

## 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	16,12
		in <sup>3</sup>	983,7
Firing order			1-5-3-6-2-4
Bore		mm	144
		in	5,67
Stroke		mm	165
		in	6,50
Compression ratio			17,5:1
Dry weight	Engine only, excluding cooling system	kg	1480
		lb	3263
	GenPac	kg	1910
		lb	4211
Wet weight	Engine only, excluding cooling system	kg	1550
		lb	3417
	GenPac	kg	2020
		lb	4453

## Performance

		r/min	1500	1800
Prime Power	without fan	kW	401	445
		hp	545	605
	with fan	kW	392	430
		hp	533	585
Standby Power	without fan	kW	440	494
		hp	598	672
	with fan	kW	431	479
		hp	586	651
Torque at:	Prime Power	Nm	2553	2361
		lbft	1883	1741
	Standby Power	Nm	2801	2621
		lbft	2066	1933
Mean piston speed		m/s	8,3	9,9
		ft/sec	27,1	32,6
Effective mean pressure at:	Prime Power	MPa	2,0	1,8
		psi	289	267
Effective mean pressure at:	Standby Power	MPa	2,2	2,0
		psi	317	296
Max combustion pressure at:	Prime Power	MPa	15	16,2
		psi	2176	2350
Max combustion pressure at:	Standby Power	MPa	16,1	17,2
		psi	2335	2495
Total mass moment of inertia, J (mR2)		kgm <sup>2</sup>	4,20	
		lbft <sup>2</sup>	99,7	
Degree of irregularity at:	Prime Power		1:52	1:97
Friction Power		kW	38	55
		hp	51,68	74,8

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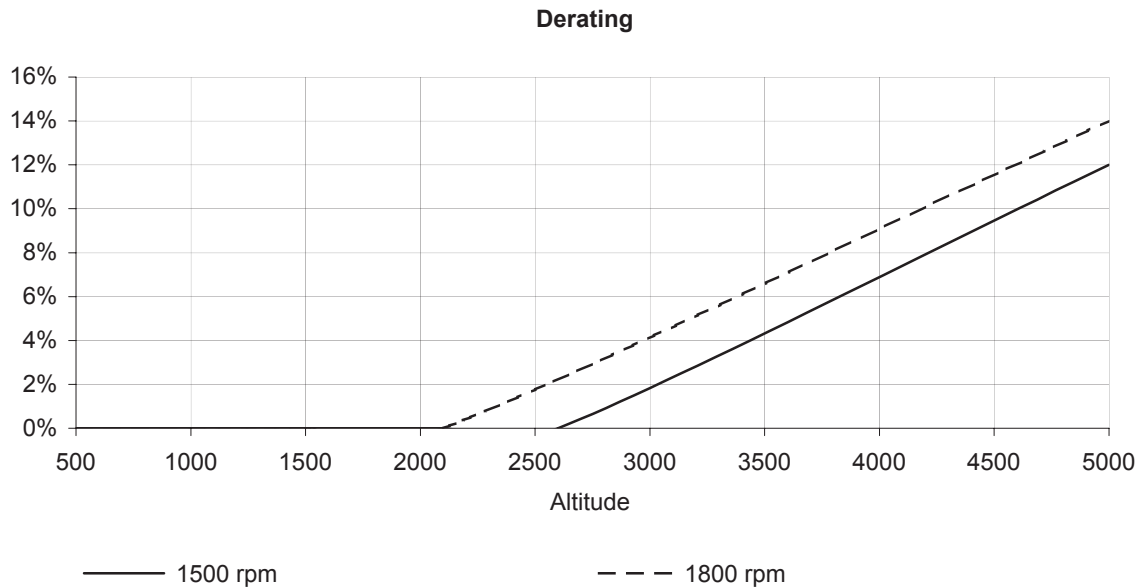
### Derating

The engine may be operated up to 2630 m altitude without derating at 1500rpm.

The engine may be operated up to 2130 m altitude without derating at 1800rpm.

For operation at higher altitudes the power will be derated according to the graph below.

There is no derating for ambient temperature or humidity.



### Engine noise emission

Test Standards: ISO 3744-1981 (E) sound power (without fan, intake and exhaust noise)

Tolerans  $\pm 0.75$  dB(A)

		r/min	1500	1800
Measured sound power Lw	No load	dB(A)	110,3	112
	Prime Power	dB(A)	114,4	115,8
	Standby Power	dB(A)	115	116,7
Calculated sound pressure Lp at 1 m	No load	dB(A)	98,3	100
	Prime Power	dB(A)	102,4	103,8
	Standby Power	dB(A)	103	104,7

### Unsilenced exhaust noise

Data calculated as sound pressure Lp.

Assumed microphone distance 1 m

	r/min	1500	1800
Prime Power	dB(A)	115	119
Standby Power	dB(A)	115	119

### Emission

440kW/1500rpm	TA-luft	mg/Nm <sup>3</sup>		
Load factor	NOx	CO	Soot	HC
55%	1939	113	7	48
83%	1895	93	3	35
110% stand by	1815	181	6	40

O<sub>2</sub>-content 5%, without fan, 1500rpm. For latest updated values, refer to "Sales Support" on Partner Network.

**Test conditions for load acceptance data**

Warm engine.	Generator	Modell	Type of AVR
	Stamford	HCI 544 C14	SX 440

Load acceptance performance can vary due to actual alternator inertia, voltage regulator, type of load and local ambient conditions. UFRO: STD-setting 47 / 57 Hz.

**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	2,3	2,5	1,6	1,7	20-100	15,4		3,7	
0-40	4,4	5,3	1,8	1,8	20-100		18,8		23,2
0-60	7,5	9,1	2,4	2,5	40-100	9,3	12,7	3,2	8,6
0-63		9,5		3,0	60-100	4,1	8,4	2,2	3,9
0-70	9,8		3,0		63-100		7,5		3,6
0-80	14,2	18,1	3,2	3,3	70-100	3,3		2,0	
0-100		29,5		7,1	80-100	2,1	2,5	1,8	1,8
0-100	24,7		4,6						
100-0	8,4	9,2	1,6	2,0					

**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	1,6	1,7	20-100	7,0	9,1	2,9	5,4
0-40	2,9	3,6	2,0	2,1	40-100	5,8	6,8	2,5	3,7
0-60	5,1	5,8	2,0	2,1	60-100	3,1	3,9	2,2	2,3
0-80	6,9	7,8	2,3	2,4	80-100	1,5	1,7	1,8	2,9
0-90		9,5		3,2	90-100		1,2		3,0
0-100	9,2	12,6	3,1	4,9					
100-0	5,8	7,0	1,8	1,9					

**Cold start performance**

		r/min	1500	1800	
Time from start to stay within 0.5% of no load speed at ambient temperature:	°C	20	s	6,3	8,2
		5	s	6,1	8,3
		-15*	s	7,0	9,5
Time from start to stay within 0.8% of no load speed at ambient temperature:	°C	20	s	5,1	7,0
		5	s	5,6	7,6
		-15*	s	6,5	9,0

\* With Lubrication oil 10W/30, block heater and MK1 fuel.

Usage of manifold heater:	Time preheating, minutes	Time postheating, minutes		
	0,5	1,6		
Ambient temp °C	Block heater type and Make	Power kW	Engaged hours	Cooling water temp engine block, °C.
-25	External Volvo	2	12	5
-15	External Volvo	2	12	17

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<b>Lubrication system</b>		<b>r/min</b>	<b>1500</b>	<b>1800</b>
Lubricating oil consumption	Prime Power	liter/h	0,10	0,10
		US gal/h	0,026	0,026
	Standby Power	liter/h	0,10	0,11
		US gal/h	0,026	0,029
Oil system capacity including filters		liter	48	
		US gal	12,7	
Oil sump capacity:	max	liter	42	
		US gal	11,1	
	min	liter	32	
		US gal	8,5	
Engine angularity limits:	front up	°	30	
	front down	°	30	
	side tilt	°	30	
Oil pressure at rated speed		kPa	300 - 650	
		psi	44 - 94	
Lubrication oil temperature in oil sump:	max	°C	130	
		°F	266	
Oil filter micron size		mm	0,040	

\* See also general section in the sales guide

<b>Fuel system</b>		<b>r/min</b>	<b>1500</b>	<b>1800</b>
<b>Prime Power</b> Specific fuel consumption at:	25%	g/kWh	227	245
		lb/hph	0,368	0,397
	50%	g/kWh	203	210
		lb/hph	0,329	0,340
	75%	g/kWh	198	202
		lb/hph	0,320	0,327
	100%	g/kWh	200	202
		lb/hph	0,323	0,328
<b>Standby Power</b> Specific fuel consumption at:	25%	g/kWh	221	234
		lb/hph	0,359	0,379
	50%	g/kWh	201	206
		lb/hph	0,326	0,334
	75%	g/kWh	197	201
		lb/hph	0,319	0,326
	100%	g/kWh	202	206
		lb/hph	0,327	0,334

Fuel system		r/min	1500	1800
Fuel to conform to		ASTM-D975-No1 and 2-D JIS KK 2204, EN 590		
System return flow		liter/h	25	
		US gal/h	6,6	
System supply flow at rated speed		liter/h	165	180
		US gal/h	44	48
Fuel supply line max restriction		kPa	10,0	
		psi	1,5	
Fuel supply line max pressure, engine stopped		kPa	0,0	
		psi	0,0	
Fuel return line max restriction		kPa	20,0	
		psi	2,9	
Maximum allowable inlet fuel temp		°C	60	
		°F	140	
Prefilter / Water separator		mm	0,010	
Governor type/make, standard		Volvo / EMS2		
Injection pump type/make		Delphi E1		

Intake and exhaust system			r/min	1500	1800
Air consumption at:	Prime Power	25°C	m <sup>3</sup> /min	31,7	39,7
		77°F	cfm	1119	1402
	Standby Power	25°C	m <sup>3</sup> /min	36,2	42,6
		77°F	cfm	1278	1504
Air intake restriction, clean filter(s)			kPa	1,1	1,7
			in wc	4,4	6,8
Max allowable air intake restriction			kPa	5	5
			in wc	20,1	20,1
Air filter type			Single stage paper cartridge		
Air filter cleaning efficiency			%	99,85	
Heat rejection to exhaust at:	Prime Power	kW	299	319	
		BTU/min	17004	18141	
	Standby Power	kW	335	381	
		BTU/min	19051	21667	
Exhaust gas temperature after turbine at:	Prime Power	°C	452	408	
		°F	846	766	
	Standby Power	°C	456	444	
		°F	853	831	
Max allowable back pressure in exhaust line			kPa	10	10
			In wc	40,2	40,2
Exhaust gas flow at:	Prime Power	m <sup>3</sup> /min	74,8	86,9	
		cfm	2642	3069	
	Standby Power	m <sup>3</sup> /min	85,4	98,0	
		cfm	3016	3461	

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Cooling system		r/min	1500	1800
Heat rejection radiation from engine at:	Prime Power	kW	18	20
		BTU/min	1024	1137
	Standby Power	kW	20	22
		BTU/min	1137	1251
Heat rejection to coolant at:	Prime Power	kW	158	176
		BTU/min	8985	10009
	Standby Power	kW	166	188
		BTU/min	9440	10691
Coolant	Volvo coolant with clean fresh water			
Radiator cooling system type		Closed circuit		
Standard radiator core area		m <sup>2</sup>	1,3	
		foot <sup>2</sup>	13,99	
Standard radiator core thickness		mm	68	
		in	2,68	
Fan diameter		mm	890	
		in	35,04	
Fan power consumption		kW	9	15
		hp	12	20
Fan drive ratio			0,97 : 1	
Coolant capacity,	engine	liter	33	
		US gal	8,72	
	engine + std radiator with hoses.	liter	60	
		US gal	15,85	
Coolant pump		drive/ ratio	Belt / 1,85:1	
Coolant flow with standard system		l/s	6,4	7,7
		US gal/s	1,69	2,03
Minimum coolant flow		l/s	6,4	7,7
		US gal/s	1,69	2,03
Maximum external coolant system restriction, including piping		kPa	50	70
		in wc	201	281
Thermostat	start to open	°C	86	
		°F	187	
	fully open	°C	96	
		°F	205	
Maximum static pressure head (expansion tank height + pressure cap setting)		kPa	100	
		in wc	401	
Minimum static pressure head (expansion tank height + pressure cap setting)		kPa	70	
		in wc	281	
Standard pressure cap setting		kPa	75	
		in wc	301	
Maximum top tank temperature		°C	103	
		°F	217	
Draw down capacity	4% of total cooling system capacity			

Intercooler system		r/min	1500	1800
Cooling power	Prime Power	kW	81	112
		BTU/min	4606	6369
	Standby Power	kW	99	129
		BTU/min	5630	7336
Combustion air inlet temp. (Charge air temp after turbo compressor)	Prime Power	°C	180	197
		°F	356	387
	Standby Power	°C	198	215
		°F	388	419
Max allowable Comb. Air temp after CAC at 25 degree ambient. (Charge air temp after intercooler)	Standby Power	°C	45	45
		°F	113	113
Maximum pressure droop over intercooler, incl. piping		kPa	10	15
		psi	1,5	2,2
Boost pressure		kPa	232	231
		psi	33,6	33,5
Standard intercooler core area		m <sup>2</sup>	1,32	
		foot <sup>2</sup>	14,21	
Standard intercooler core thickness		mm	52	
		in	2,05	

### Cooling performance

Cooling air flow and external restriction at different radiator air temperatures based on 103°C TTT and 40% antifreeze (radiator and cooling fan, see optional equipment)

Engine speed rpm	Air on temp °C	PRIME POWER		STANDBY POWER	
		Air mass flow kg/s	External restriction Pa	Air mass flow kg/s	External restriction Pa
1500	40	4,0	751	4,5	612
	45	4,5	626	5,0	467
	50	5,0	471	5,6	291
	55	5,7	280	6,4	107
	58			6,9	0
	60	6,5	79		
	62	6,9	0		
1800	40	4,8	1110	5,5	903
	45	5,4	934	6,1	701
	50	6,1	712	6,8	456
	55	6,9	448	7,8	186
	58			8,6	0
	60	8	150		
	62	8,6	0		

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### Engine management system

Functionality	Alternatives	Default setting
Governor mode	Isochronous/droop Switchable during operation	Isochronous
Governor droop	0-8%	4%
Dual speed	1500/1800	According to customer
Low Idle speed select	600-1200	900
Stop function	Energized to Run / Stop	Energized to stop
Lamp test	On / Off	On
Pre-heat on ignition	On / Off	Off

Engine protection Parameter	Alarm		Engine protection	
	Selectable span	Default setting	Protection at	Protective action Default / Alternative
Oil temperature C	120 - 130	125	Setting +5	Shut down / off *
Oil pressure kPa				
Low idle 900rpm	-	190	Default -30	Shut down / off *
1500 rpm	-	250	::	::
1800 rpm	-	300	::	::
Oil level	-	Min level	-	-
Piston cooling pressure kPa >1000rpm	-	150	150	Shut down / off *
Coolant temp	95 - 101	98	Setting +5	Shut down / off *
Coolant level	-	On	Low level	Shut down / off *
Fuel feed pressure kPa				
Low idle 900rpm	-	150	-	-
> 1400 rpm	-	300	-	-
Water in fuel	-	High level	-	-
Crank case pressure kPa	-	-	-	Shut down
Air filter diff pressure kPa	-	5,0	-	-
Altitude, above sea m	-	-		Automatic derating, see section derating
Charge air temp after cac	-	80	+5	Shut down
Charge air pressure kPa	-	290	300	Shut down
Overspeed	100 - 120% of rated speed	120% / off *	Alarm level	Shut down / on
Low voltage V	-	25,5	-	-

\*Off means no shutdown , alarm only.

<b>Electrical system</b>		<b>r/min</b>	<b>1500</b>	<b>1800</b>
Voltage and type		24V / insulated from earth		
Alternator:	make/output	Amp	Bosch / 80	
	tacho output	Hz/alt. Rev	6	
	drive ratio		3,9 : 1	
Starter motor		make	Melco	
		type	105P70	
		kW	7,0	
Starter motor solenoid,	pull current	Amp	-	
	hold current	Amp	2,3	
Number of teeth on:	flywheel		153	
	starter motor		12	
Inrush current at +20°C		Amp	700	
Cranking current at +20°C		Amp	280	
Crank engine speed at 20°C		rpm	150	
Starter motor battery capacity:	max	Ah	2 x 225	
	min at +5°C	Ah		
Inlet manifold heater (at 20 V)		kW	4,0	
Power relay for the manifold heater		Amp	1	

<b>Power take off</b>		<b>r/min</b>	<b>1500</b>	<b>1800</b>
Timing gear at compressor PTO max:		Nm	160	
		lbft	118	
Speed ratio direction of rotation viewed from flywheel side		1,31:1 / anti-clockwise		
Timing gear at servo pump PTO max:		Nm	100	
		lbft	74	
Max allowed bending moment in flywheel housing		Nm	15000	
		lbft	11063	
Max. rear main bearing load		N	5000	
		lbf	1124,0	