Rutland 914i Windcharger (12 or 24 V)

Owners Manual

Installation and Operation

Contents

Introduction

Congratulations and thank you for purchasing your Rutland 914*i* Windcharger. The utmost of care goes into the manufacture of all our products in our ISO9001 approved factory. To ensure you get the very best out of the Rutland 914*i* we recommend that you read this manual and familiarise yourself with its contents before installing and operating the Windcharger system.

Summary of Features and Uses

- Aerodynamically improved to maintain good wind flow and stability.
- Maximum power point tracking technology yields up to 30% more power than the Rutland 913.
- Low wind speed start up maximises power generation in low winds.
- High grade construction materials for durability, U.V. stability and weather resistance.
- Provides a D.C. power supply to charge 12 or 24 V battery banks.
- Designed for use on board sailing yachts, motor caravans, static caravans and sites where low power is needed for domestic devices as well as navigation equipment etc.
- Note: There are other Rutland Windchargers designed for permanent installations on land - contact Sunshine Solar to find out more.

Rutland 914*i* Profile & Dimensions

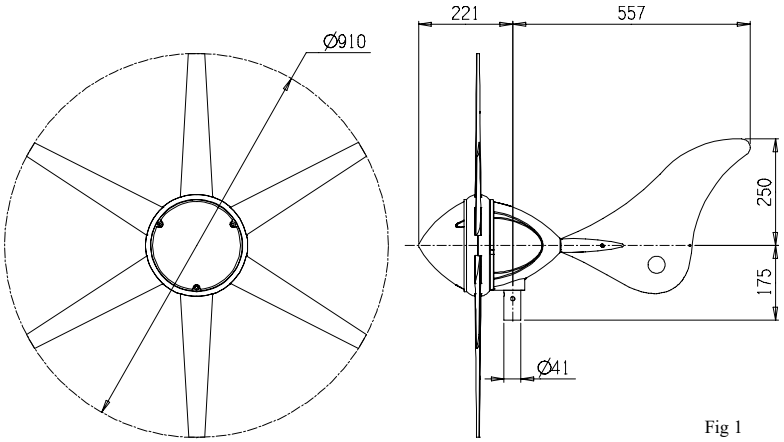


Fig 1

General Guidelines & Warnings

- *Mounting pole outside diameter MUST NOT exceed 48.5mm for at least the top 0.5m. Larger section poles must not be used as this will reduce the tower to blade clearance. In high wind conditions this could cause damage to the Windcharger by allowing the blade to come into contact with the mounting pole. A broken blade will cause turbine imbalance with consequent damage.*

- *When turning, the Windcharger is capable of generating voltages in excess of the nominal voltage. The turbine must never be allowed to rotate unless it is electrically connected to a regulator or batteries. Connecting an open circuit running turbine to the electrical system can cause serious damage to system components owing to excessive voltage. Caution must be exercised at all times to avoid electric shock.*

- *Stopping the turbine – this may be necessary to undertake battery maintenance. If possible stopping the turbine should be done in low wind speed conditions. The turbine can be slowed by rotating or orienting the tail fin upwind, this will slow the turbine sufficiently for it to be safely secured to the pole with rope. Avoid leaving the turbine tied up for any period of time, we recommend that the turbine either be covered to give protection from the weather or removed and stored in a dry location. We recommend the use of Marlec charge regulator that includes a shutdown switch.*

- *Choose a calm day to install the equipment and consider other safety aspects. No attempt to repair the system should be made until the wind generators restrained from turning.*

- *The Windcharger is fitted with ceramic magnets, which can be damaged by heavy handling. The main generator assembly should be treated with care during transit and assembly.*

- *It is essential to observe the correct polarity when connecting the Windcharger and all other components into an electrical circuit. Reverse connection will damage the Windcharger and incorrect installation will invalidate the warranty.*

- *The fuse supplied must be fitted to protect the system.*

- *The Rutland 914i Windcharger is suitable for sailing boats and some land based applications. When storm winds are forecast the turbine can be re-strained to minimise wear and tear particularly when installed on land based applications where FurlMatic model windchargers are normally recommended. Note that where the manufacturer recommends a furling type windcharger should have been used the warranty is invalidated in cases of storm damage.*

- *If in doubt, refer a competent electrical engineer or the manufacturer.*

Check You Have Received - *See Rutland 914i Exploded View*

- 24 x No.10x25mm special self-tapping screws for aerofoil blades
- 1 x No.4 x 13mm self tapping screw for tail bracket covers
- 2 x M6 x 16mm hex. Head screws for tail fin
- 2 x M6 nylock nuts for tail fin
- 1 x fuse and fuse holder
- 1 x main generator assembly
- 6 x aerofoil blades
- 1 x tail fin
- 2 x tail bracket covers
- 1 x nose cone + 3 x nylon fixing screws
- 1 x 6mm Allen key
- 1 x 2-way terminal block
- 2 x M10 buttoncap screws
- 2 x shakeproof washers

In the event of loss or damage, consult your dealer or the manufacturer.

Other Items

What You Will Need - Tools

- Suitable wire stripper
- Small terminal screwdriver
- Large flat blade screwdriver
- Crosshead screwdriver
- 10mm Spanner or Socket

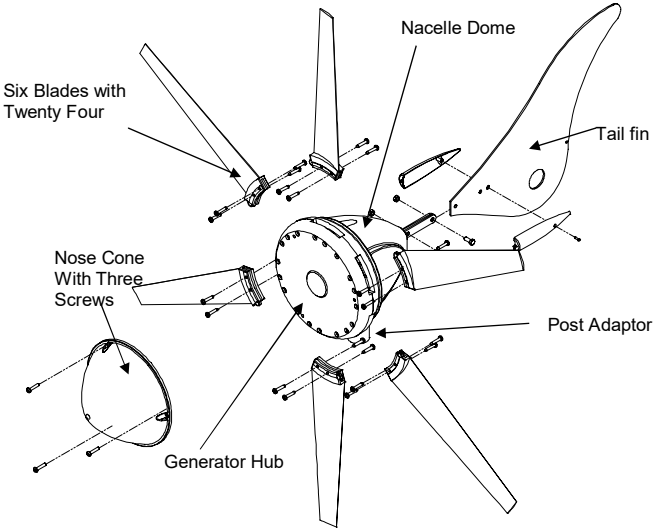
Other Items You Will Need

- Mounting pole
- Cable
- Batteries
- Battery terminals
- Connector blocks (as determined by your total system)

Other Items You May Have Selected

- HRS*i* or HRD*i* Charge Regulator
- Cable (usually 2.5mm² twin core - Part No: 902-015)
- Rutland 914*i* Marine Mounting Kit and Stays Kit (CA-12/02 & CA-12/32)
- Rutland 914*i* Land Tower & Rigging Kit (Part Nos: CA-12/08 & CA-12/07)
- Short section of stainless steel tube to adapt into your own mounting design.
- Voltmeter & Ammeter

Exploded View of The Rutland 914*i*



Assembly and Installation

Twelve Step Quick Start Guide

1. Choose an open site to expose the Windcharger to a clear flow of wind and avoiding obstructions. On board mount the Windcharger at least 2.4 metres above the deck and on land at least 4 - 6 m high. *Read the full section on* ***Siting.***

2. Choose a mounting pole with an internal diameter of 41.0mm and external diameter of no greater than 48.5 mm for the top 0.6m minimum to (i) prevent accidental damage and (ii) meet warranty conditions.

3. Mount a charge regulator, from the Marlec range, to a suitable vertical surface and close to the battery. Follow instructions supplied with the charge regulator.

4. Drill the mounting pole, if required, in preparation to accept and secure the Windcharger. *See* ***Assembly and Installation*** *section.*

5. Choose suitable two core cable to connect from the Windcharger to the regulator. Up to 20m this should be of at least 2.5mm² cross sectional area. A short section of 4mm² cross sectional area is required to link the regulator to the battery. *For other distances see the table in* ***Cable Specifications.***

6. Position the mounting pole (*this may be done on the ground before raising the pole*) so that the selected cable can be threaded along it.

7. Fit the blades, tail and nose to the Windcharger using fasteners provided. ***It is essential that 4 screws are fitted per blade.***

8. Join the cable threaded through the pole to the Windcharger output cable using the connector block provided. Wrap with insulating tape. Alternatively use a latching plug and socket. *We recommend looping back the cable and securing with a cable tie to provide strain relief to the joint.*

9. Carefully push the cables down the pole whilst sliding the post adaptor down the pole. Line up the holes and secure in place with the screws and washers provided. Tighten with the Allen key. ***Do not allow the turbine to spin freely.***

10. Locate the charge regulator close to the battery and carefully follow ALL the regulator guidelines and installation sequences for connecting the Windcharger through to the battery. *Note : Install the in-line fuse supplied with the Windcharger between the battery and charge regulator.*

11. Ensure that the battery connections are permanent as the Windcharger should NEVER be operated without a connection to the battery.

12. Raise and secure the Windcharger. It can now be allowed to rotate. Follow the **" Up and Running- Four Points Final Checklist"** featured later. Also the **" General Guidelines and Warnings"** section expands on the above points.

Assembly and Installation Detailed Instructions

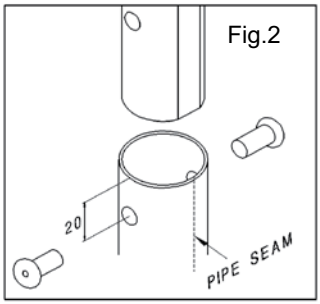


Fig.2

Tower Preparation (Fig.2)

Select a suitable pole from the suggested guidelines in Mounting the Windcharger. Note that the post adapter fitted to the 914*i* is designed to fit inside a standard 41mm (1 ") internal diameter tube. The adapter is provided with a flat on one side to clear the weld seam on seamed pipe.

2. Mark and centre-punch two positions diametrically opposite, at 90° to the pipe seam if necessary, 20mm from top of the tube
   Note: Use metric measurements for this operation
3. Drill two holes 10.5mm in diameter on centre-punch positions.
   Note :Use metric measurements for this operation
   Note: When using Rutland 914i Mounting Kit , items 2 and 3 can be ignored as Marlec supplied poles are pre-drilled.

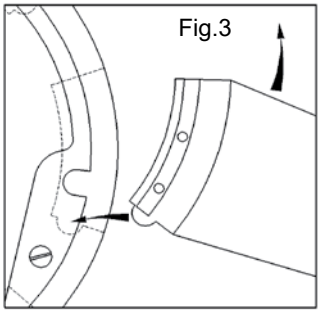


Fig.3

Blade Assembly (Fig.3)

1. Place the generator assembly on a flat surface hub-side down. Position blade as shown. *The blades will only fit one way around.***The blades will only fit one way around.**
2. Insert the protrusion at the trailing edge of the blade root fixing first into the socket to align with the corresponding recess in the blade socket. The blade can then be inserted with a lever action. A soft faced mallet may be used to tap the end of the blade to assist in fully locating the blade.
3. First fit each blade with two special self-tapping screws provided to the rear of each blade by inserting each in turn through the cut out in the nacelle, rotating the generator each time until the holes align. Fit the remaining blade screws from the front of the generator hub. Check tightness of all screws but do not over-tighten.

Caution- It is essential that all 4 screws are fitted!

Alternatively the blades, tail and nose dome can be fitted after mounting the generator assembly to the tower.

Fitting The Tail and Nose Assembly (Fig.4)

1. Slide the tail fin between the two tail brackets lining up all drilled holes.
2. Locate the two screws provided through the appropriate holes and secure with nuts.
3. Locate the tail bracket covers into the nacelle grommet whilst positioning the processes for the fixing screw into the appropriate drilled hole in the tail.
4. Secure with the self tapping screw provided.

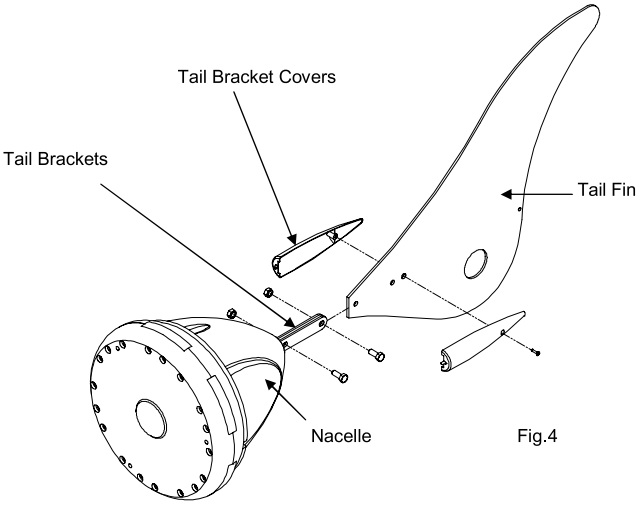
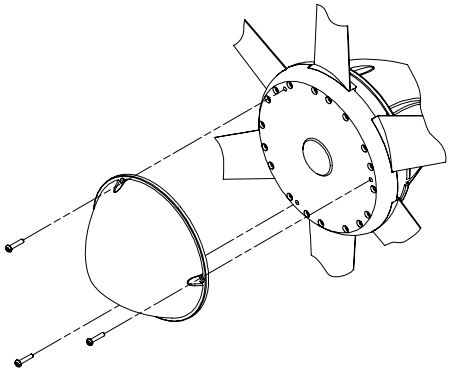


Fig.4



4. Fit the plastic nose dome in position on the front of the generator hub and secure in place with the three nylon screws provided.
5. You may now mount the Rutland 914*i* on to the tower if you have not already done so.

Electrical Connection and Fitting to The Tower

1. Run the cable selected (see Table 1) down the inside of the pole.

2. Select one of the 2 basic wiring systems on page 12 and follow the manual provided with the voltage controller.

3. Connect the wind generator flying leads to the cable protruding from the tower using the connector block supplied, taking care to observe polarity. Connect the Windcharger + to cable + and windcharger – to cable –

   Red is + Positive

   Black is - Negative

4. Wrap the connection with insulation tape to secure/protect from environment. Alternatively join the cables using a latching-type plug and socket.

5. Locate the wind generator into the tower whilst gently easing the cable from the tower base to ensure the cable is not trapped. Secure the wind generator to the tower using the button cap screws and shake proof washers provided, tighten using the 6mm Allen key provided.

Up and Running

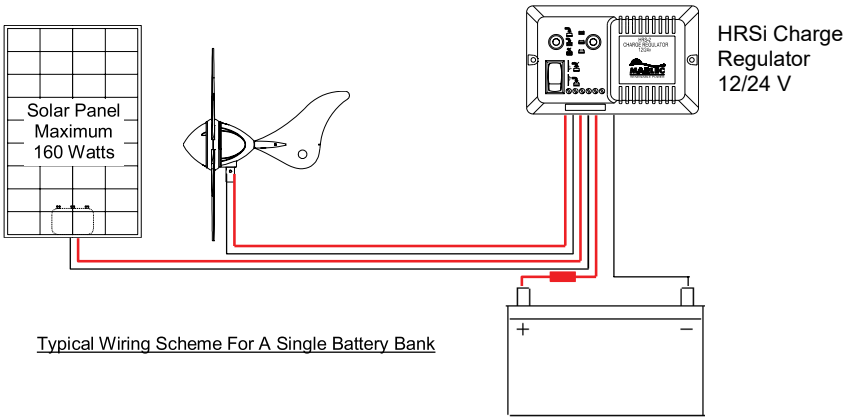
Four Point Final Checklist

Before raising and securing the wind generator:
1. Check the tightness of the blade & tail fixing screws and generator mounting screws.
2. Check free rotation of the hub and yaw axis.
3. Check that the cable is not trapped.
4. Check that all electrical connections are secure and safe.

The wind generator can now be raised into position.
Take care to avoid all moving parts when raising and lowering the wind generator.

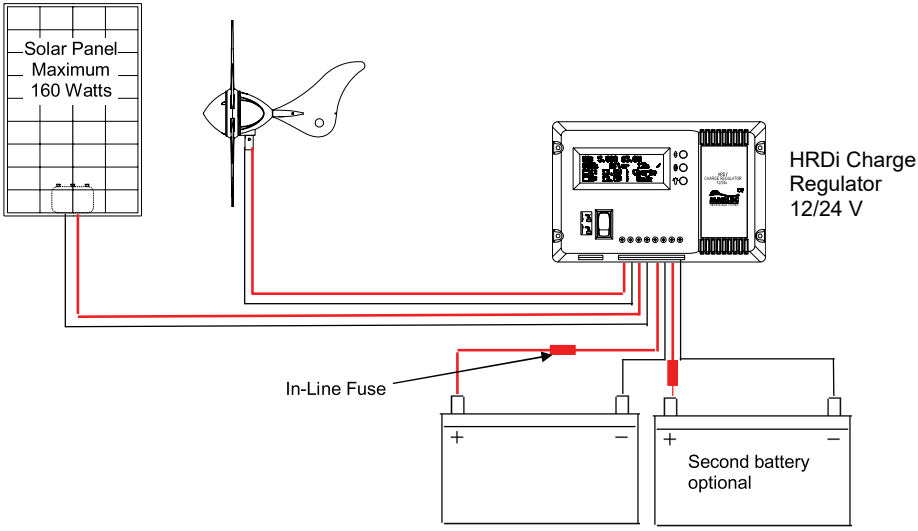
When raised, secure the structure firmly in an upright position.
Caution-The performance of your Windcharger will be impaired if the pole is not vertical.

Typical Wiring Diagrams For The Rutland 914i Windcharger



Typical Wiring Scheme For A Single Battery Bank

Typical Wiring Scheme For Single or Dual Battery Banks



Siting The Windcharger

General Considerations

The location and height of the mounting pole or tower for your wind turbine will be the major factor in the overall performance of your system. The smooth flow of wind over land and water is often interrupted by a multitude of obstructions causing wind sheer and turbulence.

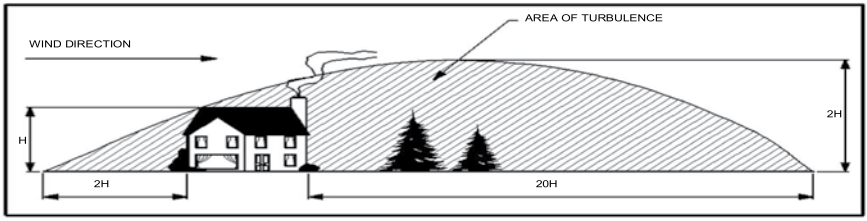
Wind shear describes the interference between the fast moving upper air and the slow moving air close to the ground and the resulting decrease in average wind speed as one gets closer to the ground.

Turbulence is caused by the wind passing over obstructions such as moored boats, trees, and buildings.

Both wind sheer and turbulence diminish with height and can be overcome simply by putting the turbine sufficiently high above them as shown in Fig 4. Wind speed decreases and turbulence increases where obstructions exist. Consider also that downwind obstructions can be as detrimental to performance as upwind obstructions.

It is therefore essential that the wind generator should be located in an area as free as possible from disturbed wind flow.

Fig. 4



Mounting The Windcharger

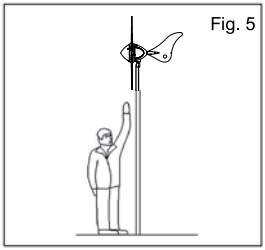


Fig. 5

On Board Systems

The wind generator should be mounted in a safe position, a minimum of 2.3 metres (7.6 feet) above the deck and away from other obstacles which could interfere with the blades or tail assembly (Fig. 5).

The Rutland 914*i* Mounting & Stays Kits (Part No. CA-12/02 & CA-12/32) are available for deck mounting, or short sections of stainless steel tube of 1200mm (47") and 600mm (23") pre-drilled are also available for your own fabrication.

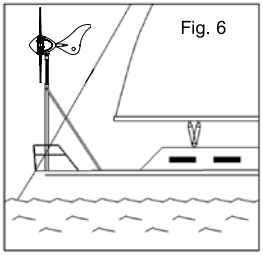


Fig. 6

The Rutland 914*i* is designed to fit inside an aluminium or stainless steel tube with an internal diameter of 41mm . IMPORTANT:The external diameter MUST NOT exceed 48.5mm see Warning in Introduction.
Suitable tubes: Stainless Steel $1\frac{3}{4}$"16 SWG and Aluminium $1\frac{7}{8}$" 10 SWG

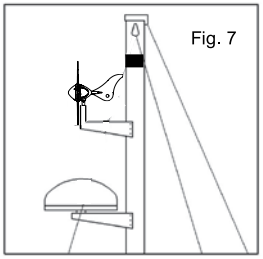


Fig. 7

We suggest the following mountings according to preference and site conditions:-

Push pit (Fig.6)
A suitable pole mounted to the deck with deck plates and solid guys is the most popular method of mounting the Windcharger on yachts, eg. Rutland 913 Mounting & Stays Kit.

Mizzen (Fig.7)
Mizzen mounting is suitable on larger yachts, taking advantage of greater wind flow the higher the wind turbine is mounted.

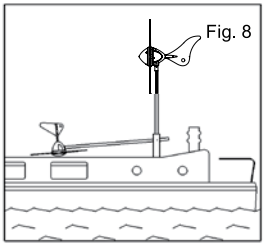
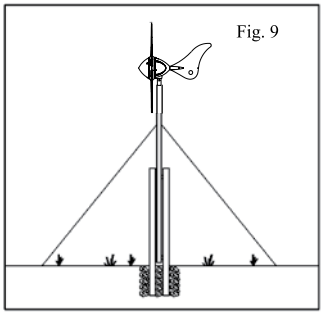
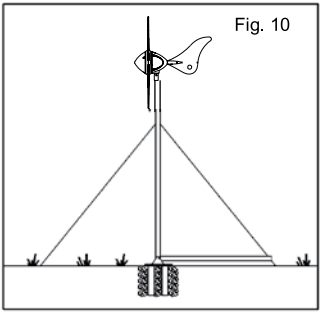


Fig. 8

River Boats (Fig.8)
A pivot pole is ideal for riverboats as the Windcharger can easily be raised and lowered.



Centre pivoted pole



Base pivoted with gin pole

Land Based Systems

The Rutland *914i* is suitable for some land based temporary and leisure applications. The Furlmatic Windcharger model is recommended for land based remote and exposed locations.

The Rutland *914i is* designed to fit inside aluminium, stainless or steel tube with an internal diameter of 41mm. IMPORTANT: The external diameter MUST NOT exceed 48.5mm see Warning in Introduction.

A suitable mounting pole can be erected using a 6.5 metre (21 feet) galvanised (medium) tube. The tube must be supported by a minimum of four guy lines. The attachment points for the guy lines to the tower should be securely fixed to the tower.

- The guy wires should be a minimum of 4mm (0.16”) in diameter.
- The shackles should be a minimum of 5mm (0.20”) in diameter.
- Rigging screws should be a minimum of 5mm (0.20”) in diameter.
- All items should be galvanised or stainless steel for protection against corrosion.
- Where guy lines are looped, the loop must incorporate a thimble and be fitted with a minimum of three rope grips.
- All ground fixings must be made suitable according to the terrain.

We suggest pivot type towers as these allow for easier installation and lowering for access to the wind generator. Two forms of pivot tower are suggested in Figs 9 & 10.

A base-hinged 6.4m tall Land Tower Kit (Part No: CA-12/08) and Rigging Kit (Part No:CA-12/07) are available from Sunshine Solar

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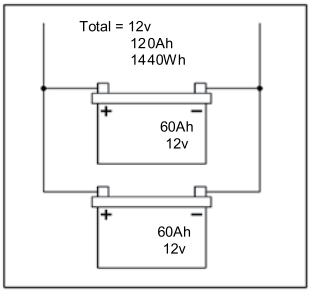
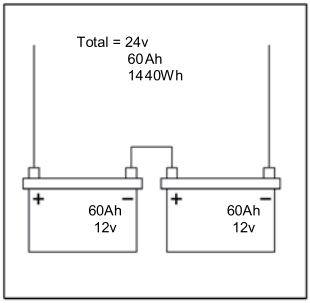
Further System Requirements



In parallel to increase amp



In series to increase voltage

Batteries

Leisure/Deep Cycle batteries are specifically designed for good performance in terms of charge/discharge cycles. Batteries are the most important part of your battery charging system and should be sized according to your load requirements and provide at least 3 days reserve capacity. This will reduce cycling, prolong the life of the battery and ensure system reliability during periods of low wind.

Permanent connections should always be made to the battery terminals. Never use crocodile clips or similar devices.

We strongly recommend that one of the voltage regulators available from Sunshine Solar is fitted to prevent batteries becoming overcharged in strong winds and is essential with gel/sealed batteries.

Batteries may be linked as shown in the figures 10 and 11. It is essential to observe polarity as follows:

Red is + Positive

Black is - Negative

Cable Specification

Cable Run (m)	12V mm²	12V AWG	24V mm²	24V AWG
00-20	2.5	13	1.5	15
21-30	4	11	2.5	13
31-45	6	9	4	11

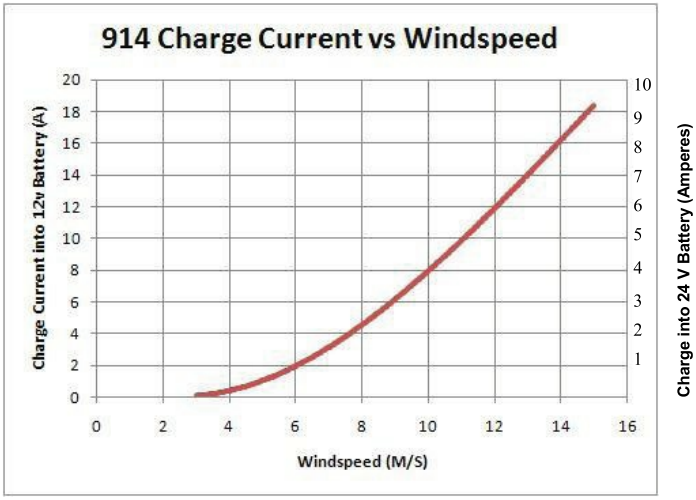
The cable used for connection of the Windcharger to the batteries should be in accordance with table 1. The use of a smaller cable than recommended will reduce the performance of the charging system.

Cable and connectors are available from Sunshine Solar.

Specification and Performance

Guideline Performance Curve

Note : The curve shown below is for clear, non-turbulent wind conditions; this may not be achieved in some installations. Refer to the section on Siting to optimise performance at your site. Wind speeds are those flowing across the turbine of the Windcharger and may not reflect those measured at mast top or those reported by the Met. Office.



Maintenance and Troubleshooting

Inspection and Maintenance

The Rutland 914*i* requires no scheduled maintenance but an annual inspection should be carried out to monitor the general condition of the system to ensure the electrical and mechanical integrity and safety of the system.

WARNING! Before inspection, the turbine should either be lowered to the ground or tied to prevent the generator from turning. To stop the generator from turning proceed as follows:

1. Either rotate the switch to stall mode on the charge regulator if used OR turn the wind generator out of the wind (180°) using the tail, a hole is provided in the tail fin to assist in this. The generator will gradually slow down.

2. Tie a blade to the mounting pole to prevent it from rotating.

Whilst the generator is stationary, the following routine checks should be performed:

1. Check the blades for damage, eg chips or nicks. Replace any damaged blades. The turbine should not be operated with damaged blades as this may cause imbalance resulting in premature wear and possible failure. Check the blade screws for tightness.
2. Check all other nuts, bolts and screws for tightness.
3. Check the yaw axis for free rotation.
4. Check tower assembly for condition.
5. Check the tension of the guy wires if applicable. The tension of guy wires should be checked frequently during the first year.
6. The unit can be wiped with a mild detergent and rinsed with water to remove dirt and debris.

Note: The Windcharger is designed for continuous running to achieve maximum resistance to water ingress. Should you wish to take the unit out of service for an extended period it is recommend that the unit be removed from the mounting and stored in a dry location or covered.

Troubleshooting

In the unlikely event that your Rutland 914*i* should develop a defect, the turbine should first be tied to prevent the blades from turning to perform the static tests below. (Follow the procedure described in the Inspection and Maintenance section) It will be necessary to let it run for the tests to check for power production.

Read the Electrical Connection and **Up and Running** sections and be satisfied that your system complies.
Is there sufficient wind? The Rutland 914*i* needs 5 knots wind speed to start charging. The wind speed across the turbine blades may be greatly reduced in a marina or built-up area compared with the reading on a masthead anemometer or weather reports.

Static Tests:
Is the battery in good condition? Check the voltage and electrolyte level of each battery.
Check electrical continuity throughout the system, especially corrosion and poor connections in cable joins and connector blocks.

Running Tests:
Check for power output from the windcharger, following this procedure:
1. Set a digital multimeter to DC Amps, scale of between 5 and 10 if possible. Connect the meter positive (+) probe to the wind generator output positive cable and the meter negative (-) to the regulator input positive. Provided there is sufficient wind there should be a current reading. This establishes that power is being delivered.

2. Using the same multimeter setting as above measure between the regulator to battery + and the battery +. Provided there is sufficient wind there should be a current reading. This establishes if power is passing through the regulator.

3. If both above are unsuccessful set the multimeter to DC Volts. Disconnect the wind generator from the regulator and connect the meter + to the wind generator + and the meter – to the wind generator -. Provided there is sufficient wind there should be a variable voltage reading according to the speed of the wind seen at the wind turbine. This will establish if the wind generator is able to deliver power or not.

4. If tests 1 and 3 are successful but test 2 fails to produce results connect the wind generator directly to the battery. Set the digital multimeter to DC Amps and measure power between the wind generator + and the battery +. If a reading is measured, providing there is sufficient wind, then the regulator is faulty.

5. If the wind turbine fails to deliver any current or open circuit V reading undertake the further tests below.

6. Mechanical inspection. It may be necessary to remove the windcharger from its pole for the following tests.

Check the brushes and slipring for wear or damage. To inspect the brushes, remove the nacelle by removing the three fixing screws and slide the nacelle backwards towards the tail fin. The brushes and slipring can be inspected by removing the four self-tapping screws holding the brush holder assembly in place. Remove any black deposits from slipring with emery paper. Heavy deposits and reduced power indicate a possible reverse connection to the battery (see Page 10).

Check hub for free rotation with generator disconnected from battery.
If the hub does not rotate freely, check for a possible short circuit in the wiring. If no wiring fault is found refer to Sunshine Solar or the manufacturer.

If the above checks have identified a need for spare parts or failed to identify the problem you should contact Sunshine Solar.

If in doubt, please contact Sunshine Solar.