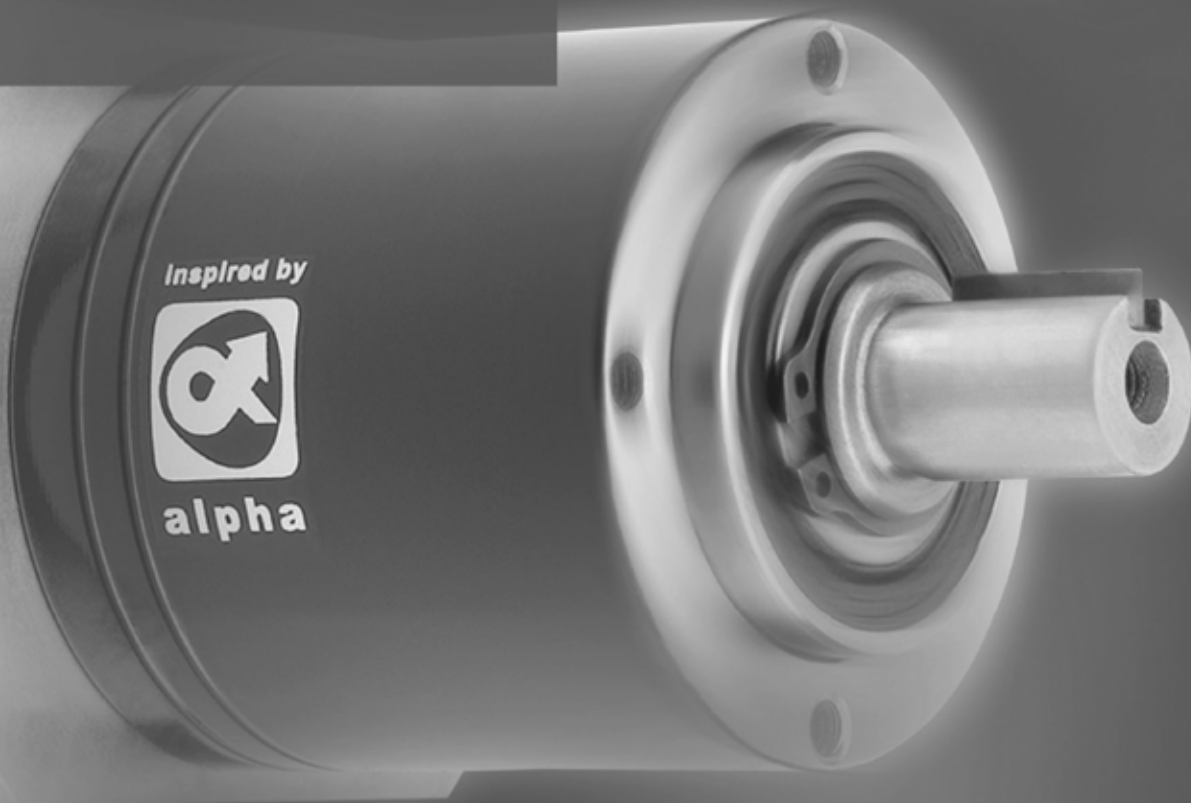


LP⁺/ LPB⁺

Operating Manual



Revision history

Revision	Date	Comment	Chapter
1	20.01.03	new version	all
2	16.01.07	technical data updated	6.4.1
3	22.12.08	technical data updated Layout WITTENSTEIN	all

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Contents

1	On this manual	2
1.1	Signal words	2
1.2	Safety symbols	2
1.3	Information symbols	3
2	Safety	4
2.1	EC – Machinery directive	4
2.2	Dangers	4
2.3	Personnel	4
2.4	Intended use	4
2.5	Guarantee and Liability	4
2.6	General safety instructions	5
3	Description of the gearhead	6
3.1	General Information	6
3.2	Overview of the gearhead components	6
3.2.1	Overview of the gearhead components LP ⁺	6
3.2.2	Overview of the gearhead components LPB ⁺	6
3.3	Type plate	7
3.4	Ordering key	7
3.5	Performance statistics	8
3.6	Weight	8
4	Transport and storage	9
4.1	Scope of delivery	9
4.2	Packaging	9
4.3	Transport	9
4.4	Storage	9
5	Assembly	10
5.1	Preparation	10
5.2	Mounting the gearhead to a machine (LPB ⁺)	11
5.3	Mounting the motor onto the gearhead (LP ⁺ /LPB ⁺)	13
5.3.1	Pre-mounting adapter plate (only LPB ⁺)	13
5.3.2	Mounting the motor (LP ⁺ /LPB ⁺)	14
5.4	Mounted components on the gear output side	15
5.4.1	Mountings on the output flange (LPB ⁺)	15
5.5	Mounting the gearhead to a machine (LP ⁺)	16
6	Startup and operation	17
7	Maintenance and disposal	18
7.1	Maintenance work	18
7.1.1	Visual inspection	18
7.1.2	Checking the tightening torques	18
7.2	Start-up after maintenance work	18
7.3	Maintenance schedule	19
7.4	Notes on the lubricant used	19
7.5	Supplementary information	19
8	Malfunctions	20
9	Appendix	21
9.1	Specifications on mounting onto a motor	21
9.2	Specifications on mounting onto a machine	21
9.3	Tightening torques for common thread sizes in general mechanics	22

1 On this manual

These instructions contain necessary information for the safe operation of the planetary gearhead LP⁺/LPB⁺, referred to as gearhead in the following.

The operator must make sure that this operating manual is read through by all persons assigned to install, operate, or maintain the gearhead, and that they understand them.

Store these instructions within reach near the gearhead.

1.1 Signal words

The following signal words are used to bring your attention to dangers, prohibitions, and important information:

	⚠ DANGER
	This signal word points out to an imminent danger that can cause serious injuries and even death.
	⚠ WARNING
	This signal word points out to a possible danger that can cause serious injuries and even death.
	⚠ CAUTION
	This signal word points out to a possible danger that can cause slight to serious injuries.
	CAUTION
	This signal word (without warning symbol) points out to a possible danger that can cause material damage.
	INFORMATION
	This signal word draws your attention to application tips or especially important information when handling the gearhead.

1.2 Safety symbols

The following safety symbols are used to bring your attention to dangers, prohibitions, and important information:



General danger



Hot surface



Suspended loads



Danger of pull-in



Environment protection



Information

1.3 Information symbols

The following information symbols are used:

- requires you to carry out an action
- ➡ indicates the results of an action
- ⓘ provides additional information on handling

2 Safety

These instructions, especially the safety instructions and the rules and regulations valid for the operating site, must be observed by all persons working with the gearhead.

In addition to the safety specifications mentioned in this operating manual, the general and also the local regulations on the prevention of accidents and on environmental protection should be observed.

2.1 EC – Machinery directive

Within terms of the EC machinery directive 2006/42/EC, the gearhead is not considered as an autonomous machine, but as a "component to install in machines".

Operation is prohibited within the area of validity of the EC directive until it has been determined that the machine in which this gearhead is installed corresponds to the regulations within this directive.

2.2 Dangers

The gearhead has been constructed according to current technological standards and accepted safety regulations.

To avoid danger to the operator or damage to the machine, the gearhead may be put to use only for its intended usage (see chapter 2.4 "Intended use") and in a technically flawless and safe state.

2.3 Personnel

Only persons who have read and understood these disassembly instructions may carry out work on the gearhead.

2.4 Intended use

The gearhead is built for industrial applications that do not fall under article 2 of the directive 2002/95/EU (usage restriction of certain dangerous materials on electro and electronic equipment).

The gearhead is specified for installment on motors that:

- correspond to the design B5 (for any divergences, please consult our Customer Service Department [Technical Customer Service]).
- show a radial and axial runout tolerance of at least "N" according to DIN 42955 and
- have a smooth shaft.





2.5 Guarantee and Liability

Guarantee and liability claims are excluded for personal injury and material damage in case of

- ignoring the information on transport and storage
- improper use
- improper or neglected maintenance and repair.
- improper assembly / disassembly or improper operation
- Operation of the gearhead when safety devices and equipment are defective
- Operation of the gearhead without lubricant
- Operation of a heavily soiled gearhead
- Modifications or reconstructions that have been carried out without the approval of

WITTENSTEIN alpha GmbH

2.6 General safety instructions

	<p style="text-align: center;">⚠ WARNING</p> <p>Objects flung out by rotating components can cause serious injuries.</p> <ul style="list-style-type: none">• Remove objects and tools from the gearhead before putting it into operation.
	<p style="text-align: center;">⚠ WARNING</p> <p>Rotating components on the gearhead can pull in parts of the body and cause serious injuries and even death.</p> <ul style="list-style-type: none">• Keep a sufficient distance to rotating machinery while the gearhead is running.
	<p style="text-align: center;">⚠ CAUTION</p> <p>Hot gearhead housing can cause serious burns.</p> <ul style="list-style-type: none">• Touch the gearhead housing only when wearing protective gloves or after the gearhead has been idle for some time.
	<p style="text-align: center;">INFORMATION</p> <p>Solvents can pollute soil and water.</p> <ul style="list-style-type: none">• Use and dispose of cleaning solvents appropriately.

3 Description of the gearhead

3.1 General Information

The gearhead is a single- or multistage, low-backlash planetary gearhead, which is manufactured as standard in the "M" version (motor installation). The output shaft bearing is designed to receive high overturning torques and axial forces.

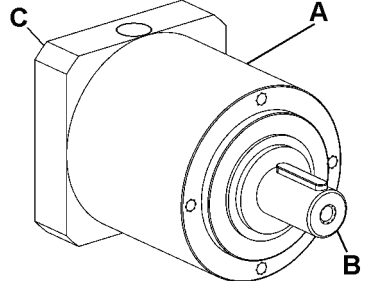
The motor is centered using the clamping hub and not with the adapter plate. Avoid a radial distortion of the motor.

Adaptation to various motors is done by an adaptor plate and a spacer sleeve.

The optional LPB⁺ has an output flange instead of an output shaft. You thus have the option of mounting a toothed belt pulley.

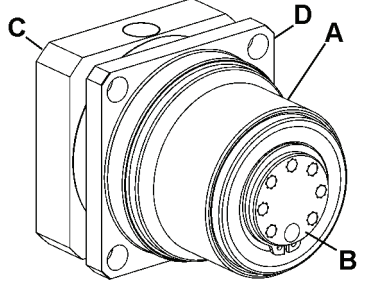
3.2 Overview of the gearhead components

3.2.1 Overview of the gearhead components LP⁺

		Gearhead components LP ⁺
	A	Gearhead housing
	B	Output shaft
	C	Adaptor plate

Tbl-1: Overview of the gearhead components

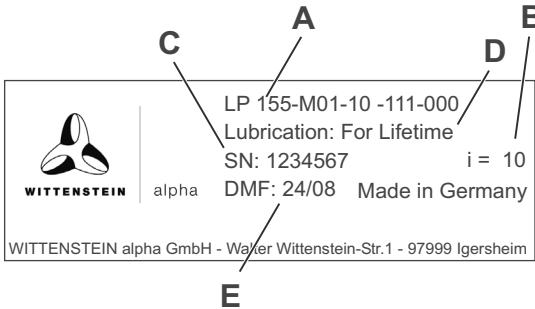
3.2.2 Overview of the gearhead components LPB⁺

		Gearhead components LPB ⁺
	A	Gearhead housing
	B	Output flange
	C	Adaptor plate
	D	Mountable flange

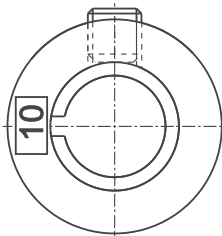
Tbl-2: Overview of the gearhead components

3.3 Type plate

The type plate is attached to the gearhead housing.

		Designation
 <p>LP 155-M01-10 -111-000 Lubrication: For Lifetime SN: 1234567 i = 10 DMF: 24/08 Made in Germany WITTENSTEIN alpha GmbH - Walter Wittenstein-Str.1 - 97999 Igersheim</p>	A	Ordering key (see chapter 3.4 "Ordering key")
	B	Ratio
	C	Serial number
	D	Lubrication information
	E	Production date

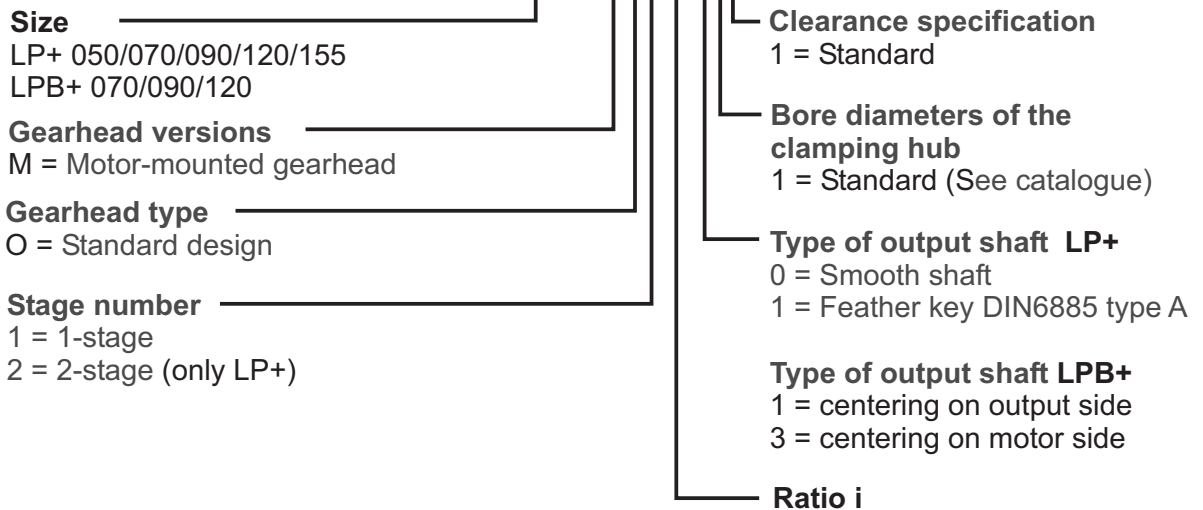
Tbl-3: Type plate (sample values)



The ratio (e.g. $i = 10$) can also be found on a label on the plug socket. The spacer sleeve is properly aligned when the slit points to the label.

3.4 Ordering key

LPB 090-MO1-3-111



3.5 Performance statistics

Please refer to our catalogue or our Internet page for the maximum permitted speeds and torques:
<http://www.wittenstein-alpha.de>

	INFORMATION
Please consult our service department if your gearhead is older than a year. You will then receive the valid performance data.	

3.6 Weight

The table "Tbl-4" specifies the gearhead dimensions with medium-sized adaptor plate. If another adaptor plate is mounted, the actual dimensions can deviate by up to 20%.

Gearhead size LP ⁺	050	070	090	120	155
1-stage [kg]	0.75	2.0	4.0	8.6	17.0
2-stage [kg]	0.95	2.4	5.0	11.0	21.0
Gearhead size LPB ⁺	050	070	090	120	155
1-stage [kg]	—	1.6	3.3	7.3	—

Tbl-4: Weight

4 Transport and storage

4.1 Scope of delivery



- Check the completeness of the delivery against the delivery note.
- ① Missing parts or damage must be notified immediately in writing to the carrier, the insurance, or **WITTENSTEIN alpha GmbH**.

4.2 Packaging

The gearhead is delivered packed in foil and cardboard boxes.

- Dispose of the packaging materials at the recycling sites intended for that. Observe the locally valid regulations for disposals.

4.3 Transport

	<p style="text-align: center;">CAUTION</p> <p>Hard knocks, for instance because of falling or hard dropping, can damage the gearhead.</p> <ul style="list-style-type: none"> • Only use hoisting equipment and transports with sufficient capacity. • The maximum permitted lift capacity of a hoist may not be exceeded. • Lower the gearhead slowly.
	<p style="text-align: center;">WARNING</p> <p>Suspended loads can fall and can cause serious injuries and even death.</p> <ul style="list-style-type: none"> • Do not stand under suspended loads.



Specifications on the weights, refer to Chapter 3.6 "Weight".

4.4 Storage

Store the gearhead in horizontal position and dry surroundings at a temperature of 0 °C to + 30 °C in the original packaging. Store the gearhead for a maximum of 2 years.

For storage logistics, we recommend the "first in - first out" method.

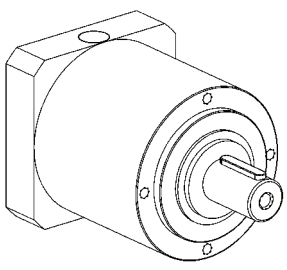
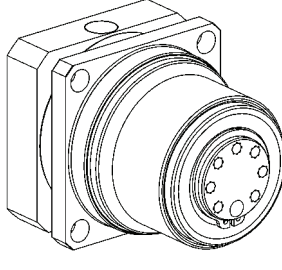
5 Assembly

	<h3>CAUTION</h3>
	<p>Loose or overloaded screw connections can damage the gearhead.</p> <ul style="list-style-type: none"> • Use a calibrated torque wrench to tighten and check all screw connections for which a tightening torque has been specified.
	<h3>CAUTION</h3>
	<p>Intensive distortions when assembling the motor (e.g. for motors with shaft shoulder, extensive chamfer radius or longer shafts than permitted for the gearhead) can damage the gearhead and the motor.</p> <ul style="list-style-type: none"> • Check the interfering edges by measuring, or by a measurement check based on our catalogue specifications and the information of the motor manufacturer. • Contact our Customer Service Department.

5.1 Preparation


The differences in the assembly sequence of LP⁺ and LPB⁺ are listed in the table "Tbl-5".

① Please consult our Customer Service Department if you have any questions.

	LP ⁺		LPB ⁺
	—	1	
	1	2	
	2	3	
	3	—	
	5.3 "Mounting the motor onto the gearhead (LP ⁺ /LPB ⁺)"	5.2 "Mounting the gearhead to a machine (LPB ⁺)"	
	5.4 "Mounted components on the gear output side"	5.3 "Mounting the motor onto the gearhead (LP ⁺ /LPB ⁺)"	
	5.5 "Mounting the gearhead to a machine (LP ⁺)"	5.4 "Mounted components on the gear output side"	

Tbl-5: Assembly sequence

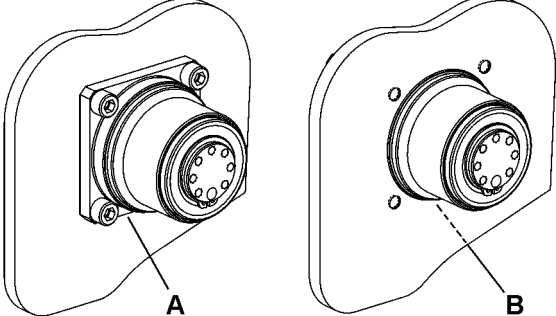
The bolts for mounting are not included in the delivery and need to be provided by the customer. Information for that can be found in the individual assembly steps.

	CAUTION
	<p>Pressurized air can damage the gearhead seals.</p> <ul style="list-style-type: none"> Do not use pressurized air to clean the gearhead.

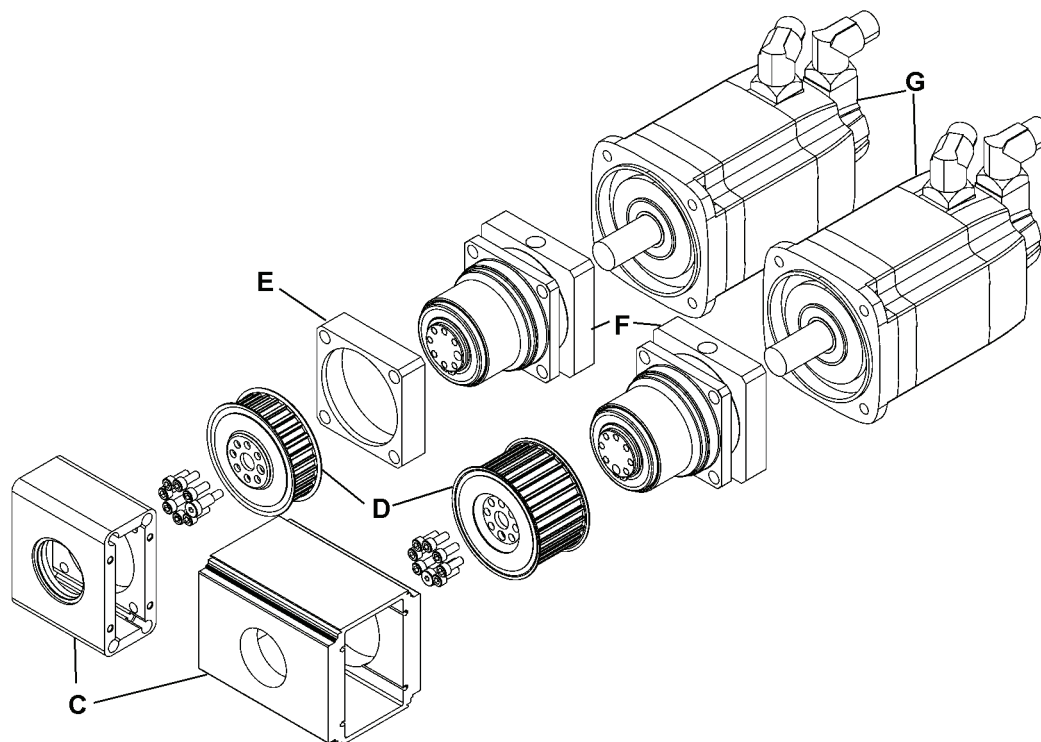
- Clean/de-grease the following components with a clean and lint-free cloth and grease-dissolving, non-aggressive detergent:
 - all fitting surfaces to neighboring components
 - centering
 - the motor shaft
 - the inner diameter of the plug receptacle
- Check the fitting surfaces in addition for damage and foreign bodies.

5.2 Mounting the gearhead to a machine (LPB⁺)

There are two centering mechanisms for assembling the gearhead to the machine:

		centering
	A	motor side
	B	gear output side

Tbl-6: Centering mechanisms



When a toothed belt pulley (D), an adapter plate (F) and a motor (G) are ordered, these arrive with mountings that have **only been tightened by hand**.

- Loosen the motor, adapter plate and the toothed belt pulley from the gearhead.
- ① If necessary, a spacer (E) may need to be placed between the gear reducer and your machine to position the gear reducer precisely. Such a spacer is **not** part of the drive's delivery and needs to be provided by the customer.
- Thoroughly clean the output flange, centering, fitting surface and spacer.

The bolts need to be provided by the customer. You can find the prescribed screw sizes and tightening torques in Chapter 9.2 "Specifications on mounting onto a machine", table "TbI-16".

- ① When using hollow profiles (C): Position the toothed belt pulley (D) in the hollow profile before you attach the gearhead.
- Smear screw-bonding agent (for example Loctite 243) onto the four bolts.
- Fasten the gearhead on the machine with the four fastening bolts through the through-holes.
- ① Mount the gearhead in such a way that the type plate remains legible, if possible.
- ① Do not use washers (e.g. plain washers, tooth lock washers).

5.3 Mounting the motor onto the gearhead (LP⁺/LPB⁺)

The standard delivery of a gearhead does not have a motor. The motor to be mounted has to:

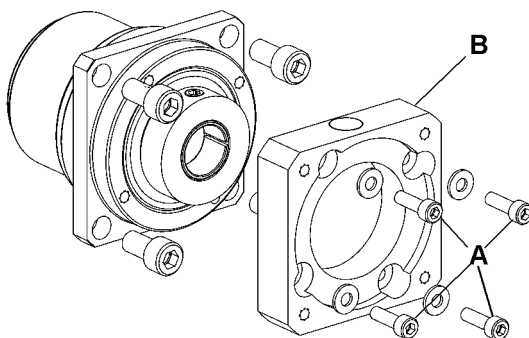
- correspond to the B5 design
- have a radial and axial runout tolerance of "N" according to DIN 42955 and
- if possible, have a smooth shaft.

① If a motor is included in the delivery, then it is:

- already firmly mounted on the LP⁺ (no assembly necessary).
- only mounted hand-tight on the LPB⁺ (assembly necessary).

5.3.1 Pre-mounting adapter plate (only LPB⁺)

The following information is valid for only the LPB⁺. On the LP⁺, the adapter plate is already mounted.



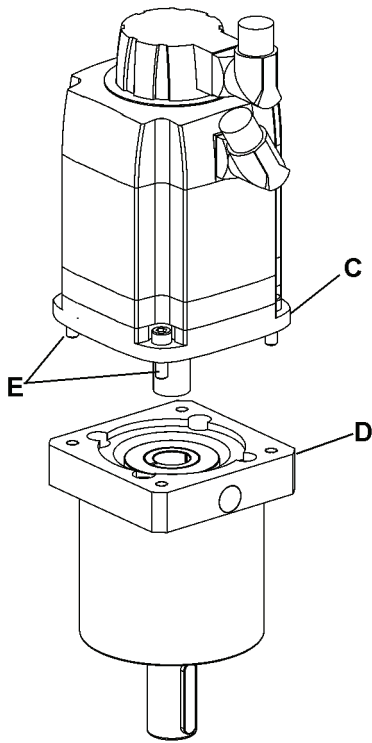
The adapter plate (B) along with the four fastening bolts (A) are included in the scope of delivery.

- Place the adapter plate onto the housing and hand-tighten the bolts at first.
- Tighten the bolts in diagonal order in at least two passes to the required tightening torque. See table "Tbl-7"

Gearhead size LPB ⁺	Size	Tightening torque [Nm]
070	M4	2,64
090	M6	8,99
120	M6	8,99

Tbl-7: Fastening bolts adapter plate

5.3.2 Mounting the motor (LP⁺/LPB⁺)




- Ensure that the motor is mounted if possible in a vertical direction.
- Clean the motor shaft, the plug socket bore hole, the spacer sleeve and the fitting surfaces of motor and gearhead.
- If the motor shaft has a shaft key, remove the shaft key.
 - ① If recommended by the motor manufacturer, insert a half wedge.
- Turn the plug socket (A) so that the threaded pin (B) can be reached through the mounting holes.
- Push the motor shaft into the plug receptacle of the gearhead.
 - ① The maximum permitted axial forces may not be exceeded, see Chapter 9.1 "Specifications on mounting onto a motor", table "Tbl-14". The motor shaft should slip in easily. If this is not the case, the threaded pin needs to be loosened more.
 - ① The slit of the spacer sleeve has to line up with the groove (if existing) of the motor shaft and be turned by 90° to the threaded pin, see table "Tbl-8".
 - ① No gap is permitted between motor (C) and the adapter plate (D).

		Designation
		A
		B
		F
		G
		H

Tbl-8: Arrangement of motor shaft, plug receptacle and spacer sleeve

- Smear screw-bonding agent (for example Loctite 243) onto the four bolts (E).
- Fasten the motor (C) onto the adapter plate (D) with the four screws (E).
- Tighten the threaded pin (B) of the plug receptacle (A).
 - ① For bolt sizes and specified torques refer to chapter 9.1 "Specifications on mounting onto a motor", table "Tbl-14".
- Press the enclosed stopper plugs up to their stop in the mounting bores of the adapter plate (D).

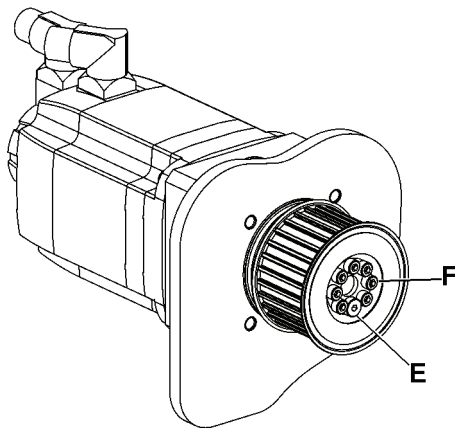
5.4 Mounted components on the gear output side

	CAUTION				
	<p>Distortions during mounting operations can damage the gearhead.</p> <ul style="list-style-type: none"> • Mount gearwheels and toothed belt pulleys onto the output shaft without forcing. • Do not on any account attempt an assembly by force or hammering! • Only use suitable tools and equipment for assembly. • If you pull on or shrink-fit a gear wheel onto the output shaft, you must make sure that the maximum permitted static axial forces of the output bearing (see table "Tbl-9") are not exceeded. 				

Size LP ⁺ / LPB ⁺	050	070	090	120	155
$F_{a \max}$ [N]	1800	4300	5100	11300	18500

Tbl-9: Maximum permitted static axial forces at static bearing statistic (s_0) = 1.8 and radial force (F_r) = 0

5.4.1 Mountings on the output flange (LPB⁺)



Only the version LPB⁺ features an output flange on which a toothed belt pulley can be mounted with the bolts.

- Coat the contact surfaces lightly with grease or lubricant in order to prevent contact corrosion.
- Place the toothed belt pulley onto the output flange and tighten the bolts initially by hand.
- Tighten the fastening bolts (F) and the close-tolerance bolt (E) (1 piece) in diagonal order making at least two passes to the required tightening torque (see table "Tbl-10").

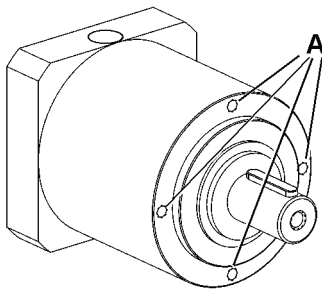
Size LPB ⁺	Close-tolerance bolt (property class 12.9)		Fastening bolts (property class 12.9)	
	Size	Tightening torque [Nm]	Size	Tightening torque [Nm]
070	M5x12	9	5 x M5x12	9
090	M6x16	15.4	7 x M6x16	15.4
120	M6x16	15.4	7 x M8x20	37.3

Tbl-10: Fastening the toothed belt pulley

The tension of the tooth belt is brought about by its construction. The toothed belt's prestressing force influences the ball bearing life of the gearhead.

- You can determine the theoretical bearing life for each case using our analysis software **cymex**[®].
- Set your toothed belt so that there are no lateral starting loads pressing on the toothed belt pulley.

5.5 Mounting the gearhead to a machine (LP⁺)






Four threaded bores are available in the gear unit housing for bolting it to your machine.

- Thoroughly clean the output shaft, centering, and fitting surface.

The bolts need to be provided by the customer. You can find the prescribed screw sizes and tightening torques in Chapter 9.2 "Specifications on mounting onto a machine", table "Tbl-15".

- Smear screw-bonding agent (for example Loctite 243) onto the four bolts.
- Fasten the gearhead on the machine with the fastening bolt through the holes.
 - ⓘ Mount the gearhead in such a way that the type plate remains legible.
 - ⓘ Do not use washers (e.g. plain washers, tooth lock washers).



6 Startup and operation

	<p style="text-align: center;">⚠ WARNING</p> <p>Objects flung out by rotating components can cause serious injuries.</p> <ul style="list-style-type: none"> • Remove objects and tools from the gearhead before putting it into operation.
	<p style="text-align: center;">⚠ WARNING</p> <p>Rotating components on the gearhead can pull in parts of the body and cause serious injuries and even death.</p> <ul style="list-style-type: none"> • Keep a sufficient distance to rotating machinery while the gearhead is running.
	<p style="text-align: center;">⚠ CAUTION</p> <p>Hot gearhead housing can cause serious burns.</p> <ul style="list-style-type: none"> • Touch the gearhead housing only when wearing protective gloves or after the gearhead has been idle for some time.

Operational conditions and requirements for the surroundings:

- Because of the factory-filled lubricant, the ambient temperature may not lie under 0 °C or over +40 °C. Operating temperature may not exceed +90 °C.
 ⓘ For other conditions of use, please consult our Customer Service Department.
- Only use the gearhead only up to its maximum limit values, see Chapter 3.5 "Performance statistics".
- Only use the gearhead only in a clean, dust-free and dry environment.

7 Maintenance and disposal

	<p style="text-align: center;">⚠ CAUTION</p> <p>Hot gearhead housing can cause serious burns.</p> <ul style="list-style-type: none"> ● Touch the gearhead housing only when wearing protective gloves or after the gearhead has been idle for some time.
	<p style="text-align: center;">⚠ WARNING</p> <p>Rotating components on the gearhead can pull in parts of the body and cause serious injuries and even death.</p> <ul style="list-style-type: none"> ● Disconnect the machine from the mains before starting maintenance work. ● Secure the motor against restarting during maintenance work.

7.1 Maintenance work

7.1.1 Visual inspection

- Check the entire gearhead for exterior damage.
- The radial shaft seals are subject to wear. Therefore also check the gearhead for leakage during each visual inspection.
 - ① You can find more general information on radial shaft seals on our partner's Internet site at <http://www.simrit.de>.
 - ① Check the mounting position, so that no foreign medium (e.g. oil) has collected on the output shaft.

7.1.2 Checking the tightening torques

- Check the tightening torque of the fastening bolts on the gearhead housing. For LPB⁺ gearheads, also check the fastening bolts on the toothed belt pulley.
 - ① You can find the prescribed tightening torques in Chapter 9.2 "Specifications on mounting onto a machine", tables "Tbl-15" and "Tbl-16" as well as in Chapter 5.4.1 "Mountings on the output flange (LPB⁺)", table "Tbl-10".
- Check the tightening torque of the threaded pin on the motor mounting.
 - ① You can find the prescribed tightening torques in chapter 9.1 "Specifications on mounting onto a motor", table "Tbl-14".

7.2 Start-up after maintenance work

- Clean the outside of the gearhead.
- Attach all safety devices.
- Do a trial run before releasing the gearhead again for operation.

7.3 Maintenance schedule

Maintenance work	At start-up	After 500 operating hours or 3 months	Every 3 months	Yearly
Visual inspection	X	X	X	
Checking the tightening torques	X	X		X

Tbl-11: Maintenance schedule

7.4 Notes on the lubricant used

	INFORMATION
	All gearheads are lubricated for their entire working life.


You can obtain further information on the lubricant from our Customer Service.

7.5 Supplementary information

Consult our Customer Service Department for supplementary information on exchanging the gearhead, on disassembly, and on disposal of the gearhead.

- Dispose of the gearhead at the recycling sites intended for this purpose.
 - ① Observe the locally valid regulations for disposals.

8 Malfunctions

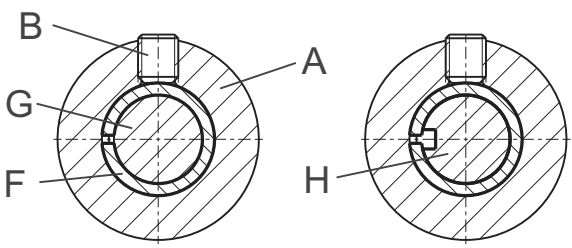
	CAUTION
	<p>Changed operational behavior can be an indication of existing damage to the gearhead or cause damage to the gearhead.</p> <ul style="list-style-type: none"> Do not put the gearhead back into operation until the cause of the malfunction has been rectified.

Fault	Possible cause	Solution
Increased operating temperature	The gearhead is not suited for the task.	Check the technical specifications.
	Motor is heating the gearhead.	Check the wiring of the motor.
		Ensure adequate cooling.
	Ambient temperature too high.	Change the motor.
Increased noises during operation	Distortion in motor mounting	Please consult our Customer Service Department.
	Damaged bearings	
	Damaged gear teeth	
Loss of lubricant	Lubricant quantity too high	Wipe off discharged lubricant and continue to watch the gearhead. Lubricant discharge must stop after a short time.
	Seals not tight	Please consult our Customer Service Department.

Tbl-12: Malfunctions

9 Appendix

9.1 Specifications on mounting onto a motor

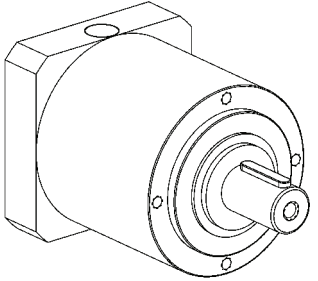
		Designation
	A	Plug receptacle
	B	Threaded pin
	F	Spacer sleeve
	G	Smooth shaft
	H	Grooved shaft

Tbl-13: Arrangement of motor shaft, plug receptacle and spacer sleeve

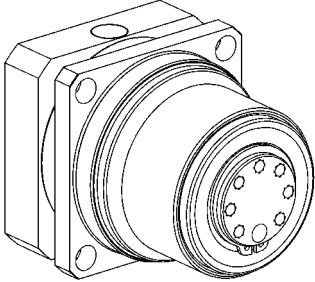
Gearhead size LP ⁺ / LPB ⁺	Clamping hub interior Ø [mm]	Width across flats, threaded pin (B) [mm]	Tightening torque [Nm]	Max. axial force [N]
050	11	3	5.6	45
070	16	4	9.5	80
090	24	5	23	100
120	32	6	45	150
155, 1-stage	42	8	78	180
155, 2-stage	32	6	45	150

Tbl-14: Specifications on mounting onto a motor

9.2 Specifications on mounting onto a machine

	Size LP ⁺	Bore Ø [mm]	Bolt size / property class	Tightening torque [Nm]
	050	44	M4 / 12.9	4.55
	070	62	M5 / 12.9	9.0
	090	80	M6 / 12.9	15.4
	120	108	M8 / 12.9	37.3
	155	140	M10 / 12.9	73.4

Tbl-15: Threaded bores in the gearhead housing LP⁺

	Gearhead size LPB ⁺	Bore Ø [mm]	Bolt size / property class	Tightening torque [Nm]
	070	82	M8 / 12.9	37.3
	090	106	M10 / 12.9	73.4
	120	144	M12 / 12.9	126

Tbl-16: Through-holes in gearhead housing LPB⁺

9.3 Tightening torques for common thread sizes in general mechanics

The specified tightening torques for headless screws and nuts are calculated values and are based on the following conditions:

- Calculation acc. VDI 2230 (Issue February 2003)
- Friction value for thread and contact surfaces $\mu=0.10$
- Exploitation of the yield stress 90 %

Property class Bolt / nut	Tightening torque [Nm] for threads												
	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24
8.8 / 8	1.15	2.64	5.24	8.99	21.7	42.7	73.5	118	180	258	363	493	625
10.9 / 10	1.68	3.88	7.69	13.2	31.9	62.7	108	173	265	368	516	702	890
12.9 / 12	1.97	4.55	9.00	15.4	37.3	73.4	126	203	310	431	604	821	1042

Tbl-17: Tightening torques for headless screws and nuts