Operating Manual for the Evance Iskra R9000 Wind Turbine

//Level 3 Procedures/L3-CS-01 Operating Manual for the Evance Iskra R9000 Wind Turbine

	Description	Author	Checked	Date
Issue 01	First Issue	JB	AT	18.11.09
Issue 02	Revised in line with MCS requirements	JB		

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Always check for the latest issue of this document

This symbol indicates a safety critical item or stage.

This symbol indicates a warning or care point, where instructions should be carefully followed.

Only personnel trained and certified by Evance, or by one of their certified installers, should install or commission Evance wind turbines. Many aspects of installation and commissioning are safety critical. Incorrect installation or commissioning can lead to failures which might endanger life. Iskra Wind Turbines Ltd (dba Evance) will not accept any liability (product related or otherwise) for turbines which have been installed by personnel not certified by Evance. If you are not certified, do not install the turbine. If you are certified, and are in any doubt about any instruction contained in this document, contact Evance.

Contents:

1. Introduction & System Description

Typically an Evance Iskra R9000 wind turbine system will comprise 9 elements:-

- The turbine
- The tower
- A Brake Control Switch
- A power cable connecting the turbine to the electrical panel
- A rectifier box
- Two 2.5kW inverters
- An energy meter
- A fuse box
- A wind system / mains isolator

The Evance Iskra R9000 is a 5kW upwind wind turbine which starts generating in a wind speed of around 3m/s and has a survival wind speed of 60m/s. It incorporates an exceptionally efficient patented purpose built generator and a patented speed regulating system which automatically pitches the blades to shed power and control turbine speed. It is designed to be mounted on a series of Evance approved tower systems.

A Brake Control Switch which can be used to apply and release the wind turbines brake is provided at the tower base.

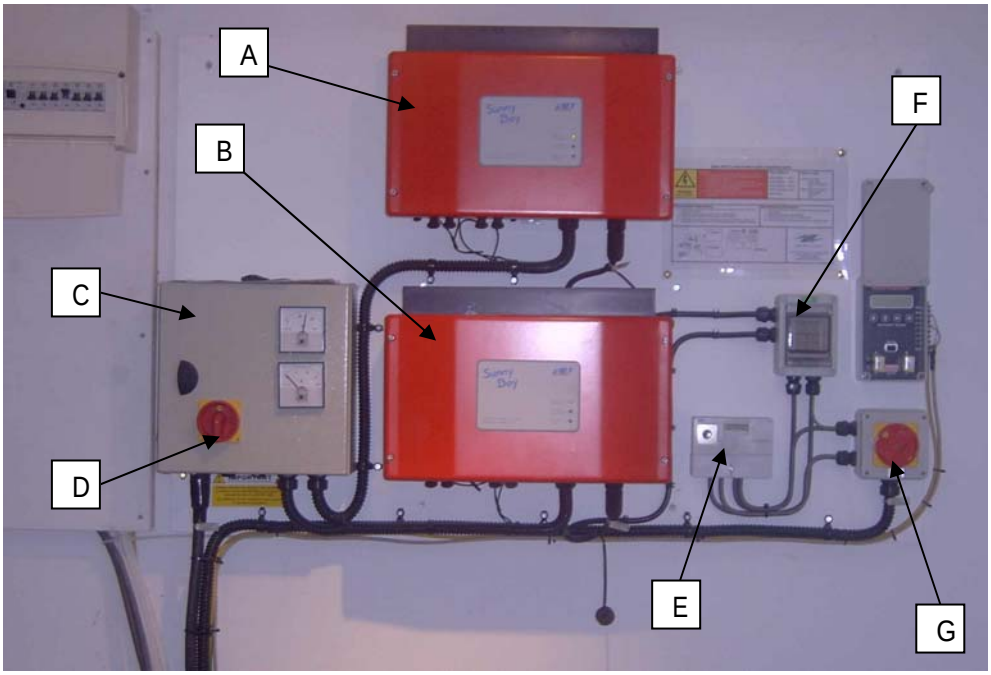


Figure 1 Typical Electrical Installation

A:	**Inverter**	**E:**	**ROCs Meter**
B:	**Inverter**	**F:**	**Fuse Box**
C:	**Rectifier Box**	**G:**	**Wind System / Mains Isolator**
D:	**Wind Turbine Isolator switch**		

The wind turbine produces 'wild ac' - alternating current electricity which varies in both frequency and voltage as the turbine changes speed. This is extremely difficult to use in electrical equipment so it is fed down the tower and through the underground power cable to the electrical equipment panel where it is connected through the Wind Turbine Isolator (D) to the Rectifier Box (C) - (See Figure 1 showing a typical electrical control panel).

In the rectifier box the 'wild ac' is turned into dc current which will typically be at between 200 and 470Vdc. This dc current is fed to the two Inverters (A & B), which convert it to the familiar 230V 50hz ac supply to match the supply that we normally get from the grid.

The Inverters also have to act as wind turbine controllers, constantly monitoring turbine speed and adjusting the amount of power that they take from the turbine ('the load') to let the turbine run at its most efficient speed.

From the Inverters the 'mains quality' 230V 50hz ac is connected via an energy meter and fuse box to the Wind System / Mains Isolator.

The energy meter provides a record of the power produced by the system as well as the (much lower) power consumed in keeping the inverters powered up when there is insufficient wind to produce useful power.

2. Starting up and Shutting Down the System

The turbine is designed to run and to automatically control its speed and its power generation without the need for any outside interference. In the case of a grid failure, or if the grid is turned off by the district network operator to allow maintenance, the inverters will automatically disconnect the turbine from the grid and refuse to take power from the turbine.

However there may be occasions when owners may wish to stop the turbine or to isolate it from the grid connection when for example electrical work is being carried out on the house wiring.

There are two levels of shut-down which can be employed:-

To Isolate the wind turbine from the grid:-

- Switch the Wind System / Mains Isolator (G in Figure 1) to 'OFF'

This will leave the turbine running, but will provide complete electrical isolation of the wind turbine system from the grid. Note that the electrical panel will still be live, as it is still connected to the wind turbine.

The supply from the turbine to the electrical panel can also be isolated using the Isolator switch mounted in the Rectifier Box (C in figure 1). NOTE:- The Wind Turbine Isolator on the Rectifier Box should never be switched from 'OFF' to 'ON' when the turbine is turning as this leads to a sudden inrush of current to the inverter which can damage the inverter. Always stop the wind turbine before turning this isolator back to 'ON'.

Shutting the turbine down

The wind turbine has a brake, which stops the wind turbine in any wind condition if its rotational speed becomes unusually high. This will happen in the unlikely event that the passive pitch over-speed protection system fails to function correctly.

To stop the wind turbine:

Locate the turbine switch box. This will normally be housed inside the turbine tower base.

A small, 3-way switch is mounted in the side of the box. On top of the box is a label giving the function of the 3 positions (figure 2). When the turbine is running, the switch is in the 'RUN' position.

When the switch is in the central 'STOP REQUEST' position, the rotational speed at which the brake will be applied is reduced so that the protection circuit will trigger in normal wind speeds above about 5 m/s. Therefore, this switch position can be used to demonstrate that the protection system is functioning correctly.

Figure 2:- Brake Control Switch

To enforce a shut down, move the switch across to the 'HOLD FOR STOP/START' position and hold it there for 3-5 seconds, or until a whistle can be heard at the top of the tower. Immediately release the switch. This operation will apply the brake and the turbine will stop.

To Start the Wind Turbine:-

To start the turbine up again move the 3-way switch back to the 'HOLD FOR STOP/START' position for about 3-5 seconds, or until you hear the buzzer, then immediately release the switch. This releases the brake. Note that in light winds the turbine may take some time to start moving. When the brake has released, move the switch to the 'RUN' position. If the switch is left at the central 'STOP REQUEST' position the turbine will automatically stop itself when it reaches around 200rpm.

The protection system obtains its power from the wind turbine itself and does not rely on batteries to function. However, whenever you enforce a stop (using 'HOLD FOR STOP/START'), or release the brake to allow the wind turbine to start, the circuit uses power from 2 x 9V batteries (PP3) that are located within the brake box. Power is drawn from these batteries only when you move the switch to the 'HOLD FOR STOP/START' position so they should last for several years. The service teams will check the batteries and exchanges them as part of the annual inspection.

3. Inverters

The inverters perform 3 main functions:

- To act as a wind turbine controller
- To convert the dc into grid friendly ac power.
- To disconnect the wind turbine from the grid if the grid supply is either absent or out of acceptable limits.

Three coloured LED's are provided on the inverter to indicate its status. There is also an LCD display which shows details of the turbine output and inverter status.

If the inverter is showing a single red light, this indicates that it has switched off. This is usually due to the grid supply either being switched off, or its voltage or frequency having moved outside of the allowable limits. The inverter should be displaying an error code which will describe the problem.

Table 1: What to expect to see on the inverters and electrical meters

Wind condition	Approximate speed of wind turbine	Expected state of the lights on the inverters
Still.	Turbine stationary or rotating at less than 50 rpm	After one hour of very low wind speed, or a still wind, the inverters will switch themselves off. All lights will go out.
Light winds that are sufficient to turn the wind turbine only slowly.	Turbine rotating at 50 - 100 rpm	The inverters will begin to come to life once the turbine reaches around 60 rpm. All three lights will come on, faintly at first then more brightly as the turbine gains speed.
Winds above 6 mph	Turbine rotating at 120 rpm or more	As the turbine speed increases the inverters will begin an initialisation period. During this the green light will start flashing and other lights will go off. The inverters are waiting for the right wind and grid conditions to be able to deliver power. In order to comply with UK grid connection standards, there is always a minimum 3 minute wait in this condition. After this wait, the inverters will come on-line. The green light will stop flashing and become constantly on.
All other normal wind conditions.	The turbine will vary speed according to the available wind. In strong winds the turbine will control its speed by varying the blade pitch. There is a distinct change in the aerodynamic sound of the wind turbine when this occurs.	The green light will be constantly on.

4. Reading the meter

The meter (E in figure 1) gives the output in kWh of your turbine since commissioning. The meter display periodically flips between a large number, which is the output of the turbine, and a much smaller number which is the energy absorbed from the grid by the inverters when the turbine is not running. There is also a red light on the meter that flashes at a frequency which increases as more power is generated by the turbine.

5. Maintenance

Servicing of the Evance Iskra R9000 wind turbine is designed to be straightforward. However, in order for the warranty to be valid, it should always be carried out by installation and maintenance teams who have been specifically trained and accredited by Evance. Please contact the company that installed the turbine to find an accredited maintenance team.

The R9000 turbine should have an annual maintenance check performed by an accredited maintenance team. The R9000 is a reliable machine and so should not need any additional maintenance. However, if problems do arise, early recognition by the owner can save costly repairs.

To be able to recognize abnormal behaviour in your AT5-1, you should first know what normal behaviour looks like and sounds like, so try to observe and listen to your turbine in all wind conditions. Do this upwind and downwind of the machine and also look at the behaviour of the lights on the inverter boxes (see section 3).

We recommend a visual and listening inspection of the turbine every couple of months.

Inspection

1. If the wind is blowing, is the rotor rotating at a speed you think looks right for the wind conditions?

2. If the wind is blowing reasonably well, is the turbine pointed into the wind?

3. For the wind conditions, are the lights on the inverter boxes as they should be (see table 1)?

4. Listen for unusual noises, eg regular noises that seem to be related to the speed of the rotor.

5. Check the tower base for loose fasteners or any unusual noises or movements.

Be careful not to confuse turbine noises with background noises on windy days. In very light winds at low rotational speeds there is often a once per revolution tapping sound from the machine. This is quite normal and is due to the blades settling under

the force of gravity as the forces on them reverse as they go over top dead centre & bottom dead centre positions.

If however there are any unusual or loud noises could potentially indicate the Evance installer who supplied the machine should be contacted immediately.

6. What to do if there is a problem?

Warranty, servicing and maintenance questions should be directed to your local distributor. If you have any concerns about the operation of your wind turbine, please contact them with:

1. an accurate description of the symptoms,

2. the wind conditions in which they occur,

3. for how long the symptoms have been occurring and

4. are they getting worse?

They can then decide if your problem is serious, or if it can be left until the next maintenance visit.

Appendix A: Certificates of Conformity

Stafford Aero Technologies

Declaration of Conformity
to Council Directive 73/23/EEC

Equipment Description	Wind Turbine system
Device name/type	AT5-1 wind turbine with standard grid connect
Test unit serial number	012
Manufacturer/Supplier	Iskra Wind Turbines
Address	Loughborough Innovations Centre Epinal Way Loughborough LE11 3EH U.K.
European Standards:	Safety: BS EN 60335-1:2002
Tests carried out by:	Stafford Aero Technologies EMC Test Dept. Clarence House Clarence Road Norwich Norfolk NR1 1HH UK
Test Certificate N°:	LVD1250
Declaration:	We hereby declare that the System complies with the required safety standards stated above.
Test Supervisor:	R.K.L.Noble
Date:	20th February 2006
Authorised by Iskra Wind Turbines	..... Position..TECHNICAL DIRECTOR Date....23/6/06.....

Stafford Aero Technologies

Declaration of Conformity

to Council Directive 89/336/EEC

Equipment Description	Wind Turbine system
Device name/type	AT5-1 wind turbine with standard grid connect
Test serial Number	012
Manufacturer/Supplier	Iskra Wind Turbines
Address	Loughborough Innovations Centre Epinal Way Loughborough LE11 3EH U.K.
European Standards:	Emissions: BS EN 61000-6-3 Immunity BS EN 61000-6-2
Tests carried out by:	Stafford Aero Technologies EMC Test Dept. Clarence House Clarence Road Norwich Norfolk NR1 1HH UK
Test Certificate N°:	CE1250
Declaration:	We hereby declare that the System complies with the required emission and immunity standards stated above.
Test Supervisor:	R.K.L.Noble
Date:	20th February 2006
Authorised by Iskra Wind Turbines	.....
Position TECHNICAL DIRECTOR	Date 23/6/06

Appendix B: label on inverter panel

Iskra AT5-1 wind turbine grid connection point

WARNING
DUAL SUPPLY

Warnings:

(1)Do not work on this equipment until it is isolated using both the wind turbine isolator and the wind system/mains isolator

(2)Components within the wind turbine isolator enclosure and inverters can remain at high voltage for several minutes after disconnection, due to capactitors within the inverters

(3) Unless specifically stopped using the switch at the tower base, the wind turbine can start generating at any time

Trip conditions:

High voltage	264V
Under voltage	207V
Over frequency	50.5Hz
Under frequency	47Hz
Loss of grid	

System ratings:

3-phase AC input:
- 400V max
- 300V AC nominal
- 13A

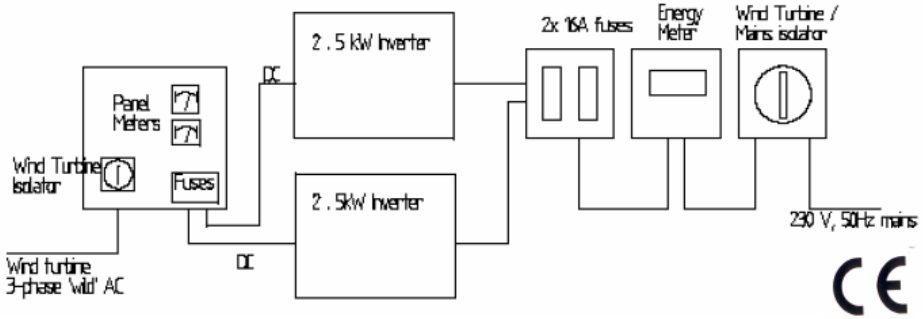
Single phase AC Output:
- 5kW output
- 230V AC
- 21 A

Disconnection instructions:

1. Except in an emergency, stop the wind turbine using the switch at the wind turbine tower base.
2. Isolate the wind turbine using the 'wind turbine isolator'
3. Isolate the grid using the 'wind system / mains isolator'
4. Wait several minutes for the internal capacitors to discharge. This can be monitored on the voltmeter on the wind turbine isolator / rectifier enclosure

Reconnection instructions

1. Ensure that the wind turbine is stopped using the switch at the tower base
2. Reconnect the 'wind turbine isolator'
3. Reconnect the 'wind system / mains isolator'
4. Re-start the wind turbine using the switch at the tower base



bringing wind energy to life

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