

|                                                    |                 |             |
|----------------------------------------------------|-----------------|-------------|
| <b>VOLVO PENTA</b><br><b>D 16 MG 1800/1500 rpm</b> | Document No     | Issue Index |
|                                                    | <b>23671222</b> | <b>01</b>   |

Base on water temp 38°C/100°F

### General

In-line four stroke diesel engine with direct injection. Rotation direction, anti-clockwise viewed towards flywheel. Turbocharged

|                     |                                       |                |              |
|---------------------|---------------------------------------|----------------|--------------|
| Number of cylinders |                                       | 6              |              |
| Displacement, total | litre<br>in <sup>3</sup>              | 16,12<br>983,9 |              |
| Firing order        |                                       | 1-5-3-6-2-4    |              |
| Bore                | mm<br>in                              | 144<br>5,67    |              |
| Stroke              | mm<br>in                              | 165<br>6,50    |              |
| Compression ratio   |                                       | 17,5:1         |              |
| Dry weight          | Engine only, excluding cooling system | kg<br>lb       | 1750<br>3858 |

| <b>Performance</b>                                                |                      | <b>rpm load</b>                       | <b>1500</b>      |              |              |              |              |
|-------------------------------------------------------------------|----------------------|---------------------------------------|------------------|--------------|--------------|--------------|--------------|
|                                                                   |                      |                                       | <b>25%</b>       | <b>50%</b>   | <b>75%</b>   | <b>100%</b>  | <b>110%</b>  |
| Power setting 479 kW                                              |                      | kW<br>hp                              | 120<br>163       | 240<br>326   | 359<br>489   | 479<br>651   | 527<br>717   |
| Torque at:                                                        | Power setting 479 kW | Nm<br>lbft                            | 762<br>562       | 1525<br>1124 | 2287<br>1687 | 3049<br>2249 | 3354<br>2474 |
| Mean piston speed                                                 |                      | m/s<br>ft/sec                         | 8,3<br>27,1      |              |              |              |              |
| Effective mean pressure at:                                       | Power setting 479 kW | MPa<br>psi                            | 0,6<br>86        | 1,2<br>172   | 1,8<br>259   | 2,4<br>345   | 2,6<br>379   |
| Max combustion pressure at:                                       | Power setting 479 kW | MPa<br>psi                            | 7,8<br>1131      | 10,4<br>1508 | 13,5<br>1958 | 17,1<br>2480 | 18,7<br>2712 |
| Total mass moment of inertia, J (mR <sup>2</sup> )<br>Engine only |                      | kgm <sup>2</sup><br>lbft <sup>2</sup> | 4,70698<br>111,7 |              |              |              |              |
| Degree of irregularity at:                                        | Power setting 479 kW |                                       | 1;353            | 1;131        | 1;71         | 1;48         | 1;43         |
| Friction Power                                                    |                      | kW<br>hp                              | 42<br>57         | 42<br>57     | 42<br>57     | 42<br>57     | 42<br>57     |
| <b>If applicable Derating are described in Technical Diagrams</b> |                      |                                       |                  |              |              |              |              |

| <b>Performance</b>                                                |                      | <b>rpm load</b>                       | <b>1800</b>      |              |              |              |              |
|-------------------------------------------------------------------|----------------------|---------------------------------------|------------------|--------------|--------------|--------------|--------------|
|                                                                   |                      |                                       | <b>25%</b>       | <b>50%</b>   | <b>75%</b>   | <b>100%</b>  | <b>110%</b>  |
| Power setting 532 kW                                              |                      | kW<br>hp                              | 133<br>181       | 266<br>362   | 399<br>543   | 532<br>724   | 585<br>796   |
| Torque at:                                                        | Power setting 532 kW | Nm<br>lbft                            | 706<br>520       | 1411<br>1041 | 2117<br>1561 | 2822<br>2081 | 3105<br>2290 |
| Mean piston speed                                                 |                      | m/s<br>ft/sec                         | 9,9<br>32,6      |              |              |              |              |
| Effective mean pressure at:                                       | Power setting 532 kW | MPa<br>psi                            | 0,5<br>80        | 1,1<br>160   | 1,6<br>239   | 2,2<br>319   | 2,4<br>351   |
| Max combustion pressure at:                                       | Power setting 532 kW | MPa<br>psi                            | 8,3<br>1204      | 11,3<br>1639 | 14,6<br>2118 | 17,7<br>2567 | 18,7<br>2712 |
| Total mass moment of inertia, J (mR <sup>2</sup> )<br>Engine only |                      | kgm <sup>2</sup><br>lbft <sup>2</sup> | 4,70698<br>111,7 |              |              |              |              |
| Degree of irregularity at:                                        | Power setting 532 kW |                                       | 1;295            | 1;264        | 1;134        | 1;88         | 1;79         |
| Friction Power                                                    |                      | kW<br>hp                              | 59<br>80,24      | 59<br>80,24  | 59<br>80,24  | 59<br>80,24  | 59<br>80,24  |
| <b>If applicable Derating are described in Technical Diagrams</b> |                      |                                       |                  |              |              |              |              |

|                                                    |                 |             |
|----------------------------------------------------|-----------------|-------------|
| <b>VOLVO PENTA</b><br><b>D 16 MG 1800/1500 rpm</b> | Document No     | Issue Index |
|                                                    | <b>23671222</b> | <b>01</b>   |

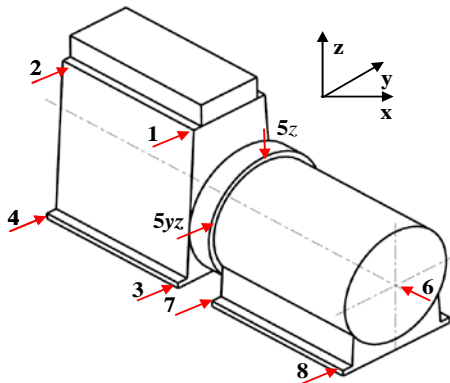
**Engine noise emission**

Test Standards: ISO 3744-1981 (E) sound power (without exhaust noise)  
Tolerans ± 0.75 dB(A)

| Measured sound power Lw | No load | dB(A) | rpm                  |     |     |       |       |      |  |
|-------------------------|---------|-------|----------------------|-----|-----|-------|-------|------|--|
|                         |         |       | load                 | 25% | 50% | 75%   | 100%  | 110% |  |
| Power setting 479 kW    |         |       |                      |     |     |       |       |      |  |
|                         |         |       | 112                  | 113 | 114 | 114,5 | 114,4 |      |  |
|                         |         |       | rpm                  |     |     |       |       |      |  |
|                         |         |       | 1800                 |     |     |       |       |      |  |
| Measured sound power Lw | No load | dB(A) |                      |     |     |       |       |      |  |
|                         |         |       | Power setting 532 kW | 114 | 115 | 116   | 116   | 117  |  |

**Vibrations (vibration velocity)**

Declared vibration levels according to ISO 8528-9



| Measuring position | rpm                                                 |                          |                        |
|--------------------|-----------------------------------------------------|--------------------------|------------------------|
|                    | 1500                                                |                          |                        |
|                    | RMS Velocity (10 - 1000Hz)<br>Measurement direction |                          |                        |
|                    | Axial [ x ]<br>mm/s                                 | Transverse [ y ]<br>mm/s | Vertical [ z ]<br>mm/s |
| 1                  | 10,7                                                | 10,6                     | 10,9                   |
| 2                  | 9,5                                                 | 12,4                     | 15,4                   |
| 3                  | 8,2                                                 | 14,7                     | 8                      |
| 4                  | 8,8                                                 | 16,8                     | 16,1                   |
| 5                  | 10,5                                                | 10,7                     | 15,8                   |
| 6                  | 10                                                  | 16,7                     | 13                     |
| 7                  | 9,3                                                 | 18,9                     | 17,4                   |
| 8                  | 9,7                                                 | 21,2                     | 17,7                   |
|                    | rpm                                                 |                          |                        |
|                    | 1800                                                |                          |                        |
| 1                  | 13                                                  | 10,4                     | 15,5                   |
| 2                  | 12                                                  | 19,5                     | 18                     |
| 3                  | 11                                                  | 19,7                     | 11,7                   |
| 4                  | 12                                                  | 27,9                     | 20,1                   |
| 5                  | 9                                                   | 11,1                     | 18,1                   |
| 6                  | 12                                                  | 23,4                     | 17,5                   |
| 7                  | 9                                                   | 27,2                     | 19,8                   |
| 8                  | 10                                                  | 23,2                     | 23                     |

**Test conditions for load acceptance data**

|              |                      |               |                    |
|--------------|----------------------|---------------|--------------------|
| Warm engine. | <b>Generator</b>     | <b>Modell</b> | <b>Type of AVR</b> |
|              | Stamford             | HCM 534F      | MX-341             |
|              | <b>Voltage droop</b> |               |                    |

Load acceptance performance can vary due to actual alternator inertia, voltage regulator, type of load and local ambient conditions.

**Single step load performance at 1500 rpm**

| Load (%) | Speed diff (%) |            | Recovery time (s) |            | Remaining load (%) | Speed diff (%) |            | Recovery time (s) |            |
|----------|----------------|------------|-------------------|------------|--------------------|----------------|------------|-------------------|------------|
|          | Nominal        | 110% power | Nominal           | 110% power |                    | Nominal        | 110% power | Nominal           | 110% power |
| 0-20     | 3,2            | 3,4        | 1,4               | 1,3        | 20-100             | 27,9           | 26,5       | 5,7               | 4,9        |
| 0-40     | 5,3            | 5,9        | 1,2               | 2,2        | 40-100             | 12,6           | 11,1       | 3,2               | 3,9        |
| 0-50     | 9,1            | 9,7        | 2,4               | 3,6        | 50-100             | 9,4            | 7,9        | 2,9               | 3,3        |
| 0-60     | 13,4           | 14,3       | 3,8               | 3,7        | 60-100             | 6,3            | 6,1        | 2,4               | 3,1        |
| 0-55,6   | 10,0           | 9,7        | 3,5               | 3,6        | 55,6-100           | 8,0            | 7,9        | 3,0               | 3,9        |
| 0-50,5   |                |            |                   |            | 50,5-100           |                |            |                   |            |
| 100-0    |                |            |                   |            |                    |                |            |                   |            |

|                    |                              |                 |
|--------------------|------------------------------|-----------------|
| <b>VOLVO PENTA</b> | Document No                  | Issue Index     |
|                    | <b>D 16 MG 1800/1500 rpm</b> | <b>23671222</b> |

**Single step load performance at 1800 rpm**

| Load (%) | Speed diff % |            | Recovery time (s) |            | Remaining load (%) | Speed diff (%) |            | Recovery time (s) |            |
|----------|--------------|------------|-------------------|------------|--------------------|----------------|------------|-------------------|------------|
|          | Nominal      | 110% power | Nominal           | 110% power |                    | Nominal        | 110% power | Nominal           | 110% power |
| 0-20     | 2,4          | 2,7        | 1,2               | 1,3        | 20-100             | 18,4           | 19,7       | 3,7               | 7,6        |
| 0-40     | 4,2          | 4,5        | 1,6               | 1,5        | 40-100             | 9,4            | 9,4        | 2,1               | 3,8        |
| 0-60     | 8,3          | 10,7       | 2,0               | 2,4        | 60-100             | 3,8            | 3,9        | 1,5               | 1,6        |
| 0-70     | 13,1         | 15,3       | 2,8               | 3,1        | 70-100             | 3,2            | 3,2        | 1,4               | 1,5        |
| 0-67,4   | 10,4         | 9,9        | 1,5               | 2,2        | 67,4-100           | 8,0            | 7,4        | 1,5               | 2,0        |
| 0-61,3   |              |            |                   |            | 2,7                |                |            |                   |            |
| 100-0    |              |            |                   |            | 2,0                |                |            |                   |            |

**Cold start performance**

|                                                                              | rpm         | 1500            | 1800                 |                                        |
|------------------------------------------------------------------------------|-------------|-----------------|----------------------|----------------------------------------|
| Time from start to no load speed at ambient temperature:                     | 20°C        | s               | 5,8                  | 6,7                                    |
|                                                                              | 5 °C        | s               | 6,0                  | 7,1                                    |
| Time from start to stay within 0.5% of no load speed at ambient temperature: | 20°C        | s               | 5,8                  | 6,7                                    |
|                                                                              | 5 °C        | s               | 6,0                  | 7,1                                    |
| <b>Block heater type</b>                                                     | <b>Make</b> | <b>Power kW</b> | <b>Engaged hours</b> | <b>Cooling water temp engine block</b> |
| Ext./Thermostat-ctrl                                                         | Volvo Penta | 2               | 12                   | 32°C<br>90°F                           |

**Lubrication system**

|                                                                                              |                                     | rpm             | load   | 25%  | 50% | 75% | 100%  | 110%  |      |
|----------------------------------------------------------------------------------------------|-------------------------------------|-----------------|--------|------|-----|-----|-------|-------|------|
| Lubricating oil consumption                                                                  | Power setting 479 kW                | liter/h         |        |      |     |     | 0,1   | 0,11  |      |
|                                                                                              |                                     | US gal/h        |        |      |     |     | 0,026 | 0,029 |      |
|                                                                                              | Power setting 532 kW                | <b>rpm 1800</b> |        |      |     |     |       |       |      |
|                                                                                              |                                     | liter/h         |        |      |     |     |       | 0,11  | 0,12 |
|                                                                                              |                                     | US gal/h        |        |      |     |     | 0,029 | 0,032 |      |
| Oil system capacity including filters                                                        |                                     | liter           | 55     |      |     |     |       |       |      |
|                                                                                              |                                     | US gal          | 14,5   |      |     |     |       |       |      |
| Oil sump capacity:                                                                           |                                     | max             | liter  | 49   |     |     |       |       |      |
|                                                                                              |                                     |                 | US gal | 12,9 |     |     |       |       |      |
|                                                                                              | min                                 | liter           | 39     |      |     |     |       |       |      |
|                                                                                              |                                     | US gal          | 10,3   |      |     |     |       |       |      |
| Oil change intervals/<br>specifications:<br>(Fuel quality dependant)                         | VDS-2. ACEA: E3, E5. API: CG-4, CH4 |                 | h      | 400  |     |     |       |       |      |
|                                                                                              | VDS. ACEA: E2. API: CF, CF-4        |                 | h      | 500  |     |     |       |       |      |
|                                                                                              |                                     |                 | h      |      |     |     |       |       |      |
|                                                                                              |                                     |                 | h      |      |     |     |       |       |      |
| Engine angularity limits, static (ref. classification rules, roll and pitch simultaneously)  |                                     | front up        | °      | 10   |     |     |       |       |      |
|                                                                                              |                                     | front down      | °      | 10   |     |     |       |       |      |
|                                                                                              |                                     | side tilt       | °      | 23   |     |     |       |       |      |
| Engine angularity limits, dynamic (ref. classification rules, roll and pitch simultaneously) |                                     | front up        | °      | 10   |     |     |       |       |      |
|                                                                                              |                                     | front down      | °      | 10   |     |     |       |       |      |
|                                                                                              |                                     | side tilt       | °      | 23   |     |     |       |       |      |

**Lubrication system**

|                                          |  | rpm | 1500 | 1800 |
|------------------------------------------|--|-----|------|------|
| Oil pressure at rated speed              |  | kPa | 425  | 440  |
|                                          |  | psi | 61,6 | 63,8 |
| Oil pressure shut down switch setting    |  | kPa | 200  | 200  |
|                                          |  | psi | 29,0 | 29,0 |
| Lubrication oil temperature in oil sump: |  | max | °C   |      |
|                                          |  |     | °F   |      |
|                                          |  |     | 128  |      |
|                                          |  |     | 262  |      |
| Oil filter micron size                   |  | μ   | 40   |      |

\* See also general section in the sales guide

|                                             |                 |             |
|---------------------------------------------|-----------------|-------------|
| <b>VOLVO PENTA</b><br>D 16 MG 1800/1500 rpm | Document No     | Issue Index |
|                                             | <b>23671222</b> | <b>01</b>   |

| <b>Fuel system</b>                  |                      | <b>rpm load</b>                                                            | <b>25%</b>  | <b>50%</b> | <b>1500 75%</b> | <b>100%</b> | <b>110%</b> |
|-------------------------------------|----------------------|----------------------------------------------------------------------------|-------------|------------|-----------------|-------------|-------------|
| Specific fuel consumption with:     | Power setting 479 kW | g/kWh                                                                      | 225         | 204        | 199             | 200         | 200         |
|                                     |                      | lb/hph                                                                     | 0,364       | 0,330      | 0,323           | 0,324       | 0,325       |
|                                     |                      | <b>rpm</b>                                                                 | <b>1800</b> |            |                 |             |             |
|                                     | Power setting 532 kW | g/kWh                                                                      | 235         | 207        | 205             | 206         | 210         |
|                                     |                      | lb/hph                                                                     | 0,381       | 0,336      | 0,331           | 0,334       | 0,340       |
| Fuel to conform to                  |                      | ASTM-D975-No. 1 and 2-D, JIS KK 2204, EN 590 MDO-DMX and MDO-DMA (ISO8217) |             |            |                 |             |             |
|                                     |                      | <b>rpm</b>                                                                 | <b>1500</b> |            |                 |             |             |
| System return flow                  | Power setting 479 kW | liter/h                                                                    | 47          | 47         | 47              | 47          | 47          |
|                                     |                      | US gal/h                                                                   | 12,4        | 12,4       | 12,4            | 12,4        | 12,4        |
|                                     |                      | <b>rpm</b>                                                                 | <b>1800</b> |            |                 |             |             |
|                                     | Power setting 532 kW | liter/h                                                                    | 51          | 51         | 51              | 51          | 51          |
|                                     |                      | US gal/h                                                                   | 13,5        | 13,5       | 13,5            | 13,5        | 13,5        |
|                                     |                      | <b>rpm</b>                                                                 | <b>1500</b> |            |                 |             |             |
| System supply flow                  | Power setting 479 kW | liter/h                                                                    | 79          | 105        | 132             | 161         | 172         |
|                                     |                      | US gal/h                                                                   | 20,9        | 27,7       | 34,9            | 42,5        | 45,4        |
|                                     |                      | <b>rpm</b>                                                                 | <b>1800</b> |            |                 |             |             |
|                                     | Power setting 532 kW | liter/h                                                                    | 88          | 117        | 148             | 181         | 197         |
|                                     |                      | US gal/h                                                                   | 23,2        | 30,9       | 39,1            | 47,8        | 52,0        |
|                                     |                      | <b>rpm</b>                                                                 | <b>1500</b> |            |                 |             |             |
| Normal fuel pressure (after filter) | Power setting 479 kW | kPa                                                                        | 455         | 449        | 445             | 438         | 437         |
|                                     |                      | psi                                                                        | 66,0        | 65,1       | 64,5            | 63,5        | 63,4        |
|                                     |                      | <b>rpm</b>                                                                 | <b>1800</b> |            |                 |             |             |
|                                     | Power setting 532 kW | kPa                                                                        | 478         | 475        | 472             | 466         | 466         |
|                                     |                      | psi                                                                        | 69,3        | 68,9       | 68,5            | 67,6        | 67,6        |

**Fuel system**

|                                                   |      |      |
|---------------------------------------------------|------|------|
| Fuel supply line max restriction                  | kPa  | 10,0 |
|                                                   | psi  | 1,5  |
| Fuel supply max pressure head (day tank, from CL) | m    | 2,0  |
|                                                   | feet | 6,6  |
| Fuel supply line max suction head (from CL)       | kPa  | 2,0  |
|                                                   | psi  | 0,3  |
| Fuel return line max restriction                  | kPa  | 20,0 |
|                                                   | psi  | 2,9  |
| Maximum allowable inlet fuel temp                 | °C   | 60   |
|                                                   | °F   | 140  |

| <b>Fuel system</b>                      |                        | <b>rpm load</b> | <b>25%</b>  | <b>50%</b>             | <b>1500 75%</b> | <b>100%</b> | <b>110%</b> |
|-----------------------------------------|------------------------|-----------------|-------------|------------------------|-----------------|-------------|-------------|
| Fuel temp rise over engine              | Power setting 479 kW   | °C              | 27          | 27                     | 27              | 27          | 27          |
|                                         |                        | °F              | 81          | 81                     | 81              | 81          | 81          |
|                                         |                        | <b>rpm</b>      | <b>1800</b> |                        |                 |             |             |
|                                         | Power setting 532 kW   | °C              | <b>32</b>   | <b>32</b>              | <b>32</b>       | <b>32</b>   | <b>32</b>   |
|                                         |                        | °F              | 90          | 90                     | 90              | 90          | 90          |
| Prefilter / Water separator micron size | μ                      | 10              |             |                        |                 |             |             |
| Fuel filter micron size                 | μ                      | 2               |             |                        |                 |             |             |
|                                         |                        | <b>rpm</b>      | <b>1500</b> |                        | <b>1800</b>     |             |             |
| Governor type/make, standard            | Electronic/Volvo EMSII |                 |             | Electronic/Volvo EMSII |                 |             |             |
| Injection pump type/make                | Unit injector          |                 |             | Unit injector          |                 |             |             |
| Injection timing std.                   | °B.T.D.C               |                 |             |                        |                 |             |             |
| Injection timing                        | °B.T.D.C               |                 |             |                        |                 |             |             |

rpm

1500

|                                                    |                 |             |
|----------------------------------------------------|-----------------|-------------|
| <b>VOLVO PENTA</b><br><b>D 16 MG 1800/1500 rpm</b> | Document No     | Issue Index |
|                                                    | <b>23671222</b> | <b>01</b>   |

| <b>Intake system</b>                                  |                      | <b>load</b>         | <b>25%</b>  | <b>50%</b> | <b>75%</b> | <b>100%</b> | <b>110%</b> |
|-------------------------------------------------------|----------------------|---------------------|-------------|------------|------------|-------------|-------------|
| Air consumption at:<br>(+25°C and 100kPa)             | Power setting 479 kW | m <sup>3</sup> /min | 14,93       | 21,43      | 29,08      | 35,4        | 37,28       |
|                                                       |                      | cfm                 | 527         | 757        | 1027       | 1250        | 1317        |
|                                                       |                      | <b>rpm</b>          | <b>1800</b> |            |            |             |             |
|                                                       | Power setting 532 kW | m <sup>3</sup> /min | 19,9        | 28,43      | 37         | 41,42       | 42,28       |
|                                                       |                      | cfm                 | 703         | 1004       | 1307       | 1463        | 1493        |
| Max allowable air intake restriction including piping |                      | kPa                 | 3           |            |            |             |             |
|                                                       |                      | psi                 | 0,4         |            |            |             |             |
| Air filter type                                       |                      | Paper cartridge     |             |            |            |             |             |
| Air filter cleaning efficiency                        |                      | %                   | 98          |            |            |             |             |

| <b>Exhaust system</b>         |                      | <b>rpm</b> | <b>load</b> | <b>25%</b> | <b>50%</b> | <b>75%</b> | <b>100%</b> | <b>110%</b> |
|-------------------------------|----------------------|------------|-------------|------------|------------|------------|-------------|-------------|
| Heat rejection to exhaust at: | Power setting 479 kW | kW         | 94          | 166        | 245        | 327        | 360         |             |
|                               |                      | BTU/min    | 5329        | 9440       | 13922      | 18590      | 20490       |             |
|                               |                      | <b>rpm</b> | <b>1800</b> |            |            |            |             |             |
|                               | Power setting 532 kW | kW         | 112         | 192        | 278        | 379        | 432         |             |
|                               |                      | BTU/min    | 6381        | 10913      | 15832      | 21553      | 24590       |             |

| <b>Exhaust system</b>                       |                      | <b>rpm</b> | <b>load</b> | <b>25%</b> | <b>50%</b> | <b>75%</b> | <b>100%</b> | <b>110%</b> |
|---------------------------------------------|----------------------|------------|-------------|------------|------------|------------|-------------|-------------|
| Exhaust gas temperature after turbine at:   | Power setting 479 kW | °C         | 320         | 381        | 408        | 441        | 457         |             |
|                                             |                      | °F         | 608         | 718        | 766        | 826        | 855         |             |
|                                             |                      | <b>rpm</b> | <b>1800</b> |            |            |            |             |             |
|                                             | Power setting 532 kW | °C         | 288         | 335        | 366        | 432        | 474         |             |
|                                             |                      | °F         | 550         | 635        | 691        | 810        | 885         |             |
| Max allowable back pressure in exhaust line |                      | kPa        | 15          |            |            |            |             |             |
|                                             |                      | psi        | 2,2         |            |            |            |             |             |

| <b>Exhaust system</b>                                                                        |                      | <b>rpm</b>          | <b>load</b> | <b>25%</b> | <b>50%</b> | <b>75%</b> | <b>100%</b> | <b>110%</b> |
|----------------------------------------------------------------------------------------------|----------------------|---------------------|-------------|------------|------------|------------|-------------|-------------|
| Exhaust gas flow at:<br>(temp and pressure after turbine at the corresponding power setting) | Power setting 479 kW | m <sup>3</sup> /min | 30,5        | 47,7       | 65,3       | 80,4       | 85,6        |             |
|                                                                                              |                      | cfm                 | 1076        | 1683       | 2307       | 2839       | 3022        |             |
|                                                                                              |                      | <b>rpm</b>          | <b>1800</b> |            |            |            |             |             |
|                                                                                              | Power setting 532 kW | m <sup>3</sup> /min | 38          | 58         | 77         | 93         | 100         |             |
|                                                                                              |                      | cfm                 | 1344        | 2042       | 2708       | 3269       | 3515        |             |

| <b>Cooling system, HT circuit, heat rejection</b>       |                      | <b>rpm</b> | <b>load</b> | <b>25%</b> | <b>50%</b> | <b>75%</b> | <b>100%</b> | <b>110%</b> |
|---------------------------------------------------------|----------------------|------------|-------------|------------|------------|------------|-------------|-------------|
| Heat rejection radiation from engine to surrounding at: | Power setting 479 kW | kW         | 1           | 5          | 11         | 17         | 22          |             |
|                                                         |                      | BTU/min    | 57          | 284        | 626        | 967        | 1251        |             |
|                                                         |                      | <b>rpm</b> | <b>1800</b> |            |            |            |             |             |
|                                                         | Power setting 532 kW | kW         | 3           | 7          | 13         | 19         | 24          |             |
|                                                         |                      | BTU/min    | 171         | 398        | 739        | 1081       | 1365        |             |

| <b>Cooling system, HT circuit, heat rejection</b> |                      | <b>rpm</b> | <b>load</b> | <b>25%</b> | <b>50%</b> | <b>75%</b> | <b>100%</b> | <b>110%</b> |
|---------------------------------------------------|----------------------|------------|-------------|------------|------------|------------|-------------|-------------|
| Heat rejection to coolant at:<br>(HT)             | Power setting 479 kW | kW         | 77          | 122        | 187        | 253        | 271         |             |
|                                                   |                      | BTU/min    | 4379        | 6938       | 10635      | 14388      | 15411       |             |
|                                                   |                      | <b>rpm</b> | <b>1800</b> |            |            |            |             |             |
|                                                   | Power setting 532 kW | kW         | 100         | 147        | 216        | 296        | 312         |             |
|                                                   |                      | BTU/min    | 5687        | 8360       | 12284      | 16833      | 17743       |             |

|                                                    |                 |             |
|----------------------------------------------------|-----------------|-------------|
| <b>VOLVO PENTA</b><br><b>D 16 MG 1800/1500 rpm</b> | Document No     | Issue Index |
|                                                    | <b>23671222</b> | <b>01</b>   |

**Cooling system, HT circuit, other data**

|                                                                                |               |             |                                                                                        |  |
|--------------------------------------------------------------------------------|---------------|-------------|----------------------------------------------------------------------------------------|--|
| Coolant volume in engine with std. expansion tank                              | liter         | 38          | Note! Expansion tank size to be calculated.<br>Recomended. 15% of total coolant volume |  |
|                                                                                | US gal        | 10,04       |                                                                                        |  |
| Max. additional coolant in HT system with std. expansion tank                  | liter         | 6           |                                                                                        |  |
|                                                                                | US gal        | 1,59        |                                                                                        |  |
| Coolant pump                                                                   | drive/ratio   | 1;1,906     |                                                                                        |  |
|                                                                                | <b>rpm</b>    | <b>1500</b> | <b>1800</b>                                                                            |  |
| Coolant flow with fully open thermostat                                        | l/s           | 373         | 460                                                                                    |  |
|                                                                                | US gal/s      | 98,54       | 121,52                                                                                 |  |
| Nominal coolant pressure with standard system                                  | kPa           | 75,0        | 75,0                                                                                   |  |
|                                                                                | psi           | 10,9        | 10,9                                                                                   |  |
| Maximum external coolant system restriction, including piping                  | kPa           | 50          | 50                                                                                     |  |
|                                                                                | psi           | 7,3         | 7,3                                                                                    |  |
| Thermostat                                                                     | start to open | °C          | 86                                                                                     |  |
|                                                                                |               | °F          | 187                                                                                    |  |
|                                                                                | fully open    | °C          | 96                                                                                     |  |
|                                                                                |               | °F          | 205                                                                                    |  |
| Design point for box cooler, engine outlet temperature                         | °C            | 92          |                                                                                        |  |
|                                                                                | °F            | 198         |                                                                                        |  |
| Coolant flow at design point                                                   | l/s           | 140         | 160                                                                                    |  |
|                                                                                | US gal/s      | 36,93       | 42,32                                                                                  |  |
| Maximum static pressure head<br>(expansion tank height + pressure cap setting) | kPa           | 100         |                                                                                        |  |
|                                                                                | psi           | 14,5        |                                                                                        |  |
| Standard pressure cap setting                                                  | kPa           | 75          |                                                                                        |  |
|                                                                                | psi           | 10,9        |                                                                                        |  |
| Maximum temperature entering engine                                            | °C            | 64          |                                                                                        |  |
|                                                                                | °F            | 147         |                                                                                        |  |

|                                   |                                                     |
|-----------------------------------|-----------------------------------------------------|
| Coolant (40% coolant / 60% water) | Volvo Penta coolant together with clean fresh water |
|-----------------------------------|-----------------------------------------------------|

**Cooling system, LT circuit, heat rejection**

|                                       |                      | <b>rpm</b> | <b>load</b> | <b>25%</b> | <b>50%</b> | <b>75%</b> | <b>100%</b> | <b>110%</b> |
|---------------------------------------|----------------------|------------|-------------|------------|------------|------------|-------------|-------------|
| Heat rejection to coolant at:<br>(LT) | Power setting 479 kW | kW         |             | 13         | 30         | 54         | 85          | 92          |
|                                       |                      | BTU/min    |             | 739        | 1706       | 3071       | 4834        | 5232        |
|                                       |                      | <b>rpm</b> | <b>1800</b> |            |            |            |             |             |
|                                       | Power setting 532 kW | kW         |             | 21         | 47         | 83         | 122         | 130         |
| BTU/min                               |                      |            | 1194        | 2673       | 4720       | 6938       | 7393        |             |

**Cooling system, LT, other data**

|                                                                                           |             |             |                                                                                        |  |
|-------------------------------------------------------------------------------------------|-------------|-------------|----------------------------------------------------------------------------------------|--|
| Coolant volume in engine charge air cooler circuit                                        | liter       | 5           | Note! Expansion tank size to be calculated.<br>Recomended. 15% of total coolant volume |  |
|                                                                                           | US gal      | 1,32        |                                                                                        |  |
| Max. additional coolant in LT system with std. expansion tank                             | liter       |             |                                                                                        |  |
|                                                                                           | US gal      |             |                                                                                        |  |
| Maximum static pressure head<br>(expansion tank height + pressure cap setting)            | kPa         | 100         |                                                                                        |  |
|                                                                                           | psi         | 14,5        |                                                                                        |  |
| Standard pressure cap setting                                                             | kPa         | 75          |                                                                                        |  |
|                                                                                           | psi         | 10,9        |                                                                                        |  |
| LT circuit pump                                                                           | drive/ratio | 1;1,31      |                                                                                        |  |
|                                                                                           | <b>rpm</b>  | <b>1500</b> | <b>1800</b>                                                                            |  |
| Nominal LT water design flow                                                              | l/s         | 78          | 84                                                                                     |  |
|                                                                                           | US gal/s    | 20,61       | 22,19                                                                                  |  |
| Nominal LT water pump pressure head at design flow                                        | kPa         | N/A         |                                                                                        |  |
|                                                                                           | psi         | N/A         |                                                                                        |  |
| Maximum LT waterpump suction head                                                         | kPa         | N/A         |                                                                                        |  |
|                                                                                           | psi         | N/A         |                                                                                        |  |
| Maximum additional pressure drop LT water circuit                                         | kPa         | 50          |                                                                                        |  |
|                                                                                           | psi         | 7,3         |                                                                                        |  |
| Maximum allowed LT water circuit pressure before<br>Heat Exchanger (External pump system) | kPa         | 10          |                                                                                        |  |
|                                                                                           | psi         | 1,5         |                                                                                        |  |
| Maximum temperature entering charge air cooler                                            | °C          | 48          |                                                                                        |  |
|                                                                                           | °F          | 118         |                                                                                        |  |

|                                  |                                                     |
|----------------------------------|-----------------------------------------------------|
| Coolant (40% coolant / 60%water) | Volvo Penta coolant together with clean fresh water |
|----------------------------------|-----------------------------------------------------|

|                                             |                 |             |
|---------------------------------------------|-----------------|-------------|
| <b>VOLVO PENTA</b><br>D 16 MG 1800/1500 rpm | Document No     | Issue Index |
|                                             | <b>23671222</b> | <b>01</b>   |

| <b>Charge air cooler system</b> |                                                                   | <b>rpm load</b>      | <b>25%</b>  | <b>50%</b>  | <b>75%</b>  | <b>100%</b> | <b>110%</b> |     |
|---------------------------------|-------------------------------------------------------------------|----------------------|-------------|-------------|-------------|-------------|-------------|-----|
| Cooling power                   | Power setting 479 kW                                              | kW                   | 8,1         | 28,9        | 63,1        | 100,3       | 113,4       |     |
|                                 |                                                                   | BTU/min              | 461         | 1644        | 3588        | 5704        | 6449        |     |
|                                 |                                                                   |                      | <b>rpm</b>  | <b>1800</b> |             |             |             |     |
|                                 | Power setting 532 kW                                              | kW                   | 15          | 48          | 93          | 132         | 148         |     |
|                                 |                                                                   | BTU/min              | 876         | 2707        | 5277        | 7512        | 8422        |     |
|                                 |                                                                   |                      | <b>rpm</b>  | <b>1500</b> |             |             |             |     |
| Charge air mass flow            | Power setting 479 kW                                              | kg/s                 | 0,289       | 0,415       | 0,564       | 0,686       | 0,722       |     |
|                                 |                                                                   |                      |             | <b>rpm</b>  | <b>1800</b> |             |             |     |
|                                 | Power setting 532 kW                                              | kg/s                 | 0,392       | 0,56        | 0,729       | 0,816       | 0,833       |     |
|                                 |                                                                   |                      |             | <b>rpm</b>  | <b>1500</b> |             |             |     |
|                                 | Charge air inlet temp.<br>Charge air temp after turbo compressor) | Power setting 479 kW | °C          | 67          | 113         | 159         | 197         | 210 |
|                                 |                                                                   |                      | °F          | 153         | 235         | 318         | 387         | 410 |
|                                 |                                                                   | <b>rpm</b>           | <b>1800</b> |             |             |             |             |     |
| Power setting 532 kW            |                                                                   | °C                   | 80          | 129         | 176         | 216         | 233         |     |
|                                 |                                                                   | °F                   | 176         | 264         | 349         | 421         | 451         |     |
|                                 |                                                                   | <b>rpm</b>           | <b>1500</b> |             |             |             |             |     |

| <b>Charge air cooler system</b>                                      |                      | <b>rpm load</b>   | <b>25%</b>  | <b>50%</b>  | <b>75%</b> | <b>100%</b> | <b>110%</b> |  |
|----------------------------------------------------------------------|----------------------|-------------------|-------------|-------------|------------|-------------|-------------|--|
| Charge air outlet temp.<br>(Charge air temp after charge air cooler) | Power setting 479 kW | °C                | 40          | 44          | 48         | 52          | 55          |  |
|                                                                      |                      | °F                | 104         | 111         | 118        | 126         | 131         |  |
|                                                                      |                      |                   | <b>rpm</b>  | <b>1800</b> |            |             |             |  |
|                                                                      | Power setting 532 kW | °C                | 41          | 45          | 50         | 55          | 57          |  |
|                                                                      |                      | °F                | 106         | 113         | 122        | 131         | 135         |  |
|                                                                      |                      |                   | <b>rpm</b>  | <b>1500</b> |            |             |             |  |
| Maximum pressure drop over charge air cooler, incl. piping           |                      | kPa               | 6           |             |            |             |             |  |
|                                                                      |                      | psi               | 0,87        |             |            |             |             |  |
|                                                                      |                      | <b>rpm</b>        | <b>1500</b> |             |            |             |             |  |
| Charge air pressure                                                  | Power setting 479 kW | kPa               | 239         |             |            |             |             |  |
|                                                                      |                      | psi               | 34,66       |             |            |             |             |  |
|                                                                      |                      |                   | <b>rpm</b>  | <b>1800</b> |            |             |             |  |
|                                                                      | Power setting 532 kW | kPa               | 239,00      |             |            |             |             |  |
|                                                                      |                      | psi               | 34,66       |             |            |             |             |  |
|                                                                      |                      |                   | <b>rpm</b>  | <b>1500</b> |            |             |             |  |
| Standard charge air cooler core area                                 |                      | m <sup>2</sup>    | 0,04        |             |            |             |             |  |
|                                                                      |                      | foot <sup>2</sup> | 0,43        |             |            |             |             |  |

**Engine management system**

| <b>Functionality</b>  | <b>Alternatives</b>                             | <b>Default setting</b> |
|-----------------------|-------------------------------------------------|------------------------|
| Governor mode         | Isochronus/Droop<br>Switchable during operation | Droop                  |
| Governor droop        | 0-5%                                            | 0,0                    |
| Governor response     | P, I and D via VODIA                            |                        |
| Idle speed            | 600-1200rpm                                     | 900rpm                 |
| Fine speed adjustment | N/A                                             | ±120rpm                |
| Stop function         | Energized to run / stop                         | Energized to stop      |

|                    |                              |                 |
|--------------------|------------------------------|-----------------|
| <b>VOLVO PENTA</b> | Document No                  | Issue Index     |
|                    | <b>D 16 MG 1800/1500 rpm</b> | <b>23671222</b> |

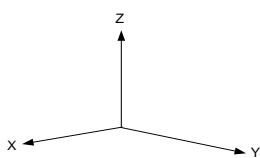
| Engine protection                 |           | Alarm level             |                 |
|-----------------------------------|-----------|-------------------------|-----------------|
| Parameter                         | Unit      | Setting range           | Default setting |
| Oil temp                          | °C        | N/A                     | 125             |
| Oil pressure                      | Low idle  | kPa                     | N/A             |
|                                   | 1500 rpm  | kPa                     | N/A             |
|                                   | 1800 rpm  | kPa                     | N/A             |
| Oil level                         |           | N/A                     | Low level       |
| Piston cooling pressure >1000 rpm | kPa       | N/A                     | 150±20          |
| Coolant temp                      | °C        | 95-103                  | 98              |
| Coolant level                     |           | N/A                     | Low level       |
| Fuel feed pressure                | Low idle  | kPa                     | N/A             |
|                                   | >1400 rpm | kPa                     | N/A             |
| Water in fuel                     |           | N/A                     | N/A             |
| Crank case pressure               | kPa       | N/A                     | Inc pressure    |
| Charge air temp                   | °C        | N/A                     | 80              |
| Charge air pressure               | kPa       | N/A                     | 40000%          |
| Engine speed                      | rpm       | 100-120% of rated speed | 120%            |
|                                   |           |                         |                 |

**Note** complete sensor list available

**Electrical system**

**rpm 1500 and 1800**

| Voltage and type                 |               | 24V / insulated from earth |                       |
|----------------------------------|---------------|----------------------------|-----------------------|
| Alternator:                      | make/output   | Amp                        | Bosch 20849349/35-80A |
|                                  | tacho output  | Hz/alt. Rev                | 6                     |
|                                  | drive ratio   |                            | 4                     |
| Starter motor                    | make          |                            | Melco                 |
|                                  | type          |                            | 24V/7kW               |
|                                  | kW            |                            | 7kW                   |
| Starter motor solenoid,          | pull current  | Amp                        | 2                     |
|                                  | hold current  | Amp                        | N/A                   |
| Number of teeth on:              | flywheel      |                            | 153                   |
|                                  | starter motor |                            | 12                    |
| Inrush current at +20°C \ 5°C    | Amp           | 2000                       | \ 2100                |
| Cranking current at +20°C \ 5°C  | Amp           | 375                        | \ 390                 |
| Crank engine speed at 20°C \ 5°C | rpm           | 165                        | \ 140                 |
| Starter motor battery capacity:  | max           | Ah                         | 2x220 700A DIN        |
|                                  | min at +5°C   | Ah                         | 2x180 600A DIN        |
| Max. g-force                     | x             | m/s <sup>2</sup>           |                       |
|                                  | y             | m/s <sup>2</sup>           |                       |
|                                  | z             | m/s <sup>2</sup>           |                       |
|                                  |               |                            |                       |



**VOLVO PENTA**

D 16 MG 1800/1500 rpm  
D 16 MG 1800/1500 rpm

Document No

**23671222**

Issue Index

**01**

| Sensors                         |                 |          |                               |                                          |                       |                   | Switches                                   |                               |
|---------------------------------|-----------------|----------|-------------------------------|------------------------------------------|-----------------------|-------------------|--------------------------------------------|-------------------------------|
| Control and Monitoring System   |                 |          |                               |                                          |                       |                   | Engine Shutdown System                     |                               |
| Sensors                         | Signal          | Unit     | Range                         | Warning Initial Delay /<br>Warning Delay | Warning Level         | Derating<br>Level | Shutdown Initial Delay /<br>Shutdown Delay | Shutdown Level<br>(Tolerance) |
| Charge air pressure             | 0,5-4,5 V       | kPa      | 50 - 400<br>(150-500<br>abs). | 30 sec from start / 5 sec                | 300<br>(400 absolute) | NA                | NA                                         | NA                            |
| Charge air temperaure           | 50-0 k $\Omega$ | °C       | -40 - 130                     | 30 sec from start / 5 sec                | 80                    | NA                | NA                                         | NA                            |
| Coolant level switch            | Digital         |          | ON/OFF                        | 30 sec from start / 5 sec                | Low (ON / Closed)     | NA                | NA                                         | NA                            |
| Coolant temperature             | 50-0 k $\Omega$ | °C       | -40 - 140                     | 30 sec from start / 5 sec                | 98                    | NA                | 4 sec from start/ 1 sec                    | 105 ( $\pm$ 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 1500<br>+15% | Frequency       | rpm / Hz | 153 puls./rev.                | Instant                                  | Lost signal           | NA                | Instant                                    | 1725 / 4399 Hz (-1 to 0%)     |
| Eng. overspeed SDU 1800         | Frequency       | rpm / Hz | 153 puls./rev.                | Instant                                  | Lost signal           | NA                | Instant                                    | 2070 / 5279 Hz (-1 to 0%)     |
| Exhaust gas temperature         | PT200           | °C       | 0 - 850                       | 30 sec from start / 5 sec                | 650                   | NA                | NA                                         | NA                            |
| Oil level sensor                | Digital         |          | ON/OFF                        | 30 sec from start / 5 sec                | Low level             | NA                | NA                                         | NA                            |
| Oil temperature                 | 50-0 k $\Omega$ | °C       | -40 - 140                     | 30 sec from start / 5 sec                | 125                   | NA                | NA                                         | NA                            |
| Piston cooling switch           | Digital         | kPa      | ON/OFF                        | Above 1000 rpm instant                   | 120 $\pm$ 20          | NA                | NA                                         | NA                            |
| Water In fuel switch            | Digital         |          | ON/OFF                        | All the time                             | Water in fuel         | NA                | NA                                         | NA                            |

NA = Not applicable

**VOLVO PENTA**

D 16 MG 1800/1500 rpm

D 16 MG 1800/1500 rpm

Document No

**23671222**

Issue Index

**01**

| Sensors (rpm dependent)                      | Signal    | Unit | Range  | Initial Delay /           | Warning Level / Derating Level / Shutdown Level |                |                 |                 |                 | Switches                                                                                    |
|----------------------------------------------|-----------|------|--------|---------------------------|-------------------------------------------------|----------------|-----------------|-----------------|-----------------|---------------------------------------------------------------------------------------------|
| <b>Coolant pressure</b>                      | 0,5-4,5 V | kPa  | 0-300  |                           | <b>0 rpm</b>                                    | <b>600 rpm</b> | <b>1000 rpm</b> | <b>1500 rpm</b> | <b>1900 rpm</b> |                                                                                             |
| Warning Level                                |           | kPa  |        | 30 sec from start / 5 sec | 0                                               | 5              | 55              | 100             | 130             |                                                                                             |
| Derating Level                               |           | kPa  |        | NA                        | NA                                              | NA             | NA              | NA              | NA              |                                                                                             |
| Shutdown Level<br>(Shutdown Unit Channel S4) | Digital   | kPa  | ON/OFF | 4 sec from start / 1 sec  | NA                                              | NA             | NA              | 25 (-10/+20)    | 25 (-10/+20)    | <u>Shutdown Unit Setting</u><br>S4:1150 rpm ±2%<br>2933 Hz ±2%<br>153 pulses / revolution   |
| <b>Differential oil pressure</b>             | NA        | kPa  | NA     |                           | <b>0 rpm</b>                                    | <b>500 rpm</b> | <b>1000 rpm</b> | <b>1500 rpm</b> | <b>1800 rpm</b> |                                                                                             |
| Warning Level                                |           | kPa  |        | NA                        | NA                                              | NA             | NA              | NA              | NA              |                                                                                             |
| Derating Limit                               |           | kPa  |        | NA                        | NA                                              | NA             | NA              | NA              | NA              |                                                                                             |
| <b>Fuel pressure</b>                         | 0,5-4,5 V | kPa  | 0-700  |                           | <b>0 rpm</b>                                    | <b>600 rpm</b> | <b>1000 rpm</b> | <b>1500 rpm</b> | <b>1800 rpm</b> |                                                                                             |
| Warning Level                                |           | kPa  |        | 30 sec from start / 5 sec | -50                                             | 50             | 75              | 175             | 200             |                                                                                             |
| Derating Level                               |           | kPa  |        | NA                        | NA                                              | NA             | NA              | NA              | NA              |                                                                                             |
| <b>Oil pressure</b>                          | 0,5-4,5 V | kPa  | 0-700  |                           | <b>0 rpm</b>                                    | <b>500 rpm</b> | <b>1000 rpm</b> | <b>1500 rpm</b> | <b>1900 rpm</b> |                                                                                             |
| Warning Level                                |           | kPa  |        | 30 sec from start / 5 sec | -100                                            | 150            | 200             | 250             | 250             |                                                                                             |
| Derating Level                               |           | kPa  |        | NA                        | NA                                              | NA             | NA              | NA              | NA              |                                                                                             |
| Shutdown Level<br>(Shutdown Unit Channel S3) | Digital   | kPa  | ON/OFF | 4 sec from start / 1 sec  | NA                                              | NA             | 200 ±20         | 200 ±20         | 200 ±20         | <u>Shutdown Unit Setting</u><br>S2,S3:850 rpm ±2%<br>2168 Hz ±2%<br>153 pulses / revolution |
| <b>Seawater pressure</b>                     | 0,5-4,5 V | kPa  | 0-300  |                           | <b>0 rpm</b>                                    | <b>600 rpm</b> | <b>1400 rpm</b> | <b>1700 rpm</b> | <b>1900 rpm</b> | Only HE and KC                                                                              |
| Warning Level                                |           | kPa  |        | 30 sec from start / 5 sec | -20                                             | 5              | 25              | 35              | 40              | Only HE and KC                                                                              |
| Derating Level                               |           | kPa  |        | NA                        | NA                                              | NA             | NA              | NA              | NA              |                                                                                             |

Warning = Yellow Lamp active

Derating = Red Lamp active

**VOLVO PENTA**

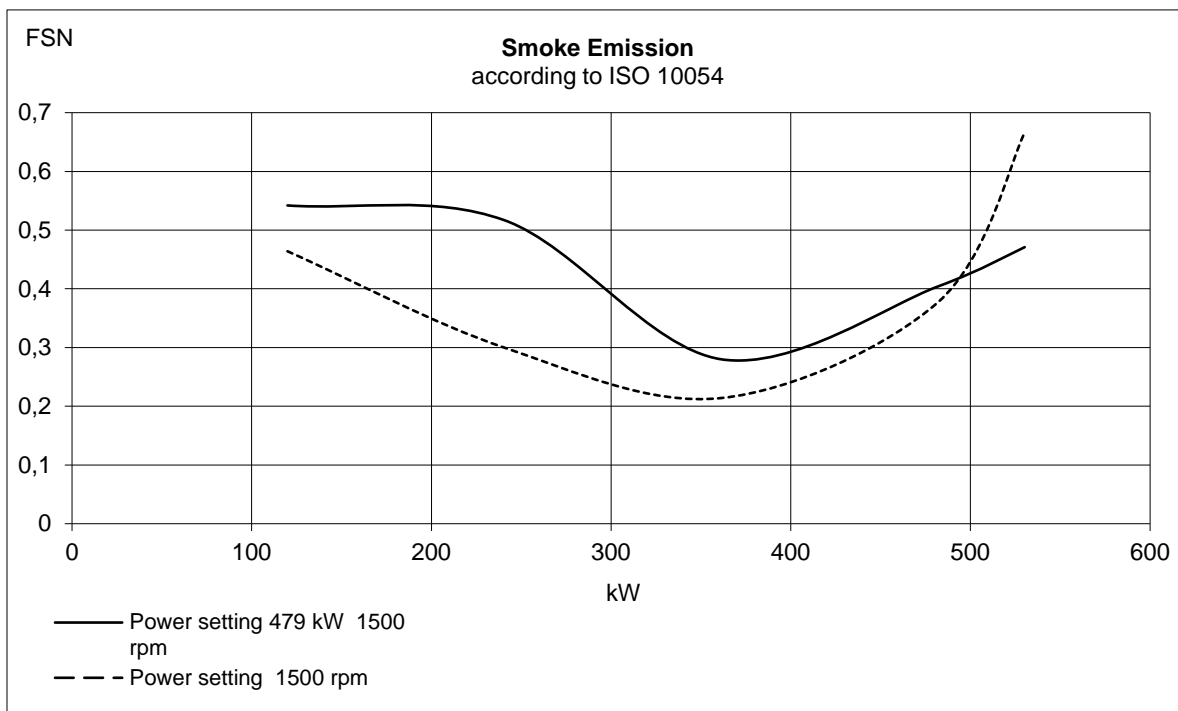
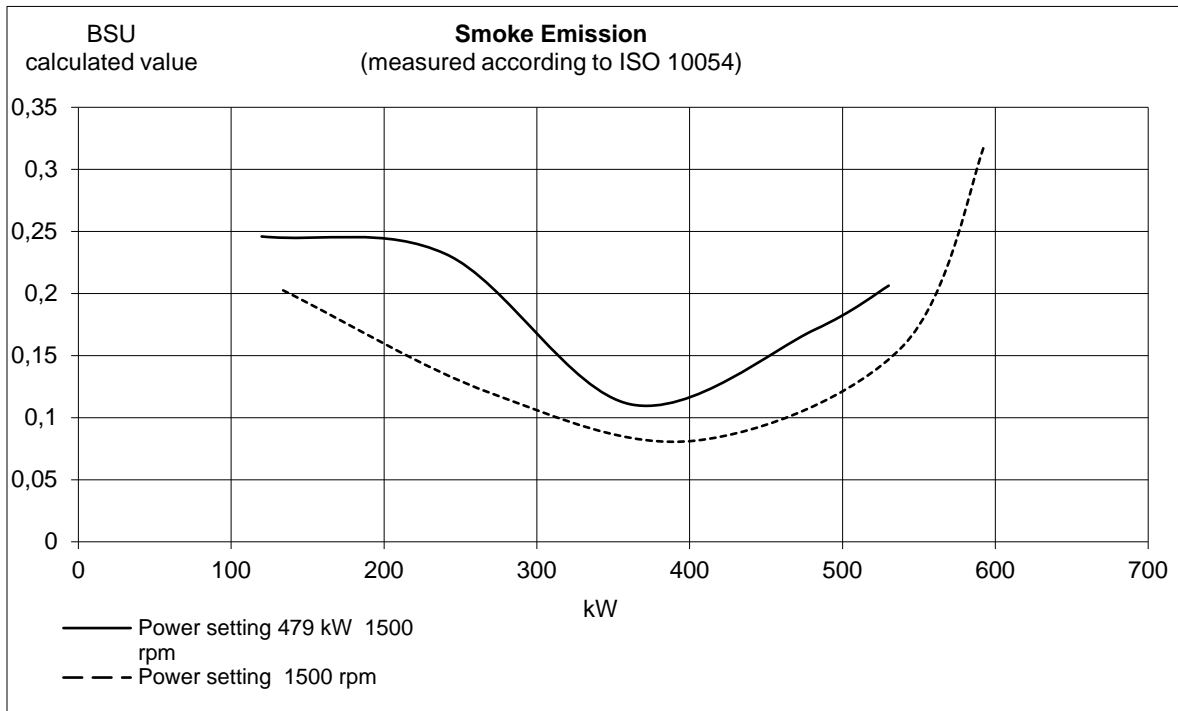
Document No

Issue Index

**D 16 MG 1800/1500 rpm**

**23671222**

**01**



**VOLVO PENTA**

**D 16 MG 1800/1500 rpm**

Document No

**23671222**

Issue Index

**01**

