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 ⚠ nsidered 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.

General

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

Number of cylinders			6
Displacement, total		liters	10,84
		in^3	661
Firing order			1-5-3-6-2-4
Bore		mm	123
		in	4,84
Stroke		mm	152
		in	5,98
Compression ratio			17,0:1
Wet weight	Engine only (Estimated) (excl after treatment comp.)	kg	1072
		lb	2363
	Power pac	kg	1351
		lb	2978

Performance				**rpm**	**1300**	**1800**	**2000**	**2100**
ICFN Power 235 kW		without fan		kW	213	235	235	235
				hp	290	320	320	320
		with fan 890 mm		kW	209	222	220	218
				hp	284	302	300	297
Torque at:		ICFN Power		Nm	1568	1247	1122	1068
				lbf ft	1156	920	827	788
Max torque at engine speed	ICFN Power	rpm	1260 rpm	Nm	1581			
				lbf ft	1166			
Power tolerance				%	±2			
Mean piston speed				m/s	6,6	9,1	10,1	10,6
				ft/sec	21,6	29,9	33,2	34,9
Effective mean pressure at:		ICFN Power		MPa	1,81	1,45	1,30	1,24
				psi	263	210	189	180
Max combustion pressure at:		ICFN Power		MPa	13,1	12,3	11,7	11,7
				psi	1901	1778	1698	1697
Total mass moment of inertia, J (mR^2) (not including flywheel)				kgm^2	1,034			
				$lbft^2$	24,5			
Friction Power				kW	24	43	53	58
				hp	32	58	71	79
Derating see Technical Diagrams								

Engine brake performance (only engines with VCB)		rpm	1300	1800	2000	2100
Brake power:	without fan	kW	83	169	184	189
		hp	113	230	250	256
Brake torque:	without fan	Nm	610	897	879	857
		lbf ft	450	661	649	632
Engine speed range for VCB activation:		rpm	1000-2200			
Min engine speed with VCB still active:		rpm	900			
Min oil temperature for VCB activation:		°C	55			

Cold start performance

*Cold start limit temperature	without starting aid	°C	-15	
		°F	5	
	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 VDS3 or VDS4 15W/40 T<-15°C Oil VDS3 or VDS4 5W/40			
Heater type	Make	Power kW	Engaged hours (-30°C)	Cooling water temp engine block
Self circulating	Volvo	1,2	12	-1°C 30°F

* See also general section in the sales guide

Lubrication system

Lubricating oil consumption (average)		l/hr	0,02	
Oil system capacity including filters		liter	37	
		US gal	9,77	
Oil pan capacity: (both variants)	Max	liter	32	
		US gal	8,45	
	Min	liter	27	
		US gal	7,13	
Oil change intervals/specifications	VDS3	h	500*	
	VDS4	h	500*	
Engine angularity limits:	front up	°	30	
	front down	°	30	
	side tilt	°	30	
Oil pressure at rated speed		kPa	350 - 600	
		psi	51 - 87	

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

Lubrication system

Lubrication oil temperature in sump:	max	°C	127
		°F	261
Oil filter filtration efficiency	99%	µ	38
(in accordance with ISO 4548-12)	50%	µ	14

Fuel system

System supply flow at max. Speed		liter/h US gal/h	108 28,5
Fuel supply line max. restriction (measured at fuel inlet connection)		kPa psi	10 1,5
Fuel supply line max. pressure, during engine stand still (meassured at fuel inlet connection)		kPa psi	16,5 2,4
Fuel supply line min. pressure, during engine stand still (meassured at fuel inlet connection)		kPa psi	-12,5 -1,8
System return flow at max. Speed		liter/h US gal/h	30,0 7,9
Fuel return line max. restriction (measured at fuel return connection)		kPa psi	20 2,9
Max. allowable inlet fuel temp (Measured at fuel inlet connection)		°C °F	60 140
Prefilter / Water separator micron size		µ	10
Fuel filter filtration efficiency	96%	µ	6
Fuel filter micron size		µ	5
Injection pump type/make			Delphi E3
Specific UREA consumption in Nonroad Transient Cycle (NRTC)		Vol%	N/A
Fuel to conform to			Fuel corresponding to EN590:1999 or ASTM D 975-No or JIS KK2204:2004

Intake and exhaust system		**rpm**	**1300**	**1800**	**2000**	**2100**
Charge air consumption at: Charge air consumption at: (+25°C and 100kPa)	ICFN Power	m³/min cfm	16,2	20,1	21,4	22,1
⚠ **See front page for important information** Max allowable air intake restriction including piping		kPa psi		5 0,7		
Heat rejection to exhaust at:	ICFN Power	kW BTU/min	146	188	206	210
Exhaust gas temperature after turbine at:	ICFN Power	°C °F	431	446	458	455
⚠ **See front page for important information** Max allowable back pressure in exhaust line (after turbine) Pipe dimension Ø: 125 mm		kPa psi	-	-	-	15 2,2
⚠ **See front page for important information** Max allowable temperature drop between turbine and SCR muffler inlet.		Δ°C Δ°F	N/A	N/A	N/A	N/A
SCR muffler pressure drop		kPa psi	N/A	N/A	N/A	N/A
Exhaust gas flow at:	ICFN Power	m³/min	37,8	45,8	48,8	49,8

Cooling system			rpm	1300	1800	2000	2100
Heat rejection radiation from engine at:		ICFN Power	kW BTU/min	6,7	7,4	7,9	7,9
Heat rejection to coolant at:		ICFN Power	kW BTU/min	102	133	129	134
			Volvo Penta coolant "ready mix" or Volvo Penta coolant				
Radiator cooling system type				Closed circuit			
Standard radiator core area			m² foot²	0,8			
Fan diameter	890 mm		mm in	890			
Fan power consumption	890 mm		kW hp	4,2	12,7	14,6	17,0
Coolant capacity:	engine		liter US gal	17 4,5			
	std. 0,8m² radiator with hoses		liter US gal	21			
Coolant pump			drive/ratio	belt/1,41:1 cw			
Coolant flow with standard system			l/s US gal/s	5,1 1,3	7,2 1,9	8 2,1	8,4 2,2
Minimum coolant flow			l/s US gal/s	2,0 0,5	2,5 0,7	2,5 0,7	2,7 0,7
Maximum outer circuit restriction incl. piping			kPa psi	55,0 8,0			
Thermostat:		start to open	°C °F	82 180			
		fully open	°C °F	92 198			
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	1300	1800	2000	2100
Heat rejection to charge air cooler	ICFN Power	kW	36,9	42,5	45,5	47,9
		BTU/min	2096	2415	2586	2723
Charge air mass flow	ICFN Power	kg/s	0,32	0,39	0,42	0,43
Charge air inlet temp.	ICFN Power	°C	160	155	157	160
(Charge air temp after turbo compressor)		°F	320	311	315	321
⚠ **See front page for important information** Max allowable Charge air outlet temp.		°C	45	50	50	50
(Charge air temp after charge air cooler)		°F	113	122	122	122
⚠ **See front page for important information**		kPa	12			
Maximum pressure drop over charge air cooler incl. piping		psi	1,74			
Charge air pressure		kPa	179	167	163	163
(Relative, after charge air cooler)		psi	26,01	24,22	23,59	23,63
Standard charge air cooler core area		m²	0,8			
		foot²	8,61			

Cooling performance: 0.8 m² radiator and pull 890 fixed fan standard drive ratio 0.9
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.

Engine speed	Engine power	Air on temp		Air flow		External restriction	
rpm	kW hp	°C	°F	kg/s	lb/s	Pa	psi
2100	235	71,8	161,3	8,68	19,13	0	
(fix 0.9)	320	70,2	158,4	8,07	17,78	150	0,022
		67,9	154,2	7,33	16,16	300	0,044
		64,9	148,8	6,55	14,43	450	0,065

Cooling performance: 0.8 m² radiator and push 890 fixed fan standard drive ratio 0.9
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.

Engine speed	Engine power	Air on temp		Air flow		External restriction	
rpm	kW hp	°C	°F	kg/s	lb/s	Pa	psi
2100	235	73,1	163,6	9,58	21,13	0	
(fix 0.9)	320	71,9	161,4	9,06	19,97	150	0,022
		70,4	158,8	8,51	18,76	300	0,044
		68,6	155,5	7,89	17,39	450	0,065

Cooling performance: 0,8 m² radiator and pull 890 Visco fan standard drive ratio 0.9
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.

Engine speed	Engine power	Air on temp		Air flow		External restriction	
rpm	hp	°C	°F	kg/s	lb/s	Pa	psi
2100	235	70,3	158,6	8,43	18,59	0	
	320	68,3	155,0	7,76	17,10	150	0,022
		65,7	150,2	7,00	15,44	300	0,044
		62,1	143,8	6,18	13,63	450	0,065

Cooling performance: **0,8 m² radiator and** **push 890** **Visco fan standard drive ratio 0.9**

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.

Engine speed	Engine power	Air on temp		Air flow		External restriction	
	kW						
rpm	hp	°C	°F	kg/s	lb/s	Pa	psi
2100	235	71,9	161,3	9,33	20,56	0	
	320	70,5	158,9	8,79	19,37	150	0,022
		68,9	156,0	8,22	18,12	300	0,044
		66,6	151,9	7,53	16,60	450	0,065

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		

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
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
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 incr	Rapid pres incr	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
Charge air pressure		kPa	N/A	value	+ 40kPa	Soft derate
Engine speed		rpm	x % of rated speed	110% of rated speed	Alarm level	Alarm only

Parameter	Warning Yellow Lamp	Alarm Red Lamp	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	N/A
Oil temp	125°C	130°C	130°C	132°C	N/A	N/A
Low oil pressure	Warning	Alarm map	N/A	N/A	N/A	Alarm map value
High charge air temp	80°C	85°C	85°C	86°C	N/A	N/A

Electrical system

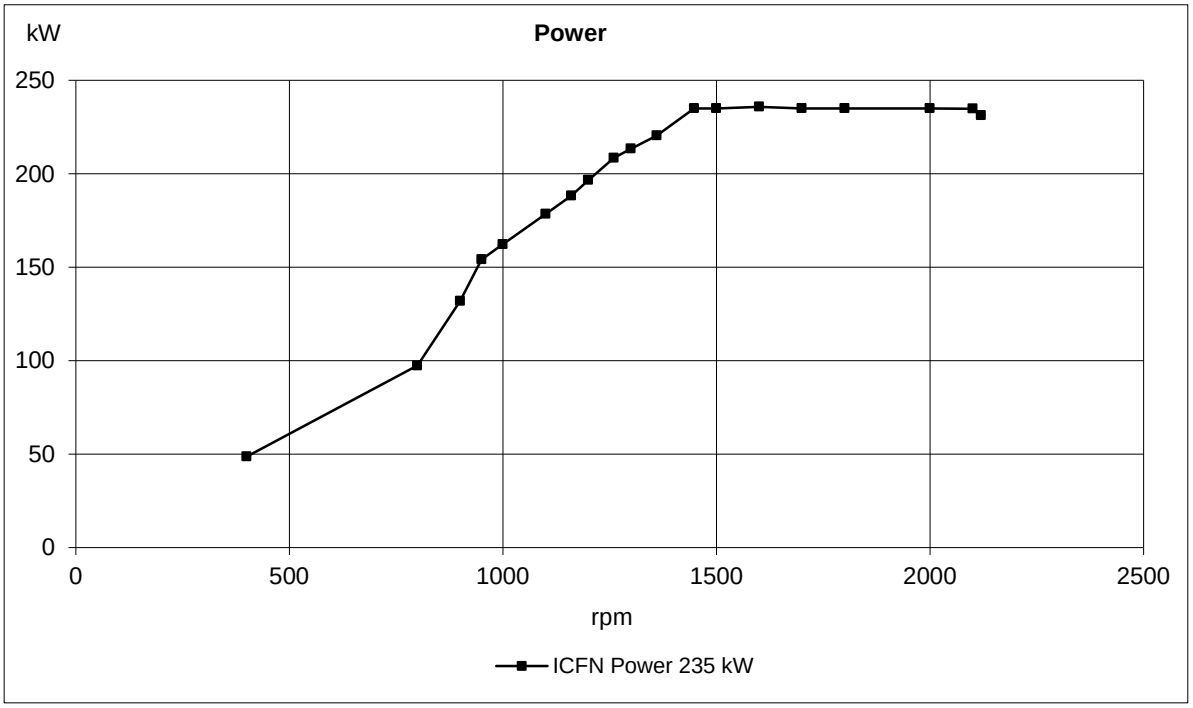
Voltage and type					24V		
Alternator:	output	A			110/150		
	tacho output	Hz/alternator rev.			6		
	drive ratio				5,25		
Starter motor:	type			90P55 / (105P70 ISS för start/stop)			
	output	kW hp		5.5 / (7.0)			
Number of teeth on:	flywheel			153			
	starter motor			11			
Inlet manifold heater (at 20 V)		kW		3.5			
Power relay for the manifold heater		A		1			
Conditions:	**Temperature**	**°C**		**25**	**0**	**-15**	
(4 mΩ main circuit resistance@ 20°C)	**Battery**	**Ah / CCA**		**140 / 800**	**140 / 800**	**145 / 1050**	
Crank speed		rpm		165	150	100	
Crank current		A		240	310	370	
Starter input power during crank		kW		5	6,1	6,3	
Battery power during crank		kW		5,3	6,5	6,8	
Min battery @ 0°C		Ah / CCA		140/800			

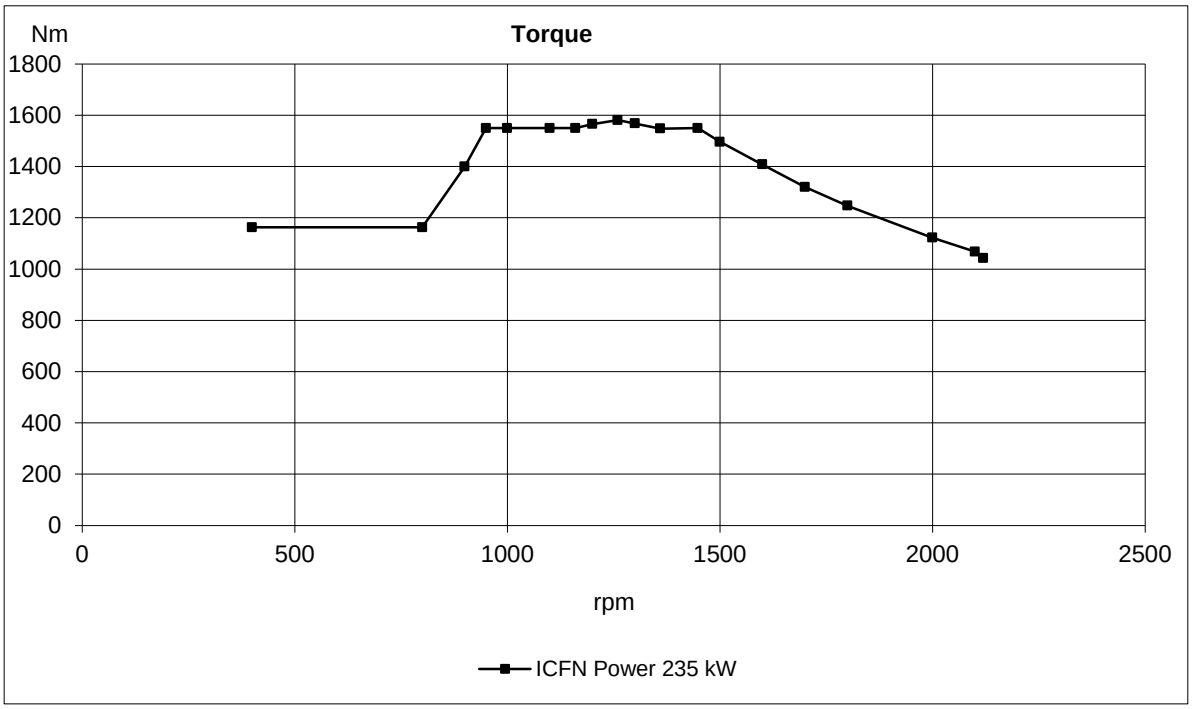
Power take off - Front		**rpm**	**1300**	**1800**	**2000**	**2100**
Front end in line with crank shaft max:*		Nm	1568	1213	1119	1068
(with a total added mass moment of inertia, J (mR2)≤ 0,05 kgm²)		lbf ft	1156	895	825	788
Front end belt pulley load. Direction of load viewed from flywheel side:	max up	kW	17	23	26	27
		hp	23	31	35	37
(Pulley diameter 201 mm with distance 190 mm from main bearing nr 1)	max side	kW	17	23	26	27
		hp	23	31	35	37
	max down	kW	34	47	52	55
		hp	46	64	71	75

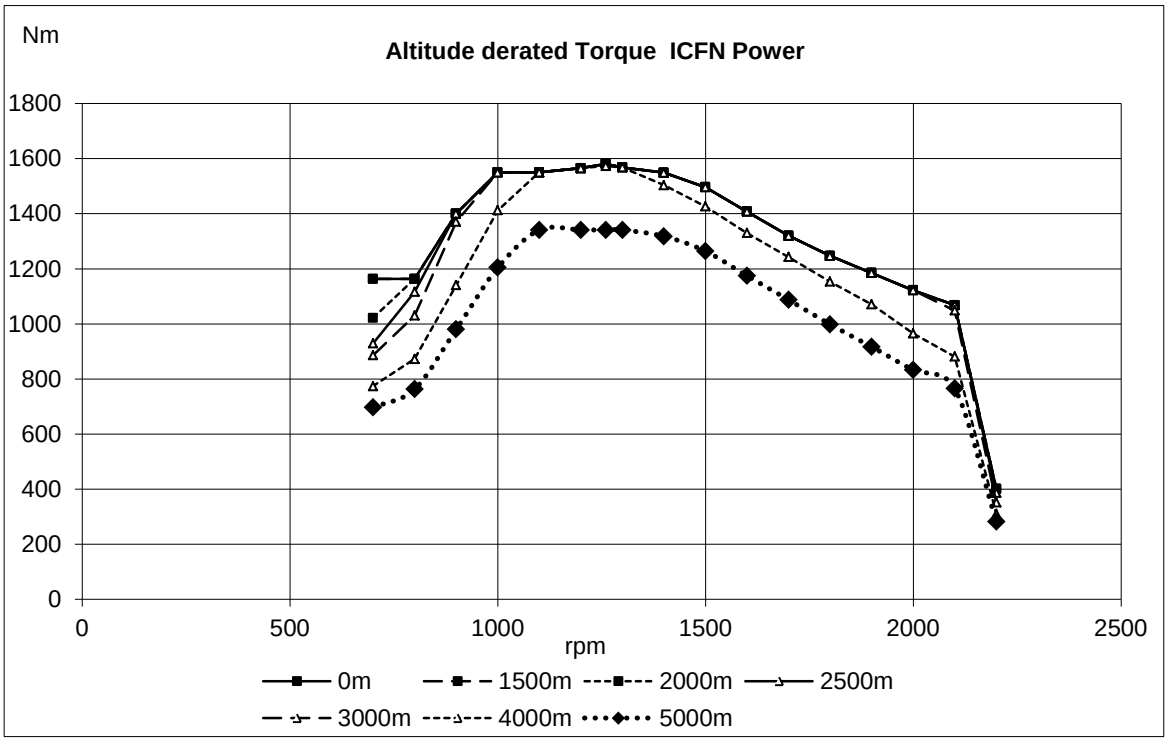
Power take off - Rear with Flywheel housing Standard

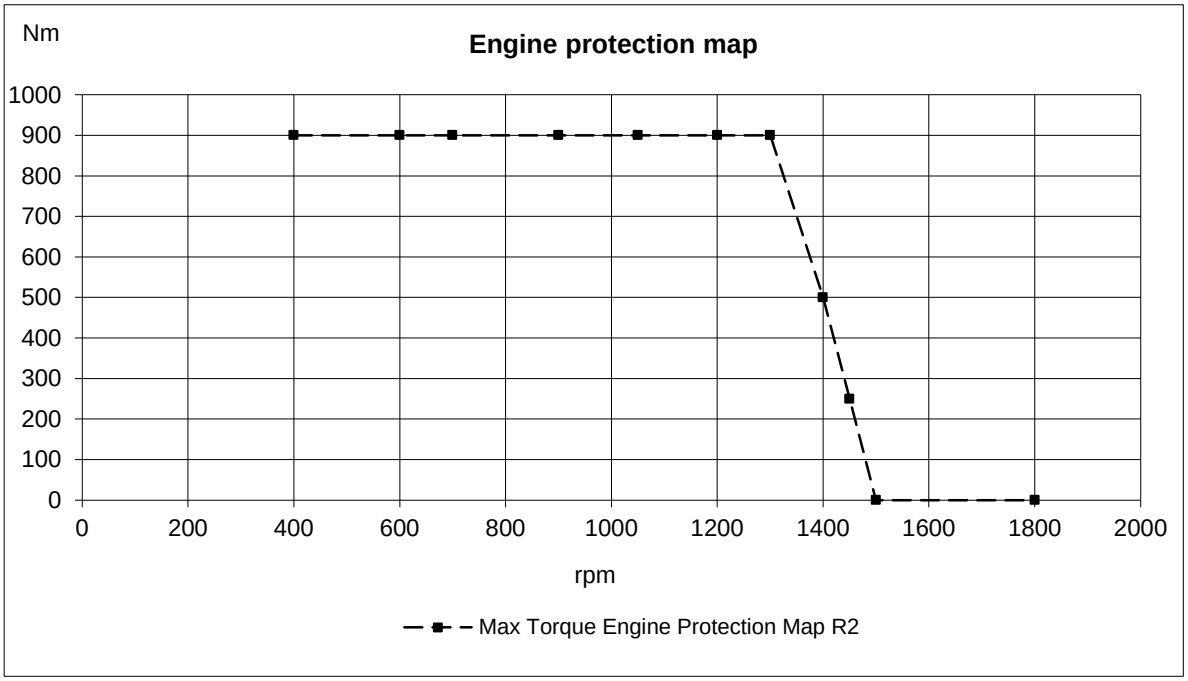
Timing gear at servo pump PTO max:*****	Nm lbf ft	100 74	
Speed ratio direction of rotation viewed from flywheel side		1,08:1/ccw	
Continuous torque on timing gear at rear PTO*, SAE B spline	Nm lbf ft	300 221	
Continuous torque on timing gear at rear PTO* DIN 5462 spline	Nm lbf ft	650 479	
Speed ratio direction of rotation viewed from flywheel side for all rear PTO's		1,08:1/ccw	
Continuous torque on timing gear at compressor PTO***** SAE B spline	Nm lbf ft	300 221	
Speed ratio direction of rotation viewed from flywheel side		1,29:1/ccw	
Max allowed bending moment in flywheel housing	Nm lbf ft	7000 5163	
Max. rear main bearing load	N lbf	3000 674,4	

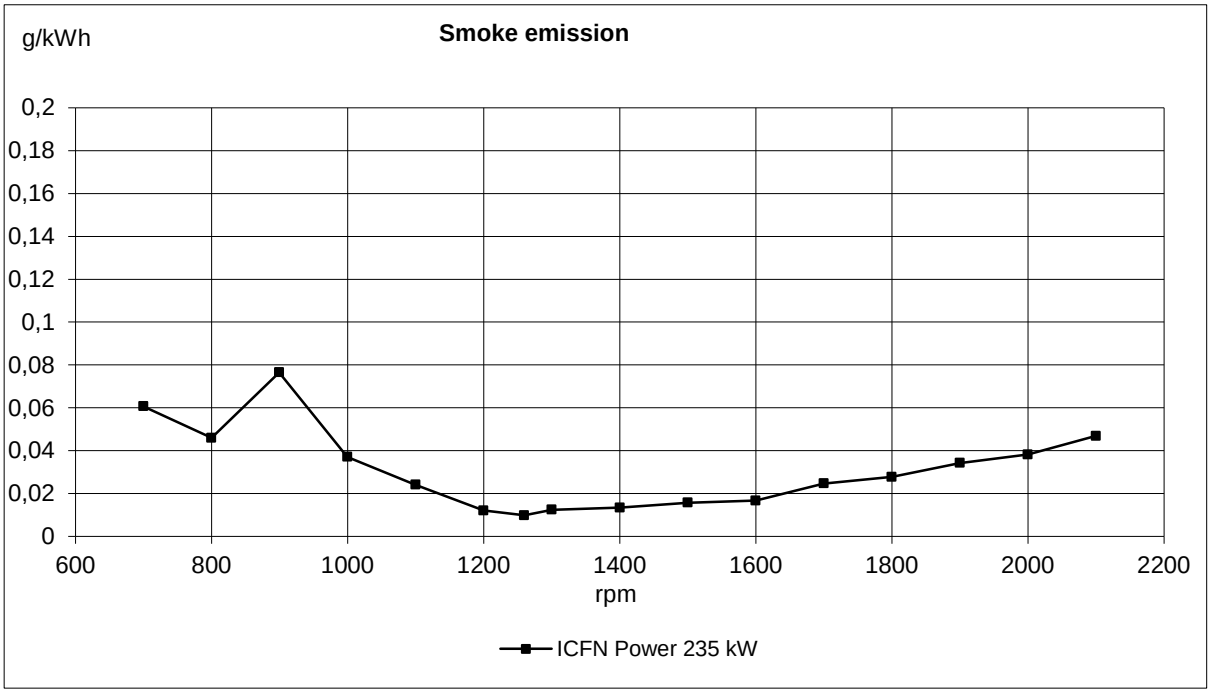
**** Maximum allowed torque at individual PTO´s.***
If more than one PTO output is used simultaneously, calculations needs to be performed to determine available maximum.
Available torque depends on application inertia.

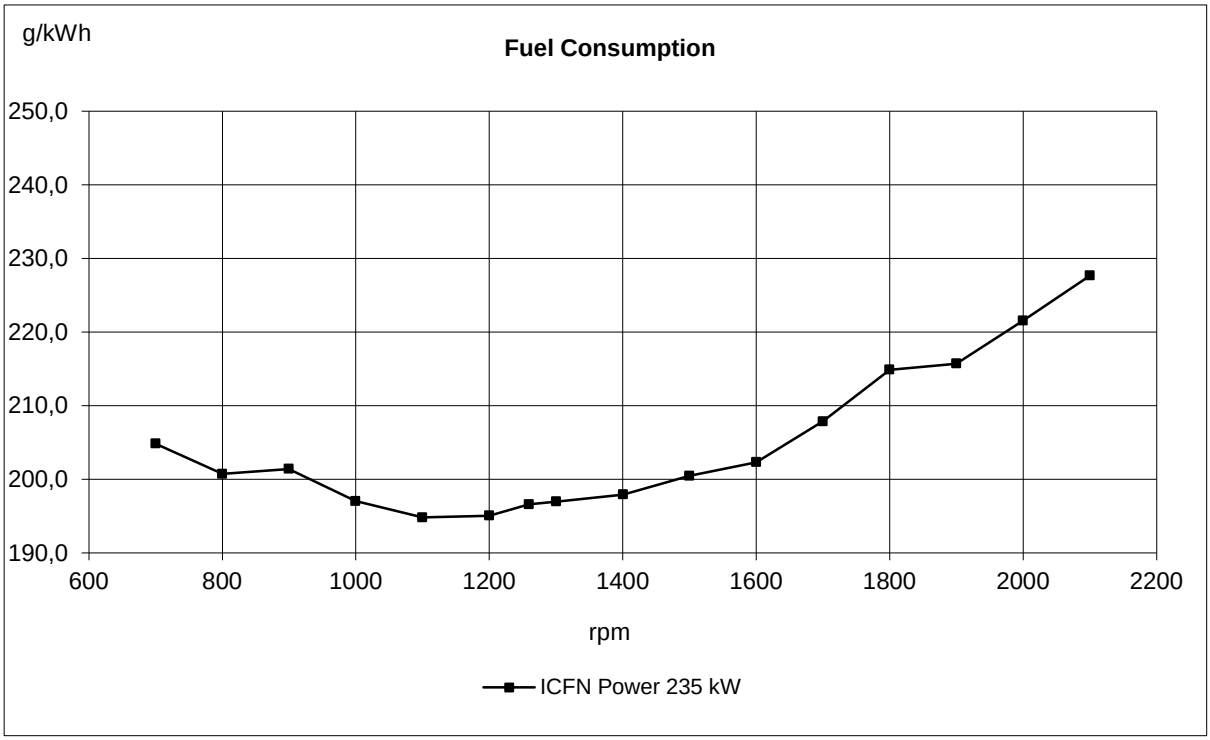

kW
Power
250
200
150
100
50
0
0
500
1000
1500
2000
2500
rpm
ICFN Power 235 kW

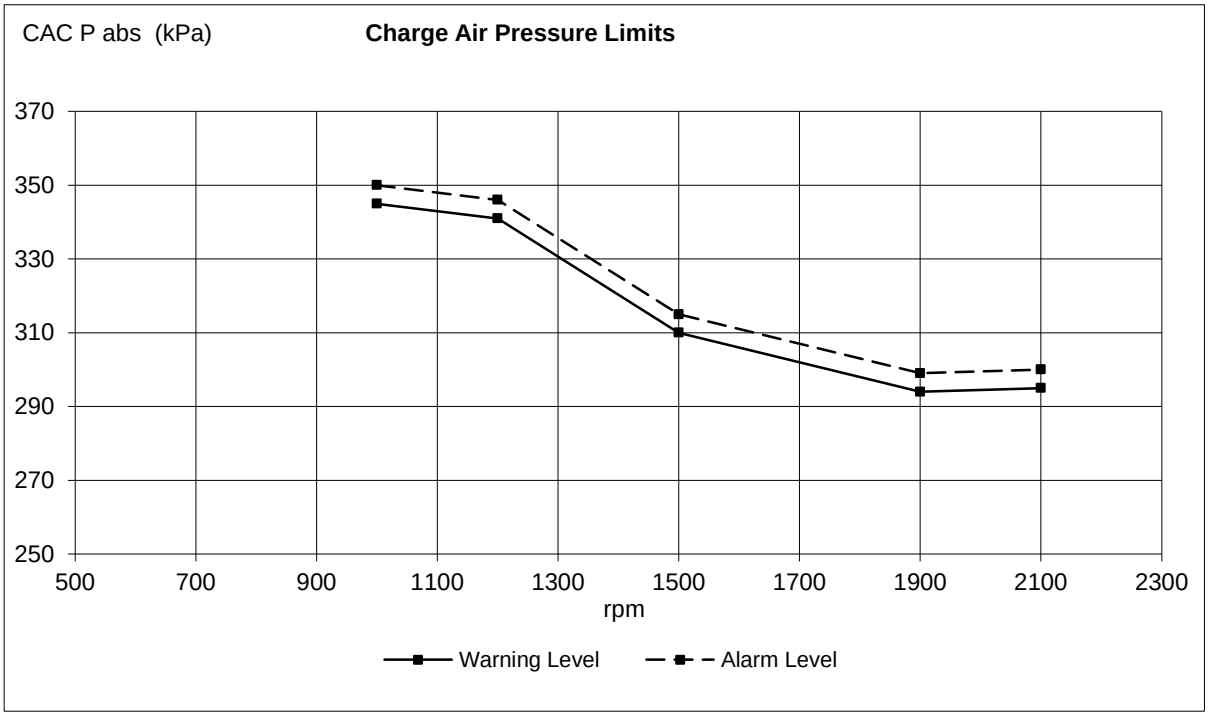

Nm
Torque
1800
1600
1400
1200
1000
800
600
400
200
0
0
500
1000
1500
2000
2500
rpm
ICFN Power 235 kW

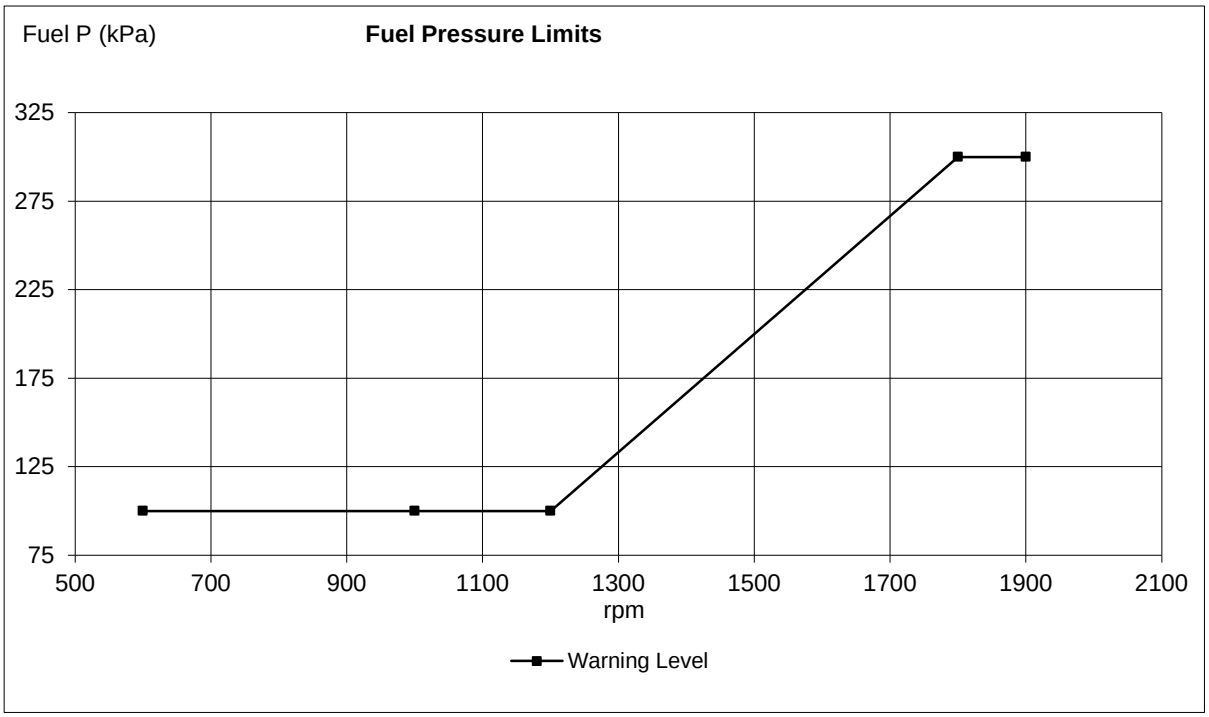

Nm
Altitude derated Torque ICFN Power
1800
1600
1400
1200
1000
800
600
400
200
0
0
500
1000
1500
2000
2500
rpm
0m
1500m
2000m
2500m
3000m
4000m
5000m

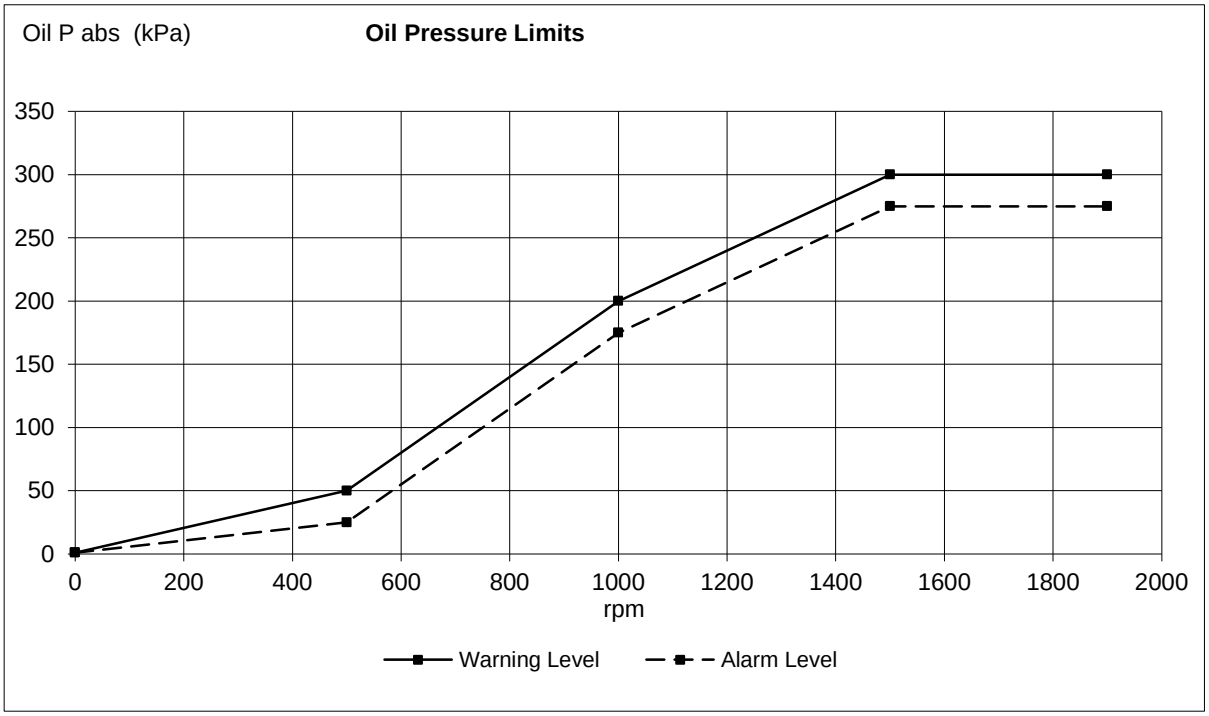

Nm
Engine protection map
1000
900
800
700
600
500
400
300
200
100
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
rpm
Max Torque Engine Protection Map R2

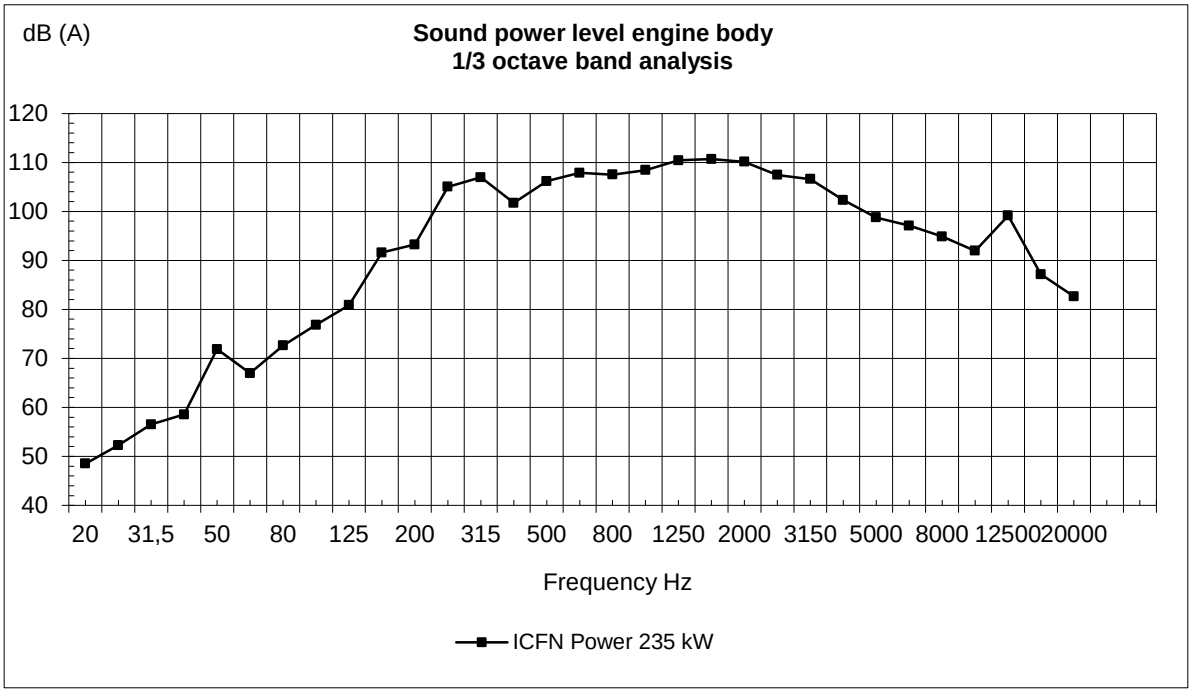

Smoke emission
g/kWh
0,2
0,18
0,16
0,14
0,12
0,1
0,08
0,06
0,04
0,02
0
600
800
1000
1200
1400
1600
1800
2000
2200
rpm
ICFN Power 235 kW

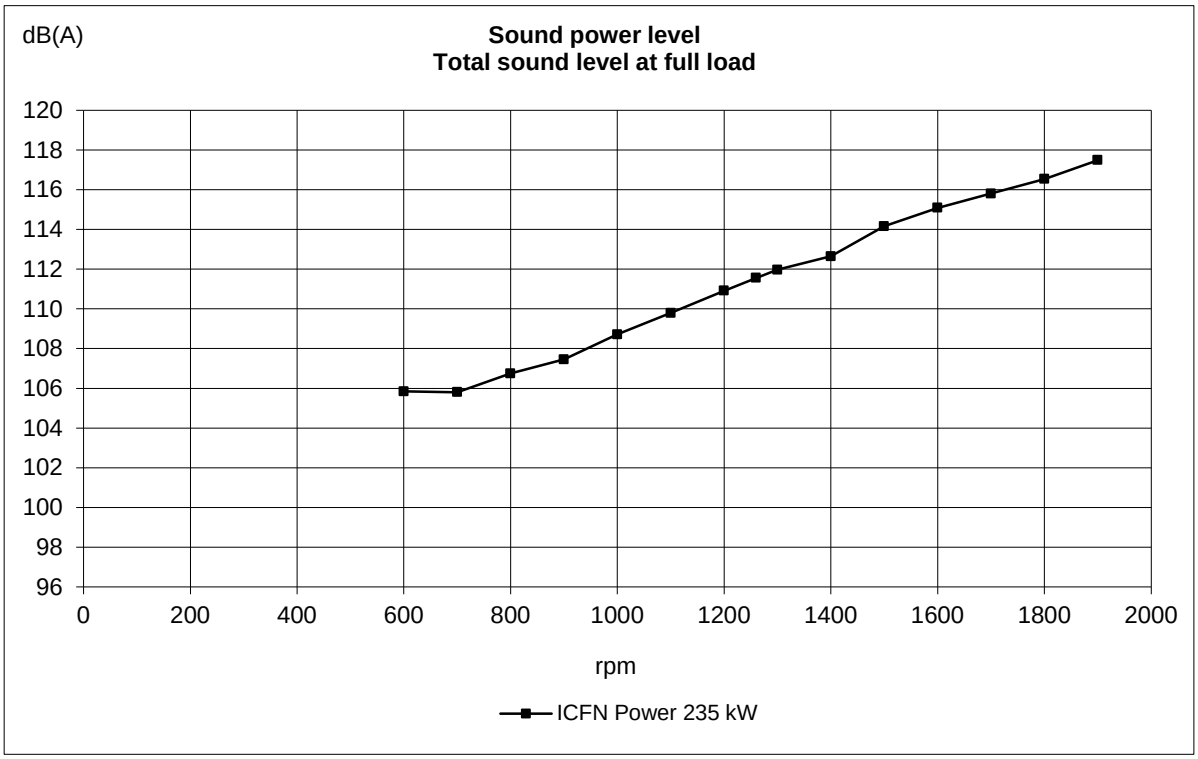

Fuel Consumption
g/kWh
250,0
240,0
230,0
220,0
210,0
200,0
190,0
600
800
1000
1200
1400
1600
1800
2000
2200
rpm
ICFN Power 235 kW

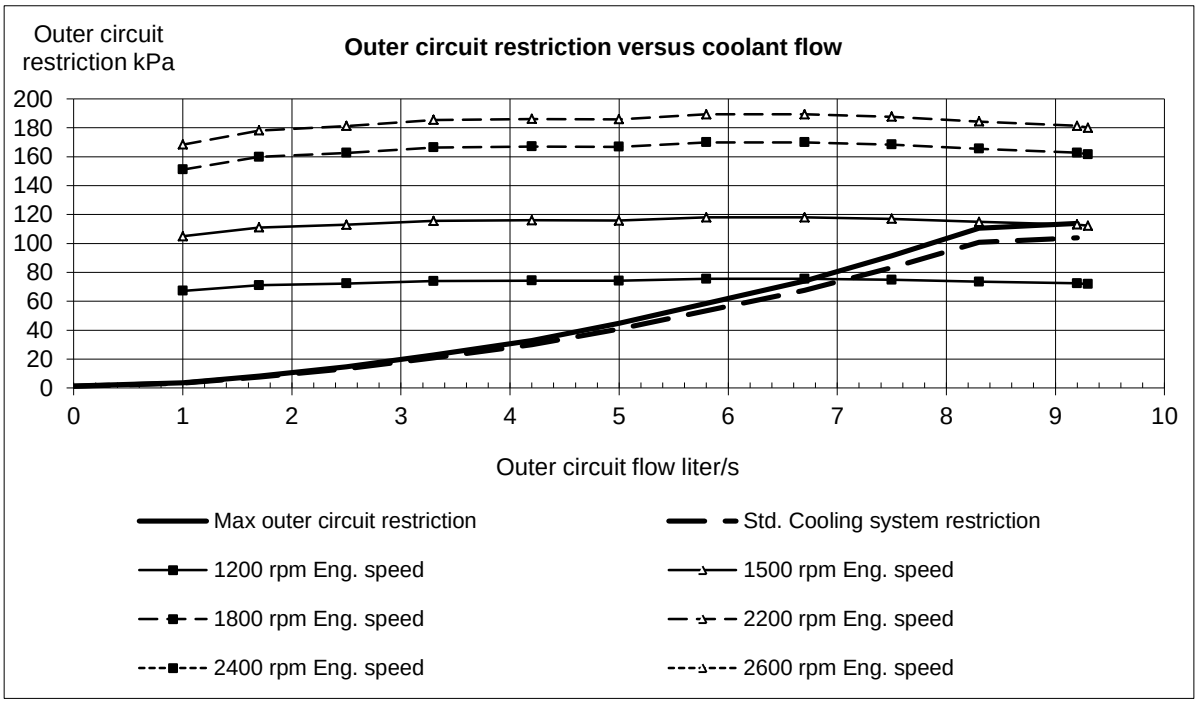

CAC P abs (kPa)
Charge Air Pressure Limits
370
350
330
310
290
270
250
500
700
900
1100
1300
1500
1700
1900
2100
2300
rpm
Warning Level
Alarm Level

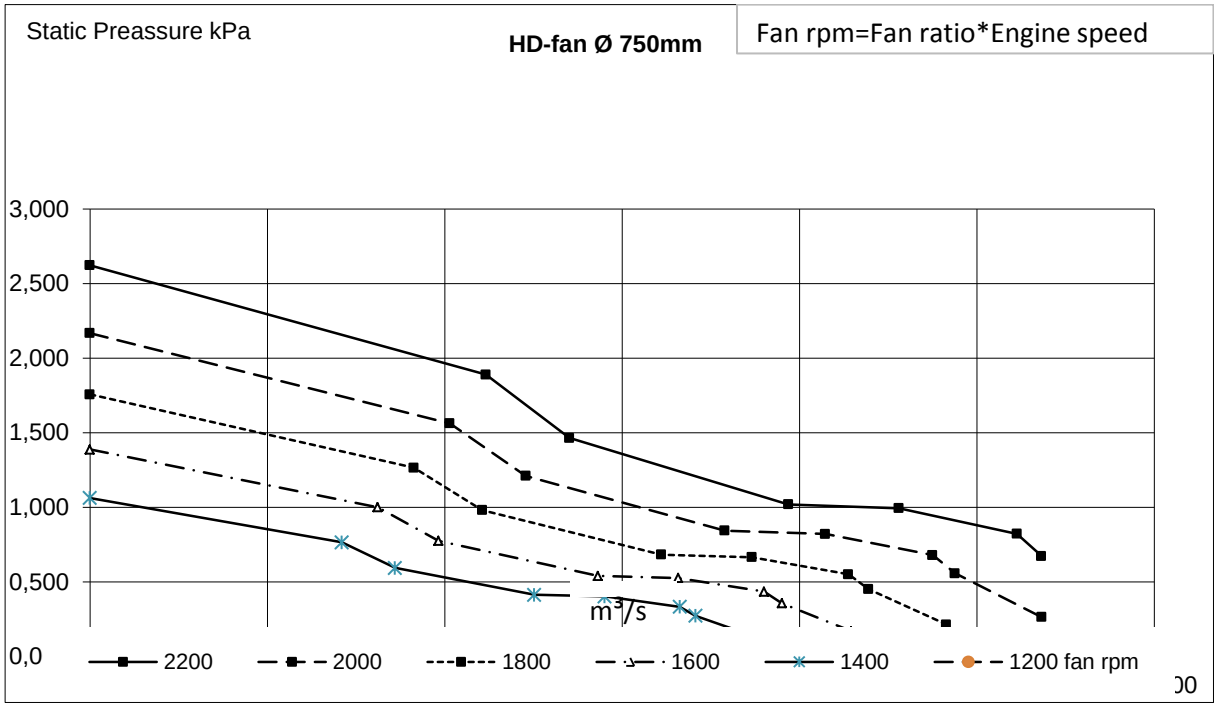

Fuel P (kPa)
Fuel Pressure Limits
325
275
225
175
125
75
500
700
900
1100
1300
1500
1700
1900
2100
rpm
Warning Level

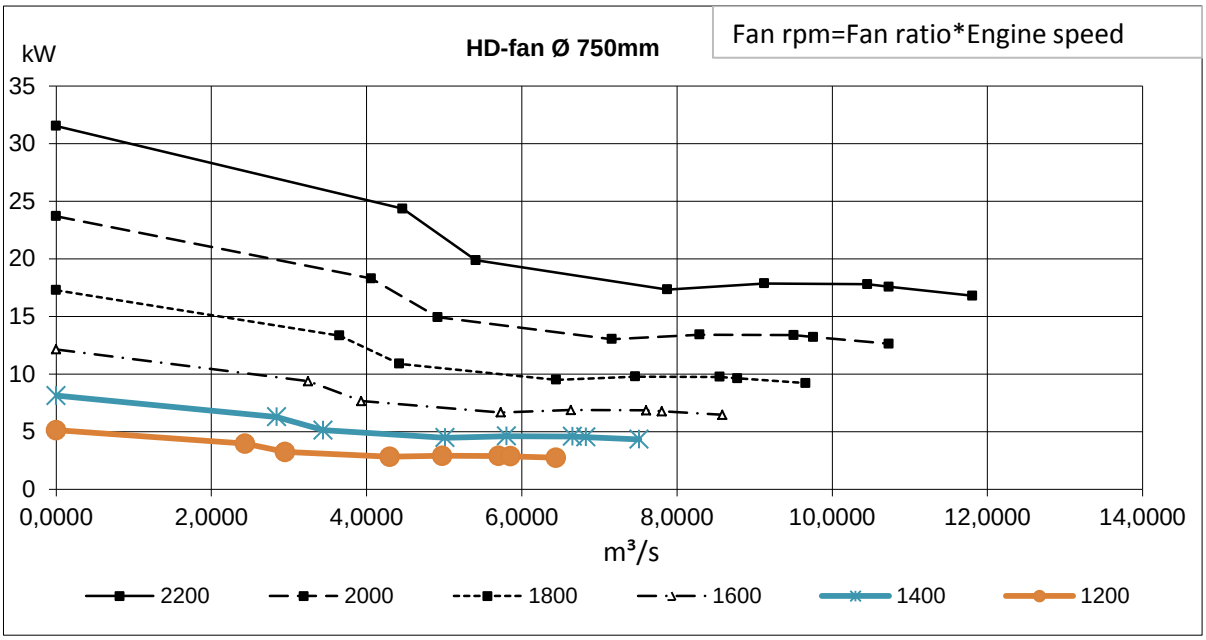

Oil P abs (kPa)
Oil Pressure Limits
350
300
250
200
150
100
50
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
rpm
Warning Level
Alarm Level

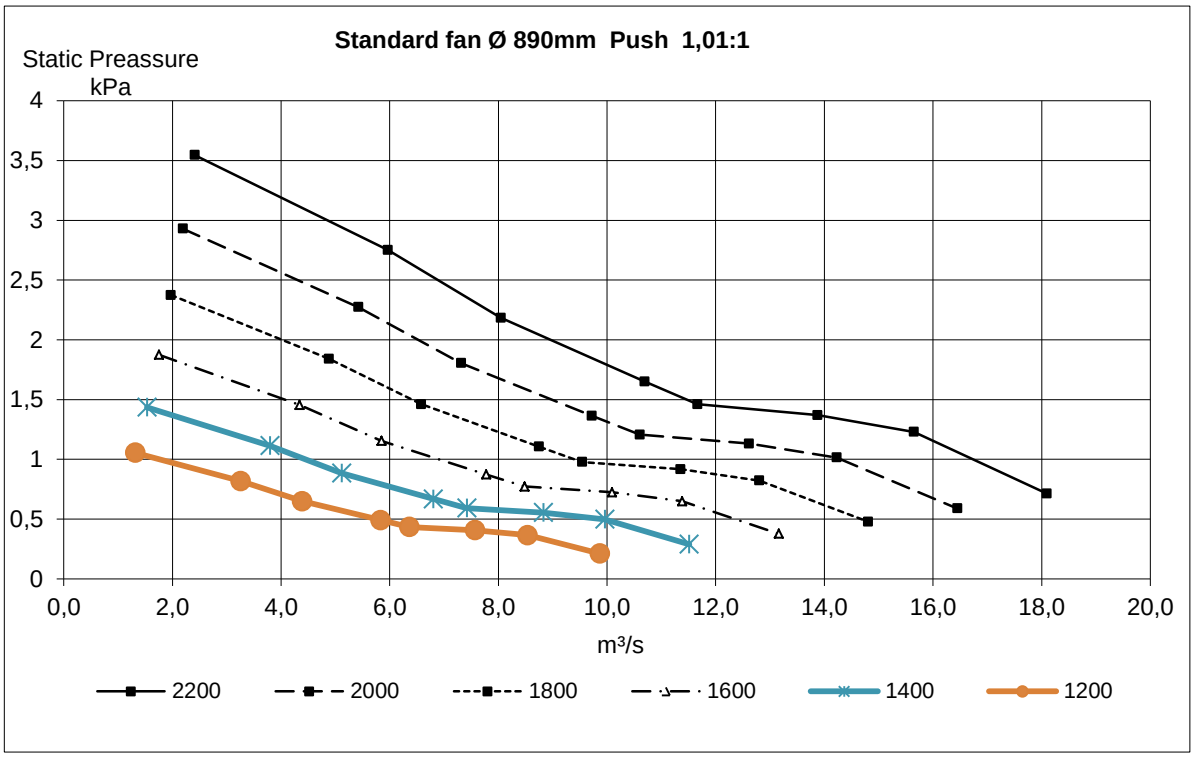

dB (A)
Sound power level engine body
1/3 octave band analysis
120
110
100
90
80
70
60
50
40
20
31,5
50
80
125
200
315
500
800
1250
2000
3150
5000
8000
12500
20000
Frequency Hz
ICFN Power 235 kW

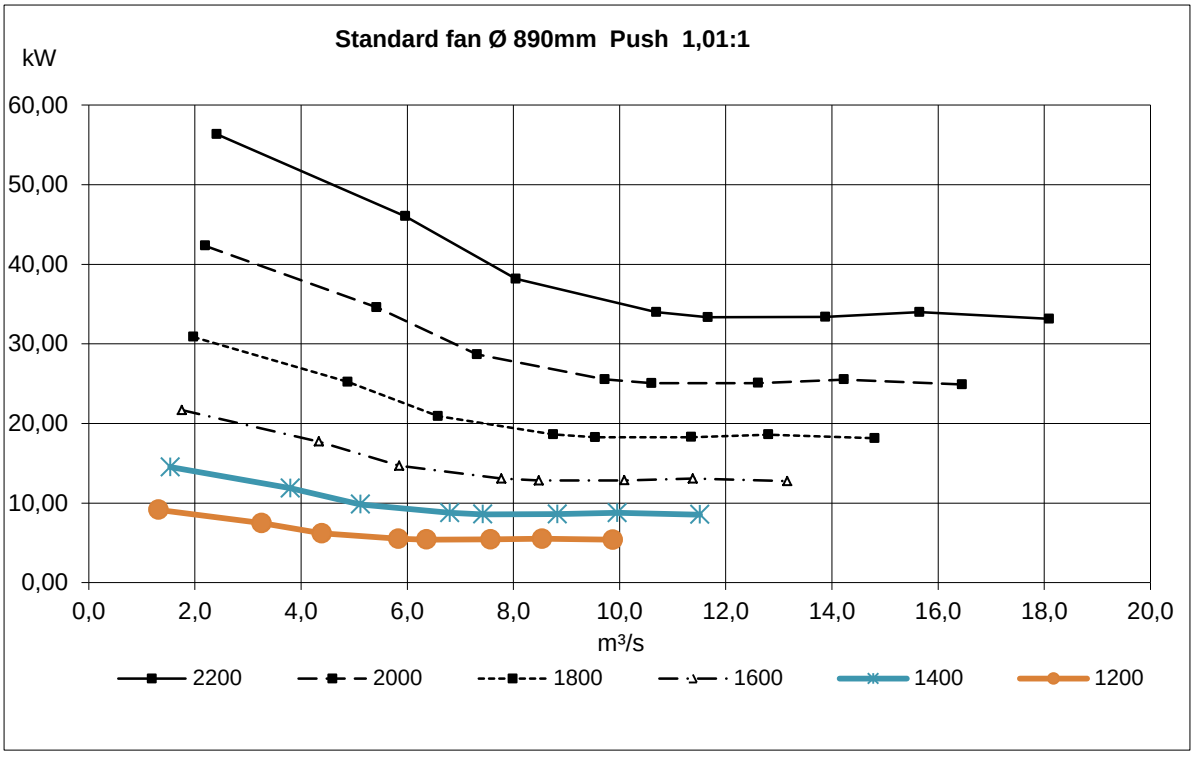

dB(A)
Sound power level
Total sound level at full load
120
118
116
114
112
110
108
106
104
102
100
98
96
0
200
400
600
800
1000
1200
1400
1600
1800
2000
rpm
ICFN Power 235 kW


Outer circuit restriction kPa
Outer circuit restriction versus coolant flow
200
180
160
140
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
Outer circuit flow liter/s
Max outer circuit restriction
Std. Cooling system restriction
1200 rpm Eng. speed
1500 rpm Eng. speed
1800 rpm Eng. speed
2200 rpm Eng. speed
2400 rpm Eng. speed
2600 rpm Eng. speed

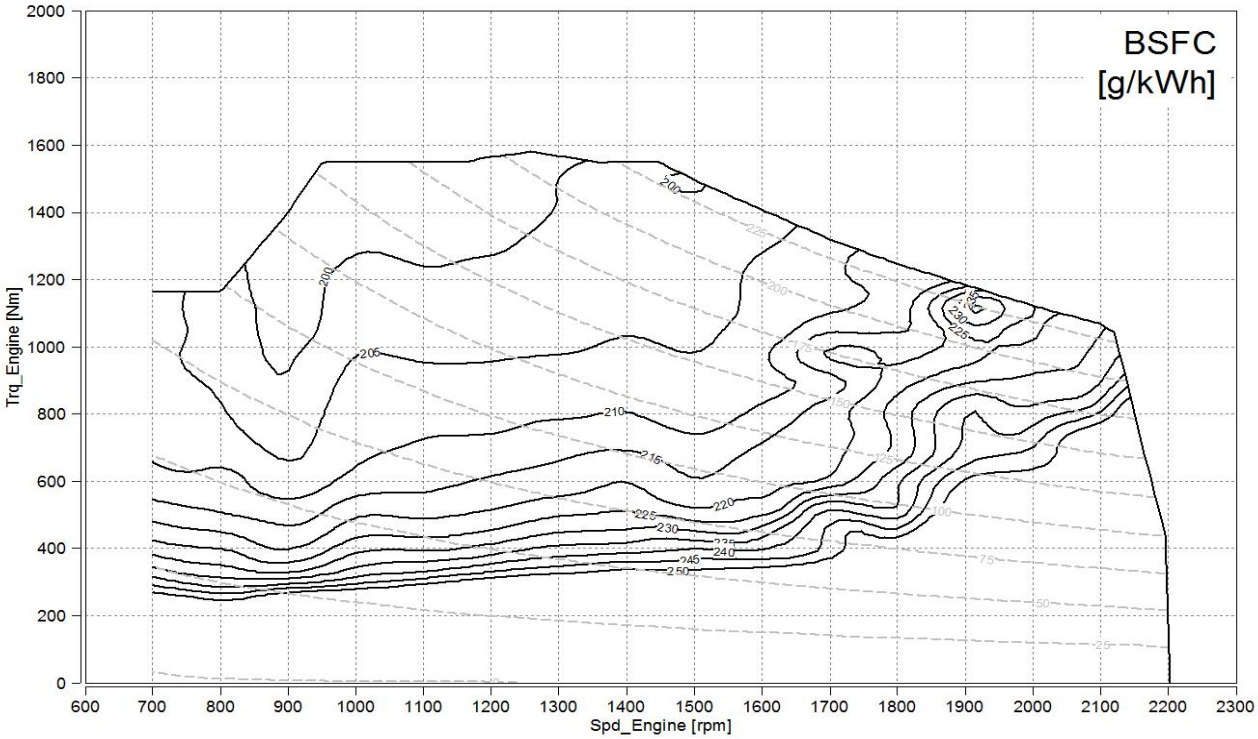

Static Preassure kPa
HD-fan Ø 750mm
Fan rpm=Fan ratio*Engine speed
3,000
2,500
2,000
1,500
1,000
0,500
0,0
m³/s
2200
2000
1800
1600
1400
1200 fan rpm


kW
HD-fan Ø 750mm
Fan rpm=Fan ratio*Engine speed
35
30
25
20
15
10
5
0
0,0000
2,0000
4,0000
6,0000
8,0000
10,0000
12,0000
14,0000
m³/s
2200
2000
1800
1600
1400
1200


Standard fan Ø 890mm Push 1,01:1
Static Preassure
kPa
4
3,5
3
2,5
2
1,5
1
0,5
0
0,0
2,0
4,0
6,0
8,0
10,0
12,0
14,0
16,0
18,0
20,0
m³/s
2200
2000
1800
1600
1400
1200


Standard fan Ø 890mm Push 1,01:1
kW
60,00
50,00
40,00
30,00
20,00
10,00
0,00
0,0
2,0
4,0
6,0
8,0
10,0
12,0
14,0
16,0
18,0
20,0
m³/s
2200
2000
1800
1600
1400
1200

BSFC [g/kWh]



Fuel consumption [l/h]