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
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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

"Skostream 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 Skostream Software",
    email by Robert Vane, Southwest Windpower, [1] inbox 19.03.2008 noted

"Identification of Skostream 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 Skostream 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
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.


2.6 ENA Energy Networks Association “Engineering Recommendations GB3/1 – 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


2.8 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

Germanischer Lloyd Industrial Services GmbH
Business Segment Wind Energy

[Signature]

Tobias Bublat
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