

| | | |
|-------------------------------------------------------------------|-----------------|-------------|
| VOLVO PENTA D13B-E MH (R2-550), D13B-E MH (FE) (R2-550) | Document No | Issue Index |
| | 21720665 | 03 |

General

4-stroke direct injected, turbocharged and aftercooled diesel engine

| | | |
|-------------------------------------------------------|---------------------------|--------------------------------------|
| Number of cylinders | | 6 |
| No of valves | | 24 |
| Displacement, total | litres in ³ | 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 R2 | rpm | 1900 |
| Propeller selection range R2 | rpm | 1870 - 1970 |
| Dry weight engine BT | kg lb | HE=1520, KC=1480 HE=3351, KC=3263 |

| Performance | Rating | rpm | 600 800 1000 1200 1400 1500 1600 1800 1900 | | | | | | | | | |
|--------------------------------------------------------------------------------|--------|--------|--------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| | | | | | | | | | | | | |
| Crankshaft power 1), 5) | 2 | kW | 81 | 164 | 245 | 294 | 346 | 369 | 393 | 405 | 405 | |
| | | hp | 110 | 223 | 333 | 399 | 471 | 502 | 534 | 550 | 550 | |
| Propeller shaft power 1) (At full load) With drive Twin Disc 5114 | 2 | kW | 77 | 157 | 235 | 282 | 333 | 354 | 377 | 388 | 388 | |
| | | hp | 105 | 214 | 320 | 383 | 452 | 482 | 513 | 528 | 528 | |
| Propellershaft power at prop. load x ³ With drive Twin Disc 5114 | 2 | kW | 12 | 29 | 57 | 98 | 155 | 191 | 232 | 330 | 388 | |
| | | hp | 17 | 39 | 77 | 133 | 211 | 260 | 315 | 449 | 528 | |
| Torque at crankshaft 2) | 2 | Nm | 1283 | 1958 | 2341 | 2337 | 2363 | 2348 | 2343 | 2146 | 2033 | |
| | | lbf ft | 946 | 1444 | 1726 | 1724 | 1743 | 1732 | 1728 | 1583 | 1499 | |
| Mean piston speed | | m/s | 3,2 | 4,2 | 5,3 | 6,3 | 7,4 | 7,9 | 8,4 | 9,5 | 10,0 | |
| | | ft/s | 10,4 | 13,8 | 17,3 | 20,7 | 24,2 | 25,9 | 27,6 | 31,1 | 32,8 | |
| Effective mean pressure 2) | 2 | MPa | 1,26 | 1,93 | 2,30 | 2,30 | 2,32 | 2,31 | 2,30 | 2,11 | 2,00 | |
| | | psi | 183,0 | 279,2 | 333,9 | 333,4 | 337,0 | 334,9 | 334,2 | 306,1 | 290,0 | |
| Max combustion pressure 2) | 2 | MPa | 11,7 | 15,4 | 16,0 | 16,3 | 17,6 | 17,8 | 17,9 | 16,7 | 15,7 | |
| | | psi | 1697 | 2234 | 2321 | 2364 | 2553 | 2582 | 2596 | 2422 | 2277 | |

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

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| Fuel system | Rating | rpm | 600 | 800 | 1000 | 1200 | 1400 | 1500 | 1600 | 1800 | 1900 |
|---------------------------------------------------------------|--------|----------|------|------|------|------|------|------|------|------|------|
| Specific fuel consumption at full load US EPATier 3 | 2 | g/kWh | 233 | 215 | 198 | 195 | 197 | 199 | 203 | 211 | 213 |
| | | lb/hph | 0,38 | 0,35 | 0,32 | 0,32 | 0,32 | 0,32 | 0,33 | 0,34 | 0,35 |
| Specific fuel consumption at full load IMO Tier II | 2 | g/kWh | 241 | 219 | 196 | 190 | 191 | 193 | 196 | 200 | 204 |
| | | lb/hph | 0,39 | 0,35 | 0,32 | 0,31 | 0,31 | 0,31 | 0,32 | 0,32 | 0,33 |
| Fuel consumption at prop. load x ³ US EPATier 3 | 2 | l/h | 4 | 9 | 15 | 26 | 40 | 49 | 59 | 86 | 103 |
| | | US gal/h | 1,1 | 2,4 | 4,0 | 6,9 | 10,6 | 12,9 | 15,6 | 22,7 | 27,2 |
| Fuel consumption at prop. load x ³ IMO Tier II | 2 | l/h | 4 | 9 | 15 | 25 | 38 | 46 | 56 | 82 | 98 |
| | | US gal/h | 1,1 | 2,4 | 4,0 | 6,6 | 10,0 | 12,2 | 14,8 | 21,7 | 25,9 |
| Fuel consumption at full load US EPATier 3 | 2 | l/h | 23 | 42 | 58 | 69 | 82 | 88 | 95 | 102 | 103 |
| | | US gal/h | 6,0 | 11,2 | 15,3 | 18,1 | 21,6 | 23,2 | 25,1 | 27,0 | 27,3 |
| Fuel consumption at full load IMO Tier II | 2 | l/h | 23 | 43 | 58 | 67 | 79 | 85 | 92 | 97 | 99 |
| | | US gal/h | 6,1 | 11,4 | 15,2 | 17,6 | 20,9 | 22,5 | 24,3 | 25,6 | 26,1 |

| Intake and exhaust system | Rating | rpm | 600 | 800 | 1000 | 1200 | 1400 | 1500 | 1600 | 1800 | 1900 | |
|----------------------------------------------------------------------------------------------|--------|------------|------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| Specific exhaust heating effect in percent of crankshaft power | 2 | % | 72 | 69 | 63 | 61 | 61 | 62 | 64 | 69 | 73 | |
| Exhaust temperature at the exhaust pipe connecting flange after the turbo charger. | 2 | °C | 569 | 576 | 496 | 423 | 403 | 408 | 424 | 447 | 464 | |
| | | °F | 1056 | 1069 | 925 | 793 | 757 | 766 | 795 | 837 | 867 | |
| Permitted back pressure in the exhaust line at rated speed. (Installed back pressure) | | kPa | | | | | | | | Max | 12 | |
| | | psi | | | | | | | | | 1,7 | |
| | | kPa | | | | | | | | Min | 0 | |
| | | psi | | | | | | | | | 0,0 | |
| Engine air consumption at 25°C / 77°F atmospheric pressure 100kPa and relative humidity 30%. | 2 | m³/min | 4,7 | 9,0 | 14,6 | 20,5 | 25,7 | 27,4 | 28,9 | 29,6 | 29,8 | |
| | | cu.ft./min | 165 | 319 | 515 | 725 | 908 | 969 | 1022 | 1046 | 1052 | |
| Charge air pressure Inlet manifold | 2 | kPa | 39,0 | 103,0 | 165,0 | 216,0 | 249,0 | 256,0 | 259,0 | 236,0 | 224,0 | |
| | | psi | 5,7 | 14,9 | 23,9 | 31,3 | 36,1 | 37,1 | 37,6 | 34,2 | 32,5 | |
| Exhaust gas flow | 2 | m³/min | 14,5 | 28 | 39,6 | 48,9 | 57,9 | 61,6 | 65,9 | 69,4 | 71,1 | |
| | | cu.ft./min | 512 | 989 | 1400 | 1727 | 2043 | 2174 | 2326 | 2450 | 2511 | |

| Cooling system | Rating | rpm | 600 | 800 | 1000 | 1200 | 1400 | 1500 | 1600 | 1800 | 1900 |
|--------------------------------------------------------------------------------------------------------------------|--------|------------|-------|------|------|------|------|------|------|------|------|
| Radiated heat in percent of crankshaft power. | 2 | % | 5,7 | 5 | 4,5 | 4,6 | 4,7 | 4,8 | 4,8 | 5 | 5,2 |
| Heat rejection to charge air cooler in percent of crankshaft power. | 2 | % | 1,4 | 5 | 11,3 | 19,6 | 22,6 | 23,9 | 23,1 | 22,4 | 22 |
| Coolant heat rejection to HE, incl. engine oil cooler and excl. charge air cooler, in percent of crankshaft power. | 2 | % | 82,9 | 67,2 | 56,3 | 49 | 48,5 | 48,2 | 50 | 53,2 | 55 |
| Coolant flow with fully open thermostat and std cooling system | | l/min | 120 | 192 | 246 | 306 | 360 | 384 | 408 | 450 | 480 |
| | | cu.ft./min | 4,2 | 6,8 | 8,7 | 10,8 | 12,7 | 13,6 | 14,4 | 15,9 | 17,0 |
| 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).
- 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

| | | |
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| Raw water circuit | rpm | 600 | 800 | 1000 | 1200 | 1400 | 1500 | 1600 | 1800 | 1900 |
|------------------------------------------------------------------------------------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Nominal raw water design flow | l/min | 161 | 216 | 273 | 320 | 368 | 392 | 414 | 456 | 468 |
| | cu.ft./min | 5,7 | 7,6 | 9,6 | 11,3 | 13,0 | 13,8 | 14,6 | 16,1 | 16,5 |
| Nominal raw water pump pressure head at design flow. (measured before and after pump) | kPa | 19 | 30 | 49 | 66 | 84 | 95 | 107 | 131 | 136 |
| | psi | 2,8 | 4,4 | 7,1 | 9,6 | 12,2 | 13,8 | 15,5 | 19,0 | 19,7 |
| 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 | 1800 | 1900 |
|----------------------------------------------------------------------------------|---------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Maximum temperature to charge air cooler from external LT-cooling system circuit | 2 | °C | | | | | | | | | 43 |
| | | °F | | | | | | | | | 109,4 |
| Coolant flow through keel cooler, LT-cooling system circuit | 2 | l/min | 33 | 45 | 58 | 70 | 81 | 85 | 90 | 96 | 98 |
| | | cu.ft./min | 1,2 | 1,6 | 2,0 | 2,5 | 2,9 | 3,0 | 3,2 | 3,4 | 3,5 |
| 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 | 1800 | 1900 |
|-----------------------------------------------------------------------------|---------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Design point for keel cooler, engine outlet temperature | 2 | °C | | | | | | | | | 88 |
| | | °F | | | | | | | | | 190 |
| Maximum temperature to engine from external HT-cooling system circuit | 2 | °C | | | | | | | | | 70 |
| | | °F | | | | | | | | | 158 |
| Coolant flow through keel cooler, HT-cooling system circuit at design point | 2 | l/min | | | | | | | | | 187 |
| | | cu.ft./min | | | | | | | | | 6,6 |
| Maximum coolant flow through keel cooler, HT-cooling system circuit | 2 | l/min | | | | | | | | | 295 |
| | | cu.ft./min | | | | | | | | | 10,4 |
| 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 | 1800 | 1900 |
|-----------------------------------------|---------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Smoke at prop. load x ³ | 2 | *BSU | 0,04 | 0,16 | 0,14 | 0,29 | 0,17 | 0,16 | 0,13 | 0,16 | 0,29 |
| Noise at prop. load x ³ . 4) | 2 | dBA | 100,4 | 103,8 | 107,4 | 109,5 | 111,5 | #N/A | 112,7 | 114 | 113,5 |

*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).
- 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

| Rating | Power (Hk) | Rpm |
|--------|------------|------|
| R2 | 550 | 1900 |
| R2 | 405 | 1900 |
| | | |

| 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 1900 rpm+15% | Frequency | rpm / Hz | 153 puls./rev. | Instant | Lost signal | NA | Instant | 2185 rpm / 5572 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 rpm Map (relative pressure) | | | | | Derating / Notes |
|----------------------------------------------|-----------|------|--------------------|-----------------------------|--------------------------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|----------------------------------------------------------------------------------------------|
| | | | | | 600 rpm | 1000 rpm | 1500 rpm | 1700 rpm | 1900 rpm | |
| Charge air pressure | 0,5-4,5 V | kPa | 50 - 600 ± 4.2 kPa | | 600 rpm | 1000 rpm | 1500 rpm | 1700 rpm | 1900 rpm | |
| Warning Level | | kPa | | 30 sec from start / 2 sec | 310 | 310 | 299 | 282 | 256 | |
| Derating Level | | kPa | | Instant | 320 | 320 | 309 | 292 | 266 | 0-50% @ 1200-1900rpm |
| Shutdown Level | NA | NA | NA | NA | NA | NA | NA | NA | NA | |
| Charge air Temperature | 50 - 0 kΩ | °C | -40 - 130°C ±4% | | 600 rpm | 1000 rpm | 1500 rpm | 1700 rpm | 1900 rpm | |
| Warning Level | | °C | | 90 sec from start / 22 sec | 80 | 80 | 80 | 78 | 75 | |
| Derating Level | | °C | | Instant | 85 | 85 | 85 | 83 | 80 | Soft derate 4 |
| Shutdown Level | NA | NA | NA | NA | NA | NA | NA | NA | NA | |
| Coolant pressure | 0,5-4,5 V | kPa | 0-300 kPa | | 600 rpm | 1000 rpm | 1500 rpm | 1700 rpm | 1900 rpm | |
| Warning Level | | kPa | | 30 sec from start / 4 sec | 5 | 30 | 55 | 72 | 90 | |
| Derating Level | | kPa | | Instant | -5 | 20 | 45 | 62 | 80 | 0-50% @ 1200-1900rpm / |
| Shutdown Level | NA | NA | NA | NA | NA | NA | NA | NA | NA | Run detection S4=S2,S3 |
| Seawater pressure | 0,5-4,5 V | kPa | 0-300 kPa | | 600 rpm | 1000 rpm | 1500 rpm | 1700 rpm | 1900 rpm | |
| 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% @ 1200-1900rpm |
| Shutdown Level | NA | NA | NA | NA | NA | NA | NA | NA | NA | |
| Fuel pressure | 0,5-4,5 V | kPa | 0-700 kPa | | 600 rpm | 1000 rpm | 1500 rpm | 1700 rpm | 1900 rpm | |
| Warning Level | | kPa | | 30 sec from start / Instant | 180 | 240 | 270 | 270 | 270 | |
| Derating Level | | kPa | | NA | NA | NA | NA | NA | NA | |
| Shutdown Level | NA | NA | NA | NA | NA | NA | NA | NA | NA | |
| Oil pressure | 0,5-4,5 V | kPa | 0-700 kPa | | 600 rpm | 1000 rpm | 1500 rpm | 1700 rpm | 1900 rpm | |
| Warning Level | | kPa | | 30 sec from start / 3 sec | 136 | 200 | 265 | 265 | 265 | |
| Derating Level | | kPa | | Instant | 106 | 170 | 235 | 235 | 235 | 0-70% @ 1200-1900rpm |
| 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 | <u>Shutdown Unit Setting</u> S2,S3: 510 rpm ±2% 1300 Hz ±2% 153 pulses / revolution |

D13B-E MH (R2-550), D13B-E MH (FE) (R2-550)

Remarks

| 1) Soft derate Coolant temp | Speed / °C | 101°C | 103°C | 106°C |
|------------------------------------|-------------------|--------------|--------------|--------------|
| Remaining torque in % | 1200 rpm | 100% | 100% | 100% |
| | 1500 rpm | 100% | 77% | 54% |
| | 1900 rpm | 100% | 75% | 50% |

| 2) Soft derate Exhaust temp | Speed / °C | 600°C | 605°C | 610°C | 615°C |
|------------------------------------|-------------------|--------------|--------------|--------------|--------------|
| Remaining torque in % | 1200 rpm | 100% | 100% | 100% | 100% |
| | 1500 rpm | 100% | 72% | 63% | 54% |
| | 1900 rpm | 100% | 70% | 60% | 50% |

| 3) Soft derate Oil temp | Speed / °C | 135° C | 137°C | 139°C |
|--------------------------------|-------------------|---------------|--------------|--------------|
| Remaining torque in % | 1200 rpm | 100% | 100% | 100% |
| | 1500 rpm | 100% | 54% | 35% |
| | 1900 rpm | 100% | 50% | 30% |

| 4) Soft derate Charge air Temp | Speed / °C | 80°C | 85°C | 90° C |
|---------------------------------------|-------------------|-------------|-------------|--------------|
| Remaining torque in % | 1200 rpm | 100% | 100% | 100% |
| | 1500 rpm | 100% | 100% | 54% |
| | 1900 rpm | 100% | 50% | 30% |