WITTENSTEIN | alpha

alpha Value Line
NPS / NPR / NPT

Operating Manual

2022-D054420

Revision: 01a

Revision history

Revision	Date	Comment	Chapter
01	30.09.15	New version	All
01a	25.11.15	NPR	5.4.2

Service

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Contents

1 Regarding this manual

These instructions contain necessary information for the safe operation of the alpha Value Line NPS / NPR / NPT planetary gearhead, referred to as gearhead in the following.

If this manual is supplied with an amendment (e.g. for special applications), then the information in the amendment is valid. Contradictory specifications in this manual thereby become obsolete.

The operator must ensure that these instructions are read through by all persons assigned to install, operate, or maintain the gearhead, and that they fully comprehend them.

Store these instructions within reach of 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

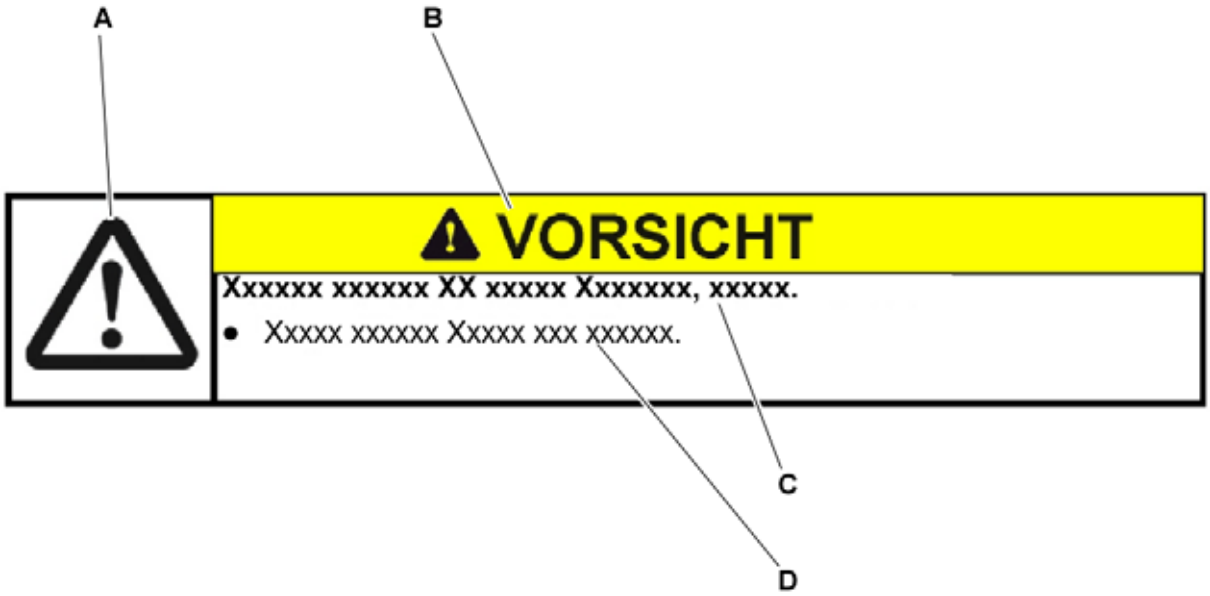

Danger of being pulled in


Environment protection


Information

1.3 Design of the safety instructions

The safety instructions of these instructions 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:

- Indicates an action to be performed
  - ➲ 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 instructions in this manual, also observe any (legal and otherwise) applicable environmental and accident prevention rules and regulations (e.g. personal safety equipment).

2.1 EC directives

2.1.1 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.

2.1.2 RoHS

The homogeneous materials used in the gearhead fall below the amounts of hazardous materials limited by directive 2011/65/EU Annex II.

- Lead (0.1%)
- Mercury (0.1%)
- Cadmium (0.01%)
- Hexavalent chromium (0.1%)
- Polybrominated biphenyls (PBB) (0.1%)
- Polybrominated diphenyl ether (PBDE) (0.1%)

Installation of the gearhead therefore has no effect on the restriction of using certain hazardous materials in electrical and electronic equipment as required in the 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.

- Read 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 suitable for all industrial applications.

The gearhead may not be operated in areas with explosion hazards. In food processing, the gearhead may be used only next to or under the foodstuff area.

The gearhead is intended for installation on motors that:

- Correspond to the design B5 (in the event of deviations, consult our Customer Service department [technical Customer Service department]).
- Have a radial and axial runout tolerance according to DIN EN 50347.
- Have a cylindrical shaft end with tolerance class h6 to k6.

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 (e.g. test run without secure attachment)
- 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.
- Remove/Secure the shaft key (if available) if the gearhead is operated without attachments on the output/drive side.

⚠ 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 and maintenance work (e.g. uncontrolled lowering of lifting axes).

⚠ WARNING

A damaged gearhead can cause accidents and injury.

- Never use a gearhead that has been overloaded to due misuse or a machine crash (see chapter 2.5 "Reasonably predictable misuse").
- Replace the affected gearhead, even if no external damage is visible.

⚠ 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.

⚠ WARNING

Lubricants are flammable.

- Do not spray with water to extinguish.
- Suitable extinguishing agents are powder, foam, water mist, and carbon dioxide.
- Observe the safety instructions of the lubricant manufacturer (see Chapter 7.4 "Notes on the lubricant used").

⚠ CAUTION

Solvents and lubricants can cause skin irritations.

- Avoid direct skin contact.

Solvents and lubricants can pollute soil and water.

- Use and dispose of cleaning solvents and lubricants properly.

3 Description of the gearhead

The gearhead is a single or multistage planetary gearhead which is manufactured in the version "M" (motor-mounted) by default. The output shaft bearing is realized in such a manner that it can accommodate extensive tilting moments and axial forces.

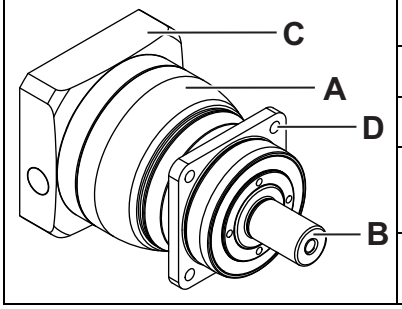
For applications with special safety requirements (e.g. vertical axes, distorted gear inputs) we recommend employing exclusively our products alpheno®, RP+, SP+, TP+, TP+ HIGH TORQUE or consulting with **WITTENSTEIN alpha GmbH** .

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

Various types of motors can be accommodated using an adapter plate and, where necessary, a bushing.

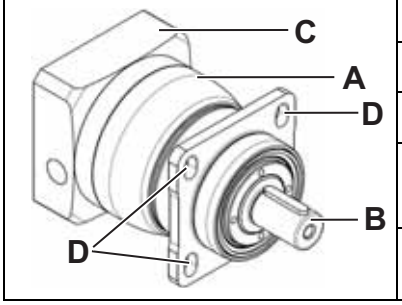
3.1 Overview of the gearhead components

3.1.1 NPS overview

		Gearhead components
	A	Gearhead housing
	B	Output shaft
	C	Adapter plate
	D	Through-holes (see section 5.5 "Attaching an NPS / NPT to a machine")

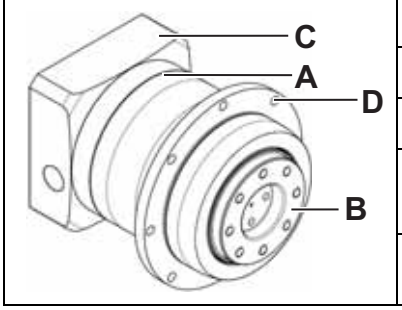
Tbl-1: Overview of the NPS gearhead components

3.1.2 NPR overview

		Gearhead components
	A	Gearhead housing
	B	Output shaft
	C	Adapter plate
	D	Slotted holes (see Chapter 5.4 "Attaching an NPR to a machine")

Tbl-2: Overview of the NPR gearhead components

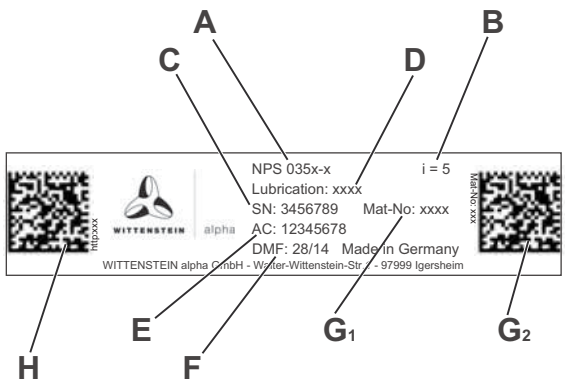
3.1.3 NPT overview

		Gearhead components
	A	Gearhead housing
	B	Output flange
	C	Adapter plate
	D	Through-holes (see section 5.5 "Attaching an NPS / NPT to a machine")

Tbl-3: Overview of the NPT gearhead components

3.2 Identification plate

The identification plate is attached to the gearhead housing.

		Designation
	A	Gearhead type (e.g. NPS / NPR / NPT) Gearhead size (e.g. 035)
	B	Ratio
	C	Serial number
	D	Lubricant information
	E	Article code
	F	Production date
	G	Material number (option)
	H	Data matrix code (optional) For opening the Internet service platform

Tbl-4: Identification plate (sample values)

3.3 Performance statistics

For the maximum permitted speeds and forces, refer to the respective customer-specific performance data (2093–D...).

For additional information, please contact **WITTENSTEIN alpha GmbH**. Always provide the serial number in this case.

3.4 Weight

The table "Tbl-5" specifies the gearhead weights with a small adapter plate. If a different adapter plate is mounted, the actual weight can deviate by up to 30 %.

NPS gearhead size	**—**	**015**	**025**	**035**	**045**
1–stage [kg]	—	1.8	3.6	9.0	18.7
2–stage [kg]	—	1.9	3.9	9.4	21.9
NPR gearhead size	**—**	**015**	**025**	**035**	**045**
1–stage [kg]	—	1.9	3.7	9.3	19.2
2–stage [kg]	—	2.0	4.0	9.7	22.4
NPT gearhead size	**005**	**015**	**025**	**035**	**045**
1–stage [kg]	0.9	2.0	4.4	9.4	13.4
2–stage [kg]	1.1	2.1	4.7	10.9	22.5

Tbl-5: Weight

3.5 Noise emission

For the continuous noise pressure level, see the respective customer-specific performance data (2093–D...).

- Observe the total noise pressure level of the machine.

For additional information, please contact **WITTENSTEIN alpha GmbH**. Always provide the serial number in this case.

4 Transport and storage

4.1 Scope of delivery

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

  ⓘ Immediately notify the carrier, the insurance company, or **WITTENSTEIN alpha GmbH** in writing of any missing parts or damage.

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

⚠ WARNING

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

- Do not stand under suspended loads.
- Secure the gearhead before transport with suitable fasteners (e.g. belts).

NOTICE

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

- 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.

No special transport mode is prescribed for transporting the gearhead.

Specifications on the weights, refer to Chapter 3.4 "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. Consult our Customer Service department if the conditions are different.

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

5 Assembly

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

The gearhead can be used in any mounting position.

ⓘ For applications with special safety requirements (e.g. vertical axes, distorted gear inputs) we recommend employing exclusively our products alpheno®, RP+, SP+, TP+, TP+ HIGH TORQUE or consulting with **WITTENSTEIN alpha GmbH** .

5.1 Preparations

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

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.

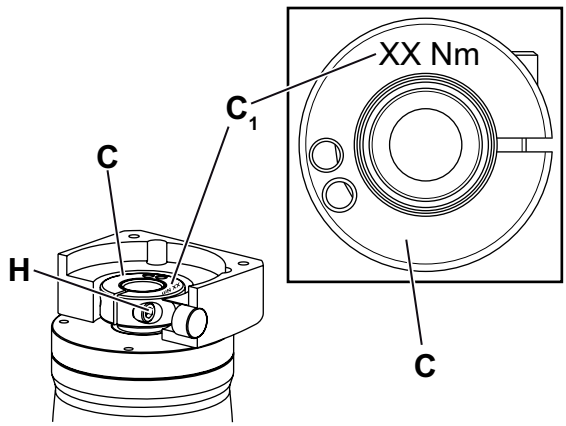
5.2 Mounting the motor onto the gearhead

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

- correspond to the B5 design
- have a radial and axial runout tolerance according to DIN EN 50347
- and if possible, have a smooth shaft.

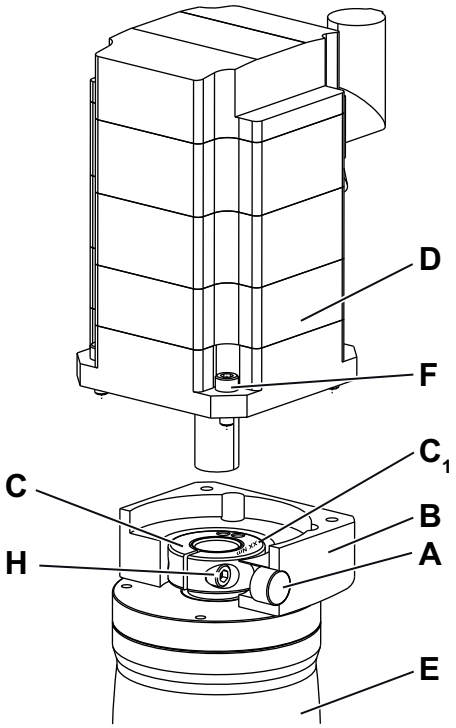
ⓘ If a motor is included in the scope of delivery, then it is already firmly mounted (no assembly necessary).

- Observe the specifications and safety instructions of the motor manufacturer.
- Observe the safety and processing instructions for the threadlocker to be used.

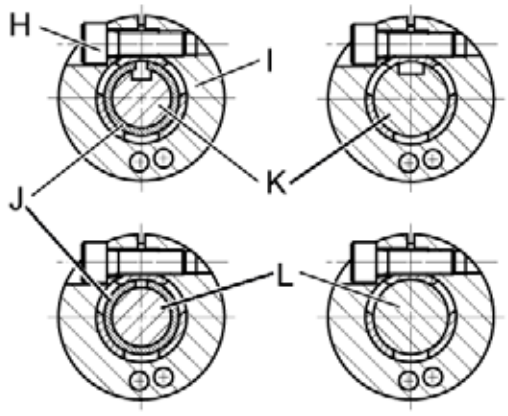


The tightening torque value (C_1) of the clamping bolt (H) can be found on the clamping hub (C).

ⓘ The value for the tightening torque can also be found in section 9.1 "Specifications for mounting onto a motor", table "Tbl-12".



- 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, insert a half wedge.
- Remove the stopper plug (A) from the mounting bore in the adapter plate (B).
- Turn the clamping hub (C) until the clamping bolt (H) can be reached by the mounting bore.
- Loosen the clamping bolt (H) of the clamping hub (C) by one revolution.
- Push the motor shaft into the clamping hub of the gearhead (E).
  ⓘ The motor shaft should slip in easily. If this is not the case, the clamping bolt needs to be loosened some more.
  ⓘ A slotted bushing has to be additionally installed for certain motor shaft diameters and applications.
  ⓘ The slot of the bushing (if present) and clamping hub have to be flush with the groove (if present) of the motor shaft, see Table "Tbl-6".
  ⓘ No gap is permitted between motor (D) and the adapter plate (B).

		Designation
	H	Clamping bolt
	I	Clamping ring [part of the clamping hub (C)]
	J	Bushing
	K	Keyed motor shaft
	L	Smooth motor shaft

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

ⓘ Motor centering of the motor-mounted gearhead is performed by the clamping hub.

- Smear threadlocker (for example Loctite 243) onto the four bolts (F).
- Fasten the motor (D) onto the adapter plate (B) with the four screws (F).
- Tighten the clamping bolt (H) of the clamping hub (C).
  ⓘ The value for the tightening torque can also be found in section 9.1 "Specifications for mounting onto a motor", table "Tbl-12".
- Press the enclosed stopper plugs (A) into the mounting bore of the adapter plate (B).

5.3 Components mounted onto the output side

NOTICE

Clamping forces during assembly can damage the gearhead.

- Do not use force when mounting gearwheels and toothed belt pulleys onto the output side.
- Never attempt to assemble by force or hammering!
- Only use suitable tools and devices for assembly.

5.3.1 Mountings on the output shaft (only NPS / NPR)

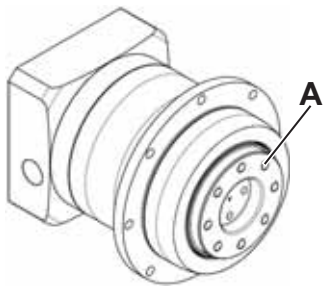
NOTICE

- Make sure not to exceed the maximum permissible static axial forces on the output bearing (see Table "Tbl-7") when pulling or shrink-fitting a gear onto the output shaft.

NPS / NPR gearhead size	015	025	035	045
$F_{a\ max}$ [N]	9250	10750	18500	31250

Tbl-7: Maximum permissible static axial forces at static load rating (s0) = 1.8 and radial force (Fr) = 0

5.3.2 Mountings on the output flange (NPT only)



- Maintain the maximum screw depth of mountings in the threaded bores (A).

ⓘ For the prescribed screw sizes, screw depths, and tightening torques for mountings on the output flange see Chapter 9.2 "Specifications for mounting onto the output side", Table "Tbl-13".

5.4 Attaching an NPR to a machine

- Observe the safety and processing instructions for the threadlocker to be used.

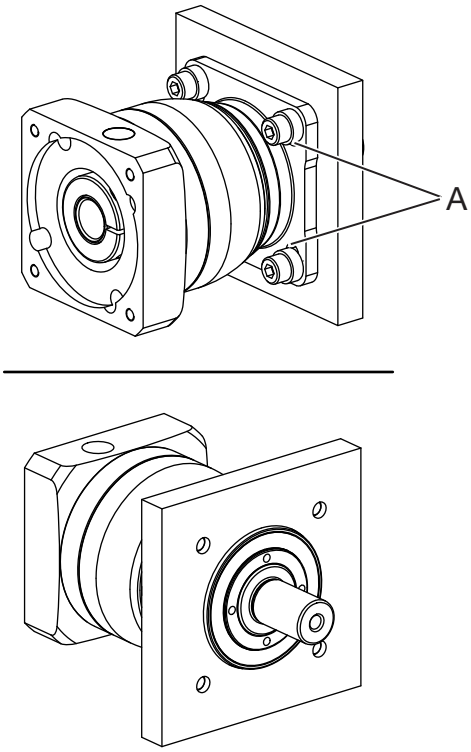
- Use only the washers included within the scope of delivery for fastening the gearhead to a machine.

  ⓘ For specifications on the washers, refer to Chapter 9.3 "Specifications for mounting onto a machine", Table "Tbl-15".

- Note the different attachment modes when attaching the gearhead to the machine:
  - 5.4.1 "NPR with output shaft"
  - 5.4.2 "NPR with mounted output pinion"

ⓘ Our Customer Service department is available to answer any questions.

5.4.1 NPR with output shaft

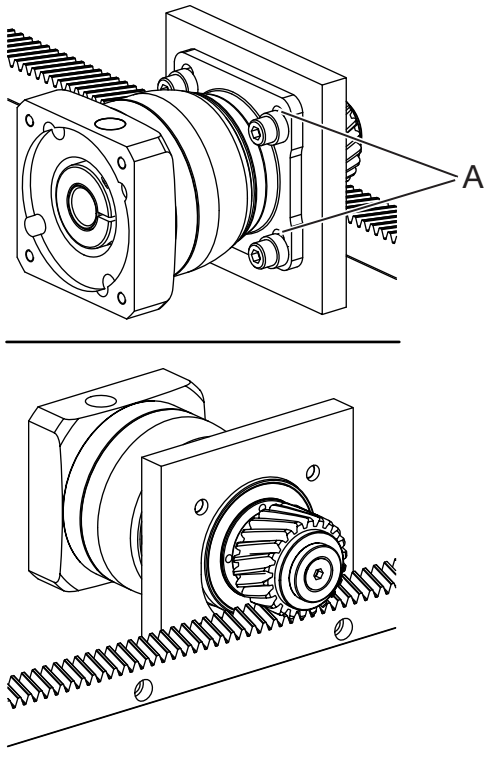


- Center the gearhead in the machine base.
- Slide the washers onto the fastening screws.
  - ⓘ For specifications on the washers, refer to Chapter 9.3 "Specifications for mounting onto a machine", Table "Tbl-15".
- Smear the fastening screws with a threadlocker (e.g. Loctite 243).
- Fasten the gearhead on the machine with the fastening screws through the slotted holes (A).
  - ⓘ Mount the gearhead in such a way that the identification plate remains legible.
  - ⓘ For appropriate screw sizes and tightening torques, see Chapter 9.3 "Specifications for mounting onto a machine", Table "Tbl-15".

5.4.2 NPR with mounted output pinion

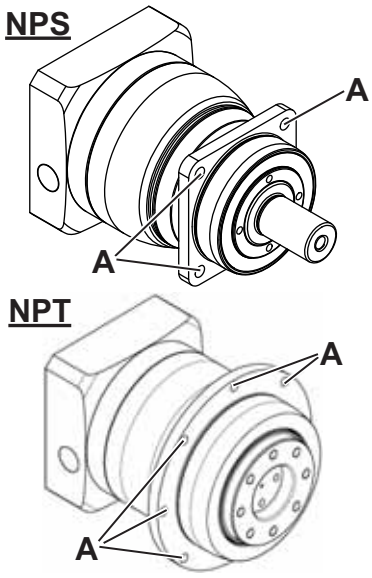
For adjusting the gearing backlash between output pinion and toothed rack / counter-wheel, the gearhead features slotted holes. An additional adjustment device is no longer necessary.

	Operating the gearhead without a motor (e.g. using a hand wheel) is permitted for setting / aligning the output pinion on the toothed rack. ● When doing so, ensure **never** to tilt / bend the clamping hub.



- Adjust gearing backlash between output pinion and toothed rack / counter-wheel.
  - ⓘ For the proper setting of the gearing backlash, you will find further information on the "alpha rack & pinion system" manual.
- Slide the washers onto the fastening screws.
  - ⓘ For specifications on the washers, refer to Chapter 9.3 "Specifications for mounting onto a machine", Table "Tbl-15".
- Smear the fastening screws with a threadlocker (e.g. Loctite 243).
- Fasten the gearhead on the machine with the fastening screws through the slotted holes (A).
  - ⓘ Mount the gearhead in such a way that the identification plate remains legible.
  - ⓘ For appropriate screw sizes and tightening torques, see Chapter 9.3 "Specifications for mounting onto a machine", Table "Tbl-15".

5.5 Attaching an NPS / NPT to a machine



The NPS / NPT housings have through-holes (A) for attaching to a machine.

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

The bolts need to be provided by the customer. The prescribed screw sizes and tightening torques can be found in Chapter 9.3 "Specifications for mounting onto a machine", Table "Tbl-15".

- Coat the bolts with a threadlocker (e.g. Loctite 243).
- Fasten the gearhead on the machine with the fastening screws through the threaded bores.
  - ⓘ Mount the gearhead in such a way that the identification plate remains legible.
  - ⓘ Do **not** use washers (e.g. plain washers, tooth lock washers).

6 Startup and operation

- Read 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, consult our Customer Service department. ● Only use the gearhead only up to its maximum limit values, see Chapter 3.3 "Performance statistics". ● Only use the gearhead only in a clean, dust-free and dry environment.

7 Maintenance and disposal

- Read 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 clamping bolt on the motor mounting. If you discover while checking the tightening torque that the clamping bolt can be turned further, tighten it with the prescribed tightening torque.
  - ⓘ The prescribed tightening torques can be found in Chapter 9.1 "Specifications for mounting onto a motor", Table "Tbl-12".
- For the NPT, check the tightening torque of the fastening screws on the output flange. If you discover while checking the tightening torque that the fastening screw can be turned further, tighten it with the prescribed tightening torque.
  - ⓘ The prescribed tightening torques can be found in Chapter 9.2 "Specifications for mounting onto the output side", Table "Tbl-13".
- Check the tightening torque of the fastening screws on the gearhead housing. If, while checking the tightening torque, you discover that a fastening screw can be further tightened, follow the instructions in "Remounting the screw".
  - ⓘ The prescribed tightening torques can be found in Chapter 9.3 "Specifications for mounting onto a machine", Tables "Tbl-15", "Tbl-14" and "Tbl-16".

Remounting the screw

	● Make sure that it is possible to remount the screw on the gearhead without damaging the entire machine.

- Loosen the screw.
- Remove the glue residue from the threaded bore and the screw.
- De-grease the screw.
- Coat the screw with a threadlocker (e.g. Loctite® 243).
- Screw in the screw and tighten it with the prescribed tightening torque.

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-8: 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 identification plate). All bearings are permanently lubricated by the company.

The manufacturer listed below will provide any further information on the lubricants:

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-9: 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

NOTICE

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.

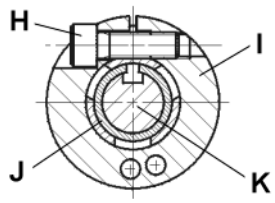
Rectifying of malfunctions may only be done by specially trained technicians.

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-10: Malfunctions

9 Appendix

9.1 Specifications for mounting onto a motor

		Designation
	H	Clamping bolt
	I	Clamping ring (part of the clamping hub)
	J	Bushing
	K	Motorshaft

Tbl-11: Arrangement of motor shaft, clamping hub, and bushing

Clamping hub interior Ø [mm]	Code letter	Clamping screw (H) / DIN ISO 4762	Width across flats [mm]	Tightening torque [Nm] property class 12.9	max. axial force clamping hub [N]
8	Z	M3	2.5	2	70
9	A	M3	2.5	2	70
11	B	M4	3	4.1	70
14	C	M5	4	9.5	70
16	D	M6	5	14	150
19	E	M6	5	14	150
24	G	M8	6	35	220
28	H	M6	5	14	220
32	I	M10	8	79	300
38	K	M10	8	79	300

Tbl-12: Specifications for mounting onto a motor

9.2 Specifications for mounting onto the output side

Gearhead size NPT	Hole circle Ø [mm]	Quantity x Thread x Screw depth [ ] x [mm] x [mm]	Tightening torque [Nm] Property class 12.9
005	25	8 x M4 x 6	4.55
015	31.5	8 x M5 x 7	9.0
025	50	8 x M6 x 10	15.4
035	63	12 x M6 x 12	15.4
045	80	12 x M8 x 15	37.5

Tbl-13: Thread in the NPT output flange

9.3 Specifications for mounting onto a machine

Gearhead size NPS	Hole circle Ø [mm]	Bore Ø [mm]	For screw size / property class	Tightening torque [Nm]
015	68	5.5	M5 / 12.9	9.0
025	85	6.6	M6 / 12.9	15.4
035	120	9.0	M8 / 12.9	37.5
045	165	11.0	M10 / 12.9	73.5

Tbl-14: Specifications for mounting onto a machine

Gearhead size NPR	Hole circle Ø [mm]	Bore Ø [mm]	For screw size / property class	Tightening torque [Nm]	Dimensions of the washers	
					Outer Ø [mm]	Clamping length [mm]
015	75	6.6	M6 / 12.9	15.4	14	5
025	91	9.0	M8 / 12.9	37.5	16	6
035	125	11.0	M10 / 12.9	73.5	20	8
045	165	13.0	M12 / 12.9	126	24	10

Tbl-15: Specifications for mounting onto a machine

Gearhead size NPT	Hole circle Ø [mm]	Quantity x diameter [ ] x [mm]	For screw size / property class	Tightening torque [Nm]
005	67	8 x 3.4	M3 / 12.9	1.97
015	79	8 x 4.5	M4 / 12.9	4.55
025	109	8 x 5.5	M5 / 12.9	9.0
035	135	8 x 5.5	M5 / 12.9	9.0
045	168	12 x 6.6	M6 / 12.9	15.4

Tbl-16: Specifications for mounting onto a machine

9.4 Tightening torques for common thread sizes in general mechanical engineering

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

- Calculation in accordance with VDI 2230 (February 2003 version)
- Friction value for thread and contact surfaces μ=0.10
- Exploitation of the yield stress 90%
- Torque tools type II classes A and D in accordance with ISO 6789

The settings are values rounded to usual commercial scale gradations or setting possibilities.

- Set these values **precisely** on the scale.

	Tightening torque [Nm] with thread												
Property class Screw / nut	**M3**	**M4**	**M5**	**M6**	**M8**	**M10**	**M12**	**M14**	**M16**	**M18**	**M20**	**M22**	**M24**
8.8 / 8	1.15	2.64	5.2	9.0	21.5	42.5	73.5	118	180	258	362	495	625
10.9 / 10	1.68	3.88	7.6	13.2	32.0	62.5	108	173	264	368	520	700	890
12.9 / 12	1.97	4.55	9.0	15.4	37.5	73.5	126	202	310	430	605	820	1040

Tbl-17: Tightening torques for headless screws and nuts

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