When the 2011 National Electrical Code® (NEC) became available in October 2010, there was a new Article 694 that covered small wind electric systems. Section 690.1 stated that the provisions of Article 694 apply to small wind (turbine) electric systems consisting of one or more wind electric generators with individual generators having a rated power up to and including 100 kW. These small wind turbines could include generators, alternators, inverters and controllers. Several sections within Article 694 of the 2011 NEC require equipment such as inverters, DC-rated overcurrent protective devices and flexible cords to be listed. However, a requirement to list the entire small wind turbine system was missing.

Fast forward to the 2014 NEC — for which several code proposals were accepted by code making panel 4 (CMP 4) to expand the scope of Article 694 to include all wind turbines regardless of size as well as to require that an entire wind turbine system be listed and labeled for the application. These code proposals identified that Article 694 was unnecessarily limited to small wind turbines. Further, they noted that large wind turbines are being installed across the United States within the purview of the NEC and are outside the scope of Article 694. The proposals also recognized that there is little difference between the electrical installations for a wind turbine less than 100kW and those larger than 100kW, and that the requirements developed for small wind systems are appropriate for intermediate as well as large wind systems, when installed within areas covered by NEC section 90.2(A). The proposals acknowledged that from a U.S. electrical
safety standard point of view, the electrical safety requirements are very similar for both small and large wind turbines.

The 2014 NEC Article 694 now applies to all wind (turbine) electric systems, regardless of size. Section 694.7(B) requires that wind electric systems be listed and labeled for the application. This new requirement will assist AHJs with the inspection and approval process of wind turbine electrical systems. As an example, NEC section 90.7 identifies that inspection of factory-installed internal wiring or the construction of equipment at the time of installation is unnecessary if the equipment has been listed by a qualified electrical testing laboratory, such as UL.

Because the requirement for listed wind turbines is new, an AHJ may encounter a wind turbine that does not bear the listing mark required by the NEC. Should this happen, UL can assist by conducting a Field Evaluation of an installed wind turbine. Once UL determines that a wind turbine is compliant with the applicable UL Standard, a UL Field Evaluated label is affixed to the wind turbine. This meets the NEC requirement for a listed wind turbine, and an AHJ can base acceptance on the UL Field Evaluation label and report.

Certified (Listed)
Wind Turbines

Wind turbines certified by UL are covered by two different product categories: ZGEN for small wind turbine generating systems and ZGEA for large wind turbine generating systems. Additional information on both product categories can be found in the UL White Book or the UL Online Certifications Directory. Both small and large wind turbines are investigated for risk of fire and shock, including safety-related control system electrical performance and grid interconnection performance, and are intended for installation in accordance with Articles 694 and 705 of the NEC. Wind turbines may be used in either a stand-alone (grid independent) or a utility interactive (grid-connected) application.

Product category ZGEN covers small wind turbine generating systems. Small wind turbines are considered small when they can be operated or maintained without a user or service person entering them. Small wind turbines provided with an inverter or converter is classed as utility interactive, stand-alone or multimode. Utility interactive devices operate in parallel with the utility grid. Stand-alone devices are intended to operate independent of the utility grid. Multimode devices can operate as either stand-alone or utility interactive.

Product category ZGEA covers large wind turbine generating systems. Large wind turbines are considered large when a user or service person is intended or required to enter them to operate or perform maintenance. Large wind turbines consist of various electrical hardware subassemblies and safety-related control systems constructed and interconnected in accordance with electrical safety requirements to create a complete wind turbine system. These systems are typically assembled on-site from multiple sections.
Markings and Installation Instructions

Wind turbines are required to be marked in an area readily visible after installation with:

- The manufacturer’s name, trademark, or other descriptive marking
- Rated power
- Maximum output power
- Maximum output voltage
- Maximum output current
- Operating voltage range
- Operating frequency range
- A plaque displaying basic instructions on how to shut down the turbine

Wind turbine systems and subassembly components must include installation instructions and be installed in accordance with the NEC. Installation instructions include:

- Specific instructions on how to operate and shutdown the wind turbine
- Symbol identification when illustrated symbols are used

The UL certification Mark for both small and large wind turbines includes the UL symbol, the words “CERTIFIED” and “SAFETY,” the geographic identifier(s), and a file number. Additionally, small wind turbines will be marked UL 6142 while large wind turbines will be marked with:

**UL SUBJECT 6140**

+ SUBASSEMBLY

++ OF +++ TOTAL SUBASSEMBLIES

+ Name of subassembly (e.g., **NACELLE, BLADE, BASE SECTION, TOWER SECTION**)

++, +++ Indicates the number of assemblies included in the complete wind turbine (e.g., 1 of 5, 2 of 5, 3 of 5, etc.)

Summary

All wind turbines regardless of size, except those installed in areas identified in NEC section 90.2(B), are now required by the 2014 NEC section 694.7(B) to be listed. In brief, some requirements of the NEC applicable to wind turbines as well as some requirements of the applicable UL Standards have been mentioned in this article. Remember the requirement for installation instructions and NEC section 110.3(B), which states that listed equipment shall be installed and used in accordance with any instructions included in the listing.

For additional information on certified wind turbines, please contact Jeff Fecteau at Jeffrey.Fecteau@ul.com or at +1.952.838.5453.