

Technical Data

4000 Series

Diesel Engine - Electrounit

4016TAG
4016TAG1
4016TAG2

Basic technical data

Number of cylinders ... 16
Cylinder arrangement ... 60°
Cycle ... 4 stroke, compression ignition
Induction system ... Turbocharged
Compression ratio ... 13.6:1 nominal
Bore ... 160 mm
Stroke ... 190 mm
Cubic capacity ... 61.123 litres
Direction of rotation ... Anti-clockwise viewed on flywheel
Firing order ... 1^A, 1^B, 3^A, 3^B, 7^A, 7^B, 5^A, 5^B, 8^A, 8^B, 6^A, 6^B, 2^A, 2^B, 4^A, 4^B
Cylinders 1 furthest from flywheel

Cylinders Designated A are on the left side of the engine when viewed from front (opposite end to flywheel)

Total weight Electrounit (engine only)

4016TAG (dry) 5570 kg ... 4016TAG1/2 (dry) 5570 kg

4016TAG (wet) 5847 kg ... 4016TAG1/2 (wet) 5847 kg

Overall dimensions ... Height 2128 mm

... Length 3302 mm

... Width 1723 mm

Moment of inertia ... Engine 11.15 kgm² Flywheel 9.57 kgm²

Cyclic irregularity for engine/flywheel (Prime power):

1500 rev/min... 1.308 ... N/A... 1800 rev/min... 4016TAG

1500 rev/min... 1.300 ... N/A... 1800 rev/min... 4016TAG1

1500 rev/min... 1.277 ... N/A... 1800 rev/min... 4016TAG2

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 ... 1500 rev/min

Static injection timing... See engine number plate

Cooling water exit temp... <93 °C

Fuel data

To conform to BS2869 class A1, A2.

Performance

Sound pressure level 1500 rev/min ... 103/112 dBA

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

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 (nominal) ... 3.0 kPa

For load acceptance figures please refer to Applications Dept

General installation 4016TAG

Designation	Units	50Hz 1500 rev/min			60Hz 1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Gross engine power	kWb	1202	1502	1649	-	-	-
Fan power	kWm	42			-		
Net engine power	kWm	1160	1460	1607	-	-	-
BMEP gross	bar	15.7	19.7	21.6	-	-	-
Combustion air flow	m ³ /min	104	128	138	-	-	-
Exhaust gas temperature max (after turbo)	°C	469			-		
Exhaust gas flow max (after turbo)	m ³ /min	353			-		
Boost pressure ratio	-	2.35	2.50	2.80	-	-	-
Mechanical efficiency	%	88	90	92	-	-	-
Overall thermal efficiency	%	41	41	41	-	-	-
Friction power and pumping losses	kWm	160			-		
Mean piston speed	m/s	9.5			-		
Engine coolant flow (min)	l/s	16.1			-		
Typical Genset Electrical Output 0.8pf 25 °C (100kPa)	kVA	1392	1752	1928	-	-	-
	kWe	1114	1402	1543	-	-	-
Assumed alternator efficiency	%	96			-		

General installation 4016TAG1

Designation	Units	50Hz 1500 rev/min			60Hz 1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Gross engine power	kWb	1270	1588	1741	-	-	-
Fan power	kWm	51			-	-	-
Net engine power	kWm	1219	1537	1690	-	-	-
BMEP gross	bar	16.6	20.8	22.8	-	-	-
Combustion air flow	m ³ /min	117	129	135	-	-	-
Exhaust gas temperature max (after turbo)	°C	500			-	-	-
Exhaust gas flow max (after turbo)	m ³ /min	362			-	-	-
Boost pressure ratio	-	3.10	3.80	3.90	-	-	-
Mechanical efficiency	%	89	91	92	-	-	-
Overall thermal efficiency	%	43	41	40	-	-	-
Friction power and pumping losses	kWm	160			-	-	-
Mean piston speed	m/s	9.5			-	-	-
Engine coolant flow (min)	l/s	19			-	-	-
Typical Genset Electrical Output 0.8pf 25 °C (100kPa)	kVA	1463	1844	2028	-	-	-
	kWe	1170	1476	1622	-	-	-
Assumed alternator efficiency	%	96			-	-	-

General installation 4016TAG2

Designation	Units	50Hz 1500 rev/min			60Hz 1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Gross engine power	kWb	1413	1766	1937	-	-	-
Fan power	kWm	51			-		
Net engine power	kWm	1362	1715	1886	-	-	-
BMEP gross	bar	18.5	23.1	25.4	-	-	-
Combustion air flow	m ³ /min	130	147	155	-	-	-
Exhaust gas temperature max (after turbo)	°C	480			-		
Exhaust gas flow max (after turbo)	m ³ /min	411			-		
Boost pressure ratio	-	3.36	3.96	4.20	-	-	-
Mechanical efficiency	%	90	92	92	-	-	-
Overall thermal efficiency	%	42	40	39	-	-	-
Friction power and pumping losses	kWm	160			-		
Mean piston speed	m/s	9.5			-		
Engine coolant flow (min)	l/s	19			-		
Typical Genset Electrical Output 0.8pf 25 °C (100kPa)	kVA	1634	2058	2263	-	-	-
	kWe	1307	1646	1811	-	-	-
Assumed alternator efficiency	%	96			-		

Note: Not to be used for CHP design purposes. (Indicative figures only). Consult Perkins Engines Co. Ltd. Assumes complete combustion.

Continuous Baseload rating Power available for continuous full load operation. **Prime Power rating** is available for unlimited hours per year with a variable load of which the average engine load factor is 80% of the published prime power rating, incorporation of a 10% overload for 1 hour in every 12 hours of operation which is permitted. **Standby Power rating** is for the supply of emergency power at variable load for the duration of the non-availability of the mains power supply. NO OVERLOAD capacity is available at this rating. Engines must not be allowed to have facilities for parallel operation with the mains supply. This rating should be applied only when reliable mains power is available. Should this not be the case then refer to Prime Power rating. A standby rated engine should be sized for an average load factor of 80% based on published standby rating for 500 operating hours per year. Standby ratings should never be applied except in true emergency power failure conditions.

On 16 cylinder engines used for baseload operation, the following items must be incorporated:-

1. Auto lubricating oil pump (extra price, see options).
2. Centrifugal bypass filter to be baseframe mounted (extra price, see options).
3. Electrically driven radiators on separate baseframe (customer supply).

4. Start/stop sequence as follows:-

- START - 4 minutes priming
2 minutes start & no load 1500 rev/min
Synchronise and ramp to full load over 3 minutes
- STOP - Ramp down to no load 1500 rev/min
5 minutes no load and running
Stop engine and run oil priming pump for 4 minutes

Energy balance

Note: Not to be used for CHP design purposes. (Indicative figures only). Consult Perkins Engines Co. Assumes complete combustion.

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	Units	1500 rev/min			1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Energy in fuel	kWt	2311	3638	4043	-	-	-
Energy in power output (Gross)	kWb	1202	1502	1649	-	-	-
Energy to cooling fan	kWm	42	42	42	-	-	-
Energy in power output (Net)	kWm	1160	1460	1607	-	-	-
Energy to exhaust	kWt	864	1041	1159	-	-	-
Energy to coolant and oil	kWt	439	550	590	-	-	-
Energy to radiation	kWt	98	116	125	-	-	-
Energy to charge coolers	kWt	308	429	520	-	-	-

4016TAG1

	Units	1500 rev/min			1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Energy in fuel	kWt	2986	3903	4316	-	-	-
Energy in power output (Gross)	kWb	1270	1588	1741	-	-	-
Energy to cooling fan	kWm	51	51	51	-	-	-
Energy in power output (Net)	kWm	1219	1537	1690	-	-	-
Energy to exhaust	kWt	850	1096	1251	-	-	-
Energy to coolant and oil	kWt	460	579	644	-	-	-
Energy to radiation	kWt	90	115	127	-	-	-
Energy to charge coolers	kWt	316	474	553	-	-	-

4016TAG2

	Units	1500 rev/min			1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Energy in fuel	kWt	3389	4382	4927	-	-	-
Energy in power output (Gross)	kWb	1413	1766	1937	-	-	-
Energy to cooling fan	kWm	51	51	51	-	-	-
Energy in power output (Net)	kWm	1362	1715	1886	-	-	-
Energy to exhaust	kWt	931	1265	1456	-	-	-
Energy to coolant and oil	kWt	518	646	721	-	-	-
Energy to radiation	kWt	117	143	172	-	-	-
Energy to charge coolers	kWt	410	562	641	-	-	-

Cooling system

Recommended coolant: 50% inhibited ethylene glycol or 50% inhibited propylene glycol and 50% clean fresh water. For combined heat and power 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 bottles under Perkins Part No. OE 45350 (1 litre).
Nominal jacket water pressure in crankcase 1.7 bar

The following is a guide based on ambient air conditions of 52 °C on a Perkins supplied radiator
Total coolant capacity:
Electrounit (engine only) 95 litres
Electropak (engine/radiator) 4016TAG255 litres
Electropak (engine/radiator) 4016TAG1/2316 litres
Pressure cap setting 0.69 bar
Fan. Incorporated in radiator
Diameter 4016TAG 1524 mm (Pusher)
Diameter 4016TAG1/2 1905 mm (Pusher)
Ambient Cooling Clearance (Open Electropak Prime power) based on air temp at fan 3 °C above ambient.

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Maximum additional restriction (duct allowance) to cooling airflow (Prime power) and resultant minimum airflow					
Ambient Clearance 50% glycol		Duct Allowance mm H ₂ O		Min airflow m ³ /min	
rev/min		rev/min		rev/min	
1500	1800	1500	1800	1500	1800
52 °C	52 °C	16	-	1914	-

4016TAG1

Maximum additional restriction (duct allowance) to cooling airflow (Prime power) and resultant minimum airflow					
Ambient Clearance 50% glycol		Duct Allowance mm H ₂ O		Min airflow m ³ /min	
rev/min		rev/min		rev/min	
1500	1800	1500	1800	1500	1800
52 °C	52 °C	25	-	2208	-

4016TAG2

Maximum additional restriction (duct allowance) to cooling airflow (Prime power) and resultant minimum airflow					
Ambient Clearance 50% glycol		Duct Allowance mm H ₂ O		Min airflow m ³ /min	
rev/min		rev/min		rev/min	
1500	1800	1500	1800	1500	1800
52 °C	52 °C	25	-	2208	-

Coolant pump speed and method of drive . . . 1.4 x e rev/min Gear
Maximum static pressure head on pump above engine crank centre line 7 m
Maximum external permissible restriction to coolant pump flow 20 KPa
Thermostat operating range... . 71-85 °C
Shutdown switch setting96 °C rising
coolant immersion heater capacity 4 kW x 2

Jacket cooling water data	Unit s	1500 rev/min	1800 rev/min
Coolant flow 4016TAG	l/s	16.1	-
Coolant flow 4016TAG1/2	l/s	19.0	-
Coolant exit temperature (max)	°C	93	-
Coolant entry temperature (min)	°C	70	-
Coolant entry temperature (max)*	°C	85	-
Coolant entry temperature (max)**	°C	80	-

*4016TAG **4016TAG1/2

Lubrication system

Recommended lubricating oil to conform with the specification of APICD or CCMCD4

Lubricating oil capacity:

Sump maximum ... 214 litres

Sump minimum ... 147 litres

Lubricating oil temperature maximum to bearings ... 105 °C

Lubricating oil pressure:

at 80 °C temperature to bearing gallery (minimum) ... 0.34 MPa

4016TAG

Oil consumption Prime Power	Units	1500 rev/min	1800 rev/min
After RUNNING - IN*	g/kWhr	0.50	-
Oil flow rate from pump	l/s	6.70	-

*Typical after 250 hours

4016TAG1

Oil consumption Prime Power	Units	1500 rev/min	1800 rev/min
After RUNNING - IN*	g/kWhr	0.50	-
Oil flow rate from pump	l/s	6.70	-

*Typical after 250 hours

4016TAG2

Oil consumption Prime Power	Units	1500 rev/min	1800 rev/min
After RUNNING - IN*	g/kWhr	0.52	-
Oil flow rate from pump	l/s	6.70	-

*Typical after 250 hours

Sump drain plug tapping size ... G1

Oil pump speed and method of drive ... 1.4 x e rev/min, gear

Oil pump flow 1500 rev/min... 6.70 litres/sec

Shutdown switch setting ... 1.93 bar falling

Normal operating angles

Fore and aft... 5°

Side tilt ... 10°

Fuel system

Recommended fuel To conform to BS2869 1998 Class A1, A2
Type of injection systemDirect injection
Fuel injection pump ... Combined Unit injector
Fuel injector ... Combined Unit Injector
Fuel injector opening pressure... 234 bar
Fuel lift pump . Tuthill TCH 5
Delivery/hour at 1500 rev/min ... 1380 litres
Delivery/hour at 1800 rev/min ... N/A litres
Heat retained in fuel to tank 4016TAG... 11.0 kW
Heat retained in fuel to tank 4016TAG1/2... 12.0 kW
Temperature of fuel at lift pump to be less than. ... 58 ° C
Fuel lift pump pressure ... 3.0 bar
Fuel lift pump maximum suction head ... 2.5 m
Fuel lift pump maximum pressure head (see installation manual)
Fuel filter spacing ... 8 microns)
Governor type ... Electronic
Torque at the Governor output shaft... 1.631 kgm
Static injection timing ... See engine number plate
Tolerance on Fuel consumption. ... +5%

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Fuel consumption gross				
Designation	g/kWh		Litres/hr	
rev/min	1500	1800	1500	1800
At Standby Max power rating	207	-	402	-
At Prime Power rating	205	-	362	-
At Continuous Baseload rating	205	-	290	-
At 75% of Prime Power rating	205	-	272	-
At 50% of Prime Power rating	209	-	185	-
At 25% of Prime power rating	223	-	99	-

4016TAG1

Fuel consumption gross				
Designation	g/kWh		Litres/hr	
rev/min	1500	1800	1500	1800
At Standby Max power rating	209	-	428	-
At Prime Power rating	208	-	389	-
At Continuous Baseload rating	199	-	297	-
At 75% of Prime Power rating	197	-	276	-
At 50% of Prime Power rating	200	-	187	-
At 25% of Prime power rating	223	-	104	-

4016TAG2

Fuel consumption gross				
Designation	g/kWh		Litres/hr	
rev/min	1500	1800	1500	1800
At Standby Max power rating	215	-	490	-
At Prime Power rating	210	-	436	-
At Continuous Baseload rating	203	-	337	-
At 75% of Prime Power rating	202	-	315	-
At 50% of Prime Power rating	202	-	210	-
At 25% of Prime power rating	222	-	115	-

Induction System

Emissions data with combustion air temperature of 25 °C
at continuous base load
Maximum air intake restriction of engine:
Clean filter ...127 mm H₂O
Dirty filter ...380 mm H₂O
Air filter type ... 5000.00.00 MF&T

Exhaust system

Maximum back pressure for total system

Designation	Units	1500 rev/min	1800 rev/min
4016TAG/1/2	mmH ₂ O	949	-

Exhaust outlet flange size ... 2 x 254 mm (Table 'D')
Recommended pipe sizes Refer to Installation Manual.

Electrical system

Type ... Insulated return
Alternator. ... 24 volts with integral regulator
Alternator output...40 amps at a stabilised output 28 volts at 20 °C ambient
Starter motor ... 24 volts
Starter motor power. ...16.4 kW
Number of teeth on flywheel ...156
Number of teeth on starter motor ...12
Minimum cranking speed (0 °C ... 120 rev/min
Pull in current of each starter motor solenoid (2off) ... 30 amps at 24 volts
Hold in current of each starter motor solenoid 9"off) ...9 amps at 24 volts
Engine stop solenoid ...24 volts
Pull in current of stop solenoid ... 60 amps at 24 volts
Hold in current of stop solenoid...1.1 amps at 24 volts

Engine Mounting

Position of centre of gravity (wet engine) forward from rear

face of crankcase 1117 mm

Engine vertical centre line above crankshaft centre line 50 mm

Maximum additional load applied to flywheel due to all rotating components 850 kg

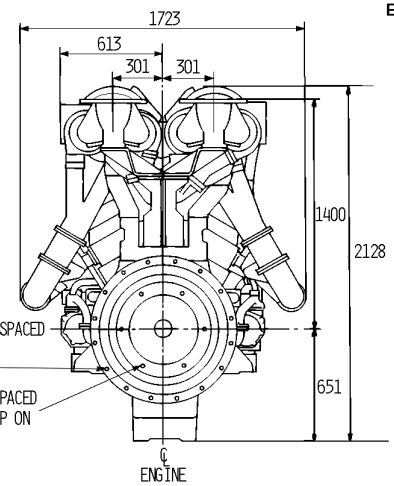
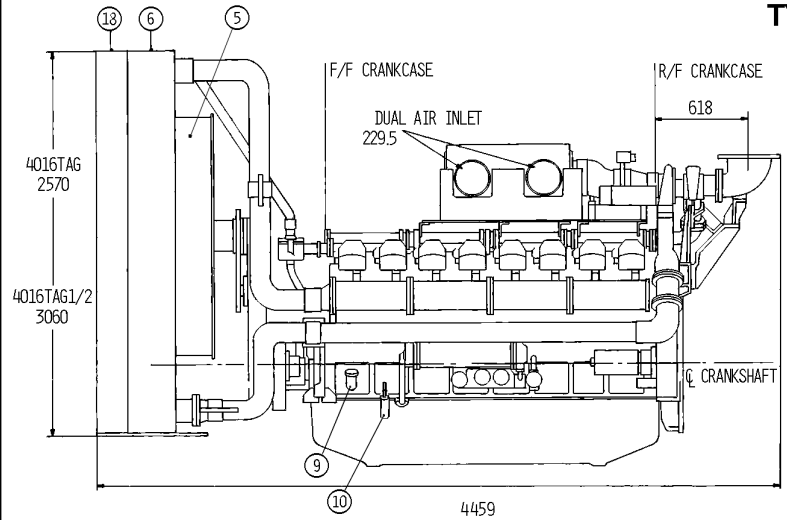
Starting Requirements

Temperature Range	
Range Down to 0 °C (32 °F)	Oil: SAE 30 Starter: 2 x 24V Battery: 4 x 12 volts x Ah 286 Max breakaway current: 2000 amps Cranking current: 957 amps Aids: Not necessary Starter cable size: 120 mm Maximum length: 6 m

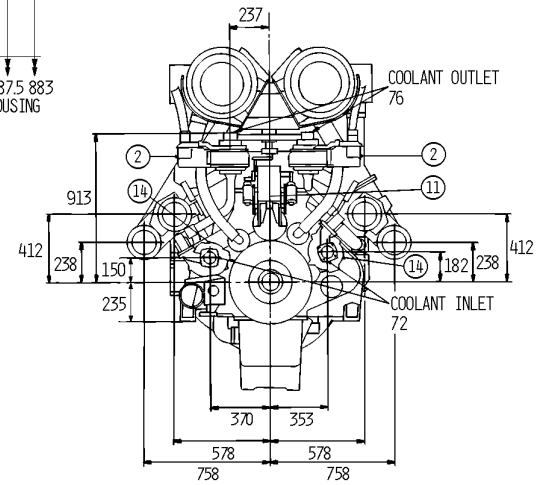
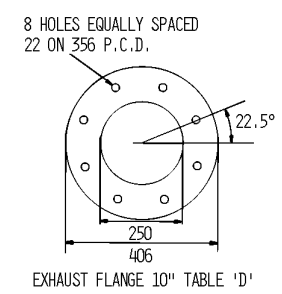
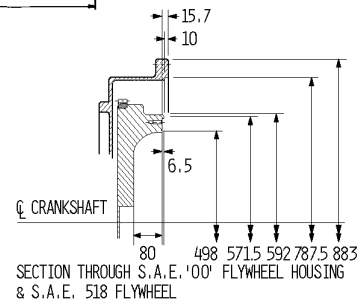
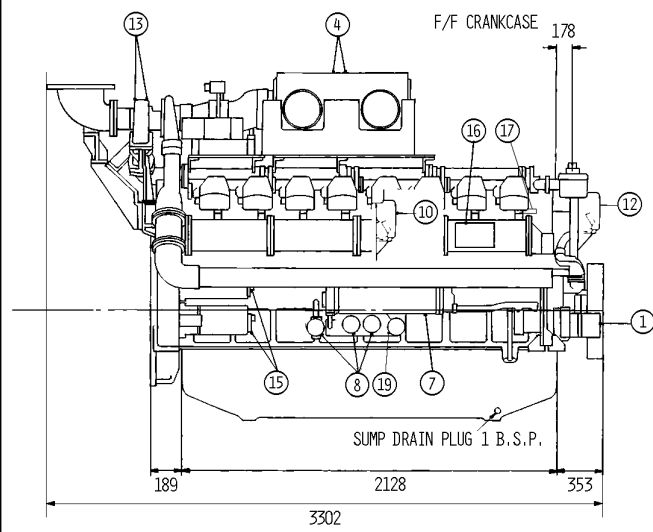
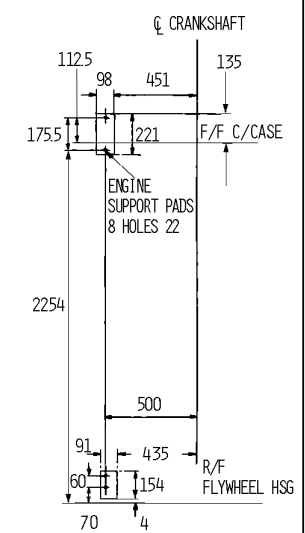
Notes:

- Battery capacity is defined by the 20 hour rate at 0 °C.
- 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 battery capacity available. Cables should be capable of handling the transient current which may be up to double the steady cranking current.

TYPICAL ENGINE



Electrounit Support and Pad Dimensions



ITEM	
1	ALTERNATOR
2	BREATHER
3	DAMPERS
4	AIR CLEANERS
5	FAN
6	RADIATOR (COVRAD)
7	OIL COOLER
8	LUBRICATING OIL FILTERS
9	OIL FILLER
10	DIPSTICK
11	STOP SOLENOID
12	GOVERNOR ACTUATOR
13	TURBOCHARGERS
14	COOLANT PUMP
15	24V STARTER
16	GOVERNOR CONTROL BOX
17	FUEL LEAK OFF
18	CHARGE COOLER
19	FUEL FILTER

DIM 011
THIS DRAWING SHOWS APPROX DIMENSIONS ONLY. FOR INSTALLATION DETAILS, G.A. DRAWINGS MUST BE OBTAINED FROM PERKINS ENGINES COMPANY STAFFORD LTD A 52°C AIR AMBIENT RADIATOR CAN BE SUPPLIED AS AN OPTION.

4016TAG/4016TAG1/4016TAG2 DIESEL ENGINES

Noise levels

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

Octave analysis

The following histograms show an octave band analysis at the position of the maximum noise level.

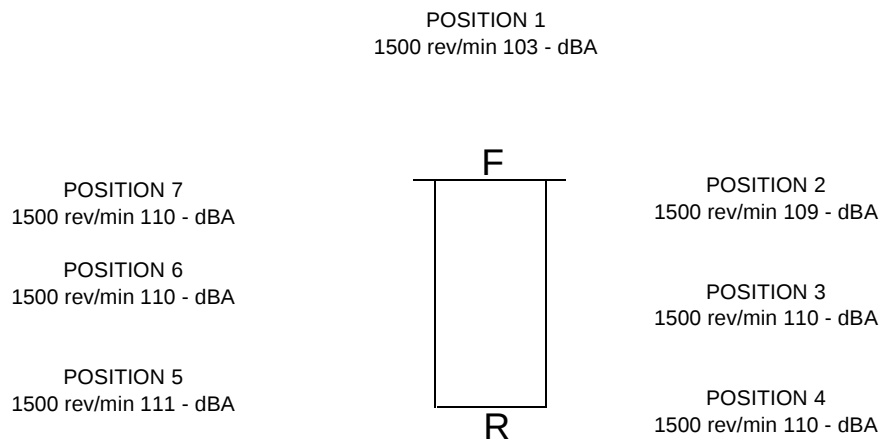
Total noise level

Sound pressure level re: 20×10^{-6} pa

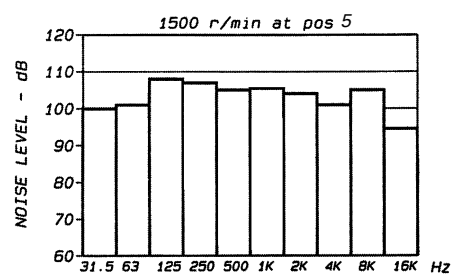
Speed 1500 rev/min.....Ambient noise level 75 dBA.

Octave analysis carried out at the position of maximum noise.

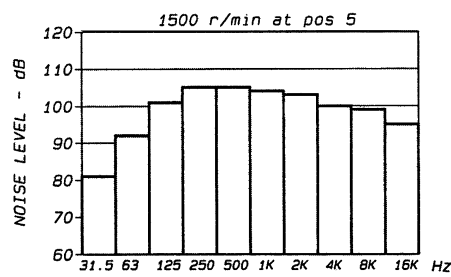
4016TAG/1/2



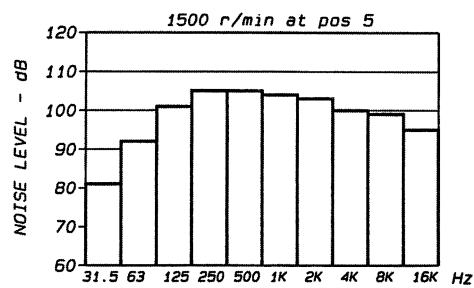
4016TAG



4016TAG1



4016TAG2



The information given on technical data sheets are for standard ratings only. For ratings other than shown contact Perkins Engines Co Ltd Stafford.

Notes

4000 Series

4016TAG 4016TAG1 4016TAG2

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