LIEBHERR

UP LOAD

The magazine for customers and friends of Liebherr-Werk Ehingen GmbH

1 | 2018

The management team of Liebherr-Werk Ehingen GmbH: Christoph Kleiner, Mario Trunzer, Dr Ulrich Hamme and Dr Hubert Hummel

Dear Readers,

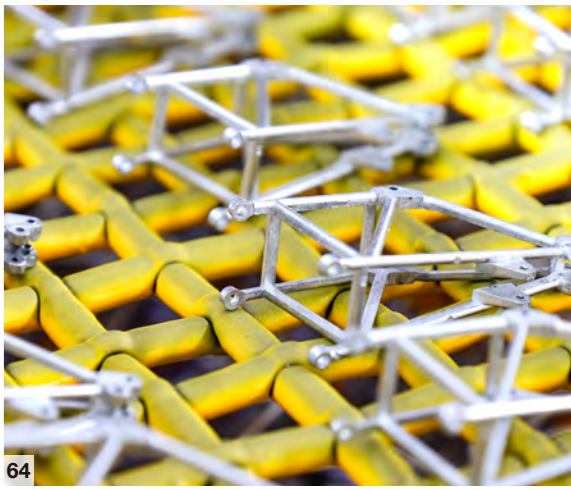
You and we share a passion – cranes. On tyres or tracks, with telescopic or lattice booms. Our brand-new customer magazine UpLoad means that we have now given this passion a forum. Yes, it took a while! 49 years to be exact. Since Liebherr-Werk Ehingen GmbH first opened for business in February 1969, we have constantly sought out new things – and now we have decided to create a customer magazine. And we consciously decided on a printed product. In these times of social media, when rolling news is so commonplace, UpLoad is our attempt to provide you with impressions which last more than one day.

UpLoad, of course, is not just a name but also a programme. Every day you, the crane operators, face the challenge of transporting ever heavier loads to ever greater heights. We support you in your efforts with new crane models, innovative technologies and sustainable concepts. For example, our two rough-terrain cranes are new products which we are delighted to show you in more detail on page 26.

But our other articles also deserve your attention. For example, our new star in the 4-axle sky can be found on page 20. We tell you all about the amazing cross country trip of the St. Benedikt on page 34. We hope you enjoy reading our first edition. And please do not hesitate to contact us if you have any ideas, anecdotes of your own or honest criticism. We look forward to hearing from you.

Christoph Kleiner | Mario Trunzer | Dr Ulrich Hamme | Dr Hubert Hummel

Mobile cranes



Crawler cranes

The world with Liebherr

Moments

**Whether they are new, particularly powerful or stunningly beautiful –
in the following we have captured some extraordinary crane moments for you and posterity.**

Imposing pioneer
Lattice booms arise from the Ehingen fog – and can be seen for miles around in any weather, showing where one of the largest, most modern crane factories in the world is located.

Wide awake
Glinting sunshine, the water reflecting the light and a glimmering LTM 1090-4.2 provide the perfect start to a day in Upper Swabia.

Demanding
The powerful trio of Liebherr cranes assembling a steel bridge in Essen weighing 418 tonnes and measuring 50 metres long in challenging conditions.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Towards the sky
More than hot air despite the bright sunshine – an LR 11000 hoists a gondola weighing 154 tonnes to a height of 87 metres in Oklahoma.


NORTHWEST

Sleepless
These crane professionals with their LR 1750/2 worked tirelessly in the low wind hours of the night to complete a wind turbine in a wind farm in the German state of Mecklenburg-Vorpommern.

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Full power ahead
Liebherr now also builds rough-terrain cranes. See page 26 for more details.


EBHERR

Mobile cranes


LTM 1090-4.2
LIEBHERR
LTM 1090-4.2
LIEBHERR

A new star in the 4-axle sky

The LTM 1090-4.2 is a shining example of sophisticated mobile crane technology – high lifting capacities, variable driving states, ECOdrive, ECOmode, VarioBase®, VarioBallast® and much more make it a flexible, economical, powerful all-rounder.

Tommy Borgring, Christoph Kleiner, Per Thorsen Christiansen and Kristian Holst at the handover ceremony for the first LTM 1090-4.2

Maximum mobility, performance and economy

The comment by Per Thorsen Christiansen says everything about the new LTM 1090-4.2. He is the Managing Director of Danish crane and heavy haulage contractor BMS A/S at its Aarhus branch. "When the concept and the technical highlights of the LTM 1090-4.2 were explained to me, I decided I had to have the first one of this new model. I'm delighted that the decision has come to fruition. The new 90-tonne crane from Liebherr impressed me immediately because it has a very long telescopic boom, is just 2.55 metres wide and can carry a great deal of ballast with an axle load of 12 tonnes. Furthermore, Liebherr has also incorporated its VarioBallast® and VarioBase® innovations on this model."

"The new 90-tonne crane from Liebherr convinced me straight away."

Per Thorsen Christiansen,
Managing Director BMS A/S, Aarhus branch

A real winner

The LTM 1090-4.2 is an economical all-rounder with high lifting capacities – so powerful that it exceeds every other 4-axle crane on the market with an axle load of 12 tonnes. Its boom length of 60 metres also places the LTM 1090-4.2 on the podium. And in terms of flexibility it is the clear winner of the gold medal: VarioBase® and VarioBallast® mean that the crane is extremely flexible. It wins the cup for economy thanks to its sophisticated, variable driving states: uniformly distributed axle loads of 10 tonnes, 12 tonnes or 16 tonnes ensure low cost mobility all over the world. The result is massive benefits in terms of licensing and road permits. The wide range of storage boxes on the vehicle is another plus for the crane driver. The wooden chocks are perfectly stored between the outriggers which means less legwork to place them under the outrigger pads. At the rear of the vehicle there is additional space for lifting equipment which means that the crane carries everything it needs for the hoisting work.

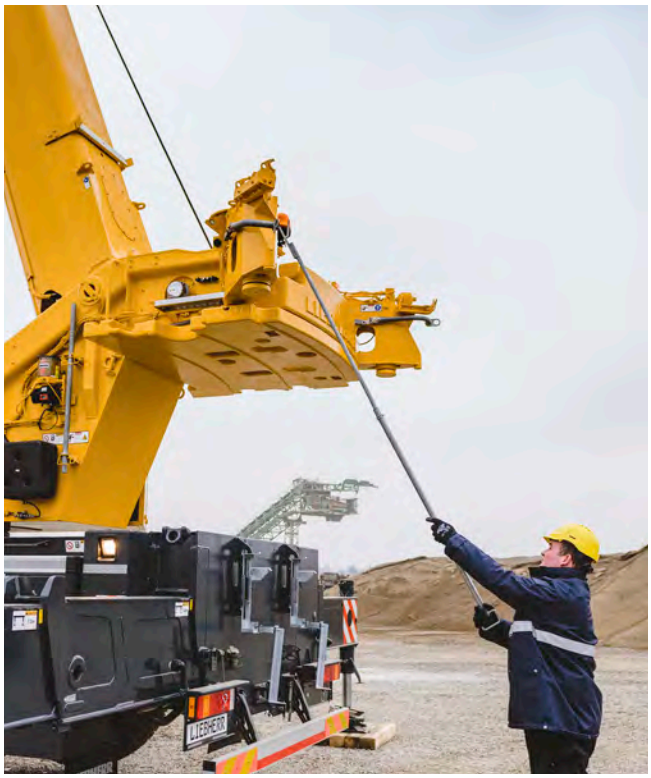
Available from the start: ZF-TraXon

The modern engine on the LTM 1090-4.2 ensures it is highly economical. The crane is also the first mobile crane to feature the new ZF-TraXon gearbox. This enables the crane driver to choose between the reduced consumption and reduced noise ECOdrive program and high performance power mode. The details are explained in the interview on page 24 of this brochure. In crane mode, the time-tested ECOmode on the modern Liebherr single-engine concept can also be activated to achieve a significant reduction in fuel consumption and noise. Overall a magnificent crane concept!

VarioBallast® with mechanical adjustment

The LTM 1090-4.2 features the innovative VarioBallast® system which means that it can be operated with two different ballast radii: 3.77 metres or 4.71 metres. The ballast radius can be reduced by 940 millimetres quickly and easily using standard mechanically slewing ballasting cylinders to ensure that the ballast radius remains inside the outriggers. This solution is a major benefit on constricted sites.

Find out more:
https://youtu.be/HsdbZH_iiCM



The radius of the ballasting cylinders can be adjusted quickly and easily

Large ballast radius

Small ballast radius

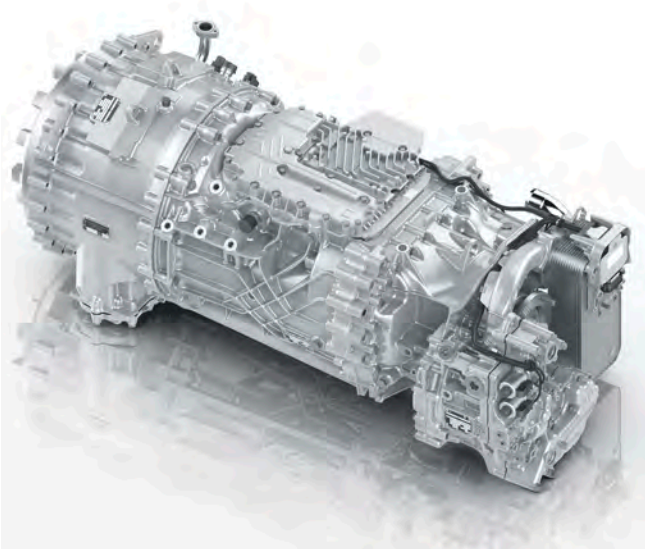
Ready for the future

Good partners in conversation – ZF has developed a new, innovative gearbox called TraXon. Oliver Salzbrunn, Project Manager and Key Account Manager at ZF, and Liebherr's Mikica Rafailovic, Crane Chassis Development and Design Department Manager, and Martin Dony, Drivetrain Development and Design, talk about the technology of the gearbox and its use in mobile cranes.

Why did ZF decide to develop a new gearbox? What were the objectives of the new development?
Oliver Salzbrunn: The basic thought on the part of ZF for new developments is always to deliver greater economy and benefits to its customers. Our idea behind the TraXon was modularity – combining a basic gearbox with multiple start-up elements – in concrete terms, for example, with a dry clutch or a torque converter. A hybrid module and other modules are already being planned. That means that TraXon can satisfy the demand from the market for a versatile solution for a wide range of uses, in other words for trucks, buses and special vehicles.

What challenges confronted ZF during the development work?
Oliver Salzbrunn: The biggest challenge proved to be our own demands, namely delivering this modularity not only for various applications but also for various drivetrain versions and installation situations. Together with Liebherr we overcame the challenge of satisfying the special requirements for mobile cranes. Liebherr is the first mobile crane manufacturer to use TraXon.

Mikica Rafailovic, Oliver Salzbrunn



TraXon Torque

What was the form of collaboration between ZF and Liebherr? Did Liebherr have any influence on the development?
Oliver Salzbrunn: We have been working with Liebherr for many years on a very close basis. Since both companies are based in the same region, much of the coordination work is done in person. Liebherr included the wishes of the end customer in the development process. For example, an ECO-mode, a kick down function and a hill start feature were developed and tested as new functionalities in close collaboration with Liebherr.

Mikica Rafailovic: From the very outset, ZF has been a very good partner to us and we work very closely together. The fact that ZF takes account of our special wishes and requirements is very valuable for us.

Which Liebherr cranes will feature the new gearbox?
Mikica Rafailovic: All crane vehicles with three to five axles will be fitted with TraXon. The cranes with six to nine axles will feature the TraXon Torque.

What benefits does TraXon deliver for mobile cranes?
Oliver Salzbrunn: With TraXon, ZF has set new standards with a whole host of innovations both on the gearbox hardware and also on the control software, making an enormous range of functions possible in the gearbox. Examples include the new clutch release and gearshift control system which have been designed to be more robust and therefore guarantee maximum reliability. A new tilt sensor in the gearbox ensures that the perfect gear is selected for any situation – even on challenging terrain.

Martin Dony: The TraXon Torque delivers some additional features for mobile cranes with six or more axles. Even though very high input torques are involved, starting and manoeuvring is comfortable with no shuddering and also zero wear thanks to the hydrodynamic torque converter. Both gearbox versions receive braking support from an integral secondary retarder with 600 kW of braking force – also with zero wear.

Has TraXon changed the handling? Will there be other changes for crane operators or crane drivers?
Martin Dony: The new functionalities also deliver benefits for operators and drivers. The new ECOmode makes the vehicle significantly more comfortable and quieter due to the low engine speed. Furthermore, faster gearshifts ensure greater scope for off-road use.

When was the first ZF gearboxes used by Liebherr in Ehingen? How has the collaboration developed since then?
Mikica Rafailovic: We have been working together for 40 years now. In 1978, Liebherr launched the first all-terrain mobile crane on the market in the form of the LTM 1025. This featured a ZF powershift gearbox.

Oliver Salzbrunn: The first AS Tronic gearbox was used in the LTM 1100/2 in 1999. Complicated, intensive testing was carried out at the time because an automated manual transmission was completely new in the mobile crane industry. As a result of that close collaboration, we have since created lots of innovative ideas which we have then developed and implemented together.
In addition to our collaboration with the Liebherr Plant in Ehingen, our relationship with the Liebherr Engine Development Division in Bulle, Switzerland, has also been particularly valuable. That enabled us to tune the drivetrain perfectly.

Mikica Rafailovic, Oliver Salzbrunn, Martin Dony

The large Liebherr mobile cranes with six or more axles have featured a ZF gearbox, the TC-Tronic with a torque converter, since 2003. Why?
Mikica Rafailovic: The TC-Tronic delivers both the benefits of an automatic gearbox with 12 speeds and a large spread between the gears, and also the benefits of a torque converter. That enables the vehicle to climb steep gradients, start easily on a hill and be manoeuvred accurately.

Oliver Salzbrunn: ZF developed the TC-Tronic specifically for Liebherr mobile cranes to create the TC-Tronic HD. This gearbox has been used in series production since 2006.

Martin Dony: Another benefit is its compact dimensions. And the gearbox is particularly compact due to the use of the intarder instead of the primary retarder.

ZF Friedrichshafen AG
ZF is a leading global technology group involved in engine and chassis technology as well as active and passive safety equipment. ZF is one of the largest suppliers to the automotive industry in the world. The company is represented in almost 40 countries with a workforce of 137,000 at around 230 sites. Its extensive portfolio enables ZF not only to improve mobility and services for cars, but also for commercial vehicles and industrial equipment applications. These include the development and production of gearboxes and axles for agricultural and construction machinery and drive equipment for forklifts, rolling stock and special vehicles.

The safe alternative

Liebherr now also builds rough-terrain cranes. The LRT 1090-2.1 with a lifting capacity of 90 tonnes and the LRT 1100-2.1 with a lifting capacity of 100 tonnes deliver maximum safety, off-road capability, performance and flexibility.

Cool lads, cool machine – Danny Laible and Julian Rapp at their workplace

Finally. The time has come.

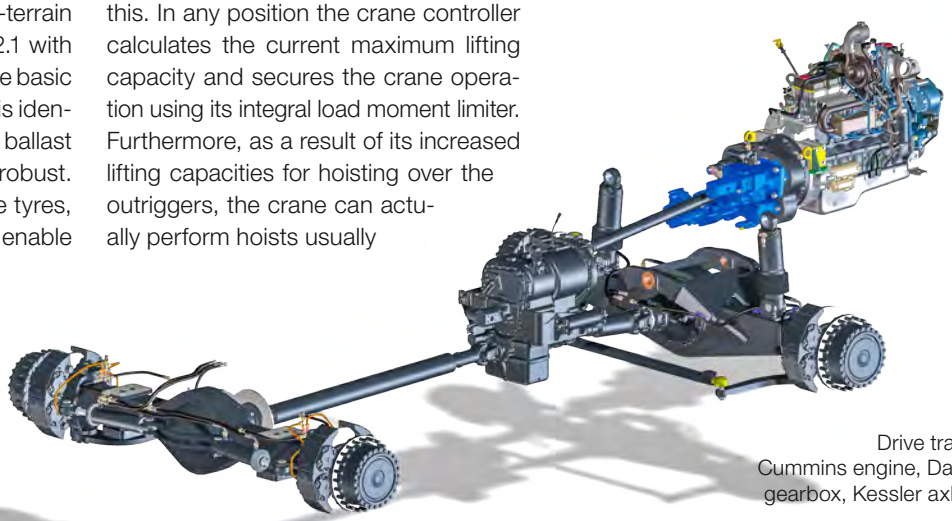
5 o'clock in the morning. The alarm rings. Danny Laible squints. He opens his eyes and is suddenly wide awake. Today is the day. He jumps out of bed, stretches and he's ready to face the day. A few minutes' drive later, he's arrived at his workplace. He works at Liebherr in Ehingen in the Technical Testing Department where he has been for the last ten years. Prior to that he trained here at the plant as an industrial mechanic. His love of Liebherr cranes started when he was a young boy. Over the last few years he has acquired a good deal of excellent technical expertise, trained as a mechanical engineer and is now adding to his knowledge every day at work. "We know the cranes from the wheels up. Nevertheless, every new development is something special. We come on board during the design phase. And when you then stand in front of the full-size crane in 3-D, that's when things really start moving." As he talks to us, Danny's enthusiasm for his job is really inspiring. "And now things are even more exciting than usual." The new Liebherr rough-terrain crane is ready for off." Danny is standing in front of a behemoth with tyres as tall as himself. His colleague Julian Rapp is already sitting in the cabin with a grin on his face as he starts the engine. 264 h.p. roars out over the yard.

> "I already have the miniature version of the LRT in 1:50 scale in my living room."
>
> Julian Rapp, Technical Testing

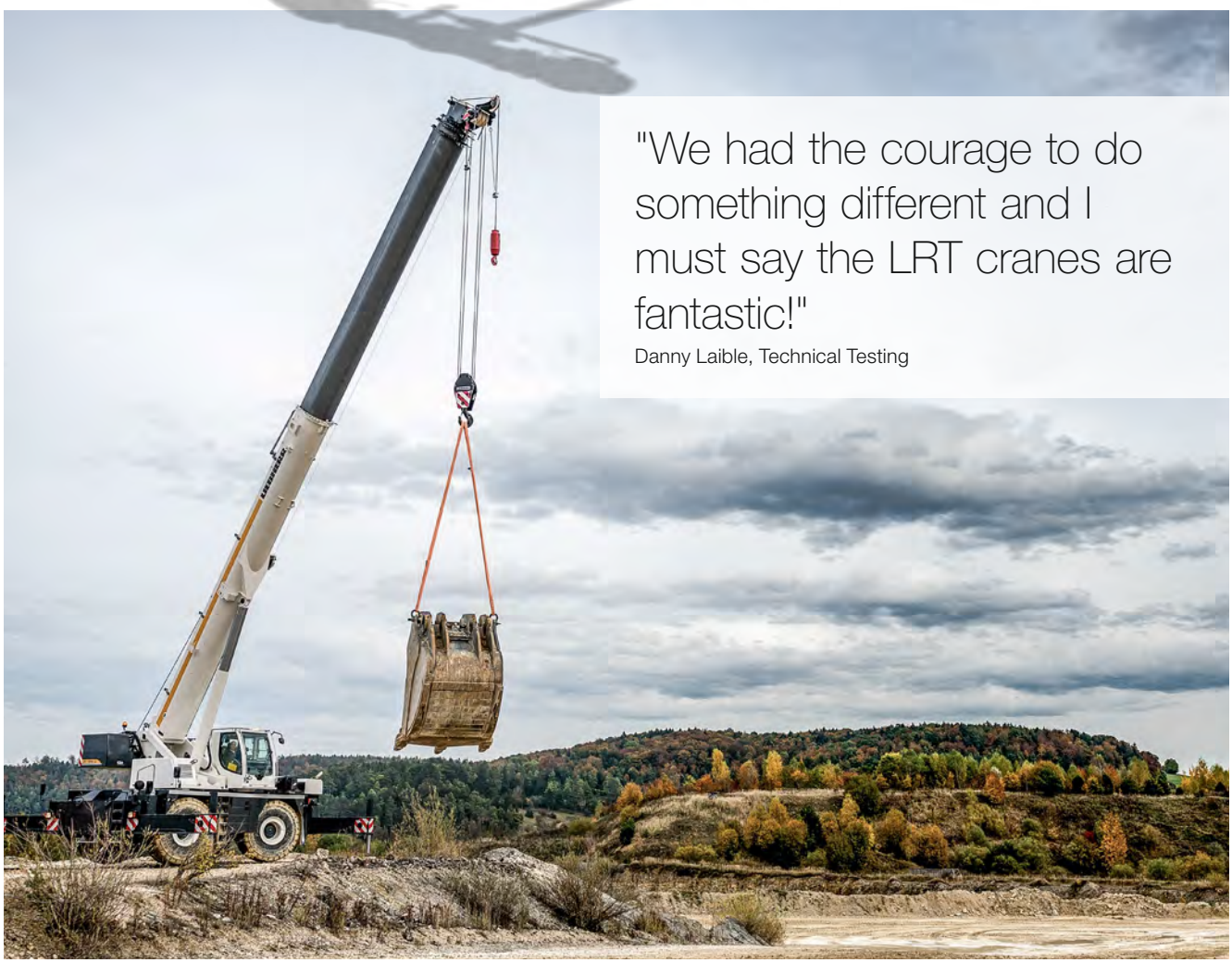
More power and safety for you

The behemoth is one of the two new developments which have expanded Liebherr's product range – an LRT 1090-2.1 with a lifting capacity of 90 tonnes. Not far from it is the next rough-terrain crane model up – the LRT 1100-2.1 with a lifting capacity of 100 tonnes. The basic technical concept of both cranes is identical apart from the boom and the ballast weight. They are powerful and robust. As the name suggests, their large tyres, six gears and powerful engine enable them to travel on any terrain.

"It was particularly important to us to build a safe crane", says Danny Laible, who accompanied the crane on its journey from the drawing board. A crane which anybody on the site can operate without any problems. The VarioBase® variable support base makes an important contribution to this. In any position the crane controller calculates the current maximum lifting capacity and secures the crane operation using its integral load moment limiter. Furthermore, as a result of its increased lifting capacities for hoisting over the outriggers, the crane can actually perform hoists usually reserved for the next higher crane class. Ladders, grab handles and a platform provide all the safety required when working with the crane.



Drive train: Cummins engine, Dana gearbox, Kessler axles



"We had the courage to do something different and I must say the LRT cranes are fantastic!"

Danny Laible, Technical Testing

Greater convenience for operation and transport

And the Liebherr design team also took their time with the crane controls. They had to be clear, self-explanatory and safe. The result: The crane driver can concentrate completely on working with the crane and the load. "I feel really at home in the LRT crane cabin", says Julian Rapp, leaning back in his seat in the cabin of the LRT 1090-2.1. "As is normal for Liebherr cranes, the cabin can also be tilted backwards. That means that I can see the entire site and the crane", he explains. Additional equipment options such as an air-conditioned storage box, a USB charging socket and the 220 millimetres of extra space compared to other crane cabins also deliver more comfort.

And how does the crane get to the site? It is 3.87 metres high, 3.3 metres wide and weighs less than 55 tonnes with all its equipment. A low loader can manage that without batting an eyelid. If there are strict regulations for driving on public roads, the equipment can be removed. In this form a Liebherr rough-terrain crane weighs just 40 tonnes which means it can be transported at low cost to the ends of the world.

Delivery of the first LRT cranes

Erich Schneider, Christoph Kleiner and Dieter Walz handover the first LRT cranes to Matthias Wasel.

"We are delighted that we can now buy rough-terrain cranes from Liebherr again. The machines are essential for opencast mining", explains Matthias Wasel in a satisfied tone. He forms half of the second-generation management team at Wasel GmbH with his brother Thomas. One major area of work for the company is lignite mining. The opencast mining experts from Bergheim ordered a total of six of the new LRT cranes. They received the first two in November 2017 – the first ever of the two LRT crane models delivered as Christoph Kleiner, Sales Director at Liebherr-Werk Ehingen GmbH, confirmed.

Opencast mining means extreme terrain and hard work. A classic mobile crane will not get far here. Not even if it is a Liebherr. Wasel GmbH has previously used rough-terrain cranes from various manufacturers. They include one from Liebherr. The LTL 1160 is the most powerful rough-terrain crane in the world and has been doing sterling service for years. It was manufactured in Ehingen in 1997. Now, though, our new rough-terrain cranes are ready to go – the LRT 1090-2.1 and LRT 1100-2.1.

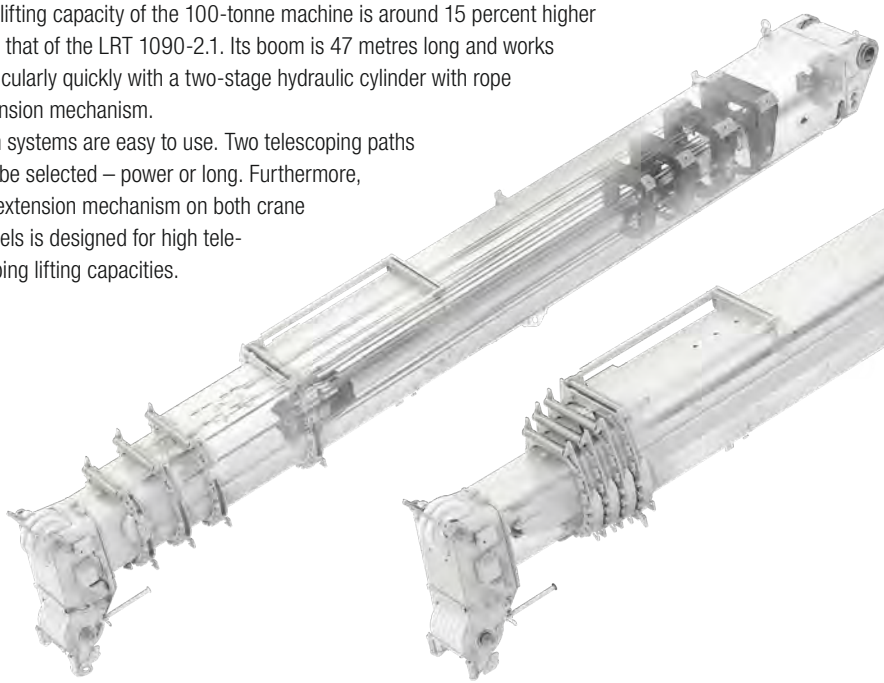
Matthias Wasel is convinced: "Compared to other manufacturers, we know that we can rely on fast spare parts supplies and excellent customer service from Liebherr." Family-run Wasel is a long term customer, reliable partner and also a dealer for Liebherr tower cranes. Its fleet includes 135 mobile and crawler cranes from Liebherr. That means that it is also extremely beneficial that the Liebherr cranes have standard controls, as Matthias Wasel stresses: "It means that the crane drivers can switch between the different vehicles quickly."

"We know that we can rely on fast spare parts supplies and excellent customer service from Liebherr."

Matthias Wasel, Managing Director of Wasel GmbH

Focus on: the boom systems

The boom on the LRT 1100-2.1 is 50 metres long and features the "Telematik" telescoping system. It works with a single cylinder which extends the four telescopic sections independently of each other and bolts them to the telescopic section above them. The lifting capacity of the 100-tonne machine is around 15 percent higher than that of the LRT 1090-2.1. Its boom is 47 metres long and works particularly quickly with a two-stage hydraulic cylinder with rope extension mechanism.
Both systems are easy to use. Two telescoping paths can be selected – power or long. Furthermore, the extension mechanism on both crane models is designed for high telescoping lifting capacities.



Rope extension mechanism

Telematik


Standard global load chart tables to ANSI, EN, GOST and AS
Monitoring the installation and angle adjustment of the double folding jib
Electrically adjustable working lights with load monitoring system
Ladders, handles and a full-length walk-on platform
VarioBase® variable supporting base

	LRT 1090-2.1	LRT 1100-2.1
m_{max}	90 t	100 t
	47 m	50 m
	66 m	69 m
	12 t	14 t

Camera monitoring for the winch and the right-hand side of the slewing platform

Rear-view camera for perfect all-round vision

Simple, self-explanatory controls

Find out more:
www.liebherr.com/lrt

A cross country trip for a ship


ST.BENEDIKT
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Going to the playground at 60

For almost 60 years the St. Benedikt worked as a liner on the Achensee in Austria. Recently two LTM 1350-6.1 cranes lifted the 82-tonne ship on land after it was replaced by a new one. However, the St. Benedikt was spared being scrapped – the ship will become a play and adventure ship in the new Atoll Leisure Park in Maurach am Achensee. Austrian crane contractor Prangl GmbH was responsible for planning and completing the job.

"There were two major challenges with this job – the ship had to be handled so that it was not damaged. It also had to be swung twice through the gap between the cranes."

Oliver Thum, Project Manager at Prangl

Pertisau lake shore – the St. Benedikt is steered precisely under the traverses and hoisting belts of the two LTM 1350-6.1 mobile cranes. To ensure no damage was caused, the hoisting belts were placed in precisely predefined positions on the ship. The two 350-tonne cranes from Prangl and Schmidbauer then hoisted the ship out of the water. The St. Benedikt was swung through the gap between the two mobile cranes with fingertip control and good coordination between the two crane drivers and the ground personnel. Just above terra firma, personnel from the Achensee shipping company removed the rudder and the screw using a flame cutter. After sunset the ship was loaded and secured on the waiting Prangl special low loader once the road outside had been closed. The low loader then took it to Maurach on the other side of the lake.

The two LTM cranes then also made their way to Maurach. The field in which the ship was to be positioned had already been prepared to support the low loader and the two cranes. The 350-tonne cranes hoisted the St. Benedikt off the low loader, swung it through again between the two of them and then placed it on the prepared concrete foundations.

On your marks

The LTM 1450-8.1 is a genuine all-rounder. Its powerful boom has a large range and can complete crane jobs normally reserved for the 500-tonne class in many areas. One feature which is rather unusual for a heavy duty crane is the fact that it can be readied for use extremely quickly on the site due to its simple, practical set-up technology. The VarioBallast® with hydraulic adjustment is convenient and makes the crane very flexible.

A quick-erection crane with a lifting capacity of 450 tonnes

"A powerful crane which can be set up quickly and easily by few personnel. That's it." This was a thought that Markus Ley had had for many years. The dream of a quick-erection crane with a high lifting capacities in the category over 400 tonnes was one that other crane operators had also mentioned to us. And so we made their dreams come true. In October 2017, Markus Ley, owner of Ley-Krane GmbH und Co. KG, took delivery of the very first LTM 1450-8.1.

At the handover ceremony the company boss explained his purchase decision. "When we heard about the new Liebherr 450-tonner, we decided very quickly to invest in this crane model. It meets our requirements exactly." The family company has thirty employees and a range of equipment including over 200 work platforms and 15 mobile cranes. The largest crane to date was a 6-axle model. But now the LTM 1450-8.1 is the proud flagship. Wind turbines, bridges and prefabricated concrete components – Ley has plenty of work for the 8-axle crane.

"The "removable telescopic boom" option makes road permits much easier for us.

Markus Ley, owner of Ley-Krane GmbH und Co. KG

Helenice and Markus Ley

Everything on board?

Easy handling, fast set-up and the latest technology – those were the specifications for the LTM 1450-8.1 design. The set-up times on site are short – arrive, position the support plates, extend the outriggers, position the ballast slabs, complete the hoist. That means that a second job on the same day is always a possibility.

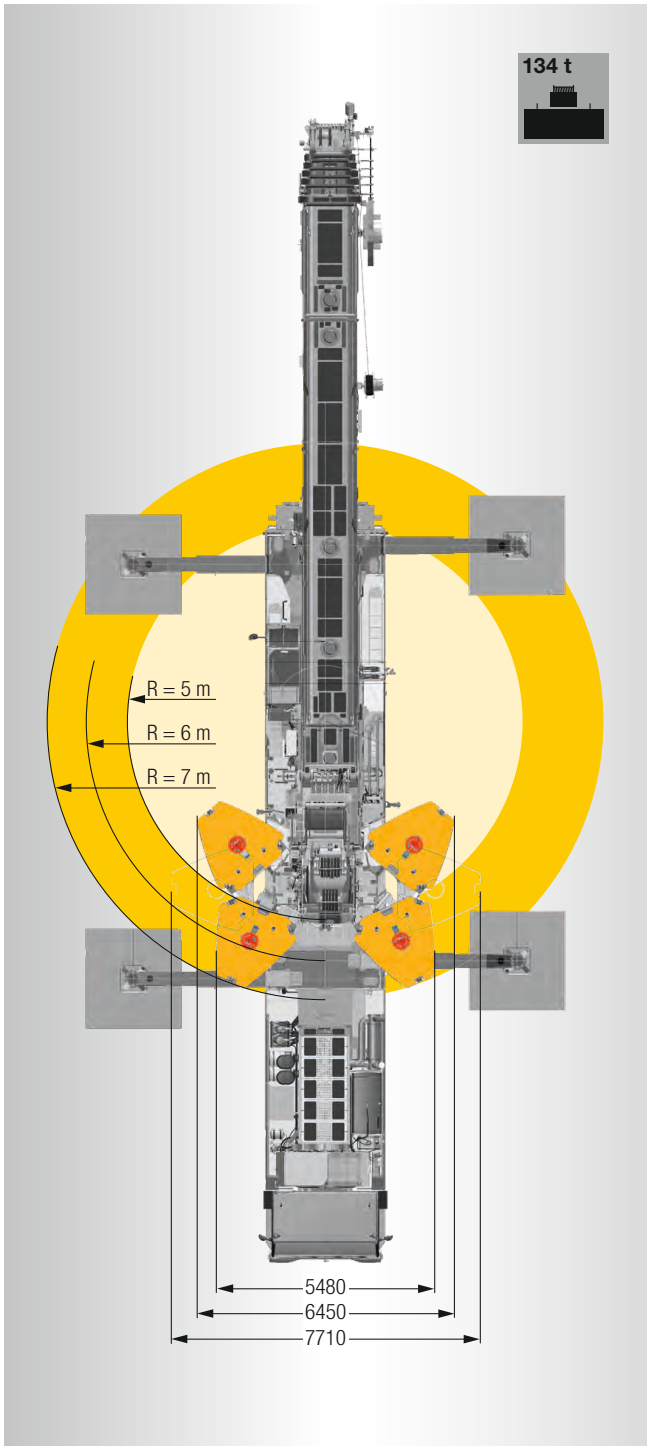
The reason that it works so well is because the 8-axle crane carries most of its equipment with it. Although it is not a holiday, it still feels like "all-inclusive". The LTM 1450-8.1 can carry its 85 metre telescopic boom on public roads with an axle load of 12 tonnes. That is unique! In addition, it also has all four outriggers, tyres of type 445/95 R 25, the winch, the large drive unit, a retarder and the eddy current brake in its suitcase. But whether it is a minimalist journey or a luxury trip, a very wide range of transport weights and axle load versions were taken into account during the design of the LTM 1450-8.1 to ensure low cost, global mobility.

Markus Ley also appreciates the flexibility of the new 450-tonne crane in terms of road licensing. "We bought the "removable telescopic boom" option. That means that in addition to the 96-tonne licence we also have one for a gross weight of less than 60 tonnes. That makes things much easier for us for travelling on public roads."

Sophisticated ballast concept VarioBallast®

The ballast radius can be reduced with infinite adjustment from 7 metres to 5 metres using a simple hydraulic swivel mechanism. The VarioBallast® ballast adjustment is of great benefit on constricted sites. For example, a radius of 5 metres corresponds to the value of mobile cranes in the 200-tonne class.

The maximum ballast on the LTM 1450-8.1 is 134 tonnes. To enhance economy, the ballast plates are compatible with the plates from the LTM 1350-6.1, the LTM 1400-7.1 and Liebherr 9-axle mobile cranes. Winch 2 with its adjustment block for luffing jib operation can be installed quickly since it is secured direct to the ballast frame.



A telescopic boom reaching (almost) up to the moon

And that is quite a long way up. Around 384,000 kilometres on average, to be exact. The LTM 1450-8.1 can manage a telescopic boom length of 85 metres – which is unique in this crane class. It is also extremely powerful as crane driver Roland Richter from BKL Baukran Logistik found to his satisfaction.

After a set-up time of just two hours, he dismantled a 75 metre high construction crane using his new 450-tonne mobile crane – a new record. The whole thing was only possible due to the 85 metre telescopic boom. Rainer Speich, BKL Site Manager in Ingolstadt, confirms: "The long telescopic boom enables us to reduce the set-up time and also means we do not need an auxiliary crane or truck." But that was not the only reason behind the purchase of the LTM 1450-8.1. He goes on: "The crane is incredibly flexible due to VarioBase® and VarioBallast®. We can get it into narrow alleys where previously the best we could offer was a 200-tonne crane."

Various lattice jibs extend the flexibility of the crane for any hoisting work. The folding jib is up to 35 metres, the fixed lattice jib up to 56 metres and the luffing lattice jib up to 84 metres in length.

"The long telescopic boom enables us to reduce the set-up time and also means we do not need an auxiliary crane or truck."

Rainer Speich, BKL Site Manager in Ingolstadt

Crawler cranes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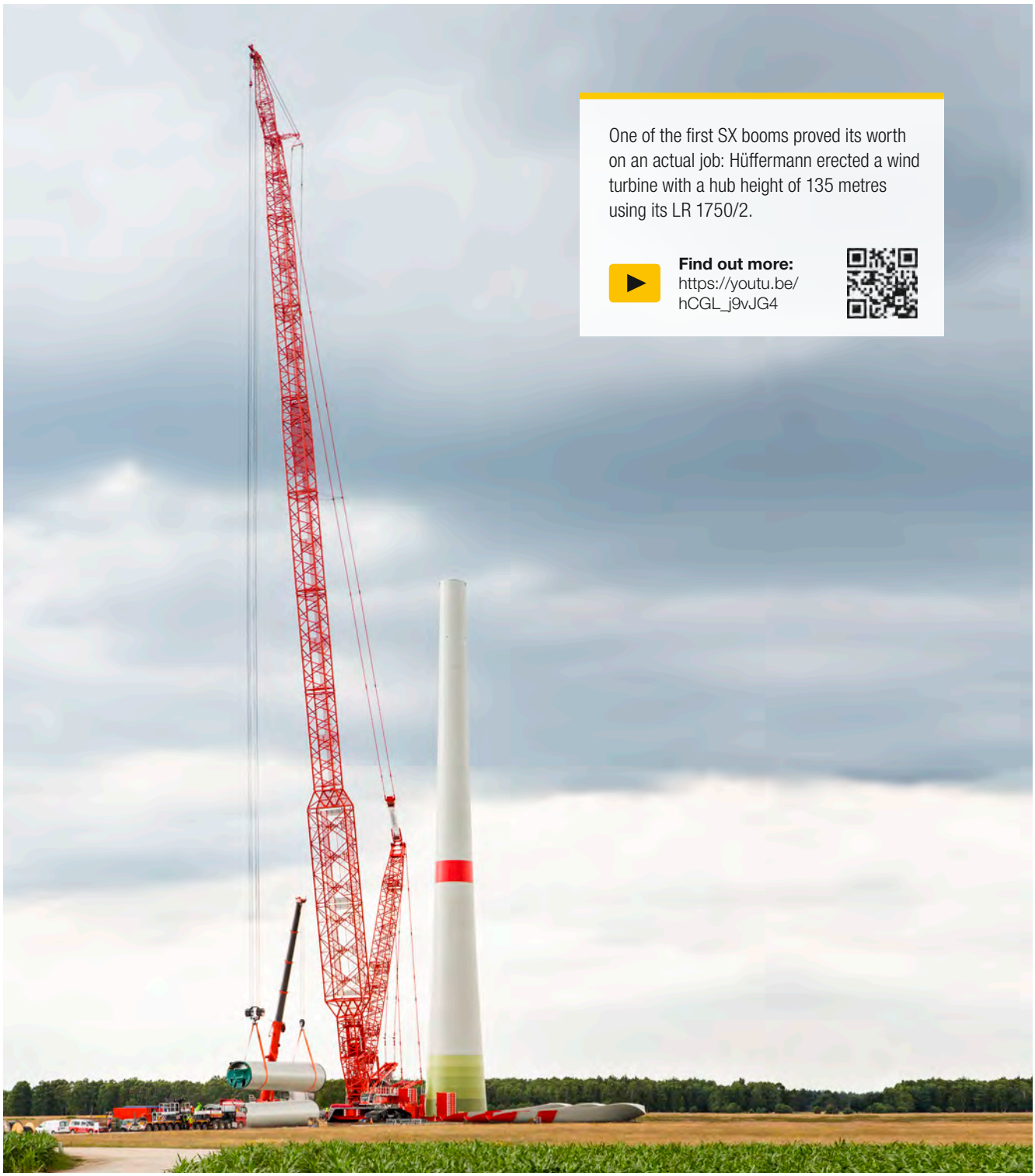
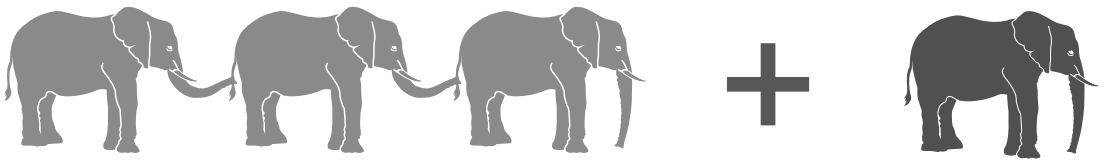
Not a vision, a visionary

With its new SX boom system, Liebherr has achieved a significant performance upgrade in terms of hoist height and lifting capacity for its LR 1750/2 and LG 1750 lattice boom cranes.



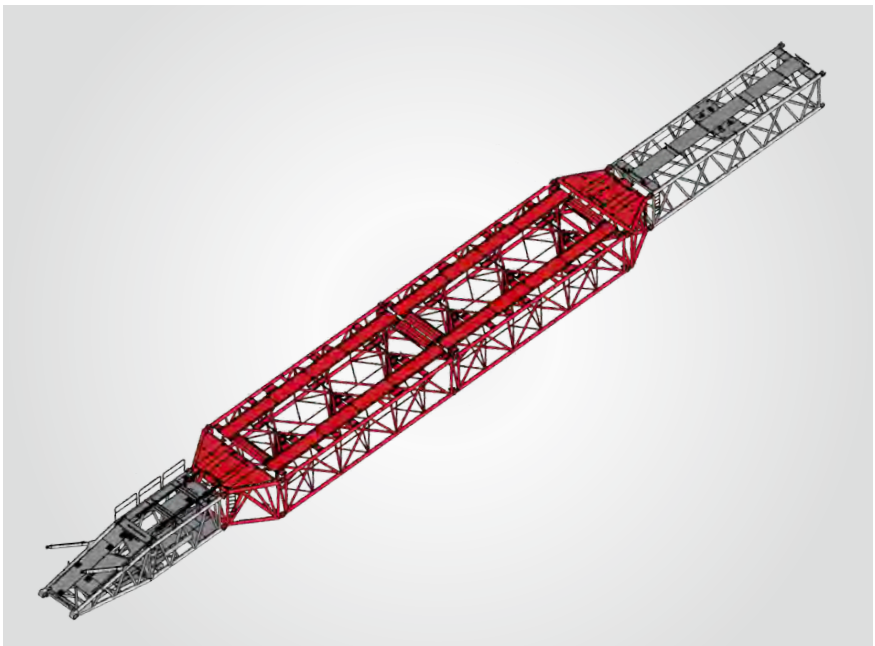
One of the first SX booms proved its worth on an actual job: Hüffermann erected a wind turbine with a hub height of 135 metres using its LR 1750/2.

Find out more:
https://youtu.be/hCGL_j9vJG4

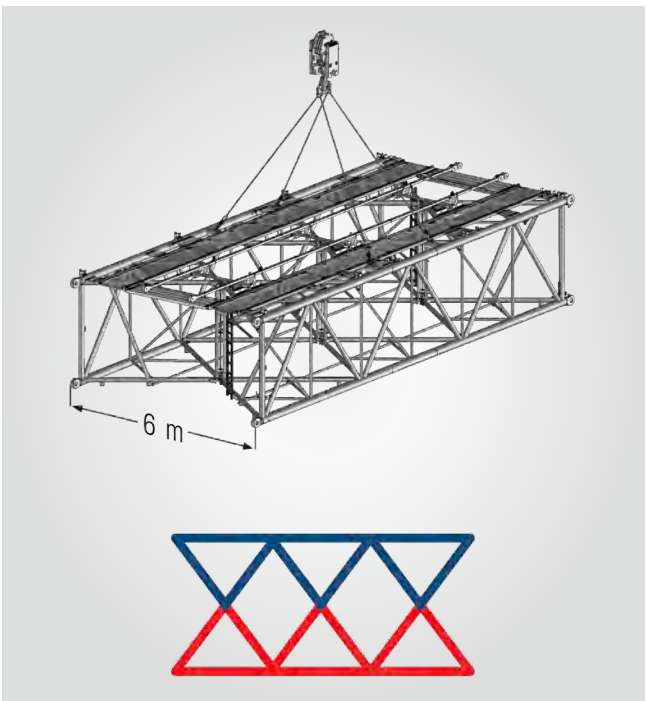


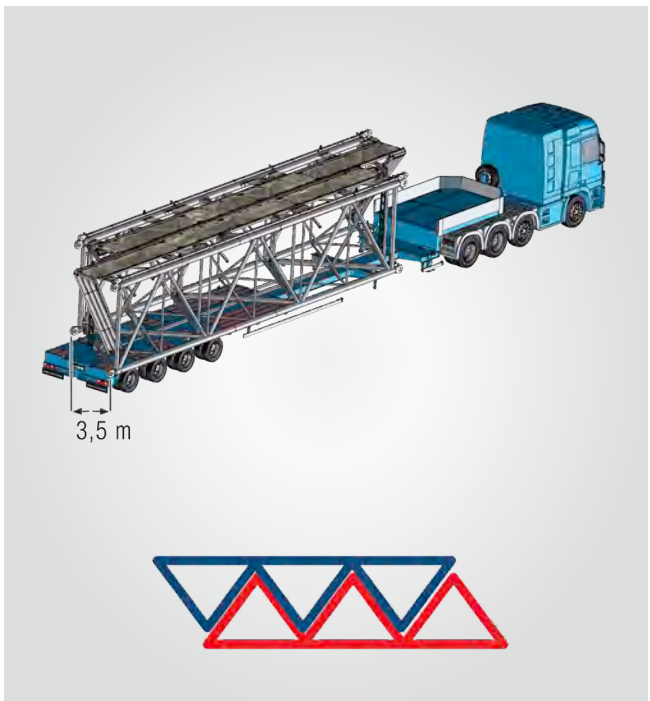
30 percent higher lifting capacity

For the SX boom, lattice sections measuring 3.5 metres wide rather than 3 metres are fitted to the bottom section of the main boom on crane models LR 1750/2 and LG 1750. The SX2 and SX3 versions are additional extensions. With these, two or three lattice boom sections 6 metres wide and 14 metres long are fitted to the bottom section of the main boom. "The SX2 stabilises the boom and produces a massive increase in lifting capacity", confirms Heiner Kluck, a crane driver at Hüffermann Krandienst. "That is particularly good for turbines which have a hub height of 150 to 160 metres." The improved lifting capacity values raise the 750-tonne cranes to the next higher class with a lifting capacity of around 1000 tonnes.



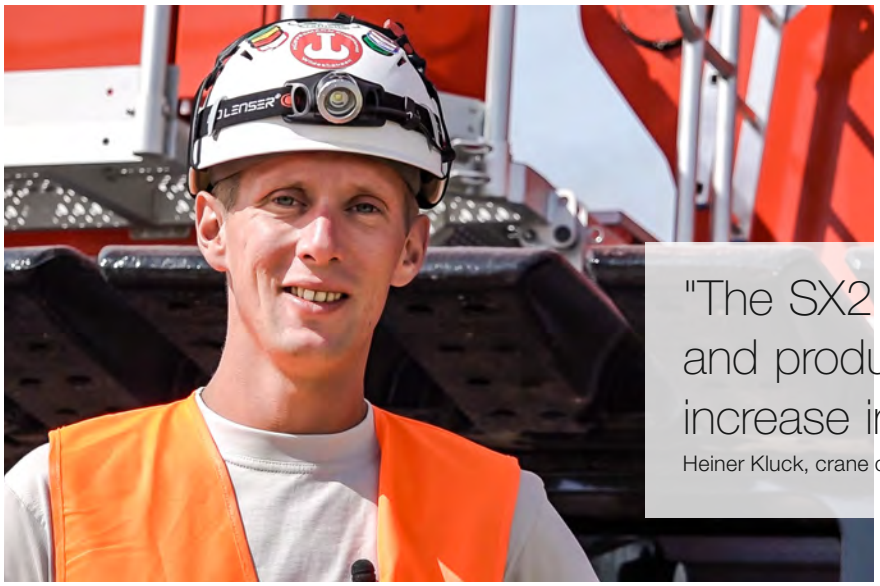
So what is the secret? During transport all the lattice sections remain within the low cost width of 3.5 metres. For this purpose the 6 metre wide boom sections were designed in two halves which are bolted in the centre. For transport they are put together so that they engage in each other like gear wheels. This enables them to be transported efficiently all over the world.





Fit for the future

Daniel Janssen, Managing Director at Hüffermann, was one of the first owners of an LR 1750/2 with the new boom. "Actually, at Hüffermann we were not previously involved in the crawler crane business", he explains with a smile. But the company from Wildeshausen near Bremen has a clear strategy: "We love innovations which prepare us for future areas of business such as wind energy. The SX2 boom enables our LR 1750/2 to achieve peerless lifting capacity values." Crane driver Heiner Kluck is also delighted and, after using the new system a few times, commented: "The crane reacts very delicately and sensitively. The controller is fantastically easy to use!"



"The SX2 stabilises the boom and produces a massive increase in lifting capacity."

Heiner Kluck, crane driver at Hüffermann

Faster, higher, further?

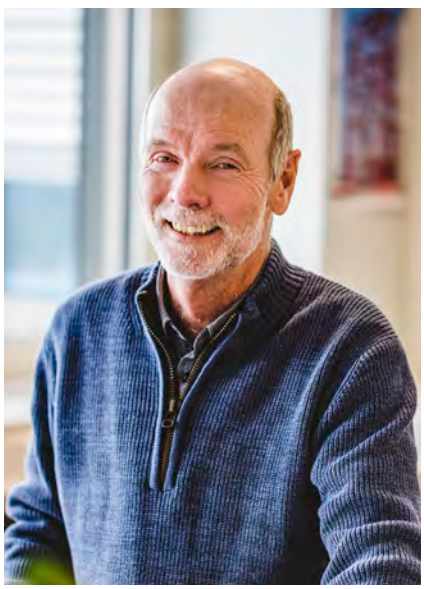
We are not trying to break any records. Our aim is to find the best solution for you. The best is difficult to define. It is different for everybody. But perhaps faster, higher or further is exactly what we all want? In any case efficiency gets you a long way if you want to get better or stay better.

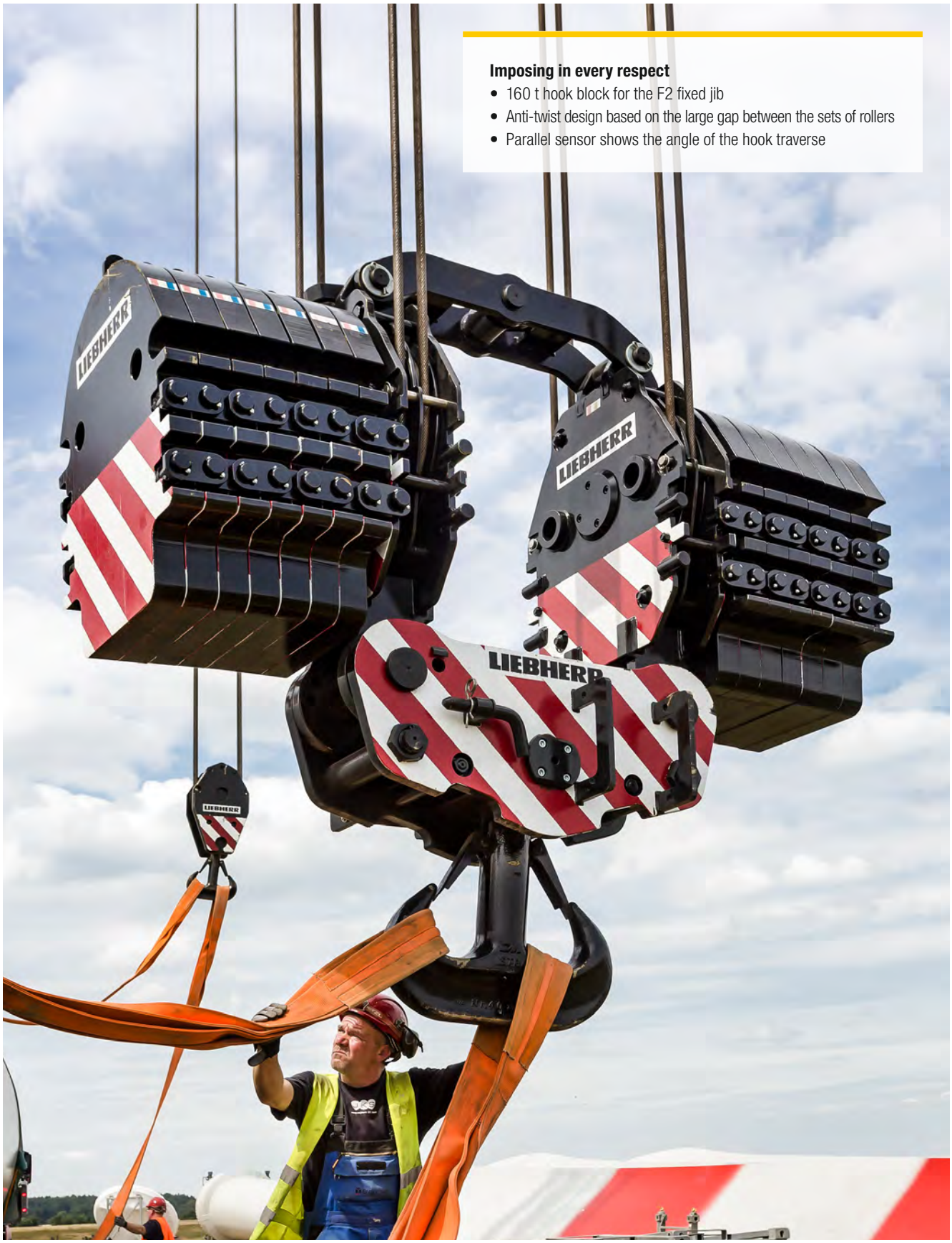
But what exactly is efficiency? Achieving a great deal with few resources. Low cost for us is also low cost for you. Generally the environment also benefits from these low resource ideas. But they require more than just the will to find them. They need expertise, intelligence, combined forces and the courage to approach something from a different perspective.

"Sometimes you have a vision and that gut feeling that the idea is a really good one. After you play around with it a little with your colleagues, it can turn into a highly promising concept," says Uwe Frommelt, Crawler Crane Design Department Manager. When he talks about how the SX boom started, he can say one thing for certain: "As it turns out it is now clear to everybody that it is a really fantastic design."

"The increase in lifting capacity is significantly higher than the required investment."

Uwe Frommelt,
Crawler Crane Design Department Manager





Imposing in every respect

- 160 t hook block for the F2 fixed jib
- Anti-twist design based on the large gap between the sets of rollers
- Parallel sensor shows the angle of the hook traverse

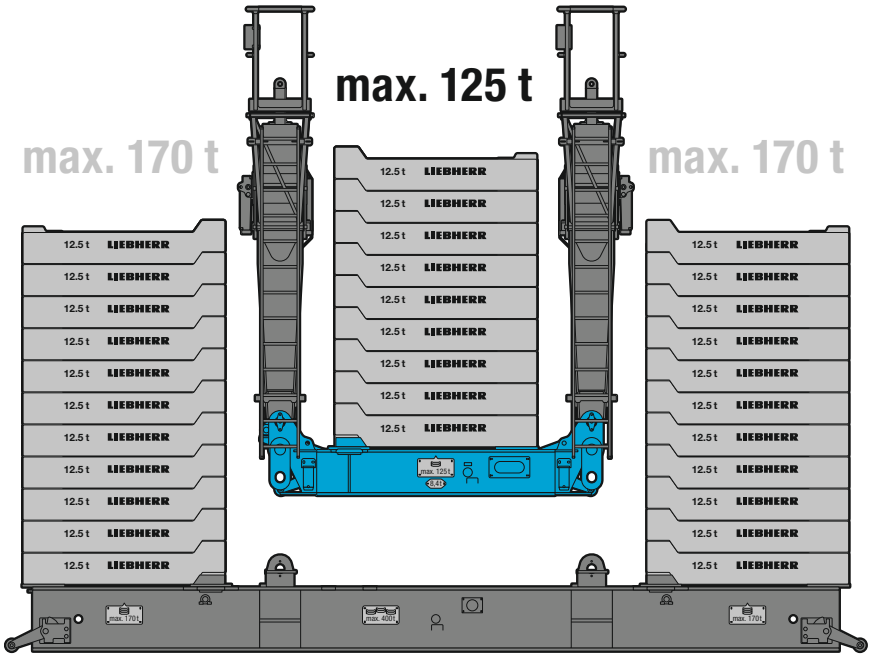
Slow ballast? You've got to be joking

See you later, time wasters

Unbolting rather than unstacking: The innovative VarioTray® ballast system enables the central section of the suspended ballast to be simply unbolted. The result is a massive increase in flexibility and significantly less work on site.

An idea becomes reality, progress is here and the future is now. Everything comes together. Ideas are often whispered to us from the market. We heard "The suspended ballast is too inflexible". An example: A long boom is required to erect wind turbines with heights of 160 metres being far from rare. The boom is assembled on the ground and then raised. Everything

stands and falls with the laws of physics: The law of leverage explains why we need a high counterweight to get this long boom into the air. Once the boom is upright, the suspended ballast sinks to the ground. The crane is fixed in position and cannot be moved. However, that is rather impractical for follow-up hoists. The ballast slabs then have to be unstacked individually until the correct counterweight has been reached. The hoist can take place, the wind turbine in our example can be erected. And then? We restack the ballast slabs so that we can lower the long boom correctly and safely. But all that takes time. And time is money.



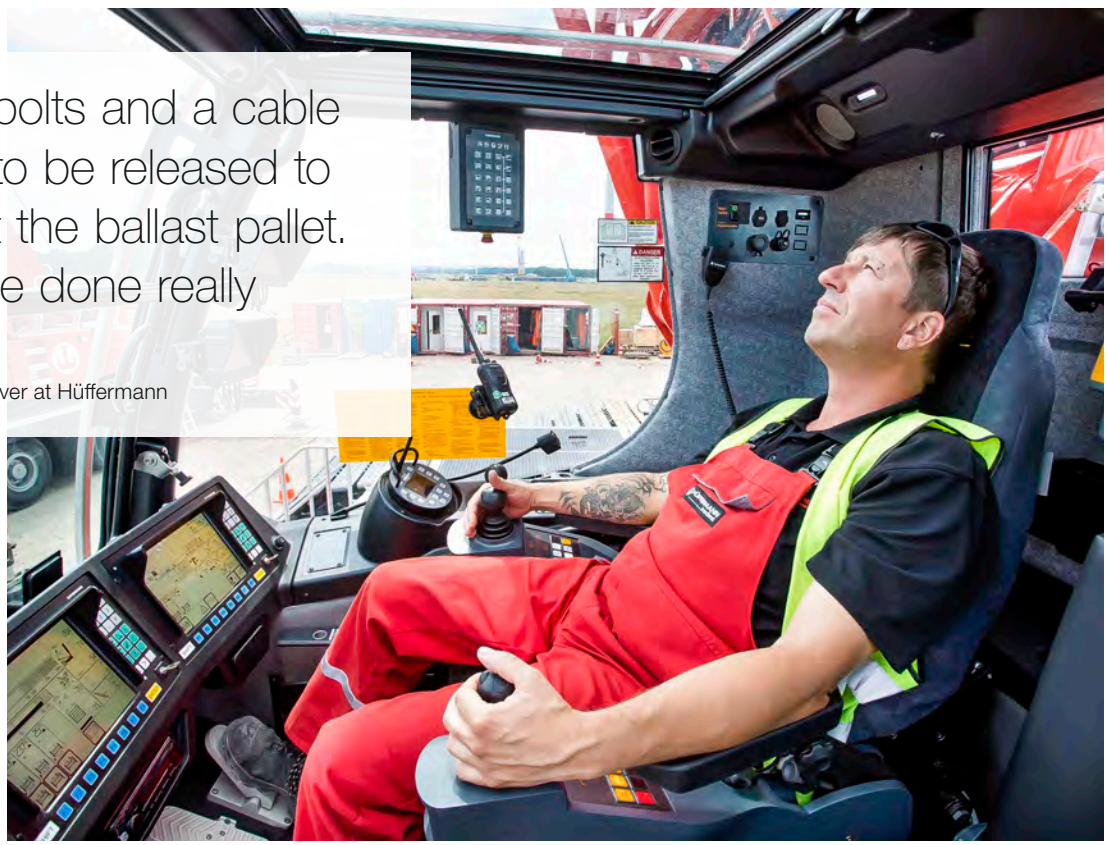
Interested? VarioTray® is available for the LR 1600/2, LR 1750/2 and LR 11000 crawler cranes and the LG 1750 lattice boom mobile crane.

Our solution: VarioTray®

We have an elegant solution for these cases. VarioTray®. A short name for a smart concept. A smaller ballast pallet is docked on the centre of the large ballast pallet. After the boom has been raised the small pallet is unbolted. The large, heavy part remains in place whilst the smaller part is still suspended on the derrick boom. This makes it easy to work with. And the ballast can be bolted back into place to lower the boom. Hüffermann Krandienst has already tested the system on its LR 1750/2 crawler crane. Crane driver Sven Jakobs says: "Without VarioTray® it would definitely have taken us three to four hours longer to erect the wind turbine. What a great idea!"

"Only four bolts and a cable plug have to be released to disconnect the ballast pallet. That can be done really quickly."

Sven Jacobs, crane driver at Hüffermann



Off to new shores

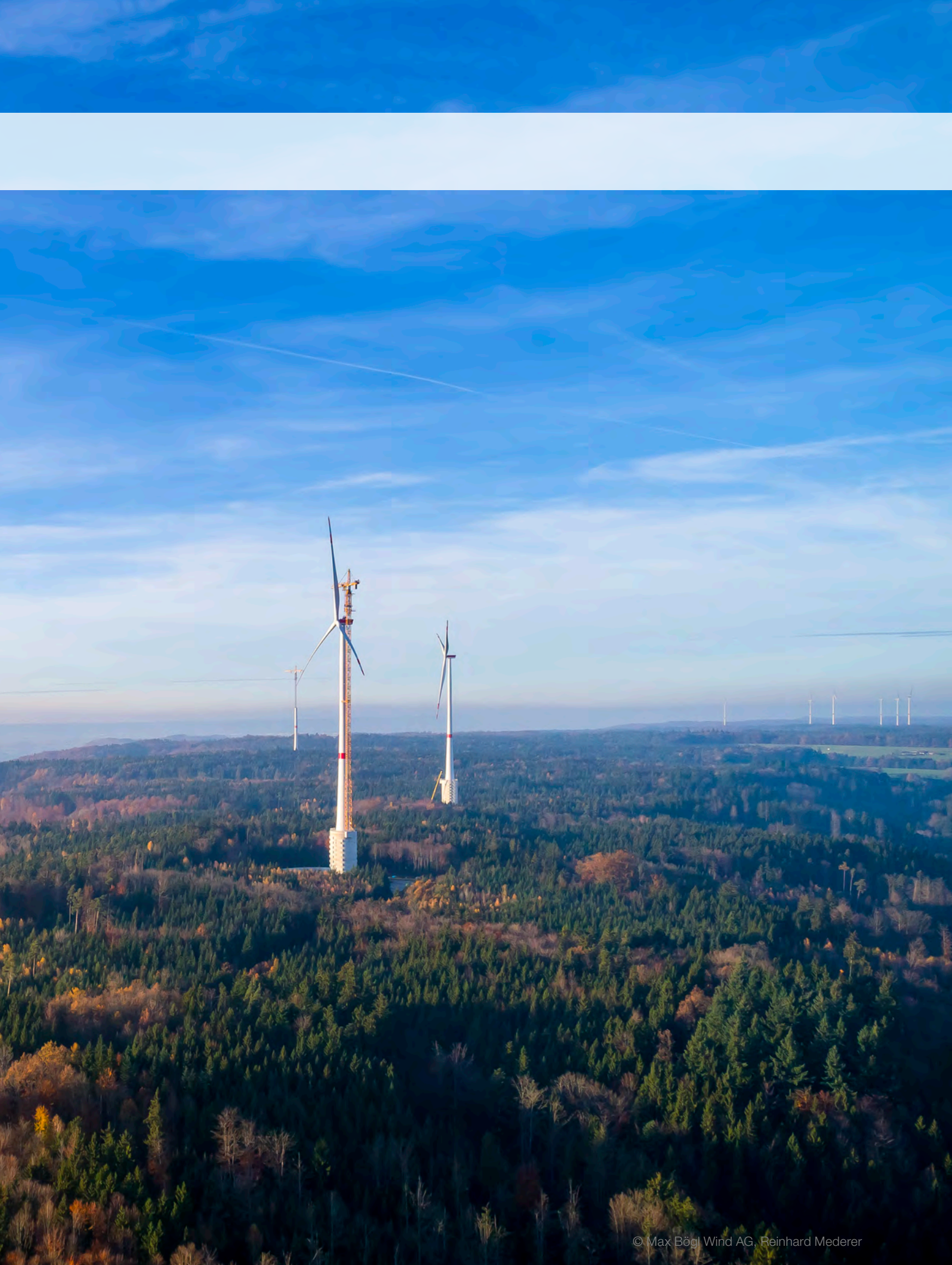
Michael Egger knows all about mobile cranes. He and his brother Markus are the third generation to manage the Swiss company Emil Egger AG, which specialises in cranes and heavy haulage. Until summer 2017, the company's fleet did not feature any crawler cranes at all. And then everything changed. Egger invested – and did so properly. The new LR 11000 is now the most powerful crawler crane in Switzerland. "We are really proud of our new flagship! It is the most modern crane in this class and is incredibly flexible. VarioTray® just adds to that." You can see the enthusiasm on Egger's face as he talks. He goes on: "And we know that we can rely on Liebherr's great service."

The first job for the new 1000-tonne crane was a large newbuild in Zurich. For six months the crawler crane assembled reinforced concrete girders and heavy façade parts with various weights between 25 and 58 tonnes and radii ranging from very small to very large. VarioTray® was absolutely ideal for this job. A set-up crane would have been hard-pressed to find any space on the constricted site. And the alternative of a ballast trailer would have significantly increased the ground pressure – which would have meant making a special concrete slab. Edgar recalls: "VarioTray® really paid dividends on this job. We did not have to stack and unstack the individual ballast slabs for the various hoists. That saved us lots of time and lots of money."


12.5t LIEBHERR

Easy work
The small ballast pallet is simply unbolted. The large part, which is only required to raise and lower the boom, remains on the ground.

The world with Liebherr



Energy revolution 2.0 – the green electricity storage facility

One of the most exciting systems of the future in the energy revolution is currently being constructed near Schwäbisch Hall. The "Gaildorf green electricity storage facility" pilot project sees wind turbines combined with a decentralised pumped-storage power plant make green energy storable for the first time, making it available flexibly. Liebherr mobile and tower cranes are involved in the construction of the facilities.

Full concentration. Everybody is looking up. You could hear a pin drop on the site. Slewing freely, the Liebherr 630 EC-H 70 Litronic tower crane hoists the rotor blade which measures almost 70 metres long and weighs 17 tonnes. Very slowly. Right up to the hub of the wind turbine at a height of 178 metres.

Never before has a wind turbine of this size been built. Crane drivers Wilhelm Lepertz and Georg Brodwolf therefore took on this challenge together up in the tower crane. Four eyes can see more than two. They are in contact with Thomas Ziegenbein by radio. The Wind Installation Project Manager at international construction contractor Max Bögl is the direct link between the crane drivers and the ground crew which is responsible for securing and controlling the suspended components with ropes from inside the forest. All of them are concentrating hard. The only sound that can be heard around the site are the radio messages being sent between the site manager and the cabin. There is a great sense that a piece of engineering history is being written today.

An important pilot project for global energy supplies

The energy revolution is currently being taken to a whole new level in Gaildorf, in the Swabian-Franconian Forest on the Limpurg Hills. The Wind Division of international construction contractor Max Bögl is not only erecting the highest onshore wind turbine in the world, measuring 246.5 metres, but the water battery (a completely new, decentralised energy storage technology) is also the very first of its kind with its four wind turbines. "The water battery is a combination of the wind farm and a pumped-storage power plant. This enables wind power to be stored, controlled and above all supplied when it is actually needed in the power network," explains Overall Project Manager Johannes Kaltner. The active and passive tanks at the foot of the wind turbine store the power. They will later be connected by a pressurised pipeline to the water reservoir of the bottom tank with the pumped-storage power plant between them. "The installation work for the water pipelines will start in spring," says Kaltner.

During the construction of the facilities in Gaildorf, the mobile and tower cranes combined closely. However, crane driver Ralf Karras and his LTM 11200-9.1 mobile crane initially started work on building the active tank on their own. The job at that time for him was to hoist the 22 tonne quarters of the bottom concrete shells off the low loaders, assemble them on the crane assembly area and install them into the facility with one 88 tonnes hoist. It was not until the active tank at an altitude of 40 metres was in place that the tower crane could be erected on this foundation. Karras received a total of 22 truckloads, six of which were heavy haulage trucks. "I hoisted the first crane modules using my LTM, then the tower crane erected itself using its special self-climbing hydraulic system", says Karras. Now, on an ongoing basis, Karras "only" has to position the large, awkward components for his colleague up in the crane to pick up easily.

Karras comes from Berlin and is a passionate crane driver. Using the joystick he controls his enormous LTM 11200-9.1 mobile crane which he has christened "Hercules" out of respect. And there is a very good reason for this. The 9-axle Liebherr mobile crane has one of the longest telescopic booms in the world at 100 metres and delivers a maximum lifting capacity of 1200 tonnes. "I always dreamt of becoming a crane driver. It involves massive power and capacity with years of experience and fingertip control. My crane and I make a great team, staying calm and relaxed when things are happening up in the air."

Crane driver Ralf Karras from Max Bögl has christened his LTM 11200-9.1 "Hercules" out of respect.

Hand-in-hand with Mother Nature

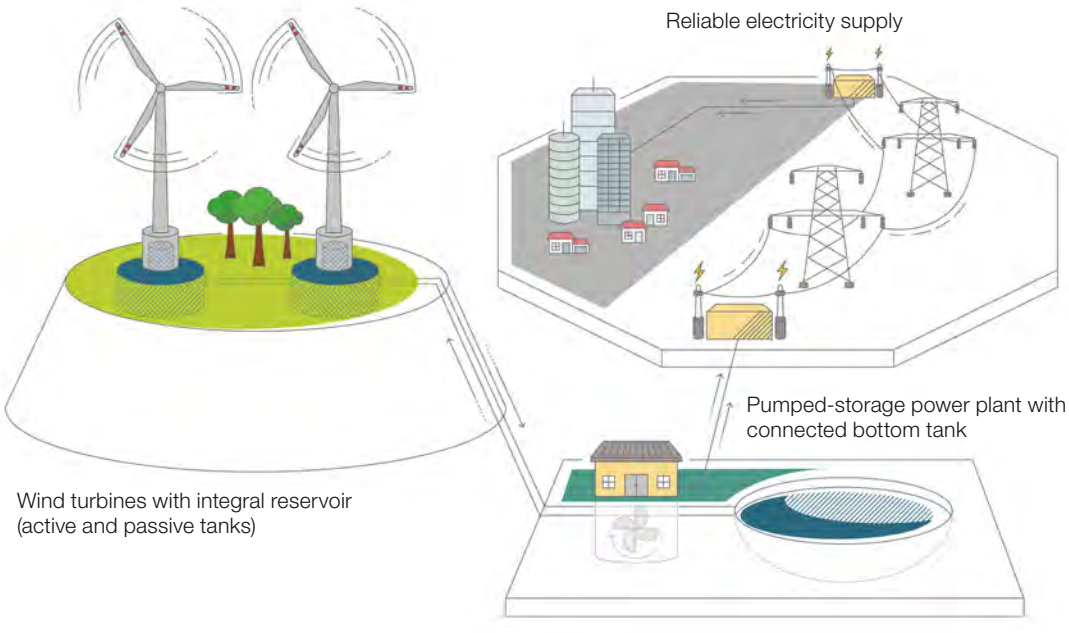
Since the foundation stone was laid in April 2016, around 35 tradesmen have been working full-time in Gailsdorf. It is the attraction of innovations and finding out what is technically feasible which continues to drive his team, says Johannes Kaltner. "The fact that this site represents a whole new chapter of the energy revolution is not an everyday occurrence, even for experienced wind power professionals", says Kaltner.

Erecting four wind turbines in the middle of a forest is not just a technical challenge, but also a logistical one. There is no space in the forest for large storage areas. "Therefore our logistics team has to deliver on a just-in-time basis. At the foot of the system there is only space for one rotor blade to be hoisted", says Thomas Ziegenbein. After that the mobile crane has to get to work again and hoist the next heavy blade from the site access road over the treetops and move it into position. "The hard work is worthwhile", says Ziegenbein. "When we have gone, Mother Nature will quickly reclaim the whole area."

The Gaildorf green electricity storage pilot project

Each of the wind turbines has a rating of 3.4 megawatts. A total of 160,000 cubic metres of water will be used to store the energy in the active and passive tanks. The reservoir is connected to the generator in the pumped-storage power plant by underground pressurised pipelines. When the wind blows, the electricity that cannot be fed into the network is used to pump the water into the wind turbines' integral reservoir. If the wind is not blowing, the water is released downhill to drive the turbines in the pumped-storage power plant. This means that the wind farm can continue to generate electricity on a reliable, plannable basis and feed it into the network.

The combination of wind and hydroelectric power ensures the uniform, planned supply of households, business and industry with green electricity. The annual electricity generation in Gailsdorf from the wind may be up to 42 gigawatt-hours.



"The fact that this site represents a whole new chapter of the energy revolution is not an everyday occurrence, even for experienced wind power professionals".

Johannes Kaltner, Overall Project Manager

Find out more:
www.liebherr.com/
greenenergystorage

The fascination of models

From really big to absolutely tiny. The world of models has a particular attraction and fascinates almost everybody. Models of all types of vehicle are particularly popular. Bavarian company Conrad was one of the first professional model making companies and has been producing models for Liebherr for almost 50 years. In an interview, Günther Conrad and his daughter Christine give us an insight into the world of miniatures.

Christine Conrad

Mr and Mrs Conrad, you grew up in this industry. Can you explain in a few words the attraction and passion for model vehicles?
Christine Conrad: I think the fascination is that models are a source of calm. I can hold the model, get a feel for its weight and its contours, I can look at its functions and its details. Models take you to a whole new world. They are toys, but very special ones. Models can slow life down. At the same time, one of the attractions is that you can look at the entire machine in miniature at a glance. Where the models are of large machines, it is very imposing how long for example the boom is even when it has been reduced to the scale of the model. The boom on the LG 1750 model, for example, reaches a height of 4.20 metres. It is very impressive that the whole thing actually does not tip over.

Günther Conrad: There is also the passion for collecting models. Enthusiasts even regard the model packaging as being a high value item since it is regarded as an integral part of the model itself. Many fans keep their models in the boxes and whilst they take them out to look at them every so often, they do not actually build them.

Please tell us a little bit about your company and its history.
Günther Conrad: My father Ludwig Conrad started the company in 1956 in Kalchreuth near Nuremberg manufacturing electrical components. Initially he also produced electronic model railway accessories as a hobby. In 1970 he then took over the long-established Nuremberg toy company Gescha which specialised in metal toys. The product range already included a model of the Liebherr R 961 excavator which was painted in bright colours for the toy market, but only enjoyed moderate sales success. Conrad changed the colours and painted the model so that it looked identical to the full-size version. And that proved to be a success – the toy became a collectors' item. Conrad was one of the first companies to enter this market – with Liebherr as a major customer.

Mr Conrad, when did you finally join the company?
Günther Conrad: I joined the company in 1971. In 1978 we stopped manufacturing electrical components and focused entirely on models. The same year I became a member of the management team and took over the company completely in 1987. My daughter Christine came into the company in 2007 and joined the management team in 2015.

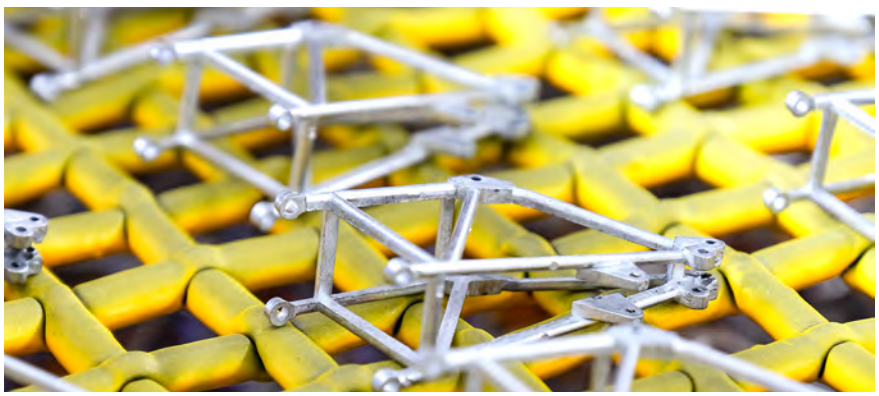
What are the special features of your company?
Christine Conrad: All models are of very high quality and functional. We value quality very highly. They are robust, have realistic functions and can also withstand the stresses of children's hands. At the same time we design and to be realistic with lots of fine, sophisticated details.

Günther Conrad

Günther Conrad: In contrast to other manufacturers, at the end of the nineties we did not relocate our production plant to China, and instead we made a conscious decision to remain in Germany. We have two companies in Kalchreuth which do

all the work, including design, mould making, zinc die casting, painting, production of the plastic parts and assembly. We opened an assembly plant in the Czech Republic in 2010, which supplies us with low cost, high quality labour. Our 90-strong workforce are all passionate about their work.

A plate thickness of 2 millimetres on the original machine cannot simply be reduced to the required scale since a minimum thickness of 1 millimetre is required for the die casting process. This means that the proportions change and the model must be redesigned so that it looks right.



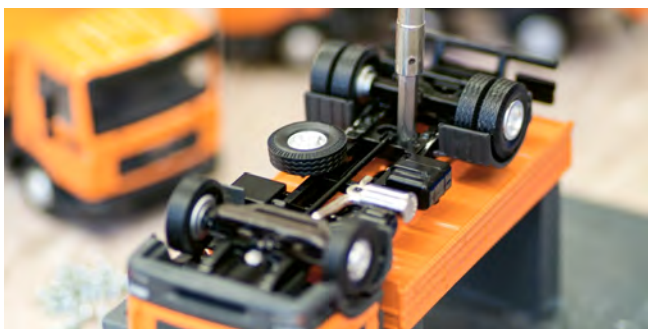
And what sort of relationship do you have with Liebherr? What was the first model for Liebherr and what is the latest one?
Günther Conrad: We have had a close partnership with Liebherr for almost 50 years. We are always delighted to make something for Liebherr and attempt to comply with all their wishes. In return, Liebherr helps us if we need anything. We have a direct, open and honest relationship with Liebherr.

Can you give us a few insights into the model production? How they are produced and using what materials? What are the challenges in the process?
Günther Conrad: Most of our miniatures are made of die-cast zinc. Zinc is a natural material which gives the model its weight and the feel of a robust construction machine. One disadvantage is the fact that the parts cannot simply be clicked together and instead have to be pinned, riveted or bolted. The production of every component requires a mould consisting of two halves in which the material is pressed using very high pressure.

Christine Conrad: The design is based on the original 3-D data for the machine. However, the data cannot simply be reduced to the required scale and instead has to be redeveloped and restructured. Our designers adjust lots of details manually to give the model an appearance identical to the full-size machine. An example:

Christine Conrad: We made the first crane for the Liebherr Plant in Ehingen for the Bauma in 1977. That was an LT 1100. The latest crane is a rough-terrain crane, the LRT 1100. The 1070-4.1 is a bestseller. We make it with over forty different paintwork versions for different customers.

Models with special paintwork are often highly sought-after. What are their special features?
Christine Conrad: Special paintwork often has its own attraction and really catches the eye. For customers, too, it is very important. One has have to be aware, however, that models are produced on a mass scale. Special paintwork, adjustment processes, colour sampling and the like mean additional costs. The plastic parts also have to be specially finished in the appropriate colour. If a customer purchases 100 units we can offer special paintwork if we can incorporate the production run in our series production. If we cannot do the two together due to deadline pressure, the minimum order quantity is 250 units.



Extending service life

My Tip

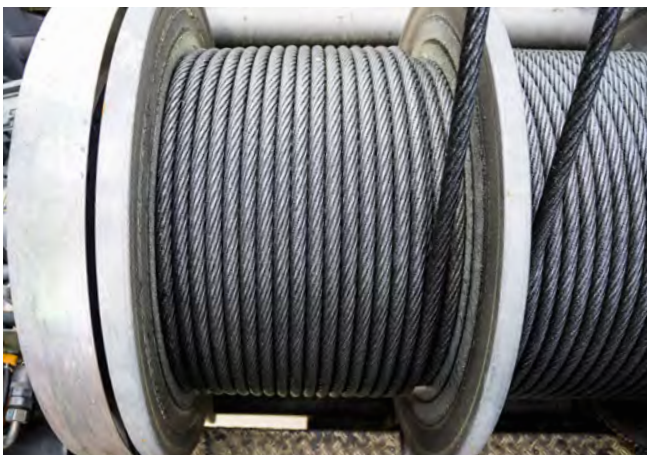
A hoist rope has a tense life – in every sense of the word. Harald Rieger explains how to take care of a rope so that it lasts longer. He is a customer service technician with 17 years experience with cranes and works in Ehingen and all over the world.

"Up and down, high and low – with a massive load on the hook or sometimes with very little on it. The hoist rope on a crane is subject to constant stress and completes a range of tasks. Although variety is the spice of life, it means a great deal of stress for the hoist rope. Rope care is very important to ensure that the rope is not allowed to go over its load limit. This enables the service life of the rope to be significantly extended. One major point is that the hoist rope should be regularly coiled up with adequate tension. This is not difficult, nor does it take lots of time. Furthermore, the process can often be completed during down times on the site. The rope is then neatly coiled on the winch so that there is no risk of cutting into the layers beneath.

"Try it. It's really worthwhile!"

Harald Rieger, Customer Service Fitter

During my work in many countries around the world I have found that calculating the tension and coiling up the rope is not easy to explain in words. In fact, the whole process is really not difficult once you have seen it done. That is why we have made an information film – How to extend the service life of hoisting ropes. Take a look at it, and if you have any questions simply get in touch with your Liebherr partner."

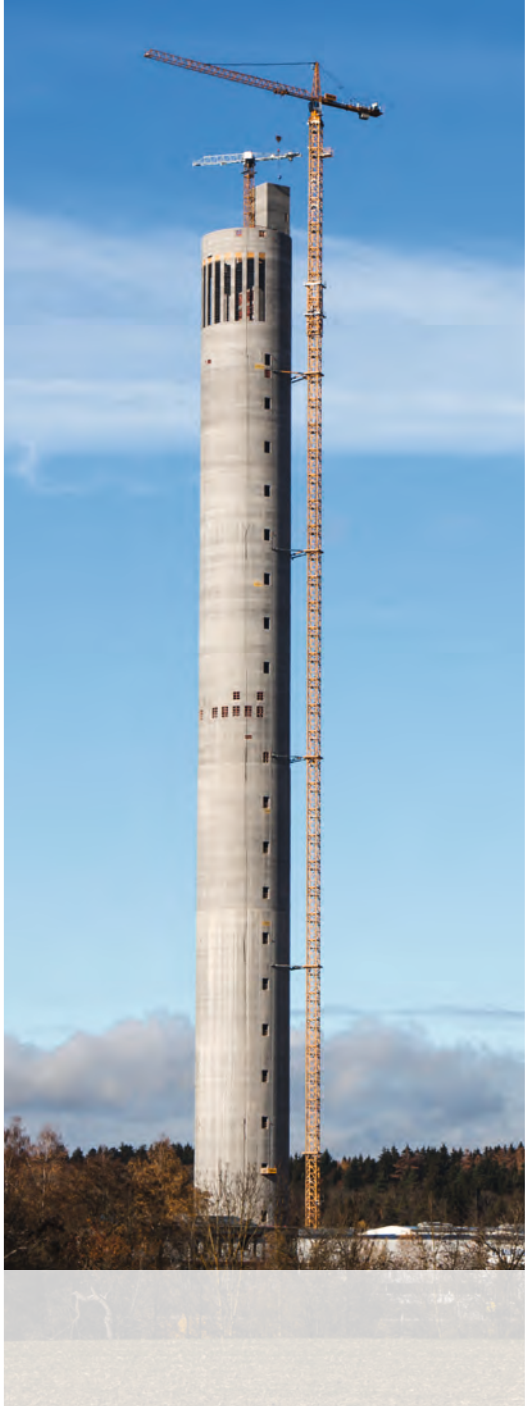


Hoist rope perfectly coiled

Cutting into the rope must be avoided at all costs.

Find out more:
www.liebherr.com/
training-mobile-cranes


A perfectly coiled hoist rope is an absolute must for erecting wind turbines and in particular for replacing heavy components.
© Andreas Vallbracht



The Liebherr Group

The Liebherr Group recorded the highest turnover in its history in 2017 at €9,845 million.

Turnover development differed widely in the various regions. In the main sales region for Liebherr of Western Europe, turnover rose dramatically. This was due, among other factors, to renewed growth in Germany, the largest market for Liebherr, and positive development in France. Turnover in Great Britain remained at the same level as the previous year.

On the other hand, turnover development in Eastern Europe, particularly in Russia, was very pleasing. In Poland, however, turnover fell. In the Far East, Australia and America, revenues were also above the previous year's levels. Falls were recorded however, in the Near and Middle East and Africa.

Employee numbers once again rose in 2017. The Liebherr Group employed a total of 43,869 people around the world. This corresponds to a rise of 1561 or 3.7 % compared to the previous year. Workforce numbers at Liebherr companies will once again increase slightly in 2018.

Regular investments in production plants and the global sales and service network have always been very important for the Group. During the past year, the Group invested €749 million, which corresponds to a slight fall of 0.3 %. This was countered by depreciations of €485 million. The Group will continue to invest heavily in its global production plants and its sales and service network.

According to current forecasts, the global economy will grow even more this year than last. The dynamic will particularly increase in threshold and developing countries whilst economic growth in the industrial countries will remain at the same levels as the previous year. The Group is expecting turnover to rise further during 2018. Liebherr is expecting positive development in both the Construction Machinery and Mining Divisions and in the other product divisions.

Find out more:
www.liebherr.com

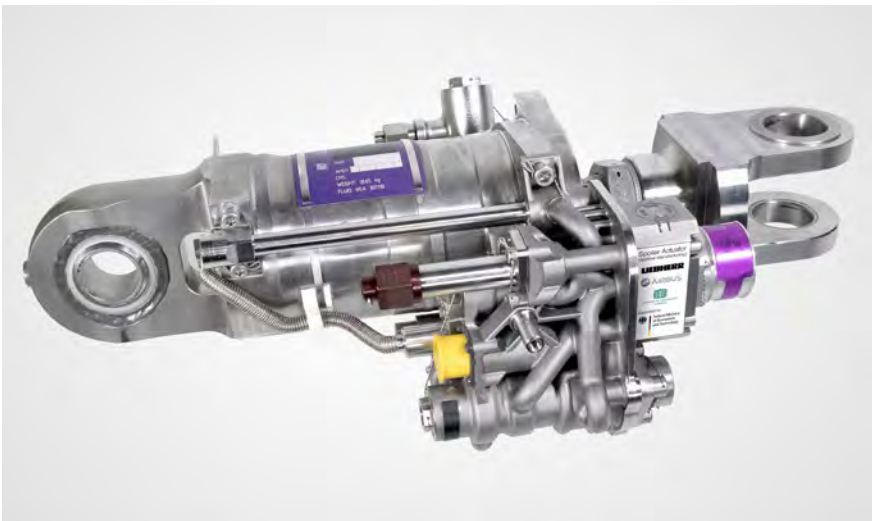
Aerospace

Aerospace components from a 3-D printer

World première: In March 2017 an Airbus A380 flew a test flight for the first time with a titanium valve block from the 3-D printer at Liebherr-Aerospace. Never before has a hydraulic component from the primary flight controller, made of titanium powder, been used in an Airbus.

The valve block is part of the spoiler actuator supplied by Liebherr-Aerospace and is responsible for several important functions on board the A380, for example for manoeuvring the aircraft and decelerating it after landing. The 3-D printed component is just as capable as a conventional titanium valve block but has two outstanding advantages – it is 35% lighter and is made of fewer individual parts. In addition the production process is less complex and extremely material-efficient compared to the conventional milling process. Fine titanium powder is melted using a laser and welded in layers to form a component with only small quantities of titanium waste being produced.

© Airbus



Liebherr-Aerospace developed the hydraulic component in close collaboration with Airbus and the Technical University of Chemnitz. The project was partly funded by the Federal Ministry for Economic Affairs and Energy. The first test flight with a three-D printed hydraulic component in the primary flight controller demonstrated that Liebherr-Aerospace and Airbus are pioneers when it comes to future development and production processes for aircraft systems. Their continuous investments in the research and development of 3-D printing are now visibly bearing fruit.

Earthmoving

Time-tested technology with enormous potential

The new Liebherr L 507 and L 509 stereo loaders celebrated their global première at the Intermat 2018. Their launch meant that the latest series of stereo loaders is now complete, comprising a total of four models with operating weights between 5.5 and 9.2 tonnes. Liebherr stereo loaders feature stereo steering which has proven its worth for the last 20 years. This steering system, which was developed in-house, delivers a significantly smaller turning circle compared to other articulated wheeled loaders. The new L 507 and L 509 models feature a large driver's cabin and intuitive control. They make life on site easier with lots of useful new ideas such as the improved Z kinematics.

The L 507 and L 509 stereo loaders are among the largest all-rounders in Liebherr's range of wheeled loaders. They produce outstanding work in landscaping and for local councils with high productivity. They can tackle earth moving or preparation work on sites. Their powerful hydrostatic travel drive unit delivers lots of power. To order, both models can be supplied in a "Speeder" version. This enables the wheeled loaders to reach a top speed of 38 km/h. That saves operators time and enables them to relocate their stereo loader from one job to the next quickly.

The stereo steering developed by Liebherr in 1994 is still unique. The stereo steering is an ideally balanced combination of articulated steering and a steered rear axle. This combines the benefits of a conventional articulator steering with those of all-wheel steering. The result is a tiny turning circle which is particularly useful on small sites. The steered rear axle enables the Liebherr engineers to reduce the articulation angle of the stereo loaders to 30 degrees. As a result the centre of gravity remains in the centre of the machine even when transporting large loads thus increasing its stability.

Household Appliances

The digital future of freshness

Digitalisation and the networking of household appliances are very trendy subjects at the current time and are changing the expectations of consumers. In the future, the focus will not just be on the purchase of a single refrigerator and freezer but on the smart interaction of networked solutions to simplify household work and deliver greater comfort and ease to the kitchen. Liebherr always focuses on maximum customer benefit and supplies digital offerings and services which will deliver added value to customers in the future.

Liebherr refrigerators and freezers can network with mobile devices using a new generation of the SmartDeviceBox and not only tell consumers if the door is open or there has been a power failure – their innovative food management system is also available both at home and elsewhere. The food stored in the appliances can be recorded using cameras, for example. These not only show images but also detect the various pieces of food inside the appliance. This information is automatically recorded on an inventory list. This enables the customer to see quickly and easily everything that is in the refrigerator and what has to be put on the shopping list.

The app for iOS and Android also makes it possible to access the shopping and inventory list when the customer is away from home. Currently additional recipe recommendations are displayed using the Liebherr "FreshMAG" freshness magazine.

Maritime cranes

Hybrid rope excavator with a load capacity of 300 t at work

The HS 8300 HD from Liebherr with its impressive 300-tonne load capacity is one of the largest hydraulic rope excavators in the world. This power pack has been dredging in the port of Piombino in Italy since summer 2017. The water depth in the entrance to the port has fallen to just 8 m in some places due to deposits of sediment over the last few years. The work not only involves removing the sediment deposits but also excavating to a greater depth of 14 m to ensure that larger vessels can enter the port in the future. The project work in Piombino is scheduled to last 6 months and is being carried out by Italian dredging specialist Zeta S.r.l.

Zeta S.r.l. assembled the HS 8300 HD without crawler tractors on its new dredging ship, the Maria Vittoria Z. The total capacity of the vessel is 3000 t of material. Its large grab capacity and short work cycles of just 45 seconds means that the Liebherr rope excavator can handle 2000 t of material per hour. That means that the Maria Vittoria Z. can be fully laden in less than 2 hours. The excavated material is being used profitably in the immediate vicinity to expand the port of Piombino.

Find out more:
https://youtu.be/e57rm5AoQjI

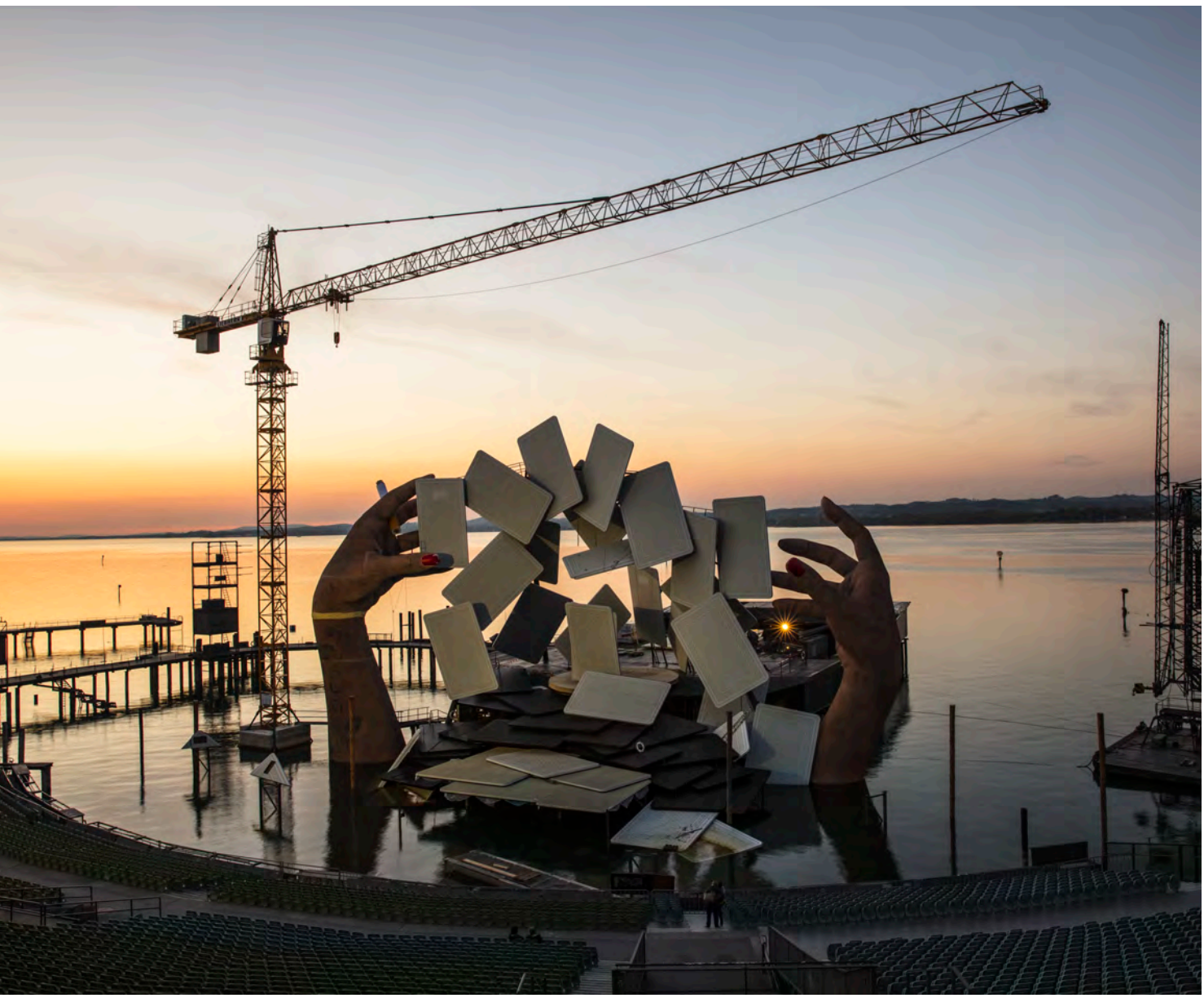
Tower cranes

Technology meets art

Liebherr is the Construction Partner of the Bregenz Festival. Two Liebherr tower cranes – a 154 EC-H 6 Litronic and a 71 K – built the stage set for the opera Carmen measuring 43 metres wide and 24 metres high. The impressive set comprises two giant women's hands, each consisting of around 190 individual parts, a steel framework and 59 cards. Each card is 30 square metres in size and weighs around 2.5 tonnes.

The larger crane, the 154 EC-H 6 Litronic, was assembled in August 2016 immediately next to the lake stage in the water on so-called pilots. These wooden piles were driven into the bed of Lake Constance to provide the foundation for the crane. The crane itself operated with a hook height of 33 metres and a maximum radius of 60 metres. Its maximum lifting capacity is 6000 kilograms.

The 71 K quick-erection crane has been used regularly since the year 2000 as a reliable all-purpose hoisting machine. It was assembled on a floating pontoon measuring 15 by 13 metres so that it can be moved to where it is actually required.



Mining

New 100-tonne T 236 mining truck

The new T 236 mining truck with a rigid frame and diesel-electric power unit marks the entry of Liebherr into the 100-tonne class. It sets new standards in terms of power, maximum operating times and particularly low running costs. All the components of the truck have been developed to ensure long term rugged use in extreme mining conditions.

The truck has a wide range of special design features to deliver major benefits during use which have hitherto been unknown. Here are two examples.

Whilst other trucks in the class have a mechanical power unit, the T 236 uses the benefits of an innovative electric power unit, the so-called Litronic-Plus-Generation-2-AC. This system delivers a constant torque to the rear wheels, regardless of the engine speed and travel speed. This eliminates annoying load change influences on gearshifting. Furthermore, the diesel engine in this system can be used to assist the brakes, which has a positive effect on energy consumption and brake wear.

And there is plenty more to say on the subject of brakes – the T 236 is the first diesel-electric heavy duty truck in its class with wet multi-disc brakes (brakes in an oil bath) on both the front and rear axles. In contrast to standard dry brakes, the wet system enhances braking performance on long downhill stretches, delivers a longer service life and therefore results in generally lower maintenance costs over the entire life-cycle of the truck. This all has a positive effect on operational reliability, mechanical availability and the costs of the machine.

Since it was first unveiled at the MINExpo 2016 in Las Vegas, the T 236 has successfully completed its test phase and started its first field work at Erzberg Eisenerzbergwerk in Austria in autumn 2017.

Find out more:
www.liebherr.com/erzberg

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| 1 | Liebherr LTM 1050-3.1 mobile crane. 1:50 scale replica of the 50 t class all-terrain mobile crane. Zinc die-cast model from WSI. Length: around 20 cm. **Part No.** 10652277 **Price: €108.00**

| 2 | Bedlinen. Two-piece flannelette bedlinen set consisting of a duvet cover and pillowcase with construction machinery motifs. 100 % cotton in flannelette quality. Ökotex 100-certified. Washable at 60 degrees. Made in Germany. Main colour: White Size: 135 x 200 cm, pillow 80 x 80 cm. **Part No.** 12219216 **Price: €32.90**

| 3 | Liebherr LRT 1100-2.1 rough-terrain crane. Scale miniature replica of the highly mobile 100 t rough-terrain crane on a scale of 1:50. Zinc die-cast model from Conrad. Length: around 20 cm. **Part No.** 12203025 **Price: €167.00**

| 4 | Polo shirt. Sporty polo shirt in black. Comfort fit. With 3-button placket and denim detail. Ribbed sleeve with narrow grey contrast stripe. Material: 100 % cotton (polo pique). Sizes: S - 3XL. **Size / Part No.** S / 12217321 M / 12217322 L / 12217323 XL / 12217324 XXL / 12217325 3XL / 12217326 **Price: €35.00**

| 5 | Children's cap. Trendy black children's with large badge and decorative embroidery. Embroidered air holes. Universally adjustable with Velcro fastening. Material: 100 % cotton. Size: Standard size from around 4 years of age. **Size / Part No.** 11839169 **Price: €6.50**

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