VOLVO PENTA

D13 MH (R2-600)

Document No	Issue Index
23432750	**03**

General

4-stroke direct injected, turbocharged and aftercooled diesel engine

Number of cylinders		6
No of valves		24
Displacement, total	litres in³	12.78 779.7
Firing order		1-5-3-6-2-4
Rotational direction, viewed from the front		Clockwise
Bore	mm in	131 5.16
Stroke	mm in	158 6.22
Compression ratio		18.5
Compression pressure at 240 rpm	MPa psi	3.5 508
Max. static forward inclination:	°	0
Max. static backward inclination:	°	10
Max. intermittent forward inclination while running:	°	35
Max. intermittent backward inclination while running:	°	35
Max. intermittent side inclination while running:	°	35
Idling speed	rpm	550-800
Rated speed R2	rpm	1900
Propeller selection range R2	rpm	1870-1970
Dry weight engine BT	kg lb	HE=1520, KC=1480 HE=3351, KC=3263

1) ISO 3046, fuel temp 40°C.
ISO 8665 (=SAE J 1228=ICOMIA 28-83)
2) At power according to 1).
3) If reverse gear is used, 4% in heat rejection will be added for its oil cooler.
4) Acc. to ISO 3744
5) At installed back pressure

VOLVO PENTA

D13 MH (R2-600)

Document No	Issue Index
23432750	**03**

Performance	**Rating**	**rpm**	**600**	**800**	**1000**	**1200**	**1400**	**1500**	**1600**	**1800**	**1900**
Crankshaft power 1), 5)	2	kW	81	159	252	327	381	413	436	441	441
		hp	110	216	342	444	519	561	593	599	600
Propeller shaft power 1) (At full load)	2	kW	78	153	242	313	366	396	418	423	424
With drive Twin Disc 5114		hp	105	208	328	426	498	539	569	575	576
Propellershaft power at prop. load $x^{2,5}$	2	kW	24	49	86	135	198	235	276	371	424
With drive Twin Disc 5114		hp	33	67	116	183	269	320	376	504	577
Propellershaft power at prop. load x^{3}	2	kW	14	32	62	107	170	209	254	304	424
With drive Twin Disc 5114		hp	18	44	84	146	231	284	345	413	577
Torque at crankshaft 2)	2	Nm	1286	1899	2403	2598	2601	2626	2602	2337	2218
		lbf ft	948	1401	1772	1916	1918	1937	1919	1724	1636
Mean piston speed	2	m/s	3.2	4.2	5.3	6.3	7.4	7.9	8.4	9.5	10.0
		ft/s	10.4	13.8	17.3	20.7	24.2	25.9	27.6	31.1	32.8
Effective mean pressure 2)	2	MPa	1.26	1.87	2.36	2.56	2.56	2.58	2.56	2.30	2.18
		psi	183.4	270.9	342.7	370.6	371.0	374.6	371.1	333.3	316.4
Max combustion pressure 2)	2	MPa	13.9	15.1	20.6	19.8	19.6	19.7	20.5	20.4	20.4
		psi	2016	2190	2988	2872	2843	2857	2973	2959	2959

Lubricating system

Specific lubricating oil consumption.	g/kWh	0.06
Max. oil volume including filters for all allowed installation inclinations:	litres	49
	US gal	12.94
Max. oil volume excluding filters for all allowed installation inclinations:	litres	44
	US gal	11.62
Min. oil volume excluding filters for all allowed installation inclinations:	litres	35
	US gal	9.25

Fuel system	**Rating**	**rpm**	**600**	**800**	**1000**	**1200**	**1400**	**1500**	**1600**	**1800**	**1900**
Specific fuel consumption att full load	2	g/kWh	248.8	219.3	194	189.1	193.4	194.2	196.7	198.6	200.2
		lb/hph	0.403	0.355	0.314	0.306	0.313	0.315	0.319	0.322	0.324
Fuel consumption at prop. load $x^{2,5}$	2	l/h	7.0	13.0	22.0	33.0	47.0	56.0	66.0	91.0	105.0
		US gal/h	1.8	3.4	5.8	8.7	12.4	14.8	17.4	24.0	27.7
Fuel consumption at prop. load x^{3}	2	l/h	4.0	9.0	16.0	27.0	41.0	51.0	61.0	88.0	105.0
		US gal/h	1.1	2.4	4.2	7.1	10.8	13.5	16.1	23.2	27.7
Fuel consumption at full load	2	l/h	24.1	41.8	58.4	73.9	88.2	95.9	102.6	104.7	105.7
		US gal/h	6.4	11.0	15.4	19.5	23.3	25.3	27.1	27.7	27.9

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VOLVO PENTA

D13 MH (R2-600)

Document No	Issue Index
23432750	**03**

Intake and exhaust system	**Rating**	**rpm**	**600**	**800**	**1000**	**1200**	**1400**	**1500**	**1600**	**1800**	**1900**	
Specific exhaust heating effect in percent of crankshaft power	2	%	55.0	49.7	51.9	59.2	60.9	62.4	61.3	62.6	63.3	
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	2	°C	552	580	505	445	474	463	471	475	475	
		°F	1026	1076	941	833	885	865	880	887	887	
Exhaust back pressure after turbocharger at rated speed during test.		kPa									12	
		psi									1.7	
Permitted exhaust back pressure after turbocharger. (Installed back pressure)		kPa							Max		17	
		psi									2.5	
		kPa							Min		0	
		psi									0.0	
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPA	2	m³/min	4.6	8.2	13.8	23.5	25	27.7	28.7	29.6	29.8	
		cu.ft./min	162.4	289.6	487.3	829.9	882.9	978.2	1014	1045	1052	
Charge air pressure Inlet manifold	2	kPa	37	85	151	216	231	250	247	230	220	
		psi	5.4	12.3	21.9	31.3	33.5	36.3	35.8	33.4	31.9	
Exhaust gas flow	2	m³/min	12.1	21.6	35.9	53.2	64	70.8	73.6	75.7	76.2	
		cu.ft./min	427.3	762.8	1268	1879	2260	2500	2599	2673	2691	

Cooling system	**Rating**	**rpm**	**600**	**800**	**1000**	**1200**	**1400**	**1500**	**1600**	**1800**	**1900**	
Radiated heat (per engine)	2	kW	5	5	5	5	6	6	7	7	7	
Heat rejection to charge air coolers	2	kW	3	12	30	57	72	87	92	94	94	
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air coolers.	2	kW	112	167	171	160	195	199	228	233	236	
Coolant flow with fully open thermostat and std cooling system		l/min	120	192	246	306	360	384	408	450	480	
		cu.ft./min	4.2	6.8	8.7	10.8	12.7	13.6	14.4	15.9	17.0	
Max. permissible temperature on coolant in engine outlet		°C	98									
		°F	208									
Coolant volume engine, including heat exchanger and charge air cooler		litres	51									
		US gal.	13.47									
Max. additional coolant for cabin heater etc. with std. Expansion tank		litres	15									
		US gal.	3.96									
Maximum coolant flow to cabin heater etc.		l/min	42									
		cu.ft./min	1.48									
Thermostat, start open at		°C	82									
		°F	180									
Thermostat, fully open at		°C	92									
		°F	198									

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VOLVO PENTA
D13 MH (R2-600)

Document No	Issue Index
23432750	**03**

Raw water circuit	**rpm**	**600**	**800**	**1000**	**1200**	**1400**	**1500**	**1600**	**1800**	**1900**
Nominal raw water design flow	l/min	161	216	273	320	368	392	414	436	456
	cu.ft/min	5.7	7.6	9.6	11.3	13.0	13.8	14.6	15.4	16.1
Nominal raw water pump pressure head at design flow. (measured before and after pump)	kPa	19	30	49	66	84	95	107	119	131
	psi	2.8	4.4	7.1	9.6	12.2	13.8	15.5	17.3	19.0
Maximum raw water pump suction head	kPa	-30								
	psi	-4.4								
Maximum raw water temperature entering heat exchanger	°C	32								
	°F	90								

2 circuit keel cooling system, LT	**Rating**	**rpm**	**600**	**800**	**1000**	**1200**	**1400**	**1500**	**1600**	**1800**	**1900**
Maximum temperature to charge air cooler from external LT-cooling system	2	°C									42
		°F									108
Coolant flow through keel cooler, LT-cooling system circuit	2	l/min	33	45	58	70	81	85	90	96	98
		cu.ft./min	1.2	1.6	2.0	2.5	2.9	3.0	3.2	3.4	3.5
Pressure drop in external LT-cooling system circuit, including piping		kPa	85								
		psi	12.3								
Coolant volume charge air cooler		litres	5								
		US gal.	1.32								

2 circuit keel cooling system, HT	**Rating**	**rpm**	**600**	**800**	**1000**	**1200**	**1400**	**1500**	**1600**	**1800**	**1900**
Design point for keel cooler, engine outlet temperature	2	°C									88
		°F									190
Maximum temperature to engine from external HT-cooling system circuit	2	°C									70
		°F									158
Coolant flow through keel cooler, HT-cooling system circuit at design point	2	l/min									182
		cu.ft./min									6.4
Maximun coolant flow through keel cooler, HT-cooling system circuit	2	l/min									295
		cu.ft./min									10.4
Pressure drop in external HT-cooling system circuit, including piping		kPa	85								
		psi	12.3								
Coolant volume engine, excl. heat exchangers		litres	28								
		US gal.	7.40								

Emissions	**Rating**	**rpm**	**600**	**800**	**1000**	**1200**	**1400**	**1500**	**1600**	**1800**	**1900**
Smoke at prop. load $x^{2,5}$	2	*BSU	0.06	0.08	0.41	0.24	0.13	0.11	0.07	0.10	0.15
Smoke at prop. load x^3	2	*BSU	0.07	0.07	0.24	0.21	0.16	0.20	0.08	0.10	0.15
Noise at prop. load x^3. 4)	2	dBA	99.5	101.7	103.8	108.4	109.8	110.2	111.1	113.2	114

***NB.!** BSU are calculated values. Measured values are acc. to ISO 10054 in FSN units

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VOLVO PENTA

D13 MH (R2-600)

Document No	Issue Index
23432750	03

Sensors : Control and Monitoring System							Engine protection action
Sensors	**Signal**	**Range**	**Unit**	**Warning Initial Delay / Warning Delay**	**Warning Level**	**Derating Level**	
AUS/DEF concentration	Ultrasonic 1 Hz	0 - 62.5	%	N/A	<28	N/A	Warning only
AUS/DEF Tank Empty	Ultrasonic 1 Hz	0-100	%	30 sec	0	N/A	Warning only
AUS/DEF Tank Low level	Ultrasonic 1 Hz	0-100	%	30 sec	15	N/A	Warning only
AUS/DEF tank temp High alarm	Resistive	-40 - 125 ±1.5°C	°C	1 sec	70	N/A	Warning only
Coolant level switch	Digital	ON/OFF		30 sec from start / 11 sec	Low	N/A	Warning only
Coolant temperature	50-0 kΩ	-40 - 140 ±1.5°C	°C	30 sec from start / 2 sec	98	101	See derating map
Engine speed cam	Frequency		rpm	Instant	Lost signal	N/A	Warning only
Engine speed crank	Frequency		rpm	Instant	Lost signal	N/A	Warning only
Exhaust gas temperature after turbine	PT200	-40 - 750 ± 2.5%	°C	30 sec from start / 2 sec	532	550	See derating map
					N/A	532	Engine derate*
Oil level sensor	Digital	± 1.9 mm		30 sec from start / 5 sec	Low level	N/A	Warning only
Oil temperature	50-0 kΩ	-40 - 140 ± 1.5°C	°C	30 sec from start/1.5 sec	125	130	See derating map
Exhaust temperature before muffler	PT200	-40 - 750 ± 2.5%	°C	30 sec from start / 2 sec	532	N/A	Warning only
Water In fuel switch	Digital	ON/OFF		Instant	Water in fuel	N/A	Warning only
Wet Exhaust temp	PT200	0 - 850	°C	30 sec from start / 5 sec	192	200	See derating map

* Engine will decrease torque to reduce temperatures in the engine and SCR.

VOLVO PENTA

D13 MH (R2-600)

Document No	Issue Index
23432750	**03**

Sensors (rpm dependent)	Signal	Range	Unit	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Comment
Charge air pressure	0,5-4,5 V	50-600 ±4.2 kPa	kPa		**600 rpm**	**1000 rpm**	**1200 rpm**	**1500 rpm**	**1900 rpm**	*From prop curve 2.5 with IPS drive*
Warning Level			kPa	30 sec from start / 2.2sec	280	280	280	290	368	
Derating Level			kPa	10% trq. decr. per sec	290	290	290	300	378	
Charge air temperature	50-0 kΩ	-40 - 130 ±4%	°C		**600 rpm**	**1000 rpm**	**1200 rpm**	**1500 rpm**	**1900 rpm**	
Warning Level			°C	60 sec from start / 15 sec	80	80	80	80	75	
Derating Level			°C		85	85	85	85	80	**See derating map**
Coolant pressure	0,5-4,5 V	0-300 ± 3%	kPa		**600 rpm**	**1000 rpm**	**1200 rpm**	**1500 rpm**	**1900 rpm**	
Warning Level			kPa	30 sec from start /1.5sec	0	25	35	50	85	
Derating Level			kPa	10% trq. decr. per sec	-5	20	30	45	80	
Fuel pressure	0,5-4,5 V	0-700 ±2.5%	kPa		**600 rpm**	**1000 rpm**	**1200 rpm**	**1500 rpm**	**1900 rpm**	
Warning Level			kPa	60 sec from start / 5 sec	80	80	80	205	280	
Derating Level			kPa	NA	NA	NA	NA	NA	NA	
Oil pressure	0,5-4,5 V	0-700 ±2.5%	kPa		**600 rpm**	**1000 rpm**	**1200 rpm**	**1500 rpm**	**1900 rpm**	
Warning Level			kPa	30 sec from start / 3 sec	120	200	224	260	260	
Derating Level			kPa	10% trq. decr. per sec	95	175	199	235	235	
Seawater pressure	0,5-4,5 V	0-300 ± 3%	kPa		**600 rpm**	**1000 rpm**	**1200 rpm**	**1500 rpm**	**1900 rpm**	
Warning Level			kPa	30 sec from start /5 sec	-5	10	18	30	50	
Derating Level			kPa	10% trq. decr. per sec	-15	0	8	20	40	

Warning = Yellow Lamp active

Derating = Red Lamp active

VOLVO PENTA

D13 MH (R2-600)

Document No	Issue Index
23432750	**03**

Remarks

Charge Air Temp [°C]	**rpm**	**90°C**	**95°C**	**105°C**
Remaining torque in %	600	100%	100%	100%
	1200	100%	82%	74%
	1800	100%	66%	52%

Coolant temp [°C]	**rpm**	**96°C**	**103°C**	**106°C**
Remaining torque in %	600	100%	100%	100%
	1200	100%	97%	93%
	1800	100%	50%	0%

Exhaust Temp [°C]	**rpm**	**550°C**	**560°C**	**565°C**	**570°C**
Remaining torque in %	600	100%	100%	100%	100%
	1200	100%	97%	95%	93%
	1800	100%	50%	25%	0%

Oil temp [°C]	**rpm**	**125°C**	**132°C**	**134°C**
Remaining torque in %	600	100%	100%	100%
	1200	100%	97%	93%
	1800	100%	50%	0%

Wet exhaust temp [°C]	**rpm**	**190°C**	**200°C**	**205°C**	**210°C**
Remaining torque in %	600	100%	100%	100%	100%
	1200	100%	96%	93%	89%
	1800	100%	93%	86%	80%

VOLVO PENTA
D13 MH (R2-600)

Document No	Issue Index
23432750	03

Tranmission: Control and Monitoring System						Engine protection action
Sensors	**Signal**	**Range**	**Unit**	**Warning Initial Delay / Warning Delay**	**Warning Level**	
Gear oil temperature (EVC)	50-0 kΩ	-30 - 130 ± 4%	°C	N/A	95	Warning only
Gear oil pressure (EVC)	0.5-4.5V	0-3000 ±3%	kPa	60 sec from start/7sec	700	Warning only

For SDM only

Sensors Control and Monitoring System						Engine protection action
Sensors	**Signal**	**Range**	**Unit**	**Warning Initial Delay / Warning Delay**	**Shutdown level**	
Coolant temperature	Digital	ON/OFF ON= Shutdown	°C	12sec from start/1 sec	105	Shutdown
Eng. overspeed SDM 1900+15%	Frequency	153 puls./rev	rpm / Hz	Instant	2185 rpm/5572 Hz	Shutdown

Sensors (rpm dependent)	Signal	Range	Unit	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Engine protection action
					0 rpm	600 rpm	1000 rpm	1500 rpm	1800 rpm	
Oil pressure	Digital	ON/OFF	kPa	12 sec from start / 1 sec	NA	120 ±20	120 ±20	120 ±20	120 ±20	Shutdown
Gear oil pressure (IPS)	Digital	ON/OFF	kPa	12 sec from start / 1 sec	NA	400 ±20	400 ±20	400 ±20	400 ±20	Shutdown
Gear oil pressure (Reverse gear ZF)	Digital	500-3000	kPa	12 sec from start / 1 sec	NA	2100±20	2100±20	2100±20	2100±20	Shutdown
Gear oil pressure (Reverse gear Other)	Digital	500-3000	kPa	12 sec from start / 1 sec	NA	X±20	X±20	X±20	X±20	Shutdown Level depending on type of gearbox

VOLVO PENTA D13 MH (R2-600)	Document No 23432750	Issue Index 03

Technical data - Exhaust AfterTreatment System data (EATS)

Weight data:

SCR system weight: (incl SCR unit, AUS injector pipe, AUS sensor and bracket)			kg lb	115.7 255.1
Total SCR system weight for IPS: (incl SCR unit, AUS injector pipe, AUS sensor and bracket, exhaust piping)			kg lb	115.7 255.1
AUS pump			kg lb	3.1 6.8
AUS cabinet 20l weight: (incl tank, pump,UQS, ACM)			kg lb	36.4 80.2
AUS tank 160l weight:			kg lb	45.0 99.2
UQS - Lenght/Weight	mm in	439.0 17.3	kg lb	1.2 2.6
UQS - Lenght/Weight	mm in	597.0 23.5	kg lb	1.2 2.6
UQS - Lenght/Weight	mm in	715.0 28.1	kg lb	1.3 2.9

Dimension data:

SCR Surface area		m2/ft2	2.2 / 23.7
SCR Flange:	Standard type		
	Diameter:	in/mm	6 / 152
	Number of Inlet / Outlet:	1 inlet / 2 outlet	

Flow data:

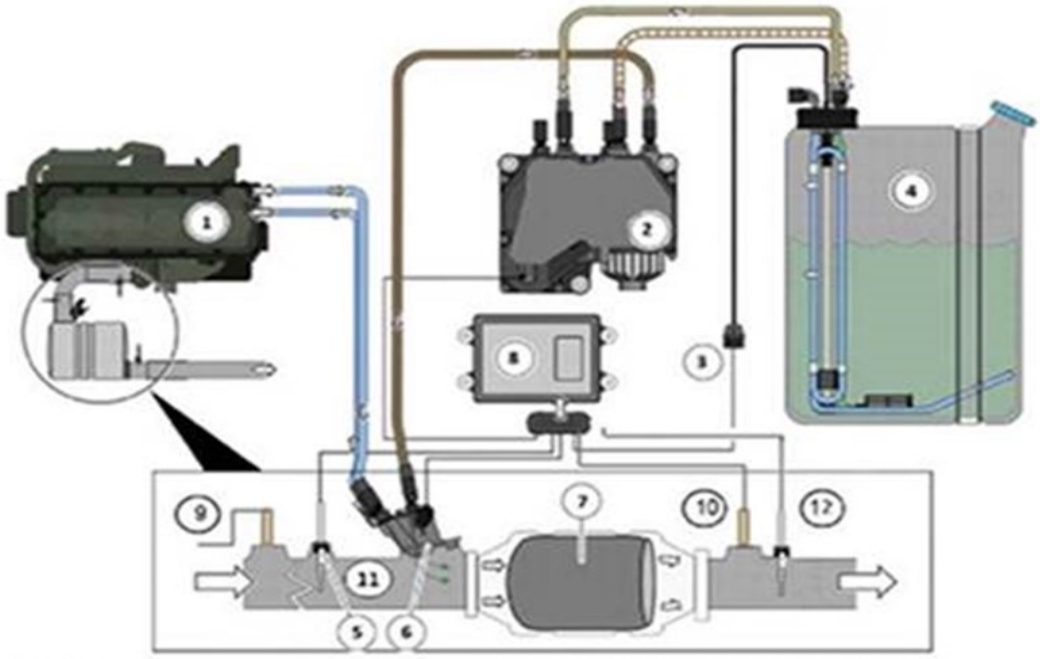
Max AUS flow to injector	l/h US gal/h	7.9 2.1
Max collant flow to AUS injector	l/h US gal/h	6.7 1.8

Exhaust system	**Rating**	**rpm**	**600**	**800**	**1000**	**1200**	**1300**	**1400**	**1500**	**1600**	**1800**	**1900**
Max allowable temperature drop between turbine and SCR muffler inlet.		°C °F	10 50	10 50	10 50	10 50	10 50	10 50	10 50	10 50	10 50	10 50
SCR muffler pressure drop at prop. load x^3		kPa psi	0	1 0.1	1 0.1	1 0.1	2 0.3	2 0.3	3 0.4	4 0.6	5 0.7	8 1.2
SCR muffler pressure drop at Full load		kPa psi	1 0.1	1 0.1	3 0.4	4 0.6	5 0.7	5 0.7	6 0.9	7 1.0	7 1.0	8 1.2

VOLVO PENTA D13 MH (R2-600)	Document No 23432750	Issue Index 03

AUS system	Rating	rpm	600	800	1000	1200	1300	1400	1500	1600	1800	1900
Specific AUS consumption		g/kWh	8.06	8.96	14.38	12.78	12.93	10.89	11.20	11.03	12.68	13.59
		lb/hph	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
AUS consumption at prop. load $x^{2,5}$		l/h	0.31	0.61	1.02	1.64	2.20	2.75	3.09	3.55	5.56	6.50
		US gal/h	0.08	0.16	0.27	0.43	0.58	0.73	0.82	0.94	1.47	1.72
AUS consumption at prop. load x^{3}		l/h	0.00	0.25	0.57	1.10	1.72	2.21	2.83	3.61	5.46	6.55
		US gal/h		0.07	0.15	0.29	0.45	0.58	0.75	0.95	1.44	1.73
AUS consumption at Full load		l/h	0.71	1.55	3.94	4.55	5.00	4.53	5.04	5.24	6.10	6.54
		US gal/h	0.19	0.41	1.04	1.20	1.32	1.20	1.33	1.38	1.61	1.73

AUS concentration 32.5%

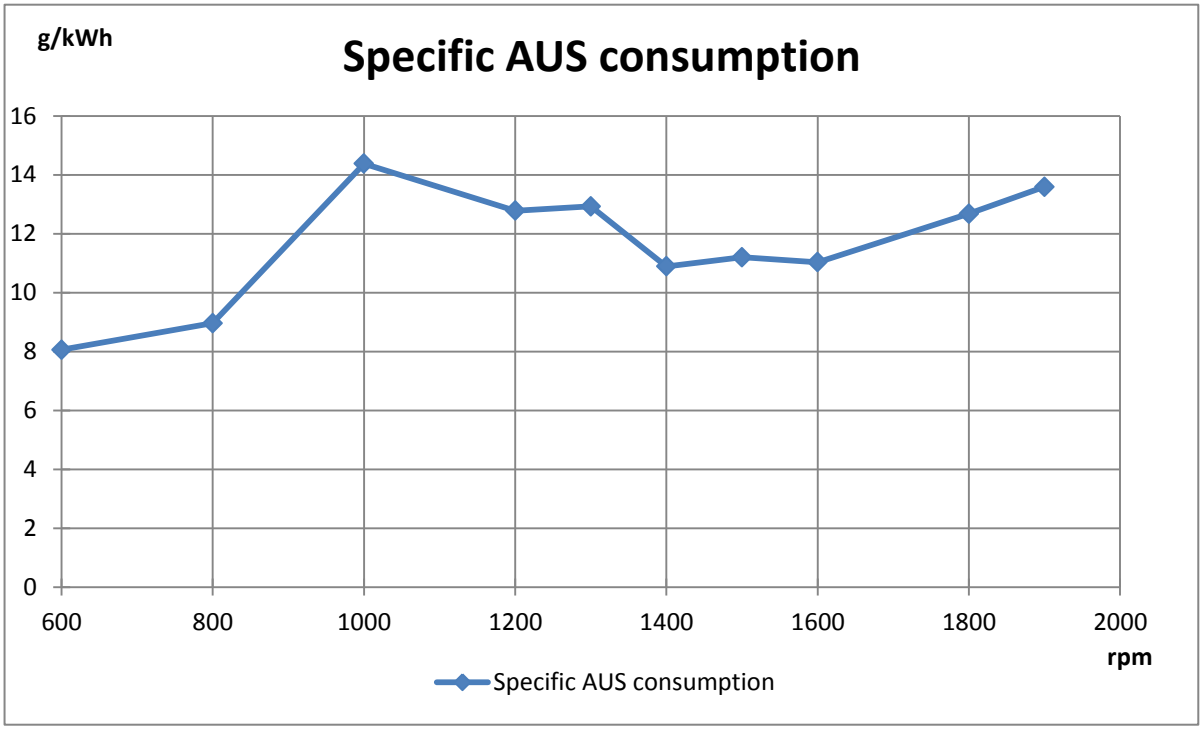


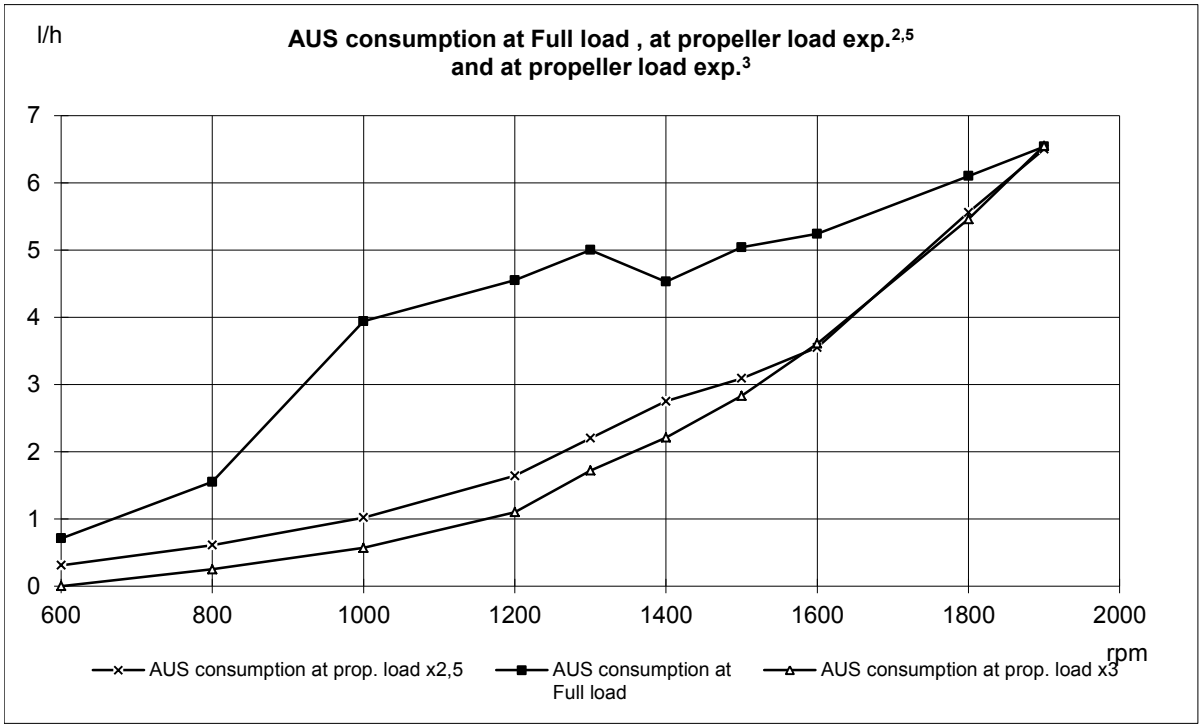
1. Engine
2. AUS pump
3. Sensor connector QLT
4. AUS tank with QLT
5. Front exhaust temperature sensor
6. AUS injector
7. Catalytic converter (SCR)
8. ACM (After Treatment Module)
9. Front NOx sensor
10. Rear NOx sensor
11. Injector pipe
12. Rear exhaust temperature sensor

Abbreviations:

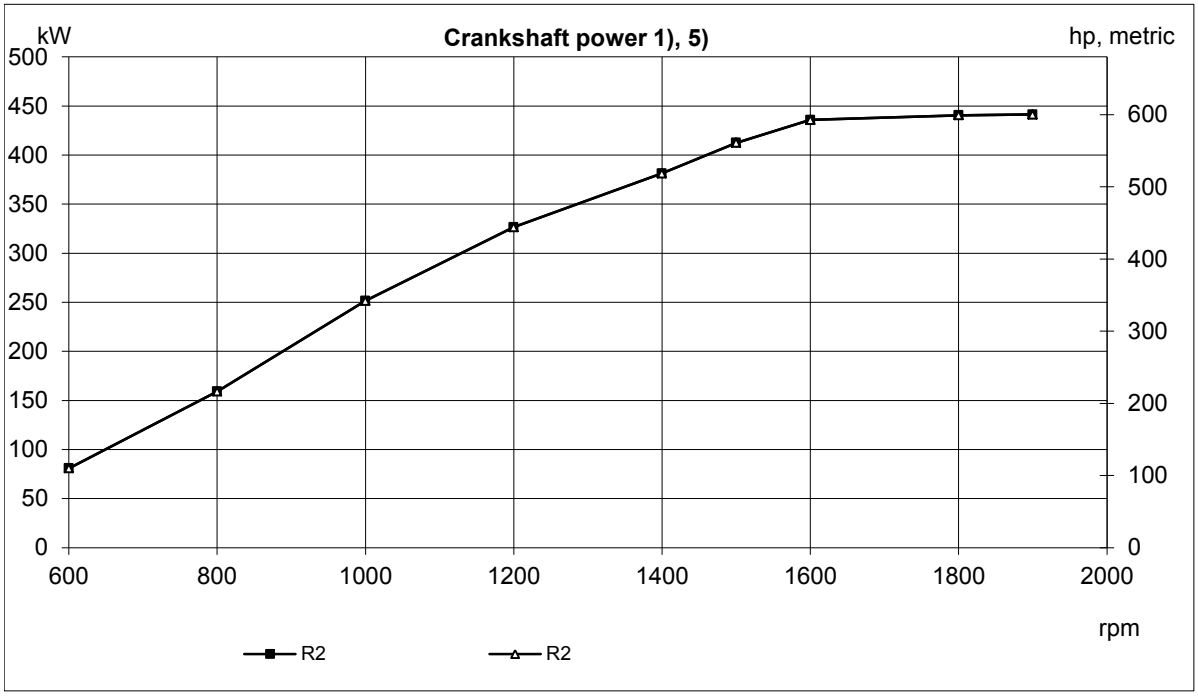
ACM	Aftertreament Control Module
AUS	Aqueous Urea Solution
EATS	Exhaust Aftertreatment System
SCR	Selective Catalytic Reduction
UDS	Urea Dosing System
UQS	Urea Quality Sensor

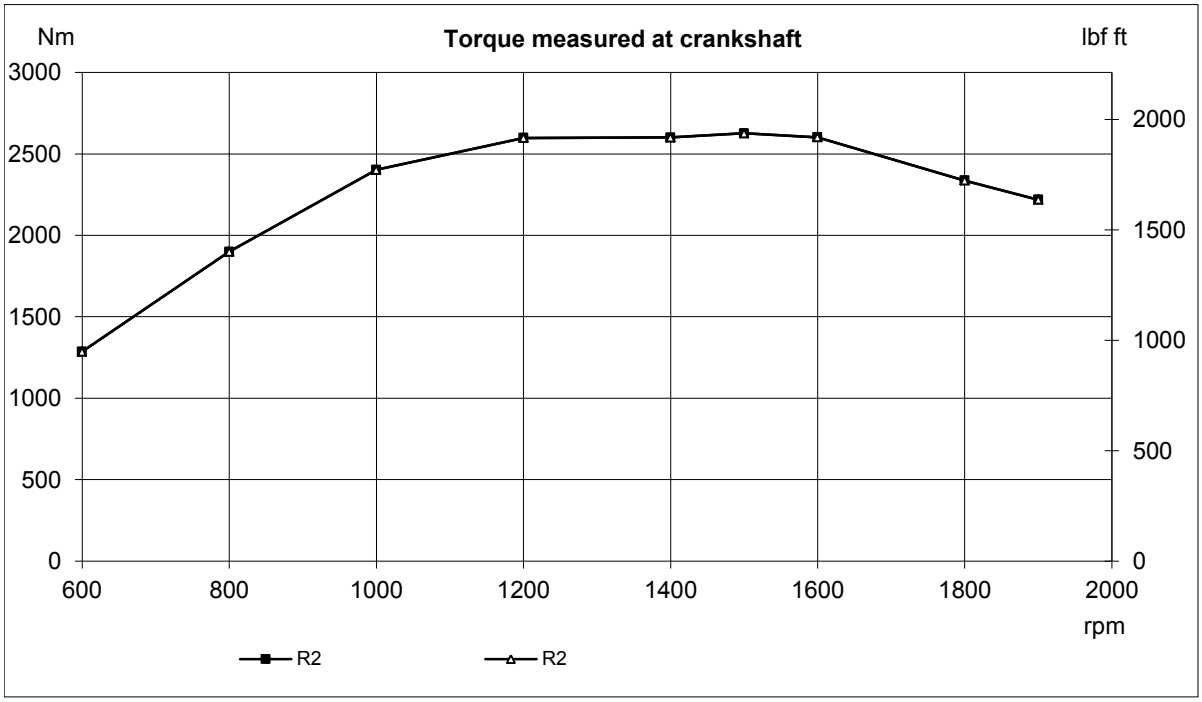
VOLVO PENTA D13 MH (R2-600)	Document No 23432750	Issue Index 03



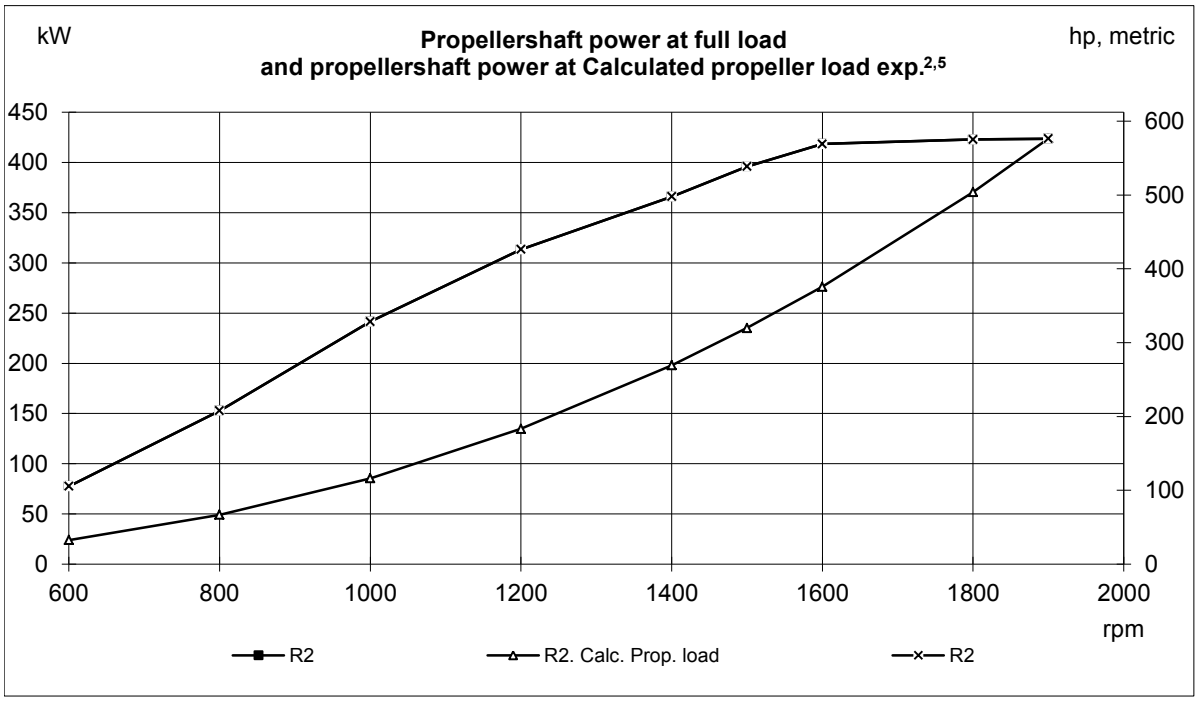


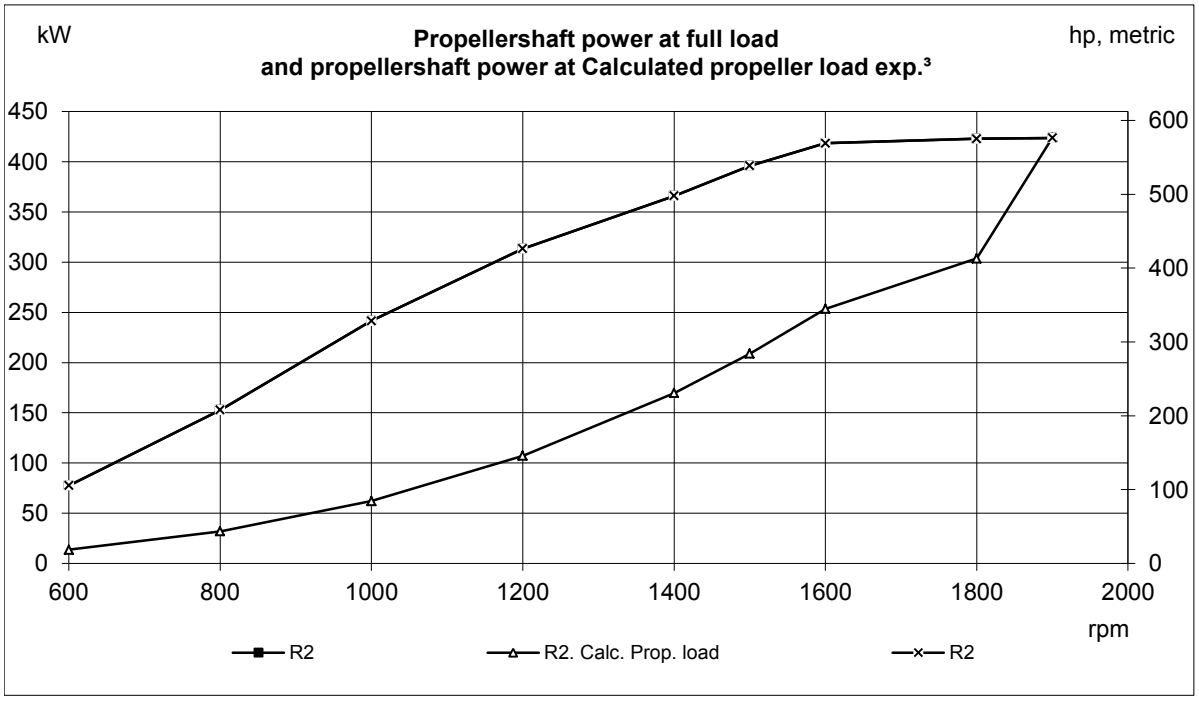
VOLVO PENTA D13 MH (R2-600)	Document No 23432750	Issue Index 03





VOLVO PENTA D13 MH (R2-600)	Document No 23432750	Issue Index 03





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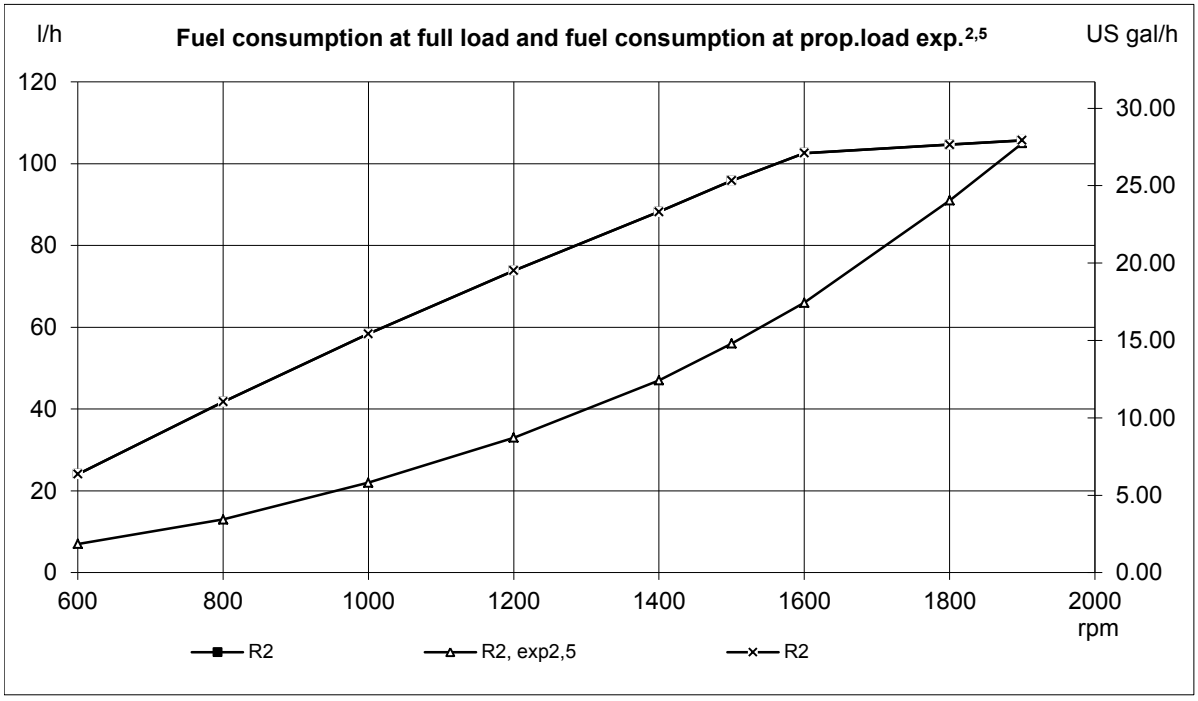
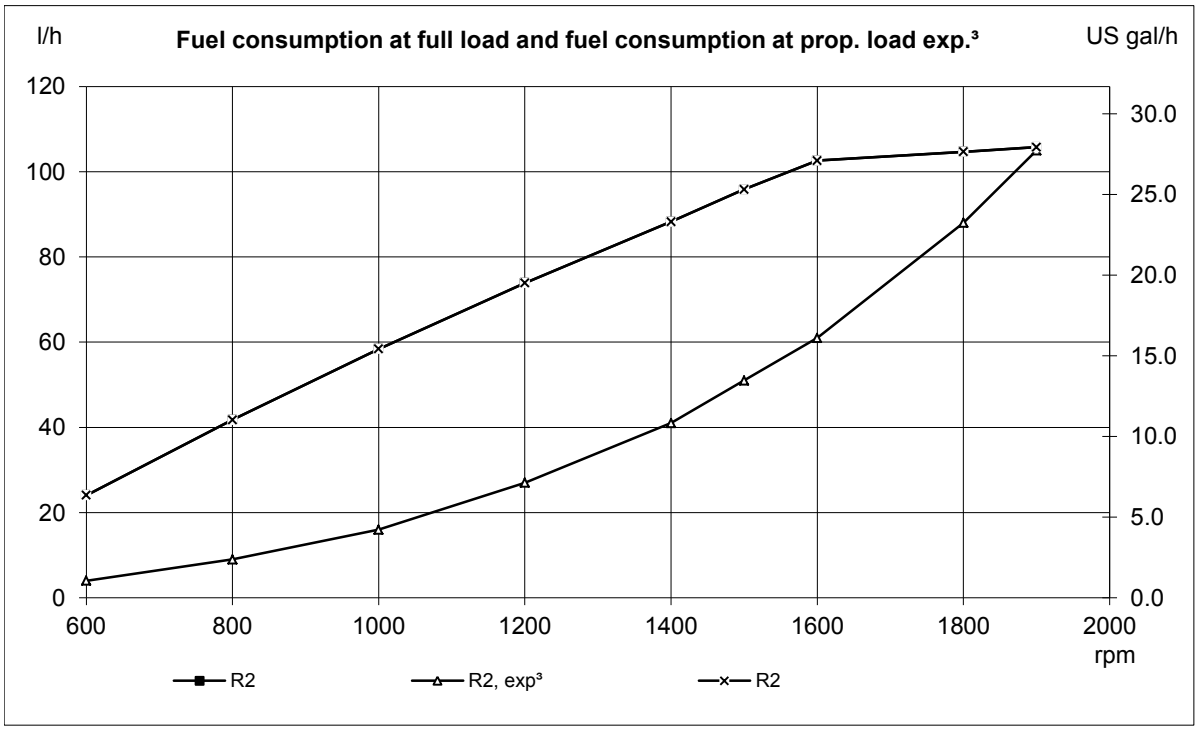
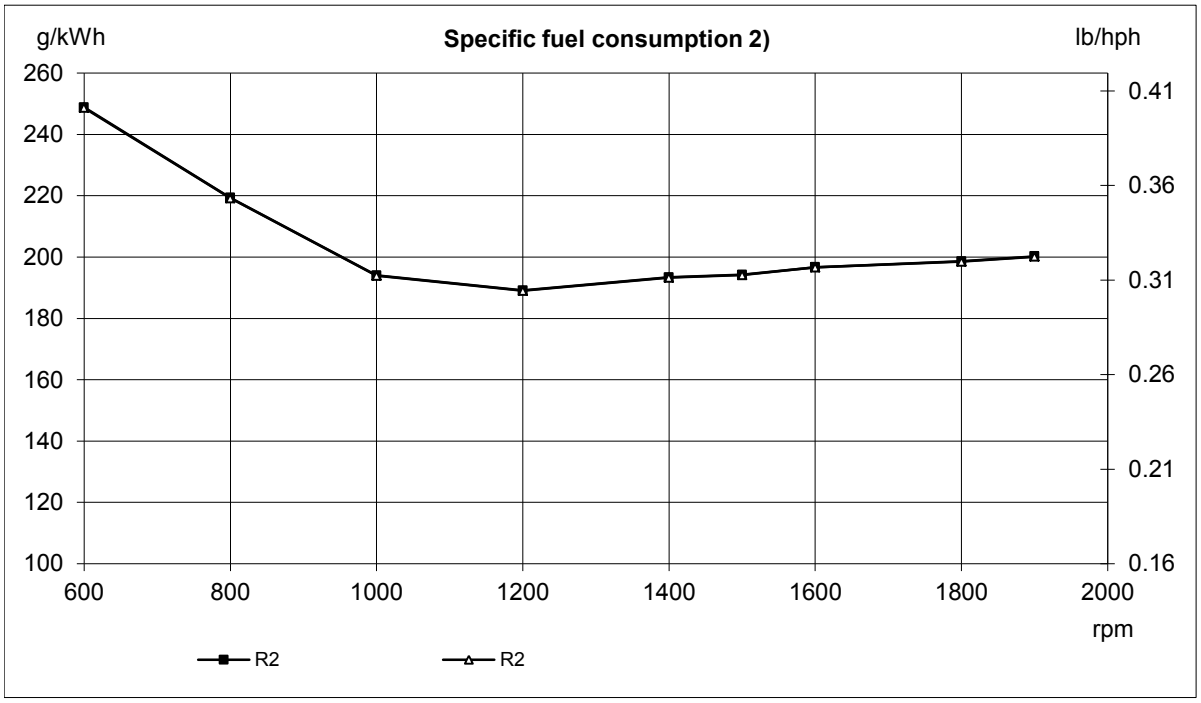




VOLVO PENTA D13 MH (R2-600)	Document No 23432750	Issue Index 03



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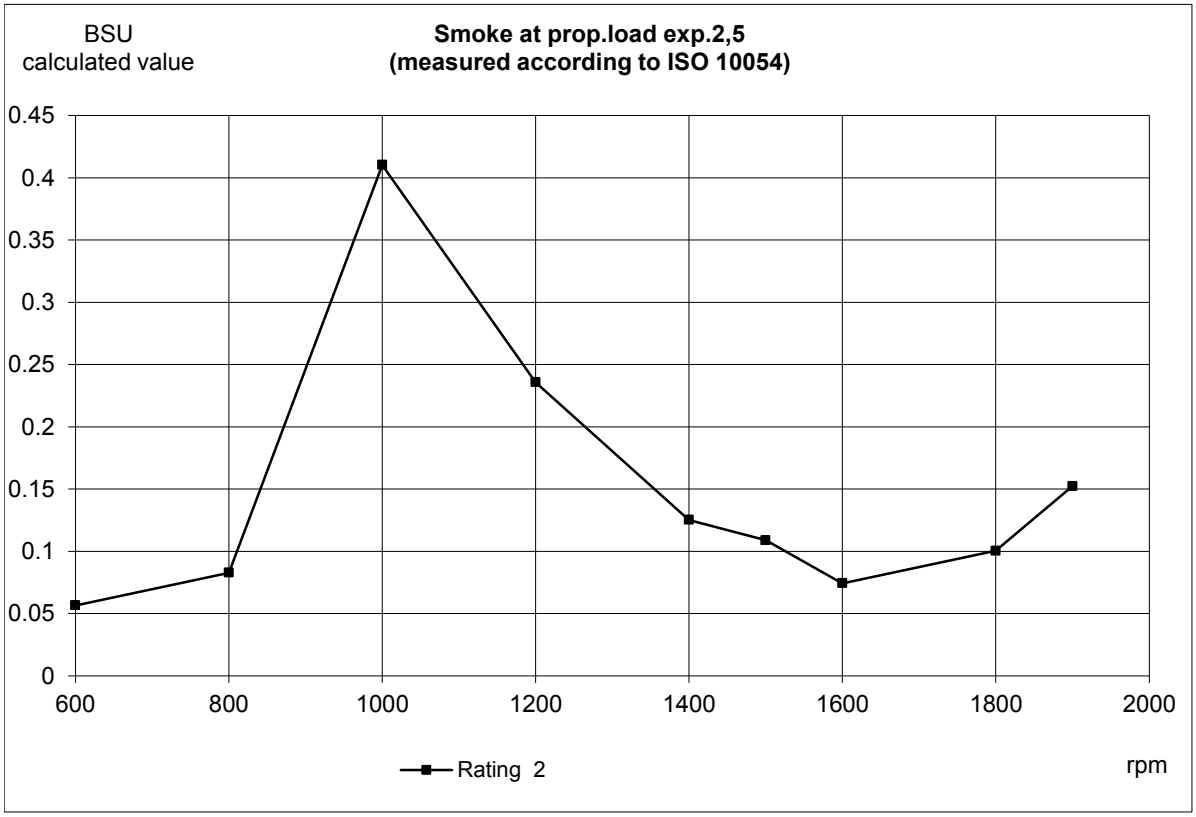

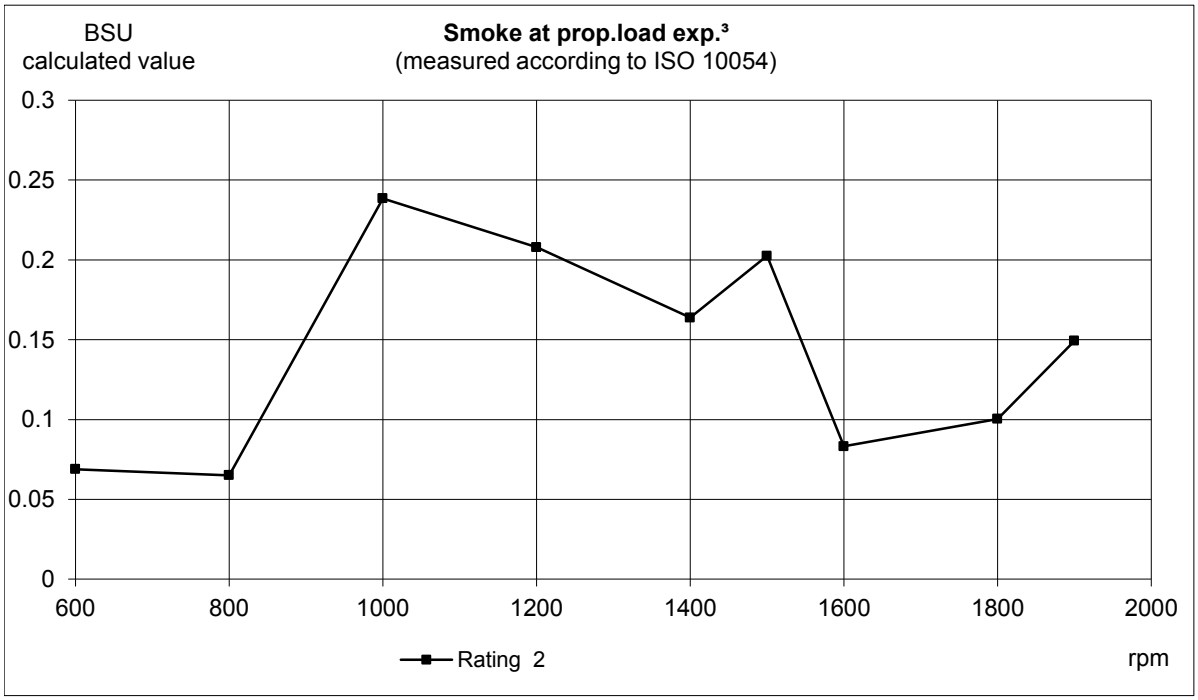

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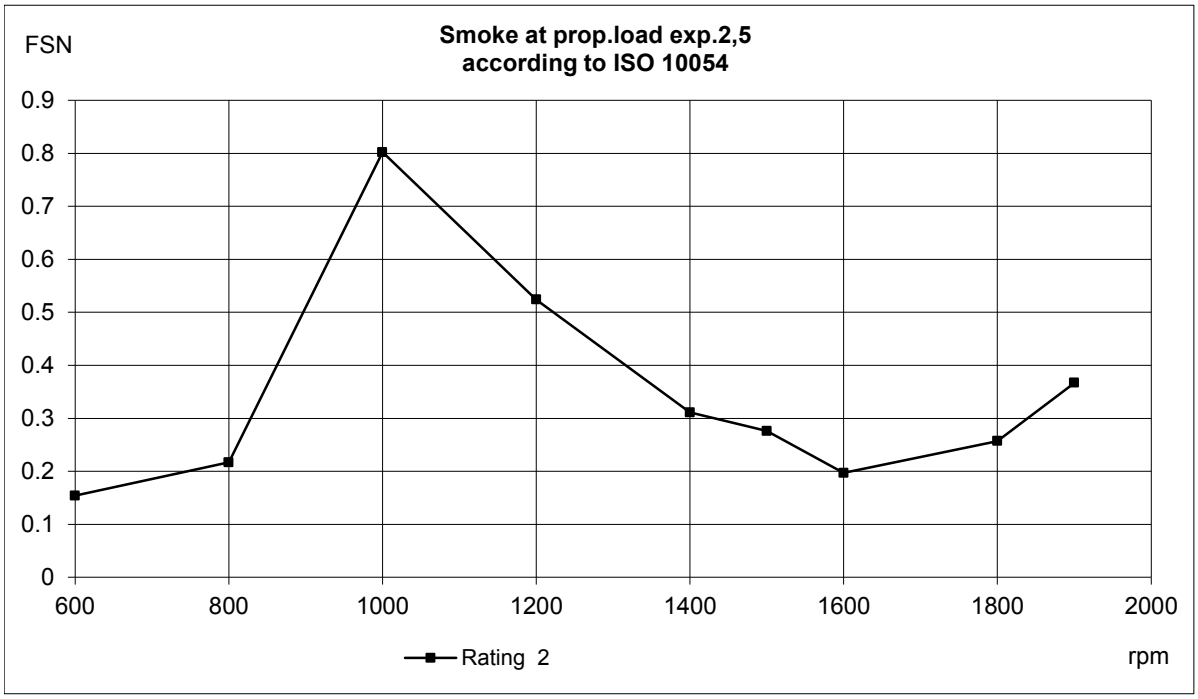

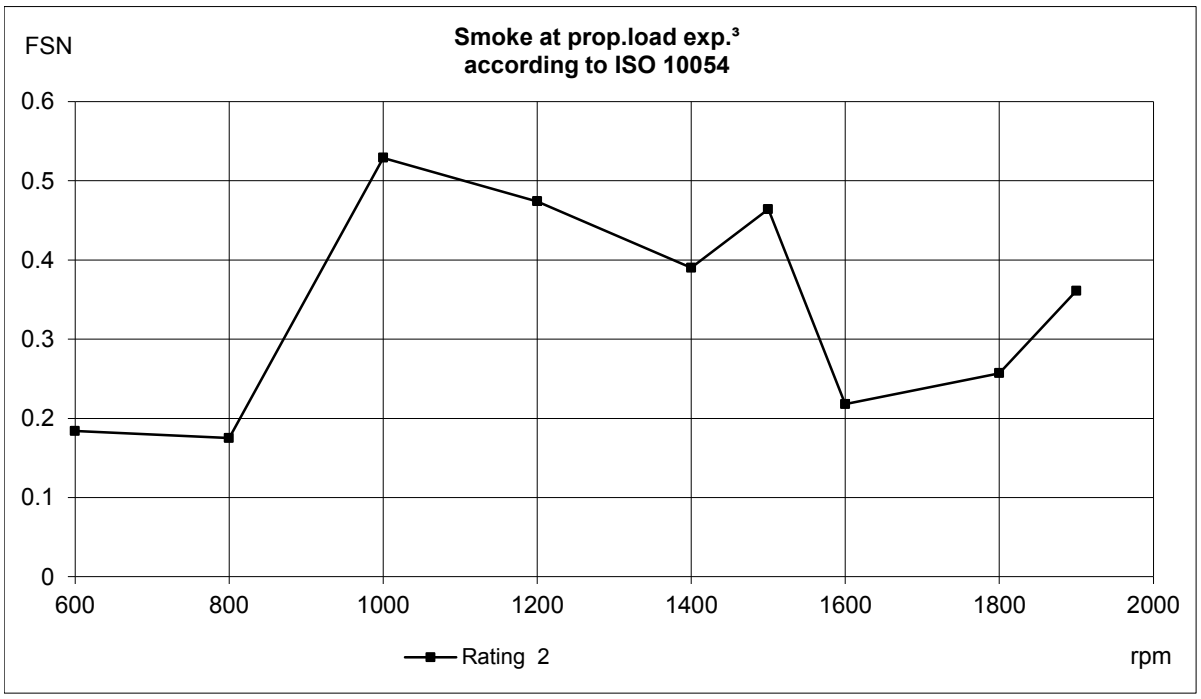

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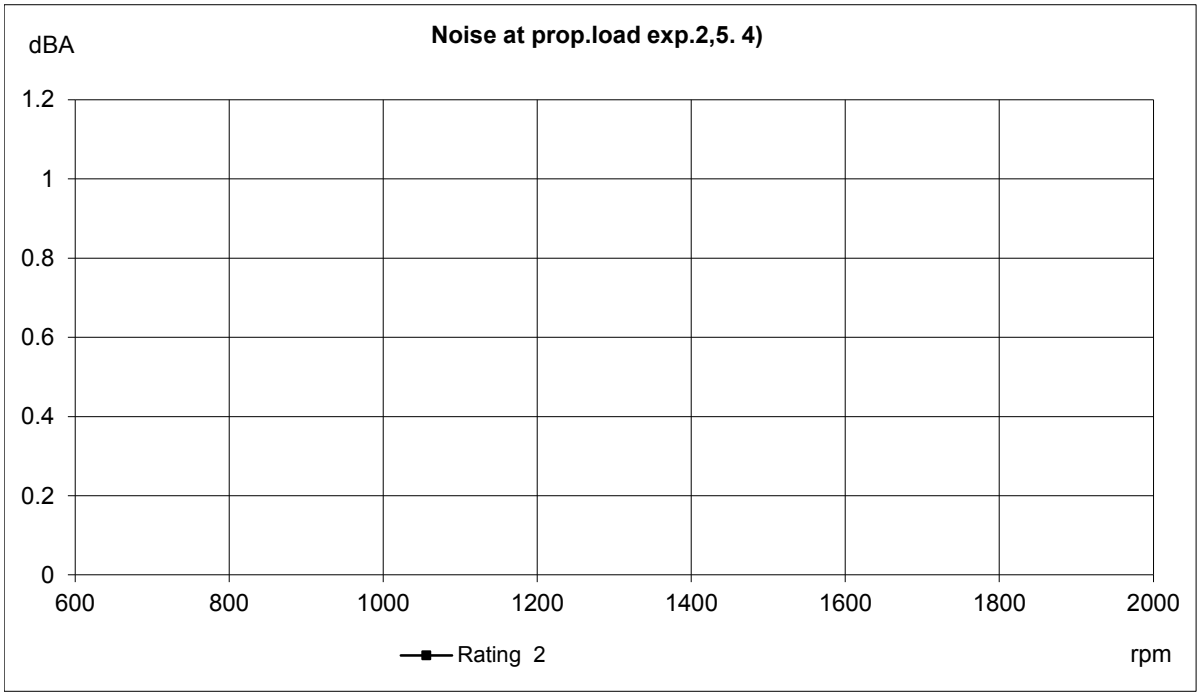
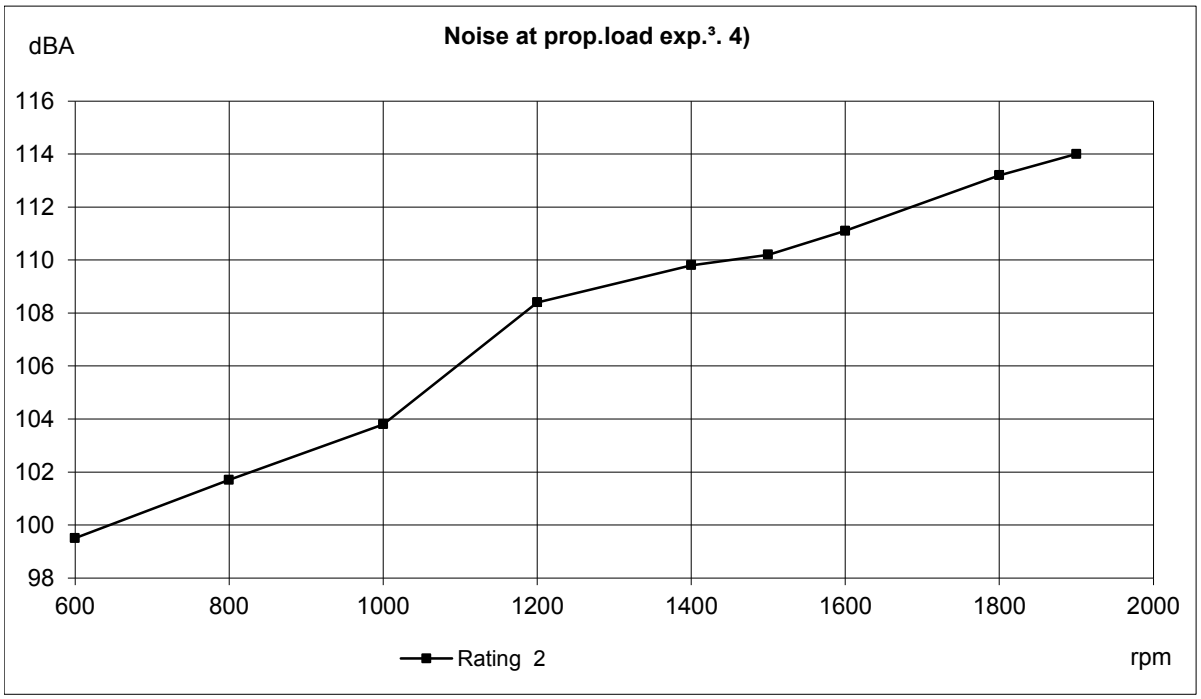


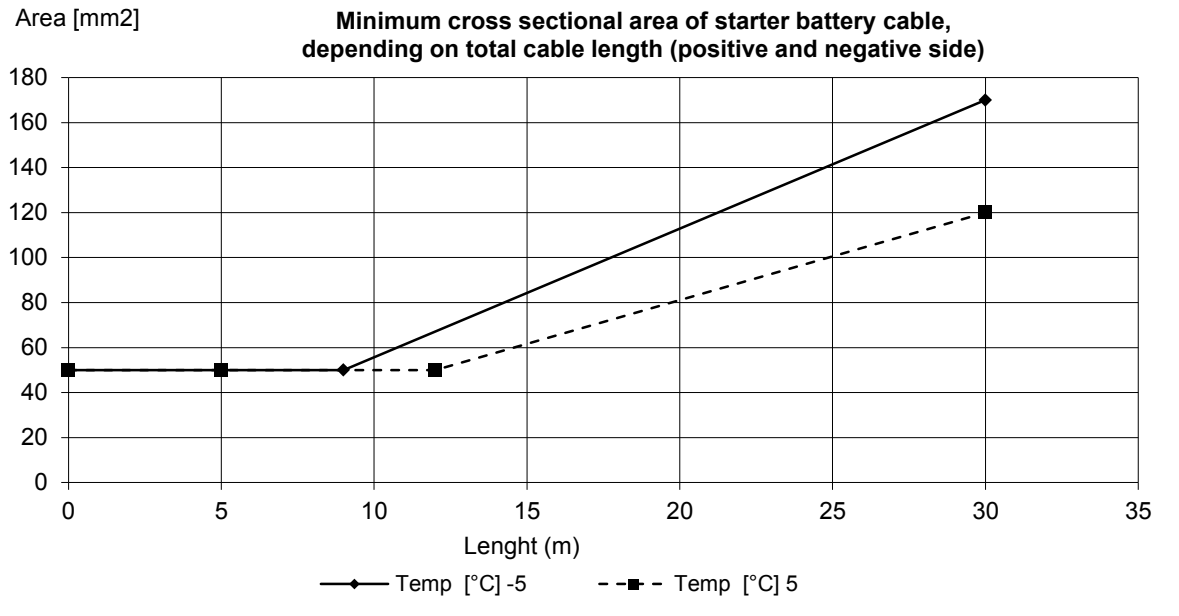


VOLVO PENTA D13 MH (R2-600)	Document No 23432750	Issue Index 03

Battery capacity

Temp [°C]	Min battery size [Ah]	CCA EN (Cold cranking Amps) [A]	Max line resistance @ 20°C [mΩ]	Recommended max cable resistance @ 20°C [mΩ]	Min cross sectional area (due to heat increase) [mm²]
5					
-5					

Minimum cable cross sectional area



Fuses size:

	[A]
Engine:	
Control system:	

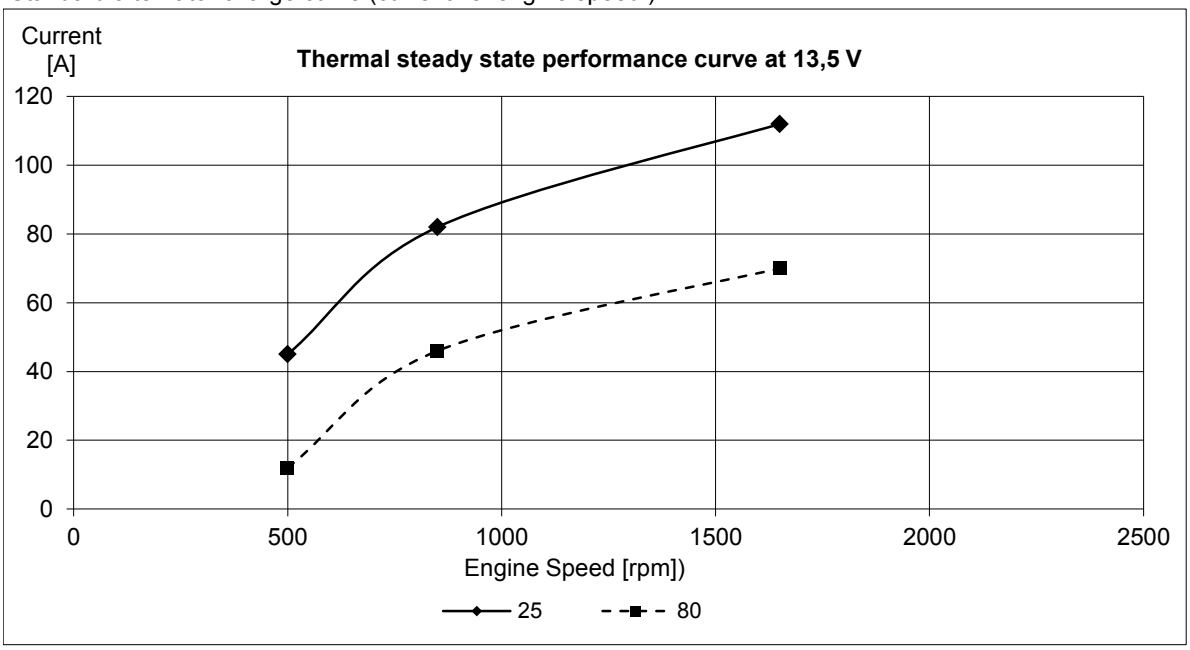
Max current consumption during normal operation:

	[A]
Engine :	

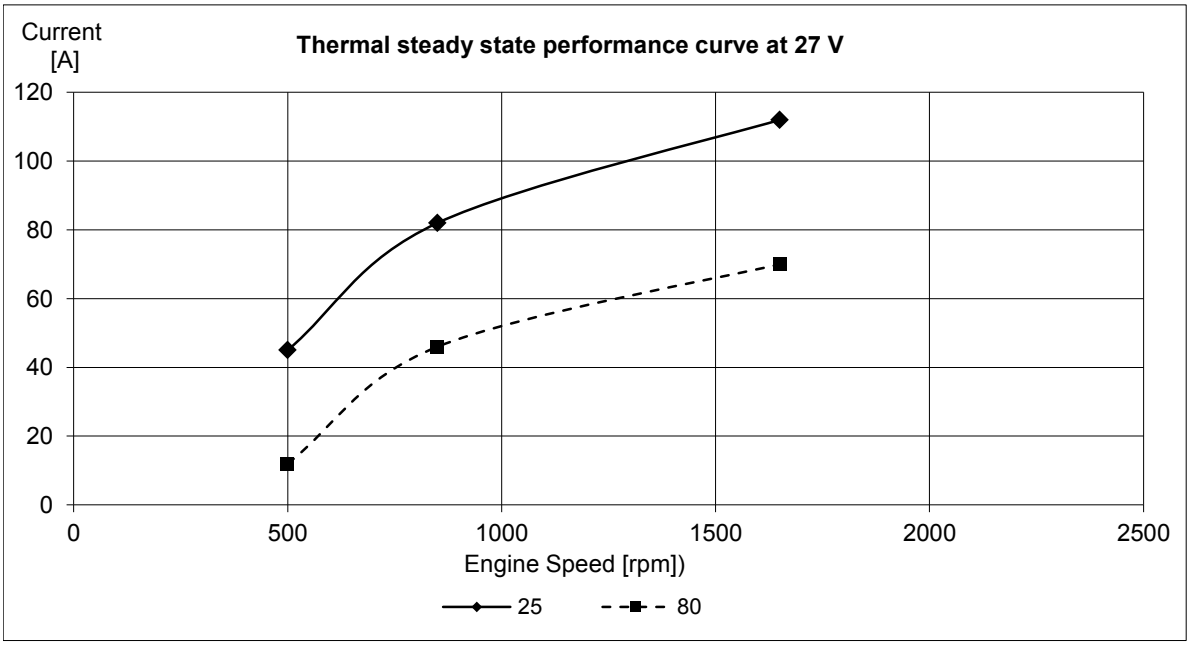
VOLVO PENTA D13 MH (R2-600)	Document No 23432750	Issue Index 03

Alternator data:

Standard alternator charge curve (current vs. engine speed.)



Constant charge voltage: [V]	14.3	+/- 0,3

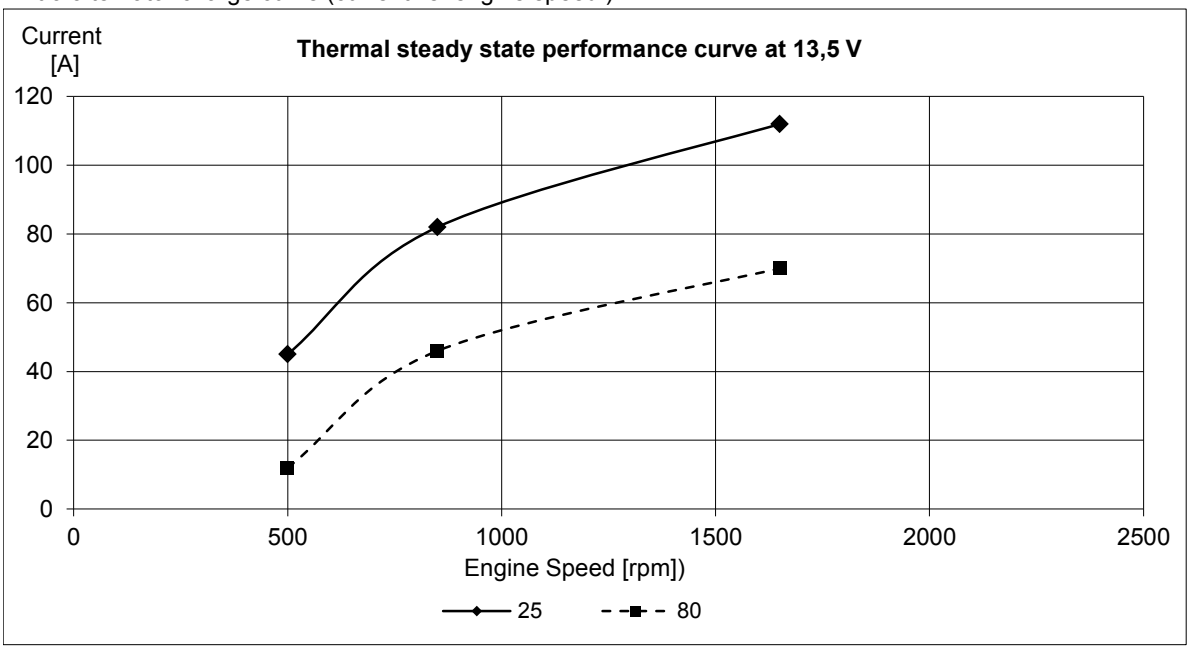


Constant charge voltage: [V]	28.3	+/- 0,3

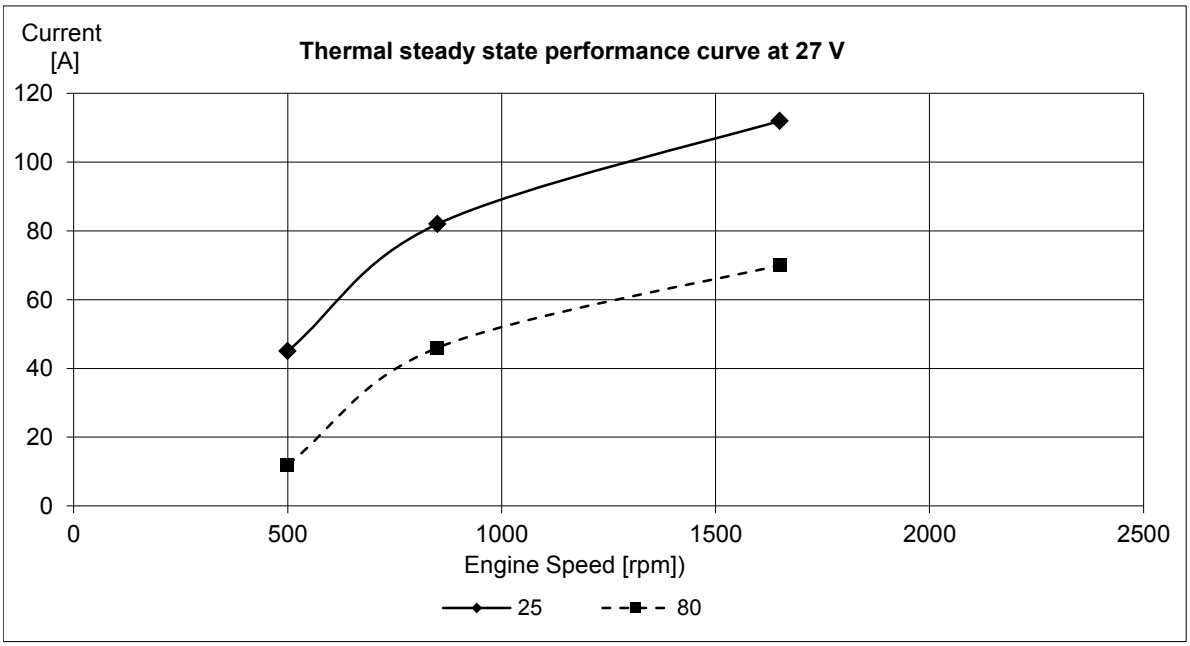
VOLVO PENTA D13 MH (R2-600)	Document No 23432750	Issue Index 03

Alternator data:

Extra alternator charge curve (current vs. engine speed.)



Constant charge voltage: [V]	14.3	+/- 0,3



Constant charge voltage: [V]	28.3	+/- 0,3