

## TURBINE COMPONENT SAFETY COMPLIANCE

*A guide to avoiding costly missteps in component safety certification*

*Intertek Group*

As wind energy continues to grow, the increase in the annual number of wind turbine installations will draw more manufacturers of wind turbines and components into the U.S. and Canadian markets. However, before a manufacturer can take advantage of this growing opportunity they need to be familiar with the regulatory requirements pertaining to these markets.

As background, before a WTG can begin operating it must comply with national, state/province and local electrical codes. The person responsible to make this determination is an Authority Having Jurisdiction (AHJ). In the case of WTGs the AHJ is an electrical inspector.

An AHJ can call upon the National or local Codes or Standards as they relate to the WTG as the basis for denying approval to begin operating the unit. If an AHJ challenges a WTG's compliance to Code the manufacturer is required to make the necessary equipment or installation corrections to satisfy the AHJ's local code requirements. This must be satisfied before the WTG can begin operating. These corrections often require extensive equipment modifications which can result in costly delays. By understanding of the regulatory

issues related to WTGs manufacturers can avoid many potential AHJ objections and unnecessary costly delays.

The purpose of this paper is to provide the manufacturers of WTGs and their components, and WTG customers and investors with information on how to avoid time consuming and costly pitfalls, and improve the overall WTG product safety certification process. This paper contains information on the regulatory issues related to WTGs and provides advance planning tactics to reduce the likelihood of an AHJ objection. What's more, the paper includes best practices to achieve AHJ approval in the event of an AHJ challenge. These methods are based on Intertek's broad experience with power generation equipment and evaluation of over 1,000 WTGs in North America alone.

### **KEY DEFINITIONS FROM NFPA 70, THE U.S. NATIONAL ELECTRIC CODE, ARTICLE 100**

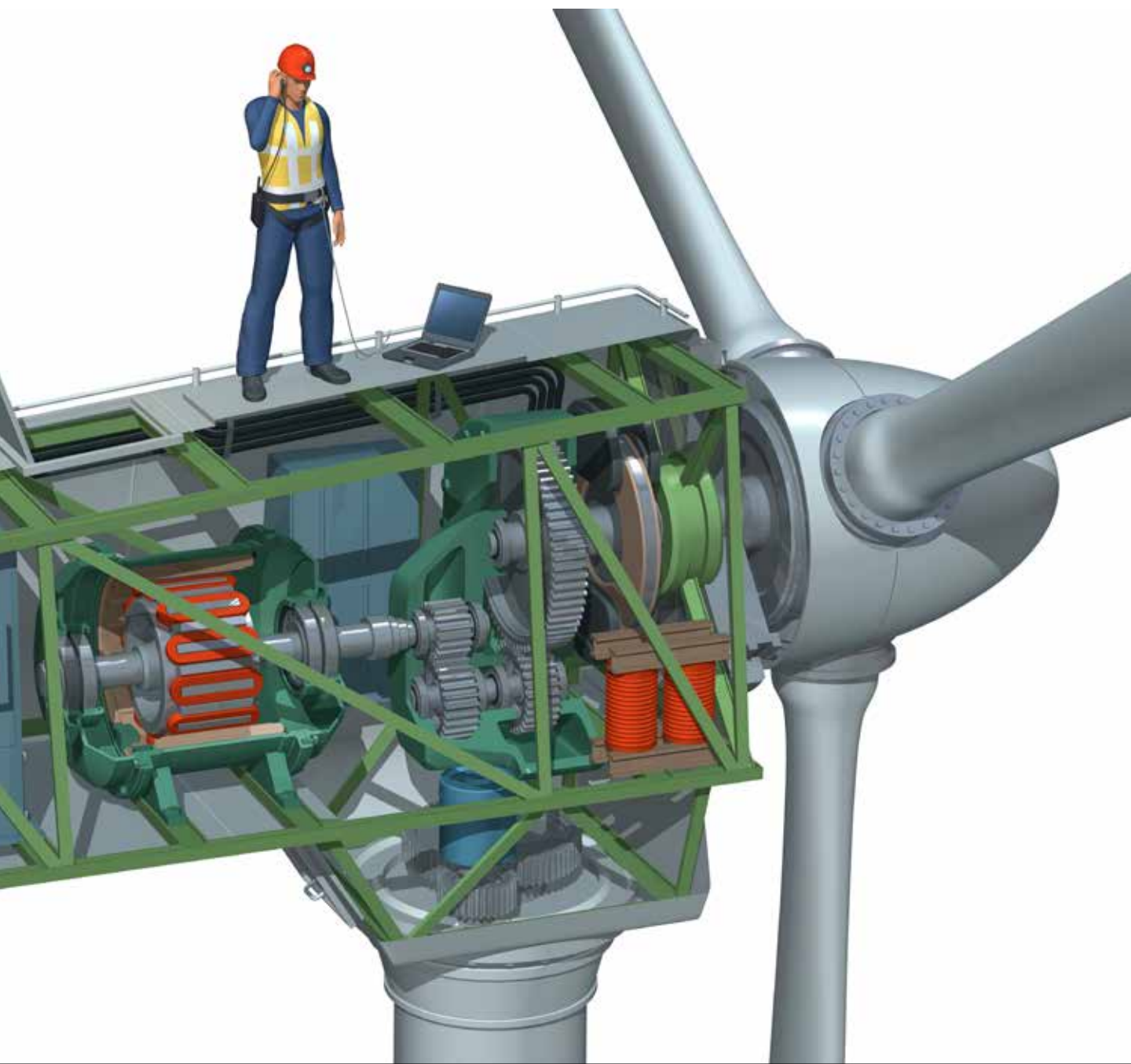
**Approved** — Acceptable to the authority having jurisdiction.

**Authority Having Jurisdiction (AHJ)** — An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving

equipment, materials, an installation, or a procedure.

**Labeled** — Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production





of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Listed** — Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with

evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

#### ALSO IN THIS SECTION:

**30 Profile:**  
Eickhoff Corporation

**32 Conversation:**  
Brian Winter  
Encoder Product Manager  
Nidec Avtron Automation

### THE REGULATORY ENVIRONMENT FOR WTGS

Electrical product safety regulations are based on compliance with the National Electric Code (NEC) in the U.S. and the Canadian Electric Code (CEC) in Canada. The most common means to demonstrate compliance to code is for a manufacturer to have their product “Listed.” A Listing is demonstrated by a certification mark such as the ETL, UL or CSA Marks from a third party testing organization such as Intertek, Underwriters Laboratories or CSA, respectively. Such third party testing organizations are called Nationally Recognized Testing Laboratories (NRTL), which are accredited by the U.S. Occupational Safety and Health Administration (OSHA), in the U.S. In Canada, these are called Certification Organizations (CO) and are accredited by the Standards Council of Canada (SCC).

The regulatory issues pertaining to WTG are highly complex for the following reasons:

- There is not an agreed upon standard covering the electrical safety certification of WTGs. Without an agreed upon electrical safety standard it is difficult for third party testing organizations to provide a Listing that is certain to be accepted by the AHJ.
- Since there is not an agreed upon standard covering the electrical safety of WTGs, interpretation regarding specific WTG requirements can vary from state to state and between the U.S. and Canada.
- WTGs are highly complex power generation units containing several thousand components. An AHJ can refuse to commission the entire WTG because of any single component that the AHJ does not consider to be compliant to relevant Code.
- A WTG is not considered a “complete product” until it is assembled at the installation site. Therefore, the Listing must be based on an evaluation of the entire WTG as an assembled entity in the field. The Listing can not be based on factory evaluation as is the case with most electrical equipment.

Because there is no agreed upon standard a WTG can be evaluated to, manufacturers are working with their NRTL / CO to obtain Field Evaluated Labels for their WTGs. A Field Evaluated Label is acquired when an NRTL / CO examines an installed product to ensure that minimum safety requirements have been met. In the U.S. this is typically called a Field Evaluation, and in Canada, a Canadian Special Electrical Inspection (in accordance with standard, CAN/CSA SPE-1000- 99). In the case of WTGs the NRTL /CO will consult with the AHJ to identify the certification issues and will propose an evaluation plan to address those issues. When the NRTL/CO is confident the WTG meets with the AHJ’s requirements a Field Evaluated Label is provided. Field Evaluations are site-specific, although the data gained on the components may be utilized to qualify future units.

### THIRD PARTY CERTIFICATION REQUIREMENTS

*Can manufacturers sell products in the U.S. and Canada without third party certifications?*

Compliance to the National Electric Code in the U.S. and the Canadian Electric Code in Canada requires equipment to be Listed by a Nationally Recognized Testing Laboratory (NRTL) in the US, or a

Certification Organization (CO) and in Canada. While the CE Marking scheme in Europe can be applied based on self declaration, certification for the U.S. and Canadian markets requires third party certification. Without third party certification an electrical inspector can deny approval for a WTG to begin operation based on National or local Codes or Standards. To date, such challenges have arisen based on lack of compliance with specific sections of the US National Electric Code (NEC – Standard NFPA 70) and the Canadian Electric Code (CAN/CSA C22.2 No. 0). Until the AHJ is satisfied that their regulatory requirements have been met, the installed turbines may not begin operating.

In evaluating the components in a WTG AHJs rely on a third party Listings. When evaluating the entire WTG AHJs work with an NRTL /CO to agree on the requirements for the NRTL /CO to apply a Field Evaluated Label.

### COMPONENT LISTINGS

*How difficult is it to obtain a Listing?*

In order to achieve a Field Evaluated Label for a WTG, each component must be examined for compliance with the most applicable National standard. The suppliers of each component will need to have their products tested and Listed. Further, as part of the Listing process each supplier will be subject to continuing factory audits as long as they continue to mark their product under the Listing program.

Due to the increasing global demand for wind energy and the supply chain constraints, many component manufacturers are producing at or near capacity to meet current demand. Since the manufacturers’ current certi-

fications enable them to sell in numerous markets, many component manufacturers may be hesitant to go through the Listing process. Furthermore, the time-frame for a Listing evaluation can run from weeks to months. While the certification of cables, control panels, break systems, and wind anemometers can happen quickly, generator and motor manufacturers may not receive results for up to two years on the suitability of their Electrical Insulation System (EIS) to ANSI/UL 1446, a prerequisite to Listing the generator or motor as a whole.

For WTG manufactures eager to capitalize on the growing U.S. and Canadian markets it is important to plan early. The amount of time it takes to have a product Listed can vary greatly between testing organization. Because of the large number and complexity of the components in a WTG it is important for manufacturers to develop a comprehensive supply chain strategy.

***A WTG and its components are not listed yet. What needs to be done?***

The first step in assessing the scope of your regulatory challenges is to work with an NRTL /CO to conduct a compliance evaluation. The result will be an engineering findings report detailing the items that must be addressed in order to qualify for a Field Evaluation Label.

A desktop examination of your design will identify which components are already Listed. Items that are not listed are at risk of initiating an AHJ challenge for that component or the electrical system as a whole. With this report in hand, you can identify those items that should be replaced with Listed alternatives and those items that can get List-

ed by their suppliers. Beginning with items requiring longer lead times for Listing (e.g. Generators) and prioritizing those items typically reviewed by AHJs (e.g. field installed cables, control panels), the NRTL /CO can help you develop a “compliance plan.” For some items, like a light fixture, the easiest solution is to simply replace the item with a Listed equivalent part. However, for an item like the generator, this may be difficult or even impossible based on the availability of currently Listed products.

Next, the NRTL / CO will help ensure that the Listed components are being installed in accordance with the manufacturers’ instructions, and that they’re being used within their ratings.

This early engagement of an NRTL /CO will identify compliance-related risks and help you to avoid costly delays.

***What if something needs to be changed in order to qualify for a Field Label?***

It is better to identify potential problems early when it is still possible to fix them at the factory rather than when the installation is “complete.” Product retrofits performed in the field become more difficult and more expensive to execute. Many minor modifications can be quickly identified by the inspecting agency engineer and quickly addressed in manufacturing; e.g. adding additional cable supports or warning labels.

***What if the AHJ never grants approval, because of some flaw in the design or component selection?***

In our experience with more than 1,000 large wind turbines, we have never seen this happen. However, significant field

retrofits have been required on some designs at a limited number of sites. So far, to the best of our knowledge, every unit evaluated under this program has been eventually authorized for labeling and accepted by the AHJ for use.

**INTERTEK**

Intertek, a NRTL and CO, has developed a unique program that supports manufacturers and AHJs by providing engineering evaluations on installed equipment in order to determine compliance with specific National Codes and Standards, for both the U.S. and Canada. Intertek has Field Evaluated and Labeled over 1,000 large wind turbine generators in the U.S. and Canada. The evaluation techniques employed have been validated by AHJs across North America, resulting in some authorities specifically advising WTG manufacturers to consult with Intertek if they’re challenged under the State or Provincial regulations. With our proven experience in efficiently evaluating both the system and component designs to U.S., Canadian, and other International standards, and the desire to support a reasonable and cost-considerate solution acceptable to all involved parties, Intertek stands alone in our ability to guide WTG manufacturers to success for all their U.S. and Canadian projects.

---

***For more information*** about Intertek, including answers to technical questions or quotes, contact Intertek at [icenter@intertek.com](mailto:icenter@intertek.com) or (800) 967-5352. This paper was developed with contributions from Intertek’s Energy Services Engineering team and Intertek Corporate Liason Joe Welch.

---



## OEMs



### VESTAS WINS 33 MW ORDER FROM OX2 IN SWEDEN

Vestas has received a firm and unconditional order for 10 V126-3.3 MW turbines for the Maevaara 2 wind power plant. The order also includes the first Vestas De-icing System for the V126-3.3 MW.

The order was placed by Nordic renewable energy developer OX2. The wind power plant will be in northern Sweden. This project is the second in Sweden to utilise the V126-3.3 MW turbine model. Turbine delivery is planned to begin in the second quarter of 2016 with installation during second and third quarter of 2016.

The contract includes supply, installation and commissioning of 10 V126-3.3 MW turbines, along with a VestasOnline® Business SCADA solution and a 15-year full-scope service agreement (AOM 5000), which was signed with Allianz Cap-

ital Partners, the Allianz Group's in-house investment division for alternative investments. Allianz, with a combined generation capacity of more than 1,200 MW, is one of the world's largest financial investors in renewable energy and has recently purchased the Maevaara 2 wind power plant from OX2.

"We're very pleased to be installing Vestas V126-3.3MW turbines at the extension to the Maevaara project and look forward to working closely with Vestas to ensure optimal through-life operational performance," states David Jones, Head of Renewable Energy at Allianz Capital Partners.

"The new V126-3.3 MW with de-icing is a good match for the Nordic environment and ensures that the site is utilised in an optimal way," says Paul Stormoen, CEO of OX2

Wind. "We are very pleased with our long-term relationship with Vestas and are looking forward to work together on this project."

"Sweden is an increasingly important renewable energy market. Vestas' ability to offer leading technology solutions such as the V126-3.3 MW and the Vestas De-icing System provides our customers there with a competitive value proposition for generating more energy on low wind sites," says Klaus Steen Mortensen, President of Vestas Northern Europe. "Vestas is very pleased to continue our successful partnership with OX2 and Allianz Capital Partners realizing this wind energy project."

Today, Vestas has delivered about 1,500 wind turbines totalling more than 2,400 MW to Sweden.

— Source: Vestas



Courtesy of GE

## **TURKISH DEVELOPER TO DEBUT GE TURBINE MODEL**

### *İÇDAS places 60 MW order of 3.2-103 for BIGA RES project*

GE recently announced it will supply energy developer İÇDAS with 19 brilliant GE 3.2-103 wind turbines for the BIGA RES wind farm, located near the town of Canakkale in northwestern Turkey.

The 60 MW wind farm will feature GE's most powerful wind turbine—the 3.2-103—and will be the first units of this type installed anywhere in the world.

The BIGA RES wind farm will contribute to the Turkish government's goals of reaching 20 GW of wind energy and 30 percent of primary energy supplied from renewable sources by the year 2023. According to the Turkish Wind Association, the country had 3,424 MW of wind energy capacity installed as of the first half of 2014.

"We are pleased to collaborate with GE on this new wind farm that will help to provide Turkey with renewable energy and assists with meeting the country's goals," said General Manager Bülend Engin. "GE's proven wind turbine technology and experience in power generation is a great fit for İÇDAS, and we

are excited both for our customers and Turkey."

With an 85-meter hub height designed to harness Turkey's medium to strong wind conditions with low shear, GE's 3.2-103 can provide strong power while being able to meet tip height requirements found frequently across Europe.

"Wind energy is a natural fit for Turkey and its citizens," said Mete Maltepe, national commercial executive for Turkey with GE's Power and Water business. "At GE, we are proud to contribute to the country's efforts to meet its renewable energy targets."

As a brilliant turbine, the 3.2-103 utilizes the power of the Industrial Internet to help manage the variability of wind for smooth, predictable power. By analyzing tens of thousands of data points every second, the 3.2-103 can wield advanced forecasting algorithms while communicating seamlessly with neighboring turbines, service technicians and operators.

— Source: GE



## GAMESA RECEIVES 260 MW OF ORDERS FROM INDIA

Gamesa continues to grow in India, a strategic market in which it has firmly established itself as one of the leading turbine makers, having recently signed two new agreements for the supply of an aggregate 260 MW.

The first order, from Indian developer and independent power producer (IPP) Greenko, encompasses the supply, installation and commissioning of 80 of the company's G97-2.0 MW turbines (160 MW). More specifically, Gamesa will install 30 turbines at Jaisalmer region, in the state of Rajasthan, and another 50 at Basavanabagewadi, in Karnataka. The turbines are slated for delivery during the first quarter of this year

and the wind farms are expected to be commissioned by June 2015. The company will also operate and maintain all 80 turbines in the long term.

This contract is included in a new framework agreement to commission 300 MW wind power projects in India, signed by Gamesa and Greenko. The second phase of 140 MW is expected to be secured during the second quarter of the year, in different wind farms located in the states of Karnataka and Andhra Pradesh.

The second order, meanwhile, placed by Indian developer CLP India, covers the turn-key construction of a 100-MW wind farm at Chandgarh, in the state

of Madhya Pradesh. The company, which will handle all of the infrastructure needed to install and operate the complex, will install 50 G97-2.0 MW turbines and also service them in the long term. The turbines are due for delivery during the first half of this year and the wind farm will be commissioned in December 2015.

Both the 80 turbines which Gamesa will install for Greenko and the 50 it will install for CLP will be its G97-2.0 MW Class S make, with a tower height of 104 metres, a new model specifically designed for low wind speed sites in the Indian market.

These two new contracts put Gamesa's 2014 Indian order intake at

850 MW. From January to September, India accounted for 27% of the MW sold by the company.

"These new order wins reinforce our leadership position in India, a rapidly-growing market, and evidence the stock placed by customers in Gamesa's technology and experience", according to Ramesh Kymal, Gamesa's Chairman and Managing Director in India.

In recent years, India has emerged as one of the most promising wind power markets: installed capacity is expected to increase from close to 22,000 MW today to 36,000 MW by the end of 2018, driven by huge pent-up demand for electricity, according to sector consultancy BTM.

Gamesa's presence in India - as technology provider and wind farm developer - dates back to 2009. In the last five years, Gamesa has emerged as the number-one turbine OEM by market share (20% in 2013), according to BTM data. To date, Gamesa has installed over 1,700 MW and services close to 1,400 MW under O&M agreements. In addition, in its capacity as wind farm developer, it has developed over 1,000 MW.

— Source: Gamesa



## SIEMENS TO SUPPLY THREE PROJECTS IN SOUTH AFRICA

Siemens has secured a large wind power contract in South Africa with an order for 157 wind turbines for three projects in the South Africa province of Northern Cape. The 2.3 MW Siemens G2 platform turbines will be installed at the wind power plants Khobab, Loeriesfontein 2 and Noupoot. The customer, a consortium led by Mainstream Renewable Power, had just commissioned Jeffrey's Bay Wind Farm in the middle of last year — also partnering with Siemens Wind Power. The new contract includes a service and maintenance agreement for a period of 10 years.

The three wind power plants

have a combined generation capacity of 360 MW. The 140 MW Khobab wind farm and the 140 MW Loeriesfontein 2 wind farm, are both located in the Namakwa District Municipality, and the 80 MW Noupoot wind farm is located in Umsobomvu Local Municipality, 400 kilometers north of Port Elizabeth. All projects will be equipped with the Siemens SWT-2.3-108 wind turbine with a rotor diameter of 108 meters and towers with a hub height of 99.5 meters. Turbine installation will start in August 2015. Commissioning of the three projects is scheduled from early 2016 to the end of 2017. The towers

will be sourced primarily in South Africa.

“We are pleased to be working as a partner again in major projects with Mainstream Renewable Power,” said Markus Tacke, CEO of the Siemens Division Wind Power and Renewables. “This order also clearly demonstrates that, with its Renewable Energy Independent Power Producer Procurement Programme (REIPPP), South Africa is on a successful path for achieving the governments stated goal of installing 3,725 megawatts of renewable energy capacity.”

— Source: Siemens



## VESTAS REPORTS STRONG 2014 UNDER NEW STRATEGIC PLAN

2014 was the first year in the implementation of Vestas' new strategic plan, Profitable Growth for Vestas, and it proved to be a year of strong performance. Compared to 2013, general performance substantially improved due to a successful execution of the strategic plan combined with a continued focus on the parameters which were at the centre of the previous turnaround plan. Wind turbine order intake increased by 10 percent in 2014 and the service order backlog increased as well, providing continued evidence of Vestas' strong position in the market.

For full year 2014, revenue amounted to EUR 6.9bn, EBIT margin before special items was 8.1 percent, total investments was EUR 285m, and the free cash flow amounted to EUR 841m. This was all in line with the latest expectations of revenue of EUR

6.4bn-7.0bn, EBIT margin before special items of 7-8 percent, total investments of approx EUR 250m, and free cash flow around EUR 850m. The activity level and earnings of the period were a result of stable execution throughout the year.

The wind turbine order intake increased from 5,964 MW in 2013 to 6,544 MW in 2014 and the value of the service order backlog increased by EUR 0.3bn to EUR 7.0bn, despite the carve-out of the offshore service order backlog during the year.

For 2015, Vestas expects revenue to amount to minimum EUR 6.5bn with an EBIT margin before special items of minimum 7 per cent, total investments of approx EUR 300m, and a free cash flow of minimum EUR 400m.

As a result of the strong performance during the year, Vestas' capital structure targets have been met and, as per the dividend policy of

the company, the Board of Directors recommends to the Annual General Meeting that a dividend of DKK 3.90 per share, equivalent to 29.5 per cent of the net profit for the year, be distributed to the shareholders.

"I'm pleased to see that Vestas' financial performance continues to improve, with solid results on all key financial and operational parameters. One year on, the "Profitable Growth for Vestas" strategy is very much on track. Vestas' strong results are creating value for our shareholders, as illustrated by the Board's recommendation to distribute a dividend for the first time since 2002," says Anders Runevad, Group President & CEO. He continues: "I also want to commend the Vestas employees for their tremendous efforts, leading to the strong results we present today."

— Source: Vestas

Stahlwille Tools is the ONLY tool company with dimensionally accurate hand tools!

**STÄHLWILLE**

**TORQUE WRENCHES**

- Super accurate scale designed for industrial applications
- Can be used as a breaker bar with no damage
- Designed to ISO 12 month calibration cycle
- Does not need to be "zero'd" after use
- Interchangeable insert heads

**MOBILE TORQUE TESTERS**

STÄHLWILLE TOOLS NA: SARASOTA FL: 877-548-1617  
WWW.STÄHLWILLETOOLS.COM

Dealer Inquiries Invited

**STÄHLWILLE**

Professional Tools made in Germany  
877-548-1617

## NORDEX AWARDED FIRST CONTRACT FOR N131/3000 IN FINLAND

Launched last year, Nordex's N131/3000 wind turbine is attracting growing demand outside Germany as well. Thus, Finnish asset management company Taaleritehdas has ordered the first models from this series. Accordingly, Nordex will be enlarging the "Mylykangas" wind farm with the addition of a further three turbines, namely two N131/3000 turbines and one N117/2400 turbine. The contract also includes premium service for a period of 12 years.

Installation work is to commence in the autumn following the completion of the current construction phase for 19 N117/2400 turbines. The wind farm is located in the north of Finland close to the town of Ii. In view of the prevailing cold conditions, the N131/3000 rotors

will be fitted with an anti-icing system. Moreover, the turbines are designed to make the most of the local wind conditions and will achieve an above-average capacity factor of more than 40 percent.

"The low noise level of 104.5 dB and the high efficiency of the 3-MW turbine prompted us to enlarge the wind farm swiftly. Quiet turbines with large rotor offer a major advantage in Finland in particular," says Taamir Fareed, Director of Renewable Energy Business at Taaleritehdas Private Equity Funds. Nordex has already installed or is currently installing three wind farms with a capacity of almost 90 MW for this customer.

— Source: Nordex

## OEMs - NORTH AMERICA

### VESTAS TO SUPPLY 298 MW FOR KINGFISHER WIND IN OKLAHOMA

Vestas has received from First Reserve a firm and unconditional order for 149 V100-2.0 MW turbines to be installed at the 298 MW Kingfisher Wind project in Oklahoma.

First Reserve, the largest global private equity and infrastructure investment firm exclusively focused on energy, has agreed to acquire the construction-ready 298-MW Kingfisher Wind power generation project from Apex Clean Energy. When complete, Kingfisher is expected to be one of the two largest single-phase wind projects in Oklahoma.

Apex developed the Kingfisher Wind project, will manage construction, and will serve as asset manager during facility operation. Previously, Vestas supplied 49 V100-2.0 MW turbines to Apex for the Hoopston Wind project in Illinois, which was subsequently acquired by IKEA.

The Kingfisher Wind project enjoys a strong, consistent wind resource. The project is scheduled to be completed in 2015.

The project's wind turbine order comprises



supply and commissioning as well as a 10-year Active Output Management (AOM 5000) service agreement.

AOM 5000 includes an energy-based availability guarantee ensuring that turbines are operational when the wind is blowing.

"We are excited to secure our first agreement with First Reserve for the Kingfisher project," said Chris Brown, president of Vestas' sales and service division in the United States and Canada. "Driven by high reliability and steadily

decreasing cost of energy, wind offers an attractive investment opportunity. The participation by a diversified energy investor such as First Reserve is a sign that our industry is mature and evolving."

Mark Florian, Managing Director and Head of Infrastructure Funds for First Reserve, commented "First Reserve is pleased to be making one of the initial investments in its second energy infrastructure fund. Kingfisher Wind represents the opportunity to diversify the

portfolio of our energy infrastructure program with experienced and reliable counterparties such as Vestas."

"This transaction highlights Apex's broad capabilities to deliver turn-key clean energy solutions for our financial partners," said Mark Goodwin, Apex Clean Energy President. "Apex is excited to continue its involvement in managing all aspects of Kingfisher Wind, from development through asset management."

— Source: Vestas



## **PATTERN CHOOSES SIEMENS FOR 200 MW PROJECT IN TEXAS**

Siemens recently secured order from Pattern Energy Group to supply and install 87 wind turbines for the Logan's Gap Wind project in Texas. The 200 MW project, located in Comanche County, will create enough clean energy to power 50,000 homes in Texas annually. The SWT-2.3-108 wind turbines to be supplied have a power rating of 2.3 MW. Installation of the wind turbines at the Logan's Gap project

is scheduled to begin this year, with the start of operations expected for autumn. A service and maintenance agreement was also signed to help ensure the turbines operate at optimal levels.

Logan's Gap, located near the Dallas-Fort Worth area, is the fourth wind project in Texas owned by Pattern Energy Group. The energy provided by these turbines is part of more than 1,200 turbines which Siemens has already installed in

this state. Logan's Gap represents the 12th project between Siemens and Pattern Development in the U.S., Canada, Puerto Rico and South America. The nacelles for the project will be assembled at Siemens facility in Hutchinson, Kansas. The blades, with a length of 53 meters will be manufactured at the Siemens blade facility in Fort Madison, Iowa.

"We are proud that Siemens is partnering with

Pattern Development on this project, continuing our success with wind power projects across the Americas," said Markus Tacke, CEO of Siemens Wind Power and Renewables Division. "Pattern Development is an important and trusted customer with a proven ability to deliver clean, renewable energy, and we greatly value our continued partnership with them."

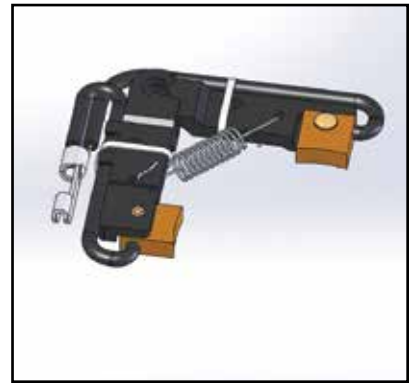
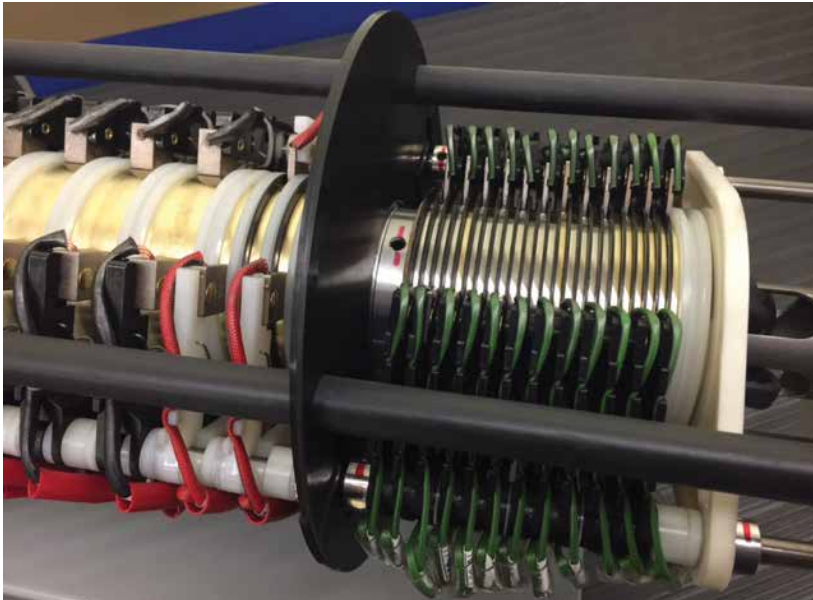
— Source: Siemens

# SLIP RINGS: SMALL COMPONENTS WITH A BIG IMPACT

*Initial product selection affects long-term costs*

By: Kyle Riegel

United Equipment Accessories



When engineering a new wind turbine, it's a design process that relies on thousands of different components working seamlessly together. While the focus may get drawn toward bigger components like motors and blades, it's the small components that can make or break a system.

Take for example the slip ring assembly — known also as an electric rotary union — for pitch control systems. In the big picture of a turbine, it's a small component. But its importance is all but miniscule. If your slip ring shuts down, your turbine shuts down.

So even though in the scheme of things a slip ring seems small, it's a big deal. It's important to choose a slip ring that's custom designed for your turbine and built to last.

When looking at the effectiveness of a wind turbine slip ring, we take into consideration a variety of factors, including maintenance frequency, maintenance downtime, and power transfer.

## MAINTENANCE

More maintenance means more time and more money. If you have to replace slip ring brushes every 50 million revolutions, you'll be stuck in a never-ending loop of slip ring maintenance.

However, the latest innovations allow for slip ring assemblies to go up to 200 million revolutions before brush replacement. UEA uses highly engineered copper graphite and silver graphite materials specifically designed for the rotational speeds, power usage and duty cycles for a turbine pitch control system to ensure maximum life potential. Can you imagine only having to replace your brushes every 10 years? That's a huge savings in parts and labor.

## DOWNTIME

UEA's slip ring design allows for only a single brush to be replaced—not the entire assembly. Other designs require entire sets of brushes to be replaced at one time. This can lead to an inefficient use of time spent replacing working brushes and material costs. Brush

replacement on UEA slip rings takes about five minutes per brush, which gets turbines back up and running faster.

When your downtime is reduced, your productivity and profit increase.

## EFFICIENCY

Slip rings have a reputation for power loss and limited capacity. That mindset is an outdated one. Today's slip rings can transfer higher wattage with decreasing power loss. For example, UEA slip rings have handled over 55 kW for pitch control motor use with circuits rated up to 100 amps and 690 VAC — all with a power factor (efficiency) of more than 99.5 percent.

Wattage transfer capacity and power loss are affected by a lot of factors, which is why custom designed slip rings are recommended for wind turbine applications to ensure proper capacity and function.

All things considered, relatively small slip rings are a big deal.

The same concept can be applied across the board to other components that are small in size but have big importance. While some parts often cost less up front, but lead to more expense in the long run — more maintenance, more downtime, more hassle, which add up to more money.



## Eickhoff Corporation

*What began as a German mining foundry 150 years ago has expanded its reach to North America as a supplier of wind turbine gearboxes. Here, we'll see how Eickhoff serves its customers in the wind power industry in the U.S. and Canada while remaining a medium-sized family-owned business.*

By Anna Claire Conrad

Take more than 150 years of history, throw in a wide demographic reach spanning 10 countries on five continents, add a medium-sized family-owned company, and what do you get?

It's hard to believe a company like that exists today—where they're able to combine big-company assets with the customer service appeal of a family business—but there is one that encompasses all of these characteristics.

Eickhoff Corporation is that company, and it has established a name for itself among its top competitors.

“Eickhoff Group is still considered a small company,” said Steve Koscelnik, Eickhoff sales manager of gearbox services for North America. “Although competing companies have a wide breadth of product avenues to pursue, and despite their budgetary allowances to enter markets, Eickhoff is extremely innovative and very competitive within the wind market.”

Eickhoff's history began in 1864 when Johann Heinrich Carl Eickhoff founded the company as a small foundry in Bochum, Germany. It was built to supply the mining industry with wheels for mining trolleys.

However, in 1990—a long way from its roots in the mining industry—Eickhoff, like many industries at the time, set its eyes on the skies and started to manufacture gearboxes specifically engineered for wind turbines.

Almost 20 years later, early in 2009, Eickhoff began producing a large



series of gear components while also assembling gearboxes for wind turbine gearboxes at the Eickhoff Wind Power GmbH facility, which, at the time, was a new, modern machining plant near Dresden, Germany.

Today, the German parent company has subsidiaries all over the world, stretching from South Africa and Australia to Pittsburgh, Pennsylvania, where Koscelnik's facility is located.

“We are one of the many service centers for Eickhoff Group, and we, Eickhoff Corporation, represent them here in the United States,” Koscelnik said. “We handle the services, repairs, and field work for the Americas.”

Since they are operating out of a 35,000-square-foot facility at the Pittsburgh location with seven technicians in the field and at the facility

along with eight administrative staff members, Koscelnik said they don't have much room for keeping projects in house, but that's not slowing them down.

"Our services and projects completed in the facility quickly have to either move to our storage location or go directly to our customers," Koscelnik said.

According to Koscelnik, Eickhoff Corporation primarily serves the wind power industry in Canada and the U.S. with very little of its operations reaching South America. Full engineering support is provided by Eickhoff in Bochum, Germany, which has been supplying wind turbine gearboxes to this industry for approximately 20 years.

"We perform full gearbox repairs and rebuilds at our Pittsburgh facilities, encompassing the inspection of the damaged gearbox, issuing of new and repairable parts, and commissioning a fully reassembled and load-tested gearbox within the parameters of our customer's orders," Koscelnik said. "Our staff also splits their time between our facility and the services they provide in the field. From exchanging shafts and bearings to performing visual and vibration inspections, Eickhoff technicians are well-versed in performing the tasks needed to solve gearbox issues uptower."

According to Koscelnik, once a gearbox reaches the Pittsburgh facility, it will be completely disassembled. All of the components and gear stages of the gearbox will be inspected and measurements will be taken. From there, the gearbox will be completely cleaned, refurbished, and reassembled. Once the reassembled gearbox has passed a series of tests—including a no-load, full-speed on-site function test with full load testing up to 3 MW available at a contractor's test stand—the unit is ready to be returned to the customers. This repair process has been approved by GE.

While the Eickhoff Corporation



has the capabilities and reach of a larger company, it also provides the customer service many companies seek out in the wind power industry.

"Eickhoff's quality is second to none," Koscelnik said. "The size of our company allows for more flexibility in answering and responding to customer inquiries in a more timely manner, whether it's their need to having a gearbox inspected in the field, or a more lengthy process of finding a root-cause analysis of a gearbox failure. I think that because we don't have as many departments or doors for a project to go through, our response time and flexibility is what a customer is looking for, especially in an industry of rapid change and technological advances that are happening on a daily basis.

"If a customer has a need, we always try to respond quickly so their daily operations don't suffer. As a service hub for Eickhoff gearboxes, we will do everything in our power to relieve them of their issues and concerns."

Koscelnik also said that while Eickhoff may not be the first name to come to people's minds when looking for wind turbine gearbox repair or reconstruction, it should be.

"We offer as much as any of our competitors," Koscelnik said. "We can perform any uptower, gear-

box inspection—whether it's with a visual boroscope inspection or vibration monitoring. Eickhoff has experienced technicians can not only perform the inspections, but they also have the knowledge needed to focus on a gearbox concern and evaluate what is occurring within a customer's product."

"From that point, we can change out and work on a number of the areas of a gearbox, including the high-speed shaft, bearings, intermediate-stage gears, cable tube exchanges, etc.. Also, replacements of external parts can be done by either the site or us. That includes oil coolers, oil pumps, external motors and drive."

According to Koscelnik, Eickhoff Corporation is looking for new and improved ways to keep gearboxes in the sky while completing repairs and installations.

"With our primary customers, we're trying to improve product life and perform as much uptower work as possible," Koscelnik said. "We're trying to come out with new technologies and capacities of performing more repairs uptower. We're trying to alleviate the need to bring gearboxes down-tower. Coming up with such solutions—that is definitely one of Eickhoff's focuses right now." ❧

## Brian Winter

Encoder Product Manager  
Nidec Avtron Automation

 (216) 642-1230

 [www.avtronencoders.com](http://www.avtronencoders.com)

 [sales@nidec-avtron.com](mailto:sales@nidec-avtron.com)

 @AvtronEncoders

 AvtronEncoders



### Could you tell our readers about Nidec Avtron's encoders for the wind energy industry?

Nidec Avtron manufactures a full line of encoders, including incremental and magnetic encoders, incremental and absolute. Our encoders are used on several applications in wind turbines, including the slip ring, blade pitch, and generator controls.

### What are some important trends regarding encoders for the wind industry?

The biggest trend we see in the wind market is the end-user push for higher reliability and uptime. OEMs struggle with the cost balance between long-term reliability and the need to keep equipment costs down. End-users don't have that balance: they own the equipment, they want it to last forever, and they want zero downtime. So end-users are retrofitting OEM equipment, solving longer-term reliability problems. And end-users are becoming more forceful with the wind turbine

manufacturers, pushing higher-reliability components to solve pain points.

Another big trend is diagnostics. Formerly, 99 percent of all the encoders sold in the wind industry used to be "black boxes" — you couldn't tell if they were working. This led to a lot of unnecessary part swapping. Is it the encoder failing? The coupling? The wiring? The drive or PLC input card? No one could tell. So Nidec Avtron has added diagnostics and a few competitors have tried to follow. Predictive diagnostics are key knowing that the device is working well, or if it is drifting toward a bad condition. With this knowledge, you save a huge amount of in-tower time. You don't replace working encoders, and you can replace units that could fail, before they actually fail. You get to replace things on scheduled maintenance time, not by the encoder failing and causing downtime on your turbines.

You also want your diagnostics simply — a relay contact and visible LED output so the technician can tell at a glance if the encoder is working well or needs replacement. Some people tried sophisticated diagnostics where you had to hook up a laptop, communicate with the encoder — it's just not practical. Climb a 70 meter-tower, climb out on top, go forward down into the front nose assembly, and then you realize, hey, this isn't a place where I want to try to lug a laptop and some specialized cable. I just want to know if the encoder is good now, or is it threatening to fail? An LED does

that, and a remote contact does that from the ground before you climb the tower.

### How long has Nidec Avtron been serving the wind energy industry?

We've been selling to the wind energy market for over ten years. We sell globally, to OEMs and end users in Asia, Europe, and North America. We only sell components into the wind turbines themselves — we don't supply anything for the ground-based equipment/converters.

### Please talk briefly about the support and service that Nidec Avtron offers its customers and end users.

Service and support are critical because wind turbines run 24/7/365. So our free technical support is available 24/7/365. The caller talks to real engineers, not a telephone call center. We back all Avtron encoders with long no-hassle warranties because we know they can withstand the wind turbine conditions. We have field service engineers that can fly to your location, diagnose problems and help with long-term solutions. They know encoders.

### What is it that is unique about Nidec Avtron and its encoders that stands out to customers.

Nidec Avtron has over 40 years experience designing encoders for heavy-duty markets. Many encoder OEMs showed up to the wind business with their machine-tool grade encoders and assumed all would work out fine, but it didn't. Machine tool encoders get good treatment — they don't have heavy vibration, they

don't see constant temperature swings, they don't have magnetic fields and brakes. Literally, some competitors have a specification on how many millimeters of dust are allowed on the housing, and how clean the environment has to be when you wire them! Nidec Avtron had experience in steel mills, paper mills, marine cranes, oil drilling and more, all of which taught us how to build ultra-rugged encoders that you can hit, you can stand on, you can expose to temperature, rain and all kinds of conditions.

As I mentioned before, we back those ultra-rugged encoders with 24 hour support worldwide. Some encoder vendors are only open 4 days a week, and no other vendor offers 24-hour support.

Nidec Avtron can also assist onsite. We can perform an assessment of the encoders at a site (or an OEM), and advise you on solving present problems, avoiding future problems, ensuring spare parts, etc. Encoders are electro-mechanical devices, so we try to understand the full application electrically and mechanically before we advise customers. Our field engineers have decades of experience with encoders so they can give specific advice.

Nidec Avtron has designed our encoders to replace other brands. So you can remove a light-duty model, and drop our unit right into the machine with no mechanical modifications.

We also have the ability build an encoder, 24 hours a day. We can call in a work crew and build your encoder any day, any time. So if your turbine is down, and you just used your last spare on another repair, we can get an encoder built, get it shipped via air, and get you back up and running. We've even had customers fly or drive to our factory in the middle of the night and pick up encoders to get back running again!

### Please talk about the importance of encoders withstanding the often-harsh conditions of wind industry applications

Encoders are the forgotten device. When they work, no one knows what an encoder is, where it is in the tower, or what it does. But encoders are 100 percent required for operation of the turbine. If your encoders don't work 24/7/365, your blades won't pitch, your generator won't sync with the line, and you are losing valuable generation hours.

In particular, frequent temperature cycling and magnetic fields cause a lot of competitive encoders to fail. Parts can easily get dropped inside the turbine or nose cone area, giving high shocks. We've specifically designed our units to withstand these conditions. ↙

women of wind  
of ENERGY

TO OUR MEMBERS,  
VOLUNTEERS AND  
CORPORATE SPONSORS

THANK YOU!

Our 2014 successes were  
made possible by you!



WoWE 2014 Rudd Mayer Fellows

(L-R): Michelle Montague (WoWE Board);  
Kalie Brunton, Tanzila Ahmed, Allie Brown,  
Kaitlyn Bunker, Melissa Showers, Huiyi Zhang,  
Kristen Graf (WoWE Staff)



Spring 2014 WoWE Board Meeting

(Back Row L-R): Trudy Forsyth, Karen Conover,  
Jan Blomstrann, Michelle Montague, Jennifer Martin,  
and Julia Dalger (Front Row L-R): Kristen Graf,  
Lisa Daniels, Suzanne Tegen

Your company can be part of this great effort!

Email [giving@womenofwindenergy.org](mailto:giving@womenofwindenergy.org) for more information.

Thank you to our lead sponsors!



AMERICAN  
WIND ENERGY  
ASSOCIATION



GE Energy



north american  
**WINDPOWER**



**Windpower**



DNV GL



20p renewables



Invenergy





WIND  
SYSTEMS



enerG



EDF  
renewable energy



IBERDROLA



inGen



STOEL RIVES

windssystemsmag.com 33