

# Technical Data

## 4000 Series

## 4012-46TWG2A

## 4012-46TWG3A

### Diesel Engine - ElectropaK

### 1800 rev/min

#### Basic technical data

Number of cylinders	12
Cylinder arrangement	Vee 60°
Cycle	4 stroke, compression ignition
Induction system	turbocharged
Combustion system	direct injection
Compression ratio	13:1
Bore	160 mm
Stroke	190 mm
Cubic capacity	45-482 litres
Direction of rotation	Anti clockwise viewed on 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.

#### Total weight of ElectropaK

Engine - dry	
-temperate	4440 kg
-tropical	4440 kg
ElectropaK - dry <sup>(1)</sup>	
-temperate	5220 kg
-tropical	5283 kg
ElectropaK - wet <sup>(1) (2)</sup>	
-temperate	5547 kg
-tropical	5615 kg

1. Includes fuel cooler.

2. Includes engine lubricating oil and water jacket

#### Overall dimensions of ElectropaK

Height	2255 mm
Length	3714 mm
Width	
-temperate	1780 mm
-tropical	1978 mm

#### Moment of inertia (mk<sup>2</sup>)

Flywheel	9,57 kgm <sup>2</sup>
Engine	9,73 kgm <sup>2</sup>

#### Cyclic irregularity

For engine/flywheel maximum:

-4012-46TWG2A @ 1800 rev/min	1:1147
-4012-46TWG3A @ 1800 rev/min	1:752

#### Ratings

Steady state speed stability at constant load  $\pm 0,25\%$   
 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	spill timing 22°
Cooling water exit temperature	< 98 °C

#### Performance

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

Estimated sound pressure level at 1 metre 112 d(B)A

**Note:** Noise levels represent highest recorded at 1800 rev/min

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 temperatures 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 power (nominal)	3,0 kPa
-maximum fuel temperature (inlet pump)	58 °C

For test conditions relevant to data on load acceptance, please refer to Cold start recommendations on page 22 of this document.

**General installation - 4012-46TWG2A (Temperate) 60 Hz @ 1800 rev/min**

Designation	Units	Type of operation and application		
		Base	Prime	Standby
Gross engine power	kWb	884	1106	1217
Fan and battery charging alternator power	kW	51		
Net engine power	kWm	833	1055	1166
Brake mean effective pressure (gross)	kPa	1286	1608	1770
Combustion air flow at ISO conditions	m <sup>3</sup> /min	95	109	114
Exhaust gas temperature (max) after turbo	°C	430		
Exhaust gas flow (max) at atmospheric pressure	m <sup>3</sup> /min	235		
Boost pressure ratio	-	2.40	2.80	3.00
Mechanical efficiency	%	88.0	90.1	91.0
Overall thermal efficiency (nett)	%	37.5	37.0	38.0
Friction and pumping power losses	kWm	121		
Mean piston speed	m/s	11,4		
Engine coolant flow	l/min	1000		
Typical GenSet electrical output (0.8pf)	kVA	989	1253	1385
	kWe	791	1002	1108
Assumed alternator efficiency	%	95		

**General installation - 4012-46TWG2A (Tropical) 60 Hz @ 1800 rev/min**

Designation	Units	Type of operation and application		
		Base	Prime	Standby
Gross engine power	kWb	891	1113	1224
Fan and battery charging alternator power	kW	58		
Net engine power	kWm	833	1055	1166
Brake mean effective pressure (gross)	kPa	1296	1619	1780
Combustion air flow at ISO conditions	m <sup>3</sup> /min	96	111	116
Exhaust gas temperature (max) after turbo	°C	435		
Exhaust gas flow (max) at atmospheric pressure	m <sup>3</sup> /min	235		
Boost pressure ratio	-	2.41	2.81	3.00
Mechanical efficiency	%	88	90	91
Overall thermal efficiency (nett)	%	37,5	37,0	38,0
Friction and pumping power losses	kWm	121		
Mean piston speed	m/s	11,4		
Engine coolant flow	l/min	1000		
Typical GenSet electrical output (0.8pf)	kVA	989	1253	1385
	kWe	791	1002	1108
Assumed alternator efficiency	%	95		

**Notes:**

- All quoted gross engine powers include an allowance of 1.5% for installation variance
- Not to be used for CHP design purposes (indicative figures only). Consult Perkins Engines Stafford Limited. Assumes complete combustion.

### General installation - 4012-46TWG3A (Temperate), 60 Hz @ 1800 rev/min

Designation	Units	Type of operation and application		
		Base	Prime	Standby
Gross engine power	kWb	960	1200	1314
Fan and battery charging alternator power	kW	51		
Net engine power	kWm	909	1149	1263
Brake mean effective pressure (gross)	kPa	1396	1745	1911
Combustion air flow at ISO conditions	m <sup>3</sup> /min	96	110	116
Exhaust gas temperature (max) after turbo	°C	478		
Exhaust gas flow (max) at atmospheric pressure	m <sup>3</sup> /min	250		
Boost pressure ratio	-	2.60	3.10	3.30
Mechanical efficiency	%	87.0	90.0	91.0
Overall thermal efficiency (nett)	%	37.0	38.0	38.0
Friction and pumping power losses	kWm	122		
Mean piston speed	m/s	11.4		
Engine coolant flow	l/min	1000		
Typical GenSet electrical output (0.8pf)	kVA	1079	1364	1500
	kWe	864	1092	1200
Assumed alternator efficiency	%	95		

### General installation - 4012-46TWG3A (Tropical), 60 Hz @ 1800 rev/min

Designation	Units	Type of operation and application		
		Base	Prime	Standby
Gross engine power	kWb	967	1207	1321
Fan and battery charging alternator power	kW	58		
Net engine power	kWm	909	1149	1263
Brake mean effective pressure (gross)	kPa	1406	1755	1921
Combustion air flow at ISO conditions	m <sup>3</sup> /min	96	111	117
Exhaust gas temperature (max) after turbo	°C	482		
Exhaust gas flow (max) at atmospheric pressure	m <sup>3</sup> /min	240		
Boost pressure ratio	-	2.60	3.10	3.30
Mechanical efficiency	%	87.0	90.0	91.0
Overall thermal efficiency (nett)	%	37.0	38.0	38.0
Friction and pumping power losses	kWm	122		
Mean piston speed	m/s	11.4		
Engine coolant flow	l/min	1000		
Typical GenSet electrical output (0.8pf)	kVA	1079	1364	1500
	kWe	864	1092	1200
Assumed alternator efficiency	%	95		

#### Notes:

- All quoted gross engine powers include an allowance of 1.5% for installation variance
- Not to be used for CHP design purposes (indicative figures only). Consult Perkins Engines Stafford Limited. Assumes complete combustion.

## 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 rating over each 24 hr. period 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.

### Emissions capability

All 4012-46TWG 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

### 4012-46TWG2A - Temperate

Designation	Units	Baseload	Prime	Standby
Energy in fuel	kWt	2157	2691	3057
Energy in power output (gross)	kWb	884	1106	1217
Energy to cooling fan	kWm	51		
Energy in power output (nett)	kWm	833	1055	1166
Energy to exhaust	kWt	711	914	1050
Energy to coolant and oil	kWt	358	387	450
Energy to radiation	kWt	67	81	90
Energy to charge cooler	kWt	136	203	250

### 4012-46TWG2A - Tropical

Designation	Units	Baseload	Prime	Standby
Energy in fuel	kWt	2172	2712	3084
Energy in power output (gross)	kWb	891	1113	1224
Energy to cooling fan	kWm	58		
Energy in power output (nett)	kWm	833	1055	1166
Energy to exhaust	kWt	717	921	1055
Energy to coolant and oil	kWt	359	389	457
Energy to radiation	kWt	67	84	96
Energy to charge cooler	kWt	138	205	252

### 4012-46TWG3A - Temperate

Designation	Units	Baseload	Prime	Standby
Energy in fuel	kWt	2319	2940	3322
Energy in power output (gross)	kWb	960	1200	1314
Energy to cooling fan	kWm	51		
Energy in power output (nett)	kWm	909	1149	1263
Energy to exhaust	kWt	767	1010	1150
Energy to coolant and oil	kWt	363	407	480
Energy to radiation	kWt	72	90	100
Energy to charge cooler	kWt	157	232	278

### 4012-46TWG3A - Tropical

Designation	Units	Baseload	Prime	Standby
Energy in fuel	kWt	2302	2920	3344
Energy in power output (gross)	kWb	967	1207	1321
Energy to cooling fan	kWm	58		
Energy in power output (nett)	kWm	909	1149	1263
Energy to exhaust	kWt	755	995	1155
Energy to coolant and oil	kWt	355	400	490
Energy to radiation	kWt	71	88	100
Energy to charge cooler	kWt	154	229	278

**Note:** Not to be used for combined heat and power (CHP) purposes (indicative figures only), if required, please consult Perkins Engines Company Limited.

## Exhaust system

Outlet size (internal) ... .. 2 x 254 mm  
 Outlet flange size ... .. 10" table D  
 Back pressure for total system... .. 5.0 kPa  
 For recommended pipe sizes, refer to the Installation Manual.

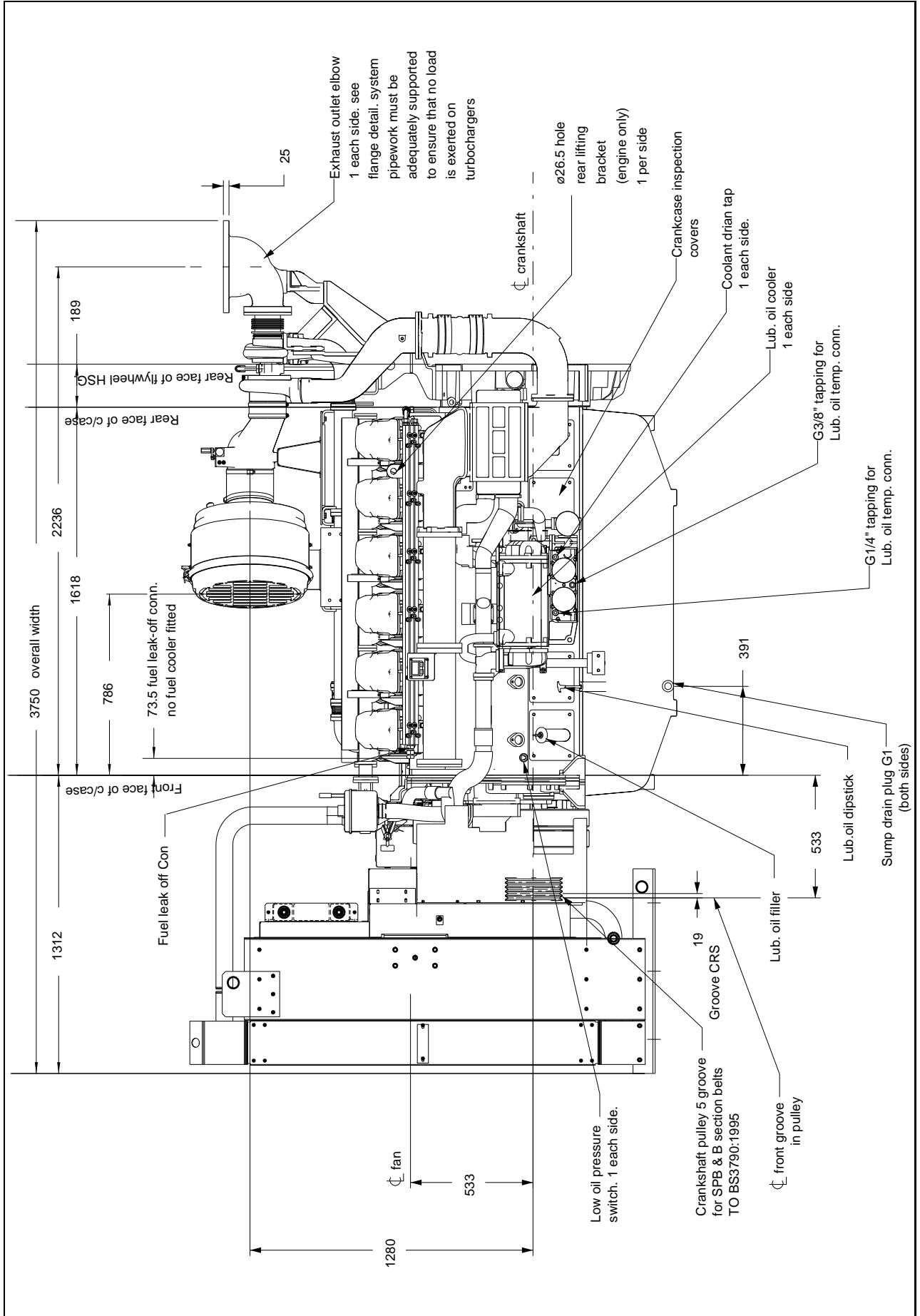
## Induction system

Emissions data with combustion air temperature of 25 °C

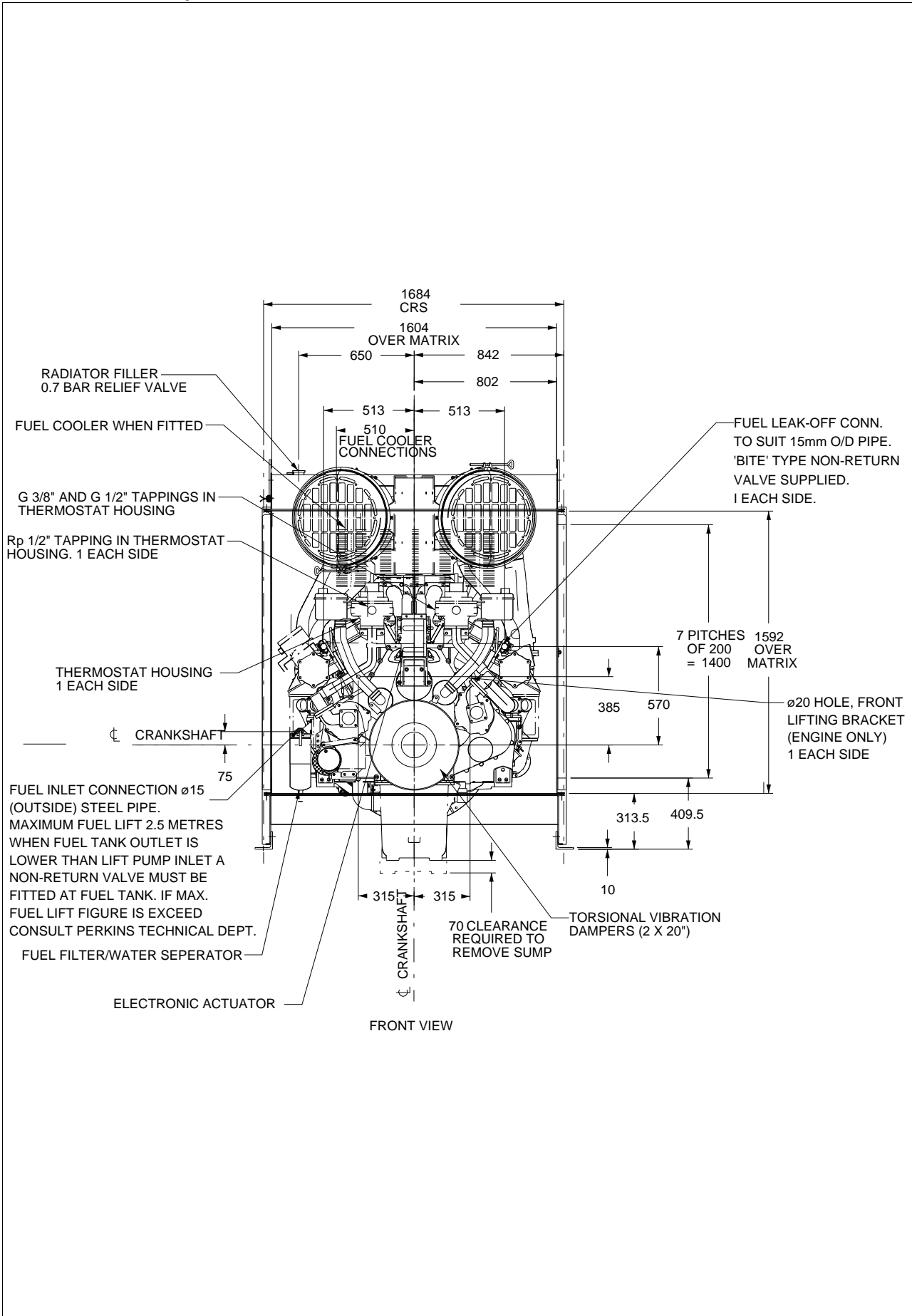
Maximum air intake restriction of engine:

-clean filter ... .. 2.0 kPa  
 -dirty filter ... .. 4.0 kPa  
 -air filter type ... .. cylindrical paper pleat

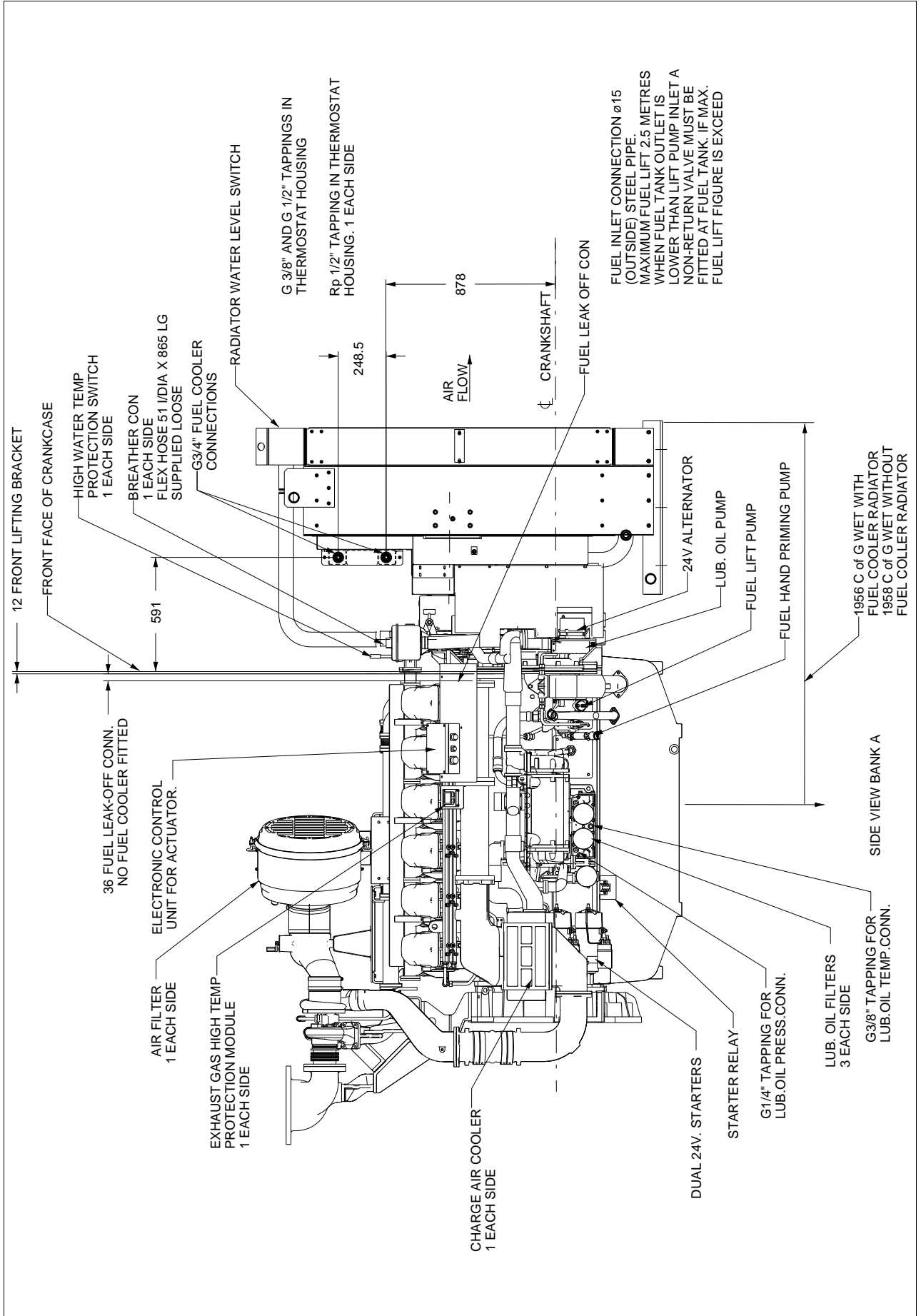
4012-46TWG2A Temperate - left view



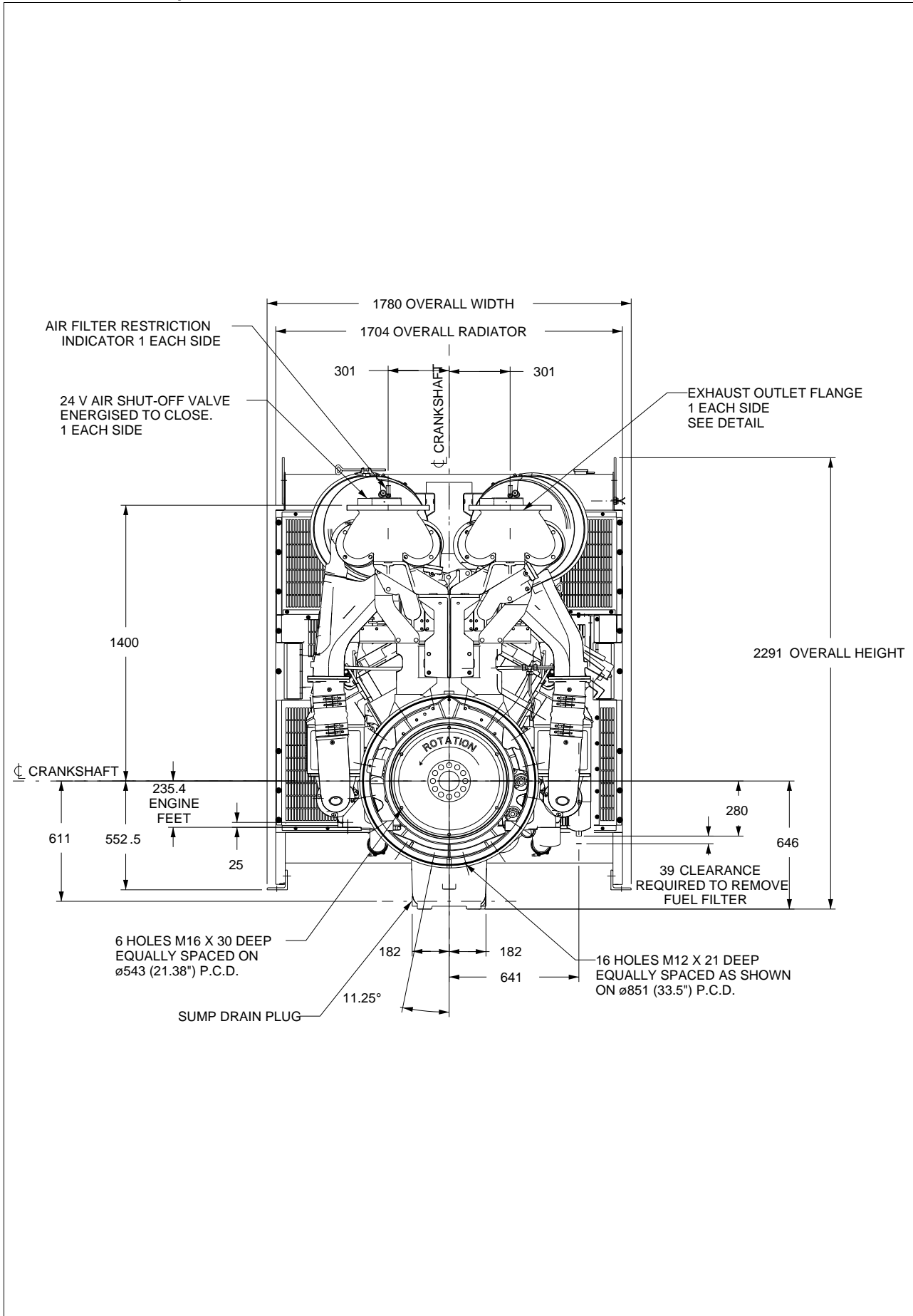
**4012-46TWG2A Temperate - front view**



4012-46TWG2A Temperate - right view

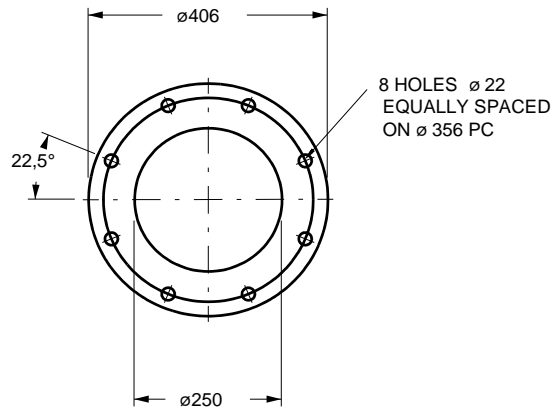


4012-46TWG2A Temperate - rear view

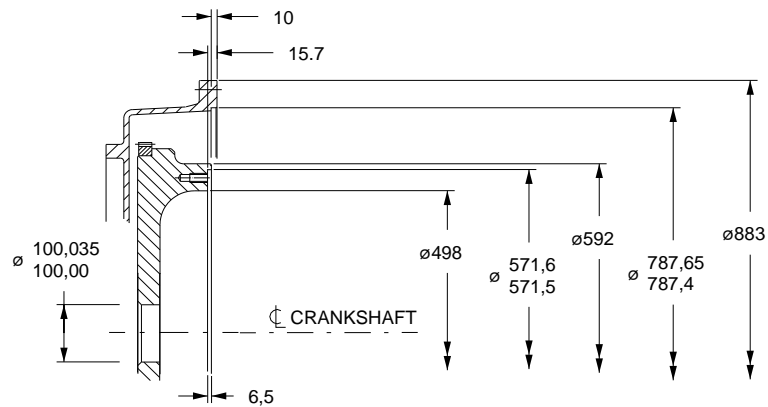




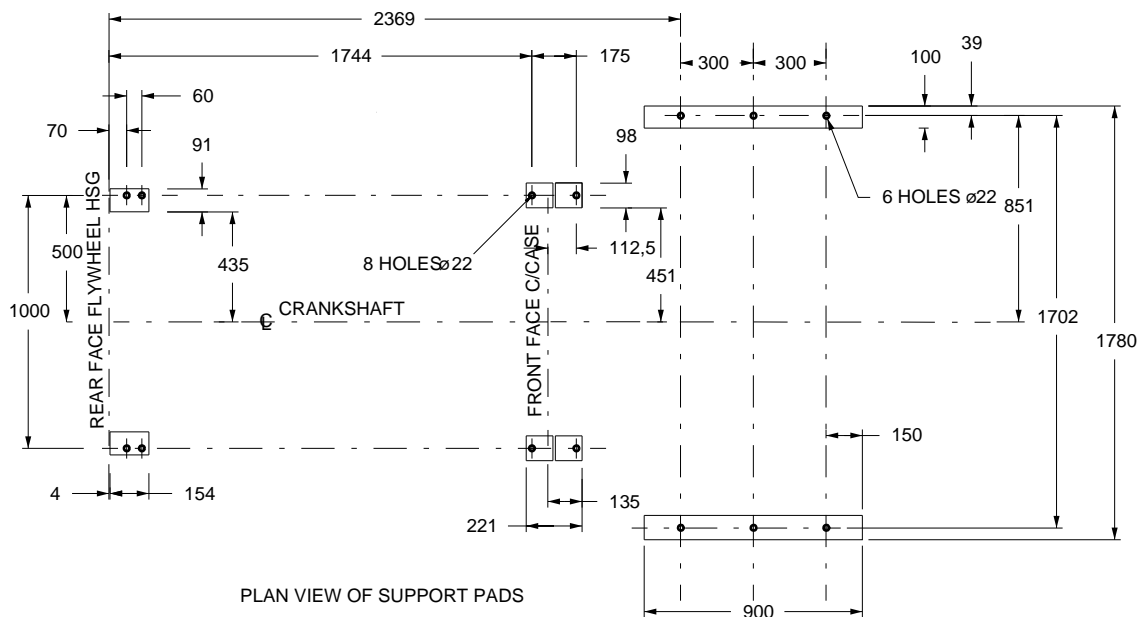
4012-46TWG2A Temperate - Support pads, exhaust outlet flange and flywheel detail



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

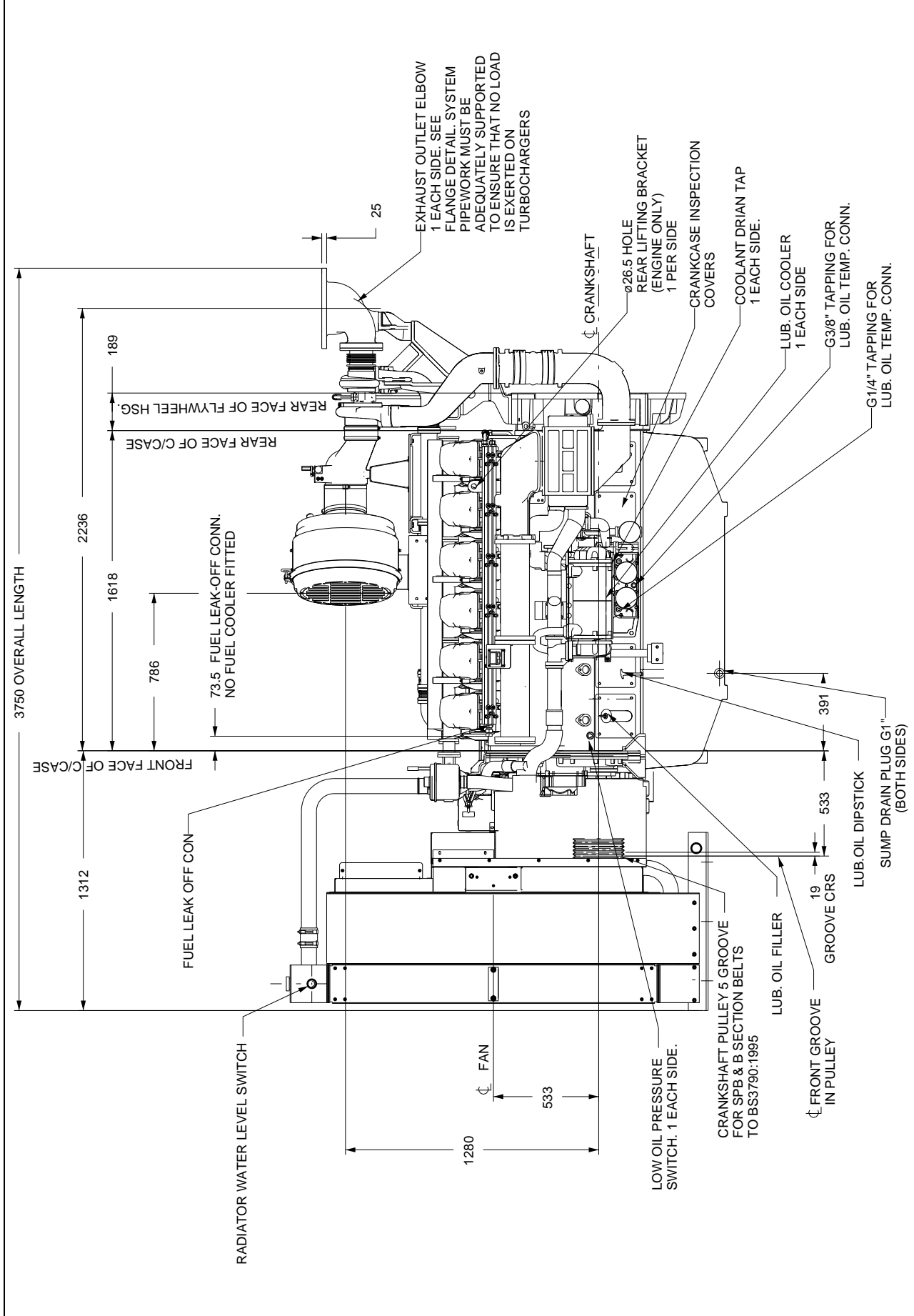


DETAIL OF SAE 518 FLYWHEEL  
AND SAE 00 FLYWHEEL HOUSING  
(METRIC TAPPINGS)  
SCALE 1:5

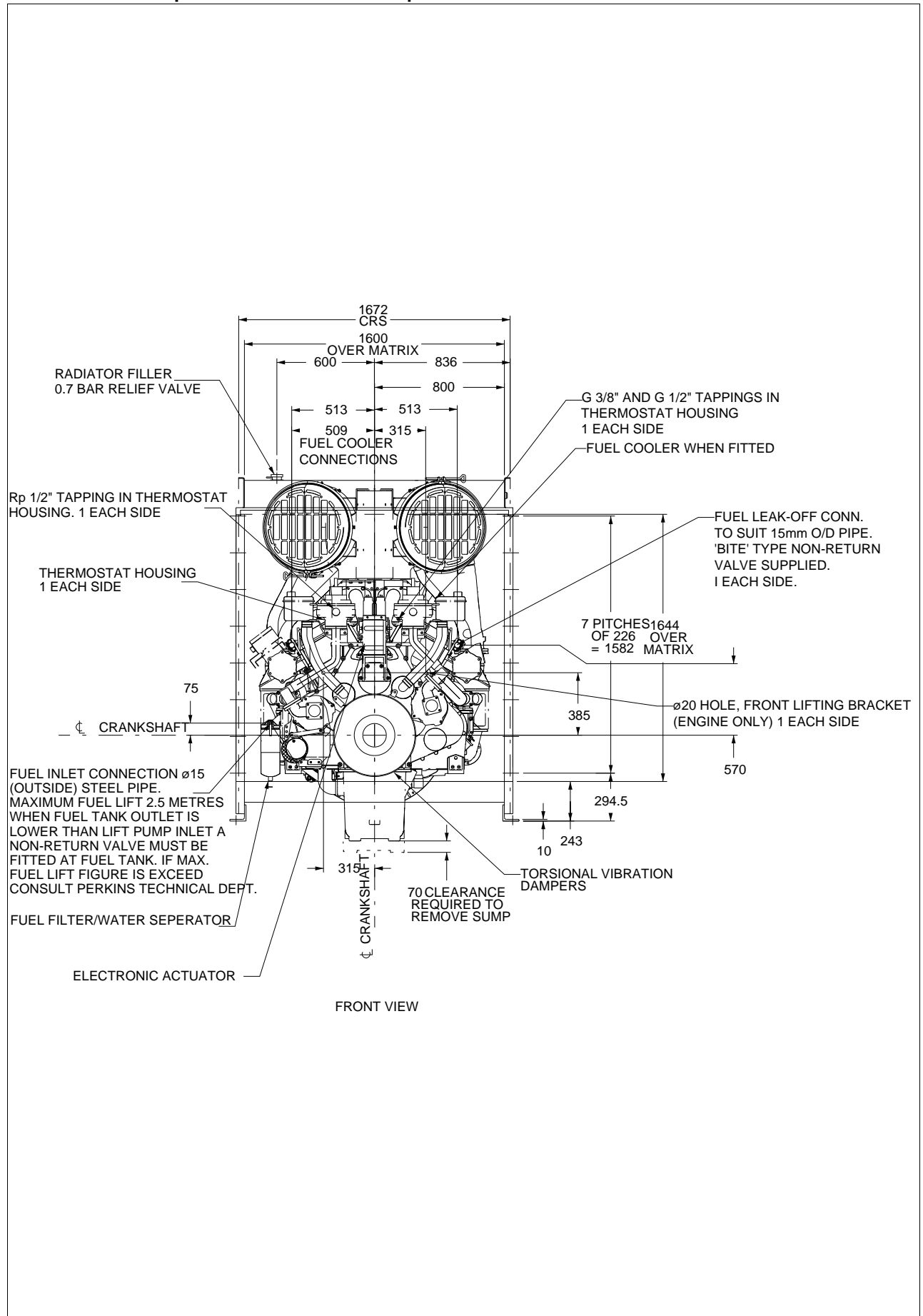


PLAN VIEW OF SUPPORT PADS

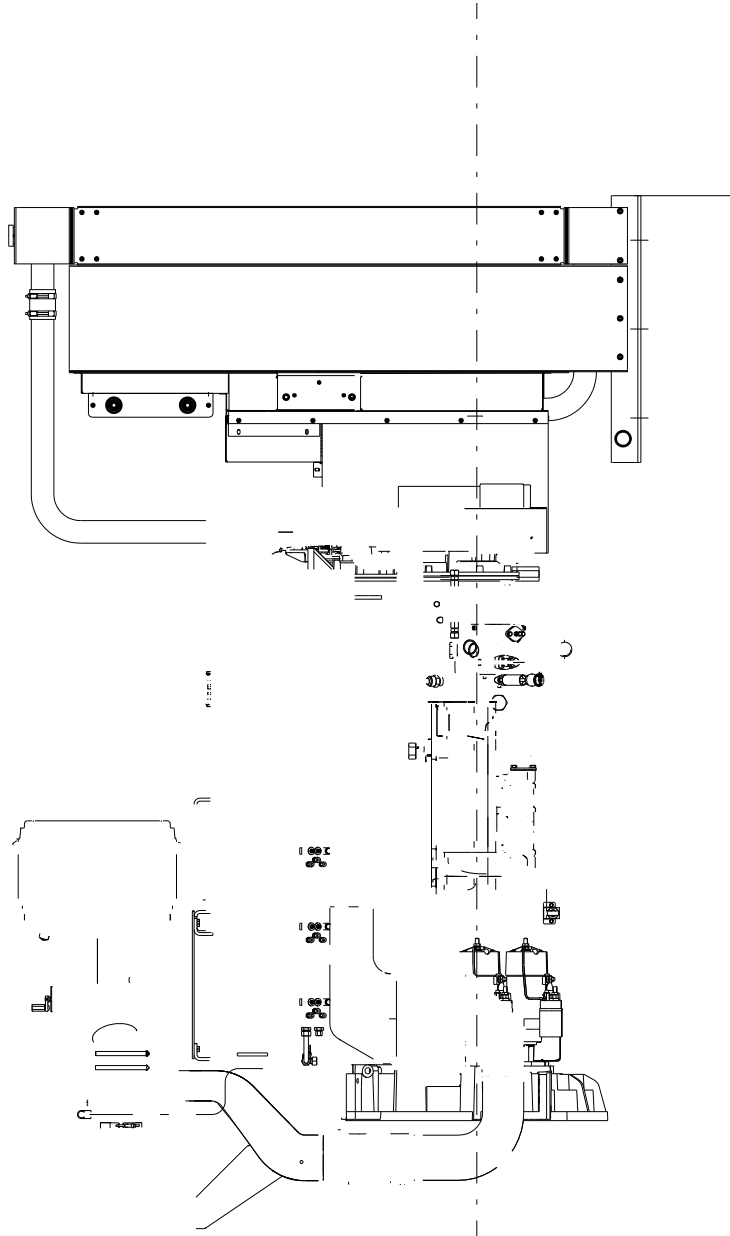
4012-46TWG2A Tropical - 4012-46TWG3A Temperate - left view



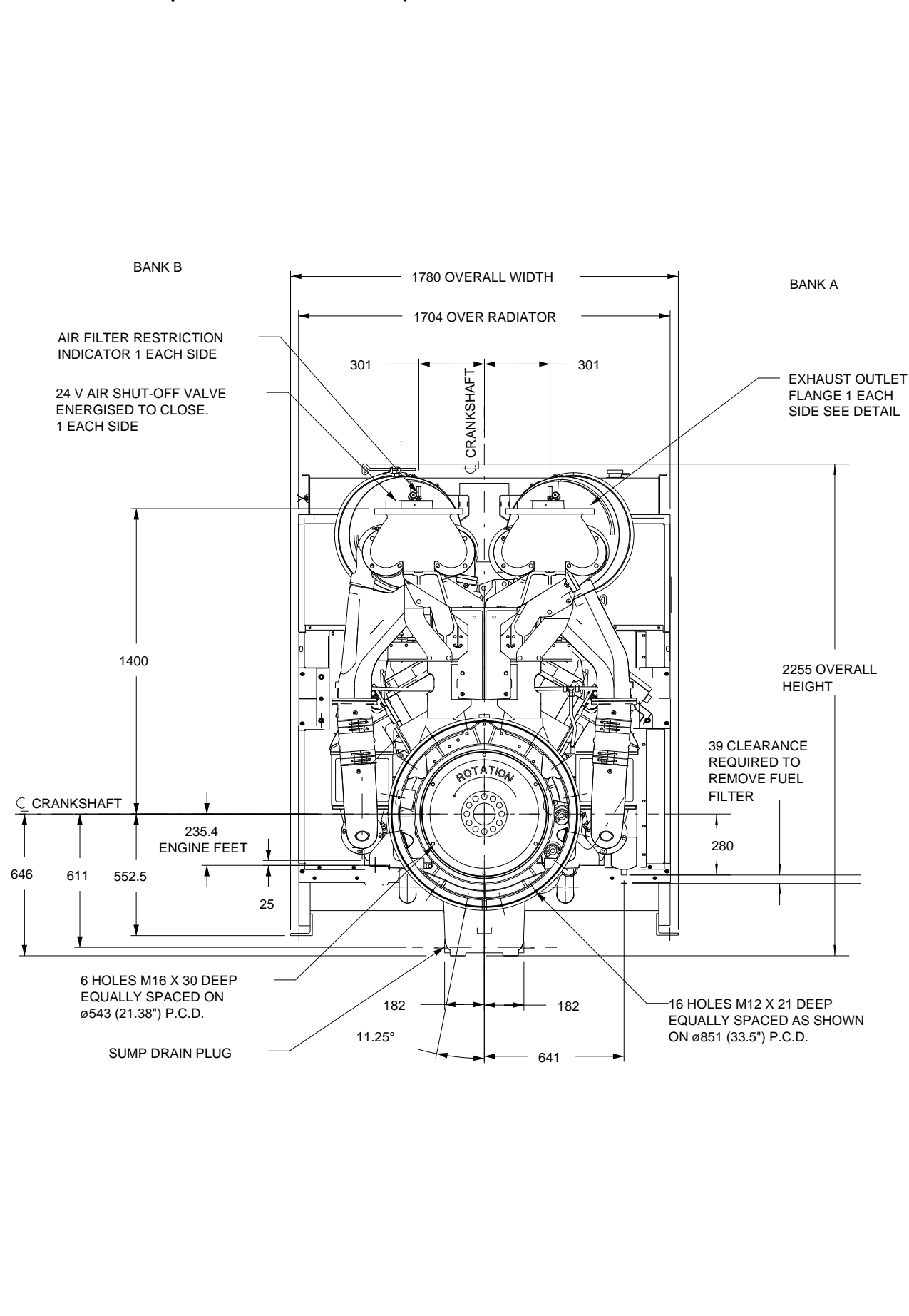
4012-46TWG2A Tropical - 4012-46TWG3A Temperate - front view



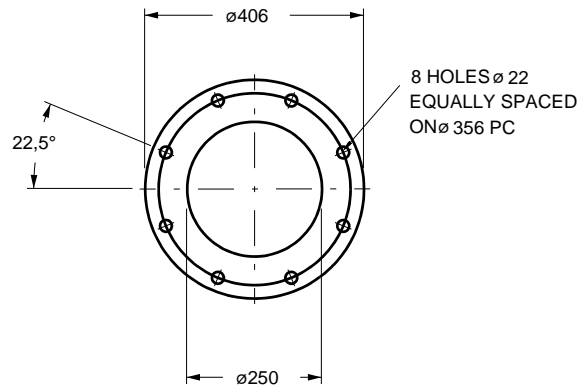
4012-46TWG2A Tropical - 4012-46TWG3A Temperate - right view



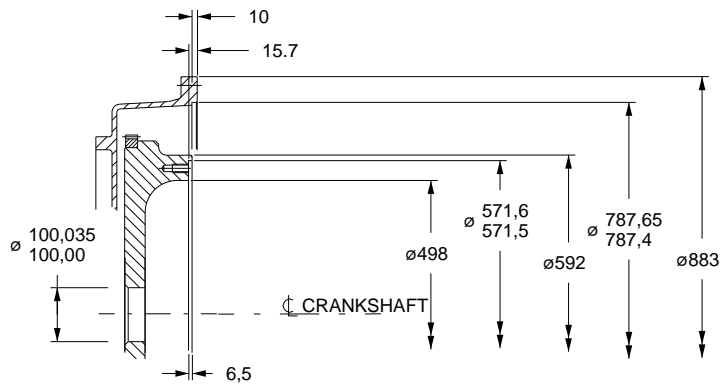
4012-46TWG2A Tropical - 4012-46TWG3A Temperate- rear view



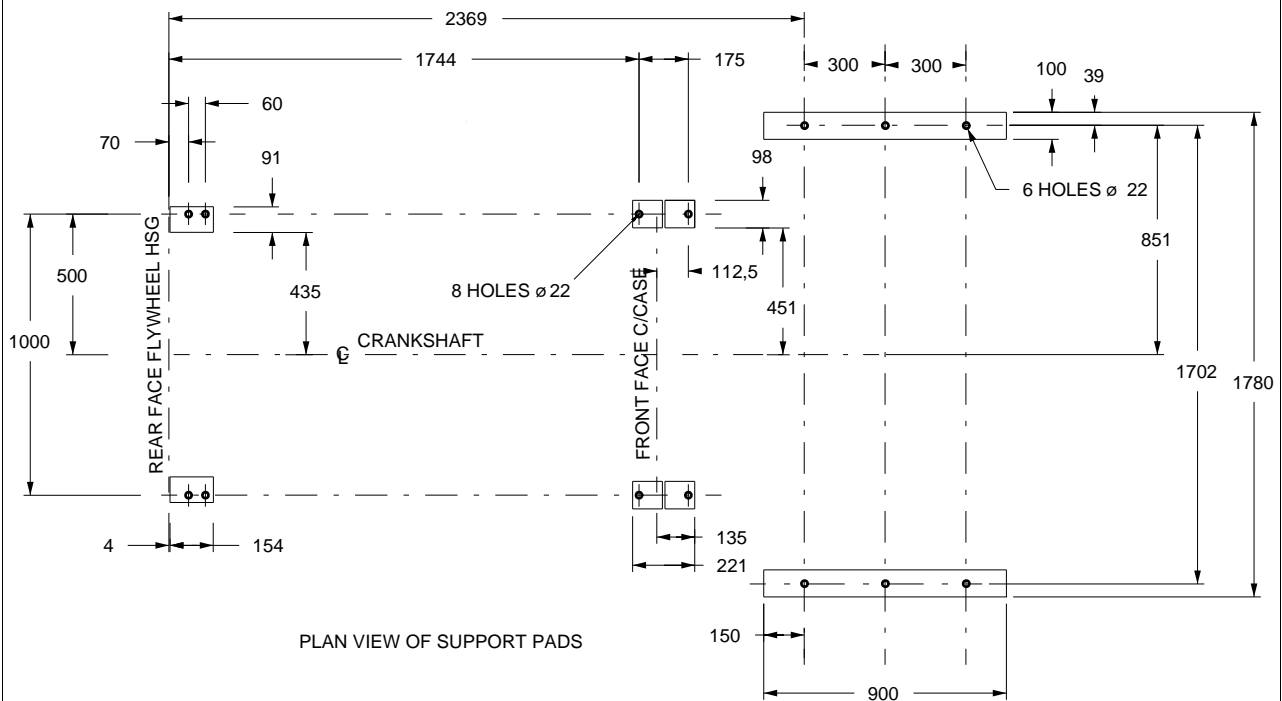
4012-46TWG2A Tropical - 4012-46TWG3A Temperate - Support pads, exhaust outlet flange and flywheel detail



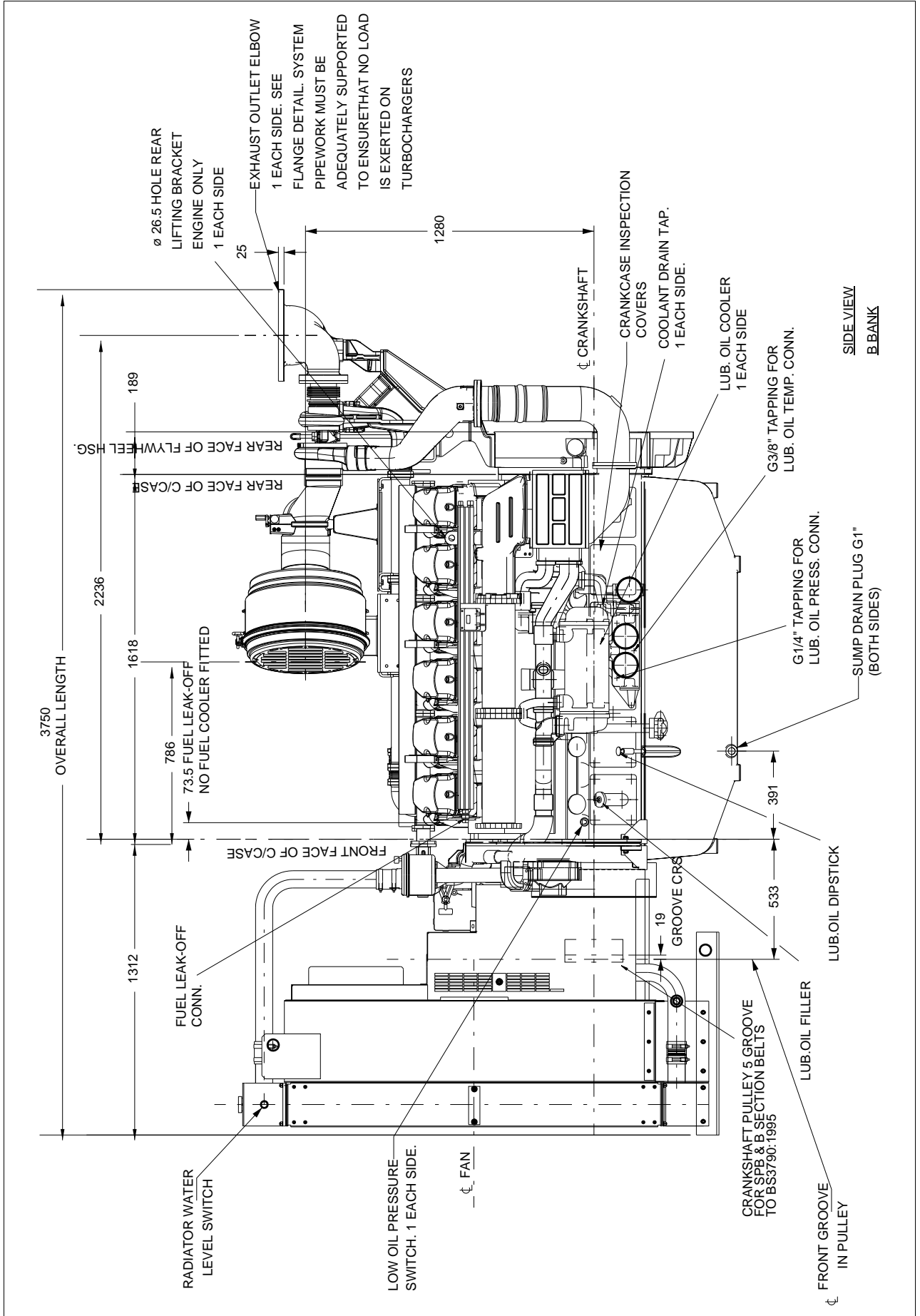
DETAIL OF EXHAUST OUTLET FLANGE  
(B.S.10 TABLE D)  
SCALE 1:5



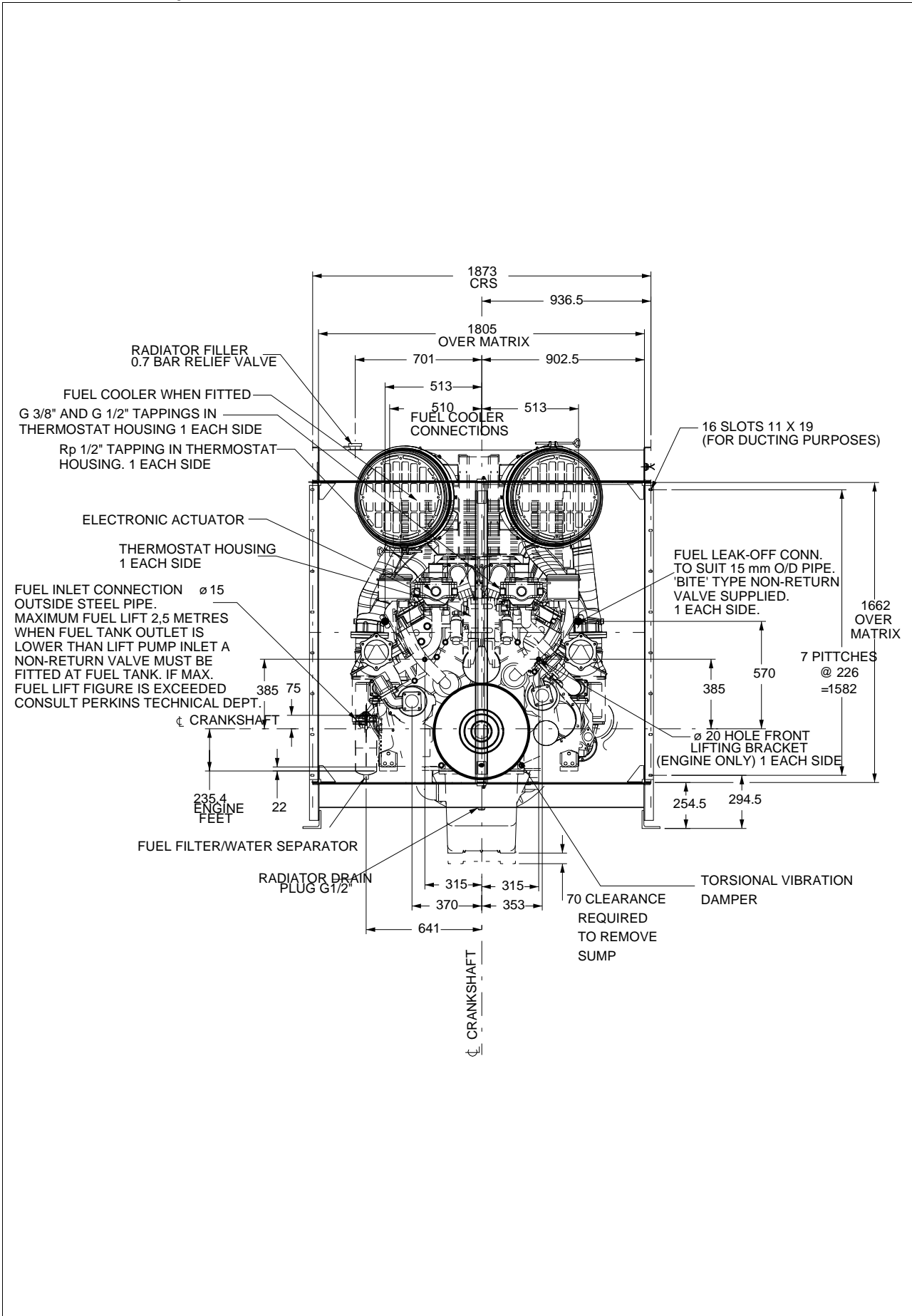
DETAIL OF SAE 518 FLYWHEEL  
AND SAE 00 FLYWHEEL HOUSING  
(METRIC TAPPINGS)  
SCALE 1:5



**4012-46TWG3A Tropical - left view**

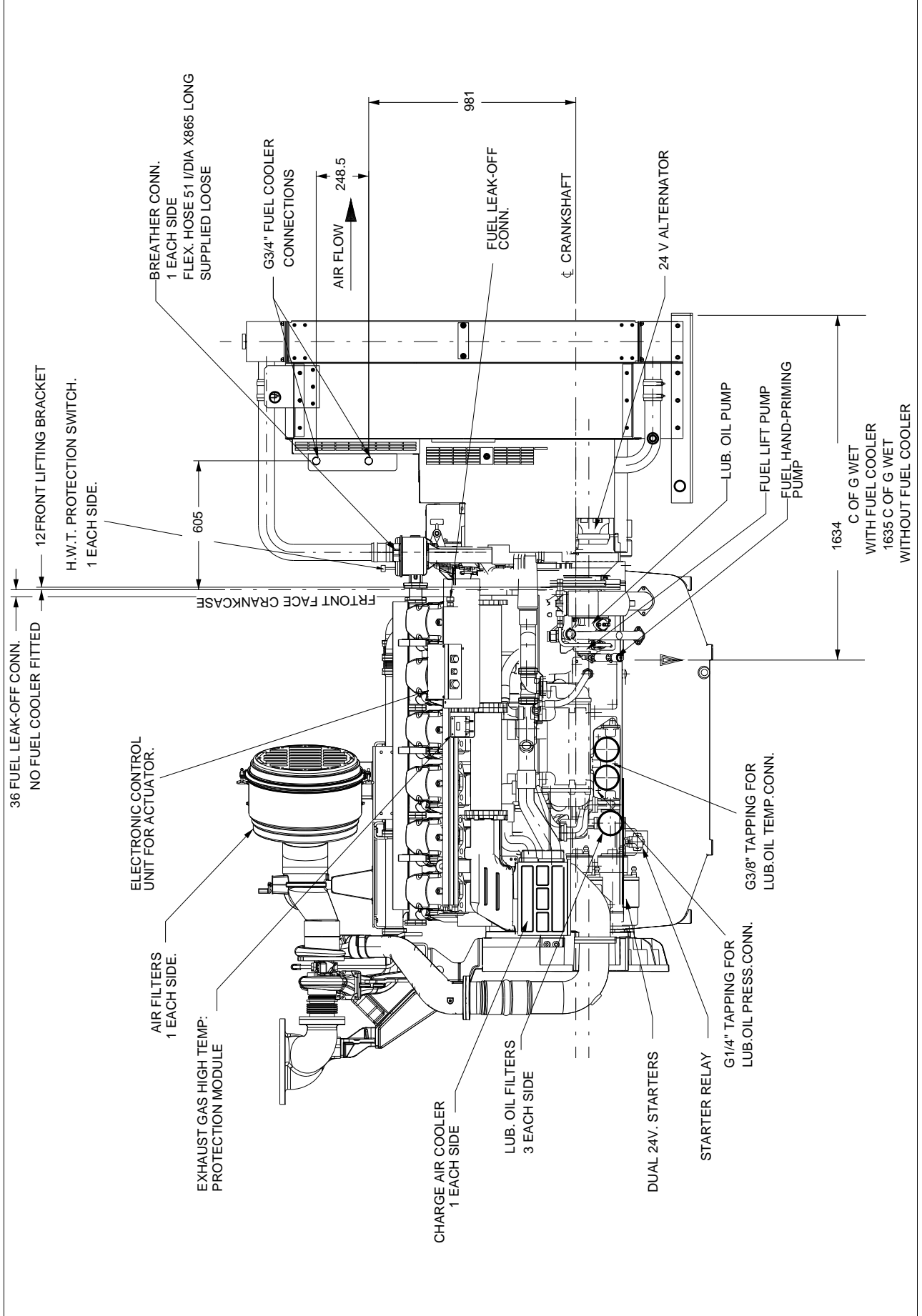


4012-46TWG3A Tropical - front view

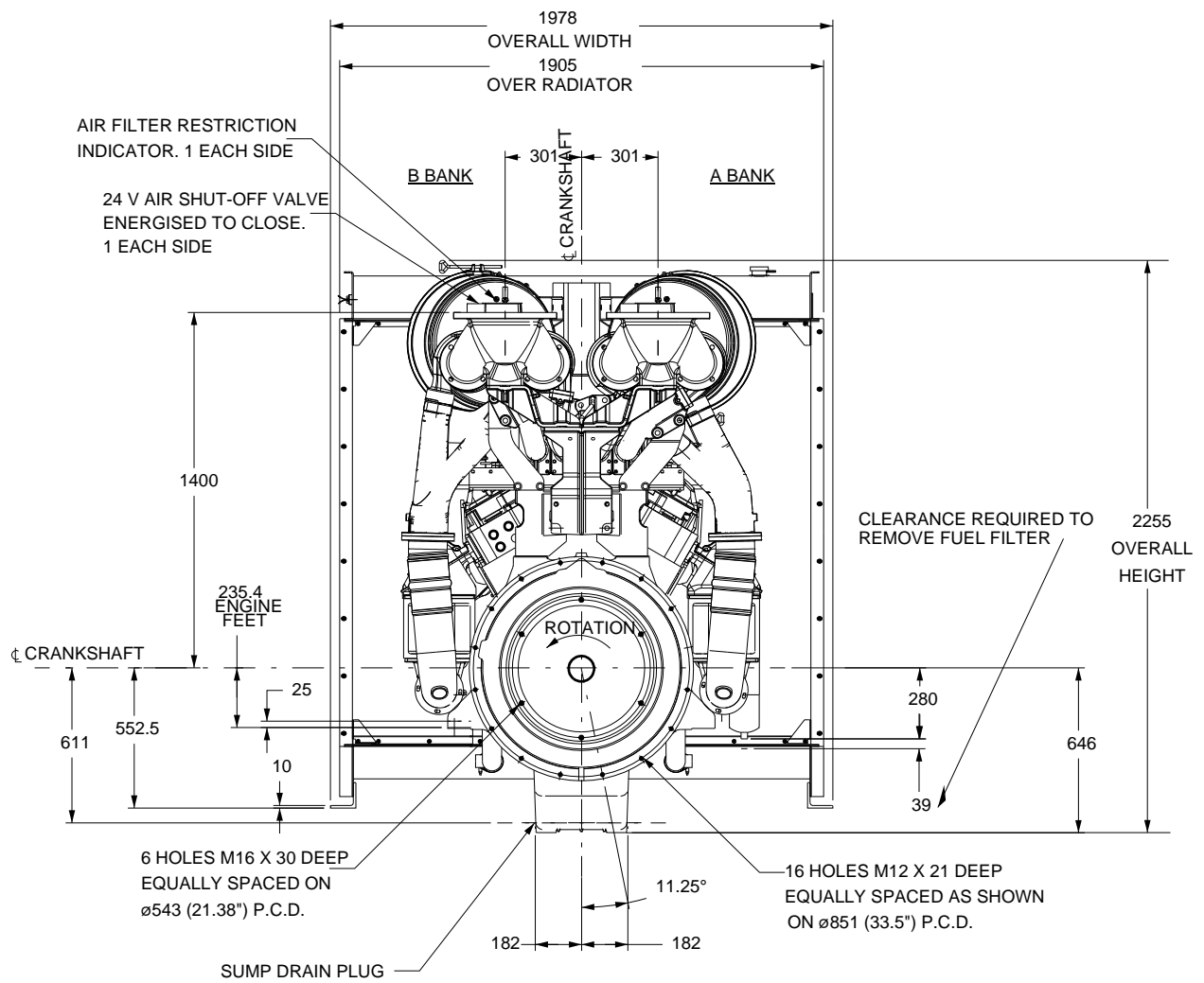




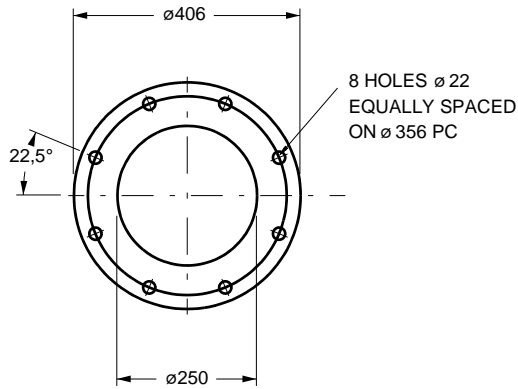
# 4012-46TWG3A Tropical - right view



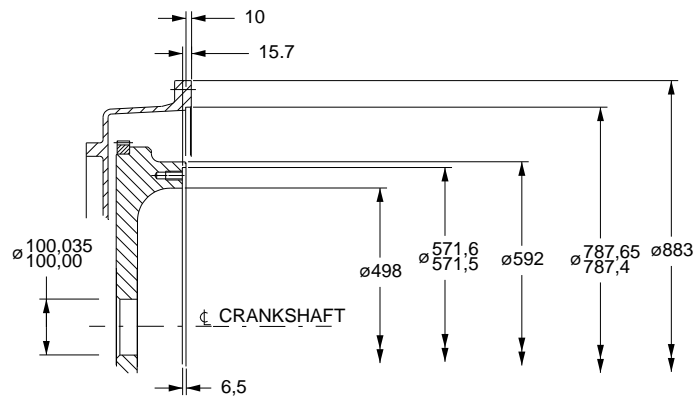
**4012-46TWG3A Tropical - rear view**



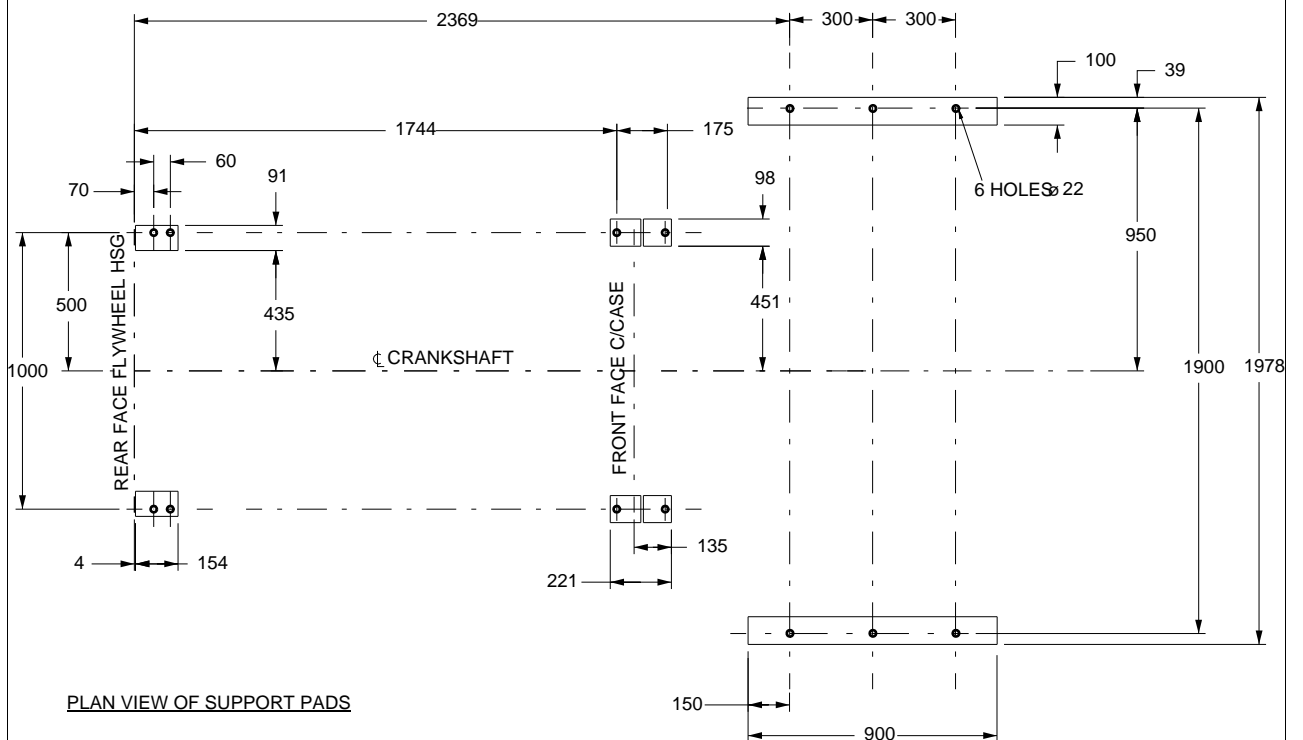
**4012-46TWG3A Tropical - Support pads, exhaust outlet flange and flywheel details**



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



## Cooling system

Recommended coolant: 50% inhibited ethylene glycol or 50% inhibited propylene glycol and 50% clean fresh water. For CHP systems 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 all Perkins Distributors.

Maximum pressure in crankcase water jacket . . . . . 170 kPa  
 Maximum top tank temperature (standby) . . . . . 98 °C  
 Maximum static pressure on pump . . . . . 70 kPa  
 Maximum pressure cap setting . . . . . 70 kPa

### Total coolant capacity

Electronit (engine only) . . . . . 73 litres  
 ElectropaK  
 -temperate (engine and radiator) . . . . . 196 litres  
 -tropical (engine and radiator) . . . . . 201 litres  
 Maximum permissible restriction to coolant pump flow . . . . . 20 kPa  
 Thermostat operating range . . . . . 71 - 85 °C  
 Temperature rise across the engine (standby power) with inhibited coolant . . . . . 8 to 12 °C  
 Shutdown switch setting . . . . . 101 °C (rising)  
 Coolant immersion heater capacity . . . . . 2 x 4 kW

### Water jacket cooling data

Coolant flow . . . . . 1000 l/min  
 Coolant exit temperature (max) . . . . . 98 °C  
 Coolant inlet temperature (min) . . . . . 70 °C  
 Coolant inlet temperature (max) . . . . . 85 °C

## Coolant pump

-speed . . . . . 1.4 x engine rev/min  
 -method of drive . . . . . engine (gear) driven

## Radiator

Face area  
 -temperate . . . . . 2630400 mm<sup>2</sup>  
 -tropical . . . . . 2967420 mm<sup>2</sup>  
 Number of rows and material . . . . . 226  
 Fins per inch and material . . . . . 7  
 Width of matrix  
 -temperate . . . . . 1600 mm  
 -tropical . . . . . 1805 mm  
 Height of matrix . . . . . 1644 mm  
 Weight (dry)  
 -temperate . . . . . 780 kg  
 -tropical . . . . . 843 kg  
 Total coolant capacity  
 -temperate . . . . . 123 litres  
 -tropical . . . . . 128 litres  
 Pressure cap setting (min) . . . . . .69 kPa

## Fan

Type . . . . . engine driven  
 Diameter  
 -temperate . . . . . 1400 mm  
 -tropical . . . . . 1530 mm  
 Number of blades . . . . . 12  
 Material . . . . . Aluminium  
 Drive ratio  
 -temperate . . . . . 1:1  
 -tropical . . . . . 1:0,9

## Cooling clearance

### 4012-46TWG2A - Temperate (584/470FC)

Maximum additional restriction (duct allowance) to cooling airflow, and resultant min airflow			
Description	°C	Pa	m <sup>3</sup> /min
Ambient clearance: Inhibited coolant	Dependent on radiator selection		
Duct allowance	25	250	N/A
Minimum airflow	25	250	1104

### 4012-46TWG2A - Tropical (584/471FC)

Maximum additional restriction (duct allowance) to cooling airflow, and resultant min airflow			
Description	°C	Pa	m <sup>3</sup> /min
Ambient clearance: Inhibited coolant	50	Dependent on radiator selection	
Duct allowance	50	120	N/A
Minimum airflow	50	120	1700

### 4012-46TWG3A - Temperate (584/471FC)

Maximum additional restriction (duct allowance) to cooling airflow, and resultant min airflow			
Description	°C	Pa	m <sup>3</sup> /min
Ambient clearance: Inhibited coolant	40	Dependent on radiator selection	
Duct allowance	40	250	N/A
Minimum airflow	40	250	1600

### 4012-46TWG3A - Tropical (584/485FC)

Maximum additional restriction (duct allowance) to cooling airflow, and resultant min airflow			
Description	°C	Pa	m <sup>3</sup> /min
Ambient clearance: Inhibited coolant	50	Dependent on radiator selection	
Duct allowance	50	120	N/A
Minimum airflow	50	120	1855

## Fuel system

Injection system .....	direct injection
Fuel injection pump .....	Delphi
Fuel Injector type .....	unit injector
Injector pressure .....	23,4 MPa
Fuel lift pump type.....	Gerotor
Delivery flow.....	1020 litres/hr
Heat retained in fuel to tank	
-4012-46TWG2A .....	8,5 kW
-4012-46TWG3A .....	9,0 kW
Fuel inlet temperature to be less than .....	58 °C
Delivery pressure .....	300 kPa
Maximum suction head at pump inlet .....	24,5 kPa
Maximum static pressure head .....	see installation manual for details
Fuel filter spacing.....	10 microns
Governing type.....	electronic
Governing .....	to ISO 8528-5 2005
Torque at the governor output shaft.....	1-631
Tolerance on fuel consumption.....	to ISO 8528-1 1993

## Fuel specification

Recommended fuel to conform to: ..... -BS2869 1998 class A2 or BS EN590

## Fuel consumption

**Note:** All fuel consumption figures are based on assumed fuel density of 0.862.

### 4012-46TWG2A - Temperate

Designation	Fuel consumption calculated on nett rated powers	
	g/kWh	litres/hr
Standby	220	298
Prime power	217	266
Baseload power	217	210
At 75% of Prime power		
At 50% of Prime power		

### 4012-46TWG2A - Tropical

Designation	Fuel consumption calculated on nett rated powers	
	g/kWh	litres/hr
Standby	220	298
Prime power	217	266
Baseload power	216	209
At 75% of Prime power		
At 50% of Prime power		

### 4012-46TWG3A - Temperate

Designation	Fuel consumption calculated on nett rated powers	
	g/kWh	litres/hr
Standby	221	324
Prime power	217	289
Baseload power	216	228
At 75% of Prime power		
At 50% of Prime power		

### 4012-46TWG3A - Tropical

Designation	Fuel consumption calculated on nett rated powers	
	g/kWh	litres/hr
Standby	222	325
Prime power	218	291
Baseload power	215	227
At 75% of Prime power		
At 50% of Prime power		

## Electrical system

System voltage ... 24 volts  
 Alternator  
 -type ... insulated return  
 -output ... 40 amps  
 Starter  
 -type ... (axial) electric  
 -motor power ... 16,4 kW  
 Number of teeth on  
 -flywheel ... 156  
 -starter motor ... 12  
 Minimum cranking speed ... 120 rev/min  
 Starter solenoid (24V)  
 -pull in current @ -25 °C max. ... 30 amps  
 -hold in current @ -25 °C max ... 9 amps  
 Engine stop solenoid current ... 1,1 amps

## Engine mounting

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

## Centre of gravity

Bare engine (wet) 4012-46TWG2A / 4012-46TWG3A  
 -forward of rear face of cylinder block ... 658 mm  
 -above crankshaft centre line ... 32 mm  
 ElectropaK (wet) - Temperate  
 -forward of rear face of cylinder block ... 960 mm  
 -above crankshaft centre line ... 32 mm  
 ElectropaK (wet) - Tropical  
 -forward of rear face of cylinder block ... 1286 mm  
 -above crankshaft centre line ... 32 mm

## Cold start recommendations

Temperature down to 0 °C (32 °F)  
 Oil: ... API CG 15W40  
 Starter: ... 2 x 24 volts  
 Battery: ... 4 x 12V 286 Ah  
 Max breakaway current: ... 1600 amps  
 Cranking current: ... 810 amps  
 Starting 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.

## Lubrication system

Recommended multigrade oil viscosity (15W40) which adequately meets the specifications of API CH4. For further details refer to the engine OMM.

### Lubricating oil capacity

Total system ... 177 litres  
 Sump maximum ... 157,5 litres  
 Sump minimum ... 115 litres  
 Oil temperature at normal operating conditions ... 95 °C  
 Oil temperature (in rail) - maximum continuous operation .. 105 °C

### Lubricating oil pressure

minimum ... 340 kPa  
 At rated speed ... 450 kPa  
 Oil relief opens ... 400 kPa  
 Oil filter screen spacing ... 20 microns  
 Sump drain plug tapping size ... G1  
 Lubricating oil pump speed ... 1.4 x engine rev/min  
 Lubricating oil pump drive method ... engine driven  
 Shutdown switch - pressure setting (where fitted) 193 kPa (falling)

### Normal operating angles

-front and rear ... 5°  
 -side tilt ... 10°

Oil consumption (prime power)		4012-46TWG2A	4012-46TWG3A
After running-in (typically after 250 hours)	g/kWhr	0.7	0.7
Oil flow rate from oil pump	l/s	7	7

## Noise levels

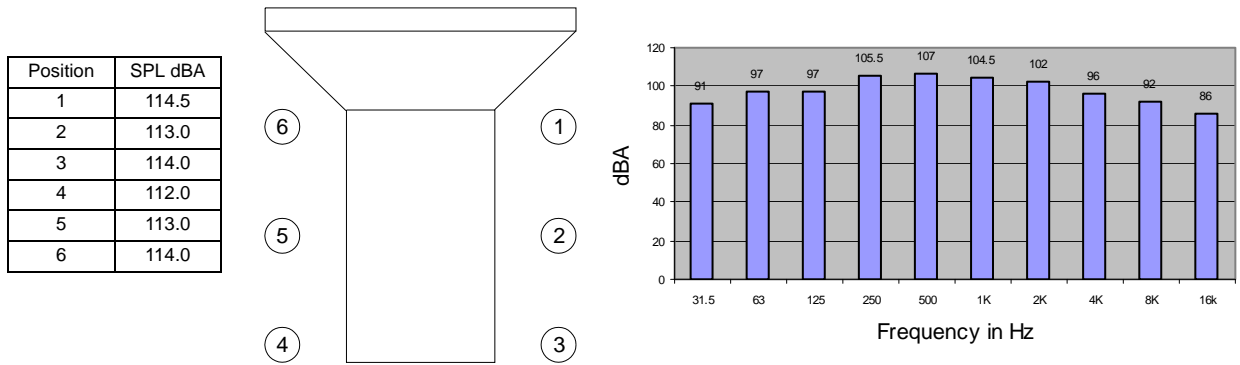
The figures for total noise levels are typical for an engine running at the standby power rating in a semi-reverberant environment and measured at a distance of one metre from the periphery of the engine (sound pressure level re:  $-20 \times 10^{-6}$  Pa).

Ambient noise level..... 70 d(B)A

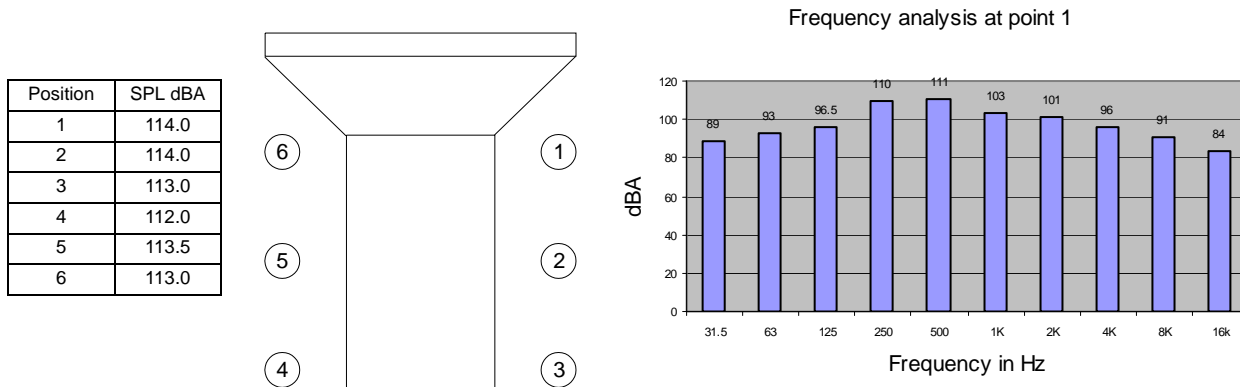
### Octave analysis

The following diagrams show maximum noise level.

#### Noise data 4012-46TWG3A, 1800 rev/min 1263 kWb with radiator 584/471FC



#### Noise data 4012-46TWG3A, 1800 rev/min 1263 kWb with radiator 584/485FC



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

### Load acceptance (cold)

4012-46TWG2A (prime %)	72
4012-46TWG3A (prime %)	65
Engine block temperature (cold)	45 °C
Ambient temperature	25 °C
Governing mode	Isochronous
Alternator inertia	50 kgm <sup>2</sup>
Under frequency roll off (UFRO) point set to	49 Hz
UFRO rate set to	16 V/Hz
LAM on/off	on

#### Notes:

- All test were conducted using an engine installed and serviced to Perkins Engine Company Limited recommendations
- Applied load is a percentage of the generator electrical output efficiencies as published in the general installation section of this data sheet.



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

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