

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 penalties as described in the Clean Air Act.

General

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

Number of cylinders			6
Displacement, total	liters		16,12
	in ³		984
Firing order			1-5-3-6-2-4
Bore	mm		144
	in		5,67
Stroke	mm		165
	in		6,50
Compression ratio			17,0:1
Wet weight	Engine only (Estimated) (excl after treatment comp.)	kg	1395
		lb	3075
	Power pac	kg	1840
		lb	4057

Performance

Performance				rpm	1200	1500	1800	1900	
IFN Power		405 kW		without fan	kW	340	405	405	405
					hp	462	551	551	551
		with fan 890 mm		kW	See diagram for fan power consumption				
				hp					
Torque at:		IFN Power		Nm	2703	2577	2148	2035	
				lbf ft	1994	1901	1584	1500	
Max torque at engine speed		rpm	1260 rpm	Nm	2757				
				lbf ft	2033				
Power tolerance				%	±2				
Mean piston speed				m/s	6,6	8,3	9,9	10,5	
				ft/sec	21,7	27,1	32,5	34,3	
Effective mean pressure at:		IFN Power		MPa	2,11	2,01	1,67	1,59	
				psi	306	291	243	230	
Max combustion pressure at:		IFN Power		MPa					
				psi					
Total mass moment of inertia, J (mR ²) (not including flywheel)				kgm ²	1,43				
				lbft ²	33,9				
Friction Power				kW	26	39	55	61	
				hp	35	53	75	83	

Derating see Technical Diagrams

Engine brake performance (only engines with VCB)

		rpm	1200	1500	1800	1900
Brake power:	without fan	kW hp	N/A	N/A	N/A	N/A
Brake torque:	without fan	Nm lbf ft	N/A	N/A	N/A	N/A
Engine speed range for VCB activation:		rpm	N/A			
Min engine speed with VCB still active:		rpm	N/A			
Min oil temperature for VCB activation:		°C	N/A			

Cold start performance

*Cold start limit temperature	without starting aid	°C	-10	
		°F	14	
	with manifold heater 3.5 kW	°C	-25	
		°F	-13	
	with manifold heater 3.5 kW and block heater	°C	-30	
		°F	-22	
*Specify oil and fuel quality	T>-15°C Oil VDS4/VDS3 15W/40 T<-15°C Oil VDS4/VDS3 5W/40			
Heater type	Make	Power kW	Engaged hours (-30°C)	Cooling water temp engine block
Self circulating	Volvo 21578298	2	12	1°C 34°F

* See also general section in the sales guide

Lubrication system

Lubricating oil consumption (average)		Vol%	0,03		
Oil system capacity including filters		liter US gal	48 12,68		
Oil sump capacity: (both variants)	Max	liter	42		
		US gal	11,10		
	Min	liter	32		
		US gal	8,45		
Oil change intervals/specifications	VDS3	h	500*		
	VDS4	h	500*		
Engine angularity limits: Standard sump / optional aluminium sump	front up	°	11 / 30		
	front down	°	11 / 30		
	side tilt	°	11 / 30		
Oil pressure at rated speed		kPa psi	300 - 650 44 - 94		

*** Oil change intervals vary depending on oil grade, sulfur content of the fuel and running conditions. Oil sample analyses is recommended to determine application specific oil change interval.**

Lubrication system

Lubrication oil temperature in sump:	max	°C	130		
		°F	266		
Oil filter filtration efficiency (in accordance with ISO 4548-12)	99%	μ	38		
	50%	μ	14		

Fuel system

System supply flow at max. Speed		liter/h	135
		US gal/h	35,7
Fuel supply line max. restriction (measured at fuel inlet connection)		kPa	10
		psi	1,5
Fuel supply line max. pressure, during engine stand still (measured at fuel inlet connection)		kPa	165
		psi	23,9
Fuel supply line min. pressure, during engine stand still (measured at fuel inlet connection)		kPa	-125
		psi	-18,1
System return flow at max. Speed		liter/h	30,0
		US gal/h	7,9
Fuel return line max. restriction (measured at fuel return connection)		kPa	20
		psi	2,9
Max. allowable inlet fuel temp		°C	60
Prefilter / Water separator micron size		μ	10
Fuel filter filtration efficiency	96%	μ	6
	75%	μ	4
Engine Control System, standard	Volvo/EMS2.3		
Specific UREA consumption in Nonroad Transient Cycle (NRTC)	Vol%	N/A	
Fuel to conform to		Fuel corresponding to EN590 or ASTM D 975 (No 1-D, No 2-D) or JIS KK2204	

Intake and exhaust system

Intake and exhaust system		rpm	1200	1500	1800	1900
Charge air consumption at: (+25°C and 100kPa)	IFN Power	m³/min cfm	20,6 727	27,4 968	31,5 1112	31,1 1098
 See front page for important information		kPa psi	5 0,7			
Max allowable air intake restriction including piping						
Heat rejection to exhaust at:	IFN Power	kW BTU/min	243 13819	314 17857	330 18767	382 21724
Exhaust gas temperature after turbine at:	IFN Power	°C °F	537 999	528 982	491 916	516 961
 See front page for important information						
Max allowable back pressure in exhaust line (after turbine)		kPa	10	12	14	15
Pipe dimension Ø: 125 mm		psi	1,5	1,7	2,0	2,2
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	  IFN Power	m³/min cfm	57,0 2013	71,3 2518	75,6 2670	81,5 2878

Cooling system

Cooling system		rpm	1200	1500	1800	1900	
Heat rejection radiation from engine at:		IFN Power	kW BTU/min	10 569	10 569	10 569	11 626
Heat rejection to coolant at:		IFN Power	kW BTU/min	145 8246	172 9781	180 10209	204 11601
Coolant			Yellow Volvo Coolant Solution (VCS)				
Radiator cooling system type				Closed circuit			
Standard radiator core area		IFN Power	m² foot²	1,42 15,28			
HD radiator core area			m² foot²	0,87 9,36			
Fan diameter	890 mm	IFN Power	mm in	890 35,04			
Fan power consumption	890 mm		kW hp	See diagram for actual fan drive ratio power.			
Fan drive ratio	fan Ø890			See diagram for cooling performance			
Coolant capacity:	Engine	liter US gal	24 6,3				
	STD. 1,42m² radiator with hoses Pusher syst. Core thickness 63mm	liter US gal	37 9,8				
	STD. 1,42m² radiator with hoses Puller syst. Core thickness 41mm	liter US gal	30 7,9				
	HD 0,87m² radiator with hoses	liter US gal	32 8,5				
Coolant pump			drive/ratio	belt/1,77:1 cw			
Coolant flow with standard system			l/s US gal/s	4,7 1,2	5,8 1,5	7 1,8	7,3 1,9
Minimum coolant flow			l/s US gal/s	4,3 1,1	5,4 1,4	6,6 1,7	6,9 1,8
Maximum outer circuit restriction incl. piping			kPa psi	70,0 10,2			
Thermostat:	start to open	°C	82				
		°F	180				
	fully open	°C	92				
		°F	198				
Maximum static pressure head (expansion tank height + pressure cap setting)			kPa psi	100 14,5			
Minimum static pressure head (expansion tank height + pressure cap setting)			kPa psi	70 10,2			
Standard pressure cap setting			kPa psi	75 10,9			
Maximum top tank temperature			°C °F	107 225			
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 are functioning			liter US gal	2 0,5			

Charge air cooler system

		rpm	1200	1500	1800	1900
Heat rejection to charge air cooler	IFN Power	kW	51	71	81	77
		BTU/min	2900	4038	4606	4379
Charge air mass flow	IFN Power	kg/s	0,4	0,54	0,61	0,61
Charge air inlet temp. (Charge air temp after turbo compressor)	IFN Power	°C	164	178	183	175
		°F	327	352	361	347
 See front page for important information Max allowable Charge air outlet temp. (Charge air temp after charge air cooler at 25°C ambient)		°C	40	47	50	50
		°F	104	117	122	122
 See front page for important information Maximum pressure drop over charge air cooler incl. piping		kPa	12			
		psi	1,74			
Charge air pressure (Relative, after charge air cooler)		kPa	178	204	205	189
		psi	25,82	29,59	29,73	27,41
Standard charge air cooler core area		m²	0,76			
		foot²	8,18			

Cooling performance: STD cooling package 1,42m² radiator and suction 890mm fan

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

Fix fan drive ratio 1:0,97

Engine speed	Engine power	Air on temp		Air flow		External restriction	
rpm	kW hp	°C	°F	kg/s	lb/s	Pa	psi
1900	405 551	64	147	12,1	26,6	0	
		62	144	11,4	25,0	150	0,022
		61	142	10,7	23,6	300	0,044
		59	139	10,0	22,1	450	0,065

Cooling performance: STD cooling package 1,42m² radiator and suction 890mm electronically controlled visco fan

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

Visco fan drive, ratio 1:0,88

Engine speed	Engine power	Air on temp		Air flow		External restriction	
rpm	kW hp	°C	°F	kg/s	lb/s	Pa	psi
1900	405 551	59	139	10,5	23,3	0	
		57	135	9,8	21,5	150	0,022
		55	132	9,0	19,9	300	0,044
		53	127	8,2	18,1	450	0,065

Cooling performance: STD cooling package 1,42 m² radiator and pusher 890mm fan

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

Fix fan drive ratio 1:1,13

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m ³ /s	ft ³ /s	Pa	psi
1900	405 551	69	156	10,0	353,1	450	0,065
		70	158	10,5	371,9	300	0,044
		71	159	11,1	392,3	150	0,022
		71	160	11,7	413,5	0	

Fix fan drive ratio 1:1,04

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m ³ /s	ft ³ /s	Pa	psi
1900	405 551	67	153	9,1	321,7	450	0,065
		68	155	9,6	338,3	300	0,044
		69	157	10,2	358,4	150	0,022
		70	158	10,7	377,2	0	

Fix fan drive ratio 1:0,97

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m ³ /s	ft ³ /s	Pa	psi
1900	405 551	65	150	8,4	297,7	450	0,065
		67	152	8,8	312,2	300	0,044
		68	154	9,4	331,3	150	0,022
		69	155	9,8	346,8	0	

Fix fan drive ratio 1:0,88

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m ³ /s	ft ³ /s	Pa	psi
1900	405 551	63	145	7,6	269,5	450	0,065
		64	147	8,0	281,5	300	0,044
		65	149	8,5	298,8	150	0,022
		66	151	8,8	310,4	0	

Cooling performance: STD cooling package 1,42m² radiator and pusher 890mm electronically controlled visco fan

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

Visco fan drive, pulley ratio 1:0,88

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m ³ /s	ft ³ /s	Pa	psi
1900	405	62	144	7,5	263,1	450	0,065
	551	63	146	7,8	274,4	300	0,044
		65	148	8,2	290,6	150	0,022
		65	150	8,5	300,9	0	

Cooling performance, HD cooling package with 890mm fan and fan drive ratio 1:0,97

Cooling air flow and external restriction at different radiator air temperatures based on 107°C TTT and 40% antifreeze (radiator and cooling fan, see optional equipment)

Engine speed rpm	External restriction n	PRIME POWER		STANDBY POWER	
		Air mass flow kg/s	Air on temp C°	Air mass flow kg/s	Air on temp C°
1500	0		72		70
	100		69		67
	200		67		64
	300		63		61
	400		61		57
1800	0		73		70
	100		70		68
	200		69		66
	300		68		65
	400		66		63

Engine management system

Functionality	Alternatives		Default setting
Governor mode		Isochronous	
Governor droop		0	
Governor response	Adjustable PI-constants		1
Idle speed		600-900	700
Stop function	Ignition off stop engine		
Preheating function		On/Off	
Lamp test		On/Off	

Engine sensors and switch settings			Warning level (Yellow lamp)		Engine protection (Red lamp)	
Parameter		Unit	Setting range	Default setting	Level	Action. Default/Alternative
Oil temp		°C	125-130	125	130	Soft derate VE / Shut down, Powerpack
Oil pressure	Low idle	kPa	N/A	50	25	Shut down, ON/OFF*
	Rated speed	kPa	N/A	300	275	Shut down, ON/OFF*
Oil level						
Piston cooling pressure >1000 rpm		kPa				
Coolant temp		°C	105-107	105	107	Soft derate VE / Shut down, Powerpack
Coolant level			See cooling system	On		
Fuel feed pressure	1200rpm	kPa		100		
Water in fuel			Alarm When Closed			
Crank case pressure		kPa	N/A	Rapid Pres inc	Rapid Pres inc	Shut down, ON/OFF*
Air filter pressure drop				5		
Altitude, above sea		m				Automatic derating, see section derating
Charge air temp		°C	N/A	80	85	Soft derate VE / Shut down, Powerpack
Charge air pressure		kPa	N/A	Demand value +35kPa	Demand value +40kPa	Soft derate VE / Shut down, Powerpack
Engine speed		rpm	100-120% of rated speed	120% of rated speed	Alarm level	Alarm only

* Off means no shut down, alarm only

Parameter	Warning	Alarm	Derated 0% to engine protection map	Derated 100% to engine protection map	Forced idle after sec	Forced shut down after 2 sec
Coolant temp	105°C	107°C	107°C	108°C	N/A	Powerpack
Oil temp	125°C	130°C	130°C	132°C	N/A	Powerpack
Low oil pressure	Warning map value	Alarm map value	N/A	N/A	N/A	Alarm map value
High charge air temp	80°C	85°C	85°C	86°C	N/A	Powerpack
High charge air pressure	Warning map value	Alarm map value	Alarm map value	Alarm map value	N/A	Powerpack

Electrical system

Electrical system				24V			
Voltage and type				Bosch			
Alternator:		make		110/150			
Alternator:		output	A	6			
		tacho output	Hz/alternator rev.	3,9:1			
		drive ratio					
Starter motor:		make		Melco			
		type		105P70			
		output	kW hp	7			
				9,5			
Number of teeth on:		flywheel		153			
		starter motor		12			
Max wiring resistance main circuit			mΩ	2			
Cranking current at +20°C			A	280			
Crank engine speed at 20°C			rpm	150			
Starter motor battery capacity		max	Ah/A	2x225			
		min at +5°C	Ah/A				
Inlet manifold heater (at 20 V)			kW	3.5			
Power relay for the manifold heater			A	1			
Conditions:		Temperature		°C	25	0	-15
(4 mΩ main circuit resistance@		Battery		Ah / CCA	235 / 1300	145 / 1050	145 / 1050
Crank speed				rpm	171	118	98
Crank current				A	290	400	480
Starter input power during crank				kW	6,2	7,5	7,7
Battery power during crank				kW	6,5	8,1	8,5
Min battery @ 0°C				Ah / CCA	140/800		

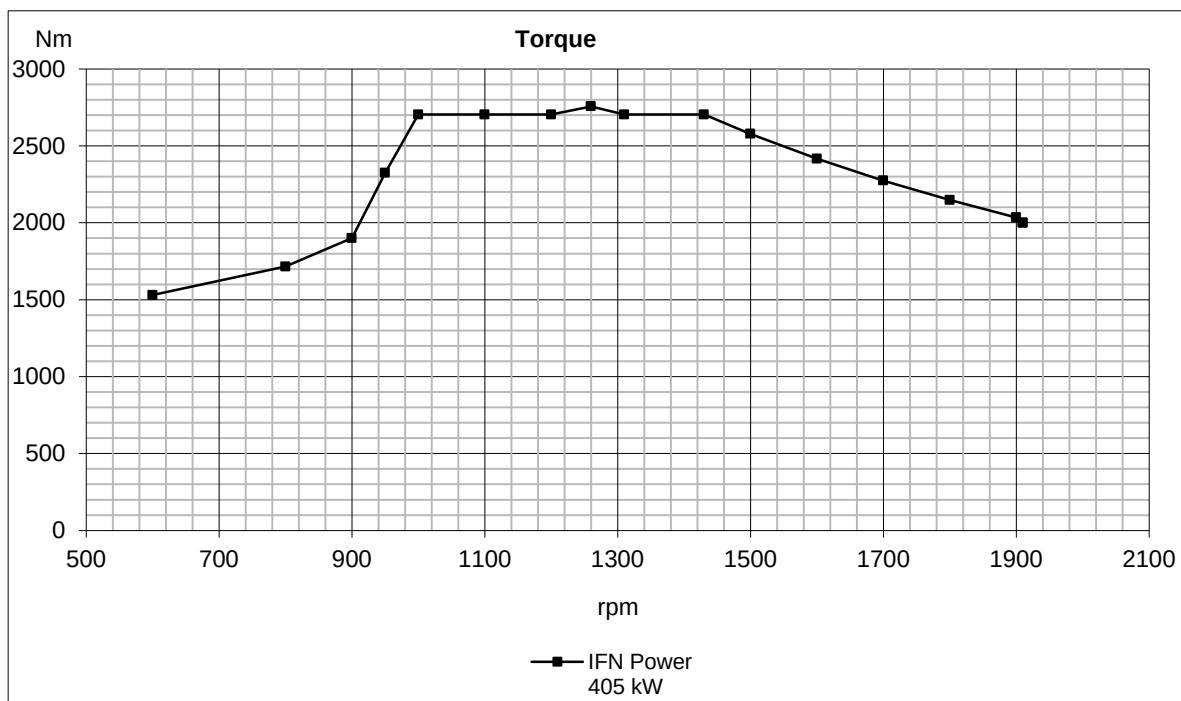
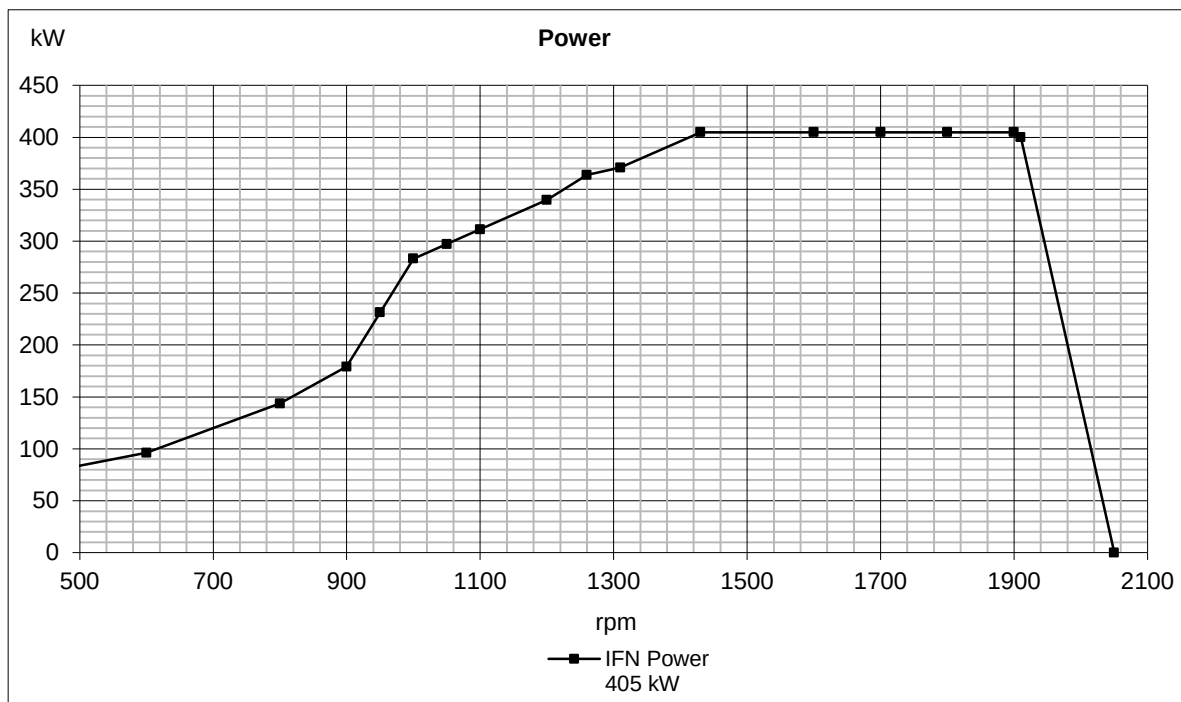
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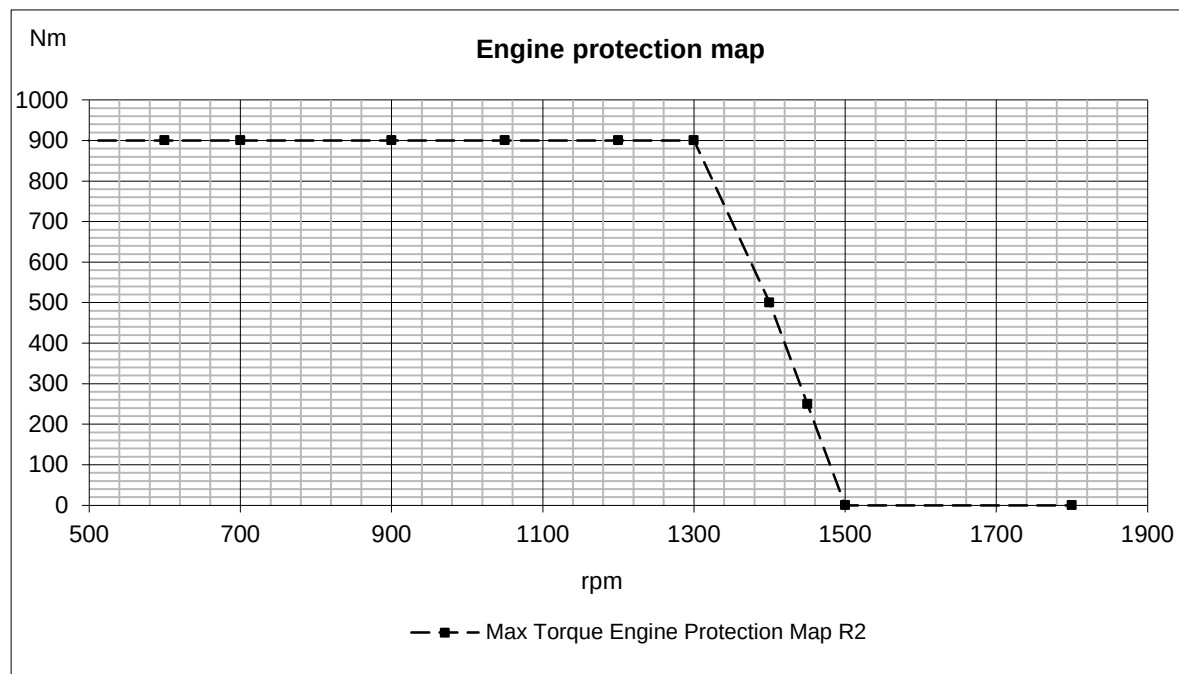
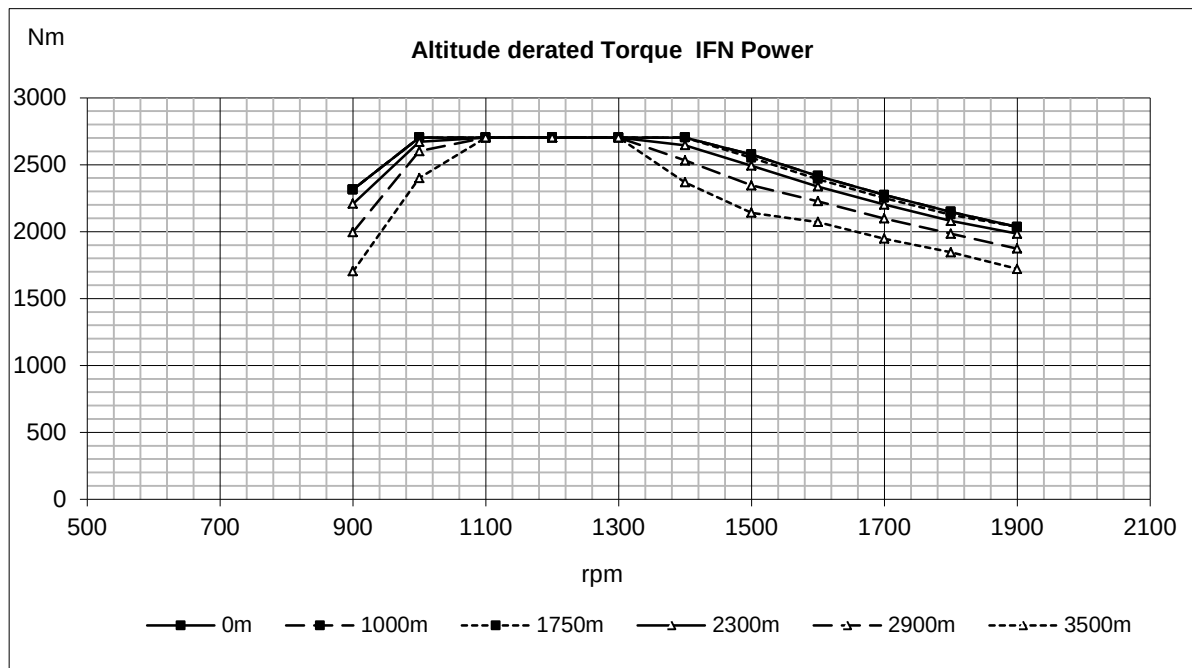
Power take off		rpm	1200	1500	1800	1900
Front end in line with crank shaft max:*		Nm	2703	2577	2148	2035
(with a total added mass moment of inertia, J (mR2)≤0,05 kgm²)		lbf ft	1993	1901	1584	1501
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW	26	33	40	
		hp	35	45	54	
	max down	kW	60	75	90	
		hp	82	102	122	
	max right	kW	26	33	40	
		hp	35	45	54	
Timing gear at servo pump PTO max:*		Nm	100			
		lbf ft	74			
Speed ratio direction of rotation viewed from flywheel side			1,58:1/ccw			
Timing gear at compressor PTO max:*		Nm	600			
		lbf ft	443			
Speed ratio direction of rotation viewed from flywheel side			1,31:1/ccw			
Max allowed bending moment in flywheel housing		Nm	15000			
		lbf ft	11063			
Max. rear main bearing load		N	5000			
		lbf	1124,0			

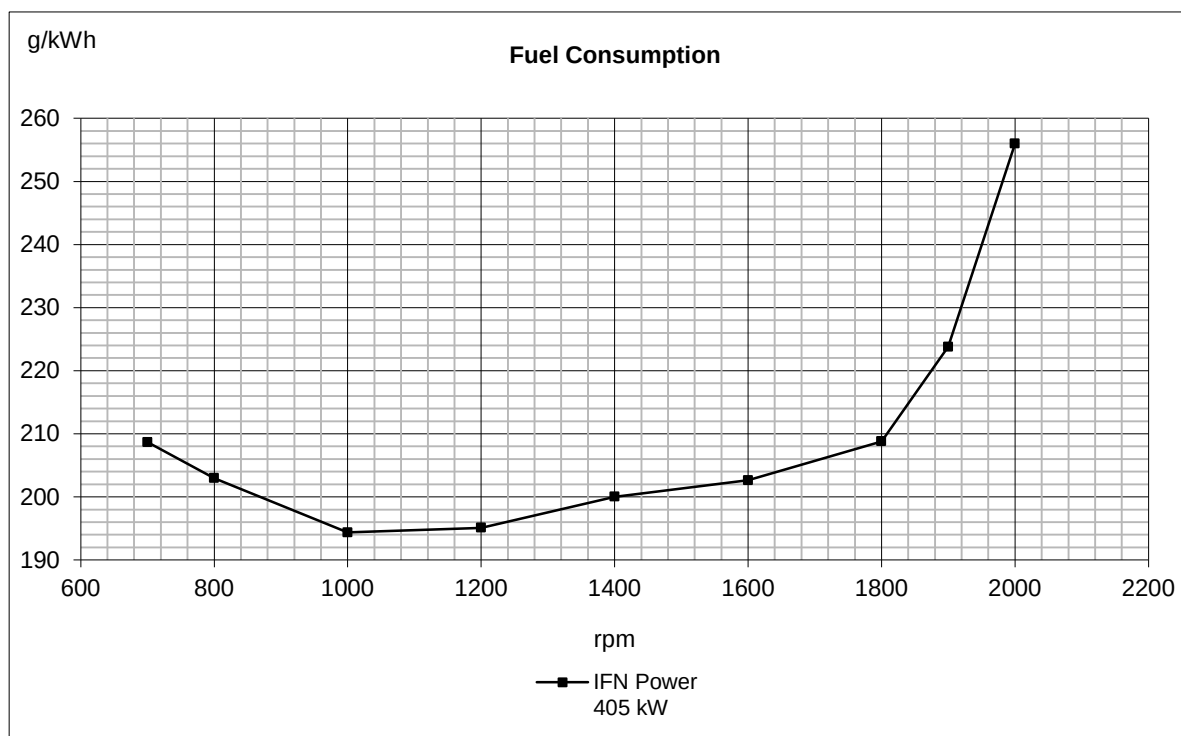
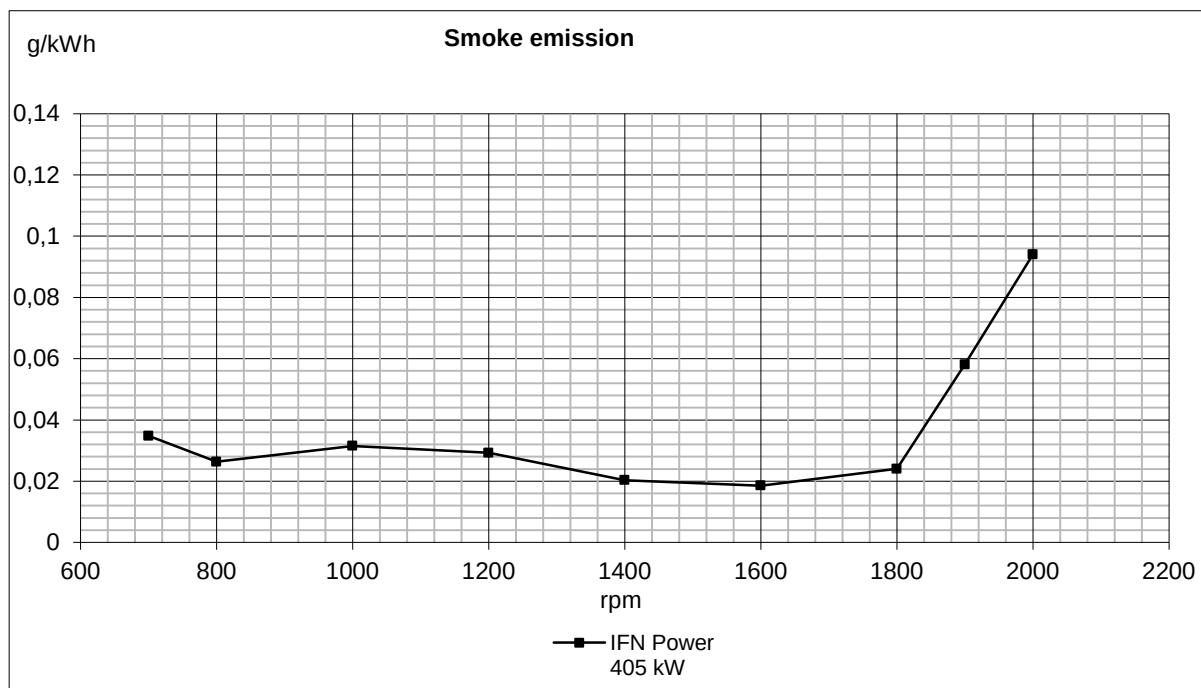
*** Maximum allowed torque at individual PTO's.**

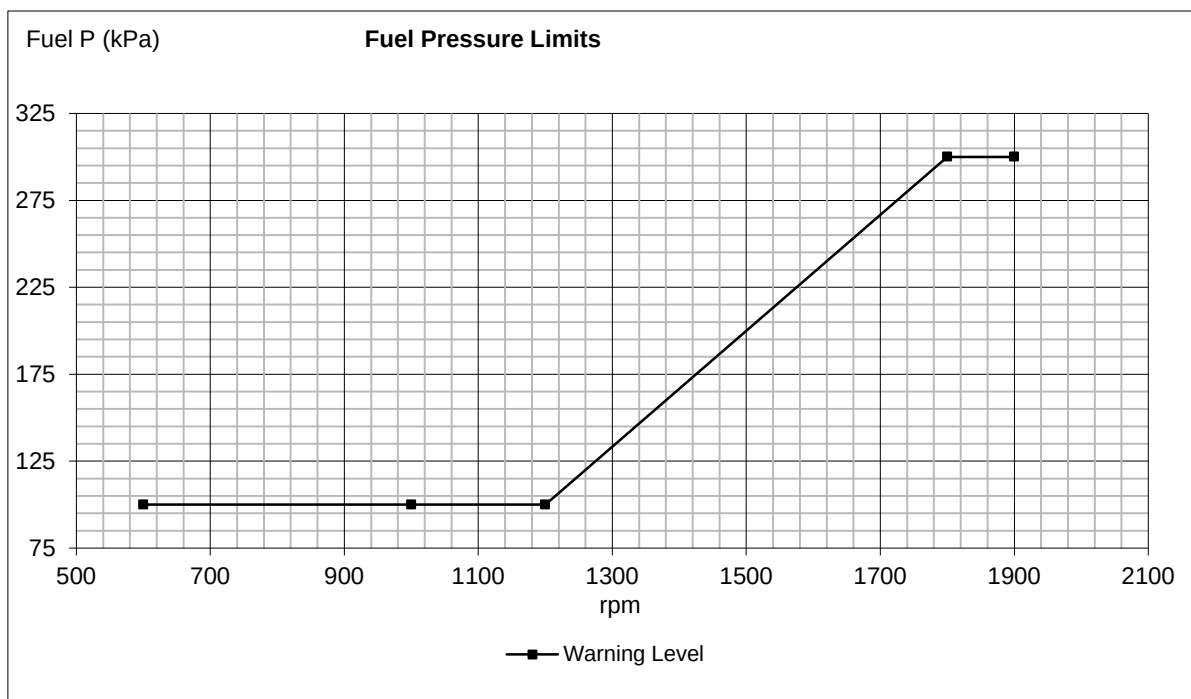
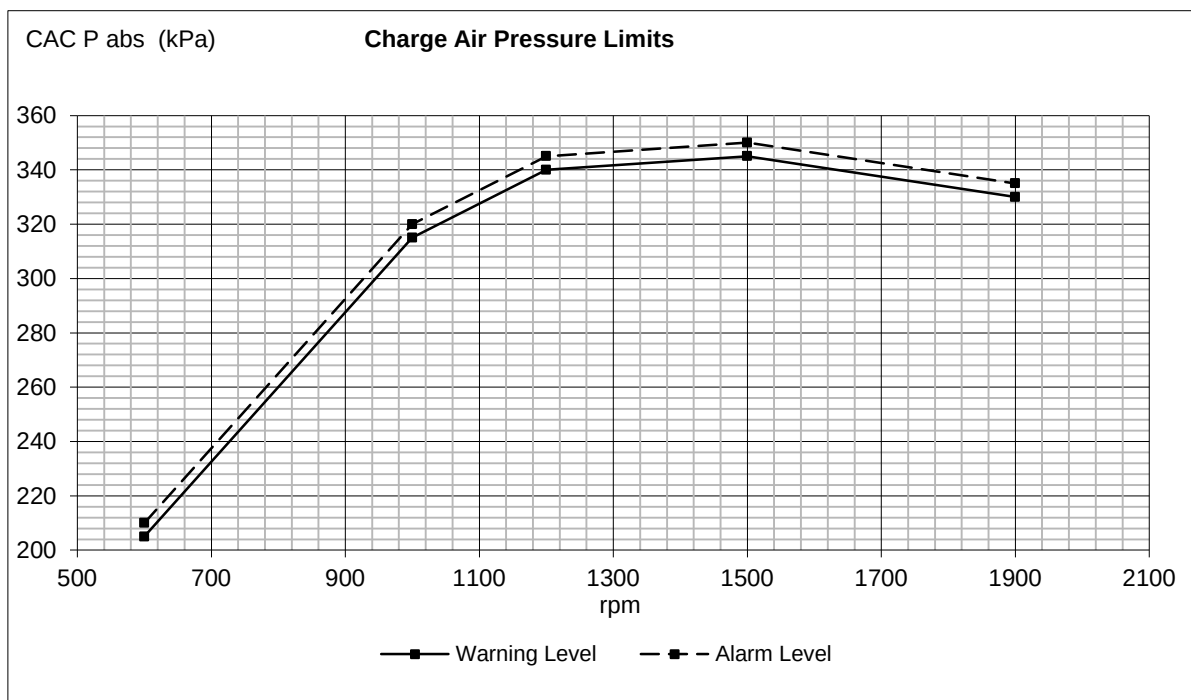
If more then one PTO output is used simultaneously, calculations needs to be performed to determine available maximum.

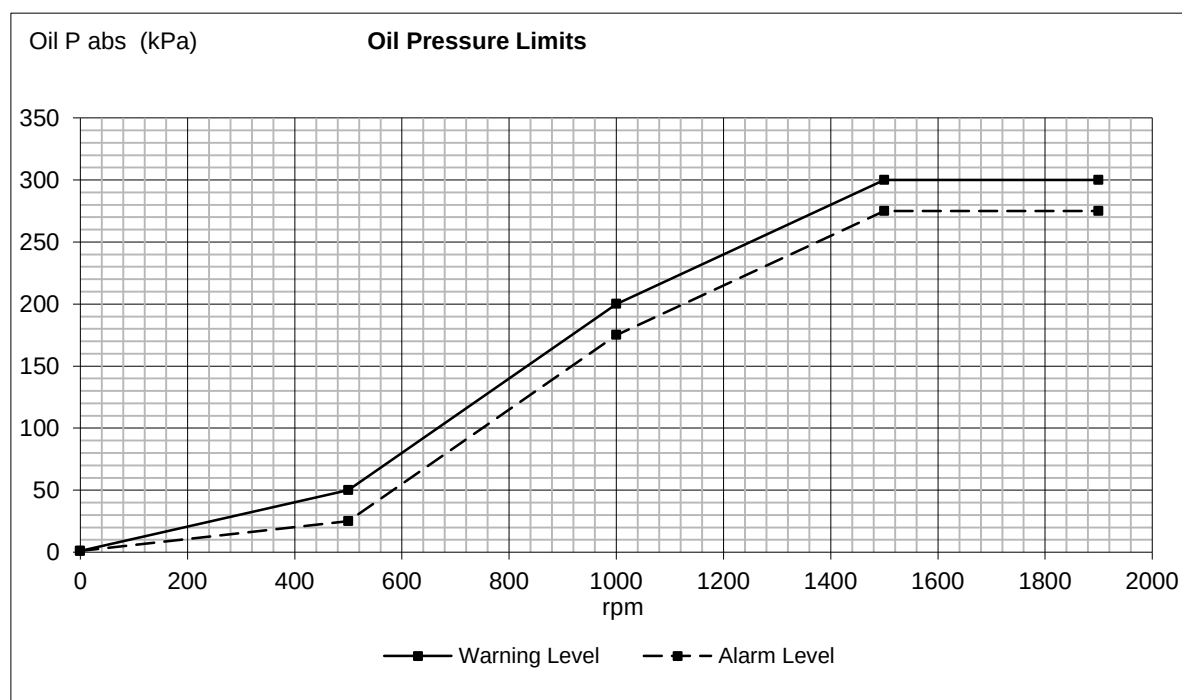
Available torque depends on application inertia.

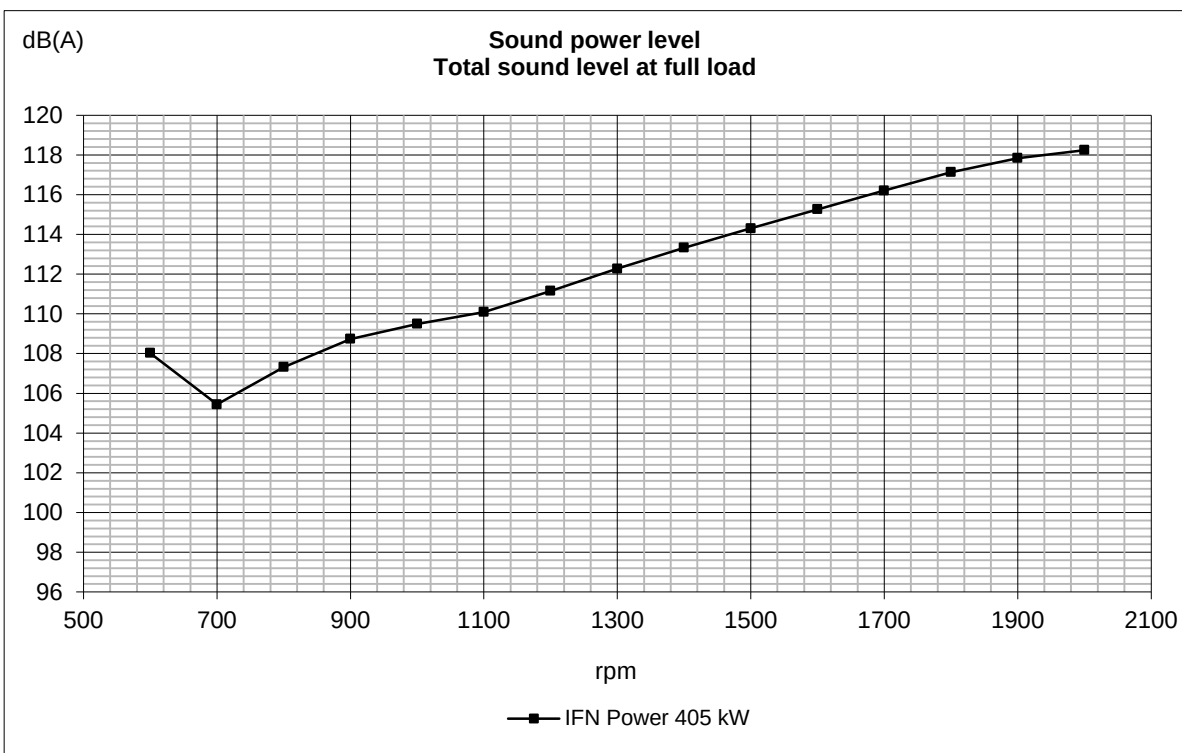
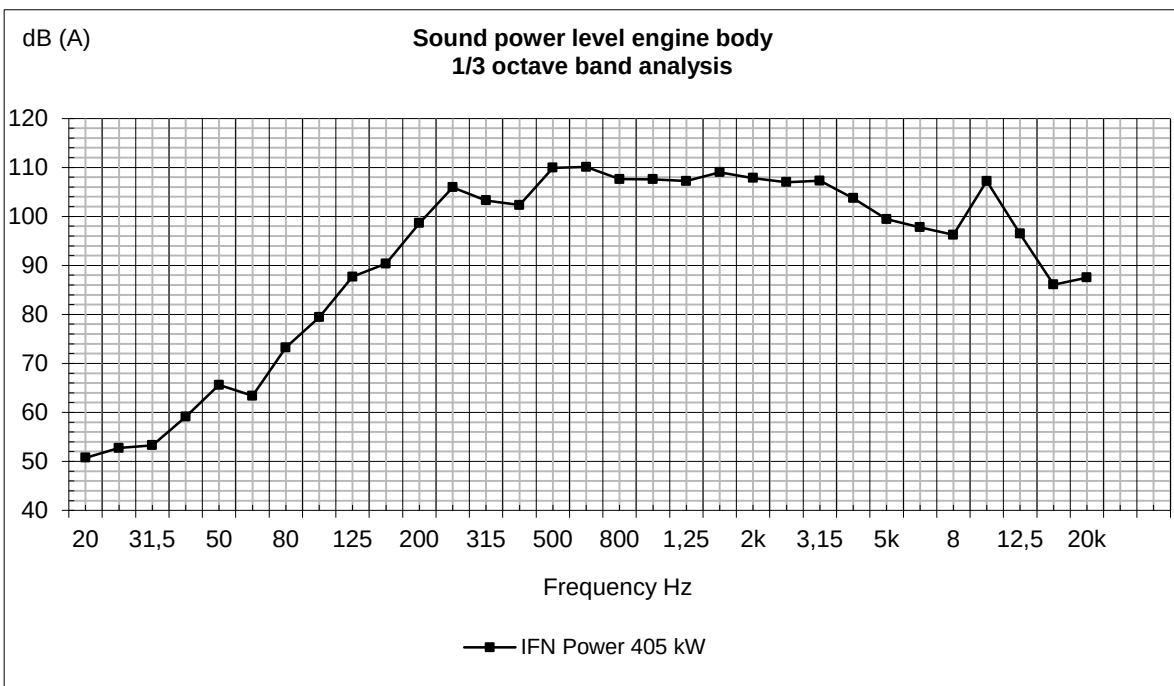


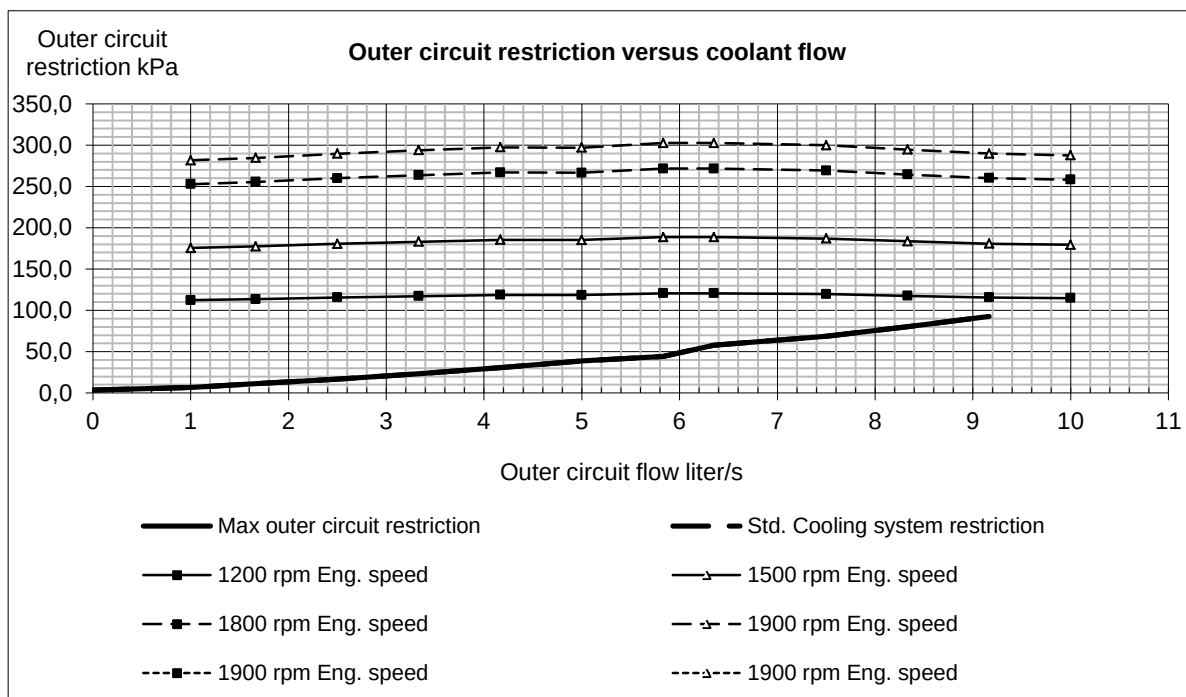




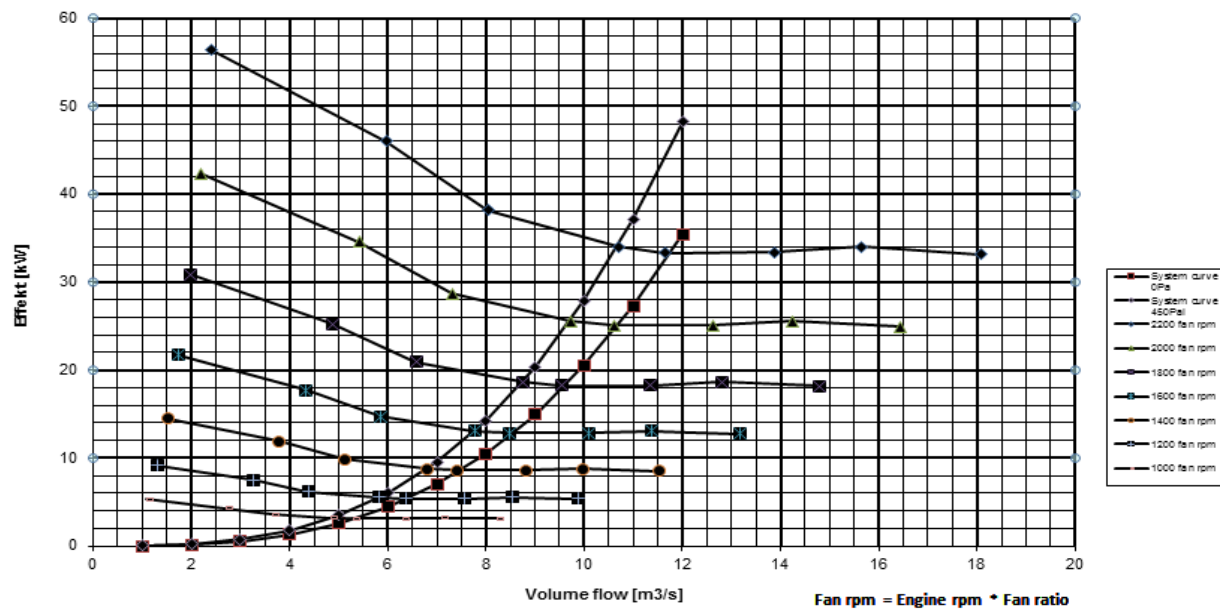




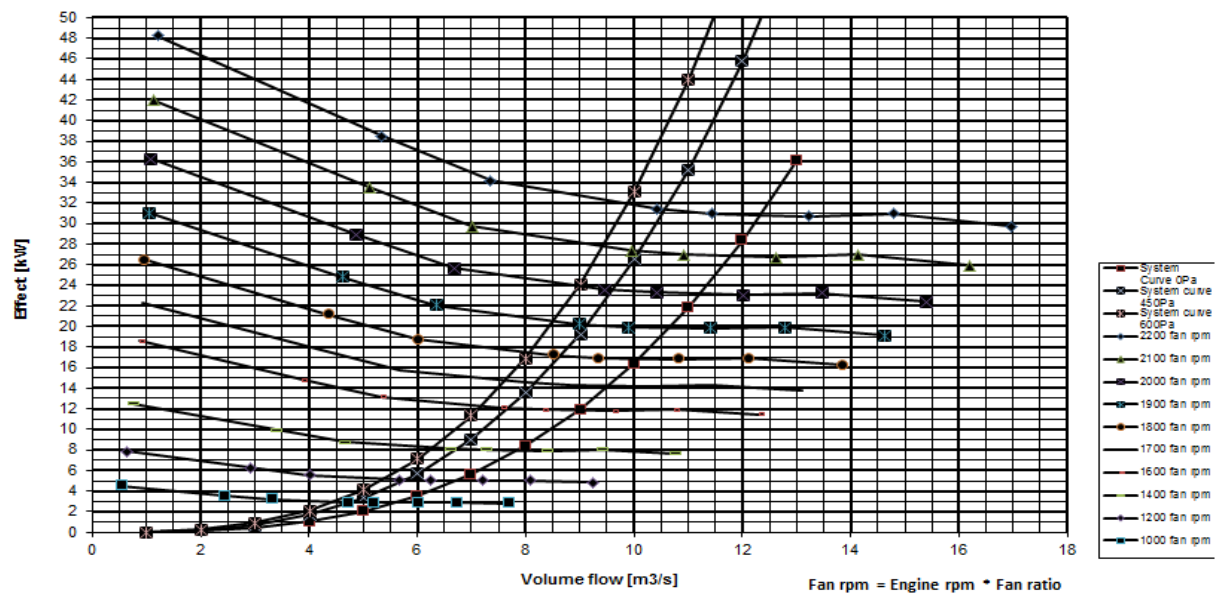




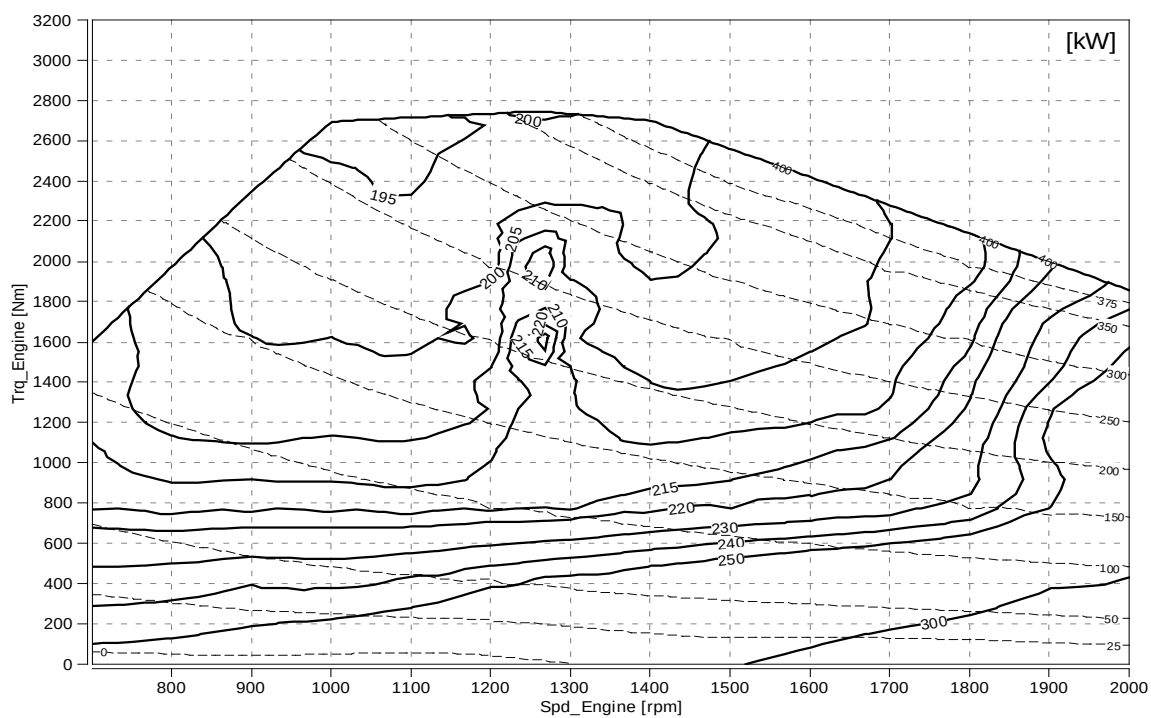
Fan power 890mm Pusher fan



Fan power 890mm Puller fan



BSFC [g/kWh]



Fuel consumption [l/h]

