General

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

Number of cylinders			6
Displacement, total		litre in^3	12,78 779,7
Firing order			1-5-3-6-2-4
Bore		mm in	131 5,16
Stroke		mm in	158 6,22
Compression ratio			18.1:1
Wet weight	Engine only	kg lb	1325 2921
	Engine incl. cooling system and air filtration system	kg lb	1596 3519
	Engine incl. cooling system, air filtration system, and frame	kg lb	1790 3946

Performance		**rpm**	**1500**	**1800**
Standby Power	without fan	kW hp	404 549	400 544
	with fan	kW hp	390 530	376 511
Prime Power	without fan	kW hp	369 502	368 500
	with fan	kW hp	355 483	344 468
Torque at:	Standby Power	Nm lbft	2572 1897	2122 1565
	Prime Power	Nm lbft	2349 1732	1952 1440
Mean piston speed		m/s ft/sec	7,9 26,0	9,5 31,2
Effective mean pressure at:	Standby Power	MPa psi	2,5 367	2,1 303
Effective mean pressure at:	Prime Power	MPa psi	2,3 335	1,9 278
Max combustion pressure at:	Standby Power	MPa psi	19,8 2872	17,8 2582
Max combustion pressure at:	Prime Power	MPa psi	19,3 2799	16,1 2335
Total mass moment of inertia, J (mR^2)		kgm^2 $lbft^2$	3,43 81,4	
Friction Power		kW hp	31 42,16	44 59,84
Derating see Technical Diagrams				

Engine noise emission

Test Standards: ISO 3744-1981 (E) sound power

Tolerance ± 0.75 dB(A)

		rpm	1500	1800
Measured sound power Lw	No load	dB(A)	113,5	111,3
	Standby Power	dB(A)	115,6	114,5
	Prime Power	dB(A)	115,6	114,1
Calculated sound pressure Lp at 1 m	No load	dB(A)	102,5	100,3
	Standby Power	dB(A)	104,6	103,5
	Prime Power	dB(A)	104,6	103,1

Unsilenced exhaust noise

Data calculated as sound pressure Lp.

Assumed microphone distance 1 m

	rpm	1500	1800
Standby Power	dB(A)	114	118
Prime Power	dB(A)	114	118

Test conditions for load acceptance data

Warm engine.	**Generator**	**Model**	**Type of AVR**
	Stamford	HCI 434 F1	MX 341
AVR Settings	Frequency:50/60HZ, Voltage:400/440V, UFRO:47/57Hz, STAB:50/70%, DIP:50/50%		

Load acceptance performance can vary due to actual alternator inertia, voltage regulator, type of load and local ambient conditions.

Single step load performance at 1500 rpm

Load (%)	Speed diff (%)		Recovery time (s)		Remaining load	Speed diff (%)		Recovery time (s)	
	Prime	Standby	Prime	Standby	(%)	Prime	Standby	Prime	Standby
0-20	1,7	1,9	1,2	1,2	20-100	13,6	14,9	2,4	3,2
0-40	3,5	4,2	1,3	1,3	40-100	4,9	5,5	1,5	2,1
0-50,5		7,0		2,2	50,5-100		3,5		1,5
0-55,5	7,0		2,2		55,5-100	3,0		1,4	
0-60	8,0		2,2		60-100	2,5		1,4	
0-60,5		10,0		2,4	60,5-100		2,8		1,3
0-66,5	10,0		2,3		66,5-100	2,2		1,3	
0-80	14,6	18,3	2,3	2,6	80-100	1,2	1,1	1,0	1,1
0-100	22,1	29,4	3,2	5,0					
100-0	-5,8	-6,3	1,5	1,6					

Single step load performance at 1800 rpm

Load (%)	Speed diff %		Recovery time (s)		Remaining load	Speed diff (%)		Recovery time (s)	
	Prime	Standby	Prime	Standby	(%)	Prime	Standby	Prime	Standby
0-20	1,6	1,8	0,9	0,9	20-100	7,4	7,5	1,7	2,2
0-40	3,0	3,1	1,1	1,2	40-100	4,1	4,9	1,2	2,1
0-60	4,7	5,5	1,0	1,0	60-100	2,9	3,7	1,0	1,5
0-70		7,0		1,3	70-100		2,1		1,0
0-77,5	7,0		1,3		77,5-100	1,4		0,8	
0-80	7,8	9,4	1,3	1,7	80-100	1,1	1,2	0,7	0,7
0-82		10,0		1,8	82-100		1,2		0,6
0-90,5	10,0		1,7		90,5-100	0,6		0,0	
0-100	11,7	13,5	2,2	2,7					
100-0	-3,7	-3,8	1,5	1,5					

Cold start performance			rpm	1500	1800
Time from start to stay within 0.5% of no load speed at ambient temperature:	°C	20	s	5,2	5,7
		5	s	6,0	6,4
		-15*	s	6,2	7,0
		-30**	s	7,3	9,1

* With manifold heater 4 kW egaged, lubrication oil 15W/40 and block heater.

** With manifold heater 4 kW egaged, lubrication oil 5W/30 and block heater, Fuel MK-1.

Block heater type	Make	Power kW	Engaged hours	Cooling water temp engine block
	Volvo	2	12	10°C 50°F

Lubrication system			rpm	1500	1800
Lubricating oil consumption	Standby Power		litre/h	0,04	0,05
			US gal/h	0,011	0,013
	Prime Power		litre/h	0,04	0,05
			US gal/h	0,011	0,013
Oil system capacity including filters			litre	36	
			US gal	9,5	
Oil sump capacity:		max	litre	30	
			US gal	7,9	
		min	litre	19	
			US gal	5,0	
Oil change intervals/specifications:	VDS 3		h	600	
	VDS 2		h	400	
			h		
Engine angularity limits:		front up	°	11	
		front down	°	11	
		side tilt	°	11	
Oil pressure at rated speed			kPa	370 - 520	
			psi	54 - 75	
Lubrication oil temperature in oil sump:		max	°C	130	
			°F	266	
Oil filter micron size			µ	40,000	

* See also general section in the sales guide

Fuel system		rpm	1500	1800
Standby Power	25%	g/kWh	238	253
Specific fuel consumption at:		lb/hph	0,386	0,410
	50%	g/kWh	221	214
		lb/hph	0,358	0,347
	75%	g/kWh	206	209
		lb/hph	0,334	0,339
	100%	g/kWh	195	200
		lb/hph	0,316	0,324
Prime Power	25%	g/kWh	242	258
Specific fuel consumption at:		lb/hph	0,392	0,418
	50%	g/kWh	222	217
		lb/hph	0,360	0,352
	75%	g/kWh	205	208
		lb/hph	0,332	0,337
	100%	g/kWh	192	199
		lb/hph	0,311	0,323

Fuel system	rpm	1500	1800
Fuel to conform to	ASTM-D975-No1 and 2D JIS KK 2204, EN 590		
System supply flow at:	litre/h	112,0	113,0
	US gal/h	29,6	29,9
Fuel supply line max restriction	kPa	30,0	30,0
(Measured at fuel inlet connection)	psi	4,4	4,4
Fuel supply line max pressure, engine stopped	kPa	0,0	0,0
	psi		
System return flow	litre/h	18,0	18,0
	US gal/h	4,8	4,8
Fuel return line max restriction	kPa	20,0	20,0
(Measured at fuel return connection)	psi	2,9	2,9
Maximum allowable inlet fuel temp	°C	60	60
(Measured at fuel inlet connection)	°F	140	140
Prefilter / Water separator micron size	µ	10,000	
Fuel filter micron size	µ	5,000	
Governor type/make, standard	Volvo / EMS 2.2		
Injection pump type/make	Delphi E3.18		

Intake and exhaust system			**rpm**	**1500**	**1800**
Air consumption at: (+25°C and 100kPa)	Standby Power		m^3/min cfm	24 848	26 918
	Prime Power		m^3/min cfm	23 812	26 918
Max allowable air intake restriction including piping			kPa psi	5 0,7	5 0,7
Air filter restriction clean Volvo Penta filter			kPa psi		
Heat rejection to exhaust at:		Standby Power	kW BTU/min	260 14786	280 15923
		Prime Power	kW BTU/min	236 13421	252 14331
Exhaust gas temperature after turbine at:		Standby Power	°C °F	501 934	502 936
		Prime Power	°C °F	476 889	457 855
Max allowable back pressure in exhaust line		Standby Power	kPa psi	10 1,5	10 1,5
		Prime Power	kPa psi	8 1,2	8 1,2
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)		Standby Power	m^3/min cfm	61,0 2154	65,0 2295
		Prime Power	m^3/min cfm	58,0 2048	61,0 2154

Cooling system			rpm	1500	1800
Heat rejection radiation from engine at:		Standby Power	kW BTU/min	13 739	9 512
		Prime Power	kW BTU/min	12 682	8 455
Heat rejection to coolant at:		Standby Power	kW BTU/min	162 9213	177 10066
		Prime Power	kW BTU/min	156 8872	164 9327
Radiator cooling system type				Closed circuit	
Standard radiator core area			m² foot²	0,8 8,61	
Fan diameter			mm in	890 35,04	
Fan power consumption			kW hp	14 19	24 33
Fan drive ratio				1.07:1	
Coolant capacity,	engine		litre US gal	20 5,28	
	engine with std radiator and hoses		litre US gal	24 6,34	
Coolant pump			drive/ratio	Belt / 1.43:1	
Coolant flow with standard system			l/s US gal/s	5 1,32	5,5 1,45
Minimum coolant flow			l/s US gal/s	5,0 1,32	5,0 1,32
Maximum outer circuit restriction, including piping			kPa psi	39 5,7	40 5,8
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	
Draw down capacity. The difference between min coolant level in the expansion tank and the lowest level where the engine's coolant system still is functioning			litre US gal	1,8 0,48	

Charge air cooler system		rpm	1500	1800
Heat rejection to charge air cooler	Standby Power	kW	82	84
		BTU/min	4663	4777
	Prime Power	kW	72	81
		BTU/min	4095	4606
Charge air mass flow	Standby Power	kg/s	0,49	0,53
	Prime Power	kg/s	0,47	0,52
Charge air inlet temp. (Charge air temp after turbo compressor)	Standby Power	°C	220	210
		°F	428	410
	Prime Power	°C	201	204
		°F	394	399
Charge air outlet temp. (Charge air temp after intercooler)	Standby Power	°C	52	45
		°F	126	113
	Prime Power	°C	51	43
		°F	124	109
Maximum pressure drop over charge air cooler incl. piping		kPa	8	
		psi	1,16	
Charge air pressure (After charge air cooler)		kPa	264	
		psi	38,29	
Standard charge air cooler core area		m²	0,89	
		foot²	9,58	

Cooling performance

Cooling air flow and external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm. (radiator and cooling fan, see optional equipment)

Engine speed rpm	Air on temp °C	PRIME POWER		STANDBY POWER	
		Air flow m^3/s	External restriction Pa	Air flow m^3/s	External restriction Pa
1500	40				
	53			6,3	290
	55	6,0	370	6,7	160
	57	6,5	225	7,1	0
	60	7,1	0		
1800	40	4,5	1350	5,0	1140
	50	4,9	1170	5,5	975
	55	5,6	940	6,2	685
	60	6,6	510	7,1	250
	61			7,7	0
	65	7,7	0		

Note! External restrictions are calculated for values >0 Pa

Engine management system

Functionality	Alternatives	Default setting
Governor mode	Isochronus / Droop	Isochronus
Governor droop	0-8 %	4,0
Governor response	Adjustable PID-constants (VODIA)	Standard
Dual speed	1500 / 1800 rpm	According to customer
Idle speed	600-1200 rpm	900 rpm
Fine speed adjustment	± 120 rpm	0,0
Stop function	Energized to Run / Stop	Energized to Stop
Preheating function	On / Off	On
Lamp test	On / Off	On

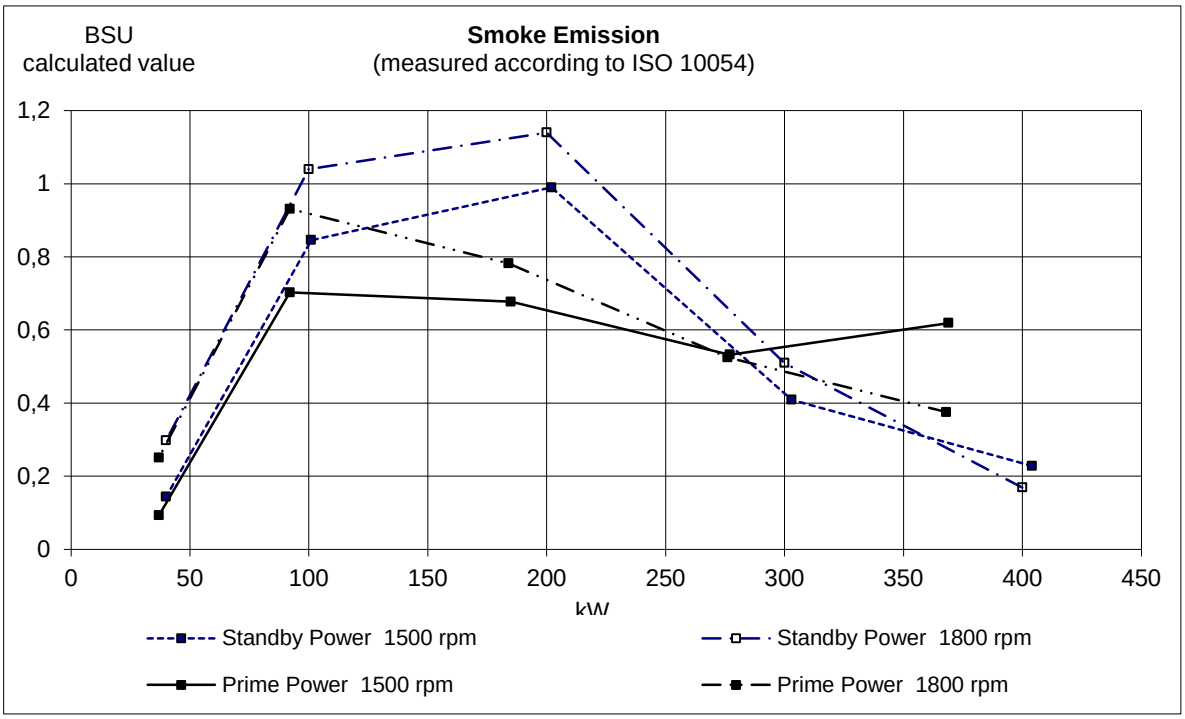
Engine sensor and switch settings

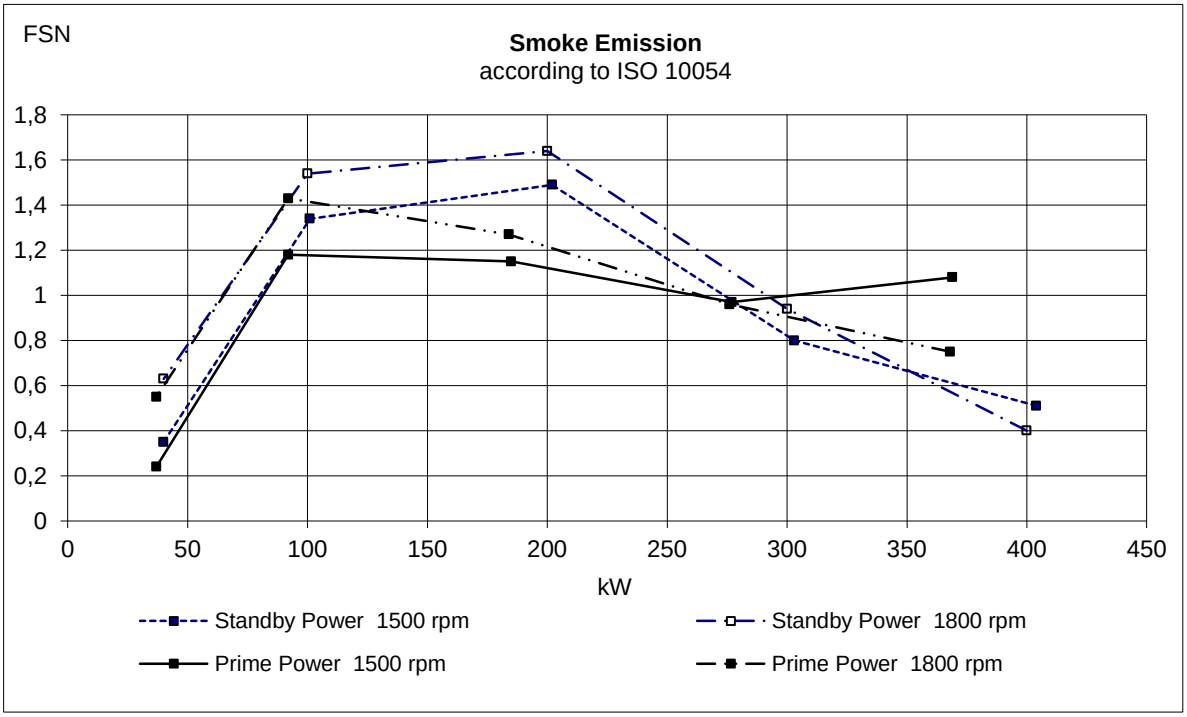
			Alarm level		Engine protection	
Parameter		**Unit**	**Setting range**	**Default setting**	**Level**	**Action. Default/Alternative**
Oil temp		°C	120 - 130	125	Setting +5	Shut down.
Oil pressure	Low idle	kPa	-	150,0	120,0	Shut down
	1500 rpm	kPa	-	250,0	220,0	Shut down
	1800 rpm	kPa	-	300,0	270,0	Shut down
Oil level			-	Min level	-	-
Piston cooling pressure >1000 rpm		kPa	-	150	150,0	Shut down
Coolant temp		°C	95 - 103	102	Setting +5	Shut down.
Coolant level			-	On	Low level	Shut down.
Fuel feed pressure	Low idle	kPa	-	150	-	-
	>1400 rpm		-	300	-	-
Water in fuel			-	High level	-	-
Crank case pressure		kPa	-	Increased Pressure	Increased Pressure	Shut down
Air filter pressure droop		kPa	-	5	-	-
		0,0	Alarm level		Engine protection	
Altitude, above sea		m	-	-	-	Automatic derating, see section derating
Charge air temp		°C	-	80	85,0	
Charge air pressure		kPa	-	310	320,0	
Engine speed		rpm	100 - 120% of rated speed	120%	Alarm level	Shut down.
Engine protection can be disabled. For consequences please see VP International Limited Warranty Policy						

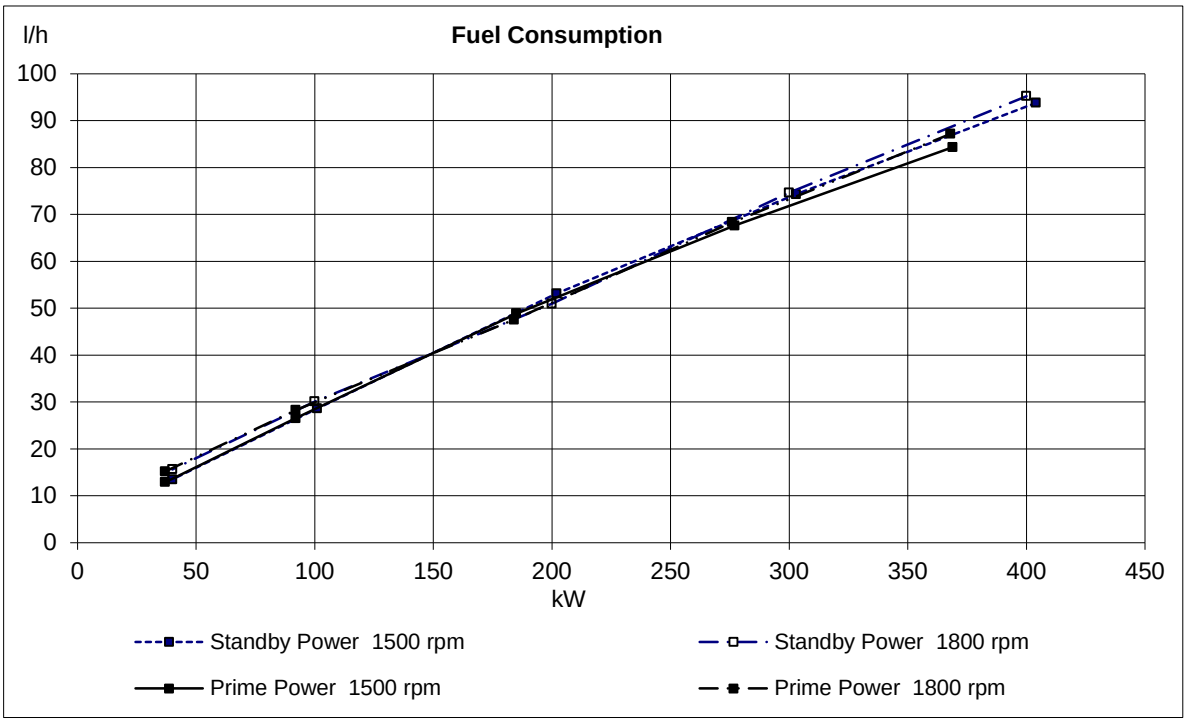
Electrical system

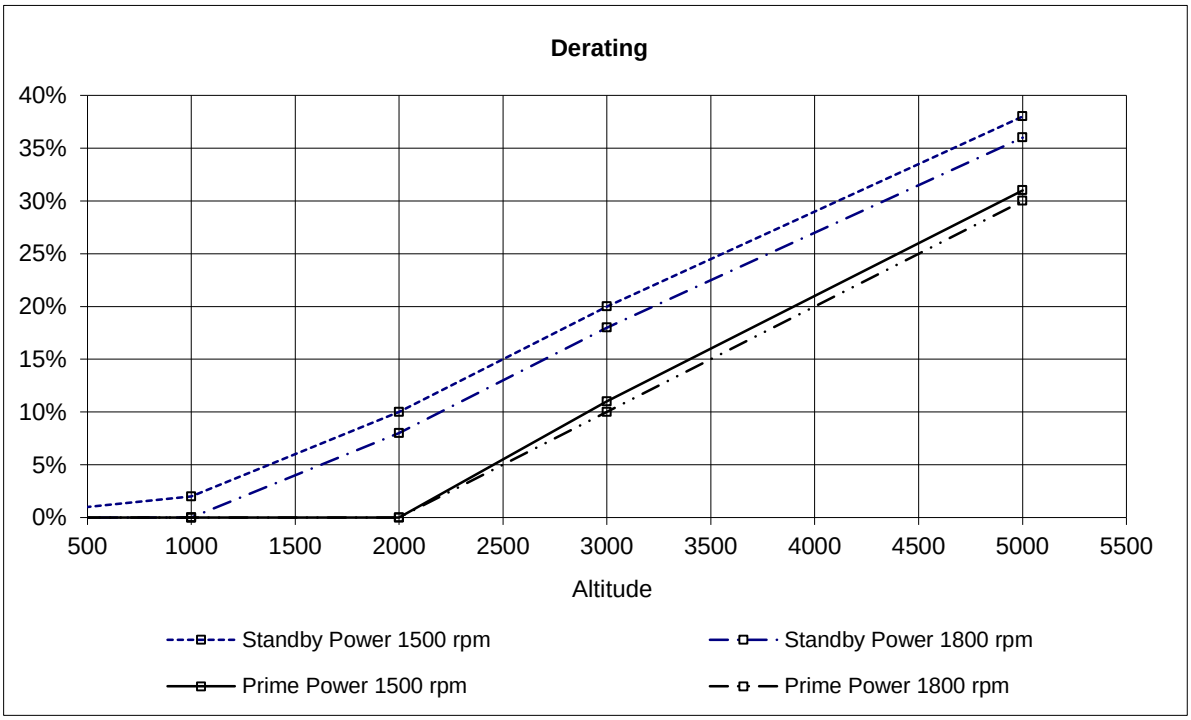
Voltage and type		24 V / insulated from earth	
Alternator:	make/output	A	Bosch / 80
	tacho output	Hz/alt. Rev	6
	drive ratio		5.3 : 1
Starter motor		make	Melco
		type	105 P70
		kW	7,0
Number of teeth on:	flywheel		153
	starter motor		12
Max wiring resistance main circuit		mΩ	2
Cranking current at +20°C		A	280
Crank engine speed at 20°C		rpm	155
Starter motor battery capacity:	max	Ah/A	2x225
	min at +5°C	Ah/A	-
Inlet manifold heater (at 20 V)		kW	4,0
Power relay for the manifold heater		A	1

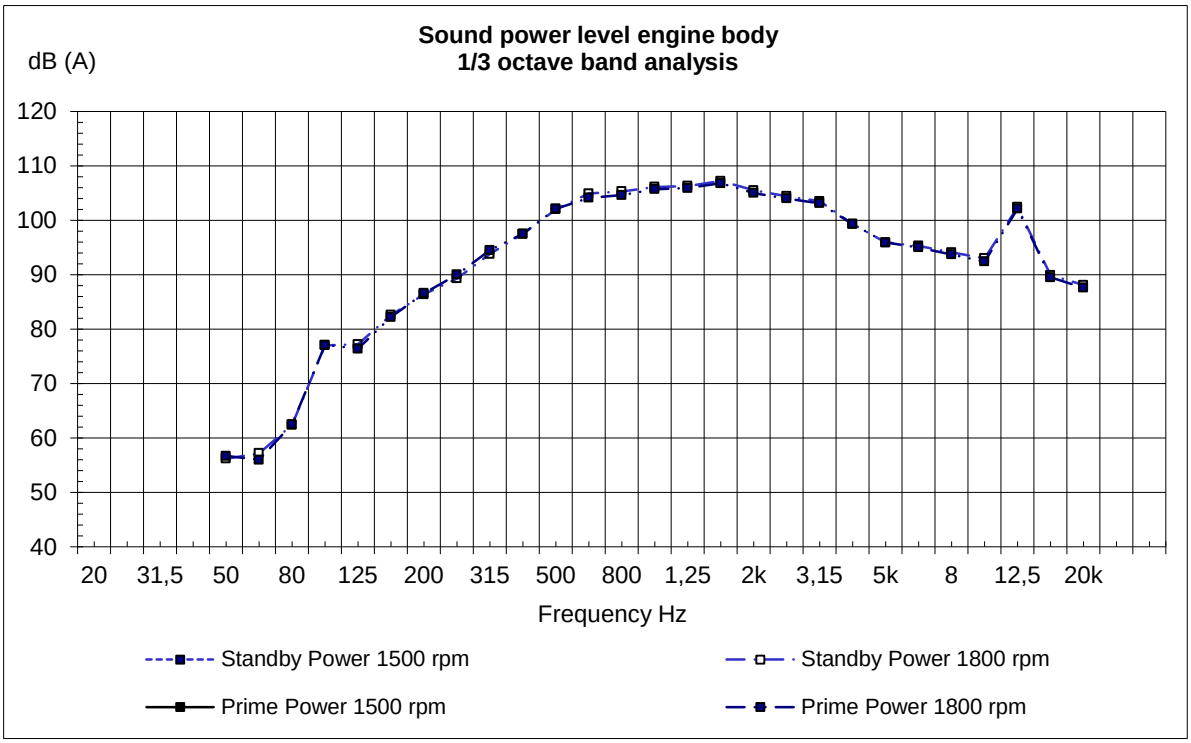
Power take off		**rpm**	**1500**	**1800**
Front end in line with crank shaft max:		Nm lbft	-	
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW hp	-	-
	max down	kW hp	-	-
	max right	kW hp	-	-
Timing gear at compressor PTO max:		Nm lbft	160 118	
Speed ratio direction of rotation viewed from flywheel side			1.31:1/ccw	
Timing gear at servo pump PTO max:		Nm lbft	100 74	
Speed ratio direction of rotation viewed from flywheel side			1,75:1/ccw	
Timing gear at hydraulic pump PTO max:		Nm lbft	-	
Speed ratio direction of rotation viewed from flywheel side				
Max allowed bending moment in flywheel housing		Nm lbft	15000 11063	
Max. rear main bearing load		N lbf	4000 899,2	

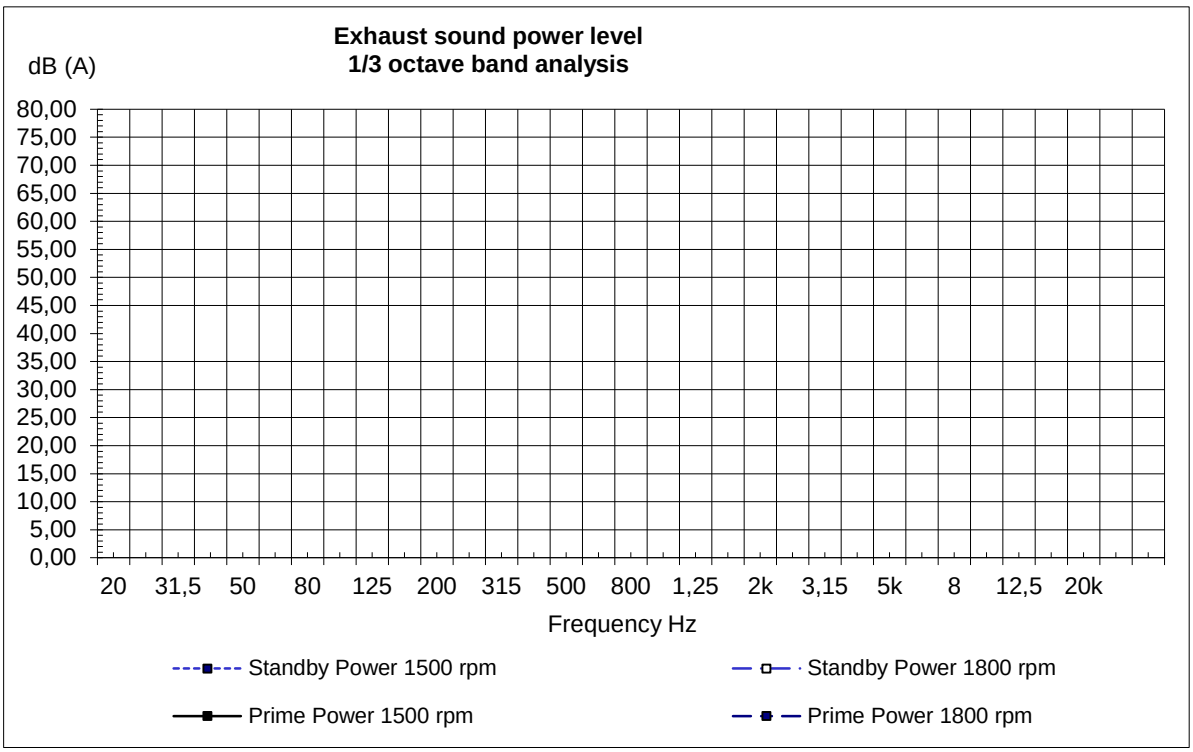

BSU
calculated value
Smoke Emission
(measured according to ISO 10054)
1,2
1
0,8
0,6
0,4
0,2
0
0
50
100
150
200
250
300
350
400
450
kW
Standby Power 1500 rpm
Standby Power 1800 rpm
Prime Power 1500 rpm
Prime Power 1800 rpm

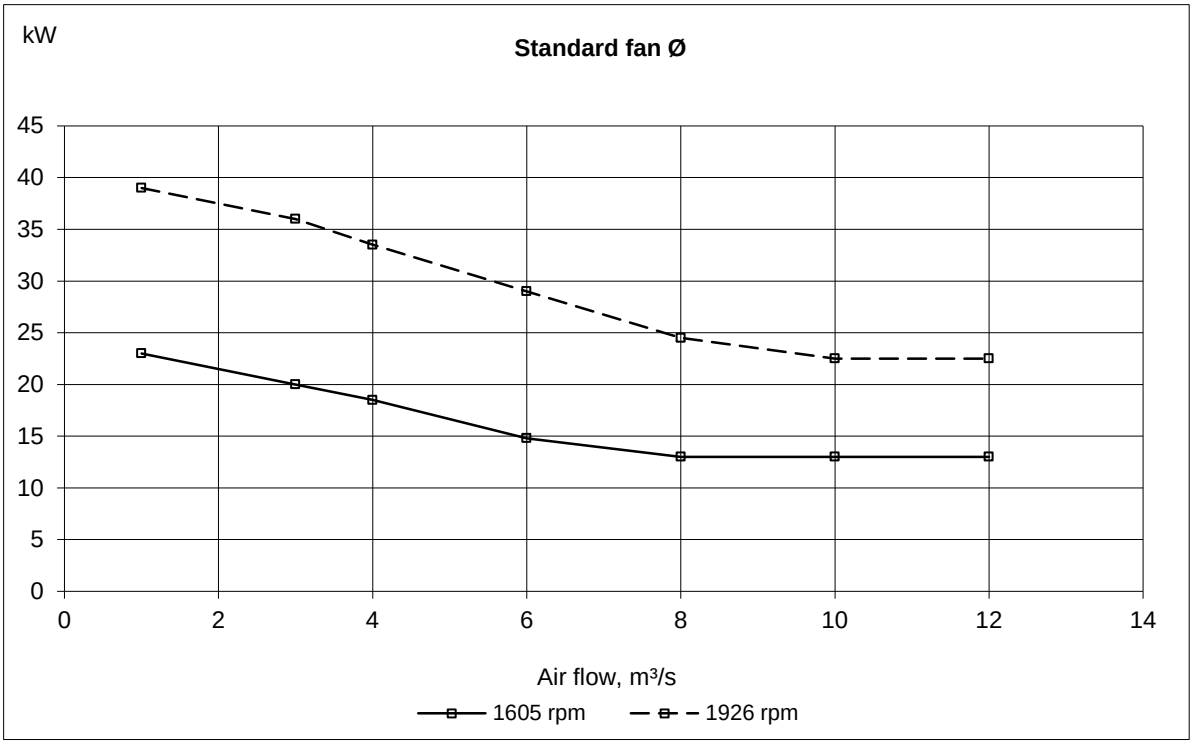

FSN
Smoke Emission
according to ISO 10054
1,8
1,6
1,4
1,2
1
0,8
0,6
0,4
0,2
0
0
50
100
150
200
250
300
350
400
450
kW
Standby Power 1500 rpm
Standby Power 1800 rpm
Prime Power 1500 rpm
Prime Power 1800 rpm

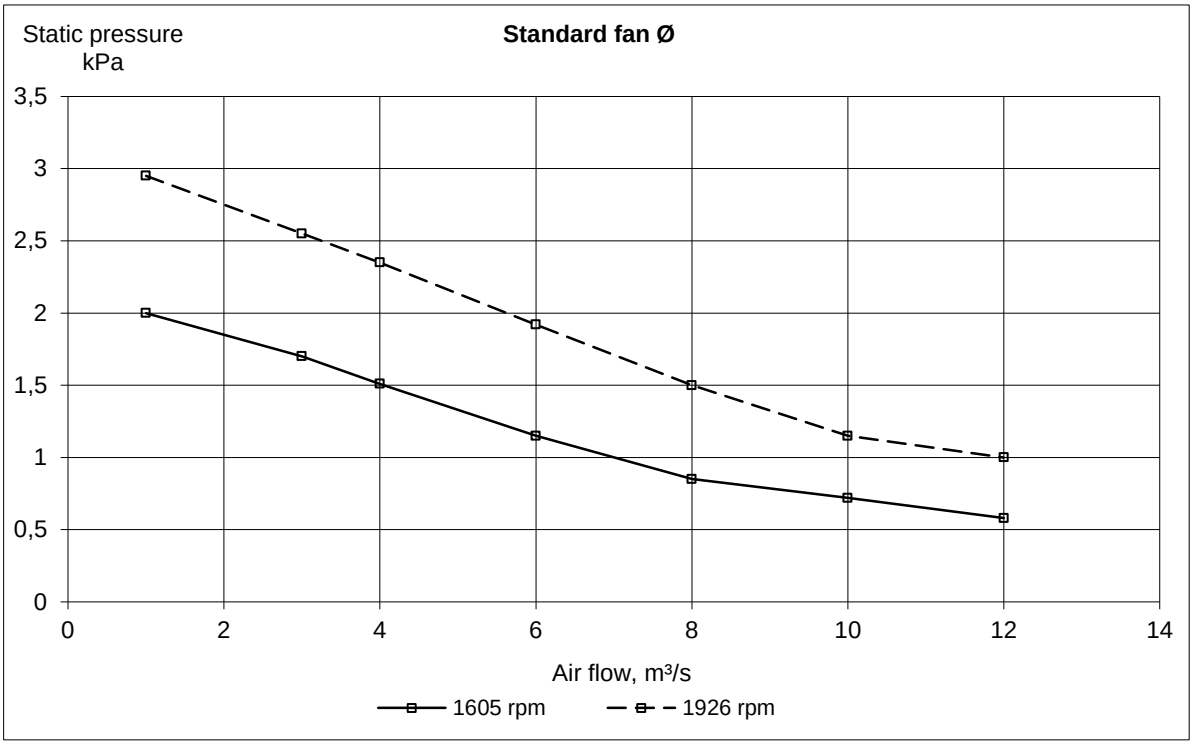

Fuel Consumption
l/h
100
90
80
70
60
50
40
30
20
10
0
0
50
100
150
200
250
300
350
400
450
kW
Standby Power 1500 rpm
Standby Power 1800 rpm
Prime Power 1500 rpm
Prime Power 1800 rpm

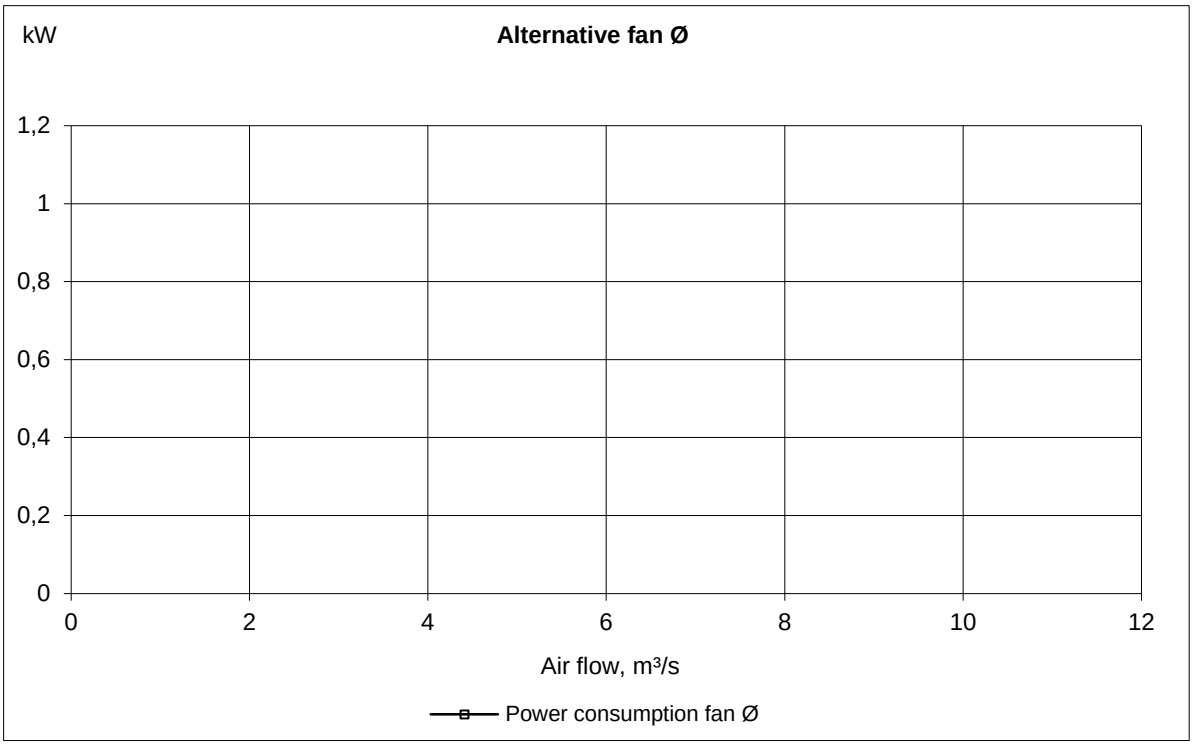

Derating
40%
35%
30%
25%
20%
15%
10%
5%
0%
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
Altitude
Standby Power 1500 rpm
Standby Power 1800 rpm
Prime Power 1500 rpm
Prime Power 1800 rpm

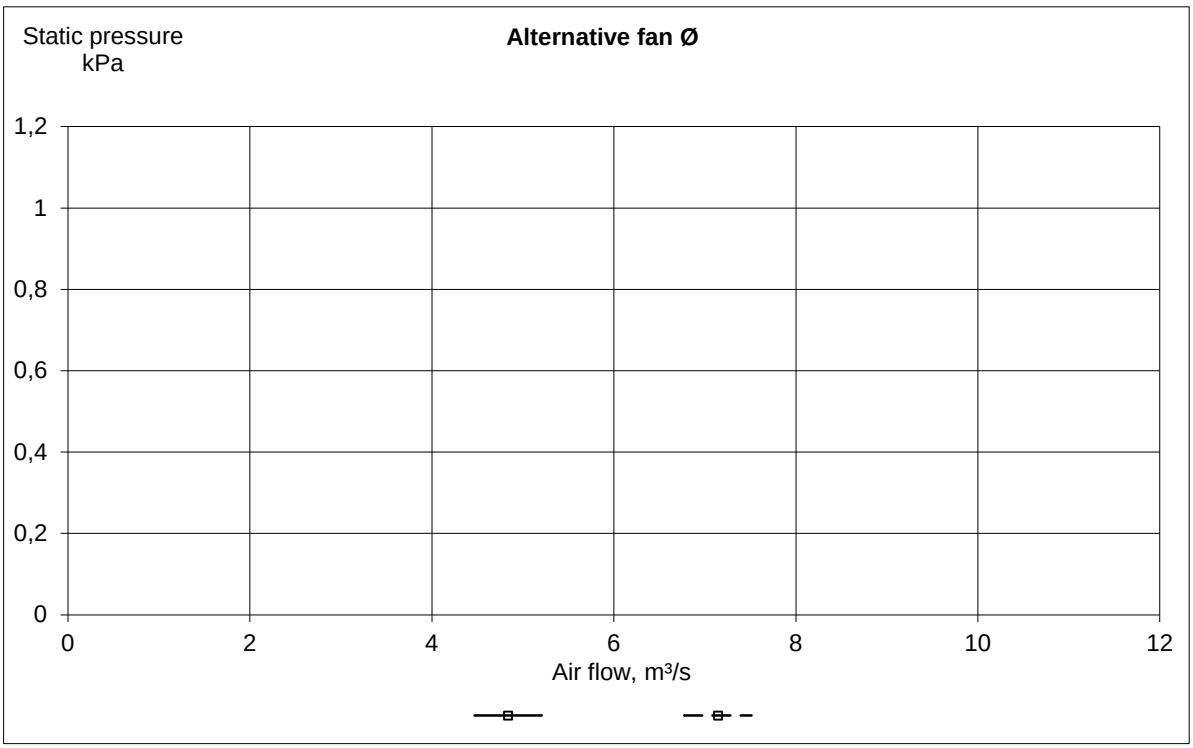

Sound power level engine body
1/3 octave band analysis
dB (A)
120
110
100
90
80
70
60
50
40
20
31,5
50
80
125
200
315
500
800
1,25
2k
3,15
5k
8
12,5
20k
Frequency Hz
Standby Power 1500 rpm
Standby Power 1800 rpm
Prime Power 1500 rpm
Prime Power 1800 rpm


Exhaust sound power level
1/3 octave band analysis
dB (A)
80,00
75,00
70,00
65,00
60,00
55,00
50,00
45,00
40,00
35,00
30,00
25,00
20,00
15,00
10,00
5,00
0,00
20
31,5
50
80
125
200
315
500
800
1,25
2k
3,15
5k
8
12,5
20k
Frequency Hz
Standby Power 1500 rpm
Standby Power 1800 rpm
Prime Power 1500 rpm
Prime Power 1800 rpm


kW
Standard fan Ø
45
40
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
14
Air flow, m³/s
1605 rpm
1926 rpm


Static pressure
kPa
Standard fan Ø
3,5
3
2,5
2
1,5
1
0,5
0
0
2
4
6
8
10
12
14
Air flow, m³/s
1605 rpm
1926 rpm


kW
Alternative fan Ø
1,2
1
0,8
0,6
0,4
0,2
0
0
2
4
6
8
10
12
Air flow, m³/s
Power consumption fan Ø


Static pressure
kPa
Alternative fan Ø
1,2
1
0,8
0,6
0,4
0,2
0
0
2
4
6
8
10
12
Air flow, m³/s