IN THE GROOVE

The bulletin of Lebus International Engineers GmbH

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Lebus system is installed on next generation of super-heavylift cranes

Mammoet, one of the world's leading heavy-lifting specialists, is once again relying on Lebus to ensure perfect spooling for its new generation of super-heavylift cranes.

The Dutch company already has four PTC Platform Twin-ring Containerised cranes in its fleet, all fitted with Lebus sleeves for multi-layer spooling. Now it is building three more PTC machines that are even larger and stronger than its previous ones.

All PTC cranes are mounted on a steel ring, upon which they rotate. This reduces both footprint and ground-bearing pressure. Other key features include a twin boom design and the ability to be broken down into components that can all be transported in standard sized containers.

The new version, called PTC 120 DS and PTC 160 DS depending on the size of ring that they are mounted on, have a maximum rated capacity of 3200 tonnes. Maximum main boom length is 140m and maximum jib length is 100m.

The reach and power of these machines really becomes apparent, however, in their load moment rating (lift capacity x radius), which is 120,000 tonnes for the PTC 120 DS and 160,000 tonnes for the PTC 160 DS. The extra capacity of the PTC 160 DS is achieved by using a ring that is 54.6m diameter rather than 44.7m.

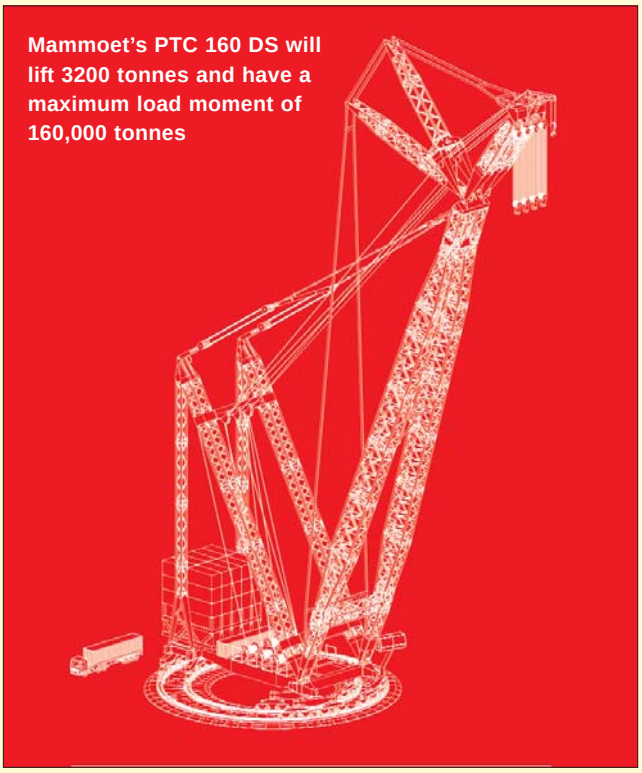
The three units, the first of which will be in operation in 2011, will be working in power, petrochemical, civil and offshore industries. To minimise the risk of any interruptions to smooth operations, Mammoet specified the Lebus spooling system.

As well as a main winch for heavy lifts, each crane also has an auxiliary winch for lifting lighter loads at speed, as well as winches for boom and jib operations. Lebus Germany has supplied a total of 21 sleeves – seven for each crane – each specifically designed for the application.

The sleeves were delivered to Liebherr, which is manufacturing the winches and gearboxes for Mammoet. The sleeves were mounted onto the winch drums by Lebus personnel at Liebherr's factory in Biberach, Germany.

The Lebus sleeves are 2385mm between the flanges. All the hoisting winches are fitted with 45mm diameter Diepa B65 wire rope in eight layers, with 51 wraps on each layer. Diepa SKZ8 wire rope, also 45mm diameter, is used on the drums that lower and raise the boom and jib.

For winches like these, it had to be the original Lebus system!



Mammoet's PTC 160 DS will lift 3200 tonnes and have a maximum load moment of 160,000 tonnes

Lebus joins EWRIS

Lebus International Engineers GmbH has joined the European Federation of Wire Rope Industries (EWRIS) as an associate member and is looking forward to taking an active role in the organisation.

EWRIS exists to promote and develop the common interests of steel wire rope manufacturers. Associate membership is extended to companies that supply wire rope manufacturers or are closely affiliated to them.

Its secretariat, led by secretary general Dr Anne Jourdain, is based in Paris. Lebus thanks EWRIS for the kind welcome that has been extended to it by the federation, and by the assistance offered by Dr Jourdain in particular.

Further information on EWRIS is available at www.ewris.com.

Customer focus

Kley France

Kley France supplies specialised handling equipment to diverse markets, including the oil industry, oceanography, civil and naval engineering, as well as nuclear plants. All products are engineered to suit the customer's specific application.

Based in Rueil Malmaison, near Paris, Kley France has more than 50 years' experience in design, manufacturing, supply and installation of special winches such as linear winches up to 850t pulling capacity, traction winches, drum winches and other equipment.

It takes projects from concept definition phase through design, manufacture and assembly, up to testing, installation, and subsequent long-term customer support.

In recent years it has developed expertise in the use of synthetic rope, whose main advantage over steel wire rope is its low weight. They are being increasingly used for scientific deep sea operations such as gravity coring, with loads in the range 5t to 40t and more. There are two challenges in using synthetic ropes: the first relates to the spooling of ropes, which can be up to 10km long, or even more; the second is to manage the tendency of the rope to stretch.

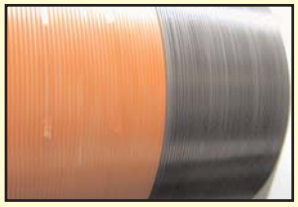
Kley France has developed and patented annular traction winch technology to respond to these challenges. The traction winch is equipped with synthetic self elongating grooves designed to match the rope elongation. Damage and heat generation induced by friction sliding are then minimised. High quality spooling of rope is achieved by using a large diameter storage drum, equipped with Lebus sleeves. The spooling sheave is driven through a regulation loop developed by Kley

France, to perfectly serve the Lebus sleeves pattern.

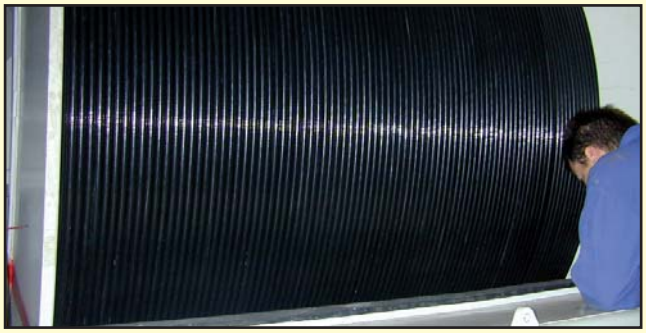
Oceanographic research vessels fitted with Kley France winches with Lebus sleeves include the G.O. Sars, which is operated by the Norwegian Institute of Marine Research and the University of Bergen, and the Sagar Nidhi, an ice-class research vessel operated by the Indian National Institute of Ocean Technology. The winches are powered by electrical AC motors with high performance IGBT frequency drives.

On the Sagar Nidhi, the winch holds 10km of 25mm diameter Phillystran torque balanced synthetic rope in 88 wraps on its 2250m long drum in up to 16 layers perfectly smoothly.

The winch on the G.O. Sars holds 6km of 20mm diameter aramid rope, spooling 70 wraps and 16 layers.



Synthetic rope spooling perfectly, from the bottom layer to the top



Jakl, the first apprentice, marks 30 years of service

Lebus Germany had much to celebrate in 2010: business has been good, especially in Asia, and the new assembly hall is now in full operation.

"But the biggest cause for celebration", says managing director Cris Seidenather, "is the completion of 30 years' service by our longest serving employee - Jakob Stefan Lindermayr. He was our very first apprentice and has for a long time been one of our most versatile and indispensable associates."

Jakob, who is popularly known as "Jakl" within the family of the company, joined Lebus on 1 September 1980 when he was just 14 years old.

Cris Seidenather and colleagues celebrated Jakl's contribution on the 30th anniversary of his joining the company with a barbecue and Bavarian poems.

The next generation arrives

Tim and Michaela with baby Leo

The newest member of the Seidenather family, and – who knows – perhaps one day the fourth generation to lead the company, entered the world on 21 September 2010.

Leo Seidenather weighed in at 3,050g. He is the first child of Lebus production and quality manager Tim Seidenather and his wife Michaela. Leo is also the first grandchild of managing director Cris and Rosie Seidenather.

Solving problems caused by empty hooks and unused lower layers

The Strong Man at the circus withstands punches to his stomach by tensing his muscles. With tension the ability to absorb pressure is significantly increased. This is well known to civil engineers, who use concrete that is pre-stressed and post-tensioned for extra structural strength.

Tensioning is just as important in wire rope that is spooled around a winch drum in multiple layers. It is one of the basic requirements for multi-layer spooling that the wire rope is initially installed on the drum under tension. Without tension in the rope, the lower layers are unable to withstand the impact of the pressure exerted by the upper layers.

Other critical items to consider include the D:d-ratio, fleet angle, the safety factor and rope construction.

Even if the rope has been installed correctly, there are certain applications where this is not enough. Usually, cranes are used for lifting heavy objects. The rope unspools to lower the hook to ground level; a heavy load is attached to the hook; and as the load is raised the rope spools onto the drum under the tension of the downward force exerted by the load.


Always avoid spooling an empty hook

Sometimes, though, the crane may be used to lower a heavy load - perhaps lifting tunnelling machinery down a shaft or to lift off the blades of a wind turbine for repair. In such applications, force is applied as the rope is unspooled, but when re-spooling back onto the drum, there is only the weight of the hook block and tackle acting on the drum. In most cases this does not generate sufficient tension in the rope as it goes back onto the drum. This slack spooling is the crane operator's enemy. It leads to the rope snagging, cutting in and becoming damaged.

There are several options to prevent slack spooling in applications that lift empty hooks, none of which is perfect, but all should be considered.

1. Get a heavier hook

A heavier hook obviously uses up more of the system's lifting capacity, but if you have some to spare, it can help to prevent slack spooling. Alternatively, consider adding weighted plates to the hook block to put extra tension in the rope.

2. Get a bigger drum

Although this is unlikely to be a realistic option in most applications, a bigger rope drum – either longer or fatter – means that the rope can be spooled in fewer layers. The fewer the layers, the less scope there is for damage on lower layers. A fatter drum increases the bending radius, which reduces the amount of pretension required. Still, 0.75-1% of the nominal breaking load at a safety factor of 5:1 is necessary to avoid damaging the rope. Ideally, the drum should be big enough to accommodate your entire rope in a single layer.

3. Use the ultimate uncrushable rope

Sadly this rope has not yet been invented. Wire rope manufacturers are continually making advances in the crush resistant properties of their special ropes, which help significantly in preventing the damage caused by slack spooling. But even the best of these is not absolutely uncrushable, especially if there is insufficient tension in it.

4. Always spool under tension

Some crane owners, in certain applications, have found ingenious solutions to avoid lifting an empty hook. One of these, for example, is to put water bags on the hook at ground level and then empty the bag when the hook is at full height and the rope fully spooled onto the drum.

5. Minimise dead turns

For safety, it is always necessary to have dead turns that never spool off the drums. These should be kept to a minimum, however, and spooled with maximum possible tension at the outset.

A related problem to spooling with an empty hook is using only the upper layers of the rope. For example, a tower crane on a high-rise building will conduct many lifts using just a fraction of its wire rope before being jumped or climbed to the next height as the building progresses. Only when the crane reaches its full height will the full length of the rope come into play.

A customer came to us recently with a similar problem, although this involves just a winch rather than a crane. The application here was the construction of a 6km-long tunnel. In such projects, as the tunnel boring machine (TBM) progresses under the ground, a winch at the opening of the tunnel pulls the trucks that carry excavated spoil out of the tunnel for disposal. The 2600mm-wide winch drum holds 3.8km of 43mm-diameter wire rope in eight layers. In the early stages of construction, the winch needs to let out only short lengths of rope. As the TBM progresses, the distance travelled by the spoil trucks increases and more rope comes into play. Just like the climbing tower cranes, here is another example of lifting heavy loads using - at least until later stages - only the upper layers of the rope.

A good solution, in both examples, is to use three separate ropes for different stages of the project – a short rope, a mid length rope and a long rope, so that throughout operations, a much larger proportion of the rope is being unspooled from the drum and spooled back onto it under tension.

In the tunnelling example above, this is exactly the solution that was adopted after it was proposed by Lebus to the winch supplier Paul Reber AG of Switzerland and the TBM manufacturer Aker Wirth.

While this may seem more expensive than relying on a single rope, the extra cost of the additional ropes is far outweighed by the cost of mis-spooling bringing a project to a standstill, and then still having to buy another full length rope anyway.

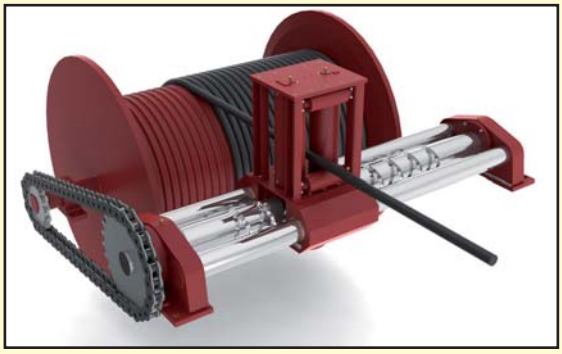
Engineers' Corner

Guidance on the Lebus level winder

Aside from the design of the drum there is probably no function of the layout that is more important for smooth spooling than the fleet angle. If the fleet angle is too large, the wire will tend to break away from the flange at the layer changes and spool towards the centre, leaving gaps. If the fleet angle is too small, the rope will climb up the flange and bang down, damaging the rope and the equipment.

The recommended fleet angle is between 0.25º and 1.25º. If this is not possible, an additional spooling device such as a fleet angle compensator (automatically driven by the rope tension) or a Lebus level wind pay on gear (mechanically driven) must be installed to guide the cable along the drum between flanges. Normally, a guideline to potential problems with fleet angle is the factor 23:1: if the drum width (A) is 1m, the distance between the drum and the fixed sheave (B) should be at least 23m. Using a level wind pay on gear – or level winder – we can reduce this ratio to 6:1 and cope with fleet angles of up to 5º.

The mechanical level winder comprises a main shaft (lead screw), which is endless grooved (diamond screw shaft), driving the housing wherein the follower is integrated. The housing includes two hardened vertical rollers and one horizontal roller, or alternatively a wire rope sheave. The horizontal movement of the housing is generated by a chain drive sprocket ratio between the drum and lead screw.



The Lebus level winder

The level wind is engineered to be compatible with the parallel grooving on the drum. It is adjusted for the specific rope diameter, and the gear ratio is fixed (using a standard sprocket-chain connection) to match the ratio between coils of wire on drum to pitches on the lead screw. The result is perfect and controlled spooling, regardless of the number of layers or slight changes in wire rope size.

Conditions for the level winder to function properly

The level winder pay on gear unit must be installed in front of the drum in line with the first fixed sheave when using vertical rollers to guide the wire rope. However, with a sheave installed on the housing frame the system can be installed anywhere around the drum.

The rope must go from the drum through the vertical rollers or level wind sheave to a fixed point such as a fairlead or fixed sheave.

To avoid excessive angles of the rope on the sheaves, the minimum distance between the fairlead or fixed sheave must be at least seven times the drum width.

The drum must be equipped with the Lebus parallel groove for multi-layer spooling or helical groove for up to three layers.

There must be sufficient tension on the cable during the spooling operation when spooling more than one layer: Recommended minimum tension is 1% of the wire rope's breaking load.

There are a couple of disadvantages to using the level winder. It is space consuming; and it is sensitive to high axial forces and shock loads.

However, there are also several advantages, namely:

- Synchronised and perfect controlled spooling in multiple layers. (It has been proven in oceanographic installations for up to 46 layers.)
- In case of slack in line spooling, the level winder keeps the rope in the correct position all the time.
- Once adjusted to match the drum groove, no further adjustment is necessary.
- In case of damage, parts are easy to replace immediately. No specialist is required as it would be, for example, with an electric, hydraulic and/or electric driven device.
- The system needs minimum inspection and maintenance.

About Lebus rope drums

In 1937 Frank LeBus, a supplier of equipment to oilfields, patented the use of a groove bar on hoisting drums to guide the spooling of rope. In the 1950s he refined the grooving geometry and came up with the LeBus Counterbalanced Spooling System, which is still the most effective way to ensure that wire rope wrapped around a hoist drum in multiple layers continues to spool totally smoothly, and in a way that maximises the life of the rope. Tests have shown that a Lebus drum, with grooves designed specifically to match rope size, can extend rope life by more than 500%.

Today, the term 'Lebus' is often used incorrectly to refer to any drum with parallel grooves. In fact, only a drum or sleeve produced by Lebus can truly claim to be a Lebus drum.

About Lebus International

Lebus International Engineers GmbH was established by Karl Seidenather in 1962. It is a sister company of Lebus International Inc. of the USA and also has sister companies in the UK and Japan.

Lebus International manufactures drums and rope spooling systems for a wide range of onshore and offshore winching applications. Products include:

- Rope drums with grooves cut directly into them (with or without bolted or welded flanges, as required)
- Grooved split sleeves that can be placed over smooth, ungrooved drums – good for retrofitting and for applications where drums may require replacing in future.
- Spooling accessories such as spooling angle compensator and cross thread spindles.

Contact us:

For any queries concerning wire rope spooling, Lebus products or details of how Lebus can help you, please contact:

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