

Technical Data

4000 Series

4016TAG1A

4016TAG2A

Diesel Engine - Electrounit

Emission compliant engines

Basic technical data

Number of cylinders ... 16
 Cylinder arrangement ... 60° Vee
 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 are furthest from flywheel.

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

Total weight Electrounit (engine only) ... (dry) 5570 kg
 ... (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):
 4016TAG1A ... 1500 rev/min. ... 1,300
 4016TAG2A ... 1500 rev/min. ... 1,277

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 below
 Cooling water exit temp. ... <93 °C

Fuel data

To conform to BS2869 class A1, A2.

Performance

Estimated sound pressure level 1500 rev/min ... 106/112 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

General installation 4016TAG1A

Designation	Units	Spill timing 12°					
		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	107	132	140	-	-	-
Exhaust gas temperature max (after turbo)	°C	400	460		-	-	-
Exhaust gas flow max (after turbo)	m ³ /min	252	353		-	-	-
Boost pressure ratio max (after turbo)	-	3,0	3,30	3,50	-	-	-
Mechanical efficiency	%	88	91	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	19			-	-	-
Typical Genset electrical output 0,8 pf 25 °C (100 kPa)	kVA	1463	1844	2028	-	-	-
	kWe	1170	1476	1622	-	-	-
Assumed alternator efficiency	%	96			-	-	-

General installation 4016TAG2A

Designation	Units	Spill timing 14°					
		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	1890	-	-	-
Fan power	kWm	51			-	-	-
Net engine power	kWm	1362	1715	1839	-	-	-
BMEP gross	bar	18,5	23,1	25,4	-	-	-
Combustion air flow	m ³ /min	117	137	145	-	-	-
Exhaust gas temperature max (after turbo)	°C	450	493		-	-	-
Exhaust gas flow (max)	m ³ /min	275	393		-	-	-
Boost pressure ratio	-	3,0	3,49	3,80	-	-	-
Mechanical efficiency	%	88	92	92	-	-	-
Overall electrical efficiency	%	41	40	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 0,8 pf 25 °C (100 kPa)	kVA	1634	2058	2206	-	-	-
	kWe	1307	1646	1765	-	-	-
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. **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 by-pass 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 and 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. Ltd. Assumes complete combustion.

4016TAG1A

	Units	Spill timing 12°			1800 rev/min		
		1500 rev/min			1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Energy in fuel	kWt	3200	3903	4347	-	-	-
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	947	1138	1289	-	-	-
Energy to coolant and oil	kWt	520	580	629	-	-	-
Energy to radiation	kWt	58	97	117	-	-	-
Energy to charge coolers	kWt	405	500	571	-	-	-

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	Units	Spill timing 14°			1800 rev/min		
		1500 rev/min			1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Energy in fuel	kWt	3535	4514	4853	-	-	-
Energy in power output (gross)	kWb	1413	1766	1890	-	-	-
Energy to cooling fan	kWm	51	51	51	-	-	-
Energy in power output (net)	kWm	1362	1715	1839	-	-	-
Energy to exhaust	kWt	1048	1346	1513	-	-	-
Energy to coolant and oil	kWt	550	677	690	-	-	-
Energy to radiation	kWt	68	130	150	-	-	-
Energy to charge coolers	kWt	456	595	610	-	-	-

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 temperatures 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. 21825 735.

Maximum 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:

Electronit (engine only) ... 95 litres

ElectropaK (engine/radiator) ... 316 litres

Pressure cap setting ... 0,69 bar

Fan ... Incorporated in radiator

Diameter ... 1905 mm (pusher)

Ambient cooling clearance (open ElectropaK Prime power) based on air temperature 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	-	17	-	2394	-

4016TAG2A

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	-	15	-	2430	-

Coolant pump speed and

method of drive ... 1,4 x e rev/min, gear driven

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 setting ... 96 °C rising

Coolant immersion heater capacity... 4 kW x 2

Jacket cooling water data	Units	1500 rev/min	1800 rev/min
Coolant flow	l/s	19	-
Coolant exit temperature (max)	°C	93	-
Coolant entry temperature (min)	°C	70	-
Coolant entry temperature (max)	°C	80	-

Lubrication system

Recommended lubricating oil to conform with the specification of API CG4.

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

Oil consumption	Units	1500 rev/min 4016TAG1A	1500 rev/min 4016TAG2A
After running-in*	g/kWhr	0,50	0,52
Oil flow rate from pump	l/s	6,70	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 driven

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 system ... Direct 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

Heat retained in fuel to tank ... 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 ... 18 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%

4016TAG1A

Fuel consumption (gross)				
Designation	g/kWh		Litres/hr	
	1500	1800	1500	1800
At Standby Max power rating	210	-	430	-
At Prime Power rating	208	-	389	-
At Continuous Baseload rating	206	-	308	-
At 75% of Prime Power rating	205	-	287	-
At 50% of Prime Power rating	205	-	191	-
At 25% of Prime Power rating	222	-	104	-

4016TAG2A

Fuel consumption (gross)				
Designation	g/kWh		Litres/hr	
	1500	1800	1500	1800
At Standby Max power rating	216	-	488	-
At Prime Power rating	213	-	447	-
At Continuous Baseload rating	210	-	349	-
At 75% of Prime Power rating	209	-	326	-
At 50% of Prime Power rating	204	-	212	-
At 25% of Prime Power rating	216	-	112	-

Induction system

Maximum air intake restriction of engine:

Clean filter 127 mm H₂O
 Dirty filter 380 mm H₂O
 Air filter type MF&T 5000-00-00

Exhaust system

Maximum back pressure for total system at standby max power

Designation	Units	1500 rev/min	1800 rev/min
4016TAG1A	mm H ₂ O	949	-
4016TAG2A	mm H ₂ O	673	-

Exhaust outlet flange size 2 x 254 mm (table 'D')
 For 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 at 0 °C 120 rev/min
 Pull-in current of each starter
 motor solenoid 30 amps at 24 volts
 Hold-in current of each starter
 motor solenoid 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

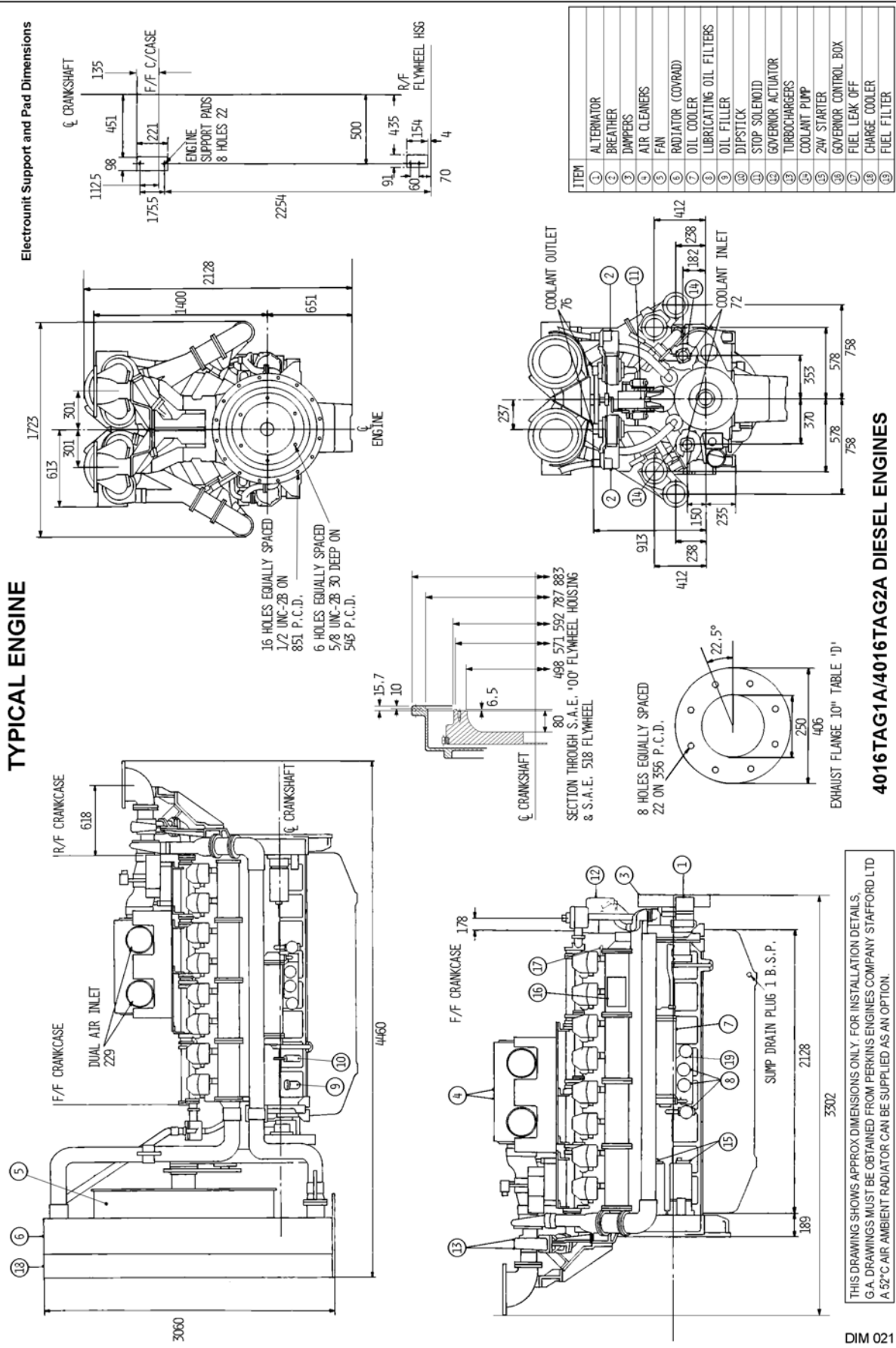
Starting requirements

Temperature range	
Range Down to 0 °C (32 °F)	Oil: SAE 30 Starter: 2 x 24V Battery: 4 x 12 volts x 286 Ah 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



4016 TAG1A/4016TAG2A DIESEL ENGINES

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.

Load acceptance (cold)

4016TAG1A 1500 rev/min

Initial load application when engine reaches rated speed (15 seconds max after engine starts to crank)				Second load application immediately after engine has recovered to rated speed (5 seconds after initial load application)			
Prime power %	Load kWm/kWe	Transient frequency deviation %	Frequency recovery time seconds	Prime power %	Load kWm/kWe	Transient frequency deviation %	Frequency recovery time seconds
67	1030/989	≤ -10	5	33	307/487	≤ -10	5

4016TAG2A 1500 rev/min

Initial load application when engine reaches rated speed (15 seconds max after engine starts to crank)				Second load application immediately after engine has recovered to rated speed (5 seconds after initial load application)			
Prime power %	Load kWm/kWe	Transient frequency deviation %	Frequency recovery time seconds	Prime power %	Load kWm/kWe	Transient frequency deviation %	Frequency recovery time seconds
57	978/938	≤ -10	5	43	737/708	≤ -10	5

Above complies with requirements of Classifications 3 & 4 of ISO 8528-12 and G2 operating limits stated in ISO 8528-5.

The above figures were obtained under test conditions as follows:

Engine block temperature 45 °C

Alternator efficiency 96%

Minimum ambient temperature 10 °C

Isochronous governing.

Under Frequency Roll Off (UFRO) set to 1 Hz below rated frequency.

Typical alternator inertia. 50 kgm²

All tests were conducted using an engine which was installed and serviced to Perkins Engines Company Limited recommendations.

Emissions chart

4016TAG1A

Spill timing 12° @ 50 Hz conform to					
Rating	German TA-Luft 1 to 3 MW	German ½ TA-Luft Limit @ >3 MW	German TA-Luft Limit @ >3 MW	French Limits 2000 @ <500 hours/year	French Limits 1500 @ >500 hours/year
Baseload	N/A	No	Yes	Yes	No
Prime power	N/A	N/A	Yes	Yes	No
Standby	N/A	N/A	Yes	Yes	No

4016TAG2A

Spill timing 14° @ 50 Hz conform to					
Rating	German TA-Luft 1 to 3 MW	German ½ TA-Luft Limit @ >3 MW	German TA-Luft Limit >@ 3 MW	French Limits 2000 @ <500 hours/year	French Limits 1500 @ >500 hours/year
Baseload	N/A	No	Yes	Yes	No
Prime power	N/A	N/A	Yes	Yes	No
Standby (107%)	N/A	N/A	Yes	Yes	No

Noise level

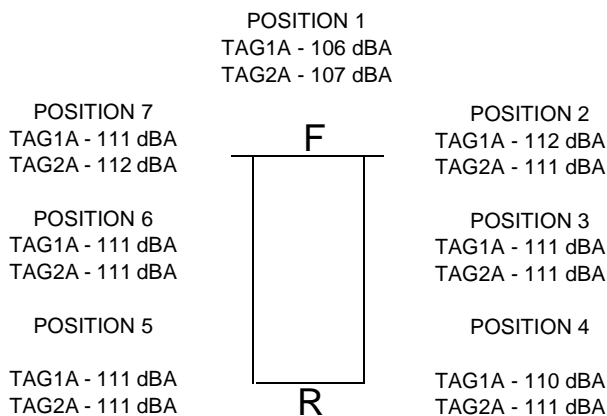
The figures for total noise levels are typical for an engine running at Prime Power rating in a semi-reverberant environment and measured at a distance of one metre from the periphery of the engine.

Octave analysis

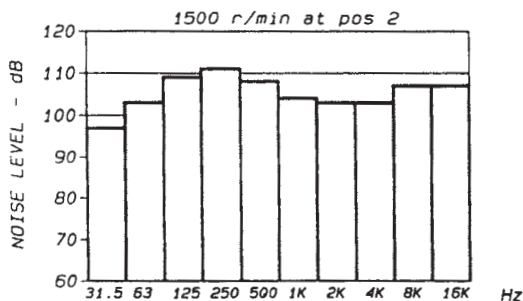
The following histograms show an octave band analysis at the position of the maximum noise level.

Total noise level

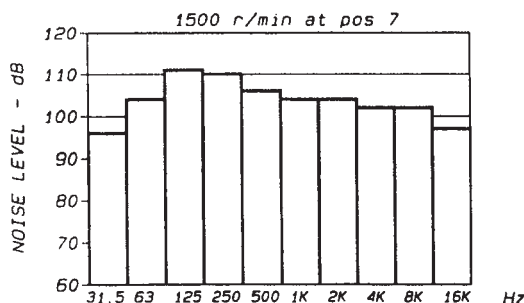
Sound pressure level re: -20×10^{-6} pa.
 Speed 1500 r/min.....Ambient noise level 75 dBA.
 Octave analysis performed at the position of maximum noise.



4016TAG1A



4016TAG2A



The information given on technical data sheets is for standard ratings only. For ratings other than shown contact Perkins Engines Company Limited, Stafford.

Notes



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