Important

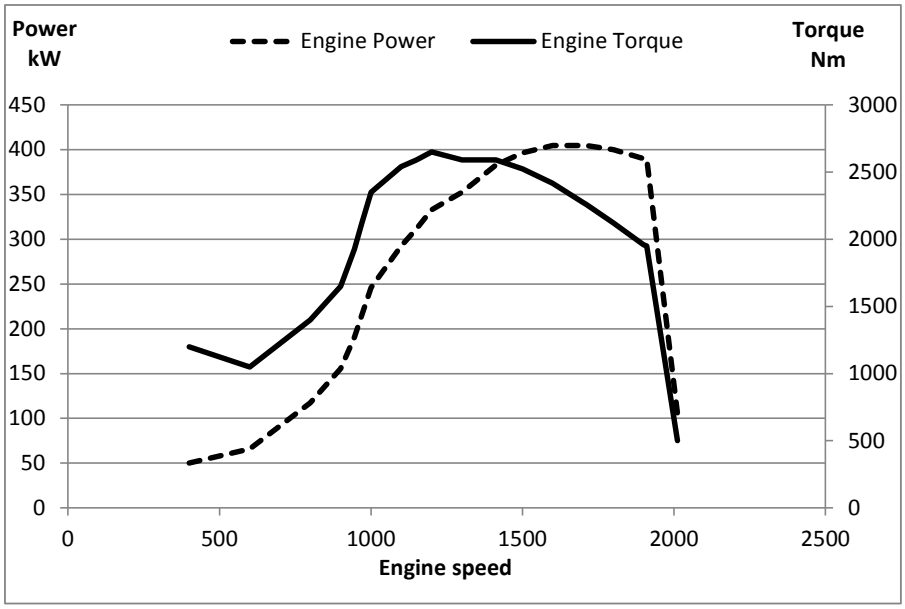
This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta application for certification.

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	405
		hp	551
		rpm	1700
Peak Torque		Nm	2650
		rpm	1200
Dimensions	L	mm	1251
	W	mm	923
	H	mm	1200



Consumption data

		rpm	1200	1500	1800	1900
Specific fuel consumption at:	25%	g/kWh	206	216	240	253
		lb/hph	0,33	0,35	0,39	0,41
	50%	g/kWh	195	198	212	219
		lb/hph	0,32	0,32	0,34	0,35
	75%	g/kWh	192	195	206	210
		lb/hph	0,31	0,32	0,33	0,34
	100%	g/kWh	193	198	206	209
		lb/hph	0,31	0,32	0,33	0,34

Specific AdBlue®/DEF consumption of diesel consumption, NRTC	Vol%	6,50

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	667,1

General

Number of cylinders			6
Displacement, total		liters in^3	12,78 780
Firing order			1-5-3-6-2-4
Bore		mm in	131 5,16
Stroke		mm in	158 6,22
Compression ratio			16,8:1
Wet weight	Engine only	kg lb	1267 2793
	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		

Performance

Rated power	kW	405
	rpm	1700
IFN Power	kW	405
ICFN Power	kW	285

For ICFN please see Techincal data for TAD1381VE

The engine performance corresponds to ISO 3046.

			rpm	1200	1500	1800	1900
Power	without fan		kW	333	397	400,0	390
			hp	453	539	544	530
For performance with fan see options technical data for the desired module.							
Torque (IFN)	without fan		Nm	2650	2525	2122	1960
			lbf ft	1954	1862	1565	1445
Max torque at engine speed	1200	rpm	Nm	2650			
			lbf ft	1954			
Power tolerance			%	±3%			
Total mass moment of inertia, J (mR2) for two mass calculations			kgm²	1,075			
(not including flywheel)			lbft²	25,5			
Total mass moment of inertia, J (mR^2) for transient load response calculations (not including flywheel)			kgm²	1,075			
			lbft²	25,5			
Friction Power warm engine			kW	20	30	43	48
			hp	27	40	58	65

Engine brake performance option		rpm	1200	1500	1900	2200
Brake power:	without fan	kW	149	183	244	297
		hp	203	249	332	403
Brake torque:	without fan	Nm	1190	1168	1229	1288
		lbf ft	877	861	906	950
Engine speed range for engine brake activation:		rpm	890			
Engine brake automatically deactivates at:		rpm	≤880			
Min oil temperature for engine brake activation:		°C	55			

Cold start performance

Cold start limit temperature	Preheater required @	°C	-15
	Preheater 4 kW	°F	5
	Preheater + block heater req @ Blockheater: Volvo 21694291 1500W/230V	°C °F	-30 -22
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 %	0,014
Oil change intervals/specifications	VDS 4.5	h	1000
		h	
Oil pressure at rated speed	Max	kPa	530
		psi	77
Oil pressure at rated speed	Min	kPa	250
		psi	36
Lubrication oil temperature in oil pan:	Max	°C	128
		°F	262,4
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	180
		US gal/h	47,6
Fuel supply line max. restriction (measured at fuel inlet connection)		kPa	10,0
		psi	1,45
Fuel supply line max. pressure, during engine running		kPa	16,5
(measured at fuel inlet connection @ engine)		psi	2,39
Fuel supply line max. pressure, during engine stand still		kPa	16,5
(measured at fuel inlet connection @ engine)		psi	2,39
Fuel supply line min. pressure, during engine stand still		kPa	-12,5
(measured at fuel inlet connection @ engine)		psi	-1,81
Maximum system return flow		liter/h	60
		US gal/h	15,9
Fuel return line max. restriction (measured at fuel return connection)		kPa	20,0
		psi	2,90
Max. allowable inlet fuel temp (Measured at fuel inlet connection)		°C	60
		°F	140
Prefilter / Water separator filtration efficiency	99%	µ	30
	0%	µ	N/A
Fuel filter filtration efficiency	98%	µ	5
	96%	µ	4
Injector type		F2	
Fuel to conform to		EN590 98/70/EC (For details see Volvo Penta Industrial fuel bulletin.)	

Intake system	**rpm**	**1200**	**1500**	**1800**	**1900**
Air consumption at: (+25°C and 100kPa)	m³/min	21,1	26,9	28,5	28,6
	cfm	744	949	1006	1008
⚠ **See front page for important information** Max allowable air intake restriction including piping, with clean air filters	kPa	6			
	psi	0,9			

Exhaust system	rpm	1200	1500	1800	1900
Heat rejection to exhaust:	kW	231	303	322	310
	BTU/min	13142	17233	18326	17623
Exhaust gas temperature after turbine at:	°C	478	492	495	476
	°F	892	918	923	889
⚠ **See front page for important information** Max allowable back pressure in exhaust line at full load (after turbine)	kPa	45	45	45	45
	psi	6,5	6,5	6,5	6,5
⚠ **See front page for important information** Max allowable temperature drop between turbine and muffler 1 inlet at exhaust temperature 480° C and exhaust gas flow 0.58 kg/s.	Δ°C	10	10	10	10
	Δ°F	18	18	18	18
⚠ **See front page for important information** Max allowable temperature drop between muffler 1 and muffler 2 at exhaust temperature 480° C and exhaust gas flow 0.58 kg/s.	Δ°C	N/A	N/A	N/A	N/A
	Δ°F	N/A	N/A	N/A	N/A
Muffler 1 pressure drop	kPa	19	25	27	27
(at exhaust gas flow and exhaust temp specified in this table)	psi	2,8	3,7	4,0	3,9
Muffler 2 pressure drop	kPa	N/A	N/A	N/A	N/A
(at exhaust gas flow and exhaust temp specified in this table)	psi	N/A	N/A	N/A	N/A
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	m³/min	45,0	53,1	54,9	54,4
	cfm	1588	1875	1938	1922
⚠ **See front page for important information** Engine speed during stand still regeneration	rpm	1400 ± 100			
⚠ **See front page for important information**	Nm	1000			
Max allowed load during stand still regeneration	lb ft	738			

Cooling system		rpm	1200	1500	1800	1900
Heat rejection radiation from engine at:		kW	12	12	13	14
		BTU/min	667	698	731	820
Heat rejection to coolant at:		kW	147	175	192	188
		BTU/min	8357	9955	10940	10702
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	20			
For coolant capacity for engine and cooling packages see Technical data for the specific option.		US gal	5,3			
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	40	46	48	42
		psi	5,8	6,7	6,9	6,2
Coolant pressure drop over complete engine circuit		kPa	19	29	45	50
(at coolant flow below)		psi	2,8	4,2	6,5	7,2
Coolant flow		l/s	4,19	5,28	6,34	6,69
		US gal/s	1,106	1,394	1,674	1,766
Minimum coolant flow		l/s	3,20	4,20	5,50	5,50
At fully opened thermostat		US gal/s	0,845	1,110	1,453	1,453
Maximum outer circuit restriction incl. piping		kPa	65			
		psi	9,4			
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	2,0			
		US gal	0,528			

Charge air cooler system		rpm	1200	1500	1800	1900
Heat rejection to charge air cooler		kW	60	80	85	82
		BTU/min	3436	4577	4806	4665
Charge air mass flow		kg/s	0,41	0,52	0,56	0,56
Charge air inlet temp @ 25 °C (Charge air temp after turbo compressor)		°C	181	194	196	191
		°F	359	381	384	376
⚠ **See front page for important information** Max allowable Charge air outlet temp @ 25 °C ambient temperature (Charge air temp after charge air cooler)		°C	50	50	50	50
		°F	122	122	122	122
⚠ **See front page for important information** Maximum pressure drop over charge air cooler incl. piping		kPa	6	9	12	13
		psi	0,9	1,3	1,7	1,8
Charge air pressure - relative pressure at sea level (After charge air cooler)		kPa	222	235	208	196
		psi	32,2	34,0	30,2	28,4

Electrical system

Engine Management System			EMS 2.4			
Voltage and type			24V DC			
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)		120/700	140/800	145/1050

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	1200	1500	1800	1900
Flywheel for flexible coupling or 14" friction clutch						
With a total added mass moment of inertia		J (mR2)	≤ 0.05kgm2			
Max torque at continous load:		Nm	2590	2110	1420	1460
		lbt ft	1910	1556	1047	1077
PTO at flywheel						
Max allowed bending moment in flywheel housing		Nm	15000			
		lbf ft	11063			
Max load on rear main bearing		N	4000			
		lbf	899			

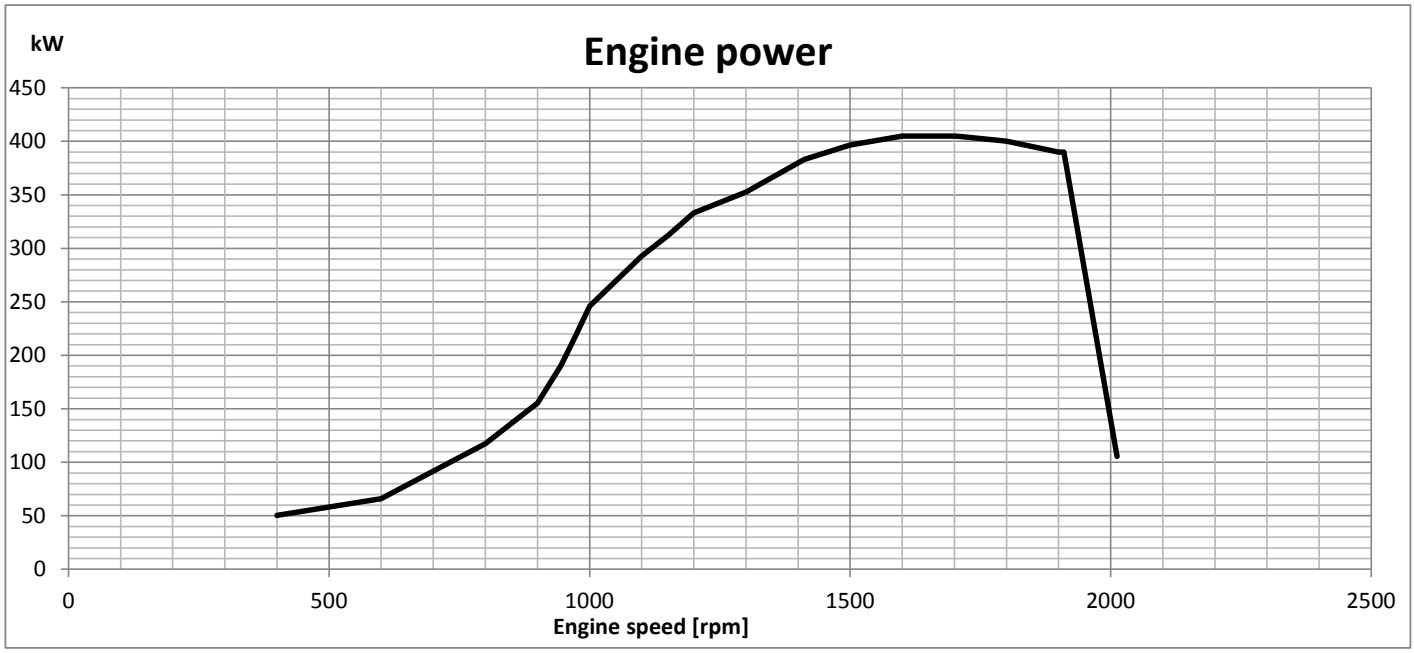
Engine Protection

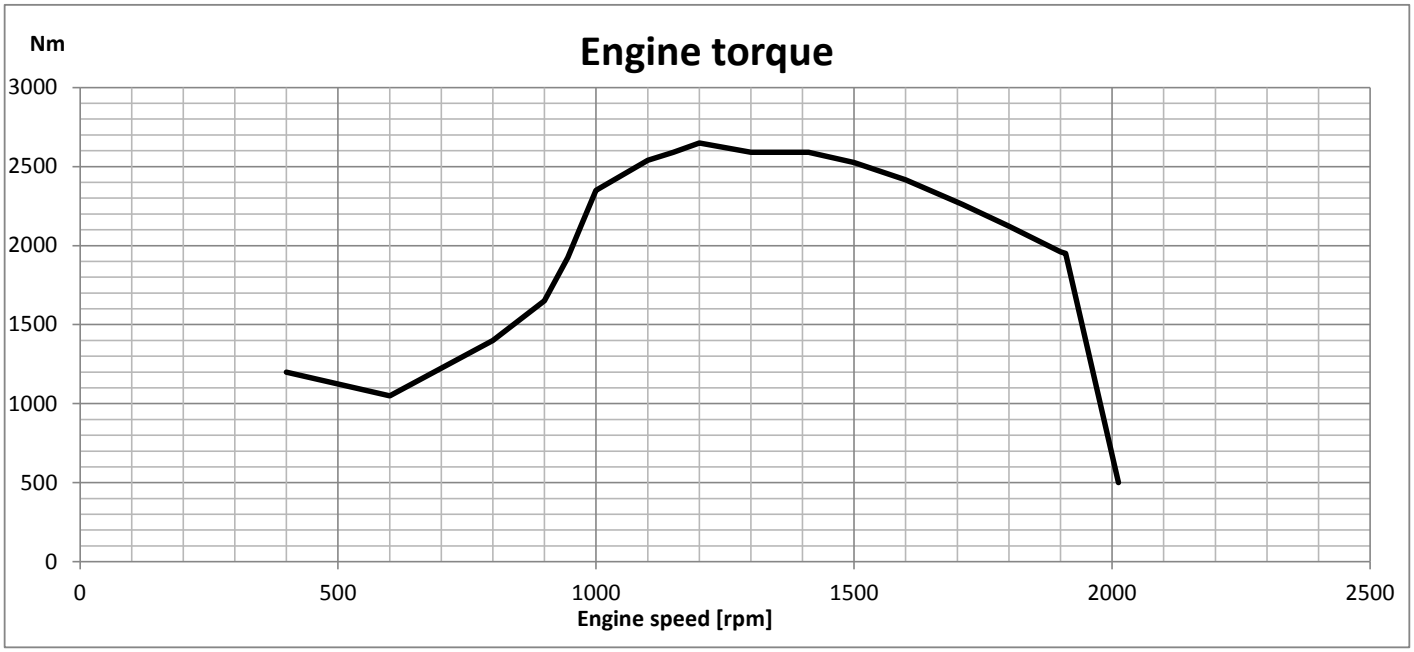
Warning implies that a Indication message is sent. Derate means an engine power derate.

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	See below	See below	Shut down	See below	Shut down
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

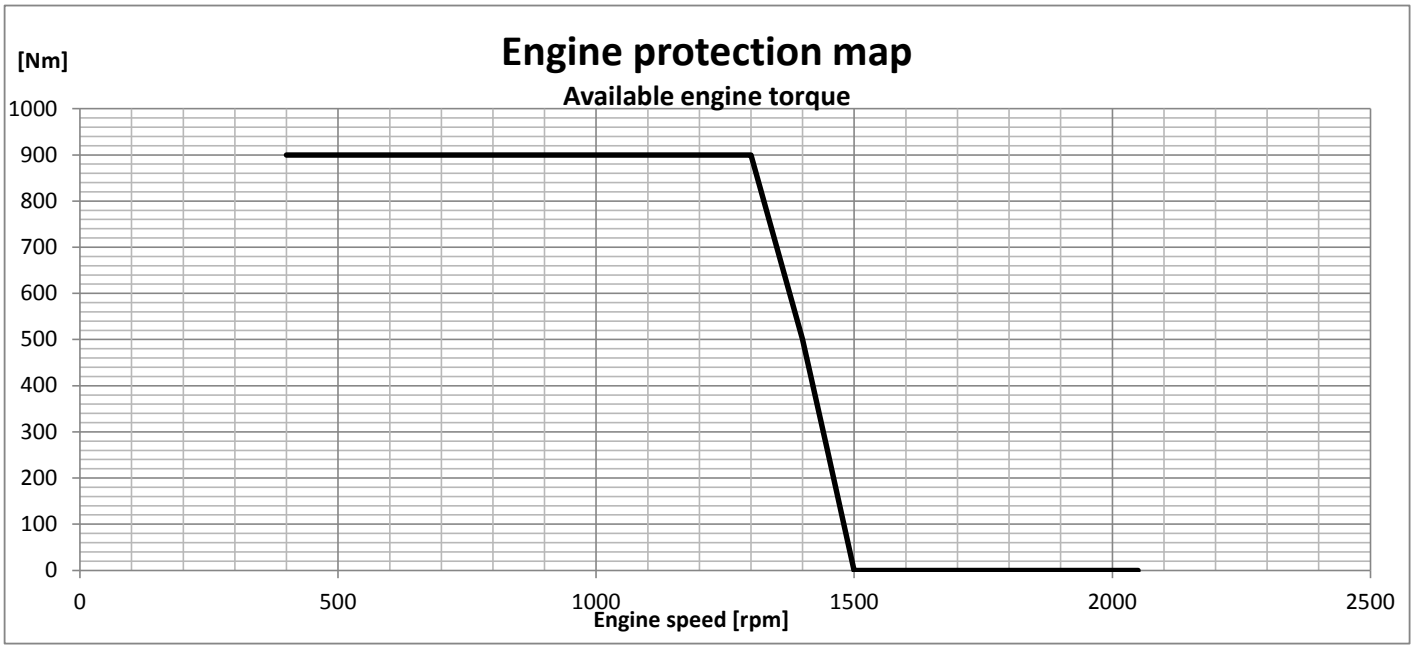
[1] Sensor not installed for this engine type

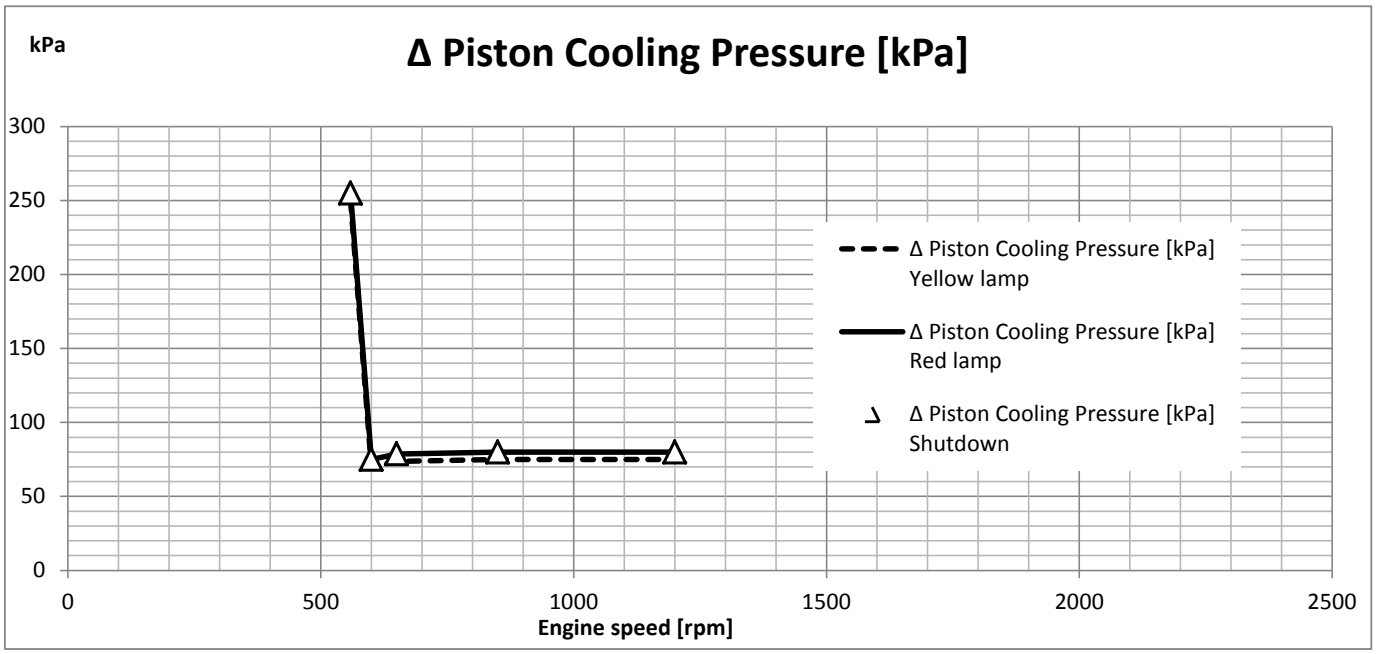
Graphs

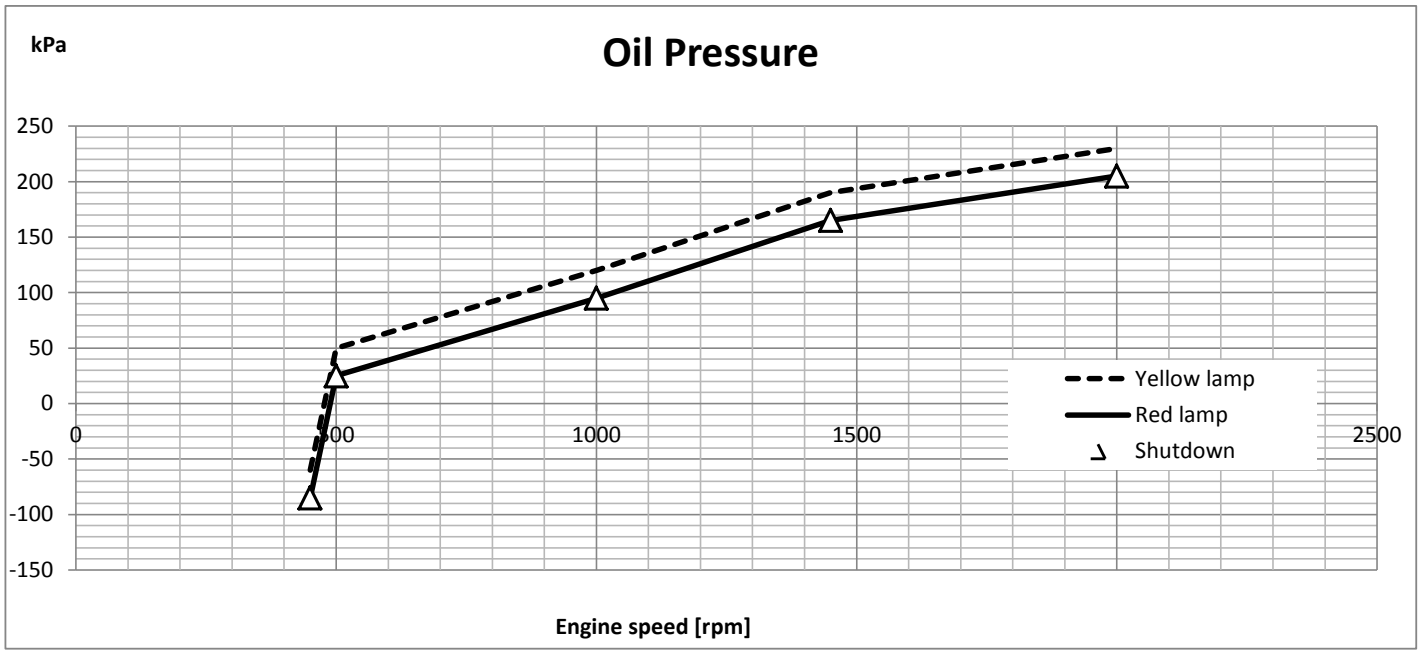

Engine power
kW
450
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
Engine speed [rpm]


Engine torque
Nm
3000
2500
2000
1500
1000
500
0
0
500
1000
1500
2000
2500
Engine speed [rpm]

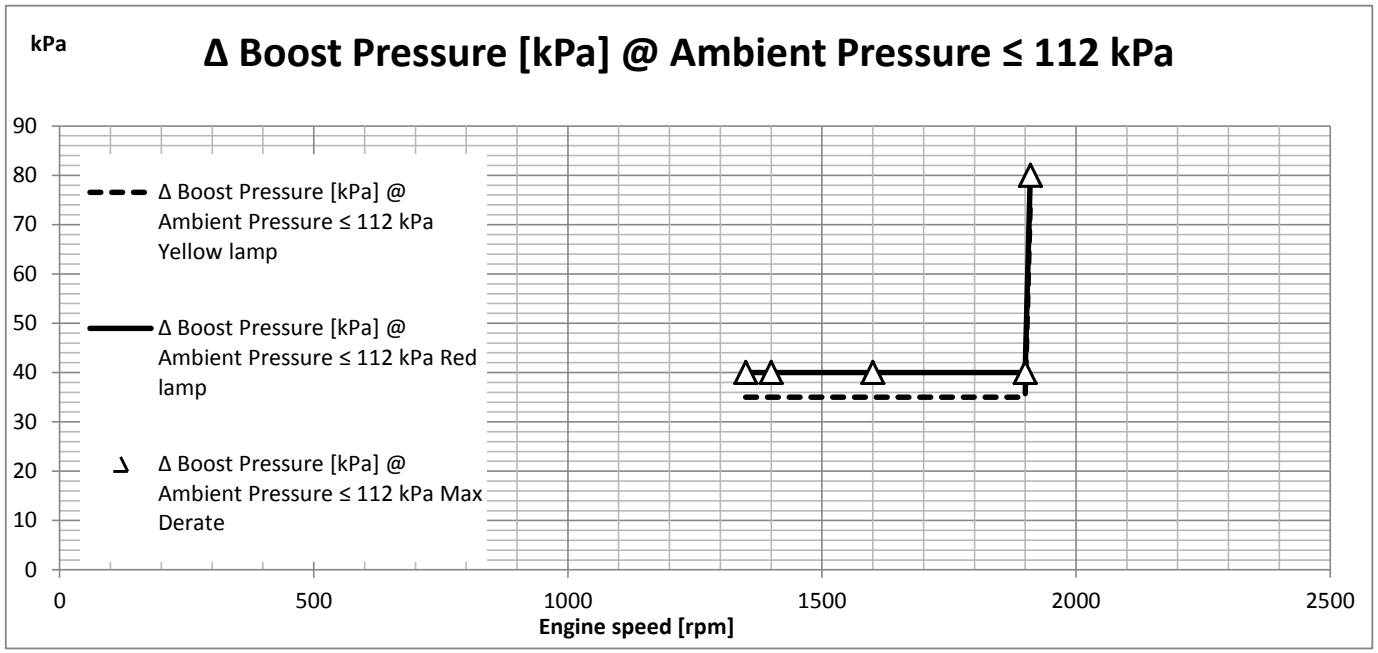
Warning and derate maps

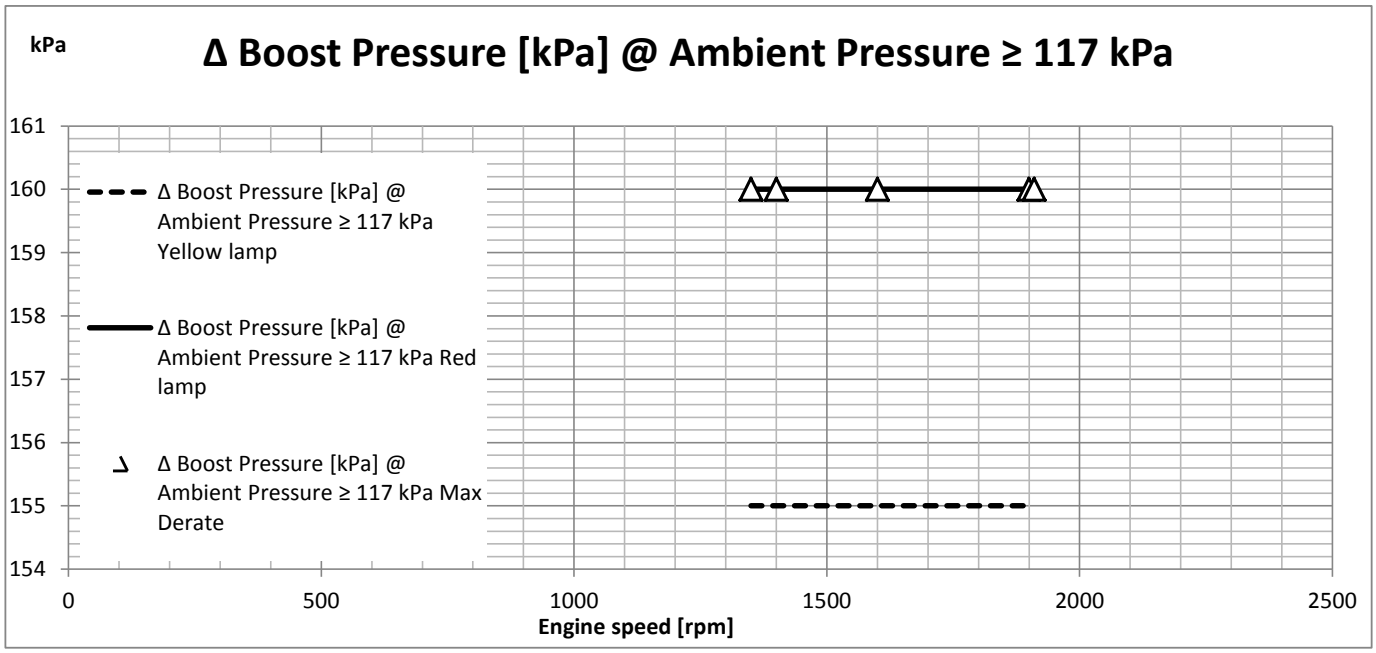


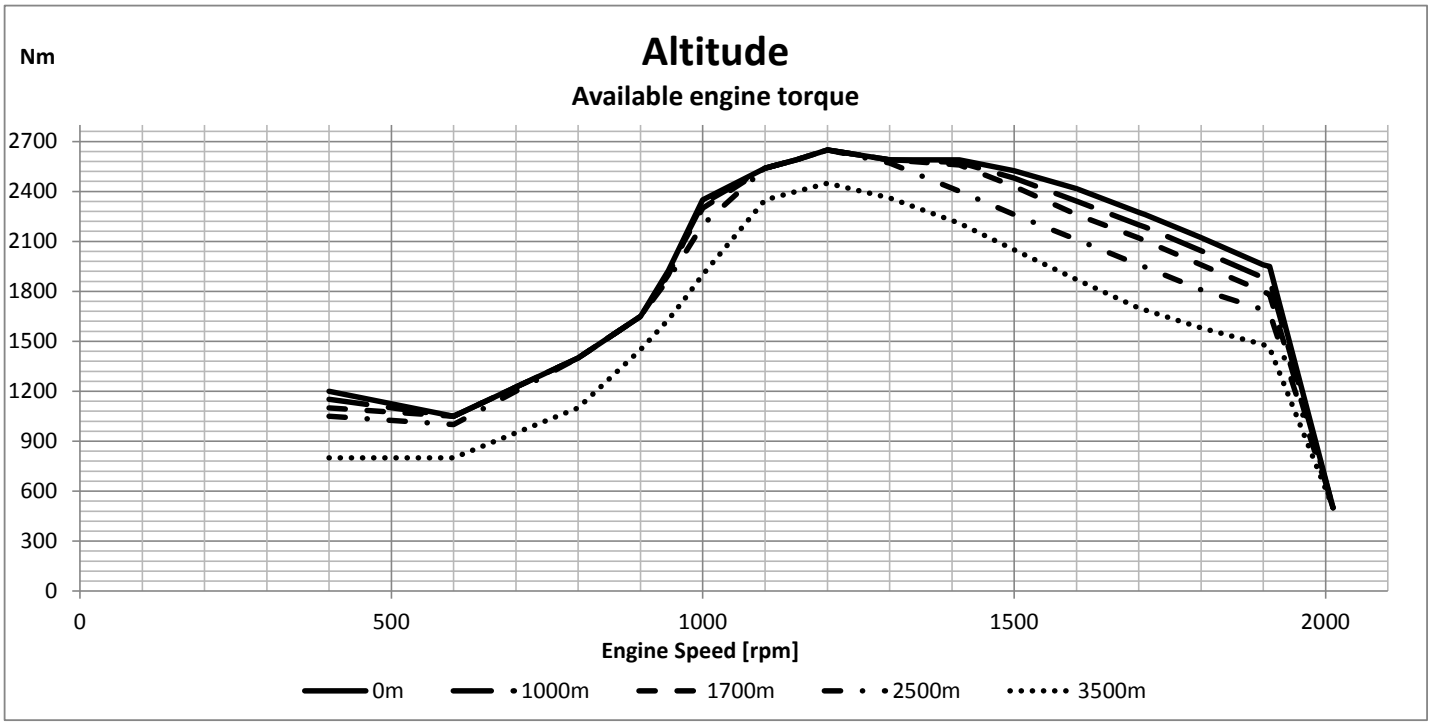

Δ Piston Cooling Pressure [kPa]
kPa
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
Engine speed [rpm]
Δ Piston Cooling Pressure [kPa] Yellow lamp
Δ Piston Cooling Pressure [kPa] Red lamp
Δ Piston Cooling Pressure [kPa] Shutdown

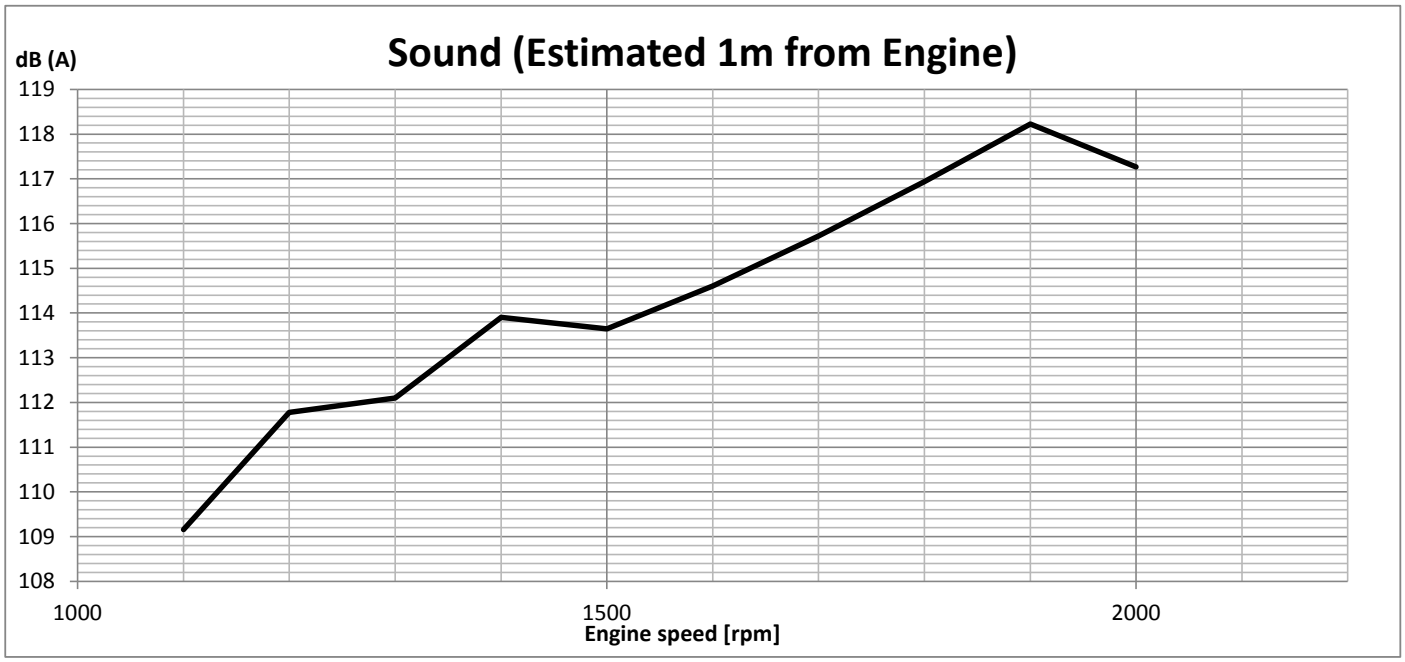

Oil Pressure
kPa
250
200
150
100
50
0
-50
-100
-150
0
1000
1500
2500
Engine speed [rpm]
Yellow lamp
Red lamp
Shutdown

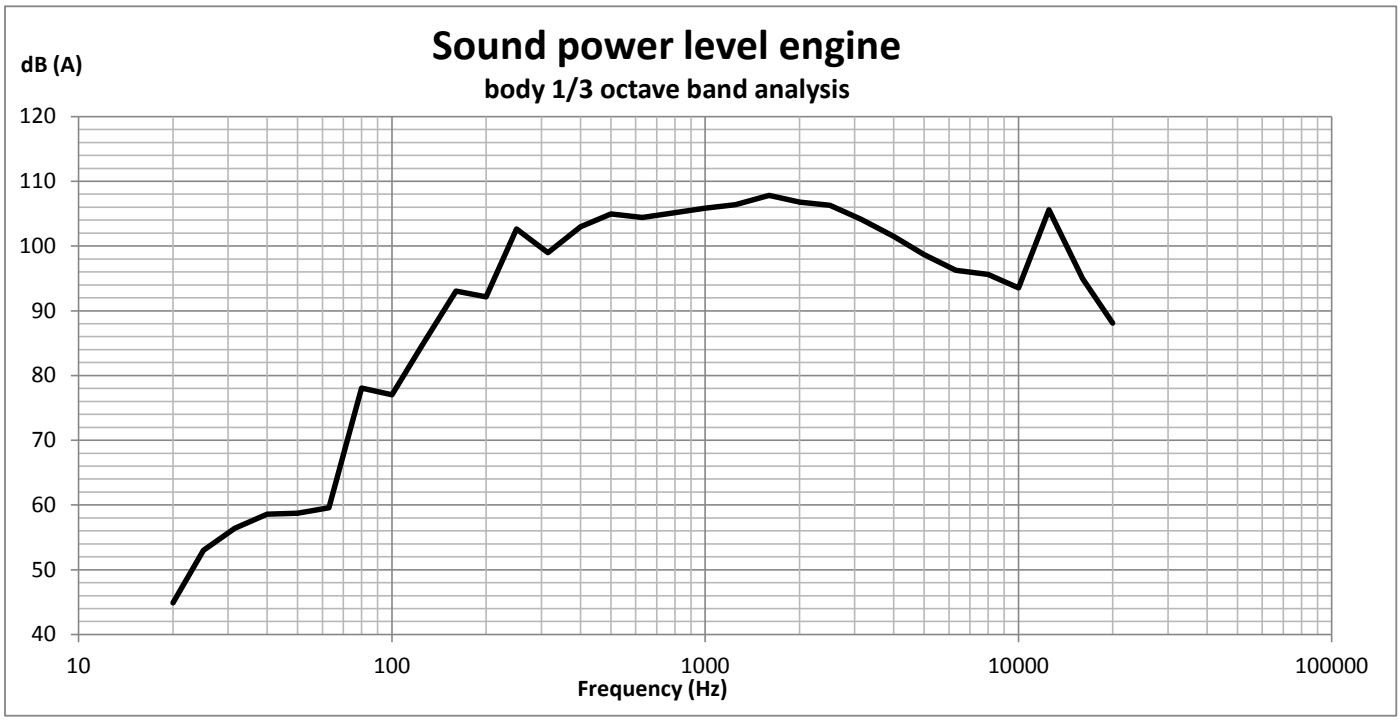
Engine protection for charge air pressure is complex and the trigger levels varies depending on engine mode, altitude and charge air temperature, ambient temperature.
Below is an example of engine protection limits for charge air pressure for normal operation engine mode, on the sea level with charge 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.

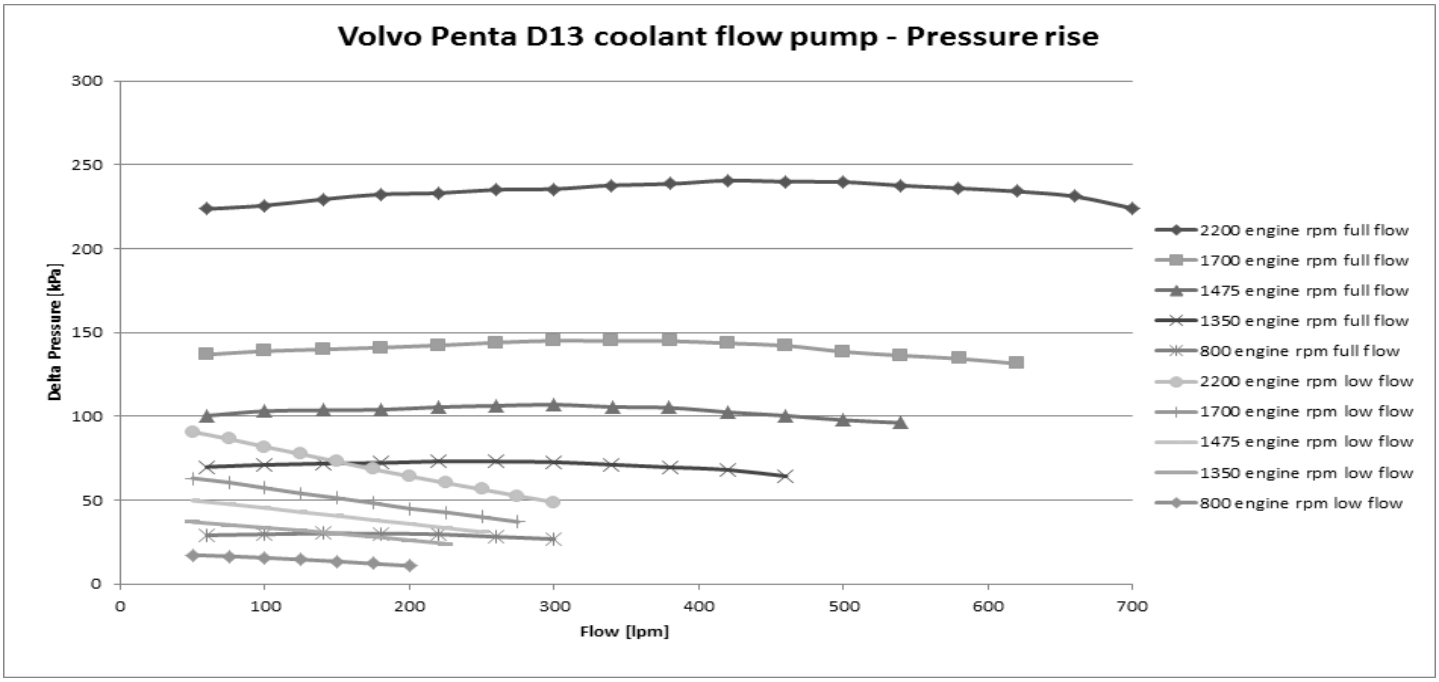


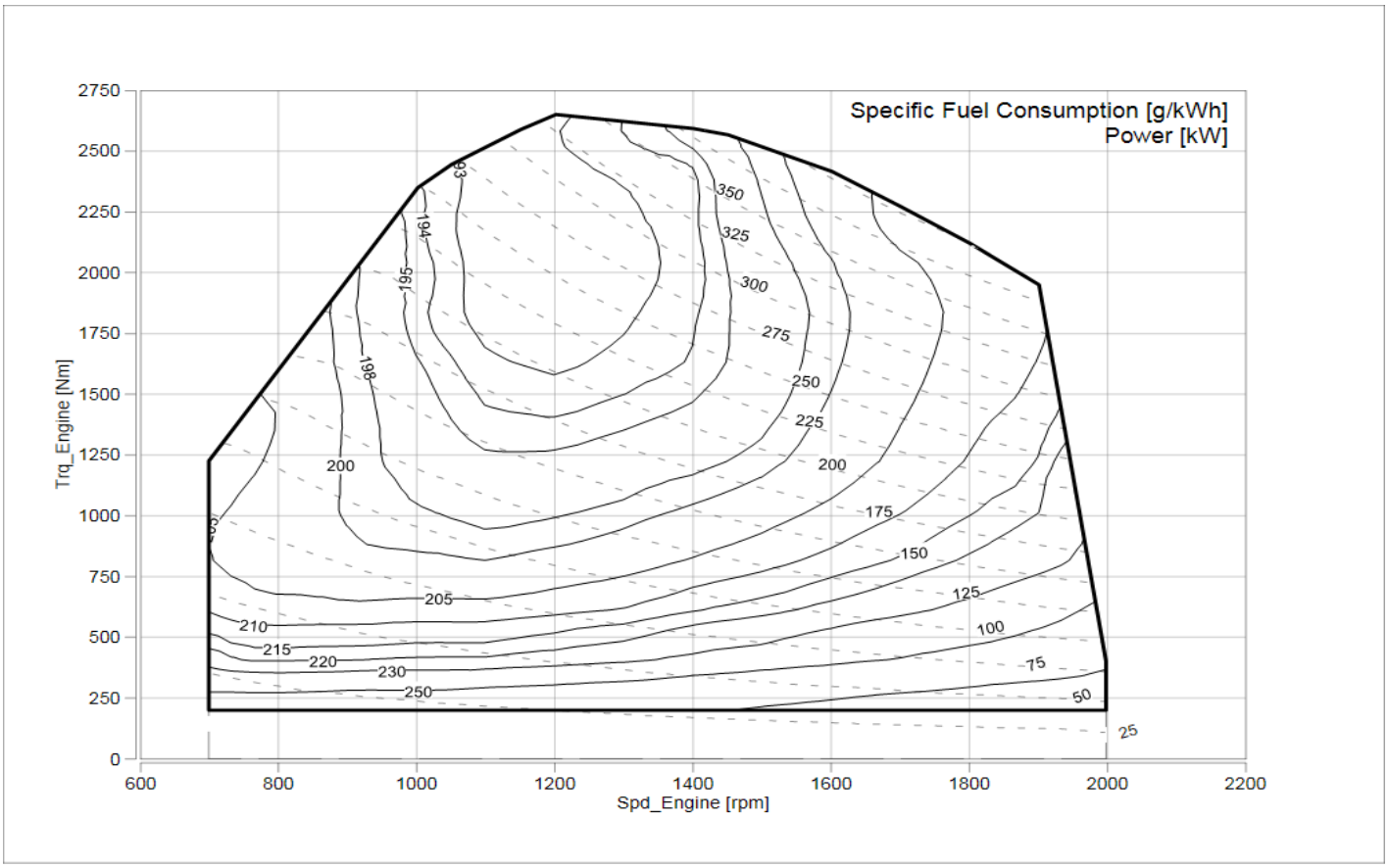


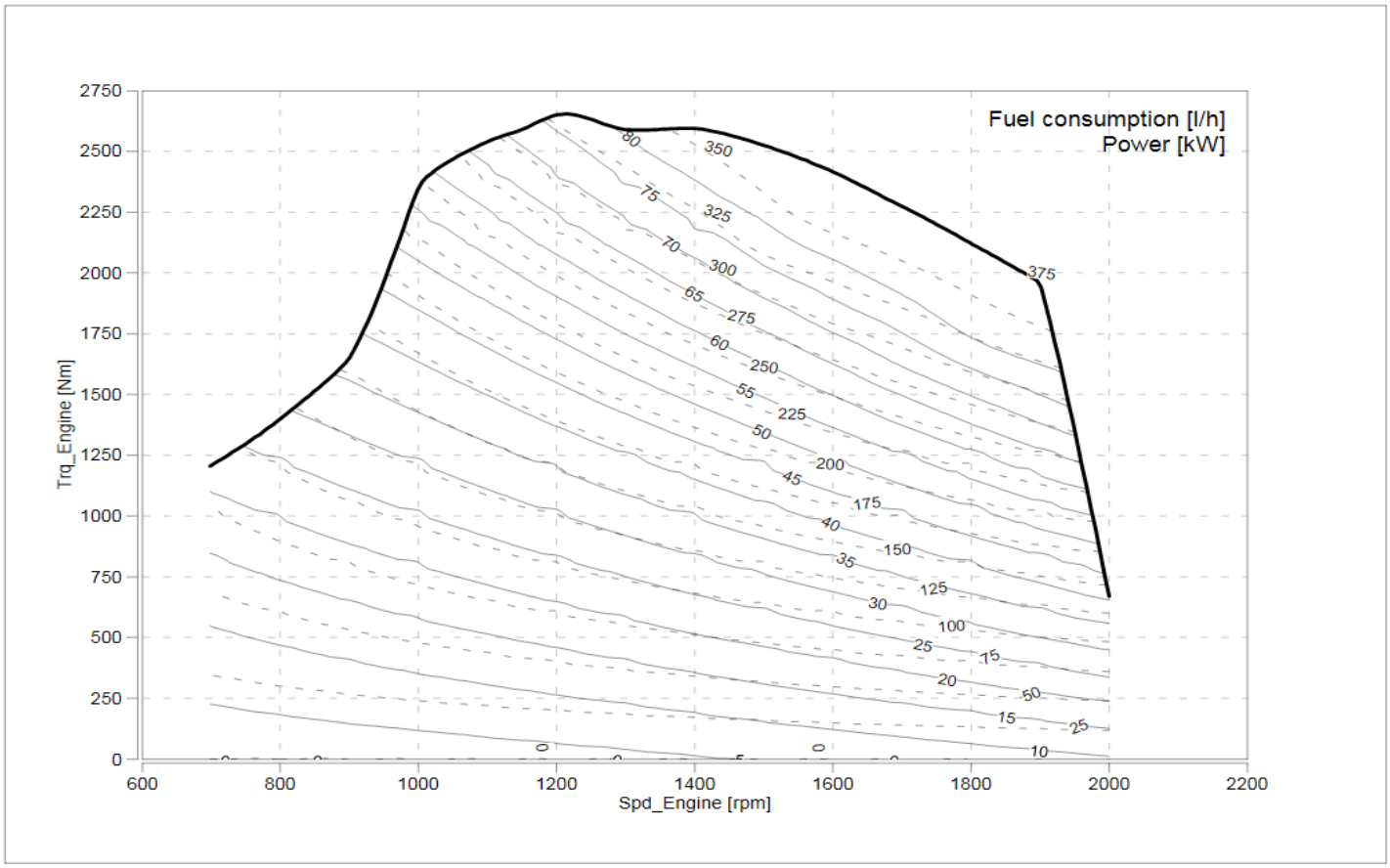

Nm
Altitude
Available engine torque
2700
2400
2100
1800
1500
1200
900
600
300
0
0
500
1000
1500
2000
Engine Speed [rpm]
0m
1000m
1700m
2500m
3500m


Sound (Estimated 1m from Engine)
dB (A)
119
118
117
116
115
114
113
112
111
110
109
108
1000
1500
2000
Engine speed [rpm]


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


Volvo Penta D13 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]
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
600
800
1000
1200
1400
1600
1800
2000
2200
350
325
300
275
250
225
200
175
150
125
100
75
50
25
205
210
215
220
230
250


Fuel consumption [l/h]
Power [kW]
Trq_Engine [Nm]
Spd_Engine [rpm]
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
600
800
1000
1200
1400
1600
1800
2000
2200
350
325
300
275
250
225
200
175
150
125
100
75
50
25
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
0
375