



## TECHNICAL DOCUMENTS

According to  
Revised MARPOL Annex VI and NOx Technical Code 2008

Applies for:

Engine type	DI1259M
Engine number	6521462
Power (kW)	331 kw
Rated speed (rpm)	1800 rpm
Engine built	2009
Engine family	DI12M EMS
Approval number	GL 24205-11 HH



TECHNICAL FILE NO: 2033724 2011-12-01

 According to Revised MARPOL Annex VI and  
 NOx Technical Code 2008

For the engine family: DI12 M EMS

Date for original application: 2011-02-08

**CONTENTS**

1.	<b>Record of engine performance and emission relevant components and</b>	2
	Allowable adjustment of components	2
	Diesel fuel	2
	Emission relevant components and settings	3 - 4
2.	<b>On board verification procedure</b>	5
	Injector part No. (see page 3 - 4)	6
3.	<b>Test reports for parent engines</b>	7
	Engine Information	7
	Specified ambient conditions	7
	Application / Intended for	7
	Emission test results	7
	Engine family information	8
	Miscellaneous features	8
	Test cell information, Measurement equipment, Test fuel characteristics	9
	Emission test report for parent engine C1	10
	Emission test report for parent engine E3	11
	Emission test report for parent engine D2	12
	Emission test report for parent engine E2	13

## 1. Record of engine performance and emission relevant components and settings

### Allowable adjustment of components

Allowable adjustment of components and settings is described in the "On board verification procedure".

### Diesel fuel

The engine exhaust emissions and power output are dependent on the fuel quality.

The diesel fuel shall comply with standard: EN 590 (European standard).

Viscosity at 40°C	2.0 - 4.5 mm <sup>2</sup> /s (cSt)
Density at 15°C	0.82 - 0.86 kg/dm <sup>3</sup>
Sulphur (concentration by mass)	max. 0.2%
Ignitability (CET rating)	min. 49
Flashpoint, min	56°C

**Emission relevant components and settings**

Selection criteria for parent engine = Max NOx emission, g/kWh

Engine type	DI12 59M	DI12 60M	DI12 65M	DI12 66M	DI12 62M	DI12 69M	
Application	C1/E3				D2/E2	E3	
No. of cylinders	6						
Rated power, kW	162 - 331	342 - 441	217 - 316	404 - 478	199 - 315	220 - 335	405 - 552
D:o max per cyl, kW	55.2	73.5	52.7	79.7	52.5	55.8	92.0
Rated speed, r/min	1800	2100	2100	2200	1500	1800	2300
Bore/Stroke, mm	127 x 154						
Selected parent	X/X				X/X		
<b>Emission relevant components</b>							
Cylinder head	1743122 2062680	1448282	1750995	1846123	1909203	1787039	1944927
Cyl head gasket	1444941	1468555	1743553	1892765			
Piston	1499635	1528397	1734585	1791501			1794625
Connecting rod	1401729	1768416	1538036				
Camshaft	1523424						
Turbo charger	1386877	1423870 1423020	1386877	1423870	1386877		1777453
Charge air cooler	1421456						1421456 1748153
Test plan number	1737521 to 1737530 1850656	1737537 1737538 1737539 1737541 1737542	1737531 to 1737536	1737540 1737543 1737544	1737546 1737548 1737550 1737552	1737547 1737549 1737551 1737553	1852201 1862386 1862388 1862389 1862428 1902412
Injector	1478643	1487472	1478643	1487472	1478643		1487472
<b>Emission relevant settings</b>							
Inject. timing BTDC*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Valve clearance*	Cold engine: Intake 0.45 mm, outlet 0.70 mm						

Engine type	DI12 70M				DI12 64M		
Application	C1/E3				D2/E2	D2/E2	
No. of cylinders	6						
Rated power, kW	221 - 331	236 - 316	331	211 - 283	234 - 301	315, 377	199-398
D:o max per cyl, kW	55.2	52.7	55.2	47.2	50.2	62.8	66.3
Rated speed, r/min	1800	2200	2300	1500	1800	1500	1800
Bore/Stroke, mm	127 x 154						
Selected parent							
<b>Emission relevant components</b>							
Cylinder head	1743122	1448282	1750995	1846123	1909203	1787039	1944927
Cyl head gasket	1444941	1468555	1743553	1892765			
Piston	1499635	1528397	1734585	1791501			
Connecting rod	1768416	1538036					
Camshaft	1509917					1523424	
Turbo charger	1386877						
Charge air cooler	1421456						
Test plan number	1851460 to 1851463	1851464 1851465 1851466	1851467	1851461 1851462 1851463	1851461 1851462 1851463	1885890 1885891 1885892	1885889 1885890 1885892
Injector	1505199					1487472	
<b>Emission relevant settings</b>							
Inject. timing BTDC*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Valve clearance*	Cold engine: Intake 0.45 mm, outlet 0.70 mm						

\*Also see label on rocker cover



**Emission relevant components and settings**

Selection criteria for parent engine = Max NOx emission, g/kWh

Engine type**	6SY-STP	6SY-STP2	6SY650	6SY700	6SY720	6SY750		
Application	E3							
No. of cylinders	6							
Rated power, kW	530	530	481	515	530	552		
D:o max per cyl, kW	88.3	88.3	80.2	85.8	88.3	92.0		
Rated speed, r/min	2300							
Bore/Stroke, mm	127 x 154							
Selected parent								
<b>Emission relevant components</b>								
Cylinder head	1743122	1448282	1750995	1846123	1909203	1787039	1944927	2062680
Cyl head gasket	1444941	1468555	1743553	1892765				
Piston	1499635	1528397	1734585	1791501	1794625			
Connecting rod	1401729	1768416	1538036					
Camshaft	1523424							
Turbo charger	1777453							
Charge air cooler	1421456	1421456	1748153					
Test plan number	1737880	1772826	1862386	1862387	1902412	1852201		
Injector	1487472							
<b>Emission relevant settings</b>								
Inject. timing BTDC*	N/A	N/A	N/A					
Valve clearance*	Cold engine: Intake 0.45 mm, outlet 0.70 mm							

\*Also see label on rocker cover

\*\* These Yanmar engine types are produced by Scania for Yanmar

## 2. On board verification procedure

The method to verify the on board NOx emissions is the engine parameter check method  
 Components and settings to check

Turbo charger	These components/settings can be checked without dismantling. Location of part numbers, see sketches below.	No adjustment are allowed
Test plan number, see below		See "Important information" below
Valve clearance		See chapter 1, page 3
Cylinder head	These components can only be checked after dismantling and should only be checked during maintenance <b>or</b> if there is doubt about the correctness of the components.	No adjustment are allowed
Cylinder head gasket		No adjustment are allowed
Piston		No adjustment are allowed
Connecting rod		No adjustment are allowed
Cam shaft		No adjustment are allowed
Charge air cooler		No adjustment are allowed
Injector	Location of part numbers, see sketches below.	No adjustment are allowed

### Important information

The injection advance timing of the Engine Control Unit (ECU) is the same for all engines within an engine type. Different ratings, within an engine type, are obtained by variation of the fuel delivery. A test plan number, labeled on the ECU, is introduced for individual combinations of power and speed within an engine type.

Modifications and verification of the software and ECU can only be carried out by Scania service organisation and all program modifications are electronically monitored. Unauthorized access to the ECU, the related settings and software will result in immediate suspension of the certificates and breach of the warranties.

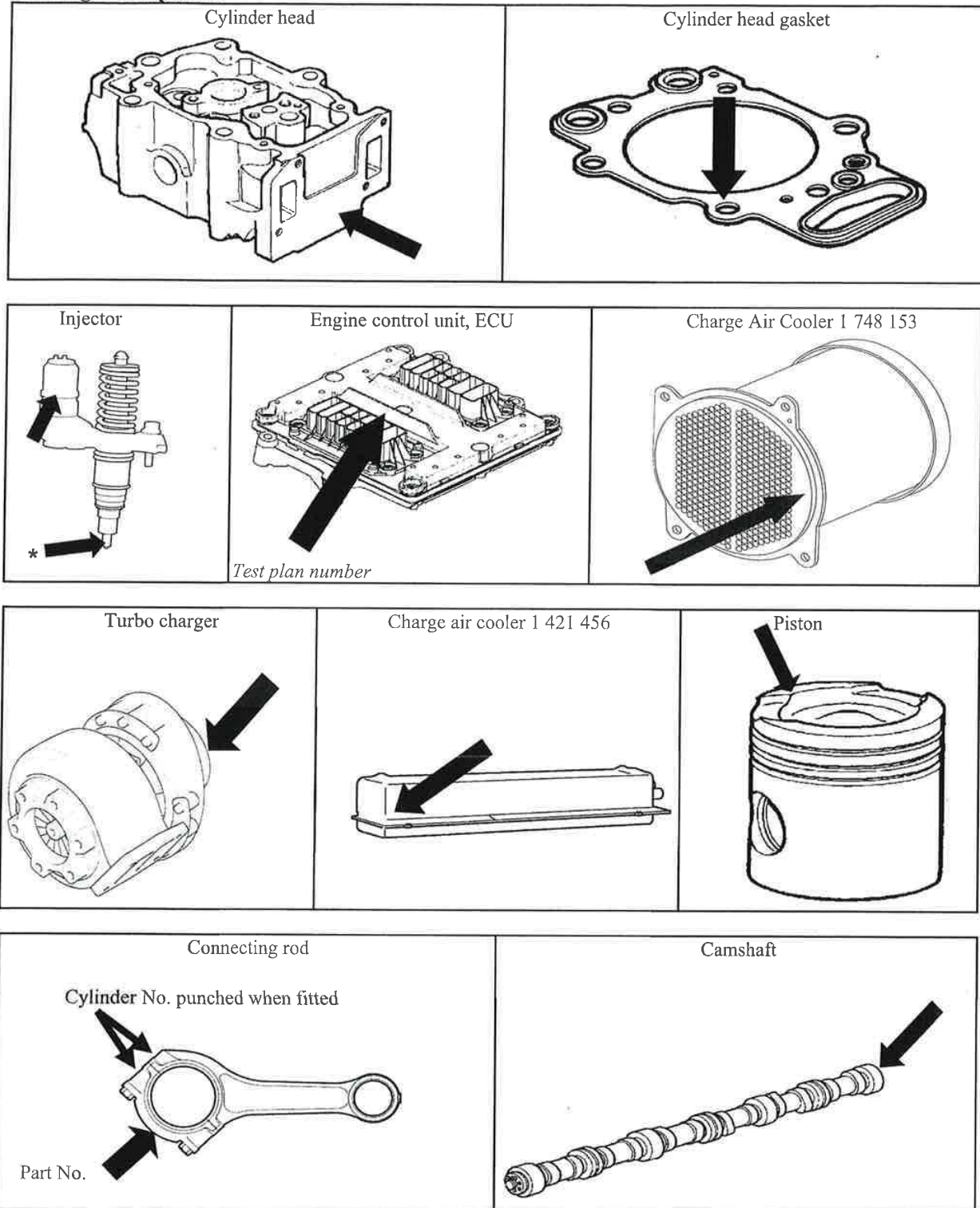
2020-01-10



Approval No EIAPP-F-024205-0068  
 Page 5 of 13

## 2. On board verification procedure

### Marking on components



\*  
Injector part No. (see p. 3)

1 487 472  
1 478 643  
1 505 199

Bosch type

DLA 150 P1269  
DLA 150 P1239  
DLA 150 P1239

Marking

1269  
1239  
1239



Marking, example



Approval No EIAPP-F-024205-0068

Page 6 of 13



**3. Test reports for parent engines**

<b>Engine information</b>					
Manufacturer	SCANIA CV AB				
Family Identification	DI12 M EMS				
Engine intended for cycle	<b>C1</b>	<b>E3</b>	<b>D2</b>	<b>E2</b>	
Engine type, parent engine (tested engine)	DI12 59M	DI12 59M	DI12 62M	DI12 62M	
Serial number, test engine	6505878	6505878	6505878	6505878	
Rated speed	1800	1800	1500	1500	r/min
Rated power	331	331	199	199	kW
Intermediate speed	1350	1350	1500	1500	r/min
Maximum torque at intermediate speed	1756	1756	1276	1276	Nm
Static injection pump timing	N/A	N/A	N/A	N/A	° BTDC
Electronic injection control	Yes	Yes	Yes	Yes	
Variable injection timing	Yes	Yes	Yes	Yes	
Variable turbo charger geometry	No	No	No	No	
Cylinder number and configuration	In-Line 6	In-Line 6	In-Line 6	In-Line 6	
Nominal compression ratio	16:1	16:1	16:1	16:1	
Mean effective pressure at rated power	18,9	19,0	13,7	13,7	bar
Max cylinder pressure at rated power	133,6	133,8	89,8	89,8	bar
<b>Specified ambient conditions</b>					
Nominal coolant into engine *	55	55	55	55	° C
Nominal charge air temperature, if applicable *	92	92	80	80	° C
Cooling system spec: Intermediate cooler	Yes	Yes	Yes	Yes	
Cooling system spec: Charge air stages	1	1	1	1	
L/H temp cooling system set points	75/87	75/87	75/87	75/87	° C
Maximum inlet depression	-5	-5	-5	-5	kPa
Maximum exhaust back pressure	10	10	10	10	kPa
Fuel specification	Acc. to EN590				
Fuel temperature	35	35	35	35	° C
Lubricating oil specification	Acc. to ACEA E3, E4 or better, also see Operator's manual				

\* Applies for keel cooling engines

<b>Application / Intended for</b>					
Customer	X	X	X	X	
Final application/installation: Ship					
Final application/installation: Engine	Aux C1	Main E3	Aux D2	Main E2	
<b>Emission test results</b>					
Cycle	<b>C1</b>	<b>E3</b>	<b>D2</b>	<b>E2</b>	
NOx	7,09	7,03	7,16	6,51	g/kWh
Test identification	69068295	69068295	69068295	69068295	
Date	04-11-03	04-11-03	04-11-03	04-11-03	
Test site: Scania Engine Lab, cell No.	F7	F7	F7	F7	
Test number	69068295	69068295	69068295	69068295	
Surveyor					
Date and place of report					
Signature					



### 3. Test reports for parent engines

<b>Engine family information</b>	
Combustion cycle	4 stroke
Cooling medium	50/50 Water/Glycol coolant
Cylinder configuration	In-line
Method of aspiration	Pressure charger, turbo charger
Fuel type to be used on board	Destillate
Combustion chamber	Open chamber
Valve port configuration	Cylinder head cross flow
Valve port number and size	2 inlet Ø 34,8 mm, 2 outlet Ø 35 mm
Fuel system type	Electronic unit injectors

<b>Miscellaneous features</b>	
Exhaust gas recirculation	No
Water injection/emulsion	No
Air injection	No
Charge cooling system	Yes, air-to-water charge air cooling
Exhaust after-treatment	No
Exhaust after-treatment type	No
Dual fuel	No



**3. Test reports for parent engines**

<b>Test cell information</b>	<b>Test cell:</b>	<b>Tested running cycle:</b>	<b>Date:</b>
	F7	C1	04-11-03
		E3	04-11-03
		D2	04-11-04
		E2	04-11-04
<b>Exhaust pipe</b>			
Diameter	mm	115	
Length	m	10	
Insulation		Yes, 8 m	
Probe location		1,5 m after turbo charger	
Remark			

<b>Measurement equipment</b>					
				<b>Calibration</b>	
<b>Analyser</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Measurement range</b>	<b>Span gas conc.</b>	<b>Deviation</b>
NO <sub>x</sub> analyser	Horiba	CLA-755A	500/5000	910 ppm	1%
CO analyser	Horiba	AIA-721A	5000	896 ppm	1%
CO <sub>2</sub> analyser*	Horiba	AIA-722	15%	13,5 % by volume	1%
O <sub>2</sub> analyser*	N/A	N/A	N/A	N/A	N/A
HC analyzer	Horiba	FIA-725A	500/5000	182,5/1820 ppmC	1%
Speed	Leine & Linde	8650 008994/2048	0 - 2979		±3 r/min
Torque	Hottinger	T10F	0 - 5 kN	0-3,6 om 600 Nm	8 Nm
Power, if appl.	N/A	N/A	N/A	N/A	N/A
Fuel flow	AVL	7131 - 18	0 - 200 kg/h	200 g	0,3 g
Air flow	Holset	4"	0 - 60 kg/min		2%
<b>Temperatures</b>					
Coolant	Pentronic	PT100	0 - 200 °C	0/150 °C	0,1/0,85 °C
Lubricant	Pentronic	PT100	0 - 200 °C	0/150 °C	0,1/0,85 °C
Exhaust gas	Pentronic	Termoelement Typ K	0 - 700 °C	600 °C	0,85 °C
Inlet air	Pentronic	PT100	0 - 200 °C	0/150 °C	0,1/0,85 °C
Intercooled air	Pentronic	PT100	0 - 200 °C	0/150 °C	0,1/0,85 °C
Fuel	Pentronic	PT100	0 - 200 °C	0/150 °C	0,1/0,85 °C
<b>Pressures</b>					
Exhaust gas	Druck	PMP4160	±35 kPa	0/35 kPa	0,5%
Inlet manifold	Kavlico	P657-2 D/E1A	±7 kPa	0/-3,5/-7 kPa	0,5%
Atmospheric	Newpoert	INF-1	500 - 1100 mbar	900-1100 mbar	1 mbar
<b>Vapour pressure</b>					
Intake air	N/A				
<b>Humidity</b>					
Intake air	Mitchell	DEWMET-TDH	-59 - +90 Cdp	-30 - +20 Cdp	0,4 Cdp

Note! The exhaust mass flow was calculated from fuel and air flow measurements

<b>Test fuel characteristics</b>					
<b>Fuel type</b>	Diesel fuel acc to ISO 8217, ISO-F-DMA				
<b>Properties</b>					
Density	ISO 3675	835,1	kg/m <sup>3</sup>		
Viscosity	ISO 3104:94/COR 1:97	2,61	mm <sup>2</sup> /s		
<b>Fuel elemental analysis and test methods</b>					
Carbon	ASTM D 5292	86,52	% mass		
Hydrogen	PRR	13,47	% mass		
Nitrogen	ASTM D4629-96	0,003	% mass		
Oxygen	SS-EN 13132:2000	< 0,1	% mass		
Sulphur	ISO 8754:1992	0,0048	% mass		
Energy	SS 15 51 38:1992	42,94	MJ/kg		



## 3. Test reports for parent engines

## Emission test report for parent engine C1

Engine name: DI12 59M		Date: 2004-11-03				Protocol: 69068295			
Mode		1	2	3	4	5	6	7	8
Torque %	-	100	75	50	10	100	75	50	0
Speed	rpm	Rated				Intermediate			Idle
Start time	min	10	20	30	40	50	60	70	80
<b>Engine performance data</b>									
Engine Power Uncorrected (EM00)	kW	332	248	167	35	248	186	125	1
Speed (NM00)	rpm	1800	1800	1800	1800	1350	1350	1350	700
Fuel Consumption Uncorrected (QB01)	g/kWh	206,4	207,9	209,3	302,0	201,9	205,6	206,5	997,9
Fuel mass flow (QB00)	g/min	1144,1	862,0	582,9	176,0	835,6	640,3	429,8	22,6
Coolant temperature before engine (TW54)	°C	49,1	48,7	38,4	32,6	40,8	37,7	32,7	28,7
Charge air outlet temperature (TL30)	°C	74,5	65,3	62,3	47,7	66,0	59,8	67,9	46,4
Charge air reference temperature	°C	74,5	65,3	62,3	47,7	66,0	59,8	67,9	46,4
Charge air pressure (PL30)	bar	2,05	1,54	0,86	0,16	1,42	0,99	0,54	-0,01
<b>Ambient and gaseous emission</b>									
Barometric pressure of intake air (PL00)	mbar	1022,0	1022,0	1021,8	1021,8	1021,8	1021,6	1021,6	1021,4
Temperature of intake air (TL15)	°C	27,61	22,08	27,02	23,64	25,52	25,42	22,79	26,26
Humidity of intake air (RL13)	g/kg	4,85	4,85	4,64	4,64	4,64	3,91	3,91	3,80
Intake air mass flow (QL01)	kg/min	31,86	27,37	20,32	13,07	19,49	16,34	12,63	4,27
Atmospheric factor (fa)	-	0,99	0,96	0,99	0,97	0,98	0,98	0,97	0,99
NOx Wet (RG26)	ppm	832,8	612,4	587,2	362,2	1055,5	813,9	764,2	203,2
CO Dry (RG27)	ppm	51,3	51,2	46,8	189,4	49,6	48,4	60,4	115,7
HC Wet (RG25)	ppm	76,3	76,8	119,6	177,6	63,6	90,4	111,7	166,2
CO2 Concentration dry (RG28) *	%	9,01	7,47	6,42	3,15	10,85	9,84	8,33	2,43
O2 Concentration dry (RG29) *	%	8,54	10,61	12,01	16,43	6,05	7,44	9,48	17,47
Exhaust temperature (TG21) at sampling point	°C	418	379	353	193	482	455	401	126
Exhaust back pressure (PG23) at sampling point	mbar	34,9	25,9	17,7	3,2	25,2	19,6	13,4	0,0
<b>Correction factors</b>									
NOx humidity correction factor (k <sub>hd</sub> )	-	0,94	0,93	0,94	0,93	0,93	0,93	0,92	0,93
Dry to wet correction (k <sub>wr</sub> )	-	0,93	0,94	0,95	0,97	0,92	0,93	0,94	0,99
<b>Calculated gas mass flow</b>									
NOx (IMO)	kg/h	2,46	1,53	1,10	0,42	1,91	1,22	0,87	0,08
HC	kg/h	0,07	0,06	0,07	0,07	0,04	0,04	0,04	0,02
CO	kg/h	0,09	0,08	0,05	0,14	0,05	0,04	0,04	0,03
CO <sub>2</sub>	kg/h	225,94	170,19	114,98	34,34	165,72	126,53	84,87	4,35
O <sub>2</sub>	kg/h	209,36	204,48	163,50	145,51	100,63	96,81	88,10	54,70
Exhaust mass flow Wet (QG24)	kg/h	1980,11	1694,11	1254,36	794,74	1219,81	1018,84	783,69	257,55
<b>Calculated specific emission</b>									
NOx (IMO)	g/kWh	7,41	6,15	6,56	12,15	7,70	6,53	7,02	56,77
CO	g/kWh	0,28	0,32	0,32	4,06	0,22	0,24	0,34	21,05
HC	g/kWh	0,22	0,25	0,43	1,94	0,15	0,24	0,34	15,13
CO <sub>2</sub>	g/kWh	680,48	685,81	689,12	983,18	669,19	678,75	681,55	3212,81
O <sub>2</sub>	g/kWh	630,56	824,01	979,89	4166,45	406,36	519,30	707,48	40360,39

Weighted specific emission: C1										Sum
C1 Weighting factors	-	0,15	0,15	0,15	0,10	0,10	0,10	0,10	0,15	1,000
Weighted power	kW	49,804	37,223	25,028	3,492	24,765	18,642	12,452	0,203	171,609
NOx (IMO)	g/kWh	2,152	1,335	0,957	0,247	1,111	0,710	0,509	0,067	7,09
HC	g/kWh	0,063	0,054	0,063	0,039	0,022	0,026	0,024	0,018	0,31
CO	g/kWh	0,080	0,069	0,047	0,083	0,031	0,026	0,025	0,025	0,39
CO <sub>2</sub>	g/kWh	197,487	148,758	100,505	20,008	96,569	73,733	49,454	3,806	690,32

**Note:**

The exhaust mass flow was calculated from fuel and air flow measurements according to revised MARPOL 73/78, Annex VI, NOx Technical Code 2008 part 5.5.3. Grey fields are measured values by AVL PUMA.

Values marked with an asterisk were not measured, they were calculated.



## 3. Test reports for parent engines

**Emission test report for parent engine E3**

Engine name: DI12 59M		Date: 2004-11-03		Protocol: 69068302	
Mode		1	2	3	4
Power %	-	100	75	50	25
Speed %	rpm	100	91	80	63
Start time (HM)	min	10	20	30	40
<b>Engine performance data</b>					
Engine Power Uncorrected (EM00)	kW	333	249	166	83
Speed (NM00)	rpm	1800	1638	1440	1134
Fuel Consumption Uncorrected (QB01)	g/kWh	206,7	203,2	203,3	206,2
Fuel mass flow (QB00)	g/min	1148,5	844,9	564,5	286,5
Coolant temperature before engine (TW54)	°C	49,4	48,0	36,8	33,6
Charge air outlet temperature (TL30)	°C	74,9	64,6	58,5	56,3
Charge air reference temperature	°C	74,9	64,6	58,5	56,3
Charge air pressure (PL30)	bar	2,06	1,50	0,83	0,24
<b>Ambient and gaseous emission</b>					
Barometric pressure of intake air (PL00)	mbar	1017,5	1017,3	1017,3	1017,3
Temperature of intake air (TL15)	°C	25,9	23,5	24,7	25,9
Humidity of intake air (RL13)	g/kg	4,98	5,02	5,02	5,02
Intake air mass flow (QL01)	kg/min	32,0	24,4	16,1	8,7
Atmospheric factor (fa)	-	0,99	0,97	0,98	0,99
NOx Wet (RG26)	ppm	823,7	744,8	742,7	979,6
CO Dry (RG27)	ppm	50,7	42,7	46,6	75,4
HC Wet (RG25)	ppm	75,8	80,9	101,3	124,0
CO2 Concentration dry (RG28) *	%	7,80	7,49	7,62	7,16
O2 Concentration dry (RG29) *	%	10,27	10,68	10,50	11,14
Exhaust temperature (TG21) at sampling point	°C	417	403	412	359
Exhaust back pressure (PG23) at sampling point	mbar	34,65	25,78	17,90	8,55
Air fuel ratio (RL06)	-	0,04	0,03	0,04	0,03
<b>Correction factors</b>					
NOx humidity correction factor (khd)	-	0,94	0,93	0,94	0,94
Dry to wet correction (kwr)	-	0,93	0,94	0,93	0,94
<b>Calculated gas mass flow</b>					
NOx (IMO)	kg/h	2,44	1,67	1,10	0,78
CO	kg/h	0,09	0,06	0,04	0,04
HC	kg/h	0,07	0,06	0,05	0,03
CO2	kg/h	226,82	166,87	111,47	56,54
O2	kg/h	209,82	167,13	107,90	61,79
Exhaust mass flow Wet (QG24)	kg/h	1986,6	1516,8	997,1	536,5
<b>Calculated specific emission</b>					
NOx (IMO)	g/kWh	7,318	6,716	6,614	9,405
CO	g/kWh	0,273	0,235	0,252	0,441
HC	g/kWh	0,217	0,236	0,291	0,383
CO2	g/kWh	681,572	670,293	670,543	679,466
O2	g/kWh	630,480	671,361	649,076	742,631

Weighted specific emissions: E3						Sum
E3 Weighting factors	-	0,20	0,50	0,15	0,15	1,000
Weighted power	kW	66,558	124,472	24,935	12,481	228,446
NOx (IMO)	g/kWh	2,132	3,659	0,722	0,514	7,03
HC	g/kWh	0,063	0,129	0,032	0,021	0,24
CO	g/kWh	0,079	0,128	0,028	0,024	0,26
CO2	g/kWh	198,578	365,219	73,190	37,122	674,11

**Note:**

The exhaust mass flow was calculated from fuel and air flow measurements according to revised MARPOL 73/78, Annex VI, NOx Technical Code 2008 part 5.5.3. Grey fields are measured values by AVL PUMA. Values marked with an asterisk were not measured, they were calculated.



## 3. Test reports for parent engines

**Emission test report for parent engine D2**

Engine name: DI12 62M		Date: 2004-11-04			Protocol: 69068305	
<b>Mode</b>		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Torque %	-	100	75	50	25	10
Speed	rpm	Rated				
Start time	min	10	20	30	40	50
<b>Engine performance data</b>						
Engine Power Uncorrected (EM00)	kW	200	147	100	50	19
Speed (NM00)	rpm	1500	1500	1500	1500	1500
Fuel Consumption Uncorrected (QB01)	g/kWh	206,4	206,1	213,3	235,7	345,6
Fuel mass flow (QB00)	g/min	689,7	506,3	356,9	197,3	110,2
Coolant temperature before engine (TW54)	°C	39,5	34,8	32,8	31,9	31,6
Charge air temperature (TL30)	°C	63,3	58,0	63,5	44,5	38,3
Charge air reference temperature	°C	63,3	58,0	63,5	44,5	38,3
Charge air pressure (PL30)	bar	1,15	0,72	0,40	0,14	0,06
<b>Ambient and gaseous emission</b>						
Barometric pressure of intake air (PL00)	mbar	1010,2	1010,2	1010,1	1010,1	1010,0
Temperature of intake air (TL15)	°C	23,4	24,2	26,7	22,8	26,3
Humidity of intake air (RL13)	g/kg	6,13	6,13	6,15	6,15	6,21
Intake air mass flow (QL01)	kg/min	19,3	15,7	12,7	10,7	10,0
Atmospheric factor (fa)	-	0,98	0,98	1,00	0,98	0,99
NOx Wet (RG26)	ppm	693,1	632,7	594,3	482,1	297,4
CO Dry (RG27)	ppm	47,1	52,4	76,0	199,9	346,8
HC Wet (RG25)	ppm	118,9	114,9	131,5	159,1	221,9
CO2 Concentration dry (RG28) *	%	7,7	7,0	6,1	3,9	2,3
O2 Concentration dry (RG29) *	%	10,3	11,4	12,6	15,5	17,7
Exhaust temperature (TG21) at sampling point	°C	421	387	338	230	159
Exhaust back pressure (PG23) at sampling point	mbar	21,79	15,22	10,99	4,84	2,57
Air fuel ratio (RL06)	-	0,05	0,05	0,04	0,03	0,02
<b>Correction factors</b>						
NOx humidity correction factor (khd)	-	0,94	0,95	0,95	0,94	0,95
Dry to wet correction (kwr)	-	0,93	0,94	0,95	0,96	0,98
<b>Calculated gas mass flow</b>						
NOx (IMO)	kg/h	1,25	0,92	0,70	0,47	0,27
HC	kg/h	0,07	0,05	0,05	0,05	0,06
CO	kg/h	0,05	0,05	0,05	0,12	0,20
CO2 Concentration dry (RG28)	kg/h	136,04	99,85	70,28	38,62	21,24
O2 Concentration dry (RG28)	kg/h	127,61	114,10	102,84	107,45	115,33
Exhaust mass flow Wet (QG24)	kg/h	1201,7	970,7	781,4	651,4	603,8
<b>Calculated specific emission</b>						
NOx (IMO)	g/kWh	6,237	6,265	6,999	9,366	14,192
CO	g/kWh	0,255	0,313	0,541	2,414	10,333
HC	g/kWh	0,342	0,363	0,491	0,990	3,357
CO2	g/kWh	680,000	678,389	700,757	769,869	1111,227
O2	g/kWh	637,832	775,183	1025,452	2141,857	6033,248

Weighted specific emissions: D2							Sum
D2 Weighting factors	-	0,05	0,25	0,30	0,30	0,10	1,000
Weighted power	kW	10,003	36,797	30,086	15,050	1,912	93,848
NOx (IMO)	g/kWh	0,665	2,456	2,244	1,502	0,289	<b>7,16</b>
HC	g/kWh	0,036	0,142	0,157	0,159	0,068	<b>0,56</b>
CO	g/kWh	0,027	0,123	0,173	0,387	0,210	<b>0,92</b>
CO2	g/kWh	72,481	265,993	224,650	123,461	22,635	<b>709,22</b>

**Note:**

The exhaust mass flow was calculated from fuel and air flow measurements according to revised MARPOL 73/78, Annex VI, NOx Technical Code 2008 part 5.5.3. Grey fields are measured values by AVL PUMA. Values marked with an asterisk were not measured, they were calculated.



## 3. Test reports for parent engines

**Emission test report for parent engine E2**

Engine name: DI12 62M		Date: 2004-11-04		Protocol: 69068305	
Mode		1	2	3	4
Torque %	-	100	75	50	25
Speed	rpm	Rated			
Start time	min	10	20	30	40
<b>Engine performance data</b>					
Engine Power Uncorrected (EM00)	kW	200	147	100	50
Speed (NM00)	rpm	1500	1500	1500	1500
Fuel Consumption Uncorrected (QB01)	g/kWh	206,4	206,1	213,3	235,7
Fuel mass flow (QB00)	g/min	689,7	506,3	356,9	197,3
Coolant temperature before engine (TW54)	°C	39,5	34,8	32,8	31,9
Charge air outlet temperature (TL30)	°C	63,3	58,0	63,5	44,5
Charge air reference temperature	°C	63	58	63	44
Charge air pressure (PL30)	bar	1,15	0,72	0,40	0,14
<b>Ambient and gaseous emission</b>					
Barometric pressure of intake air (PL00)	mbar	1010,2	1010,2	1010,1	1010,1
Temperature of intake air (TL15)	°C	23,4	24,2	26,7	22,8
Humidity of intake air (RL13)	g/kg	6,13	6,13	6,15	6,15
Intake air mass flow (QL01)	kg/min	19,3	15,7	12,7	10,7
Atmospheric factor (fa)	-	0,98	0,98	1,00	0,98
NOx Wet (RG26)	ppm	693,1	632,7	594,3	482,1
CO Dry (RG27)	ppm	47,1	52,4	76,0	199,9
HC Wet (RG25)	ppm	118,9	114,9	131,5	159,1
CO <sub>2</sub> Concentration dry (RG28) *	%	7,7	7,0	6,1	3,9
O <sub>2</sub> Concentration Wet (RG29) *	%	10,3	11,4	12,6	15,5
Exhaust temperature (TG21) at sampling point	°C	421	387	338	230
Exhaust back pressure (PG23) at sampling point	mbar	21,79	15,22	10,99	4,84
Air fuel ratio (RL06)	-	0,05	0,05	0,04	0,03
<b>Correction factors</b>					
NOx humidity correction factor (k <sub>hd</sub> )	-	0,94	0,95	0,95	0,94
Dry to wet correction (k <sub>wr</sub> )	-	0,93	0,94	0,95	0,96
<b>Calculated gas mass flow</b>					
NOx (IMO)	kg/h	1,25	0,92	0,70	0,47
CO	kg/h	0,05	0,05	0,05	0,12
HC	kg/h	0,07	0,05	0,05	0,05
CO <sub>2</sub>	kg/h	136,04	99,85	70,28	38,62
O <sub>2</sub>	kg/h	127,61	114,10	102,84	107,45
Exhaust mass flow Wet (QG24)	kg/h	1201,7	970,7	781,4	651,4
<b>Calculated specific emission</b>					
NOx (IMO)	g/kWh	6,237	6,265	6,999	9,366
CO	g/kWh	0,255	0,313	0,541	2,414
HC	g/kWh	0,342	0,363	0,491	0,990
CO <sub>2</sub>	g/kWh	680,000	678,389	700,757	769,869
O <sub>2</sub>	g/kWh	637,832	775,183	1025,452	2141,857

Weighted specific emissions: E2						Sum
E2 Weighting factors	-	0,20	0,50	0,15	0,15	1,000
Weighted power	kW	40,013	73,595	15,043	7,525	136,176
NOx (IMO)	g/kWh	1,833	3,386	0,773	0,518	6,51
HC	g/kWh	0,101	0,196	0,054	0,055	0,41
CO	g/kWh	0,075	0,169	0,060	0,133	0,44
CO <sub>2</sub>	g/kWh	199,806	366,628	77,411	42,543	686,39

**Note:**

The exhaust mass flow was calculated from fuel and air flow measurements according to revised MARPOL 73/78, Annex VI, NOx Technical Code 2008 part 5.5.3. Grey fields are measured values by AVL PUMA.

Values marked with an asterisk were not measured, they were calculated.

