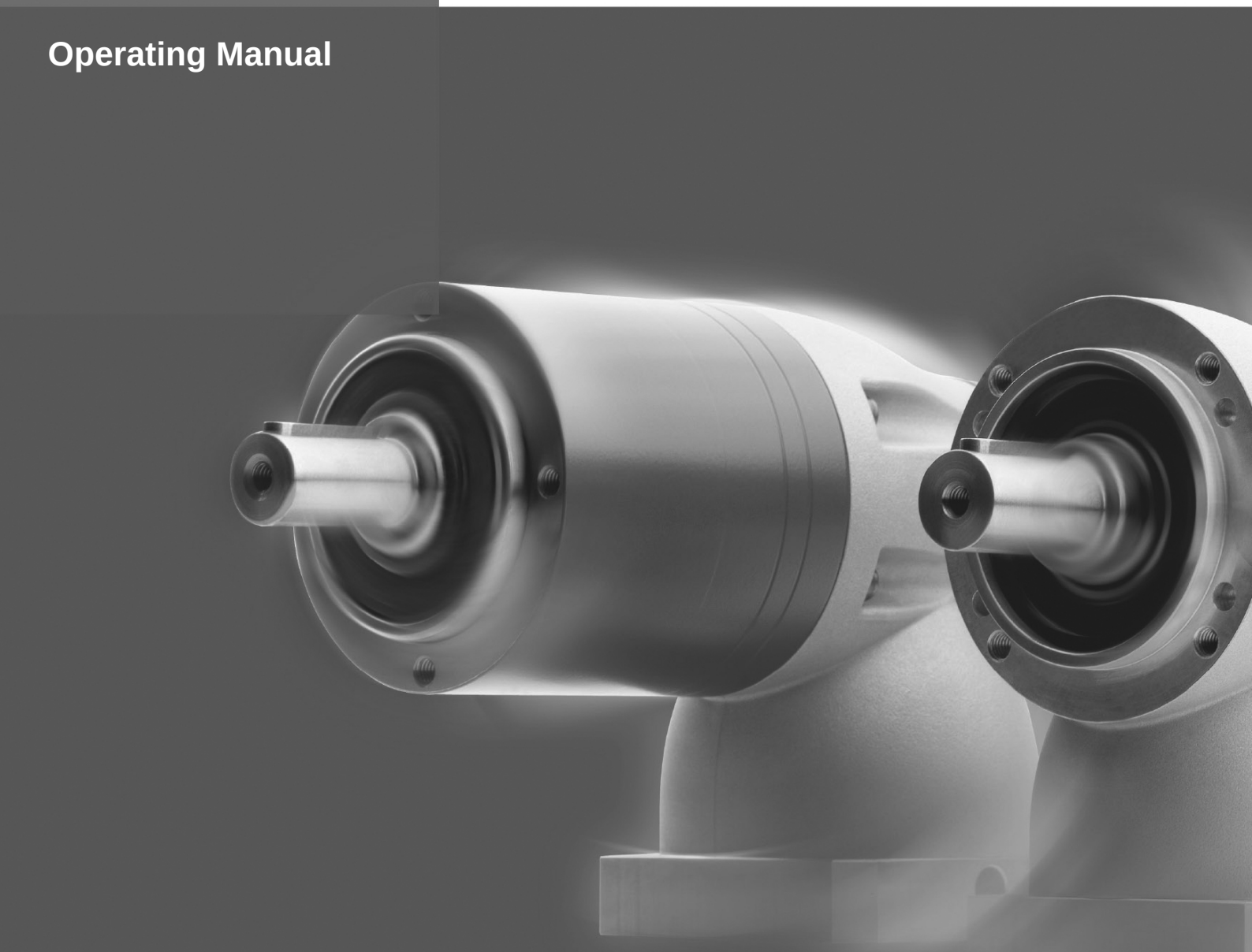
WITTENSTEIN | alpha

LK+/LPK+/LPBK+

Operating Manual



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Revision: 04

Revision history

Revision	Date	Comment	Chapter
01	24.05.07	New version	All
01a	11.02.09	WITTENSTEIN Layout	All
02	01.08.09	Machinery Directive	1, 2, 3, 4, 6
03	09.03.10	LPBK+	All
03a	26.07.10	Technical Data	5.4.1
04	01.09.10	Technical Data	5.4, 9.1

Service

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Contents

1 Regarding this manual

These instructions contain necessary information for the safe operation of the right-angle gearhead LK+/LPK+/LPBK+, 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.

These **safety instructions** should be shared with colleagues working in the vicinity of the device to ensure individual safety.

The original instructions were prepared in German; all other language versions are translations of these instructions.

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 to an imminent danger that can cause serious injuries and even death.**
	⚠ WARNING **This signal word points to a possible danger that can cause serious injuries and even death.**
	⚠ CAUTION **This signal word points to a possible danger that can cause slight to serious injuries.**
	NOTICE **This signal word points to a possible danger that can cause material damage.**
	A note without 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

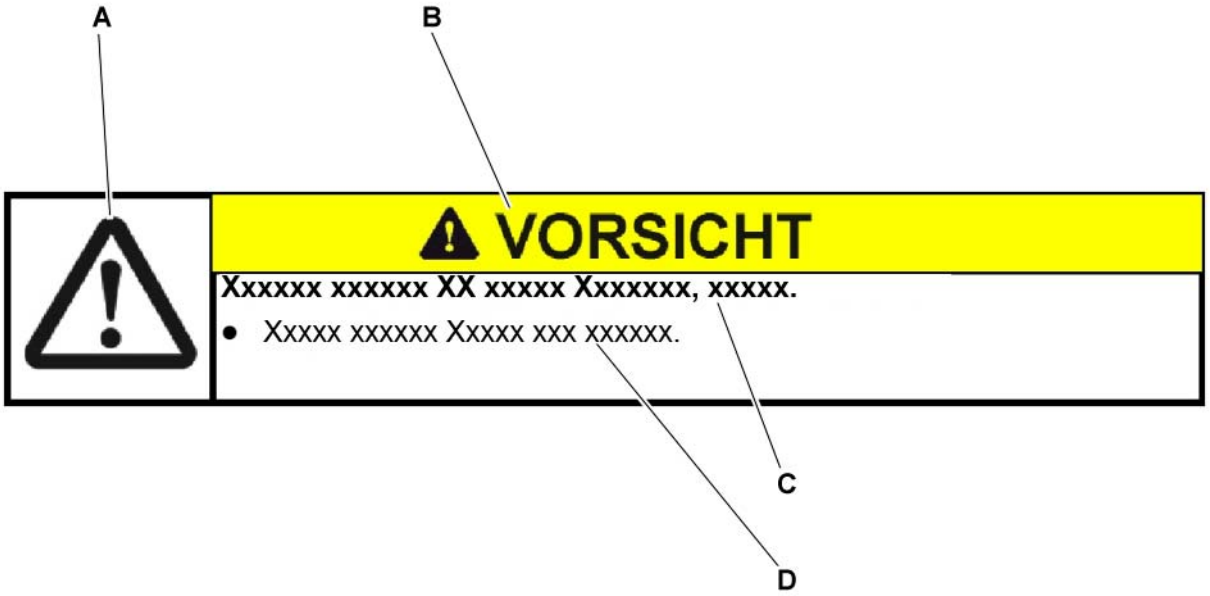

Danger of being pulled in


Environment protection


Information

1.3 Design of the safety instructions

The safety instructions of this operating manual are designed according to the following pattern:



A = Safety symbol (see Chapter 1.2 "Safety symbols")
B = Signal word (see Chapter 1.1 "Signal words")
C = Type and consequence of the danger
D = Prevention of the danger

1.4 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 (for instance, personal safety equipment) and on environmental protection should be observed.

2.1 EC – Machinery directive

The gearhead is considered a "machine component" and is therefore not subject to the EC Machinery Directive 2006/42/EC.

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.

- Be informed of the general safety instructions before beginning work. (see Chapter 2.7 "General safety instructions").

2.3 Personnel

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

2.4 Intended use

The gearhead serves to convert torques and speeds. It 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 Reasonably predictable misuse

Any usage that exceeds the maximum permitted speeds, torques and temperature is considered a misuse and is therefore prohibited.

2.6 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 (misuse)
- 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**

2.7 General safety instructions

⚠ WARNING

Objects flung out by rotating components can cause serious injuries.

- Remove objects and tools from the gearhead before putting it into operation.

⚠ WARNING

Rotating components on the gearhead can pull in parts of the body and cause serious injuries and even death.

- Keep a sufficient distance to rotating machinery while the gearhead is running.
- Secure the machine against restarting and unintentional movements during assembly maintenance work.

⚠ CAUTION

Hot gearhead housing can cause serious burns.

- Touch the gearhead housing only when wearing protective gloves or after the gearhead has been at standstill for some time.

NOTICE

Loose or overloaded screw connections can damage the gearhead.

- Use a calibrated torque wrench to tighten and check all screw connections for which a tightening torque has been specified.

Solvents and lubricants can pollute soil and water.

- Use and dispose of cleaning solvents as well as lubricants appropriately.

3 Description of the gearhead

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

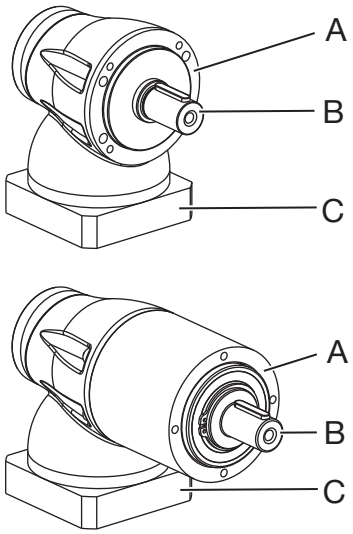
Adaptation to various motors is done by an adapter plate and a bushing.

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

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

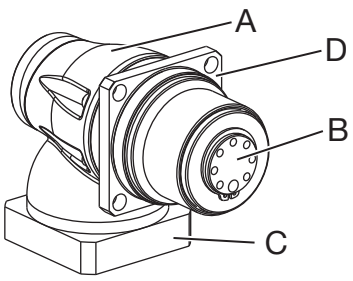
3.1 Overview of the gearhead components

3.1.1 Overview of the gearhead components LK+/LPK+

		Gearhead components LK+/LPK+
	A	Gearhead housing
	B	Output shaft
	C	Adapter plate

Tbl-1: Overview of the gearhead components

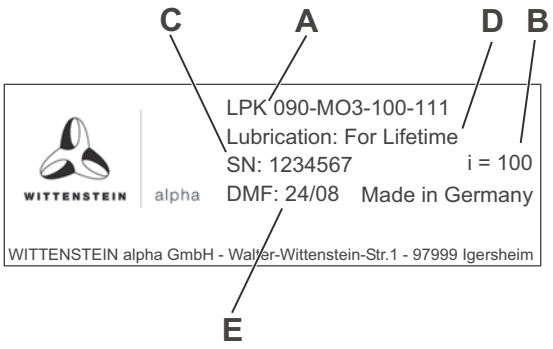
3.1.2 Overview of the gearhead components LPBK+

		Gearhead components LPBK+
	A	Gearhead housing
	B	Output flange
	C	Adapter plate
	D	Mountable flange

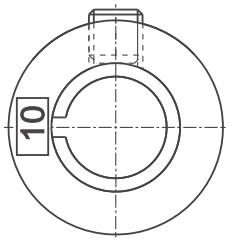
Tbl-2: Overview of the gearhead components

3.2 Type plate

The type plate is attached to the gearhead housing.

		Designation
	A	Ordering code (see Chapter 3.3 "Ordering code")
	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 clamping hub (plug receptacle). The bushing is properly aligned when the slit points to the label.

3.3 Ordering code

LPK 090 - MO3 - 100 - 111

Gearhead type
LK+/LPK+ 050/070/090/120/155
LPBK+ 070/090/120

Gearhead variations
M = Motor attachment gearhead

Gearhead model
O = Standard

Number of stages
1 = 1-stage (LK+)
2 = 2-stage (LPK+/LPBK+)
3 = 3-stage (LPK+)

Backlash
1 = Standard

Clamping hub bore hole diameter
1 = Standard
(See catalogue)

Output shaft shape LK+/LPK+
0 = Smooth shaft
1 = Shaft with key DIN 6885 Form A

Output shape LPBK+
1 = centering on output side

Ratios i

3.4 Performance statistics

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

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

3.5 Weight

You will find the weights of the gearhead with medium-sized adapter plate in Table "Tbl-4". If another adapter plate is mounted, the actual weight can deviate by up to 10%.

Gearhead size LK+	**050**	**070**	**090**	**120**	**155**
1–stage [kg]	0.7	1.,9	3.2	8.9	18.9
Gearhead size LPK+	**050**	**070**	**090**	**120**	**155**
2–stage [kg]	1.4	3.	6.9	16.8	34.7
3–stage [kg]	1.6	4.2	7.,9	19.2	38.7
Gearhead size LPBK+	**—**	**070**	**090**	**120**	**—**
2–stage [kg]	—	3.4	6.2	15.5	—

Tbl-4: Weight

3.6 Noise emission

Depending on the gearhead type and product size, the continuous sound pressure level is between 70 and 78 dB(A).

Contact our Customer Service department if you need information about your particular product.

4 Transport and storage

4.1 Scope of delivery

- Check the completeness of the delivery against the delivery note.

  ⓘ 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 recycling sites intended for that. Observe the locally valid regulations for disposals.

4.3 Transport

NOTICE

Hard knocks, for instance because of falling or hard dropping, can damage the gearhead.

- Use only hoisting equipment and transportation devices with sufficient capacity.
- The permitted lifting weight of a hoist may not be exceeded.
- Lower the gearhead slowly.

⚠ WARNING

Suspended loads may fall and cause serious injuries and even death.

- Do not stand under suspended loads.

⚠ WARNING

The plastic lid on the gearhead may come off.

- Never transport the gearhead by the plastic lid.

No special transport mode is prescribed to transport the gearhead.

For specifications on the weights see Chapter 3.5 "Weight".

4.4 Storage

Store the gearhead in horizontal position and dry surroundings at a temperature of 0 °C to +40 °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.

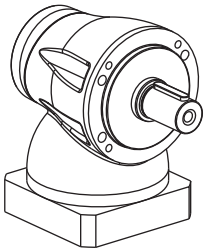
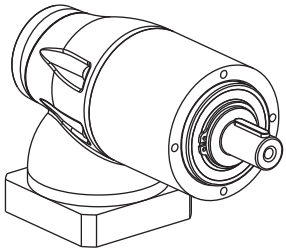
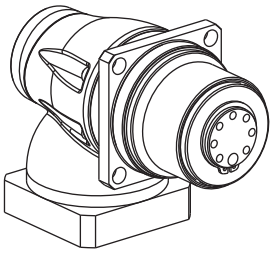
5 Assembly

- Be informed of the general safety instructions before beginning work. (see Chapter 2.7 "General safety instructions").

5.1 Preparations

The differences in the assembly sequence of LK+ /LPK+ and LPBK+ are listed in the table "Tbl-5".

ⓘ If you have any questions, please contact our Customer Service department.

<table>
<tr><th colspan="3">LK+/LPK+</th><th colspan="2">LPBK+</th></tr>
<tr><td rowspan="4"> 
  </td><td>—</td><td>1
5.2 "Mounting the gearhead to a machine (only LPBK+)"</td><td rowspan="4">  </td></tr>
<tr><td>1
5.3 "Mounting the motor onto the gearhead"</td><td>2
5.3 "Mounting the motor onto the gearhead"</td></tr>
<tr><td>2
5.4 "Mounted components on the gear output side"</td><td>3
5.4 "Mounted components on the gear output side"</td></tr>
<tr><td>3
5.5 "Mounting the gearhead to a machine (only LK+/ LPK+)"</td><td>—</td></tr>
</table>

Tbl-5: Assembly sequence

NOTICE

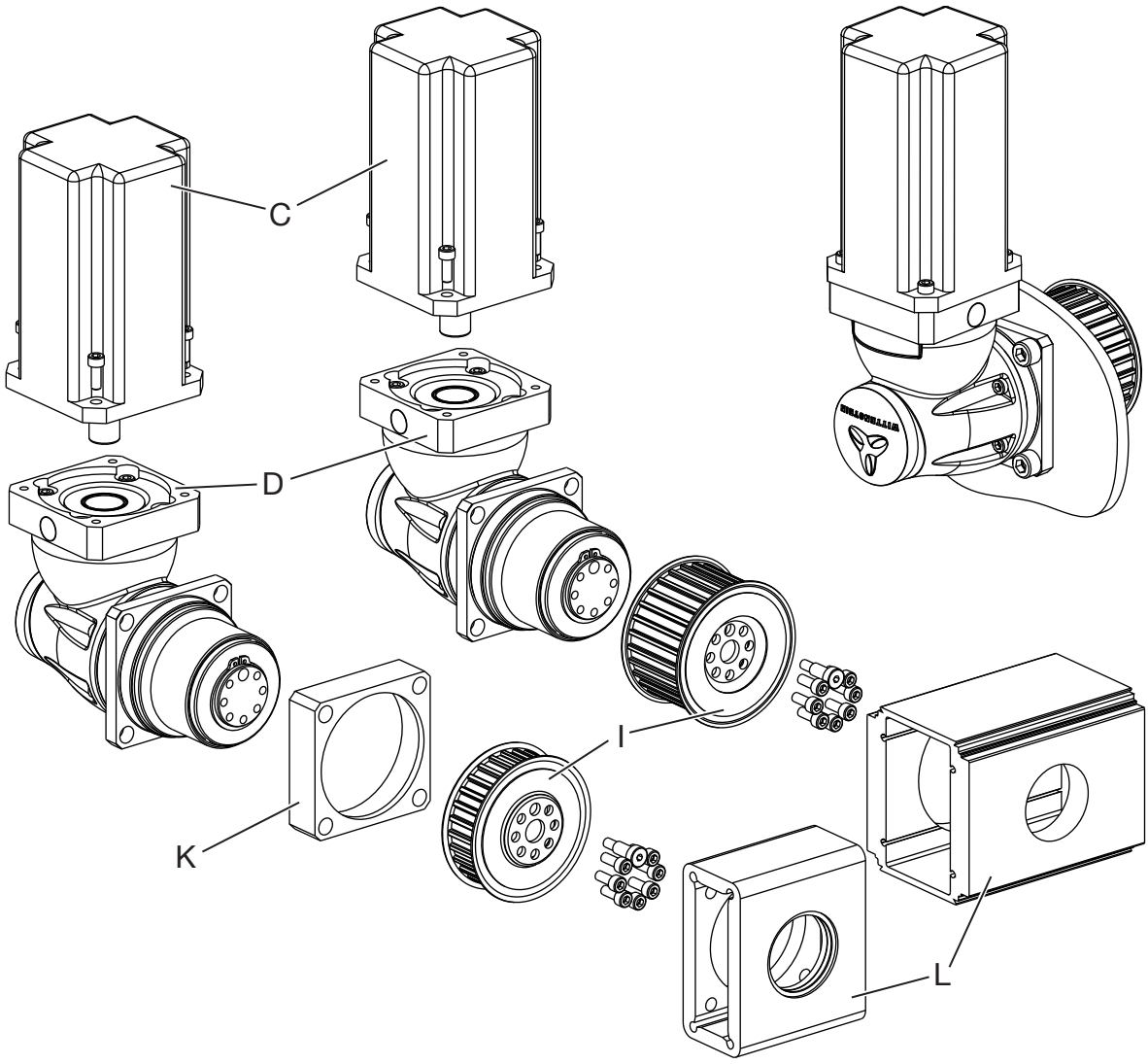
Pressurized air can damage the gearhead seals.

- 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 inside diameter of the clamping hub
  - The bushing inside and out
- Check the fitting surfaces additionally for damage and impurities.

5.2 Mounting the gearhead to a machine (only LPBK+)

	● Observe the safety and processing instructions of the cleaning agents and screw-bonding agents to be used.



ⓘ If necessary, a spacer (K) 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, spacer and toothed belt pulley. The anti-corrosion agent on the toothed belt pulley must be removed.

  ⓘ To remove the Aceton or Loctite 7063 anti-corrosion agent, use a clean, lint-free cloth.
- Also clean the browned toothed belt pulley with a brush and remove any salt residue between the flanged wheel and toothed belt wheel.

The fastening screws need to be provided by the customer.

ⓘ For prescribed screw sizes and torques refer to Chapter 9.2 "Information on mounting onto a machine", table "Tbl-16".

ⓘ When using hollow profiles (L): Position the toothed belt pulley (I) in the hollow profile before you attach the gearhead.

- Smear screw-bonding agent (for example Loctite 243) onto the fastening bolts.

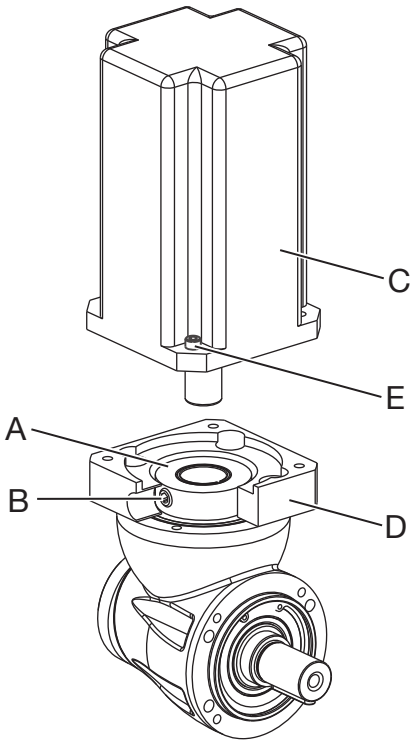
- Fasten the gearhead to the machine with the fastening screws through the through-holes.

ⓘ Mount the gearhead in such a way that the type plate remains legible, if possible.

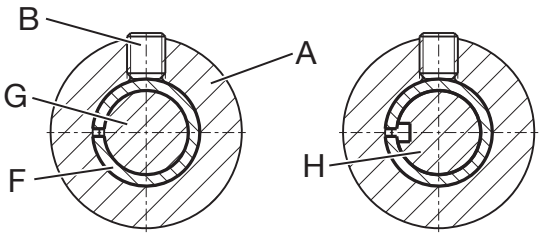
ⓘ Do not use washers (e.g. plain washers, tooth lock washers).

5.3 Mounting the motor onto the gearhead

	● Observe the general information and safety instructions of the motor manufacturer. ● Observe the safety and processing instructions of the screw-bonding agents to be used.



- Ensure that the motor is mounted if possible in a vertical direction.
- If the motor shaft has a shaft key, remove the shaft key.
  ⓘ If recommended by the motor manufacturer, apply a half wedge.
- Turn the clamping hub (A) so that the threaded pin (B) can be reached through the mounting bores.
- Push the motor shaft into the clamping hub of the gearhead.
  ⓘ The motor shaft should slip in easily. If this is not the case, the threaded pin needs to be loosened more.
  ⓘ The slit of the bushing 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-6".
  ⓘ No gap is permitted between motor (C) and the adapter plate (D).



	Designation
A	Clamping hub
B	Threaded pin
F	Bushing
G	Smooth shaft
H	Keyed shaft

Tbl-6: Arrangement of motor shaft, clamping hub, and bushing

- 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 clamping hub (A).
  ⓘ For bolt sizes and specified torques refer to chapter 9.1 "Information on mounting onto a motor", table "Tbl-13".
- 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

NOTICE

Distortions during mounting operations can damage the gearhead.

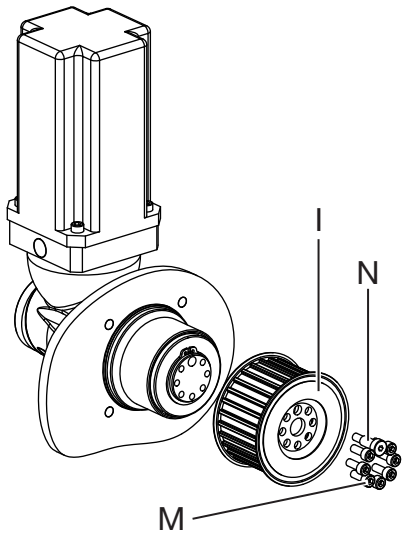
- Mount gearwheels and toothed belt pulleys onto the output shaft without forcing.
- Do not on any account attempt an assembly by force or hammering!
- Only use suitable tools and equipment for assembly.
- If you pull on or shrink-fit a gear wheel onto the output shaft, you must make sure that the maximum permitted static axial forces of the output bearing (see table "Tbl-7") are not exceeded.

Gearhead size LK+	050	070	090	120	155
F_{2AMAX} [N]	100	200	450	750	1000
Gearhead size LPK+	**050**	**070**	**090**	**120**	**155**
F_{2AMAX} [N]	700	1550	1900	4000	6000
Gearhead size LPBK+	**—**	**070**	**090**	**120**	**—**
F_{2AMAX} [N]	—	1550	1900	4000	—

Tbl-7: Maximum permitted static axial forces at static bearing statistic (s0) = 1.8 and radial force (FR) = 0

5.4.1 Mountings on the output flange (only LPBK+)

- Observe the safety and processing instructions of the cleaning agents and screw-bonding agents to be used.



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

- Thoroughly clean the output flange, centering, fitting surface, spacer and toothed belt pulley. The anti-corrosion agent on the toothed belt pulley must be removed.

  ⓘ To remove the Aceton or Loctite 7063 anti-corrosion agent, use a clean, lint-free cloth.
- Also clean the browned toothed belt pulley with a brush and remove any salt residue between the flanged wheel and toothed belt wheel.
- Place the toothed belt pulley onto the output flange.
- Brush the screws with a screw-bonding agent (such as Loctite 243) and tighten the screws by hand initially.
- Tighten the fastening bolts (M) and the close-tolerance bolt (N) (1 piece) in diagonal order making at least two passes to the required tightening torque (see table "Tbl-8").

Gearhead size LPBK+	Close-tolerance bolt		Fastening bolts	
	Thread x Depth [mm] x [mm]	Tightening torque [Nm] Property class 10.9	Quantity x Thread x Depth [ ] x [mm] x [mm]	Tightening torque [Nm] Property class 12.9
070	M5 x 12	7,69	5 x M5 x 12	9
090	M6 x 16	13,2	7 x M6 x 16	15,4
120	M6 x 16	13,2	7 x M8 x 20	37,3

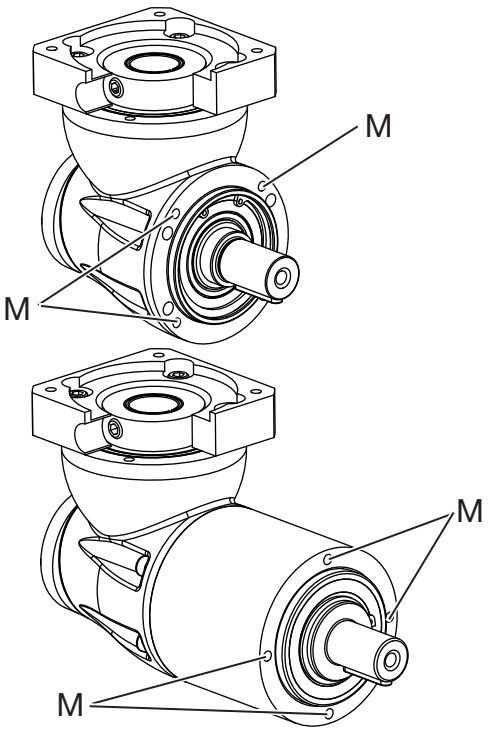
Tbl-8: Fastening the toothed belt pulley

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 (only LK+/LPK+)

	● Observe the safety and processing instructions of the screw-bonding agents to be used.



- Smear screw-bonding agent (for example Loctite 243) onto the fastening bolts.
- Fasten the gearhead to the machine with the fastening bolts **only** through the threaded bores (M).
  - ⓘ Mount the gearhead in such a way that the type plate remains legible.
  - ⓘ Do not use washers (e.g. plain washers, tooth lock washers).
  - ⓘ For specified screw sizes and torques refer to Chapter 9.2 "Information on mounting onto a machine", tables "Tbl-14" and "Tbl-15".

6 Startup and operation

- Be informed of the general safety instructions before beginning work. (see Chapter 2.7 "General safety instructions").

	Improper use can cause damage to the gearhead. ● Make sure that - the **ambient temperature** does not drop below –15 °C or exceed +40 °C and - the **operating temperature** does not exceed +90 °C. ● Avoid icing, which can damage the seals. ● For other conditions of use, please consult our Customer Service Department. ● Only use the gearhead only up to its maximum limit values, see Chapter 3.4 "Performance statistics". ● Only use the gearhead only in a clean, dust-free and dry environment.

7 Maintenance and disposal

- Be informed of the general safety instructions before beginning work. (see Chapter 2.7 "General safety instructions").

7.1 Maintenance work

7.1.1 Visual inspection

- Check the entire gearhead for exterior damage.
- The sealings are subject to wear. Therefore also check the gearhead for leakage during each visual inspection.
  - ⓘ 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.
  - ⓘ You can find the prescribed tightening torques in Chapter 9.2 "Information on mounting onto a machine", table "Tbl-14", "Tbl-15" and "Tbl-16".
- For LPBK+ gearheads, also check the fastening bolts on the toothed belt pulley.
  - ⓘ You can find the prescribed tightening torques in Chapter 5.4 "Mounted components on the gear output side", table "Tbl-8".
- Check the tightening torque of the threaded pin on the motor mounting.
  - ⓘ You can find the prescribed tightening torques in chapter 9.1 "Information on mounting onto a motor", table "Tbl-13".

7.2 Startup 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 startup	First time after 500 operating hours or 3 months	Every 3 months	Yearly
Visual inspection	X	X	X	
Checking the tightening torques	X	X		X

Tbl-9: Maintenance schedule

7.4 Notes on the lubricant used

All gearheads are lubricated for their service life by the manufacturer with a mineral oil-based lithium soap grease or with a food-safe synthetic grease (carbon hydride oil, aluminum complex soap) (see type plate). All bearings are permanently lubricated by the company.

You can receive further information on the lubricants directly from the manufacturer:

Standard lubricants	Lubricants for the food industry (USDA-H1 registered)
Castrol Industrie GmbH, Mönchengladbach Tel.: + 49 2161 909-30 www.castrol.com	Klüber Lubrication München KG, Munich Tel.: + 49 89 7876–0 www.klueber.com

Tbl-10: Lubricant manufacturers

7.5 Disposal

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

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

8 Malfunctions

Changed operational behavior can be an indication of existing damage to the gearhead or cause damage to the gearhead.

- Do not put the gearhead back into operation until the cause of the malfunction has been rectified.

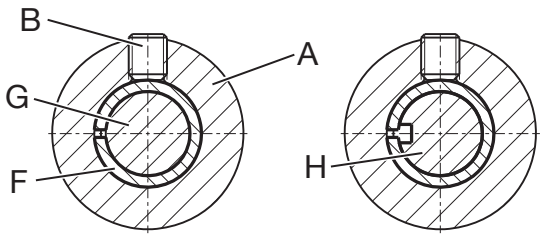
Rectifying of malfunctions may be done by only by especially trained technicians.

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.
		Change the motor.
	Ambient temperature too high.	Ensure adequate cooling.
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-11: Malfunctions

9 Appendix

9.1 Information on mounting onto a motor

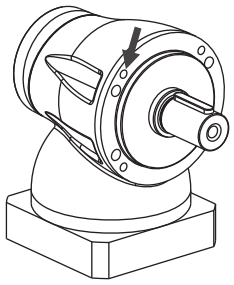
		Designation
	A	Clamping hub
	B	Threaded pin
	F	Bushing
	G	Smooth shaft
	H	Keyed shaft

Tbl-12: Arrangement of motor shaft, clamping hub, and bushing

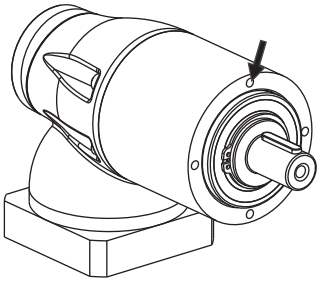
Gearhead size		Clamping hub interior Ø [mm]	Width across flats Threaded pin (B) [mm]	Tightening torque [Nm]	Max. axial force [N]
LK+/LPK+	**050**	11	3	5.6	45
LK+/LPK+/ LPBK+	**070**	16	4	14	80
	090	24	5	23	100
	120	32	6	45	150
LK+/LPK+	**155, 1–/2–stage**	42	8	78	180
	155, 3–stage	32	6	45	150

Tbl-13: Information on mounting onto a motor

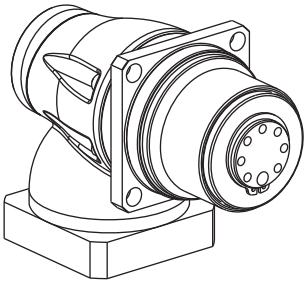
9.2 Information on mounting onto a machine

	Gearhead size LK+	Bore Ø [mm]	Screw size / property class	Tightening torque [Nm]
	**050**	44	M4 / 8.8	2.64
	070	62	M5 / 8.8	5.24
	090	80	M6 / 8.8	8.99
	120	108	M8 / 8.8	21.7
	155	140	M10 / 8.8	42.7

Tbl-14: Threaded bores in the gear unit housing LK+

	Gearhead size LPK+	Bore Ø [mm]	Screw size / property class	Tightening torque [Nm]
	**050**	44	M4 / 12.9	4.55
	070	62	M5 / 12.9	9
	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 gear unit housing LPK+

	Gearhead size LPBK+	Bore Ø [mm]	For screw 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 LPBK+

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 μ=0.10
- Exploitation of the yield stress 90 %

	Tightening torque [Nm] for threads												
Property class Bolt / nut	**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

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