

# Technical Data

## 4000 Series

Diesel Engine - Electropak

# 4012-46TAG3A

1800 rev/min

### 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<sup>A</sup>, 6<sup>B</sup>, 5<sup>A</sup>, 2<sup>B</sup>, 3<sup>A</sup>, 4<sup>B</sup>, 6<sup>A</sup>, 1<sup>B</sup>, 2<sup>A</sup>, 5<sup>B</sup>, 4<sup>A</sup>, 3<sup>B</sup>  
 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

Total engine inertia ..... 19,3 kgm<sup>2</sup>

### 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 - temperate cooling (wet)

-forward of the rear face of the cylinder block... .. 1227 mm

-above the crankshaft centre line... .. 152 mm

Electropak - tropical cooling (wet)

-forward of the rear face of the cylinder block... .. 1089 mm

-above the crankshaft centre line... .. 190 mm

### Cyclic irregularity for engine/flywheel maximum

4012-46TAG3A ..... 1:975

### Ratings

Steady state speed stability at constant load ..... ± 0.25%

Electrical ratings are based on average alternator efficiency and are for guidance only (0.8 power factor being used).

### Operating point

Engine speed ..... 1800 rev/min

Static injection timing ..... 20° BTDC

see engine number plate

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

Estimated sound pressure level at 1 metre ..... 114dB(A)

### 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 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 on the Perkins Secured Web site.

For test conditions relevant to data on load acceptance, refer to the rear of this document.

### 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.

## General installation

### 4012-46TAG3A - Tropical cooling

Designation	Units	Type of operation and application - 60Hz		
		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	1826	2175	2383
Combustion air flow at ISO conditions	m³/min	120	136	145
Exhaust gas temperature (max) after turbo	°C	390	417	434
Exhaust gas flow (max) at atmospheric pressure	m³/min	276	312	336
Exhaust gas mass flow (max)	kg/s	2,3	2,6	2,8
Boost pressure ratio	-	2,9:1	3,3:1	3,5:1
Mechanical efficiency	%	90,1	91,6	92,3
Overall thermal efficiency (nett)	%	38	38	38
Regenerative power (estimated)	kWm	69		
Mean piston speed	m/s	9,5		
Engine coolant flow	l/s	1200		
Typical Genset electrical output (0.8pf)	kVA	1425	1710	1880
	kWe	1140	1368	1504
Assumed alternator efficiency	%	95		

### 4012-46TAG3A - Temperate cooling

Designation	Units	Type of operation and application - 60Hz		
		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	1832	2181	2389
Combustion air flow at ISO conditions	m³/min	120	136	145
Exhaust gas temperature (max) after turbo	°C	390	417	434
Exhaust gas flow (max) at atmospheric pressure	m³/min	276	312	336
Exhaust gas mass flow	kg/s	2,3	2,6	2,8
Boost pressure ratio	-	2,9:1	3,3:1	3,5:1
Mechanical efficiency	%	90	92	92
Overall thermal efficiency (nett)	%	38		
Regenerative power (estimated)	kWm	69		
Mean piston speed	m/s	9,5		
Engine coolant flow	l/s	1200		
Typical Genset electrical output (0.8pf)	kVA	1420	1705	1875
	kWe	1136	1364	1500
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

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

### 4012-46TAG3A - Tropical cooling

Designation	Units	Baseload power	Prime power	Standby power
Energy in fuel	kW	3123	3750	4124
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	947	1160	1287
Energy to coolant and oil	kW	499	554	586
Energy to radiation	kW	79	97	108
Energy to charge coolers	kW	338	439	499

### 4012-46TAG3A - Temperate cooling

Designation	Units	Baseload power	Prime power	Standby power
Energy in fuel	kW	3112	3740	4113
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	943	1157	1284
Energy to coolant and oil	kW	498	553	585
Energy to radiation	kW	75	93	104
Energy to charge coolers	kW	336	437	498

**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. 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 kPa

### Total coolant capacity

Electrounit (engine only) ... 73 litres  
 Electropak (engine and radiator and pipes):

-temperate... 225 litres  
 -tropical... 209 litres

Maximum permissible restriction to coolant pump flow... .20 kPa  
 Thermostat operating range... 71 - 85 °C  
 -coolant flow... 1200 litres/min  
 Ambient cooling clearance is 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 m<sup>2</sup>  
 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 ... 2112 mm  
 Height of matrix... 1662 mm  
 Weight of radiator (dry) ... 1289 kg  
 Pressure cap setting ... 70 kPa

#### Tropical

Radiator face area ... 4,2 m<sup>2</sup>  
 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 ... 2074 mm  
 Height of matrix... 2062 mm  
 Weight of radiator (dry) ... 1660 kg  
 Pressure cap setting ... 70 kPa

### Water jacket cooling data

#### Temperate and Tropical

-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 ... Pusher  
 Diameter

-Temperate ... 1600 mm  
 -Tropical ... 1730 mm

Number of blades

Temperature ... 8  
 Tropical ... 12

Material ... Aluminium  
 Drive ratio

-Temperate ... 0.75:1  
 -Tropical ... 0.67:1

## 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 (m <sup>3</sup> /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 (m <sup>3</sup> /sec)
50 °C	125	36

## 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).

Oil temperature at normal operating conditions to bearings 105 °C

Oil filter screen spacing ... 20 microns

Sump drain plug tapping size ... G1

Oil pump speed ... 2100 rev/min

Method of drive ... gear

Oil pump flow ... 42 litres/min

### Lubricating oil capacity

-total system capacity... 177 litres  
 -sump maximum... 157,5 litres  
 -sump minimum... 115 litres

### Lubrication oil pressure

-at rated speed ... 400 kPa  
 -minimum at 80 °C... 340 kPa  
 -oil relief valves open ... 400 kPa  
 -shutdown switch pressure setting (where fitted) .. 193 kPa falling

### Normal operating angles

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

### Oil consumption

as a % of fuel consumption ... 0,2  
 (typically after 250 hours of running) ...

## Induction system

Maximum air intake restriction of engine:

- clean filter ..... 2 kPa
- dirty filter ..... 5 kPa
- air filter type ..... paper element

## Exhaust system

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.

## 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 ..... 1224 litres/hour
- Heat retained in fuel to tank ..... 8 kWt
- 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

4012-46TAG3A Tropical cooling - 60 Hz		
Ratings	g/kWhr	litres/hr
Standby	213	390
Prime	213	356
Baseload	210	280
75% Prime	221	277
50% Prime	222	185

**Note:** Fuel consumption calculated on nett rated powers.

### Fuel consumption

4012-46TAG3A Temperate cooling - 60 Hz		
Ratings	g/kWhr	litres/hr
Standby	213	390
Prime	213	356
Baseload	210	281
75% Prime	221	277
50% Prime	222	185

**Note:** Fuel consumption calculated on nett rated powers.

## Electrical system

- Type ..... negative ground / 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 <sup>(1)</sup> ..... 30 amps at 24 volts
  - Hold in current of starter motor
  - solenoid @ -25 °C max ..... 9 amps at 24 volts
  - Stop solenoid pull-in current <sup>(1)</sup> ..... 31 amps at 24 volts
  - Stop solenoid hold-in..... 0,6A at 24 volts
1. All leads to rated at 10 amps minimum

## Cold start recommendations

Temperature range	
5 °C down to -10 °C	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

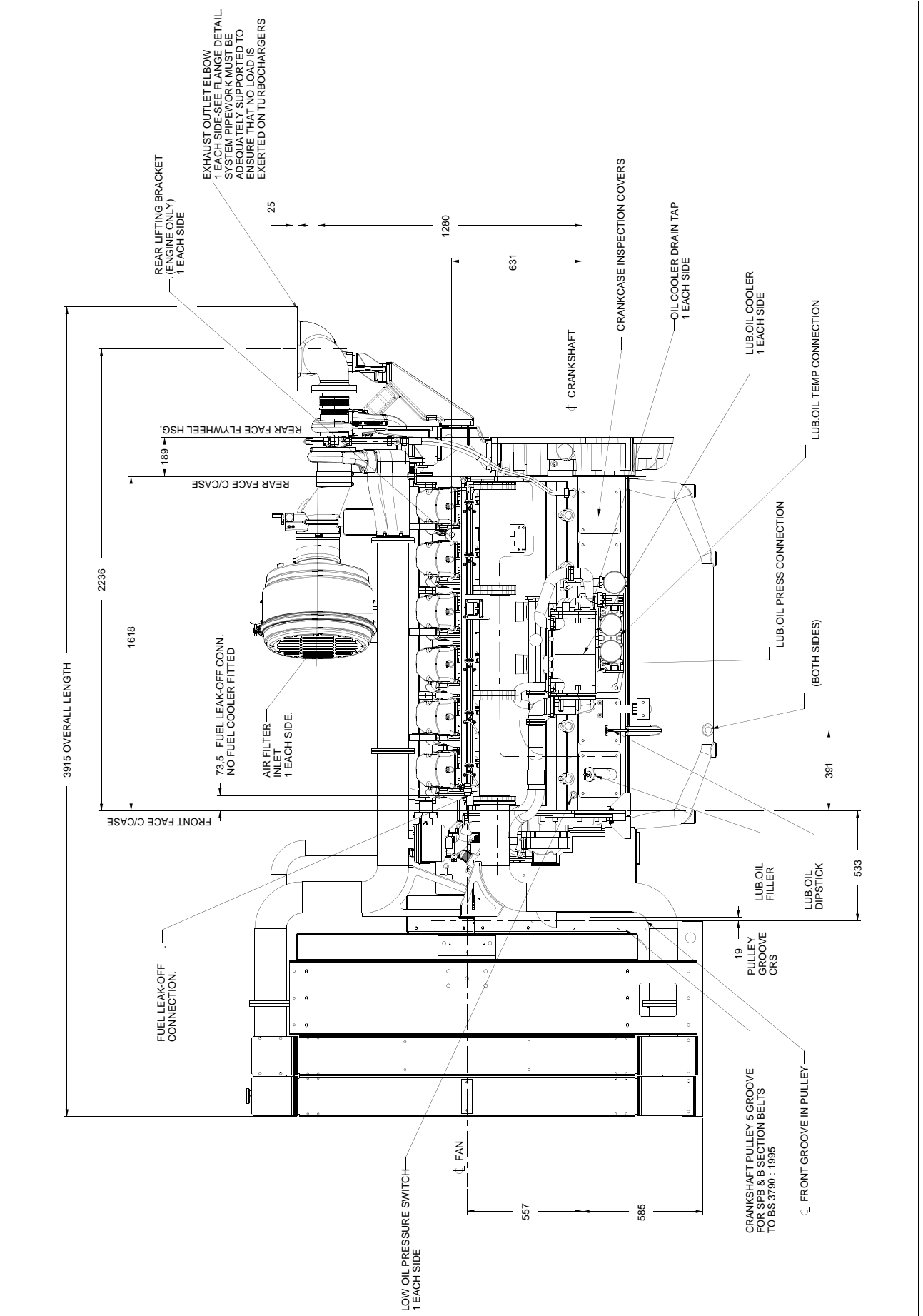
### Notes:

- 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.

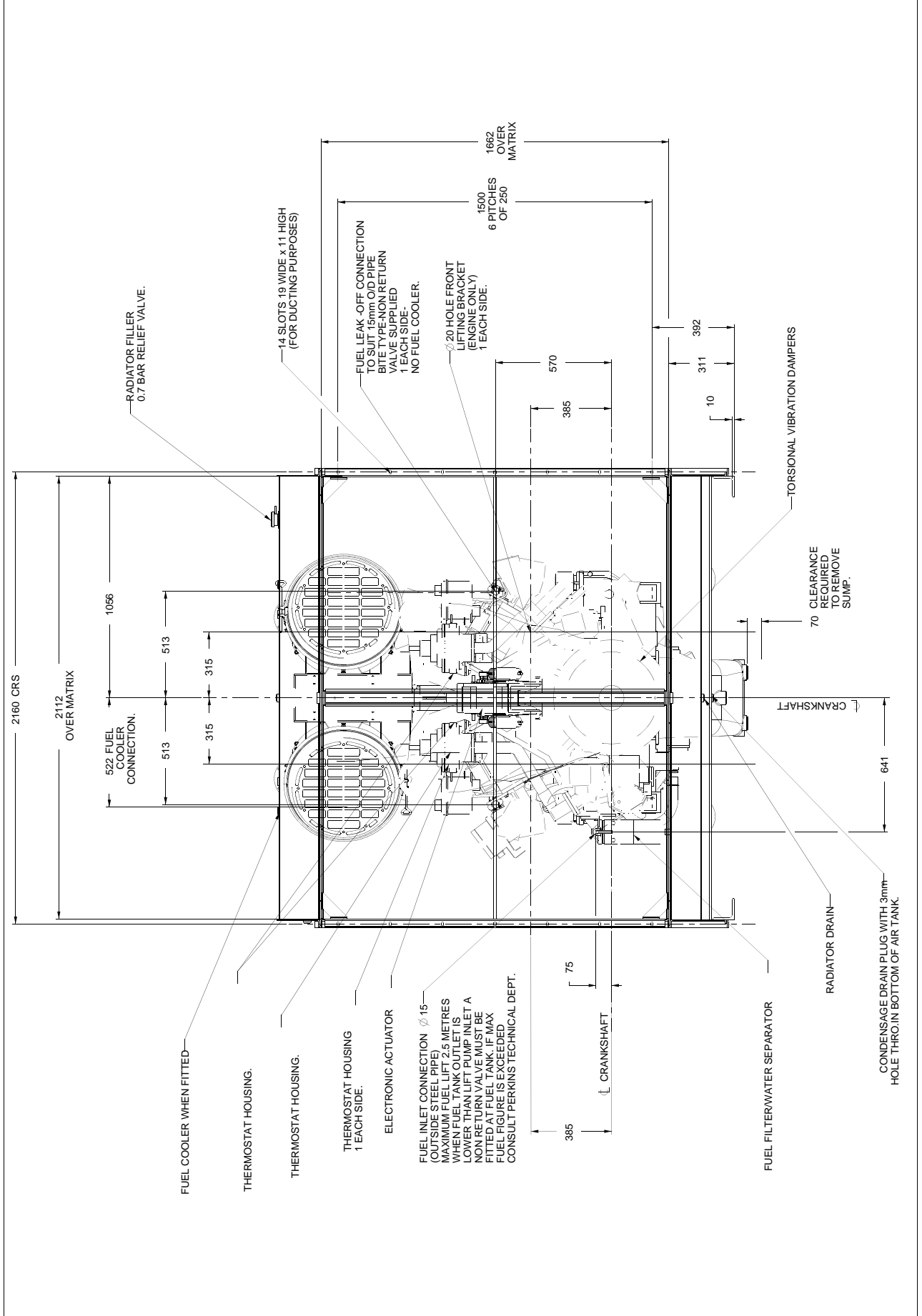
## Engine mounting

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

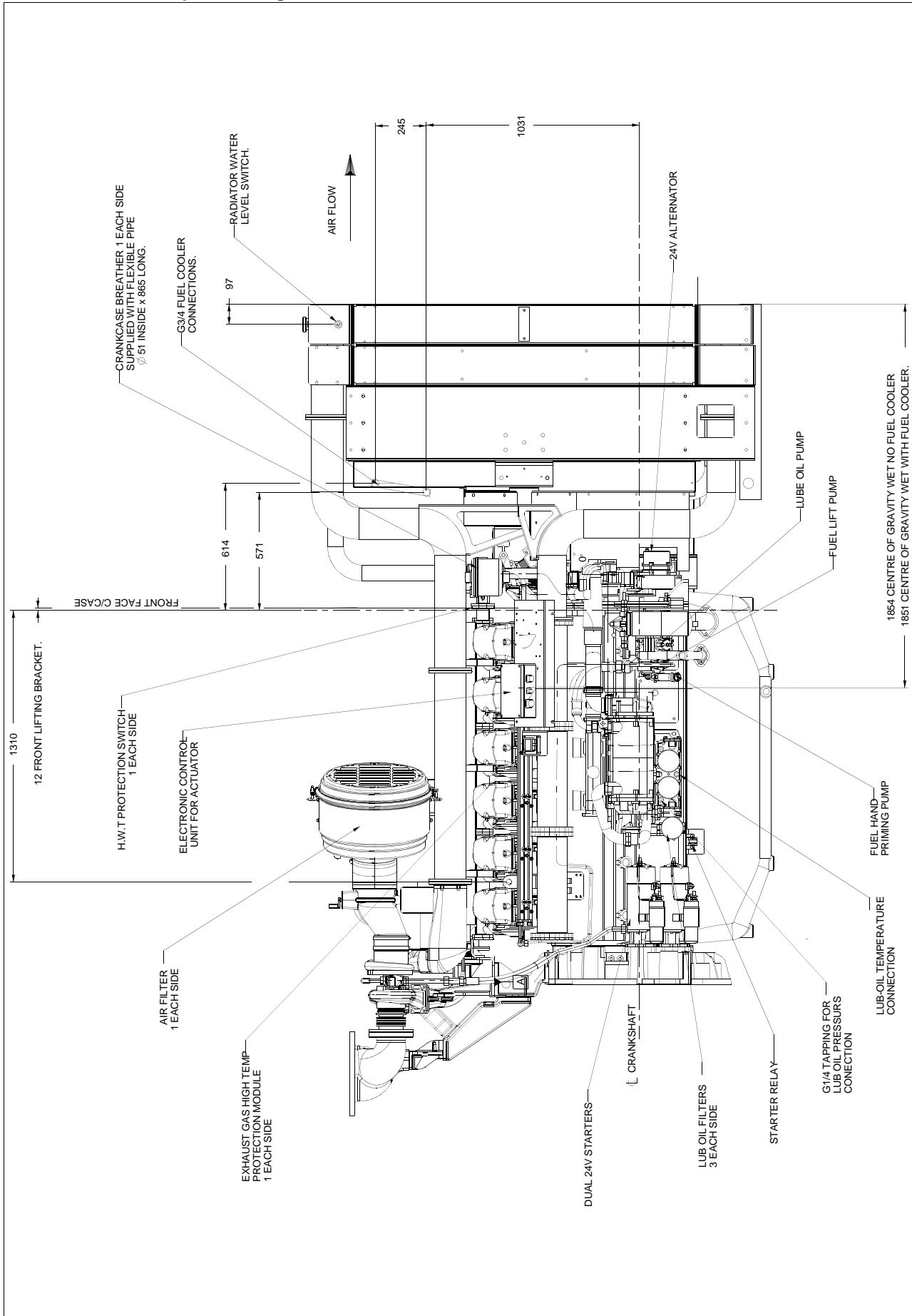
**4012-46TAG3A Temperate - Left hand side view**



4012-46TAG3A Temperate - Front view

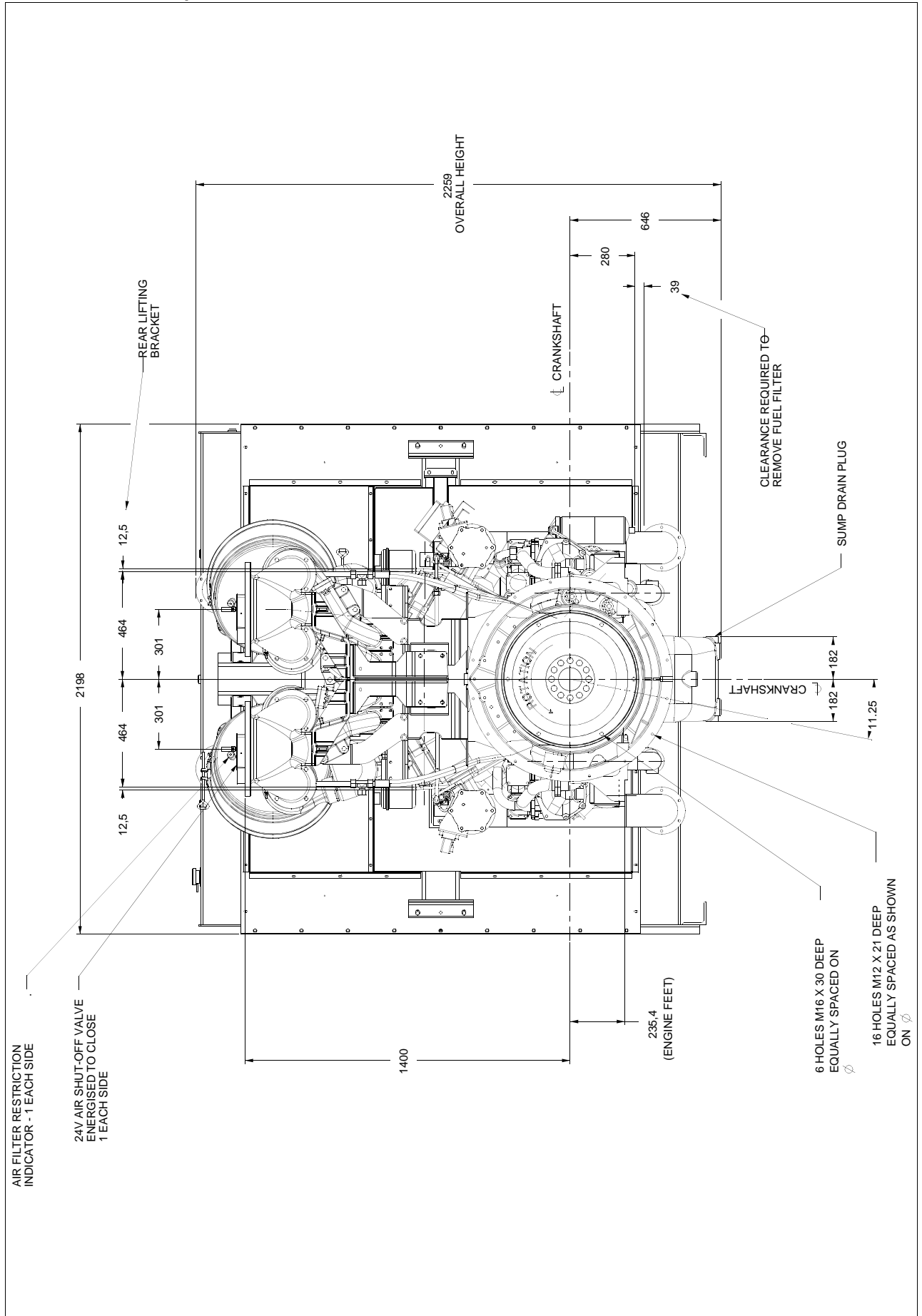


# 4012-46TAG3A Temperate - Right hand side view

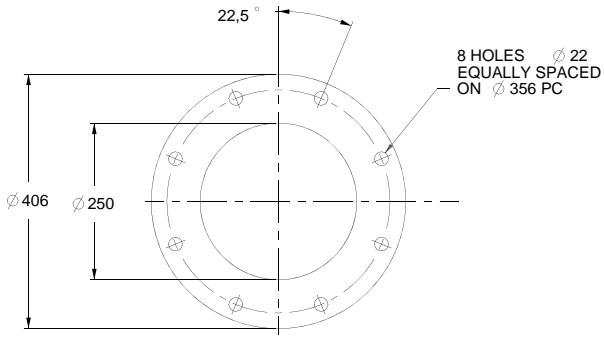




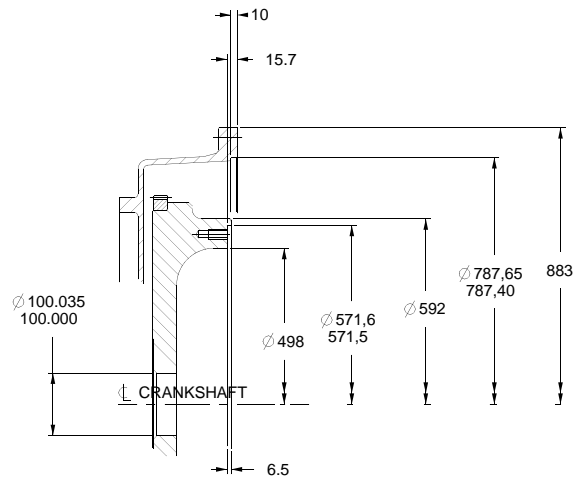
4012-46TAG3A Temperate - Rear view



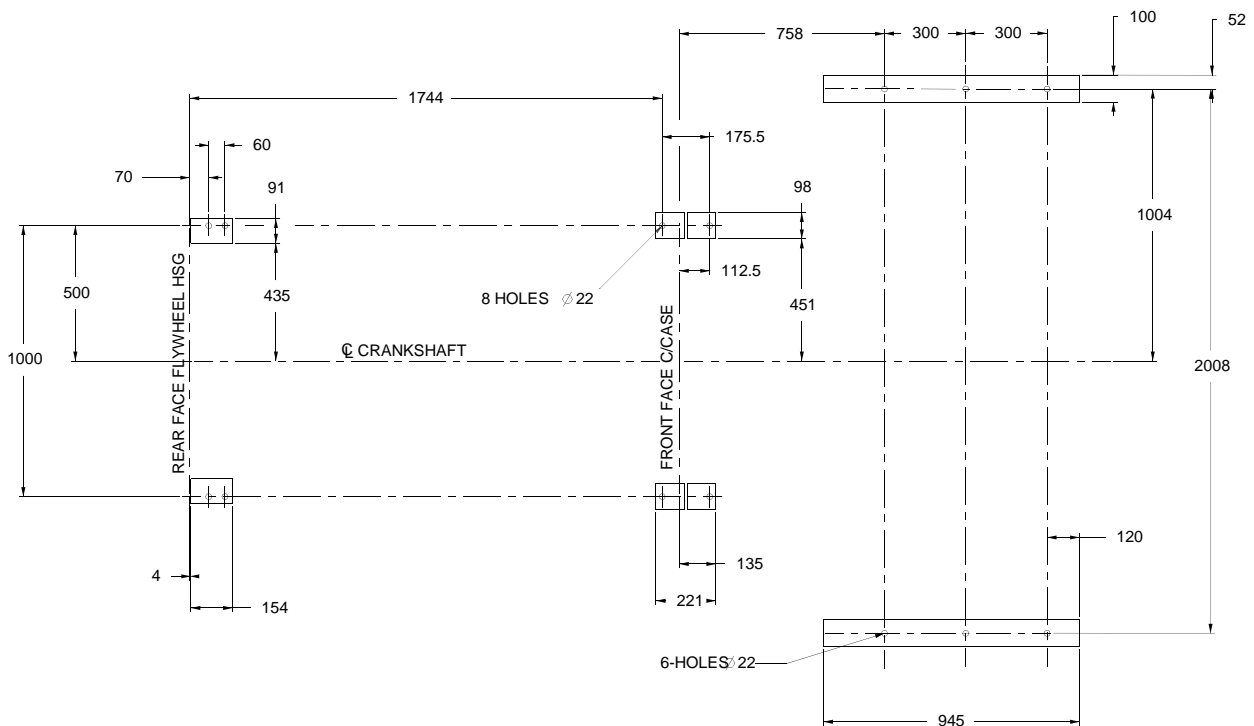
**4012-46TAG3A Temperate - Plan view of support pads, exhaust outlet flange and flywheel**



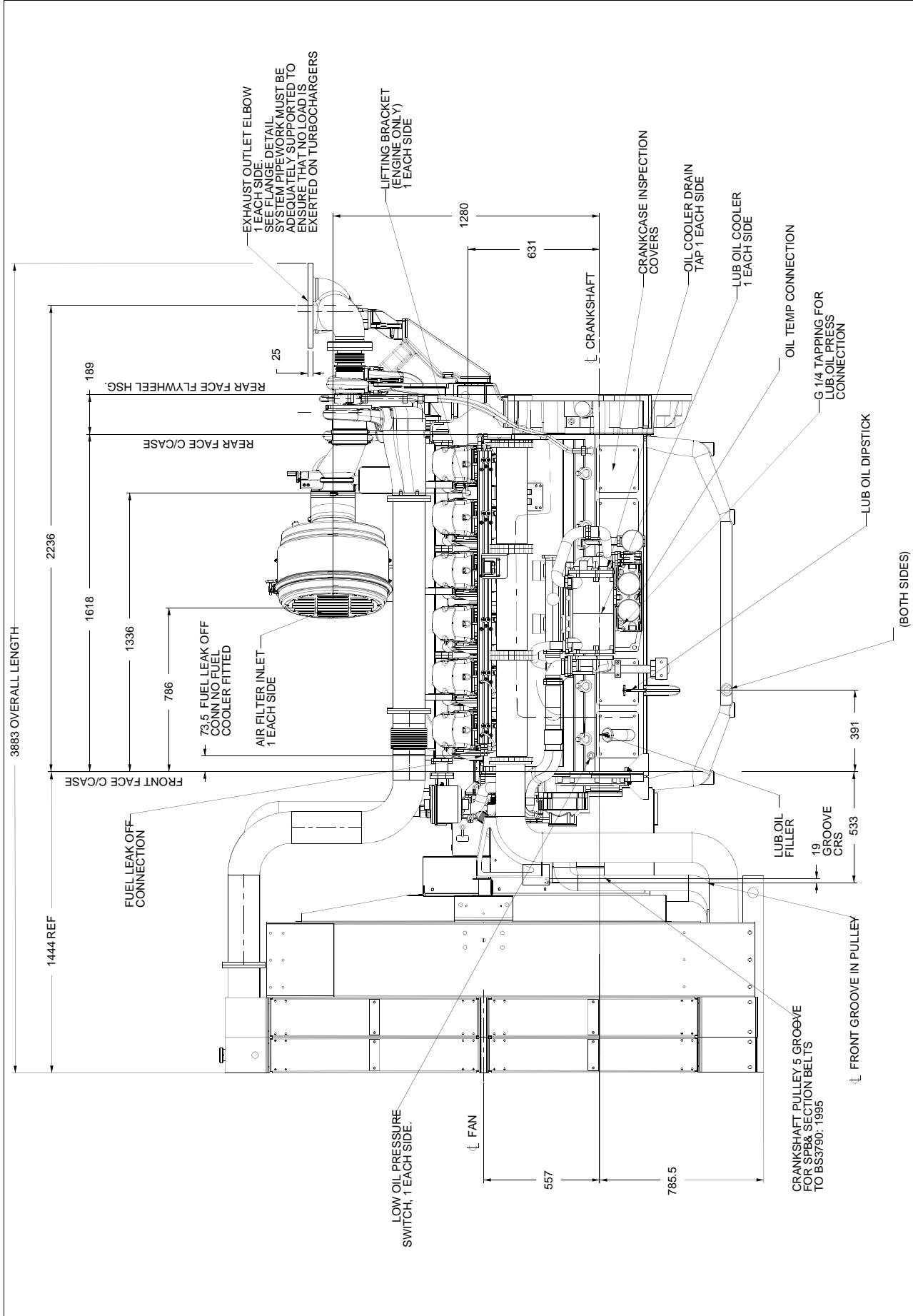
DETAIL OF EXHAUST OUTLET FLANGE  
(B.S.10 TABLE D)  
SCALE 1:5



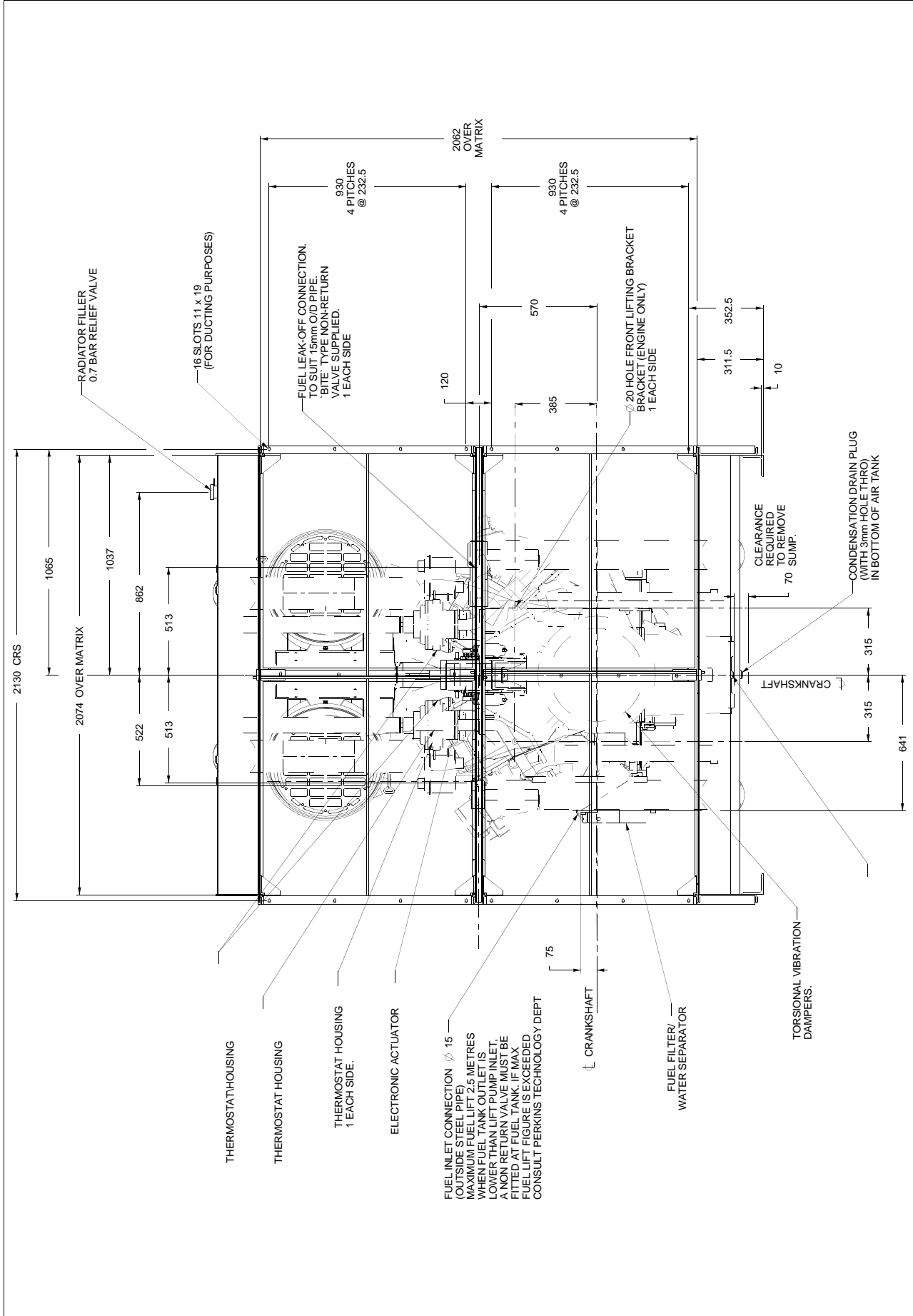
DETAIL OF SAE 518 FLYWHEEL  
AND SAE 00 FLYWHEEL HOUSING  
(METRIC TAPPINGS)  
SCALE 1:5



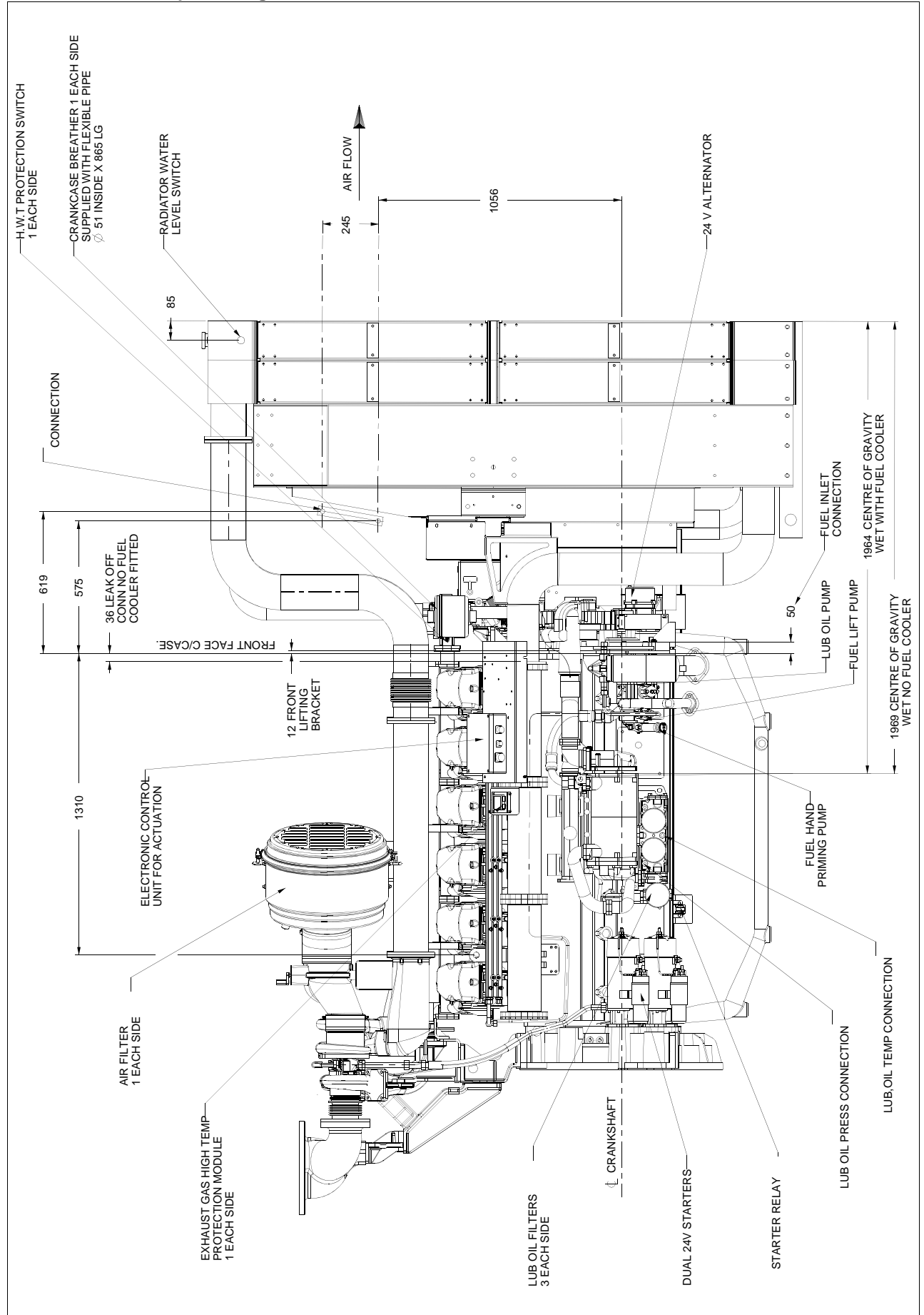
4012-46TAG3A Tropical - Left hand side view



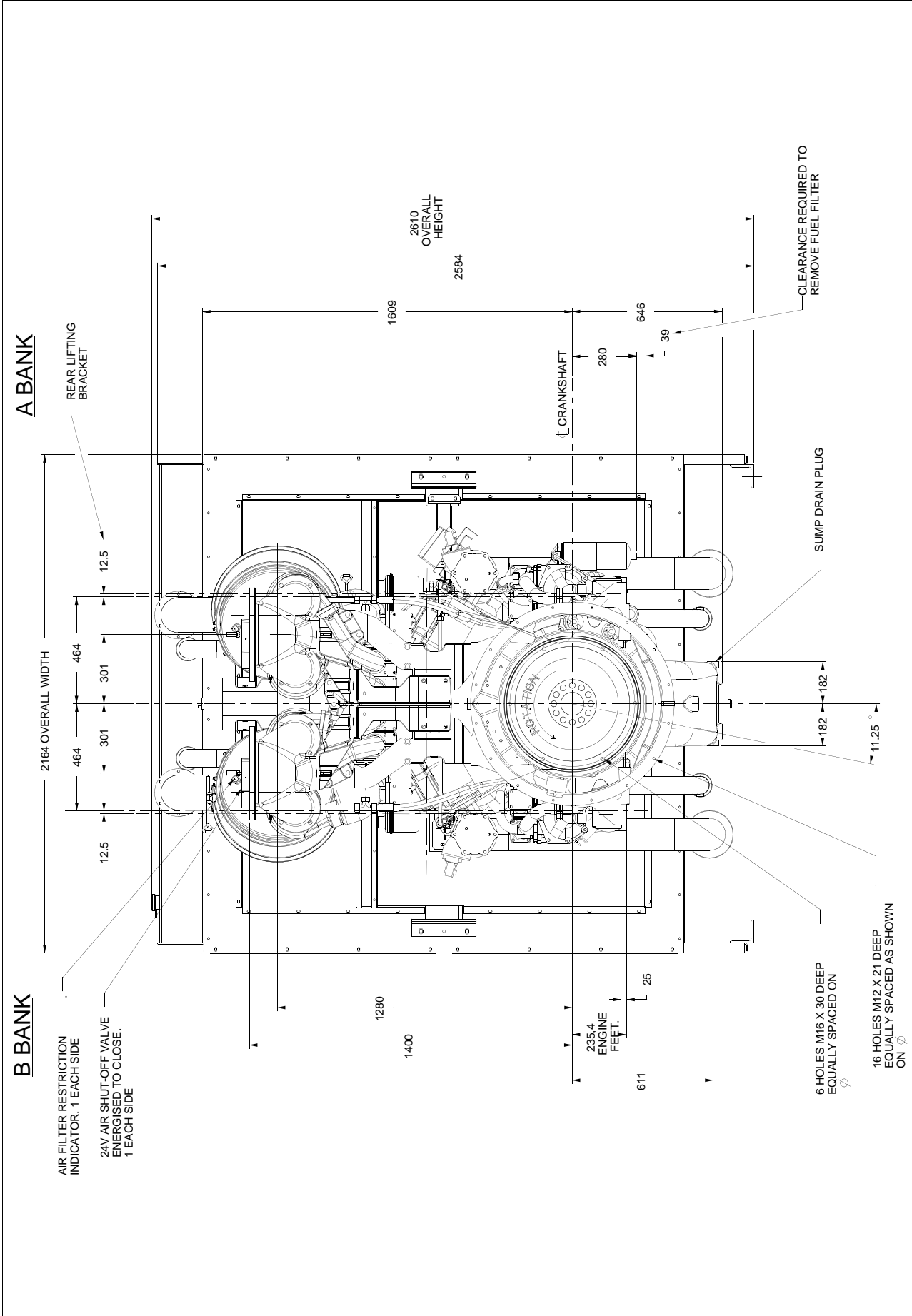
**4012-46TAG3A Tropical - Front view**



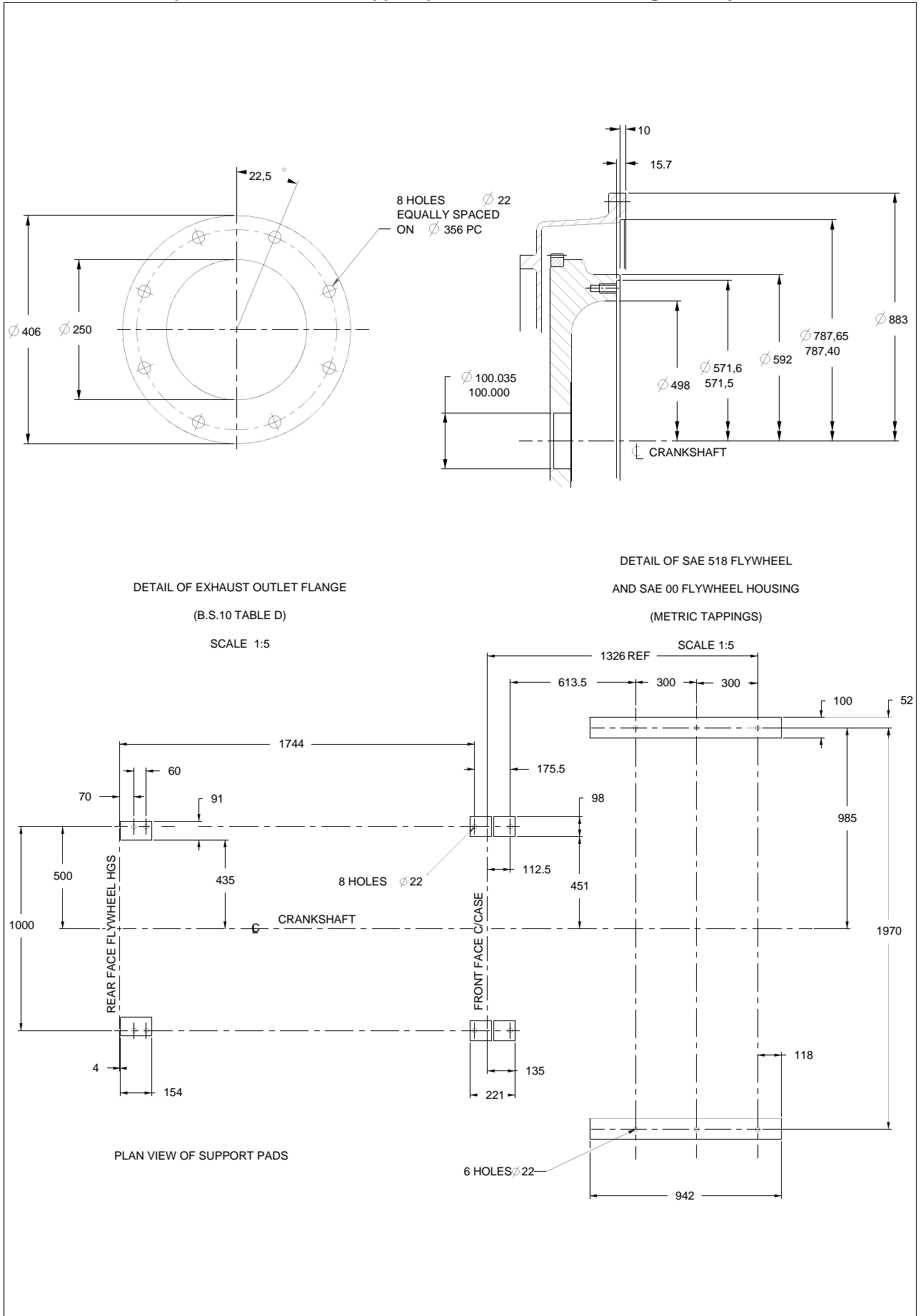
# 4012-46TAG3A Tropical - Right hand side view



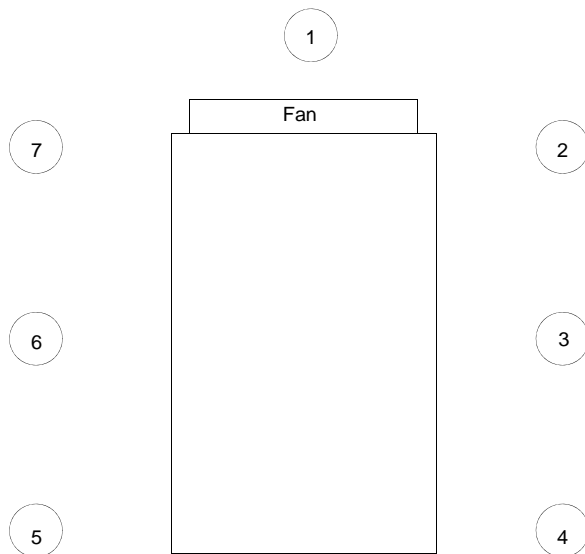
4012-46TAG3A Tropical - Rear view



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



**Noise**



1800 rev/mins standby power	
Position	dB(A)
1	110
2	114
3	114
4	108
5	109
6	113
7	113

1800 rev/mins standby power	
1/3 (1/1 bandwidth)	
Octave analysis	
Hz	dB @ position 3
31.5	91
63	99
125	94.6
250	105
500	110
1k	104
2k	100
4k	98
8k	96

**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.

**Typical load acceptance (cold)**

Engine type	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)			
	Prime power%	Load kW net	Transient frequency deviation %	Frequency recovery time seconds	Prime power%	Load kW net	Transient frequency deviation %	Frequency recovery time seconds
4012-46TAG3A	70	955	≤ 10	5	30	341	≤ 10	5

The above figures were obtained under test conditions as follows:

- Engine block temperature . . . . . 45 °C
- Ambient temperature . . . . . 15 °C
- Governing mode . . . . . Isochronous
- Alternator inertia. . . . . 50 kgm<sup>2</sup>
- Under frequency roll off (UFRO) point set to . . . . . 1 Hz below rated
- UFRO rate set to . . . . . 2% voltage / 1% frequency
- 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.**

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