

<b>VOLVO PENTA</b> D13B-E MH(R1-450), D13B-E MH (FE) (R1-450)	Document No	Issue Index
	<b>21720660</b>	<b>03</b>

## General

4-stroke direct injected, turbocharged and aftercooled diesel engine

Number of cylinders		6
No of valves		24
Displacement, total	litres in <sup>3</sup>	12,78 779,7
Firing order		1-5-3-6-2-4
Rotational direction, viewed from the front		Clockwise
Bore	mm in	131 5,16
Stroke	mm in	158 6,22
Compression ratio		18,5
Compression pressure at 240 rpm	MPa psi	3,5 508
Max. static forward inclination:	°	0
Max. static backward inclination:	°	10
Max. intermittent forward inclination while running:	°	35
Max. intermittent backward inclination while running:	°	35
Max. intermittent side inclination while running:	°	35
Idling speed	rpm	550 - 800
Rated speed R1	rpm	1800
Propeller selection range R1	rpm	1770 - 1870
Dry weight engine BT	kg lb	HE=1520, KC=1480 HE=3351, KC=3263

Performance	Rating	rpm	600 800 1000 1200 1400 1500 1600 1700 1800									
			600	800	1000	1200	1400	1500	1600	1700	1800	
Crankshaft power 1), 5)	1	kW	80,7	166	206	246	290	308	330	331	331	
		hp	110	225	280	335	394	418	449	450	450	
Propeller shaft power 1) (At full load) With drive Twin Disc 5114	1	kW	77	159	198	236	278	295	317	318	318	
		hp	105	216	269	322	378	401	431	432	432	
Propellershaft power at prop. load x <sup>3</sup> With drive Twin Disc 5114	1	kW	14	33	65	112	178	218	265	318	318	
		hp	19	45	88	152	242	297	361	432	432	
Torque at crankshaft 2)	1	Nm	1284	1976	1966	1960	1975	1958	1970	1860	1756	
		lbf ft	947	1457	1450	1446	1457	1444	1453	1372	1295	
Mean piston speed		m/s	3,2	4,2	5,3	6,3	7,4	7,9	8,4	9,0	9,5	
		ft/s	10,4	13,8	17,3	20,7	24,2	25,9	27,6	29,4	31,1	
Effective mean pressure 2)	1	MPa	1,26	1,94	1,93	1,93	1,94	1,93	1,94	1,83	1,73	
		psi	183,2	281,8	280,5	279,6	281,7	279,2	280,9	265,4	250,5	
Max combustion pressure 2)	1	MPa	11,6	15,0	15,0	13,7	14,4	14,7	15,0	14,6	14,2	
		psi	1682	2176	2176	1987	2089	2132	2176	2118	2060	

## Lubricating system

Specific lubricating oil consumption.	g/kWh	0,06
Max. oil volume including filters for all allowed installation inclinations:	litres	49
	US gal	12,94
Max. oil volume excluding filters for all allowed installation inclinations:	litres	44
	US gal	11,62
Min. oil volume excluding filters for all allowed installation inclinations:	litres	35
	US gal	9,25

1) ISO 3046, fuel temp 40°C.

ISO 8665 (=SAE J 1228=ICOMIA 28-83)

2) At power according to 1).

3) If reverse gear is used, 4% in heat rejection will be added for its oil cooler.

4) Acc. to ISO 3744

5) At installed back pressure

Fuel system	Rating	rpm	600	800	1000	1200	1400	1500	1600	1700	1800
Specific fuel consumption at full load US EPATier 3	1	g/kWh	233	215	199	196	200	200	202	205	211
		lb/hph	0,38	0,35	0,32	0,32	0,32	0,32	0,33	0,33	0,34
Specific fuel consumption at full load IMO Tier II	1	g/kWh	237	217	197	191	191	191	194	196	200
		lb/hph	0,38	0,35	0,32	0,31	0,31	0,31	0,31	0,32	0,32
Fuel consumption at prop. load x <sup>3</sup> US EPATier 3	1	l/h	4	8	15	25	38	47	57	69	84
		US gal/h	1,1	2,1	4,0	6,6	10,0	12,4	15,1	18,2	22,2
Fuel consumption at prop. load x <sup>3</sup> IMO Tier II	1	l/h	4	8	15	24	37	45	55	66	79
		US gal/h	1,1	2,1	4,0	6,3	9,8	11,9	14,5	17,4	20,9
Fuel consumption at full load US EPATier 3	1	l/h	22	43	49	58	69	74	80	81	84
		US gal/h	5,9	11,3	12,9	15,2	18,3	19,4	21,1	21,4	22,1
Fuel consumption at full load IMO Tier II	1	l/h	23	43	49	56	66	70	77	78	79
		US gal/h	6,0	11,4	12,8	14,8	17,5	18,6	20,2	20,6	20,9

Intake and exhaust system	Rating	rpm	600	800	1000	1200	1400	1500	1600	1700	1800	
Specific exhaust heating effect in percent of crankshaft power	1	%	71	69	61	63	64	64	65	67	69	
Exhaust temperature at the exhaust pipe connecting flange after the turbo charger.	1	°C	560	570	486	418	386	379	384	383	386	
		°F	1040	1058	907	784	727	714	723	721	727	
Permitted back pressure in the exhaust line at rated speed. (Installed back pressure)		kPa								Max	12	
		psi									1,7	
Engine air consumption at 25°C / 77°F atmospheric pressure 100kPa and relative humidity 30%.	1	m <sup>3</sup> /min	4,7	8,7	12,0	17,7	23,0	25,1	27,0	27,8	28,6	
		cu.ft./min	165	308	422	626	813	886	952	981	1011	
Charge air pressure Inlet manifold	1	kPa	38,0	96,0	118,0	170,0	210,0	220,0	229,0	225,0	221,0	
		psi	5,5	13,9	17,1	24,7	30,5	31,9	33,2	32,6	32,1	
Exhaust gas flow	1	m <sup>3</sup> /min	14,3	26,8	32,3	42,1	50,6	53,8	57,6	58,8	60,4	
		cu.ft./min	241	945	1139	1485	1785	1901	2032	2075	2134	

Cooling system	Rating	rpm	600	800	1000	1200	1400	1500	1600	1700	1800
Radiated heat in percent of crankshaft power.	1	%	5,7	5	4,6	4,7	4,7	4,7	4,8	5,1	5,1
Heat rejection to charge air cooler in percent of crankshaft power.	1	%	1,4	5	11,5	16,7	22	23,1	24,7	26	26,8
Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air cooler, in percent of crankshaft power.	1	%	82,9	68	55,5	50,6	51	49	50,3	51,6	53
Coolant flow with fully open thermostat and std cooling system		l/min	120	192	246	306	360	384	408	420	450
		cu.ft./min	4,2	6,8	8,7	10,8	12,7	13,6	14,4	14,8	15,9
Coolant volume engine, including heat exchanger and charge air cooler		litres	51								
		US gal.	13,47								
Max. additional coolant for cabin heater etc. with std. Expansion tank		litres	16								
		US gal.	4,23								
Maximum coolant flow to cabin heater etc.		l/min	42								
		cu.ft./min	1,48								
Thermostat, start open at		°C	82								
		°F	180								
Thermostat, fully open at		°C	92								
		°F	198								

1) ISO 3046, fuel temp 40°C.

ISO 8665 (=SAE J 1228=ICOMIA 28-83)

2) At power according to 1).

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5) At installed back pressure

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Raw water circuit	rpm	600	800	1000	1200	1400	1500	1600	1700	1800
Nominal raw water design flow	l/min	161	216	273	320	368	392	414	436	456
	cu.ft./min	5,7	7,6	9,6	11,3	13,0	13,8	14,6	15,4	16,1
Nominal raw water pump pressure head at design flow. (measured before and after pump)	kPa	19	30	49	66	84	95	107	119	131
	psi	2,8	4,4	7,1	9,6	12,2	13,8	15,5	17,3	19,0
Maximum raw water pump suction head	kPa	-30								
	psi	-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	1700	1800
Maximum temperature to charge air cooler from external LT-cooling system circuit	1	°C									43
		°F									109,4
Coolant flow through keel cooler, LT-cooling system circuit	1	l/min	33	45	58	70	81	85	90	93	96
		cu.ft./min	1,2	1,6	2,0	2,5	2,9	3,0	3,2	3,3	3,4
Pressure drop in external LT-cooling system circuit, including piping		kPa	85								
		psi	12,3								
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	1700	1800
Design point for keel cooler, engine outlet temperature	1	°C									89
		°F									192
Maximum temperature to engine from external HT-cooling system circuit	1	°C									70
		°F									158
Coolant flow through keel cooler, HT-cooling system circuit at design point	1	l/min									145
		cu.ft./min									5,1
Maximum coolant flow through keel cooler, HT-cooling system circuit	1	l/min									216
		cu.ft./min									7,6
Pressure drop in external HT-cooling system circuit, including piping		kPa	85								
		psi	12,3								
Coolant volume engine, excl. heat exchangers		litres	28								
		US gal.	7,40								

Emissions	Rating	rpm	600	800	1000	1200	1400	1500	1600	1700	1800
Smoke at prop. load x <sup>3</sup>	1	*BSU	0,04	0,08	0,18	0,23	0,25	0,21	0,18	0,15	0,18
Noise at prop. load x <sup>3</sup> . 4)	1	dBA	100,4	104,2	107,3	110,1	111,4	#N/A	112,0	#N/A	113,6

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

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- 2) At power according to 1).
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- 4) Acc. to ISO 3744
- 5) At installed back pressure

Rating	Power (Hk)	Rpm
R1	450	1800
R1	331	1700

Sensors Control and Monitoring System							Switches Engine Shutdown System	
Sensors	Signal	Unit	Range	Initial Delay / Warning Delay	Warning Level	Derating Level	Shutdown Initial Delay / Shutdown Delay	Shutdown Level (Tolerance)
Coolant level switch	Digital		ON/OFF	30 sec from start / 75 sec	Low (ON / Closed)	NA	NA	NA
Coolant temperature	50-0 kΩ	°C	- 40 - 140 ±1.5°C	30 sec from start / 3 sec	98	101 (soft 1)	NA	NA
Coolant temperature (SDU)	Digital	°C	ON/OFF	NA	NA	NA	1 sec. from start / 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 rpm+15%	Frequency	rpm / Hz	153 puls./rev.	Instant	Lost signal	NA	Instant	2070 rpm / 5278 Hz (-1 to 0%)
Exhaust gas temperature	PT200	°C	- 40 - 750 ± 2.5%	30 sec from start / 22 sec	575	600 (soft 2)	NA	NA
Crankcase pressure	0,5-4,5 V		0-15 kPa	20 sec from start / Instant	Rapid Pressure Increase	0-75% @ >1200 rpm	NA	NA
Oil level sensor	Analogue	%	±1.9mm	30 sec from start / 5 sec	Low level	NA	NA	NA
Oil temperature	50-0 kΩ	°C	-40 - 140	30 sec from start / 22 sec	130	135 (soft 3)	NA	NA
Gear oil temperature (EVC)	50-0 kΩ	°C	-40 - 140 ± 2.5%	NA	NA	NA	NA	NA
Gear oil pressure (EVC)	0,5-4,5V	kPa	0 - 3000 ±3%	60 sec from start / 7 sec	700	NA	NA	NA
Gear oil pressure (SDU)	Digital	kPa	ON/OFF	NA	NA	NA	11 s ±20% from start/ 1 s	400±20 <u>Shutdown Unit Setting</u> S2,S3: 510 rpm ±2% 1300 Hz ±2% 153 pulses / revolution

NA = Not applicable

Sensors Alarm	Signal	Unit	Range	Initial Delay / Delay	Warning Level / Derating Level / Shutdown Level					Derating / Notes
					rpm Map (relative pressure)					
<b>Charge air pressure</b>	0,5-4,5 V	kPa	50 - 600 ± 4.2 kPa		<b>600 rpm</b>	<b>1000 rpm</b>	<b>1200 rpm</b>	<b>1500 rpm</b>	<b>1800 rpm</b>	
Warning Level		kPa		30 sec from start / 2 sec	310	310	310	299	261	
Derating Level		kPa		Instant	320	320	320	309	271	0-50% @ 1200-1800rpm
Shutdown Level	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>Charge air Temperature</b>	50 - 0 kΩ	°C	-40 - 130°C ±4%		<b>600 rpm</b>	<b>1000 rpm</b>	<b>1200 rpm</b>	<b>1500 rpm</b>	<b>1800 rpm</b>	
Warning Level		°C		90 sec from start / 22 sec	80	80	80	80	75	
Derating Level		°C		Instant	85	85	85	85	80	Soft derate 4
Shutdown Level	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>Coolant pressure</b>	0,5-4,5 V	kPa	0-300 kPa		<b>600 rpm</b>	<b>1000 rpm</b>	<b>1200 rpm</b>	<b>1500 rpm</b>	<b>1800 rpm</b>	
Warning Level		kPa		30 sec from start / 4 sec	5	30	30	55	81	
Derating Level		kPa		Instant	-5	20	20	45	71	0-50% @ 1200-1800rpm /
Shutdown Level	NA	NA	NA	NA	NA	NA	NA	NA	NA	Run detection S4=S2,S3
<b>Seawater pressure</b>	0,5-4,5 V	kPa	0-300 kPa		<b>600 rpm</b>	<b>1000 rpm</b>	<b>1200 rpm</b>	<b>1500 rpm</b>	<b>1800 rpm</b>	
Warning Level		kPa		30 sec from start / 7.5 sec	5	15	25	40	40	
Derating Level		kPa		Instant	-5	5	15	30	30	0-35% @ 1200-1800rpm
Shutdown Level	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>Fuel pressure</b>	0,5-4,5 V	kPa	0-700 kPa		<b>600 rpm</b>	<b>1000 rpm</b>	<b>1200 rpm</b>	<b>1500 rpm</b>	<b>1800 rpm</b>	
Warning Level		kPa		30 sec from start / Instant	180	240	255	270	270	
Derating Level		kPa		NA	NA	NA	NA	NA	NA	
Shutdown Level	NA	NA	NA	NA	NA	NA	NA	NA	NA	
<b>Oil pressure</b>	0,5-4,5 V	kPa	0-700 kPa		<b>600 rpm</b>	<b>1000 rpm</b>	<b>1200 rpm</b>	<b>1500 rpm</b>	<b>1800 rpm</b>	
Warning Level		kPa		30 sec from start / 3 sec	136	200	226	265	265	
Derating Level		kPa		Instant	106	170	196	235	235	0-70% @ 1200-1800rpm
Shutdown Level (Shutdown Unit Channel S3)	Digital	kPa	ON/OFF	11 s ±20% from start / 1 s	NA	NA	120 ±20	120 ±20	120 ±20	Shutdown Unit Setting S2,S3: 510 rpm ±2% 1300 Hz ±2%

**D13B-E MH(R1-450), D13B-E MH (FE) (R1-450)**

## Remarks

<b>1) Soft derate Coolant temp</b>	<b>Speed / °C</b>	<b>101°C</b>	<b>103°C</b>	<b>106°C</b>
Remaining torque in %	1200 rpm	100%	100%	100%
	1500 rpm	100%	75%	50%
	1800 rpm	100%	75%	50%

<b>2)Soft derate Exhaust temp</b>	<b>Speed / °C</b>	<b>600° C</b>	<b>605° C</b>	<b>610° C</b>	<b>615° C</b>
Remaining torque in %	1200 rpm	100%	100%	100%	100%
	1500 rpm	100%	70%	60%	50%
	1800 rpm	100%	70%	60%	50%

<b>3) Soft derate Oil temp</b>	<b>Speed / °C</b>	<b>135° C</b>	<b>137°C</b>	<b>139°C</b>
Remaining torque in %	1200 rpm	100%	100%	100%
	1500 rpm	100%	50%	30%
	1800 rpm	100%	50%	30%

<b>4)Soft derate Charge air Temp</b>	<b>Speed / °C</b>	<b>80°C</b>	<b>85°C</b>	<b>90°C</b>
Remaining torque in %	1200 rpm	100%	100%	100%
	1500 rpm	100%	100%	50%
	1800 rpm	100%	50%	30%