

☐ Others:

1.15.1 Specific lubrication oil consumption

SLOC: - _____

[g/kWh]

Breaking-in period:

- ☐ Finished
☐ Not finished
☐ Not applicable

1.15.2 Cylinder liner lubrication

- ☐ None
☒ Yes, active at

<input type="checkbox"/> 100%	Feed rate:	8160 [g/h]
<input type="checkbox"/> 75%	Feed rate:	6488 [g/h]
<input type="checkbox"/> 50%	Feed rate:	4162 [g/h]
<input type="checkbox"/> 25%	Feed rate:	2550 [g/h]
<input type="checkbox"/> 10%	Feed rate:	1273 [g/h]

Breaking-in period:

- ☒ Finished
☐ Not finished
☐ Not applicable

1.15.3 Inlet valve seat lubrication

- ☒ None
☐ Yes, active at

<input type="checkbox"/> 100%	Feed rate:	- [g/h]
<input type="checkbox"/> 75%	Feed rate:	- [g/h]
<input type="checkbox"/> 50%	Feed rate:	- [g/h]
<input type="checkbox"/> 25%	Feed rate:	- [g/h]
<input type="checkbox"/> 10%	Feed rate:	- [g/h]

1.16 Exhaust gas treatment device

- ☐ None ☒ Yes

- ☒ SCR
☐ Scrubber
☐ EGR
☐ Water injection
☐ Others: _____

2. Fuel**2.1 Fuel in use**

- | | | | | |
|--|------------------------------|------------------------------|------------------------------|---|
| <input type="checkbox"/> ULSD | <input type="checkbox"/> DMX | <input type="checkbox"/> DMA | <input type="checkbox"/> DMZ | <input type="checkbox"/> DMB |
| <input type="checkbox"/> RMA | <input type="checkbox"/> RMB | <input type="checkbox"/> RMD | <input type="checkbox"/> RME | <input checked="" type="checkbox"/> RMG |
| <input type="checkbox"/> Other: _____ | acc. standard: _____ | | | <input type="checkbox"/> RMK |
| <input type="checkbox"/> Natural Gas | | | | |
| <input type="checkbox"/> Other gases acc. IGF: _____ | | | | |

- ☐ Liquid to gas fuel ratio as certified at mode point:

100%	_____
75%	_____
50%	_____
25%	_____
10%	_____

Fuel properties and composition (in use during testing)

2.2 Gas

Please fill in as far as possible
most important marked with *)

Property	Unit / Standard		Actual value	Remark
Methane number*)	[-] / DIN EN 16726			
Lower calorific value*)	[MJ/kg] / ISO 6976			
Higher calorific value	[MJ/kg] / ISO 6976			
Wobbe Indices Ws / Wi	[MJ/m ³] / ISO 6976			
Density*)	[kg/m ³] / ISO 6976			
Methane*)	wt.-% [kg/kg] / ISO 6974 or DIN 51894			
Ethane*)	wt.-% [kg/kg] / ISO 6974 or DIN 51894			
Propane*)	wt.-% [kg/kg] / DIN 51894			
Isobutane*)	wt.-% [kg/kg] / DIN 51894			
N-Butane*)	wt.-% [kg/kg] / DIN 51894			
Pentane	wt.-% [kg/kg] / DIN 51894			
Hexane	wt.-% [kg/kg] / DIN 51894			
Heptane	wt.-% [kg/kg] / DIN 51894			
Nitrogen	wt.-% [kg/kg] / ISO 6974			
Sulphur*)	wt.-% [kg/kg] / ISO 6326-5			
Hydrogen sulfide	wt.-% [kg/kg] / ISO 8819			
Carbon dioxide	wt.-% [kg/kg] / ISO 6974			
Hydrogen	wt.-% [kg/kg] / DIN 51894			
Others				

2.3 Liquid fuel

Please fill in as far as possible
most important marked with *)
essential **)

Property	Unit / Standard		Actual value	Remark
Type of fuel	Grade / ISO 8217		RMG380	
Flash point*)	[°C] / ISO 2719		105	ISO 2719
Viscosity @ 40/50°C **)	[mm ² /s] / ISO 3104		365.1	ISO 3104
Density @ 15°C *)	[kg/m ³] / ISO 3675 or 12185		990.1	ISO 12185
Net calorific value (Hu) *)	[J/g] / DIN 51900		42400	ASTM D 4809
Sulphur content*)	ppm [mg/kg] / ISO 8754 or 14596		2.4	ISO 8754
Ash content*)	ppm [mg/kg] / ISO 6245		57	ISO 6245
Water content*)	ppm [mg/kg] / ISO 3733		1000	ISO 3733
Carbon content*)	wt.-% [kg/kg] / ASTM D5291		85.82	ASTM D5291
Hydrogen content*)	wt.-% [kg/kg] / ASTM D5291		9.58	ASTM D521
Nitrogen content*)	wt.-% [kg/kg] / DIN 51444		0.047	ASTM D 4809
Oxygen content*)	wt.-% [kg/kg] / DIN 51732		1.46	Calc.
Cetane index*)	ISO 4264		-	-
CCAI*)			852	Calc.
FAME content*)	wt.-% [kg/kg] / EN 14078		-	
Mono aromatic compounds*)	wt.-% [kg/kg] / EN 12916		-	
Poly aromatic compounds*)	wt.-% [kg/kg] / EN 12916		-	
Di aromatic compounds	wt.-% [kg/kg] / EN 12916		-	
Tri aromatic compounds	wt.-% [kg/kg] / EN 12916		-	
Inorganic constituents (V)	ppm [mg/kg] / ISO 14597 or 8691		-	
Inorganic constituents (Ni)	ICP		-	
Carbon residues*)	wt.-% [kg/kg] / ASTM D4530		-	
Others				

3. Lube oil properties and composition (in use during testing; Producers specification can be used)

3.1 Circulation lubrication oil Please fill in as far as possible

Property	Unit / Standard		Actual value	Remark
Lube oil	Brand / Type		BP Energol	
Grade	Multi / Mono		HT30	
BN	mg KOH/g / ISO 3771		8.14	
Ash content	wt.-% [kg/kg] / ISO 6245		-	
Viscosity	[mm ² /s] / ASTM D7042		112.37	at 40°C
Sulphur content	wt.-% [kg/kg] / ISO 20884		0.054945	

3.2 Cylinder oil Please fill in as far as possible Please fill in if applicable

Property	Unit / Standard		Actual value	Remark
Lube oil	Brand / Type		BP / CLO	
Grade	Multi / Mono		50M	
BN	mg KOH/g / ISO 3771		70	
Ash content	wt.-% [kg/kg] / ISO 6245			
Viscosity	[mm ² /s] / ASTM D7042			
Sulphur content	wt.-% [kg/kg] / ISO 20884			

3.3 Valve seat lubrication oil Please fill in as far as possible Please fill in if applicable

Property	Unit / Standard		Actual value	Remark
Lube oil	Brand / Type			
Grade	multi / mono			
BN	mg KOH/g / ISO 3771			
Ash content	wt.-% [kg/kg] / ISO 6245			
Viscosity	[mm ² /s] / ASTM D7042			
Sulphur content	wt.-% [kg/kg] / ISO 20884			

4. Measurement equipment information (to be completed before measurement) and parameters

Measurement instrument

4.1 BC measurement instrument information Make: AVL Model: 415S

4.2 Measurement principle ☐ LII ☒ FSN ☐ PAS ☐ MAAP
☐ Others: _____

4.3 Values reported as ☐ EC (thermal) Protocol acc.: _____
☐ rBC
☐ eBC
☒ FSN
☐ Others: _____

4.4 Values reported in unit ☐ mg/m_n^3 (wet basis; act. O_2 -concentration) $\text{H}_2\text{O-conc.}$: _____ [Vol.-%] (wet)
☐ mg/m_n^3 (dry basis; act. O_2 -concentration)
☐ mg/m_n^3 (dry basis; Ref. O_2 -concentration) $\text{O}_2\text{-conc.}$: _____ [Vol.-%] (dry)
☐ mg/kWh refer to 5.
☒ FSN
☐ $\text{mg}/\text{kg fuel}$ refer to 5.
☐ Others: _____

4.5 Reference conditions Norm temperature: _____ [°C]
(only if 4.4 is referred to Norm-cubic meters [m_n^3]) Norm pressure: _____ [mbar]

4.6 Sampling time / -number Sampling time of each measurement: 30 [s]
If mean values are reported: Number of consecutive
measurements at each mode point: 5 [-]
Acc. manufacturer specification: ☒ Yes ☐ No

4.7 BC instrument parameter Temperature inside measuring cell: 70 [°C]
Pressure inside measuring cell: Ambient [mbar]
Wavelength(s) used: 550 [nm]
Mass absorption cross section(s) used: 5 [m^2/g]
Conversion equation(s) used: -
Repeatability of the instrument used: $\leq 0.005 \text{ FSN} + 3\%$ of measured value
Reproducibility of the instrument used: $\leq 0.005 \text{ FSN} + 6\%$ of measured value
Acc. manufacturer specification: ☒ Yes ☐ No

Other parameters which could influence the measured values:

Parameter / Correction	Unit

4.8 BC Instrument Calibration

Date of last calibration: - _____ (dd.mm.yyyy)

Calibration procedure according manufacturer specification:

☐ Yes ☐ No ☐ Others: _____Calibration including zero point: ☐ Yes ☐ No

Used medium for zero point calibration: _____

Used calibration standard: ☐ Synthetic flame soot☐ Printex-U☐ Graphite spark aerosol generator GfG soot☐ Soot with inorganic coatings☐ Soot without inorganic coatings☐ Reflectance standards☐ Others: _____

Remark: _____

Leakage test performed before or after calibration: ☐ Yes ☐ No ☐ Not applicable**4.9 Sample gas pre-treatment**

Please fill in if applicable

Exhaust gas dilution: ☐ Yes ☒ No

If yes, dilution ratio (1:x) _____ at mode point: _____ [%]

Dilution medium: ☐ Ambient air ☐ Exhaust gas☐ Others: _____Filtration of the dilution medium before dilution: ☐ Yes ☐ No

Temperature of the dilution medium: _____ [°C]

Temperature of the diluted exhaust gas: _____ [°C]

Evaporation tube ☐ Yes ☒ NoTemperature _____ [°C] acc. manufacturer spec. ☐ Yes ☐ NoCatalytic stripper ☐ Yes ☒ NoTemperature _____ [°C] acc. manufacturer spec. ☐ Yes ☐ NoThermo-denuder ☐ Yes ☒ NoTemperature _____ [°C] acc. manufacturer spec. ☐ Yes ☐ No

Others: _____

4.10 Sample flow rate/volumeAcc. manufacturer specification: ☒ Yes ☐ No

Sample flow rate of the raw exhaust gas: _____ 10 [l/min]

Sample flow rate of the diluted exhaust gas: _____ [l/min]

Sample volume of the raw exhaust gas: _____ [l]

Sample volume of the diluted exhaust gas: _____ [l]

☐ Subkinetic ☐ Isokinetic ☐ Superkinetic ☐ Not applicable

Sample line and probe

4.11 Sample/transfer line

Please fill in if applicable

Use of a sample line: ☒ Yes ☐ No (in situ,...)

Acc. manufacturer specification: ☒ Yes ☐ No

Length of the sample line: 3 [m]

Heated sample line: ☒ Yes ☐ No Temperature: 70 [°C]

Sample line material: Viton

Inner diameter of the sample line: 4 [mm]

Isolated or heated connections between sample line, measurement instrument and probe: ☒ Yes ☐ No

Electrical conductive (sample line material): ☐ Yes ☐ No

Grounded: ☐ Yes ☒ No

Grounding method: _____

Backflushing sample line between measurements: ☒ Yes ☐ No

4.12 Sample probe

Please fill in if applicable

Use of sample probe: ☒ Yes ☐ No (in situ,...)

Acc. manufacturer specification: ☒ Yes ☐ No

Material: ☒ Stainless steel ☐ Others: _____

Type/design:

☐ Probe with single hole at the end (pipe)

☒ Probe with single hole at the end (45° beveled)

☐ Multi-hole

☐ L-shaped pipe with single hole, opening shielded with preclassifier (e.g. hat)

☐ Others: _____

Direction of the probe opening relative to the exhaust gas flow:

☐ With flow ☒ Against flow

☐ Others: _____

Effective cross section of sample hole opening(s) 17.8 [mm²]

Backflushing sample probe between measurements: ☒ Yes ☐ No

Sampling point and probe location

4.13 Sample point and probe location ■ Engine Outlet

☐ Downstream heat exchanger

☐ Downstream exhaust gas treatment device

Treatment device active during measurement:

☐ Yes

☐ No

☐ Others: _____

Distance between engine outlet and sampling point: _____

6 [m]

Diameter of the exhaust gas pipe: _____

1.002

[m]

Type of exhaust gas pipe where the sample probe is located:

☐ Straight part of the exhaust gas pipe

☐ Bent part of the exhaust gas pipe

Immersion depth of the sample probe: _____

0.2

[m]

Orientation of the exhaust gas pipe where the sample probe is located:

☐ Horizontal ☐ Vertical

■ Others: _____

downward

Length of straight part of the exhaust gas pipe,

if sample probe is located at straight part of the exhaust gas pipe:

Upstream sample probe: _____

4

[m]

Downstream sample probe: _____

1

[m]

Exhaust gas pulsation at the sampling point during measurement:

■ No

☐ Yes

_____ [mbar]

5. Determination of engine load, exhaust gas flow, exhaust water content, fuel mass flow, O₂ and CO₂ (if applicable)

5.1 Determination of values, instrument performance and calibration shall be in accordance with the requirements of NOx Technical Code 2008 (NTC 2008) and its applicable appendices

5.2.1 Method of load determination

[Electrical WB Signal 4-20mA](#)

5.2.2 Estimated accuracy of engine load determination

+/- < 1

_____ [%] of reading

5.3.1 Method of exhaust gas flow determination

Calculation

5.3.2 Estimated accuracy of exhaust gas flow determination	+/- 1	[%] of reading
5.4.1 Method of exhaust water content determination	Calculation	
5.4.2 Estimated accuracy of exhaust water content determination	+/- 1	[%] of reading
5.5.1 Method of fuel mass flow determination	Load Cells	
5.5.2 Estimated accuracy of fuel mass flow determination	+/- < 1	[%] of reading
5.6.1 Method of O ₂ and CO ₂ determination	Horiba 7170H	
5.6.2 Estimated accuracy of O ₂ and CO ₂ determination	+/- < 1	[%] of reading

6. Measured values for BC determination (to be completed during measurement; measured values)

Date of measurement (dd.mm.yyyy)

04.04.2014	04.04.2014	04.04.2014	04.04.2014	04.04.2014	04.04.2014
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Engine parameters

Measurement at mode points:	100	85	75	50	25	10	[%]
	↓		↓	↓	↓	↓	
6.1 Stabilized mode point							
Actual Speed	114.4	108.3	103.9	90.8	72.1	53.2	[rpm]
Speed variation during measuring	1	1	1	1	1	1	+/- [%]
Actual Load	10201	8658	7652	5103	2569	1014	[kW]
Load variation during measuring	1	1	1	1	1	1	+/- [%]
6.2 Charge air temperature	43.5	34.6	32	30	29.2	29.1	[°C]
6.3 Charge air pressure	3820.000	3220.000	2920.000	1740.000	580.000	100.000	[mbar]
6.4 Exhaust gas temp. at engine outlet	266	240	229	221	271	286	[°C]

6.5 Exh. gas temp. at sampling point

264	240	229	224	267	278
-----	-----	-----	-----	-----	-----

 [°C]

(only if there is a significant difference to the exhaust gas temperature at the engine outlet)

6.6 Exhaust gas back pressure

58.49	49.97	45.49	28.49	12.09	3.56
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 [mbar]

6.7 Exhaust gas mass flow

77968.000	69508.000	65204.000	47784.000	22947.000	8352.000
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 [kg/h]

Ambient conditions

6.8 Ambient temp. at engine inlet

12.7	16	16.8	17	17.3	17.5
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 [°C]

6.9 Ambient pressure at engine inlet

952.28	952.69	952.61	952.4	952.08	952.06
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 [mbar]

6.10 Absolute humidity of ambient air

6.1	7.3	8.1	8.3	8	7.4
-----	-----	-----	-----	---	-----

 [g/kg]

7. Black Carbon

Reported as (see 4.3):

FSN

Unit (see 4.4): FSN

7.1 Estimated accuracy of measured value

-	-	-	-	-	-
---	---	---	---	---	---

 +/- [%]

7.2 Black Carbon emission

0.106	0.105	0.105	0.087	0.132	0.179
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Remark:

8. Measurement repeatability Indicators

8.1 95% confidence interval

-	-	-	-	-	-
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(+/- unit measured)

8.2 Variance

-	-	-	-	-	-
---	---	---	---	---	---

8.3 Sample size

5	5	5	5	5	5
---	---	---	---	---	---

(number of measurements taken)