

Operating instructions | EN

# AG2800

Stainless steel planetary gear unit





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- EP1456722
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- DE102015105702



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## Version numbers



### Provision of revision levels

On request, you can obtain a list of revision levels for changes in the operating instructions.

- Send your request to: [motion-documentation@beckhoff.de](mailto:motion-documentation@beckhoff.de)

### Origin of the document

These operating instructions were originally written in German. All other languages are derived from the German original.

### Product features

Only the product properties specified in the current operating instructions are valid. Further information given on the product pages of the Beckhoff homepage, in emails or in other publications is not authoritative.

## Scope of the documentation

Apart from these operating instructions, the following documents are part of the overall documentation:

Documentation	Definition
Short information	Accompanying document with general notes on handling the gear units. Included with each product.

## Staff qualification

These operating instructions are intended for trained control and automation specialists with knowledge of the applicable and required standards and directives.

Specialists must have knowledge of drive technology and electrical equipment as well as knowledge of safe working on electrical systems and machines. This includes knowledge of proper setup and preparation of the workplace as well as securing the working environment for other persons.

The operating instructions published at the respective time of each installation and commissioning is to be used. The products must be used in compliance with all safety requirements, including all applicable laws, regulations, provisions and standards.

### **Instructed person**

Instructed persons have a clearly defined task area and have been informed about the work to be carried out. Instructed persons are familiar with:

- the necessary protective measures and protective devices
- the intended use and risks that can arise from use other than for the intended purpose

### **Trained person**

Trained persons meet the requirements for instructed persons. Trained persons have additionally received training from the machine builder or vendor:

- machine-specific or
- plant-specific

### **Trained specialists**

Trained specialists have received specific technical training and have specific technical knowledge and experience. Trained specialists can:

- apply relevant standards and directives
- assess tasks that they have been assigned
- recognize possible hazards
- prepare and set up workplaces

## **Qualified electricians**

Qualified electricians have comprehensive technical knowledge gained from a course of study, an apprenticeship or technical training. They have an understanding of control technology and automation. They are familiar with relevant standards and directives. Qualified electricians can:

- independently recognize, avoid and eliminate sources of danger
- implement specifications from the accident prevention regulations
- assess the work environment
- independently optimize and carry out their work



## Safety and instruction

Read the contents that refer to the activities you have to perform with the product. Always read the chapter For your safety in the operating instructions. Observe the warnings in the chapters so that you can handle and work with the product as intended and safely.

## Explanation of symbols

Various symbols are used for a clear arrangement:

- ▶ The triangle indicates instructions that you should execute.
- The bullet point indicates an enumeration.
- [...] The square brackets indicate cross-references to other text passages in the document.
- [1] The number in the square brackets refers to the position in the adjacent figure.
- [+] The plus sign in square brackets indicates ordering options and accessories.

In order to make it easier for you to find text passages, pictograms and signal words are used in warning notices:

### **DANGER**

Failure to observe will result in serious or fatal injuries.

### **WARNING**

Failure to observe may result in serious or fatal injuries.

### **CAUTION**

Failure to observe may result in minor or moderate injuries.



Notes are used for important information on the product. The possible consequences of failure to observe these include:

- Malfunctions of the product
- Damage to the product
- Damage to the environment



### Information

This sign indicates information, tips and notes for dealing with the product or the software.



### Examples

This symbol shows examples of how to use the product or software.



### QR-Codes

This symbol shows a QR code, via which you can watch videos or animations. Internet access is required in order to use it.

You can read the QR code, for example, with the camera of your smartphone or tablet. If your camera doesn't support this function you can download a free QR code reader app for your smartphone. Use the Appstore for Apple operating systems or the Google Play Store for Android operating systems.

*If you cannot read the QR code on paper, make sure that the lighting is adequate and reduce the distance between the reading device and the paper. In the case of documentation on a monitor screen, use the zoom function to enlarge the QR code and reduce the distance.*

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## Downloadfinder

Our download finder contains all the files we offer for download: from our application reports to our technical documentation and configuration files.

Web: [www.beckhoff.com/dokumentationen](http://www.beckhoff.com/dokumentationen)

Read this chapter containing general safety information. The chapters in these operating instructions also contain warning notices. Always observe the safety instructions for your own safety, the safety of other persons and the safety of the product.

When working with control and automation products, many dangers can result from careless or incorrect use. Work particularly thoroughly, not under time pressure and responsibly towards other people.

## General safety instructions

This chapter provides you with instructions on safety when handling the gear units. They cannot run independently. The gear units are therefore regarded as incomplete machines. They must be installed in a machine or plant by the machine manufacturer. The documentation created by the machine manufacturer must be read.

## Before operation

### **Keep the immediate environment clean**

Keep your workplace and the surrounding area clean. Ensure safe working.

### **Shut down and secure the machine or plant**

Shut down the machine or plant. Secure the machine or plant against being inadvertently started up.

### **Observe tightening torques**

Mount and repeatedly check connections and components, complying with the prescribed tightening torques.

### **Use the original packaging only**

Use the original packaging for dispatch, transportation, storage and packing.

### **Secure feather key against loss**

Secure the existing feather key against loss, for example:

- during transportation or
- during operation without mounted parts

## During operation

### **Do not touch hot surfaces**

Check the cooling of the surfaces with a thermometer. Do not touch the components during and immediately after operation. Allow the components to cool sufficiently after switching off.

### **Avoid overheating**

Operate the components according to the technical specifications. Refer here to the chapter: "Technical data". Provide for sufficient cooling. Switch the components off immediately if the temperature is too high.

### **Do not touch any moving or rotating components**

Do not touch any moving or rotating components. Fasten all parts or components on the machine or plant.

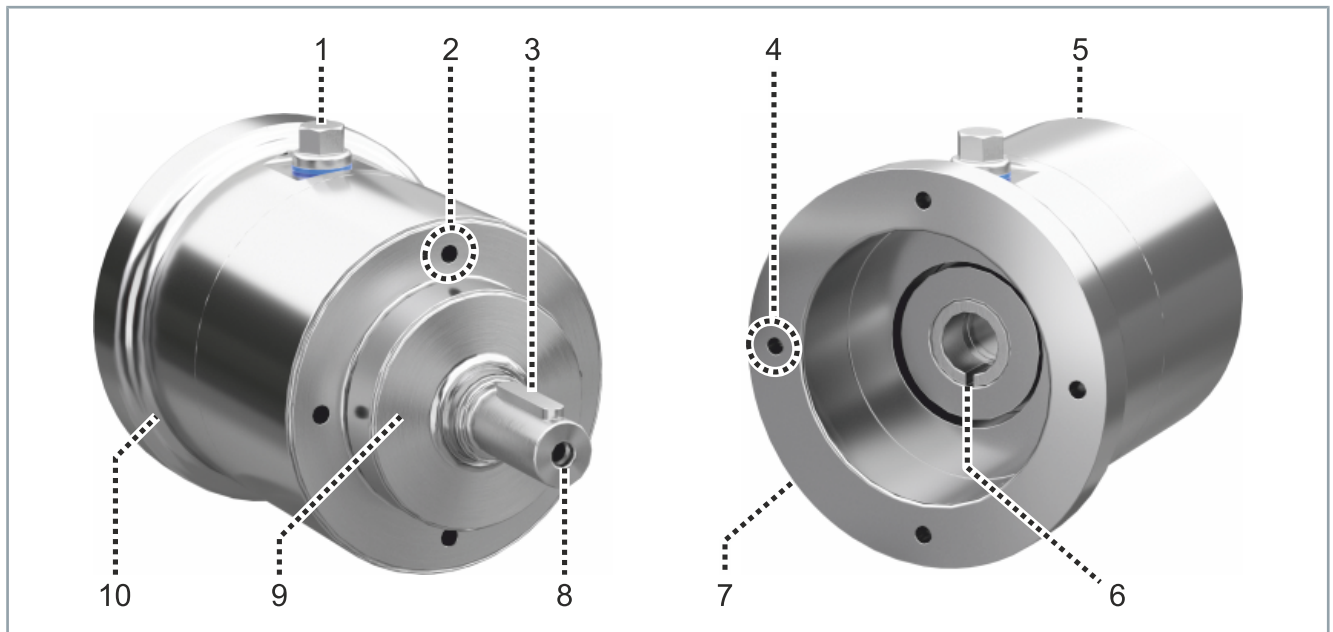
## After operation

### **De-energize and switch off components before working on them**

Check the functionality of all safety-relevant devices. Secure the working environment. Secure the machine or plant against being inadvertently started up. Observe the chapter: "Decommissioning".

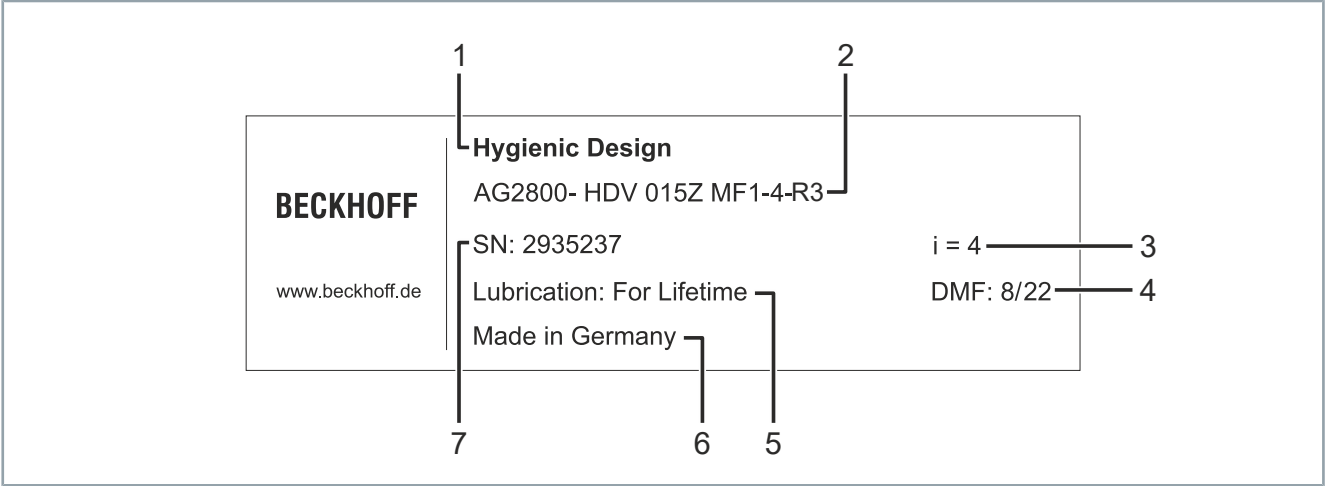
### **No direct skin contact with solvents or lubricants**

In case of improper use, the solvents or lubricants used can lead to skin irritations. Avoid direct skin contact.



Number	Explanation
1	Screw plug
2	4 holes for output side
3	Feather key [ + ]
4	4 holes for the motor attachment
5	Gear housing
6	Clamping hub with spacer sleeve
7	Adapter plate
8	Output shaft with center bore
9	Shaft seal at the output
10	O-ring seal

Name plate



Number	Explanation
1	Series
2	Gear unit type
3	Ratio
4	Date of manufacture
5	Lubrication
6	Country of manufacture
7	Serial number



## Type key

AG2800 – HDV015S – MF1 – 3 – 1C1 – R3		Explanation
AG2800		Gear unit series AG2800 = stainless steel planetary gear unit HDV
HDV		Gear type HDV = Standard
015		Size HDV 015 HDV 025 HDV 035
S		Lubrication S = Standard
M		Gear unit variant M = Motor-mounted gear unit
F		Gear unit version F = Standard
1		No. of stages 1 = single-stage 2 = two-stage
3		Ratio See documentation
1		Type of output 0 = smooth shaft 1 = feather key DIN 6885 shape A 2 = splined shaft DIN 5480
C		Clamping hub identifying letter Not freely selectable Is selected on the basis of the motor to be mounted
1		Torsional backlash 1 = Standard
R3		Beckhoff flange size R3 R4 R5

## Product characteristics

### **Wide range of possible applications**

The stainless steel planetary gear unit can be used in any installation position. This gives you the opportunity to install the gear units in a variety of ways in your machine or system. The gear units are delivered in the "M" variant for motor attachment.

### **Hygienic design**

The stainless steel planetary gear units have been specially developed for hygienically demanding applications in food processing. They are made of highly resistant stainless steel and are suitable for cleaning with aggressive cleaning agents or disinfectants.

### **Direct process integration**

The direct process integration of the stainless steel planetary gear units allows new, constructive freedom and an open machine concept without enclosures.

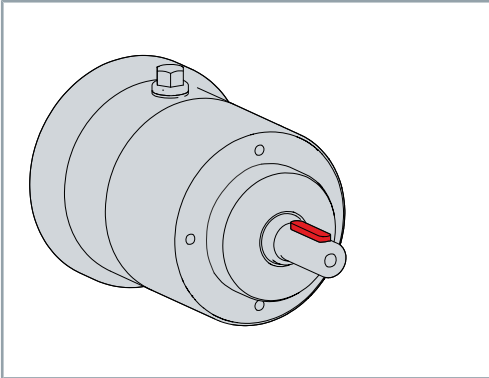
### **Maintenance-free ball bearings**

The ball bearings are lifetime-lubricated and maintenance-free.

## Ordering options

Ordering options are defined via the type key and must be ordered separately. The listed components cannot be retrofitted.

### Feather key



A feather key transmits torque to an output element.

The gear units are available with feather key groove and inserted feather key according to DIN 6885.

## Intended use

The planetary gear units from the AG2800 series may be operated only in the intended ambient and environmental conditions defined in this documentation.

The components are installed in plants or machines. Stand-alone operation of the components is not permitted.

The gear unit is intended for attachment to motors under the following conditions:

- The design of the motors is B5
- The concentricity tolerance or axial run-out tolerance conforms to EN 50347
- The cylindrical shaft end has the tolerance class h6 to k6



### **Observe the approvals for gear units with the Ex-marking**

Gear units marked with the Ex-marking comply with EU Directive 2014/34/EN; ATEX and are approved for use in potentially explosive atmospheres. The performance data are limited and can be found in the chapter: "Technical data" of this translation of the original instructions.

### **Read the entire drive system documentation:**

- This translation of the original instructions
- Original operating instructions for the motors
- Machine manufacturer's complete documentation for the machine

## Improper use

Any type of use that exceeds the permissible values from the technical data is regarded as inappropriate and is thus prohibited.

The planetary gear units from the AG2800 series are not suitable for use in the following areas:

- Potentially explosive atmospheres without a suitable housing
- Areas with ionizing radiation and nuclear plants
- Aerospace industry
- Installation situations in which external media such as oil are present at the output shaft

Below you will find definitions of terms, environmental conditions, operating details and technical data for the planetary gear units.

## Definitions

When attaching a gear unit, the performance may be reduced by up to 20 %. The flange of the motor used for heat dissipation is fitted with a gear unit that generates heat during operation. The power derating therefore has thermal reasons.

## Technical terms

This chapter provides information on various technical terms and their meaning.

### **Equivalent force on the output $F_{2\_eq}$ [N]**

The equivalent force on the output describes the force that is relevant for dimensioning the gear unit.

### **Equivalent application torque $T_{2\_eq}$ [Nm]**

The equivalent application torque describes the torque that is relevant for the dimensioning of the gear unit.

### **Dimensioning factor $f_a$**

The dimensioning factor describes the influence of the daily operating time and the operating factor on the application torque.

### **Operating mode factor $K_M$**

The operating mode factor describes the influence of duty cycle, number of cycles and dynamics on the application torque.

### **Mass moment of inertia; based on the drive $J_1$ [kgcm<sup>2</sup>]**

The mass moment of inertia is a measure for the tendency of a body to maintain its motion state (whether at rest or in motion).

### **Running noise $L_{pA}$ [dB/A]**

The running noises are influenced, for example, by:

- transmission ratio and speed
- lubricants and gearing or
- Installation position

**Maximum radial force  $F_{2R}$  [N]**

The radial force is the force component that acts at right angles to the output shaft and parallel to the output flange. It acts perpendicular to the axial force and can have an axial distance  $x_2$  to the shaft shoulder or the shaft flange. This distance acts as lever arm. The lateral force generates a bending moment.

**Maximum torque at the output  $T_{2a}$  [Nm]**

Represents the maximum torque that can be transmitted by the gear unit. This value may be lower, depending on application-specific boundary conditions.

**EMERGENCY STOP torque  $T_{2Emerg}$  [Nm]**

The EMERGENCY STOP torque is the maximum permissible torque at the gear unit output. It may be reached 1000 times at the most during the service life of the gear unit and must never be exceeded.

## Data for operation and environment



### Operate the gear units only under the specified environmental conditions

Operate the gear units only in accordance with the specifications for operation and the environment listed in this chapter. This way you can ensure a long service life and operation as intended.

*If you do not adhere to the permissible specifications for the operation and the environment, this can lead, for example, to icing of the seal and damage to the gear unit.*

Beckhoff products are designed for operation under certain environmental conditions, which vary according to the product. The following specifications must be observed for operation and environment in order to achieve the optimum service life of the products.

Environmental requirements	
Climate category	2K3 according to EN 60721
Ambient temperature during operation	-25 °C to +40 °C, extended temperature range
Ambient temperature for transport and storage	0 °C to +40 °C, maximum fluctuation 20 K/hour
Permissible humidity in operation	15 % to 95 % relative humidity, no condensation
Permissible humidity during transport and storage	15 % to 95 % relative humidity, no condensation
Specifications for intended use	
Protection class	IP 69X
Lubrication	Grease; maintenance-free
Direction of rotation	Drive side and output side in the same direction

## Gear unit design

The two speeds that are relevant for the gear unit design are the maximum permitted nominal speed and the permitted nominal input speed.

The maximum permitted nominal speed  $n_{1\max}$  may not be exceeded. Cycle operation is dimensioned based on this value.

The permitted nominal input speed  $n_{1N}$  must not be exceeded during continuous operation.

## HDV015 MF

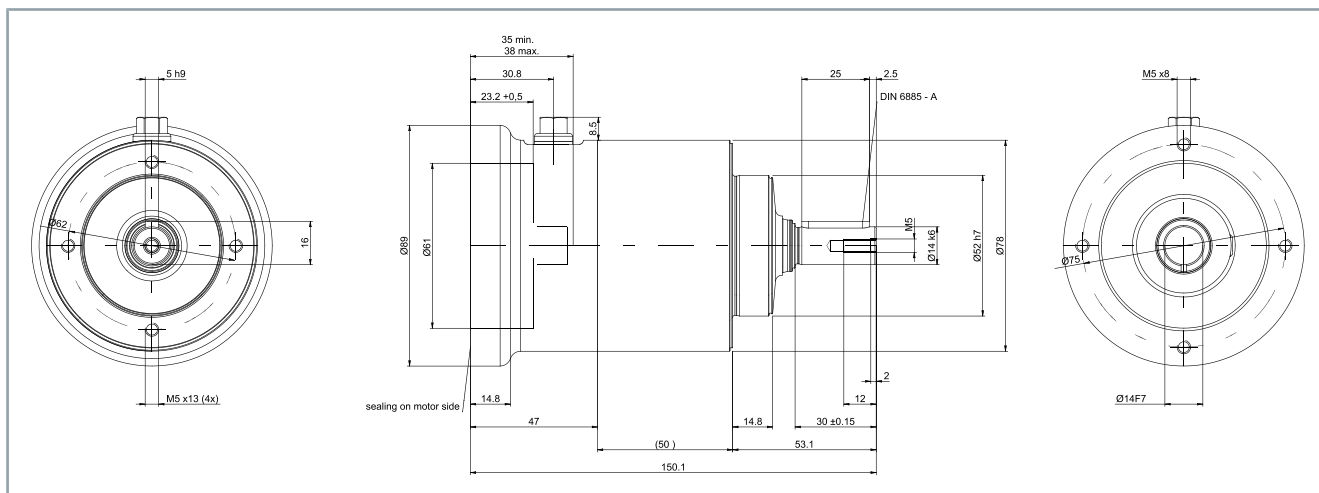
Mechanical data	1-stage				2-stage							
Ratio	4	5	7	10	16	20	25	35	50	70	100	
Efficiency under full load $\eta$ [%]	97				95							
Running noise $L_{pA}$ [dB] <i>at <math>n_1 = 3000</math> rpm without load</i>	$\leq 60$											
Service life $L_h$ [h]	$> 20000$											
Weight [kg] <i>Depending on the clamping hub diameter and selected adapter plate</i>	3.2				3.8							
<b>Mass moment of inertia <math>J_1</math> [kgcm<sup>2</sup>]</b> <i>Based on the drive</i> <i>Letters = specification of the clamping hub diameter</i>												
C = 14 mm	0.18	0.17	0.15	0.15	0.17	0.16	0.16	0.15	0.15	0.15	0.15	
<b>Torques and speeds</b>												
Maximum torque $T_{2a}$ [Nm]	51	51	51	46	51	51	51	51	51	51	46	
Nominal output torque $T_{2N}$ [Nm] <i>at <math>n_{1N}</math></i>												
Maximum acceleration torque $T_{2B}$ [Nm] <i>Maximum 1000 cycles per hour</i>	32	32	32	29	32	32	32	32	32	32	29	
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] <i>Possible 1000 times during the service life of the gear unit</i>	75											
Nominal input speed $n_{1N}$ [min <sup>-1</sup> ]	3000				3700							
Maximum input speed $n_{1Max}$ [min <sup>-1</sup> ]	6000											
Idle torque $T_{012}$ [Nm] <i>Based on the drive</i>	0.15											
<b>Torsion and forces</b>												
Maximum torsional backlash $j_t$ [ar-cmin]	Standard $\leq 10$				Standard $\leq 15$							
Maximum torsional rigidity $C_{t21}$ [ar-cmin]	2.3	2.3	2.3	2	2.3	2.3	2.3	2.3	2.3	2.3	2	
Maximum axial force $F_{2AMax}$ [N] <i>In relation to the shaft center at the output</i>	Standard: 500 HIGH FORCES: 1000											
Maximum lateral force $F_{2QMax}$ [N] <i>In relation to the shaft center at the output</i>	Standard: 350 HIGH FORCES: 1600											
Maximum breakdown torque $M_{2Max}$ [Nm]	Standard: 20 HIGH FORCES: 105											
<b>Temperature [°C]</b>												
Maximum housing temperature	+ 90											
Ambient temperature	-25 to +40											
<b>Housing</b>												
Properties	Stainless steel											
Seal	Sealed bearing disks											



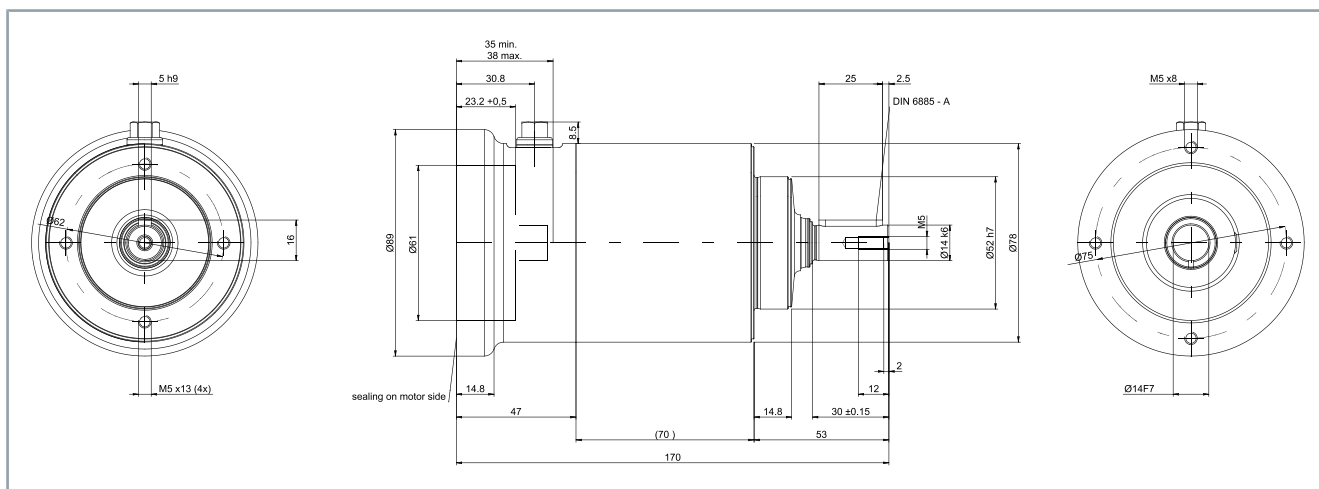
## Dimensional drawing

- All figures in millimeters
- Dimensions without tolerance  $\pm 1$  mm
- Clamping hub diameter depending on the motor size
- Center bore according to DIN 332-DR M5x12
- Feather key 5h9x25 according to DIN 6885-A

### 1-stage



### 2-stage



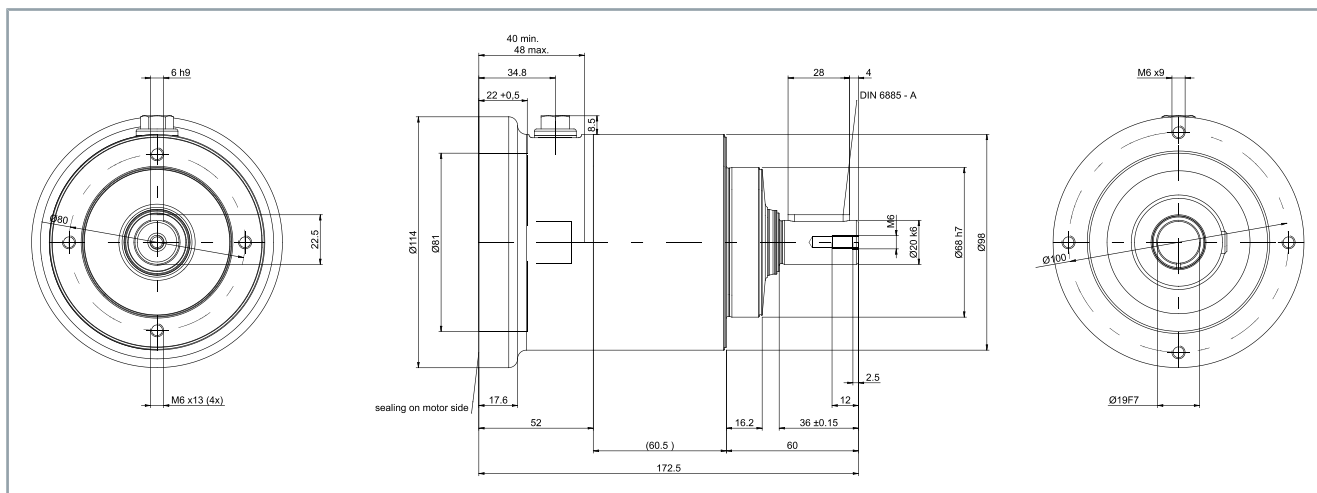
## HDV025 MF

Mechanical data	1-stage				2-stage							
Ratio	4	5	7	10	16	20	25	35	50	70	100	
Efficiency under full load $\eta$ [%]	97				95							
Running noise $L_{pA}$ [dB] <i>at <math>n_1 = 3000</math> rpm without load</i>	$\leq 63$											
Service life $L_h$ [h]	$> 20000$											
Weight [kg] <i>Depending on the clamping hub diameter and selected adapter plate</i>	5.2				6.5							
<b>Mass moment of inertia <math>J_1</math> [kgcm<sup>2</sup>]</b> <i>Based on the drive</i> <i>Letters = specification of the clamping hub diameter</i>												
E = 19 mm	0.63	0.54	0.52	0.46	0.60	0.52	0.54	0.50	0.52	0.52	0.46	
<b>Torques and speeds</b>												
Maximum torque $T_{2a}$ [Nm]	128	128	128	115	128	128	128	128	128	128	115	
Nominal output torque $T_{2N}$ [Nm] <i>at <math>n_{1N}</math></i>												
Maximum acceleration torque $T_{2B}$ [Nm] <i>Maximum 1000 cycles per hour</i>	80	80	80	72	80	80	80	80	80	80	72	
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] <i>Possible 1000 times during the service life of the gear unit</i>	190											
Nominal input speed $n_{1N}$ [min <sup>-1</sup> ]	2700				3400							
Maximum input speed $n_{1Max}$ [min <sup>-1</sup> ]	6000											
Idle torque $T_{012}$ [Nm] <i>Based on the drive</i>	0.3											
<b>Torsion and forces</b>												
Maximum torsional backlash $j_t$ [ar-cmin]	Standard $\leq 10$				Standard $\leq 15$							
Maximum torsional rigidity $C_{t21}$ [ar-cmin]	7.5	7.5	7.5	5.5	7.5	7.5	7.5	7.5	7.5	7.5	5.5	
Maximum axial force $F_{2AMax}$ [N] <i>In relation to the shaft center at the output</i>	Standard: 500 HIGH FORCES: 1500											
Maximum lateral force $F_{2QMax}$ [N] <i>In relation to the shaft center at the output</i>	Standard: 500 HIGH FORCES: 2500											
Maximum breakdown torque $M_{2Max}$ [Nm]	Standard: 31 HIGH FORCES: 185											
<b>Temperature [°C]</b>												
Maximum housing temperature	+ 90											
Ambient temperature	-25 to +40											
<b>Housing</b>												
Properties	Stainless steel											
Seal	Sealed bearing disks											

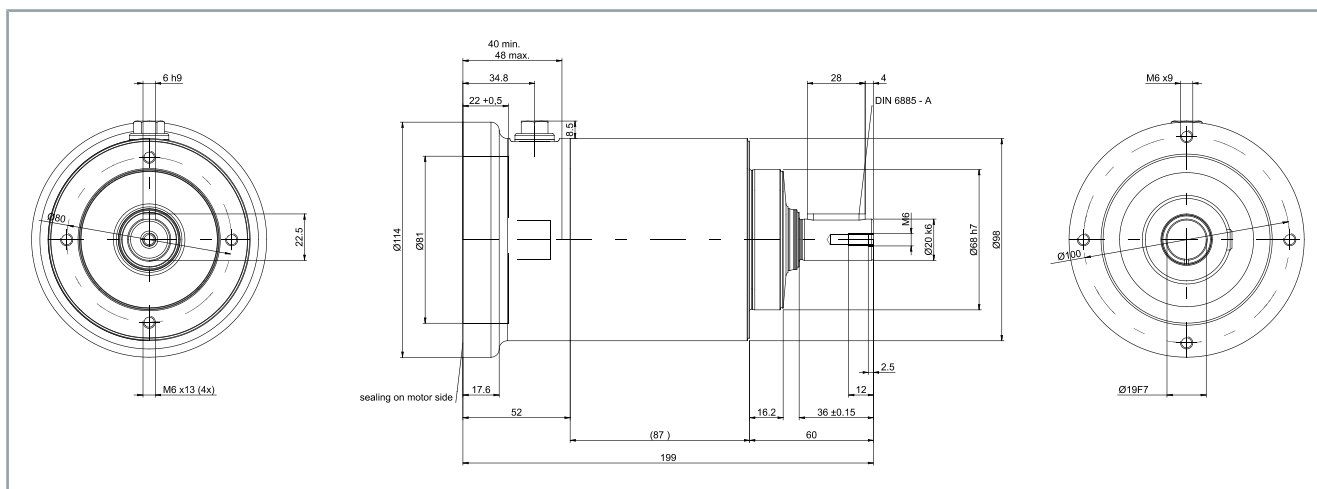
## Dimensional drawing

- All figures in millimeters
- Dimensions without tolerance  $\pm 1$  mm
- Clamping hub diameter depending on the motor size
- Center bore according to DIN 332-DR M6x12
- Feather key 6h9x28 according to DIN 6885-A

### 1-stage



### 2-stage



## HDV035 MF

Mechanical data	1-stage				2-stage							
Ratio	4	5	7	10	16	20	25	35	50	70	100	
Efficiency under full load $\eta$ [%]	97				95							
Running noise $L_{pA}$ [dB] <i>at <math>n_1 = 3000</math> rpm without load</i>	$\leq 68$											
Service life $L_n$ [h]	$> 20000$											
Weight [kg] <i>Depending on the clamping hub diameter and selected adapter plate</i>	13.6				16.6							
<b>Mass moment of inertia <math>J_1</math> [kgcm<sup>2</sup>]</b> <i>Based on the drive</i> <i>Letters = specification of the clamping hub diameter</i>												
G = 24 mm	2.6	2.3	2	1.8	2.3	2.1	2.1	1.9	1.8	1.8	1.8	
<b>Torques and speeds</b>												
Maximum torque $T_{2a}$ [Nm]	320	320	320	288	320	320	320	320	320	320	288	
Nominal output torque $T_{2N}$ [Nm] <i>at <math>n_{1N}</math></i>												
Maximum acceleration torque $T_{2B}$ [Nm] <i>Maximum 1000 cycles per hour</i>	200	200	200	180	200	200	200	200	200	200	180	
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] <i>Possible 1000 times during the service life of the gear unit</i>	480											
Nominal input speed $n_{1N}$ [min <sup>-1</sup> ]	2000				2600							
Maximum input speed $n_{1Max}$ [min <sup>-1</sup> ]	4800											
Idle torque $T_{012}$ [Nm] <i>Based on the drive</i>	0.5											
<b>Torsion and forces</b>												
Maximum torsional backlash $j_t$ [arcmin]	Standard $\leq 10$				Standard $\leq 15$							
Maximum torsional rigidity $C_{t21}$ [arcmin]	24											
Maximum axial force $F_{2AMax}$ [N] <i>In relation to the shaft center at the output</i>	Standard: 1700 HIGH FORCES: 3000											
Maximum lateral force $F_{2QMax}$ [N] <i>In relation to the shaft center at the output</i>	Standard: 1200 HIGH FORCES: 4250											
Maximum breakdown torque $M_{2Max}$ [Nm]	Standard: 95 HIGH FORCES: 407											
<b>Temperature [°C]</b>												
Maximum housing temperature	+ 90											
Ambient temperature	-25 to +40											
<b>Housing</b>												
Properties	Stainless steel											
Seal	Sealed bearing disks											





### **Check the scope of supply for missing or damaged parts**

Check your delivery for completeness. If any parts are missing or became damaged during transport, contact the carrier, vendor or our service department immediately.

Please check that the delivery includes the following items:




- Gear units from the AG2800 series with packaging
- Short information

Bolts for fastening the gear unit to the motor or the machine are not included in the scope of delivery .

No motor is included in the standard delivery of a planetary gear unit from the AG2800 series.

## Packaging

Instructions for handling are printed on the packaging:

Symbol	Explanation
	This is the correct position for the packaging.
	The packaging must be protected from moisture.
	The contents are fragile.



## Avoid damaging the gear unit

Observe the conditions and the following chapters on transport and storage.

*Disregarding the conditions can lead to damage to the gear unit and invalidation of the guarantee.*

## Conditions

Make sure that the gear units are not damaged during transport and storage.

Observe the specifications in the following chapters and comply with the following conditions:

- Climate category: 2K3 according to EN 60721
- Temperature: -25 °C to +70 °C, maximum fluctuation 20 K/hour
- Air humidity: 5 % to 95 % relative humidity, no condensation
- Use of suitable means of transport
- Transport and storage only in a horizontal position
- Use of the vendor's original packaging

## Transport

### ⚠ WARNING

#### Do not move under suspended loads

Use suitable means of transport and secure the gear unit against falling down.

*If the gear unit falls down it can cause a fatal accident.*



#### Use means of transport with a sufficient lifting capacity

Use means of transport or hoists with a sufficient lifting capacity to transport the gear unit. Ensure secure fastening. Avoid impacts against the gear unit.

*Means of transport with an insufficient lifting capacity can tear and thus damage the gear unit or motor/gear unit combination due to falling down or impacts.*



#### Legal regulations for the lifting of loads

When transporting individual gear units or motor/gear unit combinations without a hoist, adhere to the legal requirements for the lifting of loads by employees.

## Gear unit

The following options are available to you for the transportation of the gear unit:

- Without aids, by hand in compliance with the legal requirements for the lifting of loads
- Using suitable transport slings on the gear unit with averaged center of gravity, with sufficiently dimensioned hoists
- using suitable transport slings on the gear unit and on the motor with averaged center of gravity, with sufficiently dimensioned hoists



## Long-term storage



### Observe the storage conditions

Store the gear unit in a dry, clean interior room protected against UV radiation. Temperature changes with formation of condensation, shocks or vibrations are to be avoided.

*Failure to comply with the specified storage conditions may result in changes in the processed materials and surfaces on and in the gear unit.*



### Observe storage times

Ensure suitable storage conditions if the gear units are not installed directly.

For storage times of more than one year, up to two years:

- Provide shafts and bare surfaces with corrosion protection
- Store the gear units in a horizontal position

*Failure to comply with the specified storage conditions and storage times may result in changes in the processed materials and surfaces on and in the gear unit.*



### Prevent the formation of condensation

Ensure a constant ambient temperature in the range from -25°C to +70°C at the storage location. Avoid high humidity.

*Failure to comply may result in the formation of condensation. Condensation can cause damage in later operation or rust formation on the gear unit.*

You have the possibility to store the gear unit in a horizontal position and a dry environment over a short or long period. For storage we always recommend the original packaging. Observe the conditions specified in chapter: Transport and storage.

## Installation position



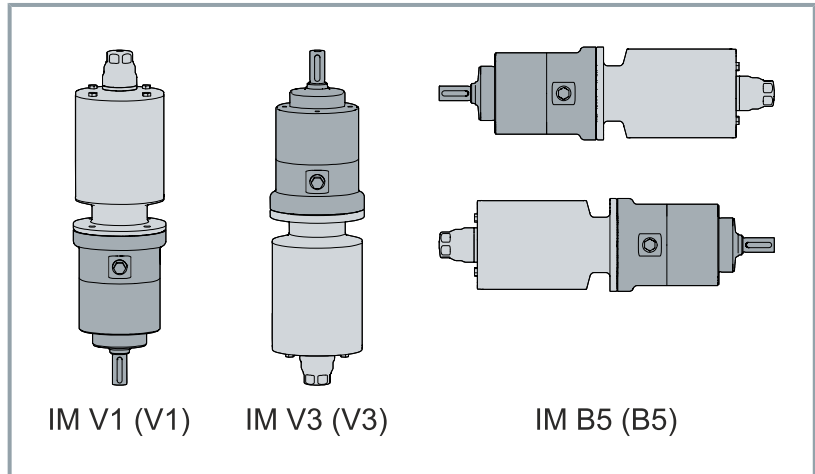
### Observe the maintenance intervals and mounting positions

Carry out maintenance at regular intervals.

In the horizontal mounting position IM V3, liquid which has been left on the flange for a longer period can penetrate the motor through capillary action. In mounting position IM V1 liquid can escape.

*If you do not observe the maintenance intervals, the motor may overheat depending on the mounting position. Ingress and leakage of liquids may damage the motor.*

The standard installation position of the gear unit is the motor attachment M. Alternatively, it can be used in any other installation position.




**Carefully clean the inner components of the gear unit**

Use a cloth for cleaning. Spray only the cloth with cleaning agent and carefully clean the clamping hub.

*Compressed air can damage the seals of the gear unit and cleaning agent directly sprayed inside can affect the coefficient of friction of the clamping hub.*

## General tightening torques

### Steel

The specified tightening torques for nuts and bolts are mathematical values based on the following requirements:

- Calculation according to VDI 2230 (February 2003 edition)
- Friction coefficient for threads and contact surfaces  $\mu = 0.10$
- Elastic limit utilization 90%
- Torque tools type II classes A and D according to ISO 6789

The setting values are rounded to conventional scalings or adjustment possibilities:

Bolt size	Quality of the bolts		
	8.8	10.9	12.9
	Tightening torque in Nm		
M3	1.15	1.68	1.97
M4	2.64	3.88	4.55
M5	5.2	7.6	9
M6	9	13.2	15.4
M8	21.5	32	37.5
M10	42.5	62.5	73.5
M12	73.5	108	126
M14	118	173	202
M16	180	264	310
M18	258	368	430
M20	362	520	605
M22	495	700	820
M24	625	890	1040

## Stainless steel

The specified tightening torques for stainless steel bolts are mathematical values based on the following requirements:

- Calculation according to VDI 2230 (February 2003 edition)
- Friction coefficient for threads and contact surfaces  $\mu = 0.10$
- Elastic limit utilization 90%
- Only valid for bolts according to ISO 4762, ISO 4014, ISO 4017
- Only valid for nuts according to ISO 4032, ISO 4033
- Torque tools type II classes A and D according to ISO 6789

The setting values are rounded to conventional scalings or adjustment possibilities:

Bolt size	Quality of the bolts		
	Ax-50	Ax-70	Ax-80
	Tightening torque in Nm		
M3	0.376	0.806	1.07
M4	0.868	1.86	2.48
M5	1.72	3.68	4.91
M6	2.95	6.4	8.4
M8	7.2	15.2	20.5
M10	14	30	40
M12	24	51.5	69
M14	38.5	83	111
M16	59	127	169
M18	82	176	234
M20	115	248	330
M22	157	336	450
M24	199	425	570

## Motor on gear unit



### If a motor is included in the scope of delivery:

Motors included in the scope of delivery are pre-mounted. No further installation is required.

*For optimal performance data, we recommend attachment to Beckhoff synchronous servomotors from the AM8xxx series.*

### Requirements for the attachment of a motor to the gear unit:

- Design B5
- Concentricity and axial run-out tolerance according to EN 50347
- Smooth shaft
- Motor attachment if possible in a vertical position

## Clamping hub

The following table provides a description of the clamping hub:

Infographic	Position	Name
	C	Clamping hub
	H	Set screw
	J	Spacer sleeve
	K	Grooved motor shaft
	L	Smooth motor shaft
	M	Marking hole

## Tightening torques

Information on the bolt sizes and tightening torques can be found in the table below:

Set screw quality = strength class 45 H				
Gear unit HDV	Internal diameter of the clamping hub [mm]	Width across flats of the set screw [mm]	Tightening torque [Nm]	Maximum axial force [N]
015	14	4	14	80
025	19	5	23	100
035	24	6	45	150

## Mounting

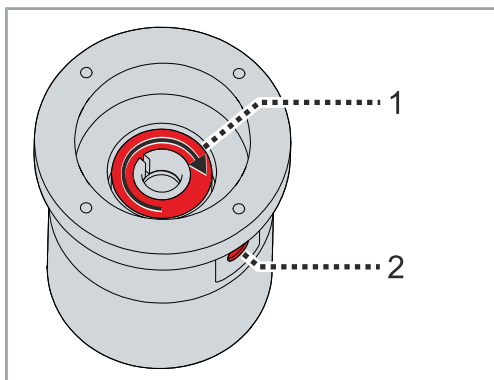
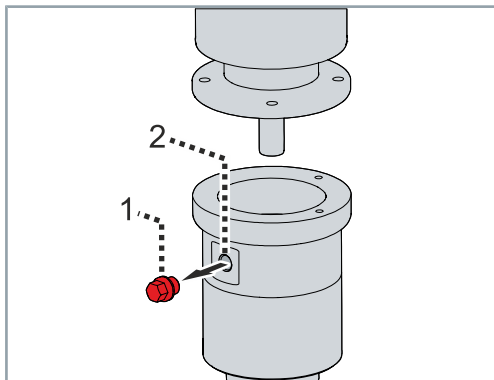
► Carefully degrease the following components with a cloth:

- Contact surfaces with adjacent components
- Centering and motor shaft
- Internal diameter of the clamping hub
- Spacer sleeve inside and outside

### In case of motor with feather key [+]

► Remove feather key [+] and insert half wedge

► Remove the screw plug [1] from the mounting hole [2]



► Turn the clamping hub [1] until the set screw can be seen above the mounting hole [2]

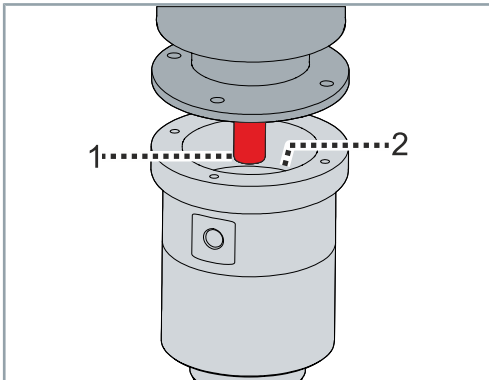
► Loosen the set screw of the clamping hub by one turn



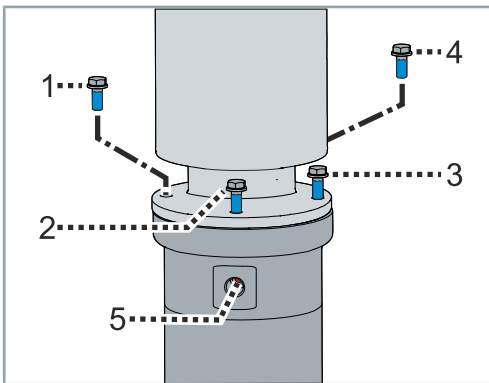
## Do not exceed the permissible axial forces

If the motor shaft cannot be inserted easily, the set screw on the clamping hub must be loosened a little more.

With certain motor shaft diameters, a slotted spacer sleeve must be installed in addition. If there is a groove on the motor shaft, it must be aligned with the slot in the spacer sleeve.



- Make sure that there is an O-ring seal between the motor and the gear unit. The seal is included in the scope of delivery of the AM88xx.
- Insert the motor shaft [1] into the clamping hub [2] inside the gear unit.
- Make sure that no gap is created between the motor and the adapter plate



This example shows a motor size with four fixing points in the flange.

- Coat bolts with washers [1], [2], [3] and [4] with threadlocker
- Insert bolts [1], [2], [3] and [4] and tighten evenly
- Tighten the set screw [5]. Refer to the chapter "Clamping hub", [Page 37].
- Insert the screw plug back into the adapter plate

## Gear unit to machine



### No washers necessary

Beckhoff recommends not using washers if the material of the bolt contact surface has an adequate interface pressure.

## Output side



### Avoid damage due to stresses

Use suitable tools for the assembly. Mount gear wheels and toothed belt pulleys without force on the output shaft and avoid mounting by driving or hammering on.

*The gear unit can be damaged if stress occurs during mounting.*

- ▶ Seal any gap over a wide area when attaching to the output side
- ▶ Make sure that the surfaces of the attached parts have a low roughness
- ▶ Use only screw head seals and o-rings for sealing

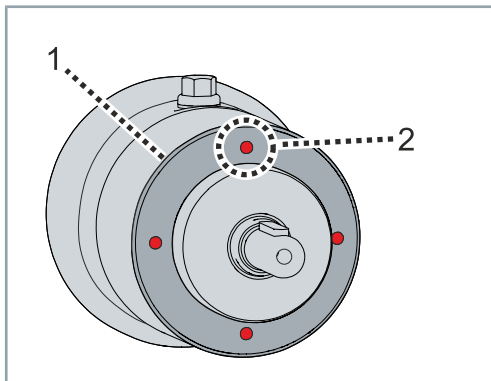
## Permissible axial forces

The following table shows the maximum permissible static axial forces. The permitted forces refer to the center of the shaft:

Gear unit HDV	015	025	035
Fa max [N]	500	500	1700



## Mounting



## Tightening torques

- Carefully degrease the following components with a cloth:
  - Contact surfaces with adjacent components
  - Output shaft and centering

There are four threaded holes [2] in the gear unit housing [1] for the bolted connection with your machine

- Coat suitable bolts with threadlocker
- Fasten the gear unit to the machine with the suitable screws via the threaded holes [2]
- Make sure that the surface of the machine has a low roughness
- Attach the gear unit such that the screw plug faces downward and the name plate is readable

In the following you will find supplementary information regarding the attachment of the gear unit to a machine:

Quality of the bolts = stainless steel bolts			
Gear unit HDV	Pitch circle diameter [mm]	Thread	Tightening torque [Nm]
015	62	M5	9
025	80	M6	15.4
035	108	M10	73.5



## Avoid overloading

Motors and gear units often have different operating areas. With higher transmission ratios the gear unit may be overloaded due to multiplication of the motor torque. In this case, the nominal motor torque and/or the peak motor torque must be limited.

*Failure to limit this can result in overloading and damage to the gear unit.*



## Observe the operating instructions for the motors

For commissioning, read the original operating instructions for the motors used and follow the steps according to the chapter: "Commissioning".

## Commissioning example

The procedure for commissioning is described as an example. A different method may be appropriate or necessary, depending on the application of the components.



## Example:

Limitation of rated motor current and peak motor current.

### Calculation based on the rated motor current:

Standstill torque  $M_0$  of the motor: 1 Nm

Nominal torque  $T_{2N}$  of the gear unit: 8 Nm

Output torque of the gear unit with a transmission ratio  $i$  of 10:  
 $1 \text{ Nm} \times 10 = 10 \text{ Nm}$

**Result:** The rated motor current must be limited to 80%.

### Calculation based on the peak motor current:

Standstill torque  $M_{pmax}$  of the motor: 5 Nm

Maximum acceleration torque  $T_{2B}$  of the gear unit: 20 Nm

Output torque of the gear unit with a transmission ratio  $i$  of 10:  
 $5 \text{ Nm} \times 10 = 50 \text{ Nm}$

**Result:** The peak motor current must be limited to 40%.

## Relevant parameters

Servo drive	Nominal current	Peak current
AX5000	P-0-0093 "Configured channel current"	P-0-0092 "Configured channel peak current"
AX8000	„Configured channel rated current“	„Configured channel peak current“
Servo terminal	0x7010:0B „Torque limitation“	0x2003:11 „Max current“

## Before operation

Checklist that helps to check important points before starting operation:

- Inspect the gear unit for damage
- Check mounting and alignment
- Tighten screw connections correctly
- Installing mechanical, thermal and electrical protective devices

## During operation

Checklist that helps to check important points during operation:

- Check function and adjustment of attachments
- Observe information for environment and operation
- Check protective measures against moving and live parts
- Pay attention to unusual noise developments
- Always check gear unit surfaces and cables for dirt, leaks, moisture or dust
- Check temperature development
- Check for lubricant leakage
- Observe recommended maintenance intervals
- Check function of safety devices

## ⚠ WARNING

### Shut down and secure the machine or plant

Make sure that the machine or plant is shut down and secured against accidental start-up.

*Failure to observe may result in components moving in the machine or plant. Rotating or moving components can lead to serious injuries.*



### Carefully clean the gear unit

Carefully spray the gear unit with a water jet of maximum 28 bar.

*Failure to observe this will result in damage to the surface and the gear unit, as well as leakage problems.*

Contamination, dust or chips can have a negative effect on the function of the components. In the worst case, contamination can lead to failure. Therefore, clean and service the components at regular intervals.

## Cleaning agents

Clean the components carefully with a damp cloth or a brush.

Use grease-dissolving and non-aggressive cleaning agents such as isopropanol for cleaning. You will also receive information about non-approved cleaning agents.

## Not applicable

Cleaning agents	Chemical formula
Aniline hydrochloride	$C_6H_5NH_2HCl$
Bromine	$Br_2$
Sodium hypochlorite; bleaching solution	$NaClO$
Mercury (II) chloride	$HgCl_2$
Hydrochloric acid	$HCl$

## Intervals

Under nominal conditions, the motor components have different operating hours. We have provided you with a list of maintenance work and intervals for the associated components below:

Component	Interval	Maintenance
Gear unit	During commissioning <b>Thereafter:</b> Every three months	Check gear unit for external damage and leaks Check drive shaft and output shaft for foreign media such as oil and dirt Check gear unit for corrosion
Clamping screw Motor attachment	During commissioning <b>Thereafter:</b> Every three months	Check tightening torques
Fastening screw Gear unit housing	During commissioning <b>Thereafter:</b> Every three months	Check tightening torques

## Lubrication



### Notes on lubrication

Beckhoff gear units from the AG2800 series are lubricated for life. The lubricant used does not have to be renewed.  
*If you wish to change the lubricant, contact Beckhoff Service.*

All gear units are factory lubricated for life with a food grade synthetic lubricating oil or grease:

- Synthetic lubricating oil: CLP PG-OIL
- Synthetic lubricating grease: KW-OIL, consistency enhancer AL-complex soap

Refer to the name plate for detailed information on lubrication. All bearings are lubricated for life at the factory.

Further information on the lubricants can be obtained directly from the manufacturer.

The following table describes a selection of faults. Depending on the application, other causes may be responsible for the malfunction.

Error	Possible cause	Remedy
Increased operating temperature	Gear unit unsuitable for the application	Check the technical data
	Heating up by the motor	Check the motor wiring
		Ensure sufficient cooling
		Replace the motor
	Ambient temperature too high	Ensure sufficient cooling
Increased operating noises	Distorted motor mounting	Contact Beckhoff Service
	Damage to the bearings	
	Damage to the toothing	
	Toothed belt tension too high	Check and correct toothed belt tension
Lubricant loss	Lubricant quantity too high	Wipe off lubricant, refill and monitor the gear unit
	Gear unit leaking	Contact Beckhoff Service
Loose screws	Tightening torque too low	Retighten the screws

Disassembly may only be carried out by qualified and trained technical personnel. For more information please refer to Chapter: Documentation notes.

When disposing of electronic waste, make sure that you dispose of it in accordance with the regulations applicable in your country. Read and follow the instructions for proper disposal.

## Disassembly

### **WARNING**

#### **Risk of injury from leaking oil**

Prevent oil from leaking. Soak up any leaked oil with approved binding agents. Mark the danger spot.

*Leaking oil can cause slips and falls, resulting in serious or fatal injury.*



#### **Impermissible removal of gear unit components**

Only Beckhoff Automation GmbH & Co. KG is permitted to dismantle the gear unit.

*Contact Beckhoff Service for further information.*

#### **Removal of the gear unit from the machine**

- Remove necessary lines and connections
- Allow the gear unit to cool down
- Loosen and remove the gear unit screws
- Transport the gear unit to the workplace or put it into storage

## Disposal

Depending on your application and the products used, ensure the professional disposal of the respective components:

### Cast iron and metal

Dispose of cast and metal parts as scrap metal for recycling.

### Cardboard, wood and foam polystyrene

Dispose of packaging materials made of cardboard, wood or foam polystyrene in accordance with the regulations.

### Plastics and hard plastics

You can recycle parts made of plastic and hard plastic via the recycling depot or re-use them depending on the component designations and markings.

### Oils and lubricants

Dispose of oils and lubricants in separate containers. Hand over the containers at the used oil collection station.

### Batteries and rechargeable batteries

Batteries and rechargeable batteries may also be marked with the crossed-out trash can symbol. You must separate these components from the waste and are legally obliged to return used batteries and rechargeable batteries within the EU. Observe the relevant provisions outside the area of validity of the EU Directive 2006/66/EC.



### Electronic components

Products marked with a crossed-out waste bin must not be disposed of with general waste. Electronic components and device are considered as waste electrical and electronic equipment for disposal. Observe the national regulations for the disposal of old electrical and electronic equipment.

## Returning to the vendor

In accordance with the WEEE-2012/19/EU directives, you can return used devices and accessories for professional disposal. The transport costs are borne by the sender.

Send the used devices with the note "For disposal" to:

Beckhoff Automation GmbH & Co. KG  
"Service" Building  
Stahlstrasse 31  
D-33415 Verl

In addition, you have the option to contact a local certified specialist company for the disposal of used electrical and electronic appliances. Dispose of the old components in accordance with the regulations applicable in your country.



Test procedures and certifications vary by product. Beckhoff products are certified and tested according to the following directives and standards.

## EU conformity



### Provision

Beckhoff Automation GmbH & Co KG will be pleased to provide you with EU declarations of conformity and manufacturer's declarations for all products on request.

Please send your request to: [info@beckhoff.com](mailto:info@beckhoff.com)

## RoHS

All homogeneous materials used in the gear unit fall below the prescribed limit values of Directive 2011/65/EU Annex II. The following table contains an overview of the proportional quantities of harmful substances:

Material	Percentage share [%]
Lead	0.1
Mercury	0.1
Cadmium	0.01
Hexavalent chromium	0.1
Polybrominated biphenyls; PBB	0.1
Polybrominated diphenyl ethers; PBDE	0.1

Installation of the gear unit as a machine component therefore does not affect the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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More Information:  
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