


VOLVO PENTA	Document No	Issue Index
	TWD1644GE	23110277

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 diesel engine with direct injection. Rotation direction, anti-clockwise viewed towards flywheel. 2 - stage turbocharged with intercooling and aftercooling.

Number of cylinders			6
Displacement, total		litre	16,12
		in ³	983,9
Firing order			1-5-3-6-2-4
Bore		mm	144
		in	5,67
Stroke		mm	165
		in	6,50
Compression ratio			16,8
Wet weight (Not including after treatment system)	Engine only	kg	1810
		lb	3990
	Engine incl. cooling system and air filtration system	kg	2217
		lb	4888
	Engine incl. cooling system, air filtration system, and frame	kg	2767
		lb	6100

Performance

		rpm	1500	1800
Prime Power	without fan	kW	575	616
		hp	783	838
	with fan	kW	554	582
		hp	754	792
Standby Power	without fan	kW	630	674
		hp	857	917
	with fan	kW	609	640
		hp	828	870
Torque at:	Prime Power	Nm	3663	3268
		lbft	2702	2410
	Standby Power	Nm	4011	3576
		lbft	2958	2637
		%		
Mean piston speed		m/s	8,3	9,9
		ft/sec	27,1	32,6
Effective mean pressure at:	Prime Power	MPa	2,86	2,55
		psi	414	369
Effective mean pressure at:	Standby Power	MPa	3,13	2,79
		psi	453	404
Max combustion pressure at:	Prime Power	MPa	18,8	17,5
		psi	2727	2538
Max combustion pressure at:	Standby Power	MPa	21,2	19,5
		psi	3075	2828
Total mass moment of inertia, SAE 1 14" flywheel J (mR ²)		kgm ²	4,40	
		lbft ²	104,3	
Total mass moment of inertia, SAE 0 18" flywheel J (mR ²) (an adapter is used to convert 14" flywheel to 18")		kgm ²	6,10	
		lbft ²	144,8	
Friction Power		kW	39	57
		hp	53,6	76,8
Derating due to altitude - see Technical Diagrams				

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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)		115,9	119,1
	Prime Power	dB(A)		118,3	120,6
	Standby Power	dB(A)		118,5	120,5
Calculated sound pressure Lp at 1 m	No load	dB(A)		103,9	107,1
	Prime Power	dB(A)		106,3	108,6
	Standby Power	dB(A)		106,5	108,5

Unsilenced exhaust noise

Data calculated as sound pressure Lp.

Assumed microphone distance 1 m

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

Test conditions for load acceptance data

Warm engine.	Generator	Model	Type of AVR			
	ABB	AMG 0355CC04 DBPM	Basler Electric DECS - 150			
AVR Settings	UFRO (Hz):	3	DIP *:	1,4	DWELL *:	1,4
			Voltage (V):	400	Load factor:	1.0

Applies to Stamford nomenclature,

* (V/Hz) :

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 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.

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

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time G3 +/- 8 V (s)	Voltage Recovery time G2 +/- 20 V (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time G3 +/- 8 V (s)	Voltage Recovery time G2 +/- 20 V (s)
0-20	2,0	0,0	-	-	-	20-100	18,8	2,1	-	-	-
0-40	18,8	1,0	-	-	-	40-100	9,7	1,1	-	-	-
0-50	-	-	-	-	-	50-100	-	-	-	-	-
0-60	12,9	1,5	-	-	-	60-100	5,1	0,8	-	-	-
0-45 (G3)	7,0	1,1	-	-	-	38-100	-	-	-	-	-
0-52 (G2)	10,0	1,4	-	-	-	51-100	-	-	-	-	-
0-80	20,3	2,2	-	-	-	80-100	1,9	0,0	-	-	-
0-100	27,5	2,9	-	-	-						
100-0	3,1	0,4	-	-	-						

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

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time G3 +/- 8 V (s)	Voltage Recovery time G2 +/- 20 V (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time G3 +/- 8 V (s)	Voltage Recovery time G2 +/- 20 V (s)
0-20	2,2	0,5	-	-	-	20-100	19,5	2,4	-	-	-
0-40	4,5	1,0	-	-	-	40-100	10,9	1,5	-	-	-
0-50	-	-	-	-	-	50-100	-	-	-	-	-
0-60	12,9	1,5	-	-	-	60-100	7,3	1,1	-	-	-
0-41 (G3)	7,0	1,1	-	-	-	41-100	-	-	-	-	-
0-47 (G2)	10,0	1,4	-	-	-	47-100	-	-	-	-	-
0-80	24,1	2,4	-	-	-	80-100	1,9	0,0	-	-	-
0-100	27,5	2,9	-	-	-						
100-0	6,7	1,0	-	-	-						

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

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time G3 +/- 8 V (s)	Voltage Recovery time G2 +/- 20 V (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time G3 +/- 8 V (s)	Voltage Recovery time G2 +/- 20 V (s)
0-20	1,5	0,0	-	-	-	20-100	11,1	1,5	-	-	-
0-40	4,2	0,7	-	-	-	40-100	7,9	1,1	-	-	-
0-50	-	-	-	-	-	50-100	-	-	-	-	-
0-60	8,8	1,1	-	-	-	60-100	5,0	0,9	-	-	-
0-52 (G3)	6,8	1,0	-	-	-	53-100	-	-	-	-	-
0-62 (G2)	9,8	1,2	-	-	-	67-100	-	-	-	-	-
0-80	14,3	1,5	-	-	-	80-100	1,6	0,0	-	-	-
0-100	19,6	2,1	-	-	-						
100-0	2,7	0,3	-	-	-						

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

Load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time G3 +/- 8 V (s)	Voltage Recovery time G2 +/- 20 V (s)	Remaining load (%)	Speed diff (%)	Speed Recovery time (s)	Voltage diff (%)	Voltage Recovery time G3 +/- 8 V (s)	Voltage Recovery time G2 +/- 20 V (s)
0-20	1,7	0,0	-	-	-	20-100	12,9	2,2	-	-	-
0-40	5,0	1,0	-	-	-	40-100	9,4	1,0	-	-	-
0-50	-	-	-	-	-	50-100	-	-	-	-	-
0-60	10,3	1,5	-	-	-	60-100	5,8	1,2	-	-	-
0-47 (G3)	6,8	1,0	-	-	-	47-100	-	-	-	-	-
0-56 (G2)	9,8	1,2	-	-	-	56-100	-	-	-	-	-
0-80	16,7	1,7	-	-	-	80-100	1,9	0,0	-	-	-
0-100	22,4	2,6	-	-	-						
100-0	3,7	0,4	-	-	-						

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Cold start performance	Ambient temperature deg C	Cooling water temp engine block with heater deg C	1500	1800
			Time from start to stay within 0.5% of no load speed at ambient temperature: °C	20
	5			7
	-15 *			9
	-30 **	4,2		7,2
	Min start temp*	°C		

* With air inlet pre-heater 4 kW engaged, lubrication oil 10W/30.

** With air inlet pre-heater 4 kW engaged, lubrication oil 10W/30 and block heater 2 kW (230 V), Fuel SD10

Block heater type	Heater on / off (Deg C)	Power kW 230 V / 110 V	Engaged hours	Cooling water temp engine block
Calix PH	30 / 50	2 / 1,5	10 h 1,5 kW at - 30 C	-2°C

Lubrication system

		rpm	1500	1800
Lubricating oil consumption	Prime Power	litre/h	0,10	0,10
		US gal/h	0,026	0,026
	Standby Power	litre/h	0,11	0,11
		US gal/h	0,029	0,029
Oil system capacity including filters		litre	48	
		US gal	12,7	
Oil sump capacity:	max	litre	42	
		US gal	11,1	
	min	litre	32	
		US gal	8,5	
Oil change intervals/specifications:	VDS-2 / VDS-3	h	500	
	VDS, ACEA E3	h	400	
	ACEA E2, API CD, CF, CF-4, CG-4	h	200	
Engine angularity limits:	front up	°	30	
	front down	°	30	
	side tilt	°	30	
Oil pressure at rated speed		kPa	300 - 500	
		psi	44 - 73	
Main Oil filter; cleaning efficiency 99% at particle size		µm	38	
By-pass Oil filter; cleaning efficiency 99% at particle size		µm	11	

* See also general section in the sales guide

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Fuel system		rpm	1500	1800
Prime Power Specific fuel consumption at:	25%	g/kWh	225	235
		lb/hph	0,364	0,380
	50%	g/kWh	196	204
		lb/hph	0,318	0,331
	75%	g/kWh	194	199
		lb/hph	0,315	0,323
	100%	g/kWh	194	199
		lb/hph	0,314	0,322



Standby Power Specific fuel consumption at:	25%	g/kWh	221	227
		lb/hph	0,359	0,367
	50%	g/kWh	195	202
		lb/hph	0,317	0,327
	75%	g/kWh	195	199
		lb/hph	0,317	0,323
	100%	g/kWh	193	198
		lb/hph	0,312	0,320

Fuel system		rpm	1500	1800
Fuel to conform to	ASTM-D975-NO 1 and 2-D JIS KK 2204, EN590			
System supply flow at: Standby Power	litre/h		170	185
	US gal/h		44,9	48,9
Fuel supply line max restriction (Measured at fuel inlet connection at full engine load)	kPa		-10,0	-10,0
	psi		-1,5	-1,5
Fuel supply line max pressure when engine is stopped. To avoid lube oil dilution by fuel.	kPa		16,5	16,5
	psi		2,4	2,4
System return flow	litre/h		25,0	25,0
	US gal/h		6,6	6,6
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		60	60
	°F		140	140
Prefilter - Water separator efficiency (minimum)	%		98	
Prefilter - cleaning efficiency with new filter 98% at particulate size	µm		30	
Fuel filter - cleaning efficiency with new filter 98% at particulate size	µm		5	
Governor type/make, standard	Volvo / EMS 2.3			
Injection pump type/make	Unit Injector Delphi E3			


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Intake and exhaust system

		rpm	1500	1800
Air consumption at: (+25°C and 100kPa)	Prime Power	m ³ /min cfm	39,1 1381	42,3 1495
	Standby Power	m ³ /min cfm	42,1 1486	46,7 1649
 See front page for important information				
Max allowable air intake restriction including piping with a clean air filter		kPa psi	-3,0 -0,4	-3,0 -0,4
Measured pressure drop standard Penta air inlet installation & clean filter		kPa	-1,8	-2,1
Measured at standard inlet depression sensor position. Stand-by rating		psi	-0,3	-0,3
Heat rejection to exhaust at:	Prime Power	kW	406	464
		BTU/min	23089	26387
	Standby Power	kW BTU/min	432 24567	495 28150
Exhaust gas temperature after LP turbine at:	Prime Power	°C	485	509
		°F	905	948
	Standby Power	°C	480	495
		°F	896	923
 See front page for important information				
Max allowable back pressure in exhaust line	Prime Power	kPa psi	9 1,3	9 1,3
	Standby Power	kPa psi	10 1,5	10 1,5
Exhaust gas flow at: (temp and pressure after LP turbine at the corresponding power setting)	Prime Power	m ³ /min cfm	93,5 3302	105,6 3729
		Standby Power	m ³ /min cfm	100,0 3532

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Cooling system		Cooling system		1500	1800
Heat rejection radiation & convection from engine at:	Prime Power	kW	21	23	
		BTU/min	1177	1297	
	Standby Power	kW	24	24	
		BTU/min	1365	1342	
Heat rejection to coolant HT circuit engine radiator at:	Prime Power	kW	211	233	
		BTU/min	11999	13250	
	Standby Power	kW	228	246	
		BTU/min	12966	13990	
Heat rejection to coolant LT circuit CAC radiator at:	Prime Power	kW	116	122	
		BTU/min	6574	6910	
	Standby Power	kW	133	147	
		BTU/min	7564	8360	
Radiator cooling system type		Two circuits, HT & LT			
Coolant		Volvo Penta coolant "ready mix" or Volvo Penta coolant mixed with clean fresh water 40 / 60			
Engine radiator core area		m ²	1,77		
		foot ²	19,05		
CAC radiator core area		m ²	1,77		
		foot ²	19,05		
Fan diameter		mm	965		
		in	37,99		
Fan power consumption		kW	21	34	
		hp	29	46	
Fan drive ratio		1,04			
Coolant capacity	Engine only	litre	25		
		US gal	6,60		
	Charge air coolers (HP + LP CAC)	litre	10		
		US gal	2,64		
	Coolant radiators incl piping, Engine circuit, (HT)	litre	50		
		US gal	13,21		
	Coolant radiators incl piping, CAC circuit, LT	litre	50		
		US gal	13,21		
	Expansion tank, Engine circuit, water volume	litre	11,8		
	US gal	3,12			
Expansion tank, Engine circuit, air volume	litre	6,5			
	US gal	1,72			
Expansion tank, CAC circuit water volume	litre	4,3			
	US gal	1,14			
Expansion tank, CAC circuit air volume	litre	2,4			
	US gal	0,63			
Coolant pump, HT		drive/ratio	Belt / 1,85		
Coolant pump, CAC circuit, LT		drive/ratio	Belt / 2,29		
Thermostat	start to open	°C	82		
		°F	180		
	fully open	°C	92		
		°F	198		
Maximum static pressure head, at water pump inlet (expansion tank height + pressure cap setting)		kPa	100		
		psi	14,5		
Minimum static pressure head (expansion tank height + pressure cap setting)		kPa	70		
		psi	10,2		
Standard pressure cap setting		kPa	75		
		psi	10,9		
Maximum top tank temperature		°C	107		
		°F	225		
Charge air pressure (Prime power) (measured in inlet manifold, absolute pressure)		kPa (a)	395	366	
		psi (abs)	57,3	53,1	
Charge air pressure (Stand-by power) (measured in inlet manifold, absolute pressure)		kPa (a)	427	402	
		psi (abs)	61,9	58,3	
 See front page for important information					
Charge air temp. Measured in inlet manifold, at 25 deg ambient temp	Prime Power	°C	46	46	
		°F	115	115	
	Standby Power	°C	47	45	
		°F	117	113	

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OEM cooling system design:**- move of standard radiators**

		rpm	1500	1800
Maximum additional coolant with standard expansion tank		litre		15
		US gal	3,96	
Maximum additional coolant, CAC with standard expansion tank		litre	5	
		US gal	1,32	
Maximum distance in vertical direction with standard pressure cap (75 kPa)		m	2,5	
		ft	8,20	
Maximum additional pressure drop due to move		KPa	10	
		psi	1,5	
Heat rejection to coolant HT circuit engine radiator at:	Prime Power	kW	211	233
		BTU/min	11999	13250
	Standby Power	kW	228	246
		BTU/min	12966	13990
Heat rejection to coolant LT circuit CAC radiator at:	Prime Power	kW	116	122
		BTU/min	6574	6910
	Standby Power	kW	133	147
		BTU/min	7564	8360
Minimum coolant flow engine radiator (at fully open thermostat)		litre/s	4,8	6
		US gal/s	1,27	1,59
Minimum coolant flow CAC radiator (at fully open thermostat)		litre/s	1,7	2,1
		US gal/s	0,45	0,55
Maximum coolant pressure drop over engine- radiator incl. Piping (at coolant flow above)		kPa	45	65
		psi	6,5	9,4
Maximum coolant pressure drop over CAC - radiator incl. piping (at coolant flow above)		kPa	40	70
		psi	5,8	10,2
Maximum coolant pressure drop over complete engine cooling system (at coolant flow above)		kPa	110	160
		psi	16,0	23,2
Maximum coolant pressure drop over complete CAC cooling circuit (at coolant flow above)		kPa	87	135
		psi	12,6	19,6
Nominal coolant pressure before CAC circuit coolant pump		kPa	50	50
		psi	7,3	7,3
Nominal coolant pressure before engine circuit coolant pump		kPa	50	50
		psi	7,3	7,3

OEM cooling system design: 2-circuit system - engine coolant circuit

		rpm	1500	1800
Heat rejection to coolant engine coolant circuit:	Prime Power	kW		
		BTU/min		
	Standby Power	kW		
		BTU/min		
Min coolant flow engine coolant circuit (at fully open thermostat)		litre/s		
		US gal/s		
Maximum coolant temperature entering engine		°C		
		F		
Maximum external engine coolant circuit restriction, including piping		kPa		
		psi		
Nominal coolant pressure		kPa		
		psi		

- charge air cooler (CAC) coolant circuit

Heat rejection to coolant CAC coolant circuit:	Prime Power	kW		
		BTU/min		
	Standby Power	kW		
		BTU/min		
Minimum coolant flow CAC coolant circuit:		litre/s		
		US gal/s		
Maximum coolant temperature entering CAC (at air inlet temperature 25°C)		°C		
		F		
Coolant pressure drop over charge air coolers (at Minimum coolant flow CAC coolant circuit above)		kPa		
		psi		
Nominal CAC coolant pressure		kPa		
		psi		

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Cooling performance

Standard far 965 mm

Fan ratio: 1,04

Fan type: FIX

Top Tank temperatur TT: 107°C

Antifreeze content: 40%, Temperature inlet air at filter; 40°C

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	65	11,4	0	11,4	0	
	62,5					
	60,6					150
	58,1					300
	55,1					450
1800	65,1	13,4	0	13,3	0	
	63					
	63,1					150
	61					300
	59,5					450

Note! External restrictions are calculated for values >0 Pa

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Engine management system

Functionality	Alternatives			Default setting
Governor mode	Droop	Isochronous		Isochronous
Governor droop	4%	0		N/A
Governor response	Adjustable PID-constants (VODIA)			
Dual speed	1500 rpm, 50 Hz / 1800 rpm, 60 Hz			1500 rpm, 50 Hz / 1800 rpm, 60 Hz
Idle speed	600 - 1200			900
Fine speed adjustment	+/- 90 rpm			0
Preheating function	Ignition	Request	Request + temp	If preheat available, preheat will be active at ignition on if temp low or demanded.
Ignition off stop engine	Yes		No	No

Engine sensor and switch settings

Parameter	Unit	Engine protection action				
		Warning level (Yellow)	Alarm level (Red)	Default	Optional	
Oil temp	°C	125	127,5	Shut down after 10s	N/A	
Oil pressure	900 rpm	kPa	170	145	Shut down	N/A
	1500 rpm		300	275	Shut down	N/A
	1800 rpm		300	275	Shut down	N/A
Oil level		Low level	N/A	Fault code only	N/A	
Coolant temp	°C	103	107	Shut down after 10s	N/A	
Coolant level		N/A	Low level	Shut down after 10s	N/A	
Fuel feed pressure	900 rpm	kPa	100	N/A	Fault code only	N/A
	1500 rpm		225	N/A	Fault code only	N/A
	1800 rpm		300	N/A	Fault code only	N/A
Water in fuel		Alarm when closed	N/A	Fault code only	N/A	
Crank case pressure	kPa	N/A	Alarm at high peaks	Shut down	N/A	
Air filter pressure droop	kPa	5	N/A	Fault code only	N/A	
Altitude, above sea	m	N/A	N/A	Automatic derating, see section derating	N/A	
Charge air temp	°C	80	82,5	Shut down after 10s	N/A	
Charge air pressure	kPa	30 above demand	40 above demand	Shut down after 1s	N/A	
Engine overspeed	rpm	1900	N/A	Fault code only	N/A	

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Electrical system

Voltage and type		24 V / insulated from earth	
Alternator:	make/output	A	Bosch / 80
	tacho output	Hz/alt. Rev	6
	drive ratio		3,94 : 1
Starter motor	make	Mitsubishi Electric	
	type	24V 7 kW 12/3. 17F	
	kW	7,0	
Number of teeth on:	flywheel	153	
	starter motor	12	
Max wiring resistance starter circuit (harness, main switch, connectors, etc), at 20°C		mΩ	3
Cranking current at +20°C		A	300
Crank engine speed at 20°C		rpm	155
Starter motor battery capacity:	min	Ah/A	2 x 145
	CCA at -18°C	A	900
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	N/A	
		lbft	N/A	
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW	N/A	N/A
		hp		
	max down	kW	N/A	N/A
		hp		
	max right	kW	N/A	N/A
		hp		
Timing gear at compressor PTO max:		Nm	600	
		lbft	443	
Speed ratio / direction of rotation viewed from flywheel side		0,91:1 / clockwise		
Timing gear at servo pump PTO max:		Nm	100	
		lbft	74	
Speed ratio / direction of rotation viewed from flywheel side		1,58:1 / clockwise		
Max allowed bending moment in flywheel housing		Nm	15000	
		lbft	11063	
Max. rear main bearing load		N	N/A	
		lbf		

