

Commission Regulation (EU) 2017/2400 of 12 December 2017 implementing Regulation (EC) No 595/2009 of the European Parliament and of the Council as regards the determination of the CO<sub>2</sub> emissions and fuel consumption of heavy-duty vehicles and amending Directive 2007/46/EC of the European Parliament and of the Council and Commission Regulation (EU) No 582/2011 (Text with EEA relevance)

## CHAPTER 1

### GENERAL PROVISIONS

- Article 1 Subject matter
- Article 2 Scope
- Article 3 Definitions
- Article 4 Vehicle groups
- Article 5 Electronic tools

## CHAPTER 2

### LICENCE TO OPERATE THE SIMULATION TOOL FOR THE PURPOSES OF TYPE-APPROVAL WITH REGARD TO EMISSIONS AND VEHICLE REPAIR AND MAINTENANCE INFORMATION

- Article 6 Application for a licence to operate the simulation tool with a view to determining CO<sub>2</sub> emissions and fuel consumption of new vehicles
- Article 7 Administrative provisions for the granting of the licence
- Article 8 Subsequent changes to the processes set up for the purposes of determining CO<sub>2</sub> emissions and fuel consumption of vehicles

## CHAPTER 3

### OPERATION OF THE SIMULATION TOOL WITH A VIEW TO DETERMINING THE CO<sub>2</sub> EMISSIONS AND FUEL CONSUMPTION FOR THE PURPOSES OF REGISTRATION, SALE AND ENTRY INTO SERVICE OF NEW VEHICLES

- Article 9 Obligation to determine and declare CO<sub>2</sub> emissions and fuel consumption of new vehicles
- Article 10 Modifications, updates and malfunction of the electronic tools
- Article 11 Accessibility of the simulation tool inputs and output information

## CHAPTER 4

### CO<sub>2</sub> EMISSIONS AND FUEL CONSUMPTION RELATED PROPERTIES OF COMPONENTS, SEPARATE TECHNICAL UNITS AND SYSTEMS

- Article 12 Components, separate technical units and systems relevant for the purposes of determining CO<sub>2</sub> emissions and fuel consumption
- Article 13 Standard values

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- Article 14 Certified values
- Article 15 Family concept regarding components, separate technical units and systems using certified values
- Article 16 Application for a certification of the CO<sub>2</sub> emissions and fuel consumption related properties of components, separate technical units or systems
- Article 17 Administrative provisions for the certification of CO<sub>2</sub> emissions and fuel consumption related properties of components, separate technical units and systems
- Article 18 Extension to include a new component, separate technical unit or system into a component family, separate technical unit family or system family
- Article 19 Subsequent changes relevant for the certification of CO<sub>2</sub> emissions and fuel consumption related properties of components, separate technical units and systems

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- Article 20 Responsibilities of the vehicle manufacturer, the approval authority and the Commission with regard to the conformity of simulation tool operation
- Article 21 Remedial measures for the conformity of simulation tool operation
- Article 22 Responsibilities of the manufacturer and approval authority with regards to conformity of CO<sub>2</sub> emissions and fuel consumption related properties of components, separate technical units and systems
- Article 23 Remedial measures for the conformity of CO<sub>2</sub> emissions and fuel consumption related properties of components, separate technical units and systems

## CHAPTER 6

### FINAL PROVISIONS

- Article 24 Transitional provisions
- Article 25 Amendment to Directive 2007/46/EC
- Article 26 Amendment to Regulation (EU) No 582/2011
- Article 27 Entry into force  
Signature

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## ANNEX I

### CLASSIFICATION OF VEHICLES IN VEHICLE GROUPS

- 1. Classification of the vehicles for the purpose of this Regulation...
  - 1.1 Classification of vehicles of category N

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## ANNEX II

### REQUIREMENTS AND PROCEDURES RELATED TO THE OPERATION OF THE SIMULATION TOOL

1. The processes to be set up by the vehicle manufacturer...
  - 1.1. The manufacturer shall set up at least the following processes:...
2. Assessment by the approval authority
  - 2.1. The approval authority shall verify whether the processes set out...

#### Appendix 1

### MODEL OF AN INFORMATION DOCUMENT FOR THE PURPOSES OF OPERATING...

#### SECTION I

##### 1 Name and address of manufacturer:

- 1 Name and address of manufacturer:
- 2 Assembly plants for which the processes referred to in point...
- 3 Vehicle groups covered:
- 4 Name and address of the manufacturer's representative (if any)

#### SECTION II

##### 1. Additional information 1.1. Data and process flow handling description...

1. Additional information
  - 1.1. Data and process flow handling description (e.g. flow chart)
  - 1.2. Description of quality management process
  - 1.3. Additional quality management certificates (if any)
  - 1.4. Description of simulation tool data sourcing, handling and storage
  - 1.5. Additional documents (if any)
2. Date: ...
3. Signature: ...

#### Appendix 2

### MODEL OF A LICENCE TO OPERATE THE SIMULATION TOOL WITH...

Maximum format: A4 (210 × 297 mm)

### LICENCE TO OPERATE THE SIMULATION TOOL WITH A VIEW TO...

#### SECTION I

##### 0.1 Name and address of manufacturer:

- 0.1 Name and address of manufacturer:

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- 0.2 Assembly plants for which the processes referred to in point...
- 0.3 Vehicle groups covered:

## SECTION II

### 1. Additional information 1.1 Assessment report performed by an approval...

- 1. Additional information
  - 1.1 Assessment report performed by an approval authority
  - 1.2. Data and process flow handling description (e.g. flow chart)
  - 1.3. Description of quality management process
  - 1.4. Additional quality management certificates (if any)
  - 1.5. Description of simulation tool data sourcing, handling and storage
  - 1.6 Additional documents (if any)
- 2. Approval authority responsible for carrying out the assessment
- 3. Date of the assessment report
- 4. Number of assessment report report
- 5. Remarks (if any): see Addendum
- 6. Place
- 7. Date
- 8. Signature

## ANNEX III

### INPUT INFORMATION RELATING TO THE CHARACTERISTIC OF THE VEHICLE

- 1. Introduction
- 2. Definitions
- 3. Set of input parameters
- 4. Vehicle mass
  - 4.1 The vehicle mass used as input for the simulation tool...
  - 4.2 If not all the standard equipment is installed, the manufacturer...
  - 4.3 The weight of the construction elements referred to in point...
- 5. Hydraulically and mechanically driven axles
- 6. Gear dependent engine torque limits set by vehicle control
- 7. Vehicle specific engine idling speed
  - 7.1. The engine idling speed has to be declared in VECTO...
- 8. Advanced driver assistance systems
  - 8.1. The following types of advanced driver assistance systems, which are...
  - 8.2. The eleven combinations of the advanced driver assistance systems as...
  - 8.3. Any advanced driver assistance system declared in the input into...
  - 8.4. If an advanced driver assistance system is declared in the...

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## ANNEX IV

### MODEL OF THE MANUFACTURER'S RECORDS FILE AND OF THE CUSTOMER INFORMATION FILE

#### PART I

#### Vehicle CO<sub>2</sub> emissions and fuel consumption – Manufacturer's records file...

1. Vehicle, component, separate technical unit and systems data
  - 1.1. Vehicle data
    - 1.1.1. Name and address of manufacturer
    - 1.1.2. Vehicle model
    - 1.1.3. Vehicle identification number (VIN) ...
    - 1.1.4. Vehicle category (N1 N2, N3, M1, M2, M3) ...
    - 1.1.5. Axle configuration ...
    - 1.1.6. Max. gross vehicle weight (t) ...
    - 1.1.7. Vehicle group in accordance with Table 1 ...
    - 1.1.8. Corrected actual curb mass (kg) ...
    - 1.1.9. Vocational vehicle (yes/no) ...
    - 1.1.10. Zero emission heavy-duty vehicle (yes/no) ...
    - 1.1.11. Hybrid electric heavy-duty vehicle (yes/no) ...
    - 1.1.12. Dual-fuel vehicle (yes/no) ...
    - 1.1.13. Sleeper cab (yes/no) ...
  - 1.2. Main engine specifications
    - 1.2.1. Engine model
    - 1.2.2. Engine certification number ...
    - 1.2.3. Engine rated power (kW) ...
    - 1.2.4. Engine idling speed (1/min) ...
    - 1.2.5. Engine rated speed (1/min) ...
    - 1.2.6. Engine capacity (ltr) ...
    - 1.2.7. Fuel type (Diesel CI/CNG PI/LNG PI...) ...
    - 1.2.8. Hash of the engine input data and input information .....
  - 1.3. Main transmission specifications
    - 1.3.1. Transmission model
    - 1.3.2. Transmission certification number ...
    - 1.3.3. Main option used for generation of loss maps (Option1/Option2/Option3/Standard values)...
    - 1.3.4. Transmission type (SMT, AMT, APT-S, APT-P) ...
    - 1.3.5. Nr. of gears ...
    - 1.3.6. Transmission ratio final gear ...
    - 1.3.7. Retarder type ...
    - 1.3.8. Power take off (yes/no) ...
    - 1.3.9. Hash of the transmission input data and input information .....
  - 1.4. Retarder specifications
    - 1.4.1. Retarder model
    - 1.4.2. Retarder certification number ...
    - 1.4.3. Certification option used for generation of a loss map (standard...
    - 1.4.4. Hash of the other torque transferring components input data and...
  - 1.5. Torque converter specification
    - 1.5.1. Torque converter model
    - 1.5.2. Torque converter certification number ...
    - 1.5.3. Certification option used for generation of a loss map (standard...
    - 1.5.4. Hash of the torque converter input data and input information...

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- 1.6. Angle drive specifications
    - 1.6.1. Angle drive model
    - 1.6.2. Axle certification number ...
    - 1.6.3. Certification option used for generation of a loss map (standard...
    - 1.6.4. Angle drive ratio ...
    - 1.6.5. Hash of the additional driveline components input data and input...
  - 1.7. Axle specifications
    - 1.7.1. Axle model ...
    - 1.7.2. Axle certification number ...
    - 1.7.3. Certification option used for generation of a loss map (standard...
    - 1.7.4. Axle type (e.g. standard single driven axle) ...
    - 1.7.5. Axle ratio ...
    - 1.7.6. Hash of the axle input data and input information .....
  - 1.8. Aerodynamics
    - 1.8.1. Model
    - 1.8.2. Certification option used for generation of CdxA (standard values / measurement)...
    - 1.8.3. CdxA Certification number (if applicable) ...
    - 1.8.4. CdxA value ...
    - 1.8.5. Hash of the air drag input data and input information...
  - 1.9. Main tyre specifications
    - 1.9.1. Tyre dimension axle 1 ...
    - 1.9.2. Tyre certification number ...
    - 1.9.3. Specific RRC of all tyres on axle 1 ...
    - 1.9.3a. Hash of the tyre input data and input information axle...
    - 1.9.4. Tyre dimension axle 2 ...
    - 1.9.5. Twin axle (yes/no) axle 2 ...
    - 1.9.6. Tyre certification number ...
    - 1.9.7. Specific RRC of all tyres on axle 2 ...
    - 1.9.7a. Hash of the tyre input data and input information axle...
    - 1.9.8. Tyre dimension axle 3 ...
    - 1.9.9. Twin axle (yes/no) axle 3 ...
    - 1.9.10. Tyre certification number ...
    - 1.9.11. Specific RRC of all tyres on axle 3 ...
    - 1.9.11a. Hash of the tyre input data and input information axle...
    - 1.9.12. Tyre dimension axle 4 ...
    - 1.9.13. Twin axle (yes/no) axle 4 ...
    - 1.9.14. Tyre certification number ...
    - 1.9.15. Specific RRC of all tyres on axle 4 ...
    - 1.9.16. Hash of the tyre input data and input information axle...
  - 1.10. Main auxiliary specifications
    - 1.10.1. Engine cooling fan technology ...
    - 1.10.2. Steering pump technology ...
    - 1.10.3. Electric system technology ...
    - 1.10.4. Pneumatic system technology ...
  - 1.11. Engine torque limitations
    - 1.11.1. Engine torque limit at gear 1 (% of max engine...
    - 1.11.2. Engine torque limit at gear 2 (% of max engine...
    - 1.11.3. Engine torque limit at gear 3 (% of max engine...
    - 1.11.4. Engine torque limit at gear ... (% of max engine...
  - 1.12. Advanced driver assistance systems (ADAS)
2. Mission profile and loading dependent values

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- 2.1. Simulation parameters (for each profile/load/fuel combination)
  - 2.1.1. Mission profile (long haul/long haul (EMS)/regional/regional (EMS)/urban/municipal/construction) ...
  - 2.1.2. Load (as defined in the simulation tool) (kg) ...
  - 2.1.3. Fuel (diesel/petrol/LPG/CNG/...) ...
  - 2.1.4. Total vehicle mass in simulation (kg) ...
- 2.2. Vehicle driving performance and information for simulation quality check
  - 2.2.1. Average speed (km/h) ...
  - 2.2.2. Minimum instantaneous speed (km/h) ...
  - 2.2.3. Maximum instantaneous speed (km/h) ...
  - 2.2.4. Maximum deceleration (m/s<sup>2</sup>) ...
  - 2.2.5. Maximum acceleration (m/s<sup>2</sup>) ...
  - 2.2.6. Full load percentage on driving time ...
  - 2.2.7. Total number of gear shifts ...
  - 2.2.8. Total driven distance (km) ...
- 2.3. Fuel and CO<sub>2</sub> results
  - 2.3.1. Fuel consumption (g/km) ...
  - 2.3.2. Fuel consumption (g/t-km) ...
  - 2.3.3. Fuel consumption (g/p-km) ...
  - 2.3.4. Fuel consumption (g/m<sup>3</sup>-km) ...
  - 2.3.5. Fuel consumption (l/100km) ...
  - 2.3.6. Fuel consumption (l/t-km) ...
  - 2.3.7. Fuel consumption (l/p-km) ...
  - 2.3.8. Fuel consumption (l/m<sup>3</sup>-km) ...
  - 2.3.9. Fuel consumption (MJ/km) ...
  - 2.3.10. Fuel consumption (MJ/t-km) ...
  - 2.3.11. Fuel consumption (MJ/p-km) ...
  - 2.3.12. Fuel consumption (MJ/m<sup>3</sup>-km) ...
  - 2.3.13. CO<sub>2</sub> (g/km) ...
  - 2.3.14. CO<sub>2</sub> (g/t-km) ...
  - 2.3.15. CO<sub>2</sub> (g/p-km) ...
  - 2.3.16. CO<sub>2</sub> (g/m<sup>3</sup>-km) ...
- 3. Software and user information
  - 3.1. Software and user information
    - 3.1.1. Simulation tool version (X.X.X) ...
    - 3.1.2. Date and time of the simulation
    - 3.1.3. Hash of simulation tool input information and input data .....
    - 3.1.4. Cryptographic hash of the manufacturer's records file ...

## PART II

### Vehicle CO<sub>2</sub> emissions and fuel consumption - Customer information file...

- 1. Vehicle, component, separate technical unit and systems data
  - 1.1. Vehicle data
    - 1.1.1. Vehicle identification number (VIN) ...
    - 1.1.2. Vehicle category (N1 N2, N3, M1, M2, M3) ...
    - 1.1.3. Axle configuration ...
    - 1.1.4. Max. gross vehicle weight (t) ...
    - 1.1.5. Vehicle's group ...
    - 1.1.6. Name and address of manufacturer ...
    - 1.1.7. Model ...
    - 1.1.8. Corrected actual curb mass (kg) ...

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- 1.1.9. Vocational vehicle (yes/no) ...
- 1.1.10. Zero emission heavy-duty vehicle (yes/no) ...
- 1.1.11. Hybrid electric heavy-duty vehicle (yes/no) ...
- 1.1.12. Dual-fuel vehicle (yes/no) ...
- 1.1.13. Sleeper cab (yes/no) ...
- 1.2. Component, separate technical unit and systems data
  - 1.2.1. Engine rated power (kW) ...
  - 1.2.2. Engine capacity (ltr) ...
  - 1.2.3. Fuel type (Diesel CI/CNG PI/LNG PI...) ...
  - 1.2.4. Transmission values (measured/standard) ...
  - 1.2.5. Transmission type (SMT, AMT, AT-S, AT-S) ...
  - 1.2.6. Nr. of gears ...
  - 1.2.7. Retarder (yes/no) ...
  - 1.2.8. Axle ratio ...
  - 1.2.9. Average rolling resistance coefficient (RRC) of all tyres of the...
  - 1.2.10. Average fuel efficiency labelling class of all tyres of the...
  - 1.2.11. Engine stop-start during vehicle stops (yes/no) ...
  - 1.2.12. Eco-roll without engine stop-start (yes/no) ...
  - 1.2.13. Eco-roll with engine stop-start (yes/no) ...
  - 1.2.14. Predictive cruise control (yes/no) ...
- 2. CO<sub>2</sub> emissions and fuel consumption of the vehicle (for...
  - 2.1. Payload low [kg]:
  - 2.2. Payload representative [kg]:
  - 2.3. Specific CO<sub>2</sub> emissions [gCO<sub>2</sub>/tkm] ...
  - 2.4. Average payload value [t] ...
  - 2.5. Software and user information

- 3. Cryptographic hash of the manufacturer's records file ...

### PART III

CO<sub>2</sub> emissions and fuel consumption of the vehicle (for each...

### ANNEX V

#### VERIFYING ENGINE DATA

- 1. Introduction
- 2. Definitions
- 3. General requirements
  - 3.1 Test conditions
    - 3.1.1 Laboratory test conditions
    - 3.1.2 Engine installation
    - 3.1.3 Crankcase emissions
    - 3.1.4 Engines with charge air-cooling
    - 3.1.5 Engine cooling system
  - 3.2 Fuels
  - 3.3 Lubricants
  - 3.4 Fuel flow measurement system
  - 3.5 Measurement equipment specifications



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- 3.5.1 Measurement equipment verification
- 4. Testing procedure
  - 4.1 Overview of testruns to be performed
  - 4.2 Allowed changes to the engine system
  - 4.3 Testruns
    - 4.3.1 Engine full load curve
    - 4.3.2 Engine motoring curve
    - 4.3.3 WHTC test
      - 4.3.3.1 Measurement signals and data recording
    - 4.3.4 WHSC test
      - 4.3.4.1 Measurement signals and data recording
    - 4.3.5 Fuel consumption mapping cycle (FCMC)
      - 4.3.5.1 Handling of interruptions during the FCMC
        - 4.3.5.1.1 Provisions for continuing the FCMC
      - 4.3.5.2 Grid of target setpoints
        - 4.3.5.2.1 Definition of target engine speed setpoints
        - 4.3.5.2.2 Definition of target torque setpoints
      - 4.3.5.3 Measurement signals and data recording
      - 4.3.5.4 Preconditioning of the engine system
      - 4.3.5.5 Test sequence
      - 4.3.5.6 Data evaluation for emission monitoring
        - 4.3.5.6.1 Definition of control area
          - 4.3.5.6.1.1 Engine speed range for the control area
          - 4.3.5.6.1.2 Engine torque and power range for the control area
        - 4.3.5.6.2 Definition of the grid cells
        - 4.3.5.6.3 Calculation of specific mass emissions
      - 4.3.5.7 Validity of data
        - 4.3.5.7.1 Requirements for validation statistics of the FCMC
        - 4.3.5.7.2 Requirements for emission monitoring
- 5. Post-processing of measurement data
  - 5.1 Calculation of engine work
  - 5.2 Calculation of integrated fuel consumption
  - 5.3 Calculation of specific fuel consumption figures
    - 5.3.1 Specific fuel consumption figures for WHTC correction factor
    - 5.3.2 Specific fuel consumption figures for cold-hot emission balancing factor
    - 5.3.3 Specific fuel consumption figures over WHSC
      - 5.3.3.1 Corrected specific fuel consumption figures over WHSC
      - 5.3.3.2 Special provisions for B7 reference fuel
  - 5.4 Correction factor for engines equipped with exhaust after-treatment systems that...
- 6. Application of engine pre-processing tool
  - 6.1 Input data for the engine pre-processing tool
    - 6.1.1 Full load curve of the CO<sub>2</sub>-parent engine
    - 6.1.2 Full load curve
    - 6.1.3 Motoring curve of the CO<sub>2</sub>-parent engine
    - 6.1.4 Fuel consumption map of the CO<sub>2</sub>-parent engine
    - 6.1.5 Specific fuel consumption figures for WHTC correction factor

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- 6.1.6 Specific fuel consumption figures for cold-hot emission balancing factor
- 6.1.7 Correction factor for engines equipped with exhaust after-treatment systems that...
- 6.1.8 NCV of test fuel
- 6.1.9 Type of test fuel
- 6.1.10 Engine idle speed of the CO<sub>2</sub>-parent engine
- 6.1.11 Engine idle speed
- 6.1.12 Engine displacement
- 6.1.13 Engine rated speed
- 6.1.14 Engine rated power
- 6.1.15 Manufacturer
- 6.1.16 Model
- 6.1.17 Technical Report ID

## Appendix 1

### MODEL OF A CERTIFICATE OF A COMPONENT, SEPARATE TECHNICAL UNIT...

Maximum format: A4 (210 × 297 mm)

#### CERTIFICATE ON CO<sub>2</sub> EMISSIONS AND FUEL CONSUMPTION RELATED PROPERTIES OF...

### SECTION I

0.1. Make (trade name of manufacturer):

- 0.1. Make (trade name of manufacturer):
- 0.2. Type:
- 0.3. Means of identification of type
  - 0.3.1. Location of the certification marking:
  - 0.3.2. Method of affixing certification marking:
- 0.5. Name and address of manufacturer:
- 0.6. Name(s) and address(es) of assembly plant(s):
- 0.7. Name and address of the manufacturer's representative (if any)

### SECTION II

1. Additional information (where applicable): see Addendum

- 1. Additional information (where applicable): see Addendum
- 2. Approval authority responsible for carrying out the tests:
- 3. Date of test report:
- 4. Number of test report:
- 5. Remarks (if any): see Addendum
- 6. Place:
- 7. Date:
- 8. Signature:

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## Appendix 2

### Engine Information Document

Notes regarding filling in the tables:

#### PART 1

Essential characteristics of the (parent) engine and the engine types...

Notes:

- (1) Delete where not applicable (there are cases where nothing needs...
- (3) This figure shall be rounded off to the nearest tenth...
- (4) This value shall be calculated and rounded off to the...
- (5) Specify the tolerance.
- (6) Determined in accordance with the requirements of Regulation No. 85...
- (7) Please fill in here the upper and lower values for...
- (8) To be documented in case of a single OBD engine...

#### Appendix to information document

##### Information on test conditions

1. Spark plugs
  - 1.1. Make
  - 1.2. Type
  - 1.3. Spark-gap setting
2. Ignition coil
  - 2.1. Make
  - 2.2. Type
3. Lubricant used
  - 3.1. Make
  - 3.2. Type (state percentage of oil in mixture if lubricant and...
  - 3.3. Specifications of lubricant
4. Test fuel used
  - 4.1. Fuel type (in accordance with paragraph 6.1.9 of Annex V...
  - 4.2. Unique identification number (production batch number) of fuel used
  - 4.3. Net calorific value (NCV) (in accordance with paragraph 6.1.8 of...
  - 4.4. Reference fuel type (type of reference fuel used for testing...
5. Engine-driven equipment
  - 5.1. The power absorbed by the auxiliaries/equipment needs only be determined,...  
Note: Requirements for engine-driven equipment differ between emissions test and power...
  - 5.2. Enumeration and identifying details
  - 5.3. Power absorbed at engine speeds specific for emissions test
  - 5.4. Fan constant determined in accordance with Appendix 5 to this...
    - 5.4.1. Cavg-fan (if applicable)
    - 5.4.2. Cind-fan (if applicable)
6. Engine performance (declared by manufacturer)
  - 6.1. Engine test speeds for emissions test according to Annex 4...
  - 6.2. Declared values for power test according to Regulation No. 85...

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### Appendix 3

#### Engine CO<sub>2</sub>-Family

1. Parameters defining the engine CO<sub>2</sub>-family
  - 1.1. Combustion relevant geometric data
    - 1.1.1. Displacement per cylinder
    - 1.1.2. Number of cylinders
    - 1.1.3. Bore and stroke data
    - 1.1.4. Combustion chamber geometry and compression ratio
    - 1.1.5. Valve diameters and port geometry
    - 1.1.6. Fuel injectors (design and position)
    - 1.1.7. Cylinder head design
    - 1.1.8. Piston and piston ring design
  - 1.2. Air management relevant components
    - 1.2.1. Pressure charging equipment type (waste gate, VTG, 2-stage, other) and...
    - 1.2.2. Charge air cooling concept
    - 1.2.3. Valve timing concept (fixed, partly flexible, flexible)
    - 1.2.4. EGR concept (uncooled/cooled, high/low pressure, EGR-control)
  - 1.3. Injection system
  - 1.4. Auxiliary/equipment propulsion concept (mechanically, electrically, other)
  - 1.5. Waste heat recovery (yes/no; concept and system)
  - 1.6. Aftertreatment system
    - 1.6.1. Reagent dosing system characteristics (reagent and dosing concept)
    - 1.6.2. Catalyst and DPF (arrangement, material and coating)
    - 1.6.3. HC dosing system characteristics (design and dosing concept)
  - 1.7. Full load curve
    - 1.7.1. The torque values at each engine speed of the full...
    - 1.7.2. The torque values at each engine speed of the full...
    - 1.7.3. Torque values within a tolerance band related to the reference...
  - 1.8. Characteristic engine test speeds
    - 1.8.1. The engine idle speed,  $n_{idle}$ , of the CO...
    - 1.8.2. The engine speed  $n_{95h}$  of all other engines than the...
    - 1.8.3. The engine speed  $n_{57}$  of all other engines than the...
  - 1.9. Minimum number of points in the fuel consumption map
    - 1.9.1. All engines within the same CO<sub>2</sub>-family shall have a minimum...
2. Choice of the CO<sub>2</sub>-parent engine
  - 2.1. Highest power rating of all engines within the engine CO<sub>2</sub>-family....

### Appendix 4

#### Conformity of CO<sub>2</sub> emissions and fuel consumption related properties

1. General provisions
  - 1.1. Conformity of CO<sub>2</sub> emissions and fuel consumption related properties shall...
  - 1.2. If an engine certificate has had one or more extensions,...
  - 1.3. All engines subject to tests shall be taken from the...

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- 1.4 The tests may be conducted with the applicable market fuels....
- 1.5 If tests for the purpose of conformity of CO<sub>2</sub> emissions...
2. Number of engines and engine CO<sub>2</sub>-families to be tested
  - 2.1 0,05 percent of all engines produced in the past production...
  - 2.2 Notwithstanding the provisions in point 2.1, a minimum number of...
  - 2.3 The resulting figure for nCOP<sub>base</sub> determined in accordance with points...
  - 2.4 In the case that a manufacturer has less CO<sub>2</sub>-families than...
3. Selection of engine CO<sub>2</sub>-families to be tested
4. Testrun to be performed
5. Run-in of newly manufactured engines
  - 5.1 The tests shall be carried out on newly manufactured engines...
  - 5.2 At the request of the manufacturer, the tests may be...
  - 5.3 When the manufacturer requests to conduct a running-in procedure in...
  - 5.4 If the provisions defined in point 5.3 (b) of this...
  - 5.5 In the case described in point 5.4 of this Appendix...
  - 5.6 Instead of using a running-in procedure in accordance with points...
  - 5.7 If the evolution coefficient in accordance with point 5.3 (b)...
6. Target value for assessment of conformity of the certified CO<sub>2</sub>...
7. Actual value for assessment of conformity of the certified CO<sub>2</sub>...
  - 7.1 The specific fuel consumption over the WHSC, SFCWHSC, shall be...
  - 7.2 If market fuel was used during testing in accordance with...
  - 7.3 If reference fuel was used during testing in accordance with...
  - 7.4 The measured emission of gaseous pollutants over the WHSC performed...
8. Limit for conformity of one single test
9. Assessment of conformity of the certified CO<sub>2</sub> emissions and fuel...
  - 9.1 The emission test results over the WHSC determined in accordance...
  - 9.2 A single test of one engine tested in accordance with...
  - 9.3 For the current sample size of engines tested within one...
  - 9.4 If neither a pass nor a fail decision is reached,...

## Appendix 5

### Determination of power consumption of engine components

1. Fan
2. Electric components/equipment

## Appendix 6

1. Markings
  - 1.1. The manufacturer's name or trade mark
  - 1.2. The make and identifying type indication as recorded in the...
  - 1.3. The certification mark as a rectangle surrounding the lower-case letter...
  - 1.4. The certification mark shall also include in the vicinity of...
    - 1.4.1 Example and dimensions of the certification mark (separate marking)
  - 1.5. In the case that the certification in accordance with this...
    - 1.5.1. Example of the certification mark (joined marking)
  - 1.6. On request of the applicant for certification and after prior...
  - 1.7. The markings, labels, plates or stickers must be durable for...

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## 2 Numbering

- 2.1. Certification number for engines shall comprise the following:

### Appendix 7

#### Input parameters for the simulation tool

- Introduction
- Definitions
- Set of input parameters

### Appendix 8

#### Important evaluation steps and equations of the engine pre-processing tool...

1. Reading of input files and automatic check of input data...
  - 1.1 Check of requirements for input data according to the definitions...
  - 1.2 Check of requirements for recorded FCMC data according to the...
2. Calculation of characteristic engine speeds from full load curves of...
3. Processing of fuel consumption (FC) map
  - 3.1 FC values at nidle are copied to engine speed (nidle...
  - 3.2 FC values at n95h are copied to engine speed (n95h...
  - 3.3 Extrapolation of FC values at all engine speed setpoints to...
  - 3.4 Adding of FC = 0 for interpolated motoring torque values at...
  - 3.5 Adding of FC = 0 for minimum of interpolated motoring torque...
4. Simulation of FC and cycle work over WHTC and respective...
  - 4.1 WHTC reference points are denormalized using the full load curve...
  - 4.2 FC is calculated for WHTC denormalized reference values for engine...
  - 4.3 FC is calculated with engine inertia set to 0
  - 4.4 FC is calculated with standard PT1-function (as in main vehicle...
  - 4.5 FC for all motoring points is set to 0
  - 4.6 FC for all non-motoring engine operation points is calculated from...
  - 4.7 Cycle work and FC are calculated according to equations defined...
  - 4.8 Simulated specific FC values are calculated analogous to equations defined...
5. Calculation of WHTC correction factors
  - 5.1 Measured values from input to pre-processing tool and simulated values...
  - 5.2  $CF_{Urban} = SFC_{meas,Urban} / SFC_{simu,Urban}$
  - 5.3  $CF_{Rural} = SFC_{meas,Rural} / SFC_{simu,Rural}$
  - 5.4  $CF_{MW} = SFC_{meas,MW} / SFC_{simu,MW}$
  - 5.5 In case that the calculated value for a correction factor...
6. Calculation of cold-hot emission balancing factor
  - 6.1 This factor is calculated in accordance with the equation in...
  - 6.2  $BF_{cold-hot} = 1 + 0,1 \times (SFC_{meas,cold} - SFC_{meas,hot}) / SFC_{meas,hot}$
  - 6.3 In case that the calculated value for this factor is...
7. Correction of FC values in FC map to standard NCV...
  - 7.1 This correction is performed in accordance with the equation in...
  - 7.2  $FC_{corrected} = FC_{measured,map} \times NCV_{meas} / NVC_{std}$
  - 7.3  $FC_{measured,map}$  shall be the FC value in the FC map...
  - 7.4  $NCV_{meas}$  and  $NVC_{std}$  shall be defined in accordance with paragraph...

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- 7.5. In the case that reference fuel of the type B7...
- 8. Converting of engine full load and motoring torque values of...
  - 8.1. If the average logging frequency of the engine speed of...

## ANNEX VI

### VERIFYING TRANSMISSION, TORQUE CONVERTER, OTHER TORQUE TRANSFERRING COMPONENT AND ADDITIONAL DRIVELINE COMPONENT DATA

- 1. Introduction
- 2. Definitions
- 3. Testing procedure for transmissions
  - 3.1 Option 1: Measurement of the torque independent losses, calculation of...
    - 3.1.1. The torque dependent losses of a transmission system shall be...
      - 3.1.1.1. For each indirect gear  $g$  of common transmissions with a...
      - 3.1.1.2. For each active gear mesh, the torque dependent efficiency shall...
      - 3.1.1.3. The product of these torque dependent efficiencies in active gear...
      - 3.1.1.4. The total torque dependent efficiency  $\eta_{Tg}$  for the gear...
      - 3.1.1.5. The torque dependent loss coefficient  $f_{Tg}$  for the gear  $g$ ...
      - 3.1.1.6. The torque dependent loss  $T_{l,in}Tg$  on the input shaft for...
      - 3.1.1.7. The torque dependent efficiency of the planetary range section in...
      - 3.1.1.8. For all other transmission types with more complex split power...
      - 3.1.1.9. Assuming 1 rad/s of input speed and 1 Nm of...
      - 3.1.1.10 For each planetary gear set, the relative speeds sun-to-carrier and...
      - 3.1.1.11 The loss-producing powers in the gear meshes shall be computed...
      - 3.1.1.12 All loss-adjusted power values shall be added up to the...
      - 3.1.1.13 The torque dependent loss coefficient for bearings,
      - 3.1.1.14 The torque dependent losses on the input shaft for the...
    - 3.1.2. The torque independent losses shall be measured in accordance with...
      - 3.1.2.1. General requirements
      - 3.1.2.2. Differential measurements
      - 3.1.2.3. Run-in
        - 3.1.2.3.1 The procedure shall not exceed 30 hours per gear and...
        - 3.1.2.3.2 The application of the input torque shall be limited to...
        - 3.1.2.3.3 The maximum input speed shall be limited by the specified...
        - 3.1.2.3.4 The speed and torque profile for the run-in procedure shall...
        - 3.1.2.3.5 The run-in procedure shall be documented by the manufacturer with...
        - 3.1.2.3.6 The requirements for the ambient temperature (3.1.2.5.1.), measurement accuracy (3.1.4.),...

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- 3.1.2.4. Pre-conditioning
  - 3.1.2.4.1 Pre-conditioning of the transmission and the test rig equipment to...
  - 3.1.2.4.2 The pre-conditioning shall be performed on the direct drive gear...
  - 3.1.2.4.3 The maximum input speed shall be limited by the specified...
  - 3.1.2.4.4 The maximum combined time for the pre-conditioning shall not exceed...
  - 3.1.2.4.5 The pre-conditioning time shall not be accounted to the time...
- 3.1.2.5. Test conditions
  - 3.1.2.5.1 Ambient temperature
  - 3.1.2.5.2 Oil temperature
  - 3.1.2.5.3 Oil quality
  - 3.1.2.5.4 Oil viscosity
  - 3.1.2.5.5 Oil level and conditioning
- 3.1.3. Installation
  - 3.1.3.1. The electric machine and the torque sensor shall be mounted...
  - 3.1.3.2. The installation of the transmission shall be done with an...
  - 3.1.3.3. The internal oil pump shall be included in the transmission....
  - 3.1.3.4. If an oil cooler is either optional or required with...
  - 3.1.3.5. Transmission testing can be done with or without power take-off...
  - 3.1.3.6. Measuring the transmission may be performed with or without single...
  - 3.1.3.7. The individual influence of parasitic loads shall be calculated for...
- 3.1.4. Measurement equipment
  - 3.1.4.1. Torque
  - 3.1.4.2. Speed
  - 3.1.4.3. Temperature
  - 3.1.4.4. Pressure
  - 3.1.4.5. Voltage
  - 3.1.4.6. Electric current
- 3.1.5. Measurement signals and data recording
- 3.1.6. Test procedure
  - 3.1.6.1. Zero torque signal compensation:
  - 3.1.6.2. Speed range:
  - 3.1.6.3. Measurement sequence:
- 3.1.7. Measurement validation
  - 3.1.7.1. The arithmetic mean values of torque, speed, (if applicable) voltage...
  - 3.1.7.2. The averaged speed deviation shall be below  $\pm 5$  rpm...
  - 3.1.7.3. The mechanical torque losses and (if applicable) electrical power consumption...
  - 3.1.7.4. The mechanical torque losses and (if applicable) electrical power consumption...
  - 3.1.7.5. The deviation between the averaged torque losses of the two...
  - 3.1.7.6. If the deviation is higher, the largest averaged torque loss...
  - 3.1.7.7. The deviation between the averaged electric power consumption (voltage \*...
  - 3.1.7.8. If the deviation is higher, the set of averaged voltage...



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- 3.1.8. Measurement uncertainty
- 3.2. Option 2: Measurement of the torque independent losses, measurement of...
  - 3.2.1. The torque losses shall be measured in accordance with the...
    - 3.2.1.1. General requirements:
    - 3.2.1.2. Differential measurements:
    - 3.2.1.3. Run-in
    - 3.2.1.4. Pre-conditioning
    - 3.2.1.5. Test conditions
      - 3.2.1.5.1 Ambient temperature
      - 3.2.1.5.2 Oil temperature
      - 3.2.1.5.3 Oil quality / Oil viscosity
      - 3.2.1.5.4 Oil level and conditioning
  - 3.2.2. Installation
  - 3.2.3. Measurement equipment
  - 3.2.4. Measurement signals and data recording
  - 3.2.5. Test procedure
    - 3.2.5.1. The torque independent losses shall be determined by the procedure...
    - 3.2.5.2. Determine the torque dependent losses for each of the gears...
  - 3.2.6. Measurement validation
  - 3.2.7. Measurement uncertainty
- 3.3. Option 3: Measurement of the total torque loss.
  - 3.3.1. General requirements
    - 3.3.1.1 Differential measurements:
  - 3.3.2. Run-in
    - 3.3.2.1 Pre-conditioning
  - 3.3.3. Test conditions
    - 3.3.3.1. Ambient temperature
    - 3.3.3.2. Oil temperature
    - 3.3.3.3. Oil quality / Oil viscosity
    - 3.3.3.4. Oil level and conditioning
  - 3.3.4. Installation
  - 3.3.5. Measurement equipment
  - 3.3.6. Test procedure
    - 3.3.6.1. Zero torque signal compensation:
    - 3.3.6.2. Speed range
    - 3.3.6.3. Torque range
    - 3.3.6.4. Measurement sequence
      - 3.3.6.4.1 The measurements shall be performed beginning with the lowest up...
      - 3.3.6.4.2 The input torque shall be varied according to the above...
      - 3.3.6.4.3 For each speed and torque step a minimum of 5...
      - 3.3.6.4.4 The measurement set shall be performed two times in total....
  - 3.3.7. Measurement signals and data recording
  - 3.3.8. Measurement validation
    - 3.3.8.1. The arithmetic mean values of torque, speed, if applicable voltage...
    - 3.3.8.2. The measured and averaged speed at the input shaft shall...
    - 3.3.8.3. The mechanical torque losses and (if applicable) electrical power consumption...

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- 3.3.8.4. The mechanical torque losses and (if applicable) electrical power consumption...
- 3.3.8.5. The deviation between the averaged torque losses of the two...
- 3.3.8.6. The deviation between the averaged electric power consumption (voltage\*current) values...
- 3.3.8.7. If the deviation is higher, the set of averaged voltage...
- 3.3.9. Measurement uncertainty
- 3.4. Complement of input files for the simulation tool
  - 3.4.1. In the cases the highest tested input speed was the...
  - 3.4.2. In the cases the highest tested input torque was the...
  - 3.4.3. In the case of extrapolation of the torque loss values...
  - 3.4.4. If the maximum output torque exceeds 10 kNm (for a theoretical...
  - 3.4.5. For speeds below the defined minimum speed and the additional...
  - 3.4.6. To cover the range of negative input torques during vehicle...
  - 3.4.7. Upon agreement of an approval authority, the torque losses for...
  - 3.4.8. If the measurement of speed points is technically not possible...
  - 3.4.9. The torque loss map data shall be formatted and saved...
- 4. Torque converter (TC)
  - 4.1. Option A: Measured torque converter characteristics at constant speed
    - 4.1.1. General requirements
    - 4.1.2. Oil temperature
    - 4.1.3. Oil flow rate and pressure
    - 4.1.4. Oil quality/Oil viscosity
    - 4.1.5. Installation
    - 4.1.6. Measurement equipment
      - 4.1.6.1. Torque
      - 4.1.6.2. Speed
      - 4.1.6.3. Temperature
    - 4.1.7. Test procedure
      - 4.1.7.1. Zero torque signal compensation
      - 4.1.7.2. Measurement sequence
        - 4.1.7.2.1The input speed  $n_{p_{um}}$  of the TC shall be fixed...
        - 4.1.7.2.2The speed ratio  $v$  shall be adjusted by increasing the...
        - 4.1.7.2.3The step width shall be 0,1 for the speed ratio...
        - 4.1.7.2.4The upper limit of the speed ratio may be limited...
        - 4.1.7.2.5For each step a minimum of 3 seconds stabilization time...
        - 4.1.7.2.6For each step the signals specified in 4.1.8. shall be...
        - 4.1.7.2.7The measurement sequence (4.1.7.2.1. to 4.1.7.2.6.) shall be performed two...
    - 4.1.8. Measurement signals and data recording
    - 4.1.9. Measurement validation
      - 4.1.9.1. The arithmetic mean values of torque and speed for the...
      - 4.1.9.2. The measured torques and speeds from the two sets shall...
      - 4.1.9.3. The deviation between the averaged torque of the two measurement...
      - 4.1.9.4. The measured and averaged speed and torque at the input...
    - 4.1.10. Measurement uncertainty
    - 4.1.11. Calculation of TC characteristics
  - 4.2. Option B: Measurement at constant input torque (in accordance with...
    - 4.2.1. General requirements
    - 4.2.2. Oil temperature

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- 4.2.3. Oil flow rate and pressure
  - 4.2.4. Oil quality
  - 4.2.5. Installation
  - 4.2.6. Measurement equipment
  - 4.2.7. Test procedure
    - 4.2.7.1. Zero torque signal compensation
    - 4.1.7.2. Measurement sequence
      - 4.2.7.2.1. The input torque  $T_{pum}$  shall be set to a positive...
      - 4.2.7.2.2. The speed ratio  $v$  shall be adjusted by increasing the...
      - 4.2.7.2.3. The step width shall be 0.1 for the speed ratio...
      - 4.2.7.2.4. The upper limit of the speed ratio may be limited...
      - 4.2.7.2.5. For each step a minimum of 5 seconds stabilization time...
      - 4.2.7.2.6. For each step the values specified in 4.2.8. shall be...
      - 4.2.7.2.7. The measurement sequence (4.2.7.2.1. to 4.2.7.2.6.) shall be performed two...
  - 4.2.8. Measurement signals and data recording
  - 4.2.9. Measurement validation
  - 4.2.10. Measurement uncertainty
  - 4.2.11. Calculation of TC characteristics
5. Other torque transferring components (OTTC)
- 5.1. Methods for establishing retarder drag losses
    - 5.1.1. General requirements
    - 5.1.2. Run-in
      - 5.1.2.1. If the manufacturer applies a run-in procedure to the retarder,...
    - 5.1.3. Test conditions
      - 5.1.3.1. Ambient temperature
      - 5.1.3.2. Ambient pressure
      - 5.1.3.3. Oil or water temperature
      - 5.1.3.4. Oil or water quality
      - 5.1.3.5. Oil viscosity
      - 5.1.3.6. Oil or water level
    - 5.1.4. Installation
    - 5.1.5. Measurement equipment
    - 5.1.6. Test procedure
      - 5.1.6.1. Zero torque signal compensation:
      - 5.1.6.2. Measurement sequence
        - 5.1.6.2.1. Measurement on the retarder as stand-alone unit
        - 5.1.6.2.2. Measurement in combination with the transmission
          - 5.1.6.2.2.1. In case the retarder is tested in combination with a...
          - 5.1.6.2.2. The torque loss shall be measured at the operating speeds...
          - 5.1.6.2.2. Measurement points may be added for transmission input speeds below...
          - 5.1.6.2.2. The manufacturer may separate the retarder losses from the total...
    - 5.1.7. Measurement signals and data recording
    - 5.1.8. Measurement validation
  - 5.2. Complement of input files for the simulation tool
    - 5.2.1. Retarder torque losses for speeds below the lowest measurement speed...

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- 5.2.2 In case the retarder losses were separated out from the...
- 5.2.3 The torque loss map data shall be formatted and saved...
- 6. Additional driveline components (ADC) / angle drive
  - 6.1. Methods for establishing angle drive losses
    - 6.1.1. Case A: Measurement on a separate angle drive
      - 6.1.1.1 Applicable speed range:
      - 6.1.1.2 Speed step size: 200 rpm
    - 6.1.2. Case B: Individual measurement of an angle drive connected to...
      - 6.1.2.1 The manufacturer may separate the angle drive losses from the...
  - 6.2. Complement of input files for the simulation tool
    - 6.2.1. Torque losses for speeds below the above defined minimum speed...
    - 6.2.2. In the cases the highest tested angle drive input speed...
    - 6.2.3. To calculate the torque loss data for the input shaft...
- 7. Conformity of the certified CO<sub>2</sub> emissions and fuel consumption related...
  - 7.1. Every transmission, torque converter (TC), other torque transferring components (OTTC)...
  - 7.2. Torque converter (TC), other torque transferring components (OTTC) and additional...
  - 7.3. Conformity of the certified CO<sub>2</sub> emissions and fuel consumption related...
  - 7.4. Conformity of the certified CO<sub>2</sub> emissions and fuel consumption related...
  - 7.5. The manufacturer shall test annually at least the number of...
  - 7.6. Each transmission which is tested by the manufacturer shall be...
  - 7.7. For the total annual production volumes between 1 001 and...
  - 7.8. For the total annual production volumes above 10 000 transmissions,...
  - 7.9. For the purpose of the conformity of the certified CO<sub>2</sub>...
  - 7.10. If the result of a test performed in accordance with...
- 8. Production conformity testing
  - 8.1. Conformity testing of transmissions
    - 8.1.1. The transmission efficiency shall be determined following the simplified procedure...
      - 8.1.2.1 All boundary conditions as specified in this Annex for the...
      - 8.1.2.2 For the measurement the same testing option shall be used...
        - 8.1.2.2.1 In the case Option 1 was used for certification testing,...
        - 8.1.2.2.2 The efficiency of the transmission shall be determined for 18...
      - 8.1.2.3 For each of the 18 operating points, the efficiency of...
      - 8.1.2.4 The total efficiency during conformity of the certified CO<sub>2</sub> emissions...
    - 8.1.3. The conformity of the certified CO<sub>2</sub> emissions and fuel consumption...

## Appendix 1

MODEL OF A CERTIFICATE OF A COMPONENT, SEPARATE TECHNICAL UNIT...

Maximum format: A4 (210 × 297 mm)

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## CERTIFICATE ON CO2 EMISSIONS AND FUEL CONSUMPTION RELATED PROPERTIES OF...

### SECTION I

#### 0.1 Make (trade name of manufacturer):

- 0.1 Make (trade name of manufacturer):
- 0.2 Type:
- 0.3 Means of identification of type, if marked on the component...
  - 0.3.1 Location of the marking:
- 0.4 Name and address of manufacturer:
- 0.5 In the case of components and separate technical units, location...
- 0.6 Name(s) and address(es) of assembly plant(s):
- 0.7 Name and address of the manufacturer's representative (if any)

### SECTION II

#### 1. Additional information (where applicable): see Addendum 1.1. Option used...

- 1. Additional information (where applicable): see Addendum
  - 1.1. Option used for the determination of the torque losses
    - 1.1.1 In case of transmission: specify for both output torque ranges...
- 2. Approval authority responsible for carrying out the tests:
- 3. Date of test report
- 4. Number of test report
- 5. Remarks (if any): see Addendum
- 6. Place
- 7. Date
- 8. Signature

### Appendix 2

#### Transmission information document

- 0. GENERAL
  - 0.1. Name and address of manufacturer
  - 0.2. Make (trade name of manufacturer):
  - 0.3. Transmission type:
  - 0.4. Transmission family:
  - 0.5. Transmission type as separate technical unit/Transmission family as separate technical...
  - 0.6. Commercial name(s) (if available):
  - 0.7. Means of identification of model, if marked on the transmission:...
  - 0.8. In the case of components and separate technical units, location...
  - 0.9. Name(s) and address(es) of assembly plant(s):
  - 0.10. Name and address of the manufacturer's representative:

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## PART 1

### ESSENTIAL CHARACTERISTICS OF THE (PARENT) TRANSMISSION AND THE TRANSMISSION TYPES...

- 0.0 GENERAL
  - 0.1 .....
  - 0.2 .....
  - 0.3 .....
  - 0.4 .....
  - 0.5 .....
  - 0.6 .....
  - 0.7 .....
  - 0.8 .....
  - 0.9 .....
- 1.0 SPECIFIC TRANSMISSION/TRANSMISSION FAMILY INFORMATION
  - 1.1 Gear ratio. Gearscheme and powerflow
  - 1.2 Center distance for countershaft transmissions
  - 1.3 Type of bearings at corresponding positions (if fitted)
  - 1.4 Type of shift elements (tooth clutches, including synchronisers or friction...
  - 1.5 Single gear width for Option 1 or Single gear width...
  - 1.6 Total number of forward gears
  - 1.7 Number of tooth shift clutches
  - 1.8 Number of synchronizers
  - 1.9 Number of friction clutch plates (except for single dry clutch...
  - 1.10 Outer diameter of friction clutch plates (except for single dry...
  - 1.11 Surface roughness of the teeth (incl. drawings)
  - 1.12 Number of dynamic shaft seals
  - 1.13 Oil flow for lubrication and cooling per transmission input shaft...
  - 1.14 Oil viscosity at 100 °C ( $\pm 10\%$ )
  - 1.15 System pressure for hydraulically controlled gearboxes
  - 1.16 Specified oil level in reference to central axis and in...
  - 1.17 Specified oil level ( $\pm 1$  mm)
  - 1.18 Gear ratios [-] and maximum input torque [Nm], maximum input...

#### LIST OF ATTACHMENTS

Attachment 1 to Transmission information document

Information on test conditions (if applicable)

## Appendix 3

Hydrodynamic torque converter (TC) information document

- 0. GENERAL
  - 0.1 Name and address of manufacturer
  - 0.2 Make (trade name of manufacturer):
  - 0.3 TC type:
  - 0.4 TC family:
  - 0.5 TC type as separate technical unit / TC family as...

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- 0.6 Commercial name(s) (if available):
- 0.7 Means of identification of model, if marked on the TC:...
- 0.8 In the case of components and separate technical units, location...
- 0.9 Name(s) and address(es) of assembly plant(s):
- 0.10 Name and address of the manufacturer's representative:

## PART 1

### ESSENTIAL CHARACTERISTICS OF THE (PARENT) TC AND THE TC TYPES...

- 0.0 GENERAL
  - 0.1 .....
  - 0.2 .....
  - 0.3 .....
  - 0.4 .....
  - 0.5 .....
  - 0.6 .....
  - 0.7 .....
  - 0.8 .....
  - 0.9 .....
- 1.0 SPECIFIC TORQUE CONVERTER/TORQUE CONVERTER FAMILY INFORMATION
  - 1.1 For hydrodynamic torque converter without mechanical transmission (serial arrangement).
    - 1.1.1 Outer torus diameter
    - 1.1.2 Inner torus diameter
    - 1.1.3 Arrangement of pump (P), turbine (T) and stator (S) in...
    - 1.1.4 Torus width
    - 1.1.5 Oil type according to test specification
    - 1.1.6 Blade design
  - 1.2 For hydrodynamic torque converter with mechanical transmission (parallel arrangement).
    - 1.2.1 Outer torus diameter
    - 1.2.2 Inner torus diameter
    - 1.2.3 Arrangement of pump (P), turbine (T) and stator (S) in...
    - 1.2.4 Torus width
    - 1.2.5 Oil type according to test specification
    - 1.2.6 Blade design
    - 1.2.7 Gear scheme and power flow in torque converter mode
    - 1.2.8 Type of bearings at corresponding positions (if fitted)
    - 1.2.9 Type of cooling/lubrication pump (referring to parts list)
    - 1.2.10 Type of shift elements (tooth clutches (including synchronisers) OR friction...
    - 1.2.11 Oil level according to drawing in reference to central axis...

### LIST OF ATTACHMENTS

Attachment 1 to Torque Converter information document

Information on test conditions (if applicable)

- 1. Method of measurement
  - 1.1 TC with mechanical transmission
  - 1.2 TC as separate unit

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## Appendix 4

### Other torque transferring components (OTTC) information document

0. GENERAL
  - 0.1 Name and address of manufacturer
  - 0.2 Make (trade name of manufacturer):
  - 0.3 OTTC type:
  - 0.4 OTTC family:
  - 0.5 OTTC type as separate technical unit/OTTC family as separate technical...
  - 0.6 Commercial name(s) (if available):
  - 0.7 Means of identification of model, if marked on the OTTC:...
  - 0.8 In the case of components and separate technical units, location...
  - 0.9 Name(s) and address(es) of assembly plant(s):
  - 0.10 Name and address of the manufacturer's representative:

### PART 1

### ESSENTIAL CHARACTERISTICS OF THE (PARENT) OTTC AND THE OTTC TYPES...

- 0.0 GENERAL
  - 0.1 .....
  - 0.2 .....
  - 0.3 .....
  - 0.4 .....
  - 0.5 .....
  - 0.6 .....
  - 0.7 .....
  - 0.8 .....
  - 0.9 .....
- 1.0 SPECIFIC OTTC INFORMATION
  - 1.1 For hydrodynamic torque transferring components (OTTC) / retarder
    - 1.1.1 Outer torus diameter
    - 1.1.2 Torus width
    - 1.1.3 Blade design
    - 1.1.4 Operating fluid
    - 1.1.5 Outer torus diameter - inner torus diameter (OD-ID)
    - 1.1.6 Number of blades
    - 1.1.7 Operating fluid viscosity
  - 1.2 For magnetic torque transferring components (OTTC) / Retarder
    - 1.2.1 Drum design (electro magnetic retarder or permanent magnetic retarder)
    - 1.2.2 Outer rotor diameter
    - 1.2.3 Cooling blade design
    - 1.2.4 Blade design
    - 1.2.5 Operating fluid
    - 1.2.6 Outer rotor diameter - inner rotor diameter (OD-ID)
    - 1.2.7 Number of rotors
    - 1.2.8 Number of cooling blades/blades
    - 1.2.9 Operating fluid viscosity
    - 1.2.10 Number of arms
  - 1.3 For torque transferring components (OTTC)/hydrodynamic clutch
    - 1.3.1 Outer torus diameter



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- 1.3.2 Torus width
- 1.3.3 Blade design.
- 1.3.4 Operating fluid viscosity
- 1.3.5 Outer torus diameter - inner torus diameter (OD-ID)
- 1.3.6 Number of blades

#### LIST OF ATTACHMENTS

#### Attachment 1 to OTTC information document

Information on test conditions (if applicable)

1. Method of measurement
2. Maximum test speed of OTTC main torque absorber e.g. retarder...

#### Appendix 5

Additional driveline components (ADC) information document

0. GENERAL
  - 0.1 Name and address of manufacturer
  - 0.2 Make (trade name of manufacturer):
  - 0.3 ADC type:
  - 0.4 ADC family:
  - 0.5 ADC type as separate technical unit/ADC family as separate technical...
  - 0.6 Commercial name(s) (if available):
  - 0.7 Means of identification of model, if marked on the ADC:...
  - 0.8 In the case of components and separate technical units, location...
  - 0.9 Name(s) and address(es) of assembly plant(s):
  - 0.10 Name and address of the manufacturer's representative:

#### PART 1

#### ESSENTIAL CHARACTERISTICS OF THE (PARENT) ADC AND THE ADC TYPES...

- 0.0 GENERAL
  - 0.1 .....
  - 0.2 .....
  - 0.3 .....
  - 0.4 .....
  - 0.5 .....
  - 0.6 .....
  - 0.7 .....
  - 0.8 .....
  - 0.9 .....
- 1.0 SPECIFIC ADC/ANGLE DRIVE INFORMATION
  - 1.1 Gear ratio and gearscheme
  - 1.2 Angle between input/output shaft
  - 1.3 Type of bearings at corresponding positions
  - 1.4 Number of teeth per gearwheel
  - 1.5 Single gear width
  - 1.6 Number of dynamic shaft seals
  - 1.7 Oil viscosity ( $\pm 10\%$ )

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- 1.8 Surface roughness of the teeth
- 1.9 Specified oil level in reference to central axis and in...
- 1.10 Oil level within ( $\pm$  1mm).

#### LIST OF ATTACHMENTS

#### Attachment 1 to ADC information document

##### Information on test conditions (if applicable)

- 1. Method of measurement
- 2. Maximum test speed at ADC input [rpm]

#### Appendix 6

##### Family Concept

- 1. General
  - 1.1 Special cases
  - 1.2 The family concept defines criteria and parameters enabling the manufacturer...
- 2. The Approval Authority may conclude that the highest torque loss...
- 3. Parameters defining the transmission family
  - 3.1 The following criteria shall be the same to all members...
  - 3.2 The following criteria shall be common to all members within...
- 4. Choice of the parent transmission
- 5. Parameters defining the torque converter family
  - 5.1 The following criteria shall be the same to all members...
    - 5.1.1 For hydrodynamic torque converter without mechanical transmission (serial arrangement).
    - 5.1.2 For hydrodynamic torque converter with mechanical transmission (parallel arrangement).
    - 5.1.3 The following criteria shall be common to all members within...
- 6. Choice of the parent torque converter
  - 6.1 For hydrodynamic torque converter without mechanical (serial arrangement) transmission.
  - 6.2 For hydrodynamic torque converter with mechanical transmission.
- 7. Parameters defining the other torque transferring components (OTTC) family
  - 7.1 The following criteria shall be the same to all members...
  - 7.2 The following criteria shall be the same to all members...
  - 7.3 The following criteria shall be the same to all members...
  - 7.4 The following criteria shall be common to all members within...
  - 7.5 The following criteria shall be common to all members within...
  - 7.6 The following criteria shall be common to all members within...
- 8. Choice of the parent torque transferring component
  - 8.1 The parent hydrodynamic torque transferring component/retarder shall be selected using...
  - 8.2 The parent magnetic torque transferring component / retarder shall be...
  - 8.3 The parent torque transferring component/hydrodynamic clutch shall be selected using...
- 9. Parameters defining the additional driveline components family
  - 9.1 The following criteria shall be the same to all members...

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- 9.2 The following criteria shall be common to all members within...
- 10. Choice of the parent additional driveline component
  - 10.1 The parent additional driveline component / angle drive shall be...

## Appendix 7

### Markings and numbering

- 1. Markings
  - 1.1. The manufacturer's name or trade mark
  - 1.2. The make and identifying type indication as recorded in the...
  - 1.3. The certification mark (if applicable) as a rectangle surrounding the...
  - 1.4. The certification mark shall also include in the vicinity of...
  - 1.5. Example of the certification mark
  - 1.6. On request of the applicant for certificate and after prior...
  - 1.7. The markings, labels, plates or stickers must be durable for...
  - 1.8. In the case separate certifications are granted by the same...
  - 1.9. The certification mark shall be visible when the transmission, torque...
  - 1.10. In the case that torque converter or other torque transferring...
- 2. Numbering
  - 2.1. Certification number for transmissions, torque converter, other torque transferring component...

## Appendix 8

### Standard torque loss values - Transmission

## Appendix 9

### Generic model – torque converter

## Appendix 10

### Standard torque loss values – other torque transferring components

## Appendix 11

### Standard torque loss values – geared angle drive

## Appendix 12

### Input parameters for the simulation tool

- Introduction
- Definitions
- Set of input parameters

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## ANNEX VII

### VERIFYING AXLE DATA

1. Introduction
2. Definitions
3. General requirements
  - 3.1 Run-in
    - 3.1.1 Only factory fill oil shall be used for the run-in...
    - 3.1.2 The speed and torque profile for the run-in procedure shall...
    - 3.1.3 The run-in procedure shall be documented by the manufacturer with...
    - 3.1.4 The requirements for the oil temperature (4.3.1), measurement accuracy (4.4.7)...
4. Testing procedure for axles
  - 4.1 Test conditions
    - 4.1.1 Ambient temperature
    - 4.1.2 Oil temperature
    - 4.1.3 Oil quality
    - 4.1.4 Oil viscosity
    - 4.1.5 Oil level and conditioning
  - 4.2 Test set-up
    - 4.2.1 Axle installation
    - 4.2.2 Installation of torque meters
      - 4.2.2.1 For a test setup with two electric machines, the torque...
      - 4.2.2.2 For a test setup with three electric machines, the torque...
      - 4.2.2.3 Half shafts of different lengths are permitted in a two...
    - 4.2.3 Test set-up 'Type A'  
Figure 1 Example of Test set-up 'Type A'
    - 4.2.4 Test set-up 'Type B'
  - 4.3 Test procedure
    - 4.3.1 Measurement equipment
      - 4.3.1.1 Torque measurement
      - 4.3.1.2 Rotational speed
      - 4.3.1.3 Temperatures
    - 4.3.2 Measurement signals and data recording
      - 4.3.2.1 The following minimum sampling frequencies of the sensors shall be...
      - 4.3.2.2 The recording rate of the data used to determine the...
    - 4.3.3 Torque range:
      - 4.3.3.1 The manufacturer may extend the measurement up to 20 kNm...
      - 4.3.3.2 Output torque steps to be measured:
    - 4.3.4 Speed range
    - 4.3.5 Wheel speed steps to be measured
  - 4.4 Measurement of torque loss maps for axles
    - 4.4.1 Testing sequence of the torque loss map
    - 4.4.2 Measurement duration
    - 4.4.3 Averaging of grid points
    - 4.4.4 The torque loss (at input side) of the axle shall...
    - 4.4.5 Measurement validation

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- 4.4.5.1 The averaged speed values per grid point (5-20 s interval) shall...
- 4.4.5.2 The averaged output torque values as described under 4.4.3 for...
- 4.4.5.3 If the above specified criteria are not met the measurement...
- 4.4.6 Uncertainty calculation
- 4.4.7 Assessment of total uncertainty of the torque loss
- 4.4.8 Complement of torque loss map data
  - 4.4.8.1 If the torque values exceed the upper range limit linear...
  - 4.4.8.2 For the output torque range values below 250 Nm the...
  - 4.4.8.3 For 0 rpm wheel speed rpm the torque loss values...
  - 4.4.8.4 For negative input torques (e.g. overrun, free rolling), the torque...
  - 4.4.8.5 In case of a tandem axle, the combined torque loss...
- 5. Conformity of the certified CO<sub>2</sub> emissions and fuel consumption related...
  - 5.1. Every axle type approved in accordance with this Annex shall...
  - 5.2. Conformity of the certified CO<sub>2</sub> emissions and fuel consumption related...
  - 5.3. The manufacturer shall test annually at least the number of...
  - 5.4. Each axle which is tested by the manufacturer shall be...
  - 5.5. The number of families of single reduction (SR) axles and...
  - 5.6. The two axle families with the highest production volumes shall...
  - 5.7. For the purpose of the conformity of the certified CO<sub>2</sub>...
  - 5.8. If the result of a test performed in accordance with...
- 6. Production conformity testing
  - 6.1 For conformity of the certified CO<sub>2</sub> emissions and fuel consumption...
  - 6.2 If the conformity of the certified CO<sub>2</sub> emissions and fuel...
    - 6.2.1 For that purpose the full torque loss map of the...  
Figure 2Speed and torque range for conformity of the certified CO...
    - 6.2.2 For four control areas one point shall be selected, measured...
    - 6.2.3 For each measured point of the conformity of the certified...
    - 6.2.4 The average efficiency of the control area shall be calculated...
    - 6.2.5 If the conformity of the certified CO<sub>2</sub> emissions and fuel...
  - 6.3 Determination of drag torque
    - 6.3.1 For determination of the drag torque of an axle a...
    - 6.3.2 The test conditions according to paragraph 4.1 shall apply. The...
    - 6.3.3 The drag torque shall be measured in the speed range...
  - 6.4. Conformity of the certified CO<sub>2</sub> emissions and fuel consumption related...
    - 6.4.1 A conformity of the certified CO<sub>2</sub> emissions and fuel consumption...

## Appendix 1

### MODEL OF A CERTIFICATE OF A COMPONENT, SEPARATE TECHNICAL UNIT...

Maximum format: A4 (210 × 297 mm)

CERTIFICATE ON CO<sub>2</sub> EMISSIONS AND FUEL CONSUMPTION RELATED PROPERTIES OF...

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SECTION I

0.1 Make (trade name of manufacturer):

- 0.1 Make (trade name of manufacturer):
0.2 Type:
0.3 Means of identification of type, if marked on the axle...
0.3.1 Location of the marking:
0.4 Name and address of manufacturer:
0.5 In the case of components and separate technical units, location...
0.6 Name(s) and address(es) of assembly plant(s):
0.7 Name and address of the manufacturer's representative (if any)

SECTION II

1. Additional information (where applicable): see Addendum

- 1. Additional information (where applicable): see Addendum
2. Approval authority responsible for carrying out the tests:
3. Date of test report
4. Number of test report
5. Remarks (if any): see Addendum
6. Place
7. Date
8. Signature

Appendix 2

Axle information document

- 0. GENERAL
0.1 Name and address of manufacturer
0.2 Make (trade name of manufacturer):
0.3 Axle type:
0.4 Axle family (if applicable):
0.5 Axle type as separate technical unit / Axle family as...
0.6 Commercial name(s) (if available):
0.7 Means of identification of type, if marked on the axle:...
0.8 In the case of components and separate technical units, location...
0.9 Name(s) and address(es) of assembly plant(s):
0.10 Name and address of the manufacturer's representative:

PART 1

ESSENTIAL CHARACTERISTICS OF THE (PARENT) AXLE AND THE AXLE TYPES...

- 0.0 GENERAL
0.1 .....
0.2 .....
0.3 .....
0.4 .....
0.5 .....

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- 0.6 .....
- 0.7 .....
- 0.8 .....
- 0.9 .....
- 1.0 SPECIFIC AXLE INFORMATION
  - 1.4.3 Pinion angle with respect to horizontal plane; [°]
  - 1.4.4 For portal axles only:
  - 1.4.5 Teeth number of pinion
  - 1.4.6 Teeth number of crown gear
  - 1.4.7 Horizontal offset of pinion; [mm]
  - 1.4.8 Horizontal offset of crown wheel; [mm]
  - 1.5 Oil volume; [cm<sup>3</sup>]
  - 1.6 Oil level; [mm]
  - 1.7 Oil specification
  - 1.8 Bearing type (number/ID/drawing)
  - 1.9 Seal type (main diameter, lip number); [mm]
  - 1.10. Wheel ends (number/ID/drawing)
    - 1.10.1 Bearing type (number/ID/drawing)
    - 1.10.2 Seal type (main diameter, lip number); [mm]
    - 1.10.3 Grease type
  - 1.11. Number of planetary/spur gears
  - 1.12 Smallest width of planetary/spur gears; [mm]
  - 1.13 Gear ratio of hub reduction

LIST OF ATTACHMENTS

Appendix 3

Calculation of the standard torque loss

Appendix 4

Family Concept

- 1. The applicant for a certificate shall submit to the approval...
- 2. Special cases
- 3. Parameters defining an axle family:
  - 3.1 Axle category
- 4. Choice of the parent axle:
  - 4.1 The parent axle within an axle family is determined as...
  - 4.2. The approval authority may conclude that the worst-case torque loss...
  - 4.3. If axles within the family incorporate other features which may...

Appendix 5

Markings and numbering

- 1. Markings
  - 1.4 The certification mark shall also include in the vicinity of...
    - 1.4.1 Example and dimensions of the certification mark
  - 1.5 Upon request of the applicant for a certificate and after...

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- 1.6 The markings, labels, plates or stickers must be durable for...
- 1.7 The certification number shall be visible when the axle is...
- 2. Numbering:
  - 2.1. Certification number for axles shall comprise the following:

## Appendix 6

### Input parameters for the simulation tool

- Introduction
- Definitions
- Set of input parameters

## ANNEX VIII

### VERIFYING AIR DRAG DATA

- 1. Introduction
- 2. Definitions
- 3. Determination of air drag
  - 3.1. Test track requirements
    - 3.1.1. The geometry of test track shall be either a:
    - 3.1.2. Measurement sections
    - 3.1.3. Measurement areas
    - 3.1.4. Shape of the measurement sections
    - 3.1.5. Longitudinal slope of the measurement sections
    - 3.1.6. Track surface
    - 3.1.7. Standstill area
    - 3.1.8. Distance to roadside obstacles and vertical clearance
    - 3.1.9. Altitude profile
  - 3.2. Requirements for ambient conditions
    - 3.2.1. The ambient conditions shall be measured with the equipment specified...
    - 3.2.2. The ambient temperature shall be in the range of 0 °C...
    - 3.2.3. The ground temperature shall not exceed 40 °C. This criterion is...
    - 3.2.4. The road surface shall be dry during the low speed...
    - 3.2.5. The wind conditions shall be within the following range:
  - 3.3. Installation of the vehicle
    - 3.3.1. The vehicle chassis shall fit to the dimensions of the...
    - 3.3.2. The vehicle height determined in accordance with 3.5.3.1 item vii....
    - 3.3.3. The minimal distance between cabin and the box or semi-trailer...
    - 3.3.4. The cabin and the aero accessories (e.g. spoilers) shall be...
    - 3.3.5. The vehicle shall fulfil the legal requirements for a whole...
    - 3.3.6. The setup of the semi-trailer shall be as defined in...
    - 3.3.7. The vehicle shall be equipped with tyres meeting the following...
    - 3.3.8. The axle alignment shall be within the manufacturer specifications.
    - 3.3.9. No active tyre pressure control systems are allowed to be...
    - 3.3.10. If the vehicle is equipped with an active aero device...
    - 3.3.11. The vehicle shall not have any provisional features, modifications or...
    - 3.3.12. All different removable add on parts like sun visors, horns,...



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- 3.3.13. The vehicle shall be measured without payload.
- 3.4. Measurement equipment
  - 3.4.1. Torque
    - 3.4.1.1. The direct torque at all driven axles shall be measured...
    - 3.4.1.2. The following system requirements shall be met by a single...
  - 3.4.2. Vehicle speed
  - 3.4.3. Reference signal for calculation of rotational speed of the wheels...
  - 3.4.4. Opto-electronic barriers
  - 3.4.5. (D)GPS system
    - Option a) for position measurement only: GPS
    - Option b) for vehicle speed calibration and position measurement: Differential...
  - 3.4.6. Stationary weather station
  - 3.4.7. Mobile anemometer
    - 3.4.7.1. Accuracy requirements
    - 3.4.7.2. Installation position
    - 3.4.7.3. The update rate of the anemometer shall be 4 Hz or...
  - 3.4.8. Temperature transducer for ambient temperature on vehicle
  - 3.4.9. Proving ground temperature
- 3.5. Constant speed test procedure
  - 3.5.1. The average speed within a measurement section in the low...
  - 3.5.2. The average speed within a measurement section in the high...
  - 3.5.3. The testing shall be performed strictly according to the sequence...
    - 3.5.3.1. Preparation of vehicle and measurement systems
    - 3.5.3.2. Warm-up phase
    - 3.5.3.3. Zeroing of torque meters
    - 3.5.3.4. Drive another warm-up phase of minimum 10 minutes plus, if...
    - 3.5.3.5. First low speed test
    - 3.5.3.6. Drive another warm-up phase of minimum 5 minutes at the...
    - 3.5.3.7. High speed test
    - 3.5.3.8. Second low speed test
    - 3.5.3.9. Drift check of torque meters
- 3.6. Misalignment calibration test
  - 3.6.1. At least 5 valid passings of a  $250 \pm 3$  m straight section...
  - 3.6.2. The validity criteria for wind conditions as specified in section...
  - 3.6.3. The data recorded during the misalignment calibration test shall be...
  - 3.6.4. The misalignment calibration test can be performed independently from the...
  - 3.6.5. A new misalignment test shall be performed in the following...
- 3.7. Testing Template
- 3.8. Data processing
  - 3.8.1. The recorded data shall be synchronised and aligned to 100 Hz...
  - 3.8.2. All recorded data shall be checked for any errors. Measurement...
  - 3.8.3. For the evaluation of the constant speed tests the application...
- 3.9. Input data for air drag pre-processing tool
- 3.10. Validity criteria
  - 3.10.1. Validity criteria for the constant speed test
    - 3.10.1.1. The air drag pre-processing tool accepts datasets as recorded during...
    - 3.10.1.2. The air drag pre-processing tool excludes single datasets from the...

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- 3.10.1.3 The air drag pre-processing tool excludes single combinations of measurement...
- 3.10.1.4 The air drag pre-processing tool considers the complete constant speed...
- 3.10.2. Validity criteria for the misalignment test
  - 3.10.2.1 The air drag pre-processing tool accepts datasets as recorded during...
  - 3.10.2.2 The air drag pre-processing tool considers the data from a...
  - 3.10.2.3 The air drag pre-processing tool considers the complete misalignment test...
- 3.11. Declaration of air drag value

## Appendix 1

### MODEL OF A CERTIFICATE OF A COMPONENT, SEPARATE TECHNICAL UNIT...

Maximum format: A4 (210 × 297 mm)

#### CERTIFICATE ON CO<sub>2</sub> EMISSIONS AND FUEL CONSUMPTION RELATED PROPERTIES OF...

### SECTION I

#### 0.1. Make (trade name of manufacturer):

- 0.1. Make (trade name of manufacturer):
- 0.2. Vehicle body and air drag type/family (if applicable):
- 0.3. Vehicle body and air drag family member (in case of...
  - 0.3.1. Vehicle body and air drag parent
  - 0.3.2. Vehicle body and air drag types within the family
- 0.4. Means of identification of type, if marked
  - 0.4.1. Location of the marking:
- 0.5. Name and address of manufacturer:
- 0.6. In the case of components and separate technical units, location...
- 0.7. Name(s) and address(es) of assembly plant(s):
- 0.9. Name and address of the manufacturer's representative (if any)

### SECTION II

#### 1. Additional information (where applicable): see Addendum

- 1. Additional information (where applicable): see Addendum
- 2. Approval authority responsible for carrying out the tests:
- 3. Date of test report:
- 4. Number of test report:
- 5. Remarks (if any): see Addendum
- 6. Place:
- 7. Date:
- 8. Signature:

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## Appendix 2

### Air drag information document

#### 0.0. GENERAL

- 0.1. Name and address of manufacturer
- 0.2. Make (trade name of manufacturer)
- 0.3. Air drag type (family if applicable)
- 0.4. Commercial name(s) (if available)
- 0.5. Means of identification of type, if marked on the vehicle...
- 0.6. In the case of components and separate technical units, location...
- 0.7. Name(s) and address(es) of assembly plant(s)
- 0.8. Name and address of the manufacturer's representative

#### PART 1

### ESSENTIAL CHARACTERISTICS OF THE (PARENT) AIR DRAG AND THE AIR...

#### 1.0. SPECIFIC AIR DRAG INFORMATION

##### 1.1.0. VEHICLE

- 1.1.1. HDV group according to HDV CO 2 scheme
- 1.2.0. Vehicle model
  - 1.2.1. Axle configuration
  - 1.2.2. Max. gross vehicle weight
  - 1.2.3. Cabin line
  - 1.2.4. Cabin width (max. value in Y direction)
  - 1.2.5. Cabin length (max. value in X direction)
  - 1.2.6. Roof height
  - 1.2.7. Wheel base
  - 1.2.8. Height cabin over frame
  - 1.2.9. Frame height
  - 1.2.10. Aerodynamic accessories or add-ons (e.g. roof spoiler, side extender, side...
  - 1.2.11. Tyre dimensions front axle
  - 1.2.12. Tyre dimensions driven axles(s)

#### 1.3. Body specifications (according to standard body definition)

#### 1.4. (Semi-) Trailer specifications (according to (semi-) trailer specification by standard...

#### 1.5. Parameter defining the family in accordance with the description of...

#### LIST OF ATTACHMENTS

##### Attachment 1 to Information Document

##### Information on test conditions (if applicable)

- 1.1. Test track on which tests have been conducted
- 1.2. Total vehicle mass during measurement [kg]
- 1.3. Maximum vehicle height during measurement [m]
- 1.4. Average ambient conditions during first low speed test [°C]
- 1.5. Average vehicle speed during high speed tests [km/h]
- 1.6. Product of drag coefficient (  $C_d$  ) by cross...
- 1.7. Product of drag coefficient (  $C_d$  ) by cross...
- 1.8. Average yaw angle during constant speed test  $\beta$  [°]
- 1.9. Declared air drag value  $C_d \cdot A$  declared [m<sup>2</sup>...
- 1.10. Version number of air drag pre-processing tool

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### Appendix 3

#### Vehicle height requirements

1. Vehicles measured in the constant speed test according to section...
2. The vehicle height has to be determined as described in...
3. Vehicles of vehicles groups not shown in Table 7 are...

### Appendix 4

#### Standard body and semitrailer configurations

1. Vehicles measured in the constant speed test according to section...
2. The applicable standard body or semitrailer shall be determined from...
3. The standard bodies B1, B2, B3, B4 and B5 shall...
4. The type and chassis requirements for the standard semitrailer ST1...
5. All dimensions and masses without tolerances mentioned explicitly shall be...

### Appendix 5

#### Air drag family for trucks

1. General
2. Special cases
3. ....
4. Parameter defining the air drag family:
  - 4.1. Vehicles are allowed to be grouped within a family if...  
Figure 1 Family definition
  - 4.2. An air drag family consist of testable members and vehicle...
  - 4.3. Testable members of a family are vehicle configurations, which fulfil...
5. Choice of the air drag parent vehicle
  - 5.1. The parent vehicle of each family shall be selected according...
  - 5.2. The vehicle chassis shall fit to the dimensions of the...
  - 5.3. All testable members of the family shall have an equal...
  - 5.4. The applicant for a certificate shall be able to demonstrate...
  - 5.5. The declared value  $C_d \cdot A$  declared can be used...

### Appendix 6

#### Conformity of the certified CO<sub>2</sub> emissions and fuel consumption related...

1. The conformity of the certified CO<sub>2</sub> emissions and fuel consumption...
2. A vehicle fails the conformity of the certified CO<sub>2</sub> emissions...
3. The number of vehicles to be tested for conformity with...
4. For the selection of vehicles for conformity of the certified...
5. After a vehicle was selected for conformity of the certified...

### Appendix 7

#### Standard values

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1. Standard values for the declared air drag value  $C_d$  · ...
2. For vehicle configurations ‘rigid lorry + trailer’ the overall air drag value...
3. For EMS vehicle configurations the air drag value of the...

## Appendix 8

### Markings

2. Numbering
  - 2.1. Certification number for air drag shall comprise the following:

## Appendix 9

### Input parameters for the simulation tool

- Introduction
- Definitions
- Set of input parameters

## ANNEX IX

### VERIFYING TRUCK AUXILIARY DATA

1. Introduction
2. Definitions
3. Determination of technology specific average standard power values
  - 3.1. Fan
  - 3.2. Steering System
  - 3.3. Electric system
  - 3.4. Pneumatic system
  - 3.5. Air Conditioning system
  - 3.6. Transmission Power Take-Off (PTO)

## ANNEX X

### CERTIFICATION PROCEDURE FOR PNEUMATIC TYRES

1. Introduction
2. Definitions
3. General requirements
  - 3.1. The tyre manufacturer plant shall be certified to ISO/TS 16949....
  - 3.2. Tyre rolling resistance coefficient
  - 3.3. Measurement provisions
  - 3.4. Marking and traceability
    - 3.4.1. The tyre shall be clearly identifiable in respect to the...
    - 3.4.2. The tyre manufacturer shall use the markings affixed to the...
    - 3.4.3. If an additional identifier is used it shall remain readable...

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3.4.4. In line with Article 19(2) of Directive 2007/46/EC, no type-approval...

4. Conformity of the certified CO<sub>2</sub> emissions and fuel consumption related...
  - 4.1. Any tyre certified under this Regulation shall be in conformity...
  - 4.2. In order to verify conformity of the certified CO<sub>2</sub> emissions...
  - 4.3. Frequency of the tests
    - 4.3.1 The tyre rolling resistance of at least one tyre of...
    - 4.3.2 In case the deliveries of a specific tyre type intended...
    - 4.3.3 In case the deliveries of a specific tyre type intended...
    - 4.3.4 If the volume of tyres delivered to the original equipment...
    - 4.3.5 The manufacturer shall justify (ex. by showing sales numbers) to...
  - 4.4 Verification procedure
    - 4.4.1 A single tyre shall be tested in accordance with paragraph...
    - 4.4.2 In the case the value measured is lower or equal...
    - 4.4.3. In the case, the value measured exceeds the declared value...

## Appendix 1

### MODEL OF A CERTIFICATE OF CONFORMITY (COC) FOR A COMPONENT, SEPARATE TECHNICAL UNIT OR SYSTEM

1. Manufacturer's name and address: ...
2. If applicable, name and address of manufacturer's representative: ...
3. Brand name/trade mark: ...
4. Tyre type description: ...
5. Tyre identification code(s) and technology(ies) used to provide identification code(s),...
6. Technical Service and, where appropriate, test laboratory approved for purposes...
7. Declared values:
8. Any remarks: ...
9. Place: ...
10. Date: ...
11. Signature: ...
12. Annexed to this communication are: ...

## Appendix 2

### Tyre rolling resistance coefficient information document

#### SECTION I

##### 0.1. Name and address of manufacturer

- 0.1. Name and address of manufacturer
- 0.2 Make (trade name of manufacturer)
- 0.3 Name and address of applicant:
- 0.4 Brand name/ trade description:
- 0.5 Tyre class (in accordance with Regulation (EC) No 661/2009)
- 0.6 Tyre-size designation;
- 0.7 Tyre structure (diagonal (bias-ply); radial);

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- 0.8 Category of use (normal tyre, snow tyre, special use tyre);...
- 0.9 Speed category (categories);
- 0.10 Load-capacity index (indices);
- 0.11 Trade description/commercial name;
- 0.12 Declared rolling resistance coefficient;
- 0.13 Tool(s) to provide additional rolling resistance coefficient identification code (if...)
- 0.14. ....
- 0.15 Load FZTYRE: ... [N]
- 0.16. ....

## SECTION II

### 1. Approval Authority or Technical Service [or Accredited Lab]:

- 1. Approval Authority or Technical Service [or Accredited Lab]:
- 2. Test report No.:
- 3. Comments (if any):
- 4. Date of test report:
- 5. Test machine identification and drum diameter/surface:
- 6. Test tyre details:
- 7. Test data:
- 8. Rolling resistance coefficient:
- 9. Date of test:

## Appendix 3

### Input parameters for the simulation tool

- Introduction
- Definitions
- Set of input parameters

## Appendix 4

### Numbering

- 1. Numbering:
  - 1.1. Certification number for tyres shall comprise the following:

## ANNEX Xa

### CONFORMITY OF SIMULATION TOOL OPERATION AND OF CO<sub>2</sub> EMISSIONS AND FUEL CONSUMPTION RELATED PROPERTIES OF COMPONENTS, SEPARATE TECHNICAL UNITS AND SYSTEMS: VERIFICATION TESTING PROCEDURE

- 1. Introduction
  - Figure 1 Schematic picture of the verification testing procedure method
- 2. Definitions

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3. Vehicle selection
4. Vehicle conditions
  - 4.1. Vehicle run in
  - 4.2. Fuel and lubricants
5. Measurement equipment
  - 5.1. Torque
  - 5.2. Vehicle speed
  - 5.3. Gear engaged
  - 5.4. Rotational speed of the engine
  - 5.5. Rotational speed of the wheels at the driven axle
  - 5.6. Rotational speed of fan
  - 5.7. Fuel measurement system
  - 5.8. Vehicle weight
  - 5.9. General requirements for the on-board measurements
6. Test procedure
  - 6.1. Vehicle preparation
    - 6.1.1. Validation of input data
      - 6.1.1.1. Verification of components, separate technical units or systems and input...
      - 6.1.1.2. Verification of the vehicle mass
      - 6.1.1.3. Actions to be taken
    - 6.1.2. Run in phase
    - 6.1.3. Set up of measurement equipment
    - 6.1.4. Set up of the test vehicle for the fuel consumption...
    - 6.1.5. Verification test
      - 6.1.5.1. Route selection
      - 6.1.5.2. Vehicle pre conditioning
      - 6.1.5.3. Vehicle warm up
      - 6.1.5.4. Zeroing of the torque measurement equipment
      - 6.1.5.5. Fuel consumption measurement
      - 6.1.5.6. Measurement of the drift of the torque measurement equipment
      - 6.1.5.7. Boundary conditions for the verification test
    - 6.1.6. Data reporting
7. Test evaluation
  - 7.1. Simulation of the fuel consumption
  - 7.2. Calculation of the measured fuel consumption
  - 7.3. Pass/Fail check
8. Reporting procedures
  - 8.1. General
    - 8.1.1. Name and address of the vehicle manufacturer
    - 8.1.2. Address(es) of assembly plant(s)
    - 8.1.3. The name, address, telephone and fax numbers and email address...
    - 8.1.4. Type and commercial description
    - 8.1.5. Selection criteria for vehicle and CO<sub>2</sub> relevant components (text)...
    - 8.1.6. Vehicle owner
    - 8.1.7. Odometer reading at test start of the fuel consumption measurement...
  - 8.2. Vehicle information



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- 8.2.1. Vehicle model
- 8.2.2. Vehicle identification number (VIN)
- 8.2.3. Vehicle category (N 2 , N 3 )
- 8.2.4. Axle configuration
- 8.2.5. Maximum gross vehicle weight (t)
- 8.2.6. Vehicle group
- 8.2.7. Corrected actual mass of the vehicle (kg)
- 8.2.8. Cryptographic hash of the manufacturer's records file
- 8.2.9. Vehicle combination's gross combined weight in the verification test (kg)...
- 8.3. Main engine specifications
  - 8.3.1. Engine model
  - 8.3.2. Engine certification number
  - 8.3.3. Engine rated power (kW)
  - 8.3.4. Engine capacity (l)
  - 8.3.5. Engine reference fuel type (diesel/LPG/CNG ...)
  - 8.3.6. Hash of the fuel map file/document
- 8.4. Main transmission specifications
  - 8.4.1. Transmission model
  - 8.4.2. Transmission certification number
  - 8.4.3. Main option used for generation of loss maps (Option1/Option2/Option3/Standard values)...
  - 8.4.4. Transmission type
  - 8.4.5. Number of gears
  - 8.4.6. Transmission ratio final gear
  - 8.4.7. Retarder type
  - 8.4.8. Power take off (yes/no)
  - 8.4.9. Hash of the efficiency map file/document
- 8.5. Main retarder specifications
  - 8.5.1. Retarder model
  - 8.5.2. Retarder certification number
  - 8.5.3. Certification option used for generation of a loss map (standard...)
  - 8.5.4. Hash of the retarder efficiency map file/document
- 8.6. Torque converter specification
  - 8.6.1. Torque converter model
  - 8.6.2. Torque converter certification number
  - 8.6.3. Certification option used for generation of a loss map (standard...)
  - 8.6.4. Hash of the efficiency map file/document
- 8.7. Angle drive specifications
  - 8.7.1. Angle drive model
  - 8.7.2. Axle certification number
  - 8.7.3. Certification option used for generation of a loss map (standard...)
  - 8.7.4. Angle drive ratio
  - 8.7.5. Hash of the efficiency map file/document
- 8.8. Axle specifications
  - 8.8.1. Axle model
  - 8.8.2. Axle certification number
  - 8.8.3. Certification option used for generation of a loss map (standard...)
  - 8.8.4. Axle type (e.g. standard single driven axle)
  - 8.8.5. Axle ratio
  - 8.8.6. Hash of the efficiency map file/document
- 8.9. Aerodynamics
  - 8.9.1. Model

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- 8.9.2. Certification option used for generation of CdxA (standard values/  
measurement)
- 8.9.3. CdxA Certification number (if applicable)
- 8.9.4. CdxA value
- 8.9.5. Hash of the efficiency map file/document
- 8.10. Main tyre specifications
  - 8.10.1. Tyre certification number on all axles
  - 8.10.2. Specific rolling resistance coefficient of all tyres on all axles...
- 8.11. Main auxiliary specifications
  - 8.11.1. Engine cooling fan technology
  - 8.11.2. Steering pump technology
  - 8.11.3. Electric system technology
  - 8.11.4. Pneumatic system technology
- 8.12. Test conditions
  - 8.12.1. Actual mass of the vehicle (kg)
  - 8.12.2. Actual mass of the vehicle with payload (kg)
  - 8.12.3. Warm up time (minutes)
  - 8.12.4. Average velocity at warm up (km/h)
  - 8.12.5. Fuel consumption measurement duration (minutes)
  - 8.12.6. Distance based share urban driving (%)
  - 8.12.7. Distance based share rural driving (%)
  - 8.12.8. Distance based share motorway driving (%)
  - 8.12.9. Time share of idling at stand still (%)
  - 8.12.10. Average ambient temperature (°C)
  - 8.12.11. Road condition (dry, wet, snow, ice, others please specify)
  - 8.12.12. Maximum seal level of the route (m)
  - 8.12.13. Maximum duration of continuous idling at stand still (minutes)
- 8.13. Results of the verification test
  - 8.13.1. Average fan power calculated for the verification test by the...
  - 8.13.2. Work over the verification test calculated by the simulation tool...
  - 8.13.3. Work over the verification test measured (kW)
  - 8.13.4. NCV of the fuel used in the verification test (MJ/kg)...
  - 8.13.5. Fuel consumption in the verification test measured (g/km)
  - 8.13.6. Fuel consumption in the verification test measured, corrected (g/kWh)
  - 8.13.7. Fuel consumption in the verification test simulated (g/km)
  - 8.13.8. Fuel consumption in the verification test simulated (g/kWh)
  - 8.13.9. Mission profile (long haul/long haul(EMS)/regional/regional(EMS)/  
urban/municipal/construction)
  - 8.13.10. Verified CO<sub>2</sub> emissions of the vehicle (g/tkm)
  - 8.13.11. Declared CO<sub>2</sub> emissions of the vehicle (g/tkm)
  - 8.13.12. Ratio of fuel consumption measured and simulated in the verification...
  - 8.13.13. Passed the verification test (yes/no)
- 8.14. Software and user information
  - 8.14.1. Simulation tool version (X.X.X)
  - 8.14.2. Date and time of the simulation

## ANNEX XI

### AMENDMENTS TO DIRECTIVE 2007/46/EC

- (1) In Annex I the following point 3.5.7 is inserted:

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- (2) In Annex III, in Part I, A (Categories M and...
- (3) In Annex IV, Part I, is amended as follows:
- (4) Annex IX is amended as follows:
- (5) in Annex XV, in point 2, the following row is...

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- (1) [OJ L 188, 18.7.2009, p. 1.](#)
- (2) [OJ L 263, 9.10.2007, p. 1.](#)
- (3) Commission Regulation (EU) No 582/2011 of 25 May 2011 implementing and amending Regulation (EC) No 595/2009 of the European Parliament and of the Council with respect to emissions from heavy duty vehicles (Euro VI) and amending Annexes I and III to Directive 2007/46/EC of the European Parliament and of the Council ([OJ L 167, 25.6.2011, p. 1.](#)).

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