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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.

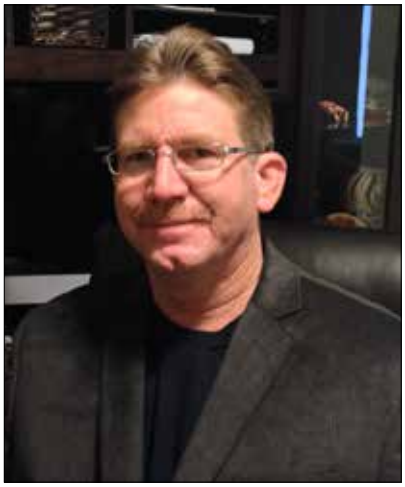
There are many different sizes of conductors on a wind turbine. Of course, the primary purpose of most all of today's turbines is to produce electricity. This electricity is transferred from the generator via electrical conductors. The conductors are sized according to the amount of electrical current 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.



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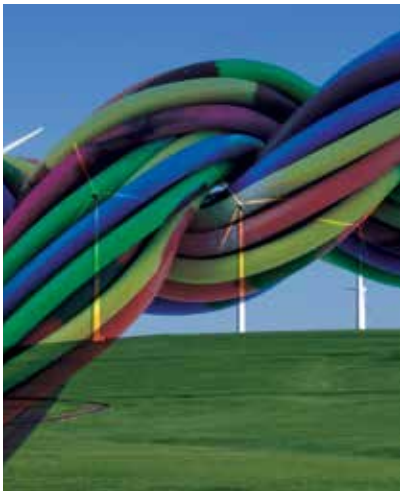
These type of impending failures are normally located visually if the damage is not caused by heat. Note that the higher the voltage, the more critical it is that the insulation jacket has no damage (including small nicks). This is especially important when we start working with voltages over 1000v. 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.