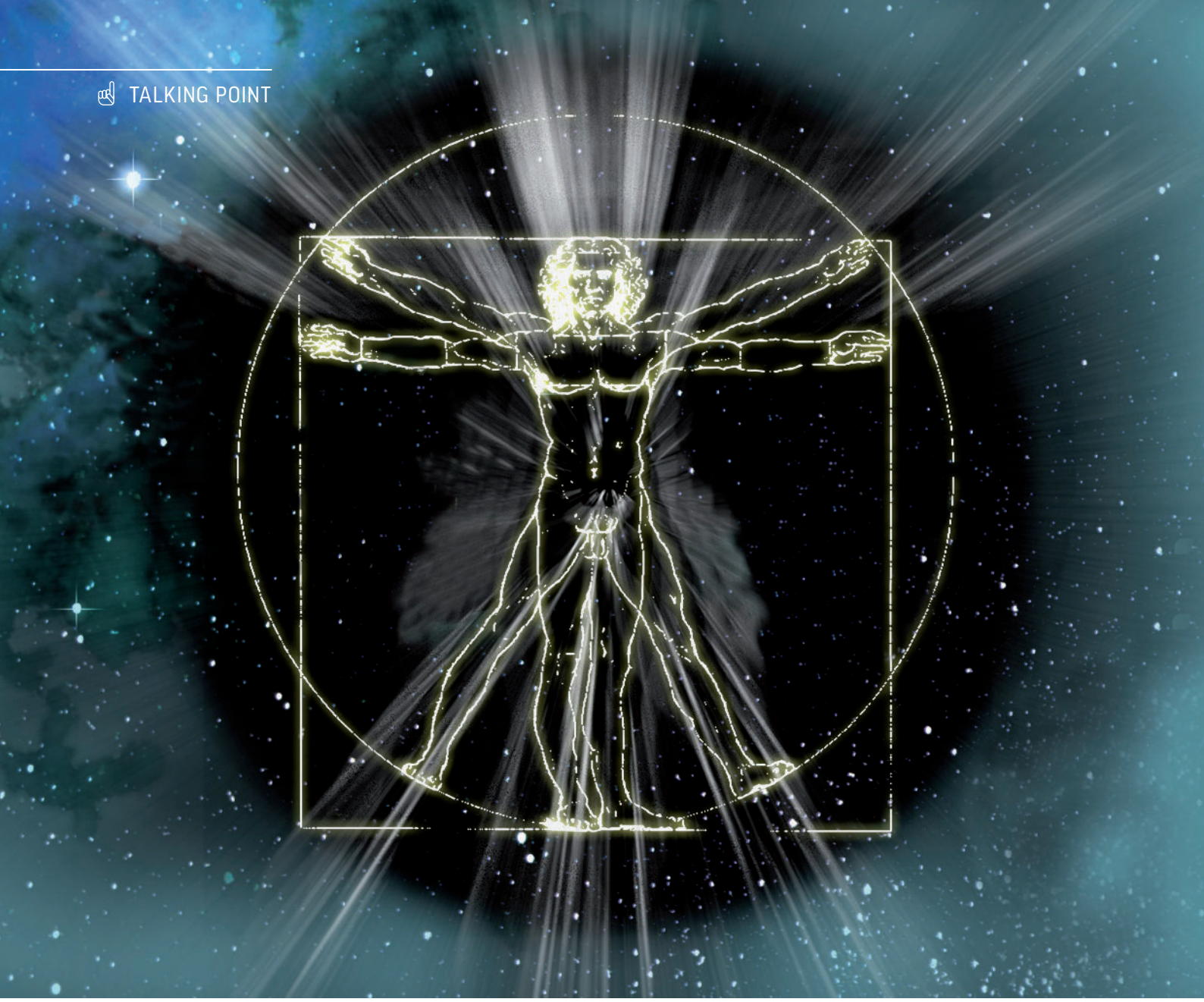


Tools in hand, safety in mind

Words: Calum Urquhart, Global Business Manager, Energy, Atlas Copco

How safe are the tools you use for work? Atlas Copco looks at how the latest innovations and technology in tool design and equipment can help the wind industry adopt a culture of safety first. When it comes to safety there should never be any compromise, it should always be a priority. However, in reality this is not always the case.

What demonstrates a real culture of safety is not what is written in corporate media presentations or painted on signage in factories or worksites. It is the active effort to evaluate new solutions, and take the time to review work task processes. To always put safety truly at the top of the decision-making criteria.

It is too easy to show scorecards and reports that indicate hundreds of days have passed with no accidents, but this means nothing if every day there remains a risk posed by exposure to work tasks and practices that could be done more safely. What is most important is not the days that have passed without incident or accident, but what could happen today, tomorrow, or at any time in the future.

Stuck in an old process

When it comes to the use of power tools and related equipment, the inherent work involved, the way tools operate, and the environment they are being used in means

users are exposed to multiple risks every day. High torque forces, lifting heavy weights, dropping hazards, tripping hazards, noise and vibration exposure are commonplace each day. Technicians on construction sites, maintenance crews, and even operators on assembly lines in the manufacturing plants all have direct interaction with powered tools and equipment.

The tools being used themselves can often be overlooked as a priority, as organisations focus instead on training and safe operation, rather than reducing the root cause of the risks, by providing the safest products or solutions available.

This is commonly the case when tools are specified into work processes and then embedded into the documentation that is distributed to contractors. Construction or maintenance teams are expected to follow the documented process, using tools that have been 'approved' some years ago, when certain features or technology was not readily available.

Typically, 'approved' solutions will be reviewed for the new platforms or when new models are introduced. While this is good, in many cases the legacy platforms remain with outdated approval lists because the documentation hasn't been updated.

Dangers may be known, but are they being addressed?

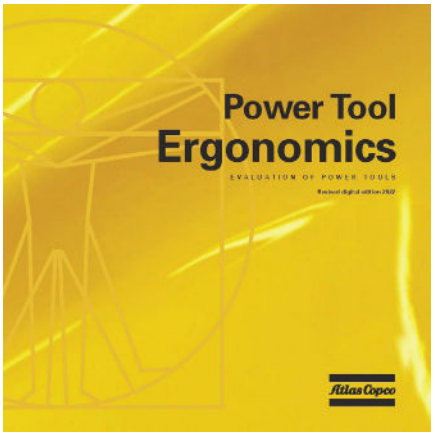
When a hand-held power tool is selected, it not only influences the task the tool is intended to perform, but also the operator´s work situation and the entire working environment. Combined, these factors have a major influence on operator health, safety and productivity.

If we take the use of power tools in the wind construction and maintenance sector, there are several common problem areas which are well known. These include hand or finger pinch/crush injuries, due to use of reaction devices when torquing bolts and dropping hazards when tools or equipment fall, comes loose, or fly off during operation. There are also tripping hazards due to hoses, or cables stretched across the work area.

These are widely known issues, with frequent campaigns to address them. Technology is improving all the time too, with new solutions to tackle these areas, but the challenges persist.

However, by looking at the use of power tools in a broader context, there are other factors around the work tasks that can also have a significant impact on operator wellbeing. Over time these can result in strain, fatigue, or loss of concentration that can subsequently lead to incidents, accidents, or long-term health deterioration.

One example is repeated heavy lifting. There are often guidelines in place to restrict how much weight an operator can lift, but this doesn't guard against the cumulative impact of lifting tools, hydraulic pumps, etc., repeatedly which results in excess fatigue and risk of strain built up over time.



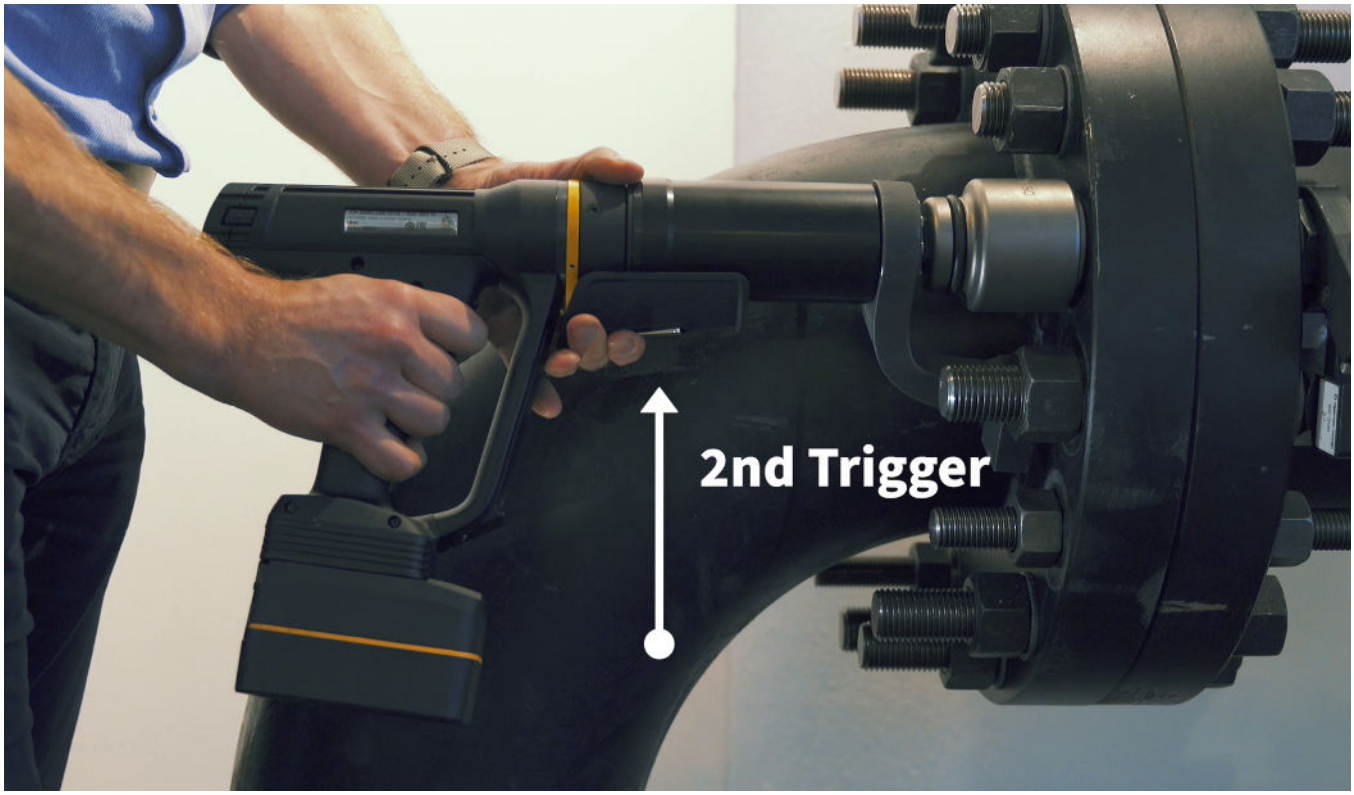
Atlas Copco published 'Power Tool Ergonomics', by Bo Lindqvist in 1997. It has just been updated in digital format in 2022

Use of impact wrenches for pre-tightening bolts is another issue

These tools are known to expose operators to excessive levels of noise and vibration, but when used inside a wind turbine the noise is amplified. When used in 'seat flanges' this results in excessive vibration exposure as they are not designed for these types of joints.

Wrong, or even no handle orientation

This also has an impact. The same type of tools are often used on all applications, regardless of the position the bolts are in. This results in operators using tools with



The integrated dual trigger of the SRB is designed to operate when the user holds the tool in the most ergonomic and intuitive way

strained wrists or arms by adapting how they hold the tool, rather than changing the type of tool they use.

Use of tool suspension devices

This can be problematic as tool weight is often misrepresented. For example, when used for a specific application a tool may have an additional reaction device, a support handle or a socket, all of which add to the weight of the tool in operation. This needs to be accounted for, so that aids such as suspension devices, or tool carriers can be used to reduce the exposure of excess strain to the operators.

A long history with ergonomics

As a company developing hand-held power tools, Atlas Copco Tools has for decades been aware of the importance of ergonomics in design. Atlas Copco first began applying ergonomics in the 1950s during the development of a drill. Medical experts were consulted frequently at the design stage and asked to give their opinions on different grips. The result was a machine that quickly became popular on the market.

In the late 1960s, Bo Lindqvist was employed to start a tool ergonomics department. An acoustics laboratory was built at the beginning of the 1970s, and research into noise and vibration began.

In 1997, Atlas Copco published a book, 'Power Tool Ergonomics', which became an industry benchmark and established Atlas Copco as a true leader in this field. This investment continues today, with an entire department dedicated to user experience, safety, and innovation to make work tasks easier, safer and more productive.

Historically, the company talked about ergonomic tools. Nowadays, it talks about tools with good ergonomics. The reason is that in every design it tries to find the best possible solution, weighing up a combination of ergonomic, technical, and economic factors against each other. This is a complicated task, but it is a critical one and has led Atlas Copco to bring many unique innovations to market.

A culture of innovation

Atlas Copco's focus on ergonomics means that it considers not only the short term aspect of avoiding accidents, but also design solutions that enable the operator to use them continuously for long periods of time, without being exposed to long-term health or injury risks. Operators that feel safe, and are exposed to less strain or fatigue will be more productive and less prone to mistakes, meaning that work gets done quicker and safer by working in a smarter way.

The following are a few examples of innovation in workplace safety and ergonomics within high torque bolting, which can make a real difference across the wind industry.

Finger pinch points

One of the most recent innovations launched to market is the introduction of a high torque battery tool, with a fully integrated dual trigger as standard. Not added as an accessory, or given as an option, but built into the tool design from the start.

The goal was to reduce or even eliminate finger pinch points, and by designing a tool which can only operate when fingers and hands are in a safe position, this can be achieved.

By using a robust mechanical trigger grip combined with software to ensure that the user cannot 'override' the function is an industry first and the market response has been extremely positive.

Another solution developed to address the challenge of finger pinch points, common especially when using hydraulic torque wrenches, is a very simple solution to the reaction bar design. Most reaction bars or pads react against an adjacent bolt or surface. However, there is a risk of fingers being crushed between the bar and the surface to which it is designed to react.

By using a 'Sliding Drive' reaction device, with an additional socket or cup that can be placed directly over an adjacent bolt, the tool is prevented from moving at all, thereby removing the risk of finger injuries.

This is a very simple and extremely cost-effective solution, which can have a very

A typical scenario where fingers can be trapped and damaged as the user moves the tool

A sliding drive reaction bar with a socket on an adjacent nut with no risk of finger or hand injury

The new 'TorcFlex' range of hydraulic wrenches incorporate various safety features designed to prevent dropping hazards and ensure safe operation. The single co-axial hose coupling promotes ease of use and can reduce tripping hazards

positive impact when used with hydraulic wrenches or electric and battery tools.

Tripping

Tripping hazards are widespread, but can be addressed in a variety of ways. One obvious solution is to remove the hazard by taking away the cables or the hydraulic hose that may be present. In recent years, electric tools have been replaced by hydraulic torque tools for the benefits of productivity, but this still results in cables in the work area.

The use of Controlled 'Battery' tools solves this issue, by enabling bolts to be torqued with no additional pump, control system or cables of hoses. This not only removes tripping hazards, but also makes the work easier for technicians due to less strain and lifting.

In the past there was some resistance to battery tools, as they were perceived to be less accurate or had a short battery life. However, the latest tools, like Atlas Copco SRB, have an integrated torque transducer, which delivers high accuracy. Along with an extensive battery life enabling high productivity, this presents a viable solution to many challenges.

The move to battery tools is clearly an advantage, but it is not always possible to do so. Sometimes the application has low clearance, or the torque level is so high that a hydraulic torque wrench must be used. In such cases, it is clear that hydraulic hoses will be present. When moving the tools around, the hoses can get twisted or tangled creating further hazards and exposing users to added strain.

To address this, the new Atlas Copco TorcFlex system incorporates a unique innovation in the hose and coupling of the wrench. By introducing a single co-axial coupling, instead of a twin line hose and coupling, the hose is free to rotate 360° to reduce twisting, so the hoses can lie flat on the floor, reducing the risk of tripping. This shows that even with conventional tools, new solutions can be found.

Stop the drop

Falling items inside a wind turbine can result in great damage. Even a small component will

Good handle design ensures the best result with minimum strain on the operator, with a focus on the integration of tool and human as one

The Smart Tensioning System has a hand controller to guide the operator, which speeds up the process, reduces the risk of errors whilst always securing safe operation

be a problem if dropped from a great height. To address this, the Atlas Copco TorcFlex range of Hydraulic wrenches have adopted some new solutions to reduce this risk. A 'retained reaction bar', allows the position of the reaction bar to be moved on the tool, without the bar itself ever being removed from the tool.

This enables adjustments to be made by the operator so they can position the tool safely, in the knowledge that the reaction bar will not come free. This tool also has a retained square drive pin system to improve safety by securing the square drive pins in place, so they don't drop out.

This focus on 'retention' in the tool design can also be seen in the support handle, which can be adjusted to the most comfortable and secure position without removing it from the tool.

Reduced strain on wrists and hands.

Handle design is an area of particular focus for Atlas Copco. After all, this is the part that interacts directly with the user and so has a direct effect on the operator's ability to work well.

When designing all of our products, we consider factors such as the angle of the handle when the tool is being used correctly, to reduce operator strain. We also consider the grip size and material to make sure the minimum force is needed to operate the tools and we even specifically design the trigger size and pressure required to ensure the tools are used safely with minimum strain, as often they will be used repeatedly over a long period of time.

As a result, there are clear similarities in the handle designs on all tool types, ranging from electric and battery tools, to the hand controller on our hydraulic tools, like the one used on the hand controller for our Smart Tensioning System.

Good ergonomics

When applying torque or force to bolts inside a wind turbine during construction or service, or even on a manufacturing assembly line, the likelihood is that the work is time critical.

Traditionally on high torque applications, hydraulic bolting solutions were used, which were slow to operate and difficult to move around. The introduction of electric tools as an alternative is a clear advantage in terms of productivity, but they also improve the experience for the user. If the work can be done in a fraction of the time, it means exposure to lifting and moving the tools is also reduced. This in turn means less fatigue, and less risk to lose concentration and ultimately less accidents or mistakes.

As such, any solution that can reduce time will help. Tools like the Tensor Revo electric nutrunner perform torque tightening at the highest rates available on the market and so can help significantly in this area. But not all bolts are torqued and there are an increasing number of applications where bolt tensioning is preferred.

To address this, our Smart Tensioning System (STS) removes some of the steps from the operator, and makes the process faster, by giving direct feedback on the handheld controller, and automatically guiding the process steps. This not only speeds up the process time, but it ensures that the work is done correctly, meaning less bolt failures, and reduced time and cost of operation.

Safety is a mindset

Ultimately, in the wind industry today there are numerous challenges and high on the agenda is workplace safety.

When it comes to the use of powered tools and equipment, the technology today is quite different from even five years ago, yet the use of tools and equipment with inherent safety risks remains.

This can be due to the desire to avoid a heavy burden on administration, or even to avoid the expense of replacing old equipment, but here lies the crux of the matter. This may be understandable, but is it acceptable?

Investing in new equipment where worker safety is prioritised certainly comes at a price, but a workplace injury comes at any even greater cost. Instead of training operators and technicians how to safely use old tools, risk exposure can be reduced by reviewing processes to remove operations or carry out tasks such as bolting in a new or better way.

Changing from corded to cordless solutions, or transforming from conventional hydraulic systems to intelligent bolting solutions is a real opportunity to truly demonstrate a culture of 'safety first', but to make it a reality requires a mindset change.

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