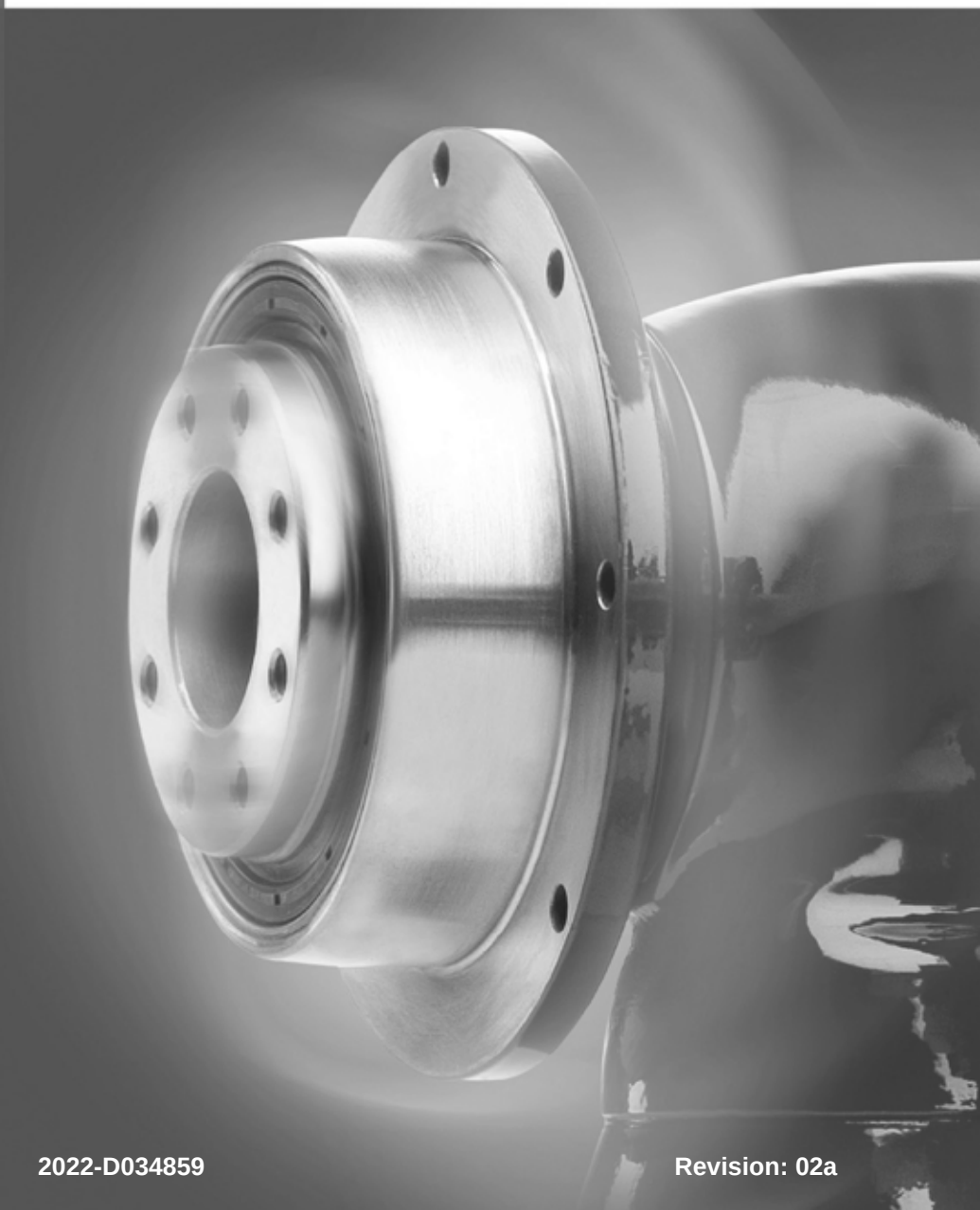
WITTENSTEIN | alpha

TK+ ATEX

Operating Manual



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Revision history

Revision	Date	Comment	Chapter
01	18.12.2009	New version	All
02	31.08.2010	2-stage design	1, 3, 5, 7, 9
02a	03.12.2012	Translation corrections	2.4, 7.3

Service

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Contents

1 Regarding this manual

These instructions contain necessary information for the safe operation of the angle gear TK+ in areas with explosion hazards, 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 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.**
	NOTICE **This signal word points out 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

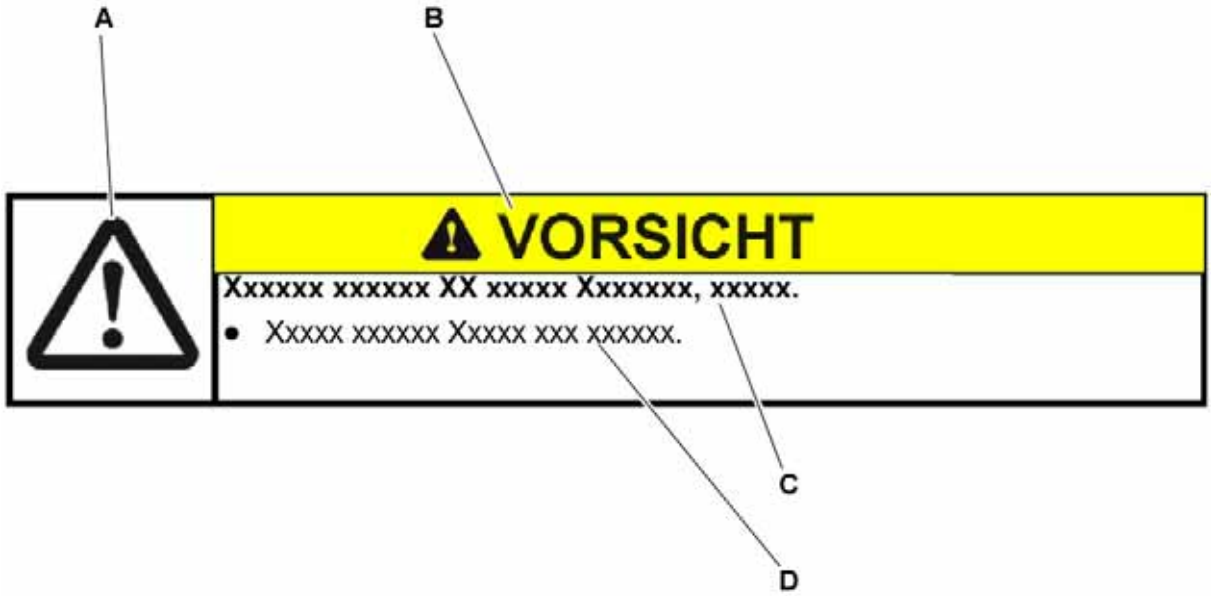

Information


Explosion


Electric voltage

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

An "explosion protection symbol" indicates information on handling in areas with explosion hazards.

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 directive for devices and protective systems in areas with explosion hazards

Within terms of the EC machinery directive 94/9 EC, the gearhead is considered a device that is mounted together with other devices in a machine. A declaration of conformity for this gearhead can be found in the appendix (see Chapter 9.7 "Declaration of Conformity").

Operation is prohibited within the area of validity of the EC directive until it has been determined that the machine in which this product 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 designed for industrial applications.

The gear reducer can be used in areas with explosion hazard group II, zones 1 and 2, and zones 22 and 21, thus in the device categories 2 and 3. The gearhead can be operated in a gas atmosphere in temperature class T3. In dust atmosphere, a maximum surface temperature of 150°C is possible.

- Observe the instructions on the type plate and the appendix on the written certificate of conformity.

The gearhead is manufactured and declared applying EN 13463 standards and the 94/9/EC directive for use in areas with explosion hazard.

- It is imperative that you observe the restrictions of speeds and torques (see Chapter 9.5 "Technical specifications").
- Please consult our Customer Service Department [technical customer service] if you have any questions or need explanations.

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
- have a smooth shaft
- feature at least the same temperature class as the gearhead.

  ⓘ We recommend temperature class T3 and higher, because the gearhead may not be permitted to heat up to more than 90 °C in normal conditions. The gearhead can be heated additionally through heat connection to the motor, and thus reach a higher housing temperature than 90 °C. The performance of our gearhead in explosion-risk areas would therefore no longer be guaranteed.

2.5 Reasonably predictable misuse

Any use transgressing the maximum permitted speeds, torques and temperature (especially ignoring the regulations on explosion protection) is not compliant with the regulations, and thus 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
- Operating the gearhead despite leakage or unusual running noises

- Operating the gearhead in an atmosphere whose ignition temperature lies under the temperature class specified on the type plate.
- Modifications or reconstructions that have been executed without written approval of **WITTENSTEIN alpha GmbH**

2.7 General safety instructions

⚠ DANGER

Operating the gearhead in areas for which it is not approved can lead to explosions that can cause serious injuries and even death.

- Make sure that the gearhead is only used in those areas for which it is permitted according to the identification plate (see Chapter 3.1 "Type plate").

⚠ DANGER

Assembly and maintenance in areas with explosion hazards can lead to explosions that can cause serious injuries and even death.

- Be certain that there is no explosive atmosphere during assembly and maintenance.

Ex	Table "Tbl-1" lists a summary of the possible hazards, their causes and protective measures for areas with explosion hazards.

Ex	Dangers	Possible causes	Protective measures
	Hot surfaces	Increased friction and dissipated power because of wear, improper assembly, overload, or leaks.	Reduction of the torques and speeds in comparison to standard gears
			Limiting the motor current and maximum speed of the motor
			Maintenance intervals for wear parts and lubrication according to maintenance schedule
			Inspection of the temperature behavior and the running-in behavior before startup
			Regular visual and acoustic inspections
			Prohibition of certain mounting positions and conditions
		Increased surface temperature because of dust deposits.	Cleaning regulations according to maintenance plan
	Mechanically caused sparks	Overload on shafts, moving parts and connection elements.	Reduction of the torques and external loads in comparison to standard gears
			Limiting the motor current of the motor
			Maximum load test before startup
	Electrostatic loading	Potential differences between components, cleaning processes, insulating layers	Grounding the gearhead and the motor

Tbl-1: Summary of the hazards and protective measures for areas with explosion hazards

⚠ 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 and 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 tightening torques have 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 two-stage, low-backlash angle gear, which is manufactured as standard in the "M" version (motor installation).

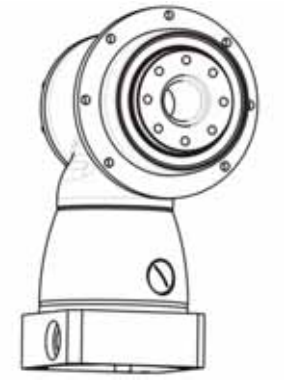
Motor centering is performed:

- up to gearhead size TP+ 025 and a motor shaft diameter of 28 mm by the clamping hub (plug receptacle or coupling)
- from gearhead size TP+ 050 and a motor shaft diameter of > 28 mm by the centering collar of the motor

A radial distortion of the motor is avoided.

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

The gearhead is equipped with an integrated linear length compensation to compensate for the expansion of the motor shaft when heated up.

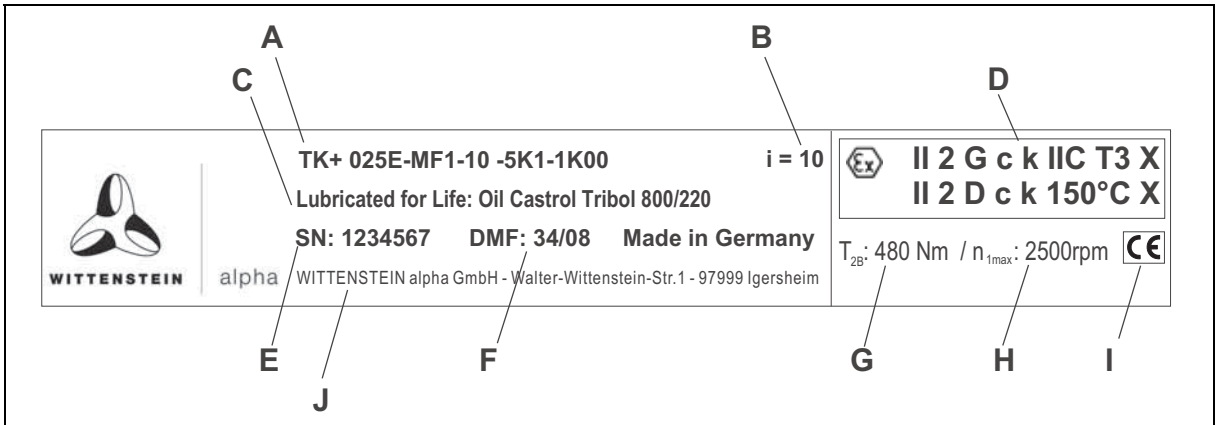


There are two centering mechanisms for the output flange, in accordance with ISO 9409.

The hollow shaft running through serves as a conduit for lines or hoses, but does not aid in securing the load. On the back side of the output flange, the position and/or the speed of the load can be measured through the hollow shaft.

3.1 Type plate

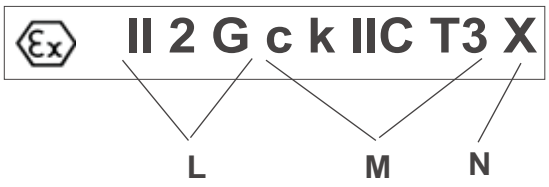
The type plate is attached to the gearhead housing.



A	Ordering code (see Chapter 3.2 "Ordering code")		F	Production date
B	Ratio		G	Maximum permitted gear output torque T_{2B}
C	Lubricant		H	Maximum permitted drive speed n_{1Max}
D	Atex identification		I	CE identification
E	Serial number		J	Name and address of manufacturer

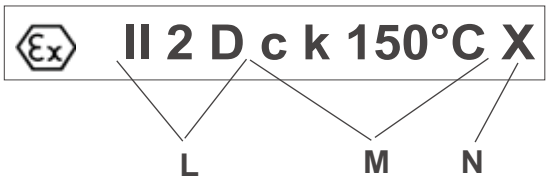
Tbl-2: Type plate (sample values)

3.1.1 Atex identification in gas atmospheres with explosion hazard

		Designation
	L	Group, category
	M	Type of ignition protection, explosion group, temperature class
	N	Ambient temperature

Tbl-3: Type plate (sample values)

3.1.2 Atex identification in dust-air atmosphere with explosion hazard

		Designation
	L	Group, category
	M	Type of ignition protection, maximum surface temperature
	N	Ambient temperature

Tbl-4: Type plate (sample values)

3.2 Ordering code

TK+ 025E - M F 1-10-5K1

Gearhead type
TK+004/010/025/050/110

Type code
E = Explosion protected according to 94/9/EG

Gearhead variations
M = Motor-mounted gearhead

Gearhead model
F = Standard (for Cyclic duty S5)

Number of Stages
1 = 1-stage
2 = 2-stages

Ratio i

Form of output flange
5 = Hollow shaft flange

Bore diameters of the clamping hub
see catalogue

Backlash
1 = Standard

3.3 Performance statistics

Based on test results, torques and speeds are reduced in relation to the standard gearhead. The shaft loads are also reduced in relation to the standard gear. Refer to Chapter 9.5 "Technical specifications".

⚠ DANGER

Deviant values can cause the loss of explosion protection.

- If values are divergent, please consult our Customer Service.

3.4 Dimensioning

⚠ DANGER

Erroneous dimensioning and inspection may lead to loss of explosion protection.

- Please observe all instructions in this chapter.

- Adopt the construction according to specifications in the total catalogue, Chapter "Information" or "Detailed construction", or contact **WITTENSTEIN alpha GmbH**.
- Note the reduced output specifications in construction according to Chapter 9.5 "Technical specifications".
- Please consult our Customer Service Department if you have any questions.
- Note the instructions in Chapter 7.1.4 "Replacing the gearhead", if the calculated **bearing life is less than 20,000 h**.
- Prevent gearhead overloading by the motor by limiting motor current and motor speed.
- Clarify the chemical stability of the gearhead for every individual case so as to avoid a premature failure of a shaft seal or corrosion on the gearhead.

  This also includes water and steam, which can cause corrosion. Contact **WITTENSTEIN alpha GmbH** about this.

3.4.1 Inspection

- Make sure that the connection of the motor to the gearhead corresponds to the required protection types (according to DIN 40050):
  - in dust atmosphere IP6x,
  - in gas atmosphere IP54.

ⓘ The required protection types can be achieved for example by the following measures:

- Use surface-bonding agent between motor flange and adapter plate.
- Use sealing plates between motor flange and adapter plate to seal the through-holes of the adapter plate.

  Sealing plates are available upon request from **WITTENSTEIN alpha GmbH**.

3.5 Weight

The table "Tbl-5" specifies the gearhead dimensions with medium-sized adapter plate. If another adapter plate is mounted, the actual dimensions can deviate by up to 10%.

Gearhead size TK+	004	010	025	050	110
1–stage [kg]	2,9	5,3	8,9	22,0	48,0
2–stage [kg]	3,2	6,1	10,6	26,0	54,0

Tbl-5: Weight

3.6 Noise emission

Depending on the gearhead type and product size, the continuous sound pressure level is up to 68 dB(A) .

Specifications on your specific product can be found in Chapter 9.5 "Technical specifications".

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.

- 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.

⚠ WARNING

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

- Do not stand under suspended loads.

Specifications on the weights, refer to 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

NOTICE

Pressurized air can damage the gearhead seals.

- Do not use pressurized air to clean the gearhead.

NOTICE

Directly sprayed cleaning agents can alter the frictional values of the clamping hub.

- Only spray cleaning agents onto a cloth, with which you can then clean the clamping hub.

- 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
- Dry all fitting surfaces to neighboring components in order to achieve the proper friction values of the screw connections.
- Check the fitting surfaces additionally for damage and impurities.

5.2 Installation conditions

- Provide a metallic frame for connection of the gear reducer.
- Provide a ground in the areas of the motor gear and gear-gear connection, so as to prevent any electrostatic charge that may arise.

5.3 Mounting the motor onto the gearhead

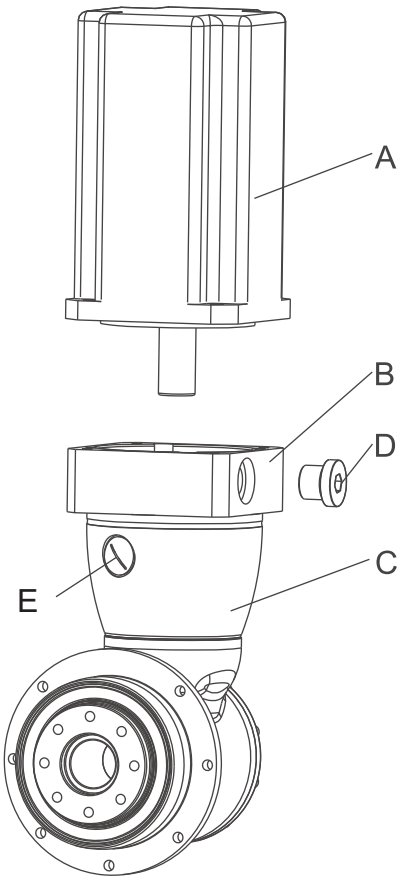
⚠ WARNING

A damaged coupling can cause ignition dangers.

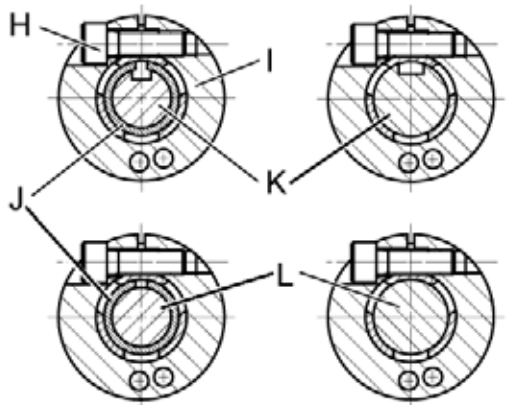
- Align the shaft ends of the motor and gearhead precisely. The offset values in table "Tbl-8" must **definitely** be maintained.

- 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 feather key, remove the feather key.
  - ⓘ If recommended by the motor manufacturer, apply a half wedge.
- Remove the plug (D) from the mounting bore in the adaptor plate (B).
- Under **no circumstance** remove the plug (E) in the **housing**.
- Turn the clamping hub (I) until the clamping bolt (H) can be reached over the mounting bore.
- Release the clamping bolt (H) of the clamping hub (I) with one revolution.
- 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 clamping bolt must be loosened more.
  - ⓘ A slotted spacer sleeve has to be installed extra for certain motor shaft diameters and applications.
  - ⓘ The slot of the spacer sleeve (if provided) and clamping hub have to be flush with the groove (if provided) of the motor shaft, see table "Tbl-6".
  - ⓘ No gap is premitted between motor (A) and the adaptor plate (B).

		Designation
	H	Clamping bolt
	I	Clamping hub
	J	Spacer sleeve
	K	Grooved shaft
	L	Smooth shaft

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

- Apply screw-bonding agent to the four screws (e.g. Loctite 243).
- Fasten the motor (A) onto the adaptor plate (B) with the four screws.
- If it concerns a **single stage gearhead (MF1)** , smear screw-bonding agent (for example Loctite 243) onto the clamping bolt (H).
- Tighten the clamping bolt (H) of the clamping hub (I).
  - ⓘ For screw sizes and specified torques refer to chapter 9.1 "Specifications on mounting onto a motor", table "Tbl-12".
- Screw in plug (D) of the adaptor plate (B).
  - ⓘ For screw sizes and specified torques refer to table "Tbl-7".

Width across flats [mm]	5	8	10
Tightening torque [Nm]	10	35	50

Tbl-7: Torques for the plugs

Gearhead size TK+	004	010	025	050	110
Axial offset [mm]	± 0,25	± 0,3	± 0,4	± 0,5	± 0,6
Angle offset [°]	0,2	0,2	0,2	0,2	0,2

Tbl-8: Permissible offset of the coupling, gearhead singlestaged (MF1)

5.4 Mounting gearhead on a machine

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

- Smear screw-bonding agent (e.g. Loctite 243) onto the fastening bolts.
- Fasten the gearhead on the machine with the bolts 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).
  - ⓘ For screw sizes and specified torques refer to chapter 9.2 "Specifications on mounting onto a machine", table "Tbl-13".

5.5 Mounting on the 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.

ⓘ For screw sizes and specified torques refer to chapter 9.3 "Specifications on mounting on the gear output side", table "Tbl-14".

6 Startup and operation

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

⚠ DANGER

Operating the gearhead in areas for which it is not approved can lead to explosions that can cause serious injuries and even death.

- Make sure that the gearhead is only used in those areas for which it is permitted according to the identification plate (see Chapter 3.1 "Type plate").

- Check the gearhead before startup for possible damage, especially the radial shaft seal on the gear output.

⚠ DANGER

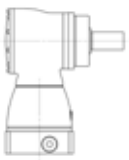
A damaged gearhead can lead to explosions that can cause serious injuries and even death.

- **Never** operate damaged or abnormally running or sounding gearheads in an area of explosion hazard.

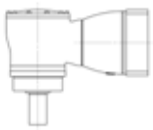
6.1 Note during startup

Improper use can cause damage to the gearhead and cause ignition dangers.

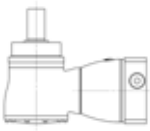
- Make sure that
  - the **ambient temperature** does not drop below 0 °C or exceed +40 °C and
  - the **operating temperature** does not exceed +90 °C.
  - the gearhead is mounted in the mounting positions depicted below to ensure the lubrication of all gearhead components.
- For other conditions of use and other mounting positions as those depicted below (e.g. tilting by an axis of these mounting positions), please consult our Customer Service Department.



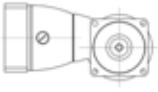
Mounting position B5/V3 (output shaft horizontal, motor shaft upwards)



Mounting position V1/B5 (output shaft downwards, motor shaft horizontal)



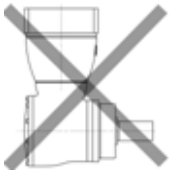
Mounting position V3/B5 (output shaft upwards, motor shaft horizontal)



Mounting position B5/B5 (output shaft horizontal, motor shaft horizontal)

- Prevent gear reducer from overloading by limiting the motor current and the maximum motor speed. Otherwise, the drive output should be switched off in case the motor temperature rises 10 °C above the usual operational temperature.
- Use the gearhead only in a clean and dry environment. Please consult our Customer Service Department if your gearhead is subjected to course dust or any kind of liquids during operation.

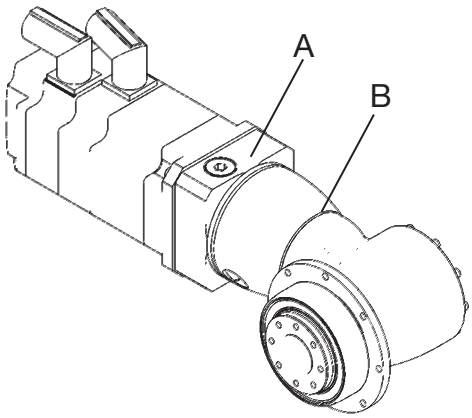
6.2 Inadmissible operational conditions



The following operational conditions are not permitted:

- Mounting position B5/V1 (output shaft horizontal, motor shaft downwards)
- Co-riding the gearhead on the drive axle is prohibited. Exceptions require a written approval and technical statement from **WITTENSTEIN alpha GmbH**.
- Use during permanent operation (S1 operation: power-on time greater than 60% or longer than 20 minutes)

6.3 Check running-in behavior



- After 4 running hours in maximum operating conditions, check the gearhead for leakage between gear and motor and on the output shaft seal.
- Measure the surface temperature on the input flange (A) and on the housing (B). Consult our Customer Service Department if the temperature exceeds +90 °C.
- Check the proper assembly of the clamping hub before startup by a maximum load test.

Increased running noises may be caused by faulty motor mounting.

- If so, mount onto motor again according to the operating manual, or consult our Customer Service Department.

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

The following maintenance work is crucial for the explosion protection.

- Perform these tasks thoroughly and diligently.

7.1.1 Visual/Noise inspection

- Dust off the housing. Make sure that the deposit of dust layers on the housing never exceeds a layer thickness of 5 mm.
- Check the entire gearhead for exterior damage and corrosion.
- Check the clamping hub for external damage when you inspect the tightening torques of the clamping bolt.
- Check the gearhead for unusual running noises and vibrations during operation.

ⓘ Please contact our Customer Service if you have any questions regarding maintenance.

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 "Specifications on mounting onto a machine", table "Tbl-13".
- Check the tightening torque of the clamping bolt on the motor mounting.
  ⓘ You can find the prescribed tightening torques in chapter 9.1 "Specifications on mounting onto a motor", table "Tbl-12".

7.1.3 Check for leakage

- Check the gear output radial shaft seal for leakage.
- Look for external emission of lubricant from the drive.

⚠ DANGER

When opening up the Ermeto coupling, dust could collect on the adapter plate and catch fire during later operation.

- Make sure that **no** explosive dust-air mixture is present and **no** dust can get into adapter plate before opening the Ermeto coupling or dismantling the motor.

- Open up the Ermeto screw connection in the adapter plate and check for any lubricant emission inside the adapter plate.
- If you detect a leak, remove the lubricant and check the inside of the adapter plate once more after a brief operation. Lubricant discharge should stop after a short time.
- In case lubricant still is emitted, shut down the gearhead and consult our Customer Service.

7.1.4 Replacing the gearhead

- Replace the gearhead:
  - When 90 % of the calculated life of the gear output bearing has been reached (see "Cymex®" design or total catalogue: Chapter "Information" or "Detailed construction").
  - At the latest after a total of 20,000 operating hours.

  ⓘ Alternatively, the gearhead can be checked by **WITTENSTEIN alpha GmbH** and if necessary, released for further operation.

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 initial startup	After running-in (4 hours)	After every 500 operating hours or 3 months	Every 5,000 operating hours	Every 10,000 operating hours
Visual/Noise inspection	X	X	X	-	-
Checking the tightening torques	X	X	X	-	-
Check running-in behavior (see Chapter 6.3 "Check running-in behavior")	-	X	-	-	-
Check for leakage	X	X	X	-	-
Exchange the radial shaft seal on the drive [1)]	-	-	-	X	-
Exchange the radial shaft seal on gear output [1)]	-	-	-	-	X
Perform an oil change [1)]	-	-	-	X	-
Replace gearhead after reaching 90% of the calculated nominal bearing life, but at the **latest** after 20,000 operating hours.					
[1)] Please consult our Customer Service Department concerning this. You will receive the necessary documents, spare parts, information and upon request training by our Customer Service.					

Tbl-9: Maintenance schedule

7.4 Notes on the lubricant used

All gearheads are filled by the manufacturer with synthetic gear oil (polyglycols) of viscosity class ISO VG100, ISO VG220.

The lubricant type and quantity can be found in the chapter 9.6 "Lubricant quantity".

The lubricant level lies within its minimal and maximum values in any approved mounting position with the correct lubricant quantity. The maximum usual pressure that may prevail in the gearhead during operation lies at 0.5 bar.

ⓘ You can receive further information on the lubricants directly from the manufacturer:
Castrol Industrie GmbH, Mönchengladbach
Tel.: + 49 (0) 21 61 / 9 09 - 30

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.

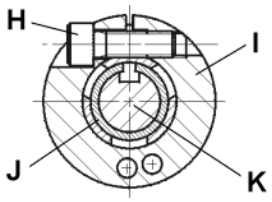
Rectifying of malfunctions may be done by only by especially trained technicians.

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.
Clamp connection is slipping	Clamping bolt not tightened properly	Check the shaft seat and hub bore for damages. Replace damaged parts. Check the screw for proper tightening torque and secure it against loosening by itself. Check the operating parameters.
	Operating parameters not maintained	
Metal bellows of the coupling broken	Operating parameters do not meet the requirements	Please consult our Customer Service Department.
	Operating errors of the plant unit	

Tbl-10: Malfunctions

9 Appendix

9.1 Specifications on mounting onto a motor

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

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

Gearhead size TK+		Clamping hub interior Ø "x" [mm]	Clamping bolt (H)/ property class DIN ISO 4762	Width across flats [mm]	Tightening torque [Nm]	max. axial force clamping hub [N]	
						Plug-in terminal	Coupling
004	1–stage	x ≤ 14 14 < x ≤ 19	M5 / 10.9 M6 / 10.9	4 5	8,5 14	—	10
	2–stage	x ≤ 11 11 < x ≤ 14	M4 / 12.9 M5 / 12.9	3 4	4,1 9,5	80	—
010	1–stage	x ≤ 19 19 < x ≤ 28	M6 / 10.9 M8 / 10.9	5 6	14 35	—	20
	2–stage	x ≤ 14 14 < x ≤ 19	M5 / 12.9 M6 / 12.9	4 5	9,5 14	100	—
025	1–stage	x ≤ 28 28 < x ≤ 38	M8 / 10.9 M10 / 10.9	6 8	35 69	—	30
	2–stage	x ≤ 19 19 < x ≤ 28	M6 / 12.9 M8 / 12.9	5 6	14 35	120	—
050	1–stage	x ≤ 38	M10 / 10.9	8	69	—	50
	2–stage	x ≤ 24 24 < x ≤ 38	M8 / 12.9 M10 / 12.9	6 8	35 79	150	—
110	1–stage	x ≤ 48	M12 / 10.9	10	86	—	200
	2–stage	x ≤ 38 38 < x ≤ 48	M10 / 12.9 M12 / 12.9	8 10	79 135	200	—

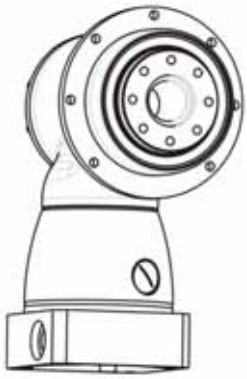
Tbl-12: Specifications on mounting onto a motor

9.2 Specifications on mounting onto a machine

Through-holes in gearhead housing				
Size / Version	**Hole circle Ø [mm]**	**Quantity x diameter [ ] x [mm]**	**For screw size/ property class**	**Tightening torque [Nm]**
004	79	8 x 4,5	M4 / 12.9	4,55
010	109	8 x 5,5	M5 / 12.9	9,0
025	135	8 x 5,5	M5 / 12.9	9,0
050	168	12 x 6,6	M6 / 12.9	15,4
110	233	12 x 9,0	M8 / 12.9	37,3

Tbl-13: Specifications on mounting onto a machine

9.3 Specifications on mounting on the gear output side

	Size / Design TK+	**Hole circle Ø [mm]**	**Quantity x thread x depth [ ] x [mm] x [mm]**	**Property class**	**Tightening torque [Nm]**
	**004**	31,5	8 x M5 x 7	12.9	9,0
	010	50	8 x M6 x 10	12.9	15,4
	025	63	12 x M6 x 12	12.9	15,4
	050	80	12 x M8 x 15	12.9	37,3
	110	125	12 x M10 x 20	12.9	73,4

Tbl-14: Thread in output flange

9.4 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-15: Tightening torques for headless screws and nuts

9.5 Technical specifications

9.5.1 Technical specifications for TK+ 004 for use in areas with explosion hazards

Technical specifications for TK+ 004, 1-stage						
Ratio		**3**	**4**	**5**	**7**	**10**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	24	24	24	20	16
	in.lb	212	212	212	177	142
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	17.5	17.5	17.5	16	12
	in.lb	155	155	155	142	106
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	40	40	40	40	40
	in.lb	354	354	354	354	354
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	1800	1900	2200	2200	2200
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	2000	2300	2800	2400	2400
Max. drive speed n_{1Max}	**rpm**	6000	6000	6000	6000	6000
Average no-load running torque T_{012} (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	1.4	1.3	1.2	1.4	1.3
	in.lb	12.4	11.5	10.6	12.4	11.5
Max. torsional backlash j_t	**arcmin**	< 5				
Torsional rigidity C_{t12}	**Nm/arcmin**	2.6	2.8	3.0	2.6	2.3
	in.lb/arcmin	23	25	26	23	20
Max. axial force F_{2AMax} [b]	**N**	1650				
	lbf	371				
Max. radial force F_{2RMax} [b]	**N**	1850				
	lbf	416				
Max. tilting moment M_{2KMax}	**Nm**	175				
	in.lb	1549				
Life L_h Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"				
Weight incl. standard adapter plate m	**kg**	2.9				
	lbm	6.4				
Noise level L_{PA} (At n_1=3000 rpm w/o load)	**dB(A)**	< 64				
Max. permissible housing temperature	**°C**	90				
	F	194				
Ambient temperature	**°C**	0 to +40				
	F	32 to 104				
Paint		Blue RAL 5002				
Direction of rotation		Drive and gear output counter-directional				
Protection class		IP 65				

Technical specifications for TK+ 004, 1-stage						
Ratio		**3**	**4**	**5**	**7**	**10**
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 14 mm	**kgcm²**	0.57	0.46	0.41	0.37	0.35
	10^{-3} in.lb.s²	0.50	0.41	0.36	0.33	0.31
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 19 mm	**kgcm²**	0.92	0.82	0.76	0.72	0.70
	10^{-3} in.lb.s²	0.81	0.72	0.68	0.64	0.62
[a] No-load running torques diminish during operation [b] Based on the shaft or flange center at the gear output						

Tbl-16: TK+ 004, 1-stage: Technical specifications for use in areas with explosion hazards

Technical specifications for TK+ 004, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	24	24	24	24	24	24	24	24	20	16
	in.lb	212	212	212	212	212	212	212	212	177	142
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	16	12
	in.lb	155	155	155	155	155	155	155	155	142	106
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	40	40	40	40	40	40	40	40	40	40
	in.lb	354	354	354	354	354	354	354	354	354	354
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	3150	3150	3150	3150	3150	3150	3150	3450	3950	3950
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	3600	3600	3600	3600	3600	3600	3600	3600	3950	3950
Max. drive speed n_{1Max}	**rpm**	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
Average no-load running torque T_{012} (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
	in.lb	1.8	1.8	1.8	1.8	1.8	1.8	0.9	0.9	0.9	0.9
Max. torsional backlash j_t	**arcmin**	≤ 5									
Torsional rigidity C_{t12}	**Nm/ arcmin**	2,8	2,8	2,8	2,8	2,8	2,8	2,8	3,0	2,6	2,3
	in.lb/ arcmin	25	25	25	25	25	25	25	26	23	20
Max. axial force F_{2AMax} [b]	**N**	1650									
	lbf	371									
Max. radial force F_{2RMax} [b]	**N**	1850									
	lbf	416									
Max. tilting moment M_{2KMax}	**Nm**	175									
	in.lb	1549									
Life $L_{h;}$ Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"									

Technical specifications for TK+ 004, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Weight incl. standard adapter plate m	**kg**	3.2									
	lbm	7.1									
Noise level L_{PA} (At n_1=3000 rpm w/o load)	**dB(A)**	≤ 64									
Max. permissible housing temperature	**°C**	+90									
	F	194									
Ambient temperature	**°C**	0 to +40									
	F	32 to 104									
Paint		Blue RAL 5002									
Direction of rotation		Drive and gear output counter-directional									
Protection class		IP 65									
Mass moment of inertia $J_{1;}$ referring to the drive; Bore diameters of the clamping hub: 11 mm	**$kgcm^2$**	0,09	0,09	0,08	0,07	0,06	0,06	0,06	0,06	0,06	0,06
	10^{-3} $in.lb.s^2$	0,08	0,08	0,07	0,06	0,06	0,06	0,05	0,05	0,05	0,05
Mass moment of inertia $J_{1;}$ referring to the drive; Bore diameters of the clamping hub: 14 mm	**$kgcm^2$**	0,21	0,20	0,19	0,19	0,18	0,18	0,17	0,17	0,17	0,17
	10^{-3} $in.lb.s^2$	0,18	0,18	0,17	0,16	0,16	0,16	0,15	0,15	0,15	0,15
[a] No-load running torques diminish during operation [b] Based on the shaft or flange center at the gear output											

Tbl-17: TK+ 004, 2-stage: Technical specifications for use in areas with explosion hazards

9.5.2 Technical specifications for TK+ 010 for use in areas with explosion hazards

Technical specifications for TK+ 010, 1-stage						
Ratio		**3**	**4**	**5**	**7**	**10**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	70	70	70	60	50
	in.lb	620	620	620	531	443
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	50	50	50	45	40
	in.lb	443	443	443	398	354
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	95	95	95	95	95
	in.lb	841	841	841	841	841
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	2100	2200	2500	2500	2500
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	2400	2800	3300	2800	2800
Max. drive speed n_{1Max}	**rpm**	3000	4000	6000	6000	6000
Average no-load running torque $T_{012;}$ (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	2.4	2.0	1.8	2.4	2.2
	in.lb	21	18	16	21	19
Max. torsional backlash j_t	**arcmin**	≤ 4				
Torsional rigidity C_{t12}	**Nm/arcmin**	6.0	7.0	8.0	8.0	8.0
	in.lb/arcmin	53	62	71	71	71

Technical specifications for TK+ 010, 1-stage						
Ratio		**3**	**4**	**5**	**7**	**10**
Max. axial force F_{2AMax} [b]	**N**	2350				
	lbf	528				
Max. radial force F_{2RMax} [b]	**N**	2800				
	lbf	630				
Max. tilting moment M_{2KMax}	**Nm**	300				
	in.lb	2655				
Life L_h Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"				
Weight incl. standard adapter plate m	**kg**	5.3				
	lbm	11.7				
Noise level L_{PA} (At n_1=3000 rpm w/o load)	**dB(A)**	≤ 66				
Max. permissible housing temperature	**°C**	+90				
	F	194				
Ambient temperature	**°C**	0 to +40				
	F	32 to 104				
Paint		Blue RAL 5002				
Direction of rotation		Drive and gear output counter-directional				
Protection class		IP 65				
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 19 mm	**$kgcm^2$**	1.81	1.39	1.18	1.02	0.93
	10^{-3} in.lb.s^2	1.60	1.23	1.05	0.90	0.82
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 28 mm	**$kgcm^2$**	3.22	2.80	2.60	2.43	2.34
	10^{-3} in.lb.s^2	2.85	2.48	2.30	2.15	2.07
[a] No-load running torques diminish during operation [b] Based on the shaft or flange center at the gear output						

Tbl-18: TK+ 010, 1-stage: Technical specifications for use in areas with explosion hazards

Technical specifications for TK+ 010, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	70	70	70	70	70	70	70	70	60	50
	in.lb	620	620	620	620	620	620	620	620	531	443
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	50	50	50	50	50	50	50	50	45	40
	in.lb	443	443	443	443	443	443	443	443	398	354
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	95	95	95	95	95	95	95	95	95	95
	in.lb	841	841	841	841	841	841	841	841	841	841
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	3100	3100	3100	3100	3100	3100	3100	3400	4000	4000

Technical specifications for TK+ 010, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
Max. drive speed n_{1Max}	**rpm**	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
Average no-load running torque T_{012} (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	0.4	0.4	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1
	in.lb	3.5	3.5	2.7	2.7	2.7	2.7	0.9	0.9	0.9	0.9
Max. torsional backlash j_t	**arcmin**	≤ 4									
Torsional rigidity C_{t12}	**Nm/ arcmin**	7.0	7.0	7.0	7.0	7.0	7.0	7.0	8.0	8.0	8.0
	in.lb/ arcmin	62	62	62	62	62	62	62	71	71	71
Max. axial force F_{2AMax} [b]	**N**	2350									
	lbf	529									
Max. radial force F_{2RMax} [b]	**N**	2800									
	lbf	630									
Max. tilting moment M_{2KMax}	**Nm**	300									
	in.lb	2655									
Life $L_{h;}$ Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"									
Weight incl. standard adapter plate m	**kg**	6.1									
	lbm	13.5									
Noise level L_{PA} (At n_1=3000 rpm w/o load)	**dB(A)**	≤ 66									
Max. permissible housing temperature	**°C**	+90									
	F	194									
Ambient temperature	**°C**	0 to +40									
	F	32 to 104									
Paint		Blue RAL 5002									
Direction of rotation		Drive and gear output counter-directional									
Protection class		IP 65									
Mass moment of inertia $J_{1;}$ referring to the drive; Bore diameters of the clamping hub: 14 mm	**$kgcm^2$**	0.31	0.28	0.24	0.23	0.21	0.20	0.19	0.18	0.18	0.18
	10^{-3} $in.lb.s^2$	0.27	0.25	0.21	0.21	0.18	0.18	0.17	0.16	0.16	0.16
Mass moment of inertia $J_{1;}$ referring to the drive; Bore diameters of the clamping hub: 19 mm	**$kgcm^2$**	0.75	0.72	0.68	0.68	0.63	0.63	0.63	0.63	0.63	0.63
	10^{-3} $in.lb.s^2$	0.66	0.64	0.61	0.60	0.56	0.55	0.56	0.56	0.55	0.55

[a] No-load running torques diminish during operation

[b] Based on the shaft or flange center at the gear output

Tbl-19: TK+ 010, 2-stage: Technical specifications for use in areas with explosion hazards

9.5.3 Technical specifications for TK+ 025 for use in areas with explosion hazards

Technical specifications for TK+ 025, 1-stage						
Ratio		**3**	**4**	**5**	**7**	**10**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	125	125	125	95	85
	in.lb	1106	1106	1106	841	752
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	75	75	75	60	55
	in.lb	664	664	664	531	487
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	200	200	200	200	200
	in.lb	1770	1770	1770	1770	1770
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	1400	1400	1600	1400	1400
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	2100	2100	2100	1600	1500
Max. drive speed n_{1Max}	**rpm**	2500	3300	4500	4500	4500
Average no-load running torque $T_{012;}$ (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	4.6	3.6	2.8	4.2	3.4
	in.lb	41	32	25	37	30
Max. torsional backlash j_t	**arcmin**	≤ 4				
Torsional rigidity C_{t12}	**Nm/arcmin**	12	13	16	16	16
	in.lb/arcmin	106	115	142	142	142
Max. axial force F_{2AMax} [b]	**N**	3950				
	lbf	889				
Max. radial force F_{2RMax} [b]	**N**	2800				
	lbf	630				
Max. tilting moment M_{2KMax}	**Nm**	580				
	in.lb	5133				
Life L_h Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"				
Weight incl. standard adapter plate m	**kg**	8.9				
	lbm	20				
Noise level L_{PA} (At n_1=3000 rpm w/o load)	**dB(A)**	≤ 66				
Max. permissible housing temperature	**°C**	+90				
	F	194				
Ambient temperature	**°C**	0 to +40				
	F	32 to 104				
Paint		Blue RAL 5002				
Direction of rotation		Drive and gear output counter-directional				
Protection class		IP 65				

Technical specifications for TK+ 025, 1-stage						
Ratio		**3**	**4**	**5**	**7**	**10**
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 28 mm	**$kgcm^2$**	5.46	4.26	3.63	3.13	2.87
	10^{-3} in.lb.s^2	4.83	3.77	3.22	2.77	2.54
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 38 mm	**$kgcm^2$**	12.7	11.5	10.9	10.4	10.1
	10^{-3} in.lb.s^2	11.2	10.2	9.6	9.2	9.0
[a] No-load running torques diminish during operation [b] Based on the shaft or flange center at the gear output						

Tbl-20: TK+ 025, 1-stage: Technical specifications for use in areas with explosion hazards

Technical specifications for TK+ 025, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	125	125	125	125	125	125	125	125	95	85
	in.lb	1106	1106	1106	1106	1106	1106	1106	1106	841	752
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	75	75	75	75	75	75	75	75	60	55
	in.lb	664	664	664	664	664	664	664	664	531	487
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	200	200	200	200	200	200	200	200	200	200
	in.lb	1770	1770	1770	1770	1770	1770	1770	1770	1770	1770
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	2700	2700	2700	2700	2700	2700	2700	3100	3700	3700
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	3600	3600	3600	3600	3600	3600	3600	3600	3750	3750
Max. drive speed n_{1Max}	**rpm**	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
Average no-load running torque $T_{012;}$ (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	0.7	0.7	0.6	0.5	0.5	0.4	0.2	0.2	0.2	0.2
	in.lb	6.2	6.2	5.3	4.4	4.4	3.5	1.8	1.8	1.8	1.8
Max. torsional backlash j_t	**arcmin**	≤ 4									
Torsional rigidity C_{t12}	**Nm/ arcmin**	13	13	13	13	13	13	13	16	16	16
	in.lb/ arcmin	115	115	115	115	115	115	115	142	142	142
Max. axial force F_{2AMax} [b]	**N**	3950									
	lbf	889									
Max. radial force F_{2RMax} [b]	**N**	2800									
	lbf	630									
Max. tilting moment M_{2KMax}	**Nm**	580									
	in.lb	5133									
Life $L_{h\ ;}$ Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"									

Technical specifications for TK+ 025, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Weight incl. standard adapter plate m	**kg**	10.6									
	lbm	23									
Noise level L_{PA} (At n_1=3000 rpm w/o load)	**dB(A)**	≤ 66									
Max. permissible housing temperature	**°C**	+90									
	F	194									
Ambient temperature	**°C**	0 to +40									
	F	32 to 104									
Paint		Blue RAL 5002									
Direction of rotation		Drive and gear output counter-directional									
Protection class		IP 65									
Mass moment of inertia $J_{1;}$ referring to the drive; Bore diameters of the clamping hub: 19 mm	**$kgcm^2$**	1.08	1.01	0.88	0.85	0.76	0.75	0.70	0.69	0.69	0.68
	10^{-3} $in.lb.s^2$	0.96	0.89	0.78	0.75	0.67	0.66	0.62	0.61	0.61	0.60
Mass moment of inertia $J_{1;}$ referring to the drive; Bore diameters of the clamping hub: 24 mm	**$kgcm^2$**	2.65	2.57	2.44	2.42	2.32	2.31	2.26	2.25	2.25	2.25
	10^{-3} $in.lb.s^2$	2.34	2.28	2.16	2.14	2.06	2.05	2.00	2.00	1.99	1.99
[a] No-load running torques diminish during operation [b] Based on the shaft or flange center at the gear output											

Tbl-21: TK+ 025, 2-stage: Technical specifications for use in areas with explosion hazards

9.5.4 Technical specifications for TK+ 050 for use in areas with explosion hazards

Technical specifications for TK+ 050, 1-stage						
Ratio		**3**	**4**	**5**	**7**	**10**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	190	190	205	185	170
	in.lb	1682	1682	1814	1637	1505
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	120	120	130	130	130
	in.lb	1062	1062	1151	1151	1151
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	400	420	420	420	400
	in.lb	3540	3717	3717	3717	3540
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	1200	1200	1400	1300	1400
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	1500	1600	1800	1600	1700
Max. drive speed n_{1Max}	**rpm**	2000	2500	3500	4200	4200
Average no-load running torque $T_{012;}$ (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	8.4	6.2	5.4	9.0	6.6
	in.lb	74	55	48	80	58
Max. torsional backlash j_t	**arcmin**	≤ 4				

Technical specifications for TK+ 050, 1-stage						
Ratio		**3**	**4**	**5**	**7**	**10**
Torsional rigidity C_{t12}	**Nm/arcmin**	36	40	46	44	42
	in.lb/arcmin	315	356	405	387	376
Max. axial force F_{2AMax} [b]	**N**	6900				
	lbf	1553				
Max. radial force F_{2RMax} [b]	**N**	6600				
	lbf	1485				
Max. tilting moment M_{2KMax}	**Nm**	1180				
	in.lb	10443				
Life L_h Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"				
Weight incl. standard adapter plate m	**kg**	22.0				
	lbm	49				
Noise level L_{PA} (At n_1=3000 rpm w/o load)	**dB(A)**	≤ 68				
Max. permissible housing temperature	**°C**	+90				
	F	194				
Ambient temperature	**°C**	0 to +40				
	F	32 to 104				
Paint		Blue RAL 5002				
Direction of rotation		Drive and gear output counter-directional				
Protection class		IP 65				
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 38 mm	**$kgcm^2$**	28.4	21.0	17.6	14.7	13.1
	10^{-3} in.lb.s^2	25.1	18.6	15.5	13.0	11.6
[a] No-load running torques diminish during operation [b] Based on the shaft or flange center at the gear output						

Tbl-22: TK+ 050, 1-stage: Technical specifications for use in areas with explosion hazards

Technical specifications for TK+ 050, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	190	190	190	205	190	205	190	205	185	170
	in.lb	1682	1682	1682	1814	1682	1814	1682	1814	1637	1505
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	120	120	120	120	120	120	120	130	130	130
	in.lb	1062	1062	1062	1062	1062	1062	1062	1151	1151	1151
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	400	420	420	420	420	420	420	420	420	400
	in.lb	3540	3717	3717	3717	3717	3717	3717	3717	3717	3540
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	2600	2600	2600	2600	2600	2600	2600	2800	2800	3500
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	3500	3500	3500	3500	3500	3500	3500	3700	3700	3700

Technical specifications for TK+ 050, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Max. drive speed n_{1Max}	**rpm**	4500	4500	4500	4500	4500	4500	4500	4500	4500	4500
Average no-load running torque T_{012} (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	1.7	1.1	0.8	0.6	0.6	0.5	0.5	0.4	0.4	0.4
	in.lb	15.0	9.7	7.1	5.3	5.3	4.4	4.4	3.5	3.5	3.5
Max. torsional backlash j_t	**arcmin**	≤ 4									
Torsional rigidity C_{t12}	**Nm/ arcmin**	40	40	40	40	40	40	40	46	44	42
	in.lb/ arcmin	356	356	356	356	356	356	356	405	387	376
Max. axial force F_{2AMax} [b]	**N**	6900									
	lbf	1553									
Max. radial force F_{2RMax} [b]	**N**	6600									
	lbf	1485									
Max. tilting moment M_{2KMax}	**Nm**	1180									
	in.lb	10443									
Life L_h Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"									
Weight incl. standard adapter plate m	**kg**	26									
	lbm	57									
Noise level L_{PA} ; (At n_1=3000 rpm w/o load)	**dB(A)**	≤ 68									
Max. permissible housing temperature	**°C**	+90									
	F	194									
Ambient temperature	**°C**	0 to +40									
	F	32 to 104									
Paint		Blue RAL 5002									
Direction of rotation		Drive and gear output counter-directional									
Protection class		IP 65									
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 24 mm	**$kgcm^2$**	4.43	3.97	3.36	3.22	2.82	2.75	2.50	2.47	2.44	2.42
	10^{-3} $in.lb.s^2$	3.92	3.51	2.97	2.85	2.50	2.44	2.21	2.18	2.16	2.14
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 38 mm	**$kgcm^2$**	11.3	10.9	10.3	10.1	9.7	9.7	9.4	9.4	9.4	9.3
	10^{-3} $in.lb.s^2$	10.0	9.6	9.1	9.0	8.6	8.6	8.3	8.3	8.3	8.3

[a] No-load running torques diminish during operation
[b] Based on the shaft or flange center at the gear output

Tbl-23: TK+ 050, 2-stage: Technical specifications for use in areas with explosion hazards

9.5.5 Technical specifications for TK+ 110 for use in areas with explosion hazards

Technical specifications for TK+ 110, 1-stage						
Ratio		**3**	**4**	**5**	**7**	**10**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	400	400	400	350	300
	in.lb	3540	3540	3540	3098	2655
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	250	250	250	230	220
	in.lb	2213	2213	2213	2036	1947
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	900	900	900	900	900
	in.lb	7965	7965	7965	7965	7965
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	900	1100	1200	1100	1100
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	1100	1300	1500	1400	1400
Max. drive speed n_{1Max}	**rpm**	1300	1700	2200	3000	3000
Average no-load running torque T_{012} ; (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	17.5	14.5	12	18	15
	in.lb	155	128	106	159	133
Max. torsional backlash j_t	**arcmin**	≤ 4				
Torsional rigidity C_{t12}	**Nm/arcmin**	76	87	99	97	96
	in.lb/arcmin	676	766	874	860	847
Max. axial force F_{2AMax} [b]	**N**	9900				
	lbf	2228				
Max. radial force F_{2RMax} [b]	**N**	10250				
	lbf	2306				
Max. tilting moment M_{2KMax}	**Nm**	2250				
	in.lb	19913				
Life L_h Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"				
Weight incl. standard adapter plate m	**kg**	48				
	lbm	106				
Noise level L_{PA} (At n_1=3000 rpm w/o load)	**dB(A)**	≤ 68				
Max. permissible housing temperature	**°C**	+90				
	F	194				
Ambient temperature	**°C**	0 to +40				
	F	32 to 104				
Paint		Blue RAL 5002				
Direction of rotation		Drive and gear output counter-directional				
Protection class		IP 65				
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 48 mm	**kgcm²**	96.5	64.6	50.5	38.2	31.8
	10^{-3} in.lb.s²	85.4	57.2	44.7	33.8	28.1
[a] No-load running torques diminish during operation [b] Based on the shaft or flange center at the gear output						

Tbl-24: TK+ 110, 1-stage: Technical specifications for use in areas with explosion hazards

Technical specifications for TK+ 110, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Max. acceleration torque T_{2B} (max. 1000 cycles per hour)	**Nm**	400	400	400	400	400	400	400	400	350	300
	in.lb	3540	3540	3540	3540	3540	3540	3540	3540	3098	2655
Nominal torque at gear output T_{2N} (At n_{1N})	**Nm**	250	250	250	250	250	250	250	250	230	220
	in.lb	2213	2213	2213	2213	2213	2213	2213	2213	2036	1947
Emergency-stop torque T_{2Not} (1000 times possible during the lifespan of the gearhead)	**Nm**	900	900	900	900	900	900	900	900	900	900
	in.lb	7965	7965	7965	7965	7965	7965	7965	7965	7965	7965
Permissible medium drive speed in n_{1N} (At T_{2N})	**rpm**	2150	2150	2150	2150	2150	2150	2150	2300	2550	2700
Max. continuous speed n_{1Ncym} (At 20% T_{2N})	**rpm**	2800	2800	2800	2800	2800	2800	2800	2800	3000	3000
Max. drive speed n_{1Max}	**rpm**	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000
Average no-load running torque T_{012} (At n_1=3000 rpm and 20°C gearhead temperature) [a]	**Nm**	3.6	2.8	2.2	1.9	1.6	1.4	1.1	1.1	1.1	1.1
	in.lb	31.9	24.8	19.5	16.8	14.2	12.4	9.7	9.7	9.7	9.7
Max. torsional backlash j_t	**arcmin**	≤ 4									
Torsional rigidity C_{t12}	**Nm/ arcmin**	87	87	87	87	87	87	87	99	97	96
	in.lb/ arcmin	766	766	766	766	766	766	766	874	860	847
Max. axial force F_{2AMax} [b]	**N**	9900									
	lbf	2228									
Max. radial force F_{2RMax} [b]	**N**	10250									
	lbf	2306									
Max. tilting moment M_{2KMax}	**Nm**	2250									
	in.lb	19913									
Life L_h Calculation see "Technical Basics"	**h**	See chapter 7.1.4 "Replacing the gearhead"									
Weight incl. standard adapter plate m	**kg**	54									
	lbm	119									
Noise level L_{PA} (At n_1=3000 rpm w/o load)	**dB(A)**	≤ 68									
Max. permissible housing temperature	**°C**	+90									
	F	194									

Technical specifications for TK+ 110, 2-stage											
Ratio		**12**	**16**	**20**	**25**	**28**	**35**	**40**	**50**	**70**	**100**
Ambient temperature	**°C**	0 to +40									
	F	32 to 104									
Paint		Blue RAL 5002									
Direction of rotation		Drive and gear output counter-directional									
Protection class		IP 65									
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 38 mm	**$kgcm^2$**	16.8	14.8	12.9	12.3	11.2	10.9	10.3	10.1	10.0	9.9
	10^{-3} $in.lb.s^2$	14.8	13.1	11.4	10.9	9.9	9.6	9.1	9.0	8.8	8.8
Mass moment of inertia J_1 referring to the drive; Bore diameters of the clamping hub: 48 mm	**$kgcm^2$**	31.5	29.5	27.6	27.0	25.9	25.6	25.0	24.8	24.7	24.6
	10^{-3} $in.lb.s^2$	27.9	26.1	24.4	23.9	22.9	22.6	22.1	22.0	21.9	21.8
[a] No-load running torques diminish during operation [b] Based on the shaft or flange center at the gear output											

Tbl-25: TK+ 110, 2-stage: Technical specifications for use in areas with explosion hazards

9.6 Lubricant quantity

Gearhead size TK+	Ratio i	Oil type	Viscosity class ISO VG	Filling quantity [cm³]
004	3, 4, 5, 16, 20, 25, 28, 35, 40, 50	Tribol 800	100	50
	7, 10, 70, 100	Tribol 800	220	60
010	3, 4, 5, 16, 20, 25, 28, 35, 40, 50	Tribol 800	100	110
	7, 10, 70, 100	Tribol 800	220	130
025	3, 4, 16, 20, 28, 40	Tribol 800	100	170
	5, 25, 35, 50	Tribol 800	100	190
	7, 10, 70, 100	Tribol 800	220	210
050	3	Tribol 800	100	270
	4, 16, 20, 28, 40	Tribol 800	100	300
	5, 25, 35, 50	Tribol 800	100	330
	7, 10, 70, 100	Tribol 800	220	380
110	3	Tribol 800	100	850
	4, 5, 16, 20, 25, 28, 35, 40, 50	Tribol 800	100	1000
	7, 70	Tribol 800	220	1200
	10, 100	Tribol 800	220	1350

Tbl-26: Lubricant quantity

9.7 Declaration of Conformity

EG-Konformitätserklärung
EC-Declaration of Conformity

Wir / *We,*	**WITTENSTEIN alpha GmbH**
Anschrift / *Address*	Walter-Wittenstein-Strasse 1 D-97999 Igersheim Germany Tel: +49 (0)700 - 493 10020 Fax: +49 (0)7931 - 493-200 E-Mail: info-alpha@wittenstein.de

erklären hiermit in alleiniger Verantwortung, dass die Erzeugnisse
hereby declare under our sole responsibility, that the products

Bezeichnung:	**TK+/SK+/HG+ Hypoid-Winkelgetriebe**
Designation:	***TK+/SK+/HG+ Hypoid right-angle gearheads***
Baugröße / *Size:*	**SK+/HG+ 060, SK+/HG+ 075, SK+/HG+ 100, SK+/HG+ 140, SK+/HG+ 180**
	TK+ 004, TK+ 010, TK+ 025, TK+ 050, TK+ 110
Ausführung:	**MF-Version**
Performance:	***MF-Version***

mit den wesentlichen Anforderungen der folgenden EN-Normen
comply with the principle demands of the following EN standards

DIN EN 13463-1:2009	Nicht-elektrische Geräte für den Einsatz in explosionsgefährdeten Bereichen - Teil 1: Grundlagen und Anforderungen
DIN EN 13463-1:2009	*Non-electrical equipment for potentially explosive atmospheres Part 1: Basic method and requirements*
DIN EN 13463-5:2004	Nicht-elektrische Geräte für den Einsatz in explosionsgefährdeten Bereichen - Teil 5: Schutz durch Konstruktive Sicherheit „c“
DIN EN 13463-5:2004	*Non-electrical equipment intended for use in potentially explosive atmospheres Part 5: Protection by constructional safety „c“*
DIN EN 13463-8:2004	Nicht-elektrische Geräte für den Einsatz in explosionsgefährdeten Bereichen - Teil 8: Schutz durch Flüssigkeitskapselung „k“
DIN EN 13463-8:2004	*Non-electrical equipment for potentially explosive atmospheres Part 8: Protection by liquid immersion „k“*

und den Prüfdokumenten übereinstimmt. Die Winkelgetriebe in der explosionsgeschützten Ausführung sind Geräte im Sinne des Artikels 1 (3) a) der EG-Richtlinie 94/9/EG und erfüllen die grundlegenden Sicherheits- und Gesundheitsanforderungen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der RL 94/9/EG.
and agree with the test documents. Right-angle gearheads in highly explosive versions are devices in terms of Article 1 (3) a) of the EU directive 94/9/EC and fulfil the basic safety and health requirements for use according to regulations in explosive areas in accordance with supplement II of directive 94/9/EC.

Kennzeichnung / *Marking:*	Ⓔx II 2G c k IIC T3 X und / *and* Ⓔx II 2D c k 150 °C X
Kennzeichnung von TK+ 110 / *Marking of TK+ 110:*	Ⓔx II 2G c k IIB T3 X und / *and* Ⓔx II 2D c k 150°C X

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WITTENSTEIN alpha

Die explosionsgeschützt ausgeführten Winkelgetriebe tragen das CE-Zeichen.
The explosion-proof versions of bevel gear reducers carry the CE symbol.

Die zugehörigen Betriebsanleitungen (Dok.-Nummern: 2022-D034857, 2022-D034858, 2022-D034859) enthalten wichtige sicherheitstechnische Hinweise und Vorschriften für die Inbetriebnahme, Umgang und Wartung der TK+/SK+/HG+ - Getriebe.
The respective operating manual (Document Numbers: 2022-D034857, 2022-D034858,2022-D034859) contains important safety-related information and regulations for start-up, handling and maintenance of the TK+/SK+/HG+ gear reducer.

Das Verfahren der Konformitätsbewertung wurde gemäß Artikel 8 (1) b) ii) der EG-Richtlinie 94/9/EG durchgeführt. Die technischen Unterlagen (Dok.-Nr.: 2098-D035459) gemäß Anhang VIII Nummer 3 der EG-Richtlinie sind bei der benannten Stelle hinterlegt:
The procedure of the conformity assessment was carried out according to Article 8 (1) b) ii) of the EU-guideline 94/9/EC. The technical documents according to Attachment VIII, No. 3 of the EU-guideline have been deposited at the appointed location:

Anschrift / *Address*

Physikalisch-Technische Bundesanstalt
Fachbereich 3.7
Bundesallee 100
D-38116 Braunschweig

Igersheim, 12.08.2010

Ort und Datum der Ausstellung
Place and Date of Issue

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