

Rutland FM910-4 Windcharger

(12V or 24V)

Owners Manual

Installation and Operation



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INTRODUCTION

Introduction

- Congratulations and thank you for purchasing your Rutland FM-910-4 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 FM-910-4 it is vital that you read this manual and familiarise yourself with its contents before installing and operating the Windcharger system.

Summary of Features and Uses

- Automatic “furling” tail fin directs turbine out wind above 15m/s for gale protection.
- Low wind speed start up maximises power generation in low winds.
- High grade construction materials for durability in the harshest environments.
- Provides a D.C. power supply to charge 12 or 24 V battery banks.
- Designed for use on permanent land based applications where low power is needed for professional and domestic devices.
- Ideally mounted on the Rutland Land Tower and Rigging Kit – see product catalogue.

General Guidelines & Warnings

- *Observe the mounting pole diameters recommended in this manual. It is essential for the effective operation of the furling tail system that the mounting pole is vertical. An unsupported tower will experience lateral movement particularly in high winds and furling could be adversely affected with potential damage to the Windcharger.*
- *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 a 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 generator is 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.*
- *High winds – The furling tail mechanism of the Furlmatic model will operate in high winds orienting the turbine out of the prevailing wind direction to slow the turbine down. It will return to face the wind as windspeeds fall and will be seen to cycle during high wind speeds. As a secondary safety feature the Windcharger has a built-in thermostat which may operate in extreme conditions to prevent the generator overheating. In this mode the output will cease and the turbine will temporarily slow down until such time as a lower temperature is reached and the generator is once again connected and charging. This may be seen to cycle in prolonged high winds particularly in high ambient temperatures.*
- *It is essential to observe the correct polarity when connecting the Windcharger and all other components into an electrical circuit. Reverse polarity connection could damage the Windcharger and/or regulator and incorrect installation will invalidate the warranty.*
- *The fuse supplied must be fitted to protect the system if Marlec regulator is not used. (HRSi and HRDi regulators have fuses fitted).*
- *If in doubt, refer to your dealer, a competent electrical engineer or the manufacturer.*

Check You Have Received

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

1 x Main generator assembly	2 x M10 buttoncap screws
1 x Tail Fin assembly	2 x M10 shakeproof washers
6 x aerofoil blades	1 x 6mm Allen key
24 x No. 10x25mm special self-tapping screws	
1 x fuse and fuse holder	
1 x 2-way terminal block	

Tools That You Will Need:

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

Other Items You Will Need:

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

Other Items You May Have Selected from Marlec:

HRSi or HRDi Charge Regulator. (Part Nos. CA-11/46 & CA-11/44)
Land Tower and Rigging Kit (Part Nos. CA-12/08 & CA-12/07).

Principle Of Operation

Generator

The 3 phase ac generator is driven directly by the aerofoil blades, rotating permanent magnets around the fixed stator winding. The variable frequency alternating current is rectified within the generator housing, and the resulting rectified current is transmitted via the sliprings and brushes at the yaw axis to the output cable.

Furling Tail System

The tail assembly is designed to direct the turbine into the main direction of the wind at windspeeds up to approx 15m/s. Above this the automatic “furling” mechanism is activated to turn the generator at an angle to the wind to protect the turbine, generator and supporting structure from severe electrical and mechanical loads due to high winds. When the wind speed subsides, the tail assembly will automatically return the turbine to normal operation. In prolonged gusty & turbulent conditions, the system may be seen to repeat this cycle many times. Power will be reduced during furling. For effective operation of the furling system the wind turbine must be sited to ensure it is as free as possible from turbulence and in a stable upright position.

Winding Over-Temperature Protection

The generator stator winding incorporates embedded thermal protection to protect the winding from damage due to over temperature during extreme winds. On reaching the thermal protection limit, the device will cut generator output current to allow the winding to cool, whereupon normal performance will be resumed. If the thermal protection is active, the turbine will reduce to a slow rotational speed, this is normal.

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 shear 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 trees and buildings.

Both wind shear and turbulence diminish with height and can be overcome simply by putting the machine sufficiently high above them as shown.

Wind speed decreases and turbulence increases where obstructions exist.

Consider also that downwind obstructions can be as detrimental to performance as upwind obstructions.

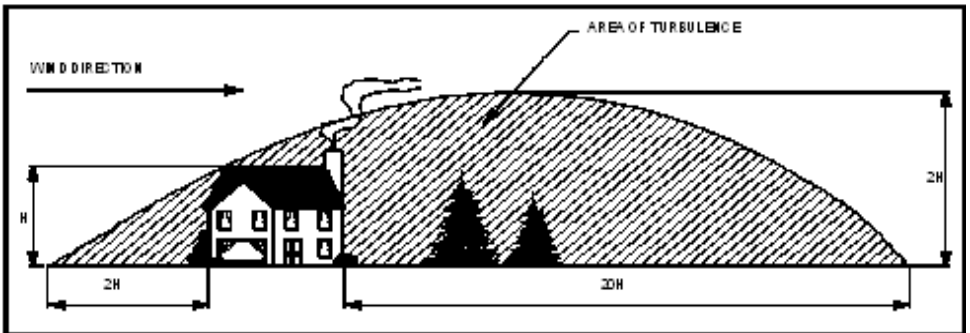


Figure 1

Tower Construction

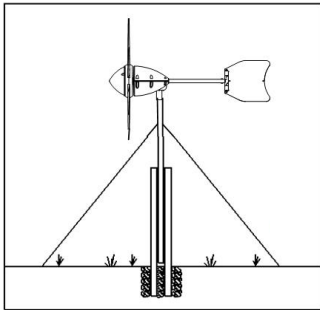
The Furlmatic 910-4 is designed to fit inside an aluminium, stainless or steel tube with an internal diameter of 41mm with a minimum wall thickness of 3mm. Maximum outside diameter of 50mm.

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.

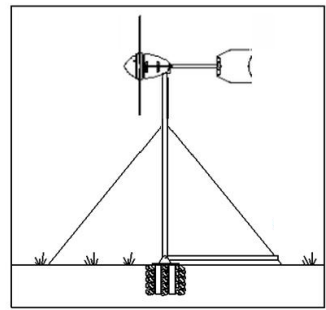
- The guy wires should be a minimum of 4mm in diameter.
- The shackles should be a minimum of 5mm in diameter.
- Rigging screws should be a minimum of 5mm in diameter.
- All items should be galvanised or stainless steel for protection against corrosion.
- Where guy lines are looped, the loop must incorporate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

Pivot type towers are recommended as these allow for easier installation and lowering for access to the wind generator. Two forms of pivot tower are suggested in Figs 2 & 3. Non-guyed pivoting towers are available, for further details contact the dealer or manufacturer.



Centre pivoted pole

Figure 2



Base pivoted with gin pole

Figure 3

NB: See the warnings section regarding the tower. It is essential that the tower is maintained vertically to minimise lateral movement which interferes with the effective operation of the furling tail.

Assembly & Installation of the Windcharger

Blade Assembly

1. Place the generator assembly on a flat surface hub-side down.
2. Position the blade as shown in Figure 4. The blade will only fit one way round. Insert the protrusion at the trailing edge of the blade root fixing first into socket to align with the corresponding recess in the blade socket. The blade can easily be inserted with a lever action. Gentle assistance with a soft faced mallet may be required.

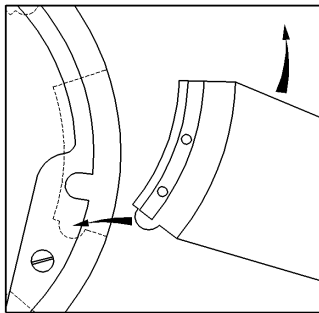


Figure 4

3. **Four screws are required for each blade.** First secure each blade with two of the special self-tapping screws provided to the rear of each blade by inserting each in turn through the moulded slot in the nacelle (Figure 5a).
4. Fit the remaining two screws at the front of the generator hub (Figure 5b).
5. Check the tightness of all screws (Do not over-tighten). Recheck again in a few weeks time as loosening is possible.

NB. IT IS VITAL THAT 4 SCREWS/BLADE ARE FITTED.

Figure 5a

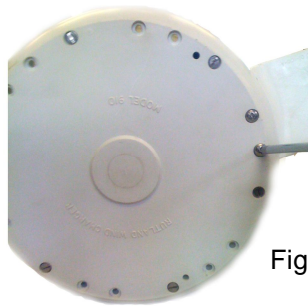


Figure 5b

Furlmatic Tail Assembly

Fit the tail fin on to the hinge assembly using the screws and washers already present (Figure 6a and 6b):-

Do **not** remove the silicone protectors from the tail stops!

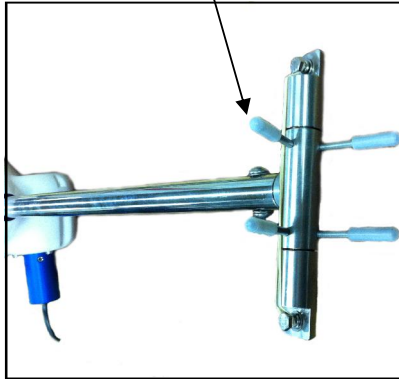


Figure 6a

NB. The tail fin is set at an angle of 15° from vertical. This is vital to the furling mechanism. For the effective operation of the furling system the wind turbine must be sited to ensure it is as free as possible from turbulence and in a stable upright position.

Figure 6b



Tower Preparation

Having selected a suitable pole from the guidelines.

1. The post adaptor fitted to the FM910-4 is designed to fit inside a standard 41mm (1 $\frac{5}{8}$ ") internal diameter tube. The adaptor 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 (*NOTE: Use metric measurements for this operation*) from the top of the tube.
3. Drill two holes 10.5mm (*NOTE: Use metric measurements for this operation*) in diameter on centre-punch positions. (Figure 7.)

Note: When using the Rutland Land Tower Kit, items 2 and 3 can be ignored as the unit is pre-drilled.

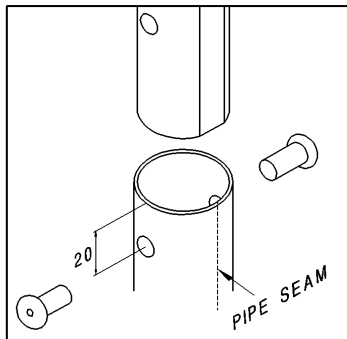


Figure 7

Batteries

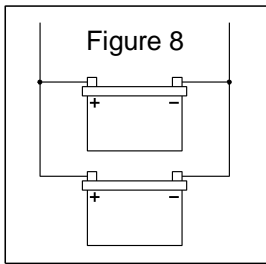
Leisure/Deep Cycle batteries are specifically designed for good performance in terms of charge/discharge cycles. Batteries are the most important part of your battery charging system and should be sized according to your load requirements and provide at least 3 days reserve capacity. This will reduce 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. Battery terminals should be well greased with petroleum jelly or similar.

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

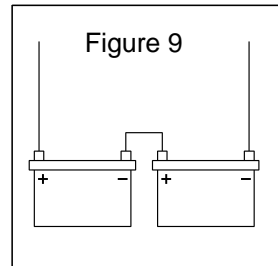
Batteries may be linked as follows:

In parallel to increase amp hours (Fig 8) In series to increase voltage (Fig 9)



12V System

**Red is positive (+)
Black is negative (-)**



24V System

Cable Specification

The cable used for connection of the Windcharger to the batteries should be in accordance with table below. The use of a smaller cable than recommended will reduce the performance of the charging system. Cable and connectors are available from your dealer or the manufacturer.

Cable Run(m)	Cable Size(mm ²) 12V system	Cable Size(mm ²) 24V system
0-20	2.5	1.5
21-30	4	2.5
31-45	6	4
46-80	10	6

Electrical Connection and Fitting To The Tower

1. Run the cable selected (see table) down the inside of the pole.
2. Select one of the 2 basic systems on page 14 and follow the manual provided with the charge regulator selected.
3. Connect the Windcharger flying lead to the cable protruding from the top of 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 the environment. Alternatively join the cables using a latching type plug and socket.
5. Locate the Windcharger into the tower whilst gently easing the cable from the tower base to ensure the cable is not trapped. Secure the Windcharger to the tower using the button cap screws and shake-proof washers provided. Tighten using the 6mm Allen key supplied.

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.

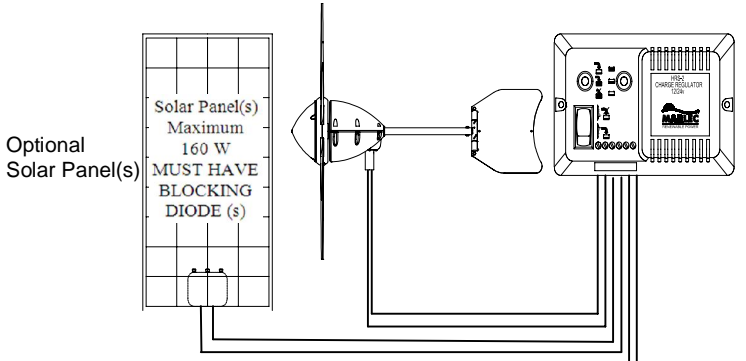
The Windcharger can now be raised into position.

Take care to avoid all moving parts when raising and lowering the wind generator.

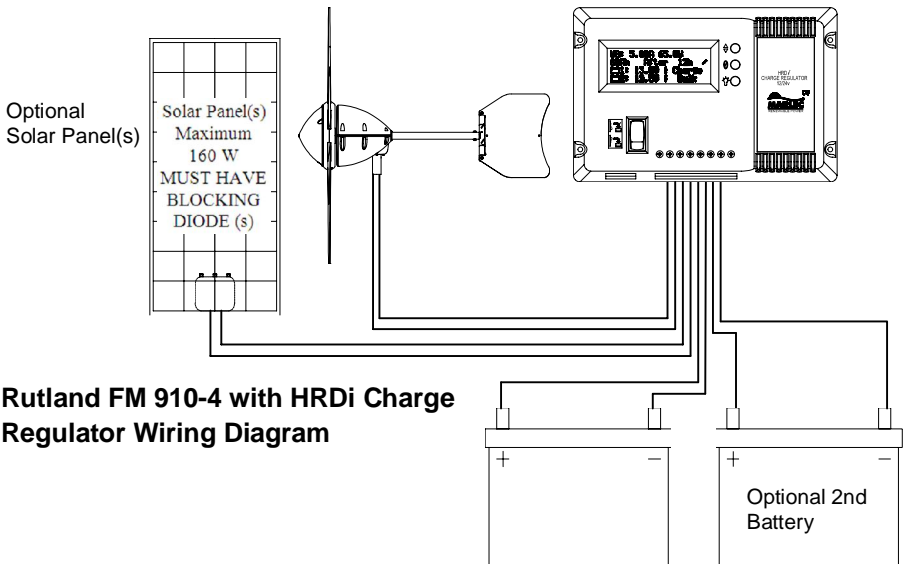
When raised, secure the structure firmly in an upright position.

Caution-The performance of your Windcharger will be impaired if the pole is not vertical.

Typical Wiring Diagrams For The Rutland FM910-4 Windcharger



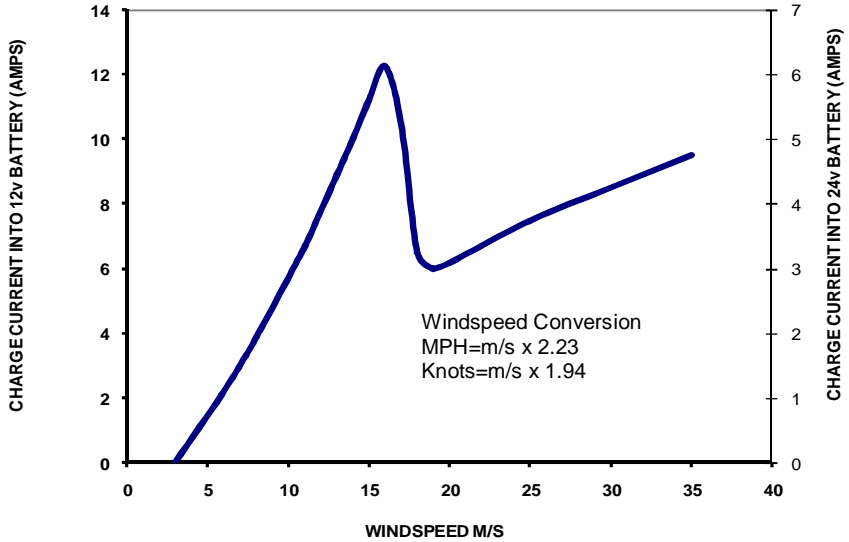
Rutland FM 910-4 with HRSi Charge Regulator Wiring Diagram.



Rutland FM 910-4 with HRDi Charge Regulator Wiring Diagram

Specification and Performance

Guideline performance curve



Inspection and Maintenance

The Rutland Furlmatic 910-4 requires no scheduled maintenance but an annual inspection should be carried out to monitor the general condition of the system.

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 follow one of the procedures below:

Lower the Windcharger on its tower to the ground, coming to rest on a structure that will prevent the Windcharger from striking the ground. Take care that all persons are clear of the area. The turbine will eventually slow down. Tie a blade to the mounting pole to prevent it from rotating.

If the tail boom is safely accessible, using the tail boom, rotate the generator out of the wind; the turbine will eventually slow down. Tie a blade to the mounting pole to prevent it from rotating.

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

- Check the blade screws for tightness.
- Check all other nuts, bolts and screws for tightness.
- Check the yaw axis for free rotation.
- Check the tail fin moves freely.
- Check tower assembly for condition.
- Check the tension of the guy wires if applicable. The tension of guy wires should be checked frequently during the first year.
- The unit can be wiped with a mild detergent and rinsed with water to remove dirt and debris.

Troubleshooting

In the unlikely event that your Rutland Furlmatic 910-4 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.

1. **Read the Electrical Connection and Up & Running** sections and be satisfied that your system complies.
2. **Is there sufficient wind?** The Rutland 910-4 needs approximately 4-5 knots wind speed to start charging. The wind speed across the turbine blades may be greatly reduced in built-up area compared with weather reports for example.
3. **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.
4. **Running Tests: Check for power output from the Windcharger, following this procedure:**
 - 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.
 - 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.
 - 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 gen + and the meter – to the wind gen -. 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.
 - If tests A and C are successful but test B fails to produce results connect the wind gen directly to the battery. Set the digital multimeter to DC Amps and measure power between the wind gen + and the battery +. If a reading is measured, providing there is sufficient wind, then the regulator is faulty. If the wind turbine fails to deliver any current or open circuit V reading undertake the further tests below.

5. **Mechanical inspection.** It will be necessary to remove the Windcharger from its pole for the following tests.
6. **Check the brushes and slipring for wear or damage.** To inspect the brushes, remove the 6 screws joining the nacelle halves together and remove top half of nacelle. Remove the 4 screws connecting the bottom half of nacelle to the post adaptor and remove bottom half of nacelle. This now gives access to the 2 sets of brush holders (2 brushes in each). The brushes and slipring can then be inspected by removing the four self-tapping screws holding the brush holder assemblies in place. Remove any black deposits from slipring with fine emery paper. Heavy deposits and reduced power indicate a possible reverse connection to the battery. Check brushes for undue wear and replace if necessary.
7. **Check hub for free rotation with generator disconnected from battery.** the hub does not rotate freely, check for a possible short circuit in the wiring. If no wiring fault is found refer to your dealer or manufacturer.

If the above checks have identified a need for spare parts or failed to identify the problem you should contact Marlec who can advise you of your nearest distributor in their world wide network. In the first instance we recommend that you contact the company from whom the product was originally purchased.

If in doubt, refer to your dealer or manufacturer.

Notes

LIMITED WARRANTY

The Marlec Engineering Company Limited Warranty provides free replacement cover for all defects in parts and workmanship for 24 months from the date of purchase. Marlec's obligation in this respect is limited to replacing parts which have been promptly reported to the seller and are in the seller's opinion defective and are so found by Marlec upon inspection. A valid proof of purchase will be required if making a warranty claim.

Defective parts must be returned by prepaid post to the manufacturer Marlec Engineering Company Limited, Rutland House, Trevithick Road, Corby, Northamptonshire, NN17 5XY, England, or to an authorised Marlec agent.

This Warranty is void in the event of improper installation, owner neglect, misuse, damage caused by flying debris or natural disasters including lightning and hurricane force winds. This warranty does not extend to support posts, inverters, batteries or ancillary equipment not supplied by the manufacturer.

No responsibility is assumed for incidental damage. No responsibility is assumed for consequential damage. No responsibility is assumed for damage caused by the use of any unauthorised components.

No responsibility is assumed for use of a non "furling" versions of the Rutland Windcharger where Marlec or one of its authorised agents finds that a generator incorporating a furling device should have been used.

Manufactured in the UK by



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