@Perkins®

Technical Data

4000 Series

4012-46TAG0A

Tropical

Diesel Engine - ElectropaK

Basic technical data

Number of cylinders 12
Cylinder arrangement ... ... Vee, 60°
Cycle. ... ... .4 stroke
Induction system... ... ... Turbocharged, air to air charge cooled
Combustion system .. .. direct injection
Compression ratio. ... ... 13.6 :1
Bore .. .. 160 mm
Stroke .. .. 190 mm
Cubic capacity .. ..45·842 litres
Direction of rotation... .. anti-clockwise when viewed from flywheel
Firing order ... ... $1^A, 6^B, 5^A, 2^B, 3^A, 4^B, 6^A, 1^B, 2^A, 5^B, 4^A, 3^B$
Cylinder 1.. ... ... Furthest from flywheel
Note: Cylinders designated 'A' are on the right hand side of the engine when viewed from the flywheel end.

Approximate weights

Description	unit	Tropical
Engine (dry)	Kg	4400
Electropak (wet) + fuel cooler	Kg	6086
Electropak (wet) - fuel cooler	Kg	6070

Overall dimensions of ElectropaK

	unit	Tropical
Height	mm	2258
Length	mm	3915
Width	mm	2198

Moment of inertia

Engine... ... ... 9,73 kgm²
Flywheel ... ... 9,57 kgm²

Cyclic irregularity for engine/flywheel maximum

4012-46TAG0A. 1:714

Ratings

Steady state speed stability at constant load . ... ± 0·25%
Electrical rating are based on average alternator efficiency and are for guidance only (0.8 power factor being used).

Operating point

Engine speed ... ... 1500 rev/min
Static injection timing . ... see engine number plate
Cooling water exit temperature .. .. < 98 °C
Fuel data ... ... .to conform to BS2869 class A2 or BS EN590

Performance

All data based on operation to ISO 3046/1, BS 5514 and DIN 6271 standard reference conditions.

Noise

For noise data, refer to page 17.
For engines operating in ambient conditions other than the standard reference conditions stated below, a suitable de-rate must be applied.
De-rate tables for increased ambient temperature and/or altitude are available, please contact Perkins Applications Department.

Test conditions

Air temperature. . ... 25 °C
Barometric pressure... ... ... 100 kPa
Relative humidity 30%
Air inlet restriction at maximum power (nominal) ... ... 2,5 kPa
Exhaust back pressure at maximum pressure (nominal)... 3,0 kPa
Fuel temperature (inlet pump) ... ... 58 °C maximum
For test conditions relevant to data on load acceptance, refer to page 18 of this document.

General installation

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Designation	Units	Type of operation and application		
		Baseload power	Prime power	Standby power
Gross engine power	kWm	906	1117	1222
Fan and battery charging alternator power	kW	64		
Nett engine power	kWm	842	1053	1158
Brake mean effective pressure (gross)	kPa	1581	1949	2132
Friction Power and Pumping Losses	kWm	120		
Combustion air flow at ISO conditions	m³/min	86	106	114
Exhaust gas temperature (max) after turbo	°C	425		
Exhaust gas flow (max) at atmospheric pressure	m³/min	280		
Boost pressure ratio	-	2.5	2.8	3.0
Mechanical efficiency	%	89	91	92
Overall thermal efficiency (nett)	%	41,0	41,5	41,0
Mean piston speed	m/s	9,5		
Engine coolant flow	l/min	1020		
Typical Genset electrical output (0.8pf)	kVA	1000	1250	1375
	kWe	800	1000	1100
Assumed alternator efficiency	%	95		

Note: Not to be used for combined heat and power (CHP) purposes (indicative figures only). If necessary, please consult the Applications Department, Perkins Engines Company Limited, Stafford.

Rating definitions

Baseload power

Unlimited hours usage with an average load factor of 100% of the published baseload power rating.

Prime power

Variable load. Unlimited hours usage with an average load factor of 80% of the published Prime Power over each 24 hour period. A 10% overload is available for 1 hour in every 12 hours.

Standby power

Limited to 500 hours annual usage with an average load factor of 80% of the published Standby Power rating over each 24 hour period.Up to 300 hours of annual usage may be run continuously. No overload is permitted on Standby Power.

Energy balance

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Designation	Units	Baseload power	Prime power	Standby power
Energy in fuel	kW	2043	2616	2883
Energy in power output (gross)	kW	906	1117	1222
Energy to cooling fan	kW	64		
Energy in power output (nett)	kW	842	1053	1158
Energy to coolant and oil	kW	229	326	379
Energy to exhaust	kW	705	848	918
Energy to charge coolers	kW	141	248	280
Energy to radiation	kW	62	77	85

Note: Not to be used for combined heat and power (CHP) purposes (indicative figures only). If necessary, please consult the Applications Department, Perkins Engines Company Limited, Stafford.

Cooling system

Recommended coolant: 50% inhibited ethylene glycol or 50% inhibited propylene glycol and 50% clean fresh water. For combined heat and power systems (CHP) and where there is no likelihood of ambient temperature below 10 °C, then clean 'soft' water may be used, treated with 1% by volume of Perkins inhibitor in the cooling system. The inhibitor is available from Perkins.
Maximum pressure in crankcase water jacket .. .. 170 kPa
Maximum top tank temperature (standby) ... ... 98 °C
Maximum static pressure head on pump .. .. 7 m

Total coolant capacity

Electrounit (engine only) ... ... 73 litres
Electropak (engine and radiator):
-tropical . ... 210 litres
Thermostat operating range.. ... ... .71 - 85 °C
Temperature rise across the engine (standby power) with inhibited coolant... ... ... 8 °C
Coolant temperature shutdown switch setting .. .. .101 °C rising
Coolant immersion heater capacity (2 off) ... ... 4 kWe each

Radiator

Tropical
Radiator face area. ... ... .3.46 m²
Material and number of rows:
-jacket water and charge air.. ... ...copper, 4 rows
Fins per inch and material:
-jacket water and charge air.. ... ... brass, 12 rows
Width of matrix .. .. 2.10 m
Height of matrix . ... 1.65 m
Weight of radiator.. ... ... 1620 kg
Pressure cap setting ... ... 70 kPa

Water jacket cooling data

Tropical
-coolant flow .. .. 1020 litres/min
-coolant exit temperature (max) ... ... 98 °C
-coolant inlet temperature (min) ... ... thermostatic control
-coolant inlet temperature (max) ... ... 92 °C

Coolant pump

Speed ... ... 1.4 x e rev/min
Method of drive . ... gear

Fan

Type .. .. axial flow
Diameter
-Tropical ... ... 1600 mm
Number of blades.. 12
Material . ... Aluminium
Drive ratio.. ... ... 0·93:1

Duct allowance Max. additional restriction to cooling airflow and resultant Min.

Description	
Ambient clearance (50% Glycol) Standby Power	52 °C
Duct allowance	200 Pa
Min airflow	32.4 m³/sec

Lubrication system

Recommended SAE viscosity: A multigrade oil conforming to the following must be used: API CH4 15W/40.
Note: For additional notes on lubricating oil specifications, please refer to the Operation and Maintenance Manual (OMM)

Lubricating oil capacity

-total system capacity. ... ... 177 litres
-sump maximum. ... ... 159 litres
-sump minimum.. ... ... 136 litres
-oil temperature at normal operating conditions to bearings 105 °C

Lubrication oil pressure

-minimum at 80 °C.. ... ... 340 kPa
-oil relief valve opens.. ... ... 400 kPa
-oil filter spacing . ... 40 microns
-sump drain plug tapping size G1
-oil pump speed.. ... ...2100 rev/min
-method of drive . ... gear
-shutdown switch pressure setting (where fitted) ... 193 kPa falling
Oil pump flow.. ... ... 6,0 litres/sec

Normal operating angles

Front and rear. ... ... 5°
Side tilt ... ... 10°

Oil consumption

After running in (typically after 250 hours).. ... ... 0.52 g/kWhr
Oil flow rate from pump .. ..6 litres/sec

Induction system

Maximum air intake restriction of engine:
-clean filter.. ... ... 2 kPa
-dirty filter ... ... 4 kPa
-air filter type... ... ... paper element

Exhaust system

Exhaust outlet size (internal) .. ..2 x 254 mm Table D flanges
Exhaust outlet flange size .. ..2 x 254 mm Table D flanges
Back pressure for total system at standby power... ... ... 5 kPa
Note: For recommended pipe sizes, please refer to the Installation Manual.

Electrical system

Type ... ... insulated return
Alternator voltage ... ... 24 volts with integral regulator
Alternator output ... 40 amps stabilised, 28 volts at 20 °C ambient
Starter type ... ... axial
Starter motor voltage . ... 24 volts
Starter motor power ... ... 16,4 kW
Number of teeth on flywheel 156
Number of teeth on starter pinion 12
Minimum cranking speed ... ... 120 rev/min
Pull in current of starter motor
solenoid @ -25 °C max [1] .. .. 30 amps at 24 volts
Hold in current of starter motor
solenoid @ -25 °C max [1] .. .. 9 amps at 24 volts
Stop solenoid hold-in current . ... 1,1 amps at 24 volts
1. All leads to rated at 10 amps minimum

Fuel system

Recommended fuel to conform to:
... ... BS2869 1998 Class A2 or BS EN590
Injection system . ... direct
Fuel injection pump and injector type ... . combined unit injector
Injector pressure ... ... 1400 bar
Lift pump type ... ... Tuthill TCH 1-089

Delivery

-4012-46TAG0A. ... ... 1020 litres/hour
Heat retained in fuel to tank ... ... 8 kW
Fuel inlet temperature to be less than ... ... 58 °C
Delivery pressure ... ... 300 kPa
Maximum suction head at pump inlet ... ... 2,5 m
Maximum static pressure head .. see installation manual for details
Fuel filter spacing ... ...10 microns
Governor type ... ... electronic
Governing toISO 8528-12 CLASS 3 and 4; ISO 8528-5 CLASS G2
Tolerance on fuel consumption 5%

Fuel consumption

Ratings	g/kWhr	litres/hr
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Standby	198.0	281
Prime	199.0	259
Baseload	203.0	214
75% Prime	204.0	199
50% Prime	215.0	139

Note: Fuel consumption calculated on gross rated powers.

Cold start recommendations

Temperature range 5 °C down to -10 °C (41 °F to 14 °F)
Oil 15W40 CH4
Starter .. .. .2 x 24 volts
Battery . ... 4 x 12V 286 Ah
Max breakaway current ... ... 1600 amps
Cranking current .. .. 810 amps
Aids . ...block heaters
Min mean cranking speed ... ... 120 rev/min

Notes:

- The 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 dependant on battery capacity available. Cables should be capable of handling the transient current which may be up to double the steady cranking current.

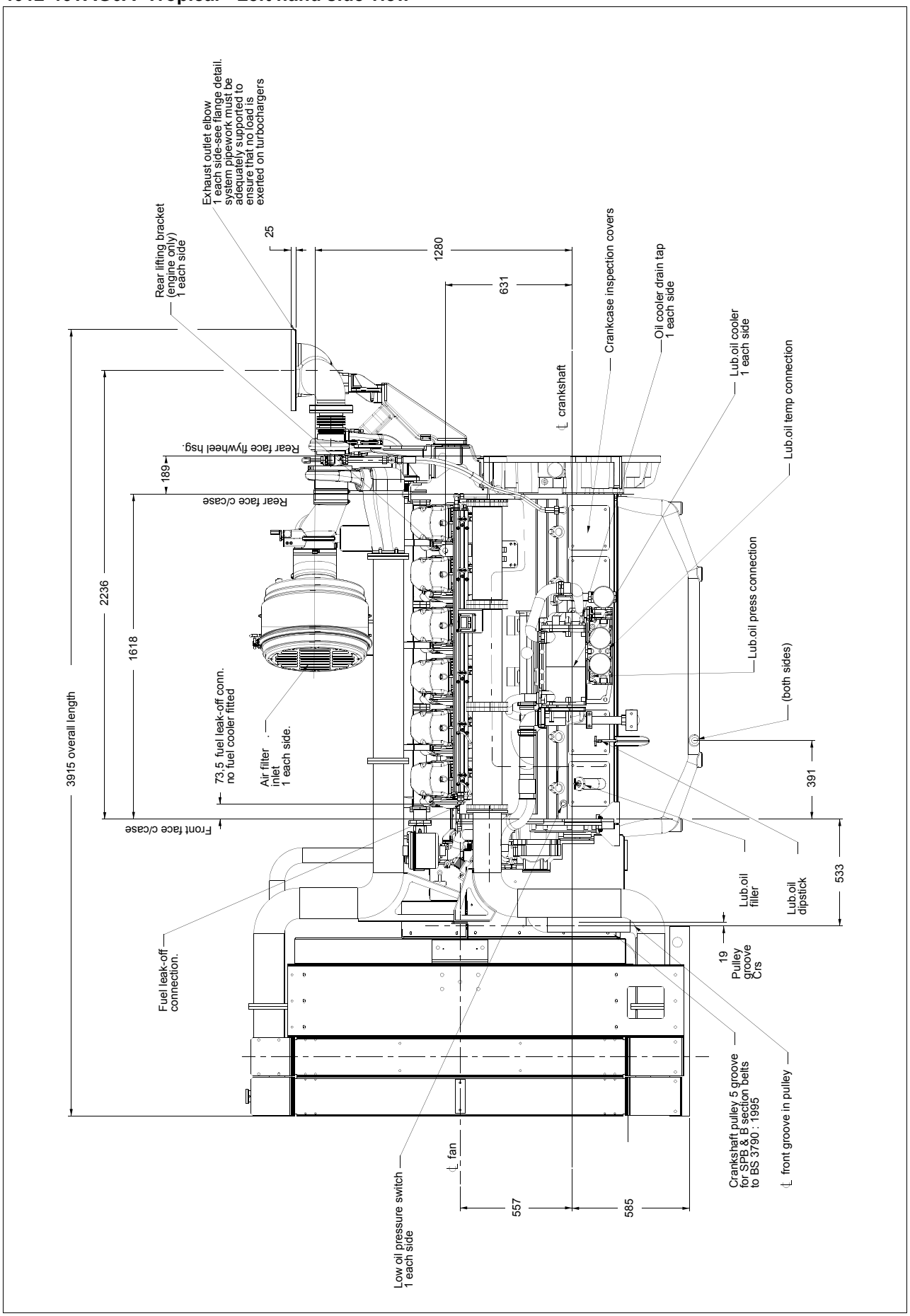
Engine mounting

Maximum static bending moment at rear face of block ... 1356 Nm
Maximum additional load applied to flywheel
due to all rotating components ... ... 850 kg

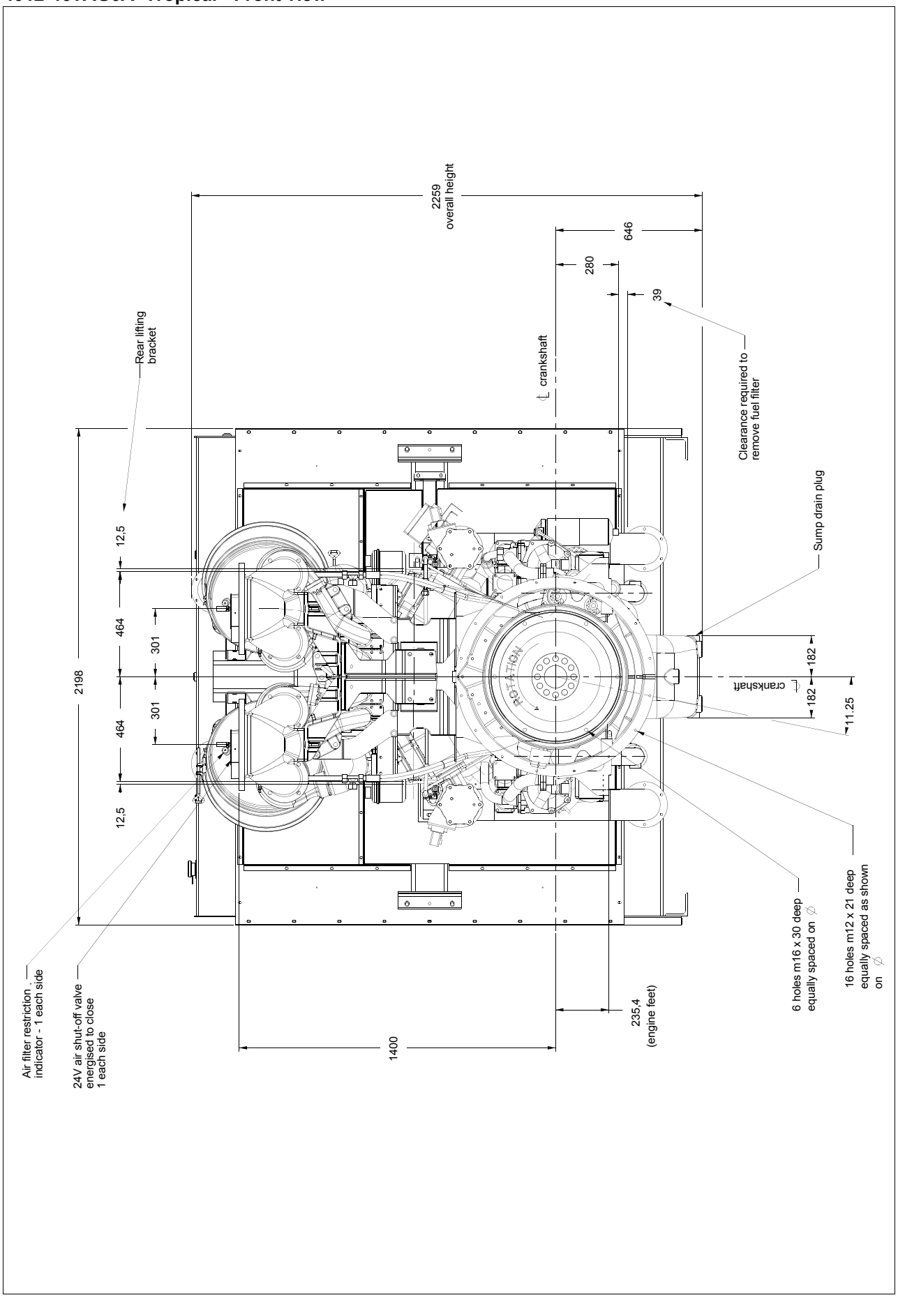
Centre of gravity

Bare engine, dry
-forward of the rear face of the cylinder block . ... 771 mm
-above the crankshaft centre line ... ... 32 mm
ElectropaK, dry
-forward of the rear face of the cylinder block . ... 1176 mm
-above the crankshaft centre line ... ... 32 mm

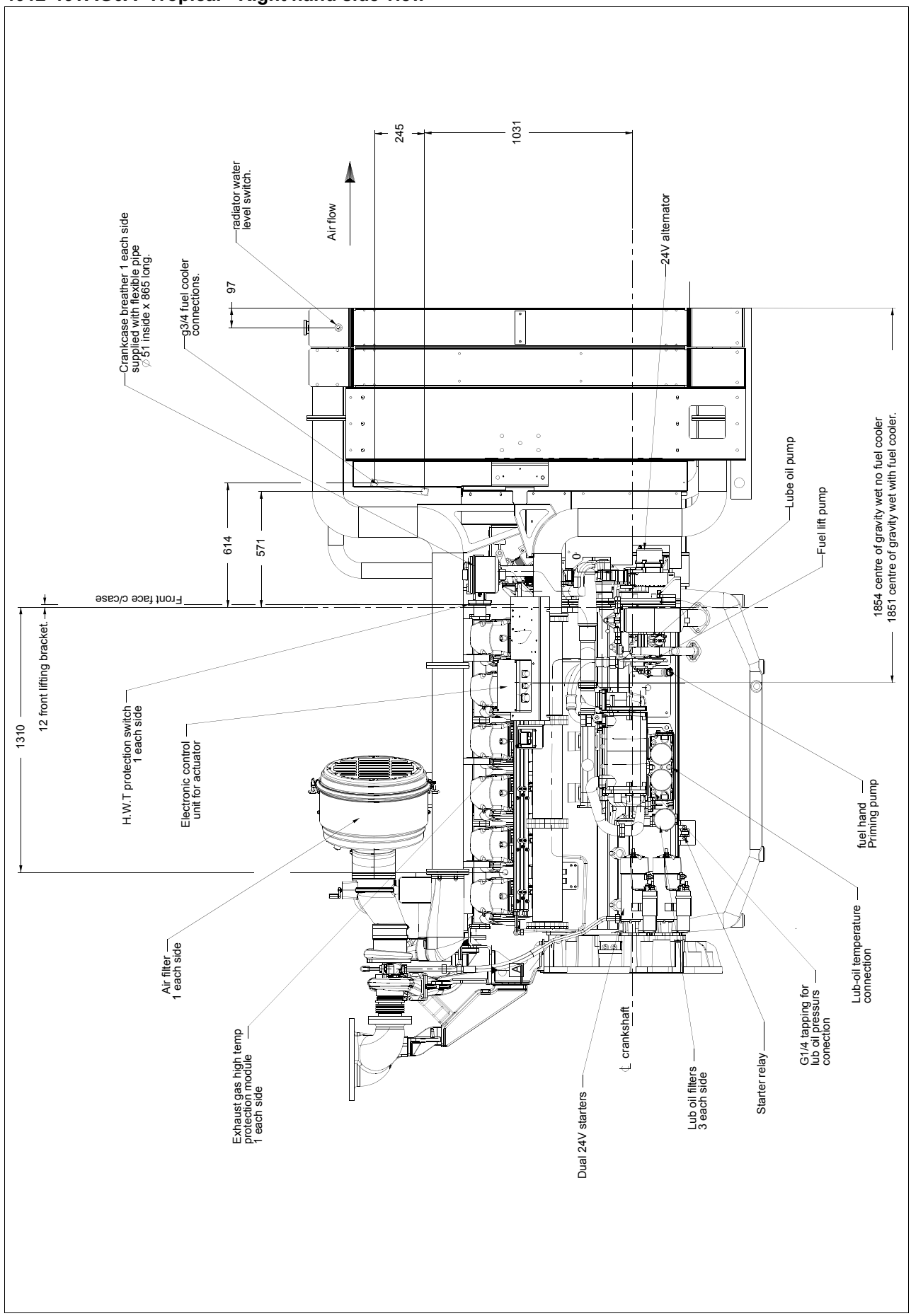
4012-46TAG0A Tropical - Left hand side view



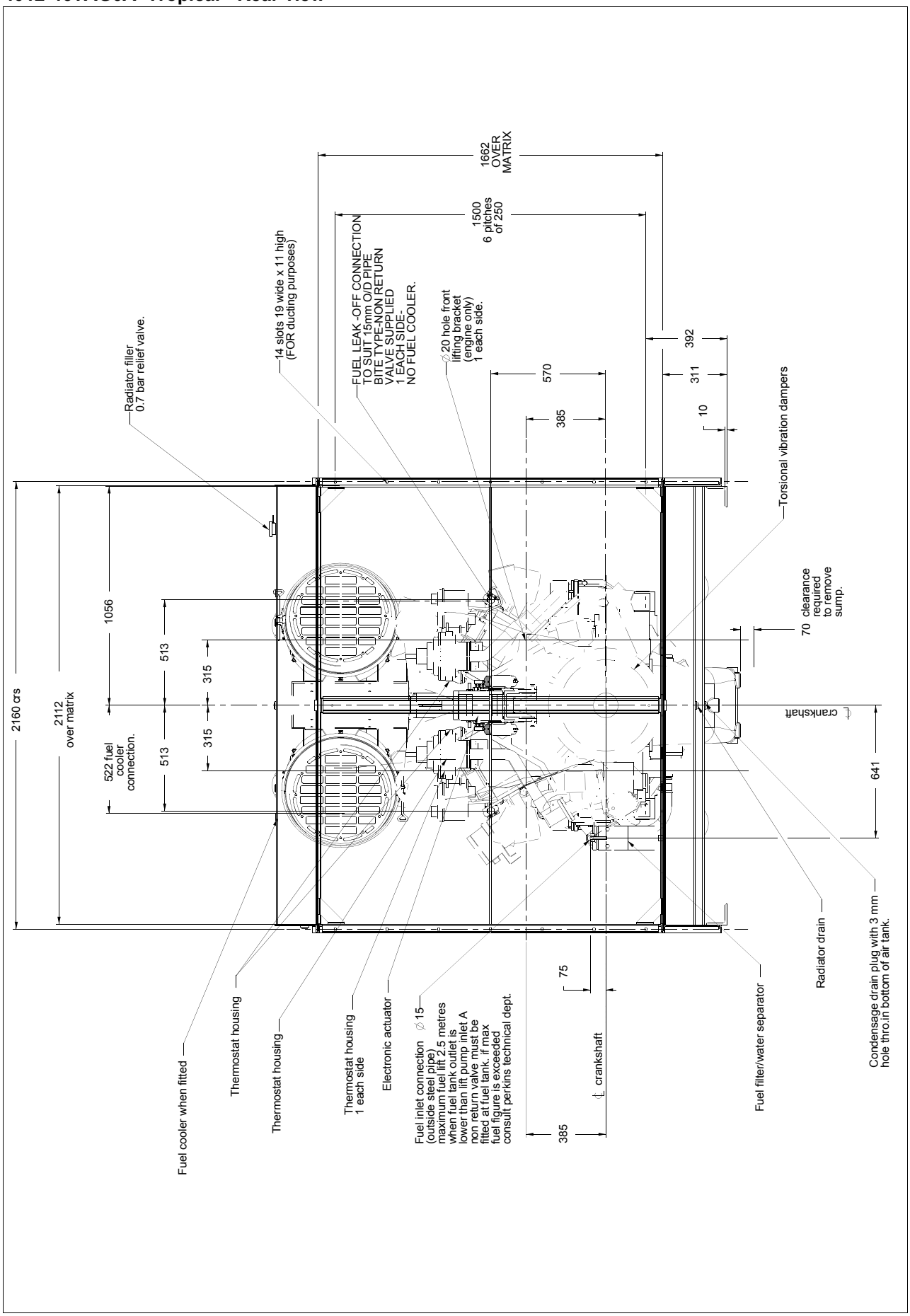
4012-46TAG0A Tropical - Front view



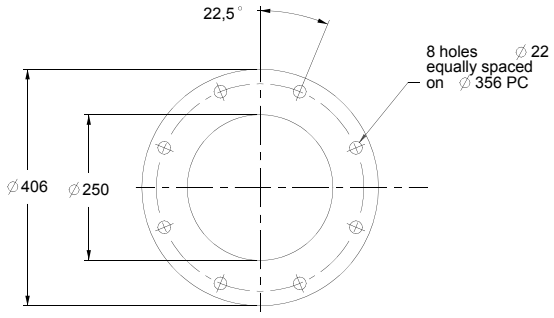
4012-46TAG0A Tropical - Right hand side view



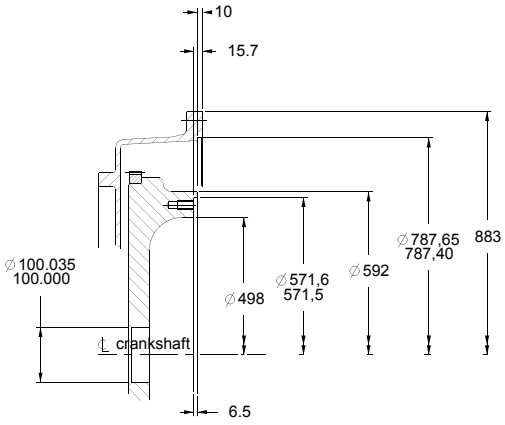
4012-46TAG0A Tropical - Rear view



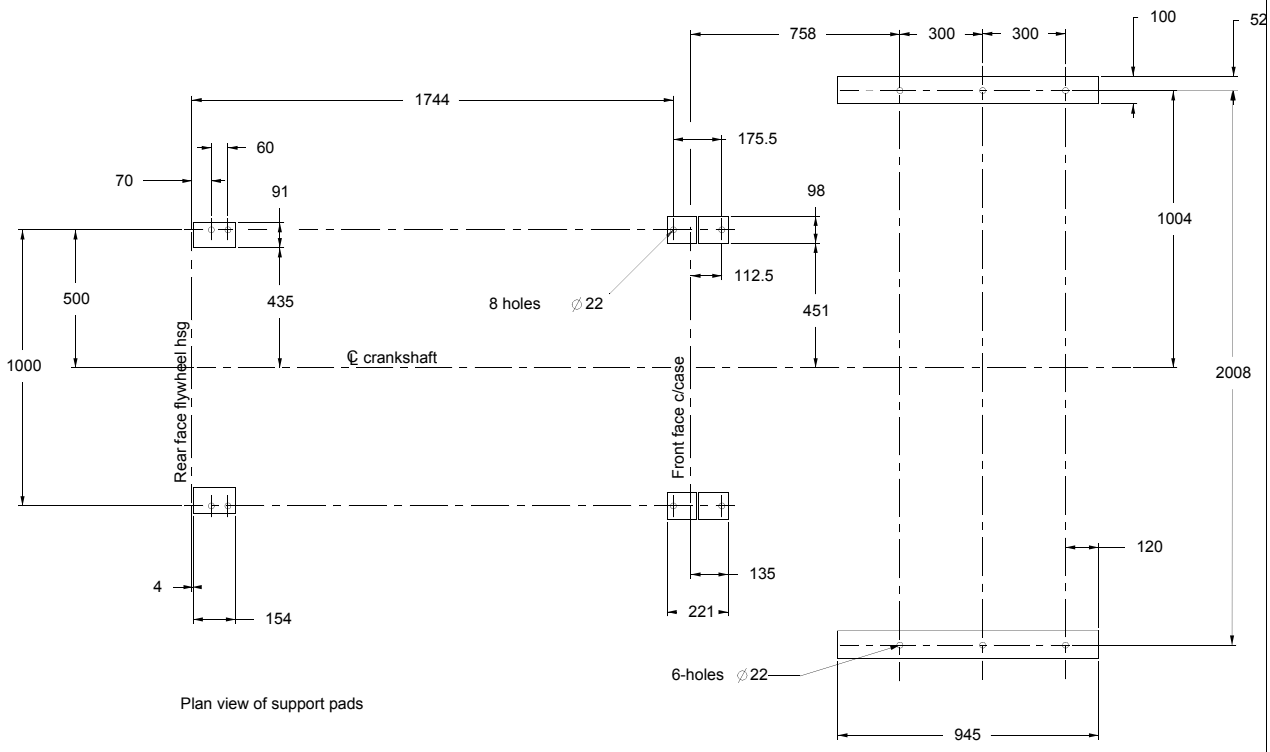
4012-46TAG0A Tropical - Plan view of support pads, exhaust outlet flange and flywheel



Detail of exhaust outlet flange
(B.S.10 table D)
scale 1:5

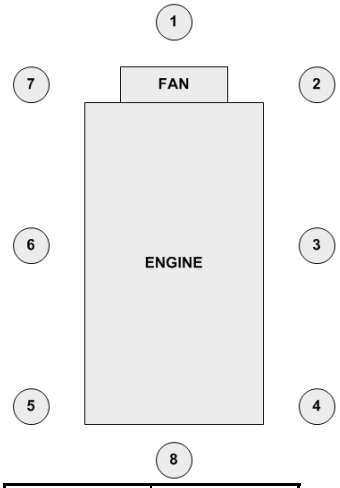


Detail of SAE 518 flywheel
and SAE 00 flywheel housing
(metric tappings)
scale 1:5



Plan view of support pads

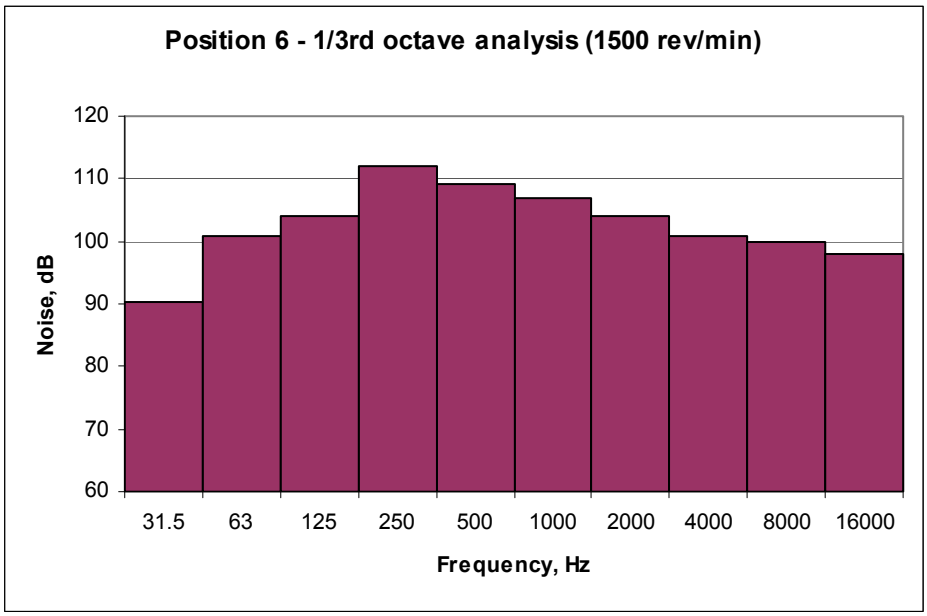
Noise



Noise Levels
The figures for total noise levels are typical for an engine running at Standby Power rating in a semi-reverberant environment and measured at a distance of one metre from the periphery of the engine.

Total Noise Level
Sound pressure level re: -20x10 Pa
Ambient noise level 79 dBA
Octave analysis performed at the position of maximum noise.

Position	Noise dB(A)
1	114
2	113
3	111
4	110
5	110
6	111
7	110
8	108



Typical load acceptance (cold)

	Initial Load Acceptance when engine reaches rated speed (15 seconds maximum after engine starts to crank)				2nd Load Application immediately after engine has recovered to rated speed (5 seconds after initial load application)			
Engine type	**Prime power %**	**Load (kWe)**	**Transient frequency deviation %**	**Frequency recovery time seconds**	**Prime power %**	**Load (kWe)**	**Transient frequency deviation %**	**Frequency recovery time seconds**
4012-46TAG0A	80	800	≤ 10	5	20	200	≤ 10	5

The above figures were obtained under test conditions as follows:
Engine block temperature .. .. 40 °C
Ambient temperature . ... 25 °C
Governing mode ... ... Isochronous
Alternator inertia. ... ... 50 kgm²
Under frequency roll off (UFRO) point set to ... ... 49,5 Hz
UFRO rate set to ... ... 16 V/Hz
LAM on / off ... ... on

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

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