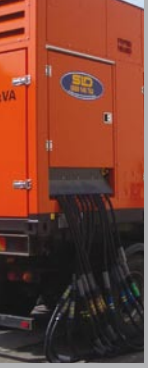
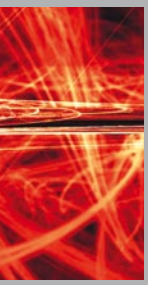


Pumps & Power

A trading division of Carrier Rental Systems



For power solutions turn to the experts SLD

The Experts Guide

Celebrating 60 years 1951 to 2011

SLD Commitment

SLD are committed to reducing the day-to-day impact their customers have on the environment, by continually sourcing and investing in the latest generator technology. This will assist in the reduction of their on-site carbon foot print.

Benefits to the environment include:

- Fully Bunded Canopied generators that are designed to avoid on-site spillage and reduce application noise.
- Latest technology engines are designed for efficiency and compliance with current EN regulations in mind.
- All new SLD generators surpass all current EN noise regulations.
- Due to the latest generator technology less oil changes and disposal are required. The benefits to SLD's clients are less frequent service visits which in turn reduces costs.
- All generator waste oil is recycled utilising an approved third party supplier.

"SLD is a clean power supplier"

SLD has an extensive range of new cutting edge, environmentally friendly, fuel efficient and high performance Generators available for hire and immediate delivery.

Contents

Fast Hire Response

Extensive Depot Network UK Local Solutions...

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SLD Pumps and Power are committed to providing the highest level of health, safety and environmental excellence for both our employees and our clients. As the industry's leading specialist, you can rest assured SLD will deliver what you need, when you need it, in a safe manner.

Our generators are more fuel efficient and as a result this causes less carbon emissions to the atmosphere.

'Being one step ahead - peace of mind for your business'.

Certifications and Trade Associations

All SLD depots are formally committed and working towards full achievement of Investors in People accreditation.

Safety Equipment

Personal Protective Equipment should be worn when working with equipment and accessories.

Safety gloves, protective footwear, ear defenders, hard hats, overalls, high vis clothing and suitable eye protection should always be worn when handling pumps and/or ancillary equipment.

Dependent upon the application, additional safety equipment may be required in certain situations.

SLD has a dedicated UK HSEQ Manager committed to ensuring health and safety excellence nationwide. SLD provide continuous internal and external HSEQ training programmes that are assessed by certified external bodies.

‘Excellence in all we do’

Many years of research and development has gone into the assembly of SLD's rental fleet for short or long term hire. The industries served include utilities, construction, events, offshore and telecommunications to mention but a few.

Whether it's Standard or Silent Generators/ Standard Generator Hire of Synchronised Packages, the expanse of our rental fleet plus the extensive knowledge gained from over 40 years of experience is your guarantee that you will always get the correct solution for your project and not simply be supplied with a restricted range of standard hire fleet units.

At SLD, we pride ourselves on our prompt response to your enquiries, being flexible and designing tailor made rental packages with you - the customer, in mind. Whether this is short term or long term we can guarantee an effective and reliable response with a power package which is specific to your application.

When reliable uninterrupted power is required, **SLD can supply**.

- 24 hour, 7 day a week emergency call-out for hire service
- Hire of specialist cable, cable ramps, distribution equipment
- Market leading bunded bulk fuel tanks with multiple supply options
- Cost effective fuel management
- Fleet capacity of Standard / Silent Generators from a 15kva to a 1,250kva stand alone sets
- Multi Mega Watt options

Synchronised Systems

Live on/off capability is available along with synchronising machine to machine. These systems are regularly used within the utilities, events and general industrial markets.

Multi Mega Watt Packages

Supplying anything from a 1mVA to 30mVA project can be achieved with relative ease generating at a low voltage or high voltage using SLD's fleet of rental transformers.

We have been independently assessed to the international ISO9001 Quality Assurance and ISO4001 Environment Standards, ensuring optimum levels of equipment reliability through rigorous testing and pre-hire inspection.

All of our personnel are highly trained in all aspects of generator rental and will advise on the most appropriate solution to meet your specific requirements.

Our generator fleet contains Environmentally Friendly Super silenced low noise design sets (61dBA to 78dBA) for use in residential areas, at events and in noise sensitive applications.

State-of-the-art diesel engine control systems contained within our fleet are designed to reduce emissions in line with all EU legislation.

With a continued high level of investment in new equipment each year, customers are provided with the most technologically advanced units in the UK, ensuring true reliability and increased site efficiency backed by a premium service and full product support around the clock.

QAS Range

The QAS Range is suitable for general use and offers a compact size, good noise characteristics and reliability of supply.

Models range from 18kva to 325kva with noise levels of 63dba to 71dba @ 7m in accordance with 2000/14/EC OND.

All generators are set to run at 50hz (1500rpm).

Voltages: Sets are sent out at 415/3/50 or 240/1/50.

Generators can be used on single set or AMF applications.

KVA Rating 0.8 Power Factor Continuous	Engine	Model	Fuel Tank Capacity (ltrs)	Fuel Usage Per Hr (ltrs) at 75% Load	Dimensions LxWxH	Wet Weight (kg)
18	YANMAR	3TNE88ACG	85	2.4	1860x811x957	800
30	PERKINS	33G2	460	5.2	2450x1100x1480	1460
45	PERKINS	33TG1	460	7.9	2450x1100x1480	1547
60	PERKINS	44-TG3	571	9.6	2940x1100x1500	1785
80	PERKINS	44-TAG1	571	12.4	2940x1100x1500	1940
100	PERKINS	44-TAG2	571	16.5	2940x1100x1500	1960
150	VOLVO	TAD731GE	313	28	3380x1180x1710	2532
200	VOLVO	TWD733GE	530	35	3471x1431x2128	3740
250	VOLVO	TAD940GE	477	50	3950x1430x2130	4154
325	VOLVO	TAD941GE	477	66	3950x1430x2130	4384

R-Range

The R range is suitable for general use and offers a compact size, good noise characteristics and reliability of supply. The range also comes complete with integral long run fuel tanks, which in certain applications can eliminate the need for an additional long tank. Models range from 30kva to 500kva with noise levels of 65dba to 70dba @ 7m in accordance with 2000/14/EC OND.

All generators are set to run at 50hz (1500rpm).

Voltages: Sets are sent out at 415/3/50 or 240/1/50.

Generators can be used on single set or AMF applications.

KVA Rating 0.8 Power Factor Continuous	Engine	Model	Fuel Tank Capacity (ltrs)	Fuel Usage Per Hr (ltrs) at 75% Load	Dimensions LxWxH	Wet Weight (kg)
30	Mitsubishi	2263SD	230	7.4	2160x966x1582	1320
40	Mitsubishi	Z2DT62SD	230	8.5	2160x966x1852	1350
60	John Deere	4045TFS70	390	12.5	2344x1080x1900	2090
80	John Deere	4045HFS72	390	13	2602x1170x1900	2500
100	John Deere	4045HFS73	505	21	2602x1170x1900	2560
150	John Deere	6068HFS73	868	31	3560x1200x2182	3560
200	VOLVO	TAD733GE	868	35	3560x1200x2182	3750
250	VOLVO	TAD734GE	950	47	4056x1380x2437	4520
315	VOLVO	TAD941GE	1368	57	4527x1410x2780	5887
400	VOLVO	TAD1242GE	1368	68	4527x1410x2780	6236
500	VOLVO	TAD1641GE	1770	84	5083x1560x2780	7290

Deci-Beater Range

The Deci beater range provides the Industry Leading Standard in Low Noise Power. These units are ideally suited for noise sensitive areas where silent power is critical. Models range from 15kva to 350kva with noise levels of 61dba @ 7m in accordance with 2000/14/EC OND.

All generators are set to run at 50hz (1500rpm) and can also be set at 60hz (1800rpm).

Voltages: Sets are sent out at 415/3/50 or 240/1/50.

Generators can be used on Single Set, AMF and Synchronising applications.

KVA Rating 0.8 Power Factor Continuous	Engine	Model	Fuel Tank Capacity (ltrs)	Fuel Usage Per Hr (ltrs) at 75% Load	Dimensions LxWxH	Wet Weight (kg)
15	Lister	LPW4	51	3.8	2000x1000x1070	800
27	Perkins	3142.4	178	6	3250x1145x2045	2241
40	Perkins	4236	178	10.5	3250x1145x2045	2368
80	Perkins	T4236	200	14.1	3700x1145x2045	2400
100	Perkins	100TG2	200	22.7	3700x1145x2045	2695
160	Cummins	6LTA8.32	421	37.1	4565x1290x2485	4321
200	Cummins	LTA10G2	421	40.5	4565x1290x2485	4721
250	Cummins	NT855G5	511	59.6	5300x1500x2805	6511
350	Cummins	NT855G4	511	73	5300x1500x2805	6761

Containerised Deci-Beater Range

The Deci-beater range provides the Industry Leading Standard in Low Noise Power. These units are ideally suited for noise sensitive areas where silent power is critical. Models range from 500kva to 1,250kva with noise levels of 60dba @ 7m in accordance with 2000/14/EC OND.

All generators are set to run at 50hz (1500rpm) and can also be set at 60hz (1800rpm).

Voltages: Sets are sent out at 415/3/50 or 240/1/50.

Generators can be used on Single Set, AMF and Synchronising applications.

KVA Rating 0.8 Power Factor Continuous	Engine	Model	Fuel Tank Capacity (ltrs)	Fuel Usage Per Hr (ltrs) at 75% Load	Dimensions LxWxH	Wet Weight (kg)
500	Cummins	KTA19G4	1000	87	6096x2438x2438	9500
800	Cummins	KTA38G3	700	140	9144x2438x2870	21500
1,250	Cummins	KTA50G3	700	210	9144x2438x2870	23500
1,250	Cummins	KTA50G3	5000	210	12000x24000x2600	23000

SLD have the capability with the Deci-Beater, PCC and Containerised range of machines to synchronise set to set, set to mains and multi megawatt synchronising packages.

1. **Set to Set**

   Isochronous load sharing is used to proportionally divide a common load between two or more generator sets while maintaining a fixed frequency.

   Droop Mode
   The droop configuration is necessary to limit the load by the engine/generator sets when paralleled with an infinite bus or dissimilar generators. The bus frequency is fixed, therefore operating isochronously will either overload the engine/generator, or cause shutdown on reverse current, depending upon whether the reference speed for the engine/generator is below or above the bus frequency.

2. **Set to Mains**

   When required to synchronise with the National Grid/Regional Electricity Company for Peak Lopping/Shaving purposes or to provide a No Break Return System so as to ensure the customer never experiences a loss of power in the event of transformer maintenance or switchgear replacement.

3. **Multi Megawatt**

When required to provide a large quantity of power to either Peak Lop/Shave and support the mains electricity supply or to actually supply the entire power required by the local authority to replace the local electricity supply.

The systems SLD are currently adapting are:

Barber Coleman, Barco, Selco, Puma and Cummins PCC.

Synchronising is a specialist field where a great deal of technical knowledge is required therefore all enquiries of this nature should liaise with Project Division so that the necessary assistance can be given to all concerned.

SLD offer the range of Crestchic Loadbanks for all Testing/Proving applications.

Efficient power generation testing system proving is vital. Loadbanks can provide a stable continuous load of the desired magnitude and power factor to fully evaluate equipment performance from 30kW - 150MVA capacities.

Load Bank rental is the most convenient solution for short term system testing. SLD offers a full range of load banks from 30kW to 6mVA in single units and multiple units for larger capacities Resistive or Resistive Reactive (0.8PF Typical).

Bunded Fuel Tanks

Whether SLD's clients need a long run tank option, in conjunction with their generator or pump, or they just require additional fuel storage capacity, then SLD's Bunded Fuel Tanks offer the quality and value they need.

The tanks represent the latest in product development. They are manufactured in the UK using the latest state-of-the-art laser and robotic technology. They meet ADR and UN requirements and comply with Pollution Protection Guidelines (PPG2/PPG26).

Bunded Fuel Tanks

SLD'S Bunded Fuel Tanks offer a quality and durability that can only be achieved with stringent quality control. SLD's hire fleet tank range features the capacities detailed below.

Model	Capacity Litres	Capacity Gallons	Dimensions (mm) Length	Dimensions (mm) Width	Dimensions (mm) Height	Weight (kg) Dry	Weight (kg) Wet
G748	2,000	400	2,480	1,120	1,160	820	2,820
G749	3,000	600	2,480	1,590	1,160	860	3,860

Environmental Benefits

All fuels must be stored and transported in an inner bunded tank to comply with current legislation. SLD's bunded tanks prevent accidental leakage of hazardous fuels and phosphates into the environment.

Distribution

In addition to the hire fleet generators, SLD offer a full range of accessories, listed as follows:

- Cable
- Distribution Boards
- Transformers
- Automatic Mains Failure Panels
- Bulk fuel Tanks
- Single and Multi-Set Synchronised Systems

A sample of the wide range of cable and distribution equipment is available with or without earth leakage trips and safe distribution of power.

Automatic Changeover Panels

Description

This panel is designed for use as an automatic supply change over panel, which will automatically start and stop a generator and changeover the supply from mains to generator and back again.

Panels can be single phase or three phase and three phase units. It can be either 3 pole or 4 pole. If a solid neutral is required the neutral pole on the contactor is lined with a copper bar per breaker.

The contactors are mechanically and electronically inter-locked so that the generator supply and the mains supply cannot be connected to the load at the same time.

The panel consists of the following equipment:

- 2 - 4 pole contactors
- 1 - 3 phase voltage/phase sequence monitor
- 1 - Delay on changeover on mains failure timer
- 1 - Delay on changeover on mains restoration timer
- 1 - Generator on load lamp
- 1 - Mains available lamp

Contacts for stopping and starting the generator set (open to stop, close to start).

Terminals for connecting the mains, generator and load cables.

The panels are mounted on galvanised stands for free standing with removable gland plates for cable entry. Panels are IP55 Rated.

Size (Amps)	No of Phases (Single/Three)	Voltage
100	Three	415
125	Single	240
125	Three	415
200	Three	415
250	Three	415
300	Three	415
400	Three	415
500	Three	415
1250	Three	415
2000	Three	415
25000	Three	415

Power Distribution

Packages Tailored to Individual Markets

Alongside SLD's extensive range of generators, a wide range of ancillary equipment is available to complete the temporary power system.

Power Distribution Panels

A complete range of distribution boards is available with many combinations of sockets/connections. These boards meet all relevant safety requirements and comply with all industry standards. Our certificated distribution board hire fleet ranges from 100amp to 1,000amp in distribution capacity.

Automatic Mains Failure Panels

This panel is designed for use with an automatic supply changeover panel, which will automatically start and stop a generator and changeover the supply from mains to generator and back again.

Panels can be single phase or three phase units. It can be either 3 pole or 4 pole. If a solid neutral is required the neutral pole on the contractor is lined with a copper bar per breaker.

The contactors are mechanically and electrically inter-locked so that the generator supply and mains supply cannot be connected to the load at the same time.

Our AMF hire fleet ranges from 250amp to 1,000amp in capacity.

Fuel Management Service

Do you need diesel fuel to be delivered to your site?

Do you have to take time out of your-day-to-day activities to order this fuel?

Would you like someone to lighten your workload?

Can we assist you with this request?

Competitive Prices

However good the service, SLD's clients want to pay the right price for peace of mind. Once the volume of fuel is established, SLD will agree a price that reflects the current market fuel costs, the delivery location and the frequency required. Once agreed, SLD could fix the price for the hire contract period*, helping you to control your monthly outgoings. This can be fixed for a maximum of 3 months.

Managed Service

SLD forward planning will ensure delivery to match your fuel consumption and fuel storage capacity. Due to our knowledge of your equipment of choice and its exact operating time (provided by you) we can assure you do not run out of fuel.

Flexible Deliveries

SLD deliver the volumes their clients require when they need them - even at weekends and on Bank Holidays when agreed in advance. They can also supply fuel for other (non SLD) equipment on-site. If working patterns change, frequency of deliveries can be adjusted to accommodate the clients' individual needs.

BS 6007 Rubber Trailing Cables

Flexible 85*C HOFR BS6007 heavy-duty rubber trailing cables. Applications include generator sets, standby power, submersible pumps, power tools and all kinds of mobile machinery and equipment.

SLD's comprehensive quality system is accredited to ISO9001.

Connector Type	Size	Max Amperage	Volts Drop/KM	Length	Description Core
12mm Spade Lug/ Power	240mmsq	645	0.23	30m	Single
Lug/Power	120mmsq	379	0.36	50m/25m	Single
Lug/Power	95mmsq	327	0.44	25mm	Single
Lug/Power	25mmsq	142	1.4	25m	Single
Ceeform (125A)	10mmsq	80	3.8	50m/25m	Three/Five
Ceeform (63A)	4mmsq	45	10.0	50m/25m	Three/Five
Ceeform (16A)	2.5mmsq	33	16.0	25m/50m	Three/Five

SY Cable

A SY cable is a power control cable with galvanised steel wire braiding, suitable for fixed installation or flexible applications. Used as measuring, checking and control cable in machine tool manufacturing, plant engineering, assembly and product lines. For unrestricted mobility without forced movement control and without exposure to tensile load. Used as energy or connecting cable in dry and moist rooms to meet safety requirements. Due to the galvanised steel wire braiding, these cables can even be used under adverse operating conditions or when exposed to high mechanical strain.

- Fine strands of bare copper wire
- Stranding acc. To VDE 0295 class 5
- PVC core insulation black with continuous white figure imprint
- Earth conductor green / yellow in the outer layer
- PVC inner sheath
- Overall screen made of tinned steel wire braid
- PVC outer sheath transparent
- Bending radius 20 x ø

Nominal Cross Sectional Area mm^2	Current Rating Amps
0.50	7
0.75	12
1.00	15
1.50	18
2.50	26
4.00	34
6.00	44
10.00	61
16.00	82
25.00	108
35.00	135
50.00	168
70.00	207
95.00	250

Hire Fleet Cable / Generator Size.

	Single Phase	Three Phase
15 kVa	10mm 3 core	6mm 5 core
30 kVa	16mm 3 core	10mm 5 core
40 kVa	35mm 3 core	16mm 5 core
60 kVa		35mm 5 core
80 kVa		35mm 5 core
100 kVa		35mm 5 core
150 kVa		120mm 5 single cores
200 kVa		120 mm 5 single cores
250 kVa		120 mm 5 single cores
350 kVa		240 mm 5 single cores
500 kVa		240 mm 5 single cores
800 kVa		240 mm 10 single cores 2 per phase 2N 2E
1,250 kVa		240 mm 10 single cores 3 per phase 2N 2E

Size MM	Length Metre	Current Rating Three Phase AC	Cable Dimensions Diameter	Cable Dimensions Weight Kg	Lug Hole mm	Dimensions Length	Dimensions Width	Dimensions Height	Dimensions Weight
6 5 Core	25	47	24.5	16.5	10	316	316	333	27.50
10 5 Core	25	64	30.5	27.15	10 12	9000	458	1190	133.15
10 5 Core	50	64	30.5	54.30	10 12	900	458	1190	160.30
35 5 Core	25	135	47.5	80.0	10 12	900	458	1190	186.0
35 5 Core	50	135	47.5	160.00	10 12	900	458	1190	266.00
95 4 Core	25	262	60.5	143.75	12 12	900	458	1190	249.70
95 4 Core	50	262	60.5	287.40	12 12	900	805	1190	413.40
95 Single Core	25	320	19.7	25.9	12 12	900	458	1190	235.00
95 Single Core	50	320	19.7	51.4	12 12	900	805	1190	383.00
120 SIngle Core	25	414	20.1	31.75	12 12	900	458	1190	264.00
120 SIngle Core	50	414	20.1	63.5	12 16	900	805	1190	443.00
240 Single Core	25	645	28.3	60	12 16	900	805	1190	486.00
240 Single Core	50	645	28.3	120	12 16	900	805	1190	606.00
240 Single Core	100	645	28.3	240	12 16	900	805	1190	606.00

Flexible copper conductors. EP rubber insulated. Heat oil and flame retardant. Rubber black sheathed. BS6007 (Type 638 TQ).

Ratings of Generators

Generators are rated in either kVA (kilovolt amperes) of kW (kilowatts), Kilo meaning 1000. The kVA is always higher than the kW. This is because kVA is divided by the power factor to give the kW. Most generators are rated with a power factor of 0.8.

Power and Power Factor

It is common to use mechanical kW to indicate the engine power but for alternators there are two ways to indicate the power:

kW (active power) and kVA (apparent power) the ratio of these two is the **Power Factor.**

kW = kVA x P.F

What does Power Factor mean?

In a DC circuit the power in Watts is a product of **Voltage x Current.**

In an AC circuit the **Active Power** is not always the product **Voltage x Current.** It is related to the **Power factor,** which depends on the type of load:

RESISTIVE LOAD (Incandescent lights, heaters)

The voltage and current peaks coincide to enable that the in-phase and the power factor are in unity.

INDUCTIVE LOAD (Motors, transformers)

On an inductive load the current waveform is LAGGING behind the voltage waveform, the voltage peaks and current peaks are not in phase, the amount of phase delay is given by the cosine of the angle (Cos) between the vectors representing voltage and current.

Capacitive Load (capacitors, cable)

The capacitive load has a current waveform which is LEADING the voltage waveform, voltage peaks and current peaks are not in-phase. The amount of phase delay is given by the cosine of the angle (Cos) between the vectors representing voltage and current.

The relation is: Watts (w) = Volts (V) x Amps (I) x P.F. (single phase)

Watts (w) = √3 x V x I P.F. (Three phase)

P.F. = (Cos) = Watts ÷ Volts x Amps

$$\frac{W}{VA} \quad \text{or} \quad \frac{KW}{kVA}$$

Frequency

Frequency (Hz) is measured in Hertz (cycles per second), this is the number of times that an AC supply oscillates in one second. The standard frequency in the UK is 50Hz and 60Hz in the US. However, bear in mind that if you are required to supply equipment offshore or on board ships, the frequency is usually 60Hz.

The frequency generated by an alternator is dependent on the number of poles in the alternator and the speed of the engine. The more poles in the alternator the slower the engine speed. A standard machine has 4 poles.

Relationship between speed and number of poles.

Engine Speed (Rpm)	Number of Poles	Frequency (Hz)
3000	2	50
1500	4	50
1000	6	50
750	8	59

The engine speed of a standard DeciBeater is 1500rpm for 50Hz and 1800rpm for 60Hz. Speed is directly proportional to frequency, therefore it is extremely important that the correct frequency is applied to its application.

Calculating kVA (Single Phase)

The calculating for single phase loads is slightly more complex due to the fact that a three phase generator has to be de-rated by a third when used on a single phase supply. This is because the current for an equivalent kVA, single phase is much higher than for a three phase.

Formulae

V = Voltage generated
I = Amps available
kVA = Kilo Volt Amps
0.66 = Derating factor 1/3

Example 1

The current which can be supplied by a three phase 50kVA generator when connected 240 volt single phase is determined as follows:

Derate by 1/3 eg. 50kVA x .66 = 33 kVA

For single phase $\frac{I = kVA \times 1000}{Volts} \quad \frac{= 33 \times 1000}{240} \quad =$ **137.5 Amps**

Example 2

A customer requires 30 Amps single phase 240 volt. What size set does he require?

1 Phase kVA $\frac{VXI}{1000} \quad \frac{= 240 \times 30}{1000} \quad =$ **7.2 kVA**

If you have a three phase machine then the derating factor must be used.

kVA $= \frac{7.2}{0.66} =$ **10.9kVA**

Calculating kVA & kW (Three Phase)

Formulae

Volts (V) = Voltage generated
Amps (I) = Amps available
P.F. Power factor of load (Usually 0.8)
√3 = 1.732

Formulae $kVA = \frac{V \times I \times \sqrt{3}}{1000}$

Example 1

A 415 volt, 3 phase generator gives 200 Amp. Calculate the kW and kVA of the generator.

$kW = \frac{V \times I \times P.F. \times \sqrt{3}}{1000}$ $\frac{415 \times 200 \times 0.8 \times 1.732}{1000}$ = **115 kW**

$kVA = \frac{kW}{P.F.}$ $\frac{115}{0.8}$ = **143 kVA**

Example 2

What is the current available from a 150kVA generator at 415 Volts?

$kW = \frac{V \times I \times \sqrt{3}}{1000}$ Therefore $I = \frac{kVA \times 1000}{V \times \sqrt{3}}$ = **208 Amps**

Example 3

If a customer requires a three phase current of 150 amps @ 440 volt, what size generator does he need?

$kW = \frac{V \times I \times \sqrt{3}}{1000}$ $\frac{440 \times 150 \times 1.732}{1000}$ =**114kW**

Note:- The calculations for kVA and kW current are the same at 50Hz or 60Hz.

Generator Formulae (Three Phase Generators)

To Find	Known Values	3 Phase
KW	Volts, Current, P.F.	$\frac{E \times I \times 1.73^2 \times PF}{1000} = KVA \times PF$
KVA	Volts, Current	$\frac{E \times I \times 1.73^2}{1000} = \frac{KW}{PF}$
RKVA	Volts, Current, P.F.	$\frac{E \times I \times 1.73^2 \times \sqrt{1 - (PF)^2}}{1000}$
KW (Required for Motor)	Motor HP, Elf	$\frac{HP \times .746}{Efficiency}$
kVA (Required for Motor)	Motor HP, Elf, P.F.	$\frac{HP \times .746}{Efficiency \times PF}$
Amps	HP, Volts	$\frac{HP \times .746}{1.73 \times E \times Efficiency \times PF}$
Amps	KW, Volts, P.F.	$\frac{KW \times 1000}{E \times 1.73^2 \times PF}$
Amps	KW, Volts	$\frac{KVA \times 1000}{E \times 1.73^2}$

Single Phase Generators (and DC)

To Find	Direct Current	Single Phase A.C.
Amperes When kilowatts is known	$\frac{KW \times 1000}{Volts}$	$\frac{KW \times 1000}{Volts \times P.F.}$
Amperes When KVA is known		$\frac{KVA \times 1000}{Volts}$
Kilowatts	$\frac{Amperes \times Volts}{1000}$	$\frac{Amps \times Volts \times P.F.}{1000}$
KVA		$\frac{Amps \times Volts}{1000}$
Power Factor		$\frac{K}{VA}$ or $\frac{KW}{kVA}$

Key to Symbols

AC	=	Alternating Current
DC	=	Direct Current
E	=	Volts
Eff	=	Efficiency
H.P.	=	Horse Power
I	=	Current
KVA	=	Kilovolt Amps
KW	=	Kilowatts
P.F.	=	Power Factor
m	=	Meters
mm	=	Millimeters

KVA/AMPERE Data

KVA										
Voltage	Phase	Hz	8	15	30	40	60	80	100	160
110	1	50	72	136	*	*	*	*	*	*
240	1	50/60	33	62	62	91	137	200	229	366
208	3	50/60	*	41	41	110	166	220	275	444
380	3	50	*	30	41	60	91	120	150	243
415	3	50	*	34	37	55	83	112	140	222
440	3	50/60	*	26	35	52	78	104	130	209
480	3	60	*	24	32	48	72	96	120	192

KVA											
Voltage	Phase	Hz	200	250	350	400	500	850	1000	1250	
110	1	50	*	*	*	*	*	*	*	*	
240	1	50/60	*	*	*	*	*	*	*	*	A
208	3	50/60	555	690	970	1110	1387	*	*	*	M
380	3	50	300	380	525	600	759	1290	1519	1899	P
415	3	50	280	350	490	560	695	1180	1390	1739	S
440	3	50/60	260	328	455	520	656	1115	1312	1640	
480	3	60	240	300	420	480	600	1022	1202	1503	

Formulae: Three Phase kVA = $\frac{\text{Volts x Amps x } 1.732}{1000}$

Single Phase kVA = $\frac{\text{Volts x Amps}}{1000}$

kW = kVA x Power Factor

Cabin and Loading Guidelines

32ft Office Cabin	8kVA	Fan Heater	2kW
Toilet/Shower block	10kVA	Water Heater	3kW
Mess Room	10kVA	Cooker	7kW
Drying Room	10kVA	Baby Belling Cooker	3kW
Toilet 5kVA	Hand Wash		3kW
	Shower (average)		8kW

Motor Starting

Sizing of Generators for Motor Starting (Direct on Line)

Assumptions

For Motors up to 200kW

6-7 times running current on start up of motor

Efficiency	90% (0.9)
PF	0.85

For motors above 200kW

5-6 times running current on start up of motor

Efficiency	95% (0.9)
PF	0.85

Allowance

Average transient voltage trip will be around 15% of rated kW of alternator. Allow max. 35% voltage dip on main input terminals on capital load.

25% for voltage dip

10% for VHz engine dip

Note: contactors may start to “drop out” at around 75% rated voltage.

Check voltage dip and locked rotor kVA curve on spec sheet for relevant alternator and multiply running kVA by assumed starting current multiplier to give starting (locked rotor) kVA.

Motor Starting - Direct On-Line

Electric Motor H.P	Electric Motor K.W	KVA Nominal at PE = 0.85	KVA Inrush current on Start up = 6.50	Selected alternator for Delta U of < 20% sustained	Rated power of the alternator
1	0.75	1.0	6	LSA37M5	7.5
1.5	1.1	1.4	9	LSA37M5	7.5
2	1.5	2.0	13	LSA37M5	7.5
3	2.2	2.9	19	LSA37M5	7.5
4	3	3.9	25	LSA37M7	13
5	3.7	4.8	31	LSA37M7	13
6	4.5	5.9	38	LSA37VL8	17
75	5.5	7.2	47	LSA42.2S4 AREP	17.5
10	7.5	9.8	64	LSA42.M6 AREP	23
12.5	9.3	12.2	79	LSA42.2L9 AREP	32
15	11	14.4	93	LSA43.2S1	35
20	15	19.6	127	LSA43.2S2	40
25	18.6	24.3	158	LSA43.2M4	53
30	22	28.8	187	LSA43.2L6	63
40	30	39.2	255	LSA44.SVS4	100
50	37	48.4	314	LSA44.2S7	120
60	45	58.8	382	LSA44.2M9	135
75	55	71.9	467	LSA46.2M5	200
100	75	98.0	637	LSA46.2L9	280
125	90	117.6	765	LSA46.2VL12	315
150	110	143.8	935	LSA47.1M6	350
175	130	169.9	1105	LSA47.1L9	450
200	150	196.1	1275	LSA47.1L10	500
250	185	241.8	1575	LSA49.1M6	725
KVA Inrush	Current on	Start up =	5.50	Above 200 KWE	
300	225	178.6	1533	LSAA49.1M6	725
400	300	371.5	2043	LSA50.1M6	1225

EFFICIENCY 0.9 <200KWE

EFFICIENCY 0.95 >200KWE

Approximate current per line or phase taken at full rated HP by motors of average efficiency and power factor.

Motor Rating	Direct Current			Alternating Current			
	110V	220V	550V	240V	380V	415V	550V
HP	Amp	Amp	Amp	Amp	Amp	Amp	Amp
0.5	5.7	2.8	1.1	3			
1	10	5	2	6	1.9	1.7	1.3
2	18	9	3.6	10	3.6	3.3	2.5
3	26	13	5.2	15	5.1	4.6	3.5
5	42	21	8.4	24	8	7.3	5.5
7.5	60	30	12	35	11.6	10.6	8
10	80	40	16	46	15.1	13.8	10.4
15	117	59	23	67	22	20	16
20	154	77	31	88	29	27	21
25	190	95	38	110	37	34	26
30	227	114	46	130	43	40	30
40	300	150	60	180	59	54	41
50	375	187	75	210	73	67	50
50	445	223	89	253	87	80	60
60	520	260	104	291	102	94	70
80	600	300	120	332	117	107	81
100	740	270	148	412	145	133	100
125		460	184	545	181	166	125
150			220		217	199	150
175			256		253	232	175
200			292		288	264	199
250					353	323	244
300					421	385	291

Voltage Drop Calculations

The voltage drop of any insulated cable is dependent upon the route length under consideration (in meters), the maximum impedance and voltage drop applicable to each cable at maximum conductor temperature and under a.c. conditions is given in the voltage drop calculations table on page **38.** For cables operating under dc conditions, the appropriate voltage drops may be calculated using the formula:

2 x route length x current x resistance x 10

The values detailed in the tables are given in m/V/Am, Volts/100 per ampere per meter) and the nominal maximum acceptable volt drop specified by the IEE Regulations is 2.5% of the system voltage; i.e. 0.025 x 415 = 10.5 volts for phase 3 working or 0.025 x 240 + 6.0 volts for a single phase working.

Consider a 3 phase system

The requirements may be for a load of 1000A to be transmitted over a route length of 150m, the cable to be clipped to the wall and close protection provided. The rating tables in the IEE Regulations indicate that a 35mm copper conductor PVC SWA. PVC cable would be suitable for the loading required, however the voltage drop must be checked.

Volt drop = Y x current x length
= 1.1 x 100 x 150 millivolts
= 1.1 x 100 x 150 volts/1000
= 16.5 volts

Where Y = value from tables (**page 35**) in mVA/m unless a particular value of voltage drop, acceptable to the user, is specified, the IEE Regulations figure of 10.5 volts must be adhered to.

Thus: total volt drop = 10.5 volts
10.5 = Y x 100 x 150
Therefore: Y = 10.5/100 x 150
=0.7/1000 volts/ampere/meters

Reference to the voltage drop tables indicates that the cable size with a voltage drop of 0.7/1000 V/A/m (0.7mVA/m) OR LESS is a 70mm copper conductor.

Therefore, in order to transmit a 3 phase current of 100A per phase over a route length of 150m, with a total voltage drop equal to or less than the statutory maximum 10.5 volts, the use would require a 70mm (cu.) multicore PVC.

Alternatively:

The user may have 150m of 35mm (cu) multicore PVC cable and require to know what maximum current rating can be applied without exceeding the allowable voltage drop. The method is exactly the same as above,

viztotal drop = 16.6
= YxAxm
=1.1 x A x 150/1000
from the tables Y = 1.1 mV/A/m
= 1.1/1000V/A/m
Therefore: A=10.5 x 1000/1.1 x 150
=64 amperes

From the foregoing, it is apparent that by knowing any two values of Y, A or M, the remaining, unknown value can readily be calculated.

The advice is to always check, clarify or suggest the most suitable size and type of cable for any particular, specified requirements.

Voltage Drop Calculations

Voltage drop for single core LV cables (mV/amp/metre)

Copper conductor	Flat arrangement	Trefoil arrangement	Aluminium conductor	Flat arrangement	Trefoil arrangement
6	5.287	5.226	25	2.161	2.100
10	3.184	3.124	35	1.602	1.542
16	2.086	2.008	50	1.222	1.162
35	1.034	0.971	95	0.686	0.623
95	0.469	0.408	185	0.420	0.360
120	0.410	0.349	240	0.353	0.293
240	0.272	0.211	400	0.245	0.185

Voltage drop per Ampere per Meter (mV).

Conductor operating temparature: 70°

Conductor cross sectional area	Two core cable D.C		Two core cable single phase A.C		Three or four core cable three phase A.C		
mm	mV		mV			Mv	
6	7.3		7.3			604	
10	4.4		4.4			308	
16	2.8		2.8			204	
		r	x	z	r	x	z
25	1.75	1.75	0.170	1.75	1.50	0.145	1.50
35	1.25	1.25	0.165	1.25	1.010	0.145	1.10
120	0.36	0.38	0.155	0.41	0.33	0.135	0.35
240	0.180	0.190	0.150	0.24	0.165	0.130	0.21

Voltage drop per Ampere per Meter (mV).

Conductor operating temparature: 70°

Conductor cross sectional area	Two core cable D.C		Two core cable single phase A.C		Three or four core cable three phase A.C		
1	2		3			4	
mm	mV		mV			Mv	
16	4.5		45			3.9	
25	2.9	29	0.175	2.9	2..5	0.150	2.5
35	2.1	2.1	0.170	2.1	1.80	0.150	1.80
120	-	-	-	-	0.53	0.135	0.55
240	-	-	-	-	0.26	0.130	0.30

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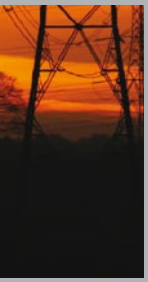

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