


### Important

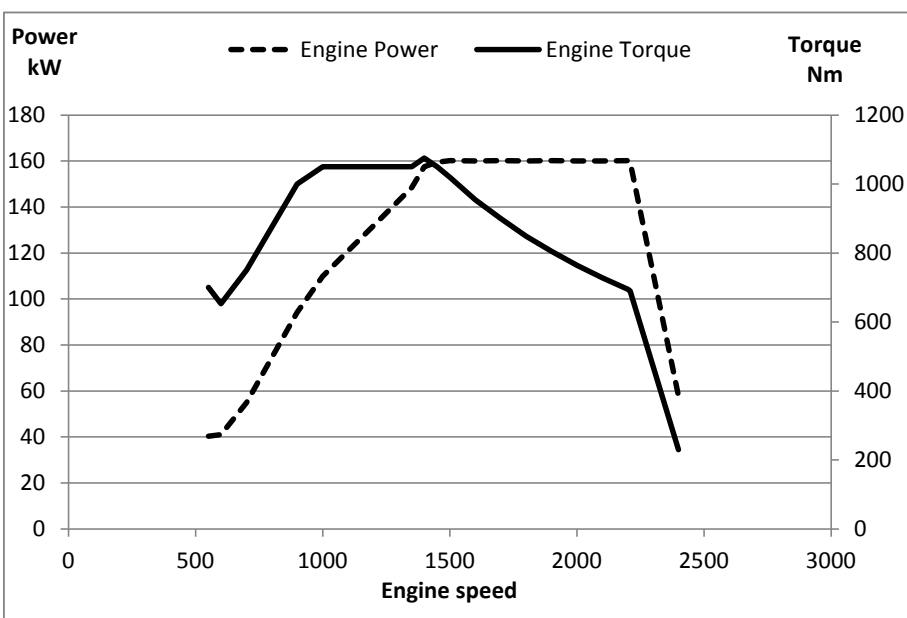
This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta application for certification.

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.

In-line four stroke-cycle diesel with common rail direct injection. Rotation direction counterclockwise viewed towards flywheel.

|             |   |     |      |
|-------------|---|-----|------|
| Peak Power  |   | kW  | 160  |
|             |   | hp  | 218  |
|             |   | rpm | 2200 |
| Peak Torque |   | Nm  | 1075 |
|             |   | rpm | 1400 |
| Dimensions  | L | mm  | 1229 |
|             | W | mm  | 876  |
|             | H | mm  | 1030 |



### Consumption data

|  |      | rpm    | 1500 | 1800 | 2000 | 2200 |
|--|------|--------|------|------|------|------|
| Specific fuel consumption at:                                | 25%  | g/kWh  | 234  | 256  | 279  | 311  |
|  |      | lb/hph | 0,38 | 0,41 | 0,45 | 0,50 |
|  | 50%  | g/kWh  | 204  | 217  | 229  | 243  |
|  |      | lb/hph | 0,33 | 0,35 | 0,37 | 0,39 |
|  | 75%  | g/kWh  | 198  | 206  | 214  | 225  |
|  |      | lb/hph | 0,32 | 0,33 | 0,35 | 0,36 |
|  | 100% | g/kWh  | 197  | 201  | 207  | 215  |
|  |      | lb/hph | 0,32 | 0,33 | 0,33 | 0,35 |
| Specific AdBlue®/DEF consumption of diesel consumption, NRTC |      | Vol%   | 5,80 |      |      |      |

### CO<sub>2</sub> emission declaration

|  |       |        |
|--|-------|--------|
| Carbon dioxide (CO <sub>2</sub> ) emissions determined during the EU type approval process and recorded in EU type approval certificate, NRTC. | g/kWh | 711,50 |
|--|-------|--------|

**General**

|                                    |  |                 |             |
|------------------------------------|--|-----------------|-------------|
| Number of cylinders                |  |                 | 6           |
| Displacement, total                |  | liters          | 7,70        |
|                                    |  | in <sup>3</sup> | 470         |
| Firing order                       |  |                 | 1-4-2-6-3-5 |
| Bore                               |  | mm              | 110         |
|                                    |  | in              | 4,33        |
| Stroke                             |  | mm              | 135         |
|                                    |  | in              | 5,31        |
| Compression ratio                  |  |                 | 17,2:1      |
| Wet weight                         | Engine only  | kg              | 723         |
|                                    |  | lb              | 1594        |
|                                    | <u>The weight includes:</u><br>The engine is weighed with components that consist of the minimum running weight including standard flywheel and excluding cooling package, hoses and air filters. For a clearer description, contact your regional application engineer. |                 |             |
|                                    | Power pack   | kg              | N/A         |
|                                    |  | lb              | N/A         |
| <u>The weight includes:</u><br>N/A |  |                 |             |
|                                    | Exhaust aftertreatment muffler DPF   | kg              | 32          |
|                                    |  | lb              | 71          |
|                                    | Exhaust aftertreatment muffler SCR   | kg              | 41          |
|                                    |  | lb              | 90          |

**Performance**

|  |     |      |
|--|-----|------|
| Rated power                            | kW  | 160  |
|  | rpm | 2200 |
| IFN Power                              | kW  | N/A  |
| ICFN Power                             | kW  | 160  |
| For ICFN please see Technical data for |     | N/A  |

The engine performance corresponds to ISO 3046.

|   |             | rpm              | 1500  | 1800 | 2000 | 2200 |
|---|-------------|------------------|-------|------|------|------|
| Power   | without fan | kW               | 160   | 160  | 160  | 160  |
|   |             | hp               | 218   | 218  | 218  | 218  |
| For performance with fan see options technical data for the desired module.   |             |                  |       |      |      |      |
| Torque (IFN)  | without fan | Nm               | 1020  | 849  | 764  | 695  |
|   |             | lbf ft           | 752   | 626  | 563  | 513  |
| Max torque at engine speed  | 1400        | rpm              | 1075  |      |      |      |
|   |             |                  | 793   |      |      |      |
| Power tolerance   |             | %                | +/-2  |      |      |      |
| Total mass moment of inertia, J (mR <sup>2</sup> ) for two mass calculations<br>(not including flywheel)                |             | kgm <sup>2</sup> | 0,398 |      |      |      |
|   |             | lbf <sup>2</sup> | 9,4   |      |      |      |
| Total mass moment of inertia, J (mR <sup>2</sup> ) for transient load response calculations<br>(not including flywheel) |             | kgm <sup>2</sup> | 0,398 |      |      |      |
|   |             | lbf <sup>2</sup> | 9,4   |      |      |      |
| Friction Power warm engine  |             | kW               | 17    | 23   | 28   | 34   |
|   |             | hp               | 23    | 31   | 38   | 46   |

**Engine brake performance option**

|  |             | rpm    | 1500     | 2200 | 2500 | 2800 |
|--|-------------|--------|----------|------|------|------|
| Brake power:                                     | without fan | kW     | 66       | 132  | 160  | 183  |
|  |             | hp     | 90       | 180  | 218  | 249  |
| Brake torque:                                    | without fan | Nm     | 420      | 574  | 613  | 625  |
|  |             | lbf ft | 309      | 423  | 452  | 461  |
| Engine speed range for engine brake activation:  |             | rpm    | 900-2800 |      |      |      |
| Engine brake automatically deactivates at:       |             | rpm    | ≤880     |      |      |      |
| Min oil temperature for engine brake activation: |             | °C     | 55       |      |      |      |

**Cold start performance**

|                               |  |    |     |
|-------------------------------|--|----|-----|
| Cold start limit temperature  | Preheater required @   | °C | -15 |
|                               | Preheate 4 kW  | °F | 5   |
|                               | Preheater + block heater req @   | °C | -30 |
|                               | Blockheater:<br>TYP UI 701<br>1500W / ~230V or ~115V                         | °F | -22 |
| Cold start oil specification  | T>-20°C VDS4.5 10W/30<br>T<-20°C VDS4.5 5W/30                                |    |     |
| Cold start fuel specification | EN590<br>98/70/EC<br>(For details see Volvo Penta Industrial fuel bulletin.) |    |     |

**Lubrication system**


|   |        |       |       |
|---|--------|-------|-------|
| Lubricating oil consumption of diesel consumption (average)       |        | Vol % | 0,020 |
| Oil change intervals/specifications                               | VDS4.5 | h     | 1000  |
|   |        | h     |       |
| Oil pressure at rated speed                                       | Max    | kPa   | 475   |
|   |        | psi   | 69    |
| Oil pressure at rated speed                                       | Min    | kPa   | 275   |
|   |        | psi   | 40    |
| Lubrication oil temperature in oil pan:                           | Max    | °C    | 130   |
|   |        | °F    | 266   |
| Oil filter filtration efficiency (in accordance with ISO 4548-12) | 75%    | μ     | 22    |
|   | 90%    | μ     | 26    |






*For oil system capacity and angularity limits see technical data per options*

**Fuel system**



|   |  |          |       |
|---|--|----------|-------|
| Suction line fuel flow at maximum output<br>(Measured at fuel inlet connection)                           |  | liter/h  | 110   |
|   |  | US gal/h | 28,93 |
| Fuel supply line max. restriction<br>(measured at fuel inlet connection)                                  |  | kPa      | 20,0  |
|   |  | psi      | 2,90  |
| Fuel supply line max. pressure, during engine running<br>(measured at fuel inlet connection @ engine)     |  | kPa      | 20,0  |
|   |  | psi      | 2,90  |
| Fuel supply line max. pressure, during engine stand still<br>(measured at fuel inlet connection @ engine) |  | kPa      | 20,0  |
|   |  | psi      | 2,90  |
| Fuel supply line min. pressure, during engine stand still<br>(measured at fuel inlet connection @ engine) |  | kPa      | -55   |
|   |  | psi      | -8    |
| Maximum system return flow  |  | liter/h  | 67    |
|   |  | US gal/h | 17,8  |
| Fuel return line max. restriction<br>(measured at fuel return connection)                                 |  | kPa      | 40    |
|   |  | psi      | 6     |
| Max. allowable inlet fuel temp<br>(Measured at fuel inlet connection)                                     |  | °C       | 80    |
|   |  | °F       | 176   |
| Prefilter / Water separator filtration efficiency   | 98%  | μ        | 30    |
|   | 50%  | μ        | 10    |
| Fuel filter filtration efficiency   | 90%  | μ        | 5     |
|   | 75%  | μ        | 4     |
| Injector type   | Denso G4S  |          |       |
| Fuel to conform to  | EN590<br>98/70/EC<br>(For details see Volvo Penta Industrial fuel bulletin.) |          |       |

**Intake system**

|  | rpm    | 1500 | 1800 | 2000 | 2200 |
|--|--------|------|------|------|------|
| Air consumption at:<br>(+25°C and 100kPa)  | m³/min | 11,1 | 12,9 | 14,2 | 15,6 |
|  | cfm    | 392  | 456  | 501  | 551  |
|  |        |      |      |      |      |
| <b>See front page for important information</b>                                    |        |      |      |      |      |
| Max allowable air intake restriction including piping                              | kPa    |      | 6    |      |      |
|  | psi    |      | 0,9  |      |      |

| Exhaust system   | rpm                 | 1500       | 1800 | 2000 | 2200 |
|--|---------------------|------------|------|------|------|
| Heat rejection to exhaust:   | kW                  | 113        | 117  | 121  | 128  |
|  | BTU/min             | 6430       | 6666 | 6901 | 7271 |
| Exhaust gas temperature after turbine at:  | °C                  | 457        | 425  | 409  | 396  |
|  | °F                  | 855        | 797  | 768  | 745  |
|  <b>See front page for important information</b>   |                     |            |      |      |      |
| Max allowable back pressure in exhaust line at full load (after turbine)   | kPa                 | 21         | 24   | 26   | 28   |
|  | psi                 | 3,1        | 3,5  | 3,8  | 4,1  |
|  <b>See front page for important information</b>   |                     |            |      |      |      |
| Max allowable temperature drop between turbine and muffler 1 inlet at exhaust temperature 495° C and exhaust gas flow 0.40 kg/s.   | Δ°C                 | 10         | 10   | 10   | 10   |
|  | Δ°F                 | 18         | 18   | 18   | 18   |
|  <b>See front page for important information</b>   |                     |            |      |      |      |
| Max allowable temperature drop between muffler 1 and muffler 2 at exhaust temperature 495° C and exhaust gas flow 0.40 kg/s.       | Δ°C                 | 5          | 5    | 5    | 5    |
|  | Δ°F                 | 9          | 9    | 9    | 9    |
| Muffler 1 pressure drop<br>(at exhaust gas flow and exhaust temp specified in this table)  | kPa                 | 6          | 8    | 9    | 10   |
|  | psi                 | 0,8        | 1,2  | 1,3  | 1,5  |
| Muffler 2 pressure drop<br>(at exhaust gas flow and exhaust temp specified in this table)  | kPa                 | 9          | 11   | 12   | 13   |
|  | psi                 | 1,3        | 1,6  | 1,7  | 1,9  |
| Exhaust gas flow at:<br>(temp and pressure after turbine at the corresponding power setting)                                       | m <sup>3</sup> /min | 25,3       | 27,2 | 28,7 | 30,5 |
|  | cfm                 | 893        | 961  | 1014 | 1077 |
|  <b>See front page for important information</b> |                     |            |      |      |      |
| Engine speed during stand still regeneration   | rpm                 | 1400 ± 100 |      |      |      |
|  <b>See front page for important information</b> |                     |            |      |      |      |
| Max allowed load during stand still regeneration   | Nm                  | 540        |      |      |      |
|  | lb ft               | 398        |      |      |      |

| <b>Cooling system</b>  |  | <b>rpm</b>  | <b>1500</b>    | <b>1800</b> | <b>2000</b> | <b>2200</b> |
|--|--|-------------|----------------|-------------|-------------|-------------|
| Heat rejection radiation from engine at:   | kW   |             | 4,8            | 4,6         | 3,9         | 3,8         |
|  | BTU/min  |             | 270            | 261         | 224         | 218         |
| Heat rejection to coolant at:  | kW   |             | 84             | 87          | 89          | 94          |
|  | BTU/min  |             | 4771           | 4935        | 5084        | 5339        |
| Coolant  | Volvo Penta Coolant VCS (Yellow) Ready Mix 40/60 or Mix 40% Volvo Penta Coolant VCS (Yellow) + 60% tap Water*.<br>* Tap water must fulfill Volvo quality standard VOLVO STD: 1285, 1 |             |                |             |             |             |
| Coolant capacity:  | Engine only  | liter       | 17             |             |             |             |
| <i>For coolant capacity for engine and cooling packages see Technical data for the specific option.</i>  |  | US gal      | 4,5            |             |             |             |
| Coolant pump   | (Engine is reference =1)   | drive/ratio | belt/1,40:1 cw |             |             |             |
| Coolant pump curve see graphs at end   |  |             |                |             |             |             |
| Nominal engine coolant pressure before engine circuit coolant pump   | kPa  |             | 54             | 55          | 55          | 57          |
|  | psi  |             | 7,8            | 8,0         | 8,0         | 8,3         |
| Coolant pressure drop over complete engine circuit<br>(at coolant flow below)  | kPa  |             | 6              | 10          | 13          | 16          |
|  | psi  |             | 0,9            | 1,5         | 1,9         | 2,3         |
| Coolant flow   | l/s  |             | 3,60           | 4,30        | 4,80        | 5,30        |
|  | US gal/s   |             | 0,951          | 1,136       | 1,268       | 1,400       |
| Minimum coolant flow<br>At fully opened thermostat   | l/s  |             | 3,20           | 3,40        | 3,60        | 4,00        |
|  | US gal/s   |             | 0,845          | 0,898       | 0,951       | 1,057       |
| Maximum outer circuit restriction incl. piping   | kPa  |             | 40             |             |             |             |
|  | psi  |             | 5,8            |             |             |             |
| Thermostat:  | start to open  | °C          | 82             |             |             |             |
|  |  | °F          | 180            |             |             |             |
|  | fully open   | °C          | 92             |             |             |             |
|  |  | °F          | 197,6          |             |             |             |
| Maximum static pressure head<br>(expansion tank height + pressure cap setting)   | kPa  |             | 110            |             |             |             |
|  | psi  |             | 16,0           |             |             |             |
| Minimum static pressure head<br>(expansion tank height + pressure cap setting)   | kPa  |             | 85             |             |             |             |
|  | psi  |             | 12,3           |             |             |             |
| Maximum top tank temperature   | °C   |             | 107            |             |             |             |
|  | °F   |             | 224,6          |             |             |             |
| Recommended Draw down capacity.<br>The difference between min coolant level in the expansion tank and the lowest level where the engine's coolant system still functioning | liter  |             | 2,00           |             |             |             |
|  | US gal   |             | 0,528          |             |             |             |

| <b>Charge air cooler system</b>  | <b>rpm</b> | <b>1500</b> | <b>1800</b> | <b>2000</b> | <b>2200</b> |
|--|------------|-------------|-------------|-------------|-------------|
| Heat rejection to charge air cooler  | kW         | 20          | 22          | 27          | 30          |
|  | BTU/min    | 1114        | 1273        | 1531        | 1713        |
| Charge air mass flow   | kg/s       | 0,21        | 0,25        | 0,28        | 0,31        |
| Charge air inlet temp @ 25 °C<br>(Charge air temp after turbo compressor)  | °C         | 132         | 127         | 129         | 131         |
|  | °F         | 270         | 261         | 264         | 268         |
| <br><b>See front page for important information</b><br>Max allowable Charge air outlet temp @ 25 °C ambient temperature<br>(Charge air temp after charge air cooler) | °C         | 42          | 48          | 50          | 50          |
|  | °F         | 108         | 118         | 122         | 122         |
| <br><b>See front page for important information</b><br>Maximum pressure drop over charge air cooler incl. piping   | kPa        | 7           | 9           | 10          | 12          |
|  | psi        | 1,0         | 1,3         | 1,5         | 1,7         |
| Charge air pressure - relative pressure at sea level<br>(After charge air cooler)  | kPa        | 123         | 120         | 121         | 124         |
|  | psi        | 17,8        | 17,4        | 17,5        | 18,0        |

**Electrical system**

|  |  |                     |           |           |           |
|--|--|---------------------|-----------|-----------|-----------|
| Engine Management System                         |  | EMS 2.4             |           |           |           |
| Voltage and type                                 |  | 24V DC              |           |           |           |
| Battery and cable resistance<br>Recommendations: | Temperature                            | °C                  | 25        | 0         | -15       |
|  |  | °F                  | 77        | 32        | 5         |
|  | Maximum main circuit resistance @ 20°C | mΩ                  | 5         | 5         | 4         |
|  | Minimum battery size                   | Ah (20h) / CCA (EN) | 100 / 680 | 100 / 680 | 140 / 800 |

**Power take off**

Maximum allowed torque at individual PTO's. If more than one PTO output is used simultaneously, calculations need to be performed to determine available maximum. Available torque depends on application inertia.

**Front end in line with crankshaft**

|  | <b>rpm</b> | <b>1400</b> | <b>1800</b> | <b>2000</b> | <b>2200</b> |
|--|------------|-------------|-------------|-------------|-------------|
| With a total added mass moment of inertia      | J (mR2)    | 0.02 kgm2   |             |             |             |
| Max torque at continuous load:                 | Nm         | 1064        | 743         | 740         | 833         |
|  | lbt ft     | 785         | 548         | 546         | 614         |
| <b>PTO at flywheel</b>                         |            |             |             |             |             |
| Max allowed bending moment in flywheel housing | Nm         | 4600        |             |             |             |
|  | lbf ft     | 3393        |             |             |             |
| Max load on rear main bearing                  | N          | 4250        |             |             |             |
|  | lbf        | 955         |             |             |             |

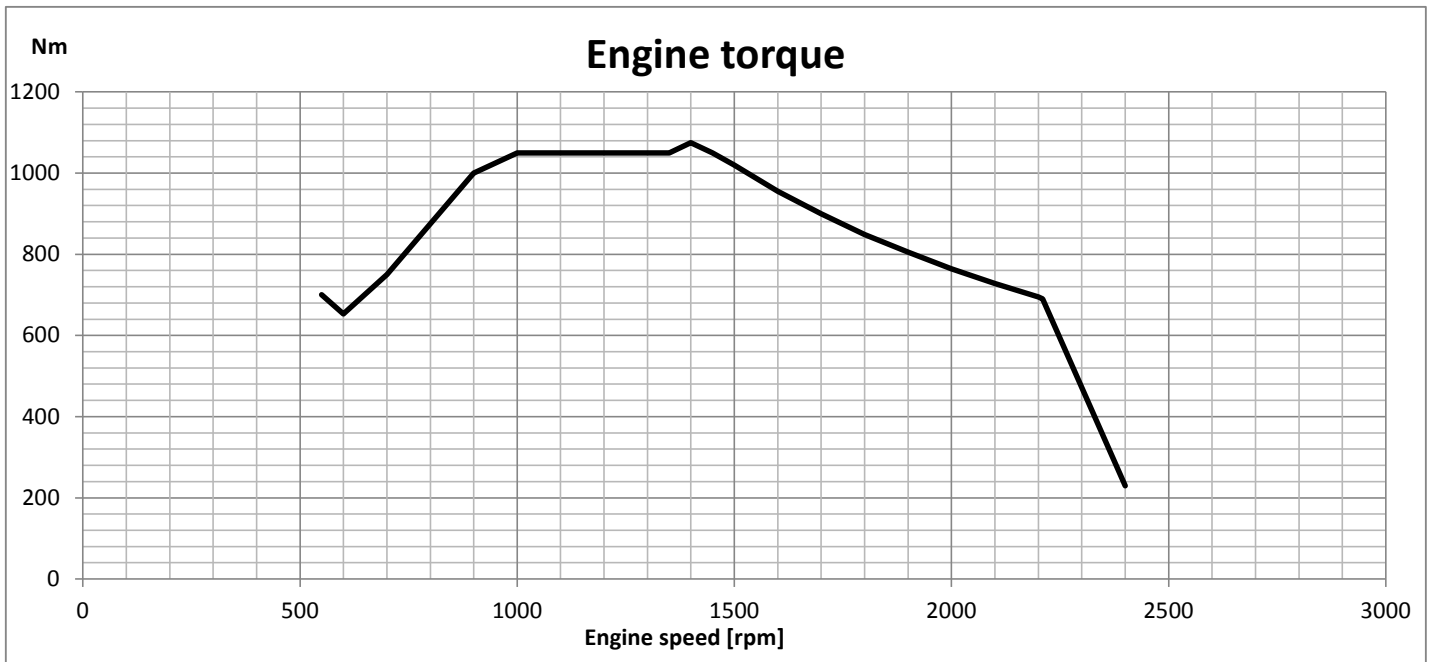
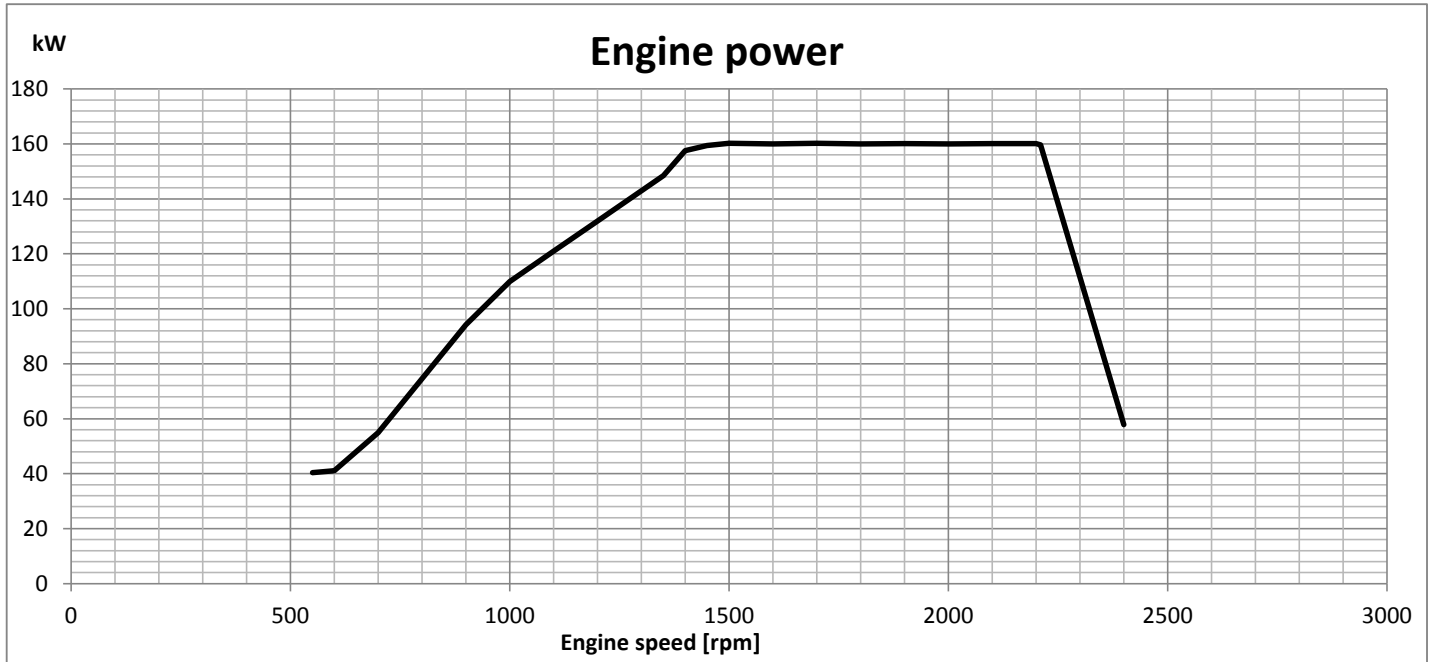
**Engine Protection**

Warning implies that a Indication message is sent. Derate means an engine power derate.

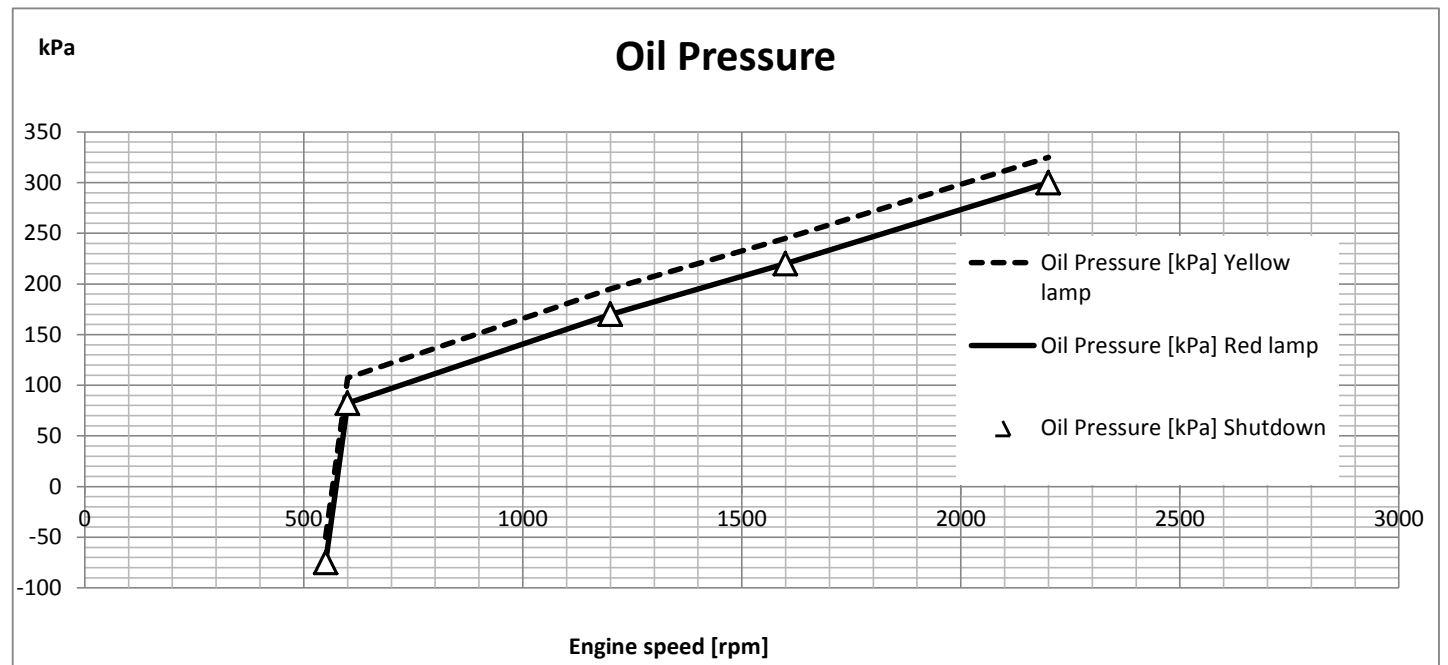
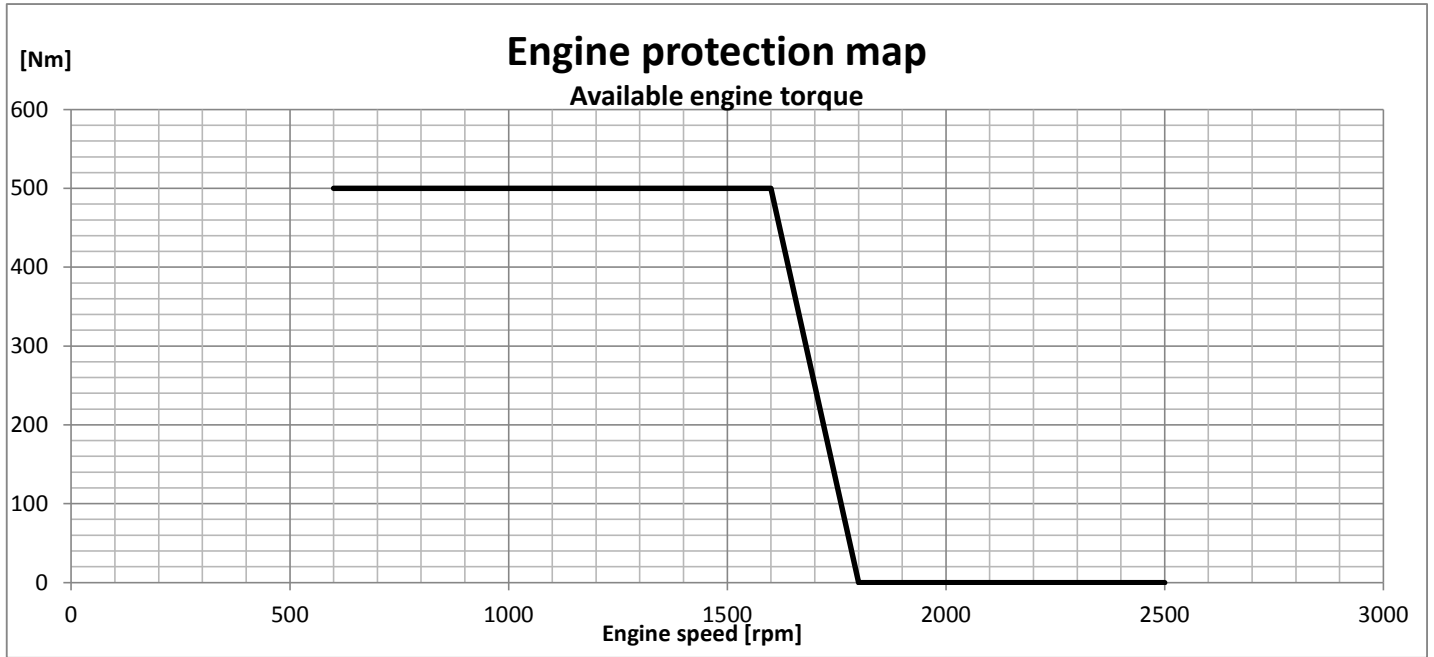
| Engine sensors                           |                |                        |                   | Engine protection action |                                       |                                     |
|--|----------------|------------------------|-------------------|--------------------------|---------------------------------------|-------------------------------------|
|  | Unit           | Warning level (Yellow) | Alarm level (Red) | Default                  | Max derate, acc engine protection map | Optional (Module or conversion kit) |
| Fuel temperature <sup>1</sup>            | °C             | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| Oil temperature                          | °C             | 125                    | 130               | Derate                   | 132                                   | Shut down                           |
| Coolant temperature                      | °C             | 105                    | 107               | Derate                   | 108                                   | Shut down                           |
| Charge Air Temperature (Boost temp)      | °C             | 120                    | 125               | Derate                   | 126                                   | Shut down                           |
| Air filter temperature <sup>1</sup>      | °C             | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| Exhaust gas temperature                  | °C             | 535                    | 550               | Shut down                | 550                                   | Shut down                           |
| EGR temperature <sup>1</sup>             | °C             | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| ECU temperature                          | °C             | 90                     | N/A               | N/A                      | N/A                                   | N/A                                 |
| Fuel feed pressure <sup>1</sup>          | kPa            | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| Fuel rail pressure <sup>1</sup>          | kPa            | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| Oil Pressure                             | kPa            | See below              | See below         | Shut down                | See below                             | Shut down                           |
| Δ Piston Cooling Pressure <sup>1</sup>   | kPa            | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| Δ Charge Air Press (Δ Boost pres)        | kPa            | See below              | See below         | Derate                   | See below                             | Shut down                           |
| Air filter pressure <sup>1</sup>         | kPa            | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| EGR pressure <sup>1</sup>                | kPa            | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| Crankcase pressure increase <sup>1</sup> | kPa            | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| DPF Differential Pressure                | kPa            | 31                     | 33                | Derate                   | 34                                    | Shut down                           |
| Oil level <sup>1</sup>                   | Digital Switch | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |
| Coolant level                            | Digital Switch | N/A                    | Low Level         | Derate                   | Low Level                             | Shut down                           |
| DEF Injector Status                      | Digital Switch | N/A                    | Error Flag        | Derate                   | Error Flag                            | Shut down                           |
| EATS System - Soot Regen Status          | Status Flag    | Warning                | Stop Request      | Derate                   | Stop Request                          | Shut down                           |
| Water in fuel <sup>1</sup>               | Digital Switch | Not installed          | Not installed     | Not installed            | Not installed                         | Not installed                       |

<sup>1</sup> Sensor not installed for this engine type

**Graphs**



**Warning and derate maps**



Engine protection for charge air pressure is complex and the trigger levels varies depending on engine mode, altitude and charge air temperature, ambient temperature.

Below is an example of engine protection limits for charge air pressure for normal operation engine mode, on the sea level with charge air temperature 50 degrees (normal charge cooler CAC efficiency) , and ambient temperature 25 degrees.

When engine speed increases above 1900 rpm (maximum power) charge pressure demand drops significantly but the actual charge pressure has a physical delay to decrease therefore the fault limit is higher to avoid false alarm.

