



# Aligning for success: the high-stakes mission facing turbine installers

As the world races to meet the urgent demands of climate change, wind energy stands at the forefront, poised to provide a significant portion of global power by 2030. Yet, behind the scenes, a battle against physics is being waged to ensure these giants not only stand tall but also align perfectly with the winds of progress. As installation of onshore and offshore wind energy continues at a breakneck pace, the demands on the supply chain have risen. Multiple sourcing of wind turbine components is rapidly becoming the norm as organisations grapple with tight project deadlines and limited sources of component supply. As a direct result, issues related to non-conformities are becoming more common.

Non-conformities are an issue wind farm installers are learning to live with, but they're also finding solutions. It's here that hydraulic tools and systems maker Enerpac is playing a vital role in keeping installers on track.

One of the biggest areas of non-conformities is in the assembly of wind turbine towers. Alex, a seasoned turbine technician, recounts

the challenge: 'You're hundreds of feet in the air, the wind's howling past you, and you've got these massive metal sections that just won't line up. It's moments like these you realise the monumental task at hand.'

His experiences underscore the critical need for precision in an environment that forgives no error. These towers, measuring 80 to 200

meters tall and weighing 100 to 400 metric tonnes for onshore turbines and offshore 500 - >1,000 metric tonnes for offshore turbines, are made up of cylindrical pipe sections with internal bolted flange connections which are bolted together.

Problems arise when the tower pipe sections arrive on site, and they are ovalised rather than perfectly cylindrical. This makes it difficult to get the flange and flange holes of the connecting sections to fit together.

Misalignments might seem a mere construction hiccup, but their ramifications ripple outward, affecting turbine efficiency, causing delays in energy production, and potentially disrupting local ecosystems. Ensuring the integrity of these structures is not just about meeting deadlines; it's about safeguarding the future of clean energy.

During fabrication the tower sections can become ovalised, especially if they are laid down for storage or transportation for an extended period. The resulting misalignment of flanges significantly increases the difficulty and time taken to assemble the towers. Correcting wind tower flange misalignment is no simple task, especially if the only tools on hand are hammers and crowbars.

What was needed was a simpler, quicker and safer method of correcting the misalignment. This is where Enerpac's

extensive know-how on overcoming flange alignment problems is making the difference.

Assessing the extent of the problem can quickly identify possible solutions. If the flange alignment is close, say within a few microns, then a solution like Enerpac Flange Alignment Pins can be perfect for the job.

Where there is a larger degree of flange misalignment then turbine installation contractors can use a tool like the Enerpac TFA Wind Turbine Tower Alignment Tool. That tool is purpose built to aid the alignment of large flanges on the inside of wind turbine towers during assembly and installation. It ensures that the bolt holes are aligned so that bolts can be inserted to join the tower sections.

The Tower Flange Alignment Tool can be used onshore and offshore in aligning de-ovalized large internal pipe flanges up to 65 mm. Reflecting the breadth of wind turbine towers, there are a range of flange alignment tools: mechanical, hand operated, up to 4.5 ton alignment force, 13.5 ton, 16.9 ton and 20.5 ton alignment force.

The Enerpac TFA Tool is positioned in such a way that the lower flange is closer to the user and the upper flange is further away. It hooks into a bolt hole of the upper flange and push the lower flange into alignment. Positioning the tool into the bolt hole ensures that the

hook is fully located into the bolt hole and the base plate of the tool is sitting flat against the upper flange.

The Alignment Piston has a 65 mm stroke. The Cylinder Adjustment Sleeve extends the reach of the tool to fit a variety of flange sizes, without compromising its maximum alignment capacity. Actuating the tool will extend the Alignment Piston and align the flanges. After the flange joint has been aligned, it can be secured by installing as many bolts as possible into the bolt holes. In some cases, it may be necessary to repeat the alignment process several times while working around the flange joint.

Once the flange is aligned, the bolting operation needs to be completed. Bolting is a vital element in the construction of the wind turbine. Poor bolting practices can lead to all kinds of unnecessary and frankly dangerous situations that can so easily be avoided through planning and the correct tool selection.

Enerpac has an extensive portfolio of hydraulic bolt tensioners and torque wrenches for critical offshore wind tower fastening applications. These improve the speed of operation for critical onshore and offshore wind tower fastening applications. Designed for maximum durability in harsh environments, the tensioners are easy to





use and extremely efficient in their speed of operation. Torquing is used on tower segment bolt connections as well, not just tensioning. The square drive torque wrenches tend to be used.

Some examples of Enerpac bolting tensioners include the PGT-Series Double Deck and Single-Stage Bolt Tensioners, which provide high performance in the tight spaces typically found in wind turbines. Key features including auto-retract pistons, over-stroke protection and auto-engage nut rundown help to make the PGT-Series Bolt tensioners fast, durable and easy to use.

The FTR-Series Foundation Bolt Tensioners and FTE-Series Elliptical Foundation Bolt Tensioners are designed specifically for tensioning wind tower foundation bolts. These bolt tensioners provide the speed and precision required by this critical application. Long stroke models provide greater speed and ease of use by enabling applications to be completed in a single pull.

The FTE-Series is an ideal fastening solution on wind tower foundation applications where limited space between the stud and wall prevent the use of standard tools. They feature an elliptical geometry, which enables fit in narrow access foundation applications without reducing load capabilities. FTE-Series Bolt Tensioners make the perfect 'universal solution' that will work on nearly any foundation application, whether standard or narrow access.

Away from wind tower foundation and tower construction, Enerpac hydraulic torque wrenches are widely used for turbine

installation. These versatile tools utilise standard impact sockets, optional direct Allen-key drives or interchangeable hexagon cassettes to provide controlled tightening of multiple sized fasteners per tool.

Carrying out bolting operations at height inevitably runs the risk of danger to those working beneath from dropped objects. The Enerpac DSX-Series Aluminium Square Drive Torque Wrenches are specifically designed for use when working at height. To help to reduce dropped-object incidents, the five models in the series feature a built-in connection point to safely tether the tool to a work belt or bag.

A standard ergonomic safety handle also helps to prevent injuries or near misses from loss of a tool. When it comes to operator protection, a fully enclosed drive prevents operator contact with moving parts inside the tool.

Made with a high-strength aluminium body, the CE Approved Enerpac DSX-Series Aluminium Torque Wrenches are lightweight and easy to use - important factors when working at height. Another feature that makes the tool simple to use is a multi-direction 360 x 180° high flow aluminium swivel that helps prevent twisted and tangled hydraulic hoses.

To help make operators more efficient on-site, the wrenches feature a fine-tooth ratchet that prevents the tool from locking on, a 35-degree rotation angle that assists with repetitive bolt tightening tasks, and a retained push-button quick release.

To match the versatility of the Enerpac tensioners and torque wrenches, the company is systematically introducing powerful, cordless battery powered hydraulic pumps, ideal for jobs that require a combination of portability, speed, and safety.

Battery-powered pumps such as the recently released innovative SC-Series, and XC2 and XC2T pumps are raising the bar for portable pump performance in remote locations without access to power. Moreover, the cordless pumps are compatible with all Enerpac hydraulic tools from cylinder applications to bolting jobs that require any of the Enerpac torque wrenches.

With a maximum operating pressure of 700 bar, the pumps high-performance, new Enerpac 54 Volt, 4 Ah lithium-ion battery provides substantial runtime for high-cycle, high-pressure applications.

Flange alignment problems are just one example of non-conformities facing a wind industry under pressure from tighter budgets and shorter deadlines. Learning to live, and thrive, in the face of non-conformity is likely to make the difference between those installation contractors that successfully embrace and implement new technologies, such as those developed by Enerpac, to their advantage and those who struggle on.

Hydraulic tools meet the demands of operations in the wind industry, ensuring efficiency, safety, and reliability in every project.

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