

Travel Drives by Liebherr

Series-production Gearboxes



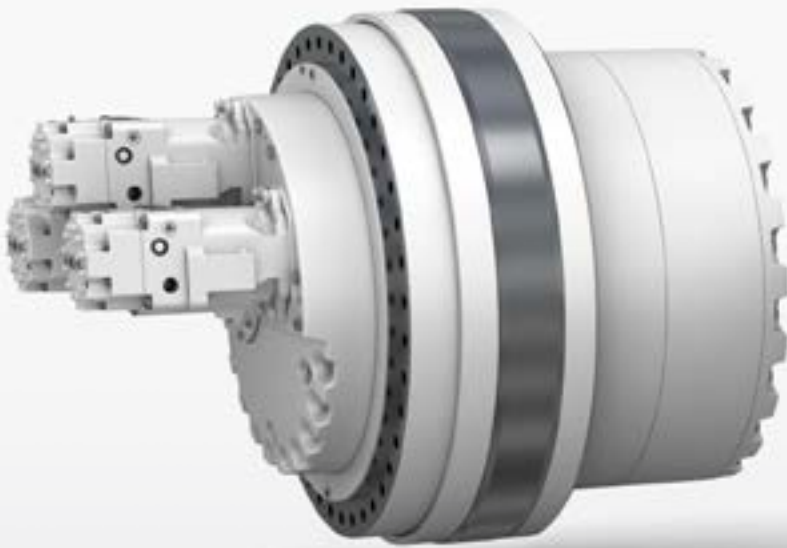
LIEBHERR

Travel drives by Liebherr

For about 40 years, Liebherr has been developing, designing and producing high-performance, versatile travel drives (FAT) for crawler vehicles such as excavators and cranes. They are characterised by their outstanding quality and excellent reliability. Every year, tens of thousands of planetary gearboxes leave the Liebherr factory in Biberach/Riss (Germany) and Dalian (China) and successfully stand up to the hostile operating conditions in machinery and equipment of customers both inside and outside the company group.

Liebherr offers its customers a series-manufactured range of travel drives that can be used for a wide range of applications. Tailor-made solutions for specific requirements can also be designed.

The gearboxes are designed using the very latest development and calculation methods. Extensive testing facilities and an in-house materials laboratory form the basis for ongoing development and even greater improvement. Travel drives from Liebherr have proved their worth in the toughest of environments thanks to their robust design and optimised sealing systems and are especially noteworthy for their high quality and ease of maintenance.



FAT 1600



FAT 1050



FAT 325



FAT 350



Since the group was established, Liebherr's strategy has been to focus on a high degree of vertical integration. For example, customers can be offered hydraulic and electric motors which are matched to the drives and designed and manufactured at the company's own development and production departments.

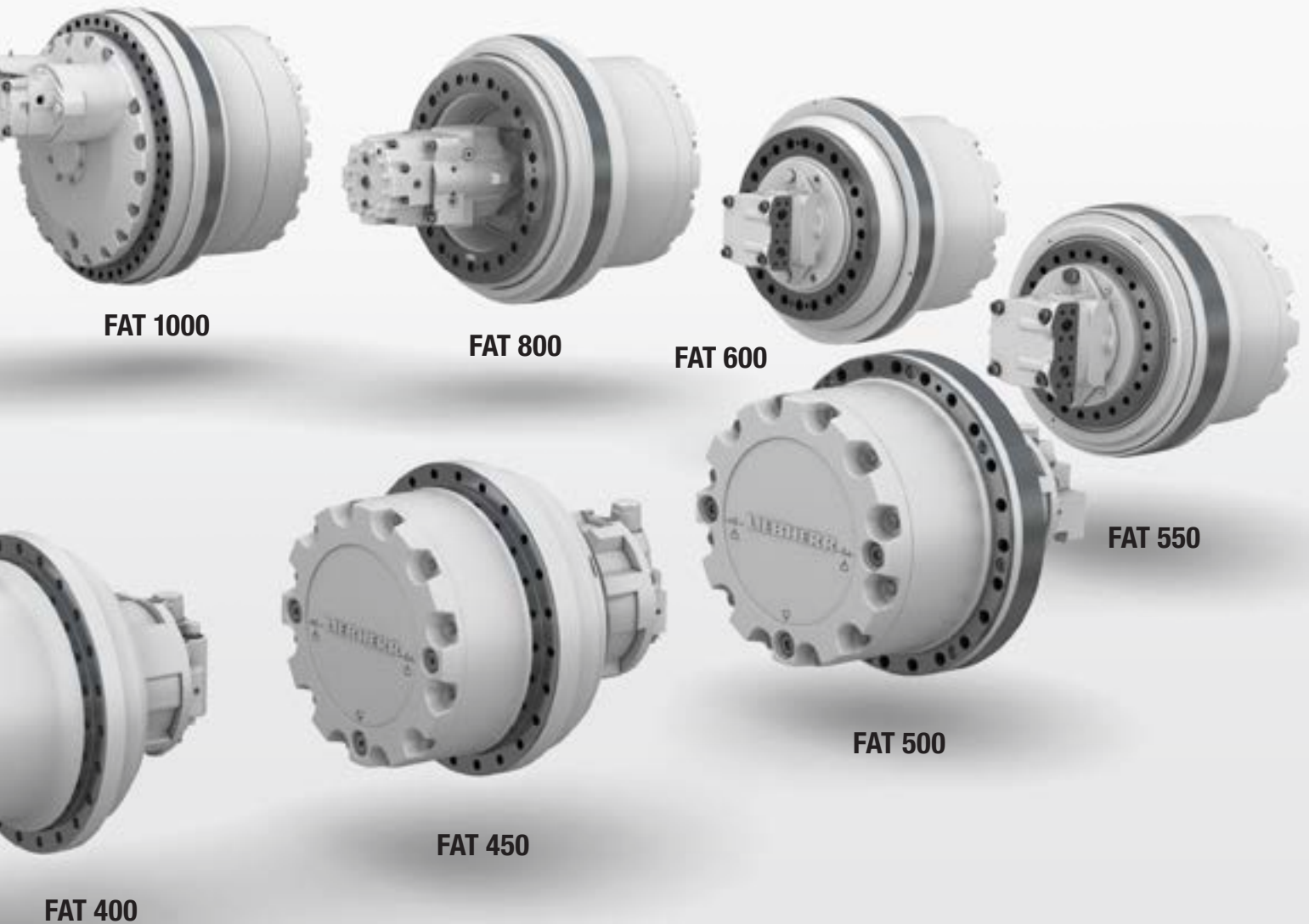
Product range

The series includes 11 gearbox sizes from the FAT 325 to the FAT 1600 in two versions - for crawler excavators or for crawler cranes. The coaxial planetary gearboxes are available as three-stage or four-stage units with a multitude of different gear ratios ranging from $i=59$ to $i=497$. Depending on the application and the underlying load collectives, the maximum dynamic output torque is up

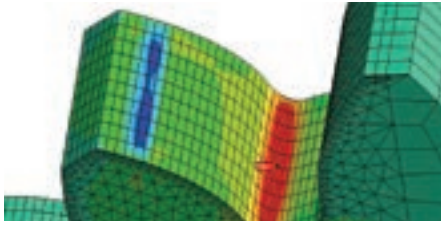
to 3,450 kNm. Travel drives are usually driven hydraulically, and the right hydraulic motors from Liebherr are provided in the scope of delivery and are also specified in the overview table. On request, however, they can also be adapted to be driven by electric motors.

Areas of application

- Crawler excavators and other construction machines with crawler running gear
- Crawler cranes as well as construction and special cranes with crawler running gear, e.g. lattice/boom cranes, telescopic cranes
- Mining equipment with crawler running gear, e.g. mining excavators and duty cycle crawler cranes
- Special machines and devices, e.g. pipeline equipment

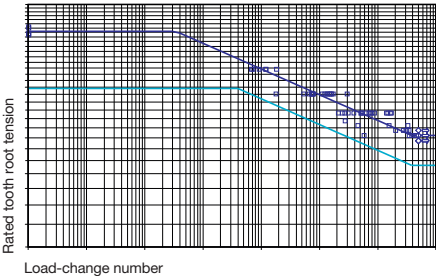


Technical design



Gearbox design

The travel drives are calculated and designed on the basis of the usual standards. In addition to the decades of experience in transmission engineering, the designers at Liebherr are also supported in component design by measurements made on the company's own high-frequency pulsator test stands and the torque change devices of the FZG (Gear Research Centre).

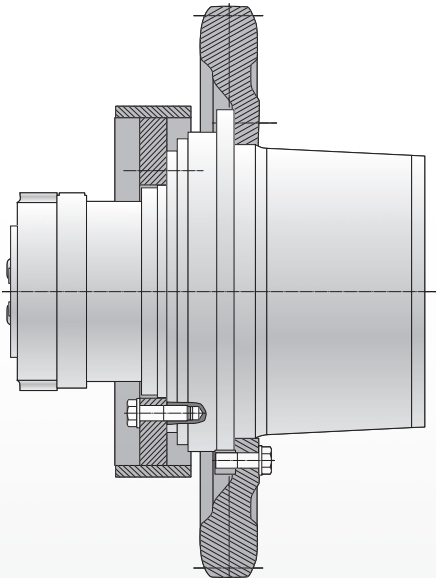


Materials

All torque-conveying gearbox components are made of top-quality case-hardened and tempered steels which are certified to the Liebherr works standards. These standards, which go beyond the currently applicable industrial standards, are based on Liebherr's decades of experience in a broad range of different application areas. The works standards also include 3.1 material certification to DIN EN 10204.

Assembly position and output

The gearboxes are designed for horizontal installation. A sprocket wheel fastened to the internal gear wheel of the gearbox transfers the output torque to the chain of the vehicle. The number and pitch circle diameter of the fastening holes for the sprocket wheel and vehicle frame are saved in the dimensions table for every size.



Seals

Permanent, tried-and-tested sealing systems offer reliable protection against the penetration of dirt and have also proven their worth in the hostile mining environment. They therefore ensure a high service life of the gearbox.

Bearings

The main bearing of the travel drives is realised in an integral design, in order to guarantee a compact gearbox design. With a reduced number of individual parts and the smallest installation space, it exhibits optimised load ratings for applications in crawler vehicles.

Gearbox structure

All sun gears and planet wheels are case-hardened and ground. The internal gear wheels are made of high-strength tempered steel, which is also used for the forged planetary supports. Well thought-out construction principles ensure an even load distribution of the individual stages and therefore a high performance density.

In addition, the gearboxes are characterised by an integral design optimised to reduce the number of components to a minimum, thereby also minimising the number of sealing points.



Efficiency

Liebherr planetary gearboxes have an efficiency of 0.98 per gear stage.

Holding brake/parking brake

Gearboxes with hydraulic drive are supplied with an integrated holding brake as standard. The brake is designed as a wet, hydraulically vented spring-operated multidisc brake.

Motor attachment

Liebherr travel drives are designed for operation with hydraulic motors from Liebherr, with which they form an especially compact unit with optimised efficiency. Thus, the CMVE plug-in motors, including multidisc holding brake and valve brake, are integrated in the travel drive housing. All hydraulic motors specified in the table are intended for the open hydraulic circuit and have a hydraulic two-point adjustment (central hydraulic control, i.e. hydraulic actuated two-point adjustment). Alternatively, motors for the closed circuit and motors with infinitely variable adjustment can also be offered. For more details, see the "Hydraulic pumps and motors from Liebherr" catalogue. In principle, the gearboxes can also be adapted for operation with electric motors, as well as for the installation of motors from other manufacturers.



Size FAT 1000 to FAT 1600: Drive with multiple hydraulic motors

From size FAT 1000, the travel drives are driven cost-effectively by a spur gearbox with two to three smaller motors instead of one large hydraulic motor. On request, this is also possible for the other sizes.



Lubrication

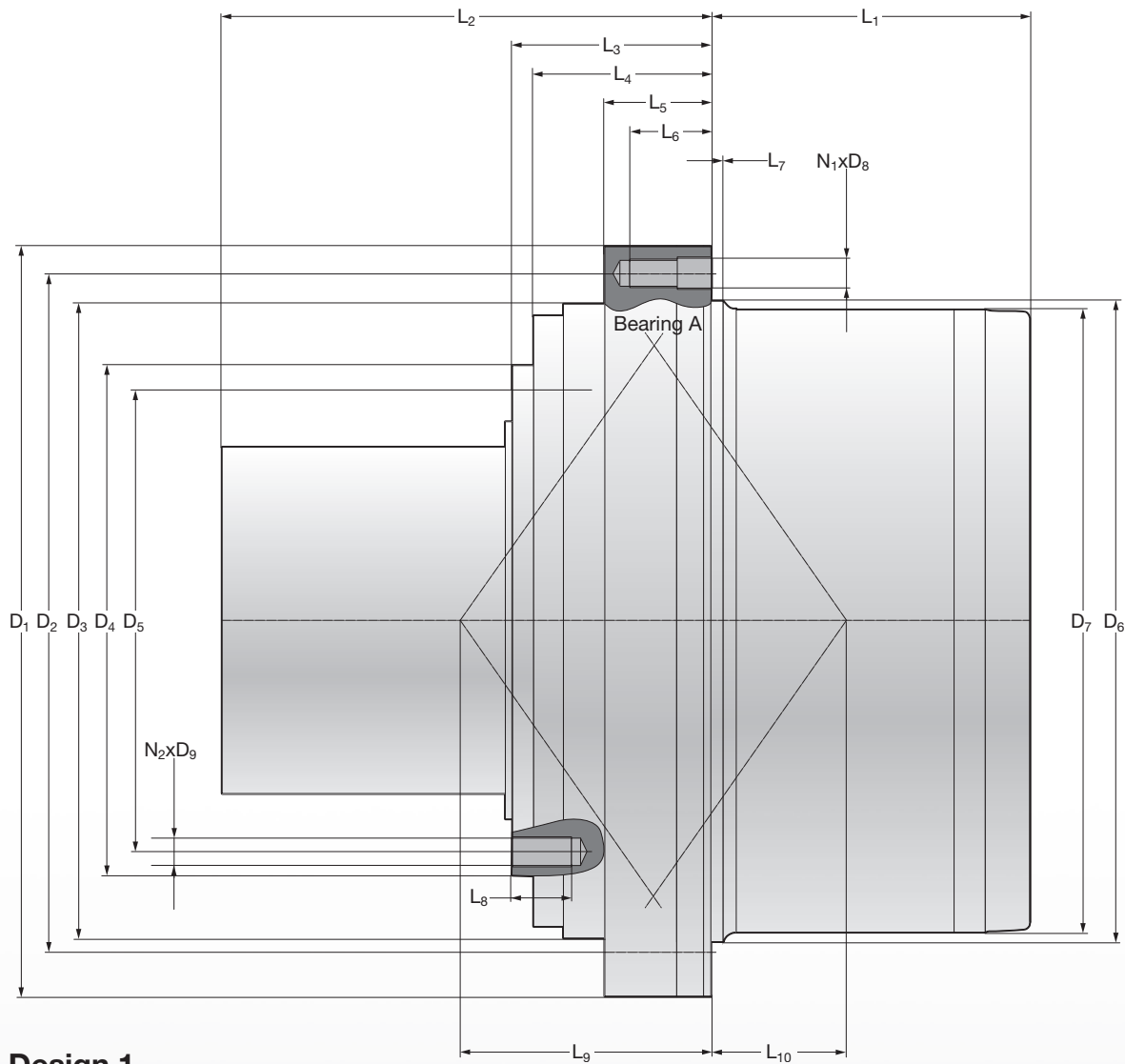
The gearbox components are protected against wear and corrosion by immersion lubrication. The oil change, which is required at regular intervals, is easy to perform thanks to the easily accessible screw plugs.

Permissible oil temperatures

Liebherr travel drives can be used at ambient temperatures as low as -20°C . The oil temperature must not exceed $+90^{\circ}\text{C}$. On request, gearboxes for lower or higher temperature ranges can also be supplied.



Sizes and dimensions



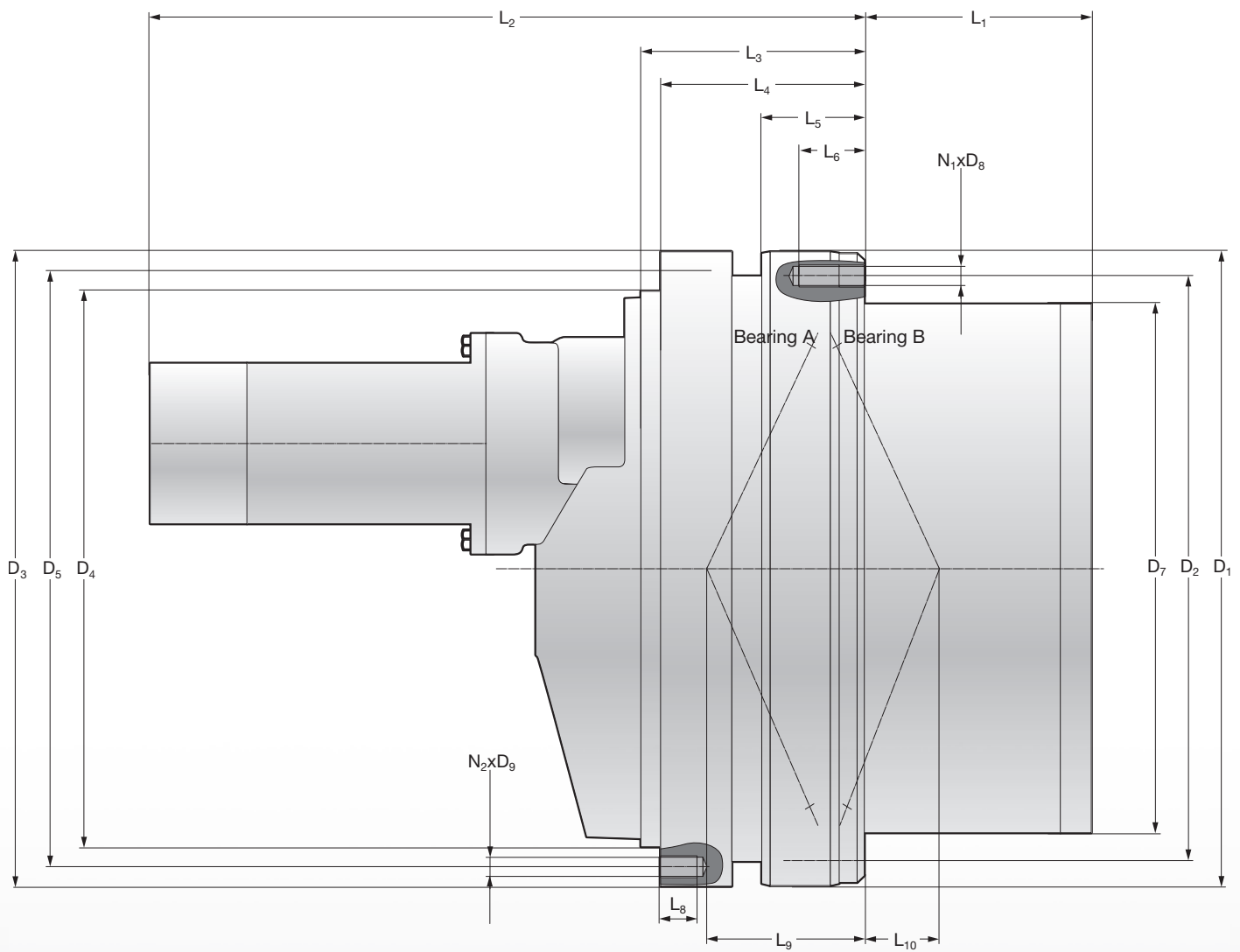
Design 1

Size	Connection dimensions for the sprocket wheel										
	D ₆	D ₃	D ₇	L ₁	L ₂	D ₂	D ₁	N ₁ x D ₈	L ₅	L ₆	L ₇
	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	Centre-Ø [mm]	1 x [mm]	[mm]	[mm]	[mm]
FAT 325	330	337	300	234	311	360	390	24 x M16	25	25	20
FAT 350	350	377	327	239	293	400	435	24 x M20	30	30	25
FAT 400	440	455	375	255	326	480	520	24 x M20	35	35	18
FAT 450	460	500	454	205	429	500	540	24 x M20	50	35	23
FAT 500	535	530	520	266	408	580	625	24 x M24	88	68	10
FAT 550	550	629	540	283	442	600	640	32 x M24	108	88	25
FAT 600		660	610	340	464	705	760	30 x M30	112	87	
FAT 800		870	740	412	763	835	930	30 x M30	157.5	122.5	
FAT 1000 ¹⁾		1032	860	415	840	940	1000	45 x M30x2	68	90	
FAT 1050 ¹⁾		1150	960	412	1292	1060	1150	40 x M36x3	185	117	
FAT 1600 ¹⁾		1620	1415	673	1463	1590	1700	40 x M48	320	191	

1) with spur wheel gear stage

2) integrated four-point bearing

3) integrated, double-row diagonal cylindrical roller bearing



Design 2

Connection dimensions for crawler frame							Sprocket bearing					
Centre-Ø	D_4	D_5	$N_2 \times D_9$	L_3	L_4	L_8	Bearing spacing		Bearing A ²⁾		Bearing A Δ Bearing B ³⁾	
							L_9	L_{10}	C_{dyn}	C_{stat}	C_{dyn}	C_{stat}
[mm]	[mm]	[mm]	1 x [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[kN]	[kN]	[kN]	[kN]
	320	285	24 x M16	110	66	24	101	88	353	576		
	250	285	20 x M20x1.5	107	91	38	106	97	368	629		
	305	350	24 x M20	125	113	30	414	91	460	860		
	400	355	24 x M24	172	134.5	53	189	98	501	1034		
	425	385	24 x M24	166	148	48	276	204			368	771
	470	410	24 x M24	227	200	48	308	204			462	938
	590	500	24 x M30	220	190	85	332	230			554	1112
	760	650	24 x M36	295	255	74	356	151			1095	2109
	880	940	45 x M30x2	290	260	60	350	230			1202	2517
	1005	1080	40 x M36x3	403	368	66	553	323			1127	2541
	1380	1500	40 x M48	622	582	76	753	321			2754	7049

Quotation request for travel drives

Company		
Contact person		
Department		
Address		
Telephone	Fax	
Email		

Date	
Application	
Equipment / Types	
Required number of items	
Delivery schedule	

Design data

Operating data

Application	
Output torque T_{max} [kNm]	
Required gear ratio i	
Max. driving speed v [km/h]	
Radial load [kN]	

Number of gearboxes N_G	
Max. chain traction force F_{max} [kN]	
Chain efficiency	
Sprocket wheel diameter d_p [mm]	
Axial load [kN]	

Design with load collectives

Collective-level	Torque T_{max} [Nm]	Output speed n_{ab} [rpm]	Time proportion [%]
1			
2			
3			
4			
			100%
Required service life [h]			

Motor data

Hydraulic motor

Manufacturer	
Type designation	
Differential pressure [bar]	
Absorption current [l/min]	
Min. displacement [cm ³]	
Max. displacement [cm ³]	

Holding brake (hydraulic motor)*

Provided in scope of delivery	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Min. air pressure [bar]		
Max. air pressure [bar]		
Max. accumulation pressure [bar]		

* Designed as a wet, hydraulically vented spring-operated multidisc brake.

Miscellaneous

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Please send to:

Liebherr-Components AG
 Postbox 222, CH-5415 Nussbaumen AG
 Fax +41 56 296 43-01
 info.cos@liebherr.com

Selection of gearbox size

The maximum output torques, as well as the motor data corresponding to the size, can be found in the reference table below.

The maximum output torques in the "Torques" column relate on the one hand to crawler excavators and other devices, which are characterised by high drive ratios in the usage period and must mainly withstand high, dynamic loads.

On the other hand, the output torques are specified for crawler cranes and other devices, which are subjected to predominantly static loads over the usage period.

To select the appropriate gearbox size, the maximum output torque required for the application must be calculated using the device-specific diameter of the sprocket wheel, the efficiency of the chain and the desired number of gearboxes per device. The result is used to select the appropriate gearbox size from the table below.

Calculation of the required maximum output torque from the required chain traction force:

$$T_{\max} = \frac{d_T * F_{\max}}{2 * \eta * N_G}$$

T_{\max}	[Nm]	Required max. dyn. output torque
d_T	[mm]	Diameter of the sprocket wheel
F_{\max}	[kN]	Maximum chain traction force of the entire device
η	[-]	Efficiency of the chain
N_G	[-]	Number of gearboxes per device

Size	Torques		Motor data				
	Max. output torque for crawler excavator	Max. output torque for crawler crane	Hydraulic motor	Max. displacement	Min. displacement ¹⁾	Max. drive speed	Max. operating pressure
	T_{\max}	T_{\max}		$V_{g \max}$	$V_{g \min}$	n_{\max} by $V_{g \min}$	Δp_{\max}
	[kNm]	[kNm]		[cm ³]	[cm ³]	[rpm]	[bar]
FAT 325	34	50	CMVE 85	85	50	5,000	380
FAT 350	37	55	CMVE 85	85	50	5,000	380
FAT 400	61	91	CMVE 135	135	81	4,550	380
FAT 450	84	126	CMVE 165	165	106	4,200	380
FAT 500	105	157	CMVE 165	165	106	4,200	380
FAT 550	145	217	FMV 250	256	160	3,640	380
FAT 600	220	330	FMV 250	256	160	3,640	380
FAT 800	430	645	DMVA 355	355	270	3,000	380
FAT 1000	600	900	2x FMV 250	2x 256	2x 160	3,640	380
FAT 1050	840	1260	2x DMVA 355	2x 355	2x 270	3,000	380
FAT 1600	2300	3450	3x DMVA 355	3x 355	3x 270	3,000	380

¹⁾ The specified values correspond to the preferred series. On request other minimum displacement are available.

Selection of gear ratios

The gear ratios printed in bold represent the preferred series to which the speeds specified in the "Selection of gearbox size" table relate. Other gear ratios are possible on request.

Ratios										
FAT 325	FAT 350	FAT 400	FAT 450	FAT 500	FAT 550	FAT 600	FAT 800	FAT 1000	FAT 1050	FAT 1600
59.76	74.13	87.29	104.19	112.98	72.68	136.37	252.64	249.80	247.02	497.00
74.13	82.33	95.95	105.88	132.88	88.32	169.44				
82.33	90.07	102.06	110.03	176.30	118.74	179.47				
93.28	102.03	113.29	122.55		154.08	197.69				
	113.29	149.30	208.08		167.90	366.40				
	118.75				434.21					
	128.29									

Liebherr-Component Technologies

Liebherr-Component Technologies AG, based in Bulle, Switzerland, is responsible for all activities of the components division of the Liebherr group. The companies and business areas belonging to this division are specialised in the development, design, manufacture and reconditioning of high-performance components in the field of mechanical, hydraulic and electrical drives and control technology. The sale of components to customers outside the Liebherr group of companies is managed centrally by Liebherr-Components AG in Nussbaumen, Switzerland.

Many Years of Experience

Liebherr has decades of experience in the manufacture of high-quality components used in cranes and construction machines, in the mining industry, maritime applications, wind turbines, in vehicle technology or in aerospace and transportation technology.

The Right Solution for Every Need

A high degree of vertical integration and the use of flexible, state-of-the-art production systems allow Liebherr to offer its customers tailor-made solutions. Liebherr is your partner for joint success – from the product idea to development, manufacture and first installation right through to series production. For the various components of the drivetrain, Liebherr also offers remanufacturing in various degrees in a dedicated factory.

System Solutions from a Single Source

Components from Liebherr are perfectly matched to each other with regard to operation. Depending on the requirement, individual components from the wide product range can be expanded through to the complete drivetrain. This results in impressive system solutions which can be integrated into a variety of applications.

Highest Quality Standards and Long Service Life

All components meet the very highest demands for functional reliability and durability, even under extreme loads and harsh conditions. Elaborate quality management and extensive analysis and test procedures are practised throughout the entire development and production process, guaranteeing reliability and long component service life.

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Biberach/Riss (Germany): large diameter bearings, gearboxes, rope winches, switchgear, electronics, electrical machines



Bulle (Switzerland): diesel engines, gas engines, splitter boxes, axial piston units, injection systems



Kirchdorf (Germany): hydraulic cylinders



Lindau (Germany): electronics, power electronics



Ettlingen (Germany): remanufactured components



Monterrey (Mexico): large diameter bearings



Dalian (China): gearboxes

Liebherr-Components AG

Postfach 222, CH-5415 Nussbaumen/AG

☎ +41 56 296 43 00, Fax +41 56 296 43 01

www.liebherr.com, E-Mail: info.cos@liebherr.com