

FASTENING, JOINING, & BOLTING

Certified technicians come with more than a diploma

Those in the wind industry have noticed that if a wind farm employs 20 technicians, no two of them are likely to work the same way. Their backgrounds, training, and tool use differs greatly. For a wind turbine, this can spell trouble. Improper torque, for example, can take a blade out of service and incur a \$100,000 charge.

Torque and tension, in particular, have had a troubled relationship. When misunderstood, these can lead to equipment failure. A technician's understanding of torque and tension, and even how to use a tool, is not standard or consistent from school to school. But consistency is something the wind industry craves.

NC3

"The days of tight is tight and too tight is broken are over," says Executive Director of The National Coalition of Certification Centers Roger Tadajewski. "The wind industry demands a well prepared workforce." Tadajewski says in a predominant training model, each college writes unique curriculum every time new equipment comes along, which contributes to the variations of skill levels.

The National Coalition of Certification Centers (NC3) was born from the frustration of companies, such as Snap-on Tools and technical colleges around the U.S. to address the lack of training standards for critical skills such as torquing and tensioning fasteners. Trane Inc. expressed similar concerns regarding HVAC equipment. Each company proposed curriculum for using torque tools and maintaining HVAC equipment with hopes that NC3 will establish a standard curriculum – a task most industrial firms are ill equipped to pursue.

The wind industry has taken an interest, says Tadajewski, because torque is integral to construction and maintenance work. "The wind industry is erecting, commissioning, and maintaining wind turbines that need a work force skilled and credentialed in the use of torque and torque instruments, and fundamentals,



Former students of Doug Lindsey, Terry Hendrickson (left) and Joe Stalker, put their backs into their work tightening bolts on turbine blade.

whether manual or hydraulic," he says. The organization further coalesced around energy topics at technical colleges across the country to develop and disseminate standardized torque certification curriculum to other colleges. Those institutions had to do something for their workforces, but funding is always an issue.

"Most programs reference how to properly torque a bolt, torque is a big factor in construction, starting from the base in the alignment, all the way up the tower to composite blades molded to cast-iron roots. You have to know what you are doing," he says.

The industry has approached schools suggesting that technicians in the tower are struggling with torquing procedures. When investigations follow incidences, companies might find that their torquing procedures were not followed. "These are all good people, but the reality is, our public workforce never had to work in nacelles until recently," says Tadajewski. "Hence, the new attention to torque."

The complexity of the torque issue quickly becomes apparent

High Plains Technical Center's Bronson Ellis (left) says he'll take his classroom on wheels just about anywhere it's needed. With him are Administrative Assistant Taryn Johannesmeyer, and Wind Turbine Tech Instructor Jack Day.



when considering dry versus wet torque, and what happens if one is substituted for the other. When a technician starts using hydraulic torque, there are more safety considerations than with manual tools. Torque is traditionally taught as a topic. "That's OK, but we advance torque to the next level and spend two to three days talking about it. We discuss torque, not as an application of force, but as a skill set with a right and wrong way to apply it," says Tadjewski.

And it's the same whether torquing a bolt on a wind tower or on an engine. Removing the type of machine lets students focus on skills so they know how to use the torque instrument and understand procedures. Then it is possible to discuss how bolts on a blade are properly torqued. When the student understands torque, its mechanics and procedures, it's possible to turn attention to specific applications. Stackable credentials

The term stackable credentials or certificates often comes up in training discussions. Essentially, it's a series of skill sets that builds on those which precede it. Consider

torque again. It's first discussion is in mechanics. Tadjewski says this would be the first of a four-hour credential that says, I have studied wet and dry torque, yield points, dissimilar metals, galling, and so forth. A second credential might be the application of mechanical torque by a hand wrench, one that operates from 0 to 350 ft-lb. It could include the proper way to use a torque wrench and what happens when misused. "The 'click' does not always mean the proper torque was applied and a strain-gaged bolt in a lab experiment can help make the point," says Tadjewski.

A third credential might be going up to 450 ft-lb and using 4-ft. long torque wrench. Classroom activity would include different sized students torque an instrumented bolt to 180 ft-lb. "Each will use a technique and their physical strength differently," he says. "Possibly, neither one reaches proper tension because of their technique, and that would be corrected."

The next credential might be torque to 750 ft-lb and the



Lakeshore Technical College recently erected a full-sized GE nacelle (storm damaged) on a 12-ft stand. One planned exercise would have students use a hydraulic torque wrench in full harness.

A CLASSROOM ON WHEELS

There are times when technical students need updates to keep their certifications current, but have a dickens of a time getting to class many miles away. Bronson Ellis, Energy Training coordinator at Oklahoma's High Plains Technical Center has a solution in his classroom on wheels that can go right to a job site and provide needed refreshers. "The self-contained classroom has and will be fairly versatile when finished, says Ellis. "We'll put in most any training simulator available and a generator will provide power no matter where we are."

The 40-ft trailer with room for six to eight students will have counter-top work areas, Snap-on cabinets, and even Wi-Fi. Simulators will include those for Amatrol controls for ac and dc industrial electronics, and PLCs. Ellis looks forward to teaching hydraulics, and bolt torque and tension from the classroom on wheels.

Although Oklahoma based, Ellis envisions taking the mobile classroom outside the state when needed. He says the semi will also provide recruiting and marketing for the school.

introduction of hydraulic wrenches. "Once students understand the basic mechanics of a torque wrench, they get to hydraulics where they no longer use physical strength," Tadajewski says. "In this way, the credentials become stackable."

This plays well in the wind industry especially with blade manufacturers. "They might call what we just mentioned one core credential, torqueing bolts," adds Tadajewski. "The blade manufacturer might want to make sure torque-credentialed students also know about handling composite blades, another credential."

Because a nacelle cannot be assembled on the ground, students need to learn about using tools at height and how are they tethered. That also calls

for safety training and how to climb. "This would bring us to a specific, for example, GE procedure for installing a blade, Tadajewski says. "We can teach this because the students would have the credentials for all that came before."

Of course, it would be impractical to send the incumbent worker back to school to learn all this, but it must be possible to send the worker to a technical college for two or three days. At the same time, the emerging work force can accumulate similar credentials as they work through college. Credentials to compliment those mentioned would be working with multimeters, taking electrical measurements, tool safety, and working at height. When an employer asks about background, the student can present

credentials that say: Here's what I know and what I can do. I have demonstrated these skills to industry standards.

Tadajewski says such a scenario looks good to the employers in Wisconsin, but what about those in Oregon or California?

NC3 is making its pitch of a standard curriculum of certified training to technical colleges across the country. Tadajewski says its model and training are scalable and the scope is repeatable in other technical colleges. The big picture so far includes about 60 schools, mostly technical and community colleges, implementing appropriate classes to meet local demand. The program also involves training the trainers.

Another benefit to students is that

known credentials help guide them to where their skills are useful. That means if a skill set is learned for automotive, it also applies to the wind industry, although it may be incomplete, such as missing the hydraulic skill set.

View from the classroom

"The thing we have lacked in the U.S. is a standard curriculum model," says Doug Lindsey, Dean, Energy Education Center at Lakeshore Technical College in Wisconsin. "That level of validation and expectation would give me more assurance we are teaching the right stuff," he says. Certification is the next evolution.

"Our concern with the curriculum for teaching torque, primarily hydraulic torque, is that it can cripple when done

wrong," says Lindsey. "A permanent injury can come from insufficient training." Such injuries are preventable when OEMs are brought to the table and asked how they train a particular discipline. "We look at their instructional materials and acknowledge tests they would like students to pass," Lindsey says. "NC3 is the bigger picture. "It includes multiple schools, as well as companies in industry."

Many companies are willing to share some of their curriculum, but rarely the critical elements, according to Lindsey. For example, most everyone has seen or used a click wrench but no one has seen inside one. But if you want cutaways, or machined-out wrenches, Snap-on provides them. Such resources are not available just anywhere," he says.

This makes NC3 all the more important. Lindsey says a gear-shaft alignment course would be useful, but it will have to wait till a known wind service company comes to NC3 and expresses such a need. However, with benchmark training for OSHA 30 and first aid, an employer could trim two weeks off required training and put students to work sooner.

So far, Lindsey's college offers certified training for manually applied and hydraulic torque for wind and industrial electrical students, mill-right students, electro-mechanical students, and those in food processing.

NC3 provides demo props and all material online including quizzes, testing, and Power Points. "We have made videos showing right and wrong

ways to do things,” Lindsey says. “I have high hopes for a shaft-alignment piece of the certified program, and the same for bearing pullers.”

Funding for Lindsey’s program came from a Dept of Energy grant based on the *20% Wind by 2030* initiative. Lakeshore Technical College is a recipient so that it might expand the number of Wind Energy Technology graduates with the right skills for this employment as determined by industry partners named in the grant, two of which are Snap on Industrial and NC3. The torque certification development was partially funded through the grant. Other academic partners included NC3 schools in the Southwest.

An OEM’s view

What do wind-industry OEMs want from tech schools? Earl Walker, trainer for the American regions of Siemens Energy, has ideas. For starters, students need a strong background in pneumatics and hydraulics, and general mechanical systems. He says how fast they progress depends on the strength of their electrical knowledge. All colleges seem to provide good fundamental courses. A limiting factor with a lot of students is that electricity is something of a mystery. The opportunity for a student to work on a real turbine is a big plus.

“I’ve been working with an Oklahoma school so they can provide our most basic training to their technicians as part of their curriculum,” Walker says. When they graduate, we can bring them right into our organization without duplicating some basics such as electrical, hydraulic, and pneumatics.”

Training will continue from there. A new Siemens technician goes through three weeks training in Houston for procedures, such as lock-out, tag-out, electrical safety, climbing, and basic harness and rescue, Walker says. Torqueing and tensioning is a huge component of what most OEMs do. A wind turbine is bolted together and subject to vibration so all those bolts

have to be checked, and most schools are good at teaching that.

Some devices used to check bolt torque are not those you’ll find in a garage. “One tensioning device for bolts clamps onto bigger one and stretches them. It’s reasonably dangerous and we want to make sure people appreciate that and how to use it properly,” Walker says.

All techs go to a safe-harbor program to make sure they are well equipped to handle work in remote locations. In the field, they spend about three to six months, depending on the technician, working with a more senior person, as they might in an apprentice program. When they satisfy their OJT requirement they return to Houston for two more weeks of training. “There we have them build hydraulic and electrical systems, troubleshoot them, learn to read single-line electrical and hydraulic diagrams, and then learn to use the turbine’s control system,” he says.

Then it’s back to the field where they are observed in service by a trained individual who decides if the new person is ready for work without supervision. Next, the student becomes a maintenance technician and can do service with an assistant.

“Certification will carry more weight after it is more widely appreciated,” Walker says. Certifications now come from several sources. For example, there’s National Institute Certification in Engineering Technologies (NISSET) and Global Wind Working Organization. The latter is working to establish on and offshore wind programs, as well as a collaborative of some bigger wind organizations and consumers.

“If the industry establishes a strong following in customers, OEMs, and third-party providers, then certification will have good meaning,” Walker says. “I’ve been waiting for it to happen for some time.” **WPE**