Important

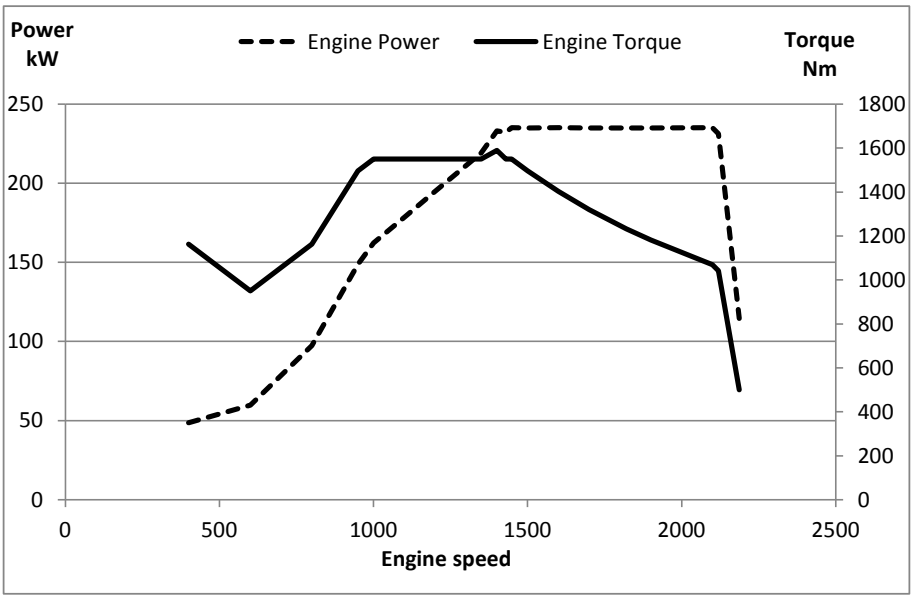
This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta application for certification.

Requirements marked with ⚠ are considered as critical for exhaust emissions compliance according to the design specification in the Volvo Penta application for certification.

Failing to follow and meet these instructions and requirements when installing a certified engine in a piece of nonroad equipment for use in the United States violates U.S. federal law (40 CFR 1068.105(b)), subject to fines or other penalities as described in the Clean Air Act.

In-line four stroke diesel engine with common rail direct injection. Rotation direction counterclockwise viewed towards flywheel.

Peak Power		kW	235
		hp	320
		rpm	2100
Peak Torque		Nm	1590
		rpm	1400
Dimensions	L	mm	1400
	W	mm	921
	H	mm	1147



Consumption data

		rpm	1400	1700	2000	2100
Specific fuel consumption at:	25%	g/kWh	229	254	290	307
		lb/hph	0,37	0,41	0,47	0,50
	50%	g/kWh	203	216	238	247
		lb/hph	0,33	0,35	0,39	0,40
	75%	g/kWh	197	204	219	227
		lb/hph	0,32	0,33	0,35	0,37
	100%	g/kWh	196	201	213	219
		lb/hph	0,32	0,33	0,35	0,35

Specific AdBlue®/DEF consumption of diesel consumption, NRTC	Vol%	5,30%

CO_2 emission declaration

Carbon dioxide (CO_2) emissions determined during the EU type approval process and recorded in EU type approval certificate, NRTC.	g/kWh	742

General

Number of cylinders			6
Displacement, total		liters in^3	10,84 661
Firing order			1-5-3-6-2-4
Bore		mm in	123 4,84
Stroke		mm in	152 5,98
Compression ratio			16.9:1
Wet weight	Engine only	kg lb	1109 2445
	The weight includes: The engine is weighed with components that consist of the minimum running weight including standard flywheel and excluding cooling package, hoses and air filters. For a clearer description, contact your regional application engineer.		
	Power pack	kg lb	N/A N/A
	The weight includes: N/A		
	Exhaust aftertreatment muffler DPF	kg lb	32 71
	Exhaust aftertreatment muffler SCR	kg lb	41 90

Performance

Rated power	kW	235
	rpm	2100
IFN Power	kW	N.A
ICFN Power	kW	235
For ICFN please see Techincal data for		N/A

The engine performance corresponds to ISO 3046.

			rpm	1400	1700	2000	2100
Power	without fan		kW	233	235	235	235
			hp	317	320	320	320
For performance with fan see options technical data for the desired module.							
Torque (IFN)	without fan		Nm	1590	1320	1122	1069
			lbf ft	1173	974	828	788
Max torque at engine speed	1400	rpm	Nm	1590			
			lbf ft	1173			
Power tolerance			%	±3%			
Total mass moment of inertia, J (mR2) for two mass calculations			kgm²	0,914			
(not including flywheel)			lbft²	21,7			
Total mass moment of inertia, J (mR^2) for transient load response calculations (not including flywheel)			kgm²	0,914			
			lbft²	21,7			
Friction Power warm engine			kW	22	33	46	53
			hp	31	45	62	72

Engine brake performance option		**rpm**	**1200**	**1500**	**1900**	**2200**
Brake power:	without fan	kW	109	150	187	208
		hp	149	204	254	283
Brake torque:	without fan	Nm	870	955	937	904
		lbf ft	642	704	691	666
Engine speed range for engine brake activation:		rpm	900			
Engine brake automatically deactivates at:		rpm	800			
Min oil temperature for engine brake activation:		°C	55			

Cold start performance

Cold start limit temperature	Preheater required @	°C	-25
	Preheater 3 kW	°F	-13
	Preheater + block heater req @ Blockheater: TYP M8T 598 1200W / ~230V	°C °F	-35 -31
Cold start oil specification	T>-20°C VDS4.5 10W/30 T<-20°C VDS4.5 5W/30		
Cold start fuel specification	EN590 98/70/EC (For details see Volvo Penta Industrial fuel bulletin.)		

Lubrication system

Lubricating oil consumption of diesel consumption (average)		Vol %	0,05
Oil change intervals/specifications	VDS4.5	h	1000
		h	12
Oil pressure at 1700rpm	Max	kPa	600
		psi	87
Oil pressure at 1700rpm	Min	kPa	250
		psi	36
Lubrication oil temperature in oil pan:	Max	°C	130
		°F	266
Oil filter filtration efficiency (in accordance with ISO 4548-12)	90%	µ	38
	50%	µ	14

For oil system capacity and angularity limits see technical data per options

Fuel system

Suction line fuel flow at maximum output (Measured at fuel inlet connection)	liter/h	130
	US gal/h	34,3
Fuel supply line min pressure, during engine running	kPa	-20,0
(measured at fuel inlet connection @ engine max power curve)	psi	2,9
Fuel supply line max. pressure, during engine stand still	kPa	17,0
(measured at fuel inlet connection @ with full tank)	psi	2,5
Fuel supply line min. pressure, during engine stand still	kPa	-12,0
(measured at fuel inlet connection @ with low tank fill)	psi	-1,8
Maximum system return flow	liter/h	50
	US gal/h	13,2
Max. allowable inlet fuel temp (Measured at fuel inlet connection)	°C	60
	°F	140
Prefilter / Water separator filtration efficiency		Use Volvo Penta original
Fuel filter filtration efficiency		Use Volvo Penta original
Injector type	F2	
Fuel to conform to	EN590 98/70/EC (For details see Volvo Penta Industrial fuel bulletin.)	

Intake system	**rpm**	**1400**	**1700**	**2000**	**2100**
Air consumption at: (+25°C and 100kPa)	m³/min	15,4	18,9	21,6	22,6
	cfm	544	668	762	799
⚠ **See front page for important information** Max allowable air intake restriction including piping	kPa	6			
	psi	0,9			

Exhaust system	rpm	1400	1700	2000	2100
Heat rejection to exhaust:	kW	169	184	198	206
	BTU/min	9631	10472	11279	11739
Exhaust gas temperature after turbine at:	°C	494	446	425	422
	°F	922	835	797	792
⚠ **See front page for important information** Max allowable back pressure in exhaust line (after turbine)	kPa	37	42	46	48
	psi	5,4	6,1	6,7	7,0
⚠ **See front page for important information** Max allowable temperature drop between turbine and muffler 1 inlet at exhaust temperature 486° C and exhaust gas flow 0.47 kg/s.	Δ°C	9			
	Δ°F	16,2			
⚠ **See front page for important information** Max allowable temperature drop between muffler 1 and muffler 2 at exhaust temperature 486° C and exhaust gas flow 0.47 kg/s.	Δ°C	4			
	Δ°F	7,2			
Muffler 1 pressure drop (at exhaust gas flow and exhaust temp specified in this table)	kPa	16	19	20	21
	psi	2,3	2,8	2,9	3,0
Muffler 2 pressure drop (at exhaust gas flow and exhaust temp specified in this table)	kPa	15	17	19	20
	psi	2,2	2,5	2,8	2,9
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	m³/min	33,8	36,8	38,8	40,0
	cfm	1194	1300	1372	1412
⚠ **See front page for important information** Engine speed during stand still regeneration	rpm	1400 ± 100			
⚠ **See front page for important information** Max allowed load during stand still regeneration	Nm	700			
	lb ft	516			

Cooling system		rpm	1400	1800	2000	2100
Heat rejection radiation from engine at:		kW	5,0	5,7	6,2	6,2
		BTU/min	282	324	355	354
Heat rejection to coolant at:		kW	112	124	134	140
		BTU/min	6369	7052	7620	7962
Coolant		Volvo Penta Coolant VCS (Yellow) Ready Mix 40/60 or Mix 40% Volvo Penta Coolant VCS (Yellow) + 60% tap Water*. * Tap water most fulfill Volvo quality standard VOLVO STD: 1285, 1				
Coolant capacity:	Engine only	liter	17			
For coolant capacity for engine and cooling packages see Technical data for the specific option.		US gal	4,5			
Coolant pump	*(Engine is reference =1)*	drive/ratio	belt/1.41:1 cw			
Coolant pump curve see graphs at end						
Nominal engine coolant pressure before engine circuit coolant pump		kPa	62	61	61	64
		psi	8,9	8,8	8,9	9,3
Coolant pressure drop over complete engine circuit		kPa	32	54	63	69
(at coolant flow below)		psi	4,6	7,8	9,1	10,0
Coolant flow		l/s	4,77	6,18	6,87	7,22
		US gal/s	1,259	1,633	1,814	1,906
Minimum coolant flow		l/s	3,00	3,83	4,25	4,50
At fully opened thermostat		US gal/s	0,793	1,013	1,123	1,189
Maximum outer circuit restriction incl. piping		kPa	55			
		psi	8,0			
Thermostat:	start to open	°C	82			
		°F	180			
	fully open	°C	92			
		°F	197,6			
Maximum static pressure head (expansion tank height + pressure cap setting)		kPa	100			
		psi	14,5			
Minimum static pressure head (expansion tank height + pressure cap setting)		kPa	70			
		psi	10,2			
Maximum top tank temperature		°C	107			
		°F	224,6			
Recommended Draw down capacity. The difference between min coolant level in the expansion tank and the lowest level where the engine's coolant system still functioning		liter	2,00			
		US gal	0,528			

Charge air cooler system		rpm	1400	1700	2000	2100
Heat rejection to charge air cooler		kW	31	39	47	50
		BTU/min	1791	2243	2651	2834
Charge air mass flow		kg/s	0,30	0,37	0,42	0,44
Charge air inlet temp @ 25 °C (Charge air temp after turbo compressor)		°C	141	146	153	156
		°F	285	294	307	313
⚠ **See front page for important information** Max allowable Charge air outlet temp @ 25 °C ambient temperature (Charge air temp after charge air cooler)	EGR valve closed*	°C	50			
		°F	122			
⚠ **See front page for important information** Max allowable Charge air outlet temp @ 25 °C ambient temperature (Charge air temp after charge air cooler)	EGR valve open*	°C	100			
		°F	212			
⚠ **See front page for important information** Maximum pressure drop over charge air cooler incl. piping		kPa	12	12	12	12
		psi	1,7	1,7	1,7	1,7
Charge air pressure - relative pressure at sea level (After charge air cooler)		kPa	140	146	149	151
		psi	20,2	21,2	21,6	21,8

*During certain operating conditions - temperature in inlet manifold is temporarily elevated intentionally using exhaust gas. This is normal. External cooling control should not counter this but instead control inlet manifold temperature only to avoid exceeding 100 C. This operating condition can be observed on CAN: EngExGasRec1ValvePos_BB1_X_E > 50%. More information available in EATS installation manual available from your local Penta representative.

Electrical system

Engine Management System			EMS2.4			
Voltage and type			24			
Battery and cable resistance Recommendations:	Temperature	°C		25	0	-15
		°F		77	32	5
	Maximum main circuit resistance @ 20°C	mΩ		5	4	3
	Minimum battery size	Ah (20h) / CCA (EN)		140/800	140/800	140/800

Power take off

Maximum allowed torque at individual PTO´s.If more then one PTO output is used simultaniusly, calculations needs to be performed to determine available maximum. Available torque depends on application inertia.

Front end in line with crankshaft		rpm	1400	1800	2000	2100
With a total added mass moment of inertia		J (mR2)	≤0,05 kgm²			
Max torque at continous load:		Nm	1490	1210	1110	1060
		lbt ft	1099	892	819	782
PTO at flywheel						
Max allowed bending moment in flywheel housing		Nm	7000			
		lbf ft	5163			
Max load on rear main bearing		N	3000			
		lbf	674			

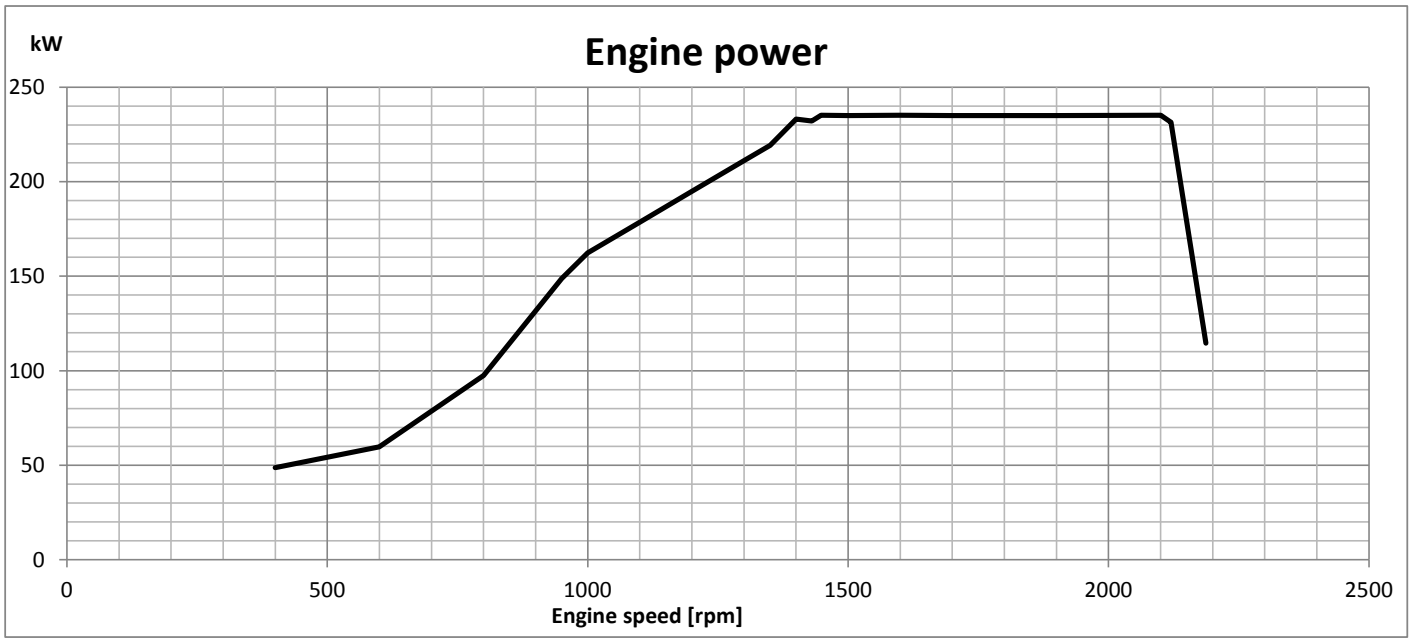
Engine Protection

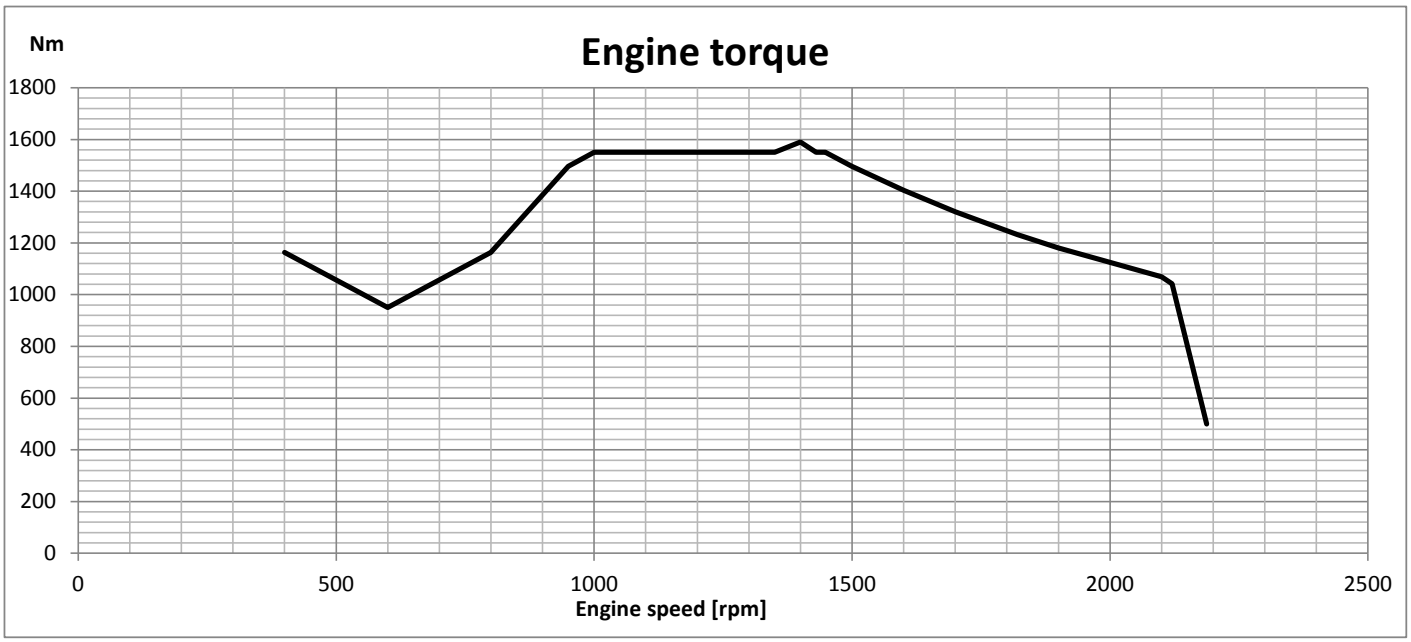
Warning implies that a Indication message is sent. Derate means an engine power derate.

Engine sensors				**Engine protection action**		
	Unit	**Warning level (Yellow)**	**Alarm level (Red)**	**Default**	Max derate, acc engine protection map	**Optional (Module or conversion kit)**
Fuel temperature[1]	°C	Not installed	Not installed	Not installed	Not installed	Not installed
Oil temperature	°C	125	130	Derate	132	Shut down
Coolant temperature	°C	105	107	Derate	108	Shut down
Charge Air Temperature (Boost temp)	°C	120	125	Derate	126	Shut down
Air filter temperature[1]	°C	Not installed	Not installed	Not installed	Not installed	Not installed
Exhaust gas temperature	°C	535	550	Shut down	550	Shut down
EGR temperature[1]	°C	Not installed	Not installed	Not installed	Not installed	Not installed
ECU temperature	°C	90	N/A	N/A	N/A	N/A
Fuel feed pressure[1]	kPa	Not installed	Not installed	Not installed	Not installed	Not installed
Fuel rail pressure[1]	kPa	Not installed	Not installed	Not installed	Not installed	Not installed
Oil Pressure	kPa	See below	See below	Shut down	See below	Shut down
Δ Piston Cooling Pressure	kPa	N/A	N/A	N/A	N/A	N/A
Δ Charge Air Press (Δ Boost pres)	kPa	See below	See below	Derate	See below	Shut down
Air filter pressure[1]	kPa	Not installed	Not installed	Not installed	Not installed	Not installed
EGR pressure[1]	kPa	Not installed	Not installed	Not installed	Not installed	Not installed
Crankcase pressure increase[1]	kPa	Not installed	Not installed	Not installed	Not installed	Not installed
DPF Differential Pressure	kPa	31	33	Derate	34	Shut down
Oil level[1]	Digital Switch	Not installed	Not installed	Not installed	Not installed	Not installed
Coolant level	Digital Switch	N/A	Low Level	Derate	Low Level	Shut down
DEF Injector Status	Digital Switch	N/A	Error Flag	Derate	Error Flag	Shut down
EATS System - Soot Regen Status	Status Flag	Warning	Stop Request	Derate	Stop Request	Shut down
Water in fuel[1]	Digital Switch	Not installed	Not installed	Not installed	Not installed	Not installed

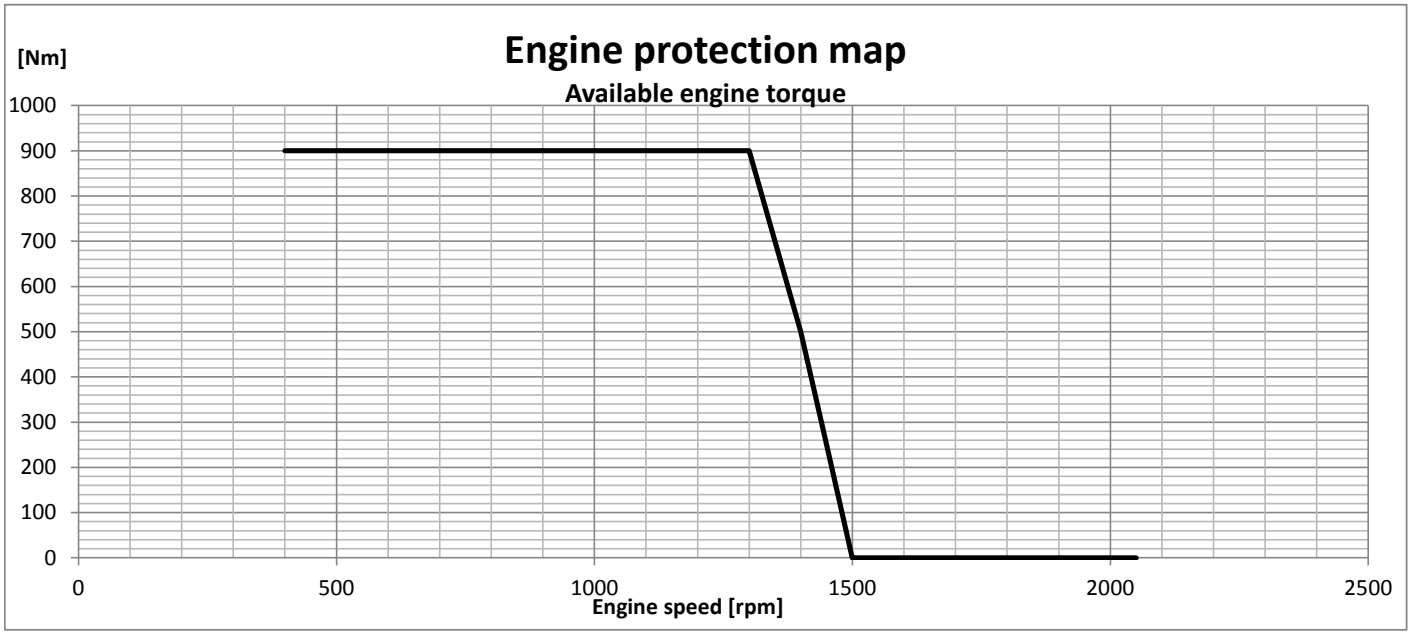
[1] Sensor not installed for this engine type

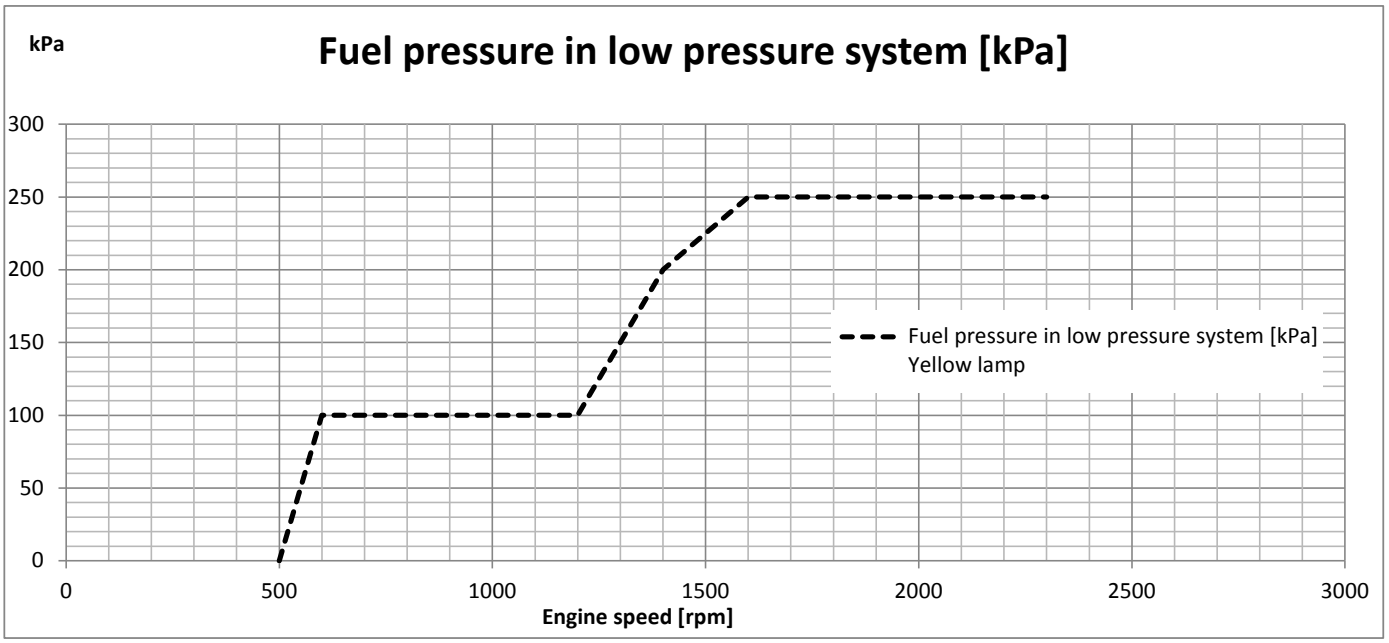
Graphs

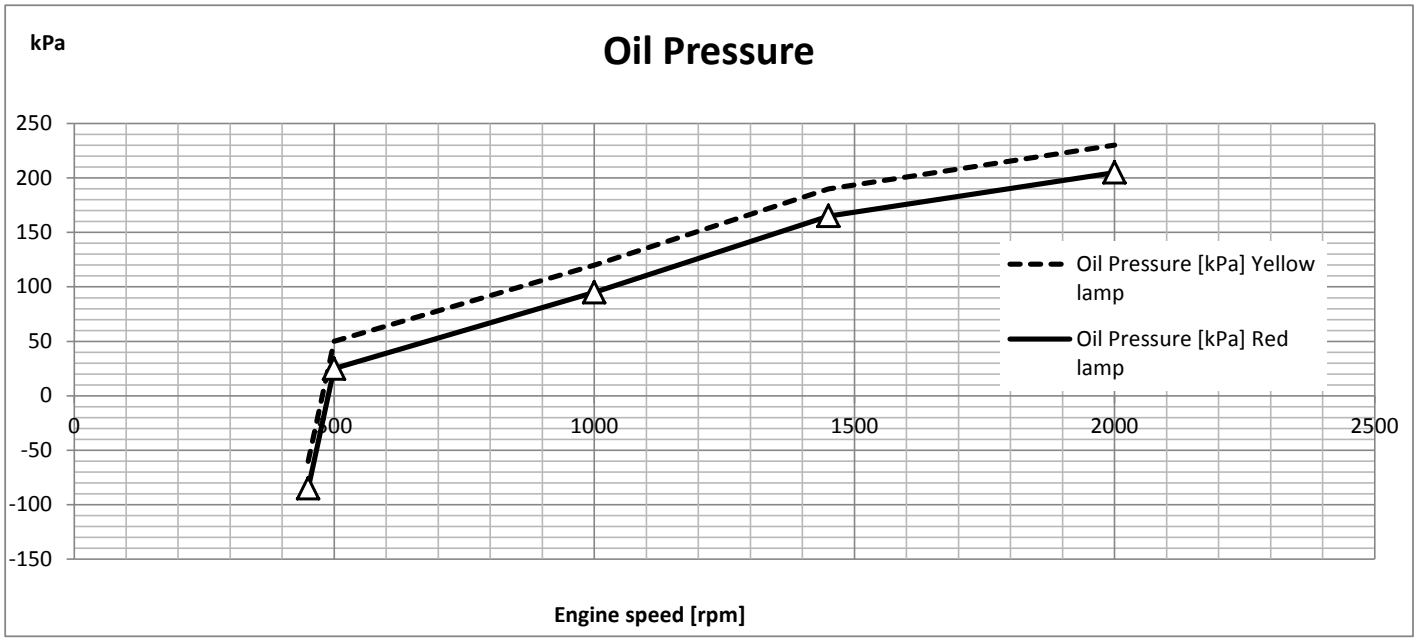

Engine power
kW
250
200
150
100
50
0
0
500
1000
1500
2000
2500
Engine speed [rpm]


Engine torque
Nm
1800
1600
1400
1200
1000
800
600
400
200
0
0
500
1000
1500
2000
2500
Engine speed [rpm]

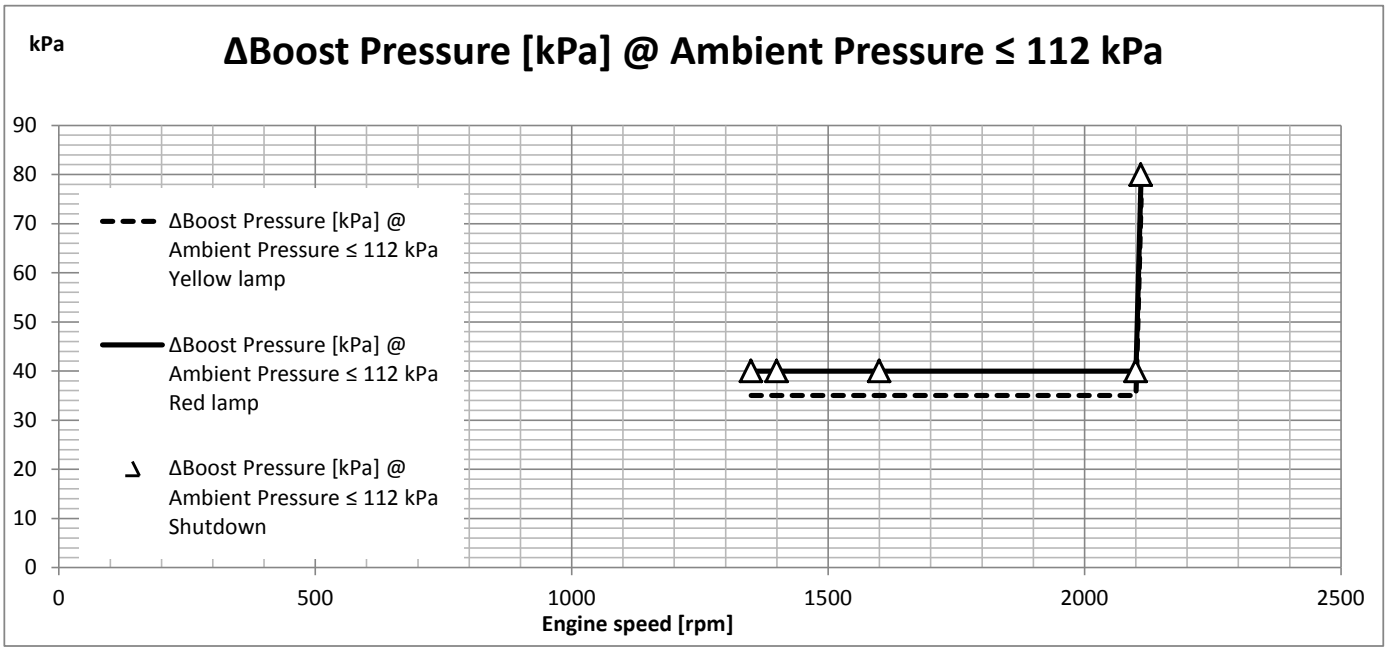
Warning and derate maps

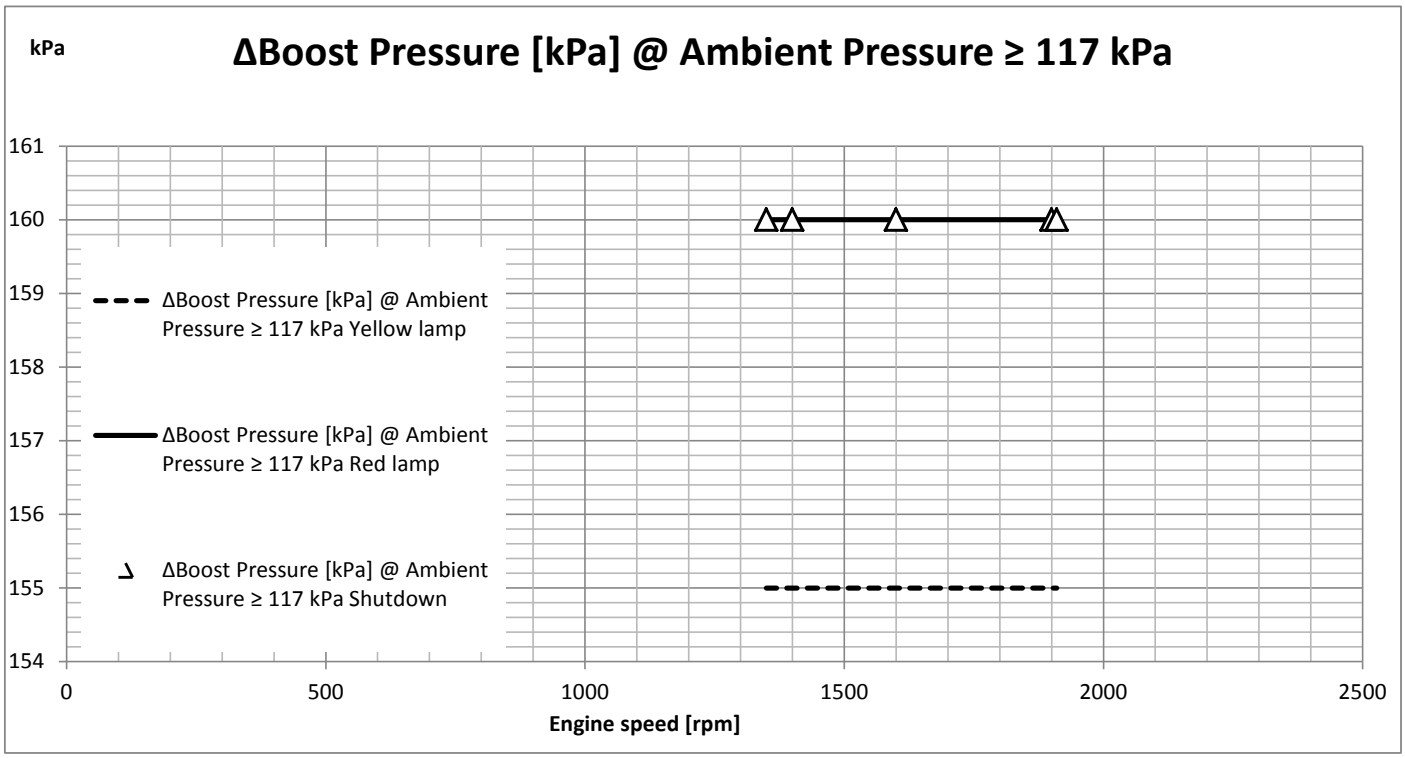


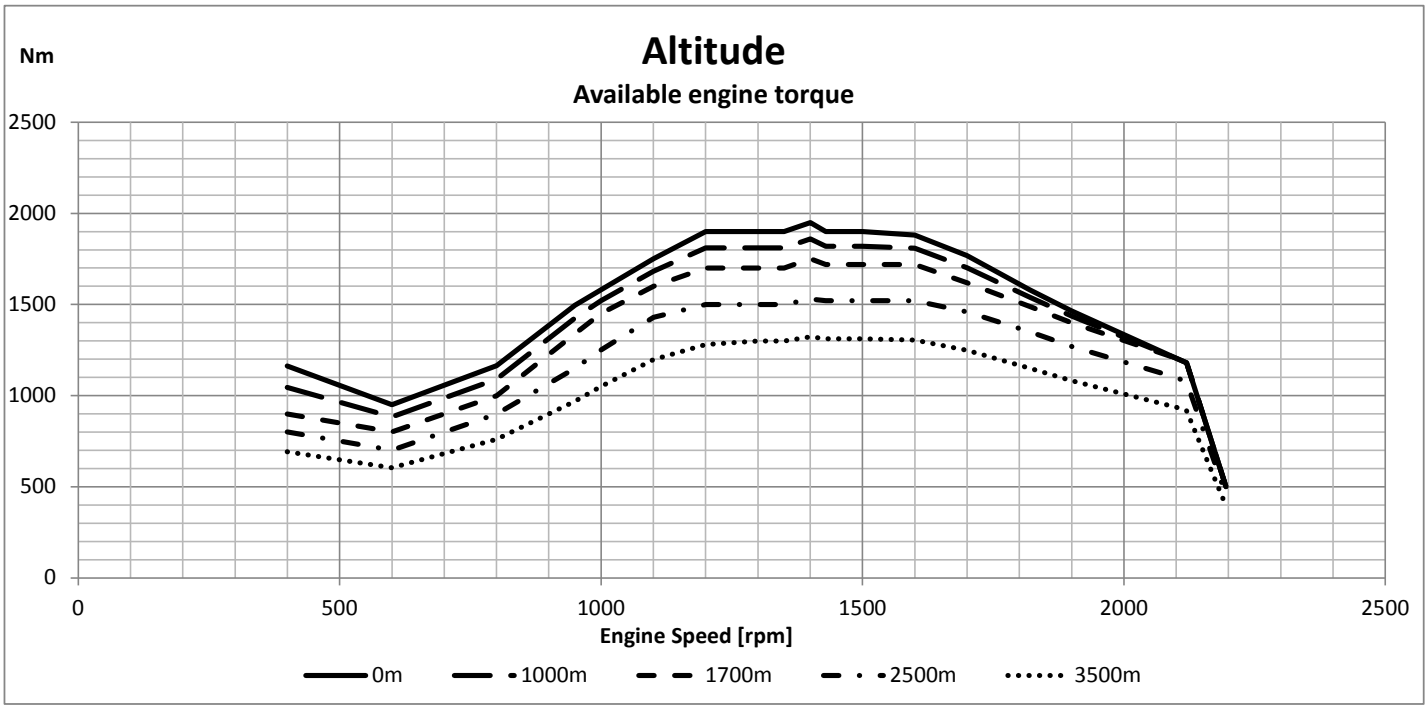


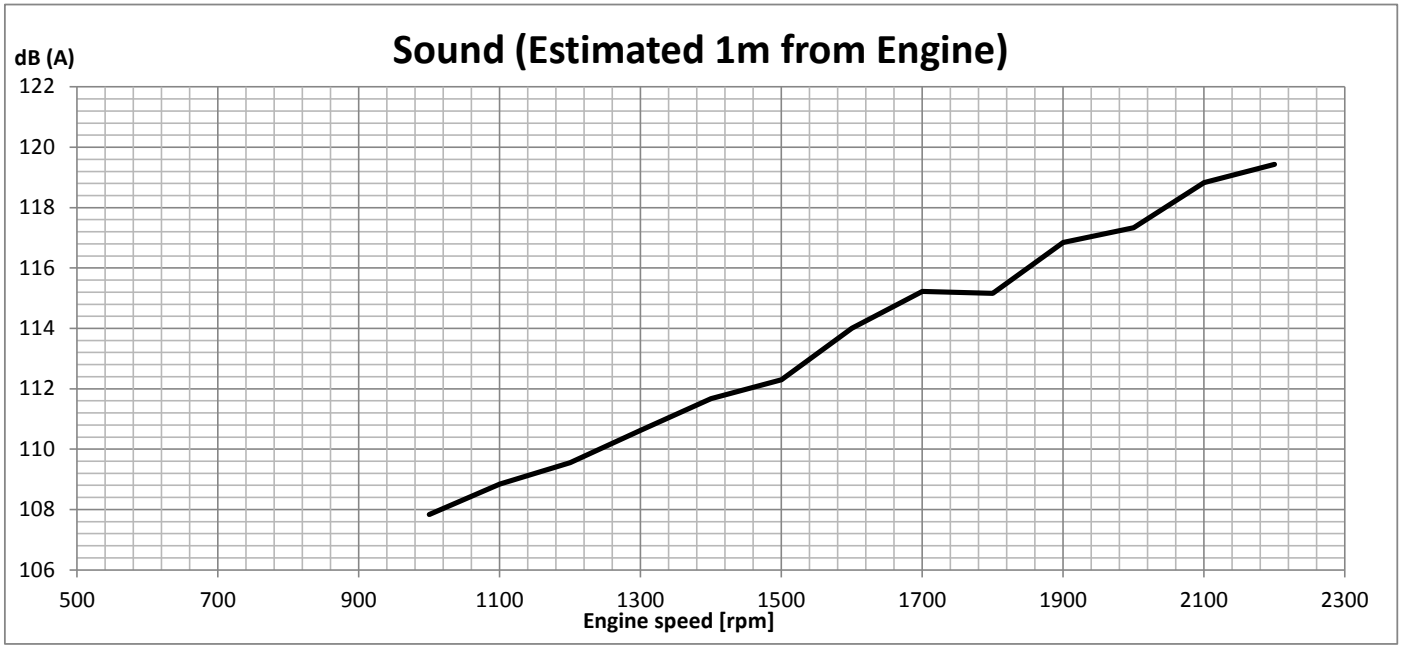

Oil Pressure
kPa
250
200
150
100
50
0
-50
-100
-150
0
1000
1500
2000
2500
Oil Pressure [kPa] Yellow lamp
Oil Pressure [kPa] Red lamp
Engine speed [rpm]

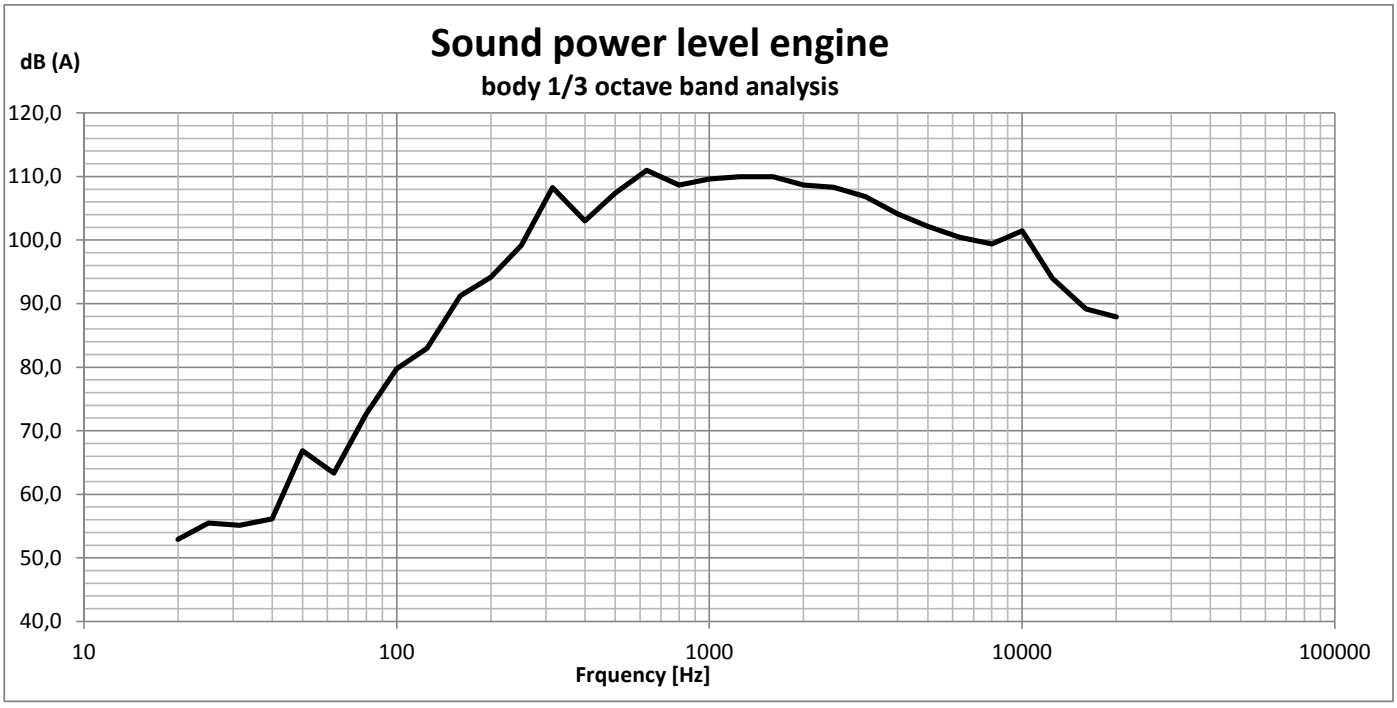
Engine protection for charge air pressure is complex and the trigger levels varies depending on engine mode, altitude and charge air temperature, ambient temperature.
Below is an example of engine protection limits for charge air pressure for normal operation engine mode, on the sea level with charge air temperature 50 degrees (normal charge cooler CAC efficiency) , and ambient temperature 25 degrees.
When engine speed increases above 1900 rpm (maximum power) charge pressure demand drops significantly but the actual charge pressure has a phycical delay to decrease therefore the fault limit is higher to avoid false alarm.

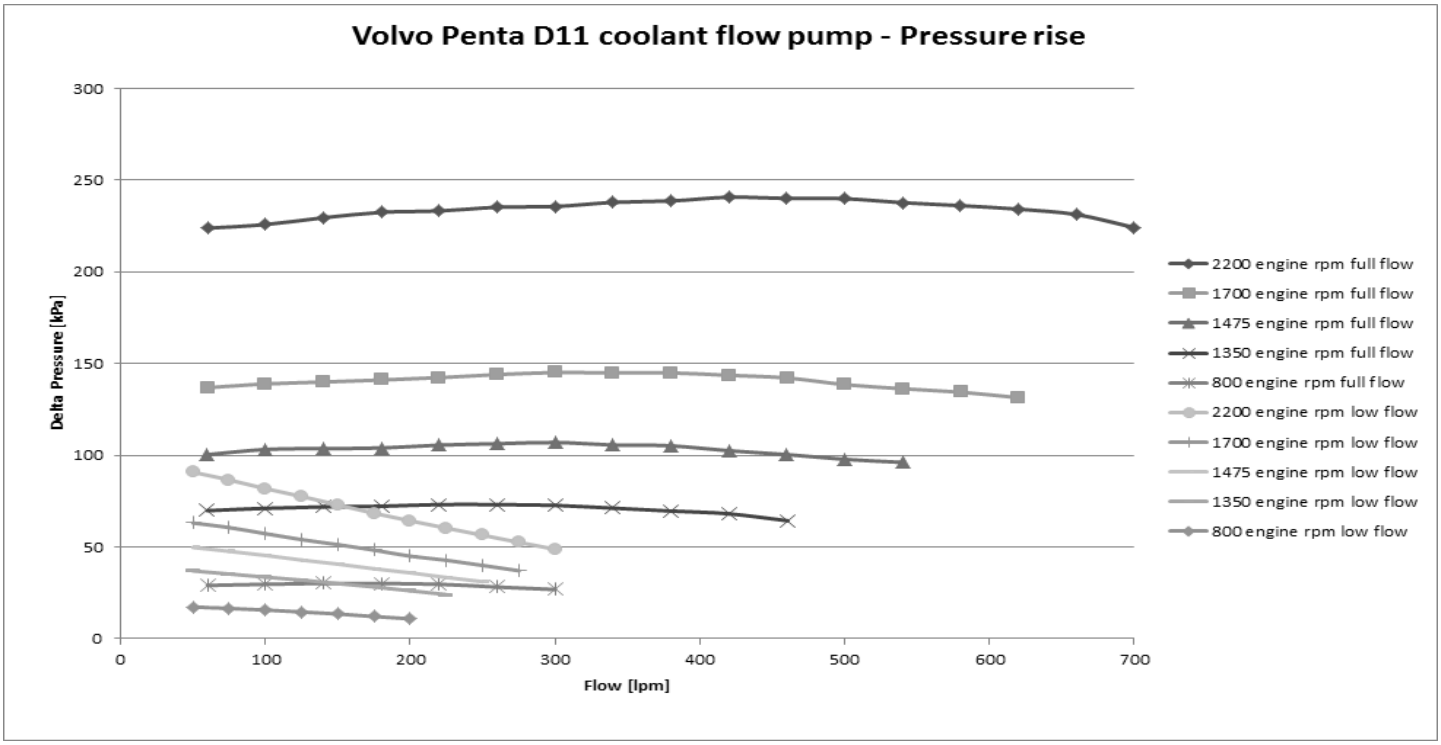


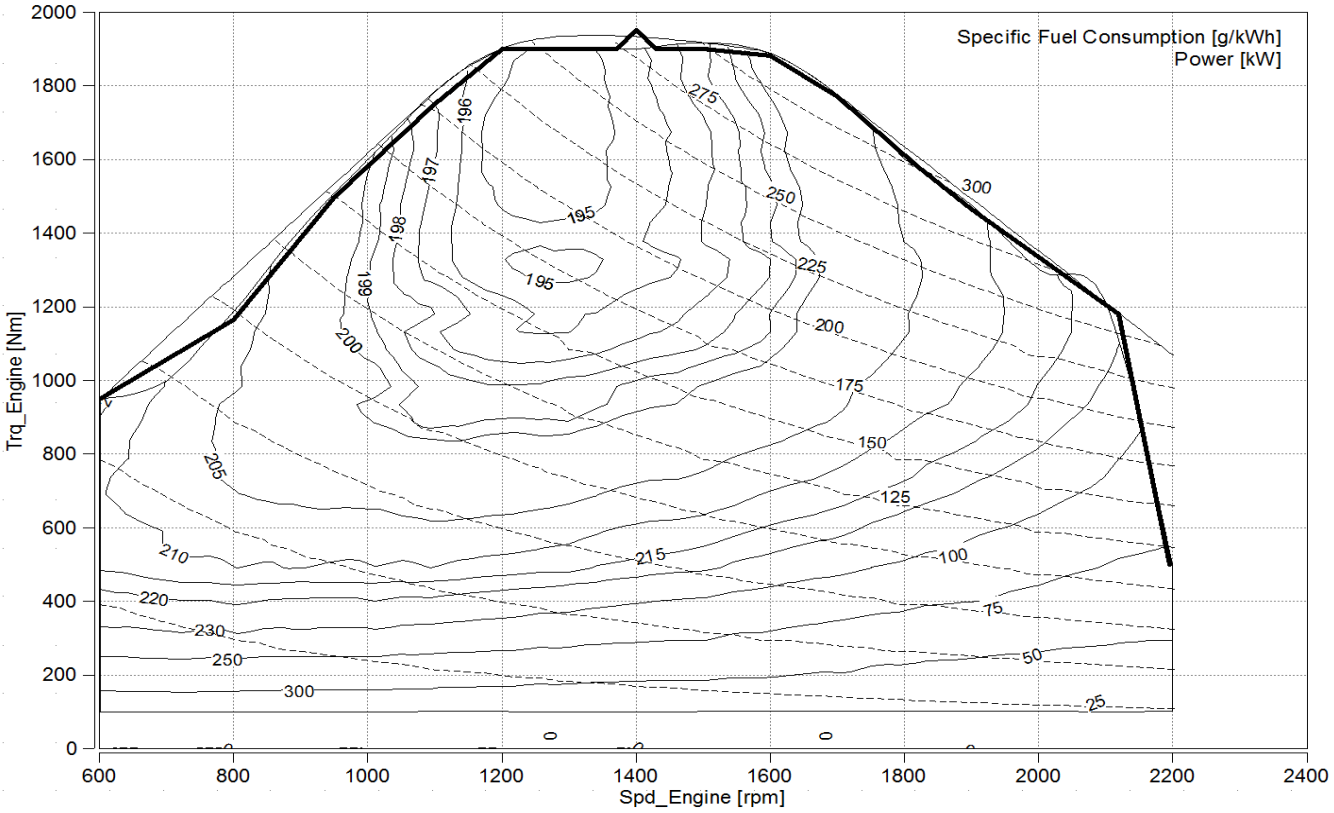


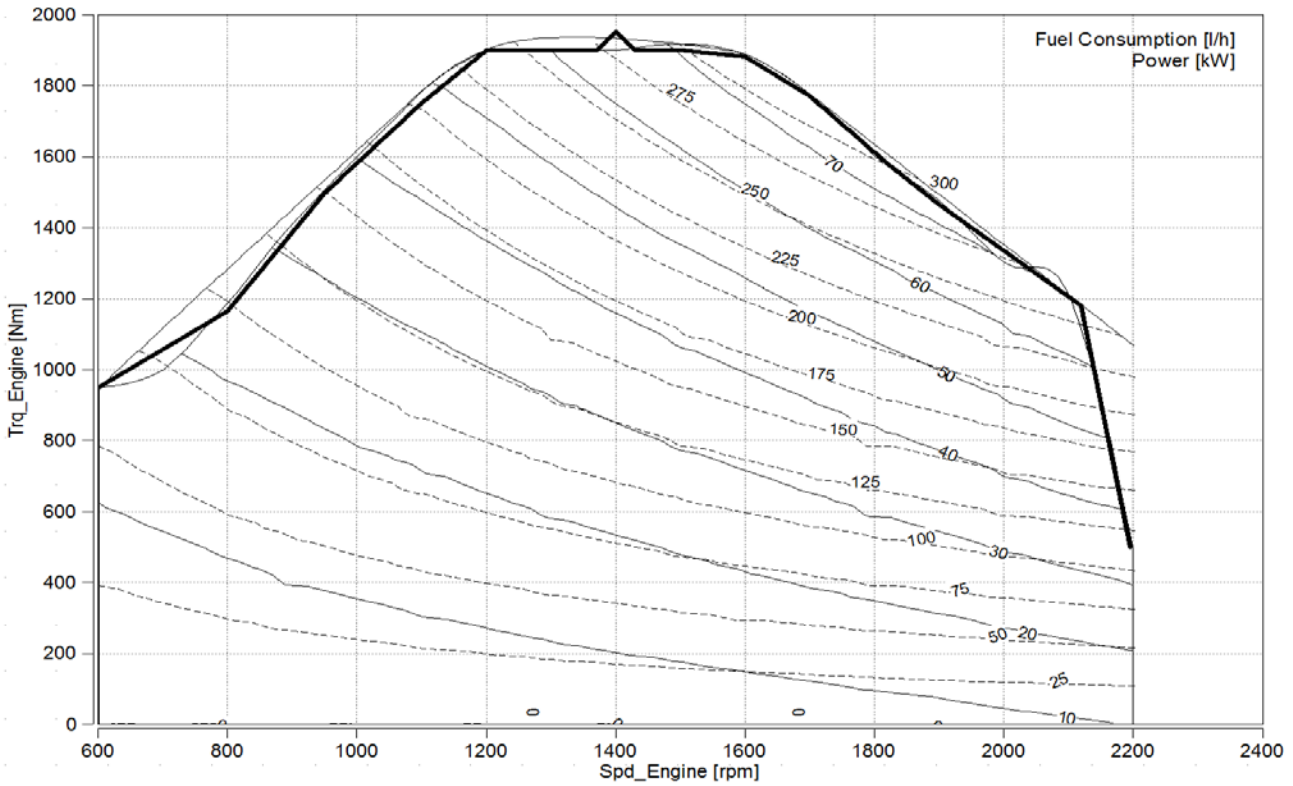

Altitude
Available engine torque
Nm
2500
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
Engine Speed [rpm]
0m
1000m
1700m
2500m
3500m


Sound (Estimated 1m from Engine)
dB (A)
122
120
118
116
114
112
110
108
106
500
700
900
1100
1300
1500
1700
1900
2100
2300
Engine speed [rpm]


Sound power level engine
body 1/3 octave band analysis
dB (A)
120,0
110,0
100,0
90,0
80,0
70,0
60,0
50,0
40,0
10
100
1000
10000
100000
Frquency [Hz]


Volvo Penta D11 coolant flow pump - Pressure rise
Delta Pressure [kPa]
Flow [lpm]
0
50
100
150
200
250
300
0
100
200
300
400
500
600
700
2200 engine rpm full flow
1700 engine rpm full flow
1475 engine rpm full flow
1350 engine rpm full flow
800 engine rpm full flow
2200 engine rpm low flow
1700 engine rpm low flow
1475 engine rpm low flow
1350 engine rpm low flow
800 engine rpm low flow


Specific Fuel Consumption [g/kWh]
Power [kW]
Trq_Engine [Nm]
Spd_Engine [rpm]
2000
1800
1600
1400
1200
1000
800
600
400
200
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
275
196
197
195
198
199
200
195
250
300
225
200
175
150
125
205
210
215
100
220
75
230
50
250
25
300
0
0
0


Fuel Consumption [l/h]
Power [kW]
Trq_Engine [Nm]
Spd_Engine [rpm]
2000
1800
1600
1400
1200
1000
800
600
400
200
0
600
800
1000
1200
1400
1600
1800
2000
2200
2400
275
70
300
250
225
60
200
50
175
150
40
125
100
30
75
50
20
25
10
0
0
0