



**ECLECTIC
ENERGY**

D400 LITE

USERS MANUAL

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:Specifications subject to change without notice.



Safety Guidance

Read carefully before proceeding with D400 Lite install

- ⚠ Working at height is inherently dangerous. Enlist help and exercise due care at all times during installation.
- ⚠ Plan the install in advance. Take account of the weight the D400 Lite (14kg) and the fact that the machine is large and an awkward shape to handle. Choose a calm and dry day for installation.
- ⚠ Check the fit of the tower liner into your chosen mount tube before attempting the install.
- ⚠ Assemble the wind generator at ground level as far as possible.
- ⚠ D400 Lite air blades are extremely sharp at the trailing edge and should be handled with care. Never approach the path of the air blades when the machine is operating as personal injury could result.
- ⚠ Always slow and stop the air rotor and secure the air blades before attempting maintenance.
- ⚠ D400 Lite can produce high voltages particularly if open circuit, i.e. disconnected from the battery or other electrical load. Caution should be exercised to avoid electric shocks from the output cables.
- ⚠ Always observe correct polarity when connecting D400. Reverse polarity may damage the wind generator and other electronic equipment.
- ⚠ Stop D400 Lite and isolate the batteries before undertaking any work involving the electrical system.
- ⚠ When operating, the wind generator should be permanently connected to an electrical load. If allowed to run when open circuit the air rotor will over speed resulting in noisy and threatening operation.

Introduction

Thank you for purchasing the D400 Lite Wind Generator designed and manufactured by Eclectic Energy Limited in the United Kingdom.

The D400 Lite features even more performance and serviceability than its predecessor D400, but in a lighter package thanks to high powered rare earth magnet rotors.

Please read the entire User Manual thoroughly prior to installation to ensure your personal safety and to optimise the performance of the equipment.

If you have any questions having read the manual, please contact Eclectic Energy Limited for further clarification. Email: sales@eclectic-energy.co.uk - Telephone: +44 1623 835400

Declaration of Conformity

Eclectic Energy Limited

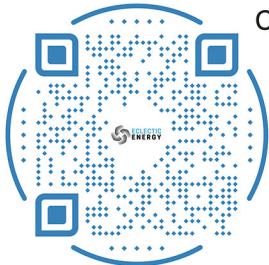
Certifies that this product complies with the following standards/directives 89/336/EEC



Product description: D400 Lite Wind Generator

Signed: P J Anderson

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Guarantee / Returns

The D400 Lite wind generator comes with a two year warranty which covers defective parts and manufacturing faults. The warranty commences from the original date of purchase. Damage resulting from mishandling, improper installation, or accident is explicitly excluded from this warranty.

The D400 Lite alternator features anti-tamper seals and if these seals are broken the warranty becomes void. In cases where accidental contact with air blades occurs or where the unit has been incorrectly installed or operated, Eclectic Energy Limited cannot be held responsible for personal injury or damage that may result.

Eclectic Energy is dedicated to providing a high level of customer care. If you have concerns about the product's functionality, contact Eclectic Energy Limited as your first course of action. We recommend getting in touch with us before proceeding with any warranty claim as most problems with new equipment are due to faulty installation rather than the machine itself. If you need to return the product for any reason contact us first to obtain the required customs information to facilitate the returns process. You can contact us via email at sales@eclectic-energy.co.uk or by telephone.

Costs associated with the return of product for warranty claim are the responsibility of the owner.



Scan to View Terms and Conditions

Check List

Check that you have received two cartons containing:-

Carton One Contents:

- 1 x Alternator
- 1 x Regulator and dump resistors (If ordered)
- 1 x Brake Switch (If ordered)

Carton Two Contents:

- 5 x Turbine blades
- 1 x Tail
- 2 x Hub plates
- 1 x Hub centre
- 1 x Fastener pack
- 1 x Tower liner
- 1 x Nose cone

Additional parts required for installation:

- Mount tower
- Extension cable
- Battery terminals connections
- Connection blocks or crimps
- Cable clips

Optional system items:

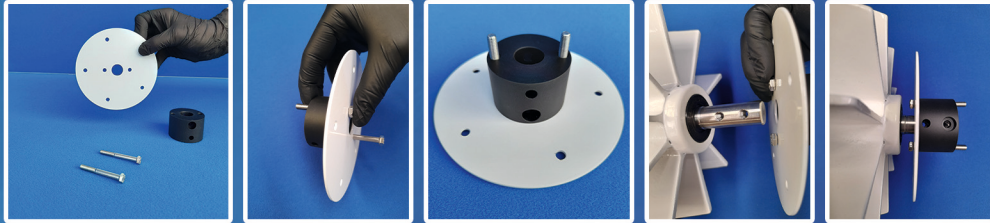
- Charge regulator
- Charge splitters
- Volt and ammeters
- Battery monitor
- Brake Switch

Tools:

- Spanners and sockets
- Screwdrivers
- Wire strippers
- Drill

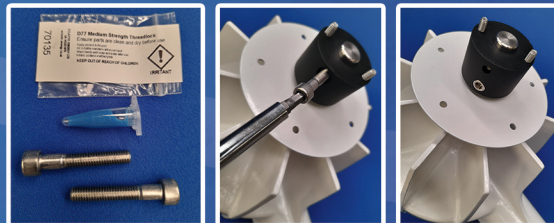
D400 Lite Air Hub Assembly

- Take the black hub centre and the white powder-coated hub plate, plus two M5 x 45 Hexagon Head shoulder bolts and M5 washers. Pass the two M5 bolts and washers through the inner holes of the plate and fit the bolts through the hub.



- Identify the two M6 Cap Head bolts and Loctite. It is important to smear a little of the Loctite thread lock compound supplied to the threads of the M6 Cap Head Bolts. These bolts are used to secure the hub centre to the alternator shaft.
- Screw the M6 Cap Head Bolts through the hub centre and alternator shaft. Fit each bolt from the side of the hub centre with the machined recess for the cap head. The bolt heads should be flush when tightened as shown the photographs.

****Important** Do not over tighten these bolts as this can distort the hub centre**



- Start to assemble the five blades of the air rotor by clipping two blades together at the root. Align and slide the tenon on the first blade into the recess on the second as shown in the photograph below. Continue joining the three remaining blades in the same manner to complete the air rotor.



- Locate the aluminium lock ring loosely into the moulded annular recess on the rear of the air blades roots, rounded edge first. Do not push the aluminium ring too deeply into the groove at this time.
- Slide the air blade assembly over the hub centre ensuring that lock ring is towards the back of the machine and the concave face of the air blades faces forward as indicated by the label on the air blade.



- Rotate the air blade assembly to align the five through holes in the air blade roots with the 5 holes in the rear hub plate.
- Select one of the M5 x 45 Hex Head screws and washer. From below pass the bolt through the inner hub plate and blade root.
- Next fit the stainless-steel outer hub plate over the three protruding M5 bolts ensuring all remaining holes are in alignment.
- Fit M5 washers and Nyloc nuts onto the three bolt threads. Do not tighten at this time.
- Fit the four remaining M5 x 45 Hex Head screws through the inner powder coated hub plate such that they pass right through the rotor blade root and the outer hub plate fitting a washer and nut to secure each one.
- Finally, evenly tighten all fasteners. Ensure that the rotor bolts are secured using the Nyloc self locking nuts supplied.

D400 Lite Tail Assembly

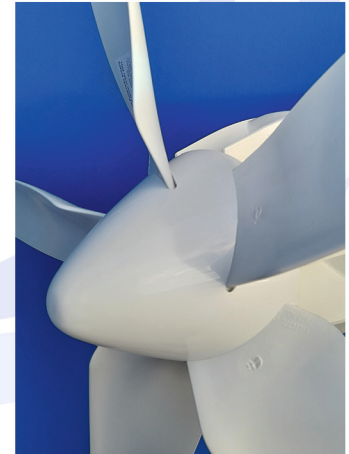
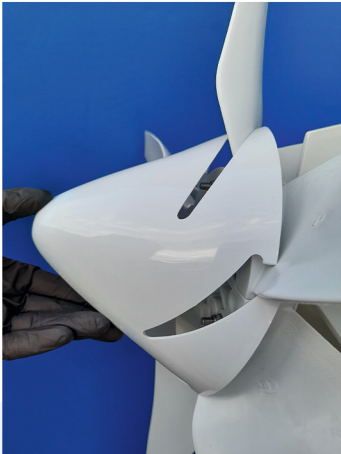
- Place the turbine face down on its rotor and attach the tail using three M6 bolts in the tail pack supplied.
- The tail should be fitted to the left-hand face of the cast backplate flange when the D400 Lite is viewed from the rear.
- The small M6 washer is placed under the bolt head adjacent to the casting. The tail is fitted with the bolt passing through the backplate flange and through the tail. Next the large rubber and stainless-steel washers are fitted and secured with an M6 Nyloc self locking nut.

Once all three bolts are fitted, they can be tightened firmly and evenly.



Fitting the Nose Cone

- To fit the nosecone, offer up the axial splits in the nose cone moulding to the leading edges of the blades while holding the cone square and central over the hub.
- Gently open each of the axial splits and guide it over the leading edge of the blades.
- Next rotate the nosecone anti clockwise. This effectively screws the nosecone onto the blade roots.
- Press the tab at the rear end of the blade slot in the cone, such that it snaps behind the trailing edge of the air blade. Repeat this with the four remaining blades to secure the nosecone in place.



Mount Tower Options & Guidance

Marine Mountings

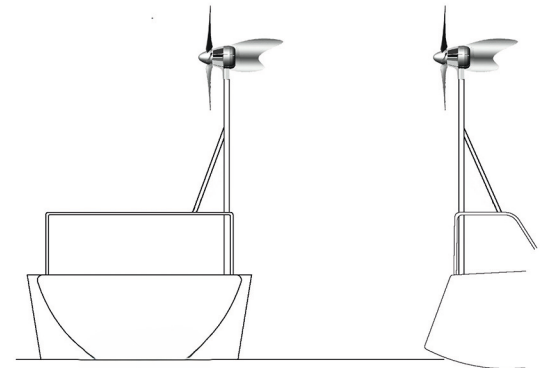
When mounting on a yacht or boat, positioning the turbine will be influenced by the configuration of the boat and other equipment fitted. It is important to ensure that the blades are at sufficient height such that injury to the crew from rotating blades is unlikely. The minimum height of the lowest point of the airblades above a crewed area should be 2.4 metres.

Also ensure that no part of the turbine can come into contact with any other part of the boat's fittings or rigging as it yaws about its vertical axis. Because the turbine is subject to dynamic loads when the yacht is in a seaway in addition to wind loadings, the tower should be securely braced or guyed both fore and aft and athwartships. The bracing struts or wires should be firmly attached to the main tower at a point 200 –300 mm below the lowest point of the blades.

The D400 Lite is an inherently quiet and low vibration machine. However, certain applications may benefit from the introduction of anti-vibration mounts under the main tower and bracing struts. Note that, on a yacht or boat, no unsupported tower should exceed 2.5 metres in length. The wind loading on the D400's Lite rotor disc can exceed 50 kg, so any tower structure should be designed to allow for a safe working lateral load of 70 kg at the hub height of the turbine.

For inland watercraft such as narrow boats, a hinge-down tower arrangement can be utilised to allow for rapid lowering of the turbine for passage under low bridges etc. For ketches and yawls, a mizzen mast mount is often suitable.

The D400 Lite is also suitable for mounting on a stub tower from stern arches and targas.



Typical yacht mount braced fore and aft

Terrestrial Mounting

The performance of your D400 Lite will be influenced by the topography of your proposed site. The golden rule with wind turbines is to mount them as high as is practically possible. The higher the turbine is mounted, the more productive it will be. This is because wind speeds reduce rapidly as they approach the ground due to the effect of friction between the airstream and the earth's surface. This 'wind shear' effect is less marked over smooth surfaces such as the sea, and more marked over 'rough' surfaces such as woods or urban areas. Obstructions such as trees and buildings also introduce turbulence into the airflow, and no wind turbine works at its best in turbulent air. Given that low windspeeds and turbulent airflow will greatly reduce the efficiency of any wind turbine, it is important to locate the D400 Lite in the clearest, fastest airflow possible.

Aim to mount your D400 Lite above the height of any surrounding obstruction within a 100 metre radius. If this is impractical, aim to mount the turbine as high as possible.

A useful assessment of the quality of airflow at a proposed location can be achieved by attaching a streamer, to a pole and letting it fly at the proposed height of the turbine. If the streamer flies straight, the airflow is uniform. If the streamer flutters and spirals, turbulence is present, and you should consider an alternative site.

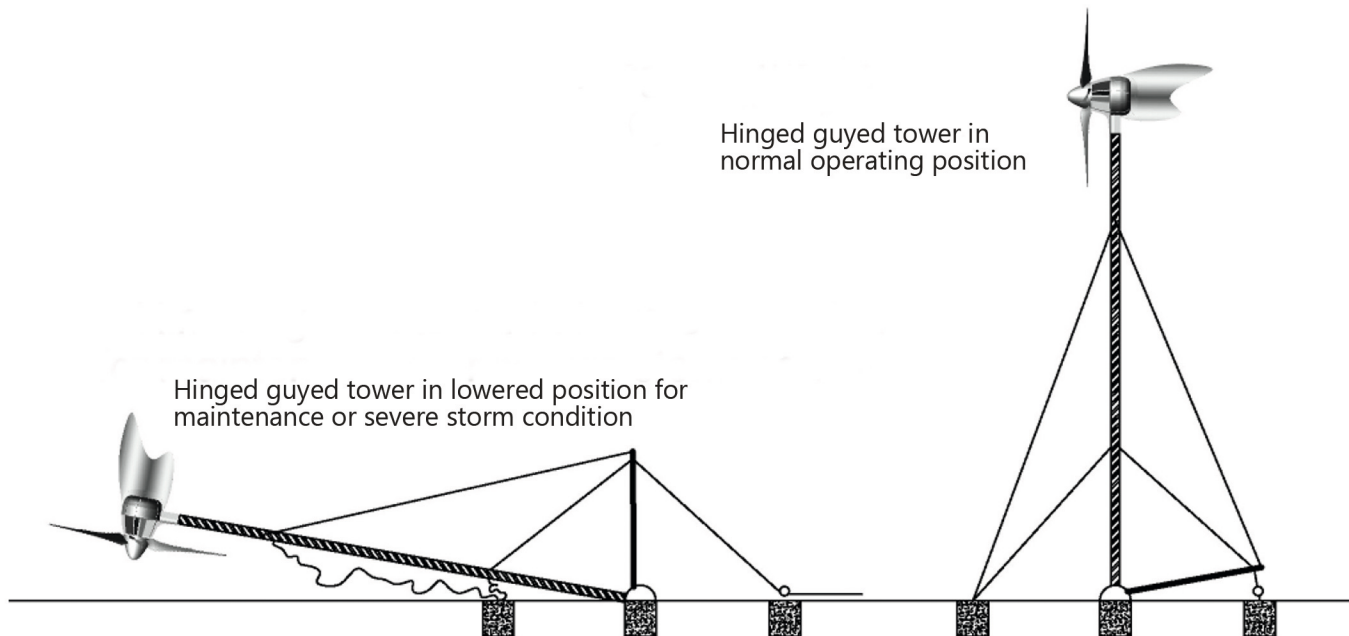
Mounting towers can be either guyed or free-standing. Free-standing towers need to be very substantial and require either a screw pile or concrete foundations. They are therefore generally expensive. Guyed towers are the more usual choice.

Guyed Towers

A typical guyed terrestrial mount for a D400 Lite would consist of a tubular tower supported by four or more guy wires. No more than 2 metres of the tower should extend above the upper guy wire attachment point. The guy wires themselves should be of at least 4mm in diameter with a breaking strain in excess of 50kg. They should be galvanised or stainless steel for protection against the weather. Shackles and bottle screws should be at least 5mm in diameter and where guy lines are looped, the loop should be held with a minimum of 3 wire rope grips, and should incorporate a thimble to form the eye.

Guyed Tilt Down Tower

Guy wire radiuses should be observed. The recommended radius for the guy wire anchors is 0.6 of the tower height. Four guy wires are preferable to three, as this enables the tower to be hinged up from its base with three guy wires always remaining in place to support the tower as is lowered or raised.



Building Mount & Cantilever Towers

Roof / Wall Mounting

Due to its quiet, vibration-free operation, the D400 Lite is particularly suitable for rooftop installation.

Building mount has the advantage of achieving additional height. The turbine can also benefit from a localised increase in wind speed as the air flow passes over the roof ridge, particularly where the prevailing wind direction is 90° to the roofline. A mount height of 1.5 to 2.5 metres above the ridge line will usually place the turbine in the best air flow.

The building structure and the mounting bracket fixings must be sufficiently strong to provide a safe working load in all wind conditions. See illustration below:



Free-standing Cantilever Towers

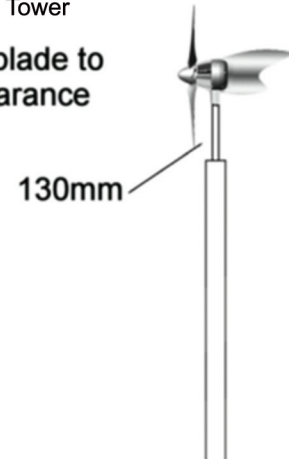
For small wind turbines such as the D400 Lite, free-standing cantilever towers can take the form of old telegraph poles, purpose designed tubular steel towers or a self-supporting steel lattice.

It is important to ensure the tower's foundation is sufficient such that the tower can withstand a horizontal load of 70kg at the hub height of the turbine.

In order to ensure that an acceptable blade to tower clearance is maintained, a stub tower should be used between the D400 Lite and the free-standing tower. See illustration below:

Correct use of Stub Tower

Minimum blade to tower clearance



Installing the D400 Lite

Fitting D400 Lite tower liner to your tower tube

D400 Lite is a socket type fit into the chosen mount tower. D400 Lite can be installed on a tube/ stub tower with an outside diameter between 45-75mm. The part that enables this fit is called the tower liner. As standard D400 Lite is supplied with a tower liner to suit a mount tower tube with 42mm inside diameter. When using tubes with a different internal diameter, steps must be taken to achieve a close sliding fit between the tube and tower liner.

The tower liner can be reduced in diameter if it is too large or packed out if it is too small. Alternatively, a custom tower liner machined to your required dimensions can be pre-ordered from Eclectic Energy. Bespoke tower liners can be specified with new machines or ordered subsequently.

It is strongly recommended that you check the fit of the tower liner into your tower tube before attempting to install the D400 Lite.

- Pass the D400 Lite output cables through the tower liner exiting at its base, and slide tower liner fully home onto yaw shaft.
- Tighten the 3 x M5 grub screws to lock the tower liner to the yaw shaft.
- Apply a small smear of Loctite compound to each grub screw before fitting to prevent them from working loose in service.
- Connect the output fly leads to an extension cable within the mount tower and insulate the joint before fitting the D400 Lite to the tower.
- Once the machine has been installed onto the mount tower drill two or more 4mm holes, 12mm deep through the tower tube and into the tower liner.
- Fit 8 x 12mm self-tapping screws into these drilled holes to secure D400 Lite to the mount tower.

Installing the D400 Lite



Electrical Installation

D400 Lite is primarily designed to charge batteries either lead acid or lithium.

It is recommended that D400 Lite is permanently hard wired forming an independent but integral part of the overall electrical system. As the wind generator outputs 'low voltage DC' it does not require a certified electrician to install. However, the electrical installation should be completed by a competent and knowledgeable individual.

CONVERSION CABLES & CABLE SIZING

When installing D400 Lite, the minimum requirement is that the rating of the cable chosen should be equal to the maximum current (amperes) that the machine can generate. Note that power (watts) = volt X amps so the maximum current generated by a 24 volt D400 lite will be half that produced by a 12 volt D400 Lite. A 48 volt turbine at full output will produce one quarter of the current of a 12 volt machine. However the actual power delivered in Watts remains the same in each case.

Using an appropriate wire gauge for a given system voltage and wire length is important for operational efficiency. Using cable with a larger conductor cross section is generally preferable as it minimises circuit resistance and voltage drop. All cables have a certain level of electrical resistance per metre, but using a larger cross sectional area of cable results in a lower resistance for a given cable length. Refer to the table on the following page for recommended minimum cable gauges.

For practical reasons when installing turbines cable selection is usually a trade-off. The greatest electrical losses only occur when the turbine is producing the highest output, and this only occurs in high winds which are relatively infrequent. As long as the cable selected is rated to safely carry the peak current, it is not generally considered practical or economic to fit very heavy cable which provides for the lowest possible loss in these rarely encountered conditions.

Most cable sizing recommendations are designed to deliver on acceptable overall transmission efficiency of around 95%. Where the recommended cable sizes below are followed electrical losses will be minimal in typical operating conditions, which prevail for most of the time.

Note that poorly made connections and corroded terminals can introduce high resistances into a low voltage circuit and are the most frequent cause of poor system performance. Tinned cable is always recommended as this offers superior corrosion resistance to untinned copper wire, particularly important in the marine environment.

All connections should be securely made using terminal block or joints can be soldered for extra security. Quality crimp connectors closed with a proper crimp tool are another option, but beware of badly crimped joints. Note also that the quality of the insulation affects the rating of cable. PVC insulated cable with a temperature rating of 75°C is typically used. Cable insulated with butyl rubber has a higher temperature rating and can therefore carry higher currents.

Cable runs should be arranged to avoid them being accidentally pulled or strained. Also avoid placing cable where heavy or sharp objects may be dropped onto them damaging the insulation. To avoid EMF interference it is preferable to route turbine output cables away from aerial and data cables. If this is not practical, as a minimum avoid bundling power cables tightly together with signal cables.

When considering which cable size to use make an assessment of the total length of the cable run in metres. Remember to include the height of any mounting tower or tube. Then multiply this by two, which gives the total circuit length i.e. positive to load and back to negative. Use this figure to select a **minimum** wire gauge from the tables below.

Table of minimum recommended cable conductor cross sections

Circuit length	0-20m	20-40m	40-60m	60-80m	80-100m	100-120m
12V system	10 ² mm	16 ² mm	25 ² mm	35 ² mm	50 ² mm	–
24V system	2.5 ² mm	4.0 ² mm	6.0 ² mm	10 ² mm	16 ² mm	25 ² mm
48V system	2.5 ² mm	2.5 ² mm	2.5 ² mm	2.5 ² mm	4.0 ² mm	6.0 ² mm

Electrical Installation Continued

The following table shows voltage drop in millivolts per ampere of current, per metre for some popular cable sizes. Note there are 1,000 millivolts to one volt DC.

Conductor Cross sectional area in ² mm	Voltage drop per ampere per metre in millivolts DC
2.5	18
4	12
6	7.6
10	4.5
16	2.7
25	1.7

This table can be used to assess the relative efficiency of different cable options. To work through an example assuming a 12V D400 Lite wind generator mounted at the stern of typical cruising yacht. Cable run turbine to batteries, 9 metres. Total circuit length i.e. positive to load negative to generator is 18 metres. Maximum probable charging current is 50 amps (approx. 650 watts). Assuming 10²mm cable, and maximum turbine output the volt drop would be 4.5 x 50 x 18 = 4050 Millivolt or 4.05 VDC, equivalent to about 33% of the total power being generated. However at more typical turbine outputs of say 5 amps the loss through the same cabling would be only 0.4 VDC or 3.3% of power generated.

Referring to wire sizing table you will see that 10²mm is actually the minimum recommended for D400 at this length of cable run. If we calculate the same example using 16²mm cable, the volt drop figures becomes 2.4 VDC and 0.24 VDC respectively. This example illustrates that in typical operating conditions electrical losses with both wire sizes are acceptable. However, the system would achieve higher overall transmission efficiencies using the 16²mm cable.

Fusing

D400 Lite and the associated battery storage are capable of producing very high currents. In order to protect the turbine and the rest of the electrical system it is important that appropriate fuses form part of the install.

D400 Lite is supplied with a Maxi Blade fuse rated at 50amp or 20amp for the 12 and 24V variant respectively. This is to limit battery current flowing back through the cables in the event of cable damage and short circuit.

This fuse should be installed between the turbine output and regulator input. Where a brake switch is fitted the fuse should be installed between the brake switch and the turbine. Secondary fuses should also be installed as specified by the charge regulator instruction manual. These fuses are wired between the regulator output and battery terminals or busbar.

Charge regulation

The stator windings of each voltage variant are perfectly matched to the intended design load and therefore D400 Lite can be connected directly to a battery if required. This does mean the charge would need to be monitored and controlled manually. For this reason we strongly advise that a charge regulator does form part of the installation as this makes the system 'fit and forget'.

The charge regulator has two main functions. It prevents possible battery damage through over charging (over voltage) and once the batteries are full it controls the rotor speed of the D400 Lite by connecting the turbine to dump resistors. With a rotating machine such as D400 Lite a dump type regulator (complete with resistive dump loads to dissipate unwanted power) is required, and we recommend that the 6TB 12/24 solid state unit or equivalent is used.

Refer to the 6TB charge regulator manual and the links below to our website for further information.

<https://eclectic-energy.co.uk/regulator-installation>

<https://eclectic-energy.co.uk/wp-content/uploads/2016/09/10545-Regulator-instructions-D400.pdf>

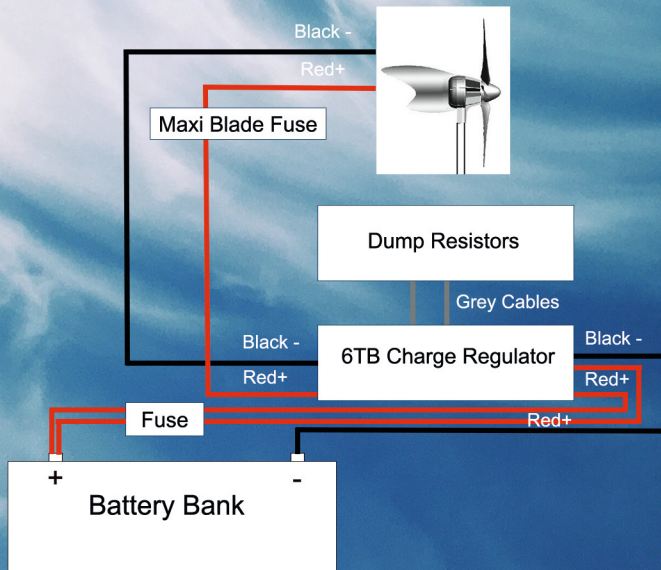
Electrical Connections

Low voltage battery-based systems can be self-installed by a competent owner. If you are unsure of your ability to install the wiring correctly seek professional assistance.

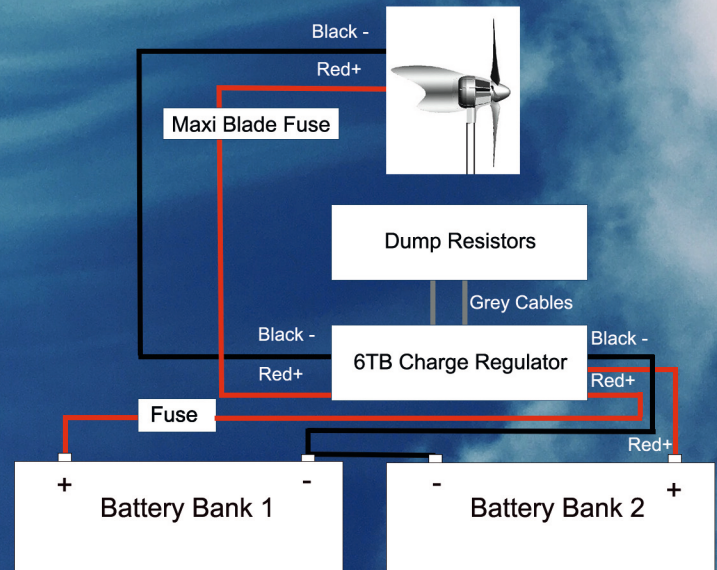
D400 Lite should be hard wired to the batteries such that it forms an integral part of the overall electrical system. There should no plugs or sockets in the wiring as these constitute a hazard if they become disconnected. For marine applications cables should enter the vessel via a waterproof cable gland. D400 Lite should always be connected to a battery when in use, open circuit operation should be avoided as the unit will overspeed. Typically connection is made via a dedicated charge regulator.

Electrical installation Schematics

Single battery bank installation

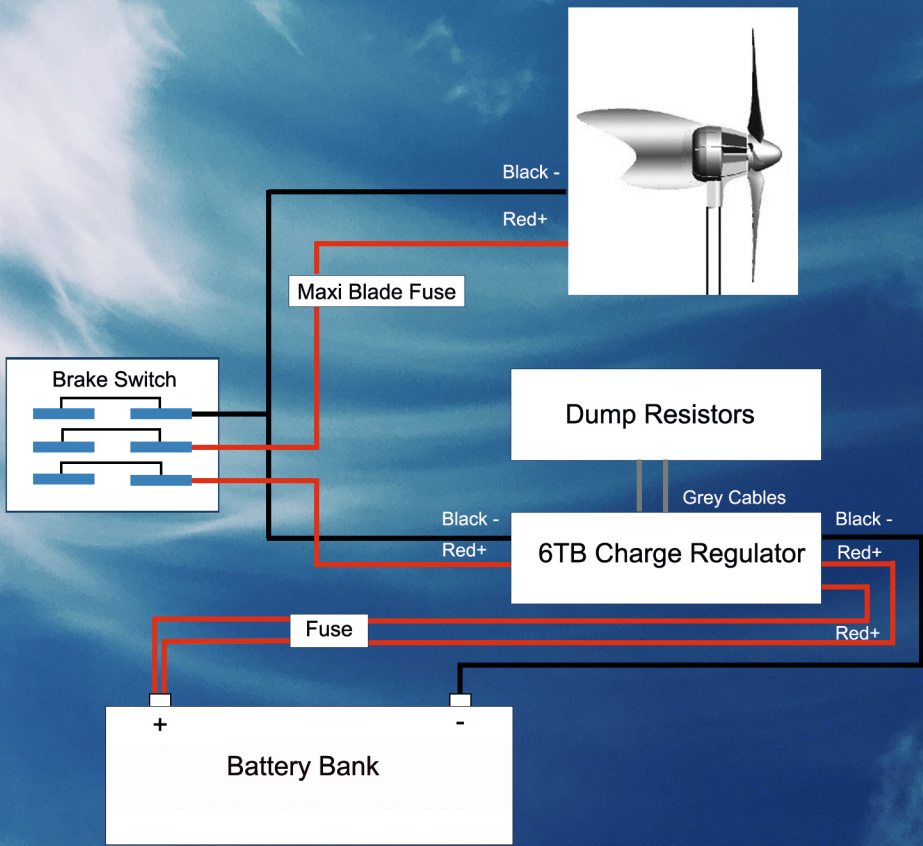


Twin independent battery bank installation



Brake Switch & Regulator

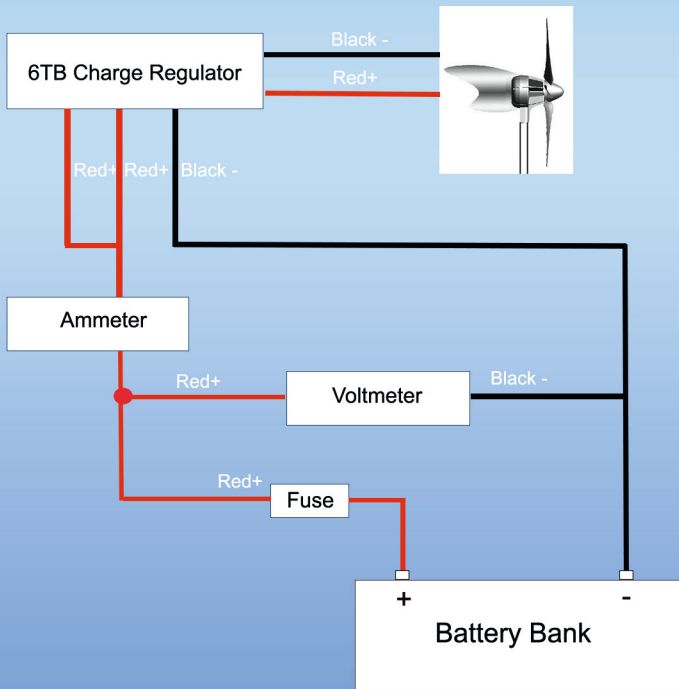
for single battery bank installation



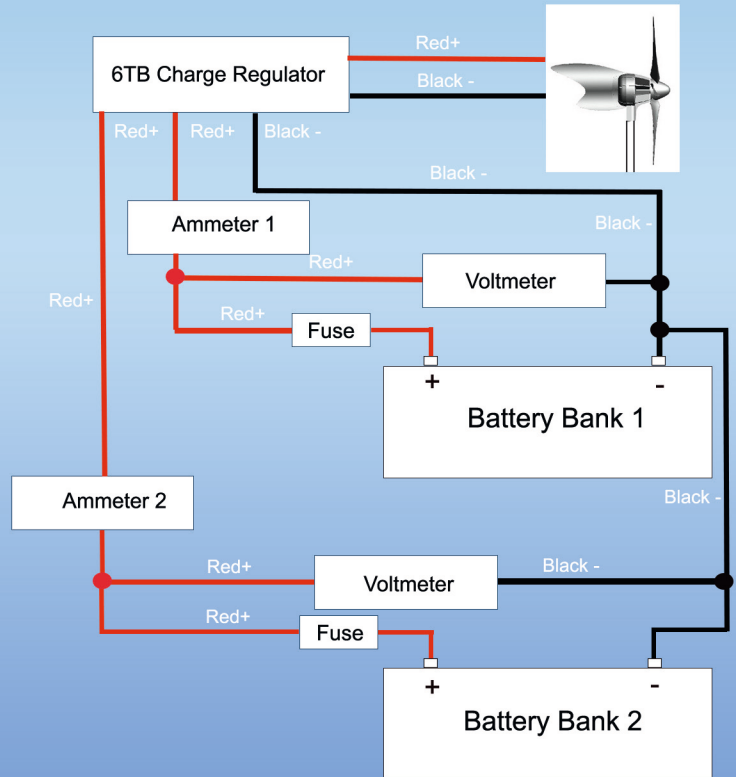
System Measurement/Monitoring

Single battery bank installation

Always observe correct polarity.
RED to POSITIVE (+)
BLACK to NEGATIVE (-)



Twin battery bank installation



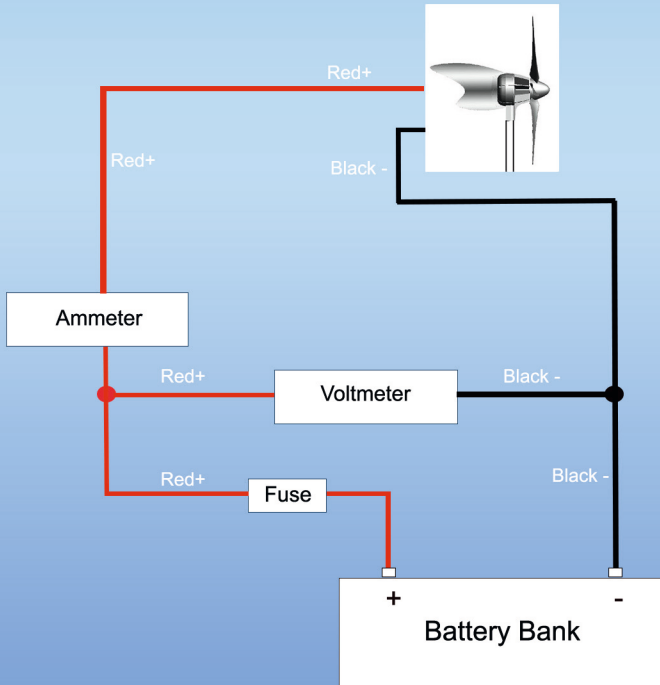
System Measuring/Monitoring

Unregulated installation

All Eclectic alternators are voltage specific and therefore will work perfectly well without an interface when connected to a battery of the appropriate voltage.

However we do not recommend unregulated operation unless:-

- a) battery bank is of very high capacity i.e. 800 Ah plus,
- b) battery state is monitored and the charge is terminated manually should system voltages rise to an undesirable level.



Battery monitors

Battery monitors measure voltage and instantaneous current as well as charge and discharge current overtime i.e. amp hours.

As both consumption and charge current are logged if correctly set the monitor can provide an accurate estimate of charge remaining in the battery bank, analogous to the petrol gauge in a car.

Battery monitors are driven by a shunt which is usually located in the negative line adjacent to the negative terminal.

Note all ships negatives must be connected to the non battery side of the shunt in order to be seen by the monitor.



Operating The D400 Lite

When operating normally D400 Lite should be quiet and stable with very little air borne noise or vibration.

If there is high pitched noise from the air blades or vibration in the accommodation it is likely that the D400 Lite is open circuit i.e. not properly connected to the battery resulting in overspeeding of the air rotors. Refer to troubleshooting guide.

Stopping the Turbine and Brake Switch

The D400 Lite air rotor can rotate at over 1000RPM. Care should be taken to prevent anything entering the air rotor disc during operation. This includes rope tails or other loose items. Take particular care to avoid contact with parts of the human body.

The D400 Lite can be stopped by using the tail to turn the unit 180 degrees away from the prevailing wind. When this is done the blades will rapidly slow and stop and can be secured using a rope lashing.

Alternatively, a braking switch can be fitted which provides a convenient method of the stopping the D400 Lite. The brake switch should be a double throw 'break before make', type rated at least 40amps for a 12V system/ 20amps for a 24V systems.

When operated, the switch isolates D400 Lite from the batteries before short circuiting the turbine output. The short circuit produces an electro magnetic braking effect slowing the rotor making it easier to stop the air blades and secure them.

Limitations of the Brake Switch

The brake switch can be used in most typical wind conditions but should not be considered as a parking brake.

In sustained high wind speeds of 40 knots (20m/s) and above, the braking effect can be overcome allowing the air blades to accelerate. If this occurs serious damage to the alternator can result. Where a turbine is left unattended a rope lashing should always be applied to secure the air rotor and prevent its rotation.

Wind Energy Explained

Wind is a function of solar energy unevenly heating the Earth's surface. As warmer air rises at the equator, cooler air flows in to replace it, setting in train global convective currents. This circulation which we call wind distributes both heat and moisture more evenly around the earth so providing us with a comfortable planet to inhabit.

The same process of convection also happens more locally, for example differential rates of heating and cooling between land and sea, producing the land and sea breezes which are most marked in the summer. These streams of moving air also provide us with an inexhaustible, if intermittent, energy source.

A wind generator works by converting some of the kinetic energy present in a wind stream to electricity. Air weighs about 1.2 kg per cubic metre at sea level, and kinetic energy is expressed by mass times the square of its velocity. Understanding this is a key to appreciating the energy available to wind generators.

In short, the amount of energy available to the wind generator rises dramatically with increasing wind speed. Regrettably, the reverse is also true. In low wind speeds there is very little energy to capture.

It is therefore important when considering where to install your wind turbine, that you choose a site with the highest possible wind speeds. In addition, the airflow should be uniform and as free from turbulence as possible.

Note as explained by the phenomena of wind shear, wind velocity increases rapidly with height. Therefore, as a general rule the higher you can mount your wind generator, the more productive it will be.

Performance & Expectations

The D400 Lite is extremely efficient by design, making it the most powerful and productive wind generator of its rotor size currently available.

D400 Lite should perform in line with the values given in the product specification and output graph. However, there are many variables which effect performance. When checking power outputs it is important that wind speed measurements are taken at the same height as the turbine rotor, and that the batteries are at least 40% discharged.

Should power outputs be well below expectations, first suspect turbulence in the wind stream. Turbulence at a given site can be specific to a particular wind direction where it is caused by an obstruction either upwind or downwind of the turbine. When the wind direction changes, and the obstruction is no longer in line with the turbine, outputs may return to expected levels. For a fixed terrestrial installation if the turbulent wind stream aligns with the prevailing wind direction, the D400 Lite should be re-sited or raised in height.

If low power outputs cannot be attributed to site conditions, re-check the whole installation against the wiring diagram and in particular ensure there are no poor or loose connections.

If you cannot read any output check that the relevant output connection from your D400 Lite or charge regulator, is made to the non-battery side of the ammeter or monitor shunt. If both the output connections are made direct to the battery terminals this will bypass the shunt and the ship's battery monitor will not read the D400 Lite's output.

Note that when batteries achieve a high level of charge, power diverted by the regulators dump circuit will not be seen by the battery monitor.

Continued...

Ensure that the battery bank is in good condition. Check the individual battery terminal voltages within the bank. A low voltage reading may indicate defective cells within that battery. Defective cells within a bank are a common cause of poor charging performance.

Note that there is a short period of 'running in' with a new wind turbine. The bearings and shaft seals of a new machine take 40 – 50 hours of operation before mechanical friction falls to its design level. As a result, your D400 Lite may seem a little slow to respond in light winds until this 'running in' period has passed.

Before deciding that your D400 Lite is faulty, please work through the 'trouble shooting' guide included in this manual. Experience has shown, 9 out of 10 reported problems prove to be installation related faults rather than an issue with the D400 Lite itself. Please feel free to contact your dealer or Eclectic Energy Ltd if you have any concerns or require additional advice.



Troubleshooting

****Warning dismantling your D400 Lite alternator voids the warranty****
****Ensure warranty security seals remain unbroken****

Mechanical checks:

- Spin the air blades by hand - they should rotate smoothly and freely with no hard spots.
- Listen for any grinding, scraping or rumbling noises - these could indicate failed bearings or contact between rotating parts inside the alternator.
- Note: if the air rotor rotates smoothly and silently, but feels stiff (like turning something in glue), refer to the electrical section on short circuits.
- Next, try rotating the D400 Lite around its yaw axis. It should turn smoothly and freely with no hard spots. If the yaw action is stiff or accompanied by undue noise, suspect the yaw bearings or the brush and slip ring assembly (refer to trouble shooting electrical checks).
- Check that the air blades are fitted correctly to the air hub. The concave surface should face forward, i.e. towards the wind.
- Ensure that the air hub is secure on the alternator shaft and that the air rotor does not 'wobble' on the main shaft due to wear at the hub centre.
- Finally, check that all fasteners are tightened evenly and are secure.

Electrical Checks - No or low power output:

Important:- Very often poor turbine performance is traced to a problem with the external wiring of the installation rather than any fault with the wind generator itself. Always check external connections and components first.

- First check that both the D400 Lite and the charge regulator are the correct voltage for the electrical system. Both items have identification labels showing the voltage, typically 12 or 24 volt.
- The most common cause of low outputs are loose or corroded connections in the output cabling. Check and re-make all connections from turbine to battery. Seawater and electricity are not a good combination, and connections can deteriorate very quickly when wet.
- Next, check the alternator by measuring its open circuit voltage. Disconnect the unit as close to the turbine as possible. If it is not too difficult, remove the turbine from its tower and measure at the fly lead cables exiting the yaw shaft of the machine.
- With a multi-meter set to the 20 volt DC range, connect the red positive meter lead to the red output, the black meter lead to the black output, and spin the unit by hand. On a 12V D400 Lite, you should be able to produce 4, 5 or even 6 volts, depending on how hard you spin. If you see voltages in this range, then the D400 Lite is probably OK. If the D400 Lite has an internal fault such as a missing phase in its alternator, then you will not be able to produce more than one or two volts.
- Assuming the output voltage is OK, try rotating the yaw shaft (where the cables exit) whilst continuing to spin the rotor. If the voltage varies or disappears as you rotate the yaw shaft, the brushes and slip rings require cleaning. Equally, if the voltage remains steady, but the yaw shaft is unduly stiff or squeaks when rotated, the brushes and slip rings would benefit from cleaning.
- If the turbine checks out OK on the open circuit voltage test, suspect the rest of the installation. Check each wiring connection for corrosion, tightness and security not forgetting the fuses and fuse holders.
- If a regulator bypass switch is incorporated within the installation, check that this is wired in accordance with the diagram contained in the charge regulator instructions. Note that a similar switch can be used as a braking switch, and the wiring for this is shown on page 21 of the User's Manual. Ensure that the two options have not been confused.

- The ship's battery monitor is driven by a shunt, which is usually mounted close to the service battery bank. Ensure the D400 Lite (or its regulator) is connected to the non-battery side of this shunt, usually in the negative line. If it is not, then the D400 Lite output will not be seen by the monitor.
- The 6TB regulator incorporates an integral charge splitter (i.e. it is provided with two outputs). If one of these has been connected to the service battery bank and one to the engine cranking battery or windlass battery, it is possible that power from the D400 Lite is flowing to those batteries in preference to the service bank. Try connecting both regulator positive outputs together and onto the service bank to see if that improves matters.
- If a dedicated ammeter is wired into the positive line between turbine and regulator input, this will read all current from the D400 Lite, including any power diverted to the regulator dump loads.

Poor Yaw Action:

- Stiffness in yaw, i.e. the D400 Lite will not rotate to face the wind. Check for any physical obstructions such as cordage or fishing line wrapped around the yaw shaft. If the yaw shaft still does not rotate freely suspect damaged or corroded yaw bearings, damaged or corroded slip rings/brush assembly or possibly a bent yaw shaft.
- Erratic yaw action i.e. the D400 Lite turns off the wind and is unstable. The D400 Lite is normally very stable in yaw. If the turbine appears to 'hunt around' its axis, this could be due to turbulence in the airflow. If so, the problem should disappear when the wind changes direction or the yacht is in a different location. Check that the D400 Lite is properly secured to the mount tower. There should be no undue play between the turbine and the tower. Also, ensure that the tower is vertical in both planes and is sufficiently rigid. If the tower is too flexible and bends excessively under wind loading, it should be braced or guyed to stiffen it.
- Open Circuit operation. This is a major cause of poor yaw action, and it indicates that the turbine is not properly connected to the batteries. This results in an open circuit condition where the air rotor will over speed and the air blades will become uncharacteristically noisy, emitting a whistling noise. The D400 Lite will frequently turn off the wind, rotating through 360° on occasion due to the excessive rotor speed. Check all wiring, looking for poor or broken connections. Also check fuses. If the fault remains, bypass the regulator to rule out regulator malfunction as the cause of the problem.

Poor Yaw Action Continued:

- Sporadic unusual or erratic yaw action could be due to an intermittent electrical fault. If you observe the turbine output abruptly dropping out and then suddenly returning, this could indicate a poor connection between the brushes and slip rings on the yaw shaft. To service, remove the four self-tapping screws that secure the brush plate. Remove the brush plate, taking care not to displace the brushes or brush springs from the plate. The slip rings and contact faces of the brushes can then be cleaned with a solvent soaked cloth or very fine wet and dry abrasive paper.
- Squeaking or grating noises audible in yaw could be caused by worn or damaged yaw bearings. More usually, it is caused by a build-up of dirt or corrosion on the slip rings and brushes. With the brush plate removed, if noise is still present, suspect degraded yaw bearings. If the squeak has gone, it confirms the noise emanates from the brush and slip ring assembly. Clean these parts as suggested in the preceding section and re-assemble.
- The sintered copper brushes contain graphite and are self-lubricating. If the machine is noisy or stiff in yaw, rotating the D400 Lite 360° on its axis will help to clean the slip rings and re-distribute a film of graphite lubricant. To improve the yaw action further using a fine file to remove any sharp edges from the contact surfaces of the brushes. On re-assembly, the yaw shaft should rotate silently. If a squeak is still evident, remove the brush plate again and spray the slip rings and brushes with an electrical lubricant (WD40 or similar) or smear a little silver-loaded grease on the slip rings.

Undue mechanically transmitted noise or vibration:

- If undue noise or vibration is evident when operating, first suspect a loose air rotor. Grasp an air blade and rock the rotor to check if there is any relative movement visible between the rear of air rotor hub and the alternator shaft. If play is seen or felt, remove hub parts and re-build, fitting a new hub centre.
- Correct fit of nose cone. A regular clicking sound could be due to a badly fitted nose cone. When fitting the nose cone ensure it is positioned correctly and that it is not catching on the alternator housing.
- Air blade damage, check that the air blades are not cracked, chipped or otherwise damaged. Damaged air blades may put the air rotor out of balance. Replace air blades as necessary.
- Tail bolts. Check tail and fasteners are installed as per manual and the bolts are evenly tightened.

Product Specifications

Power & Performance	Rated power	235 W @ 11 m/s (22 knots), 420 W @ 14 m/s (28 knots)
	Maximum power	600 + W
	Rotational speed	1100 rpm @ 14 m/s
	Cut-in wind speed	2.5 m/s (5 knots)
	Cut-out wind speed	None
	Air Rotor	Rotor type
Number of air blades		5
Airfoil type		Low Reynolds – variable camber
Diameter of rotor		1.1 m
Swept area		0.95 sq. m
Tip speed ratio		4
Typical noise level		2 – 6 dbA over background
Blade material		Glass-filled nylon/ injection moulded
Alternator	Alternator type	Direct drive – axial field 12 pole permanent magnet
	Design detail	3-phase AC with rectification Outputs direct current (DC) Rare earth annular magnet rotors Encapsulated stator windings
	Voltages available	DC: 12 V, 24 V, 48 V, 72 V AC: 240 V grid connect via inverter
	Materials	Aluminium alloy housing, hermetically sealed Alocrom 1200 corrosion protection and polyester powder coat 316 stainless steel shafts and A4 stainless fasteners
	EMF (electromagnetic emissions)	C.E. compliant
	Proven technology	Independent test data available
	Control system	External charge regulator / stall regulation
	Brake system	Electromagnetic braking switch
Yaw System	Passive yaw	Low resonance, formed aluminium tail Heavy duty yaw shaft, bearings and slip ring assembly. Saddle spring loaded sintered copper/ graphite brushes
	Turning circle	700 mm
Mounting	Via standard or custom tower liner	Typical tower/ stub tower outside diameter 50 mm – 75 mm O/D
Weight	Machine weight	14 kg
Finish/ Coating	Polyester powder coat Colours available	White or black housing with white blades
Safety	BS EN 61400	Designed to comply with internationally recognised performance and safety standards

D400 Lite Wind Generator Output

