

<b>VOLVO PENTA</b>	Document No	Issue Index
	<b>23609276</b>	<b>03</b>

**D6-400 AQ****General**

4-stroke direct injected, turbocharged and aftercooled diesel engine

Engine Rating		5
Number of cylinders		6
No of valves		24
Displacement, total	litres in <sup>3</sup>	5.50 335.6
Firing order		1-5-3-6-2-4
Rotational direction, viewed from the front		Clockwise
Bore	mm in	103 4.06
Stroke	mm in	110 4.33
Compression ratio		18.0:1
Compression pressure at 240 rpm	MPa psi	
Max. static forward inclination:	°	5
Max. static backward inclination:	°	10
Max. intermittent forward inclination while running:	°	10
Max. intermittent backward inclination while running:	°	20
Max. intermittent side inclination while running:	°	22.5 or 30 for max 30 sec
Idling speed	rpm	600-650
Rated speed R5	rpm	3500
Governed speed R5	rpm	3630
Propeller selection range R5		3450-3630
Dry weight engine BT	kg lb	645 1422
Dry weight with drive DPI	kg lb	790 1742
Dry weight with drive DPH	kg lb	780 1720
	kg lb	
	kg lb	

- 1) ISO 3046, fuel temp 40°C.  
ISO 8665 (=SAE J 1228=ICOMIA 28-83)
- 2) At power according to 1).
- 4) Acc. to ISO 3744
- 5) At installed back pressure

<b>VOLVO PENTA</b>	Document No	Issue Index
	<b>23609276</b>	<b>03</b>

**D6-400 AQ**

Performance	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600
		Crankshaft power 1), 5)	kW	71	136	207	255	286	288	292	294
	hp	97	185	282	347	389	392	397	400	400	400
Propeller shaft power 1) (At full load)	kW	68	131	199	245	275	276	280	282	282	282
	hp	93	178	270	333	373	376	381	384	384	384
Propellershaft power at prop. load x <sup>2.5</sup>	kW	12	34	70	122	162	192	226	263	282	282
	hp	17	46	95	166	220	261	307	357	384	384
Propellershaft power at prop. load x <sup>3</sup>	kW	7	22	53	103	145	178	216	259	282	282
	hp	9	30	72	140	197	242	293	352	384	384
Torque at crankshaft 2)	Nm	678	865.8	988.4	974	975.4	916.7	871.4	825.7	802.1	779.9
	lbf ft	500	639	729	718	719	676	643	609	592	575
Mean piston speed	m/s	3.7	5.5	7.3	9.2	10.3	11.0	11.7	12.5	12.8	13.2
	ft/s	12.0	18.0	24.1	30.1	33.7	36.1	38.5	40.9	42.1	43.3
Effective mean pressure 2)	MPa	1.55	1.98	2.26	2.23	2.23	2.09	1.99	1.89	1.83	1.78
	psi	224.7	286.9	327.6	322.8	323.3	303.8	288.8	273.7	265.8	258.5
Max combustion pressure 2)	MPa	17.0	18.6	19.8	19.7	18.5	17.7	16.8	16.1	16.4	16.6
	psi	2459	2697	2867	2857	2687	2569	2433	2335	2381	2412

**Lubricating system**

Specific lubricating oil consumption.	g/kWh	< 0.2
Max. oil volume including filters for all allowed installation inclinations:	litres	20
	US gal	5.28
Max. oil volume excluding filters for all allowed installation inclinations:	litres	18.5
	US gal	4.89
Min. oil volume excluding filters for all allowed installation inclinations:	litres	15
	US gal	3.96

Fuel system	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600
Specific fuel consumption 2)	g/kWh	219	211	207	207	204	206	210	217	218	220
	lb/hph	0.355	0.342	0.335	0.335	0.33	0.334	0.34	0.352	0.353	0.356
Fuel consumption, Test cycle E5 EU	g/kWh	218									
	lb/hph	0.35									
Fuel consumption at prop. load x <sup>2.5</sup>	l/h	4.0	9.2	18.3	31.7	42.1	51.2	59.9	71.3	76.7	77.4
	US gal/h	1.1	2.4	4.8	8.4	11.1	13.5	15.8	18.8	20.3	20.4

Fuel system	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600
Fuel consumption at prop. load x <sup>3</sup>	l/h	2.7	6.6	14.3	27.4	38.4	47.9	57.5	70.3	76.7	77.4
	US gal/h	0.7	1.8	3.8	7.2	10.1	12.6	15.2	18.6	20.3	20.4
Fuel consumption at full load	l/h	18.6	34.3	51.3	63.2	69.8	71.0	73.4	76.3	76.7	77.4
	US gal/h	4.9	9.1	13.5	16.7	18.4	18.8	19.4	20.2	20.3	20.4

**Full load performance at rated speed**

Fuel inlet temperature	°C	40
	°F	104
Fuel return temperature from engine	°C	62
	°F	143.6
Fuel consumption	l/h	76.7
	US gal/h	20.26
Fuel inlet flow to engine	l/h	114.5
	US gal/h	30.25
Fuel return flow from engine	l/h	37.8
	US gal/h	9.99

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<b>VOLVO PENTA</b>	Document No	Issue Index
	<b>23609276</b>	<b>03</b>

**D6-400 AQ**

Intake and exhaust system	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600	
Specific exhaust heating effect in percent of crankshaft power	%	22	28	35	46	58	58	60	64	65	65	
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	°C	327	377	397	394	411	394	385	383	380	378	
	°F	621	711	747	741	772	741	725	721	716	712	
Permitted exhaust back pressure after turbocharger at rated speed. (Installed back pressure)	kPa							Max	30			
	psi								4.4			
	kPa							Min	10			
	psi								1.5			

Intake and exhaust system	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPA	m³/min	5.3	9.4	13.6	17.5	18.7	20.3	21.9	23.4	23.9	24.4
	cu.ft./min	187.2	332	480.3	618	660.4	716.9	773.4	826.4	844	861.7
Charge air pressure Inlet manifold	kPa	110	152	180	194	184	188	193	199	197	197
	psi	16.0	22.0	26.1	28.1	26.7	27.3	28.0	28.9	28.6	28.6
Exhaust gas flow	m³/min	11.2	21.2	30.2	36.9	39.7	41	42.5	44.1	44.4	44.8
	cu.ft./min	395.5	748.7	1067	1303	1402	1448	1501	1557	1568	1582

Cooling system	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600
Radiated heat of crankshaft power at full load.	kW	3.4	6.3	8.3	8.6	8.5	8.6	8.7	8.8	8.8	8.8
Heat rejection to charge air cooler of crankshaft power at full load.	kW	12.0	27.0	42.4	57.1	54.0	59.8	66.2	73.4	75.2	77.3
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air cooler, of crankshaft power at full load.	kW	56	88	143	162	175	184	178	184	188	190
Coolant flow with fully open thermostat and std cooling system	l/min	96	144	192	240	269	289	308	325	334	342
	cu.ft./min	3.4	5.1	6.8	8.5	9.5	10.2	10.9	11.5	11.8	12.1
Extra water pump flow through charge air cooler	l/min										
	cu.ft./min										
Max. pump pressure at extra pump pressure side (pressure set system)	kPa										
	psi										
Max. permissible temperature on coolant in engine outlet	°C	55									
	°F	131									
Coolant volume engine, including heat exchanger and charge air cooler	litres	16									
	US gal.	4.23									
Max. additional coolant for cabin heater etc. with std. Expansion tank	litres	5									
	US gal.	1.32									
Maximum coolant flow to cabin heater etc.	l/min	30									
	cu.ft./min	1.06									
Thermostat, start open at	°C	78									
	°F	172									
Thermostat, fully open at	°C	90									
	°F	194									

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<b>VOLVO PENTA</b>	Document No	Issue Index
	<b>23609276</b>	<b>03</b>

**D6-400 AQ**

Raw water circuit	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600
Nominal raw water design flow	l/min	77	111	144	174	189	198	207	214	218	220
	cu.ft./min	2.7	3.9	5.1	6.1	6.7	7.0	7.3	7.6	7.7	7.8
Nominal raw water pump pressure head at design flow.	kPa	22	48	79	111	131	142	154	165	171	176
	psi	3.2	7.0	11.5	16.1	19.0	20.6	22.3	23.9	24.8	25.5
Maximum raw water pump suction head	kPa	-30									
	psi	-4.4									
Maximum additional pressure drop excl. reverse gear oil cooler	kPa										
	psi										
Pressure drop over reverse gear oil cooler (optional equipment)	kPa										
	psi										
Maximum raw water temperature entering heat exchanger	°C	32									
	°F	90									

1 circuit keel cooling system	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600
Design point for keel cooler, engine outlet temperature	°C										
	°F										
Maximum temperature to engine from external cooling system circuit	°C										
	°F										
Maximum temperature to engine inlet from external cooling system circuit	°C										
	°F										
Coolant flow through keel cooler at design point	l/min										
	cu.ft./min										
Maximum coolant flow through keel cooler	l/min										
	cu.ft./min										
Pressure drop in external circuit, including piping	kPa										
	psi										
Coolant volume engine	litres										
	US gal.										

1 1/2 circuit keel cooling system (Two circuit	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600
Design point for keel cooler, engine outlet temperature	°C										
	°F										
Maximum temperature to charge air cooler from external cooling system circuit	°C										
	°F										
Coolant flow through keel cooler at design point	l/min										
	cu.ft./min										
Maximum coolant flow through keel cooler	l/min										
	cu.ft./min										
Pressure drop in external circuit, including piping	kPa										
	psi										
Coolant volume engine	litres										
	US gal.										

2 circuit keel cooling system, LT	rpm	1000	1500	2000	2500	2800	3000	3200	3400	3500	3600
Maximum temperature to charge air cooler from external LT-cooling system	°C										27
	°F										81
Coolant flow through keel cooler, LT-cooling system circuit	l/min										220
	cu.ft./min										7.8
Pressure drop in external LT-cooling system circuit, including piping	kPa	50									
	psi	7.3									
Coolant volume charge air cooler	litres	2									
	US gal.	0.53									

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<b>VOLVO PENTA</b>	Document No	Issue Index
	<b>23609276</b>	<b>03</b>

**D6-400 AQ**

<b>2 circuit keel cooling system, HT</b>	<b>rpm</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>2500</b>	<b>2800</b>	<b>3000</b>	<b>3200</b>	<b>3400</b>	<b>3500</b>	<b>3600</b>
Design point for keel cooler, engine outlet temperature	°C										83
	°F										181
Maximum temperature to engine from external HT-cooling system circuit	°C										62
	°F										144
Coolant flow through keel cooler, HT-cooling system circuit at design point	l/min										150
	cu.ft./min										5.3
Maximum coolant flow through keel cooler, HT-cooling system circuit	l/min										342
	cu.ft./min										12.1
Pressure drop in external HT-cooling system circuit, including piping	kPa	70									
	psi	10.2									
Coolant volume engine	litres	16									
	US gal.	4.23									

<b>Emissions</b>	<b>rpm</b>	<b>1000</b>	<b>1500</b>	<b>2000</b>	<b>2500</b>	<b>2800</b>	<b>3000</b>	<b>3200</b>	<b>3400</b>	<b>3500</b>	<b>3600</b>
Smoke at prop. load x <sup>2.5</sup>	*BSU	0.1	0.1	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.4
Smoke at prop. load x <sup>3</sup>	*BSU	0.1	0.1	0.2	0.3	0.3	0.2	0.3	0.3	0.3	0.4
Noise at prop. load x <sup>2.5</sup> . 4)	dBA	99.9	102.9	105.4	108.6	109.7	111.4	112.2	113.3	113.8	114.4
Noise at prop. load x <sup>3</sup> . 4)	dBA	98.3	102.9	104.7	108.1	109.4	110.9	112.2	113.3	113.8	114.5

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

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Document No	Issue Index
<b>23609276</b>	<b>03</b>

Sensors : Control and Monitoring System							Engine protection action
Sensors	Signal	Range	Unit	Warning Initial Delay / Warning Delay	Warning Level	Derating Level	
Coolant level switch	Digital	ON/OFF		30 sec from start / 5 sec	Low (ON / Closed)	NA	Warning only
Coolant temperature	50-0 kΩ	-40 - 140	°C	30 sec from start / 5 sec	96	99	See derating map
Fuel temperature	50-0 kΩ	-40 - 140	°C		60	NA	Warning only
Engine speed cam	Frequency		rpm	Instant	Lost signal	NA	Warning only
Engine speed crank	Frequency		rpm	Instant	Lost signal	NA	Warning only
Oil level sensor	Digital	ON/OFF		30 sec from start / 5 sec	Low level	NA	Warning only
Oil temperature	PT1000	-40 - 150	°C	30 sec from start / 5 sec	132	135	See derating map
Water In fuel switch	Digital	ON/OFF		All the time	Water in fuel	NA	Warning only
Wet Exhaust temp	PT200	0 - 850	°C	30 sec from start / 5 sec	90	95	See derating map

Sensors (rpm dependent)	Signal	Range	Unit	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map					Comment
					0 rpm	1200 rpm	2000 rpm	2500 rpm	3600 rpm	
<b>Charge air temperature</b>	50-0 kΩ	-40 - 130	°C		<b>0 rpm</b>	<b>1200 rpm</b>	<b>2000 rpm</b>	<b>2500 rpm</b>	<b>3600 rpm</b>	
Warning Level			°C	30 sec from start / 5 sec	100	100	70	70	70	
Derating Level			°C							See derating map
<b>Fuel pressure</b>	0,5-4,5 V	0-200	kPa		<b>0 rpm</b>	<b>600 rpm</b>	<b>1600 rpm</b>	<b>2600 rpm</b>	<b>3600 rpm</b>	
Warning Level			kPa	30 sec from start / 5 sec	50	50	50	50	50	
Derating Level			kPa	NA	NA	NA	NA	NA	NA	
<b>Oil pressure</b>	0,5-4,5 V	0-700	kPa		<b>0 rpm</b>	<b>600 rpm</b>	<b>1200 rpm</b>	<b>2000 rpm</b>	<b>3600 rpm</b>	
Warning Level			kPa	30 sec from start / 5 sec	-50	75	150	200	230	
Derating Level (30% remain trq.)			kPa	10% trq. decr. per sec	-50	70	120	170	200	

Warning = Yellow Lamp active

Derating = Red Lamp active

## Derating map

<b>Charge Air Temp [°C]</b>	<b>rpm</b>	<b>75°C</b>	<b>80°C</b>	<b>85°C</b>
Remaining torque in %	600	100%	100%	100%
	1600	100%	100%	100%
	2200	100%	75%	50%

<b>Coolant temp [°C]</b>	<b>rpm</b>	<b>99°C</b>	<b>104°C</b>	<b>108°C</b>
Remaining torque in %	600	100%	100%	100%
	1600	100%	85%	75%
	2200	100%	75%	50%

<b>Oil temp [°C]</b>	<b>rpm</b>	<b>135°C</b>	<b>137.5°C</b>	<b>140°C</b>
Remaining torque in %	600	100%	100%	100%
	1600	100%	85%	75%
	2200	100%	75%	50%

<b>Oil pressure [kPa]</b>	<b>rpm</b>	
Remaining torque in %	600	85%
	1600	70%
	2200	50%

<b>Wet exhaust temp [°C]</b>	<b>rpm</b>	<b>95°C</b>	<b>105°C</b>	<b>115°C</b>	<b>125°C</b>
Remaining torque in %	600	100%	100%	100%	100%
	1600	100%	85%	80%	75%
	2200	100%	75%	65%	50%

Document No	Issue Index
<b>23609276</b>	<b>03</b>

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

Transmission: Control and Monitoring System: Reverse Gear							Engine protection action
Sensors	Signal	Range	Unit	Warning Initial Delay / Warning Delay	Warning Level	Derating Level	
Gear oil temperature (EVC)	50-0 kΩ	-30 - 130±4%	°C	N/A	95		Warning only

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

<b>VOLVO PENTA</b>	Document No	Issue Index
	<b>23609276</b>	<b>03</b>

D6-400 AQ

**Technical data - Drive unit**

Drive line		DPI with D4/D6
Transmission type		DPI-A
Gear ratio (total)		1,69:1 and 1,85:1
Steering angle, max.		+/- 24°
Total weight of drive unit (1)	kg	154
Oil capacity, approx.	litres	5.7
Oil volume difference MIN-MAX	litres	0.3
Oil type drive		Volvo Penta API GL5 75W/90
Propeller range		H2-H10

(1) Drive, Transom shield kit, including oil and various installation components. Propellers are not included in total weight

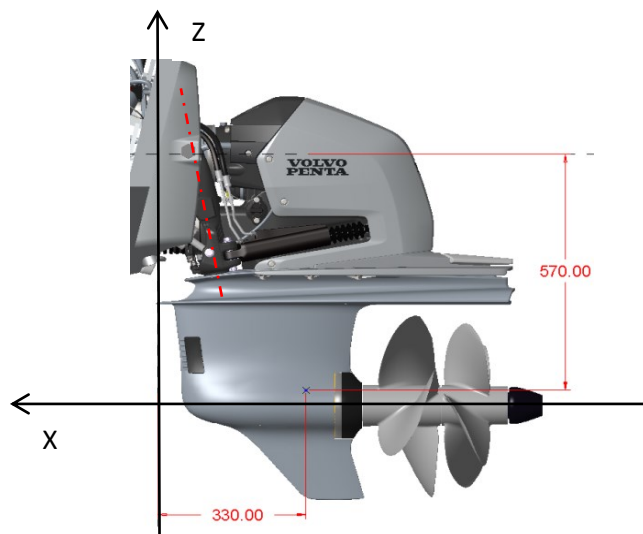
**"Generalized maximum load document"for DPI**

Valid products	Drive Unit	Gear Ratio
DPI-A with D6	DPI	1,69:1
DPI-A with D4	DPI	1,85:1

Loads provided in chart are single maximum loads i.e. not to be used for fatigue calculations

Speed range (top speed)	Load vektor	Maximum load
25-50 kn	Fx	18 kN
	Fy (+/-)	11 kN
	MCL rudder (+/-)	1.6 kNm

Fy load coordinate	570 mm
Fy load coordinate	330 mm



**VOLVO PENTA**

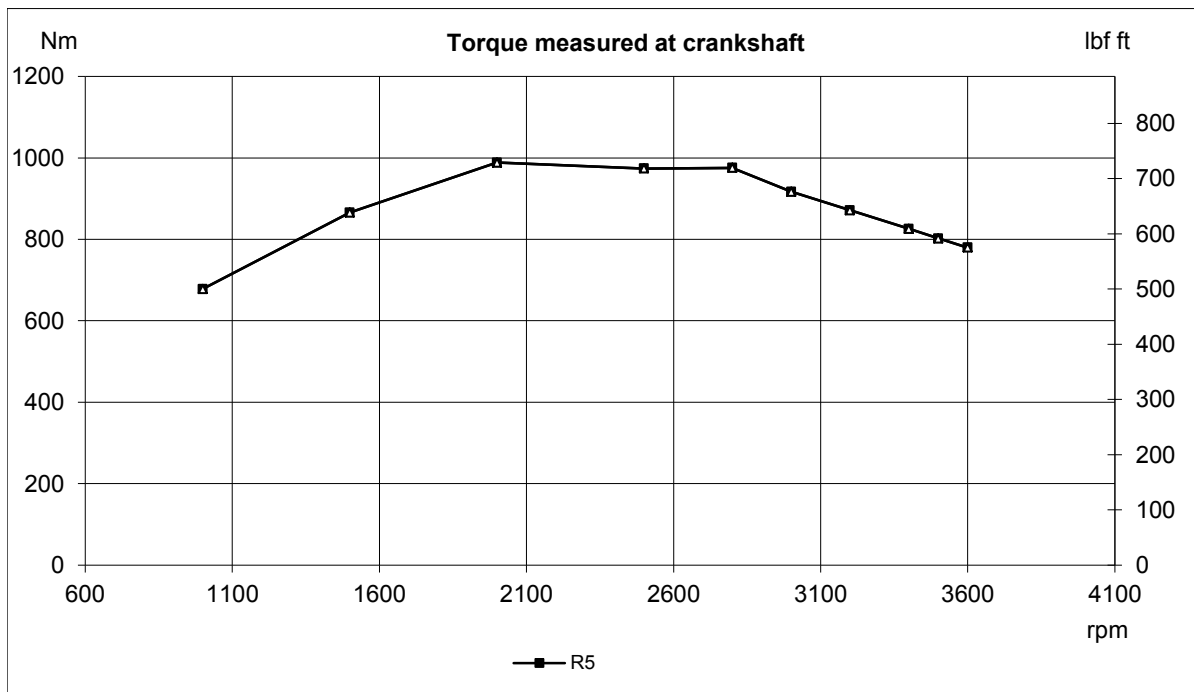
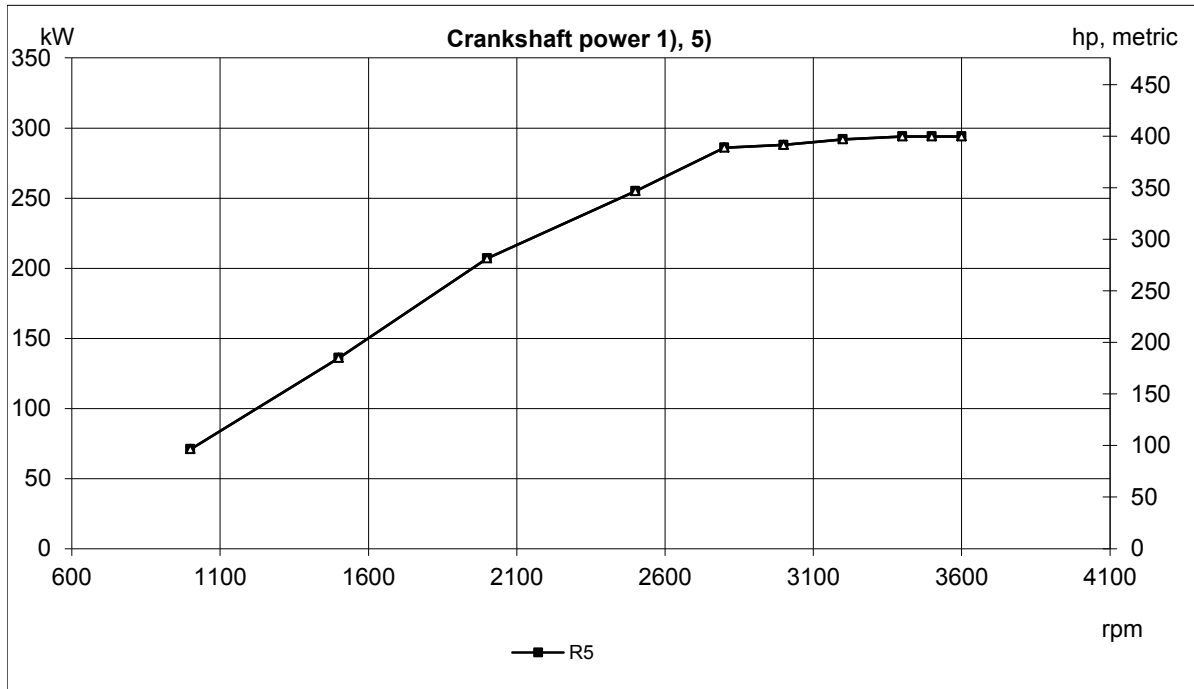
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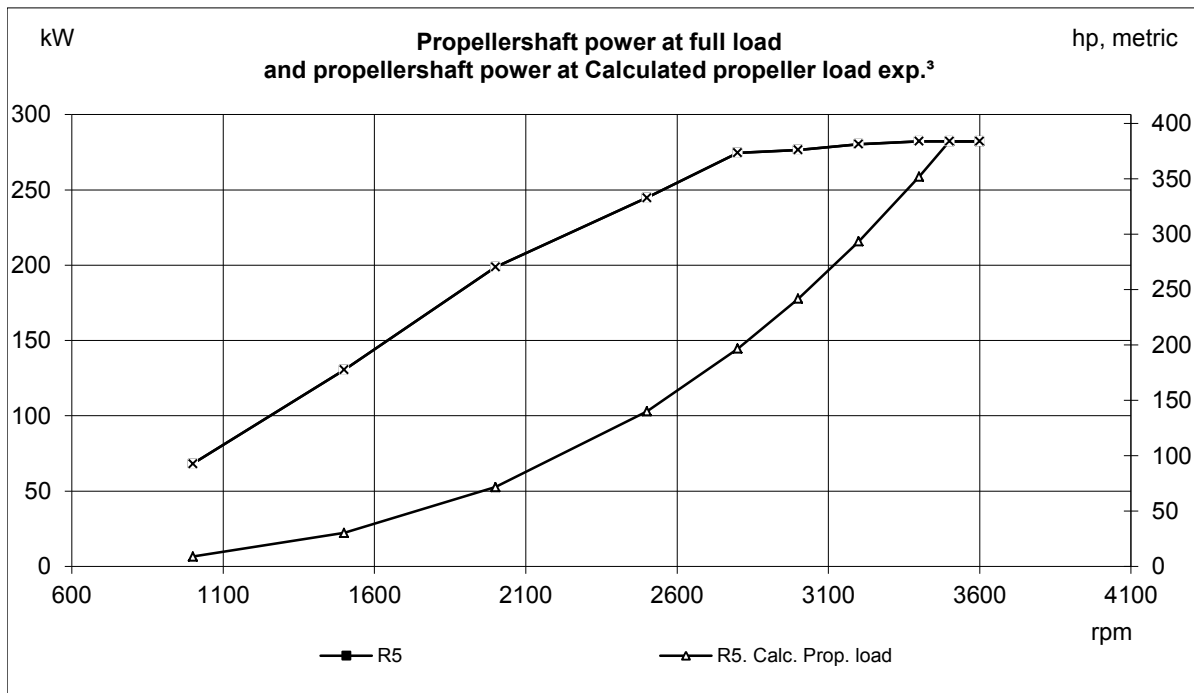
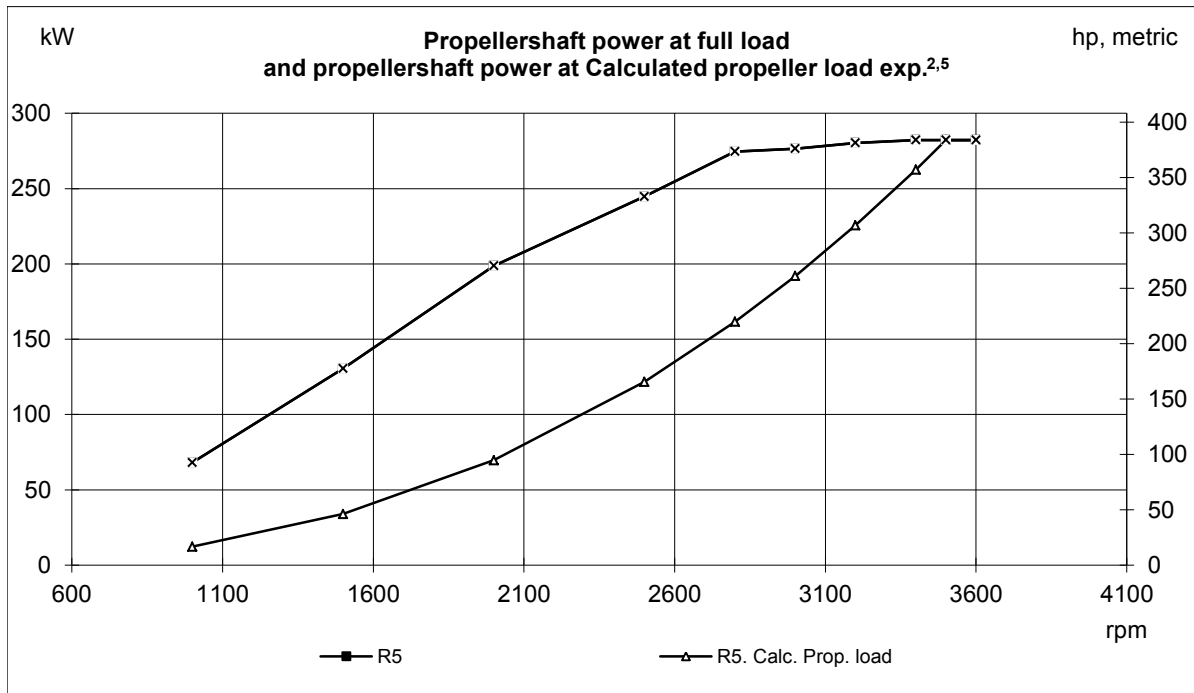
Issue Index

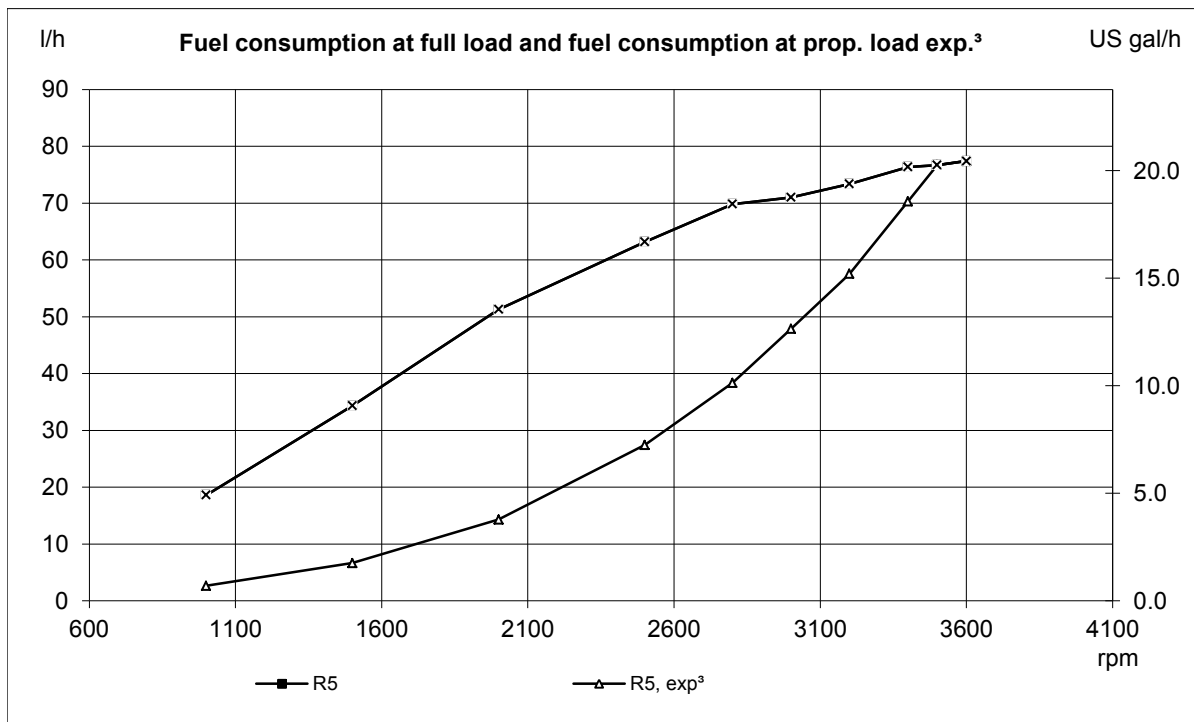
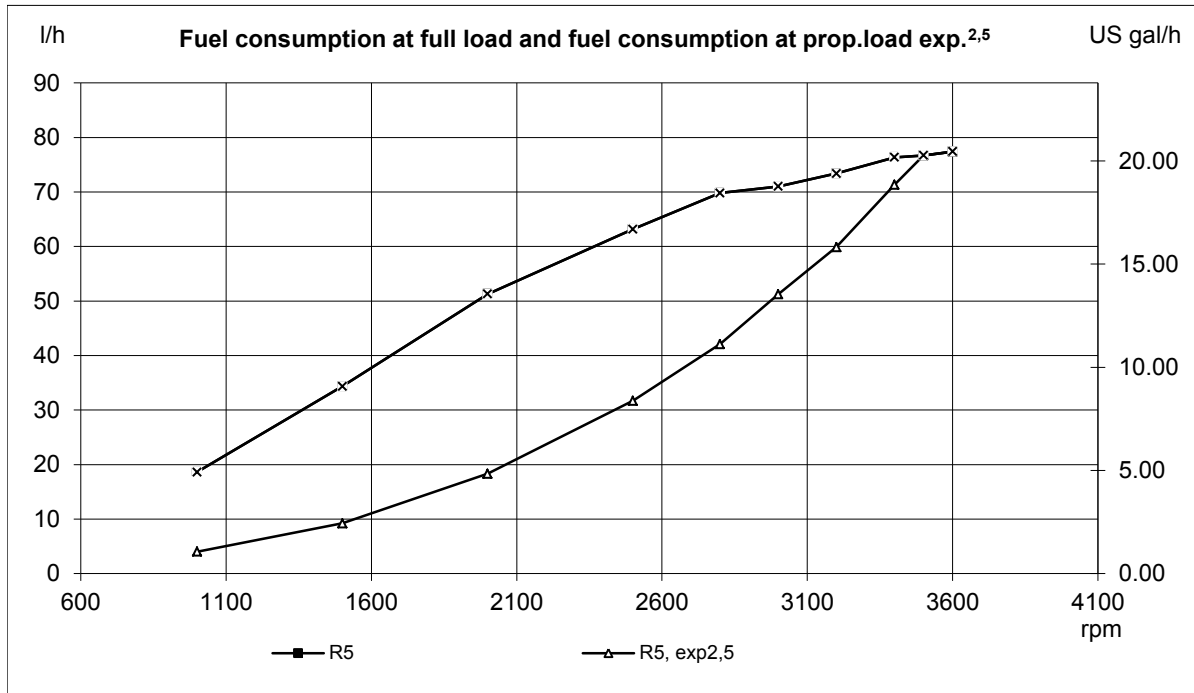
**D6-400 AQ**

**23609276**

**03**







**VOLVO PENTA**

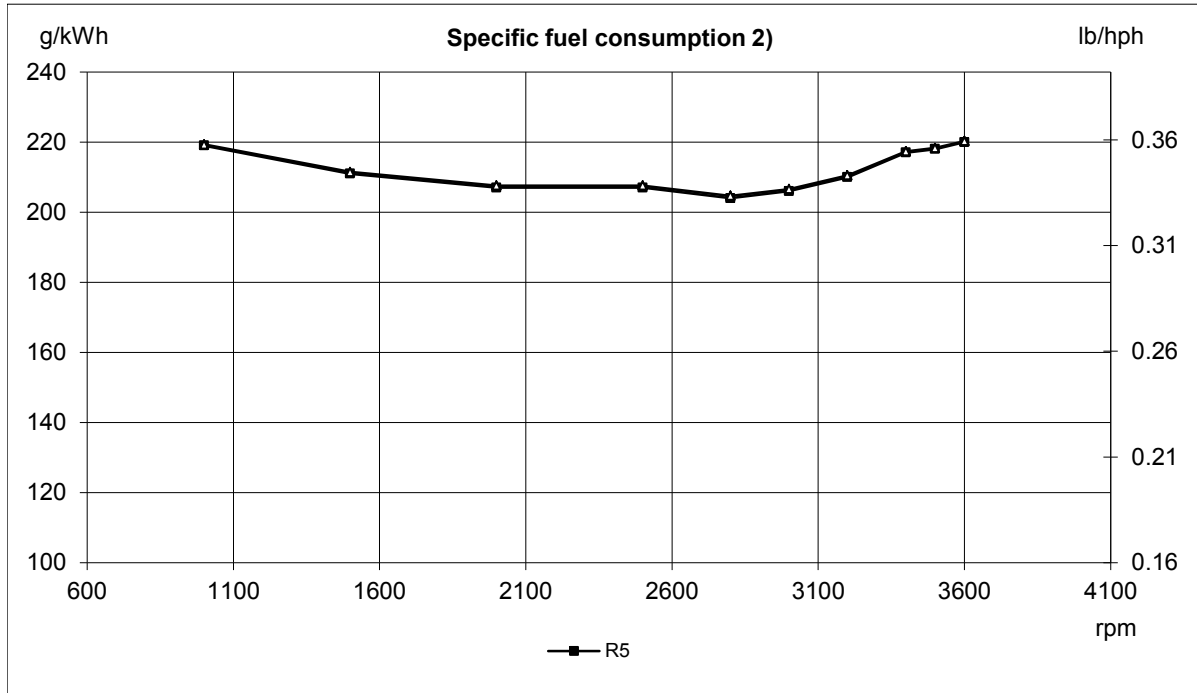
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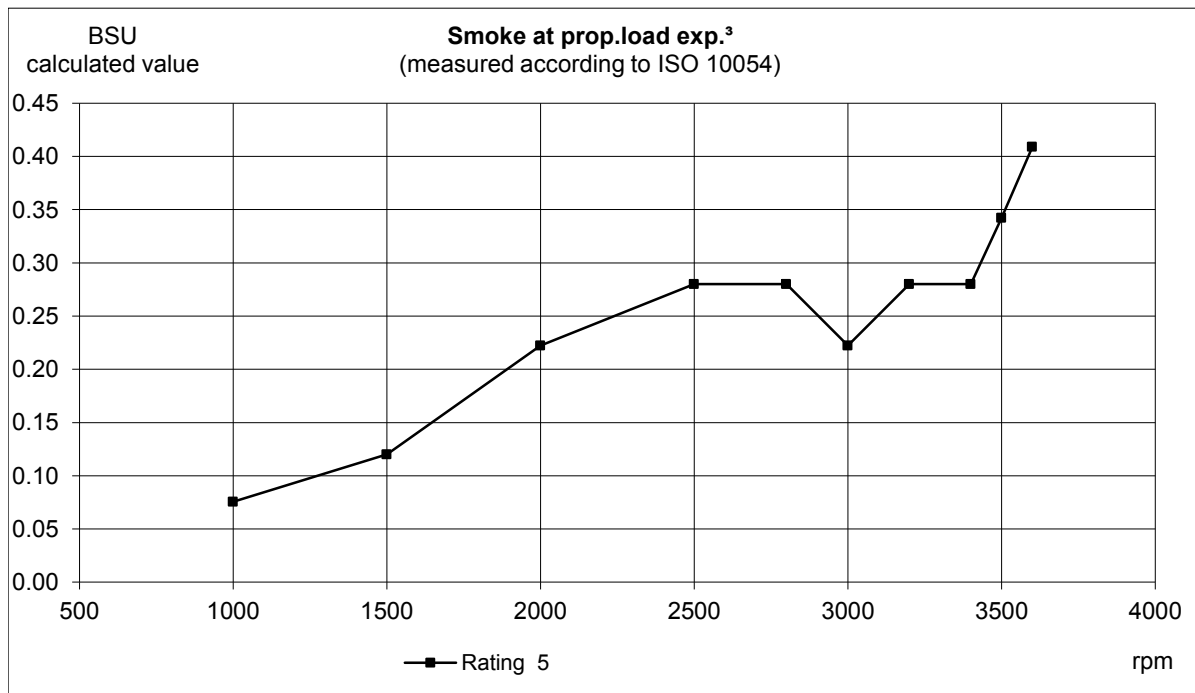
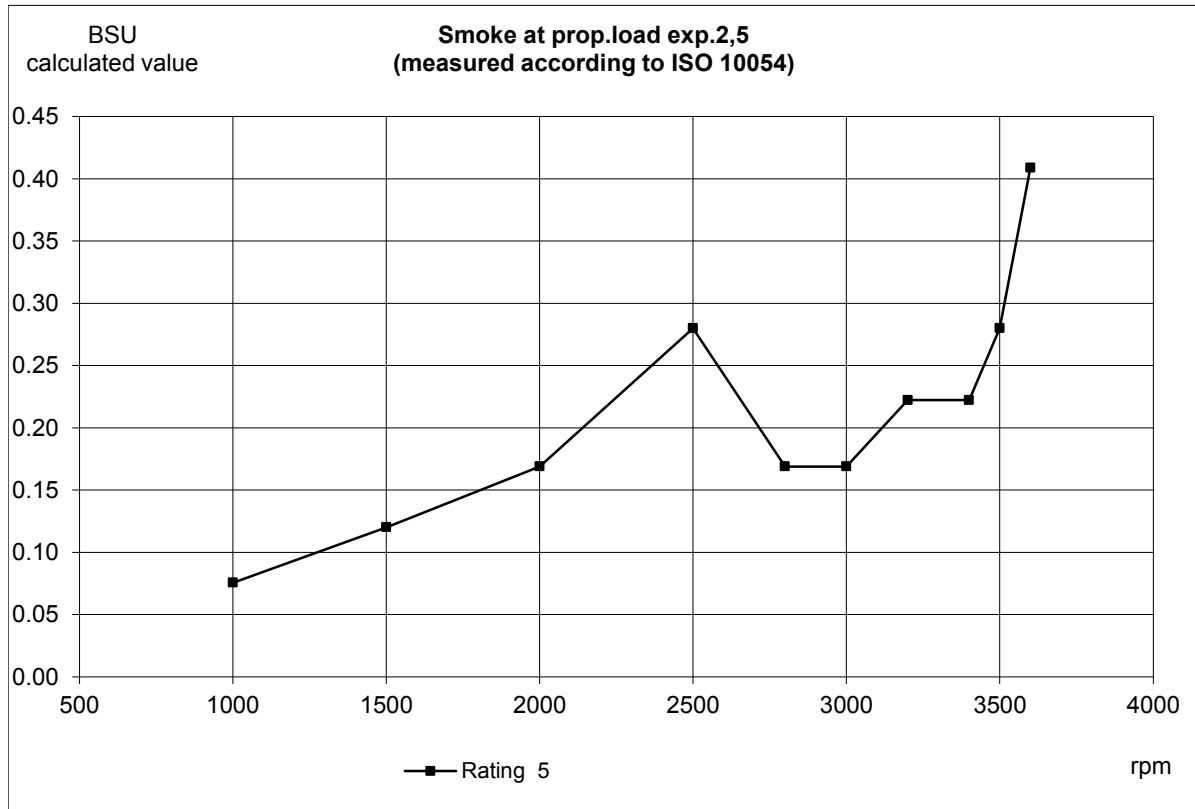
Issue Index

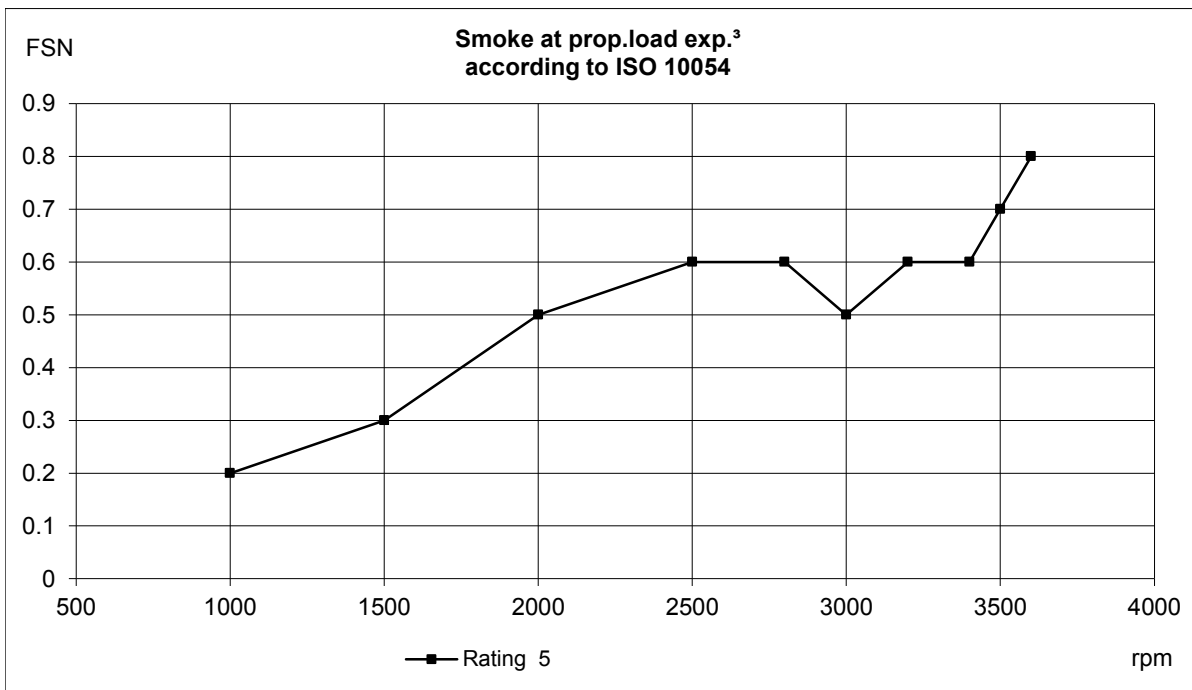
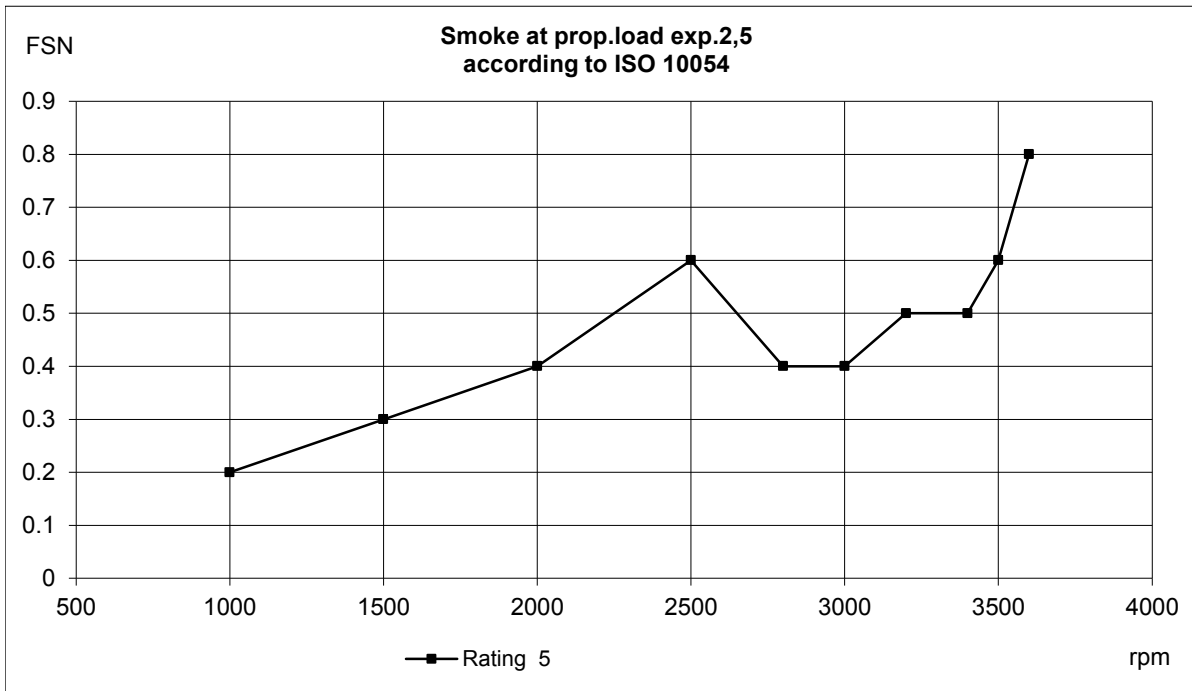
**D6-400 AQ**

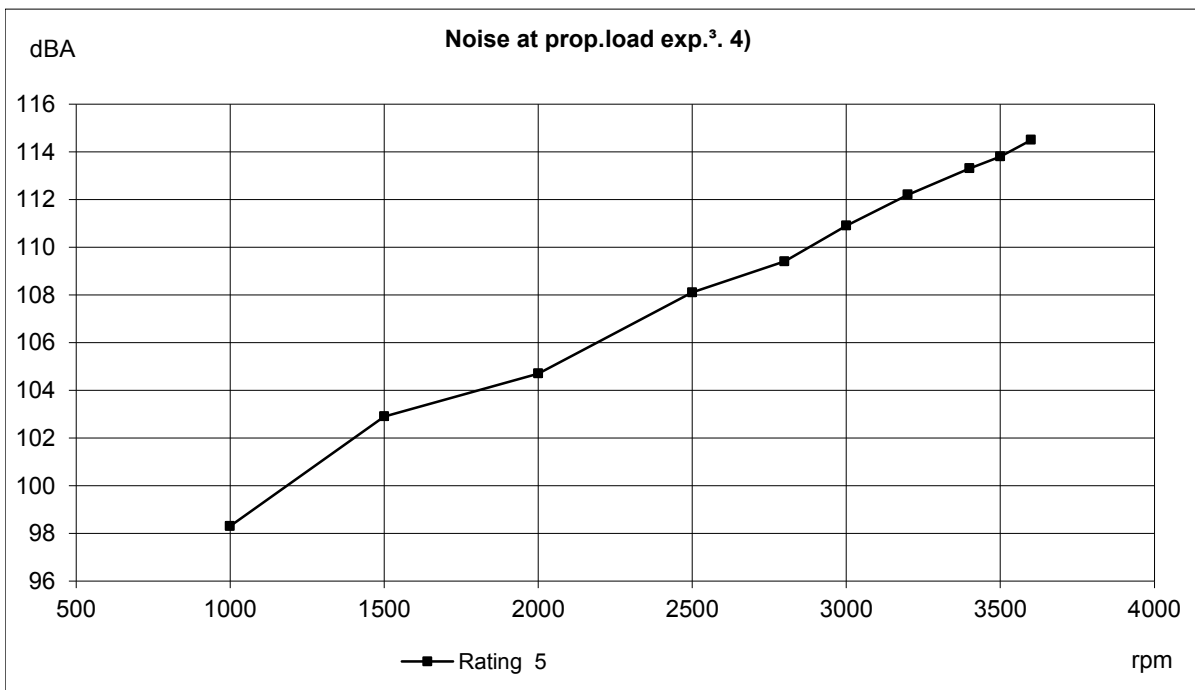
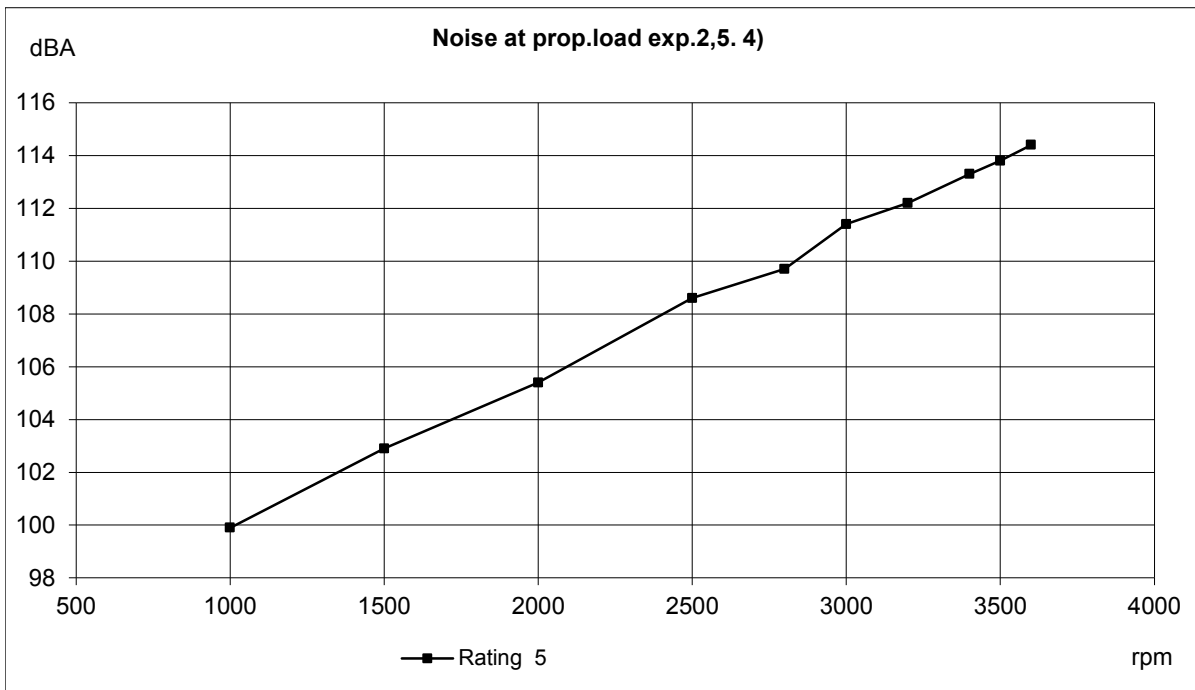
**23609276**

**03**









<b>VOLVO PENTA</b>	Document No	Issue Index
	<b>23609276</b>	<b>03</b>
<b>D6-400 AQ</b>		

**Battery capacity 12V DPI**

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	95	850 (EN)	2	1.8	70
-5	120	1150 (EN)	2	1.8	70

**Battery capacity 24V DPI**

5	75	750(EN)	2	1.8	50
-5	95	850 (EN)	2	1.8	50

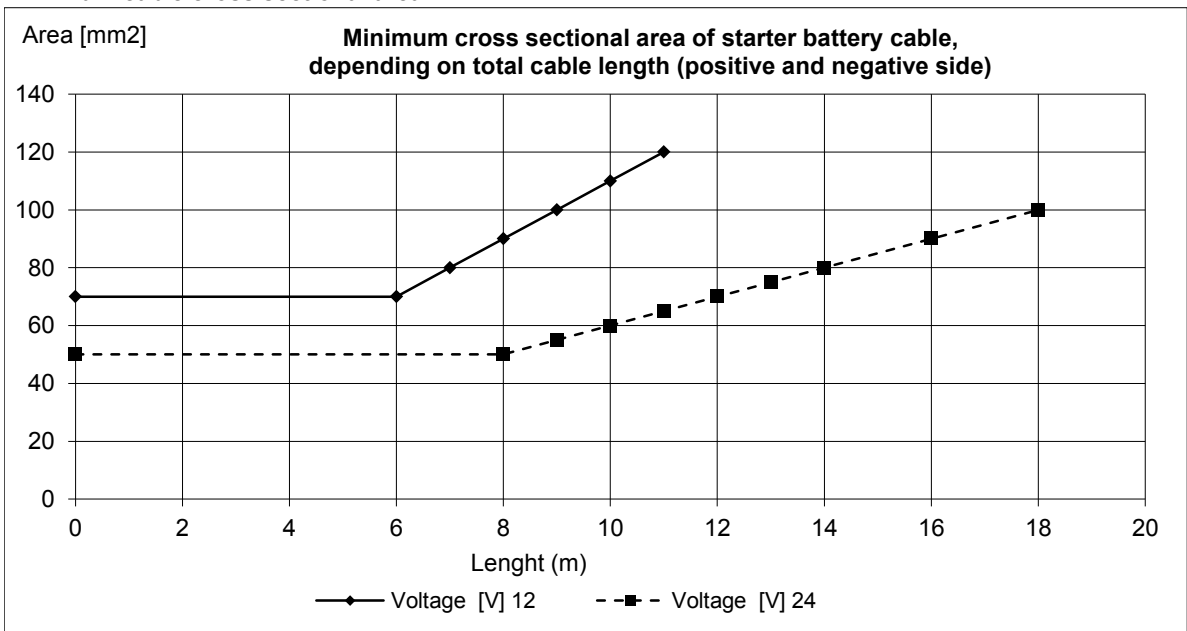
**Battery capacity 12V DPH**

5	95	750 (EN)	2	1.8	70
-5	110	850 (EN)	2	1.8	70

**Battery capacity 24V DPH**

5	70	600(EN)	2	1.8	50
-5	75	750 (EN)	2	1.8	50

**Minimum cable cross sectional area**



**Fuses size:**

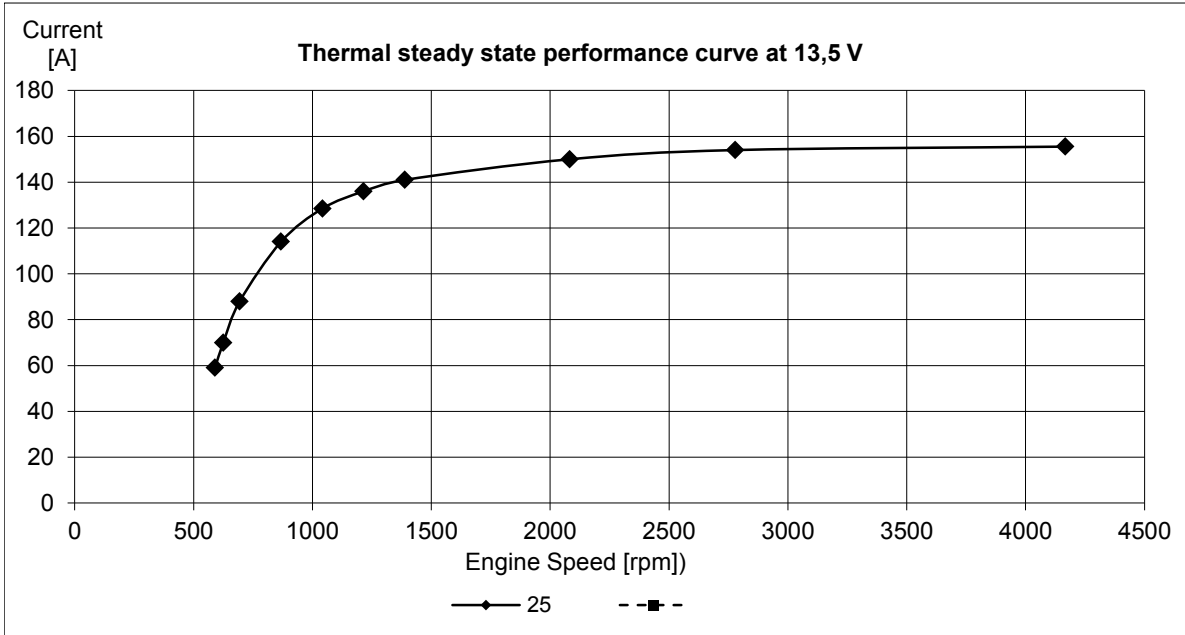
	[A]
Engine:	10
Control system:	10

**Max current consumption during normal operation:**

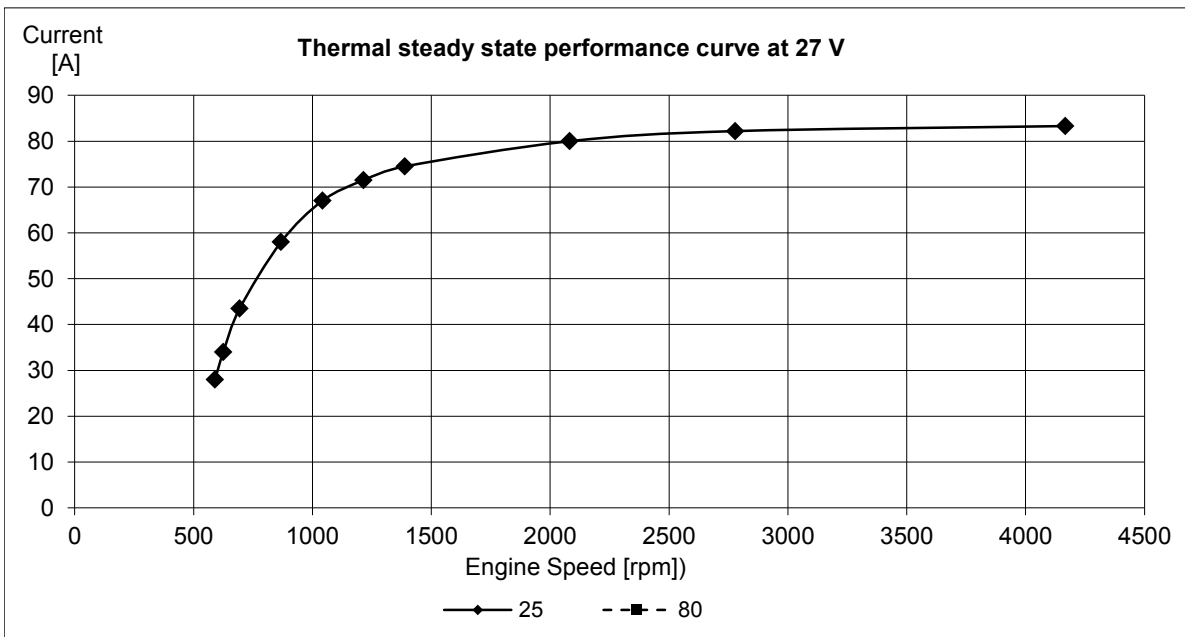
	[A]
Engine :	2 - 4

**Alternator data:**

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



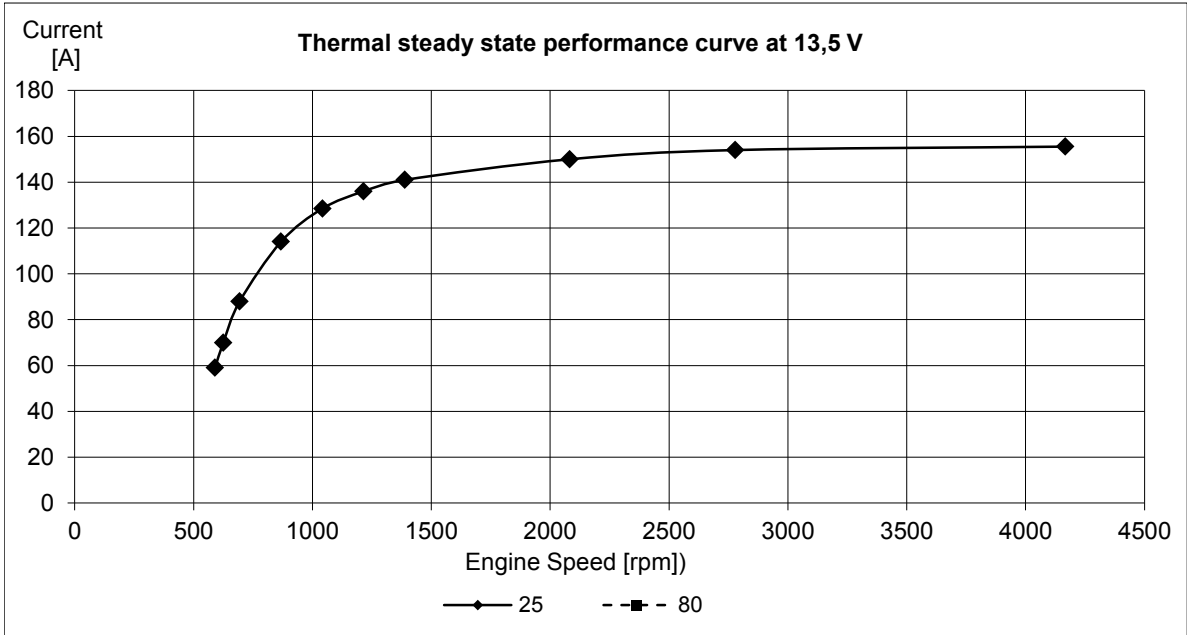
Constant charge voltage: [V]	14.3	+/- 0,3
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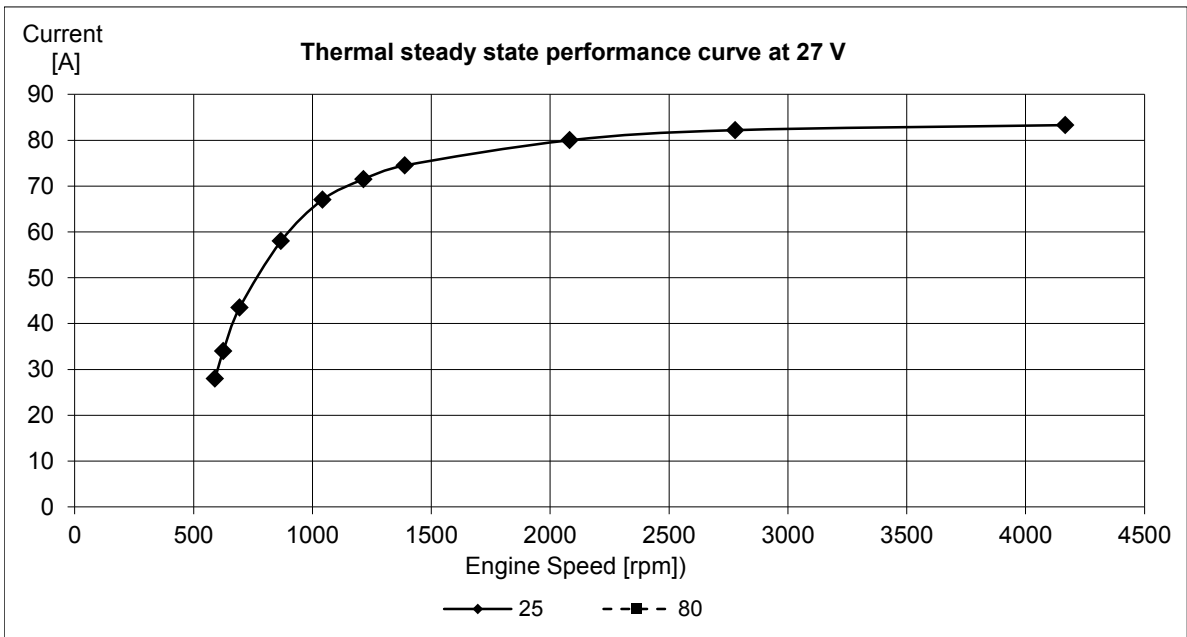
Constant charge voltage: [V]	28.3	+/- 0,3
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**Alternator data:**

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



Constant charge voltage: [V]	14.3	+/- 0,3
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Constant charge voltage: [V]	28.3	+/- 0,3
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