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.

www.liebherr.com

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

Printed in Germany by Typodruck BK COB-0.25-08.14_enGB Subject to technical modifications.

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Planetary Plug-in Gearboxes by Liebherr

Series-production Gearboxes

LIEBHERR

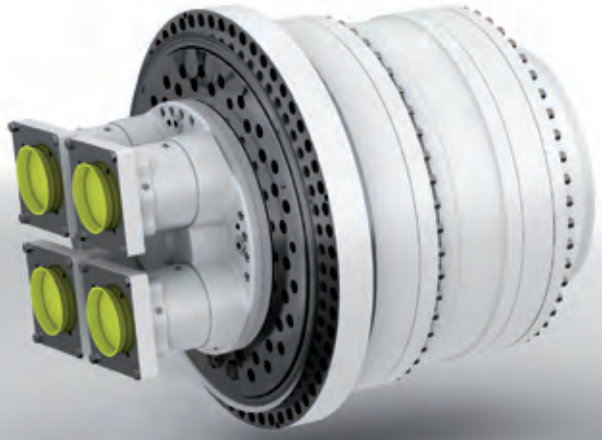
Planetary plug-in gearboxes by Liebherr

Liebherr has been developing, designing and manufacturing high-performance, versatile planetary plug-in gearboxes for over 60 years. They are characterised by their outstanding quality and excellent reliability. Tens of thousands of planetary gearboxes leave the Liebherr plant in Biberach/Riss, Germany, every year, and successfully stand up to the hostile operating conditions in machinery and equipment of customers both inside and outside the Liebherr group of companies.

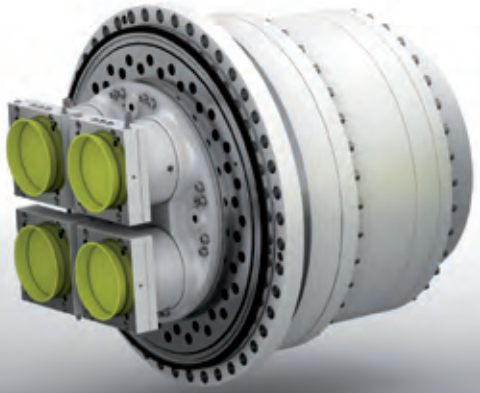
Liebherr offers its customer a series-produced range of planetary plug-in gearboxes that can be used for a wide range of applications. Furthermore, individual solutions can also be produced to meet special requirements.

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. As a result, Liebherr planetary plug-in gearboxes are characterised by maximum torque density with low installation space requirements. Liebherr planetary gearboxes are noted for very high torque density in a small space. The planetary plug-in gearboxes are also designed for simple installation and maximum ease of maintenance.

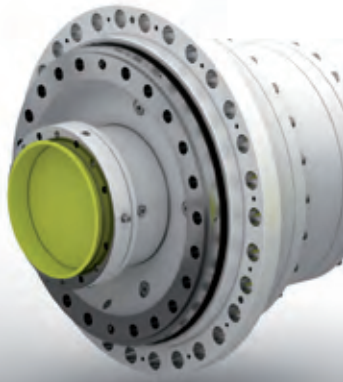
Since the Group was established, Liebherr's strategy has been to focus on a high degree of vertical integration. For example, customers can be offered hydraulic and electric motors which are matched to the drives and designed and manufactured at the company's own development and production departments.



PEG 1100 *



PEG 1000 *



PEG 900

PEG 250

PEG 300

PEG 350

PEG 400

Product range

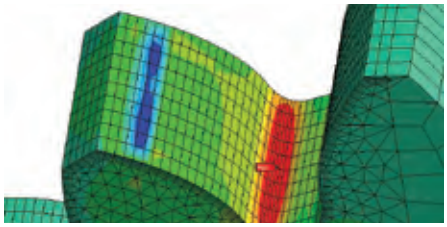
The series includes 14 gearbox sizes from the PEG 250 to the PEG 1100. The coaxial planetary gearboxes can be offered as two, three or four-stage models with a wide range of different gear ratios. The maximum dynamic torque is about 1,000,000 Nm. The standard gearboxes designed for installation in winches can be adapted both for electric and for hydraulic motors.

Areas of application

- Construction machinery, e.g. hydraulic excavators and drills
- Cranes, e.g. construction and mobile cranes
- Mining equipment, e.g. mining excavators
- Maritime applications, e.g. port, ship and offshore cranes
- Specialised machines and equipment

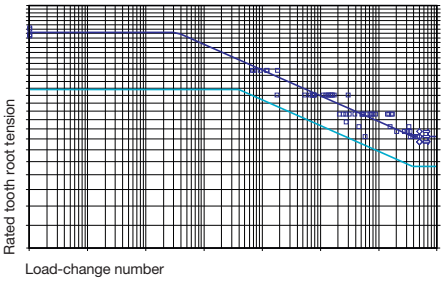
*** pictured with optional spur gear stage**

Technical design



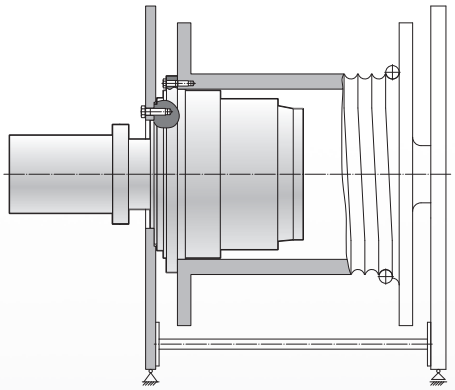
Gearbox design

The plug-in gearboxes 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 by measurements made on the company's own high-frequency pulsator test stands and FZG-torque change devices.



Materials

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



Assembly position and output

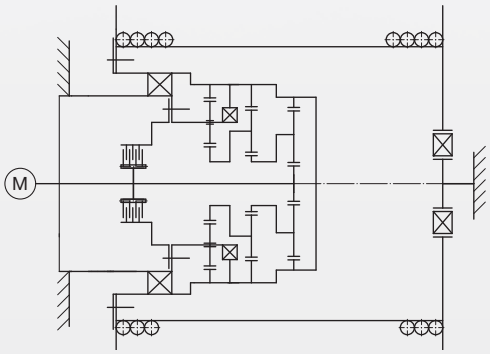
The gearboxes are designed for horizontal installation in winch drums. A redundant winch design with a gearbox inserted on both sides of the drum is also available on request. They are fixed to the framework and drum of the winch at defined fastening holes. The number of holes and the hole diameter can be found in the table of dimensions for every size. The torque is transmitted to the winch drum by the internal gear wheels.

Seals

Permanent, proven sealing systems guarantee a long service life. If it is necessary to replace the shaft seal after long hours of operation, this is easily conducted externally with the larger gearboxes. It is not necessary to disassemble the gearbox.

Bearings

The main bearings for the winch drum are integrated into the planetary plug-in gearboxes. They offer maximum support in a very small space. The thrust bearings of the winch drum can be designed as a simple floating bearing with spherical roller bearings.



Gearbox structure

All sun gears and planet gears are case-hardened and ground. They have also been optimised to minimise circumferential backlash and have minimal play. The nitrided inner gears are made of high-strength tempered steel, which is also used for the forged planet carriers. Well-devised design principles ensure uniform load distribution of the individual stages, resulting in a high power 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. It is designed as a wet-running, hydraulically-released, springoperated multi disc brake. Gearboxes with electrical drive can also be supplied with an integrated holding brake, e.g. an electromagnetically actuated spring-loaded brake.

Motor attachment

Liebherr planetary plug-in gearboxes are designed for operation both with hydraulic motors and with electric motors. If requested by the customer, the gearboxes can be prepared for motor attachment or can be supplied as a complete unit with the drive already installed. Hydraulic or electric motors from Liebherr are recommended if a particularly compact design is required. The gearboxes can, however, be adapted to allow all motor types from other manufacturers to be fitted.

Optional:
Drive with multiple hydraulic motors

If the gearbox is to be driven by up to four smaller hydraulic motors instead of one larger motor, a spur gearbox can be added to the drive on request.

Lubrication

The gearbox components are protected against wear and corrosion by immersion lubrication. Oil changes, required at defined intervals, are easily carried out on the motor side.

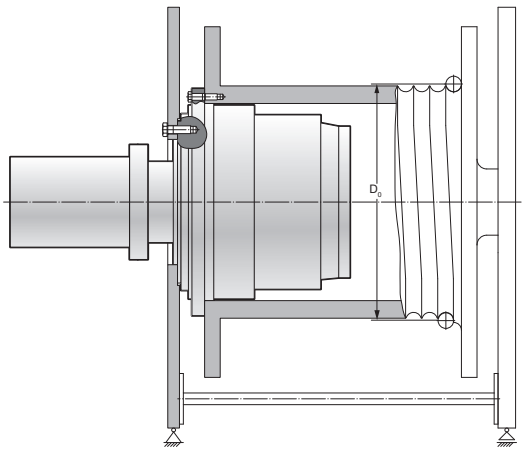
Permissible oil temperatures

Liebherr planetary plug-in gearboxes drives can be used at ambient temperatures down to -20°C. The oil temperature must not exceed +90°C. On request, gearboxes for lower or higher temperature ranges can also be supplied. Size PEG 500 and above are fitted with ports for external oil coolers as standard for very efficient cooling of the complete gearbox at high outside temperatures and/or extended operating time.

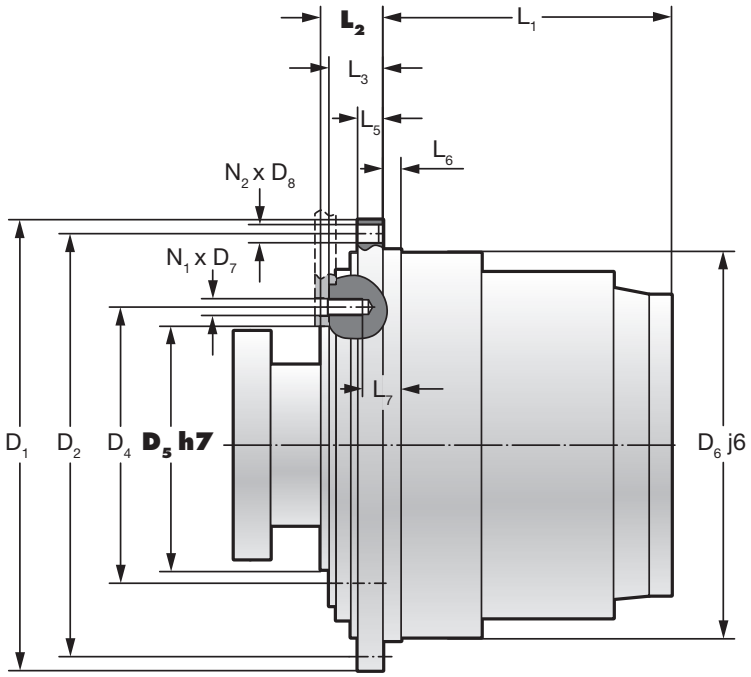
Certification of gearbox

On request, acceptance by one of the standard certification organisations such as ABS (American Bureau of Shipping), Det Norske Veritas (DNV), Germanischer Lloyd (GL) or Lloyds Register of Shipping (LRS) is available.

Sizes and dimensions



General diagram



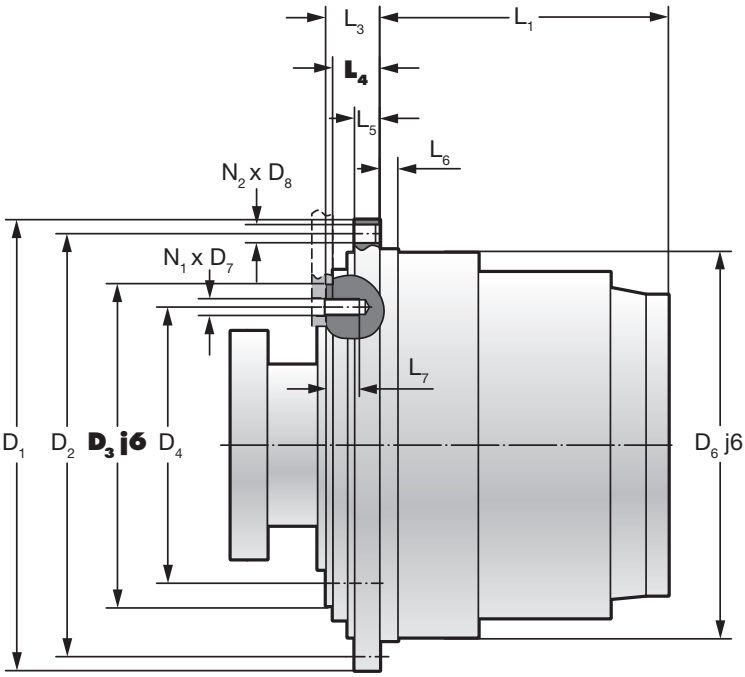
Fit (winch frame)
Type 1

Technical data of the series model range

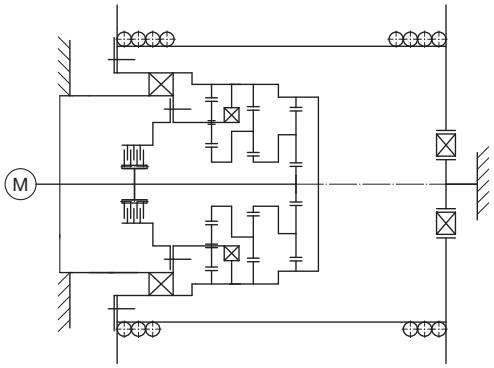
	Output torques		Rated data for winch drum		Connection dimensions for winch drum					
	$T_{dyn, r}$ [1]	T_{stat}	D_0	F_{max}	D_1	D_2	D_6 j6	N_2 x D_8 [3]	L_1	L_5
			Approx. value				Centering Ø			
	[Nm]	[Nm]	[mm]	[kN]	[mm]	[mm]	[mm]	1 x [mm]	[mm]	[mm]
PEG 250	6,000	9,600	Ø 360	33	Ø 335	Ø 310	Ø 295	24 x Ø 11	249.5	15
PEG 300	9,000	14,400	Ø 410	44	Ø 395	Ø 367	Ø 345	16 x Ø 13,5	226	14
PEG 350	23,000	36,800	Ø 450	102	Ø 432	Ø 395	Ø 360	20 x Ø 17,5	281	16
PEG 400	33,000	52,800	Ø 500	132	Ø 480	Ø 445	Ø 410	16 x Ø 17,5	358	21
PEG 450	50,000	80,000	Ø 560	179	Ø 530	Ø 500	Ø 470	30 x Ø 17,5	347.5	27.5
PEG 500	73,000	116,800	Ø 600	243	Ø 570	Ø 540	Ø 505	45 x Ø 17,5	398	25
PEG 550	103,000	164,800	Ø 680	303	Ø 645	Ø 605	Ø 560	24 x Ø 26	413	24
PEG 600	127,000	203,200	Ø 720	353	Ø 685	Ø 630	Ø 570	30 x Ø 33	469.5	30
PEG 650	151,000	241,600	Ø 730	414	Ø 685	Ø 650	Ø 610	36 x Ø 22	500	61
PEG 700	218,000	348,800	Ø 820	532	Ø 785	Ø 743	Ø 670	46 x Ø 26	434	64
PEG 800	286,000	457,600	Ø 960	596	Ø 920	Ø 850	Ø 760	33 x Ø 44	546	55
PEG 900	445,000	712,000	Ø 1,050	848	Ø 1,010	Ø 940	Ø 855	36 x Ø 39	617	60
PEG 1000	631,000	1,009,600	Ø 1,110	1,137	Ø 1,065	Ø 1,010	Ø 960	45 x Ø 36	725	59
PEG 1100	944,000	1,510,400	Ø 1,210	1,560	Ø 1,158	Ø 1,100	Ø 1,045	60 x Ø 36	821.5	101

[1] Reference torque based on M5/L2/T5 at an output speed of 15 rpm and a dynamic load (application: rope winch)
[2] Always note the dimensions in the installation drawing sent before the order. They are decisive.
[3] Strength class 10.9 for fastening screws

T_{stat} = static output torque
D_0 = minimum winding diameter for the first rope layer
F_{max} = maximum possible rope tension force
D_{0-8} = diameter
L_{1-7} = length
$N_{1,2}$ = number of fastening holes



Fit (winch frame)
Type 2



Gearbox design diagram

	Connection dimensions for winch frame								Weight
L_6	**D_3 js6**	D_4 [2]	**D_5 h7**	N_1 x D_7 [2] [3]	**L_2**	L_3	**L_4**	L_7	3-stage design.
	Centering Ø		**Centering Ø**						Approx. value
[mm]	**[mm]**	[mm]	**[mm]**	1 x [mm]	**[mm]**	[mm]	**[mm]**	[mm]	[kg]
10		Ø 225	**Ø 200**	28 x M12	**52**	45		24	100
10		Ø 265	**Ø 240**	22 x M12	**51**	46		24	130
17		Ø 270	**Ø 240**	14 x M16	**67**	62		32	170
16		Ø 310	**Ø 280**	22 x M16	**50**	45		32	260
10		Ø 375	**Ø 330**	22 x M20	**62.5**	57.5		35	360
18		Ø 370	**Ø 330**	28 x M20	**69**	59		40	410
18	**Ø 460**	Ø 395		27 x M24		59	**55**	48	560
25	**Ø 460**	Ø 410		23 x M27		63	**59**	52	680
12	**Ø 560**	Ø 520		23 x M27		87	**81**	51	840
20	**Ø 600**	Ø 545		28 x M24		128	**115**	40	1,400
40	**Ø 710**	Ø 660		22 x M36		155	**147**	64	1,750
45	**Ø 800**	Ø 740		34 x M36		172	**162**	72	2,300
60		Ø 780	**Ø 675**	22 x M36	**122**	105		72	2,600
40.5		Ø 840	**Ø 695**	22 x M42	**162**	144		84	3,600

Selection of gearbox size

The dynamic torques specified in the reference table are based on the load spectrum L2 and operating class T5 in accordance with the guidelines issued by FEM*. They were calculated for a rotational speed of 15 rpm at the winch drum. To select the appropriate gearbox size, the torque required for the application in question must be multiplied by the application factor k given below. The result is used to select the appropriate gearbox size from the table on page 6, 7. The reference torque of the gearbox must be greater than the calculated torque. It is recommended to select both the operating class appropriate to the application, and the correct load condition in accordance with the FEM directives.

$T_{dyn,max} \times k \leq T_{dyn,r}$	
$T_{dyn,max}$	Required maximum dynamic output torque
k	Application factor
$T_{dyn,r}$	Reference torque (dynamic)

Operating class T_i*	T_2	T_3	T_4	T_5	T_6	T_7	T_8
Mean running time per day in hours (h) in relation to one year	0.25 – 0.5	0.5 – 1	1 – 2	2 – 4	4 – 8	8 – 16	> 16
Life-time in hours (h) when operating for 8 years with 200 days per year	up to 800	up to 1,600	up to 3,200	up to 6,300	up to 12,500	up to 25,000	up to 50,000

Load spectrum L_i*		Drive unit class with application factor k						
L_1 light	Maximum load is the exception, otherwise low loads	M_1 0.66	M_2 0.73	M_3 0.81	M_4 0.89	M_5 1.00	M_6 1.13	M_7 1.27
L_2 medium	About the same proportions of low, medium and high loads	M_2 0.73	M_3 0.81	M_4 0.89	M_5 1.00	M_6 1.13	M_7 1.27	M_8 1.39
L_3 heavy	Loads are always close to the maximum load	M_3 0.81	M_4 0.89	M_5 1.00	M_6 1.13	M_7 1.27	M_8 1.39	M_8 1.70
L_4 very heavy	Always maximum load	M_4 0.89	M_5 1.00	M_6 1.13	M_7 1.27	M_8 1.39	M_8 1.70	M_8 2.10

* FEM-Federation Europeenne de la Manutention Section I, Rules for the design of hoisting appliances, 3rd edition 1998

Selection of gear ratios

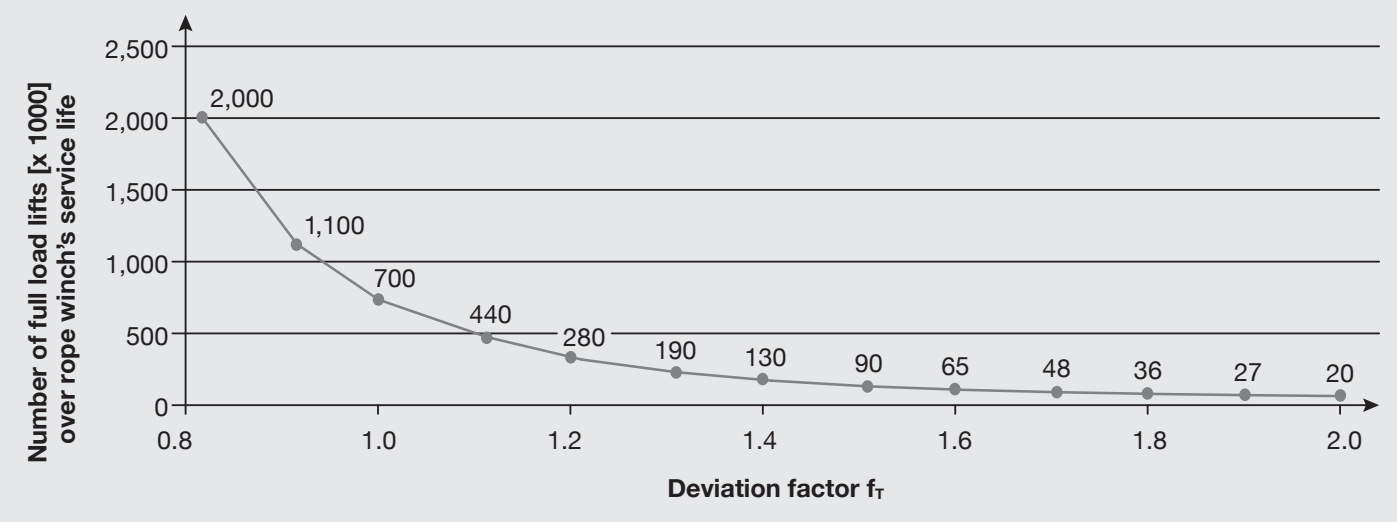
Gear ratios – 2-stage version							
PEG 250	–	20	23	26	30	35	43
PEG 300	–	20	23	26	30	35	43
PEG 350	–	–	–	20	23	27	33
PEG 400	20	22	24	26	29	33	39
PEG 450	–	21	23	26	29	33	40
PEG 500	–	–	–	–	21	24	28
PEG 550	–	–	–	–	21	24	28
PEG 600	**On request**						
PEG 650							
PEG 700							
PEG 800							
PEG 900							
PEG 1000							
PEG 1100							

Gear ratios – 3-stage version												
PEG 250	104	114	128	137	148	162	180	204	237	287	–	–
PEG 300	104	114	128	137	148	162	180	204	237	287	–	–
PEG 350	61	66	73	83	89	97	106	118	135	–	–	–
PEG 400	51	53	58	62	66	71	77	84	94	106	–	–
PEG 450	44	50	54	60	64	68	74	80	88	99	113	128
PEG 500	44	50	57	61	66	73	81	92	–	–	–	–
PEG 550	45	51	56	62	71	76	84	93	104	121	–	–
PEG 600	56	62	70	81	89	99	112	129	–	–	–	–
PEG 650	61	68	76	88	96	107	120	138	161	–	–	–
PEG 700	53	59	66	70	76	82	91	101	116	138	154	–
PEG 800	63	70	79	85	93	102	114	130	157	–	–	–
PEG 900	70	76	84	96	112	123	138	157	185	–	–	–
PEG 1000	63	70	74	78	84	90	98	108	121	138	164	–
PEG 1100	58	63	71	82	98	110	125	146	–	–	–	–

Gear ratios – 4-stage version												
PEG 250	**On request**											
PEG 300												
PEG 350												
PEG 400												
PEG 450												
PEG 500												
PEG 550												
PEG 600												
PEG 650												
PEG 700	175	192	216	248	270	297	332	426	477	545	–	–
PEG 800	232	252	278	313	337	365	400	445	505	–	–	–
PEG 900	208	227	251	284	332	365	407	463	561	669	850	–
PEG 1000	255	302	330	368	420	455	498	552	624	723	–	–
PEG 1100	178	195	216	244	286	314	351	400	440	575	693	889

* Other gear ratios available on request

Possible number of lifts under load



$$f_T = \frac{T_{dyn,max} \times \Psi}{T_{dyn,r}}$$

f_T	**Deviation factor from reference torque $T_{dyn,r}$**
Ψ	**Lift load coefficient (vibration coefficient)***

When choosing the gearbox size, not only are the torque required for the application and the drive mechanism group important, but also the number of lifts under full load, which the rope winch is expected to cope with throughout its anticipated service life. The full load lifts themselves do not have an influence on the gearing and bearings of the gearbox, but they have an effect on the structural components, such as the planetary supports, bolts and drive shaft.

In order to determine the maximum possible number of full load lifts, the required torque must be multiplied by the lift load coefficient for the respective application. The result has to be put into relation to the reference torque of the selected gearbox size.

If the calculated deviation factor is lower than 0.8, the structural components of the gearbox are fatigue resistant and an infinite number of full load lifts can be executed.

If the result is higher, the maximum number of lifts must be taken into consideration or a larger gearbox must be selected.

*Liebherr recommends the FEM guideline FEM 1.001 2.2.2.1.1 or EN 13001-2 4.2.2.2.1 for calculation of the lift load coefficient Ψ

Quotation request for planetary plug-in gearboxes

Company			
Contact person			
Department			
Postal address			
Telephone		Fax	
Email			

Date	
Application	
Machine / Type	
Required amount	
Delivery date	

Design data

Operating data

	Nominal dyn. output torque $T_{dyn,nom}$	Max. dyn. output torque** $T_{dyn,max}$	Static output torque T_{stat}
Torque [Nm]			
Speed [rpm]			

Classification according to FEM*

Max. cable pull Fmax [kN]	
at rope layer diameter D_L [mm]	
Rope speed at max. cable pull vF[m/min]	

* Liebherr recommends to design according to the guidelines of the FEM (Fédération Européenne de la Manutention) Section I, Rules for the design of hoisting appliances
** incl. all influencing factors

Design size selection according to the Liebherr "Series model range" brochure

Size	PEG 250	PEG 300	PEG 350	PEG 400	PEG 450	PEG 500	PEG 550	PEG 600	PEG 650	PEG 700	PEG 800	PEG 900	PEG 1000	PEG 1100
Reference torque $T_{dyn,r}$ [Nm]	6,000	9,000	23,000	33,000	50,000	73,000	103,000	127,000	151,000	218,000	286,000	445,000	631,000	944,000
Please tick selected size	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Selected ratio														

Motor data

Hydraulic motor

Manufacturer	
Type	
Displacement [l/min]	
Pressure differential [bar]	

Electric motor

Manufacturer	
Type	
Power [kW]	
Speed [rpm]	
Starting torque [Nm]	
Duty cycle [%]	

Holding brake (for hydraulic motor)*

Include in delivery	yes ☐	no ☐
Min. air pressure [bar]		
Max. air pressure [bar]		
Max. accumulation pressure [bar]		

Designed as wet-running, hydraulically-released, spring-loaded multiple disc brake

Miscellaneous

Please send to:

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