VOLVO PENTA	Document No	Issue Index
TWD1653GE	**22415004**	**04**

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 ⚠ e 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.

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	16,12 983,9
Firing order			1-5-3-6-2-4
Bore		mm in	144 5,67
Stroke		mm in	165 6,50
Compression ratio			16.5:1
Wet weight (Not including after treatment system)	Engine only	kg lb	1755 3869
	Engine incl. cooling system and air filtration system	kg lb	2065 4553
	Engine incl. cooling system, air filtration system, and frame	kg lb	2605 5743

Performance			**rpm**	**1500**	**1800**
Prime Power		without fan	kW hp	564 767	N/A
		with fan	kW hp	547 744	
Standby Power		without fan	kW hp	621 845	N/A
		with fan	kW hp	604 821	
Torque at:	Prime Power		Nm lbft	3591 2648	N/A N/A
	Standby Power		Nm lbft	3953 2916	N/A N/A
Power tolerance			%	+5 / -1	
Mean piston speed			m/s ft/sec	8,3 27,1	
Effective mean pressure at:	Prime Power		MPa psi	2,8 406	
Effective mean pressure at:	Standby Power		MPa psi	3,1 447	
Max combustion pressure at:	Prime Power		MPa psi	20,5 2973	N/A
Max combustion pressure at:	Standby Power		MPa psi	21 3046	N/A
Total mass moment of inertia, J (mR^2)			kgm^2 $lbft^2$	4,20 99,7	
Friction Power			kW hp	38 51,68	N/A
Derating due to altitude - 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)	131	N/A
	Prime Power		dB(A)	130	N/A
	Standby Power		dB(A)	131	N/A
Calculated sound pressure Lp at 1 m	No load		dB(A)	114	N/A
	Prime Power		dB(A)	114	N/A
	Standby Power		dB(A)	114	N/A

Unsilenced exhaust noise

Data calculated as sound pressure Lp.

Assumed microphone distance 1 m	rpm	1500	1800
Prime Power	dB(A)	116	N/A
Standby Power	dB(A)	117	N/A

Test conditions for load acceptance data

Warm engine.	**Generator**		**Model**		**Type of AVR**	
	Stamford		HCI534F1		MX341	
AVR Settings	UFRO (Hz):	57	DIP (%)*:		DWELL (%)*:	
	Stability (%)*:		Voltage (V):	400	Load factor:	1.0

Applies to Stamford nomenclature,

(%)* : % of max potentiometer setting range

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

Abbreviation:	**Full name:**	**Descriptions**
AVR	Automatic Voltage Regulator	Generator performance and safty control unit
UFRO	Under Frequency Roll Off	Overheating protection at under frequency
DIP		Controls the slope of voltage drop when the UFRO is active
DWELL		Controls the slope of voltage recovery when the UFRO is active.

Single step load performance at 1500 rpm - PRIME (Resistiv load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20									
0-40									
0-48									
0-60									
0-65									
0-80									
0-100									
100-0									

TBD

Single step load performance at 1500 rpm - STAND BY (Resistiv load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20									
0-40									
0-44									
0-59									
0-60									
0-80									
0-98									
98-0									

TBD

Single step load performance at 1800 rpm - PRIME (Resistiv load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20	N/A	N/A	N/A	N/A	20-100	N/A	N/A	N/A	N/A
0-40	N/A	N/A	N/A	N/A	40-100	N/A	N/A	N/A	N/A
0-50	N/A	N/A	N/A	N/A	50-100	N/A	N/A	N/A	N/A
0-60	N/A	N/A	N/A	N/A	60-100	N/A	N/A	N/A	N/A
0-x	7 (G3)	N/A	N/A	N/A	x-100	N/A	N/A	N/A	N/A
0-x	10 (G2)	N/A	N/A	N/A	x-100	N/A	N/A	N/A	N/A
0-80*	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
0-100*	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
100-0	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Single step load performance at 1800 rpm - STAND BY (Resistiv load)

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time (s)
0-20	N/A	N/A	N/A	N/A	20-100	N/A	N/A	N/A	N/A
0-40	N/A	N/A	N/A	N/A	40-100	N/A	N/A	N/A	N/A
0-50	N/A	N/A	N/A	N/A	50-100	N/A	N/A	N/A	N/A
0-60	N/A	N/A	N/A	N/A	60-100	N/A	N/A	N/A	N/A
0-x	7 (G3)	N/A	N/A	N/A	x-100	N/A	N/A	N/A	N/A
0-x	10 (G2)	N/A	N/A	N/A	x-100	N/A	N/A	N/A	N/A
0-80*	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
0-100*	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A
100-0	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A

Cold start performance			**rpm**	**1500**	**1800**
Time from start to stay within 0.5% of no load speed at ambient temperature:	°C	20	s	4,2	N/A
		5	s	6,8	N/A
		-15 *	s	4,8	N/A
		-30 **	s	21,0	N/A
		Min start temp*	°C	-31,0	

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

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

Block heater type	Make	Power kW	Engaged hours	Cooling water temp engine block
	Volvo Penta no: 889858	2	10	16°C 61°F

Lubrication system			rpm	1500	1800
Lubricating oil consumption	Prime Power		litre/h US gal/h	0,05 0,013	N/A
	Standby Power		litre/h US gal/h	0,05 0,013	N/A
Oil system capacity including filters			litre US gal	48 12,7	
Oil sump capacity:		max	litre US gal	42 11,1	
		min	litre US gal	32 8,5	
Oil change intervals/specifications:	VDS-3		h	500	
			h		
			h		
Engine angularity limits:		front up	°	30	
		front down	°	30	
		side tilt	°	30	
Oil pressure at rated speed			kPa psi	365-515	
Lubrication oil temperature in oil sump:		max	°C °F	130 266	
Oil filter micron size			µ	0,040	

* See also general section in the sales guide

Fuel system		rpm	1500	1800
Prime Power Specific **fuel** consumption at:	25%	g/kWh lb/hph	225 0,365	N/A
	50%	g/kWh lb/hph	209 0,339	N/A
	75%	g/kWh lb/hph	211 0,342	N/A
	100%	g/kWh lb/hph	208 0,337	N/A
% adBlue consumption at: (Compare to Fuel consumption by Volyme)	25%	%	N/A	N/A
	50%	%	N/A	N/A
	75%	%	N/A	N/A
	100%	%	N/A	N/A
Standby Power Specific **fuel** consumption at:	25%	g/kWh lb/hph	226 0,366	N/A
	50%	g/kWh lb/hph	210 0,340	N/A
	75%	g/kWh lb/hph	212 0,344	N/A
	100%	g/kWh lb/hph	204 0,331	N/A
% adBlue consumption at: (Compare to Fuel consumption by Volyme)	25%	%	N/A	N/A
	50%	%	N/A	N/A
	75%	%	N/A	N/A
	100%	%	N/A	N/A

Fuel system	rpm	1500	1800
Fuel to conform to	ASTM-D975-1D and 2D, JIS KK 2204, EN 590		
System supply flow at:	litre/h US gal/h	190,0 50,2	N/A
Fuel supply line max restriction (Measured at fuel inlet connection)	kPa psi	10,0 1,5	N/A
Fuel supply line max pressure, engine stopped	kPa psi	0,0	N/A
System return flow	litre/h US gal/h	25,0 6,6	N/A
Fuel return line max restriction (Measured at fuel return connection)	kPa psi	20,0 2,9	N/A
Maximum allowable inlet fuel temp (Measured at fuel inlet connection)	°C °F	60 140	N/A
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		

Intake and exhaust system			rpm	1500	1800
Air consumption at: (+25°C and 100kPa)	Prime Power		m^3/min cfm	42 1483	N/A
	Standby Power		m^3/min cfm	44 1554	N/A
⚠ **See front page for important information** Max allowable air intake restriction including piping			kPa psi	3 0,4	N/A
Air filter restriction clean Volvo Penta filter			kPa psi	1,4 0,2	N/A
Heat rejection to exhaust at:		Prime Power	kW BTU/min	430 24454	N/A
		Standby Power	kW BTU/min	450 25591	N/A
Exhaust gas temperature after turbine at:		Prime Power	°C °F	453 847	N/A
		Standby Power	°C °F	470 878	N/A
⚠ **See front page for important information** Max allowable back pressure in exhaust line (after turbine) Pipe dimension Ø: 23 mm		Prime Power	kPa psi	10 1,5	N/A
		Standby Power	kPa psi	10 1,5	N/A
⚠ **See front page for important information** Max allowable temperature drop between turbine and SCR muffler inlet.		Prime Power	Δ°C Δ°F	N/A	N/A
		Standby Power	Δ°C Δ°F	N/A	N/A
SCR muffler pressure drop (at exhaust gas flow and exhaust temp given)		Prime Power	kPa psi	N/A	N/A
		Standby Power	kPa psi	N/A	N/A
Pre-catalyst pressure drop		Prime Power	kPa psi	N/A	N/A
		Standby Power	kPa psi	N/A	N/A
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)		Prime Power	m^3/min cfm	105,0 3708	N/A
		Standby Power	m^3/min cfm	107,0 3779	N/A

Cooling system			rpm	1500	1800
Heat rejection radiation from engine at:		Prime Power	kW BTU/min	23 1308	N/A
		Standby Power	kW BTU/min	26 1479	N/A
Radiator cooling system type				Closed circuit	
Standard radiator core area			m² foot²	1,7 18,30	
Fan diameter			mm in	965 37,99	
Fan power consumption			kW hp	17 23	N/A
Fan drive ratio				1.04:1	
Coolant capacity,	engine only		litre US gal	33 8,72	
	CACs (Charge Air Coolers)		litre US gal	10 2,64	
	coolant radiators incl piping, engine circuit		litre US gal	48 12,68	
	coolant radiators incl piping, CAC-circuit		litre US gal	48 12,68	
	expansion tank, engine circuit		litre US gal	20 5,28	
	expansion tank, CAC circuit		litre US gal	7 1,85	
Coolant pump			drive/ratio	Belt / 1.85:1	
Coolant pump, CAC circuit			drive/ratio	Belt / 2,29:1	
Thermostat, engine circuit		start to open	°C °F	82 180	
		fully open	°C °F	92 198	
Thermostat, CAC circuit		start to open	°C °F	40 104	
		fully open	°C °F	52 126	
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	
Charge air pressure (after charge air coolers)			kPa psi	480 69,6	
See front page for important information					
Max allowable Charge air outlet temp. (Charge air temp after intercooler)	Prime Power		°C °F	48 118	N/A
	Standby Power		°C °F	50 122	N/A

OEM cooling system design:

- move of standard radiatorts		**rpm**	**1500**	**1800**
Maximum additional coolant, engine circuit, with standard expansion tank		litre US gal	15 3,96	
Maximum additional coolant, CAC circuit with standard expansion tank		litre US gal	5 1,32	
Maximum distans in vertikal direction with standard pressure cap (75 kPa)		m ft	2 6,56	
Maximum additional pressure drop due to move		KPa psi	10 1,5	
- replacement of standard radiators				
Heat rejection to coolant **engine radiator** at:	Prime Power	kW BTU/min	203 11544	
	Standby Power	kW BTU/min	215 12227	
Heat rejection to coolant **CAC radiator** at:	Prime Power	kW BTU/min	163 9270	
	Standby Power	kW BTU/min	176 10009	
Minimum coolant flow **engine radiator** (at fully open thermostat)		litre/s US gal/s	4,8 1,27	N/A
Minimum coolant flow **CAC radiator** (at fully open thermostat)		litre/s US gal/s	2 0,53	N/A
Maximum coolant pressure drop over **engine radiator** incl. Piping (at coolant flow above)		kPa psi	45 6,5	N/A
Maximum coolant pressure drop over **CAC radiator** incl. Piping (at coolant flow above)		kPa psi	40 5,8	N/A
Coolant pressure drop over complete engine circuit cooling system (at coolant flow above)		kPa psi	110 16,0	N/A
Coolant pressure drop over complete CAC circuit cooling system (at coolant flow above)		kPa psi	87 12,6	N/A
Nominal coolant pressure before engine circuit coolant pump		kPa psi	30 4,4	N/A
Nominal coolant pressure before CAC circuit coolant pump		kPa psi	30 4,4	N/A

Cooling performance

Standard fan: Fan ratio: 1 : 1.04 Fan type: FIX

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

Engine speed rpm	Air on temp °C	PRIME POWER		STANDBY POWER	
		Air flow kg/s	External restriction Pa	Air flow kg/s	External restriction Pa
1500	68	12,0	0		
	66	11,3	100	11,9	0
	65	10,7	200		
	64	10,0	300	11,3	100
	63			10,4	200
	62			10,0	300
1800	N/A	N/A	N/A	N/A	N/A

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)	Not adjusted
Dual speed	Single speed 1500rpm	1500,0
Idle speed	600-1200	900,0
Fine speed adjustment	+/-40	0,0
Stop function	Energized to run/stop	Energized to Stop
Preheating function	On / Off	Off
Lamp test	On / Off	On

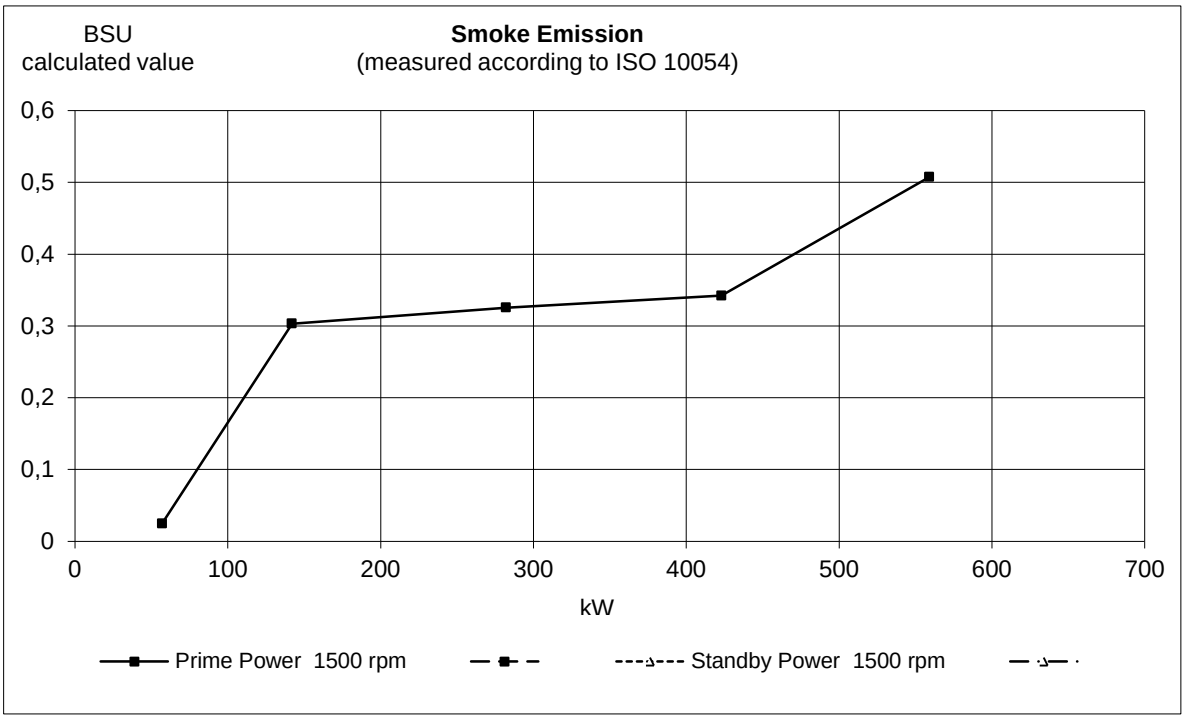
Engine sensor and switch settings

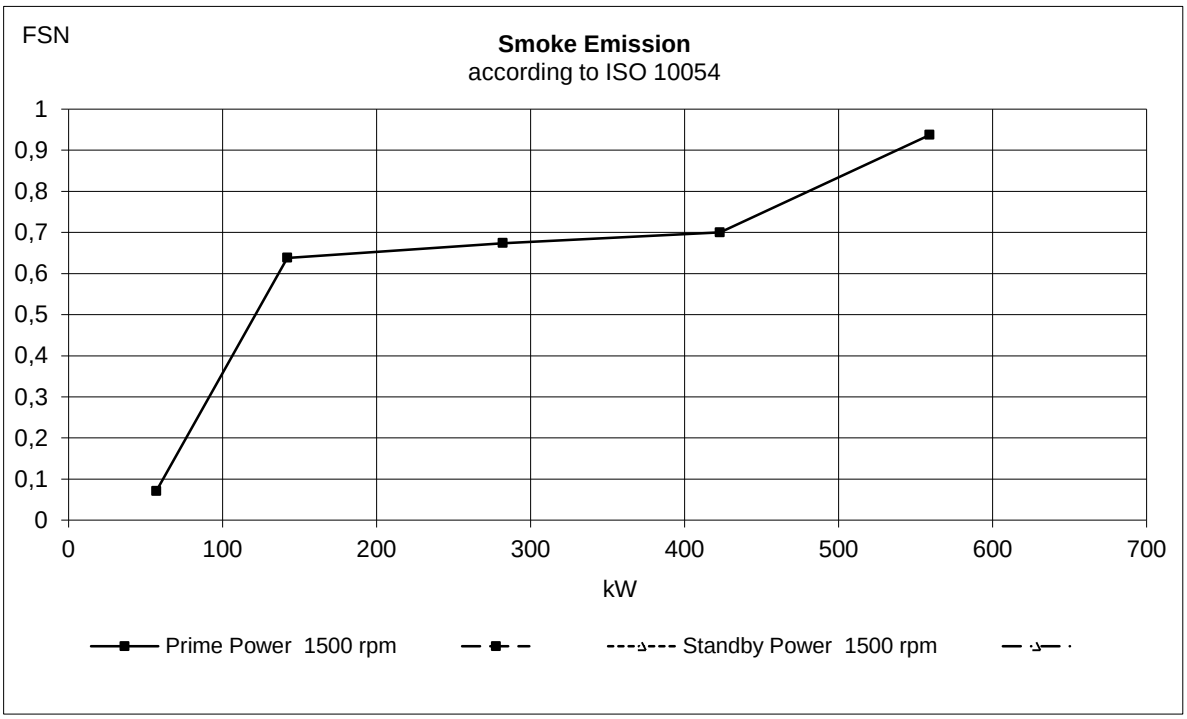
			Alarm level		Engine protection	
Parameter		**Unit**	**Setting range**	**Default setting**	**Level**	**Action. Default/Alternative**
Oil temp		°C	120 - 130	125	Setting +5	Shut down.
Oil pressure	Low idle	kPa	-	190,0	165,0	Shut down
	1500 rpm	kPa	-	300,0	275,0	Shut down
	1800 rpm	kPa	-	-	-	
Oil level			-	Min level	Low level	Shut down.
Piston cooling pressure >1000 rpm		kPa	N/A	N/A	N/A	N/A
Coolant temp		°C	95 - 103	103	Setting +5	Shut down.
Coolant level			See cooling system	On	Low level	Shut down.
Fuel feed pressure	Low idle	kPa		150		-
	>1400 rpm			250		-
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	Shut down
Charge air pressure		kPa	-	30 above demand	40 above demand	Shut down
Engine speed		rpm	100 - 120% of rated speed	115% of rated speed	Alarm level	-
Engine protection can be disabled. For consequences please see VP International Limited Warranty Policy						

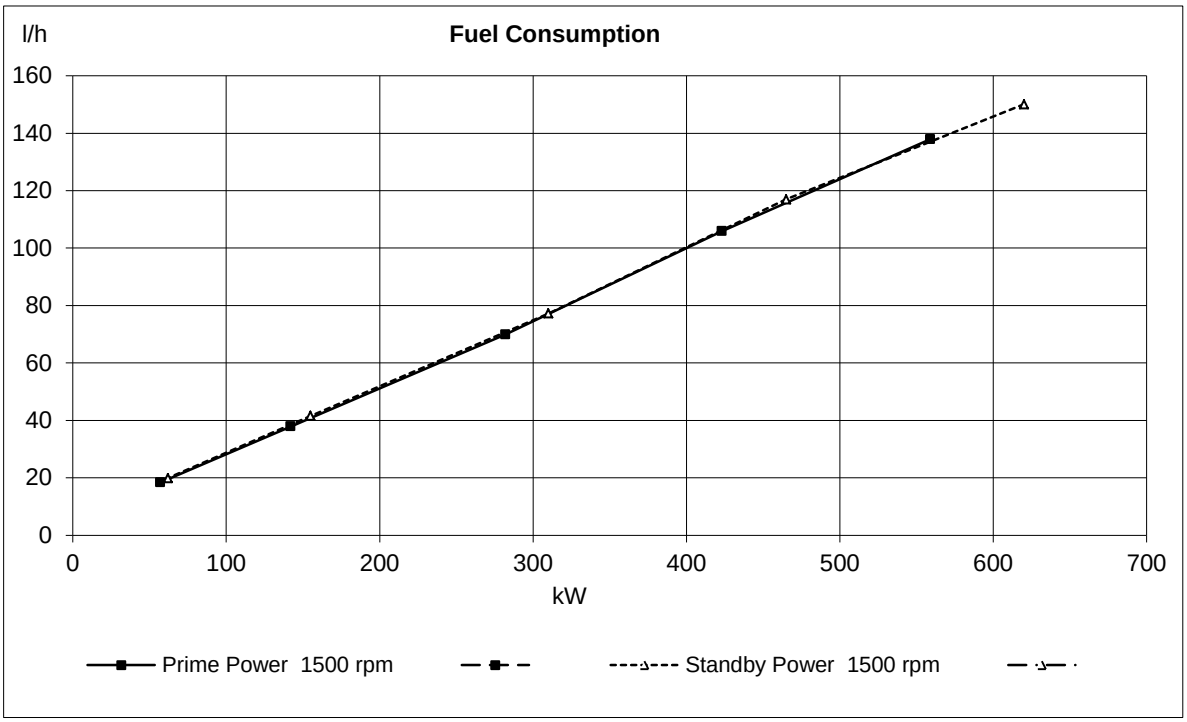
Electrical system

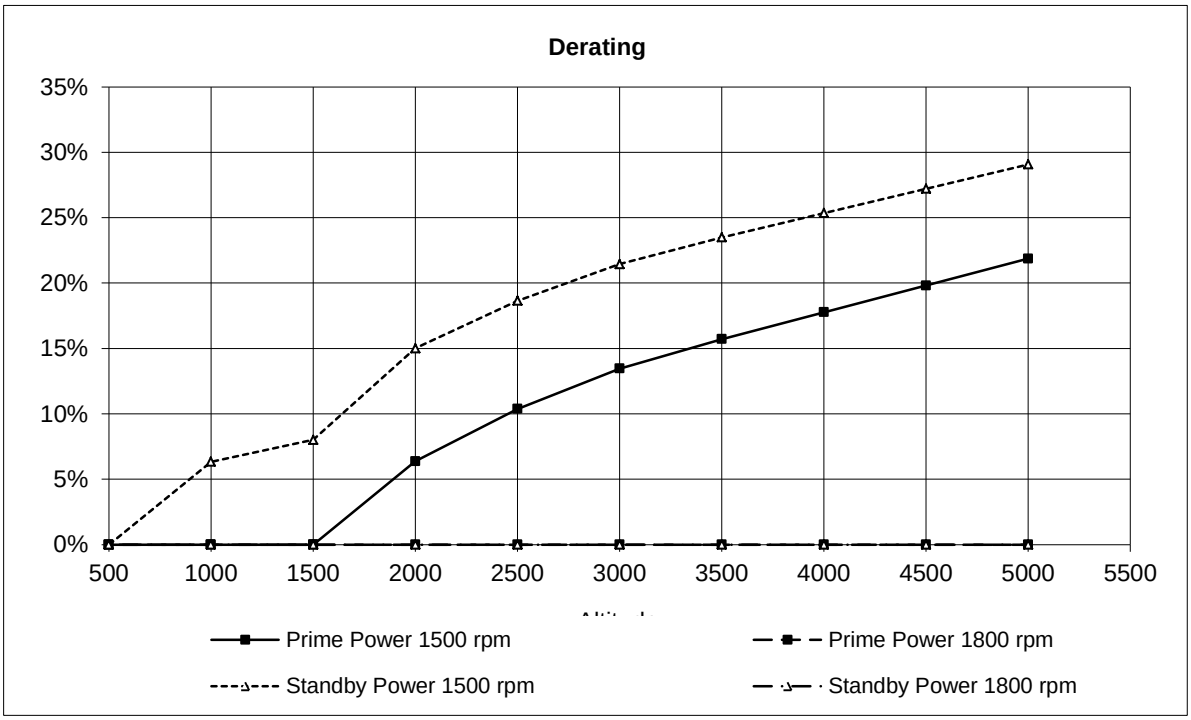
Voltage and type		24V / insulated from earth	
Alternator:	make/output	A	Bosch / 80
	tacho output	Hz/alt. Rev	6
	drive ratio		3.9 : 1
Starter motor		make	Melco
		type	105P70
		kW	7,0
Number of teeth on:	flywheel		153
	starter motor		12
Max wiring resistance main circuit		mΩ	-
Cranking current at +20°C		A	300
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

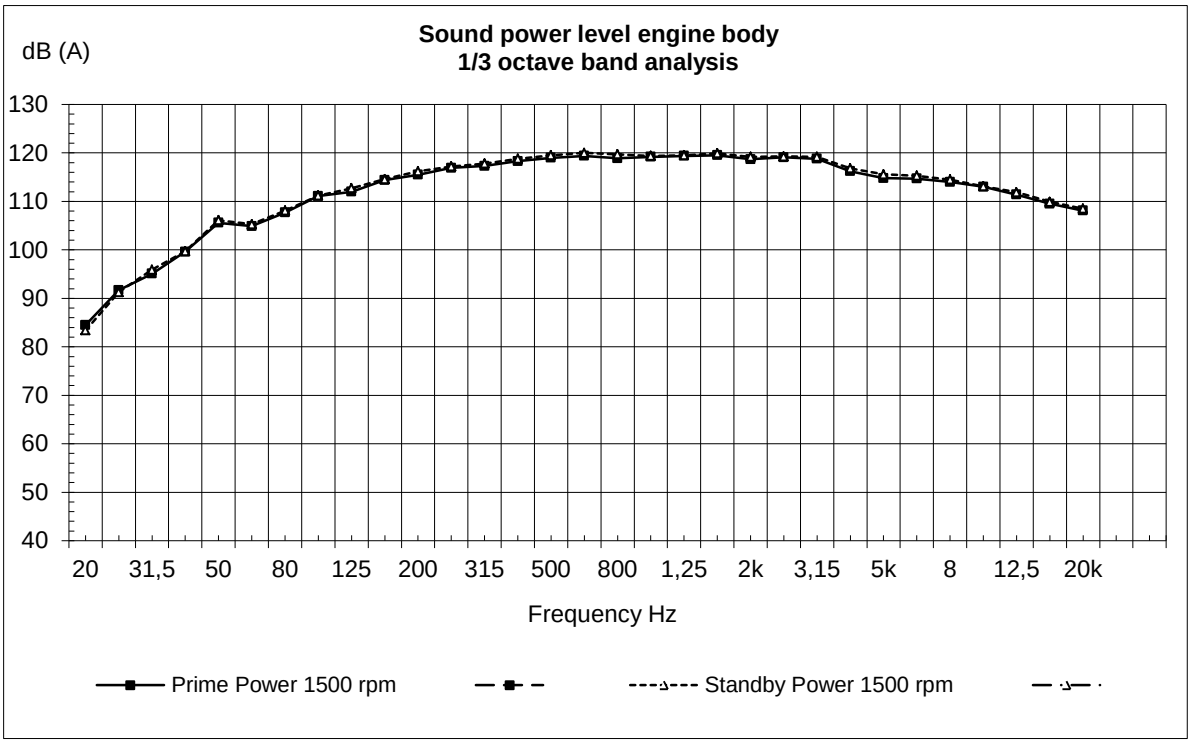
Power take off		**rpm**	**1500**	**1800**
Front end in line with crank shaft max:		Nm lbft	-	
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW hp	-	-
	max down	kW hp	-	-
	max right	kW hp	-	-
Timing gear at compressor PTO max:		Nm lbft	160 118	
Speed ratio direction of rotation viewed from flywheel side		1.31 : 1 / anti-clockwise		
Timing gear at servo pump PTO max:		Nm lbft	100 74	
Speed ratio direction of rotation viewed from flywheel side				
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	N/A	

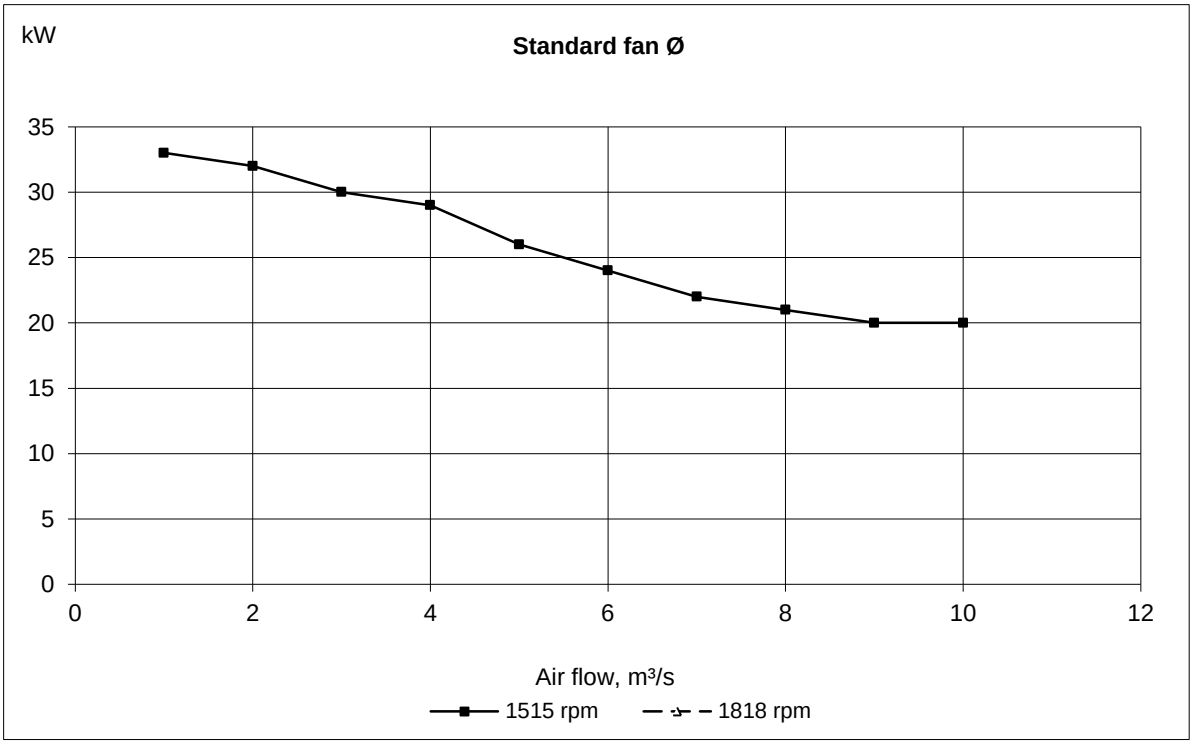

BSU
calculated value
Smoke Emission
(measured according to ISO 10054)
0,6
0,5
0,4
0,3
0,2
0,1
0
0
100
200
300
400
500
600
700
kW
Prime Power 1500 rpm
Standby Power 1500 rpm

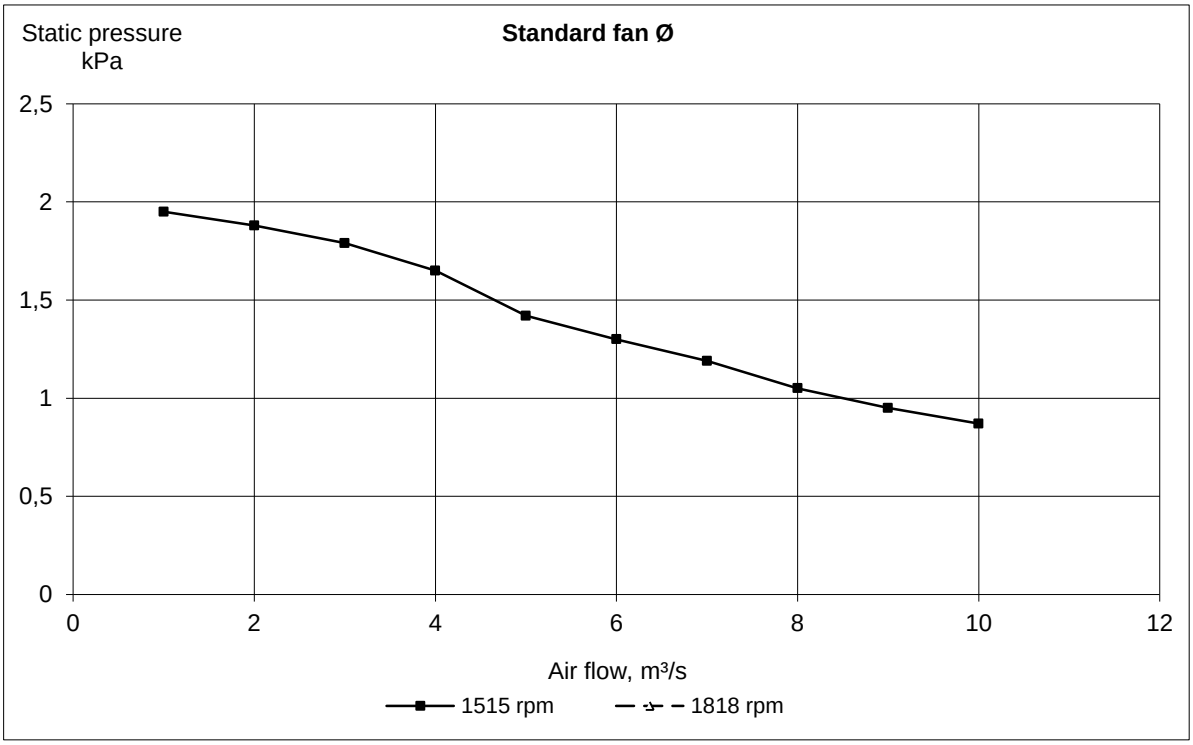

FSN
Smoke Emission
according to ISO 10054
1
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
0
100
200
300
400
500
600
700
kW
Prime Power 1500 rpm
Standby Power 1500 rpm


Fuel Consumption
l/h
160
140
120
100
80
60
40
20
0
0
100
200
300
400
500
600
700
kW
Prime Power 1500 rpm
Standby Power 1500 rpm


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


Sound power level engine body
1/3 octave band analysis
dB (A)
130
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
Prime Power 1500 rpm
Standby Power 1500 rpm


kW
Standard fan Ø
35
30
25
20
15
10
5
0
0
2
4
6
8
10
12
Air flow, m³/s
1515 rpm
1818 rpm


Static pressure
kPa
Standard fan Ø
2,5
2
1,5
1
0,5
0
0
2
4
6
8
10
12
Air flow, m³/s
1515 rpm
1818 rpm