

General

4-stroke direct injected, turbocharged and aftercooled diesel engine

Number of cylinders		6
No of valves		24
Displacement, total	litres in ³	16,12 983,9
Firing order		1-5-3-6-2-4
Rotational direction, viewed from the front		Clockwise
Bore	mm in	144 5,67
Stroke	mm in	165 6,50
Compression ratio		17.5:1
Compression pressure at 240 rpm	MPa psi	N/A
Max. static forward inclination:	°	5
Max. static backward inclination:	°	11
Max. intermittent forward inclination while running:	°	10
Max. intermittent backward inclination while running:	°	21
Max. intermittent side inclination while running:	°	30
Idling speed	rpm	550 - 800
Rated speed D16-750 R2	rpm	1900
Rated speed D16-650 R1	rpm	1800
Rated speed D16-600 R1	rpm	1800
Propeller selection range D16-750 R2	rpm	1880-1950
Propeller selection range D16-650 R1	rpm	1780-1880
Propeller selection range D16-600 R1	rpm	1780-1850
Dry weight engine BT	kg lb	1750 3858

Performance		Rating	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000	
Crankshaft power 1), 5)	D16-750	2	kW	87	165	304	410	475	502	526	551	551	426	
			hp	118	224	413	558	646	683	715	749	749	579	
	D16-650	1	kW	87	165	304	410	459	473	478	478	377	0	
			hp	118	224	413	558	624	643	650	650	650	513	
	D16-600	1	kW	87	165	304	389	429	439	441	441	441	341	0
			hp	118	224	413	529	583	597	600	600	600	464	
Propeller shaft power 1) (At full load) With reverse gear TD MG 5145	2	kW	84	160	295	398	461	487	510	534	534	413		
		hp	115	218	401	541	627	662	694	727	727	562		
	1	kW	84	160	295	398	445	459	464	464	464	366		
		hp	115	218	401	541	606	624	630	631	631	497		
	1	kW	84	160	295	377	416	426	428	428	428	331		
		hp	115	218	401	513	566	579	582	582	582	450		
Propellershaft power at prop. load x ^{2.5} With reverse gear TD MG 5145	2	kW	30	61	107	169	249	296	348	348	467	534		
		hp	41	84	146	230	339	403	473	473	635	727		
	1	kW	30	61	107	168	247	294	345	345	464			
		hp	40	83	145	229	336	400	470	470	631			
	1	kW	27	56	98	155	228	271	319	319	428			
		hp	37	77	134	211	310	369	433	433	582			
Propellershaft power at prop. load x ³ With reverse gear TD MG 5145	2	kW	17	40	78	135	214	263	319	319	454	534		
		hp	23	54	106	183	291	358	434	434	618	727		
	1	kW	17	41	80	137	218	268	326	326	464			
		hp	23	55	108	187	297	365	443	443	631			
	1	kW	16	38	73	127	201	248	300	300	428			
		hp	22	51	100	172	274	337	409	409	582			
Torque at crankshaft 2)	2	Nm	1385	1970	2903	3266	3241	3196	3138	2923	2769	2034		
		lbf ft	1021	1453	2141	2409	2391	2357	2315	2156	2043	1500		
	1	Nm	1385	1970	2903	3263	3131	3011	2852	2536	1895			
		lbf ft	1021	1453	2141	2406	2309	2221	2104	1870	1398			
	1	Nm	1385	1970	2903	3096	2926	2795	2631	2340	1714			
		lbf ft	1021	1453	2141	2283	2158	2061	1941	1726	1264			
Mean piston speed		m/s	3,3	4,4	5,5	6,6	7,7	8,3	8,8	9,9	10,5	11,0		
		ft/s	10,8	14,4	18,0	21,7	25,3	27,1	28,9	32,5	34,3	36,1		
Effective mean pressure 2)	2	MPa	1,1	1,5	2,3	2,5	2,5	2,5	2,4	2,3	2,2	1,6		
		psi	156,5	222,6	328,2	369,2	366,4	361,3	354,7	330,4	313,0	229,9		
	1	MPa	1,1	1,5	2,3	2,5	2,4	2,3	2,2	2,0	1,5			
		psi	156,5	222,6	328,2	368,8	353,9	340,4	322,4	286,7	214,2			
	1	MPa	1,1	1,5	2,3	2,4	2,3	2,2	2,1	1,8	1,3			
		psi	156,5	222,6	328,2	349,9	330,8	315,9	297,5	264,5	193,7			
Max combustion pressure 2)	2	MPa	12	15	19	19	19	19	19	19	19	16		
		psi	1711	2176	2756	2698	2727	2785	2814	2756	2698	2306		
	1	MPa	12	15	19	19	18	18	18	18	15	0		
		psi	1726	2190	2785	2698	2669	2669	2669	2596	2190			
	1	MPa	12	15	19	19	18	17	17	17	14	0		
		psi	1706	2176	2770	2727	2553	2509	2524	2480	2089			

Lubricating system

Specific lubricating oil consumption.	g/kWh	0,08
Max. oil volume including filters for all allowed installation inclinations:	litres	55
	US gal	14,53
Max. oil volume excluding filters for all allowed installation inclinations:	litres	49
	US gal	12,94
Min. oil volume excluding filters for all allowed installation inclinations:	litres	39
	US gal	10,30

Fuel system	Rating	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000
Specific fuel consumption 2)	2	g/kWh lb/hph	251 0,41	240 0,39	213 0,34	198 0,32	199 0,32	203 0,33	206 0,33	212 0,34	215 0,35	210 0,34
	1	g/kWh lb/hph	250 0,41	239 0,39	213 0,34	197 0,32	199 0,32	201 0,32	200 0,32	205 0,33	206 0,33	0
	1	g/kWh lb/hph	249 0,40	241 0,39	214 0,35	196 0,32	197 0,32	200 0,32	199 0,32	203 0,33	207 0,34	0
Fuel consumption, Test cycle E3	2	g/kWh lb/hph	214,0 0,35									
	1	g/kWh lb/hph	210,4 0,34									
	1	g/kWh lb/hph	210,9 0,34									
Fuel consumption at prop. load x ^{2,5}	2	l/h	8,6	16,3	27,6	42,1	60,4	72,3	84,9	118,2	141,5	
		US gal/h	2,3	4,3	7,3	11,1	16,0	19,1	22,4	31,2	37,4	
	1	l/h	8,5	16,3	27,3	42,0	60,3	72,1	84,9	117,4		
		US gal/h	2,3	4,3	7,2	11,1	15,9	19,0	22,4	31,0		
	1	l/h	8,0	15,1	25,3	39,1	56,3	67,0	78,6	107,5		
		US gal/h	2,1	4,0	6,7	10,3	14,9	17,7	20,8	28,4		

Fuel system	Rating	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000
Fuel consumption at prop. load x ³	2	l/h	5,5	11,2	21,0	35,7	54,7	66,0	79,3	116,1	141,5	
		US gal/h	1,5	3,0	5,6	9,4	14,4	17,4	21,0	30,7	37,4	
	1	l/h	5,6	11,4	20,8	35,7	54,6	66,4	80,4	117,4		
		US gal/h	1,5	3,0	5,5	9,4	14,4	17,5	21,2	31,0		
	1	l/h	5,3	10,7	19,5	33,8	51,5	61,3	74,4	107,5		
		US gal/h	1,4	2,8	5,1	8,9	13,6	16,2	19,7	28,4		
Fuel consumption at full load	2	l/h	26,1	47,4	77,5	97,2	113,4	121,8	129,3	139,6	141,5	106,8
		US gal/h	6,9	12,5	20,5	25,7	30,0	32,2	34,2	36,9	37,4	28,2
	1	l/h	26,0	47,3	77,4	96,8	109,1	113,5	114,5	117,0	93,1	
		US gal/h	6,9	12,5	20,5	25,6	28,8	30,0	30,3	30,9	24,6	
	1	l/h	25,9	47,5	77,8	91,4	101,1	105,2	105,2	107,3	84,6	
		US gal/h	6,9	12,6	20,5	24,1	26,7	27,8	27,8	28,3	22,4	

Intake and exhaust system	Rating	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000	
Specific exhaust heating effect in percent of crankshaft power	2	%	75	79	73	66	66	66	68	72	75		
	1		75	80	73	67	66	66	67	69			
	1		74	81	74	68	67	68	68	70			
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	2	°C	500	607	586	478	429	422	426	448	457	371	
		°F	932	1125	1087	892	804	792	799	838	855	700	
	1	°C	501	604	584	477	422	410	397	389	344	0	
		°F	934	1119	1083	891	792	770	747	732	651		
	1	°C	483	610	583	483	420	408	393	377	340		
		°F	901	1130	1081	901	788	766	739	711	644		
Permitted back pressure in the exhaust line at rated speed. (Installed back pressure)		kPa psi							Max	15 2,2			
		kPa psi							Min	0 0,0			

Intake and exhaust system		Rating	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPA and relative humidity 30%.	2	m³/min cu.ft./min	5,1 180,1	9,0 317,8	16,5 582,7	25,8 911,1	34,2 1208	37,2 1314	39,5 1395	41,2 1455	41,5 1466	38,8 1370	
	1	m³/min cu.ft./min	5,1 180,1	9,0 317,8	16,5 582,7	25,8 911,1	33,3 1176	35,8 1264	37,4 1321	39,3 1388	36,7 1296	0	
	1	m³/min cu.ft./min	5,1 180,1	9,0 317,8	16,5 582,7	23,9 844	31,1 1098	34,2 1208	35,0 1236	37,6 1328	33,7 1190		
Charge air pressure Inlet manifold	2	kPa psi	23 3,3	59 8,6	131 19,0	198 28,7	239 34,7	252 36,5	254 36,8	234 33,9	222 32,2	182 26,4	
	1	kPa psi	23 3,3	59 8,6	131 19,0	197 28,6	230 33,4	237 34,4	232 33,6	215 31,2	174 25,2	0	
	1	kPa psi	23 3,3	59 8,6	131 19,0	177 25,7	209 30,3	217 31,5	210 30,5	199 28,9	152 22,0		
Exhaust gas flow	2	m³/min cu.ft./min	20,9 738,1	34,6 1222	54,3 1918	69,2 2444	81,2 2868	85,5 3019	89,6 3164	94,4 3334	95,6 3376	81,9 2892	
	1	m³/min cu.ft./min	20,8 734,5	34,3 1211	54,3 1918	69,0 2437	78,6 2776	81,5 2878	82,7 2921	84,4 2981	75,7 2673	0	
	1	m³/min cu.ft./min	20,3 716,9	34,8 1229	54,3 1918	65,3 2306	74,1 2617	78,4 2769	77,6 2740	79,9 2822	69,9 2468	0	

Cooling system		Rating	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000
Radiated heat in percent of crankshaft power.	2	%		5,8	5,4	4,9	4,6	4,7	4,7	4,8	5,0	5,1	
	1			5,8	5,4	4,9	4,7	4,7	4,7	4,7	4,9		
	1			5,8	5,4	4,9	4,7	4,7	4,8	4,8	4,9		
Heat rejection to charge air cooler in percent of crankshaft power.	2	%		2	6	12	16	21	23	25	26	27	
	1			3	6	12	17	21	22	23	25		
	1			2	6	12	16	21	22	23	25		
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air cooler, in percent of crankshaft power.	2	%		83	76	54	47	42	46	45	48	50	
	1			82	75	49	45	44	44	41	47		
	1			97	68	52	45	43	44	41	44		
Coolant flow with fully open thermostat and std cooling system			l/min	183,0	263,8	315,4	404,3	484,3	503,5	562,5	638,3	675,0	
			cu.ft./min	6,5	9,3	11,1	14,3	17,1	17,8	19,9	22,5	23,8	
Max. permissible temperature on coolant in engine outlet													95
													°F
Coolant volume engine, including heat exchanger and charge air cooler													56
													US gal.
Max. additional coolant for cabin heater etc. with std. Expansion tank													20
													US gal.
Thermostat, start open at													86
													°F
Thermostat, fully open at													96
													°F

VOLVO PENTA

D16MH Tier3 R1-600,R1-650, R2-750

Document No

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Issue Index

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Raw water circuit	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000
Nominal raw water design flow	l/min	153	205	258	306	351	371	394	432	446	
	cu.ft/min	5,4	7,2	9,1	10,8	12,4	13,1	13,9	15,3	15,8	
Maximum raw water pump suction head	kPa	30									
	psi	4,4									
Maximum additional pressure drop excl. reverse gear oil cooler	kPa	7	10	13	17	21	26	31	33		
	psi	1,0	1,5	1,9	2,5	3,0	3,8	4,5	4,8		
Pressure drop over reverse gear oil cooler (optional equipment)	kPa	4	6	10	14	18	21	23	28	30	
	psi	0,6	0,9	1,5	2,0	2,6	3,0	3,3	4,1	4,4	
Maximum raw water temperature entering heat exchanger	°C	32									
	°F	90									

2 circuit keel cooling system, LT			Rating	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000
Maximum temperature to charge air cooler from external LT-cooling system circuit	2	°C											50	
		°F											122	
	1	°C										51		
		°F										124		
	1	°C										52		
		°F										126		
Coolant flow through keel cooler, LT-cooling system circuit	2	l/min cu.ft./min											92	
													3,2	
	1	l/min cu.ft./min										87		
												3,1		
	1	l/min cu.ft./min										85		
												3,0		
Pressure drop in external LT-cooling system circuit, including piping		kPa	50 -											
		psi	7,3 -											
Coolant volume charge air cooler		litres	5											
		US gal.	1,32											

2 circuit keel cooling system, HT			Rating	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000
Design point for keel cooler, engine outlet temperature	2	°C											92	
		°F											198	
	1	°C										91		
		°F										196		
	1	°C										90		
		°F										194		
Maximum temperature to engine from external HT-cooling system circuit	2	°C											62	
		°F											144	
	1	°C										63		
		°F										145		
	1	°C										63		
		°F										145		
Coolant flow through keel cooler, HT-cooling system circuit at design point	2	l/min cu.ft./min											172	
													6,1	
	1	l/min cu.ft./min										157		
												5,5		
	1	l/min cu.ft./min										144		
												5,1		
Maximum coolant flow through keel cooler, HT-cooling system circuit	2	l/min cu.ft./min											474	
													16,7	
	1	l/min cu.ft./min										453		
												16,0		
	1	l/min cu.ft./min										445		
												15,7		
Pressure drop in external HT-cooling system circuit, including piping		kPa	50 -											
		psi	7,3 -											
Coolant volume engine, excl. heat exchangers		litres	38											
		US gal.	10,04											

Emissions	Rating	rpm	600	800	1000	1200	1400	1500	1600	1800	1900	2000
Smoke at prop. load $x^{2.5}$	2	*BSU	0,0	0,1	0,2	0,5	0,3	0,1	0,1	0,1	0,3	
	1	*BSU	0,0	0,1	0,3	0,5	0,4	0,1	0,1	0,1		
	1	*BSU	0,0	0,1	0,3	0,7	0,5	0,2	0,1	0,1		
Smoke at prop. load x^3	2	*BSU	0,0	0,1	0,3	0,5	0,2	0,1	0,1	0,1	0,3	
	1	*BSU	0,0	0,1	0,2	0,8	0,4	0,2	0,1	0,1		
	1	*BSU	0,0	0,1	0,2	0,7	0,3	0,3	0,1	0,1		
Noise at prop. load $x^{2.5}$. 4)	2	dBA	103,4	106,0	108,5	111,4	114,0	114,4	115,8	117,9	117,1	
	1	dBA	103,4	105,8	108,8	110,8	114,2	114,1	115,8	121,3		
	1	dBA	103,4	105,7	108,6	110,5	113,7	114,1	115,8	121,0		
Noise at prop. load x^3 . 4)	2	dBA	104,1	106,1	108,1	110,8	114,1	114,4	116,3	117,6	116,9	
	1	dBA	104,0	106,0	108,5	110,7	114,0	114,1	116,0	121,3		
	1	dBA	103,8	105,9	108,4	110,4	113,6	114,5	115,2	121,3		

*NB.! BSU are calculated values. Measured values are acc. to ISO 10054 in FSN units

Sensors Control and Monitoring System							Switches Engine Shutdown System	
Sensors	Signal	Unit	Range	Warning Initial Delay / Warning Delay	Warning Level	Derating Level	Shutdown Initial Delay / Shutdown Delay	Shutdown Level (Tolerance)
Charge air pressure	0,5-4,5 V	kPa	50 - 400 (150-500 abs).	30 sec from start / 2.25 sec	300 (400 absolute)	310 (410 abs.) *	NA	NA
Charge air temperature	50-0 kΩ	°C	-40 - 130 ± 4%	90 sec from start / 2.25 sec	80	90 (soft 3)	NA	NA
Coolant level switch	Digital		ON/OFF	30 sec from start / 7.50 sec	Low (Off / Open contact)	NA	NA	NA
Coolant temperature	50-0 kΩ	°C	-40 - 140 ± 1.5%	30 sec from start / 2.25 sec	98	101 (soft 1)	1 sec	105 (±2°C) SDU Ch. S1
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 1800+15%	Frequency	rpm / Hz	153 puls./rev.	Instant	Lost signal	NA	Instant	2070 / 5279 Hz (-1 to 0%)
Eng. overspeed SDU 1900+15%	Frequency	rpm / Hz	153 puls./rev.	Instant	Lost signal	NA	Instant	2185 / 5572 Hz (-1 to 0%)
Exhaust gas temperature	PT200	°C	0 - 850	30 sec from start / 1 sec	650	665 (soft 4)	NA	NA
Oil level sensor	Digital		ON/OFF	30 sec from start / 5 sec	Low level	NA	NA	NA
Oil temperature	50-0 kΩ	°C	-40 - 140	30 sec from start / 1.50 sec	125	128 (soft 2)	NA	NA
Piston cooling switch	Digital	kPa	ON/OFF	30 sec from start / 4 sec	120 ±20	120 (70%)	NA	NA
Reversing gear temperature	NA	°C	NA	NA	NA	NA	NA	NA
Water In fuel switch	Digital		ON/OFF	All the time	Water in fuel	NA	NA	NA

NA = Not applicable

* Yes, 50% of engine prot. map.

Sensors (rpm dependent)	Signal	Unit	Range	Initial Delay /	Warning Level / Derating Level / Shutdown Level					Switches
Coolant pressure	0,5-4,5 V	kPa	0-300 ± 3%		0 rpm	600 rpm	1000 rpm	1500 rpm	1800 rpm	
Warning Level		kPa		30 sec from start / 1.5 sec	0	5	55	100	130	
Derating Level (50% remain trq.)		kPa		10% trq. decr. per sec	-50	-45	5	50	80	
Shutdown Level (Shutdown Unit Channel S4)	Digital	kPa	ON/OFF	11 sec ± 20% from start / 1 sec	NA	NA	NA	NA	NA	<u>Shutdown Unit Setting</u> S4: 510 rpm ± 2% 1300 Hz ± 2% 153 pulses / revolution
Differential oil pressure	NA	kPa	NA		0 rpm	500 rpm	1000 rpm	1500 rpm	1800 rpm	
Warning Level		kPa		NA	NA	NA	NA	NA	NA	
Derating Limit		kPa		NA	NA	NA	NA	NA	NA	
Fuel pressure	0,5-4,5 V	kPa	0-700		0 rpm	500 rpm	1000 rpm	1800 rpm	1900 rpm	
Warning Level		kPa		30 sec from start / 10 sec	-50	50	75	200	200	
Derating Level		kPa		NA	NA	NA	NA	NA	NA	
Oil pressure	0,5-4,5 V	kPa	0-700		0 rpm	500 rpm	1000 rpm	1500 rpm	1900 rpm	
Warning Level		kPa		30 sec from start / 0.75 sec	-100	160	200	250	250	
Derating Level (30% remain trq.)		kPa		10% trq. decr. per sec	-10	140	180	230	230	
Shutdown Level (Shutdown Unit Channel S4)	Digital	kPa	ON/OFF	11 sec ± 20% from start / 1 sec	NA	NA	NA	NA	NA	<u>Shutdown Unit Setting</u> S4: 510 rpm ± 2% 1300 Hz ± 2% 153 pulses / revolution
Seawater pressure	0,5-4,5 V	kPa	0-300		0 rpm	600 rpm	1400 rpm	1700 rpm	1900 rpm	Only HE and KC
Warning Level		kPa		30 sec from start / 4 sec	-20	5	25	35	40	Only HE and KC
Derating Level		kPa		NA	NA	NA	NA	NA	NA	
Reversing Gear pressure					0 rpm	600 rpm	1000 rpm	1500 rpm	1800 rpm	
Warning Level	NA	kPa	NA	NA	NA	NA	NA	NA	NA	
Derating Level	NA	kPa	NA	NA	NA	NA	NA	NA	NA	
Shutdown Level (Shutdown Unit Channel S2)	Digital	kPa	ON/OFF	4 sec from start / 1 sec	NA	400 ±20	400 ±20	400 ±20	400 ±20	<u>Shutdown Unit Setting</u> S2,S3: 510 rpm ± 2% 1300 Hz ± 2% 153 pulses / revolution

Warning = Yellow Lamp active

Derating = Red Lamp active

Remarks

Soft 1) Soft derate Coolant temp Remaining torque in %	Speed / °C	101°C	103°C	106°C
	600	100%	100%	100%
1200	100%	91%	82%	
1800	100%	83%	66%	

Soft 2) Soft derate Oil temp Remaining torque in %	Speed / °C	128°C	130°C	135°C
	600	100%	100%	100%
1200	100%	91%	74%	
1800	100%	83%	52%	

Soft 3) Soft derate Charge Air Temp Remaining torque in %	Speed / °C	90°C	95°C	105°C
	600	100%	100%	100%
1200	100%	82%	74%	
1800	100%	66%	52%	

Soft 4) Soft derate Exhaust Temp Remaining torque in %	Speed / °C	665°C	675°C	680°C	685°C
	600	100%	100%	100%	100%
1200	100%	96%	93%	89%	
1800	100%	93%	86%	80%	













