

Annex 10

1. SPECIFICATIONS OF REFERENCE FUELS FOR TESTING VEHICLES TO THE EMISSION LIMITS

1.1. TECHNICAL DATA ON THE REFERENCE FUEL TO BE USED FOR TESTING VEHICLES EQUIPPED WITH POSITIVE-IGNITION ENGINES

Type: **Petrol (E5)**

Parameter	Unit	Limits 1/		Test method
		Minimum	Maximum	
Research octane number, RON		95.0	—	EN 25164 prEN ISO 5164
Motor octane number, MON		85.0	—	EN 25163 prEN ISO 5163
Density at 15 °C	kg/m ³	743	756	EN ISO 3675 EN ISO 12185
Vapour pressure	kPa	56.0	60.0	EN ISO 13016-1 (DVPE)
Water content	% v/v		0.015	ASTM E 1064
Distillation:				
– Evaporated at 70 °C	% v/v	24.0	44.0	EN-ISO 3405
– Evaporated at 100 °C	% v/v	48.0	60.0	EN-ISO 3405
– Evaporated at 150 °C	% v/v	82.0	90.0	EN-ISO 3405
– Final boiling point	°C	190	210	EN-ISO 3405
Residue	% v/v	—	2.0	EN-ISO 3405
Hydrocarbon analysis:				
– Olefins	% v/v	3.0	13.0	ASTM D 1319
– Aromatics	% v/v	29.0	35.0	ASTM D 1319
– Benzene	% v/v	—	1.0	EN 12177
– Saturates	% v/v		Report	ASTM 1319
Carbon/hydrogen ratio			Report	
Carbon/oxygen ratio			Report	
Induction period 2/	minutes	480	—	EN-ISO 7536
Oxygen content 4/	% m/m		Report	EN 1601
Existent gum	mg/ml	—	0.04	EN-ISO 6246
Sulphur content 3/	mg/kg	—	10	EN ISO 20846 EN ISO 20884
Copper corrosion		—	Class 1	EN-ISO 2160
Lead content	mg/l	—	5	EN 237
Phosphorus content	mg/l	—	1.3	ASTM D 3231
Ethanol 5/	% v/v	4.7	5.3	EN 1601 EN 13132

1/ The values quoted in the specifications are "true values". In establishment of their limit values the terms of ISO 4259 Petroleum products - Determination and application of precision data in relation to methods of test have been applied and in fixing a minimum value, a minimum difference of 2R above zero has been taken into account; in fixing a maximum and minimum value, the minimum difference is 4R (R = reproducibility).

Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.

2/ The fuel may contain oxidation inhibitors and metal deactivators normally used to stabilise refinery gasoline streams, but detergent/dispersive additives and solvent oils shall not be added.

3/ The actual sulphur content of the fuel used for the Type I test shall be reported.

4/ Ethanol meeting the specification of prEN 15376 is the only oxygenate that shall be intentionally added to the reference fuel.

5/ There shall be no intentional addition of compounds containing phosphorus, iron, manganese, or lead to this reference fuel.

Type: Ethanol (E85)

Parameter	Unit	Limits ^{1/}		Test method ^{2/}
		Minimum	Maximum	
Research octane number, RON		95.0	—	EN ISO 5164
Motor octane number, MON		85.0	—	EN ISO 5163
Density at 15 °C	kg/m ³	Report		ISO 3675
Vapour pressure	kPa	40.0	60.0	EN ISO 13016-1 (DVPE)
Sulphur content ^{3/ 4/}	mg/kg	—	10	EN ISO 20846 EN ISO 20884
Oxidation stability	minutes	360		EN ISO 7536
Existent gum content (solvent washed)	mg/(100 ml)	—	5	EN-ISO 6246
Appearance This shall be determined at ambient temperature or 15 °C whichever is higher.		Clear and bright, visibly free of suspended or precipitated contaminants		Visual inspection
Ethanol and higher alcohols ^{7/}	% (V/V)	83	85	EN 1601 EN 13132 EN 14517
Higher alcohols (C3-C8)	% (V/V)	—	2.0	
Methanol	% (V/V)		0.5	
Petrol ^{5/}	% (V/V)	Balance		EN 228
Phosphorus	mg/l	0.3 ^{6/}		ASTM D 3231
Water content	% (V/V)		0.3	ASTM E 1064
Inorganic chloride content	mg/l		1	ISO 6227
pHe		6.5	9.0	ASTM D 6423
Copper strip corrosion (3h at 50°C)	Rating	Class 1		EN ISO 2160
Acidity, (as acetic acid CH ₃ COOH)	% (m/m) (mg/l)	—	0.005 (40)	ASTM D 1613
Carbon/hydrogen ratio		report		
Carbon/oxygen ration		report		

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Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.

^{2/} In cases of dispute, the procedures for resolving the dispute and interpretation of the results based on test method precision, described in EN ISO 4259 shall be used.

^{3/} In cases of national dispute concerning sulphur content, either EN ISO 20846 or EN ISO 20884 shall be called up similar to the reference in the national annex of EN 228.

^{4/} The actual sulphur content of the fuel used for the Type I test shall be reported.

^{5/} The unleaded petrol content can be determined as 100 minus the sum of the percentage content of water and alcohols

^{6/} There shall be no intentional addition of compounds containing phosphorus, iron, manganese, or lead to this reference fuel.

^{7/} Ethanol to meet specification of EN 15376 is the only oxygenate that shall be intentionally added to this reference fuel.

1.2. TECHNICAL DATA ON THE REFERENCE FUEL TO BE USED FOR TESTING VEHICLES
EQUIPPED WITH DIESEL ENGINE

Type: **Diesel fuel (B5)**

Parameter	Unit	Limits ^{1/}		Test method
		Minimum	Maximum	
Cetane number ^{2/}		52.0	54.0	EN-ISO 5165
Density at 15 °C	kg/m ³	833	837	EN-ISO 3675
Distillation:				
- 50 % point	°C	245	—	EN-ISO 3405
- 95 % point	°C	345	350	EN-ISO 3405
- Final boiling point	°C	—	370	EN-ISO 3405
Flash point	°C	55	—	EN 22719
CFPP	°C	—	- 5	EN 116
Viscosity at 40 °C	mm ² /s	2.3	3.3	EN-ISO 3104
Polycyclic aromatic hydrocarbons	% m/m	2.0	6.0	EN 12916
Sulphur content ^{3/}	mg/kg	—	10	EN ISO 20846 / EN ISO 20884
Copper corrosion		—	Class 1	EN-ISO 2160
Conradson carbon residue (10 % DR)	% m/m	—	0.2	EN-ISO 10370
Ash content	% m/m	—	0.01	EN-ISO 6245
Water content	% m/m	—	0.02	EN-ISO 12937
Neutralisation (strong acid) number	mg KOH/g	—	0.02	ASTM D 974
Oxidation stability ^{4/}	mg/ml	—	0.025	EN-ISO 12205
Lubricity (HFRR wear scan diameter at 60 °C)	µm	—	400	EN ISO 12156
Oxidation stability at 110 °C ^{4/ 6/}	h	20.0		EN 14112
FAME ^{5/}	% v/v	4.5	5.5	EN 14078

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Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.

^{2/} The range for cetane number is not in accordance with the requirements of a minimum range of 4R. However, in the case of a dispute between fuel supplier and fuel user, the terms of ISO 4259 may be used to resolve such disputes provided replicate measurements, of sufficient number to archive the necessary precision, are made in preference to single determinations.

^{3/} The actual sulphur content of the fuel used for the Type I test shall be reported.

^{4/} Even though oxidation stability is controlled, it is likely that shelf life will be limited. Advice shall be sought from the supplier as to storage conditions and life.

^{5/} FAME content to meet the specification of EN 14214

^{6/} Oxidation stability can be demonstrated by EN-ISO 12205 or by EN 14112. This requirement shall be reviewed based on CEN/TC19 evaluations of oxidative stability performance and test limits

2. SPECIFICATIONS OF REFERENCE FUEL TO BE USED FOR TESTING VEHICLES EQUIPPED WITH POSITIVE-IGNITION ENGINES AT LOW AMBIENT TEMPERATURE - TYPE VI TEST

Type: **Petrol (E5)**

Parameter	Unit	Limits ^{1/}		Test method
		Minimum	Maximum	
Research octane number, RON		95.0	—	EN 25164 prEN ISO 5164
Motor octane number, MON		85.0	—	EN 25163 prEN ISO 5163
Density at 15 °C	kg/m ³	743	756	EN ISO 3675 EN ISO 12185
Vapour pressure	kPa	56.0	95.0	EN ISO 13016-1 (DVPE)
Water content	% v/v		0.015	ASTM E 1064
Distillation:				
– Evaporated at 70 °C	% v/v	24.0	44.0	EN-ISO 3405
– Evaporated at 100 °C	% v/v	50.0	60.0	EN-ISO 3405
– Evaporated at 150 °C	% v/v	82.0	90.0	EN-ISO 3405
– Final boiling point	°C	190	210	EN-ISO 3405
Residue	% v/v	—	2.0	EN-ISO 3405
Hydrocarbon analysis:				
– Olefins	% v/v	3.0	13.0	ASTM D 1319
– Aromatics	% v/v	29.0	35.0	ASTM D 1319
– Benzene	% v/v	—	1.0	EN 12177
– Saturates	% v/v	Report		ASTM 1319
Carbon/hydrogen ratio		Report		
Carbon/oxygen ratio		Report		
Induction period ^{2/}	minutes	480	—	EN-ISO 7536
Oxygen content ^{4/}	% m/m	Report		EN 1601
Existent gum	mg/ml	—	0.04	EN-ISO 6246
Sulphur content ^{3/}	mg/kg	—	10	EN ISO 20846 EN ISO 20884
Copper corrosion		—	Class 1	EN-ISO 2160
Lead content	mg/l	—	5	EN 237
Phosphorus content	mg/l	—	1.3	ASTM D 3231
Ethanol ^{5/}	% v/v	4.7	5.3	EN 1601 EN 13132

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Notwithstanding this measure, which is necessary for technical reasons, the manufacturer of fuels shall nevertheless aim at a zero value where the stipulated maximum value is 2R and at the mean value in the case of quotations of maximum and minimum limits. Should it be necessary to clarify whether a fuel meets the requirements of the specifications, the terms of ISO 4259 shall be applied.

^{2/} The fuel may contain oxidation inhibitors and metal deactivators normally used to stabilise refinery gasoline streams, but detergent/dispersive additives and solvent oils shall not be added.

^{3/} The actual sulphur content of the fuel used for the Type I test shall be reported.

^{4/} Ethanol meeting the specification of prEN 15376 is the only oxygenate that shall be intentionally added to the reference fuel.

^{5/} There shall be no intentional addition of compounds containing phosphorus, iron, manganese, or lead to this reference fuel.

Type: Ethanol (E75)

Reference fuel specification to be developed in advance of the dates for setting Type VI test mandatory to ethanol-fuelled vehicles.

Annex 10a:

1. SPECIFICATIONS OF GASEOUS REFERENCE FUELS

1.1. TECHNICAL DATA OF THE LPG REFERENCE FUELS USED FOR TESTING VEHICLES TO THE EMISSION LIMITS

Parameter	Unit	Fuel A	Fuel B	Test method
Composition:				ISO 7941
C ₃ -content	per cent vol	30 ± 2	85 ± 2	
C ₄ -content	per cent vol	balance <u>1/</u>	balance <u>1/</u>	
< C ₃ , >C ₄	per cent vol	maximum 2	maximum 2	
Olefins	per cent vol	maximum 12	maximum 15	
Evaporation residue	mg/kg	maximum 50	maximum 50	ISO 13757 or EN 15470
Water at 0°C		free	free	EN 15469
Total sulphur content	mg/kg	maximum 50	maximum 50	EN 24260 or ASTM 6667
Hydrogen sulphide		none	none	ISO 8819
Copper strip corrosion	rating	class 1	class 1	ISO 6251 <u>2/</u>
Odour		characteristic	characteristic	
Motor octane number		minimum 89	minimum 89	EN 589 Annex B

1/ **Balance has to be read as follows: balance = 100 – C₃ ≤ C₃ ≥ C₄**

2/ This method may not accurately determine the presence of corrosive materials if the sample contains corrosion inhibitors or other chemicals which diminish the corrosivity of the sample to the copper strip. Therefore, the addition of such compounds for the sole purpose of biasing the test method is prohibited

1.2. TECHNICAL DATA OF THE NG **OR BIOMETHANE** REFERENCE FUELS

Characteristics	Units	Basis	Limits		Test Method
			min.	max.	
Reference fuel G ₂₀					
Composition:					
Methane	per cent mole	100	99	100	ISO 6974
Balance <u>1/</u>	per cent mole	-	-	1	ISO 6974
N ₂	per cent mole				ISO 6974
Sulphur content	mg/m ³ <u>2/</u>	-	-	10	ISO 6326-5
Wobbe Index (net)	MJ/m ³ <u>3/</u>	48.2	47.2	49.2	
Reference fuel G ₂₅					
Composition:					
Methane	per cent mole	86	84	88	ISO 6974
Balance <u>1/</u>	per cent mole	-	-	1	ISO 6974
N ₂	per cent mole	14	12	16	ISO 6974
Sulphur content	mg/m ³ <u>2/</u>	-	-	10	ISO 6326-5
Wobbe Index (net)	MJ/m ³ <u>3/</u>	39.4	38.2	40.6	

1/ Inerts (different from N₂) + C₂ + C₂+

2/ Value to be determined at 293.2 K (20 °C) and 101.3 kPa

3/ Value to be determined at 273.2 K (0 °C) and 101.3 kPa