MAINTENANCE

Operations • Service & Repair • Inspection • Safety • Equipment • Condition Monitoring • Lubrication

PROPERLY ASSESSING AND UNDERSTANDING TURBINE ELECTRICAL COMPONENTS IS CRITICAL TO TECH SAFETY

Understanding the function of the electrical conductors, insulators and electrical protection devices will help you understand the dangers and importance of safe work habits while maintaining wind turbines.

We recently took a bit of time to discuss some of the components in an electrical circuit. The components that we focused on earlier were switches and loads — or the components that do work for us. There are a few more components that comprise parts of the electrical systems that are items that we deal with daily when working at the wind farm. The other items that we would like to cover are the conductors, insulators and protective devices. For some of you, this will be basic knowledge. For others, it may be information that makes the difference between life and death.

There are many different sizes of conductors on a wind turbine. Of course, the primary purpose of most all of today's turbines is to produce electricity. This electricity is transferred from the generator via electrical conductors. The conductors are sized according to the amount of electrical current that they are expected to carry, and with a safety factor. Smaller conductors carry smaller amounts of current, while larger conductors carry more current. On most of these conductors — with the exception of overhead line cables — we have insulation. The insulation is rated according to the voltage of the electrical power being transmitted. The basic function of the insulation is to keep the current that is traveling through the conductor from leaving the conductor in an unplanned path. When the insulation fails, current can pass through it to another conductive surface or item.

It is necessary for the current to stay in the conductor to prevent short circuits and other electrical failures. Note that the turbine and tower are made of metal. These are conductors. Never place yourself in such a way that you become energized and then grounded to the tower, completing a circuit.

So current determines the conductor size and voltage that determines the thickness, size or value of the insulation. That said, "air" is an important insulator in our industry. We use it for our overhead cables that pass between high voltage poles.

As a wind turbine technician, or Windsmith, it is common for you to look for damaged conductors in a wind turbine's control or power circuits. Usually the conductors fail due to heat damage. This heat is usually due to current passing through a loose connection, causing resistance. This damage is indicated by heat discoloration, melted rubber insulation, or both. These types of failures can be found by visual inspection, smell or thermal inspection.

It is also common to look for damaged insulation in a wind turbine. Areas of concern for damaged insulation can be areas that rub and wear on an item due to the turbine's movements. A common area is related to the cable droop from the nacelle to the down-tower conductors.

By Jack Wallace
Frontier Pro Services

These type of impending failures are normally located visually if the damage is not caused by heat. Note that the higher the voltage, the more critical it is that the insulation jacket has no damage (including small nicks). This is especially important when we start working with voltages over 1000v. If the insulation fails on the conductor, usually you will have a fault due to a short-to-ground or cross circuit. This can be a spectacular failure if it occurs in a power circuit. If it happens in a control circuit, it may be difficult to find, especially if the problem causes an intermittent fault.

There is still one more item in the electrical circuits that we have not touched on. Those items are the electrical safety devices. Typical safety devices used in a wind turbine electrical system are fuses and circuit breakers. In a wind turbine, a typical configura-

tion is includes one safety device per circuit, per load. This means that usually items such as a pump motor will have its own fuse or circuit breaker; a yaw motor will have its own protection device, etc. The protection devices typically detect too much current due to thermal or magnetic sensing and open the circuit it is designed to protect. Note that this protection is there only to protect the circuit from burning due to too much current. The electrical safety device is NOT there to protect you. It's there to protect the electrical circuit from catching fire from too much current.

You may wonder if there is any electrical protection for you? The answer is almost a resounding "no." Pretty much the only electrical safety items in the electrical systems designed to protect you personally would be the electrical cabinets to keep you out, and ground fault interrupters in electrical outlets for your use of electrical tools. The rest of the electrical protection devices are there to protect the electrical conductors from catching fire.

Hopefully this article will help drive some discussion within your service group and will prevent unsafe work practices. As always work as safe as possible and work to prevent surprises.

The basic function of the insulation is to keep the current that is traveling through the conductor from leaving the conductor in an unplanned path.

COMPARING MAINTENANCE OPTIONS: OEMS AND ISPS

Operations & Maintenance tasks performed through service providers can provide wind farm owners with cost-saving alternatives

By Ron Fukui
PSI Repair Services

The clock starts ticking the moment a wind turbine stops working. Wind turbine efficiency is evaluated in terms of minutes (of production up/down-time) and dollars (spent on after-sales services as a result of system failure). As far as the bottom line is concerned, individual equipment failures and their root causes are moot points.

To maximize efficiency, the ideal wind farm would have in-house resources and know-how to conduct all necessary tests and repairs to restore turbines to full working order. To supplement these capabilities, the wind farm manager works hand-in-hand with OEMs of their turbine equipment to ensure fast turnaround and affordable replacement parts.

Economic realities make this scenwario unrealistic for most wind farms. The manpower and financial resources associated with running a wind farm and operations and maintenance team are often cost-prohibitive.

Regarding OEMs, it's important to remember that they are in the business of making and selling large quantities of the same products. If your defective part is under warranty, ordering a replacement from the OEM is typically a no-brainer. But when component failure occurs off-warranty and you need immediate, cost-effective solutions, you should consider a third-party independent service provider.

From a cost standpoint, purchasing replacement parts at full price from the OEM can be expensive and unnecessary. Wind farms can save millions every year by repairing — rather than replacing — defective components and by purchasing surplus and refurbished inventory.

As a rule of thumb, customers can expect to spend 40–70 percent less on repaired and surplus parts as opposed to new and/or replacement parts. For example, wind farm managers know that a particular replacement pitch system part costs around $5,000 from the OEM. However, when the component is outsourced to an ISP, it can be upgraded with newer technology — resulting in a part that runs cooler and lasts longer — for about 20–30 percent of the OEM replacement cost.

From a value and efficiency standpoint, ISPs are inherently geared toward providing high-quality customer service and technical solutions. In contrast to the OEM's business model, standardized product design and sales don't move their financial needle. Rather, these service-centric ISPs invest in engineering staff and advanced diagnostic equipment to help

clients resolve production challenges, and their ROI is grounded in their success doing so. For this reason, parts repaired by ISPs often exceed the performance expectations and expected lifetime of new parts from the OEM.

Of course, not all ISPs are created equal. Finding a single contractor that can handle a wide range of preventative and corrective repair services (e.g. electronics, hydraulics, precision mechanical, etc.) isn't easy. Even worse, poor craftsmanship and low-quality parts are major issues in certain corners of the aftermarket/repair industry.

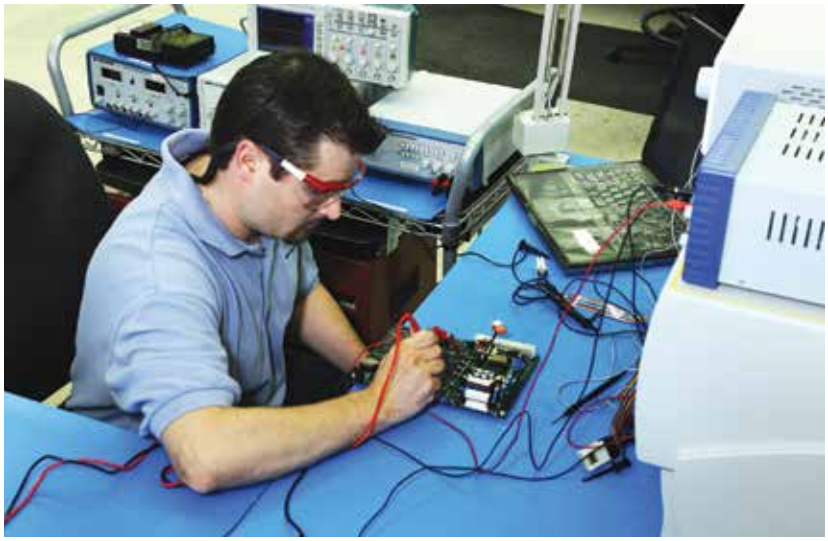
While these concerns can discourage some companies from contracting ISPs, sniffing out disreputable repair shops and counterfeit parts isn't rocket science. Here's how you can do it in five minutes or less:

Use Google to your advantage. Run search queries for the company and scan for red flags on the one hand, and articles that establish their reputation as domain experts on the other. Do complaints or scam reports appear in the top search results? What about interviews or feature articles in various news/industrial publications? Do they have a LinkedIn company profile page, and are their employees listed? Can you find pictures of their facilities and testing equipment?

Then, take a critical look at the information on their website. How long have they been in business? If you plug their address into Google Maps / Street View, does everything appear to check out (i.e. approximate square footage and exterior photographs)? Do they provide case studies and press releases that detail specific examples and applications of repair work performed?

Last but not least, what is the length of their typical warranty on services provided? If the ISP has confidence in their craftsmanship, they ought to offer superior warranties. Twelve-month warranties, for instance, offer assurances that the ISP can indeed make the part stronger than the original.

In addition to offering cost-cutting



repair services and a wide inventory of refurbished parts, some ISPs deliver even greater value by looking beyond a single component repair job toward the greater picture: efficiency. To really make an impact on a wind farm's efficiency, it's not enough to simply replace the part. ISPs can substantially increase wind farm efficiency as a whole by digging into the customer's O&M processes and equipment and finding ways to root out unscheduled downtime and expenses.

OEMs, by contrast, offer the bare minimum — at a premium price point — when it comes to dedicated, value-added customer service and engineering services. Understanding how an individual wind farm uses their equipment — and then determining (and eliminating) the root cause for failure — are capital expenditures that most OEMs often won't invest in.

PSI Repair Services has been a trusted ISP to the wind energy market since 2008. We offer wind turbine component repair and upgrade services for GE, Vestas, Siemens and Clipper turbines. We cover the critical electronic, hydraulic and precision mechanical components that drive turbine pitch and yaw systems and down-tower electronics. Components we service include printed circuit boards, pitch drive systems (such as H-bridges and hub converters), IGBTs, PLCs, controls, AEBIs, proportional valves, pitch and yaw motors, encoders, slip rings, VRCC units, hydraulic pumps, servo motors, transducers and much more. Most of our services come with a 12-month warranty.

PSI has been in the repair business for almost 50 years, with customers belonging to the automotive, aerospace, defense and military, food and beverage, healthcare, public transportation, and semiconductor industries. Our 60,000 square-foot facility in Livonia, Michigan is equipped with the most advanced diagnostic equipment in the industry.

Just recently, PSI Repair Services surpassed the 13,000 mark for components repaired/serviced for the wind industry. At an average repair price of $1,500, and a conservative 50 percent savings from the cost-of-new, PSI has saved the wind industry in the neighborhood of $10,000,000.

Customer savings aren't merely a result of paying less for repairs, however. PSI's Engineering Services Department can accurately diagnose performance issues and offer permanent cost-saving solutions by recommending and taking preventive and corrective repair actions. These actions include: removing and replacing stressed parts; improving legacy design with newer, more reliable technology; remanufacturing un-salvageable or obsolete components; as well as manufacturing custom-designed products.

(800) 325-4774

www.psi-repair.com/repair-services/wind-turbine-parts-repair

EDF Renewable Services signs O&M deal with DTE Energy

EDF Renewable Services has signed a multiyear operations and maintenance agreement with DTE Energy for the 75 MW Brookfield Wind Park. Located in Huron County, Michigan, and consisting of 44 GE 1.7 MW turbines, Brookfield joins the Thumb, Echo, and Gratiot Wind Parks, currently under contract with EDF Renewable Services, for a total of 400 MW.

"We look forward to extending our business relationship with DTE Energy and providing exceptional services to the Brookfield project," said Dalen Copeland, Director of Business Development for EDF Renewable Services. "We are confident our extensive experience, which includes over 2,000 GE turbines under contract, and resources will ensure the long-term success of this project."

Under the terms of the agreement, EDF Renewable Services will provide selected O&M for the turbines and balance of plant, project oversight, and 24/7 remote monitoring from its NERC compliant Operations Control Center.

The company's Operations Control Center (OCC) manages wind and solar projects across North America. The $4 million newly constructed facility combines the OCC, SCADA (Supervisory Control and Data Acquisition), and Operations & Maintenance auxiliary services into a technical services hub with a "One Touch" integrated front end monitoring system to improve response times and more efficiently track key performance indicators. The facility was designed to create a more efficient, reliable, and secure operating platform, while benefiting from the centralization of SCADA functionns and consolidation of multiple vendor SCADA environments to provide a common operating view.

— Source: EDF Renewable Services

Moventas offers lubrication upgrade for WinWind 3 models

Moventas has developed a special gearbox lubrication upgrade for customers operating WinWind made WWD3 turbines, to extend their lifetime considerably. The first one of these projects will be carried out for Innopower in the Ajos wind park in Kemi, Northern Finland.

This summer, Moventas carries out a lubrication upgrade for ten turbines in the Ajos wind park in Kemi as part of a larger service project. The lubrication upgrade that prolongs turbine lifetime consists of upgrading the entire gearbox lubrication system, installing extra pumps for the main bearings and e.g. adding temperature sensors, changing the coolers and updating the lubrication management logic. With the upgrade, lubrication will also be added in situations where it has previously been insufficient and therefore caused failures.

Installing the upgrade only takes a few days, but considerably prolongs turbine lifetime, as functioning lubrication efficiently prevents main component failures.

— Source: Moventas