Technical Data

4000 Series 4012-46TAG3A

Diesel Engine - ElectropaK

Basic technical data

Number of cylinders 12
Cylinder arrangement ... ... Vee, 60°
Cycle. ... ... .4 stroke
Induction system ... ... Turbocharged
Combustion system .. .. direct injection
Compression ratio. 13:1
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	Temperate
Engine (dry)	Kg	4400	4400
Electropak (wet) + fuel cooler	Kg	6450	6086
Electropak (wet) - fuel cooler	Kg	6425	6070

Overall dimensions of ElectropaK

	unit	Tropical	Temperate
Height	mm	2610	2259
Length	mm	3883	3915
Width	mm	2164	2198

Moment of inertia

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

Cyclic irregularity for engine/flywheel maximum

4012-46TAG3A. 1:638

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 16.
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 16 of this document.

General installation

4012-46TAG3A - Temperate

Designation	Units	Type of operation and application		
		Baseload power	Prime power	Standby power
Gross engine power	kWm	1260	1500	1643
Fan and battery charging alternator power	kW	64		
Nett engine power	kWm	1196	1436	1579
Brake mean effective pressure (gross)	kPa	2192	2610	2859
Combustion air flow at ISO conditions	m³/min	115	125	135
Exhaust gas temperature (max) after turbo	°C	480		
Exhaust gas flow (max) at atmospheric pressure	m³/min	350		
Boost pressure ratio	-	3,0	3,4	3,7
Mechanical efficiency	%	89	91	92
Overall thermal efficiency (nett)	%	41,5	41,0	39,0
Friction power and pumping losses	kWm	120		
Mean piston speed	m/s	9,5		
Engine coolant flow	l/min	1020		
Typical Genset electrical output (0.8pf)	kVA	1420	1705	1875
	kWe	1136	1364	1500
Assumed alternator efficiency	%	95		

4012-46TAG3A - Tropical

Designation	Units	Type of operation and application		
		Baseload power	Prime power	Standby power
Gross engine power	kWm	1260	1500	1643
Fan and battery charging alternator power	kW	60		
Nett engine power	kWm	1200	1440	1583
Brake mean effective pressure (gross)	kPa	2192	2610	2859
Combustion air flow at ISO conditions	m³/min	115	125	135
Exhaust gas temperature (max) after turbo	°C	480		
Exhaust gas flow (max) at atmospheric pressure	m³/min	350		
Boost pressure ratio	-	3,0	3,4	3,7
Mechanical efficiency	%	89	91	92
Overall thermal efficiency (nett)	%	41,5	41,0	39,0
Friction power and pumping losses	kWm	120		
Mean piston speed	m/s	9,5		
Engine coolant flow	l/min	1020		
Typical Genset electrical output (0.8pf)	kVA	1425	1710	1880
	kWe	1140	1368	1504
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.

Emissions capability

All 4012-46TAG ratings are optimised to the ‘best fuel consumption’ and do not comply to Harmonised International Regulation Emission Limits. More information on these statements can be obtained by contacting the Applications Department at Perkins Engines Company Limited.

Energy balance

4012-46TAG3A - Temperate

Designation	Units	Baseload power	Prime power	Standby power
Energy in fuel	kW	3137	3650	4100
Energy in power output (gross)	kW	1260	1500	1643
Energy to cooling fan	kW	64		
Energy in power output (nett)	kW	1196	1436	1579
Energy to exhaust	kW	1010	1102	1219
Energy to coolant and oil	kW	477	510	625
Energy to radiation	kW	90	110	123
Energy to charge coolers	kW	300	429	490

4012-46TAG3A - Tropical

Designation	Units	Baseload power	Prime power	Standby power
Energy in fuel	kW	3137	3650	4100
Energy in power output (gross)	kW	1260	1500	1643
Energy to cooling fan	kW	60		
Energy in power output (nett)	kW	1200	1440	1583
Energy to exhaust	kW	1010	1102	1219
Energy to coolant and oil	kW	477	510	625
Energy to radiation	kW	90	110	123
Energy to charge coolers	kW	300	428	490

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 in 1 litre bottles from Perkins under part number 21825 735.
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):
-temperate.. ... ... 207 litres
-tropical .. .. 210 litres
Maximum permissible restriction to coolant pump flow.. ... . 20 kPa
Thermostat operating range... ... ... 71 - 85 °C
Ambient cooling clearance (standby power) based on air temperature at fan 6 °C above ambient.
Temperature rise across the engines (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

Temperate
Radiator face area . ... 3,46 m²
Material and number of rows:
-charge air and water jacket... ... ... .copper, 4 rows
Fins per inch and material:
-charge air and water jacket... ... ... brass, 12 rows
Width of matrix ... ... 2,10 m
Height of matrix.. ... ... 1,65 m
Weight of radiator... ... ... 1620 kg
Total coolant capacity including engine and pipes. ... . 212 litres
Pressure cap setting (min) . ... 70 kPa
Tropical
Radiator face area . ... 4,08 m²
Material and number of rows:
-charge air and water jacket... ... ... .copper, 4 rows
Fins per inch and material:
-charge air and water jacket... ... ... brass, 12 rows
Width of matrix ... ... 1,97 m
Height of matrix.. ... ... 2,07 m
Weight of radiator... ... ... 1630 kg
Total coolant capacity including engine and pipes. ... . 226 litres
Pressure cap setting (min) . ... 70 kPa

Water jacket cooling data

Temperate and Tropical
-coolant flow... ... ... 1020 litres/min
-coolant exit temperature (max) . ... 98 °C
-coolant inlet temperature (min) . ... thermostatic control
-coolant inlet temperature (max) ... ... 90 °C

Coolant pump

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

Fan

Type ... ... axial flow
Diameter
-Temperate ... ... 1600 mm
-Tropical . ... 1740 mm
Number of blades... 12
Material .. .. Aluminium
Drive ratio
-Temperate ... ... 0·93:1
-Tropical . ... 0·80:1

4012-46TAG3A - Temperate, Standby power

Maximum additional restriction (duct allowance) to cooling airflow and resultant minimum airflow		
Ambient clearance: 50% Glycol	**Duct allowance (Pa)**	**Min airflow (m³/sec)**
40 °C	250	32

4012-46TAG3A - Tropical, Standby power

Maximum additional restriction (duct allowance) to cooling airflow and resultant minimum airflow		
Ambient clearance: 50% Glycol	**Duct allowance (Pa)**	**Min airflow (m³/sec)**
50 °C	125	37

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.. ... ... 157,5 litres
-sump minimum... ... ... 115 litres
-oil temperature at normal operating conditions to bearings 105 °C

Lubrication oil pressure

-at rated speed ... ... 400 kPa
-minimum at 80 °C... ... ... 340 kPa
-oil relief values open .. ..400 kPa
-oil filter spacing .. .. 20 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

Prime power	Units	
After "running in" (typically after 250 hours)	g/kWhr	0,52
Oil flow rate from pump	litres/sec	6

Electrical system

Type ... ... insulated return
Alternator voltage ... ... 24 volts with integral regulator
Alternator output ... . 40 amps output, 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
Engine stop solenoid .. .. 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 ... ... 140 MPa
Lift pump type ... ... Tuthill TCH 1-089

Delivery

-4012-46TAG3A . ... 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 to ISO 8528-12 CLASS 3 and 4; ISO 8528-5 CLASS G2
Tolerance on fuel consumption 5%

Fuel consumption

Ratings	g/kW/hr	litres/hr
4012-46TAG3A, Temperate & Tropical		
Standby	211	405
Prime	208	370
Baseload	207	310
75% Prime	206	275
50% Prime	202	187

Note: Fuel consumption calculated on gross rated powers.

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
For recommended pipe sizes, please refer to the Installation Manual.

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.

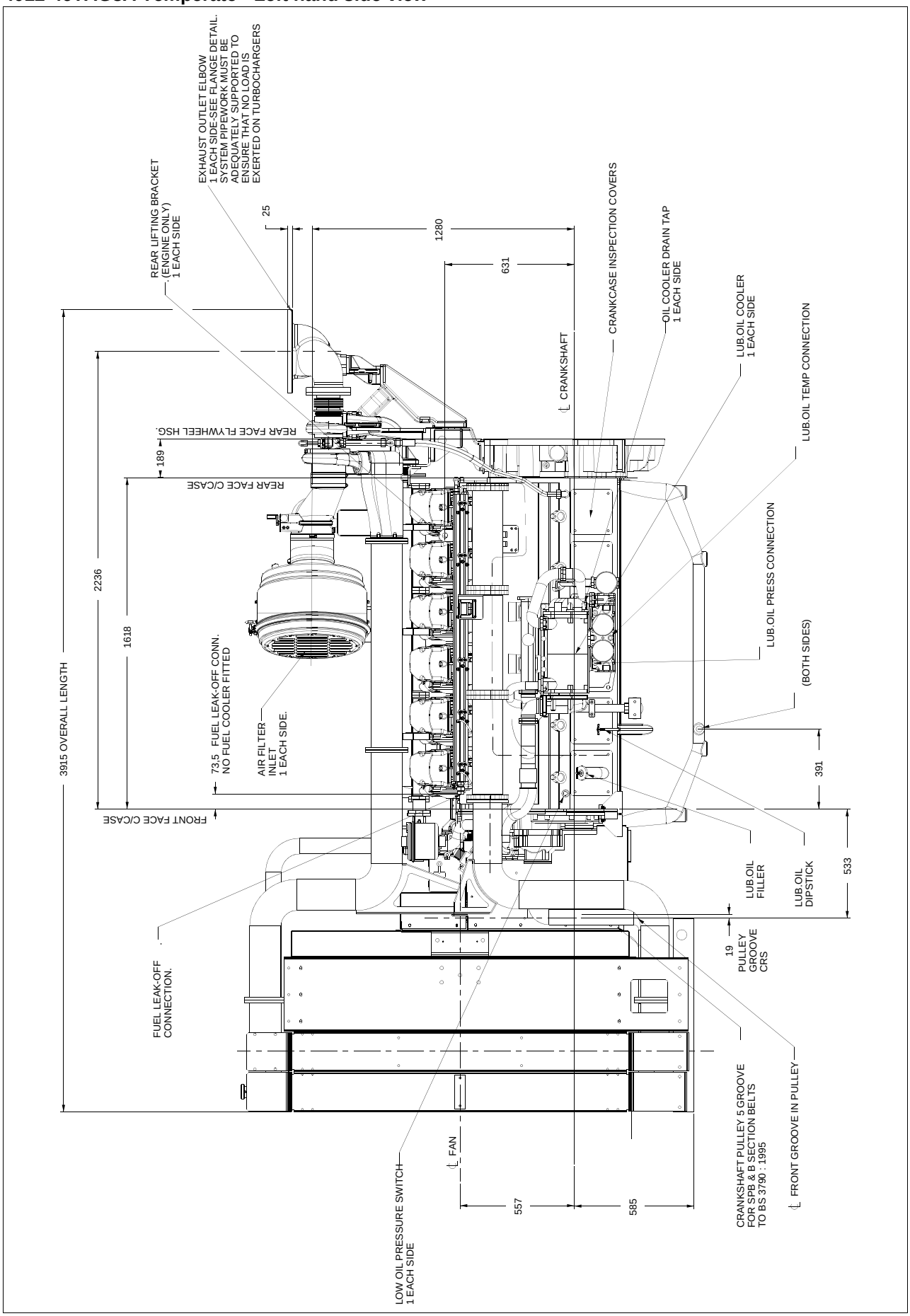
Engine mounting

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

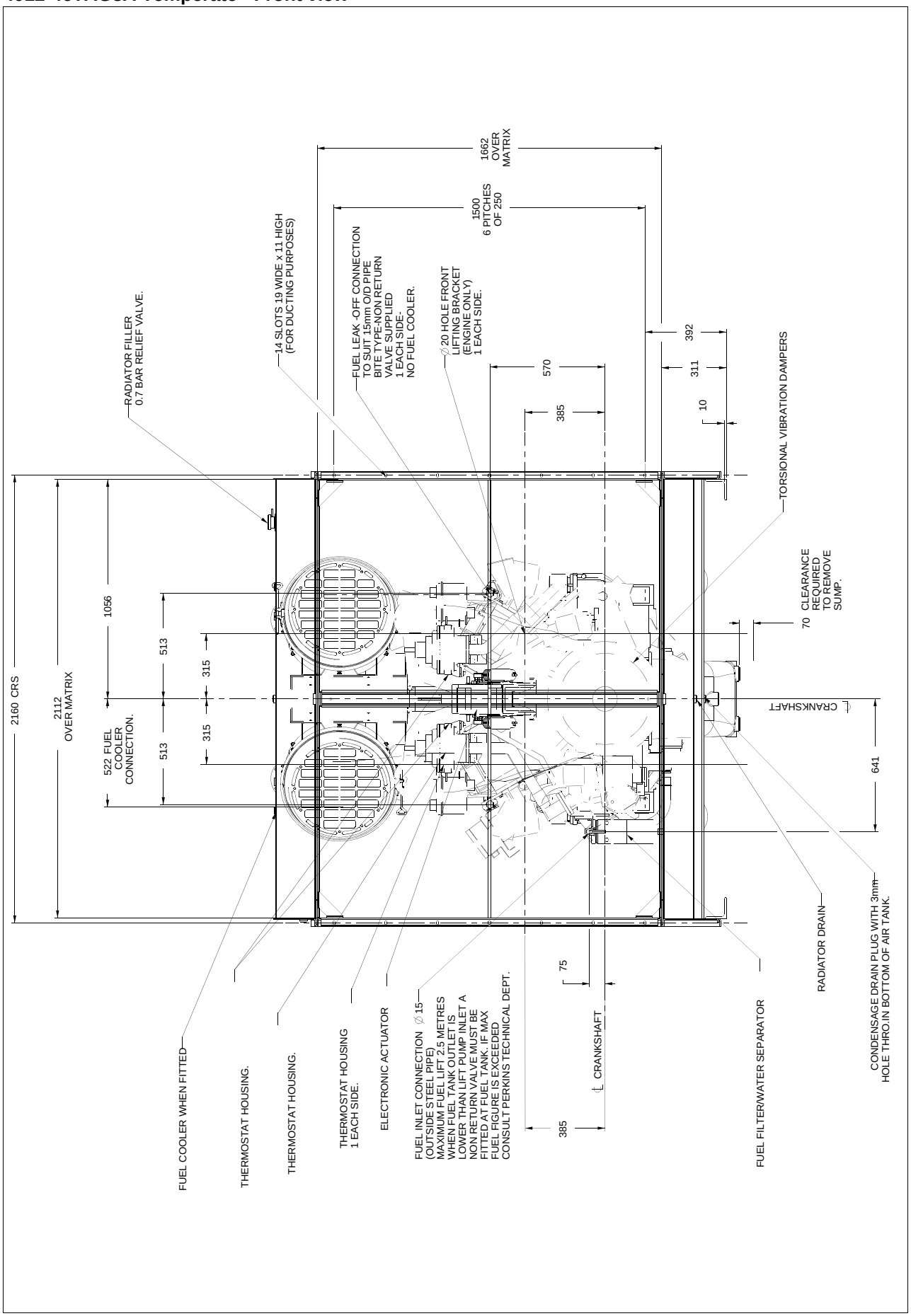
Centre of gravity

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

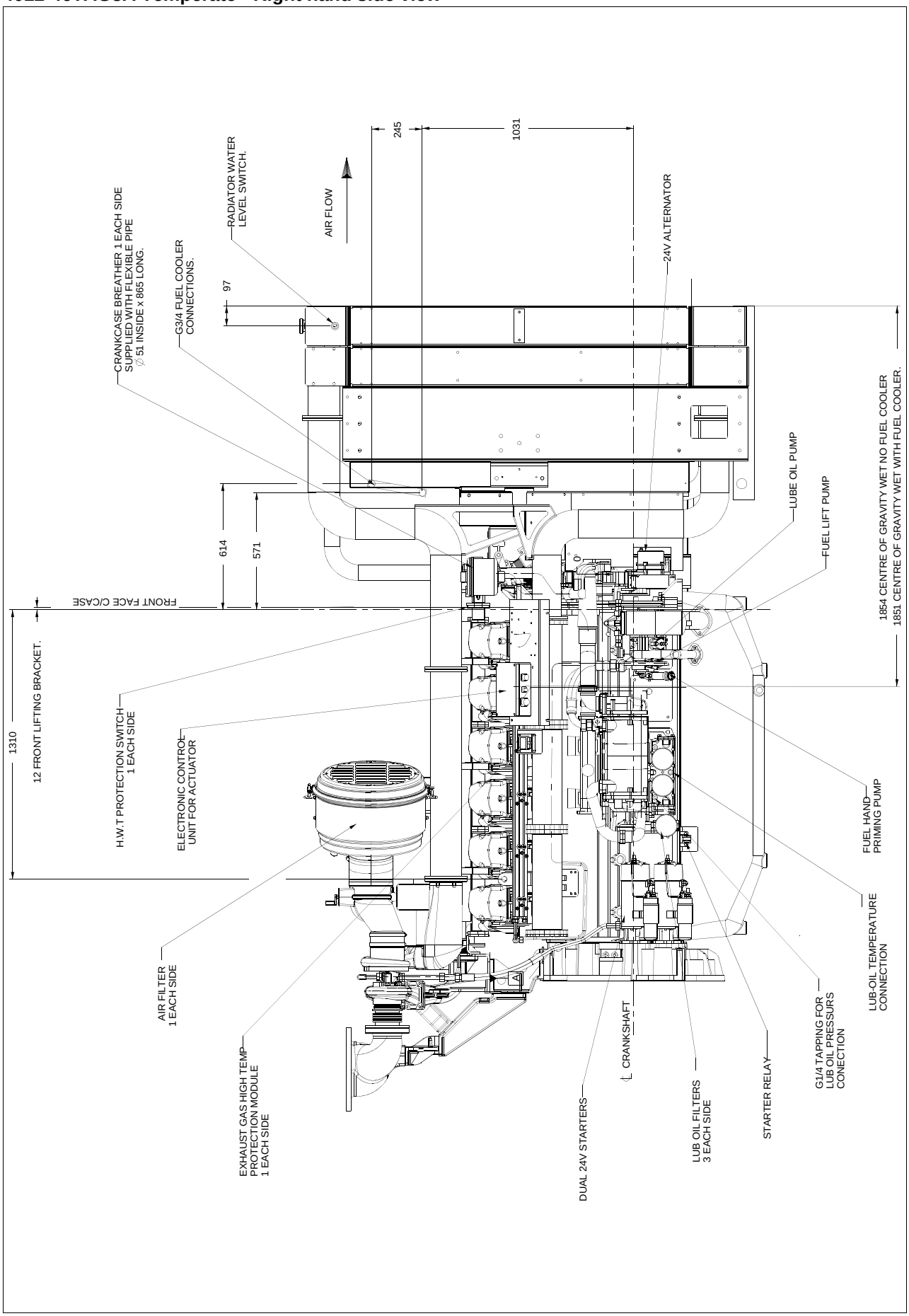
4012-46TAG3A Temperate - Left hand side view



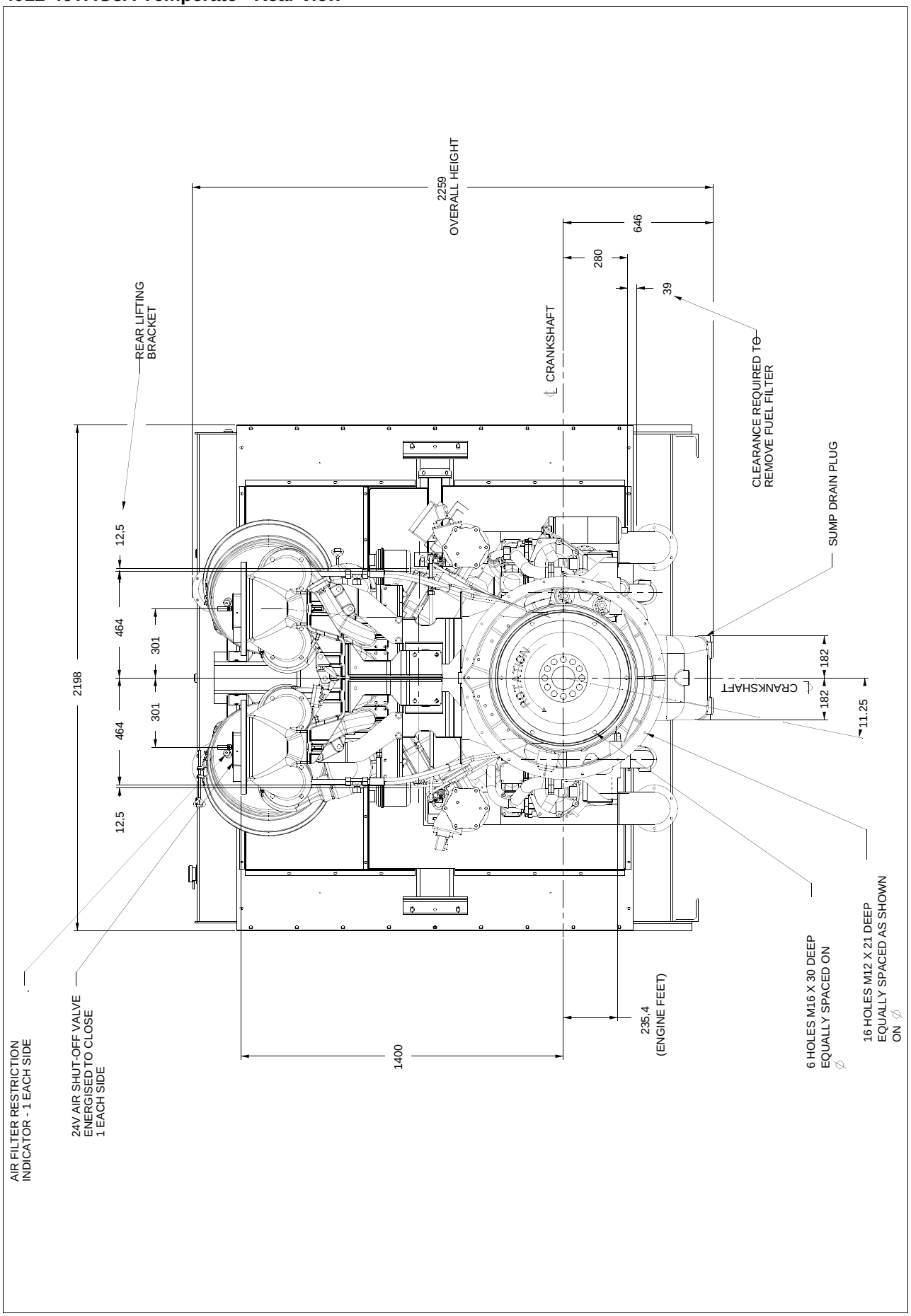
4012-46TAG3A Temperate - Front view



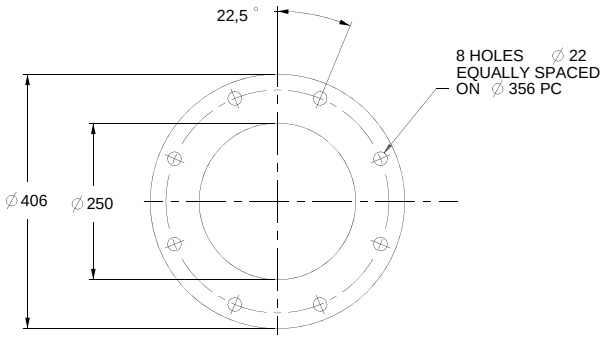
4012-46TAG3A Temperate - Right hand side view



4012-46TAG3A Temperate - Rear view



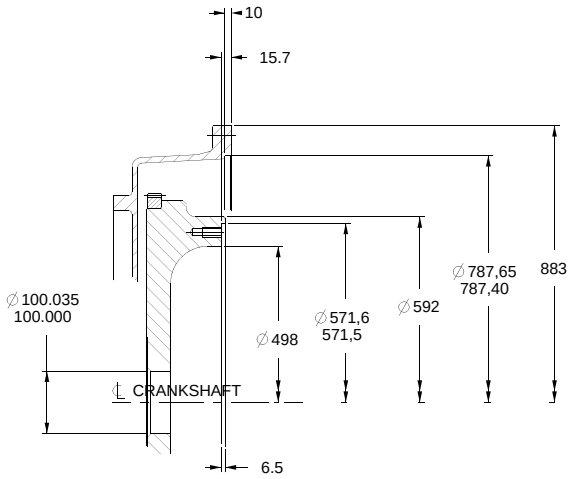
4012-46TAG3A Temperate - Plan view of support pads, exhaust outlet flange and flywheel



DETAIL OF EXHAUST OUTLET FLANGE

(B.S.10 TABLE D)

SCALE 1:5

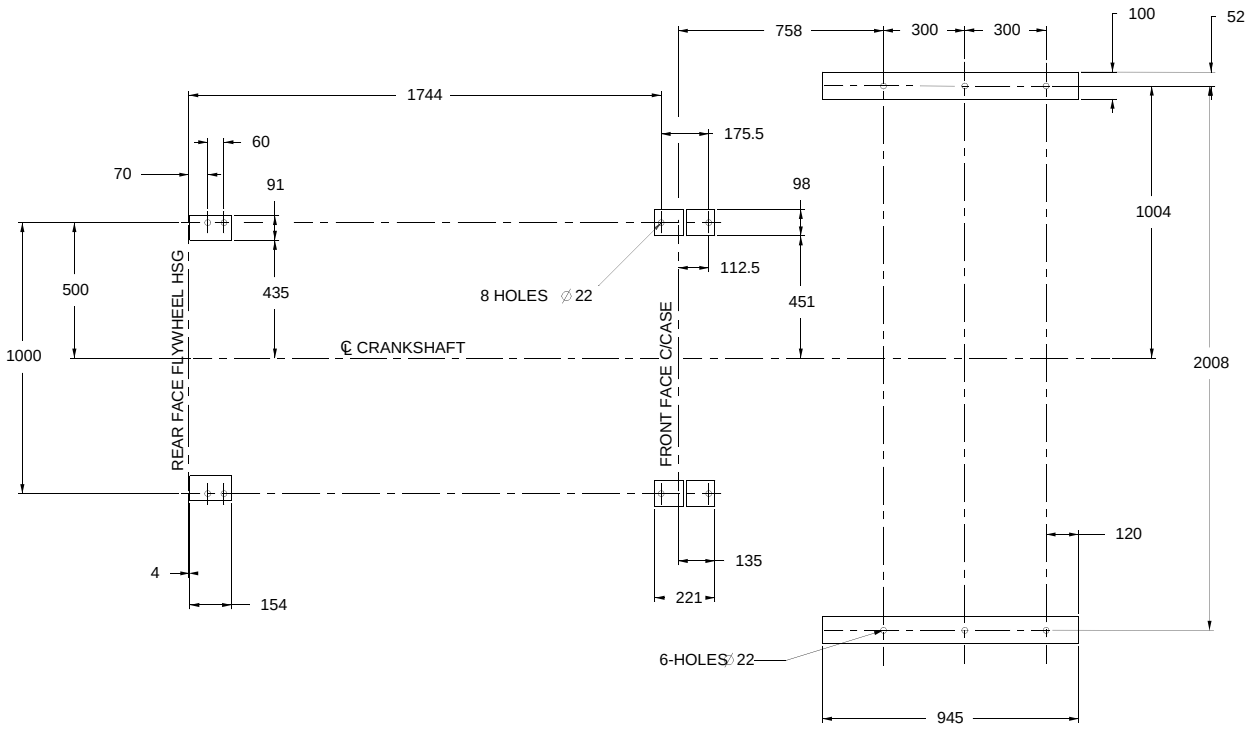


DETAIL OF SAE 518 FLYWHEEL

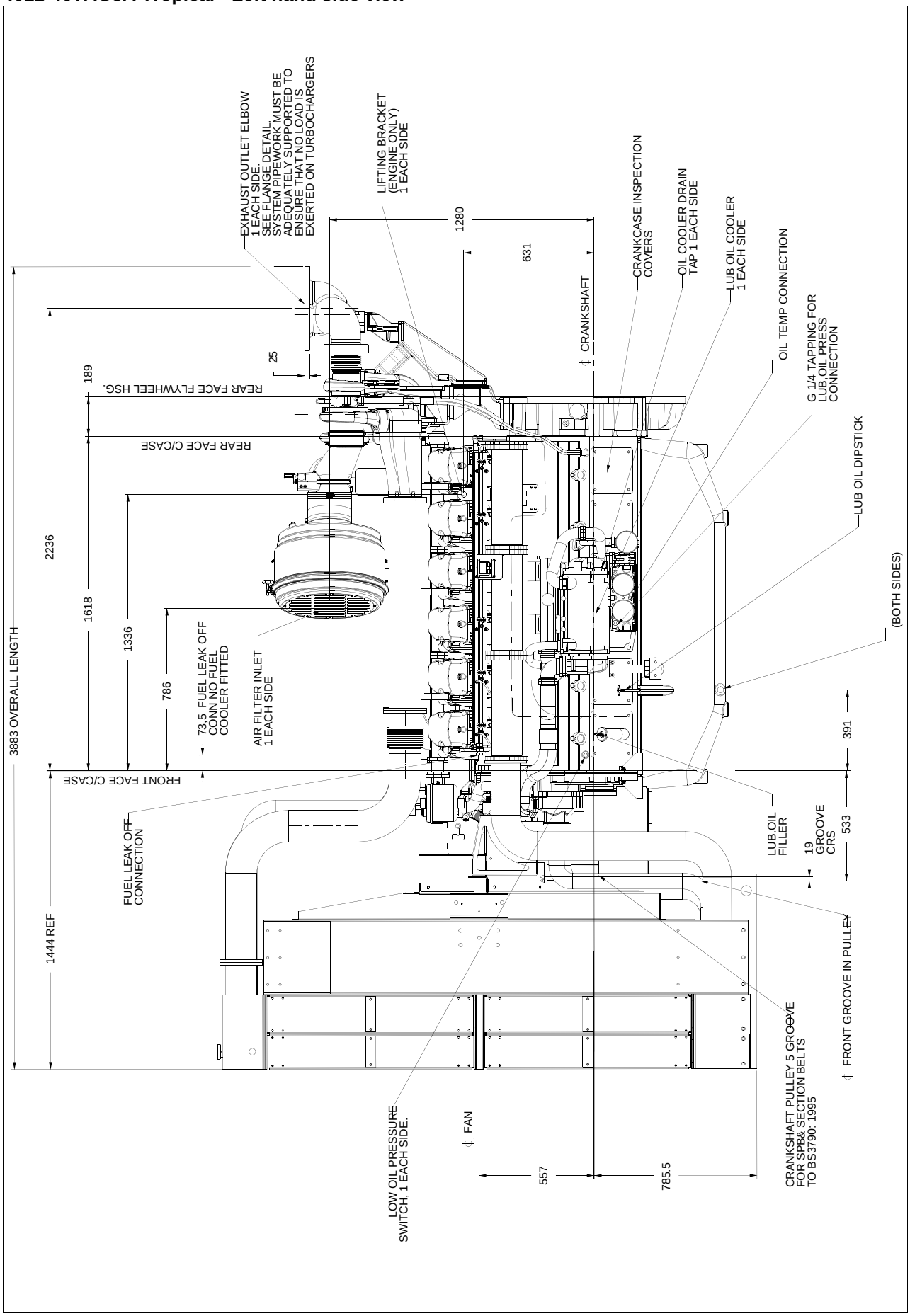
AND SAE 00 FLYWHEEL HOUSING

(METRIC TAPPINGS)

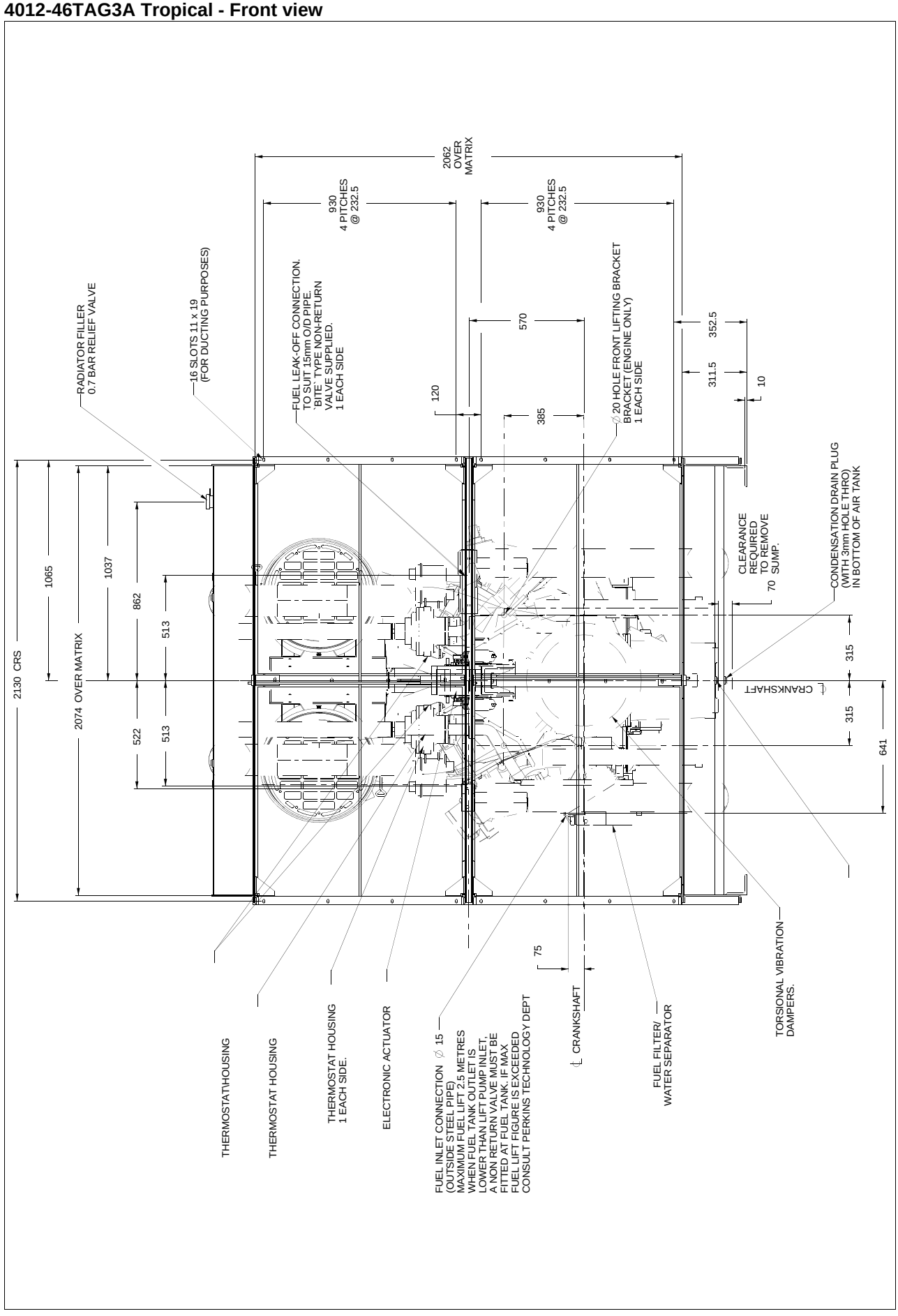
SCALE 1:5



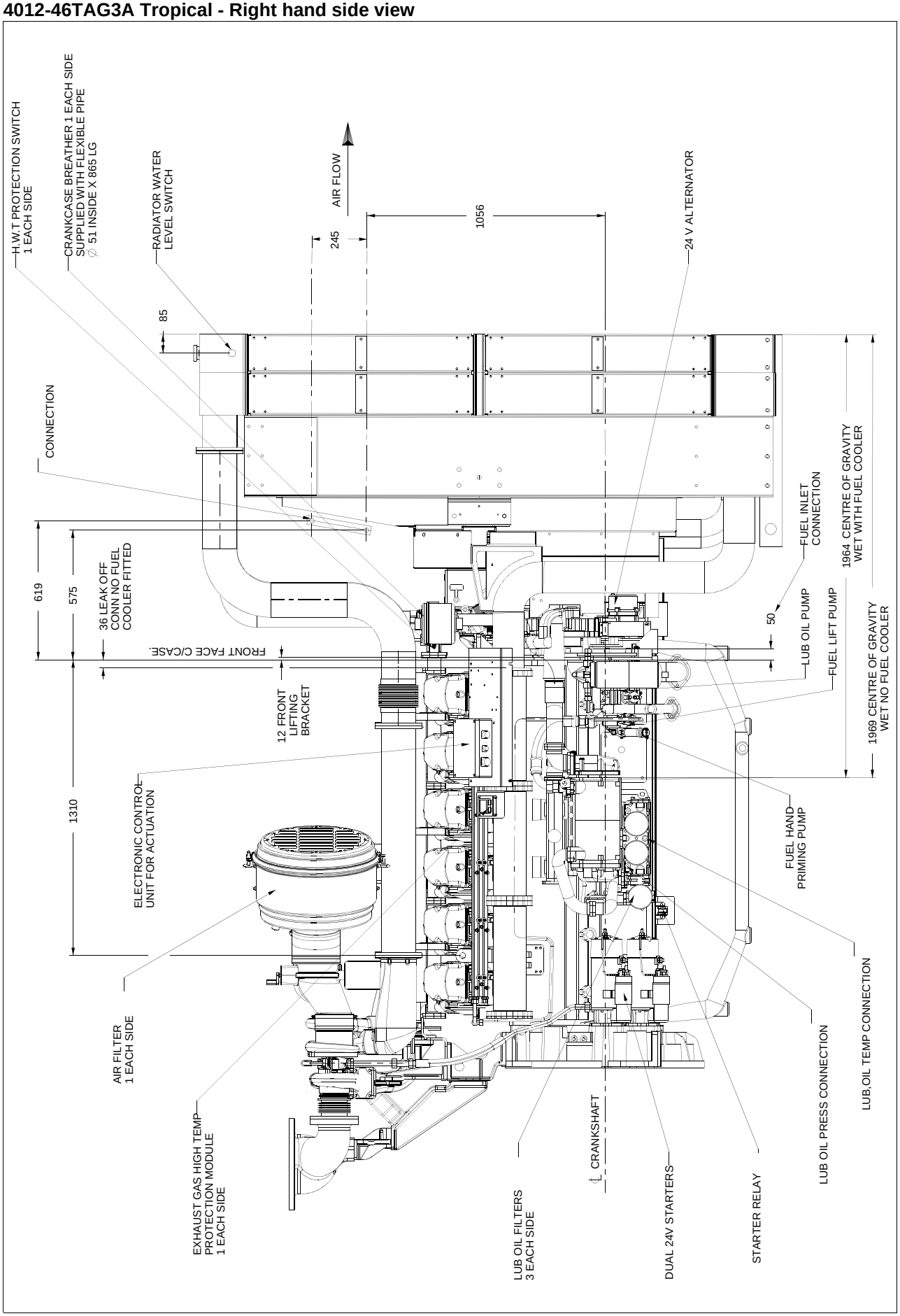
4012-46TAG3A Tropical - Left hand side view



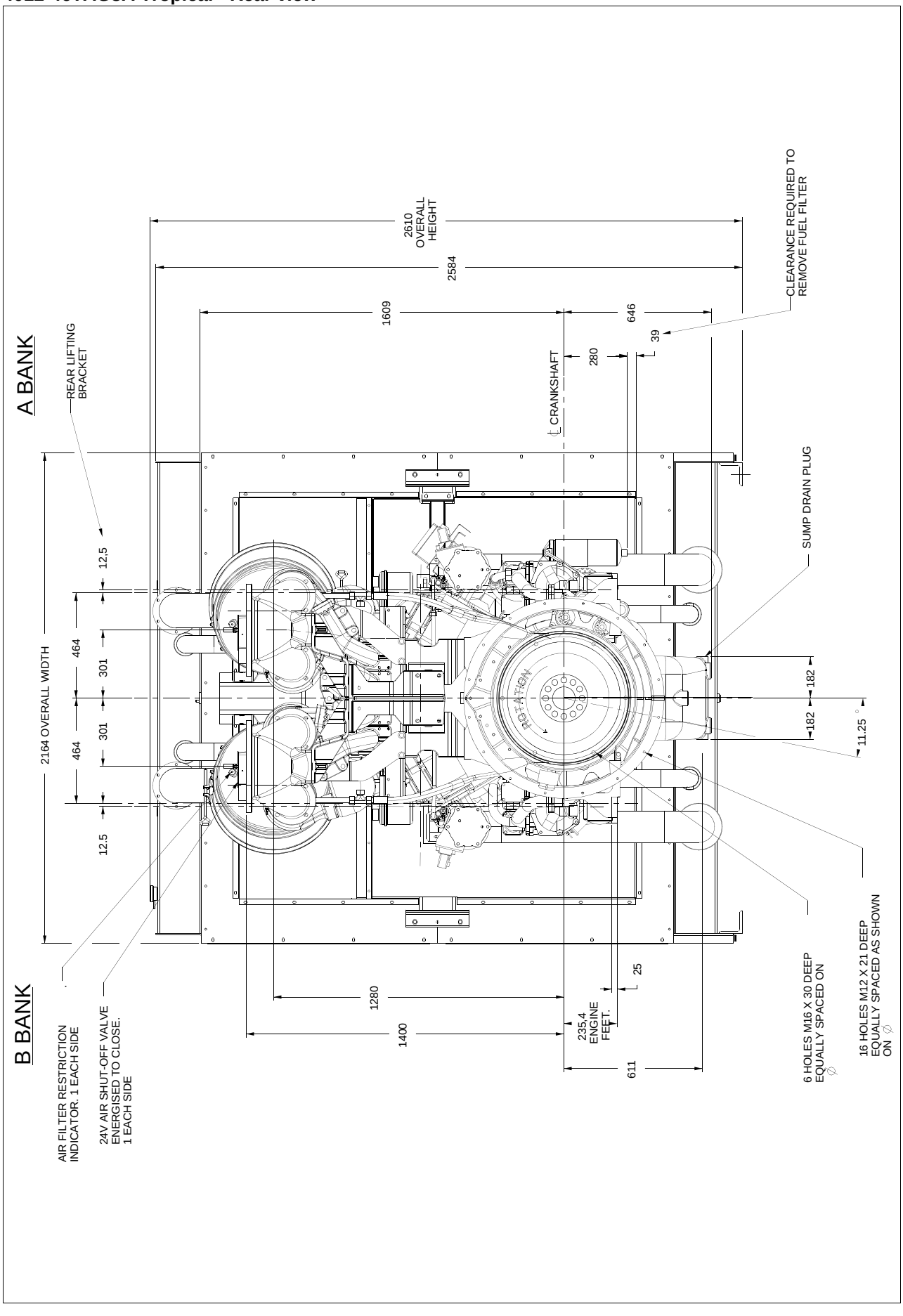
4012-46TAG3A Tropical - Front view



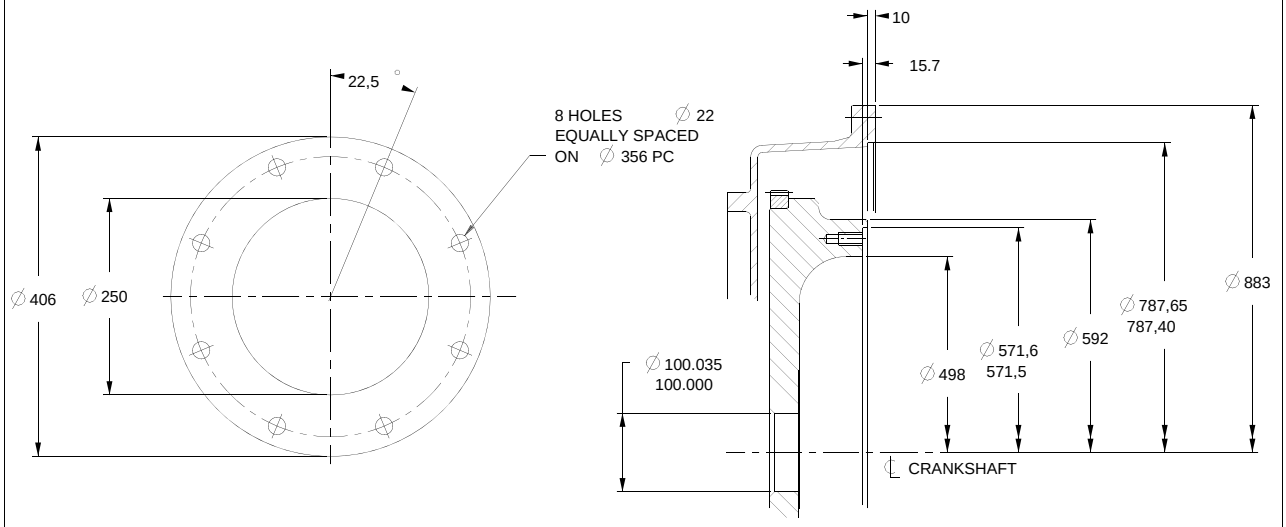
4012-46TAG3A Tropical - Right hand side view



4012-46TAG3A Tropical - Rear view



4012-46TAG3A Tropical - Plan view of support pads, exhaust outlet flange and flywheel



DETAIL OF EXHAUST OUTLET FLANGE

(B.S.10 TABLE D)

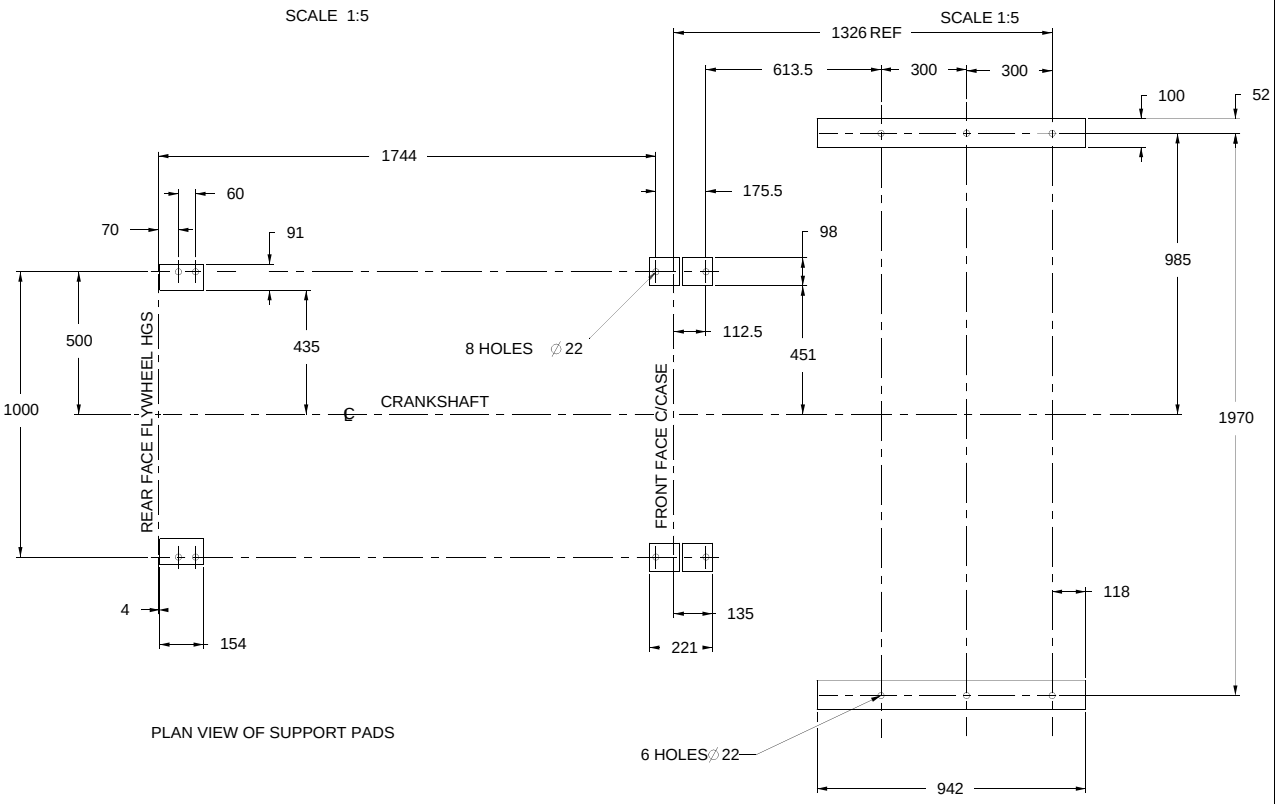
SCALE 1:5

DETAIL OF SAE 518 FLYWHEEL

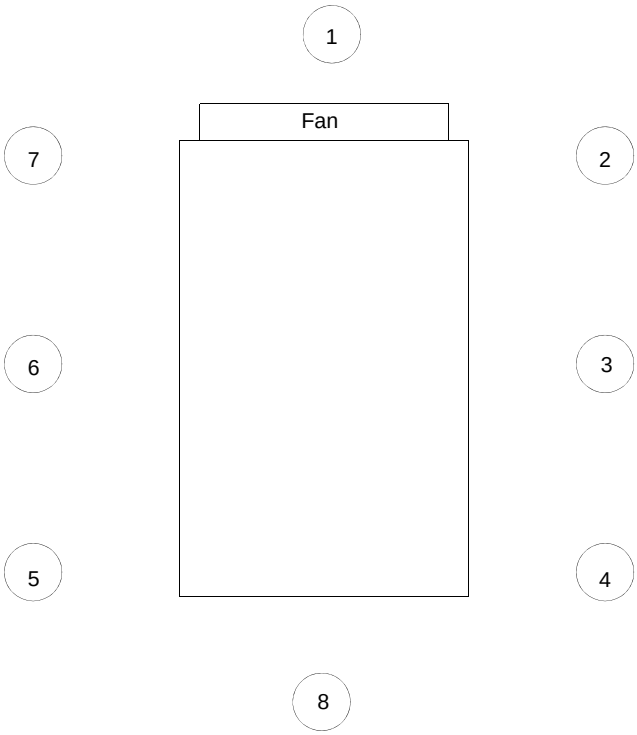
AND SAE 00 FLYWHEEL HOUSING

(METRIC TAPPINGS)

SCALE 1:5



PLAN VIEW OF SUPPORT PADS



ENGINE **1500 RPM POWER** **STANDBY**

1/3 (1/1 bandwidth)OCTAVE ANALYSIS

SITE

POSN.	DBA	HZ	DB AT POSN …6…
1	114	31.5	90.2
2	113	63	101
3	111	125	104
4	110	250	112
5	110.5	500	109
6	111	1k	107
7	110.5	2k	104
8	107	4k	101
		8k	100
		16k	98

POSN.	DBA	HZ	DB AT POSN …6…
1	114	31.5	90.9
2	113	63	101
3	111	125	104
4	110	250	110
5	110	500	109
6	111	1k	106
7	110	2k	103
8	107	4k	100
		8k	99
		16k	98

POSN.	DBA	HZ	DB AT POSN …6…
1	114	31.5	91
2	113	63	101
3	111	125	104
4	110	250	110
5	110	500	109
6	111	1k	106
7	110	2k	103
8	107	4k	100
		8k	99
		16k	98

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.

AMBIENT NOISE…79…….DBA

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 nett**	**Transient frequency deviation %**	**Frequency recovery time seconds**	**Prime power%**	**Load kWe nett**	**Transient frequency deviation %**	**Frequency recovery time seconds**
4012-46TAG3A	63	860	≤ 10	5	37	505	≤ 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
UFRO rate set to ... ... 16 v/hz
LAM on / off ... ... on
All tests were conducted using an engine installed and serviced to Perkins Engines Company Limited recommendations.
Applied load is a percentage of generator electrical output efficiency as published in the general installation section of this data sheet.
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.

Perkins Engines Company Limited
Peterborough PE1 5NA United Kingdom
Telephone +44 (0) 1733 583000
Fax +44 (0) 1733 582240
www.perkins.com

Distributed by

Publication No. TPD1587E, Issue 7. February 2010 © Perkins Engines Company Limited.