

# The Manitowoc family of cranes



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# The wind is changing

During last month's ESTA wind safety summit held in Hamburg, several wind turbine manufacturers made commitments to put safety ahead of price when it comes to lifting operations on their sites. This does not mean of course that they will use this criteria when awarding lift contracts - you can be fairly sure that low bids will still play a major role and as they say 'they assume that any crane company will put safety first'. However if their word means anything, those that win a contract based on cutting corners and using a crane that is borderline for the job, may find that their success proves costly.

One thing that should help is the planned best practice guide and minimum standards that ESTA is currently working on (See a preliminary statement in our letters section). The aim is to establish a minimum set of standards that all crane and wind companies will comply with, thus helping create a level playing field commercially, at the same time as improving safety. The worst offenders among the turbine companies may find the change saves rather than costs, as the number of dropped components is reduced or eliminated, along with time lost through accidents and near misses, not to mention a reduction in the legal fees of trying to enforce penalties on ridiculously one-sided contracts, that many of the best lifting companies are already refusing to accept.

A key effect of the wind safety summit, at least as delegates departed, was a greater appreciation of the effect of wind on blades and rotor assemblies and other loads during a lift. Most assumed that having some capacity in hand compensated for higher wind speeds and yet this is simply not the case - a heavier load may be safer!

Modern cranes are designed to lift typical loads in winds of up to a given speed. 'Typical' means flat sided loads with a weight of around one tonne per square metre. A load



Liebherr produces a free guide - Influence of wind on crane operation.

such as this will have a wind resistance or drag co-efficient of around 1.2. A ball or streamlined load can be much less - as low as 0.2 or 0.3. Cars are of course examples of products designed with a low drag factor, while turbine blades - like boat sails - are designed to catch as much wind as possible. They also tend to be very light for their size and these two factors change everything.

Imagine a crane lifting a turbine blade assembly, with a total weight of say 25 tonnes. The load's drag coefficient is 1.6 and the cranes lifting capacity is 40 tonnes at 22 metres radius. Historically the crane's load chart might suggest it to be good for a wind speed of around 50kph or 14 metres/second. However, as we have already mentioned, there are several variables that must be considered. Manufacturers now calculate the permitted wind speed for every

crane configuration and are beginning to programme this information into their load moment indicators. If we take a Liebherr LTM12000 with short boom, the load chart permits wind speeds of 14.3 metres/second with base boom, but only 11.1 metres a second on a 47.5 metre boom, and this assumes a regular load with a 1.2 drag coefficient.

The company has also introduced reference charts that allow operators and planners to calculate the maximum permitted wind speeds for special loads. So taking our rotor assembly example, let's assume a surface area of 200 square metres and a drag coefficient of 1.6. We multiply the 200 by 1.6 to give an equivalent area exposed to wind of 320 square metres. Using the special chart we see that the maximum wind speed for lifting a load with this exposed area and weight is actually only 3.5 metres a second! If the rotor had been heavier we could have lifted it safely in stronger winds.

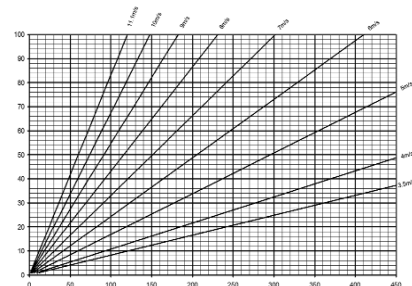
Why is this? Quite simply crane booms are designed to cope with vertical loads and not side loads. In fact most modern cranes are designed to cope with no more than a three percent side loading, so while our 25 tonnes might be well within the crane's capacity when suspended vertically, there is no way it can handle anything like this pulling sideways on the boom nose.

There is a great deal more to this than the simplistic explanation above. In order to truly understand the effect of wind on lifting, it is

useful to understand the dynamic wind loading effect on loads, which creates those side loadings and the differing effects of

the surrounding terrain or buildings. Lift planners could benefit from an excellent multilingual publication, complete with test questions and exercises that Liebherr has produced, entitled 'Influence of wind on crane operation', a copy can be found at [www.vertikal.net](http://www.vertikal.net) in the library section.

We also think that there is a strong case for an organisation such as ESTA to produce or approve a one day wind training course and exam for crane operators with a certificate and card for those passing it, entitled Crane Operators Wind Licence. After an initial period, wind turbine manufacturers could insist that any crane operators working on their sites are so qualified - simple!



Wind Speed - the measurements along the bottom are 'exposed surface area of the load' the vertical axis is total load weight.



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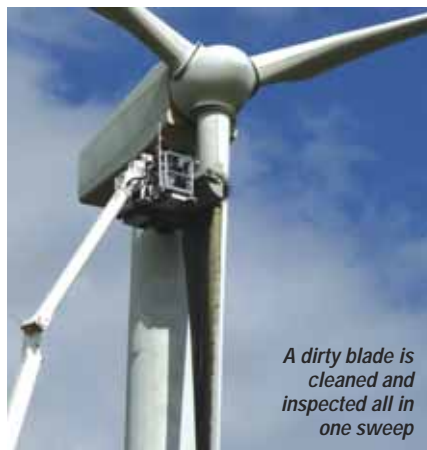


# A better way of doing things

As the use of wind turbines spreads throughout the world and the technology develops and evolves it throws up new challenges, opportunities and even businesses. The expansion of wind power is good news for the lifting industry however at first glance it might also appear to be something of a 'bubble' as land-based sites in Western Europe are developed and resistance to wind farms near urban areas grows.

However as you delve deeper it soon becomes clear that new turbine installation is just a part of this new industry. In addition to their erection, turbines need regular maintenance, inspection, repair and it now turns out, cleaning. And if all this is not enough to spike the interest of potential suppliers, there is also the need to replace or update them as they reach the end of their useful life and as technological improvements obsolete them. The increasing size and efficiency of wind turbines also triggers another new reality - the single lone turbine - opening up a host of potential new sites

One of the more surprising and yet relatively obvious facts that we recently discovered is that turbine efficiency drops by as much as 15 percent and possibly more, as the blades accumulate dirt. On top of this it is hard to inspect a dirty turbine blade, so blade cleaning - a new activity - has a dual purpose benefiting both safety and



*A dirty blade is cleaned and inspected all in one sweep*

profitability. In the beginning cleaning and inspection was carried out by teams of abseilers dropping down from the turbine nacelle on ropes. While this method is still in use, it has significant limitations - the main one being lack of experienced abseilers. Added to this is the fact that the typical abseiler tends to be a climbing buff rather than an engineer also that it is not the safest method of working at height with several fatal accidents already recorded and it is clear that alternatives are required.



*The two large brushes rotate and adjust to perfectly follow the curves of the blade*

Large truck mounted lifts are already used very effectively in this role. On their own however, they lack efficiency in that each one ties up a specialist inspector for a longer amount of time than necessary - getting to the site and waiting while the blades are cleaned etc. In order to solve this problem UK based company, Extreme Wind Services - which also trades as Extreme Access Hire - has developed a solution that is becoming increasingly popular as more turbine operators become aware of it. The potential is significant enough that the company has already started expanding this aspect of its business into other parts of Europe.

Its patented system employs a large truck mounted lift that has the spare lifting capacity required to handle a special cleaning head and inspection platform. Dubbed the EX1, the

on-board tank can keep the machine supplied for a significant amount of time between top-ups.

The system is almost fully automatic with the brush movement and pressure closely tracked by laser sensors to ensure optimum pressure is applied and that the cleaners follow the blade profile without stressing it. As cleaning progresses, cameras track the movement, recording the blade surface condition. If the onsite technician spots anything suspicious, he can activate additional specialist close up cameras carried on the platform extension and then email a still image of the possible defect to the client or specialist engineer at the touch of a button. The platform is also capable of carrying out non-destructive testing such as ultrasonic and shearography testing.



*If a blemish is spotted on the blade specialist cameras carried on the platform extension can be deployed*

device has so far been fitted to a number of 70 metre Palfinger/Wumag truck mounted lifts. Each EX1 consists of a special platform equipped with a water tank, platform mounted water jets and large rotating brushes, similar to those found in a car wash. There is also a full set of video inspection cameras and the ability to transmit the live inspection images anywhere in the world. By using the latest water recycling system that captures and reuses around 65 percent of the heated water, the

Extreme has already launched a service with partners in Spain and Portugal and is looking to add further machines in the UK later this year.



# Moving 40 metre components through the forest

With wind turbines becoming ever larger, the development of smaller wind farms with just one or two turbines is becoming more practical. The problem is that some of the locations for these lone turbines can be very difficult to reach, both for the cranes needed to erect them and also the components themselves. A case in point involved the transport of three 40 metre blades and the tower sections of an Enercon E82 turbine to the top of Mount Johannisegge, a wooded hillside in the Teutoburg Forest, near Borgholzhausen on the northern border of North Rhine Westphalia.

Negotiating the final two kilometres of steep narrow road with two hairpin bends through heavy woodland was a problem. Swiss transport specialist, Voser came up a self-propelled solution that minimised any tree felling and coped with the icy road conditions. The company used a six axle Scheuerle InterCombi SP unit equipped with a special rotor blade adapter. The nine tonne blade was lifted into the adapter with its 200 flange bolt connection and the unit was ready to go - the driver walking

behind the unit operating it via remote control. The rotor blade adapter has the ability to raise the blade by up to 23 degrees, helping it to negotiate the bends. An additional crane counterweight was placed on the deck of the transporter to provide extra counterbalance.

The trip started well with the rotor raised to clear the first bend which it negotiated perfectly, the second bend, a hairpin, proved more of a challenge with its 15 percent gradient and eight percent cross slope forcing the felling of some



The 40 metre blade is lifted into the rotor blade adaptor



Other components took just 40 minutes to complete the two km journey



Here comes the blade

taking just 40 minutes each to complete the two kilometres.

A short home video of the move can be seen on YouTube <http://www.youtube.com/watch?v=Nm1TCYkBLdk>

## Crane set in tight spaces

While the above charts the challenges of getting components onto remote sites, it can also be equally difficult to gain access with the larger cranes required to install the latest turbines. Given their modular nature, some companies are looking at using large tower cranes to install the turbines. Manitowoc is hoping that this application will prove lucrative for its innovative GTK telescopic self-erecting crane, given that it is articulated and one in position does not need the set up space that a telescopic with luffing jib requires.

small trees bordering the road. With the light falling the move was suspended and the unit parked up overnight on the slope.

Next morning fog and icy road conditions did not help, but the road was gritted and in combination with the transporter's anti-skid function the move progressed smoothly with the 60 degree steering on the Intercombi helped it get around the second hairpin smoothly to reach the site. The transport of the other two blades was completed far more quickly, with the other components



Approaching the turbine site



Raising the blade to clear overhead wires



Clearing the trees on a steep icy bend



# Wind sector unites on safety

The recent ESTA Wind Conference attracted a sizeable and varied audience to both listen and to put forward their opinion regarding the problems and dangers of erecting wind turbines. Among the more vociferous delegates was Terex Cranes' managing director of global sales Frank Bardono. Now seven months into his new role he has an almost unique combination of rental company and manufacturer experience. Mark Darwin spoke to him about the conference and the wind sector.

"The conference was a great idea and attendance was well spread between turbine manufacturers and those from the crane sector. There were enough of the key industry A-list players so that the message should get out to everyone. Perhaps it was missing some of the second tier sub-contractors - those doing the work on site - but for a first conference it was a great start."

Because of his previous careers - chief executive of US crane rental company Amquip and before that operations manager at Maxim Crane rental - Bardono has the advantage of being able to evaluate the conference from both a manufacturer's and crane rental viewpoint.

"As a crane rental company we did not chase turbine work because after the early contracts everyone in the world started quoting. Prices went so low and the terrain and applications were so difficult, that it simply did not pay to do the work - and this was when a 400 tonne



Frank Bardono

crane was big enough," says Bardono. My biggest goal working at Terex is to develop cranes that allow the user to generate enough return on his investment for his business to succeed - that is not happening at the moment because current contracts don't pay the crane supplier the market rates needed."

### Why shorter contract times?

"Project developers/clients play on the fact that crane owners are

competitive and aggressive when demanding shorter contract times, but you have to say 'enough is enough. We are almost in a 'perfect storm' situation that involves taller towers, heavier turbines and reduced installation times - a recipe for more accidents. My concern is that contract times are being reduced and the lifting contractors then penalised for days when they are winded off. That is when I really worry about safety. We are allowing the turbine manufacturers to dictate terms rather than the crane industry, which has the knowledge and experience."

"Rather than discussing increasingly heavier lifts, why aren't turbine components produced in smaller, lighter pieces? Why are we setting blades three at a time rather than one at a time, or making them out of Gortex rather than fibre to make them lighter? Larger, fewer components means faster erection speeds to comply with contract schedules. Unfortunately there will always be one crane company who says "I can do it" rather than the industry sticking together and saying we need more time. I don't think turbine designers have taken enough advice over what can and cannot be lifted. It seems to be a case of "tell me what I need to lift this" instead of saying "how big do you think I should build it."

Crane designers like to build bigger and bigger but we appear to be reaching the maximum limits. I don't think turbines will go too much

higher or heavier than they are today. If they do then only be a handful of companies will have cranes capable of installing them, so prices, roads and safety should be sorted."

### Conference message

"The crane companies' concerns over reduced prices and time schedules were voiced and heard by the main contractors. Five years ago a crane rental company would only take a crane to the top of a mountain if adequate access was provided - now the crane guys have to do it all. Clients are squeezing costs, not just on crane rental but in other areas such as reducing the width and quality of the access roads so the returns generated are nowhere close to what is required for the €5 or 6 million crane investment. Companies generally are not pitching the right price for the work they are doing."

### Accidents

"The wind sector is more dangerous than most people are aware, as we rarely hear of the incidents that occur on remote wind farms," says Bardono. "Imagine if they cut corners on the wind tower foundations and a couple fell down every month? There would be an outcry, but if a crane goes off a road and needs to be towed the crane owner gets blamed for it even if he didn't build the road? Clients just expect the work to continue safely despite price and time reductions - and of course the accidents are the

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fault of the crane supplier. I think the industry is finally saying this situation is not working and we all need to be partners in safety and performance."

### But will it change?

"The more the industry unites over safety, the more the clients will work with them, but as long as there is someone who says "I can do it cheaper and faster" nothing is likely to change. I have seen the ESTA position paper that came out after the conference and feel there is still too much burden on the crane supplier. But the hope is that with future meetings and continually raising safety awareness, conditions will improve. However turbines are getting bigger and heavier and we need the biggest cranes to erect them. But even that is no problem if we have the right set-up, good access and the time to work safely."

### Presentations

"The lifting in high winds presentation was very technical - perhaps too technical for some - but you could see that it was a wake-up call to many at the conference. We have to design cranes that can cope with windy conditions and I think manufacturers are doing a good job. Most of the problems are caused not by faulty crane designs but the conditions in which they are operating."

### AC1000 delays beneficial?

Several wind related accidents have involved large telescopic cranes. Terex's 1,200 tonne AC1000 has still not been launched, several years after its planned release date.

"We realised that there were some issues with the AC1000 and rather than rush it to market, chose to re-engineer it," explains Bardono. "We are in final prototype testing and will have a crane in the field from June 1st with a customer on a difficult contract, together with a team of engineers. The problem with a large telescopic when set up with maximum boom, jib and ballast configuration is being able to lower it quick enough when unforeseen wind and gusting blows up. I think the lattice crane is more forgiving and with less boom mass and surface area you get a different side load situation. The wind can travel through the lattice, rather than catching the boom and ice does not form as easily."

"I am not worried about selling the AC1000 for wind contracts. We are excited about the machine and six will be available by the end of the year. The design means they can work in all conditions - confined areas in a city centre, a petrochemical environment in the Middle East, heavy vessel lifting or erecting wind turbines. It was delayed because we had concerns on the heavy lift side and we thought it could be improved. We are now very happy with the end result having a crane that is versatile, affordable, easy to transport and that provides a good return."

"Our industry is smart and if a crane or type of crane works well they buy it. Future developments for Terex involve making more cost effective cranes that are safe with more modularisation and interchangeable parts, which means easier and reduced transport. We are all aware of the safety side but it is now down to the manufacturers to offer a more economical package."

### Very large cranes?

"I think you will see bigger cranes and different technology from Terex in the heavy lifting class. The gantry ringer crane is very specialist and they are only built in small numbers. That is not what we do - we try to build cranes with mass demand for global applications - a totally different market. There is always a need for a bigger crane and don't rule anything out - we will be in every lifting capacity market there is."

### Chinese cranes

At Intermat I saw the new Sany AT crane with signs saying 'No photographs allowed!' I put a sign on one of our cranes saying 'No copying!'

We see a lot of reverse engineering on products coming from China, but have we seen any innovation? Not yet. It is a global market with global competition. All we can do is offer better service/support, more performance and more reliability and the buyers will decide. Customers buy Terex for reasons other than price. If you were buying a crane would you go for a cheap copy, or one with 100 years of experience and performance?"

### Training?

"I think there will be a move



Terex CC8800 twin

towards lattice cranes for wind turbine erection and prices will increase. You will always have the rebel supplier but they will be the exception rather than the rule and clients will be under more pressure not to take the cheapest and possibly less safe option," he said.

"In the tower crane industry when things started getting dangerous we brought in legislation requiring crane rental companies to have a minimum insurance of €25 million. I can see some type of minimum standards coming in for wind. Clients also have to ask how one bid can be 40 percent lower than another?"

"At the conference I brought up the certification and training for the wind sector. Surely it makes sense to have operators fully trained on the equipment they are working on? I

see three ways of doing it. First the crane owners can sort it out themselves. Second organisations such as the NCCO (National Crane Certification Operators) can devise a wind programme and thirdly manufacturers can offer in-house training programmes for wind customers."

### Clients beware

"Clients are now aware that they had better address the issues raised at the conference or they will not get the work done. The conference put the turbine manufacturers on notice. I think it is the first time they have heard the industry get together on safety and they have to listen. If nothing else, the turbine manufacturers took the heat in the questions and went away saying they had better address this situation."





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