

Certification Report

Wind Turbine

Southwest Windpower Skystream 3.7 50 Hz

GCC (Grid Code Compliance)

Report No.: 73129-13

Date: 13.06.2008

Germanischer Lloyd Industrial Services GmbH Business Segment Wind Energy

Manufacturer	Southwest Windpower 1801 W.Route 66 Flagstaff AZ 86001 (USA)
Documentation by	the manufacturer and various companies, named in section 1.
GL Wind Order No.	4800/06/26490/66
GL Wind Turbine Code	Skystream 3.7, 1.8 kW, 50Hz, IEC IIA
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1 Documentation

Documentation by:	Manufacturer, see cover page	[1]
	WINDTEST Kaiser-Wilhelm-Koog GmbH, Germany	[2]
	Nippon Serbig Co., Ltd.	[3]
	Underwriters Laboratories Inc. (UL)	[4]
	Comitato Elettrotecnico Italiano (CEI)	[5]
1.1	Measurement reports	
	"Grid compatibility tests of Southwest Windpower according the test plan of 2008-02-27 created by the Germanischer Lloyd", WT 6420/08, [2]	dated 12.06.2008 examined
1.2	Circuit Diagrams	
	"Skystream 3.7 Owner's Manual Installation Operation Maintenance", 3-CMLT-1054, Rev. H, [1]	dated 01.08.2007 noted
1.3	Other Documents	
	"Proposed Change to Version Number for Skystream Software", email by Robert Vane, Southwest Windpower, [1]	inbox 19.03.2008 noted
	"Identification of Skystream 3.7 Software Version Tested by WINDTEST during February, 2008 Grid Compatibility Tests", [1]	dated 02.06.2008 noted
	"Electromagnetic Compatibility Test Report for Southwest Windpower", No. MC15256, Rev.1, [4]	dated 05.05.2008 noted
	"Antwort: DIN VDE V 0126-1-1, ausstehende Messungen?, Southwest Windpower Skystream 3.7", email by Marko Ibsch, WINDTEST, [2]	inbox 22.05.2008 noted
	"R: Standard CEI 11-20, Question regarding protection system", email by CEI, [5]	inbox 08.04.2008 noted
	"Erweiterung unserer Akkreditierung QMP 09 um die VDE 0126", WINDTEST Kaiser-Wilhelm-Koog, [2]	dated 11.06.2008 noted

"Identification of Skystream 3.7 Software Version tested by WINDTEST during February, 2008 Grid Compatibility Tests", Southwest Windpower, [1] dated 11.06.2008 noted

2 Assessment criteria

Grid Code Compliance of the wind turbine was assessed on the basis of:

- 2.1 GL Wind-Technical Note 065 "Grid connection compatibility of wind turbines according to Grid Codes (NAR), Certification procedure", Rev. 5, 06.06.2005, Germanischer Lloyd
- 2.2 "SWT Skystream 3.7 2.4 kW (peak) Test plan for Certification of Grid Connection Compatibility", Final, dated 27.02.2008, Germanischer Lloyd
- 2.3 FGW "Determination of Electrical Properties – Power Quality (EMC)", Revision 18, dated 01.03.2006
- 2.4 DIN V VDE V 0126-1-1 (VDE V 0126-1-1) "Automatic disconnection device between a generator and the public low voltage grid", February 2006

in consideration of the relevant grid connection requirements taken from the grid codes given below.

- 2.5 Verband der Elektrizitätswirtschaft – VDEW – e.V. "Eigenerzeugungsanlagen am Niederspannungsnetz" 4. Ausgabe, 2001
- 2.6 ENA Energy Networks Association "Engineering Recommendations G83/1 – Recommendations for the connection of small-scale embedded generators (up to 16 A per phase) in parallel with the public low-voltage distribution networks", September 2003
- 2.7 EDF Référentiel Technique "Modèle de Contrat de raccordement, d'accès et d'exploitation pour une installation de production de puissance ≤ 36 kVA raccordée au Réseau Public de Distribution basse tension Conditions Générales" / "Standard Form Agreement for the Connection, Access and Operation of Power Generating Stations ≤ 36 kVA Connected to the Public Low-Voltage Distribution Network General Terms and Conditions", Référentiel technique – NOP-RES_55E, Version V6, 2006
- 2.8 Italian Standard CEI 11-20 "Electrical energy production systems and uninterruptible power systems connected to LV and MV networks"
- 2.9 ÖVE/ÖNORM prEN 50438 "Requirements for the connection of micro-cogenerators in parallel with public low-voltage distribution system", 01.10.2004

3 Scope of assessment

The evaluation of Grid Code Compliance includes the check of the following items:

- Completeness of the documentation and measurements.
- Plausibility of the documents.
- Compliance of tests with the applicable test procedures according to the documents as per item 2.
- Conformity of test results with the requirements according to the documents as per item 2.

4 Remarks

4.1 Electro-mechanical energy conversion concept

The energy conversion from mechanical to electrical energy in the wind turbine Southwest Windpower Skystream 3.7 50 Hz is done by means of an inverter connected brushless three-phase asynchronous generator with permanent magnet rotor. There is no means of reducing mechanical power by changing rotor blade angle. The rotational speed of the rotor is reduced by increasing the current draw of the inverter, and by short circuiting device (Electronic Stall Regulation).

4.2 Main electrical components

4.2.1 Generator

Manufacturer	[1] [3]
Generator type	Brushless 3-phase generator with permanent magnet rotor and slotless torodial stator
Rated output	Refer to 4.2.2
Rated speed	330 Min ⁻¹
Cos φ	1
Degree of protection	IP 54
Insulation class	F

Duty type	S1 (continuous)
Ambient temperature	50°C
4.2.2 Converter	
Manufacturer	[1]
Type	IGBT
Max. voltage dc link	400 V
Rated output	1.8 kW (2.4 kW peak)
Rated output voltage	230 V
Rated frequency	50 Hz
Rated output current	10 A

4.2.3 PLC

Software release 2.0.

4.3 Testing conditions

All tests have been carried out on a test bench at the manufacturer's facilities. Measurements have been conducted and observed by the measuring institute WINDTEST Kaiser-Wilhelm-Koog mentioned in chapter 1.

4.4 Non-compliances

Disconnection of filters including capacitors or inductances according to 2.8 (CEI 11-20).

After disconnection of a wind turbine filters shall be disconnected due to their influence on system voltage, too.

This is not achieved with the current design of the Skystream 3.7. A filter for EMI suppression remains connected to grid after the turbine has been disconnected by the interface protection. In consideration of the CEI statement under 1.2.6 this does not comply with the requirements of CEI 11-20.

5 Conditions

The measuring institute must be accredited for the execution of tests according to DIN V VDE V 0126-1-1:2006.

The accreditation process of WINDTEST is still ongoing with respect of the standard mentioned above. Tests

performed and reported in 1.1.1 are accepted under reserve and act on the assumption that WINDTEST will achieve this accreditation at the end of year 2008 the latest.

6 Conclusion

Various tests were conducted according to the assessment criteria 2.1 and 2.4. According to the submitted documents the design and electrical characteristics of the wind turbine Southwest Windpower Skystream 3.7 50 Hz meet the requirements as set in the guidelines given under 2.5 to 2.7. All tests have been performed successfully.

Changes in design are to be approved by Germanischer Lloyd otherwise this Certification Report loses its validity.

TBU/MTr

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Business Segment Wind Energy

Tobias Bublat
Expert in Charge

