Preliminary Data Only

Perkins®

4016-61TRG3A

1500rev/min

Technical Data Requirements for Electrounit Data Sheets

4016-61TRG3A Diesel Engine Electrounit

Basic Technical Data

Designation	Units	Value
Number of cylinders		16
Cylinder arrangement	Vee	60°
Cycle	strokes	4
Induction system	type	turbocharged
Combustion system	type	direct injection
Compression ratio		13:1
Bore	mm	160
Stroke	mm	190
Cubic capacity	litres	61.123
Direction of rotation	viewed on flywheel	anti-clockwise
Firing order (number 1 cyl. Furthest from flywheel)		
Note: Cylinders designated 'A' are on the right hand side of the engine when viewed from the flywheel end		
1A,1B,3A,3B,7A,7B,5A,5B,8A,8B,6A,6B,2A,2B,4A,4B		

Total weight of Electrounit		
Engine - dry	kg	5570
Engine - wet	kg	5847

Overall Dimensions of Electrounit		
Height	mm	2128
Length	mm	3302
Width	mm	1723

Moment of Inertia (mk^2)

Flywheel	kgm^2	11.15
Engine	kgm^2	9.57

Cyclic irregularity for engine /flywheel maximum	
1500r/min	1:260

Ratings		
Steady state stability at constant speed	%	+/- 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	1500rev/min	
Static injection timing	See below	
Cooling water exit temperature	°C	<98°C

Fuel data
To conform to BS2869 class A2

Performance
All data based on operation to ISO 3046/1, BS5514 and DIN 6271 standard conditions

Noise

Estimated sound pressure levels without inlet or exhaust at 1 metre		
1500 rev/min	dB(A)	112
Note: Noise level represents highest recorded at 1500rev/min		

Test conditions		
- air temperature	°C	25
- barometric pressure	kPA	100
- relative humidity	%	30
- air inlet restriction at maximum power (nominal)	kPa	2.5
- Exhaust back pressure at maximum power (nominal)	kPa	3
- fuel temperature (inlet pump)	°C	58 max.

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General installation - 4016-61TRG3A				
Designation	Units	Type of operation and application		
		Base	Prime	Standby
		50Hz @ 1500 rev/min		
Gross engine power	kWm	1600	1975	2183
Fan and battery charging alternator power	kW	100		
Net engine power	kWm	1500	1875	2083
Brake mean effective pressure - gross	kPa	2094	2585	2857
Combustion air flow at ISO conditions	m^3/min	135	160	175
Exhaust gas temperature (after turbo)-maximum	°C	460	475	560
Exhaust gas flow-maximum at atmos.pressure.	m^3/min	490		
Boost pressure ratio	:1	4		
Mechanical efficiency	%	94.0		
Overall thermal efficiency (net)	%	40	40	40
Friction and pumping power losses	kWm	160		
Mean piston speed	m/s	9.5		
Engine coolant flow - min	l/s	23		
Typical GenSet electrical output (0.8pf)	kVA	1800	2250	2500
	kWe	1440	1800	2000
Assumed alternator efficiency	%	96		

Notes: All quoted gross engine powers include an allowance of 1.5% for installation variances
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 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.

Emissions capability
No emission compliant version at Job 1

Energy Balance

Note: Not to be used for combined heat and power (CHP) purposes (indicative figures only) If necessary, consult Perkins Engines company Ltd

Energy balance - 4016-61TRG3A				
Designation	Units	1500 rev/min		
		Baseload Power	Prime Power	Standby Power
Energy in fuel	kWt	4030	4960	5450
Energy in power output (gross)	kWb	1600	1975	2183
Energy to cooling fan	kWm	100		
Energy in power output (net)	kWm	1500	1875	2083
Energy to exhaust	kWt	1136	1400	1535
Energy to coolant and oil	kWt	614	757	830
Energy to radiation	kWt	117	135	160
Energy to charge cooler	kWt	555	684	750

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

Total jacket coolant capacity		
Electrounit (engine only)	litres	95
Maximum permissible restriction to coolant pump flow	kPa	30
Thermostat operating range	°C	71-85
Ambient cooling clearance (standby power) based on air temperature at fan of 6°C above the ambient	°C	*Dependent on radiator selection.*
Temperature rise across the engine (standby power) with Inhibited coolant @ 1500 rev/min	°C	*8-12 depending on rating*

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Water jacket cooling data		
	Units	1500
Coolant flow	l/s	23
Coolant exit temperature (max.)	°C	98
Coolant inlet temperature (min)	°C	70
Coolant inlet temperature (max)	°C	80

Water Jacket Coolant pump	
Speed	1.4 x e r/min
Method of drive	Engine driven

Secondary water circuit		
	Units	1500
Coolant flow	l/s	12
Maximum permissible restriction to coolant pump flow	kPa	30
Coolant exit temperature (max.)	°C	60
Coolant inlet temperature (min)	°C	45
Coolant inlet temperature (max)	°C	10

Water Jacket Coolant pump	
Speed	1.4 x e r/min
Method of drive	Engine driven

Lubrication System
Recommended SAE viscosity:
Multigrade oil conforming to the following must be used API CG 15W/40
Note: for additional notes on lubricating oil specifications, refer to the OMM manual

Total system capacity		
Maximum sump capacity	Litres	214
Minimum sump capacity	Litres	147
Oil temperature at normal operating conditions	°C	95
Oil temperature (in rail) - Maximum continuous operation	°C	105

Lubricating Oil Pressure		
Minimum	kPa	340
Oil filter screen spacing	microns	40
Sump Drain plug tapping size		G1
Oil pump speed and drive method	1.4 x e r/min engine driven	
Shutdown switch - pressure setting (where fitted)	kPa	193

Oil consumption		
Prime power	**Units**	**1500 rev/min**
After running in (typically after 250 hours)	g/kWhr	0.52
Oil flow rate from pump	litres / sec	6.7

Fuel System
Recommended fuel to conform to BS2869 1998 class A1, A2

Fuel specification
To Conform to BS2869 1998 Class A2

Injection system	Direct	
Fuel injection pump	Unit injector	
Injector type	Unit injector	
Injector pressure	Mpa	23.4
Lift pump type	Tuthill TCH 5	
Fuel delivery	l/hr	1380
Heat retained in fuel to tank	kW	14
Fuel inlet temperature to be less than	°C	58
Maximum suction head at pump inlet	m	2.5
Maximum static pressure head	kPa	See manual
Fuel filter spacing	microns	10
Governor type	Electronic	
Governing	To ISO 8528-5 2004	
Torque at the governor output shaft	kgm	1.631
Tolerance on fuel consumption	To ISO 8528-1 1993	

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Fuel consumption
Note: All based on assumed density of 0.862

Fuel consumption calculated on net rated powers		
Designation	**1500 rpm**	
	g/kWh	**l/hr**
Standby	209	528
Prime power	205	473
Base load power	200	373
At 75% of prime power	200	346
At 50% of prime power	204	235
At 25% of Prime power	220	127

Induction system		
Maximum air intake restriction of engine:		
Clean filter	kPa	1.24
Dirty filter	kPa	3.71
Air filter type	Donaldson	

Exhaust system		
Exhaust outlet size (internal)	mm	254
Exhaust outlet flange size	mm	10" table D
Back pressure for total system	kPa	3.91

Electrical		
Alternator type	Insulated return	
Alternator voltage	volts	24
Alternator output	amps	40
Starter type	type	Electric
Starter motor voltage	volts	24
Starter motor power	kW	16.4
Number of teeth on flywheel		156
Number of teeth on starter pinion		12
Minimum cranking speed (0 °C	rev/min	120
Starter solenoid pull-in current @ -25 °C Max	amps	30
Starter solenoid hold-in current @ -25 °C Max	amps	9
Stop solenoid hold-in current	amps	1.1
Engine stop solenoid voltage	volts	24

Cold Start Recommendations		
Down to 0 °C		
Oil	SAE grade	API CG 15W/40
Starter	type	2 x 24V
Battery		4 x 12V x 286Ah
Max breakaway current	amps	2000
Cranking current	amps	957
Minimum mean cranking speed	rev/min	120

Notes:
1) Battery capacity is defined by the 20 hour rate
2) The oil specification should be for the minimum ambient temperature as the oil will not be warmed by the immersion heater
3) Breakaway current is dependent on the battery capacity available. Cable should be capable of handling the transient current which may be up to double the steady cranking current.

Mountings		
Maximum static bending moment at rear face of block	Nm	1356

Centre of gravity (Bare engine - Wet)

Forward of rear face of cylinder block	mm	900
Above crankshaft centre line	mm	50

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Typical load acceptance

Initial load application - when engine reaches rated speed (15 seconds max after engine starts to crank)				2nd load step after speed recovery			
Prime Power %	**load kWm/kWe**	**Transient frequency deviation %**	**Frequency recovery time seconds**	**Prime Power %**	**load kWm/kWe**	**Transient frequency deviation %**	**Frequency recovery time seconds**
52	975/936	≤ -10	5	48	900/864	≤ -10	5

The figure shown in the tables above were obtained under the following test conditions		
Engine block temperature (Cold)	°C	45
Ambient temperature	°C	25
Governing mode	Isochronous	
Alternator inertia	kgm	55
Under frequency roll off (UFRO) point set to	Hz	49.5
UFRO rate set to	V/Hz	16
LAM on /off		On

All tests were conducted using an engine installed and serviced to Perkins Engine Company limited recommendations

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 x 10^{-6} pa
Speed 1500 r/min.....Ambient noise level 75 dBA.
Octave analysis performed at the position of maximum noise.