net power' means the power in EC kW obtained on...
 - 2.12. 'declared maximum power (Pmax)' means the maximum power in EC...
 - 2.13. 'per cent load' means the fraction of the maximum available...
 - 2.14. 'ESC test' means a test cycle consisting of 13 steady...
 - 2.15. 'ELR test' means a test cycle consisting of a sequence...
 - 2.16. 'ETC test' means a test cycle consisting of 1 800...
 - 2.17. 'engine operating speed range' means the engine speed range, most...

- 2.18. 'low speed (nlo)' means the lowest engine speed where 50 %...
 - 2.19. 'high speed (nhi)' means the highest engine speed where 70 %...
 - 2.20. 'engine speeds A, B and C' means the test speeds...
 - 2.21. 'control area' means the area between the engine speeds A...
 - 2.22. 'reference speed (nref)' means the 100 per cent speed value...
 - 2.23. 'opacimeter' means an instrument designed to measure the opacity of...
 - 2.24. 'NG gas range' means one of the H or L...
 - 2.25. 'self adaptability' means any engine device allowing the air/fuel ratio...
 - 2.26. 'recalibration' means a fine tuning of an NG engine in...
 - 2.27. 'Wobbe Index (lower WI; or upper Wu)' means the ratio...
 - 2.28. ' λ -shift factor ($S\lambda$)' means an expression that describes the required...
 - 2.29. 'defeat device' means a device which measures, senses or responds...
 - 2.30. 'auxiliary control device' means a system, function or control strategy...
 - 2.31. 'irrational emission control strategy' means any strategy or measure that,...
 - 2.32. Symbols and abbreviations
 - 2.32.1. Symbols for test parameters
 - 2.32.2. Symbols for chemical components
 - 2.32.3. Abbreviations
3. APPLICATION FOR EC TYPE-APPROVAL
- 3.1. Application for EC type-approval for a type of engine or...
 - 3.1.1. The application for approval of an engine type or engine...
 - 3.1.2. It shall be accompanied by the undermentioned documents in triplicate...
 - 3.1.2.1. A description of the engine type or engine family, if...
 - 3.1.3. An engine conforming to the 'engine type' or 'parent engine'...
 - 3.2. Application for EC type-approval for a vehicle type in respect...
 - 3.2.1. The application for approval of a vehicle with regard to...
 - 3.2.2. It shall be accompanied by the undermentioned documents in triplicate...
 - 3.2.2.1. A description of the vehicle type, of the engine-related vehicle...
 - 3.3. Application for EC type-approval for a vehicle type with an...
 - 3.3.1. The application for approval of a vehicle with regard to...
 - 3.3.2. It shall be accompanied by the undermentioned documents in triplicate...
 - 3.3.2.1. a description of the vehicle type and of engine-related vehicle...
4. EC TYPE-APPROVAL
- 4.1. Granting of a universal fuel EC type-approval
 - 4.1.1. In the case of diesel fuel the parent engine meets...
 - 4.1.2. In the case of natural gas the parent engine should...
 - 4.1.2.1. On the manufacturer's request the engine may be tested on...
 - 4.1.3. In the case of an engine fuelled with natural gas...
 - 4.1.3.1. At the manufacturer's request the engine may be tested on...
 - 4.1.4. In the case of natural gas engines, the ratio of...
 - 4.1.5. In the case of LPG the parent engine should demonstrate...
 - 4.1.5.1. The ratio of emission results 'r' shall be determined for...
 - 4.2. Granting of a fuel range restricted EC type-approval
 - 4.2.1. Exhaust emissions approval of an engine running on natural gas...
 - 4.2.1.1. At the manufacturer's request the engine may be tested on...
 - 4.2.1.2. The ratio of emission results 'r' shall be determined for...
 - 4.2.1.3. On delivery to the customer the engine shall bear a...

- 4.2.2. Exhaust emissions approval of an engine running on natural gas...
 - 4.2.2.1. The parent engine shall meet the emission requirements on the...
 - 4.2.2.2. At the manufacturer's request the engine may be tested on...
 - 4.2.2.3. On delivery to the customer the engine shall bear a...
 - 4.3. Exhaust emissions approval of a member of a family
 - 4.3.1. With the exception of the case mentioned in paragraph 4.3.2,...
 - 4.3.2. Secondary test engine
 - 4.4. Type-approval certificate
5. ENGINE MARKINGS
- 5.1. The engine approved as a technical unit must bear:
 - 5.1.1. the trademark or trade name of the manufacturer of the...
 - 5.1.2. the manufacturer's commercial description;
 - 5.1.3. the EC type-approval number preceded by the distinctive letter(s) or...
 - 5.1.4. in case of an NG engine one of the following...
 - 5.1.5. Labels
 - 5.1.5.1. Content
 - Note:
 - 5.1.5.2. Properties
 - 5.1.5.3. Placing
 - 5.2. In case of an application for EC type-approval for a...
 - 5.3. In case of an application for EC type-approval for a...
6. SPECIFICATIONS AND TESTS
- 6.1. General
 - 6.1.1. Emission control equipment
 - 6.1.1.1. The components liable to affect the emission of gaseous and...
 - 6.1.2. Functions of emission control equipment
 - 6.1.2.1. The use of a defeat device and/or an irrational emission...
 - 6.1.2.2. An auxiliary control device may be installed to an engine,...
 - 6.1.2.3. An engine control device, function, system or measure that operates...
 - 6.1.2.4. For the purposes of point 6.1.2.2, the defined conditions of...
 - 6.1.3. Special requirements for electronic emission control systems
 - 6.1.3.1. Documentation requirements
 - 6.1.4. To verify whether any strategy or measure should be considered...
 - 6.1.4.1. As an alternative to the requirements of Appendix 4 to...
 - 6.1.4.2. In verifying whether any strategy or measure should be considered...
 - 6.1.5. Transitional provisions for extension of type-approval
 - 6.1.5.1. This section shall only be applicable to new compression-ignition engines...
 - 6.1.5.2. As an alternative to Sections 6.1.3 and 6.1.4, the manufacturer...
 - 6.1.5.3. The manufacturer shall also provide a written statement that the...
 - 6.2. Specifications concerning the emission of gaseous and particulate pollutants and...
 - 6.2.1. Limit values
 - 6.2.2. Hydrocarbon measurement for diesel and gas fuelled engines
 - 6.2.2.1. A manufacturer may choose to measure the mass of total...
 - 6.2.3. Specific requirements for diesel engines

- 6.2.3.1. The specific mass of the oxides of nitrogen measured at...
- 6.2.3.2. The smoke value on the random test speed of the...

7. INSTALLATION ON THE VEHICLE

- 7.1. The engine installation on the vehicle shall comply with the...
 - 7.1.1. intake depression shall not exceed that specified for the type-approved...
 - 7.1.2. exhaust back pressure shall not exceed that specified for the...
 - 7.1.3. the exhaust system volume shall not differ by more than...
 - 7.1.4. power absorbed by the auxiliaries needed for operating the engine...

8. ENGINE FAMILY

- 8.1. Parameters defining the engine family
 - 8.1.1. Combustion cycle:
 - 8.1.2. Cooling medium:
 - 8.1.3. For gas engines and engines with aftertreatment:
 - 8.1.4. Individual cylinder displacement:
 - 8.1.5. Method of air aspiration:
 - 8.1.6. Combustion chamber type/design:
 - 8.1.7. Valve and porting — configuration, size and number:
 - 8.1.8. Fuel injection system (diesel engines):
 - 8.1.9. Fuelling system (gas engines):
 - 8.1.10. Ignition system (gas engines)
 - 8.1.11. Miscellaneous features:
 - 8.1.12. Exhaust aftertreatment:
- 8.2. Choice of the parent engine
 - 8.2.1. Diesel engines
 - 8.2.2. Gas engines

9. PRODUCTION CONFORMITY

- 9.1. Measures to ensure production conformity must be taken in accordance...
 - 9.1.1. If emissions of pollutants are to be measured and an...
 - 9.1.1.1. Conformity of the engine subjected to a pollutant test:
 - 9.1.1.1.1. ~~Three~~ engines are randomly taken in the series.
Engines that...
 - 9.1.1.1.2. ~~The~~ tests are carried out according to Appendix 1 to...
 - 9.1.1.1.3. ~~On~~ the basis of a test of the engine by...
 - 9.1.1.2. The tests will be carried out on newly manufactured engines...
 - 9.1.1.2.1. ~~However,~~ at the request of the manufacturer, the tests may...
 - 9.1.1.2.2. ~~When~~ the manufacturer asks to conduct a running-in procedure in...
 - 9.1.1.2.3. ~~For~~ diesel and LPG fuelled engines, all these tests may...
 - 9.1.1.2.4. ~~For~~ NG fuelled engines, all these tests may be conducted...
 - 9.1.1.2.5. ~~In~~ the case of dispute caused by the non-compliance of...
 - 9.1.1.2.6. ~~Tests~~ for conformity of production of a gas fuelled engine...

Appendix 1

PROCEDURE FOR PRODUCTION CONFORMITY TESTING WHEN STANDARD DEVIATION IS SATISFACTORY

This Appendix describes the procedure to be used to verify...

Appendix 2

PROCEDURE FOR PRODUCTION CONFORMITY TESTING WHEN STANDARD DEVIATION IS UNSATISFACTORY OR UNAVAILABLE

This Appendix describes the procedure to be used to verify...

Appendix 3

PROCEDURE FOR PRODUCTION CONFORMITY TESTING AT MANUFACTURER'S REQUEST

This Appendix describes the procedure to be used to verify,...

ANNEX II

Appendix 1

Appendix 2

ESSENTIAL CHARACTERISTICS OF THE ENGINE FAMILY

Appendix 3

Appendix 4

CHARACTERISTICS OF THE ENGINE-RELATED VEHICLE PARTS

ANNEX III

TEST PROCEDURE

1. INTRODUCTION
 - 1.1. This Annex describes the methods of determining emissions of gaseous...
 - 1.2. The test shall be carried out with the engine mounted...
 - 1.3. Measurement principle
 - 1.3.1. ESC test
 - 1.3.2. ELR test
 - 1.3.3. ETC test

2. TEST CONDITIONS
 - 2.1. Engine test conditions
 - 2.1.1. The absolute temperature (T_a) of the engine air at the...
 - 2.1.2. Test validity
 - 2.2. Engines with charge air cooling
 - 2.3. Engine air intake system
 - 2.4. Engine exhaust system
 - 2.5. Cooling system
 - 2.6. Lubricating oil
 - 2.7. Fuel
 - 2.8. Testing of exhaust aftertreatment systems

Appendix 1

ESC AND ELR TEST CYCLES

1. ENGINE AND DYNAMOMETER SETTINGS
 - 1.1. Determination of engine speeds A, B and C
 - 1.2. Determination of dynamometer settings
2. ESC TEST RUN
 - 2.1. Preparation of the sampling filters
 - 2.2. Installation of the measuring equipment
 - 2.3. Starting the dilution system and the engine
 - 2.4. Starting the particulate sampling system
 - 2.5. Adjustment of the dilution ratio
 - 2.6. Checking the analysers
 - 2.7. Test cycle
 - 2.7.1. The following 13-mode cycle shall be followed in dynamometer operation...
 - 2.7.2. Test sequence
 - 2.7.3. Analyser response
 - 2.7.4. Particulate sampling
 - 2.7.5. Engine conditions
 - 2.7.6. NO_x check within the control area
 - 2.7.7. Rechecking the analysers
3. ELR TEST RUN
 - 3.1. Installation of the measuring equipment
 - 3.2. Checking of the opacimeter
 - 3.3. Test cycle
 - 3.3.1. Conditioning of the engine
 - 3.3.2. Test sequence
 - 3.4. Cycle validation
 - 3.5. Rechecking of the opacimeter
4. CALCULATION OF THE GASEOUS EMISSIONS
 - 4.1. Data evaluation
 - 4.2. Dry/wet correction
 - 4.3. NO_x correction for humidity and temperature
 - 4.4. Calculation of the emission mass flow rates
 - 4.5. Calculation of the specific emissions

- 4.6. Calculation of the area control values
 - 4.6.1. Calculation of the specific emission
 - 4.6.2. Determination of the emission value from the test cycle
 - 4.6.3. Comparison of NO_x emission values
5. CALCULATION OF THE PARTICULATE EMISSION
 - 5.1. Data evaluation
 - 5.2. Partial flow dilution system
 - 5.2.1. Isokinetic systems
 - 5.2.2. Systems with measurement of CO₂ or NO_x concentration
 - 5.2.3. Systems with CO₂ measurement and carbon balance method
 - 5.2.4. Systems with flow measurement
 - 5.3. Full flow dilution system
 - 5.4. Calculation of the particulate mass flow rate
 - 5.5. Calculation of the specific emission
 - 5.6. Effective weighting factor
6. CALCULATION OF THE SMOKE VALUES
 - 6.1. Bessel algorithm
 - 6.1.1. Calculation of filter response time and Bessel constants
 - 6.1.2. Calculation of the Bessel algorithm
 - 6.2. Data evaluation
 - 6.3. Determination of smoke
 - 6.3.1. Data conversion
 - 6.3.2. Calculation of Bessel averaged smoke
 - 6.3.3. Final result

Appendix 2

ETC TEST CYCLE

1. ENGINE MAPPING PROCEDURE
 - 1.1. Determination of the mapping speed range
 - 1.2. Performing the engine power map
 - 1.3. Mapping curve generation
 - 1.4. Alternate mapping
 - 1.5. Replicate tests
2. GENERATION OF THE REFERENCE TEST CYCLE
 - 2.1. Actual speed
 - 2.2. Actual torque
 - 2.3. Example of the unnormalisation procedure
3. EMISSIONS TEST RUN
 - 3.1. Preparation of the sampling filters (diesel engines only)
 - 3.2. Installation of the measuring equipment
 - 3.3. Starting the dilution system and the engine
 - 3.4. Starting the particulate sampling system (diesel engines only)
 - 3.5. Adjustment of the full flow dilution system
 - 3.6. Checking the analysers
 - 3.7. Engine starting procedure
 - 3.8. Test cycle

- 3.8.1. Test sequence
- 3.8.2. Analyser response
- 3.8.3. Particulate sampling (diesel engines only)
- 3.8.4. Engine stalling
- 3.8.5. Operations after test
- 3.9. Verification of the test run
 - 3.9.1. Data shift
 - 3.9.2. Calculation of the cycle work
 - 3.9.3. Validation statistics of the test cycle
- 4. CALCULATION OF THE GASEOUS EMISSIONS
 - 4.1. Determination of the diluted exhaust gas flow
 - 4.2. NO_x correction for humidity
 - 4.3. Calculation of the emission mass flow
 - 4.3.1. Systems with constant mass flow
 - 4.3.1.1. Determination of the background corrected concentrations
 - 4.3.2. Systems with flow compensation
 - 4.4. Calculation of the specific emissions
- 5. CALCULATION OF THE PARTICULATE EMISSION (DIESEL ENGINES ONLY)
 - 5.1. Calculation of the mass flow
 - 5.2. Calculation of the specific emission

Appendix 3

A graphical display of the ETC dynamometer schedule is shown...

Appendix 4

MEASUREMENT AND SAMPLING PROCEDURES

- 1. INTRODUCTION
- 2. DYNAMOMETER AND TEST CELL EQUIPMENT
 - 2.1. Engine dynamometer
 - 2.2. Other instruments
 - 2.3. Exhaust gas flow
 - 2.4. Diluted exhaust gas flow
- 3. DETERMINATION OF THE GASEOUS COMPONENTS
 - 3.1. General analyser specifications
 - 3.1.1. Measurement error
 - 3.1.2. Repeatability
 - 3.1.3. Noise
 - 3.1.4. Zero drift
 - 3.1.5. Span drift
 - 3.2. Gas drying
 - 3.3. Analysers
 - 3.3.1. Carbon monoxide (CO) analysis
 - 3.3.2. Carbon dioxide (CO₂) analysis

- 3.3.3. Hydrocarbon (HC) analysis
- 3.3.4. Non-methane hydrocarbon (NMHC) analysis (NG fuelled gas engines only)
 - 3.3.4.1. Gas chromatographic (GC) method
 - 3.3.4.2. Non-methane cutter (NMC) method
- 3.3.5. Oxides of nitrogen (NO_x) analysis
- 3.4. Sampling of gaseous emissions
 - 3.4.1. Raw exhaust gas (ESC only)
 - 3.4.2. Diluted exhaust gas (mandatory for ETC, optional for ESC)
- 4. DETERMINATION OF THE PARTICULATES
 - 4.1. Particulate sampling filters
 - 4.1.1. Filter specification
 - 4.1.2. Filter size
 - 4.1.3. Primary and back-up filters
 - 4.1.4. Filter face velocity
 - 4.1.5. Filter loading
 - 4.2. Weighing chamber and analytical balance specifications
 - 4.2.1. Weighing chamber conditions
 - 4.2.2. Reference filter weighing
 - 4.2.3. Analytical balance
 - 4.3. Additional specifications for particulate measurement
- 5. DETERMINATION OF SMOKE
 - 5.1. General requirements
 - 5.2. Specific requirements
 - 5.2.1. Linearity
 - 5.2.2. Zero drift
 - 5.2.3. Opacimeter display and range
 - 5.2.4. Instrument response time
 - 5.2.5. Neutral density filters

Appendix 5

CALIBRATION PROCEDURE

- 1. CALIBRATION OF THE ANALYTICAL INSTRUMENTS
 - 1.1. Introduction
 - 1.2. Calibration gases
 - 1.2.1. Pure gases
 - 1.2.2. Calibration and span gases
 - 1.3. Operating procedure for analysers and sampling system
 - 1.4. Leakage test
 - 1.5. Calibration procedure
 - 1.5.1. Instrument assembly
 - 1.5.2. Warming-up time
 - 1.5.3. NDIR and HFID analyser
 - 1.5.4. Calibration
 - 1.5.5. Establishment of the calibration curve
 - 1.5.5.1. General guidelines
 - 1.5.5.2. Calibration below 15 % of full scale
 - 1.5.5.3. Alternative methods

- 1.6. Verification of the calibration
 - 1.7. Efficiency test of the NOx converter
 - 1.7.1. Test set-up
 - 1.7.2. Calibration
 - 1.7.3. Calculation
 - 1.7.4. Adding of oxygen
 - 1.7.5. Activation of the ozonator
 - 1.7.6. NOx mode
 - 1.7.7. Deactivation of the ozonator
 - 1.7.8. NO mode
 - 1.7.9. Test interval
 - 1.7.10. Efficiency requirement
 - 1.8. Adjustment of the FID
 - 1.8.1. Optimisation of the detector response
 - 1.8.2. Hydrocarbon response factors
 - 1.8.3. Oxygen interference check
 - 1.8.4. Efficiency of the non-methane cutter (NMC, for NG fuelled gas...
 - 1.8.4.1. Methane efficiency
 - 1.8.4.2. Ethane efficiency
 - 1.9. Interference effects with CO, CO₂, and NOx analysers
 - 1.9.1. CO analyser interference check
 - 1.9.2. NOx analyser quench checks
 - 1.9.2.1. CO₂ quench check
 - 1.9.2.2. Water quench check
 - 1.10. Calibration intervals
2. CALIBRATION OF THE CVS-SYSTEM
 - 2.1. General
 - 2.2. Calibration of the Positive Displacement Pump (PDP)
 - 2.2.1. Data analysis
 - 2.3. Calibration of the Critical Flow Venturi (CFV)
 - 2.3.1. Data analysis
 - 2.4. Total system verification
 - 2.4.1. Metering with a critical flow orifice
 - 2.4.2. Metering by means of a gravimetric technique
 3. CALIBRATION OF THE PARTICULATE MEASURING SYSTEM
 - 3.1. Introduction
 - 3.2. Flow measurement
 - 3.3. Checking the partial flow conditions
 - 3.4. Calibration intervals
 4. CALIBRATION OF THE SMOKE MEASUREMENT EQUIPMENT
 - 4.1. Introduction
 - 4.2. Calibration procedure
 - 4.2.1. Warming-up time
 - 4.2.2. Establishment of the linearity response
 - 4.3. Calibration intervals

ANNEX IV

TECHNICAL CHARACTERISTICS OF REFERENCE FUEL PRESCRIBED FOR APPROVAL TESTS AND TO VERIFY CONFORMITY OF PRODUCTION

- 1.1. DIESEL FUEL If it is required to calculate the thermal...
- 1.2. Ethanol for diesel engines Cetane improver, as specified by the...
2. NATURAL GAS (NG)
3. LIQUEFIED PETROLEUM GAS (LPG)

ANNEX V

ANALYTICAL AND SAMPLING SYSTEMS

1. DETERMINATION OF THE GASEOUS EMISSIONS
 - 1.1. Introduction
 - 1.2. Description of the analytical system
 - 1.2.1. Components of Figures 7 and 8
 - EP Exhaust pipe
 - Exhaust gas sampling probe (Figure 7 only)
 - SP2 Diluted exhaust gas HC sampling probe (Figure 8 only)...
 - SP3 Diluted exhaust gas CO, CO₂, NO_x sampling probe (Figure...
 - HSL1 Heated sampling line
 - HSL2 Heated NO_x sampling line
 - SL Sampling line for CO and CO₂
 - BK Background bag (optional; Figure 8 only)
 - BG Sample bag (optional; Figure 8 CO and CO₂ only)...
 - F1 Heated pre-filter (optional)
 - F2 Heated filter
 - P Heated sampling pump
 - HC
 - CO, CO₂
 - NO
 - C Converter
 - B Cooling bath (optional)
 - T1, T2, T3 Temperature sensor
 - T4 Temperature sensor
 - T5 Temperature sensor
 - G1, G2, G3 Pressure gauge
 - R1, R2 Pressure regulator
 - R3, R4, R5 Pressure regulator
 - FL1, FL2, FL3 Flowmeter
 - FL4 to FL6 Flowmeter (optional)
 - V1 to V5 Selector valve
 - V6, V7 Solenoid valve
 - V8 Needle valve
 - V9, V10 Needle valve
 - V11, V12 Toggle valve (optional)
 - 1.3. NMHC analysis (NG fuelled gas engines only)

1.3.1. Gas chromatographic method (GC, Figure 9)

Components of Figure 9

PC Porapak column
MSC Molecular sieve column
OV Oven
SLP Sample loop
P Pump
D Dryer
HC
V1 Sample injection valve
V3 Selector valve
V2, V4, V5, V6, V7, V8 Needle valve
R1, R2, R3 Pressure regulator
FC Flow capillary
G1, G2, G3 Pressure gauge
F1, F2, F3, F4, F5 Filter
FL1

1.3.2. Non-methane cutter method (NMC, Figure 10)

Components of Figure 10

NMC Non-methane cutter
HC
V1 Selector valve
V2, V3 Solenoid valve
V4 Needle valve
R1 Pressure regulator
FL1 Flowmeter

2. EXHAUST GAS DILUTION AND DETERMINATION OF THE PARTICULATES

2.1. Introduction

2.2. Partial flow dilution system

Isokinetic systems (Figures 11, 12)

Flow controlled systems with concentration measurement (Figures 13 to 17)...

Flow controlled systems with flow measurement (Figures 18, 19)

2.2.1. Components of Figures 11 to 19

EP Exhaust pipe
SP Sampling probe (Figures 10, 14, 15, 16, 18, 19)..
ISP Isokinetic sampling probe (Figures 11, 12)
FD1, FD2 Flow divider (Figure 16)
FD3 Flow divider (Figure 17)
EGA Exhaust gas analyser (Figures 13, 14, 15, 16, 17)..
TT Transfer tube (Figures 11 to 19)
DPT Differential pressure transducer (Figures 11, 12, 17)
FC1 Flow controller (Figures 11, 12, 17)
PCV1, PCV2 Pressure control valve (Figure 16)
DC Damping chamber (Figure 17)
VN Venturi (Figure 15)
FC2 Flow controller (Figures 13, 14, 18, 19, optional)
FM1 Flow measurement device (Figures 11, 12, 18, 19)
FM2 Flow measurement device (Figure 19)
PB Pressures blower (Figures 11, 12, 13, 14, 15, 16,...
SB Suction blower (Figures 11, 12, 13, 16, 17, 19)..
DAF Dilution air filter (Figures 11 to 19)

- DT Dilution tunnel (Figures 11 to 19)
- HE Heat exchanger (Figures 16, 17)
- 2.3. Full flow dilution system
 - 2.3.1. Components of Figure 20
 - EP Exhaust pipe
 - PDP Positive displacement pump
 - CFV Critical Flow Venturi
 - HE Heat exchanger (optional, if EFC is used)
 - EFC Electronic flow compensation (optional, if HE is used)
 - DT Dilution tunnel
 - DAF Dilution air filter
 - PSP Particulate sampling probe
- 2.4. Particulate sampling system
 - 2.4.1. Components of Figures 21 and 22
 - PTT Particulate transfer tube (Figures 21, 22)
 - SDT Secondary dilution tunnel (Figure 22)
 - FH Filter holder(s) (Figures 21, 22)
 - P Sampling pump (Figures 21, 22)
 - DP Dilution air pump (Figure 22)
 - FC3 Flow controller (Figures 21, 22)
 - FM3 Flow measurement device (Figures 21, 22)
 - FM4 Flow measurement device (Figure 22)
 - BV Ball valve (optional)
- 3. DETERMINATION OF SMOKE
 - 3.1. Introduction
 - 3.2. Full flow opacimeter
 - 3.2.1. Components of Figure 23
 - EP Exhaust Pipe
 - OPL Optical Path Length
 - LS Light source
 - LD Light detector
 - CL Collimating lens
 - T1 Temperature sensor (optional)
 - 3.3. Partial flow opacimeter
 - 3.3.1. Components of Figure 24
 - EP Exhaust pipe
 - SP Sampling probe
 - TT Transfer tube
 - FM Flow measurement device
 - MC Measuring chamber
 - OPL Optical path length
 - LS Light source
 - LD Light detector
 - CL Collimating lens
 - T1 Temperature sensor
 - P Sampling pump (optional)

ANNEX VI

Appendix

to EC type-approval certificate No ... concerning the type approval of a vehicle/separate technical unit/component

ANNEX VII

EXAMPLE OF CALCULATION PROCEDURE

1. ESC TEST
 - 1.1. Gaseous emissions
 - Calculation of the dry to wet correction factor KW,r (Annex...
 - Calculation of the wet concentrations:
 - Calculation of the NO_x humidity correction factor KH,D (Annex III,...
 - Calculation of the emission mass flow rates (Annex III, Appendix...
 - Calculation of the specific emissions (Annex III, Appendix 1, Section...
 - Calculation of the specific NO_x emission of the random point...
 - Determination of the emission value from the test cycle (Annex...
 - Comparison of the NO_x emission values (Annex III, Appendix 1,...
 - 1.2. Particulate emissions
 - Calculation of GEDF (Annex III, Appendix 1, Sections 5.2.3 and...
 - Calculation of the mass flow rate (Annex III, Appendix 1,...
 - Background correction (optional)
 - Calculation of the specific emission (Annex III, Appendix 1, Section...
 - Calculation of the specific weighting factor (Annex III, Appendix 1,...
2. ELR TEST
 - 2.1. General remarks on the Bessel filter
 - 2.2. Calculation of the Bessel algorithm
 - Step 1 Required Bessel filter response time tF :
 - Step 2 Estimation of cut-off frequency and calculation of Bessel constants $E,...$
 - Step 3 Application of Bessel filter on step input:
 - Step 4 Filter response time of first iteration cycle:
 - Step 5 Deviation between required and obtained filter response time of first...
 - Step 6 Checking the iteration criteria:
 - Step 7 Final Bessel algorithm:
 - 2.3. Calculation of the smoke values
 - Calculation of the k-value (Annex III, Appendix 1, Section 6.3.1):...
 - Calculation of Bessel averaged smoke (Annex III, Appendix 1, Section...
 - Calculation of the final smoke value (Annex III, Appendix 1,...
 - Cycle validation (Annex III, Appendix 1, Section 3.4)
3. ETC TEST
 - 3.1. Gaseous emissions (diesel engine)
 - Calculation of the diluted exhaust gas flow (Annex III, Appendix...
 - Calculation of the NO_x correction factor (Annex III, Appendix 2,...

- Calculation of the background corrected concentrations (Annex III, Appendix 2,...)
- Calculation of the emissions mass flow (Annex III, Appendix 2,...)
- Calculation of the specific emissions (Annex III, Appendix 2, Section...)
- 3.2. Particulate emissions (diesel engine)
 - Calculation of the mass emission (Annex III, Appendix 2, Section...)
 - Calculation of the background corrected mass emission (Annex III, Appendix...)
 - Calculation of the specific emission (Annex III, Appendix 2, Section...)
- 3.3. Gaseous emissions (CNG engine)
 - Calculation of the NO_x, correction factor (Annex III, Appendix 2,...)
 - Calculation of the NMHC concentration (Annex III, Appendix 2, Section...)
 - Calculation of the background corrected concentrations (Annex III, Appendix 2,...)
 - For NMHC, the background concentration is the difference between HCconcd...
 - Calculation of the emissions mass flow (Annex III, Appendix 2,...)
 - Calculation of the specific emissions (Annex III, Appendix 2, Section...)
- 4. λ -SHIFT FACTOR ($S\lambda$)
 - 4.1. Calculation of the λ -shift factor ($S\lambda$)
 - 4.2. Examples for the calculation of the λ -shift factor $S\lambda$
 - Example **GP5**: CH₄ = 86 %, N₂ = 14 % (by volume)
 - Example **GR**: CH₄ = 87 %, C₂H₆ = 13 % (by vol)
 - Example **USA**: CH₄ = 89 %, C₂H₆ = 4,5 %, C₃H₈ = 2,3 %,...

ANNEX VIII

SPECIFIC TECHNICAL REQUIREMENTS RELATING TO ETHANOL-FUELLED DIESEL ENGINES

IN ANNEX III, APPENDIX 1:

- 4.2. Dry/wet correction
- 4.3. NO_x correction for humidity and temperature
- 4.4. Calculation of the emission mass flow rates

IN ANNEX III, APPENDIX 2:

- 4.2. The conditions for the test should be arranged so that...
- 4.3. Calculation of the emission mass flow
 - 4.3.1 Systems with constant mass flow
 - 4.3.1.1. Determination of the background corrected concentrations
 - 4.3.2. Systems with flow compensation
- 4.4. Calculation of the specific emissions

ANNEX IX
TIME-LIMITS FOR THE TRANSPOSITION OF THE
REPEALED DIRECTIVES INTO NATIONAL LAWS

ANNEX X
CORRELATION TABLE

- (1) [OJ C 108, 30.4.2004, p. 32.](#)
- (2) Opinion of the European Parliament of 9 March 2004 ([OJ C 102 E, 28.4.2004, p. 272](#)) and Council Decision of 19 September 2005.
- (3) [OJ L 36, 9.2.1988, p. 33.](#) Directive as last amended by the 2003 Act of Accession.
- (4) [OJ L 42, 23.2.1970, p. 1.](#) Directive as last amended by Commission Directive 2005/49/EC ([OJ L 194, 26.7.2005, p. 12](#)).
- (5) [OJ L 295, 25.10.1991, p. 1.](#)
- (6) [OJ L 44, 16.2.2000, p. 1.](#)
- (7) [OJ L 107, 18.4.2001, p. 10.](#)
- (8) [OJ L 76, 6.4.1970, p. 1.](#) Directive as last amended by Commission Directive 2003/76/EC ([OJ L 206, 15.8.2003, p. 29](#)).
- (9) [OJ L 184, 17.7.1999, p. 23.](#)