



UL 6142

STANDARD FOR SAFETY

Small Wind Turbine Systems

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UL Standard for Safety for Small Wind Turbine Systems, UL 6142

First Edition, Dated November 30, 2012

Summary of Topics

New First Edition of UL 6142, Standard for Safety for Small Wind Turbine Systems, covering small wind turbine systems and electrical subassemblies intended for use in stand-alone (not grid-connected) or utility interactive applications.

The requirements are substantially in accordance with Proposal(s) on this subject dated September 16, 2011 and December 2, 2011

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The following table lists the future effective dates with the corresponding reference.

Future Effective Date	Reference
January 2, 2013	Entire Standard

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American Wind Energy Association
AWEA 6142
First Edition



Underwriters Laboratories Inc.
UL 6142
First Edition

Small Wind Turbine Systems

November 30, 2012



ANSI/UL 6142-2012

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This ANSI/UL Standard for Safety consists of the First Edition. The most recent designation of ANSI/UL 6142 as an American National Standard (ANSI) occurred on November 30, 2012. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <http://csds.ul.com>.

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APPENDIX A

Standards for Components



Preface

This is the common AWEA and UL standard for Small Wind Turbine Systems. It is the first edition of AWEA 6142, and the first edition of UL 6142.

This common standard was developed and processed in accordance with the accredited standards development procedures of Underwriters Laboratories Inc. (UL).

This standard has been approved by the American National Standards Institute as an American National Standard.

Note: *Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.*

UL effective date

As of January 2, 2013 all products Listed or Recognized by UL must comply with the requirements in this standard.

A UL effective date is established by Underwriters Laboratories Inc. and is not part of the ANSI approved standard.



SMALL WIND TURBINE SYSTEMS

INTRODUCTION

1 Scope

1.1 These requirements cover small wind turbine systems (WT) and electrical subassemblies. With respect to this standard, small WT are considered to be wind turbines where a user or service person cannot or is not intended to enter the turbine to operate it or perform maintenance. These units are intended for use in stand-alone (not grid-connected) or utility interactive applications. Utility-interactive, grid-tied WT are operated in parallel with an electric power system (EPS) to supply power to common loads.

1.2 The WT power, control and protection systems are evaluated only to the extent that they function within the manufacturer's specified limits and response times. These control and protection functions are evaluated with respect to risk of electric shock and fire. It is intended that the electrical subassemblies that address power transfer control and protection functions evaluated per this document are to be coordinated with the mechanical and structural limitations specified in AWEA 9.1, Small Wind Turbine Performance and Safety Standard, the IEC 61400 series documents, or Germanischer Lloyd: Guideline for the Certification of Wind Turbines documents.

1.3 These requirements do not cover:

- a) WT generating systems intended for off-shore installation.
- b) WT generating systems intended for hazardous locations;
- c) Mechanical or structural integrity of the WT system or subassemblies;
- d) Verification that the manufacturer-defined controls and protection limits maintain the WT system within its safe mechanical and structural limits;
- e) Mechanical loading of ladders, hoist supports, elevator mounting means, scaffolding, personnel tie offs, or other personnel load-bearing functional parts.

1.4 The wind turbine products covered by these requirements are intended to be installed in accordance with the National Electrical Code, ANSI/NFPA 70.

1.5 The evaluation of products to this standard includes evaluation of all features and functions incorporated in or available for the turbine, or referred to in the documentation provided with the turbine, if these features or functions can affect compliance of the product with this standard.

1.6 Turbines where a user or service person is intended or required to enter the turbine to operate or perform maintenance on the turbine are considered to be large wind turbine systems and are covered in the Outline of Investigation for Wind Turbine Generating Systems, UL 6140.

1.7 These requirements cover WT rated 1500 Vac or less.

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components used in the products covered by this standard. See also Section 4, Special Components and Subassemblies of WT.

2.1.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

2.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

2.1.5 Components and subassemblies of the overall WT shall be evaluated and found suitable for their operation over the rated normal operating range of electrical and environmental conditions per the WT manufacturer's specifications. These components and subassemblies shall also perform per the manufacturer's specifications during defined abnormal conditions, such as turbine shut down and abnormal electric utility grid conditions.

2.2 Units of Measurement

2.2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

2.3 Undated References

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

3 Glossary

3.1 For the purpose of this standard, the following definitions apply.

3.2 CHARGE CONTROLLER – A device intended to control the charging process of storage batteries or other energy storage device.

3.3 DIVERSION CHARGE CONTROLLER – A charge controller that regulates the charging process by diverting power from energy storage to AC loads, DC loads, or to an EPS.

3.4 DIVERSION LOAD – An electrical load that consumes power diverted to it by a diversion charge controller or diversion load controller.

3.5 DIVERSION LOAD CONTROLLER – A regulation device or system that diverts wind generator output power to AC loads, DC loads or to an EPS.

3.6 DOWN TOWER – Wind turbine location that is at ground level or near ground level, such as the base level of the turbine tower.

3.7 ELECTRIC POWER SYSTEM (EPS) – Equipment or facilities that deliver electric power to a load. The most common example of an EPS is an electric utility.

3.8 MAXIMUM CURRENT(S) – The maximum peak current(s) a wind turbine will produce. There may be several maximum current ratings defined for a product or system, such as alternator/generator output, inverter/converter output, and control output circuits.

3.9 MAXIMUM OUTPUT POWER – The maximum average power output a wind turbine in normal steady-state operation will produce over a one minute period of time. Note that the peak power output can be greater.

3.10 MAXIMUM VOLTAGE – The maximum peak voltage a wind turbine will produce during operation, including open circuit conditions.

3.11 NACELLE – The housing or enclosure for the alternator and other wind turbine parts that is generally located at the top of the tower.

3.12 OVERVOLTAGE CATEGORY – Grouping of products based on typical installed location with respect to overvoltage protection and available energy:

- a) Category IV - Primary Supply Level. Overhead lines and cable systems including distribution and its associated overcurrent protective equipment (equipment installed at the service entrance).
- b) Category III - Distribution Level. Fixed wiring and associated equipment (not electrical loads) connected to the primary supply level, Category IV.
- c) Category II - Load Level. Appliances and portable equipment and the like connected to the distribution level, Category III.

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d) Category I - Signal Level. Special equipment or parts of equipment such as low-voltage electronic logic systems, remote controls, signaling and power limited (per Article 725 of National Electrical Code, ANSI/NFPA 70) circuits connected to the load level, Category II.

3.13 POLLUTION – Any addition of contaminants, solid, liquid or gaseous (ionized gases), and moisture that may produce a reduction of dielectric strength or surface resistivity.

3.14 POLLUTION DEGREE – The level of pollution present at the location on or in a product where the clearance and creepage distance measurement is made and can be controlled by the design of the product. For example, enclosures can be used to achieve pollution degree 3, heaters within enclosures can help achieve pollution degree 2, and encapsulation can be used to achieve pollution degree 1:

a) Pollution Degree 1 - No pollution or only dry, nonconductive pollution. The pollution has no influence

b) Pollution Degree 2 - Normally, only nonconductive pollution. However, a temporary conductivity caused by condensation may be expected.

c) Pollution Degree 3 - Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation that is expected.

d) Pollution Degree 4 - Pollution that generates persistent conductivity through conductive dust or rain and snow.

3.15 RATED POWER – The highest output power of the wind turbine when operating at a wind speed of up to 11 m/s (24.6 mph).

Note: The method for measuring wind turbine power output is specified in IEC 61400-12-1, Power Performance Measurements of Electricity Producing Wind Turbines.

3.16 SMALL TURBINE – A wind turbine where a user or service person cannot or is not intended to enter the turbine to operate it or perform maintenance.

3.17 TOWER – A pole or other wind turbine support structure.

3.18 TURBINE PROTECTION SYSTEM – Emergency Stop System primarily intended to provide protection for the wind turbine structure in the event of the following conditions: excessive vibration, rotor or generator overspeed, extreme temperature, extreme wind, fire or smoke.

3.19 UP TOWER – Wind turbine location that is at or above the top of the tower such as in the nacelle and hub.

3.20 WIND TURBINE OUTPUT CIRCUIT – The circuit conductors between the internal components of a small wind turbine (which might include an alternator, integrated rectifier, controller, and/or inverter) and other equipment.

CONSTRUCTION

4 Special Components and Subassemblies of Wind Turbines

4.1 General

4.1.1 WT and subassemblies other than those noted in 2.1, Components and this section shall comply with applicable portions of the Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741, or the Standard for Industrial Control Equipment, UL 508. Constructions and subassemblies not covered by the previously mentioned UL standards shall comply with the National Electrical Code, ANSI/NFPA 70.

4.1.2 Components and subassemblies shall be suitably rated for the installation location of the component within or outside the turbine. Internal turbine environmental conditions often include dripping of water and other non-corrosive liquids, and falling dust, dirt, and other debris. Type 12 or 5 enclosure ratings address the environment of most internal wind turbine components and enclosures.

4.1.3 Equipment enclosures shall be constructed of sufficient mechanical strength to withstand the foreseeable mechanical forces during operation or service of the turbine. Such forces include, but are not limited to, rotational sway.

4.2 Wiring

4.2.1 Internal wiring within subassemblies and components that are not covered by component standards shall comply with the Standard for Industrial Control Equipment, UL 508, or the Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, UL 1741, in addition to the requirements in this section.

4.2.2 Wiring that is subject to movement, flexing, or twisting during operation of the wind turbine shall be investigated in accordance with 4.4, Cable drip loop, for suitability in the conditions of use and rated life or cycle time.

4.2.3 All wiring within a WT that is accessible to users or service personnel or run vertically up the tower shall be either in a raceway or be rated for tray cable usage. The following meets the intent of the requirement:

- a) Multiconductor cable complying with the Outline of Investigation for Flexible Motor Supply Cable and Wind Turbine Tray Cable, SU 2277, and marked for wind turbine usage.
- b) Power-limited circuit cabling complying with the Standard for Power-Limited Circuit Cables, UL 13, suitable for Tray Cable usage (Types CMG, CM, CL2, CL3, PLTC, CMR, CL2R, CL3R, CMP, CL2P, CL3P).
- c) Optical fiber circuits complying with the Standard for Optical Fiber Cable, UL 1651.
- d) Power cabling complying with the Standard for Thermoplastic-Insulated Wires and Cables, UL 83, or the Standard for Thermoset-Insulated Wires and Cables, UL 44, and additionally marked for cable tray usage ("CT", "For Cable Tray Use", "For CT Use", or "For Use in Cable Trays") or marked "FT4".
- e) Extra hard usage cord that complies with the Standard for Flexible Cords and Cables, UL 62.

- f) Armored cable in accordance with the Standard for Armored Cable, UL 4.
- g) Cables that comply with the Standard for Cables for Non-Power-Limited Fire-Alarm Circuits, UL 1425.
- h) Metal-clad cables that comply with the Standard for Metal-Clad Cables, UL 1569.

Exception: Wiring within a component need only meet the requirements for the component.

4.2.4 Tray cables shall be installed in accordance with ANSI/NFPA 70 Article 300.

4.2.5 Wiring within a rotating hub shall be additionally protected from mechanical damage and from loose debris that may impact wiring during hub rotation. Such protection may be provided by enclosures or conduit complying with one of the following or the equivalent:

- a) Standard for Metallic Outlet Boxes, UL 514A,
- b) Standard for Conduit, Tubing, and Cable Fittings, UL 514B,
- c) Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers, UL 514C,
- d) Mechanical shielding.

Exception: Wiring that is low voltage, limited energy and not part of the Safety Related Control System defined in Section 8 need not to comply with 4.2.5.

4.2.6 Wiring subjected to exposure to water or oil during normal or abnormal conditions such as a gasket or seal leak shall be suitably rated for the condition.

4.2.7 Wiring subjected to UV exposure during operation shall be rated for exposure to sunlight.

4.2.8 Wiring exposed or subjected to wear, abrasion, or impact from operation of the turbine or located in a user or service person traffic area, shall be provided with additional protection to prevent damage to the electrical insulation.