

# Technical Data



## 1600A Series

Electropak

**1606A-E93TAG4  
1606A-E93TAG5**

**200-264 kWe @ 1500 rpm**

### Basic technical data

Number of cylinders . . . . . 6  
Cylinder arrangement . . . . . Vertical in-line  
Cycle . . . . . 4 stroke  
Induction system . . . . . Air to air charge cooled, turbocharged  
Combustion system . . . . . Direct Injection (DI)  
Compression ratio . . . . . 17.2:1  
Bore . . . . . 116.6 mm (4.59 in)  
Stroke . . . . . 146.0 mm (5.74 in)  
Displacement . . . . . 9.3 litres (567.5 in<sup>3</sup>)  
Direction of rotation when viewed from flywheel . . . . . Anti-clockwise  
Direction of rotation when viewed from front . . . . . Clockwise  
Firing order (number 1 cyl. Furthest from flywheel) . . . . . 1, 5, 3, 6, 2, 4  
-est. total weight (dry) . . . . . TBA kg  
-est. total weight (wet) . . . . . TBA kg

### Overall dimensions

-height, including radiator support brackets . . . . . 1353 mm  
-length, front of radiator to rear of air cleaner . . . . . 1964 mm  
-width . . . . . 1074 mm

### Moments of rotational inertia (mk<sup>2</sup>)

SAE 1 (14 inch) flywheel at 1500 rpm . . . . . 1.4 kgm<sup>2</sup>  
SAE 2 (11.5 inch) flywheel at 1500 rpm . . . . . 1.0 kgm<sup>2</sup>  
Engine at 1500 rpm . . . . . 0.548 kgm<sup>2</sup>

### Cyclic irregularity for engine /flywheel maximum at 110% prime power @ 1500 rpm - TAG5

SAE#1 . . . . . 1.0%  
SAE#2 . . . . . 2.6%

### Centre of gravity

Forward from rear of block - wet . . . . . TBA mm  
Above crankshaft centre line - wet . . . . . TBA mm  
Offset to RHS of crankshaft centre line - wet . . . . . TBA mm

### Performance

#### Notes:

- Data based on ISO/TR14396, SAE J1995 3.1, ISO3046/1, DIN6271.
- Engine speed control in accordance with BS5514 pt.4 ; ISO3046-4 and ISO8528-5
- Electrical ratings are based on average alternator efficiency and are for guidance only
- Steady state stability at constant speed In accordance with BS5514 pt.4; ISO3046-4; ISO8528-5.

All ratings certified to within . . . . .  $\pm 3\%$   
Speed variation at constant load . . . . .  $\pm 0.25\%$

### Test conditions

Air temperature . . . . . 25°C  
Barometric pressure . . . . . 100 kPa  
Relative humidity . . . . . 30 %  
Air inlet restriction at maximum power (nominal) . . . . . 4.0 kPa  
Exhaust back pressure at maximum power (nominal) . . . . . 2.0 kPa  
Fuel temperature (inlet pump) . . . . . 25.0°C

**Note:** If the engine is to operate in ambient conditions other than those of the test conditions, suitable adjustments must be made for these changes.

For full details, contact Perkins Technical Service Department.

## General installation

### 1606A-E93TAG5

| Designation                                | Units  | Type of operation and application |         |
|--------------------------------------------|--------|-----------------------------------|---------|
|                                            |        | 50 Hz @ 1500 rpm                  |         |
|                                            |        | Prime                             | Standby |
| Gross engine power                         | kWb    | 271                               | 297     |
| Fan power                                  | kWm    | 10                                |         |
| Friction losses                            | kWm    |                                   |         |
| ElectropaK nett engine power               | kWm    | 261                               | 287     |
| Gross BMEP                                 | kPa    | 2317                              | 2540    |
| Combustion air flow                        | kg/s   | 0.36                              | 0.39    |
| Exhaust gas temperature after turbo (Max.) | °C     | 410                               |         |
| Exhaust gas flow, wet                      | kg/s   | 0.38                              | 0.41    |
| Boost pressure ratio                       | -      | 3.19                              | 3.44    |
| Overall thermal efficiency (nett)          | %      | 42.0                              |         |
| Mean piston speed                          | m/s    | 7.3                               |         |
| Engine coolant flow                        | l/min  | 360                               |         |
| Cooling fan air flow                       | m³/min | 609                               |         |
| Typical Gen Set electrical output (0.8pf)  | kWe    | 240                               | 264     |
|                                            | kVA    | 300                               | 330     |
| Assumed alternator efficiency              | %      | 92                                |         |

### Energy balance, 1606A-E93TAG5

| Designation                              | Units | Type of operation and application |         |
|------------------------------------------|-------|-----------------------------------|---------|
|                                          |       | 50 Hz @ 1500 rpm                  |         |
|                                          |       | Prime                             | Standby |
| Energy in fuel                           | kWt   | 621                               | 681     |
| Energy in power output (at shaft)        | kWb   | 261                               | 287     |
| Energy to coolant                        | kWt   | 123                               | 132     |
| Energy to exhaust                        | kWt   | 160                               | 177     |
| Energy to ACC                            | kWt   | 54                                | 64      |
| Energy to cooling fan                    | kWm   | 10                                |         |
| Energy to radiation (residual heat loss) | kWt   | 12                                |         |

## Rating definitions

### Prime Power

Variable load. Unlimited hours usage with an average load factor of 70% of the published prime power rating. A 10% overload is available for 1 hour in every 12 hour of operation.

### Standby power

Variable load. Limited to 500 hours annual usage up to 300 hours of which may be continuous running. No overload is permitted.

## General installation

### 1606A-E93TAG4

| Designation                                | Units  | Type of operation and application |         |
|--------------------------------------------|--------|-----------------------------------|---------|
|                                            |        | 50 Hz @ 1500 rpm                  |         |
|                                            |        | Prime                             | Standby |
| Gross engine power                         | kWb    | 249                               | 271     |
| Fan power                                  | kWm    | 10                                |         |
| Friction losses                            | kWm    |                                   |         |
| ElectropaK nett engine power               | kWm    | 239                               | 261     |
| Gross BMEP                                 | kPa    | 2131                              | 2317    |
| Combustion air flow                        | kg/s   | 0.34                              | 0.36    |
| Exhaust gas temperature after turbo (Max.) | °C     | 400                               |         |
| Exhaust gas flow, wet                      | kg/s   | 0.36                              | 0.38    |
| Boost pressure ratio                       | -      | 2.99                              | 3.19    |
| Overall thermal efficiency (nett)          | %      | 42                                |         |
| Mean piston speed                          | m/s    | 7.3                               |         |
| Engine coolant flow                        | l/min  | 360                               |         |
| Cooling fan air flow                       | m³/min | 609                               |         |
| Typical Gen Set electrical output (0.8pf)  | kWe    | 220                               | 240     |
|                                            | kVA    | 275                               | 300     |
| Assumed alternator efficiency              | %      | 92                                |         |

### Energy balance, 1606A-E93TAG4

| Designation                              | Units | Type of operation and application |         |
|------------------------------------------|-------|-----------------------------------|---------|
|                                          |       | 50 Hz @ 1500 rpm                  |         |
|                                          |       | Prime                             | Standby |
| Energy in fuel                           | kWt   | 571                               | 621     |
| Energy in power output (at shaft)        | kWb   | 239                               | 261     |
| Energy to coolant                        | kWt   | 116                               | 123     |
| Energy to exhaust                        | kWt   | 147                               | 160     |
| Energy to ACC                            | kWt   | 47                                | 54      |
| Energy to cooling fan                    | kWm   | 10                                |         |
| Energy to radiation (residual heat loss) | kWt   | 12                                |         |

**Note:** The above data is based on 42584 MJ/kg calorific value for diesel conforming to specification BS2869 Class A2.

## Rating definitions

### Prime Power

Variable load. Unlimited hours usage with an average load factor of 70% of the published prime power rating. A 10% overload is available for 1 hour in every 12 hour of operation.

### Standby power

Variable load. Limited to 500 hours annual usage up to 300 hours of which may be continuous running. No overload is permitted.

## Cooling system

For details of recommended coolant specifications, refer to the Operation and Maintenance Manual for this engine model.

Total coolant capacity... 30.9 litres  
-engine ... 11.8 litres  
-radiator ... 15.5 litres  
-pipes and hoses ... 3.6 litres  
Maximum pressure in engine cooling circuit ... 530 kPa  
Maximum top tank temperature ... 107°C  
Maximum static pressure head on pump ... 107 kPa  
Thermostat operating range ... 86 - 96°C  
Coolant flow, against 30 kPa restriction 1,500 rpm ... 360 litres/min  
Maximum temperature rise across the engine ... 8°C

### Radiator

Radiator face area ... 0.622 m<sup>2</sup>  
Number of rows and material ... 4 (64 / Row) Al  
Fins per inch and material ... 10 Al  
Pressure cap setting (min) ... 110 kPa

### Charge cooler

Face area ... 0.378 m<sup>2</sup>  
Number of rows and material ... 2 (19 / Row) Al  
Fins per inch and material ... 10 Al

### Width and height of matrix

Height ... 1318 mm  
Width ... 1071 mm  
Weight of cooling pack (dry) ... 82.64 kg

### Coolant pump

Method of drive ... Belt driven

### Fan type/details

Diameter ... 36 inch (914 mm)  
Drive ratio ... 1:1  
Material ... Plastic  
Number of blades ... 5  
Pusher/puller ... Pusher  
Cooling fan air flow @ 1500 rpm ... 609 m<sup>3</sup>/min

## Duct Allowance

Ambient cooling clearance (standby power) based on air temperature at fan of 7°C above the ambient.

Maximum additional restriction (duct allowance) to cooling airflow and resultant minimum airflow.

| Description                   | @ 1500 rpm |                     |
|-------------------------------|------------|---------------------|
|                               |            |                     |
| Ambient clearance             | 42         | °C                  |
| Duct allowance                | 12.5       | mm.wg               |
| Minimum airflow at conditions | 480        | m <sup>3</sup> /min |
| Ambient clearance             | 50         | °C                  |
| Duct allowance                | 20         | mm.wg               |
| Minimum airflow at conditions | 426        | m <sup>3</sup> /min |

## Normal operating angles:

-front and rear ... ± 5°  
-side tilt ... ± 5°

## Fuel system

Injection system ... Direct  
Injector type ...  
... Hydraulically Actuated Electronically Controlled Unit Injector  
Governor type ... Electronic (isochronous or droop capability)  
Recommended fuel to conform to ...  
... BS 2869 1998 CLASS A1, CLASS A2 or BSEN590  
Injector pressure ... 193 MPa  
Lift pump type ... Bosch 24P320  
Lift pump fuel delivery @ 1500 rpm ... 73.8 litres/hour  
Lift pump delivery pressure ... 482 kPa  
Maximum suction head at pump inlet ... 1 m  
Maximum static pressure head ... 517 m  
Maximum fuel inlet temperature ... TBA °C  
Fuel filter spacing ... 7 microns  
Tolerance on fuel consumption ... 5%  
Heat retained in fuel to tank ... TBA kWt

## Fuel consumption

**Note:** All figures based on Nett power.

### 1606A-E93TAG5

| Rating    | g/kWh    | l/hr |
|-----------|----------|------|
|           | 1500 rpm |      |
| Standby   | 198      | 66   |
| Prime     | 200      | 61   |
| 75% prime | 208      | 47   |
| 50% prime | 223      | 34   |

### 1606A-E93TAG4

| Rating    | g/kWh    | l/hr |
|-----------|----------|------|
|           | 1500 rpm |      |
| Standby   | 200      | 61   |
| Prime     | 202      | 56   |
| 75% prime | 211      | 44   |
| 50% prime | 228      | 32   |

## Induction system

Maximum air intake restriction of engine:

Clean filter ... ..2.50 kPa

Dirty filter . ... ..6.22 kPa

Induction indicator setting ... ..TBA kPa

Air filter type. ... .. Dry paper element

## Lubrication system

Total lubrication system capacity (dry engine).. ... ..36 litres

Total lubrication system capacity (oil change) .. ... ..33 litres

Oil temperature (in sump) maximum. ... .. 132°C

Oil temperature (in sump) normal continuous operation... .. 121°C

Shutdown switch setting (where fitted) . ... .. kPa falling

Lubricating oil pressure at bearings: . ... ..

-at rated 1500 rpm (normal).. ... ..379-413 kPa

Minimum ... .. 241 kPa

Oil relief opens at.. ... .. 345 kPa

Oil filter screen spacing. ... .. 20 microns

Lubricating oil flow at 1500 rpm ... ..105 litres/min.

Oil consumption ... .. <0.1% of fuel

Oil pump speed (gear driven) ... .. 1500 rpm

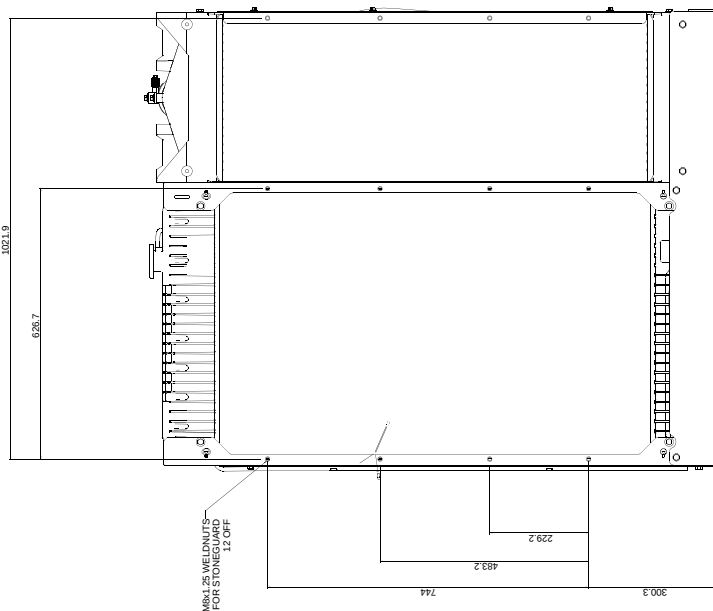
Technical drawing of a generator set, showing front and side views with detailed annotations.

**Front View Annotations:**

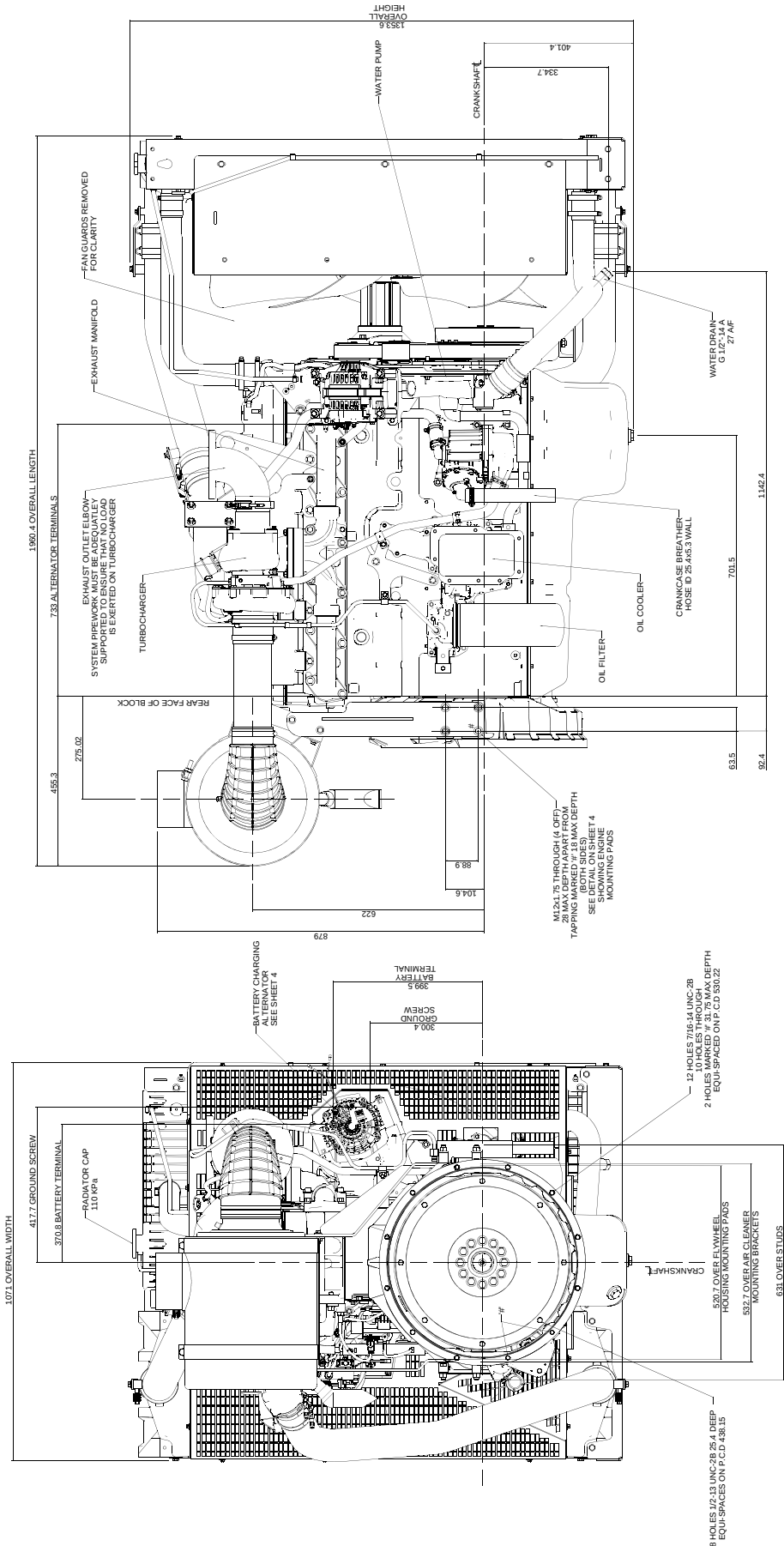
- CRANKSHAFT
- FAN
- 377.1
- 279.4
- 245.3
- FRONT ENGINE MOUNTING
- T.V DAMPER Ø 201
- SUMP DRAIN TAPPIINGS
- OIL LEVEL GUAGE & OIL FILLER CAP
- 330.4 GROUND TERMINAL
- 270.3 BATTERY TERMINAL
- 133.5 REAR FACE OF BLOCK
- 136.8 REAR FACE OF FLYWHEEL HOUSING
- SPARKER MOTOR SEE SEE 4
- ELEVATOR
- 115.9 GROUND TERMINAL
- 101.1 KEY SWITCH TERMINAL
- 34.9 BATTERY TERMINAL
- AIR CLEANER
- AIR INTAKE MANIFOLD
- PULB. PULVER ASSY SEE SHEET 4 FOR DETAILS
- FAN GUARDS REMOVED FOR CLARITY

**Side View Annotations:**

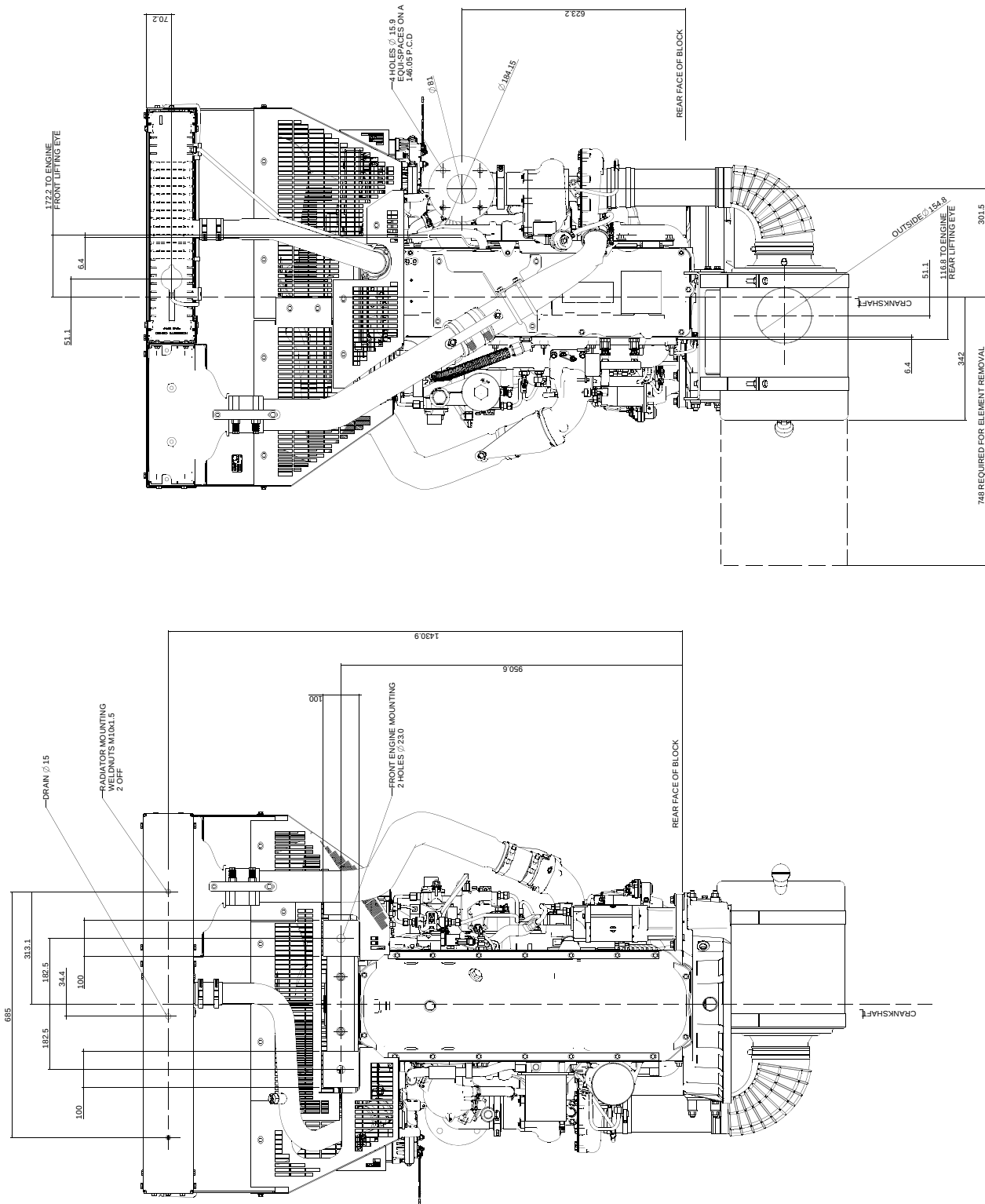
- 300.3
- 744
- 483.2
- 229.2
- 626.7
- 1021.9
- M8x1.25 WELD NUTS FOR STONEGUARD 12 OFF



264 kW @ 1500 rpm - right side view and rear view



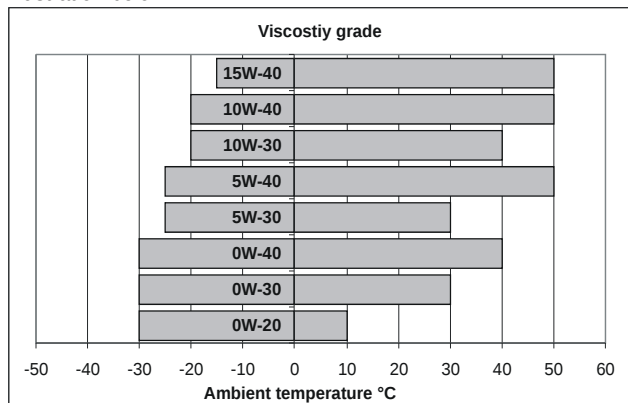
264 kWe @ 1500 rpm - plan and under view



[illegible]

## Recommended SAE viscosity

Recommended SAE viscosity: A single or multigrade oil must be used which conforms to a minimum API-CI-4 specification see illustration below:



## Electrical system

Type (grounding) . . . . . Negative ground  
Alternator type . . . . . 24SI  
Alternator voltage . . . . . 24V  
Alternator output . . . . . 70 amps  
Starter type . . . . . 38MT  
Starter motor voltage . . . . . 24V  
Starter motor power . . . . . 6.0 kW  
Number of teeth on flywheel . . . . . 148  
Number of teeth on starter pinion . . . . . 12  
Starter solenoid maximum pull-in current @ -25 °C . . . . . 200 amps  
Starter solenoid maximum hold-in current @ -25 °C . . . . . 15 amps

## Cold start recommendations

### Min. cranking speed over TDC @ -15 °C

Oil SAE . . . . . 10W30  
Starter type . . . . . 38MT  
Battery . . . . . 2 x 650 minimum  
Positive battery cable size . . . . . mm  
Max. breakaway current . . . . . amps  
Cranking current . . . . . amps  
Starting aids automatically controlled by the engine ECM

. . . . . Grid heaters  
Minimum mean cranking speed . . . . . 120 rpm

### Min. cranking speed over TDC @ -20 °C

Oil SAE . . . . . 0W30  
Starter type . . . . . 38MT  
Battery . . . . . 2 x 880 minimum  
Positive battery cable size . . . . . mm  
Max. breakaway current . . . . . amps  
Cranking current . . . . . amps  
Starting aids automatically controlled by the engine ECM

. . . . . grid heaters and block heaters  
Minimum mean cranking speed . . . . . 120 rpm

## Battery requirements

| Minimum starting temperature |    | Grade of engine lubricating oil | Battery specifications |                             |                           |              |
|------------------------------|----|---------------------------------|------------------------|-----------------------------|---------------------------|--------------|
| °C                           | °F |                                 | BS3911 cold start amps | SAE J537 cold cranking amps | Qty of Batteries required | Perkins type |
| -15                          | 5  | 10W                             | 440                    | 660                         | 2                         | A            |
| -20                          | -4 | 5W                              | 440                    | 660                         | 2                         | A            |

### Notes:

- Battery capacity is defined by the 20 hour rate
- The oil specification should be for the minimum ambient temperature as the oil will not be warmed by the immersion heater
- Breakaway current is dependent on the battery capacity available. Cables should be capable of handling transient current twice that of cranking current.

## Exhaust system

Back pressure for total system . . . . . 10 kPa

## Engine mountings

Maximum static bending moment at rear face of block . . . 1224 Nm  
Maximum permissible overhung load on flywheel . . . . . TBA kg

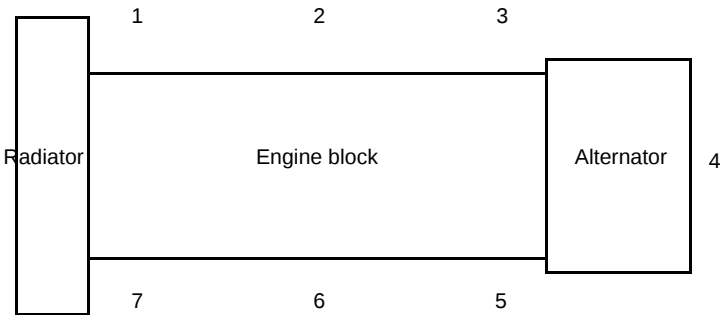
Noise Data

Noise levels

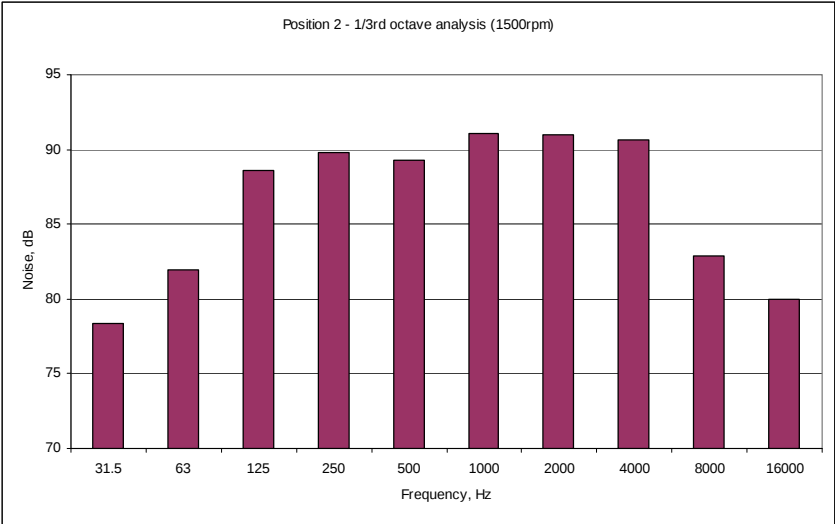
The figures for total noise levels are typical for an engine running at the continuous baseload power rating in a semi-reverberant environment and measured at a distance of one metre from the periphery of the engine (sound pressure level re:  $-20 \times 10^{-6}$  pa). Ambient noise level . . . . .78 dBA

At 1500 rpm

| Position | Noise, dBA |
|----------|------------|
| 1        | 101.5      |
| 2        | 102.7      |
| 3        | 101.8      |
| 4        | 101.0      |
| 5        | 102.2      |
| 6        | 101.5      |
| 7        | 97.7       |



Ambient noise level, load 264 kWe (Standby)



| Frequency, Hz | Noise, dB |
|---------------|-----------|
| 31.5          | 78.40     |
| 63            | 81.91     |
| 125           | 88.61     |
| 250           | 89.77     |
| 500           | 89.32     |
| 1000          | 91.10     |
| 2000          | 91.03     |
| 4000          | 90.68     |
| 8000          | 82.90     |
| 16000         | 80.01     |

# 1600A Series

200-264 kWe @ 1500 rpm

## Load acceptance (cold)

Initial load acceptance: When engine reaches rated speed (15 seconds maximum after engine starts to crank).

| Rating | % Prime | kWe | Transient Dev<br>volts, % | Recovery time<br>voltage, s | Transient Dev,<br>frequency, % | Freq rec, s |
|--------|---------|-----|---------------------------|-----------------------------|--------------------------------|-------------|
| TAG 5  | 60      | 145 | -17.1                     | 1.5                         | -10                            | 1.2         |
| TAG 4  | 66      |     |                           |                             |                                |             |

### Notes:

- Load acceptance conforms to ISO G2 criteria
- Fuelling can be attributed to the cases where load acceptance was better with no starting aid from cold.

The figure shown in the tables above were obtained under the following test conditions:

Minimum engine block temperature. .... 45°C  
Alternator efficiency . .... 92%  
Ambient temperature ... .. 15°C  
Governing mode . .... Isochronous  
Alternator inertia... .. 4.6 kgm<sup>2</sup>  
Under frequency roll off (UFRO) point set to ... .. 49 Hz  
UFRO rate set to.. .... 2V/Hz  
LAM on /off... .. OFF  
Alternator manufacturer ... .. Newage  
Alternator model... .. HCI444E  
All tests were conducted using an engine installed and serviced to Perkins Engine Company limited recommendations.

**The information given on this Technical Data Sheet is for guidance only. For ratings other than those shown, please contact Perkins Engines Company Limited.**



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