


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  are 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 penalties as described in the Clean Air Act.

General

In-line four stroke turbocharged diesel engine with direct injection.

Rotation direction, anti-clockwise viewed towards flywheel.

Number of cylinders			6
Displacement, total		litre in ³	12,78 779,9
Firing order			1-5-3-6-2-4
Bore		mm in	131 5,16
Stroke		mm in	158 6,22
Compression ratio			17.8:1
Wet weight	Engine only	kg lb	1243 2740
	Engine incl. cooling system and air filtration system	kg lb	1455 3208

Performance

			rpm	1500	1800
Standby Power	without fan	kW hp		482 656	500 680
	with fan	kW hp		470 639	479 652
Prime Power	without fan	kW hp		439 597	457 621
	with fan	kW hp		427 581	436 593
COP Power	without fan	kW hp		329 448	343 466
	with fan	kW hp		320 436	327 444
Torque at:	Standby Power	Nm lbft		3069 2263	2654 1958
		Maximum torque within fine speed range (± 90 rpm)	Nm lbft	3264 2407	2794 2061
Total mass moment of inertia, J (mR ²)		kgm ² lbft ²		3,500 83,1	

Derating due to altitude - see Technical Diagrams

Engine noise emission

Test Standards: ISO 3744-1981 (E) sound power with fan ratio 1:0.99

 Tolerance ± 0.75 dB(A)

		rpm	1500	1800
Measured sound power Lw	Standby Power	dB(A)	115,6	119,6
	Prime Power	dB(A)	115,4	118,8
	No load	dB(A)	115,6	119,0
Calculated sound pressure Lp at 1 m	Standby Power	dB(A)	103,6	107,6
	Prime Power	dB(A)	103,4	106,8
	No load	dB(A)	103,6	107,0

Tailpipe noise

Data calculated as sound pressure Lp.

Microphone distance 1 m

	rpm	1500	1800
Standby Power	dB(A)	115,1	115,5
Prime Power	dB(A)	114,0	114,9
COP	dB(A)	113,5	114,0

Test conditions for load acceptance data

Engine at working temperature, fuel that is used: EN590 B7, Nominal operating conditions

Generator	Brand	Model		Type of AVR
	Stamford	HCI 544 E1		AS440
AVR Settings	UFRO (Hz):	47/57	DIP:	std
	Stability (%):	std	Voltage (V):	400/231
			Power factor:	1

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

Nomenclature

Abbreviation:	Full name:	Descriptions
AVR	Automatic Voltage Regulator	Generator performance and safety 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.

Load Acceptance at 1500 rpm

Genset Classification

This engine fulfills G1, G2 and G3 classes, according to ISO8528-5. For other class (G4), please, see the tables below.

Load (%)	Speed diff (%)	Speed Recovery time (s)	
0-41	7 (G3)	1,4	G3 boundary conditions
0-49	10 (G2)	1,8	G2 boundary conditions

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	2,4	1,5	0,0	0,1	20-100	78,9	15,0	81,3	12,1
0-40	6,1	1,8	2,9	2,1	40-100	13,6	8,0	12,8	4,0
0-60	17,2	2,7	13,6	4,1	60-100	3,8	1,9	2,9	1,0
0-80	75,4	9,7	74,4	9,1	80-100	2,0	1,5	2,9	1,0
0-100*	79,5	17,4	79,3	12,0					
0-110*	82,3	14,3	83,7	12,1					
100-0	7,6	2,1	0,5	0,1					

* 100% = Prime power

** 110% = Standby power

Load Acceptance at 1800 rpm

Genset Classification

This engine fulfills G1, G2 and G3 classes, according to ISO8528-5. For other class (G4), please, see the tables below.

Load (%)	Speed diff (%)	Speed Recovery time (s)	
0 - 52	7 (G3)	1,0	G3 boundary conditions
0 - 63	10 (G2)	1,1	G2 boundary conditions

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	1,8	1,0	3,1	1,0	20-100	15,9	5,0	22,0	4,0
0-40	3,7	1,1	8,0	1,0	40-100	10,3	2,8	19,6	2,1
0-60	8,1	1,2	18,4	1,0	60-100	4,8	2,6	9,9	2,0
0-80	15,9	2,3	14,0	2,1	80-100	3,4	3,1	7,3	3,1
0-100*	28,8	5,8	23,8	4,1					
0-110**	29,9	6,8	25,7	6,0					
100-0	5,2	1,5	14,1	1,0					

* 100% = Prime power

** 110% = Standby power

Cold start performance	Ambient Temp. [°C]	Manifold Heater	Block heater	RPM	
				1500	1800
Time to Set Speed from start	+5	-	-	4,16	4,59
	-15	-	-	15,15	13,42
	-15*	Yes	-	6,74	7,11
	-25*	Yes	-	20,61	23,71
	-25 **	Yes	Yes	6,16	6,19

Min start temp w/o Block Heater	-25	°C
---------------------------------	-----	----

* With manifold heater 4 kW engaged, lubrication oil SAE 10W/30.

** With manifold heater 4 kW engaged, lubrication oil SAE 10W/30 and block heater, Fuel MK-1.

Block heater type	Power kW	Engaged hours	Cooling water temp engine block
Volvo 21105441	2	12	20 °C

Lubrication system		rpm		1500	1800
Lubricating oil consumption	Standby Power	litre/h	0,03	0,03	
		US gal/h	0,008	0,008	
	Prime Power	litre/h	0,03	0,03	
		US gal/h	0,008	0,008	
	COP	litre/h	0,03	0,03	
		US gal/h	0,008	0,008	
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:		h	1000		
Engine angularity limits (Plastic oil pan / Aluminium oil pan) :	front up	°	11/35		
	front down	°	11/35		
	side tilt	°	11/35		
Oil pressure at nominal set speed		kPa	240 - 540		
		psi	35 - 78		
Lubrication oil temperature in oil sump:	max	°C	128		
		°F	262		
Oil filter micron size		μ	40		

Fuel system		rpm	1500	1800
Standby Power Specific fuel consumption at:	25%	g/kWh lb/hph	210 0,341	221 0,359
	50%	g/kWh lb/hph	198 0,321	202 0,328
	75%	g/kWh lb/hph	197 0,319	201 0,326
	100%	g/kWh lb/hph	191 0,309	196 0,318

Prime Power Specific fuel consumption at:	25%	g/kWh lb/hph	213 0,345	224 0,363
	50%	g/kWh lb/hph	199 0,323	201 0,326
	75%	g/kWh lb/hph	198 0,320	200 0,323
	100%	g/kWh lb/hph	191 0,310	196 0,318

CO2 emission declaration		rpm	1500	1800
Carbon dioxide (CO ₂) emissions determined during the EU type approval process, NRSC-D2.		g/kWh	622	642

Fuel system	
Fuel to conform to	ASTM-D975_No1 and 2D JIS KK 2204. EN 590 B7 Biofuel content < B30 (See fuel bulletin: 18-8-8) High sulphur fuels < 5000 ppm Sulphur. (See fuel bulletin: 18-8-8) HVO (EN15940)

	rpm	1500	1800
System supply flow at:	litre/h	110,0	118,0
	US gal/h	29,1	31,2
Fuel supply line max restriction (Measured at fuel inlet connection)	kPa	30,0	30,0
	psi	4,4	4,4
Fuel supply line max pressure, engine stopped & running	kPa	20,0	20,0
	psi	2,9	2,9
System return flow at:	litre/h	18,0	18,0
	US gal/h	4,8	4,8
Fuel return line max restriction (Measured at fuel return connection)	kPa	20,0	20,0
	psi	2,9	2,9
Maximum allowable inlet fuel temp (Measured at fuel inlet connection)	°C	50	50
	°F	122	122
Prefilter / Water separator micron size	μ	10	
Fuel filter micron size	μ	5	
Governor type/make, standard	Volvo/EMS 2.4		
Injection pump type/make	Delphi E2.9		

Intake and exhaust system**rpm 1500 1800**

Air consumption at: (+25°C and 100kPa)	Standby Power		m ³ /min cfm	32,4 1144	37,6 1328
	Prime Power		m ³ /min cfm	31,2 1102	36,4 1285



**See front page for important information**

Max air intake restriction including piping with maintained performance		kPa psi	-5 -0,7	-5 -0,7
Max <u>allowable</u> air intake restriction including piping		kPa psi	-5 -0,7	-5 -0,7
Air filter restriction clean Volvo Penta filter		kPa psi	-3,0 -0,4	-3,0 -0,4
Heat rejection to exhaust at:	Standby Power	kW BTU/min	310 17629	341 19392
	Prime Power	kW BTU/min	284 16128	316 17959
Exhaust gas temperature after turbine at:	Standby Power	°C	449	431
		°F	840	808
	Prime Power	°C	432	401
		°F	810	754

**See front page for important information**

Max allowable back pressure in exhaust after turbine		kPa psi	10 1,5	10 1,5
Exhaust gas flow at max power: (temp and pressure after turbine)		m ³ /min	79,3	86,8
		cfm	2802	3065

Charge air cooler system**rpm 1500 1800**

Heat rejection to charge air cooler at standby power	kW	118	135
	BTU/min	6711	7677
Charge air mass flow at standby power	kg/s	0,65	0,75
Charge air inlet temp at standby power (Charge air temp after turbo compressor)	°C	217,5	218
	°F	424	424
 See front page for important information			
Max allowable Charge air outlet temp at standby power (Charge air temp after intercooler)	°C	41	44
	°F	106	111
 See front page for important information			
Maximum pressure drop over charge air cooler incl. Piping	kPa	9,5	12,5
	psi	1,38	1,81
Maximum charge air pressure in inlet manifold (After charge air cooler)	kPa	288	295
	psi	41,77	42,79
Standard charge air cooler core area	m ²	0,89	0,89
	foot ²	9,58	9,58

Cooling system

Coolant type and mixture		Volvo Penta Coolant VCS	
Coolant capacity,	engine only	litre	20
		US gal	5,28
	coolant radiators incl piping	litre	18
		US gal	4,76
expansion tank	litre	10	
	US gal	2,64	

		rpm	1500	1800
Heat rejection radiation from engine at Standby power:	kW	17	23	
	BTU/min	967	1308	
Heat rejection to coolant at standby power	kW	154	161	
	BTU/min	8758	9156	
Standard radiator core area	m ²	0,9		
	foot ²	9,69		
Min coolant flow engine coolant circuit (at fully open thermostat)	litre/s	5,5	6,5	
	US gal/s	1,45	1,72	
Maximum coolant temperature entering engine (25°C amb. Temp.)	°C	96,0	98,0	
	F	204,80	208,40	
Maximum external engine coolant circuit restriction, including piping (25°C amb. Temp.)	kPa	65		
	psi	9,4		
Nominal coolant pressure	kPa	N/A		
	psi	N/A		
Nominal coolant flow with standard system	litre/s	5,5	6,5	
	US gal/s	1,45	1,72	
Fan diameter	mm	890		
	in	35,04		
Fan power consumption	kW	12	21	
	hp	16	29	
Fan drive ratio		0.99:1		
Coolant pump	drive/ratio	Belt/1,43:1		
Thermostat	start to open	°C	82	
		°F	180	
	fully open	°C	92	
		°F	198	
Maximum static pressure head (expansion tank height + pressure cap setting)	kPa	110		
	psi	16,0		
Minimum static pressure head (expansion tank height + pressure cap setting)	kPa	70		
	psi	10,2		
Standard pressure cap setting	kPa	100		
	psi	14,5		
Maximum top tank temperature	°C	107		
	°F	225		

Cooling performance

Standard fan:	890mm	Fan ratio:	1:0.99	Fan type:	FIXED
---------------	-------	------------	---------------	-----------	-------

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	External restriction Pa	Air flow m ³ /s	STANDBY POWER	PRIME POWER
			Air on temp °C	Air on temp °C
1500	0	6,4	55	60
	150	5,6	51	56
	300	4,7	44	50
	450	4,2	39	45
1800	0	7,8	58	61
	150	7,2	56	59
	300	6,5	52	55
	450	5,8	47	51

Note! External restrictions are calculated for values >0 Pa

Standard fan:	890mm	Fan ratio:	1:1.07	Fan type:	FIXED
---------------	-------	------------	---------------	-----------	-------

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	External restriction Pa	Air flow m ³ /s	STANDBY POWER	PRIME POWER
			Air on temp °C	Air on temp °C
1500	0	7,0	59	63
	150	6,3	56	60
	300	5,4	51	55
	450	4,9	46	51
1800	0	8,5	61	64
	150	8,0	59	62
	300	7,4	56	60
	450	6,6	53	56

Note! External restrictions are calculated for values >0 Pa

Standard fan:	890mm	Fan ratio:	1:0.84	Fan type:	FIXED
---------------	-------	------------	---------------	-----------	-------

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	External restriction Pa	Air flow m ³ /s	STANDBY POWER	PRIME POWER
			Air on temp °C	Air on temp °C
1500	0	5,2	48	54
	150	4,2	38	45
	300	3,6	30	37
	450	3,0	18	27
1800	0	6,5	51	54
	150	5,7	46	49
	300	4,8	39	43
	450	4,4	34	37

Note! External restrictions are calculated for values >0 Pa

Standard fan:	890mm	Fan ratio:	1:0.99	Fan type:	Visco
---------------	-------	------------	---------------	-----------	--------------

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	External restriction Pa	Air flow m ³ /s	STANDBY POWER	PRIME POWER
			Air on temp °C	Air on temp °C
1500	0	6,4	55	60
	150	5,6	50	56
	300	4,7	43	49
	450	4,2	38	45
1800	0	7,8	58	60
	150	7,2	55	57
	300	6,5	51	54
	450	5,7	46	49

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%	0
Governor response	Adjustable PID-constant (VODIA)	Standard
Dual speed [rpm]	1500/1800	1500
Idle speed [rpm]	600-1200	900
Fine speed adjustment [rpm]	±90rpm	0
Stop function	Energized to Run / Stop	Energized to Stop
Preheating function	On / Off	On

Engine protection map

Parameter	Unit	Warning Level (Yellow)	Engine protection			
			Alarm level (Red)	Default	Optional	
Oil temp	°C	127	130	Shut down	N/A	
Oil pressure	Low idle	kPa	170	145	Shut down	N/A
	1500 rpm	kPa	300	275	Shut down	N/A
	1800 rpm	kPa	300	275	Shut down	N/A
Oil level			Min level	Shut down	N/A	
Piston cooling pressure >1000 rpm			N/A		N/A	
					N/A	
Coolant temp	°C	105	107	Shut down	N/A	
Coolant level			Min level	Shut down	N/A	
Fuel feed pressure	Low idle	kPa	80	Alarm level	N/A	
	>1400 rpm		80	Alarm level	N/A	
Water in fuel			High level		N/A	
Crank case pressure	kPa		Increased pressure	Shut down	N/A	
Air filter pressure drop	kPa		5		N/A	
Altitude, above sea	m			Automatic derating, see derating section	N/A	
Charge air temp	°C	80	85	Shut down	N/A	
Charge air pressure	kPa	35 above demanded	40 above demanded	Shut down	N/A	
Engine speed	rpm	N/A	N/A	N/A	N/A	

Electrical system

Voltage and type		24V	
Alternator:	make/output	A	Bosch 80 A
	tacho output	Hz/alt. Rev	6
	drive ratio		5.3:1
Starter motor	make		Melco
	type		105P70
	kW		7.0
Number of teeth on:	flywheel		153
	starter motor		12
Max wiring resistance main circuit		mΩ	2
Cranking current at +20°C		A	180
Crank engine speed at 20°C		rpm	155
Starter motor battery capacity:	min	Ah	120
	CCA at -18°C	Ah/A	700
Inlet manifold heater (at 24 V)		kW	4
Power relay for the manifold heater		A	1

