

Technical Data

4000 Series

Diesel Engine - Electrounit

4016TAG1

4016TAG2

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
 Cylinder 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) ... (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):
 1500 rev/min ... 1.300 4016TAG1A
 1500 rev/min ... 1.277 4016TAG2A

Ratings

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
 Estimated sound pressure level 1500 rev/min ... 110/112dBA
 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	50Hz 1500 rev/min			60Hz 1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Gross engine power	kWb	-	1588	1741	-	-	-
Fan power	kWm	51			-		
Net engine power	kWm	-	1537	1690	-	-	-
BMEP gross	bar	-	20.8	22.8	-	-	-
Combustion air flow	m ³ /min	-	132	140	-	-	-
Exhaust gas temperature max (after turbo)	°C	439			-		
Exhaust gas flow max (after turbo)	m ³ /min	343			-		
Boost pressure ratio	-	-	3.30	3.50	-	-	-
Mechanical efficiency	%	-	91	92	-	-	-
Overall thermal efficiency	%	-	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 0.8pf 25 °C (100kPa)	kVA	-	1844	2028	-	-	-
	kWe	-	1476	1622	-	-	-
Assumed alternator efficiency	%	96			-		

General installation 4016TAG12A

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	-	1766	1937	-	-	-
Fan power	kWm	51			-		
Net engine power	kWm	-	1715	1886	-	-	-
BMEP gross	bar	-	23.1	25.4	-	-	-
Combustion air flow	m ³ /min	-	137	145	-	-	-
Exhaust gas temperature max (after turbo)	°C	493			-	-	-
Exhaust gas flow max (after turbo)	m ³ /min	387			-	-	-
Boost pressure ratio	-	-	3.49	3.80	-	-	-
Mechanical efficiency	%	-	92	92	-	-	-
Overall thermal efficiency	%	-	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 0.8pf 25 °C (100kPa)	kVA	-	2058	2263	-	-	-
	kWe	-	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.

Energy balance

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

4016TAG1A

	Units	1500 rev/min			1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Energy in fuel	kWt	-	3846	4297	-	-	-
Energy in power output (Gross)	kWb	-	1588	1741	-	-	-
Energy to cooling fan	kWm	-	51	51	-	-	-
Energy in power output (Net)	kWm	-	1537	1690	-	-	-
Energy to exhaust	kWt	-	1079	1276	-	-	-
Energy to coolant and oil	kWt	-	586	629	-	-	-
Energy to radiation	kWt	-	103	107	-	-	-
Energy to charge coolers	kWt	-	490	544	-	-	-

4016TAG2A

	Units	1500 rev/min			1800 rev/min		
		Continuous Baseload	Prime Power	Standby Maximum	Continuous Baseload	Prime Power	Standby Maximum
Energy in fuel	kWt	-	4361	4908	-	-	-
Energy in power output (Gross)	kWb	-	1766	1937	-	-	-
Energy to cooling fan	kWm	-	51	51	-	-	-
Energy in power output (Net)	kWm	-	1716	1886	-	-	-
Energy to exhaust	kWt	-	1245	1490	-	-	-
Energy to coolant and oil	kWt	-	660	721	-	-	-
Energy to radiation	kWt	-	130	150	-	-	-
Energy to charge coolers	kWt	-	560	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 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).

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:

Electrounit (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 temp at fan 3 °C above ambient.

4016TAG1A

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
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	1200 rev/min	1500 rev/min
Coolant flow	l/s	19	-
Coolant exit temperature (max)	°C	93	-
Coolant entry temperature (max)	°C	70	-
Coolant entry temperature (max)	°C	80	-

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

4016TAG1A

Oil consumption Prime Power	Units	1500 rev/min	1800 rev/min
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

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 ... 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%

4016TAG1A

Fuel consumption gross				
Designation	g/kWh		Litres/hr	
rev/min	1500	1800	1500	1800
At Standby Max power rating	207	-	424	-
At Prime Power rating	205	-	383	-
At Continuous Baseload rating	199	-	297	-
At 75% of Prime Power rating	198	-	277	-
At 50% of Prime Power rating	198	-	185	-
At 25% of Prime power rating	218	-	102	-

4016TAG2A

Fuel consumption gross				
Designation	g/kWh		Litres/hr	
rev/min	1500	1800	1500	1800
At Standby Max power rating	212	-	483	-
At Prime Power rating	209	-	434	-
At Continuous Baseload rating	205	-	341	-
At 75% of Prime Power rating	203	-	316	-
At 50% of Prime Power rating	202	-	210	-
At 25% of Prime power rating	212	-	110	-

Induction System

Emissions data with combustion air temperature of 25 °C
at continuous base load

Maximum air intake restriction of engine:

Clean filter127 mm H2O

Dirty filter380 mm H2O

Air filter typeMF&T. 5000.00.00

Exhaust system

Maximum back pressure for total system

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

Exhaust outlet flange size2 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 flywheel156

Number of teeth on starter motor12

Minimum cranking speed at 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 solenoid24 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 crankcase1117mm

Engine vertical centre line above crankshaft centre line... .. 50mm

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

Starting Requirements

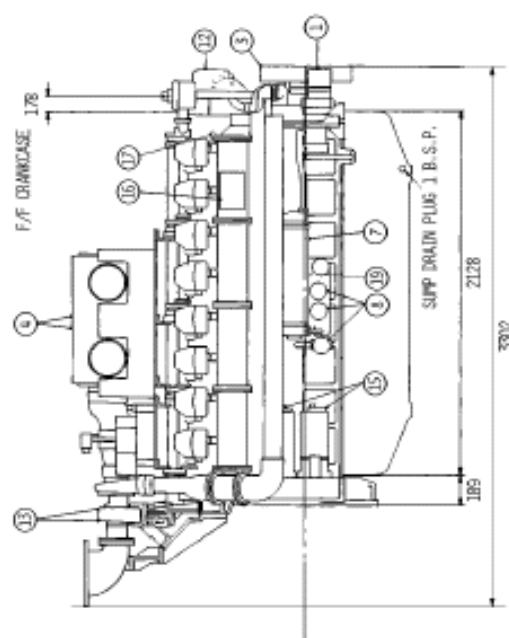
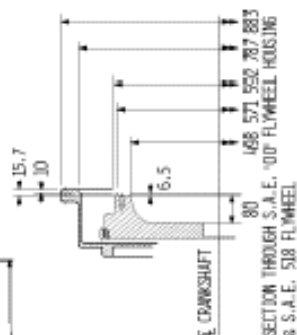
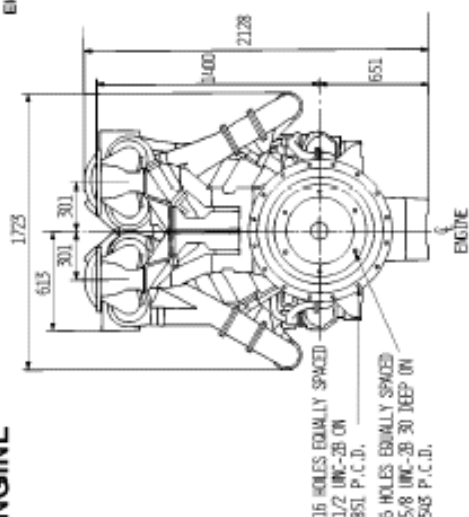
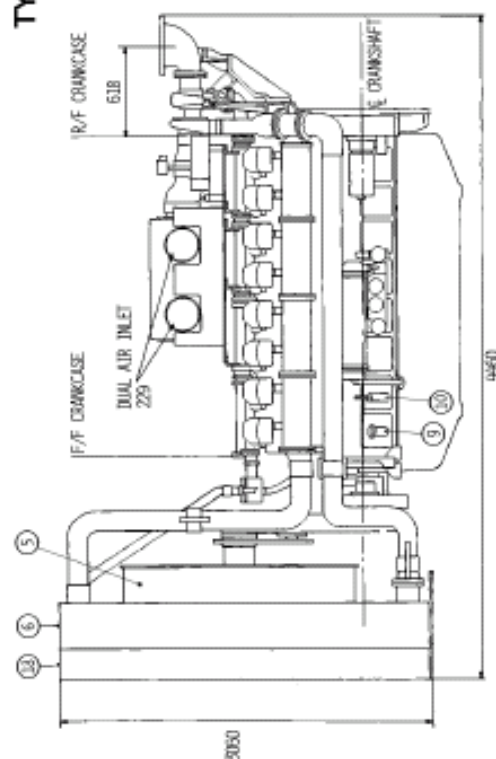
Temperature Range	
Range Down to 0 °C (32 °F)	Oil: SAE 30 Starter: 2 x 24V Battery: 4 x 12 volts x Ah 286 Max breakaway current: 2000 amps Cranking current: 957amps Aids: Not necessary Starter cable size: 120 mm Maximum length: 6m

Notes:

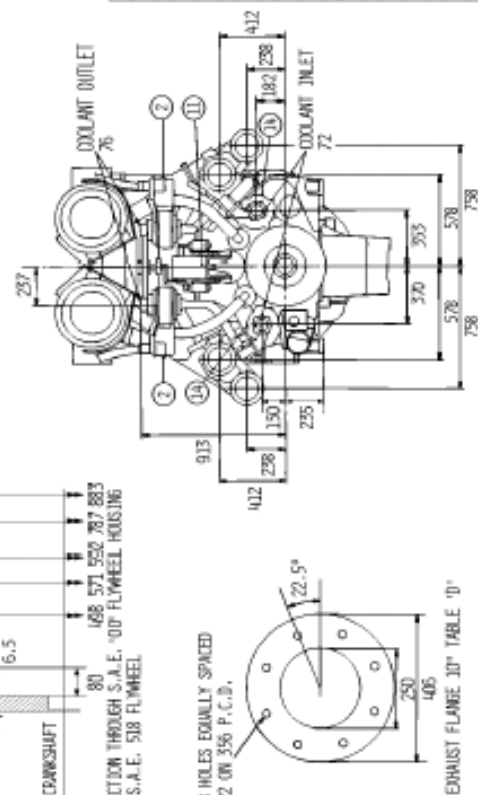
- Battery capacity is defined by the 20 hour rate at 0 °C.
 - The oil specification should be for the minimum ambient temperature as the oil will not be warmed by the immersion heater.
 - Breakaway current is dependent on battery capacity available.
- Cables should be capable of handling the transient current which may be up to double the steady cranking current.

TYPICAL ENGINE

Electrounit Support and Pad Dimensions



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.



ITEM	
1	ALTERNATOR
2	BELTDRIVER
3	DIAPHRAGM
4	AIR CLEANERS
5	FAN
6	RADIATOR (CONRAD)
7	OIL COOLER
8	LUBRICATING OIL FILTERS
9	OIL FILTER
10	DIPSTICK
11	STOP SOLENOID
12	GENERATOR ACTUATOR
13	TURBOCHARGER
14	COOLANT PUMP
15	2ND STARTER
16	GENERATOR CONTROL BOX
17	FUEL LEAK OFF
18	CHARGE COOLER
19	FUEL FILTER

DIM 021

4016TAG1A/4016TAG2A DIESEL ENGINES

Load acceptance (COLD)

4016TAG1A

1500 rev/min

INITIAL LOAD APPLICATION when engine reaches rated speed (15 seconds max after engine starts to crank)				2 nd 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	1031/990	≤ -10	5	33	506/486	≤ -10	5

4016TAG2A

1500 rev/min

INITIAL LOAD APPLICATION when engine reaches rated speed (15 seconds max after engine starts to crank)				2 nd 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	977/938	≤ -10	5	43	738/708	≤ -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 Kg^m²

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

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

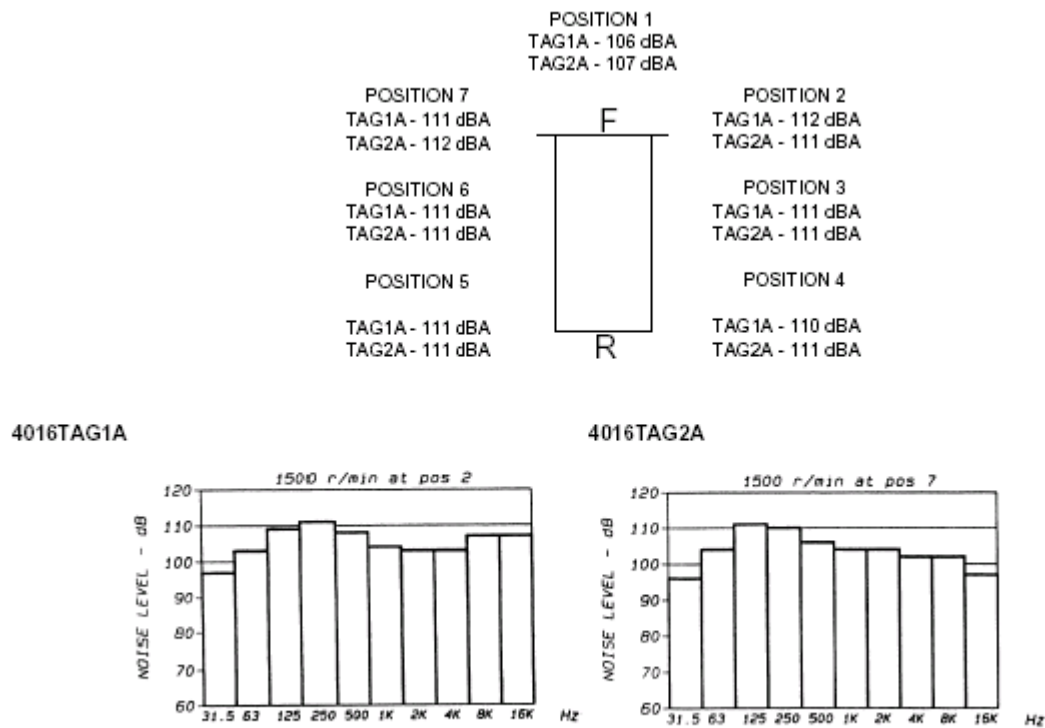
The following histograms show an octave band analysis at the position of the maximum noise level.

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.



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



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