Solutions for Deep Foundation Work
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Deep Foundation Processes

Drilling

Liebherr’s deep foundation machines can be applied for all common drilling processes. These include Kelly drilling, continuous flight auger drilling, full displacement drilling, double rotary drilling, grab drilling and down-the-hole drilling. The appropriate process is chosen in accordance with the prevailing ground conditions or depending on the required depth and/or diameter of the borehole.

The drilled cavity can be used for many purposes, for example to install a so-called cast-in-place pile when filled with fresh concrete. Precast concrete and steel elements serving as load-bearing or support elements can also be inserted.

**Kelly Drilling**

As the most common drilling process, Kelly drilling is suitable for almost all types of soil and rock. Relatively short drilling tools and telescopic Kelly bars, which facilitate large drilling depths, are distinguishing features of this process.

**Continuous Flight Auger Drilling**

This process is used for pre-drilling as well as for the installation of cast-in-place piles. The loosened soil is constantly conveyed using a continuous flight auger.

**Full Displacement Drilling**

Full displacement tools are frequently used for the production of cast-in-place piles. The soil is displaced by a smooth casing with an auger starter piece and only a small amount is conveyed to the surface.
Double Rotary Drilling
For this process the casing and auger (inside the casing) are simultaneously inserted and subsequently extracted. It is used for the production of cast-in-place piles and for pre-drilling.

Down-the-Hole Drilling
Down-the-hole drilling involves a hammer that is activated through compressed air and driven into the ground rotating and impacting simultaneously. A flushing current conveys the loosened drill cuttings to the surface. This method is mainly applied for rock and/or for penetrating large boulders.

Grab Drilling
Grab drilling is a common process which loosens the ground with a cutting or impacting action depending on the tool used. Duty cycle crawler cranes are equipped with either a pile grab, a chisel or special tools.
Pile Driving

With pile driving, so-called piling elements can be installed in the ground and extracted again. Common piling elements include steel profiles and piles made of reinforced concrete or timber.

Nowadays, mainly sheet pile walls for supporting or securing purposes, as well as foundation piles or cut-off walls are produced using the various pile driving processes. The erection of quay facilities in port construction presents difficult conditions and requires particularly heavy piling work with long piling elements. For this purpose, mainly powerful duty cycle crawler cranes with lattice booms and special leader systems are used.

Pile driving processes are divided into two categories, namely impact driving and vibrating.
Impact Driving

The piling elements are installed dynamically. An hydraulic hammer, usually mounted on a piling rig with leader, impacts on the piling element with the aid of a drop weight. Impact driving is used for the same applications as vibrating, whereby the hydraulic hammers currently available are able to transfer much higher dynamic forces.

Vibrating

High frequency vibrators with variable static moment have especially low noise and vibration levels when operating. The piling element is set into harmonious oscillation. Thanks to the weight of the vibrator and pushing with the help of the crowd system, the piling element can be installed in the ground.
Slurry Wall Installation

Slurry walls are wall structures, which are installed deep into the ground and made of concrete or reinforced concrete. They have a static and/or sealing function. Trenches are excavated in panels, and a support fluid, usually bentonite suspension, prevents the soil around the trenches from caving in.

In the single-phase process a self-hardening suspension remains in the trench. In the two-phase method the support fluid is pumped out of the trench and simultaneously replaced, for example with concrete, after the final depth has been reached. In the combined process, additional precast concrete elements, steel elements or sealing panels are inserted in the suspension before it hardens.

The powerful Liebherr duty cycle crawler cranes are used as carrier machines.

Mechanical Slurry Wall Grabs
Mechanical grabs are the most common excavation tools used for slurry wall installation. They are opened and closed via rope. Trenches up to a depth of 50 metres are possible.
Solutions for Deep Foundation Work

Hydromill

Slurry wall hydromills are suitable for great depths and particularly when very hard ground conditions prevail. In the process the soil is loosened and crushed by a cutter head on the lower end of the guide frame. The loosened material is continuously pumped to the surface in the support fluid.

Hydraulic Slurry Wall Grabs

Hydraulic slurry wall grabs are opened and closed via hydraulic cylinders. This facilitates extremely high closing forces. Additionally, they can be fitted with flexible guiding strips on the grab frame, which allow to align the grab within the trench.
Ground Improvement

This process involves the stabilization of the ground on the jobsite through treatment and/or the addition of other materials.

A number of processes are available for this purpose. Ground improvement means changing the natural properties of the soil with a view to meeting the constructional requirements of the jobsite. The natural load-bearing capacity of the ground to support construction loads is enhanced and/or the compressibility (settlement) of the ground is reduced.

Several different products can be installed for this purpose. These include various types of columns, retaining walls, cut-off walls and sealing slabs, as well as embankment and compaction structures.

Impact Compaction

A heavy drop weight is dropped from a height of up to 40 metres onto the ground which is to be compacted. This dynamic input of energy increases the density. Liebherr duty cycle crawler cranes facilitate efficient compaction thanks to free-fall winches and automatic control.
Wet Soil Mixing
For wet soil mixing the mixing tools rotate around the vertical axis of the mixing shaft. The tools break up the soil matrix and mix the suspension with the soil. The binding agents used are cement types mixed to a suspension by adding water.

Cutter Soil Mixing
For this process rotating wheels break up the ground structure. Simultaneously a self-hardening binding agent suspension is added. The wheels of the mixing tool rotate around the horizontal axis so producing soil mixing elements with a rectangular cross-section.

Deep Compaction Using Vibro-Flotation
With this process, non-cohesive ground is compacted using a vibro-flot. Through the vibration the soil grains change from their initial loose layering to a denser layering. A cylindrical compacted soil structure is created around the vibro-flot.

Deep Compaction Using Vibro-Replacement
A deep vibrator, fitted on a leader, compacts the ground through vibration and the simultaneous addition of a coarse extraneous material. Thus load-bearing gravel or crushed stone columns, which stabilize the ground, are produced.
Multiple Applications

The drilling rigs of the LB series are suitable for a wide range of applications in the deep foundation industry. In addition to the Kelly drilling process, they are also commonly used for the continuous flight auger, full displacement and double rotary drilling processes. Down-the-hole drilling is an exceptionally efficient method when working in hard ground or rock.
Liebherr presented its first drilling rig in the successful LB series, namely the LB 28, at the Bauma 2007. Today, the LB series consists of six models with torques between 200 and 510 kN.m. Depending on the process, drilling depths down to 120 metres and drilling diameters up to 4500 millimetres are possible.

The first battery-powered drilling rig in the world
The brand-new Liebherr model does not only have an alternative drive concept, it can be operated by battery without a cable, therefore: unplugged.

<table>
<thead>
<tr>
<th></th>
<th>LB 20.1</th>
<th>LB 25</th>
<th>LB 30</th>
<th>LB 35</th>
<th>LB 45</th>
<th>LB 55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>52.8 t</td>
<td>71.5 t</td>
<td>78.5 t</td>
<td>100.1 t</td>
<td>116 t</td>
<td>159 t</td>
</tr>
<tr>
<td></td>
<td>(116,404 lbs)</td>
<td>(157,630 lbs)</td>
<td>(173,063 lbs)</td>
<td>(220,683 lbs)</td>
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<td>(350,534 lbs)</td>
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<td>Max. torque</td>
<td>200 kN.m</td>
<td>250 kN.m</td>
<td>300 kN.m</td>
<td>347 kN.m</td>
<td>452 kN.m</td>
<td>550 kN.m</td>
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<tr>
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<td>(147,512 lbf-ft)</td>
<td>(184,390 lbf-ft)</td>
<td>(221,268 lbf-ft)</td>
<td>(255,934 lbf-ft)</td>
<td>(333,378 lbf-ft)</td>
<td>(405,659 lbf-ft)</td>
</tr>
<tr>
<td>Max. pull/crowd force</td>
<td>200 kN</td>
<td>300 kN</td>
<td>320 kN</td>
<td>400 kN</td>
<td>400 kN</td>
<td>560 kN</td>
</tr>
<tr>
<td></td>
<td>(44,962 lbf)</td>
<td>(67,443 lbf)</td>
<td>(71,939 lbf)</td>
<td>(89,924 lbf)</td>
<td>(89,924 lbf)</td>
<td>(125,893 lbf)</td>
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<tr>
<td>Max. drilling depth Kelly drilling</td>
<td>34.5 m</td>
<td>58.8 m</td>
<td>70.8 m</td>
<td>77 m</td>
<td>95 m</td>
<td>120 m</td>
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<tr>
<td></td>
<td>(113.2 ft)</td>
<td>(192.9 ft)</td>
<td>(232.3 ft)</td>
<td>(352.6 ft)</td>
<td>(311.7 ft)</td>
<td>(397.7 ft)</td>
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<tr>
<td>Max. drilling diameter Kelly drilling</td>
<td>1500 mm</td>
<td>3300 mm</td>
<td>3400 mm</td>
<td>4100 mm</td>
<td>4500 mm</td>
<td>4200 mm</td>
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<tr>
<td></td>
<td>(4.9 ft)</td>
<td>(10.8 ft)</td>
<td>(11.1 ft)</td>
<td>(13.5 ft)</td>
<td>(14.8 ft)</td>
<td>(13.7 ft)</td>
</tr>
<tr>
<td>Engine power</td>
<td>230 kW</td>
<td>320 kW</td>
<td>320 kW</td>
<td>390 kW</td>
<td>390 kW</td>
<td>565 kW</td>
</tr>
<tr>
<td></td>
<td>(308 hp)</td>
<td>(429 hp)</td>
<td>(429 hp)</td>
<td>(523 hp)</td>
<td>(523 hp)</td>
<td>(758 hp)</td>
</tr>
</tbody>
</table>
Characteristics

The drilling rigs from Liebherr are distinguished through a compact design meaning they can be efficiently transported and quickly mobilized on the jobsite. Their powerful diesel engines convince with both low fuel consumption and low emissions. User-friendly rotary drives allow for high torques. Designed for continuous operation the drilling rigs achieve fast working cycles.

**Leader Design**
The leader is rigid and fitted with a wide leader profile, on which all winches are directly mounted. Thanks to this robust and rigid construction, it can resist high torques and transfer high pull forces through the Kelly winch and the rope crowd system.

**Safety Concept**
The drilling rigs have a consistent safety concept that includes railings and walkways as well as an installation for winch inspection. The complete assembly and loading activities can also be carried out outside the operator’s cab with a radio remote control unit.

**Robust Steel Structure**
Drilling rigs are sometimes subjected to high stresses in deep foundation applications. These are taken into account in the steel structure of the machines of the LB series. Through optimum force transmission low wear and a long service life is achieved.
**Drive System**
The complete drive system including engine, pumps, distributor and on-board hydraulics comprises Liebherr components. These are perfectly harmonized and so achieve a high efficiency factor. This results in low fuel consumption, high drilling performance and, therefore, economic machine operation.

**Rope Crowd System**
The rope crowd system featuring extremely high pull and crowd forces contributes to the excellent performance of the Liebherr drilling rigs.

**Parallel Kinematics**
Thanks to the leader system’s proven parallel kinematics the drilling rigs have a large working range and, at the same time, work precisely.

**Swing Ring**
The drilling rigs are equipped with a triple-row roller bearing ring which increases the stability of the machine when in operation. Thanks to an optimum adjustment of the tooth flank clearance only a minimum clearance exists between the uppercarriage and undercarriage.

**Small Swing Radius**
The machines in the LB series have a relatively small swing radius.

**High Stability**
The long crawlers give the undercarriage a high level of stability and durability while minimizing the ground pressure.
Since the end of the 1990s, Liebherr in Nenzing develops and manufactures a range of combined piling and drilling rigs. Today, the series has three models, which perfectly cover the various requirements of our customers.
Piling and drilling rigs from Liebherr are deployed for various applications on the jobsite. A typical application for smaller models is the vibration of sheet pile walls. The LRB 355 was specially developed for drilling with full displacement tools. It is also suitable for all further common drilling applications as well as operation with hydraulic hammer or vibrator.

**Wide Range of Applications**

<table>
<thead>
<tr>
<th></th>
<th>LRB 16</th>
<th>LRB 18</th>
<th>LRB 355.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>50 t (110,231 lbs)</td>
<td>52 t (114,640 lbs)</td>
<td>95 - 109 t (210,762 - 239,863 lbs)</td>
</tr>
<tr>
<td>Leader length</td>
<td>12.8 m (42 ft)</td>
<td>15 m (49.2 ft)</td>
<td>22 / 27 m (72.2 / 88.6 ft)</td>
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<tr>
<td>Max. pull/crowd force</td>
<td>200 / 150 kN (44,962 lbs / 33,721 lbs)</td>
<td>200 / 150 kN (44,962 lbs / 33,721 lbs)</td>
<td>400 kN (89,904 lbs)</td>
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<tr>
<td>Max. torque rotary drive</td>
<td>120 kNm (88,507 lbs-ft)</td>
<td>120 kNm (88,507 lbs-ft)</td>
<td>450 kNm (331,903 lbs-ft)</td>
</tr>
<tr>
<td>Engine power</td>
<td>390 kW (523 hp)</td>
<td>390 kW (523 hp)</td>
<td>600 kW / 750 kW (805 hp / 1005 hp)</td>
</tr>
</tbody>
</table>
Characteristics

With the LRB series Liebherr offers its customers combined piling and drilling rigs for a diverse range of applications on the jobsite. The universal machines are characterized by both high performance and efficiency as well as reliability. Easy transportation and quick set-up are only two fundamental characteristics for the flexible application of the LRB machines on jobsites. For example, the leader can simply be folded backwards during transportation and does not need to be dismounted.

**Innovative Leader Design**
The leader absorbs large torque and is fitted with a rope crowd system for high pull and crowd forces. All winches are mounted directly on the leader meaning it is not necessary to shift the ropes when adjusting the inclination or radius of the leader.

**Parallel Kinematics**
A large working area is possible thanks to the parallel kinematics. At the same time the leader can thus be folded back.

**Robust Undercarriage**
Thanks to an extremely solid undercarriage the machines in the LRB series have excellent stability and low ground bearing pressure.
Modular Leader Top
The leader top can be appropriately equipped for the actual application. Both the radius and the rope lead-off are adjustable.

Auxiliary Winch
The LRB machines can also be used for lifting work thanks to an auxiliary winch on the leader top. It is possible to swing the auxiliary winch around 270°. Furthermore, the radius can be adjusted.

Compact Uppercarriage
Despite their high performance the machines in the LRB series have a compact uppercarriage. This results in a relatively small swing radius and therefore efficient work in restricted spaces.

Supports
Thanks to both rear and leader supports the undercarriage can be elevated and swivelled on the spot. This is of particular benefit in restricted spaces. Moreover, the supports provide more stability during operation.
Attachments and Drilling Tools for the LB and LRB Series

Rotary Drive (BAT Series)
The powerful rotary drive delivers the torque for many different drilling applications. A major advantage is the automatic torque regulation. Thanks to its continuous speed optimization it can be flexibly adjusted to suit the prevailing ground conditions on the jobsite. The Kelly shock absorber can be adjusted to suit the weight of the Kelly bar.

Double Rotary Drive (DBA Series)
Secant drilled piles and foundation piles can be installed using double rotary drives. The inner continuous flight auger is driven independently from the casing by two separate rotary drives. The compact design allows for work in close proximity to buildings (front-of-wall drilling).

Rotary Drives for DTH Drilling
Liebherr offers special rotary drives which are used for applications with DTH hammers (down-the-hole hammers). Through shift and folding functions these can be adapted to the respective requirements.

Hydraulic Hammer
Liebherr’s own H series of hydraulic free-fall hammers comprises seven types with a maximum impact energy of 225 kNm. These are guided on the leader when installed on Liebherr’s piling and drilling rigs. Through the mounting of modular drop weights the hammers can be perfectly adapted to the particular piling requirements.

High Frequency Vibrator with Slim Design
The powerful high frequency vibrators are particularly easy to maintain, mainly due to a new cooling system and also the use of state-of-the-art components. Thanks to the symmetrical layout and linear guiding of the vibrator energy loss is minimized.

Ring Vibrator
The ring vibrator allows for the installation of pipes that project beyond the leader. When installing a cast-in-place vibration pile the vibrator does not have to be detached from the pipe during reinforcement and concreting work.
**Mixing Drives (MA and MAT Series)**

Should the piling and drilling rigs be required for soil improvement processes mixing drives are used. These are characterized through their compact design. The MAT series is designed for mixing using single mixing equipment. On the other hand, the MA series is modularly designed and can be fitted with single, double or triple mixing equipment.

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**Casing Oscillators**

Hydraulic casing oscillators of various sizes can be attached to the basic machines. These are driven by the on-board hydraulics of the carrier machine. Together with the robust design of the casing oscillators this facilitates efficient operation on the jobsite.

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**Drilling and Mixing Equipment**

Tools are available for displaceable, mixable, loose and densely layered soil types, as well as for rock. They offer a high level of performance, low wear as well as a long service life.

<table>
<thead>
<tr>
<th><strong>Kelly Drilling</strong></th>
<th>![Kelly Drilling Icon]</th>
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</thead>
<tbody>
<tr>
<td>• Drilling augers, drilling buckets, core barrels, cluster drills, cross cutters, belling buckets</td>
<td></td>
</tr>
<tr>
<td>• Casing drivers</td>
<td></td>
</tr>
<tr>
<td>• Double wall drill casings</td>
<td></td>
</tr>
<tr>
<td>• Cutting shoes</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th><strong>Continuous Flight Auger Drilling</strong></th>
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<tbody>
<tr>
<td>• Augers</td>
<td></td>
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<tr>
<td>• Auger starters</td>
<td></td>
</tr>
<tr>
<td>• Drill bits</td>
<td></td>
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<table>
<thead>
<tr>
<th><strong>Double Rotary Drilling</strong></th>
<th>![Double Rotary Drilling Icon]</th>
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<tbody>
<tr>
<td>• Augers</td>
<td></td>
</tr>
<tr>
<td>• Auger starters</td>
<td></td>
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<tr>
<td>• Casing drivers</td>
<td></td>
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<tr>
<td>• Single and double wall drill casings</td>
<td></td>
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<tr>
<td>• Cutting shoes</td>
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<table>
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<tr>
<th><strong>Full Displacement Drilling</strong></th>
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<tr>
<td>• Drive tubes</td>
<td></td>
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<tr>
<td>• Displacers</td>
<td></td>
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<tr>
<td>• Drill bits</td>
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<table>
<thead>
<tr>
<th><strong>Down-the-Hole Drilling</strong></th>
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</thead>
<tbody>
<tr>
<td>• Down-the-hole hammers</td>
<td></td>
</tr>
<tr>
<td>• Casing tubes</td>
<td></td>
</tr>
<tr>
<td>• Drill bits</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Wet Soil Mixing</strong></th>
<th>![Wet Soil Mixing Icon]</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mixing shafts</td>
<td></td>
</tr>
<tr>
<td>• Mixing equipment with paddles, blades or auger screws</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Cutter Soil Mixing</strong></th>
<th>![Cutter Soil Mixing Icon]</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Kelly bars and guides</td>
<td></td>
</tr>
<tr>
<td>• Mixing cutter head</td>
<td></td>
</tr>
<tr>
<td>• Cutter wheels</td>
<td></td>
</tr>
</tbody>
</table>
Application and Configuration Examples

Flexible Application on the Jobsite

The LB and LRB machines from Liebherr are available in different configurations and are highly flexible in their application depending on the prevailing conditions on the jobsite. Additional equipment is available as an option for drilled piles with very large diameters and great depths. This includes an extension of the drilling axis, additional counterweight, as well as a leader extension.
The drilling rigs can also be fitted with a shortened leader, therefore making them ideal for use on jobsites with height restrictions.

Through a lattice boom extension the drilling depth can be significantly increased when using the full displacement drilling process.
Concrete Technology

One-Stop Shop

Liebherr is a highly diversified complete provider of concrete technology developing and manufacturing high-quality truck mixers, mixing plants and concrete pumps. This enables economic manufacturing, as well as trouble-free transportation and installation of concrete.
Concrete Pumps

The trailer and crawler concrete pumps offer high conveyance output and low emissions. The pumps are especially suitable for the conveyance of concrete via concrete lines or concrete distribution systems. Innovative pump units, the hydraulic system and state-of-the-art control ensure extremely cost-effective operation of the concrete pumps.

Thanks to an integrated solution, the main parameters of the concrete pump can be controlled from the control panel in the operator’s cab of the deep foundation machine. This means the machine operator has control of the concreting process, which leads to safer and more efficient jobsite assignments.

Flexible Application
The crawler concrete pumps require minimum space, are quickly set up and can be positioned anywhere on the jobsite.

High-Pressure Concreting
High concrete conveyance ensures quick cycles when installing cast-in-place piles.

Designed for tough everyday operation
Whether 40°C in Dubai or severe winter in Russia, they are designed for worldwide operation.
Piling Rigs
LRH Series

Flexible Piling Application

The piling rigs in the LRH series are suitable for jobs involving the installation of piling elements in widely varied types of soil. Liebherr’s piling rigs are the first choice especially when very large radii and extreme angles are required. Depending on the requirements, the carrier machine is selected from the successful series of Liebherr duty cycle crawler cranes, crawler cranes or drilling rigs, which are fitted with stable leader systems.
Efficiency on the Jobsite

Combined with a stable leader the piling rigs convince with excellent performance characteristics and flexibility. Thanks to the sophisticated hydraulic system of the carrier machines, equipment such as vibrators, hammers or rotary drives can be operated without an additional power pack. This leads to significant savings in running costs and underlines their reputation as highly efficient machines.

<table>
<thead>
<tr>
<th></th>
<th>LRH 100</th>
<th>LRH 600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>66 t (145,505 lbs)</td>
<td>330 t (727,525 lbs)</td>
</tr>
<tr>
<td>Total height</td>
<td>24 m (78.7 ft)</td>
<td>52.6 / *60 m (172.6 ft / *196.8 ft)</td>
</tr>
<tr>
<td>Max. pile length</td>
<td>19 m (62.3 ft)</td>
<td>50 m (167.3 ft)</td>
</tr>
<tr>
<td>Max. weight of hammer</td>
<td>10.4 t (22,928 lbs)</td>
<td>35 t (77,162 lbs)</td>
</tr>
<tr>
<td>Max. drilling depth</td>
<td>12 m (39.4 ft)</td>
<td>51 m (167.3 ft)</td>
</tr>
</tbody>
</table>

* swinging leader
Characteristics LRH 600

Fixed leader

The LRH 600 can be characterized as ideal for heavy piling work with a large radius. The piling rig convinces with sophisticated leader kinematics which enable a working radius of up to 15 m and a leader length of 51 m. Furthermore, backward inclination up to 14° and forward inclination up to 9.5° are possible. The leader’s lattice design provides a high level of stability. Depending on the requirements, the carrier machine is either the successful crawler crane type LR 1300, or the proven duty cycle crawler crane type HS 895 HD or its successor the HS 8200.

Vertical Travel Device

The leader is connected to the boom head via supporting tubes. This allows to change the leader height without influencing the leader inclination.

Kicker

Two compensation cylinders ensure that the leader is always parallel to the uppercarriage. This allows for maximum torque transmission of 320 kNm.
Swinging Leader

For this design, the leader hangs on a special traverse together with the attachment on a crawler crane or duty cycle crawler crane. This so-called swinging leader is especially suitable for installing long piling elements of up to 60 m, as well as for piling work with large inclinations. Therefore, the swinging leader is often used for marine constructions.

Applications

The LRH 600 is suitable for the most common deep foundation processes. In addition to pile driving with a hammer or a vibrator, these include drilling processes with continuous flight auger or down-the-hole hammer, as well as diverse soil improvement processes.

Easy Assembly

Pin connections allow for quick and easy assembly of the newly designed leader.
With this piling rig Liebherr offers its customers a compact machine with especially flexible leader kinematics. This allows for large radii as well as inclination in all directions. The LRH 100 is based on the LB 20-230, a proven drilling rig of the LB series. The design of this carrier machine enables quick and economic transportation, fully assembled with mounted hammer, so allowing for quick set-up on the jobsite. With the LRH 100 various types of timber, concrete or steel piles can be installed.

**Leader Kinematics**
Thanks to the special leader system, the LRH 100 achieves a radius of 8.75 m as well as a continuous inclination adjustment of 18° in all directions.

**Maximum Mobility**
The LRH 100 can erect and lower the leader independently (no auxiliary machines required) and it is transported with mounted hammer.
Attachments for the LRH Series

Hydraulic hammer (H series)
The hydraulic free-fall hammer from Liebherr is leader mounted. They achieve a maximum impact energy of 225 kNm. Through the mounting of modular drop weights the hammers can be perfectly adapted to the particular piling requirements. Thanks to their short and lightweight design they are user-friendly with regard to transportation and maintenance.

<table>
<thead>
<tr>
<th></th>
<th>Max. impact energy</th>
<th>Max. drop weight</th>
<th>Length of hammer</th>
<th>Max. pile length</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H 6</strong></td>
<td>72 kNm (53,105 lbf-ft)</td>
<td>6 t (13,230 lbs)</td>
<td>4268 mm (168 inch)</td>
<td>19 m (62.3 ft)</td>
<td>LRH 100</td>
</tr>
<tr>
<td><strong>H 15 L</strong></td>
<td>225 kNm (165,952 lbf-ft)</td>
<td>15 t (33,070 lbs)</td>
<td>6463 mm (254.4 inch)</td>
<td>50 m (164 ft)</td>
<td>LRH 600</td>
</tr>
</tbody>
</table>

Rotary Drive BAT 320
The Liebherr rotary drives in the BAT series are powerful and deliver high torque. Considerable advantages are the automatic torque regulation as well as four electronically adjustable speed ranges. The LRH 600 can be fitted with a BAT 320 for continuous flight auger drilling.

<table>
<thead>
<tr>
<th></th>
<th>Torque</th>
<th>Speed</th>
<th>Drilling depth</th>
<th>Max. drilling diameter</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BAT 320</strong></td>
<td>0-320 kNm (0 - 236,020 lbf-ft)</td>
<td>0-47 rpm</td>
<td>51 m (167.3 ft)</td>
<td>1200 mm (47.2 inch)</td>
<td>LRH 600</td>
</tr>
</tbody>
</table>

Pre-Drill BA 12
The pre-drill BA 12 is an attachment for the LRH 100. It is used mostly for pre-drilling prior to piling work.

<table>
<thead>
<tr>
<th></th>
<th>Torque</th>
<th>Speed</th>
<th>Drilling depth</th>
<th>Max. drilling diameter</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BA 12</strong></td>
<td>0-12 kNm (0 - 8,850 lbf-ft)</td>
<td>0-65 rpm</td>
<td>12 m (39.4 ft)</td>
<td>350 mm (13.8 inch)</td>
<td>LRH 100</td>
</tr>
</tbody>
</table>

Mixing Drive MA 35
Mixing drives are deployed when the LRH 600 is used for soil mixing in the course of soil improvement work. These are characterized through their compact design. The mixing drive MA 35 can be used for wet mixing with single, double or triple mixing equipment which can be modularly combined.

<table>
<thead>
<tr>
<th></th>
<th>1. Gear torque / speed</th>
<th>2. Gear torque / speed</th>
<th>Max. pull force</th>
<th>Max. mixing depth</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MA 35</strong></td>
<td>35 kNm / 62 rpm (25,815 lbf-ft / 62 rpm)</td>
<td>17.5 kNm / 124 rpm (12,907 lbf-ft / 124 rpm)</td>
<td>400 kN</td>
<td>51 m (167.3 ft)</td>
<td>LRH 600</td>
</tr>
</tbody>
</table>
In addition to machines purely for deep foundation work, Liebherr also offers a series of duty cycle crawler cranes which are deployed with appropriate attachments. The machines can be fitted, for example, with pile grabs and casing oscillators for drilling processes, slurry wall grabs or hydromills for the installation of slurry walls, as well as with drop weights for carrying out dynamic soil compaction.
Thanks to their robust design the HS series of machines is ideally suited to the demands of deep foundation work. The three duty cycle crawler cranes with lifting capacities between 70 and 130 tonnes are especially popular for deep foundation applications. Additionally, Liebherr also offers smaller classes of machines with lifting capacities below 70 tonnes, as well as two larger types with lifting capacities up to 300 tonnes. These machines are applied, above all, for material handling with dragline buckets or grabs, but are also sometimes applied for deep foundation work or marine construction.

<table>
<thead>
<tr>
<th>HS 8070</th>
<th>HS 8100</th>
<th>HS 8130.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max. capacity</strong></td>
<td>70 t (77 US t)</td>
<td>100 t (110 US t)</td>
</tr>
<tr>
<td><strong>Min. transport weight</strong></td>
<td>47 t (103,617 lbs)</td>
<td>40 t (88,185 lbs)</td>
</tr>
<tr>
<td><strong>Min. transport width</strong></td>
<td>3000 mm (9.8 ft)</td>
<td>3500 mm (11.5 ft)</td>
</tr>
<tr>
<td><strong>Max. drilling diameter</strong>*</td>
<td>1800 mm (5.9 ft)</td>
<td>2000 mm (6.6 ft)</td>
</tr>
<tr>
<td><strong>Max. drop weight</strong></td>
<td>19 t at 8 m radius (42,000 lbs at 26.2 ft radius)</td>
<td>25 t at 8 m radius (54,000 lbs at 26.2 ft radius)</td>
</tr>
</tbody>
</table>

* Casing oscillator
** Impact compaction
Duty cycle crawler cranes are exposed to high stresses in their various jobsite applications. A high level of stability is a basic requirement for efficiency when carrying out deep foundation work. Thus, the uppercarriage of the machine has a robust box design and is mounted on a large undercarriage. This masters the operating demands on the duty cycle crawler crane and, at the same time, an extended service life of the machine is achieved.

**Winches**
The low-maintenance hydraulic free-fall winches are installed as complete units. Depending on the model, they have a maximum line pull of 35.0 kN. Thanks to state-of-the-art variable flow hydraulic engines, the rope speed is automatically adapted for all working ranges without any output losses.

**Self-Assembly System**
No additional auxiliary crane is necessary for the assembly of duty cycle crawler cranes. All components, such as crawlers and counterweight, have a space-saving design and weights are optimized. These can be autonomously assembled using the sophisticated self-assembly system.

**Safety**
The duty cycle crawler cranes meet the highest safety standards. Furthermore, the uppercarriage can be transported with mounted railings and pedestals. This speeds up the assembly on the jobsite.
**Hydraulic System**
Thanks to the innovative hydraulic design with a closed circuit, the duty cycle crawler cranes are fuel-saving and therefore economic. The available hydraulic power is optimally split between the winches, swing and luffing gears or the external devices. Thus, parallel operation of all gears is possible.

**Crawlers**
Depending on the machine’s size the crawlers can be dismounted with the aid of the self-assembly system or, thanks to a hydraulic cylinder, they can be retracted to transport width.

**Control System**
The duty cycle crawler crane is fitted with an intelligent control system which also includes a multitude of monitoring functions. Service and machine functions are clearly displayed on high contrast colour monitors. Depending on the requirements and the application, further assistance systems, such as the slurry wall grab control, are available.
Attachments for the HS Series

Pile Grab
Duty cycle crawler cranes are equipped with universal hammer grabs when installing pile foundations with casing oscillator. These can be deployed for various ground conditions. The universal hammer grabs are extremely robust and are fitted with hard-wearing components.

Casing Oscillator
For the installation of casings, the duty cycle crawler cranes are always fitted with a casing oscillator. These are coupled with the carrier machine and excel through their extremely robust design. They are driven by the carrier machine’s hydraulic system.

Slurry Wall Grab
Mechanical grabs are opened and closed via a rope, hydraulic grabs via hydraulic cylinders. The verticality measuring system is fully integrated in the Liebherr control system. Additionally, hydraulic slurry wall grabs make it possible to carry out a vertical correction. This allows for a high level of accuracy, even at great depths.

Hydromill
Slurry walls can be installed practically vibration-free using a cutter (hydromill). Cutter wheels are mounted on the bottom of a steel profile frame and continuously break up and crush the ground at the bottom of the trench. The loosened soil particles are pumped from the trench to the surface together with the support fluid via a hose.

An important advantage of the hydromill is that it can be deployed for almost all types of soil, including rock. Furthermore, work can be carried out at depths of over 100 m.
Slurry Wall Package

Liebherr offers the slurry wall cutter, the HS 8130.1 as carrier machine and the separation plant as a complete package. The new pay-per-use model enables maximum gain with low investment and calculable maintenance costs.

Further information including video
Operator Comfort

State-of-the-Art Cabin Equipment

With Liebherr machines, the focus is on the operator. High operator comfort makes the handling of the deep foundation machines considerably easier. The innovative design of the cabin sets new standards in the construction industry regarding ergonomics, interior fittings and air conditioning. Furthermore, the optimum view from the cabin allows for precise and safe operation.
Ergonomic Cabin Design

**Ingenious Interior**
An optional cooler for provisions, various storage areas and surfaces, as well as a holder and USB port for mobile phones are all within easy reach of the comfortable seat.

**Optimized Visibility**
Safety on site is Liebherr’s highest priority. An unobstructed view from the cabin combined with a camera system for all working areas ensures this important factor.

**Modern Operating Elements**
All operating elements including redesigned joysticks, keyboards and pedals are ergonomically arranged and allow for precise control of all machine functions.

**Sunshade**
A standard sliding window and sunshade serve as additional features for improving comfort.

**Comfortable Operator Seat**
The orthopaedic seat with automatic adjustment can be heated or cooled as required.
Control and Assistance Systems

Innovative and User-Friendly

The integration of information technology into daily working processes simplifies many tasks, can improve safety on site, ensures transparency and thus provides clearer understanding and improved quality. All control and assistance systems are user-friendly solutions from Liebherr.
Control System

Liebherr’s Litronic control system is based on the latest control software and includes all control and monitoring functions. Developed in-house, it is designed for tough job-site applications even under harsh environmental conditions.

All information regarding service and machines is clearly displayed on touchscreens. Numerous functions make the handling of the machines considerably easier. This helps to achieve quicker working cycles. These include electro-hydraulic proportional control for precise operation or the handling of all machine functions with the joysticks.

Assistance Systems

Liebherr offers a large number of different operator assistance systems in order to facilitate machine operation. This is all the more important in the deep foundation sector as a lot of the work is performed underground and outside the operator’s field of vision.

Therefore, the operator profits from simplified handling even for challenging tasks. At the same time, the assistance systems increase both the level of performance as well as safety on the jobsite.

- Remote control
- Positioning system
- Automatic leader adjustment
- Kelly assistant
- Automatic shake-off
- Drilling assistant
- Vertical assistant
- Automatic winch control
- Automatic chisel control
- Process data recording
- Ground pressure assistant
- Attachment recognition
- Obstacle recognition for vibration work
- Automatic system for vibro-flotation

![Ground pressure assistant](image1)
![Obstacle recognition](image2)
Liebherr has set itself the goal of networking and optimizing the processes carried out on the jobsite with the aid of IT systems. In the progression from an experienced machine manufacturer to a full-service provider Liebherr already has a number of digital solutions, which provide substantial support for all those involved in the construction site.
Networked Solutions

While construction in the past was greatly characterised by estimates and empirical data gathering, with increasing digitization the complete construction process is becoming more transparent so enabling the optimization of many individual steps in the individual phases.

**Simulators LiSIM®**
Highly developed simulators enable safe training under realistic conditions.

**Positioning System LIPOS®**
Precise positioning of the deep foundation machine and its attachment tools.

**Data Transfer via LiDAT®**
Remote transfer of all machine and process data.

**Recording and Analysis of Process Data PDE®/PDR2**
Electronic recording and analysis of working processes.

**Tracking System via LiDAT®**
The tracking system supplies information about the location and operation of the machine and so makes it possible to efficiently manage and optimally plan operation remotely.

**Teleservice**
Liebherr service engineers can log directly on to your machine via a secure connection in order to eliminate any possible errors in the event of a fault.

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Training simulators

Positioning system
Augmented Reality: Digitization Close Up

Future-orientated technologies such as Augmented Reality (AR) are gaining ground in the construction industry. Using the AR Experience from Liebherr, virtual construction sites can be brought to life in a fun way. Difficult, complex tasks are presented and explained, simply and comprehensibly.

Liebherr AR Experience

Have you always wondered how deep foundation machines work? Discover what happens below the surface when a Liebherr deep foundation machine goes to work and be fascinated by the power and the precision involved.

All that is required for this is an AR-enabled smartphone or tablet. After successful installation of the app on a mobile device, virtual worlds can be viewed any time, any place and from any perspective.
Fuel Costs Matter

Deep foundation machines are fitted with Liebherr’s own diesel engines. The latest generation complies with Stage V/TIER 4f.

The newest drive and control systems help to reduce fuel consumption and emissions, and at the same time increase the reliability and performance of deep foundation machines.

Functions to Reduce Noise Emissions and Fuel Consumption

- **Downsizing of the Engine**
  Thanks to the machine’s optimized hydraulic system the size of the primary source can be reduced without negative effects on the performance.

- **Automatic Engine Stop**
  This control system switches the engine off automatically during longer idling periods, after having checked certain system functions.

- **Lower Engine Speed**
  All diesel engines in the latest generation have a reduced maximum speed of only 1,700 rpm. The speed has been lowered from 950 rpm to 750 rpm while idling.

- **Eco-Silent Mode**
  With the aid of this feature the engine speed is reduced to a required predefined level.
Transportation and Set-Up

Focus on Cost-Efficiency

Special attention was given to the uncomplicated and economic transportation of Liebherr’s deep foundation machines. Thanks to minimum set-up work, the machine can be quickly mobilized between jobsites so promoting economic deployment.
Efficient Transportation and Easy Set-Up

**Piling and Drilling Rigs**
The LB series of drilling rigs, the LRB series of piling and drilling rigs as well as the smallest piling rig LRH 100 can all be transported without extensive disassembly thanks to their compact measurements and low weights. This means that ropes need not be dismounted and the leader can simply be folded back. Therefore, the set-up work is completed in a considerably shorter time.

If the counterweight of a larger machine is transported separately it can be mounted on site using the leader without the need for an auxiliary crane. This means significant cost savings.

**Duty Cycle Crawler Cranes**
All components in Liebherr’s duty cycle crawler cranes have a space-saving design and weights are optimized so allowing for smooth transportation on all roads in accordance with current international transport regulations. Pendant straps and pins remain in the intended mountings during transportation so speeding up assembly.

The smaller duty cycle crawler cranes can be transported in one piece so reducing assembly and disassembly work to a minimum. By the larger models the basic machines are transported without the crawlers. First of all, the uppercarriage is unloaded independently using a jack-up system, whereby the duty cycle crawler crane is supported by hydraulic jack-up cylinders. Subsequently, the uppercarriage unloads the crawlers, counterweight and boom sections using either its A-frame or boom foot. Hydraulically activated pins, quick connections and an auxiliary rope winch simplify and accelerate the assembly process.

**Rapid Mobilization**
The rotary drive is mounted using an auxiliary winch without the need for an additional crane. If the attachment is exchanged, this is carried out using a quick connection system.

**In One Piece**
If necessary, smaller drilling rigs can also be transported with mounted attachment.

**Intelligent Assembly**
Through the self-assembly system no additional crane is necessary for the set-up or disassembly of Liebherr’s duty cycle crawler cranes.
Application and Process Technology

Practical Advice from Professionals for Professionals

The application of sometimes very complex technologies and the correct choice of suitable equipment require special knowledge and practical experience. Our application specialists use their wide experience in various working methods and processes in order to get the most from your machine - maximum utilization for maximum performance.
Application and Process Specialists
Application specialists provide assistance for a full range of tasks in the deep foundation industry, for example, drilling and vibration processes, slurry wall installations, etc. They are pleased to help in providing expert knowledge when facing particular challenges such as difficult ground conditions or confined working spaces.

Application and Performance Optimization
Thanks to the detailed communication of new technological features, our customers are always well-informed about the latest developments and can so increase performance, improve operative safety, or comply with new directives.

Machine Consulting
In combination with the choice of the most suitable machine, our application specialists also provide advice regarding the best choice of attachments and respective tools in consideration of site conditions. The aim is maximum efficiency during the production of the required product. Furthermore, fuel consumption as well as wear and tear must be minimized in the process.

Training on Site
Our application specialists are at your disposal for training purposes directly on jobsites worldwide. Ranging from the assembly or disassembly of the machine, through upgrades and retrofits, up to the optimization of the jobsite itself, Liebherr offers a broad spectrum of training possibilities including Liebherr’s own digital solutions.

Training Courses for Machine Operators
Liebherr offers training courses specifically tailored to the needs of your machine operators. These cover a wide range of topics from general operation up to comprehensive understanding and take place either on site, or independently at special training facilities. Using simulators several operators can be trained at once.

The compendium provides a wide overview of deep foundation processes, equipment and applications. Part 1: Drilling
Customer Service

Worldwide at Your Service

A well-organized worldwide network of highly qualified, experienced engineers and technical advisers, all trained by Liebherr, is available for our customers to ensure shortest response times and highest productivity.
All-round Service Excellence

Field Service
- Professional engineers
- Tailored inspections
- Recommendations for maintenance programmes
- Trouble-shooting and repairs

Remanufacturing and Exchange
Our Reman program offers three-stage reconditioning of components:
- Exchange components
- General overhaul
- Repairs

Inspection Monitoring
- Considerably reduce the probability of large repairs
- Improve the the overall availability of the crane
- Extend the service life of the crane

Parts
- Strategically located stocks worldwide
- Fast distribution service
- Long availability of parts
- Liebherr original parts - optimally suited to Liebherr machines

Upgrades and Retrofit
- Increase safety
- Reduce environmental impacts
- Improve operator comfort
- Increase efficiency and performance

Customer Portal MyLiebherr
You profit from comprehensive service and additional benefits for your product.
- Individual administration of your machines
- Access to the latest load charts and operation manuals
- Spare parts catalogue
- Online parts orders 24/7
The Liebherr Group of Companies

Wide Product Range
The Liebherr Group is one of the largest construction equipment manufacturers in the world. Liebherr’s high-value products and services enjoy a high reputation in many other fields. The wide range includes domestic appliances, aerospace and transportation systems, machine tools and maritime cranes.

Exceptional Customer Benefit
Every product line provides a complete range of models in many different versions. With both their technical excellence and acknowledged quality, Liebherr products offer a maximum of customer benefits in practical applications.

State-of-the-art Technology
To provide consistent, top quality products, Liebherr attaches great importance to each product area, its components and core technologies. Important modules and components are developed and manufactured in-house, for instance the entire drive and control technology for construction equipment.

Worldwide and Independent
Hans Liebherr founded the Liebherr family company in 1949. Since then, the family business has steadily grown to a group of more than 130 companies with nearly 48,000 employees located on all continents. The corporate headquarters of the Group is Liebherr-International AG in Bulle, Switzerland. The Liebherr family is the sole owner of the company.

www.liebherr.com