

# Technical data TAD531GE

## General

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

|                     |                            |                          |               |
|---------------------|----------------------------|--------------------------|---------------|
| Number of cylinders |                            |                          | 4             |
| Displacement, total |                            | litre<br>in <sup>3</sup> | 4,76<br>290,7 |
| Firing order        |                            |                          | 1-3-4-2       |
| Bore                |                            | mm<br>in                 | 108<br>4,25   |
| Stroke              |                            | mm<br>in                 | 130<br>5,12   |
| Compression ratio   |                            |                          | 18:1          |
| Dry weight          | Engine and cooling package | kg                       | 575           |
|                     |                            | lb                       | 1268          |
| Wet weight          | Engine and cooling package | kg                       | 606           |
|                     |                            | lb                       | 1336          |
|                     | SAE2                       | kg<br>lb                 | 36<br>79      |

## Performance

|  |                      |                                       | r/min | 1500         | 1800          |
|--|----------------------|---------------------------------------|-------|--------------|---------------|
| Standby Power  | without fan          | kW                                    |       | 102          | 111           |
|  |                      | hp                                    |       | 139          | 151           |
|  | with fan<br>low temp | kW                                    |       | 98           | 104           |
|  |                      | hp                                    |       | 133          | 141           |
| Prime Power  | without fan          | kW                                    |       | 92           | 100           |
|  |                      | hp                                    |       | 125          | 136           |
|  | with fan<br>low temp | kW                                    |       | 88           | 93            |
|  |                      | hp                                    |       | 119          | 126           |
| Torque at:   | Standby Power        | Nm                                    |       | 649          | 589           |
|  |                      | lbft                                  |       | 479          | 434           |
|  | Prime Power          | Nm                                    |       | 586          | 531           |
|  |                      | lbft                                  |       | 432          | 391           |
| Mean piston speed                                    |                      | m/s<br>ft/sec                         |       | 6,5<br>21,4  | 7,8<br>25,7   |
| Effective mean pressure at:                          | Standby Power        | MPa                                   |       | 1,7          | 1,6           |
|  |                      | psi                                   |       | 248          | 225           |
| Max combustion pressure at:                          | Standby Power        | MPa                                   |       | 12,9         | 12,8          |
|  |                      | psi                                   |       | 1871         | 1856          |
| Total mass moment of inertia, J (mR <sup>2</sup> )   |                      | kgm <sup>2</sup><br>lbft <sup>2</sup> |       | 1,43<br>33,9 |               |
| Residual speed droop at load increase from 0 to 100% |                      | %                                     |       | ≤ 5          |               |
| Friction Power                                       |                      | kW<br>hp                              |       | 6,0<br>8,16  | 8,6<br>11,696 |

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## Engine noise emission

Test Standards: ISO 3744-1981 (E)

sound power (without fan, intake and exhaust noise)

Tolerans  $\pm 0.75$  dB(A)

|                                     |               | r/min | 1500  | 1800 |
|-------------------------------------|---------------|-------|-------|------|
| Measured sound power Lw             | No load       | dB(A) | 99,5  | 101  |
|                                     | Standby Power | dB(A) | 102,5 | 104  |
|                                     | Prime Power   | dB(A) | 102,5 | 104  |
| Calculated sound pressure Lp at 1 m | No load       | dB(A) | 86,5  | 88   |
|                                     | Standby Power | dB(A) | 89,5  | 91   |
|                                     | Prime Power   | dB(A) | 89,5  | 91   |

## Unsilenced exhaust noise

Data calculated as sound pressure Lp.

Assumed microphone distance 1 m

|               |  | r/min | 1500  | 1800 |
|---------------|--|-------|-------|------|
| Standby Power |  | dB(A) | 108   | 108  |
| Prime Power   |  | dB(A) | 107,5 | 108  |

## Load acceptance

Test condition: Warm engine. 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 - EDC4

| Load (%) | Speed diff (%) |         | Recovery time (s) |         | Remaining load (%) | Speed diff (%) |         | Recovery time (s) |         |
|----------|----------------|---------|-------------------|---------|--------------------|----------------|---------|-------------------|---------|
|          | Prime          | Standby | Prime             | Standby |                    | Prime          | Standby | Prime             | Standby |
| 0-40     | 5,0            | 5,5     | 2,0               | 2,0     | 40-100             | 12,0           | -       | 4,5               | -       |
| 0-50     | 6,0            | 7,0     | 2,0               | 2,0     | 50-100             | 9,0            | -       | 4,0               | -       |
| 0-60     | 8,0            | 8,5     | 2,5               | 3,0     | 60-100             | 7,0            | -       | 3,0               | -       |
| 0-75     | 10,0           | 13,0    | 3,0               | 4,0     | 75-100             | 4,0            | -       | 2,5               | -       |
| 0-100    | -              | -       | -                 | -       |                    |                |         |                   |         |
| 100-0    | 7,5            | 9,0     | 2,0               | 2,5     |                    |                |         |                   |         |

### Single step load performance at 1800 rpm - EDC4

| Load (%) | Speed diff % |         | Recovery time (s) |         | Remaining load (%) | Speed diff (%) |         | Recovery time (s) |         |
|----------|--------------|---------|-------------------|---------|--------------------|----------------|---------|-------------------|---------|
|          | Prime        | Standby | Prime             | Standby |                    | Prime          | Standby | Prime             | Standby |
| 0-40     | 3,0          | 3,5     | 1,0               | 1,0     | 40-100             | 5,0            | 5,0     | 2,0               | 5,0     |
| 0-50     | 4,0          | 4,5     | 1,0               | 1,5     | 50-100             | 4,0            | 4,0     | 2,0               | 4,0     |
| 0-60     | 4,4          | 4,8     | 1,1               | 0,9     | 60-100             | 2,5            | 2,5     | 1,1               | 2,5     |
| 0-75     | 6,0          | 6,5     | 2,0               | 2,0     | 75-100             | 2,0            | 2,0     | 1,5               | 2,0     |
| 0-100    | 9,5          | 11,5    | 3,0               | 5,0     |                    |                |         |                   |         |
| 100-0    | 7,5          | 8,0     | 1,5               | 2,0     |                    |                |         |                   |         |

### Single step load performance at 1500 rpm - mech

| Load (%) | Speed diff (%) |         | Recovery time (s) |         | Remaining load (%) | Speed diff (%) |         | Recovery time (s) |         |
|----------|----------------|---------|-------------------|---------|--------------------|----------------|---------|-------------------|---------|
|          | Prime          | Standby | Prime             | Standby |                    | Prime          | Standby | Prime             | Standby |
| 0-75     | 6,7            |         | 0,7               |         |                    |                |         |                   |         |
| 0-100    | 16,7           |         | 2,2               |         |                    |                |         |                   |         |
| 100-0    | 6,9            |         | 2,0               |         |                    |                |         |                   |         |

### Single step load performance at 1800 rpm - mech

| Load (%) | Speed diff % |         | Recovery time (s) |         | Remaining load (%) | Speed diff (%) |         | Recovery time (s) |         |
|----------|--------------|---------|-------------------|---------|--------------------|----------------|---------|-------------------|---------|
|          | Prime        | Standby | Prime             | Standby |                    | Prime          | Standby | Prime             | Standby |
| 0-75     | 4,9          |         | 0,2               |         |                    |                |         |                   |         |
| 0-100    | 8,1          |         | 1,7               |         |                    |                |         |                   |         |
| 100-0    | 4,3          |         | 0,3               |         |                    |                |         |                   |         |

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## Cold start performance

1500/1800

|                              |    |      |
|------------------------------|----|------|
| Cold start limit temperature | °C | -15  |
|                              |    | -30* |

\* With manifold heater engaged, lubrication oil 15W/40.

## Derating, mechanical governer

The engine may be operated up to 1000 m altitude and 40°C ambient air temperature without derating. For operation at higher altitudes and temperatures the power should be derated according to the following factors:

|                                     |        |             |
|-------------------------------------|--------|-------------|
| Altitude derating factor < 3000 m   | % / m  | 4 / 500     |
| Altitude derating factor > 3000 m   | % / m  | 6 / 500     |
| Ambient temperature derating factor | % / °C | 3 / 5°C     |
| Humidity                            | %      | No derating |

## Derating, electronic governer

The engine may be operated up to 1000 m altitude and 40°C ambient air temperature without derating. For applications above 1000 m an ECU with automatic derating must be used. For operations with air ambient temperature over 40°C, see mechanical governer.

## Lubrication system

|                                       |               | r/min    | 1500      | 1800  |
|---------------------------------------|---------------|----------|-----------|-------|
| Lubricating oil consumption           | Standby Power | liter/h  | 0,08      | 0,08  |
|                                       |               | US gal/h | 0,021     | 0,021 |
| Oil system capacity including filters |               | liter    | 13        |       |
|                                       |               | US gal   | 3,4       |       |
| Oil sump capacity:                    | max           | liter    | 11        |       |
|                                       |               | US gal   | 2,9       |       |
|                                       | min           | liter    | 9         |       |
|                                       |               | US gal   | 2,4       |       |
| Oil change intervals/specifications:  |               |          |           |       |
| VDS-2. ACEA: E3, E5. API: CG-4, CH-4* |               | h        | 500       |       |
| Engine angularity limits:             | front up      | °        | 30        |       |
|                                       | front down    | °        | 30        |       |
|                                       | side tilt     | °        | 30        |       |
| Oil pressure at rated speed           |               | kPa      | 450 - 480 |       |
|                                       |               | psi      | 65 - 70   |       |
| Oil pressure shut down switch setting |               | kPa      | 200       |       |
|                                       |               | psi      | 29        |       |
| Lubrication oil temperature:          | normal        | °C       | 110       |       |
|                                       |               | °F       | 230       |       |
|                                       | max           | °C       | 125       |       |
|                                       |               | °F       | 257       |       |
| Oil filter micron size                |               | mm       | 0,040     |       |

\* See also general section in the sales guide

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| <b>Fuel system</b>                                    |      | <b>r/min</b>    | <b>1500</b>  | <b>1800</b>  |
|---|------|-----------------|--------------|--------------|
| <b>Standby Power</b><br>Specific fuel consumption at: | 25%  | g/kWh<br>lb/hph | 244<br>0,396 | 259<br>0,420 |
|   | 50%  | g/kWh<br>lb/hph | 221<br>0,358 | 226<br>0,366 |
|   | 75%  | g/kWh<br>lb/hph | 217<br>0,351 | 219<br>0,355 |
|   | 100% | g/kWh<br>lb/hph | 219<br>0,355 | 218<br>0,353 |
| <b>Prime Power</b><br>Specific fuel consumption at:   | 25%  | g/kWh<br>lb/hph | 259<br>0,419 | 277<br>0,449 |
|   | 50%  | g/kWh<br>lb/hph | 225<br>0,365 | 232<br>0,376 |
|   | 75%  | g/kWh<br>lb/hph | 218<br>0,353 | 221<br>0,358 |
|   | 100% | g/kWh<br>lb/hph | 218<br>0,353 | 218<br>0,354 |

| <b>Fuel system</b>             |                         | <b>r/min</b>                                 | <b>1500</b> | <b>1800</b> |
|--------------------------------|-------------------------|--|-------------|-------------|
| Recommended fuel to conform to |                         | ASTM-D975-No1 and 2-D<br>JIS KK 2204, EN 590 |             |             |
| Total fuel flow                | liter/h                 | 360  | 450         |             |
|                                | US gal/h                | 95   | 119         |             |
| Feed pump pressure             | kPa                     | 500 - 550                                    |             |             |
|                                | psi                     | 73 - 80                                      |             |             |
| Feed pump max suction head     | m                       | 1,5  |             |             |
|                                | foot                    | 4,9  |             |             |
| Fuel filter micron size        | mm                      | 0,005  |             |             |
| Prefilter / Water separator    | mm                      | 0,063  |             |             |
| Governor type/make, standard   | Heinzman / EDC4         |  |             |             |
| Injection pump type/make       | PFM 1 P100 S 2005/Bosch |  |             |             |

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| Intake and exhaust system                   |               | r/min                        | 1500                       | 1800         |              |
|---|---------------|------------------------------|----------------------------|--------------|--------------|
| Air consumption at:                         | Standby Power | 27°C<br>81°F                 | m <sup>3</sup> /min<br>cfm | 6,089<br>215 | 7,75<br>274  |
|   | Prime Power   | 27°C<br>81°F                 | m <sup>3</sup> /min<br>cfm | 5,7<br>201   | 7,24<br>256  |
| Air intake restriction, clean filter(s)     |               |                              | kPa<br>in wc               | 1<br>4,0     | 1<br>4,0     |
| Max allowable air intake restriction        |               |                              | kPa<br>in wc               | 3,5<br>14,1  | 3,5<br>14,1  |
| Air filter type                             |               | Single stage paper cartridge |                            |              |              |
| Air filter cleaning efficiency              |               |                              | %                          | 99,85        |              |
| Heat rejection to exhaust at:               | Standby Power |                              | kW<br>BTU/min              | 88<br>5004   | 92<br>5232   |
|   | Prime Power   |                              | kW<br>BTU/min              | 78<br>4436   | 83<br>4720   |
| Exhaust gas temperature after turbine at:   | Standby Power |                              | °C<br>°F                   | 557<br>1035  | 516<br>961   |
|   | Prime Power   |                              | °C<br>°F                   | 544<br>1011  | 518<br>964   |
| Max allowable back pressure in exhaust line |               |                              | kPa<br>In wc               | 5<br>20,1    | 7<br>28,1    |
| Exhaust gas flow at:                        | Standby Power |                              | m <sup>3</sup> /min<br>cfm | 18,4<br>650  | 22,1<br>781  |
|   | Prime Power   |                              | m <sup>3</sup> /min<br>cfm | 16,7<br>589  | 19,9<br>704  |
| Heat rejection to CAC                       | Standby Power |                              | kW<br>BTU/min              | 13,1<br>745  | 21<br>1194   |
|   | Prime Power   |                              | kW<br>BTU/min              | 11,8<br>671  | 18,9<br>1075 |

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| Cooling system   |   | r/min         | 1500         | 1800         |
|--|---|---------------|--------------|--------------|
| Heat rejection radiation from engine at:                       | Standby Power   | kW<br>BTU/min | 10<br>580    | 11<br>631    |
|  | Prime Power   | kW<br>BTU/min | 9<br>523     | 10<br>569    |
| Heat rejection to coolant at:                                  | Standby Power   | kW<br>BTU/min | 52,5<br>2986 | 53,3<br>3031 |
|  | Prime Power   | kW<br>BTU/min | 47,4<br>2696 | 48,0<br>2730 |
| Recommended coolant  | Volvo coolant or Volvo anticorrosion additive together with clean fresh water |               |              |              |
| Radiator cooling system type                                   | Closed circuit  |               |              |              |
| Radiator core area (std. size)                                 | m <sup>2</sup>  | 0,29          |              |              |
|  | foot <sup>2</sup>   | 3,12          |              |              |
| Radiator core thickness (std. size) - low temp cooling package | mm  | 62            |              |              |
|  | in  | 2,44          |              |              |
| Fan diameter - low temp cooling system                         | mm  | 516           |              |              |
|  | in  | 20,31         |              |              |
| Fan power consumption - low temp cooling system                | kW  | 4,2           | 7,1          |              |
|  | hp  | 6             | 10           |              |
| Fan power consumption - high temp cooling system               | kW  | 5,9           | 10,2         |              |
|  | hp  | 8             | 14           |              |
| Fan drive ratio  | 1,73:1  |               |              |              |
| Coolant capacity,  | engine  | liter         | 7,2          |              |
|  |   | US gal        | 1,90         |              |
|  | std radiator with hoses   | liter         | 12,5         |              |
|  |   | US gal        | 3,30         |              |
| Coolant pump   | drive/ratio   | 1,73:1        |              |              |
| Coolant flow with low temp system                              | l/s   | 2,71          | 3,42         |              |
|  | US gal/s  | 0,72          | 0,90         |              |
| Maximum external coolant system restriction                    | kPa   | 25            | 35           |              |
|  | in wc   | 100           | 141          |              |
| Thermostat,  | start to open   | °C            | 83           |              |
|  |   | °F            | 181          |              |
|  | fully open  | °C            | 95           |              |
|  |   | °F            | 203          |              |
| Maximum static pressure head                                   | kPa   | 100           |              |              |
|  | in wc   | 402           |              |              |
| Pressure cap setting on low temp radiator                      | kPa   | 90            |              |              |
|  | in wc   | 361           |              |              |
| Maximum top tank temperature                                   | °C  | 105           |              |              |
|  | °F  | 221           |              |              |
| Shutdown switch setting  | °C  | 113           |              |              |
|  | °F  | 235           |              |              |
| Recommended draw down capacity                                 | 10% of total cooling system capacity  |               |              |              |

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## Cooling performance

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 105°C TTT and 50% antifreeze (radiator and cooling fan, see optional equipment)

| Engine speed rpm | Air on temp °C | PRIME POWER                |                         | STANDBY POWER              |                         |     |
|------------------|----------------|----------------------------|-------------------------|----------------------------|-------------------------|-----|
|                  |                | Air flow m <sup>3</sup> /s | External restriction Pa | Air flow m <sup>3</sup> /s | External restriction Pa |     |
| 1500             | 53             | 1,5                        | 0                       |                            |                         |     |
|                  | low temp       | 44                         | 1,2                     | 150                        |                         |     |
|                  |                | 37                         | 1,0                     | 200                        |                         |     |
|                  |                |                            |                         |                            |                         |     |
|                  | high temp      | 63                         | 2,0                     | 0                          |                         |     |
|                  |                | 57                         | 1,6                     | 150                        |                         |     |
|                  |                | 53                         | 1,5                     | 200                        |                         |     |
|                  |                | 46                         | 1,2                     | 300                        |                         |     |
|                  | low temp       | 50                         |                         |                            | 1,5                     | 0   |
|                  |                | 40                         |                         |                            | 1,2                     | 150 |
|                  |                | 32                         |                         |                            | 1,0                     | 200 |
|                  | high temp      | 60                         |                         |                            | 2,0                     | 0   |
| 54               |                |                            |                         | 1,6                        | 150                     |     |
| 50               |                |                            |                         | 1,4                        | 200                     |     |
| 42               |                |                            |                         | 1,2                        | 300                     |     |
| 1800             | 59             | 1,9                        | 0                       |                            |                         |     |
|                  | low temp       | 51                         | 1,7                     | 150                        |                         |     |
|                  |                | 48                         | 1,4                     | 200                        |                         |     |
|                  |                | 37                         | 1,1                     | 300                        |                         |     |
|                  |                |                            |                         |                            |                         |     |
|                  | high temp      | 67                         | 2,6                     | 0                          |                         |     |
|                  |                | 64                         | 2,2                     | 150                        |                         |     |
|                  |                | 62                         | 2,1                     | 200                        |                         |     |
|                  |                | 59                         | 1,9                     | 300                        |                         |     |
|                  |                | 54                         | 1,6                     | 400                        |                         |     |
|                  | low temp       | 55                         |                         |                            | 1,9                     | 0   |
|                  |                | 47                         |                         |                            | 1,7                     | 150 |
|                  |                | 44                         |                         |                            | 1,4                     | 200 |
|                  |                | 32                         |                         |                            | 1,1                     | 300 |
|                  | high temp      | 64                         |                         |                            | 2,6                     | 0   |
|                  |                | 61                         |                         |                            | 2,2                     | 150 |
|                  |                | 59                         |                         |                            | 2,1                     | 200 |
|                  |                | 56                         |                         |                            | 1,9                     | 300 |
| 51               |                |                            |                         | 1,6                        | 400                     |     |

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| Electrical system                                |               | r/min               | 1500      | 1800 |
|--|---------------|---------------------|-----------|------|
| Voltage and type                                 |               | 12V / 1 pole system |           |      |
| Alternator:                                      | make/output   | Amp                 | Iskra/55  |      |
|  | tacho output  | Hz/alt. Rev         | 6         |      |
|  | drive ratio   |                     | 3,01:1    |      |
| Starter motor                                    | make          | Bosch               |           |      |
|  | type          | EV                  |           |      |
|  | kW            | 3,1                 |           |      |
| Starter motor solenoid,                          | pull current  | Amp                 | 60        |      |
|  | hold current  | Amp                 | 12        |      |
| Number of teeth on:                              | flywheel      |                     | 129       |      |
|  | cam wheel     |                     | 96        |      |
|  | starter motor |                     | 9         |      |
| Inrush current at +20°C                          |               | Amp                 | 1110      |      |
| Cranking current at +20°C                        |               | Amp                 | 370       |      |
| Crank engine speed at 20°C                       |               | rpm                 | 160       |      |
| Starter motor battery capacity:                  | max           | Ah                  | 176       |      |
|  | min at +5°C   | Ah                  | 110       |      |
| Stop solenoid,                                   | max           | Amp                 | 3         |      |
| Inlet manifold heater (at 12V/24V)               |               | kW                  | 2 / 3,6   |      |
| Power relay for the manifold heater (at 12V/24V) |               | Amp                 | 150 / 120 |      |