General / HE

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			18.5
Dry weight	Engine only, excluding cooling system	kg lb	1540 3395
	Genset, see dimension drawing	kg lb	

Performance		**rpm** **load**	**1500** **25%**	**50%**	**75%**	**100%**	**110%**
Power setting 360 kW		kW hp	90 122	180 245	270 367	360 490	396 539
Power setting 360 kW		kW hp	90 122	180 245	270 367	360 490	396 539
Torque at:	Power setting 360 kW	Nm lbft	573 423	1146 845	1719 1268	2292 1690	2521 1859
	Power setting 360 kW	Nm lbft	573 423	1146 845	1719 1268	2292 1690	2521 1859
Mean piston speed		m/s ft/sec			7,9 26,0		
Effective mean pressure at:	Power setting 360 kW	MPa psi	0,6 82	1,1 163	1,7 245	2,3 327	2,5 360
Max combustion pressure at:	Power setting 360 kW	MPa psi	8 1160	10,3 1494	13,6 1973	17,6 2553	19,3 2799
Total mass moment of inertia, J (mR^2) Engine only		kgm^2 $lbft^2$			3,43 81,4		
Degree of irregularity at:	Power setting 360 kW						
Friction Power		kW hp	32 44	32 44	32 44	32 44	32 44
If applicable Derating are described in Technical Diagrams							

Performance		**rpm** **load**	**1800** **25%**	**50%**	**75%**	**100%**	**110%**
Power setting 400 kW		kW hp	100 136	200 272	300 408	400 544	440 598
Torque at:	Power setting 400 kW	Nm lbft	531 391	1061 783	1592 1174	2122 1565	2334 1722
Mean piston speed		m/s ft/sec			9,5 31,2		
Effective mean pressure at:	Power setting 400 kW	MPa psi	0,5 76	1,0 151	1,6 227	2,1 303	2,3 333
Max combustion pressure at:	Power setting 400 kW	MPa psi	8,7 1262	11,5 1668	14,2 2060	17 2466	18,3 2654
Total mass moment of inertia, J (mR^2) Engine only		kgm^2 $lbft^2$			3,43 81,4		
Degree of irregularity at:	Power setting 400 kW						
Friction Power		kW hp	46 62,56	46 62,56	46 62,56	46 62,56	46 62,56
If applicable Derating are described in Technical Diagrams							

VOLVO PENTA 1500rpm/1800 rpm	Document No **21720675**	Issue Index **09**

Engine noise emission

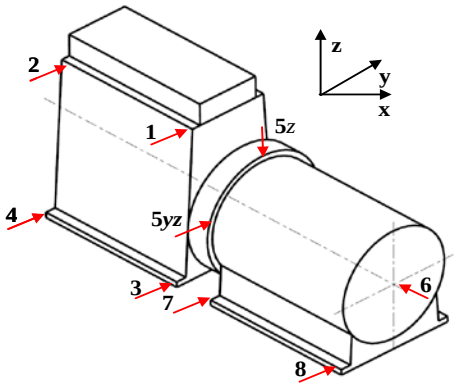
Test Standards: ISO 3744-1981 (E) sound power (without exhaust noise)

Tolerans ± 0.75 dB(A)

		rpm			**1500**		
		load	**25%**	**50%**	**75%**	**100%**	**110%**
Measured sound power Lw	No load	dB(A)	107,5	107,5	107,5	107,5	107,5
	Power setting 360 kW	dB(A)	110,6	111	111,8	111,9	112,1
		rpm			**1800**		
Measured sound power Lw	No load	dB(A)	109,1	109,1	109,1	109,1	109,1
	Power setting 400 kW	dB(A)	112,5	112,6	113	114,3	114,7

Vibrations (vibration velocity)

Declared vibration levels according to ISO 8528-9



rpm	**1500**	
RMS Velocity (10 - 1000Hz) Measurement direction		
Measuring position	Axial [x] mm/s	Transverse [y] mm/s	Vertical [z] mm/s
1	12,1	13,2	21,7
2	12,9	17,9	20
3	11,4	13	16,9
4	11,4	14,1	18,7
5	12,6	7,6	17,7
6	15,9	20	28,8
7	9,7	15,6	24,6
8	9,4	23,2	18,5
rpm		**1800**	
1	10	18	21,6
2	16	37,5	23,6
3	11	36,5	25
4	13	29,8	20,5
5	12	10,3	21,1
6	18	26,2	18,9
7	10	23,6	29,6
8	10	27,6	26,1

Test conditions for load acceptance data

Warm engine. UFRO according to stamford recommendation (Start at -3Hz) Minimum dip setting	**Generator**	**Modell**	**Type of AVR**
	Stamford	HCI534D1	MX341

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)	
	Nominal	110% power	Nominal	110% power	(%)	Nomi-nal	110% power	Nomi-nal	110% power
0-20	2,0	2,0	1,0	1,2	20-100	18,0	22,7	3,5	10,4
0-40	3,3	3,8	1,3	1,3	40-100	7,2	8,7	1,4	6,7
0-60	8,8	11,7	2,0	2,6	60-100	3,0	4,0	1,3	4,7
0-80	18,6	25,5	3,4	4,0	80-100	1,5	1,6	1,1	1,0
0-100	42,8	65,2	6,8	11,9					
0-62.7	**10,2**		2,3		62.7-100	2,7		1,3	
0-57		**10,1**		2,3	57-100		4,8		5,3
0-54.9	**7,1**		1,8		54.9-100	3,6		1,3	
0-49.9		**7,0**		1,8	49.9-100		6,1		5,8
100-0						-4,4	-4,1	1,2	1,2

Single step load performance at 1800 rpm

Load (%)	Speed diff %		Recovery time (s)		Remaining load	Speed diff (%)		Recovery time (s)	
	Nominal	110% power	Nominal	110% power	(%)	Nomi-nal	110% power	Nomi-nal	110% power
0-20	1,2	1,3	0,6	0,6	20-100	7,3	9,1	1,5	5,5
0-40	2,0	2,5	0,8	0,7	40-100	3,5	4,8	1,3	4,2
0-60	4,3	6,2	1,2	1,2	60-100	2,0	2,4	0,7	1,7
0-80	8,6	11,8	1,7	2,0	80-100	0,9	1,1	0,6	0,5
0-100	15,3	20,3	2,2	6,6					
0-84.5	**10,5**		1,9		84.5-100	0,6		0,4	
0-76.8		**10,3**		1,9	76.8-100		1,3		0,5
0-70.1	**7,1**		1,1		70.1-100	1,2		0,7	
0-63.7		**6,9**		1,2	63.7-100		2,1		1,3
100-0	-3,1	-3,3	1,3	1,4					

Cold start performance		**rpm**	**1500**	**1800**
Time from start to stay within 0.5% of no load speed at ambient temperature:	20°C	s	4,8	4,6
	5 °C	s	5,7	5,2

Lubrication system		**rpm load**	**1500 25%**	**50%**	**75%**	**100%**	**110%**
Lubricating oil consumption	Power setting 360 kW	liter/h	0,006	0,012	0,018	0,025	0,027
		US gal/h	0,002	0,003	0,005	0,006	0,007
		rpm	**1800**				
	Power setting 400 kW	liter/h	0,007	0,014	0,020	0,027	0,030
		US gal/h	0,002	0,004	0,005	0,007	0,008
Oil system capacity including filters		liter	49				
		US gal	12,9				
Oil sump capacity:	max	liter	44				
		US gal	11,6				
	min	liter	35				
		US gal	9,2				
Oil change intervals/ specifications: (Fuel quality dependant)	VDS-3	h	600				
	VDS-2	h	400				
		h					
		h					
Engine angularity limits, static (ref. classification rules, roll and pitch simultaneously)	front up	°	36				
	front down	°	36				
	side tilt	°	36				

Lubrication system		**rpm**	**1500**	**1800**
Oil pressure at rated speed		kPa	360	- 450
		psi	52	- 65
Lubrication oil temperature in oil sump:	max	°C	110	
		°F	230	
Oil filter micron size		µ	40	

* See also general section in the sales guide

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1500rpm/1800 rpm	**21720675**	**09**

Fuel system		**rpm**			**1500**		
		load	**25%**	**50%**	**75%**	**100%**	**110%**
Specific fuel consumption: US EPA Tier 3	Power setting 360 kW	g/kWh	225	204	202	202	198
		lb/hph	0,365	0,330	0,327	0,327	0,321
Specific fuel consumption IMO Tier II	Power setting 360 kW	g/kWh	220	197	190	191	192
		lb/hph	0,357	0,319	0,307	0,309	0,312
		rpm			**1800**		
Specific fuel consumption: US EPA Tier 3	Power setting 400 kW	g/kWh	245	212	212	209	210
		lb/hph	0,396	0,343	0,344	0,339	0,341
Specific fuel consumption IMO Tier II	Power setting 400 kW	g/kWh	236	203	197	199	200
		lb/hph	0,383	0,330	0,320	0,322	0,325
Fuel to conform to		ASTM-D975-No. 1 and 2-D, JIS KK 2204, EN 590 DMX and MDO-DMA (ISO8271)					
		rpm			**1500**		
System return flow	Power setting 360 kW	liter/h	46	45	44	44	44
		US gal/h	12,2	11,9	11,6	11,6	11,6
		rpm			**1800**		
	Power setting 400 kW	liter/h	49	49	48	47	47
		US gal/h	12,9	12,9	12,7	12,4	12,4
		rpm			**1500**		
System supply flow US EPA Tier 3	Power setting 360 kW	liter/h	70	89	109	131	138
		US gal/h	18,6	23,5	28,9	34,6	36,4
System supply flow IMO Tier II	Power setting 360 kW	liter/h	70	87	105	126	135
		US gal/h	18,4	23,1	27,8	33,4	35,7
		rpm			**1800**		
System supply flow US EPA Tier 3	Power setting 400 kW	liter/h	78	100	124	147	158
		US gal/h	20,7	26,3	32,8	38,9	41,7
System supply flow IMO Tier II	Power setting 400 kW	liter/h	77	98	119	142	153
		US gal/h	20,4	25,8	31,4	37,5	40,3
		rpm			**1500**		
Normal fuel pressure (after filter)	Power setting 360 kW	kPa	528	516	500	487	484
		psi	76,6	74,8	72,5	70,6	70,2
		rpm			**1800**		
	Power setting 400 kW	kPa	574	560	542	525	520
		psi	83,3	81,2	78,6	76,1	75,4

Fuel system

Fuel supply line max restriction	kPa	30
	psi	4,4
Fuel supply max pressure head (day tank, from CL)	m	2
	feet	6,6
Fuel supply line max suction head (from CL)	m	4
	feet	11,8
Fuel return line max restriction	kPa	20
	psi	2,9
Maximum allowable inlet fuel temp	°C	50
	°F	122

Fuel system

Prefilter / Water separator micron size	µ	
Fuel filter micron size	µ	2

Intake system		rpm / load	25%	50%	1500 / 75%	100%	110%
Air consumption at: (+25°C and 100kPa)	Power setting 360 kW	m^3/min	12,42	17,68	23,03	26,91	27,77
		cfm	439	624	813	950	981
		rpm			1800		
	Power setting 400 kW	m^3/min	16,35	22,6	28,09	30,26	30,24
		cfm	577	798	992	1069	1068
Max allowable air intake restriction including piping		kPa	3				
		psi	0,4				
Air filter type			Paper cartridge				
Air filter cleaning efficiency		%	98,5				

Exhaust system		rpm / rpm	25%	50%	1500 / 75%	100%	110%
Heat rejection to exhaust at:	Power setting 360 kW	kW	68	117	166	220	246
		BTU/min	3867	6654	9440	12511	13990
		rpm			1800		
	Power setting 400 kW	kW	79	129	192	264	300
		BTU/min	4493	7336	10919	15013	17061

Exhaust system		rpm / load	25%	50%	1500 / 75%	100%	110%
Exhaust gas temperature after turbine at:	Power setting 360 kW	°C	279	326	351	389	418
		°F	534	619	664	732	784
		rpm			1800		
	Power setting 400 kW	°C	254	293	339	416	464
		°F	489	559	642	781	867
Max allowable back pressure in exhaust line		kPa	10				
		psi	1,5				
		rpm			1500		
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	Power setting 360 kW	m^3/min	22,5	36,1	47,8	58,0	67,3
		cfm	794	1273	1687	2048	2375
	Power setting 400 kW	m^3/min	29	43	57	68	73
		cfm	1038	1513	1996	2399	2565

Cooling system		rpm / load	25%	50%	1500 / 75%	100%	110%
Heat rejection radiation from engine to surrounding at:	Power setting 360 kW	kW	3,5	4,0	4,5	5,0	5,2
		BTU/min	199	227	256	284	296
		rpm			1800		
	Power setting 400 kW	kW	3,8	4,3	4,8	5,3	5,5
		BTU/min	216	245	273	301	313
		rpm			1500		
Heat rejection to raw water system at:	Power setting 360 kW	kW	44	75	138	211	289
		BTU/min	2502	4265	7848	11999	16435
		rpm			1800		
	Power setting 400 kW	kW	60	96	169	264	339
		BTU/min	3412	5459	9611	15013	19279

Cooling system. Fresh water coolant circuit

Coolant volume engine, including heat exchanger, charge air cooler and std. expansion tank		liter US gal	53 14,00	
Max. additional coolant for cabin heater etc. with std. expansion tank		liter US gal		
Max. coolant flow to cabin heater etc.		l/s US gal/s	0,7 0,18	
Coolant pump	drive/ratio		1/1.5	
		rpm	**1500**	**1800**
Coolant flow with fully open thermostat		l/s US gal/s	4,6 1,22	5,5 1,45
Nominal coolant pressure with standard system		kPa psi		
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	
Standard pressure cap setting		kPa psi	75 10,9	
Coolant (40% coolant / 60% water)	See Operators Manual			

Cooling system. Engine mounted raw water pump

Raw water pump	drive/ratio		1/1.5	
		rpm	**1500**	**1800**
Nominal raw water design flow		l/s US gal/s	6,4 1,7	7,4 1,9
Nominal raw water pump pressure head at design flow (measured before and after pump)		kPa psi	79 11,4	103 14,9
Maximum raw water pump suction head		kPa psi	-10 -1,5	-14 -2,0
Maximum additional pressure drop (after heat exchanger)		kPa psi	78 11,3	105 15,2
Maximum raw water temperature entering heat exchanger		°C °F	32 90	

Cooling system. Raw water circuit central cooling	**rpm**	**1500**	**1800**
Maximum raw water flow	l/s US gal/s	7,0 1,8	
Minimum raw water flow	l/s US gal/s	4,9 1,3	5,8 1,5
Pressure drop engine raw water circuit at maximum flow	kPa psi		
Pressure drop engine raw water circuit at minimum flow	kPa psi		
Maximum allowed raw water circuit pressure before heat exchanger (external pump system)	kPa psi	150 21,8	
Maximum raw water temperature entering heat exchanger	°C °F	38 100	

Charge air cooler system		rpm / load	25%	50%	1500 75%	100%	110%
Cooling power	Power setting 360 kW	kW	11	28	55	93	119
		BTU/min	626	1592	3128	5289	6767
		rpm			1800		
	Power setting 400 kW	kW	19	38	74	109	129
		BTU/min	1081	2161	4208	6199	7336
		rpm			1500		
Charge air mass flow	Power setting 360 kW	kg/s	0,188	0,238	0,357	0,472	0,542
		rpm			1800		
	Power setting 400 kW	kg/s	0,242	0,31	0,45	0,555	0,58

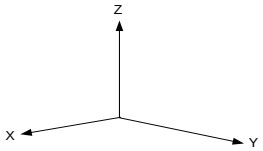
Charge air cooler system		rpm / load	25%	50%	1500 75%	100%	110%
Charge air inlet temp. (Charge air temp after turbo compressor)	Power setting 360 kW	°C	52,2	77,7	130,6	175,7	212,3
		°F	126	172	267	348	414
		rpm			1800		
	Power setting 400 kW	°C	64	93	146	195	219
		°F	147	200	295	383	425

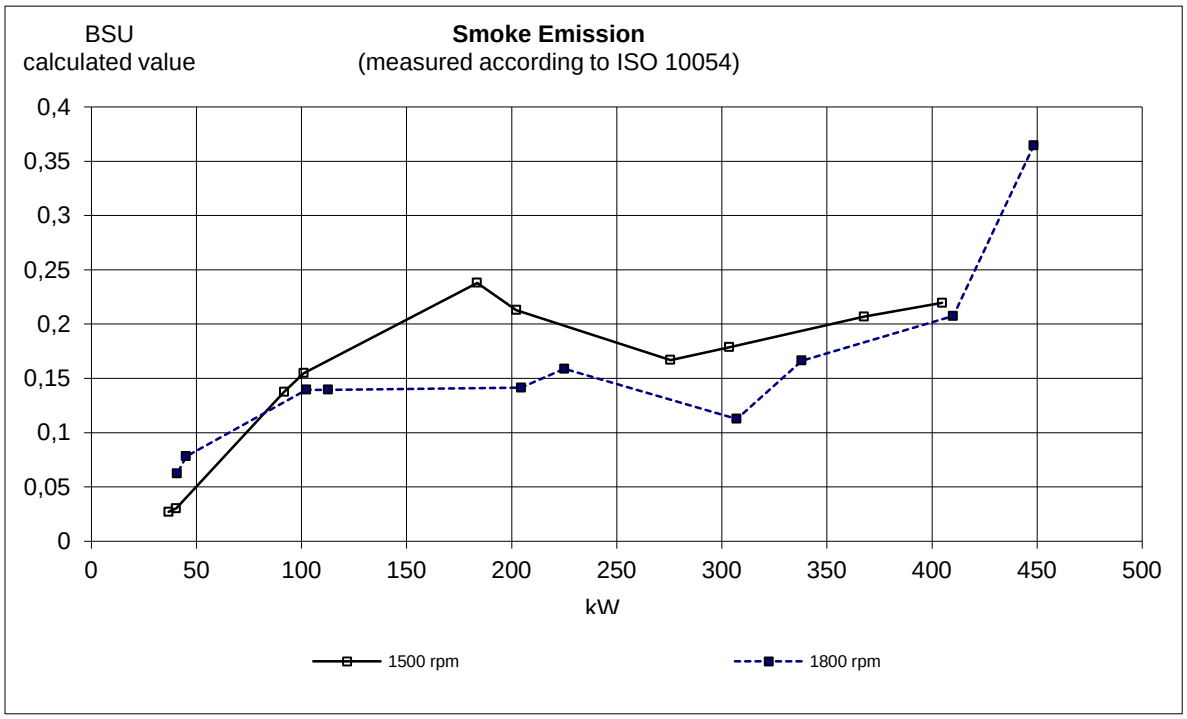
Charge air cooler system		rpm / load	25%	50%	1500 75%	100%	110%
Charge air outlet temp. (Charge air temp after charge air cooler)	Power setting 360 kW	°C	34	36	39	44	49
		°F	94	96	103	112	119
		rpm			1800		
	Power setting 400 kW	°C	35	37	41	47	50
		°F	95	99	106	116	122
Maximum pressure drop over charge air cooler, incl. piping		kPa	1,2				
		psi	0,17				
		rpm	1500				
Charge air pressure	Power setting 360 kW	kPa	272				
		psi	39,45				
		rpm	1800				
	Power setting 400 kW	kPa	246				
		psi	35,68				

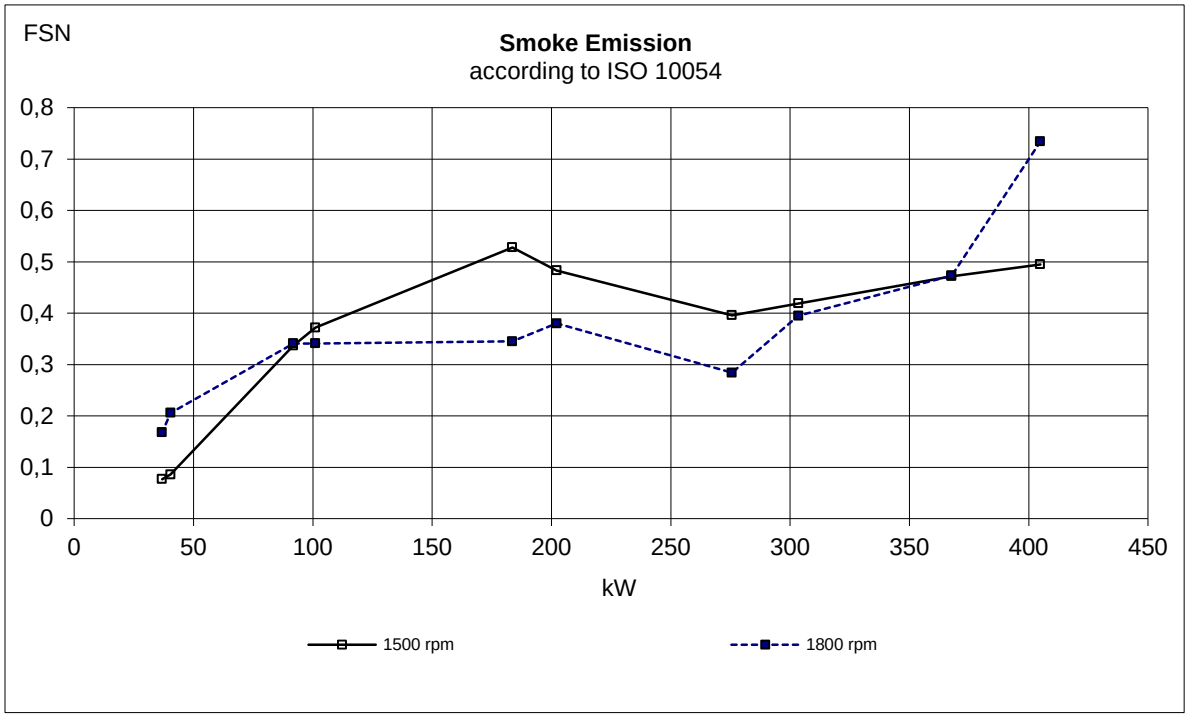
Engine management system

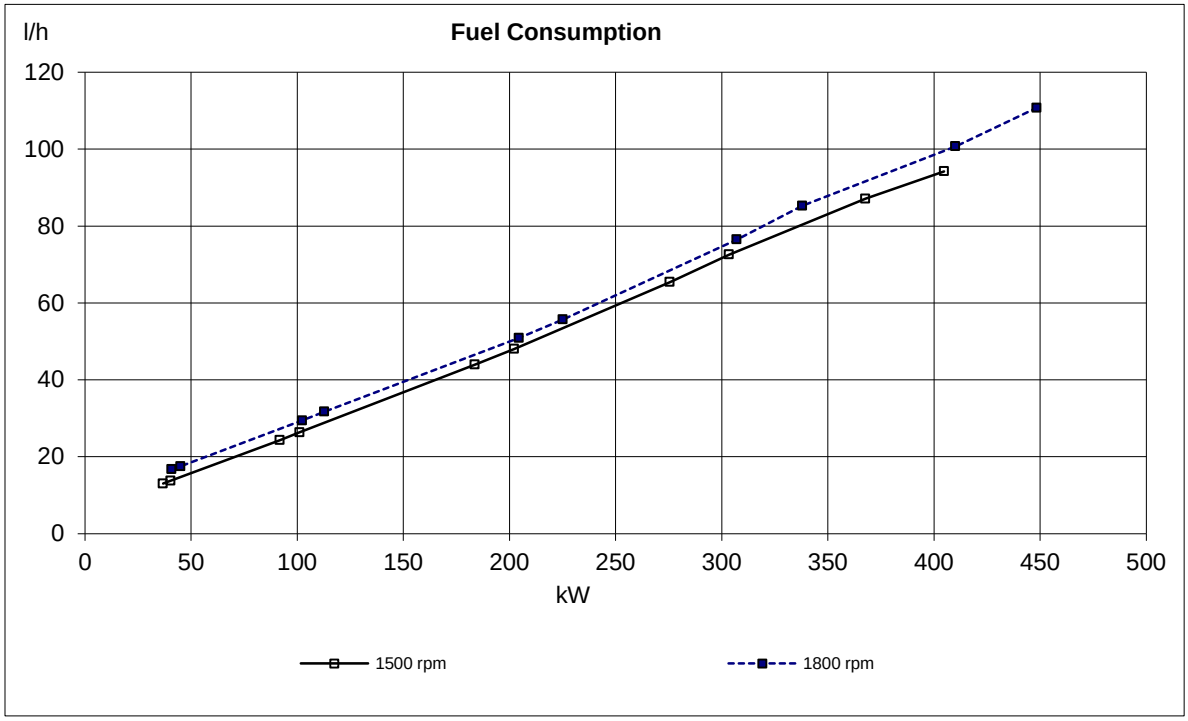
Functionality	Alternatives	Default setting
Governor mode	Isochronus / Droop	Droop
Governor droop	0 / 0,1-5%	4%
Governor response	Adjustable PID (service tool)	0/0/0
Dual speed	YES	1500 or 1800 rpm
Idle speed	600-1200	900
Fine speed adjustment	± 90	0
Stop function	Normaly Closed / Normaly Opend	Depends on order

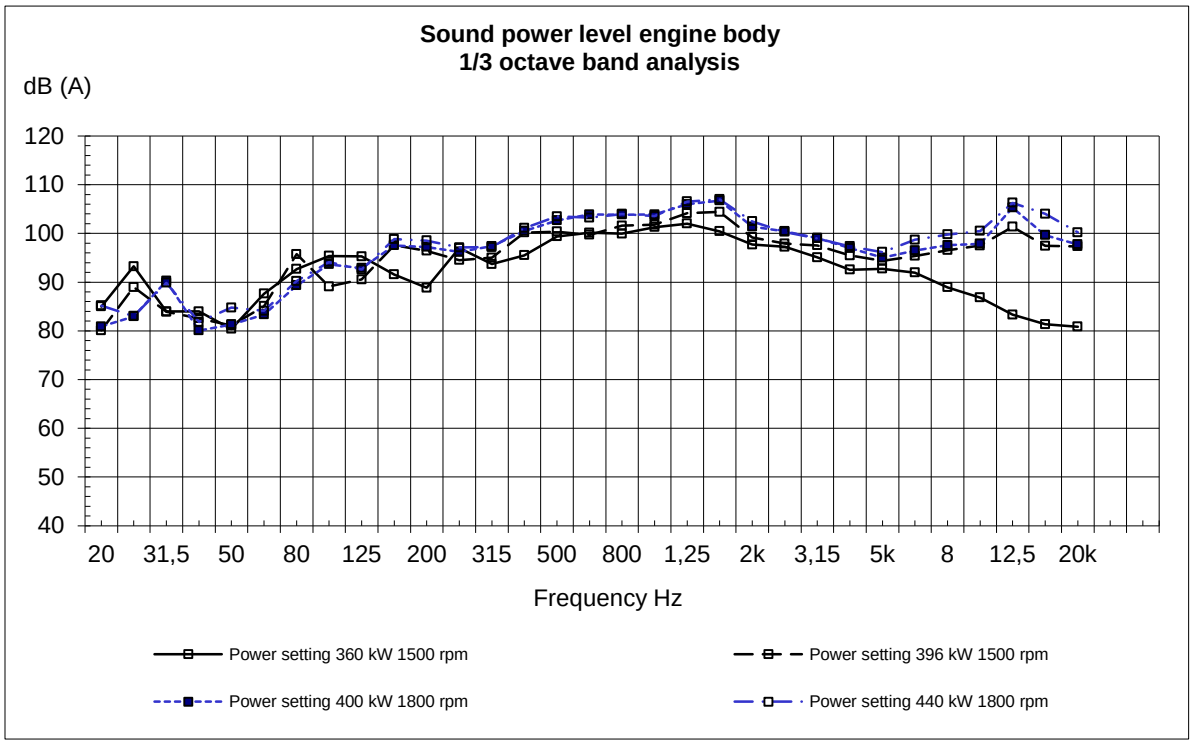
Electrical system			rpm	1500 and 1800
Voltage and type			24V / insulated from earth	
Alternator:	make/output		A	Bosch /110A
	tacho output		Hz/alt. Rev	6
	drive ratio			3,7:1
Starter motor			make	Melco
			type	105P70
			kW	7,0
Starter motor solenoid,	pull current		A	280
	hold current		A	-
Number of teeth on:	flywheel			153
	starter motor			12
Inrush current at +20°C \ +5°C			A	1020 \ 1560
Cranking current at +20°C \ +5°C			A	400 \ 530
Crank engine speed at 20°C \ +5°C			rpm	150 \ 130
Starter motor battery capacity:		max	Ah	2x225
		min at +5°C	Ah	2x180
Max. g-force		x	m/s²	2
		y	m/s²	2
		z	m/s²	6




BSU
calculated value
Smoke Emission
(measured according to ISO 10054)
0,4
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
0
50
100
150
200
250
300
350
400
450
500
kW
1500 rpm
1800 rpm


FSN
Smoke Emission
according to ISO 10054
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
0
50
100
150
200
250
300
350
400
450
kW
1500 rpm
1800 rpm


l/h
Fuel Consumption
120
100
80
60
40
20
0
0
50
100
150
200
250
300
350
400
450
500
kW
1500 rpm
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
Power setting 360 kW 1500 rpm
Power setting 396 kW 1500 rpm
Power setting 400 kW 1800 rpm
Power setting 440 kW 1800 rpm

Performance	Power (kW)	Rpm
Power setting HE	360	1500
Power setting HE	360	1500
Power setting HE	400	1800
Power setting HE	400	1800
Power setting KC	360	1500
Power setting KC	360	1500
Power setting KC	400	1800
Power setting KC	400	1800

Sensors Control and Monitoring System							Switches Engine Shutdown System	
Sensors	**Signal**	**Unit**	**Range**	**Initial Delay / Warning Delay**	**Warning Level**	**Derating Level**	**Shutdown Initial Delay / Shutdown Delay**	**Shutdown Level (Tolerance)**
Coolant level switch	Digital		ON/OFF	7,5 sec from start / 7,5 sec	Low (ON / Closed)	NA	NA	NA
Coolant temperature	50-0 kΩ	°C	- 40 - 140 ±1.5°C	30 sec from start / 2 sec	98° C	NA	NA	NA
Coolant temperature (SDU)	Digital	°C	ON/OFF	NA	NA	NA	1 sec. from start / 1 sec	105 (±2°C) SDU Ch. S1 (NA for EME. Valid for AUX and HBR modes)*
Engine speed cam	Frequency	rpm		Instant	Lost signal	NA	NA	NA
Engine speed crank	Frequency	rpm		Instant	Lost signal	NA	NA	NA
Eng. overspeed SDU 1500 rpm+15%	Frequency	rpm / Hz	153 puls./rev.	Instant	Lost signal	NA	Instant	1725 rpm / 4399 Hz (-1 to 0%)
Eng. overspeed SDU 1800 rpm+15%	Frequency	rpm / Hz	153 puls./rev.	Instant	Lost signal	NA	Instant	2070 rpm / 5278 Hz (-1 to 0%)
Exhaust gas temperature	PT200	°C	- 40 - 750 ± 2.5%	30 sec from start / 22 sec	575° C	NA	NA	NA
Crankcase pressure	0,5-4,5 V	kPa	0-15 kPa	20 sec from start / Instant	Rapid Pressure Increase	NA	NA	NA
Oil temperature	50-0 kΩ	°C	-40 - 140 °C	30 sec from start / 22 sec	130° C	NA	NA	NA

NA = Not applicable *
Emergency genset modes= EME
Auxiliary genset modes= AUX
Combined genset modes= EME, HBR

Sensors Alarm	Signal	Unit	Range	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level rpm Map (relative pressure)				Notes
Charge air pressure	0,5-4,5 V	kPa	50 - 600 ± 4 kPa				**1500 rpm**	**1800 rpm**	
Warning Level		kPa		30 sec from start / 2 sec			319	269	
Charge air Temperature	50 - 0 kΩ	°C	-40 - 130°C ±4%				**1500 rpm**	**1800 rpm**	
Warning Level		°C		90 sec from start / 22 sec			80° C	80° C	
Coolant pressure	0,5-4,5 V	kPa	0-300 kPa ±3%				**1500 rpm**	**1800 rpm**	
Warning Level		kPa		30 sec from start / 4 sec			50	70	
Seawater pressure	0,5-4,5 V	kPa	0-300 kPa ±3%				**1500 rpm**	**1800 rpm**	
Warning Level		kPa		30 sec from start / 7.5 sec			35	35	
Fuel pressure	0,5-4,5 V	kPa	0-700 kPa ±1,5%				**1500 rpm**	**1800 rpm**	
Warning Level		kPa		30 sec from start / 30 sec			270	270	
Oil pressure	0,5-4,5 V	kPa	0-700 kPa ±1,5%				**1500 rpm**	**1800 rpm**	
Warning Level		kPa		30 sec from start / 3 sec			265	265	
Shutdown Level (SDU)	Digital	kPa	ON/OFF	11 s ±20% from start / 1 s			120 ±20	120 ±20	Shutdown Unit Activated S2,S3: 510 rpm ±2% 1300 Hz ±2% 153 pulses / revolution (NA for EME. Valid for AUX and HBR modes)*