


<b>VOLVO PENTA</b>	Document No	Issue Index
	<b>23776347</b>	<b>03</b>
<b>TWD1683GE</b>		

### 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 <sup>3</sup>	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			16.8:1
Wet weight w/o EATS	Engine only	kg lb	1810 3990
	Engine incl. cooling system and air filtration system	kg lb	2217 4888
	Engine incl. cooling system, air filtration system, and frame	kg lb	2767 6100
Wet weight EATS only	EATS (XL Urea Tank, 165 Liters)	kg lb	255 562
	EATS (L Urea Tank, 70 Liters)	kg lb	226 498

### Performance

			<b>rpm</b>	<b>1500</b>	<b>1800</b>
Prime Power	without fan	kW		590	626
		hp		802	851
	with fan	kW		570	596
		hp		775	811
Standby Power	without fan	kW		647	685
		hp		880	932
	with fan	kW		627	655
		hp		853	891
COP Power	without fan	kW		443	470
		hp		602	639
	with fan	kW		428	447
		hp		581	608
Torque at:	Prime Power	Nm		3756	3321
		lbft		2770	2449
	Standby Power	Nm		4119	3634
		lbft		3038	2680
Total mass moment of inertia, J (mR <sup>2</sup> )		kgm <sup>2</sup> lbft <sup>2</sup>		2,50 59,3	

**Derating due to altitude - see Technical Diagrams**

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**Engine noise emission**

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

Tolerance  $\pm 0.75$  dB(A)

		rpm	1500	1800
Measured sound power Lw	No load	dB(A)	118,2	119,3
	Prime Power	dB(A)	118,2	119,8
	Standby Power	dB(A)	117,8	119,9
Calculated sound pressure Lp at 1 m	No load	dB(A)	106,2	107,3
	Prime Power	dB(A)	106,2	107,8
	Standby Power	dB(A)	105,8	107,9

**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	DWELL: 1.4
		Voltage (V):	400
			Power factor: 1.0

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.

**Load Acceptance at 1500 rpm**

Genset Classification

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

Load (%)	Speed diff (%)	Speed Recovery time (s)	
0-47	7 (G3)	1,8	G3 boundary conditions
0-54	10 (G2)	2,0	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	1,9	1,3	-	-	20-100	19,8	3,3	19,0	1,9
0-40	4,9	1,2	0,8	0,8	40-100	10,3	1,9	7,5	1,2
0-60	14,9	2,1	13,1	1,7	60-100	4,0	1,3	1,5	1,3
0-80	23,2	3,6	25,4	2,5	80-100	1,7	0,7	0,8	0,8
0-100	30,0	4,6	35,5	3,5					
0-110	31,7	5,0	38,3	3,7					
100-0	9,8	2,6	4,3	2,0					

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**Load Acceptance at 1800 rpm**

## Genset Classification

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

Load (%)	Speed diff (%)	Speed Recovery time (s)	
0-55	7 (G3)	1,2	G3 boundary conditions
0-64	10 (G2)	1,3	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	1,3	0,5	-	-	20-100	11,4	1,5	12,0	1,2
0-40	2,8	0,8	-	-	40-100	6,2	0,9	3,2	0,9
0-60	7,5	1,0	5,0	1,0	60-100	3,4	0,7	1,3	0,9
0-80	13,8	1,6	15,8	1,6	80-100	1,4	0,7	1,0	0,6
0-100	19,6	2,2	25,8	2,0					
0-110	21,6	2,5	29,5	2,4					
100-0	4,0	1,2	4,3	1,8					

Cold start performance	Ambient Temp. [°C]	Manifold Heater	Block heater	RPM	
				1500	1800
Time to Set Speed from start	20	-	-	4,7 sec.	5,0 sec.
	5	-	-	4,8 sec.	6,3 sec.
	-15 *	Yes	-	7,0 sec.	6,8 sec.
	-30 **	Yes	Yes	6,2 sec.	6,7 sec.

Min start temp w/o Block Heater*	-30	°C
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\* With manifold heater 6 kW engaged, lubrication oil SAE 10W/30.

\*\* With manifold heater 6 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 partnumber: 23012775	2	15	7°C 45°F

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Lubrication system		rpm	1500	1800
Lubricating oil consumption	Prime Power	litre/h	0,07	0,08
		US gal/h	0,018	0,022
	Standby Power	litre/h	0,10	0,10
		US gal/h	0,025	0,026
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 4.5 10W/30	h	500	
Engine angularity limits:	front up	°	30	
	front down	°	30	
	side tilt	°	30	
Oil pressure at rated speed		kPa	395 - 415	
		psi	57 - 60	
Lubrication oil temperature in oil sump:	max	°C	130	
		°F	266	
Oil filter micron size		μ	40,000	

\* See also general section in the sales guide

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Fuel system		rpm	1500	1800
<b>Prime Power</b> Specific fuel consumption at:	25%	g/kWh lb/hph	214 0,347	230 0,373
	50%	g/kWh lb/hph	195 0,316	203 0,329
	75%	g/kWh lb/hph	191 0,309	196 0,317
	100%	g/kWh lb/hph	191 0,309	195 0,315
% DEF consumption at: (Compare to Fuel consumption by Volyme)	25%	%	6,3	5,6
	50%	%	7,2	6,3
	75%	%	7,0	6,8
	100%	%	6,6	6,2
<b>Standby Power</b> Specific fuel consumption at:	25%	g/kWh lb/hph	211 0,341	225 0,364
	50%	g/kWh lb/hph	194 0,315	201 0,325
	75%	g/kWh lb/hph	191 0,310	194 0,315
	100%	g/kWh lb/hph	193 0,313	196 0,318
% DEF consumption at: (Compare to Fuel consumption by Volume)	25%	%	6,6	5,7
	50%	%	7,2	6,4
	75%	%	6,7	6,7
	100%	%	6,4	5,9

CO2 emission declaration	rpm	1500	1800
Carbon dioxide (CO <sub>2</sub> ) emissions determined during the EU type approval process, NRSC-D2.	g/kWh	619	647

Fuel system		rpm	1500	1800
Fuel to conform to	EN590:2013 ASTM D 975 1-D and 2-D EN15940:2016 (GTL/HVO) SS-155435:201 (MK1)			
System supply flow at:	litre/h US gal/h	177,0 46,8	195,0 51,5	
Fuel supply line max restriction (Measured at fuel inlet connection)	kPa psi	-20,0 -2,9	-20,0 -2,9	
Fuel supply line max pressure, engine stopped	kPa psi	16,5 2,4	16,5 2,4	
System return flow	litre/h US gal/h	25,0 6,6	25,0 6,6	
Fuel return line max restriction (Measured at fuel return connection)	kPa psi	20,0 2,9	20,0 2,9	
Maximum allowable inlet fuel temp (Measured at fuel inlet connection)	°C °F	60 140	60 140	
Prefilter / Water separator micron size	µ	30		
Fuel filter micron size	µ	5		
Governor type/make, standard	Volvo / EMS 2.4			
Injection pump type/make	Unit Injector Delphi			

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**Intake and exhaust system**

		rpm	1500	1800
Air consumption at: (+25°C and 100kPa)	Prime Power	m <sup>3</sup> /min	43	48
		cfm	1519	1695
	Standby Power	m <sup>3</sup> /min	45	51
		cfm	1589	1801

**See front page for important information**

Max allowable air intake restriction including piping	kPa	3	3	
	psi	0,4	0,4	
Air filter restriction clean Volvo Penta filter	kPa	2,3	2,5	
	psi	0,3	0,4	
Heat rejection to exhaust at:	Prime Power	kW	393	438
		BTU/min	22350	24909
	Standby Power	kW	448	495
		BTU/min	25477	28150
Exhaust gas temperature after turbine at:	Prime Power	°C	434	432
		°F	813	810
	Standby Power	°C	464	461
		°F	867	862

**See front page for important information**

Max allowable back pressure in exhaust line (after turbine)	Prime Power	kPa	20	20
		psi	2,9	2,9
Pipe dimension Ø:           200 mm	Standby Power	kPa	20	20
		psi	2,9	2,9

**See front page for important information**

Max allowable temperature drop between turbine and SCR muffler inlet.	Prime Power	Δ°C	10	10
		Δ°F	18	18
	Standby Power	Δ°C	10	10
		Δ°F	18	18
SCR muffler pressure drop (at exhaust max Power)	Standby Power	kPa	10	10
		psi	1,5	1,5
		Exhaust gas flow at: (temp and pressure after turbine at max Power)	Standby Power	m <sup>3</sup> /min
cfm	3673			3991

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<b>Cooling system</b>		<b>rpm</b>	<b>1500</b>	<b>1800</b>
Heat rejection radiation from engine at max Power:		kW	20	20
		BTU/min	1137	1137
Radiator cooling system type		Closed circuit		
Standard radiator core area		m <sup>2</sup>	1,68	
		foot <sup>2</sup>	18,08	
Fan diameter		mm	965	
		in	37,99	
Fan power consumption		kW	20	30
		hp	27	41
Fan drive ratio		1.04:1		
Coolant capacity,	engine only	litre	33	
		US gal	8,72	
	charge air coolers	litre	10	
		US gal	2,64	
	coolant radiators incl piping	litre	48	
	US gal	12,68		
	expansion tank	litre	20	
		US gal	5,28	
Coolant pump		drive/ratio	Belt / 1.85:1	
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	100	
		psi	14,5	
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	
Charge air pressure (after charge air coolers)		kPa	350	
		psi	50,8	



**See front page for important information**

Max allowable Charge air outlet temp. (Charge air temp after intercooler) Amb. Temp. 25°C	Prime Power	°C	50	50
		°F	122	122
	Standby Power	°C	50	50
		°F	122	122

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**OEM cooling system design:****- remote position of standard radiators**

	rpm	1500	1800
Maximum additional coolant with standard expansion tank	litre	15	15
	US gal	4	4
Maximum distance in vertical direction with standard pressure cap (100 kPa)	m	4	4
	ft	13	13
Maximum additional pressure drop due to remote position	KPa	10	10
	psi	1	1

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

	rpm	1500	1800
Heat rejection to coolant <b>engine coolant circuit:</b>	Prime Power	kW 188	214
		BTU/min 10691	12170
	Standby Power	kW 188	218
		BTU/min 10691	12397
Min coolant flow <b>engine coolant circuit</b> (at fully open thermostat)	litre/s	6,5	7,7
	US gal/s	1,71	2,04
Maximum coolant temperature entering engine (25°C amb. Temp.)	°C	82	
	F	180	
Maximum external <b>engine coolant circuit</b> restriction, including piping (25°C amb. Temp.)	kPa	90	
	psi	13,1	
Nominal coolant pressure	kPa	100	100
	psi	14,5	14,5
<b>- charge air cooler (CAC) coolant circuit</b>			
Heat rejection to coolant <b>CAC coolant circuit:</b>	Prime Power	kW 139	160
		BTU/min 7905	9099
	Standby Power	kW 151	167
		BTU/min 8587	9497
Nominal coolant flow <b>CAC coolant circuit:</b>	litre/s	1,7	2,0
	US gal/s	0,45	0,53
Maximum coolant temperature entering CAC (at air inlet temperature 25°C )	°C	40	
	F	104	
Coolant pressure drop over Low Temp. Radiator (at Nominal coolant flow CAC coolant circuit above)	kPa	65	85
	psi	9,4	12,3
Nominal CAC coolant pressure	kPa	100	100
	psi	14,5	14,5



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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 m <sup>3</sup> /s	External restriction Pa	Air flow m <sup>3</sup> /s	External restriction Pa
1500	66	11,4	0		
	64	11,0	100		
	63	10,4	200		
	62	10,0	300	11,4	0
	60			11,0	100
	59			10,4	200
	58			10,0	300
1800	67	13,4	0		
	66	12,7	100		
	65	12,2	200		
	64	11,7	300	13,4	0
	62			12,7	100
	61			12,2	200
	59			11,7	300

Note! External restrictions are calculated for values >0 Pa

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**Engine management system**

Functionality	Alternatives	Default setting
Governor mode	Isochronous	Isochronous
Governor droop		
Governor response	Adjustable PID-constants (VODIA)	
Dual speed	1500rpm 50Hz/ 1800 rpm 60Hz	1500 rpm 50 Hz
Idle speed	900-1200rpm	900rpm
Fine speed adjustment	+ - 90 rpm	
Stop function		
Preheating function	On / Off	
Lamp test		

**Engine sensor and switch settings**

Parameter	Unit	Warning Level (Yellow)	Engine protection			
			Alarm level (Red)	Default	Optional	
Oil temp	°C	125	130,0	Shut down.	N/A	
Oil pressure	Low idle	kPa	170	145,0	Shut down	N/A
	1500 rpm	kPa	300,0	275,0	Shut down	N/A
	1800 rpm	kPa	300,0	275,0	Shut down	N/A
Oil level			Low level		N/A	
DEF Dosing injector failure		Min. Level		Shut down	N/A	
Piston cooling pressure >1000 rpm	kPa	N/A	N/A	N/A	N/A	
Coolant temp	°C	103	107,0	Shut down.	N/A	
Coolant level		On	Low level	Shut down.	N/A	
Fuel feed pressure	Low idle	kPa			N/A	
	>1400 rpm				N/A	
Water in fuel					N/A	
Crank case pressure	kPa	N/A	N/A	N/A	N/A	
Air filter pressure droop	kPa				N/A	
Altitude, above sea	m			Automatic derating, see section derating	N/A	
Charge air temp	°C	80	82,5	Shut down	N/A	
Charge air pressure	kPa	30 above demanded	40 above demanded	Shut down	N/A	
Engine speed	rpm	115% of rated speed	Alarm level	Shut down.	N/A	
Exhaust Temperature (Before SCR volume)	°C	530	550,0	Shut down.	N/A	

**Engine protection can be disabled. For consequences please see VP International Limited Warranty Policy**

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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	24 V 7 kW 12/3. 17F	
	kW	7,0	
Number of teeth on:	flywheel		153
	starter motor		12
Max wiring resistance main circuit		mΩ	3
Cranking current at +20°C		A	400
Crank engine speed at 20°C		rpm	155
Starter motor battery capacity:	min	Ah	2 x 145
	CCA at -18°C	Ah/A	900
Inlet manifold heater (at 24 V)		kW	3,6
Power relay for the manifold heater		A	1

