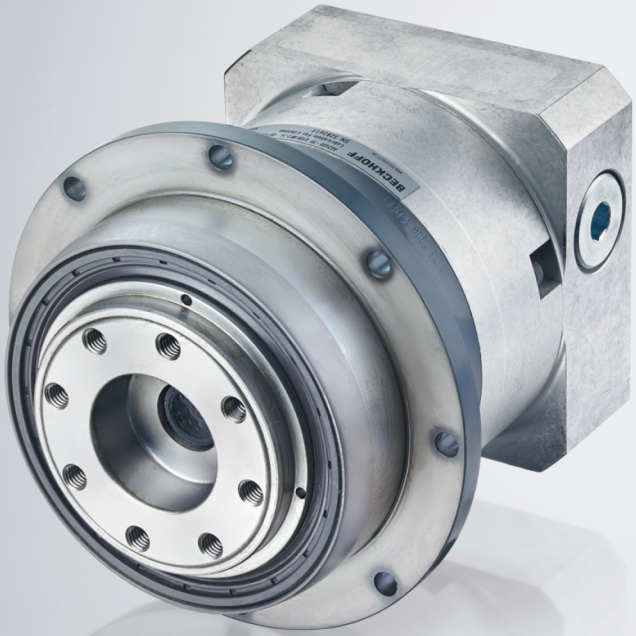
BECKHOFF New Automation Technology

Operating instructions | EN

AG2400

Highend planetary gear unit with output flange



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All components in this product as described in the operating instructions are delivered in a specific configuration of hardware and software, depending on the application regulations. Modifications and changes to the hardware or software configuration that go beyond the documented options are prohibited and nullify the liability of Beckhoff Automation GmbH & Co. KG.

The following is excluded from the liability:

- Failure to observe these operating instructions
- Improper use
- Use of untrained personnel
- Use of unauthorized spare parts

Copyright

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

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 about the gear unit	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 bracket 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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The Beckhoff Support offers technical advice on the use of individual Beckhoff products and system planning. Our support engineers provide competent support whether the customer has general questions or needs help with a specific installation.

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Web:	www.beckhoff.com/en-en/support/our-support-services/

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Service offerings

Our experts stand ready to provide support worldwide in all areas of after-sales service.

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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

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.

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.

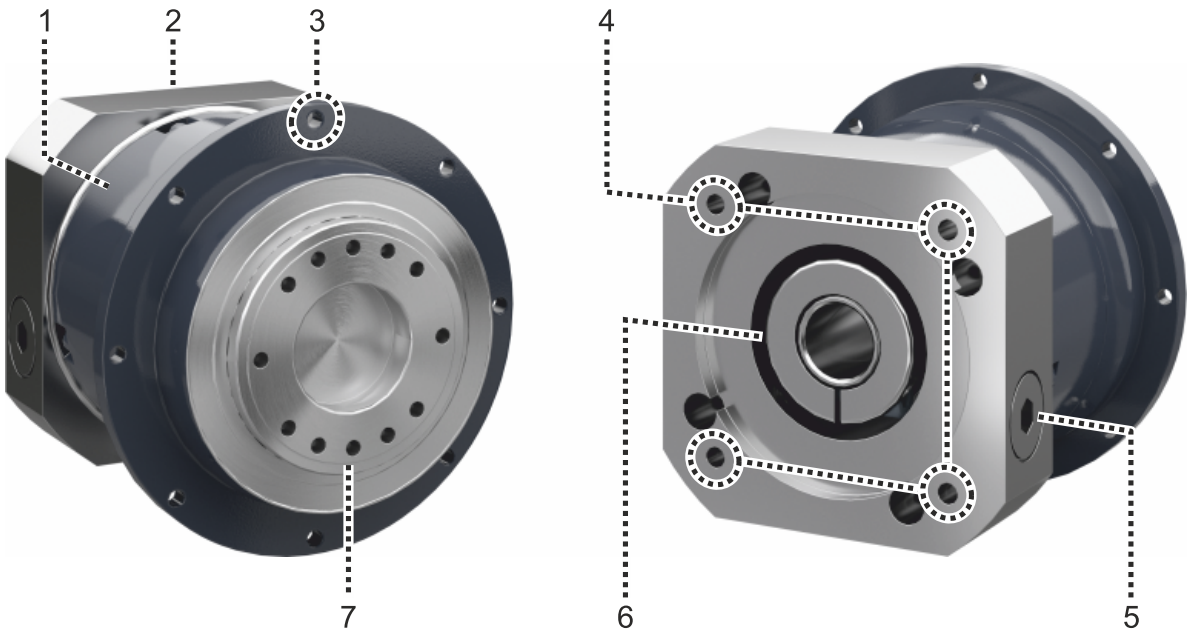
After operation

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".

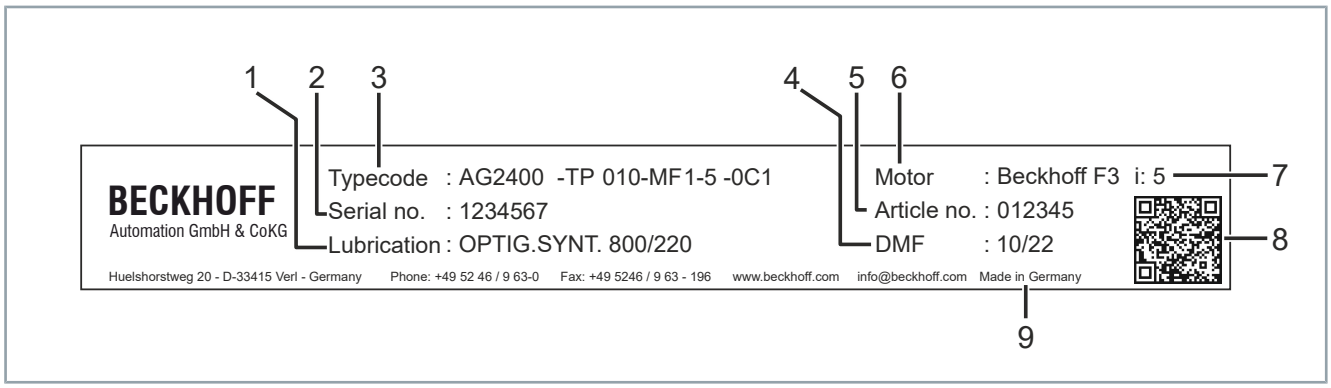
No direct skin contact with solvents or lubricants

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



Number	Explanation
1	Gear housing
2	Adapter plate
3	8 holes for the output side
4	4 holes for the motor attachment
5	Screw plug, mounting hole
6	Clamping hub with clamping screw
7	Holes for locating pins

Name plate



Number	Explanation
1	Lubrication
2	Serial number
3	Gear unit type
4	Date of manufacture
5	Order number
6	Beckhoff flange size
7	Ratio
8	Data Matrix Code with Beckhoff BTN
9	Country of manufacture

Type key

AG2400-+TP050S-MF1-3-0C1-F3	Explanation
AG2400	Gear unit series AG2400 = High-end planetary gear unit
TP	Gear type TP = Standard
050	Size 004 010 025 050 110 300 500
S	Lubrication S = Standard F = Food grade lubrication
M	Gear unit variant M = Motor-mounted gear unit
F	Gear unit version F = Standard A = High torque
1	No. of stages 1 = single-stage 2 = two-stage 3 = three-stage
3	Ratio See documentation
0	Type of output 0 = Output flange
C	Clamping hub identifying letter Not freely selectable Is selected on the basis of the motor to be mounted
1	Torsional backlash 1 = Standard/ 0 = Reduced
F3	Beckhoff flange size F1 F2 F3 F4 F5 F6 F7

Product characteristics

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

High torque requirements
The order option "High-Torque" is intended for applications with high torque requirements.

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

Ordering options

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

High-torque version

In addition to the standard MF version, the AG2400 planetary gear unit is available as a high-torque version. This version is specially designed for applications with high torsional rigidity and positioning accuracy compared to the standard version and has the type key "MA".

Intended use

The planetary gear units from the AG2400 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 is available according to DIN 50347
- The motor has a cylindrical shaft end with tolerance class h6 up 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 only 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 AG2400 series are not suitable for use in the following areas:

- Potentially explosive atmospheres without a suitable housing
- Areas with aggressive environments, for example aggressive gases or chemicals
- Areas with ionizing radiation and nuclear plants
- Aerospace industry
- Food processing, pharmacy and cosmetics
- Product areas that are not protected from abrasion
- Installation situations in which external media such as oil are present at the output flange

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 a motor serves to dissipate heat. If a gear unit is attached, heat is generated due to 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 [kgcm²]
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 Q_g [dB/A]
The running noises are influenced, for example, by:

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

Maximum radial force F_{2RMax} [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_{2N} [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_{2Stop} [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	-15 °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 65
Lubrication	lubricated for life
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_{1max} 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.

TP004 MF

Mechanical data	1-stage				
Ratio	4	5	7	8	10
Efficiency under full load η [%]	97				
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 55				
Service life L_h [h]	> 20000				
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	1.4				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*					
B = 11 mm	0.17	0.14	0.11	0.11	0.09
C = 14 mm	0.25	0.21	0.18	0.18	0.17
E = 19 mm	0.57	0.54	0.51	0.51	0.49
Torques and speeds					
Maximum torque T_{2a} [Nm]	83	83	83	56	56
Nominal output torque T_{2N} [Nm] *At n_{1N}*	27	27	26	26	27
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	66	66	66	42	42
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	100				
Nominal input speed n_{1N} [min^{-1}]	3300	3300	4000	4000	4000
Maximum input speed n_{1Max} [min^{-1}]	7500				
Idle torque T_{012} [Nm] *Based on the drive*	0.56	0.48	0.37	0.37	0.31
Torsion and forces					
Maximum torsional backlash j_t [arcmin]	Standard ≤ 4 / Reduced ≤ 2				
Maximum torsional rigidity C_{t21} [arcmin]	12	12	11	8	8
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	2119				
Maximum breakdown torque M_{2Max} [Nm]	110				
Tilting rigidity C_{2K} [Nm/arcmin]	85				
Temperature [°C]					
Maximum housing temperature	+ 90				
Ambient temperature	-15 to +40				
Housing					
Properties	Heat-treated steel				
Color	Anthracite gray; RAL 7016				
Seal	Sealed bearing disks				

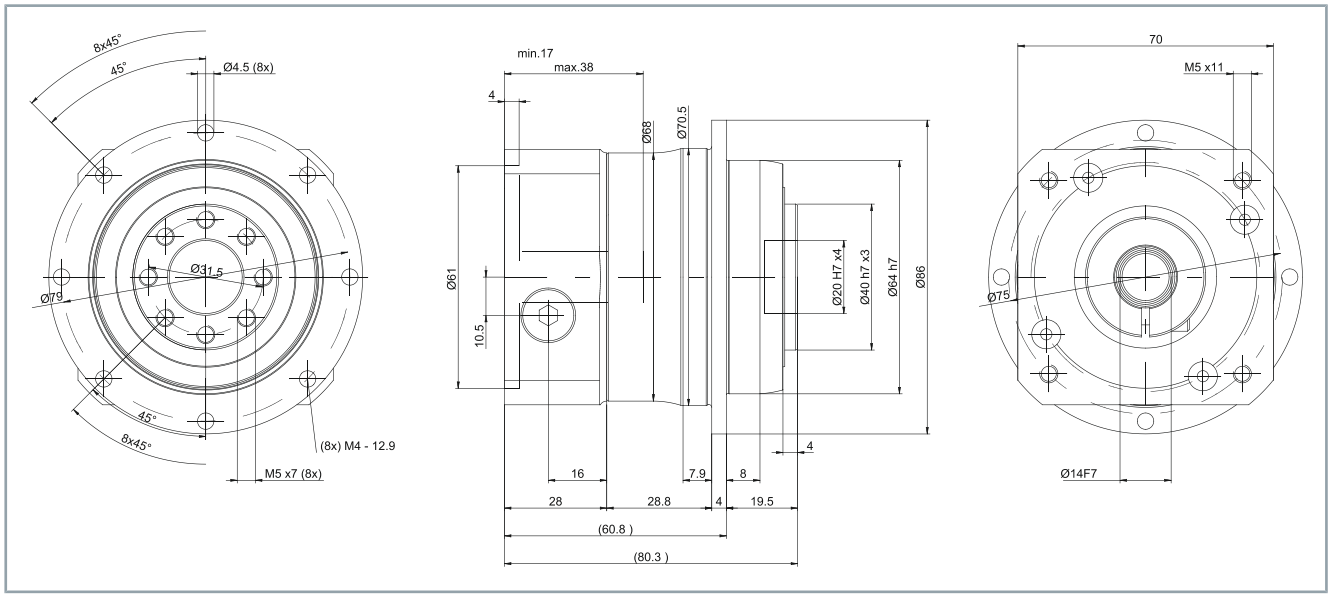
Mechanical data	**2-stage**							
Ratio	16	20	21	25	28	31	32	35
Efficiency under full load η [%]	94							
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 54							
Service life L_h [h]	> 20000							
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	1.5							
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*								
B = 11 mm	0.078	0.070	0.074	0.068	0.062	0.072	0.062	0.061
C = 14 mm	0.17	0.17	0.17	0.16	0.16	0.17	0.16	0.16
Torques and speeds								
Maximum torque T_{2a} [Nm]	57	57	60	72	57	50	57	72
Nominal output torque T_{2N} [Nm] *At n_{1N}*	39	41	32	41	45	36	39	45
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	57	57	48	66	57	48	57	66
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	100							
Nominal input speed n_{1N} [min^{-1}]	4000							
Maximum input speed n_{1Max} [min^{-1}]	7500							
Idle torque T_{012} [Nm] *Based on the drive*	0.28	0.23	0.24	0.22	0.21	0.22	0.21	0.17
Torsion and forces								
Maximum torsional backlash j_t [arcmin]	Standard ≤ 4 / Reduced ≤ 2							
Maximum torsional rigidity C_{t21} [arcmin]	12	12	10	12	12	9	12	12
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	2119							
Maximum breakdown torque M_{2Max} [Nm]	110							
Tilting rigidity C_{2K} [Nm/arcmin]	85							
Temperature [°C]								
Maximum housing temperature	+ 90							
Ambient temperature	-15 to +40							
Housing								
Properties	Heat-treated steel							
Color	Anthracite gray; RAL 7016							
Seal	Sealed bearing disks							

Mechanical data	2-stage						
Ratio	40	50	61	64	70	91	100
Efficiency under full load η [%]	95						
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 54						
Service life L_h [h]	> 20000						
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	1.5						
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*							
B = 11 mm	0.057	0.057	0.058	0.060	0.056	0.057	0.056
C = 14 mm	0.15	0.15	0.15	0.16	0.15	0.15	0.15
Torques and speeds							
Maximum torque T_{2a} [Nm]	57	72	49	48	56	43	48
Nominal output torque T_{2N} [Nm] *At n_{1N}*	46	48	39	34	45	31	34
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	57	66	49	42	56	38	42
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	100						
Nominal input speed n_{1N} [min^{-1}]	4000	4800	5500	4800	5500	5500	5500
Maximum input speed n_{1Max} [min^{-1}]	7500						
Idle torque T_{012} [Nm] *Based on the drive*	0.18	0.17	0.16	0.17	0.17	0.15	0.16
Torsion and forces							
Maximum torsional backlash j_t [arcmin]	Standard ≤ 4 / Reduced ≤ 2						
Maximum torsional rigidity C_{t21} [arcmin]	11	12	9	12	11	7	8
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	2119						
Maximum breakdown torque M_{2Max} [Nm]	110						
Tilting rigidity C_{2K} [Nm/arcmin]	85						
Temperature [°C]							
Maximum housing temperature	+ 90						
Ambient temperature	-15 to +40						
Housing							
Properties	Heat-treated steel						
Color	Anthracite gray; RAL 7016						
Seal	Sealed bearing disks						

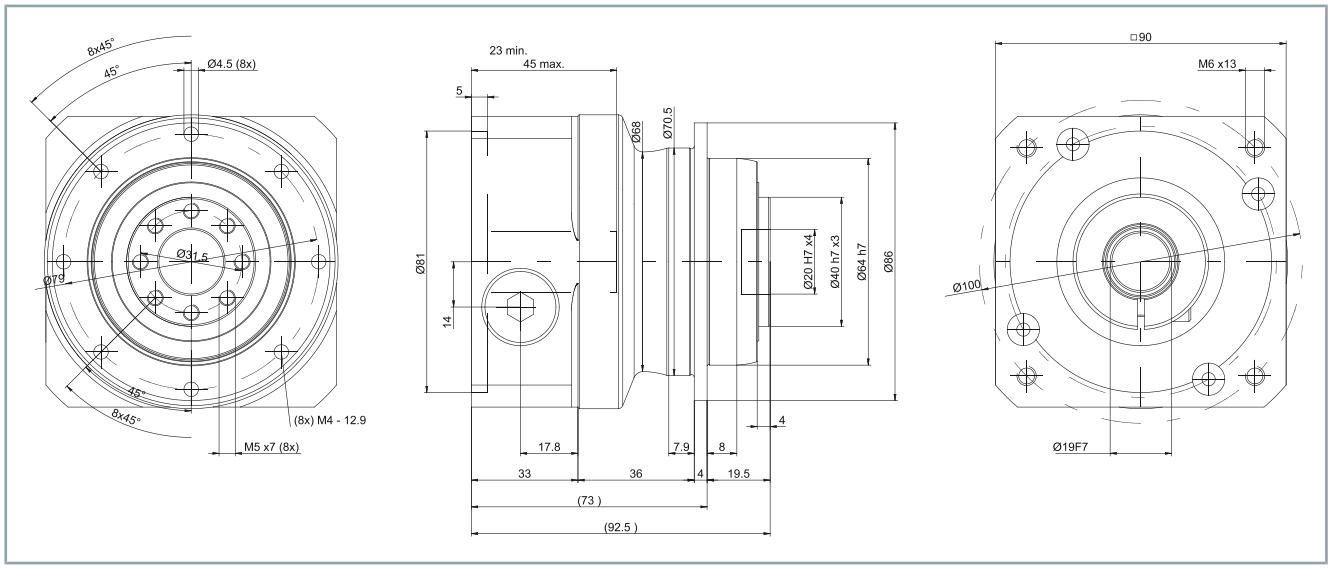
Dimensional drawing

1-stage

- All figures in millimeters
- Dimensions without tolerance ± 1 mm



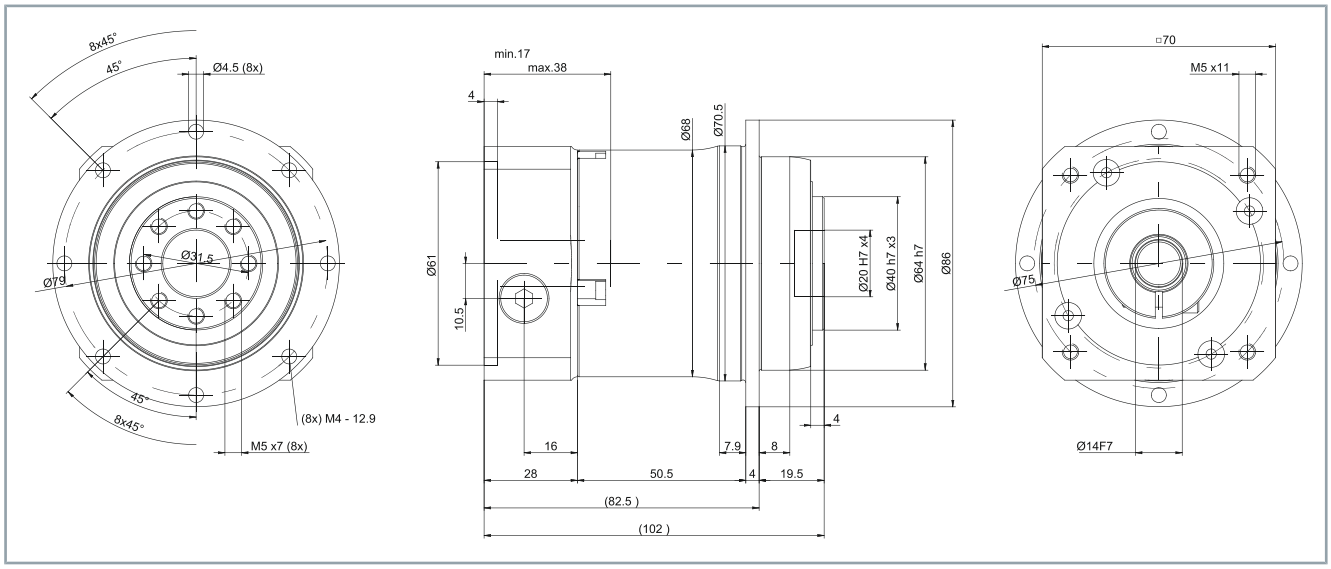
- Clamping hub diameter up to C = 14 mm



- Clamping hub diameter up to E = 19 mm

2-stage

- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to C = 14 mm

TP010 MF

Mechanical data	1-stage				
Ratio	4	5	7	8	10
Efficiency under full load η [%]	97				
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 57				
Service life L_h [h]	> 20000				
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	3.8				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*					
C = 14 mm	0.78	0.62	0.48	0.48	0.40
E = 19 mm	0.95	0.79	0.64	0.64	0.57
G = 24 mm	2.32	2.16	2.02	2.02	1.94
Torques and speeds					
Maximum torque T_{2a} [Nm]	185	210	210	168	168
Nominal output torque T_{2N} [Nm] *At n_{1N}*	84	81	81	80	81
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	172	172	172	126	126
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	250	250	251	251	251
Nominal input speed n_{1N} [min^{-1}]	2600	2900	3100	3100	3100
Maximum input speed n_{1Max} [min^{-1}]	7500				
Idle torque T_{012} [Nm] *Based on the drive*	1.3	1.1	0.84	0.84	0.64
Torsion and forces					
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1				
Maximum torsional rigidity C_{t21} [arcmin]	32	33	30	23	23
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	2795				
Maximum breakdown torque M_{2Max} [Nm]	270				
Tilting rigidity C_{2K} [Nm/arcmin]	225				
Temperature [°C]					
Maximum housing temperature	+ 90				
Ambient temperature	-15 to +40				
Housing					
Properties	Heat-treated steel				
Color	Anthracite gray; RAL 7016				
Seal	Sealed bearing disks				

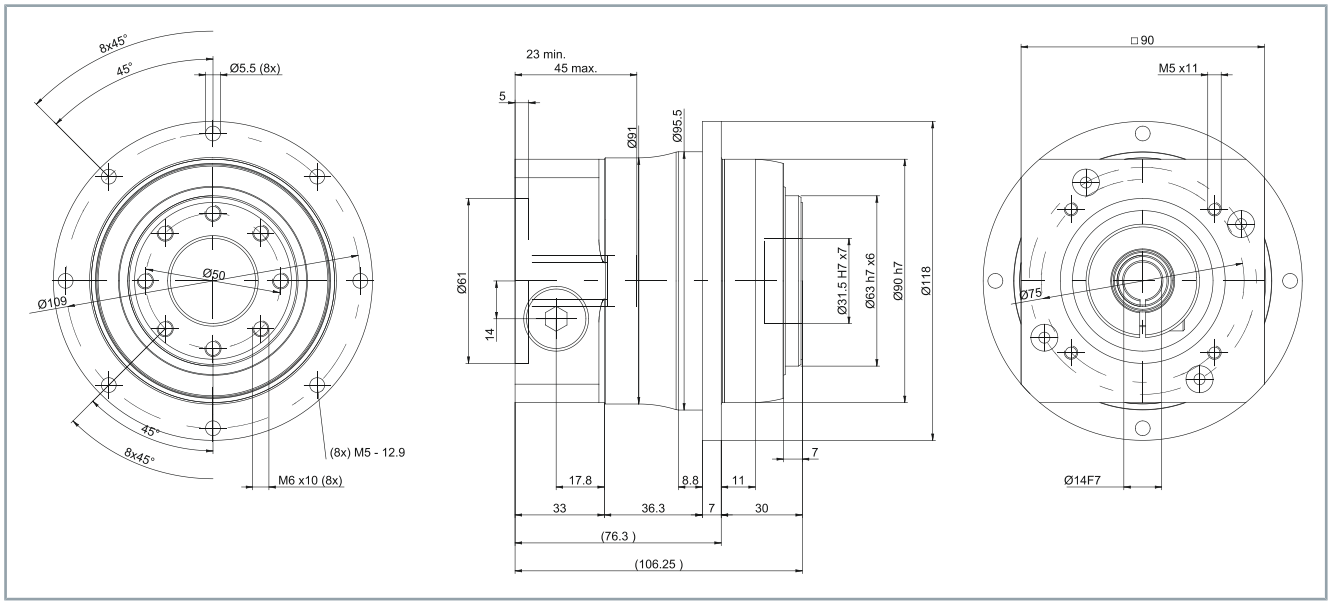
Mechanical data	**2-stage**							
Ratio	16	20	21	25	28	31	32	35
Efficiency under full load η [%]	94							
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 55							
Service life L_h [h]	> 20000							
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	3.6							
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*								
B = 11 mm	0.17	0.14	0.15	0.13	0.11	0.14	0.11	0.10
C = 14 mm	0.24	0.21	0.22	0.20	0.18	0.21	0.18	0.18
E = 19 mm	0.56	0.53	0.55	0.53	0.51	0.53	0.51	0.50
Torques and speeds								
Maximum torque T_{2a} [Nm]	157	126	133	158	157	121	157	158
Nominal output torque T_{2N} [Nm] *At n_{1N}*	106	101	96	124	107	87	119	126
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	157	126	120	158	157	121	157	158
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	251							
Nominal input speed n_{1N} [min^{-1}]	3500							
Maximum input speed n_{1Max} [min^{-1}]	7500							
Idle torque T_{012} [Nm] *Based on the drive*	0.56	0.48	0.47	0.44	0.40	0.40	0.40	0.28
Torsion and forces								
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1							
Maximum torsional rigidity C_{t21} [arcmin]	32	32	26	32	31	24	31	32
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	2795							
Maximum breakdown torque M_{2Max} [Nm]	270							
Tilting rigidity C_{2K} [Nm/arcmin]	225							
Temperature [°C]								
Maximum housing temperature	+ 90							
Ambient temperature	-15 to +40							
Housing								
Properties	Heat-treated steel							
Color	Anthracite gray; RAL 7016							
Seal	Sealed bearing disks							

Mechanical data	**2-stage**						
Ratio	40	50	61	64	70	91	100
Efficiency under full load η [%]	94						
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 55						
Service life L_h [h]	> 20000						
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	3.6						
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*							
B = 11 mm	0.09	0.09	0.09	0.10	0.09	0.09	0.09
C = 14 mm	0.17	0.17	0.17	0.17	0.16	0.17	0.16
E = 19 mm	0.49	0.49	0.49	0.52	0.49	0.49	0.49
Torques and speeds							
Maximum torque T_{2a} [Nm]	154	158	121	105	157	96	105
Nominal output torque T_{2N} [Nm] *At n_{1N}*	112	126	97	84	126	77	84
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	154	158	121	105	157	96	105
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	251						
Nominal input speed n_{1N} [min^{-1}]	3500	3800	4500	3800	4500	4500	4500
Maximum input speed n_{1Max} [min^{-1}]	7500						
Idle torque T_{012} [Nm] *Based on the drive*	0.32	0.32	0.23	0.32	0.24	0.24	0.25
Torsion and forces							
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1						
Maximum torsional rigidity C_{t21} [arcmin]	30	30	24	30	28	21	22
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	2795						
Maximum breakdown torque M_{2Max} [Nm]	270						
Tilting rigidity C_{2K} [Nm/arcmin]	225						
Temperature [°C]							
Maximum housing temperature	+ 90						
Ambient temperature	-15 to +40						
Housing							
Properties	Heat-treated steel						
Color	Anthracite gray; RAL 7016						
Seal	Sealed bearing disks						

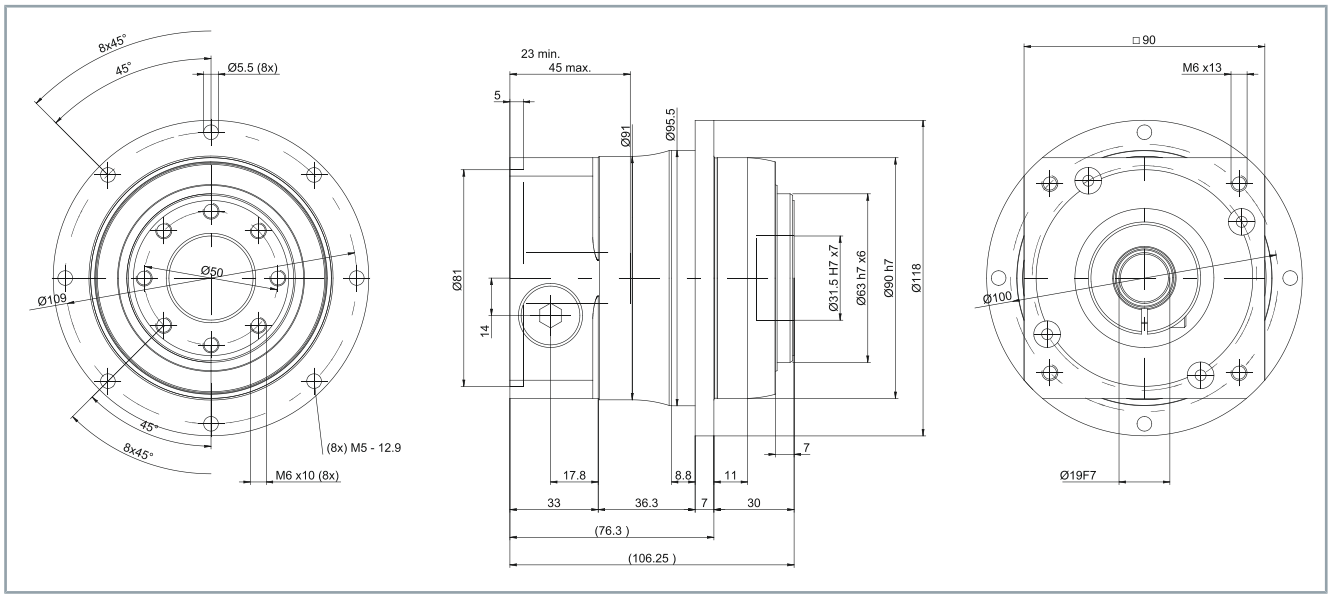
Dimensional drawing

1-stage

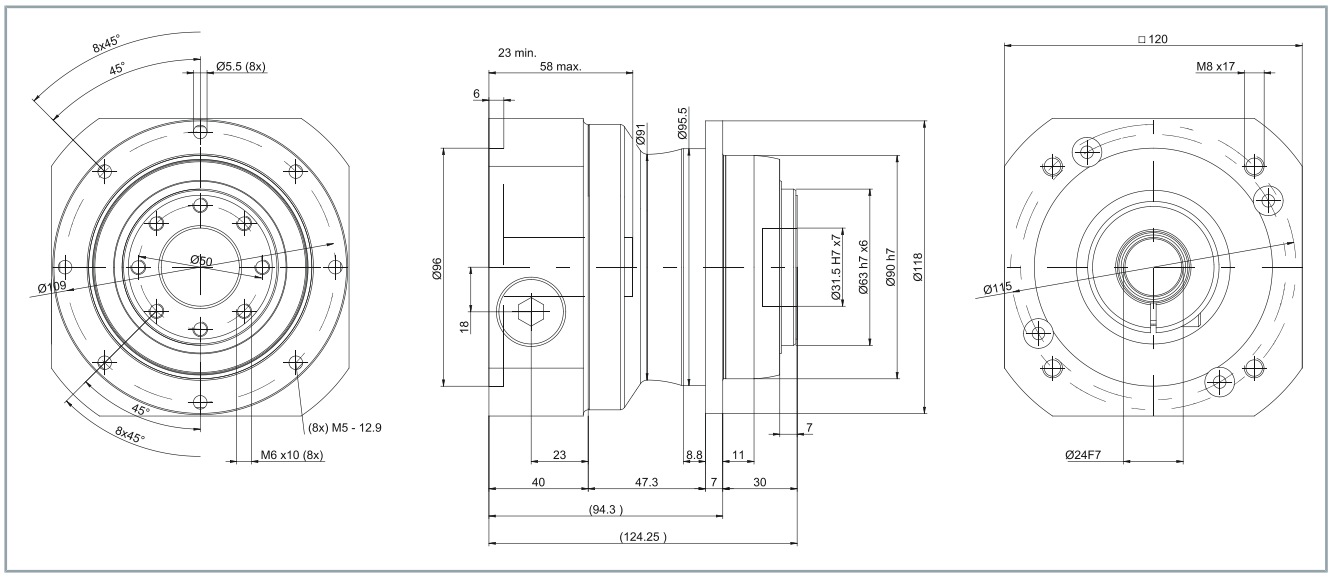
- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to C = 14 mm



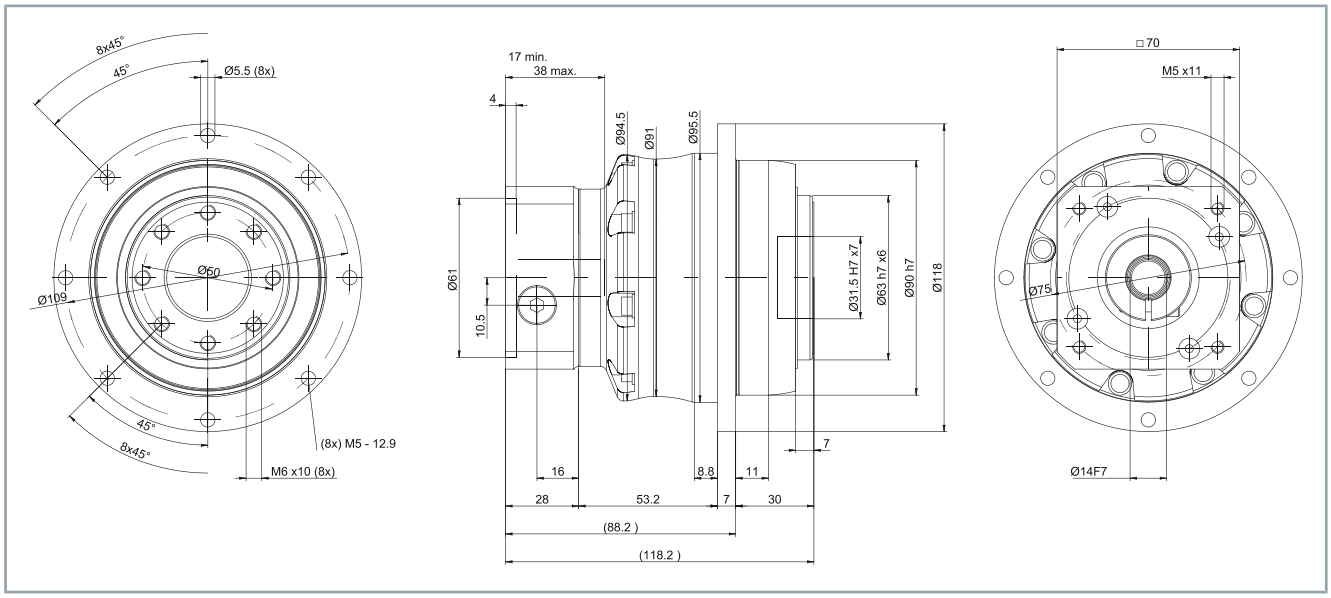
- Clamping hub diameter up to E = 19 mm



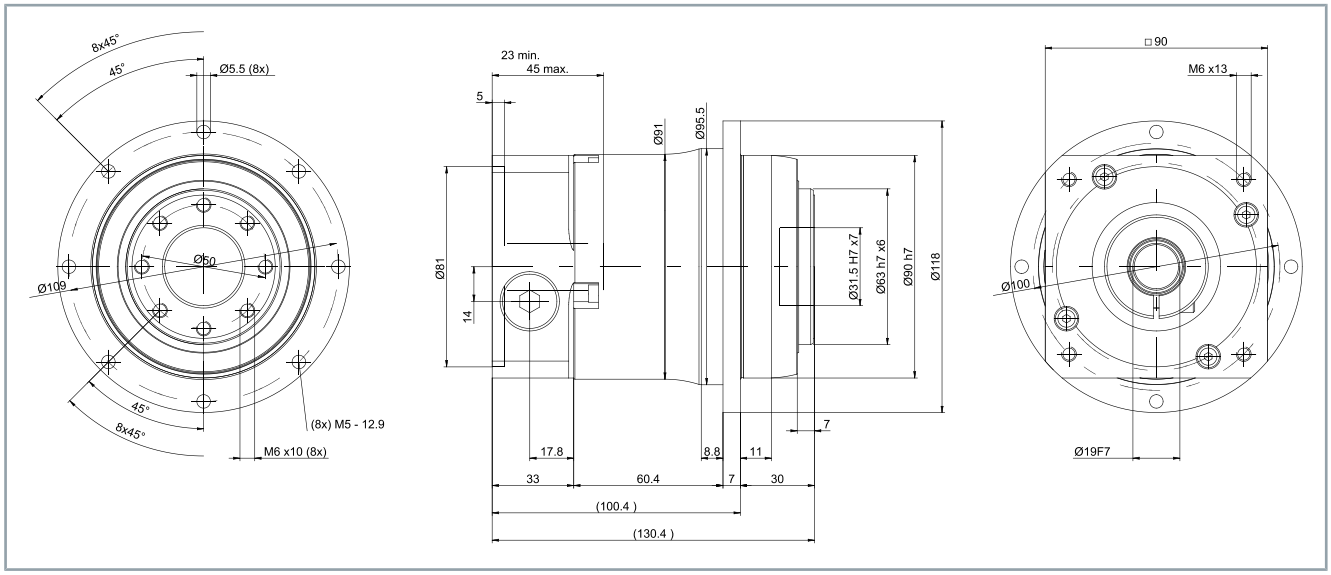
- Clamping hub diameter up to G = 24 mm

2-stage

- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to C = 14 mm



- Clamping hub diameter up to E = 19 mm

TP010 MA

Mechanical data	2-stage				3-stage			
Ratio	22	27.5	38.5	55	88	110	154	220
Efficiency under full load η [%]	94							
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 56							
Service life L_h [h]	> 20000							
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	3.2				3.6			
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*								
C = 14 mm	0.21	0.18	0.16	0.14	0.16	0.15	0.14	0.13
E = 19 mm	0.52	0.5	0.47	0.46	---	---	---	---
Torques and speeds								
Maximum torque T_{2a} [Nm]	315							
Nominal output torque T_{2N} [Nm] *At n_{1N}*	140	137	139	147	184	184	181	184
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	230							
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	525							
Nominal input speed n_{1N} [min^{-1}]	4000				4500			
Maximum input speed n_{1Max} [min^{-1}]	7500							
Idle torque T_{012} [Nm] *Based on the drive*	0.52	0.47	0.41	0.38	0.28	0.26	0.22	0.18
Torsion and forces								
Maximum torsional backlash j_t [arcmin]	≤ 1							
Maximum torsional rigidity C_{t21} [arcmin]	43	43	43	42	42	42	42	42
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	2795							
Maximum breakdown torque M_{2Max} [Nm]	270							
Tilting rigidity C_{2K} [Nm/arcmin]	225							
Temperature [°C]								
Maximum housing temperature	+ 90							
Ambient temperature	-15 to +40							
Housing								
Properties	Heat-treated steel							
Color	Anthracite gray; RAL 7016							
Seal	Sealed bearing disks							

TP025 MF

Mechanical data	1-stage				
Ratio	4	5	7	8	10
Efficiency under full load η [%]	97				
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 61				
Service life L_h [h]	> 20000				
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	6.5				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*					
E = 19 mm	2.59	2.11	1.69	1.69	1.45
G = 24 mm	3.28	2.80	2.38	2.38	2.14
H = 28 mm	2.89	2.41	1.99	1.99	1.75
K = 38 mm	10.3	9.87	9.45	9.45	9.21
Torques and speeds					
Maximum torque T_{2a} [Nm]	352	380	352	352	352
Nominal output torque T_{2N} [Nm] *At n_{1N}*	175	169	172	172	180
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	352	380	352	318	318
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	625				
Nominal input speed n_{1N} [min^{-1}]	2500				
Maximum input speed n_{1Max} [min^{-1}]	5500				
Idle torque T_{012} [Nm] *Based on the drive*	2.8	2.3	1.7	1.7	1.2
Torsion and forces					
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1				
Maximum torsional rigidity C_{t21} [arcmin]	80	86	76	62	62
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	4800				
Maximum breakdown torque M_{2Max} [Nm]	440				
Tilting rigidity C_{2K} [Nm/arcmin]	550				
Temperature [°C]					
Maximum housing temperature	+ 90				
Ambient temperature	-15 to +40				
Housing					
Properties	Heat-treated steel				
Color	Anthracite gray; RAL 7016				
Seal	Sealed bearing disks				

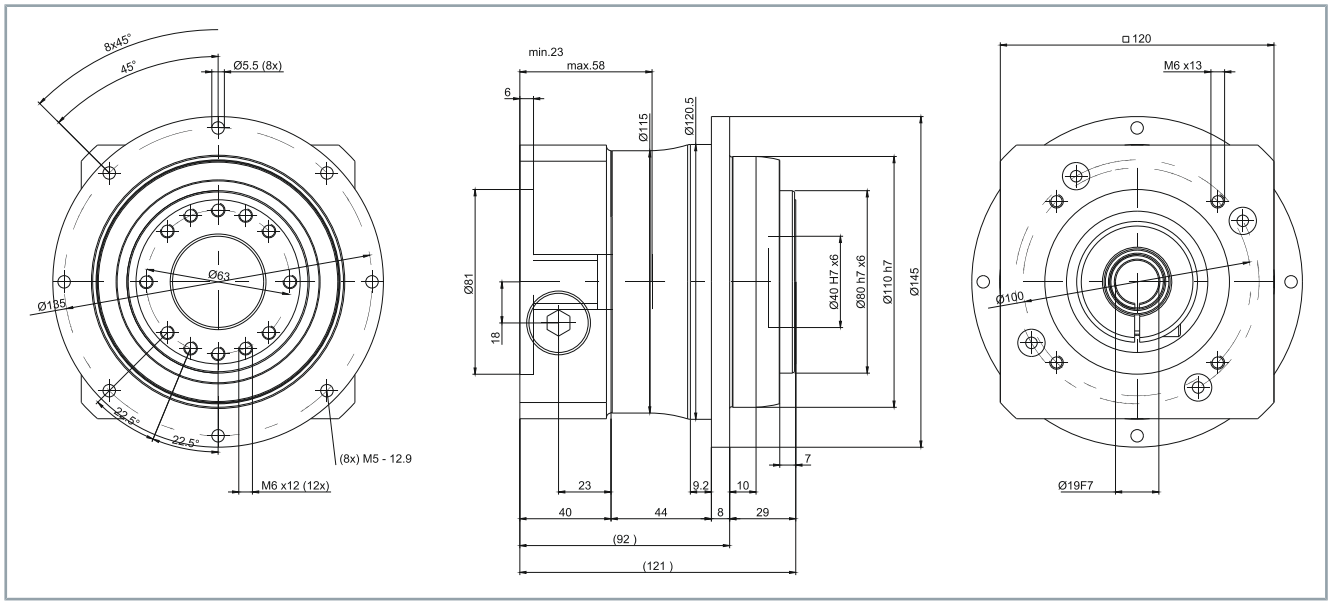
Mechanical data	**2-stage**							
Ratio	16	20	21	25	28	31	32	35
Efficiency under full load η [%]	94							
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 58							
Service life L_h [h]	> 20000							
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	6.7							
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*								
C = 14 mm	0.66	0.55	0.60	0.53	0.44	0.55	0.44	0.43
E = 19 mm	0.83	0.71	0.77	0.70	0.61	0.72	0.61	0.60
G = 24 mm	2.20	2.08	2.14	2.07	1.98	2.09	1.98	1.97
H = 28 mm	2	1.91	1.96	1.89	1.82	1.85	1.89	1.81
Torques and speeds								
Maximum torque T_{2a} [Nm]	352	352	352	380	352	352	352	380
Nominal output torque T_{2N} [Nm] *At n_{1N}*	250	267	211	265	282	231	251	294
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	352	352	330	380	352	330	352	380
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	625							
Nominal input speed n_{1N} [min^{-1}]	2800							
Maximum input speed n_{1Max} [min^{-1}]	7500							
Idle torque T_{012} [Nm] *Based on the drive*	1.2	1	1.1	0.90	0.80	0.84	0.80	0.60
Torsion and forces								
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1							
Maximum torsional rigidity C_{t21} [arcmin]	81	81	70	83	80	54	80	82
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	4800							
Maximum breakdown torque M_{2Max} [Nm]	440							
Tilting rigidity C_{2K} [Nm/arcmin]	550							
Temperature [°C]								
Maximum housing temperature	+ 90							
Ambient temperature	-15 to +40							
Housing								
Properties	Heat-treated steel							
Color	Anthracite gray; RAL 7016							
Seal	Sealed bearing disks							

Mechanical data	2-stage						
Ratio	40	50	61	64	70	91	100
Efficiency under full load η [%]	94						
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 58						
Service life L_h [h]	> 20000						
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	6.7						
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*							
C = 14 mm	0.38	0.38	0.39	0.40	0.37	0.38	0.37
E = 19 mm	0.55	0.55	0.55	0.57	0.54	0.55	0.54
G = 24 mm	1.92	1.92	1.92	2	1.91	1.92	1.91
H = 28 mm	1.76	1.76	1.76	1.83	1.75	1.75	1.75
Torques and speeds							
Maximum torque T_{2a} [Nm]	352	380	352	352	352	352	352
Nominal output torque T_{2N} [Nm] *At n_{1N}*	282	304	246	233	282	220	233
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	352	380	308	292	352	275	292
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	625						
Nominal input speed n_{1N} [min^{-1}]	2800	3100	3500	3100	3500	4200	4200
Maximum input speed n_{1Max} [min^{-1}]	7500						
Idle torque T_{012} [Nm] *Based on the drive*	0.59	0.50	0.48	0.50	0.42	0.48	0.38
Torsion and forces							
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1						
Maximum torsional rigidity C_{t21} [arcmin]	76	80	61	80	71	55	60
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	4800						
Maximum breakdown torque M_{2Max} [Nm]	440						
Tilting rigidity C_{2K} [Nm/arcmin]	550						
Temperature [°C]							
Maximum housing temperature	+ 90						
Ambient temperature	-15 to +40						
Housing							
Properties	Heat-treated steel						
Color	Anthracite gray; RAL 7016						
Seal	Sealed bearing disks						

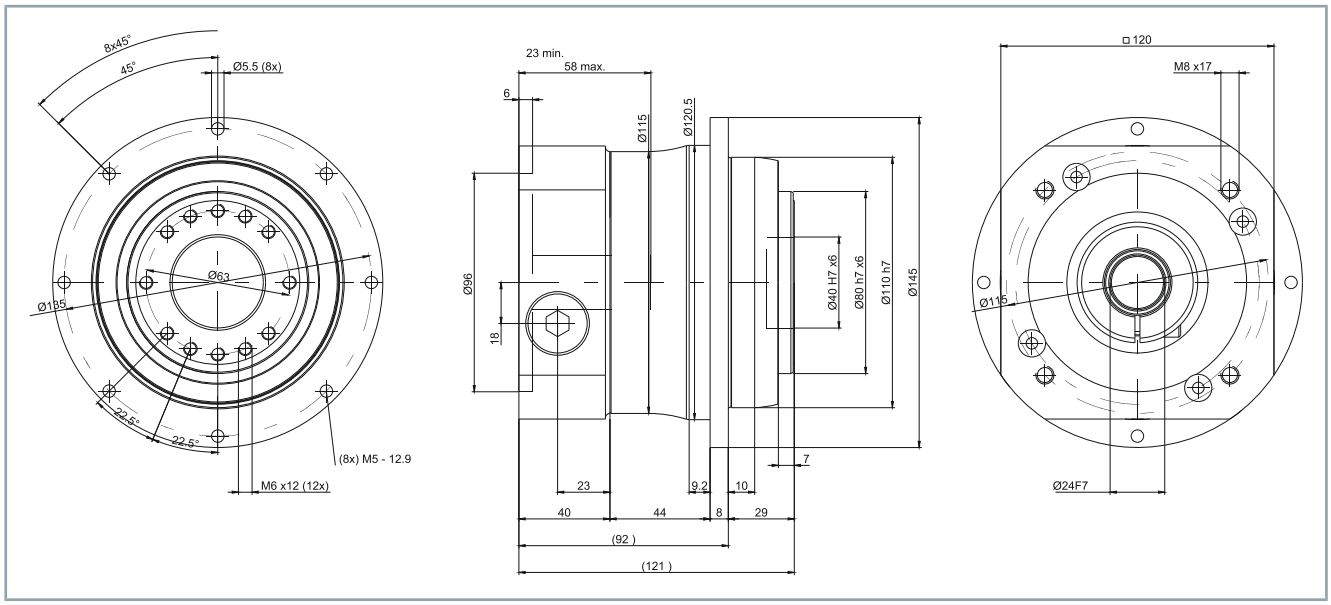
Dimensional drawing

1-stage

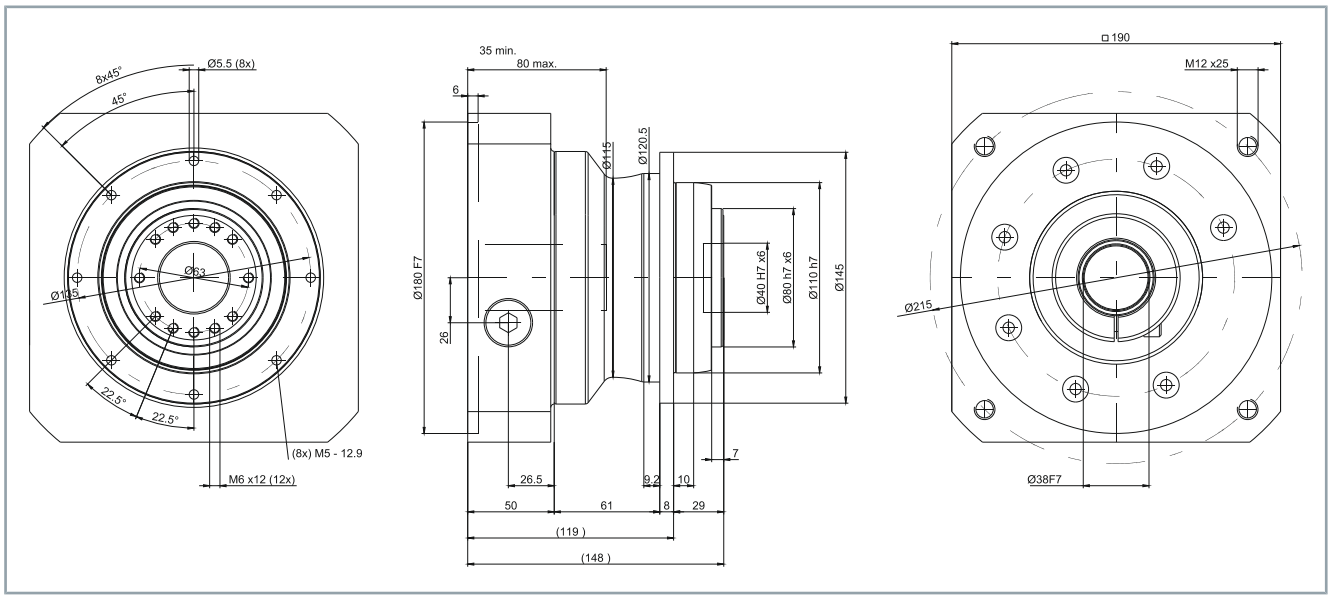
- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to E = 19 mm



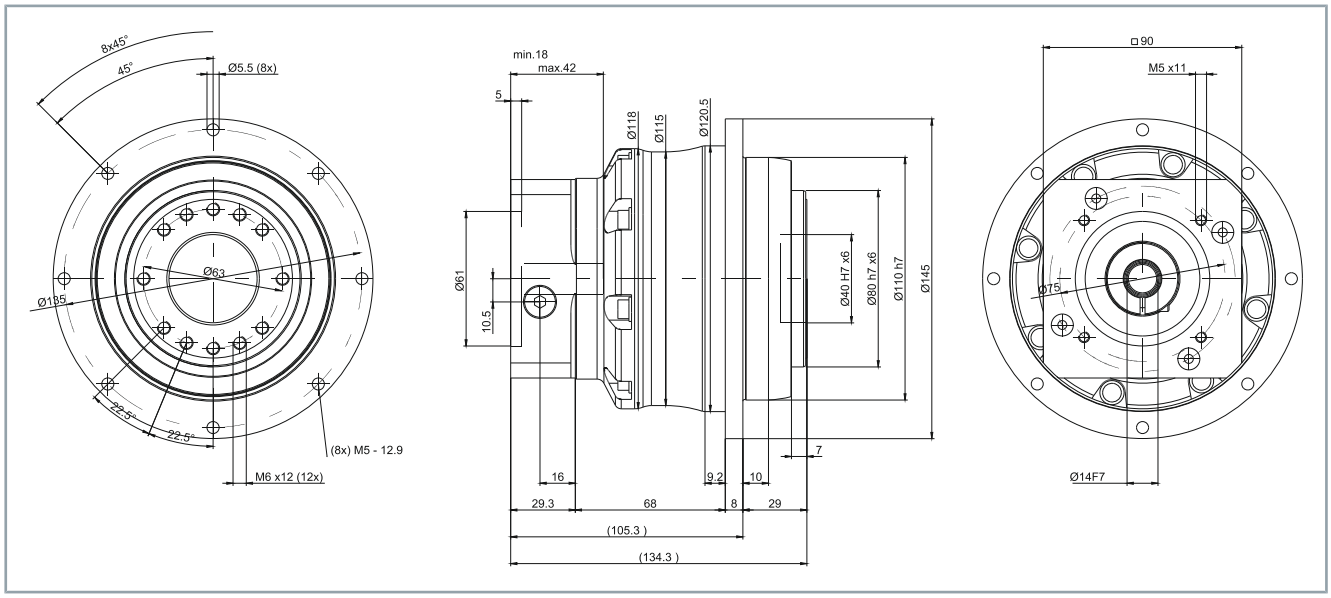
- Clamping hub diameter up to G = 24 mm



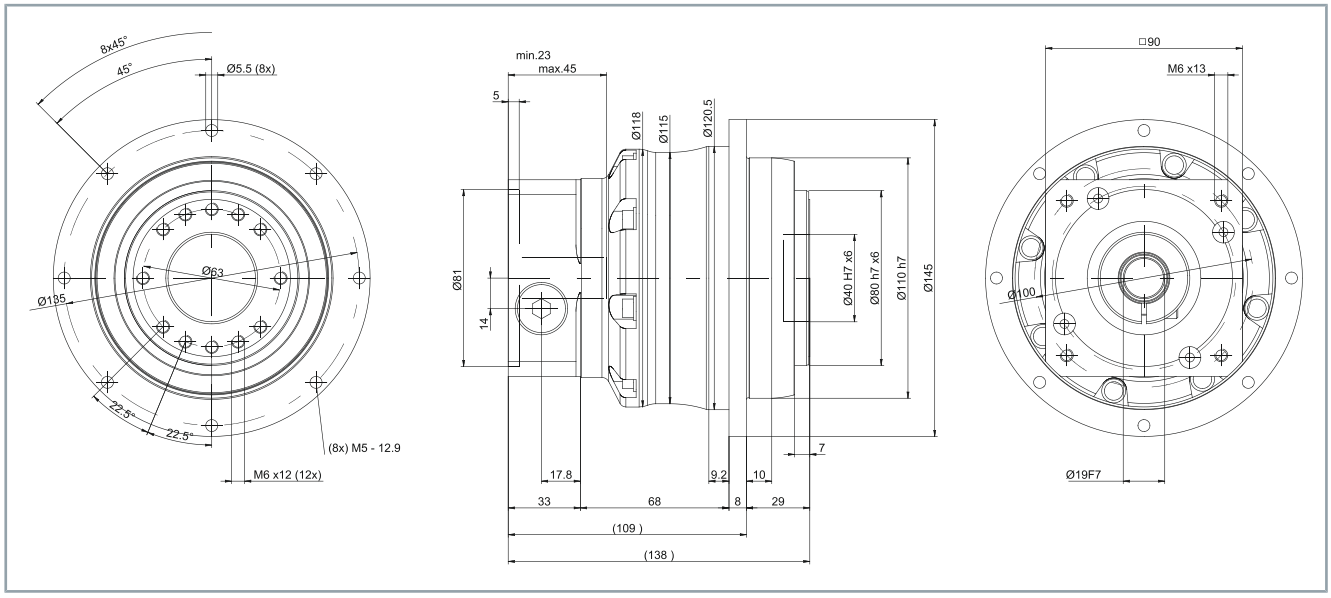
- Clamping hub diameter up to K = 38 mm

2-stage

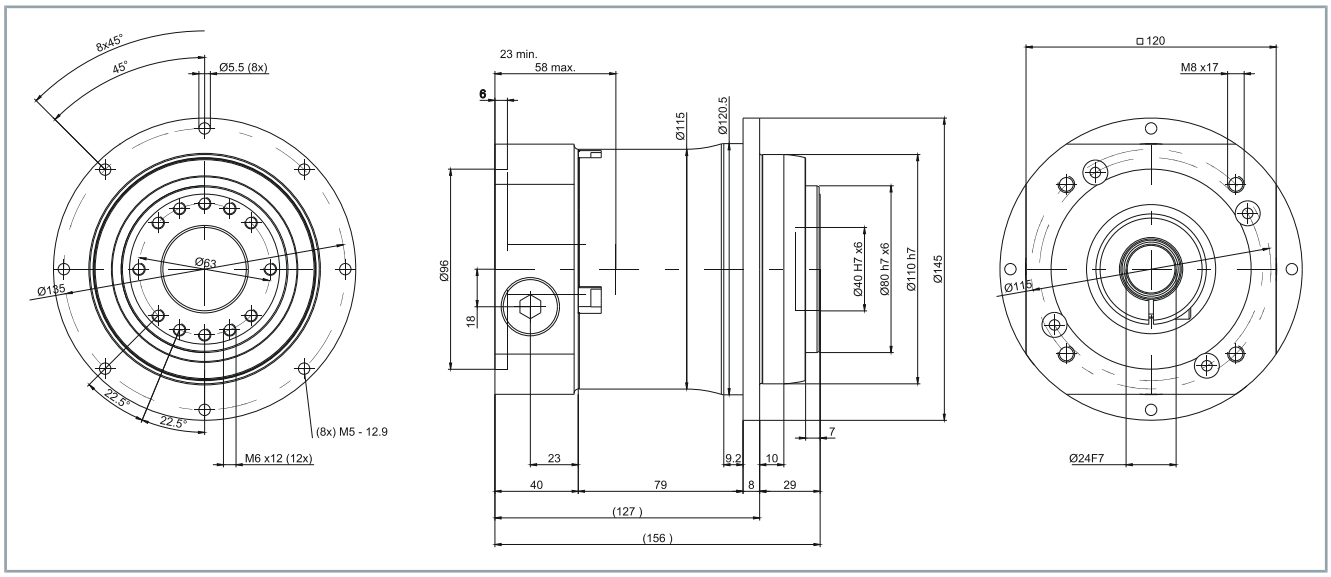
- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to C = 14 mm



- Clamping hub diameter up to E = 19 mm



- Clamping hub diameter up to G = 24 mm

TP025 MA

Mechanical data	2-stage				3-stage				
Ratio	22	27.5	38.5	55	66	88	110	154	220
Efficiency under full load η [%]	94								
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 58				≤ 56				
Service life L_h [h]	> 20000								
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	5.6				6.1				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*									
E = 19 mm	0.87	0.7	0.6	0.55	0.63	0.56	0.53	0.51	0.5
G = 24 mm	2.39	2.22	2.12	2.07	---	---	---	---	---
Torques and speeds									
Maximum torque T_{2a} [Nm]	583				525				
Nominal output torque T_{2N} [Nm] *At n_{1N}*	312	314	371	413	260	276	296	330	364
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	530				480				
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	1200								
Nominal input speed n_{1N} [min^{-1}]	3500				4000				
Maximum input speed n_{1Max} [min^{-1}]	7500								
Idle torque T_{012} [Nm] *Based on the drive*	1	0.87	0.78	0.7	0.62	0.52	0.44	0.32	0.27
Torsion and forces									
Maximum torsional backlash j_t [arcmin]	≤ 1								
Maximum torsional rigidity C_{t21} [arcmin]	105	105	105	100	95	95	95	95	95
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	4800								
Maximum breakdown torque M_{2Max} [Nm]	550								
Tilting rigidity C_{2K} [Nm/arcmin]	550								
Temperature [°C]									
Maximum housing temperature	+ 90								
Ambient temperature	-15 to +40								
Housing									
Properties	Heat-treated steel								
Color	Anthracite gray; RAL 7016								
Seal	Sealed bearing disks								

TP050 MF

Mechanical data	1-stage				
Ratio	4	5	7	8	10
Efficiency under full load η [%]	97				
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 64				
Service life L_h [h]	> 20000				
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	14				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*					
G = 24 mm	9.47	7.85	6.39	6.39	5.54
I = 32 mm	12.5	11	9.55	9.55	8.10
K = 38 mm	13.7	12.1	10.6	10.6	9.78
M = 48 mm	28.3	26.7	25.3	25.3	24.4
Torques and speeds					
Maximum torque T_{2a} [Nm]	992	992	868	720	720
Nominal output torque T_{2N} [Nm] *At n_{1N}*	345	337	322	316	331
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	840	840	840	648	648
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	1250				
Nominal input speed n_{1N} [min^{-1}]	1900	2000	2500	2500	2500
Maximum input speed n_{1Max} [min^{-1}]	5000				
Idle torque T_{012} [Nm] *Based on the drive*	6.5	5.3	3.8	3.8	2.9
Torsion and forces					
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1				
Maximum torsional rigidity C_{t21} [arcmin]	190	187	159	123	123
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	6130				
Maximum breakdown torque M_{2Max} [Nm]	1335				
Tilting rigidity C_{2K} [Nm/arcmin]	560				
Temperature [°C]					
Maximum housing temperature	+ 90				
Ambient temperature	-15 to +40				
Housing					
Properties	Heat-treated steel				
Color	Anthracite gray; RAL 7016				
Seal	Sealed bearing disks				

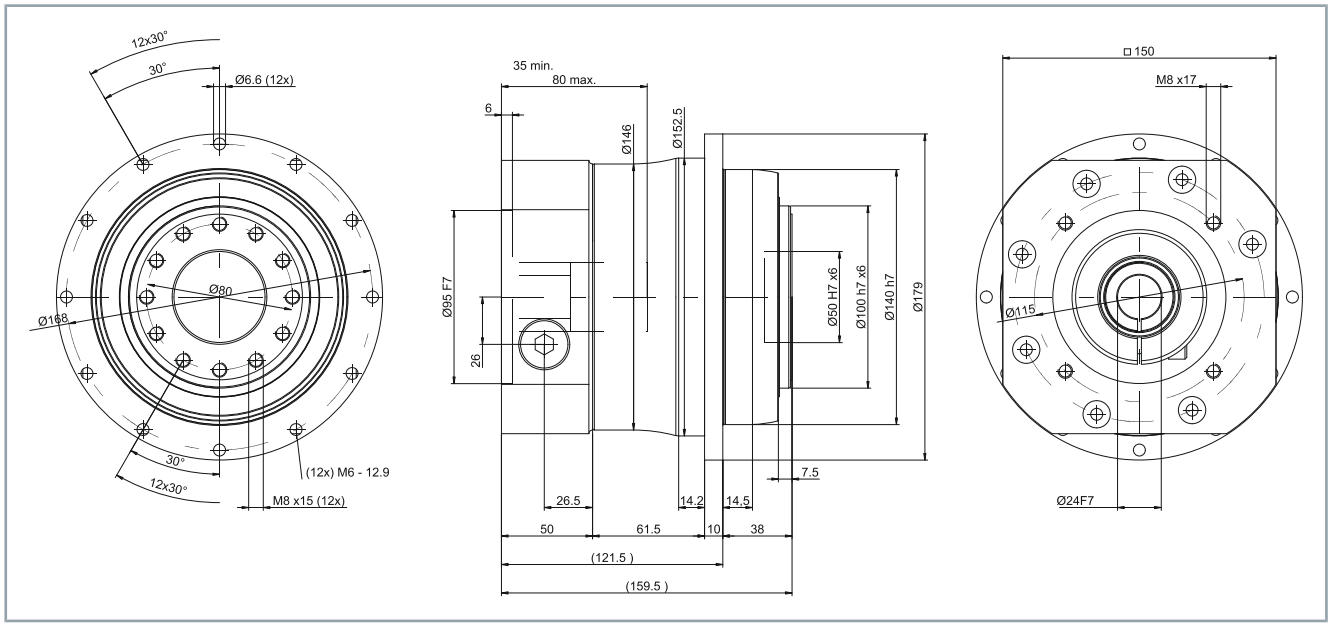
Mechanical data	**2-stage**							
Ratio	16	20	21	25	28	31	32	35
Efficiency under full load η [%]	94							
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 58							
Service life L_h [h]	> 20000							
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	14.1							
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*								
E = 19 mm	2.53	2.08	2.30	2.01	1.67	2.12	1.67	1.64
G = 24 mm	3.22	2.77	2.99	2.70	2.37	2.81	2.37	2.33
K = 38 mm	10.3	9.83	10.1	9.77	9.43	9.88	9.43	9.40
Torques and speeds								
Maximum torque T_{2a} [Nm]	825	825	660	825	825	682	825	825
Nominal output torque T_{2N} [Nm] *At n_{1N}*	461	493	393	489	545	431	464	541
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	825	825	660	825	825	682	825	825
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	1250							
Nominal input speed n_{1N} [min^{-1}]	2900							
Maximum input speed n_{1Max} [min^{-1}]	6250							
Idle torque T_{012} [Nm] *Based on the drive*	2.8	2.4	2.2	2.6	2	1.9	2	1.5
Torsion and forces								
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1							
Maximum torsional rigidity C_{t21} [arcmin]	180	185	145	180	180	130	180	175
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	6130							
Maximum breakdown torque M_{2Max} [Nm]	1335							
Tilting rigidity C_{2K} [Nm/arcmin]	560							
Temperature [°C]								
Maximum housing temperature	+ 90							
Ambient temperature	-15 to +40							
Housing								
Properties	Heat-treated steel							
Color	Anthracite gray; RAL 7016							
Seal	Sealed bearing disks							

Mechanical data	**2-stage**						
Ratio	40	50	61	64	70	91	100
Efficiency under full load η [%]	94						
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 58						
Service life L_h [h]	> 20000						
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	14.1						
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*							
E = 19 mm	1.44	1.42	1.46	1.51	1.41	1.43	1.40
G = 24 mm	2.13	2.12	2.15	2.20	2.10	2.12	2.09
K = 38 mm	9.20	9.18	9.22	9.50	9.17	9.19	9.16
Torques and speeds							
Maximum torque T_{2a} [Nm]	825	825	605	594	770	550	594
Nominal output torque T_{2N} [Nm] *At n_{1N}*	607	585	425	475	598	440	475
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	825	825	605	594	770	550	594
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	1250						
Nominal input speed n_{1N} [min^{-1}]	2900	3200	3200	3200	3200	3900	3900
Maximum input speed n_{1Max} [min^{-1}]	6250						
Idle torque T_{012} [Nm] *Based on the drive*	1.5	1.2	1	1.2	1.1	0.96	0.88
Torsion and forces							
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1						
Maximum torsional rigidity C_{t21} [arcmin]	175	175	123	175	145	100	115
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	6130						
Maximum breakdown torque M_{2Max} [Nm]	1335						
Tilting rigidity C_{2K} [Nm/arcmin]	560						
Temperature [°C]							
Maximum housing temperature	+ 90						
Ambient temperature	-15 to +40						
Housing							
Properties	Heat-treated steel						
Color	Anthracite gray; RAL 7016						
Seal	Sealed bearing disks						

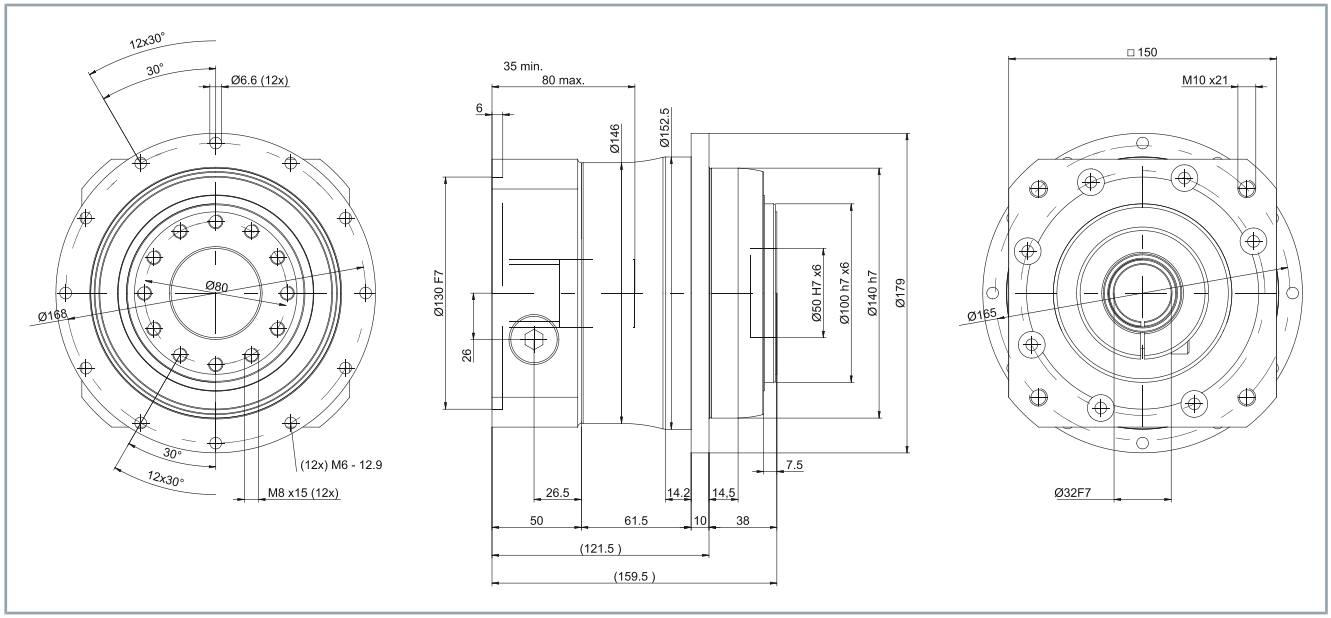
Dimensional drawing

1-stage

- All figures in millimeters
- Dimensions without tolerance ± 1 mm



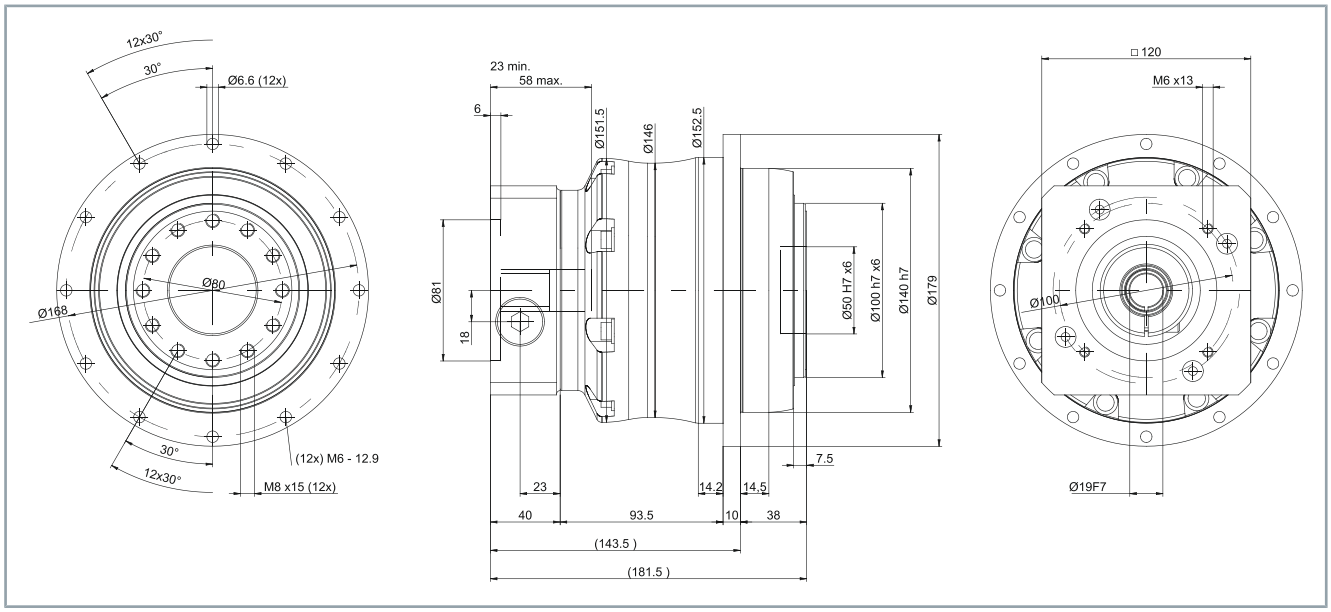
- Clamping hub diameter up to G = 24 mm



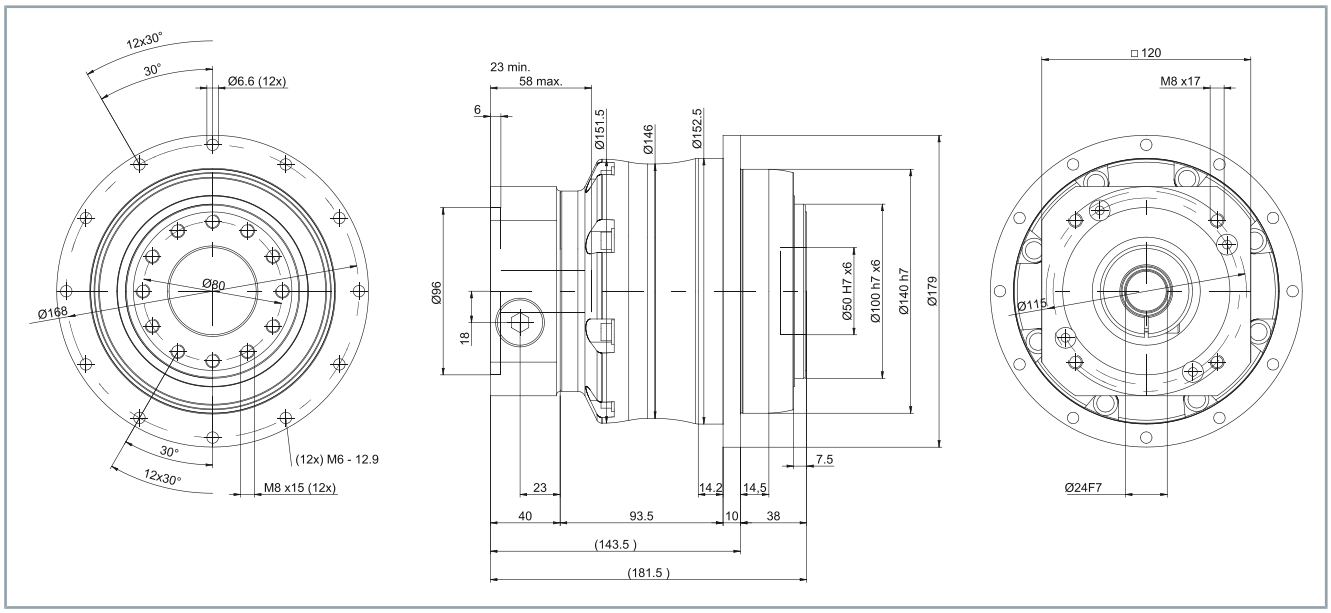
- Clamping hub diameter up to I = 32 mm

2-stage

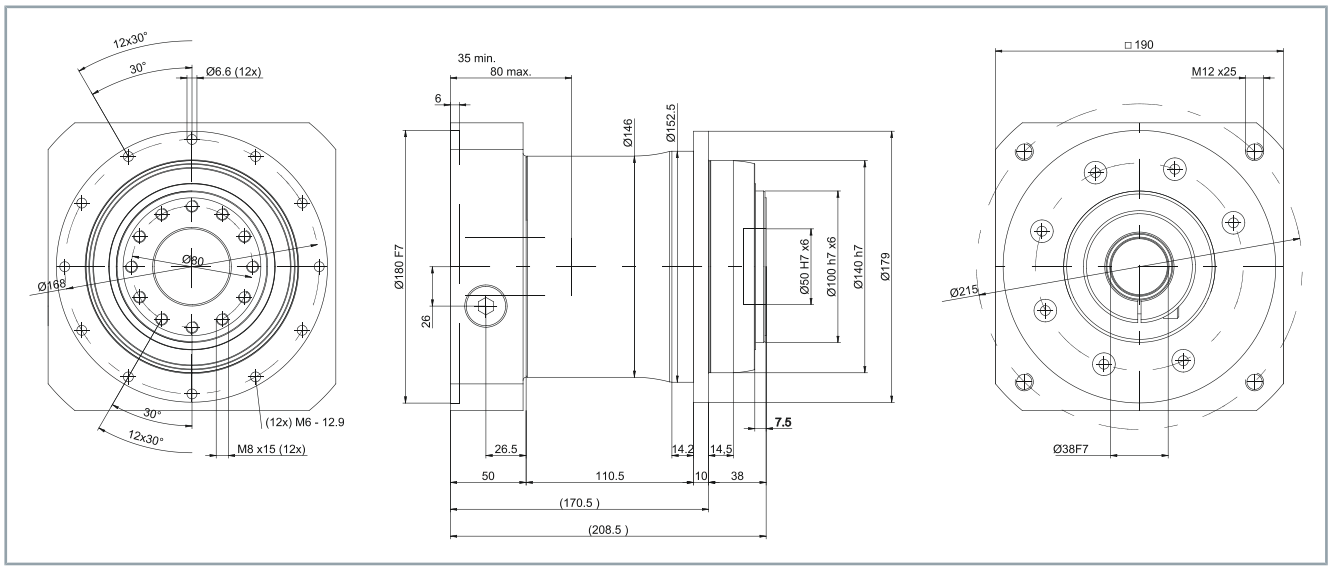
- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to B = 11 mm



- Clamping hub diameter up to C = 14 mm



- Clamping hub diameter up to C = 14 mm

TP050 MA

Mechanical data	2-stage				3-stage				
Ratio	22	27.5	38.5	55	66	88	110	154	220
Efficiency under full load η [%]	94				92				
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 60				≤ 57				
Service life L_h [h]	> 20000								
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	12.5				13.4				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*									
G = 24 mm	3.8	3.33	3	2.8	2.6	2.4	2.2	2.1	2.1
K = 38 mm	10.7	10.3	9.9	9.7	---	---	---	---	---
Torques and speeds									
Maximum torque T_{2a} [Nm]	1402								
Nominal output torque T_{2N} [Nm] *At n_{1N}*	523	566	638	717	723	794	794	794	794
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	992								
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	2375								
Nominal input speed n_{1N} [min^{-1}]	3000				3500				
Maximum input speed n_{1Max} [min^{-1}]	6250								
Idle torque T_{012} [Nm] *Based on the drive*	2.7	2.4	2.1	1.7	1.8	1.3	1.1	0.9	0.72
Torsion and forces									
Maximum torsional backlash j_t [arcmin]	≤ 1								
Maximum torsional rigidity C_{t21} [arcmin]	220				205				
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	6130								
Maximum breakdown torque M_{2Max} [Nm]	1335								
Tilting rigidity C_{2K} [Nm/arcmin]	560								
Temperature [°C]									
Maximum housing temperature	+ 90								
Ambient temperature	-15 to +40								
Housing									
Properties	Heat-treated steel								
Color	Anthracite gray; RAL 7016								
Seal	Sealed bearing disks								

TP110 MF

Mechanical data	1-stage				
Ratio	4	5	7	8	10
Efficiency under full load η [%]	97				
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 68				
Service life L_h [h]	> 20000				
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	30				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*					
K = 38 mm	44.5	34.6	25.5	25.5	20.6
M = 48 mm	58.8	41.9	32.9	32.9	28
N = 55 mm	61.5	51.5	42.3	42.3	37.3
Torques and speeds					
Maximum torque T_{2a} [Nm]	2560	2560	2560	2240	2240
Nominal output torque T_{2N} [Nm] *At n_{1N}*	946	919	861	861	901
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	1920	1920	1920	1680	1680
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	3075				
Nominal input speed n_{1N} [min^{-1}]	1400	1500	2000	2000	2000
Maximum input speed n_{1Max} [min^{-1}]	4500				
Idle torque T_{012} [Nm] *Based on the drive*	16	12	8.8	8.8	6
Torsion and forces					
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1				
Maximum torsional rigidity C_{t21} [arcmin]	610	610	550	445	445
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	10050				
Maximum breakdown torque M_{2Max} [Nm]	3280				
Tilting rigidity C_{2K} [Nm/arcmin]	1452				
Temperature [°C]					
Maximum housing temperature	+ 90				
Ambient temperature	-15 to +40				
Housing					
Properties	Heat-treated steel				
Color	Anthracite gray; RAL 7016				
Seal	Sealed bearing disks				

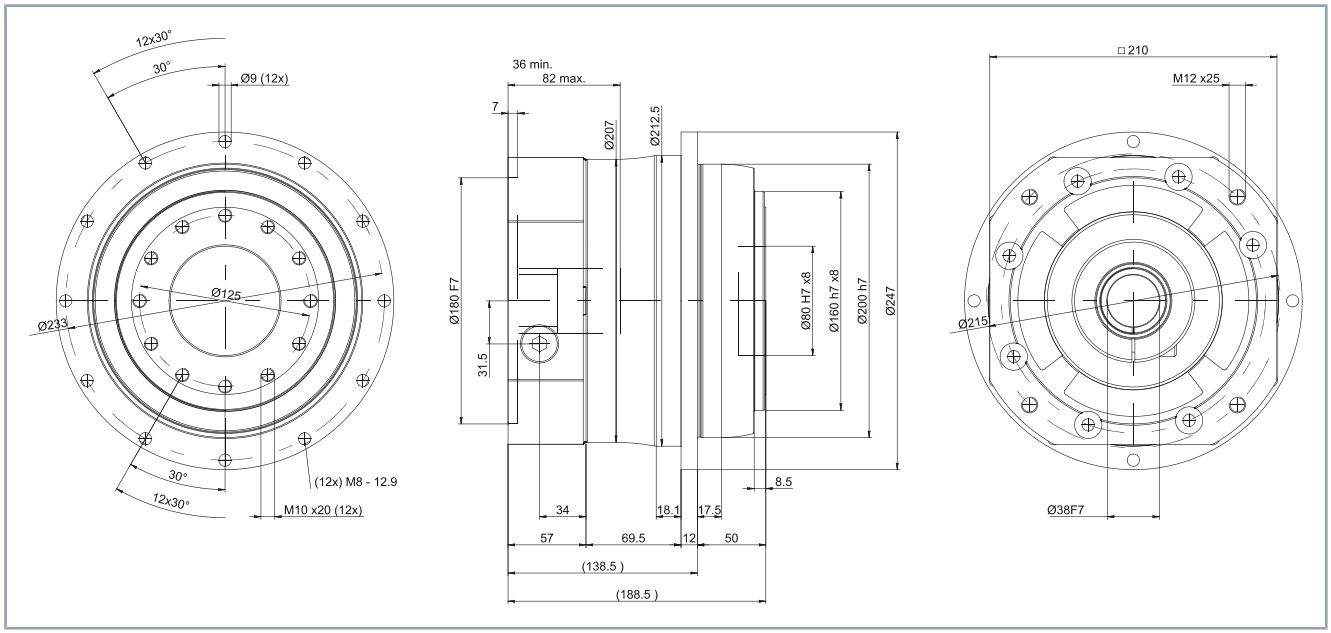
Mechanical data	**2-stage**							
Ratio	16	20	21	25	28	31	32	35
Efficiency under full load η [%]	94							
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 61							
Service life L_h [h]	> 20000							
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	34							
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*								
G = 24 mm	8.51	8.21	8.98	7.85	6.57	8.09	6.57	6.37
I = 24 mm	11.7	11.4	12.1	11	9.73	11.3	9.73	9.54
K = 38 mm	12.7	12.5	13.2	12.1	10.8	12.3	10.8	10.6
M = 48 mm	27.4	27.1	27.8	26.7	25.4	26.9	25.4	25.3
Torques and speeds								
Maximum torque T_{2a} [Nm]	1760	1760	1540	1760	1760	1760	1760	1760
Nominal output torque T_{2N} [Nm] *At n_{1N}*	1205	1240	1023	1278	1257	1065	1221	1408
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	1760	1760	1540	1760	1760	1760	1760	1760
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	3075							
Nominal input speed n_{1N} [min^{-1}]	2500							
Maximum input speed n_{1Max} [min^{-1}]	5625							
Idle torque T_{012} [Nm] *Based on the drive*	7	5.8	5.2	5.2	4.5	4.4	4.5	3.1
Torsion and forces								
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1							
Maximum torsional rigidity C_{t21} [arcmin]	585	580	465	570	560	440	560	560
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	10050							
Maximum breakdown torque M_{2Max} [Nm]	3280							
Tilting rigidity C_{2K} [Nm/arcmin]	1452							
Temperature [°C]								
Maximum housing temperature	+ 90							
Ambient temperature	-15 to +40							
Housing								
Properties	Heat-treated steel							
Color	Anthracite gray; RAL 7016							
Seal	Sealed bearing disks							

Mechanical data	2-stage						
Ratio	40	50	61	64	70	91	100
Efficiency under full load η [%]	94						
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 61						
Service life L_h [h]	> 20000						
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	34						
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*							
G = 24 mm	5.63	5.54	5.63	5.78	5.44	5.51	5.40
I = 32 mm	8.80	8.70	8.80	8.95	8.61	8.67	8.56
K = 38 mm	9.87	9.77	9.87	10	9.68	9.74	9.63
M = 48 mm	24.5	24.4	24.5	24.9	24.3	24.4	24.3
Torques and speeds							
Maximum torque T_{2a} [Nm]	1760	1760	1540	1540	1760	1430	1540
Nominal output torque T_{2N} [Nm] *At n_{1N}*	1315	1408	1232	1232	1408	1144	1232
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	1760	1760	1540	1540	1760	1430	1540
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	3075						
Nominal input speed n_{1N} [min^{-1}]	2500	2900	3200	2900	3200	3400	3400
Maximum input speed n_{1Max} [min^{-1}]	5625						
Idle torque T_{012} [Nm] *Based on the drive*	3	2.5	2.1	2.5	2	1.8	1.8
Torsion and forces							
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1						
Maximum torsional rigidity C_{t21} [arcmin]	520	525	415	525	480	360	395
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	10050						
Maximum breakdown torque M_{2Max} [Nm]	3280						
Tilting rigidity C_{2K} [Nm/arcmin]	1452						
Temperature [°C]							
Maximum housing temperature	+ 90						
Ambient temperature	-15 to +40						
Housing							
Properties	Heat-treated steel						
Color	Anthracite gray; RAL 7016						
Seal	Sealed bearing disks						

Dimensional drawing

1-stage

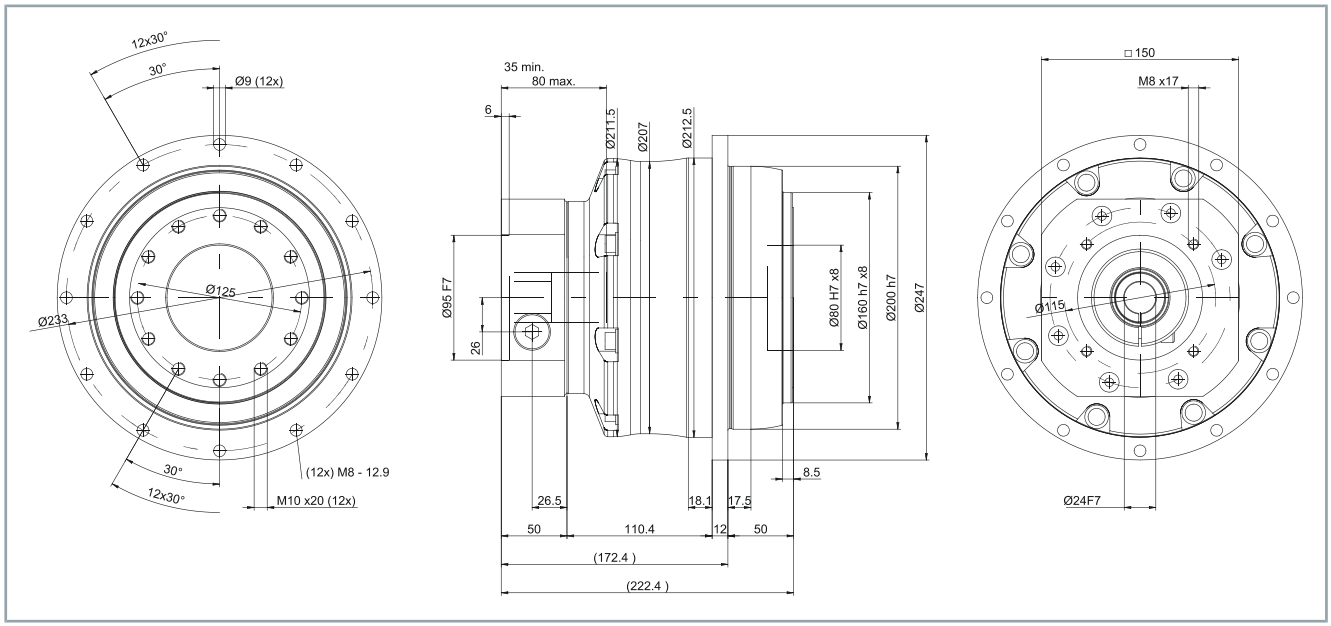
- All figures in millimeters
- Dimensions without tolerance ± 1 mm



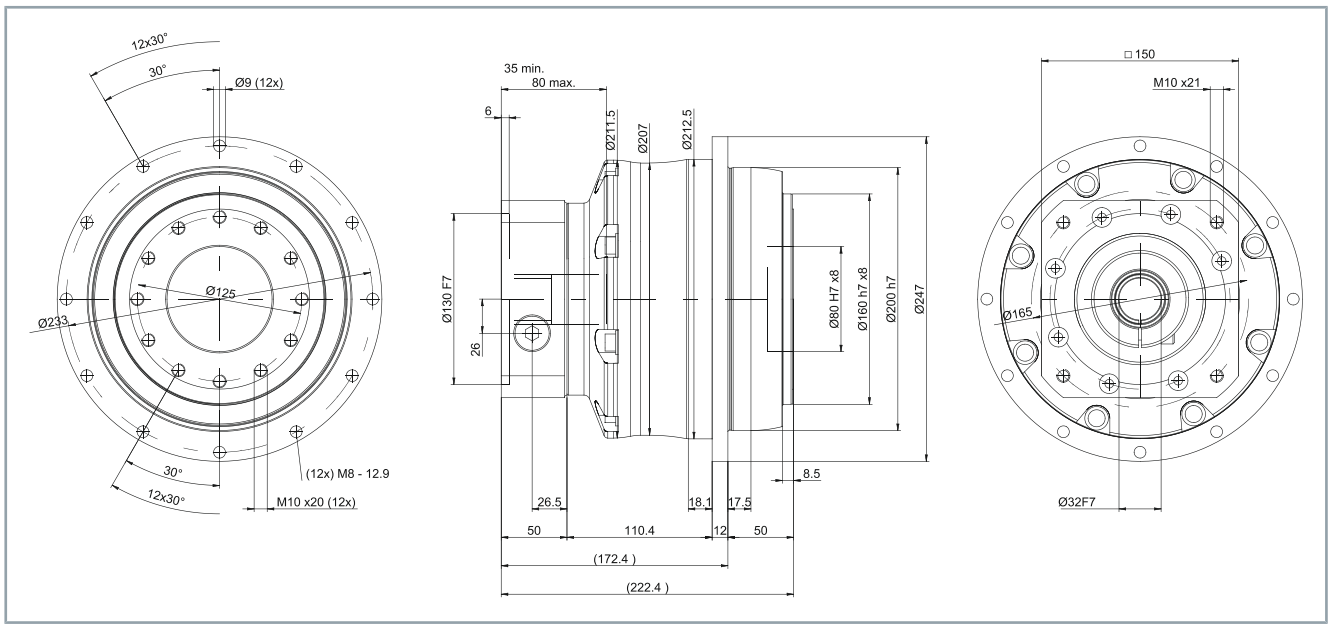
- Clamping hub diameter up to K = 38 mm

2-stage

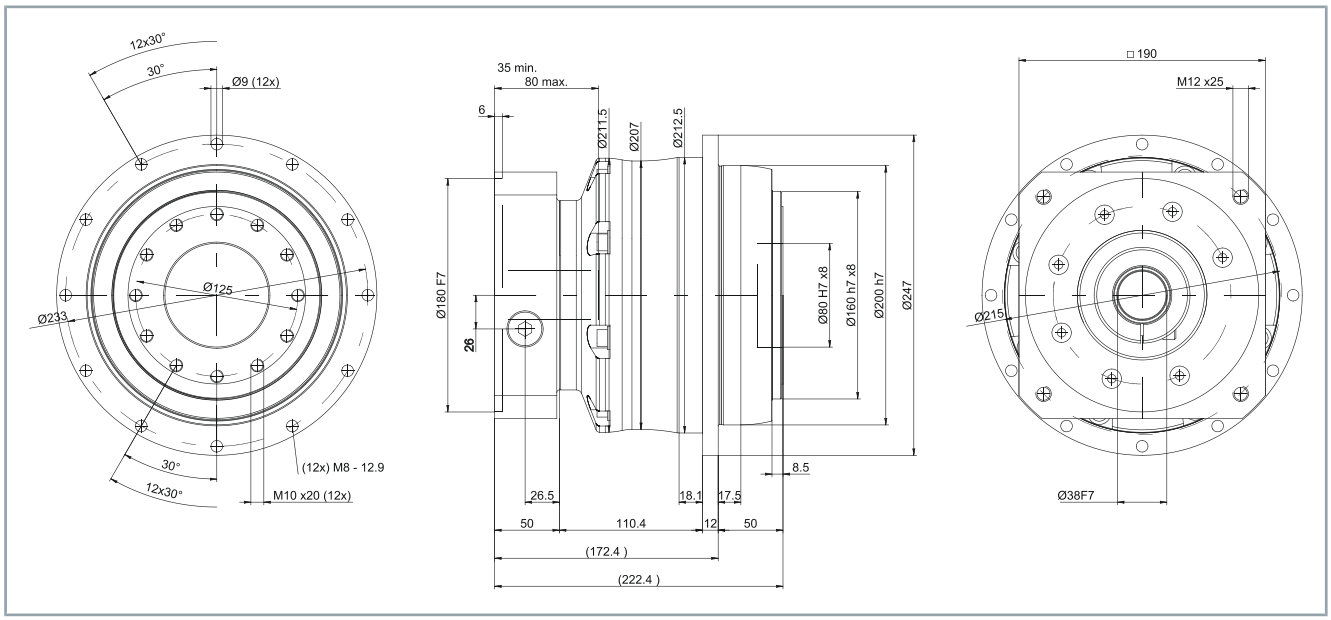
- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to G = 24 mm



- Clamping hub diameter up to I = 24 mm



- Clamping hub diameter up to K = 38 mm

TP110 MA

Mechanical data	2-stage				3-stage				
Ratio	22	27.5	38.5	55	66	88	110	154	220
Efficiency under full load η [%]	94								
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 61				≤ 59				
Service life L_h [h]	> 20000								
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	33.1				35.4				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*									
K = 38 mm	16.6	15.2	13.9	13.1	13.8	10.2	9.8	9.5	9.2
M = 48 mm	31.4	29.9	26.7	28	---	---	---	---	---
Torques and speeds									
Maximum torque T_{2a} [Nm]	3822		3200		3023				
Nominal output torque T_{2N} [Nm] *At n_{1N}*	1546	1662	2149	1827	1649	1797	1924	2080	2080
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	3100	3100	3100	2400	2600				
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	6500								
Nominal input speed n_{1N} [min^{-1}]	2500				3000				
Maximum input speed n_{1Max} [min^{-1}]	5625								
Idle torque T_{012} [Nm] *Based on the drive*	6.2	5.5	4.8	4.3	3.8	3	2.6	1.8	1.6
Torsion and forces									
Maximum torsional backlash j_t [arcmin]	≤ 1								
Maximum torsional rigidity C_{t21} [arcmin]	730	725	715	670	650	650	650	650	650
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	10050								
Maximum breakdown torque M_{2Max} [Nm]	3280								
Tilting rigidity C_{2K} [Nm/arcmin]	1452								
Temperature [°C]									
Maximum housing temperature	+ 90								
Ambient temperature	-15 to +40								
Housing									
Properties	Heat-treated steel								
Color	Anthracite gray; RAL 7016								
Seal	Sealed bearing disks								

TP300 MF

Mechanical data	1-stage			
Ratio	5	7	8	10
Efficiency under full load η [%]	95			
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 64			
Service life L_h [h]	> 20000			
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	60			
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*				
N = 55 mm	82.5	61.2	61.2	49.5
Torques and speeds				
Maximum torque T_{2a} [Nm]	5600	5250	2800	2800
Nominal output torque T_{2N} [Nm] *At n_{1N}*	1996	1835	1815	1794
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	4200	3960	2280	2280
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	9900	9900	8557	8750
Nominal input speed n_{1N} [min^{-1}]	1000	1400	1400	1700
Maximum input speed n_{1Max} [min^{-1}]	3000			
Idle torque T_{012} [Nm] *Based on the drive*	20	14	14	8.8
Torsion and forces				
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1			
Maximum torsional rigidity C_{t21} [arcmin]	1000	900	700	700
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	33000			
Maximum breakdown torque M_{2Max} [Nm]	3900			
Tilting rigidity C_{2K} [Nm/arcmin]	5560			
Temperature [°C]				
Maximum housing temperature	+ 90			
Ambient temperature	-15 to +40			
Housing				
Properties	Heat-treated steel			
Color	Anthracite gray; RAL 7016			
Seal	Sealed bearing disks			

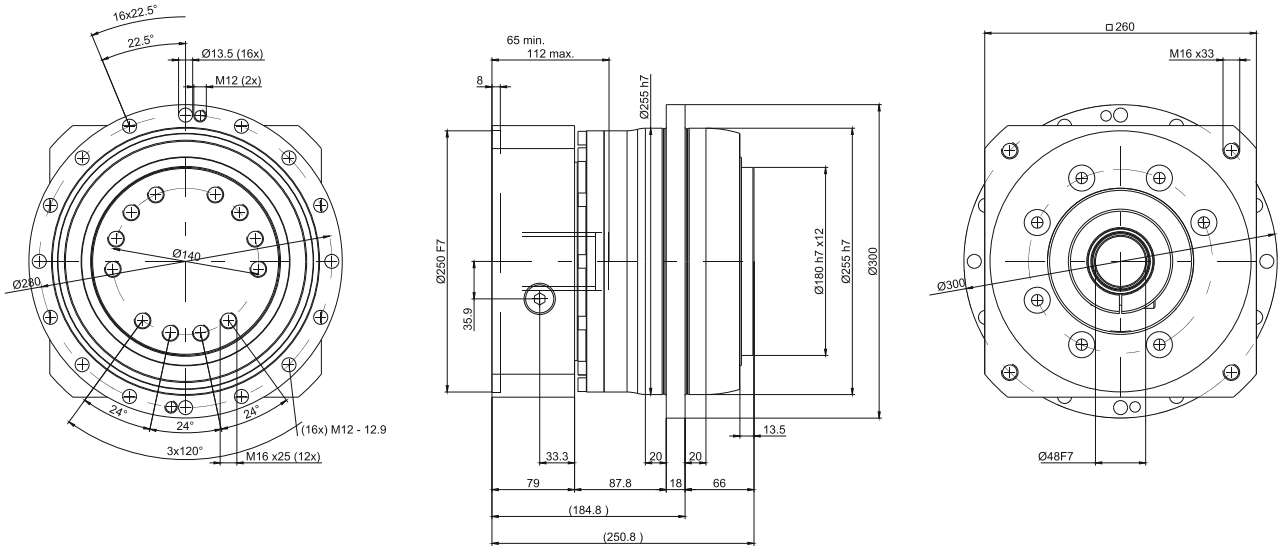
Mechanical data	**2-stage**							
Ratio	20	21	25	31	32	35	50	61
Efficiency under full load η [%]	94							
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 61							
Service life L_h [h]	> 20000							
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	58.5							
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*								
M = 48 mm	27.5	27	25.9	25.6	22.4	22.4	21.5	21.4
Torques and speeds								
Maximum torque T_{2a} [Nm]	3850	3740	3949	3850	3630	3949	3600	3080
Nominal output torque T_{2N} [Nm] *At n_{1N}*	1354	1456	1676	2114	2353	1710	1722	2070
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	3850	3740	3949	3850	3630	3949	3600	3080
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	9900	9870	9900	9156	9900	9900	9900	9900
Nominal input speed n_{1N} [min^{-1}]	2000	2000	2000	2000	2000	2000	2300	2400
Maximum input speed n_{1Max} [min^{-1}]	4375							
Idle torque T_{012} [Nm] *Based on the drive*	6.7	5.5	5.5	4.8	5.5	4	3.8	2.8
Torsion and forces								
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1							
Maximum torsional rigidity C_{t21} [arcmin]	850	800	950	750	950	900	800	700
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	33000							
Maximum breakdown torque M_{2Max} [Nm]	5900							
Tilting rigidity C_{2K} [Nm/arcmin]	5560							
Temperature [°C]								
Maximum housing temperature	+ 90							
Ambient temperature	-15 to +40							
Housing								
Properties	Heat-treated steel							
Color	Anthracite gray; RAL 7016							
Seal	Sealed bearing disks							

Mechanical data	2-stage			
Ratio	64	70	91	100
Efficiency under full load η [%]	94			
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 61			
Service life L_h [h]	> 20000			
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	58.5			
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*				
M = 48 mm	25.8	21.3	21.2	21.2
Torques and speeds				
Maximum torque T_{2a} [Nm]	2800	3630	2800	2800
Nominal output torque T_{2N} [Nm] *At n_{1N}*	2240	2339	2240	2240
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	2800	3630	2800	2800
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	9900	9900	8750	8750
Nominal input speed n_{1N} [min^{-1}]	2300	2400	2500	2500
Maximum input speed n_{1Max} [min^{-1}]	4375			
Idle torque T_{012} [Nm] *Based on the drive*	3.8	3	2.8	2.4
Torsion and forces				
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1			
Maximum torsional rigidity C_{t21} [arcmin]	800	800	600	650
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	33000			
Maximum breakdown torque M_{2Max} [Nm]	5900			
Tilting rigidity C_{2K} [Nm/arcmin]	5560			
Temperature [°C]				
Maximum housing temperature	+ 90			
Ambient temperature	-15 to +40			
Housing				
Properties	Heat-treated steel			
Color	Anthracite gray; RAL 7016			
Seal	Sealed bearing disks			

Dimensional drawing

1-stage

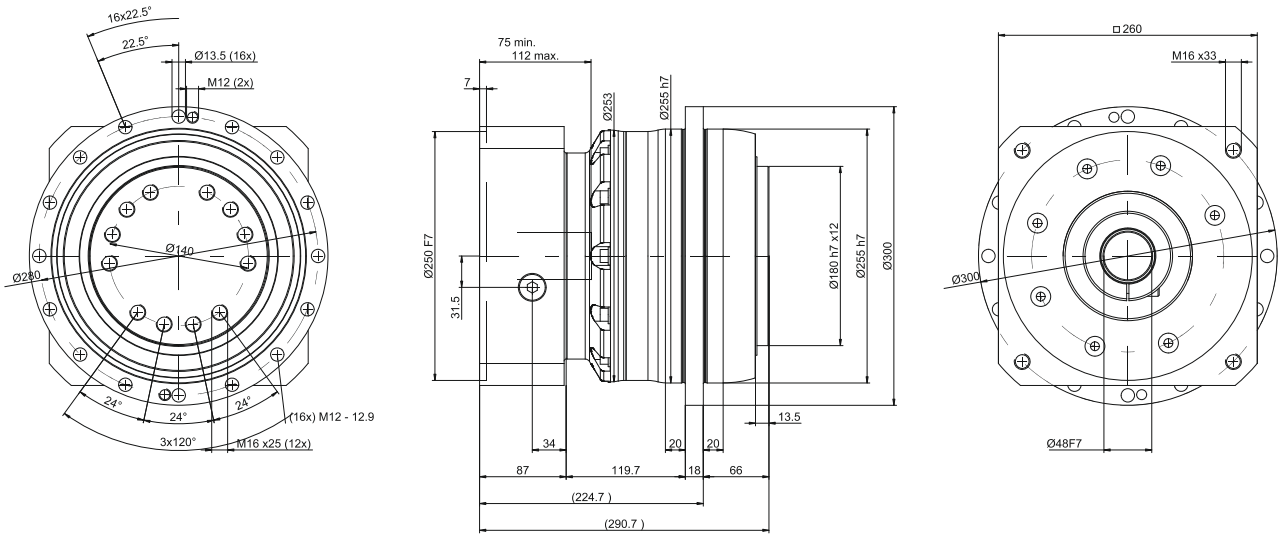
- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to M = 48 mm

2-stage

- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to M = 48 mm

TP300 MA

Mechanical data	1-stage	2-stage				3-stage				
Ratio	5.5	22	27.5	38.5	55	66	88	110	154	220
Efficiency under full load η [%]	95	93								
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 65	≤ 62				≤ 59				
Service life L_h [h]	> 20000									
Weight [kg] *Depending on the clamping hub diameter and adapter plate*	55	64				67				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*										
K = 38 mm	---	---	---	---	---	16.6	12.9	11.6	10.3	9.5
M = 48 mm	---	30.8	27.6	24.9	23	---	---	---	---	---
N = 55 mm	129	---	---	---	---	---	---	---	---	---
Torques and speeds										
Maximum torque T_{2a} [Nm]	7360	7535	7535	7535	5473	6987	6987	6987	6987	6987
Nominal output torque T_{2N} [Nm]; *At n_{1N}*	2829	3566	3788	3884	3744	3216	3506	3750	4148	4617
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	5520	6600	6600	6600	4680	6600	6600	6600	6600	6600
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	10938	15333	15333	15296	15333	15333	15333	15333	15333	15333
Nominal input speed n_{1N} [min^{-1}]	1000	2000								
Maximum input speed n_{1Max} [min^{-1}]	3125	4375								
Idle torque T_{012} [Nm] *Based on the drive*	19	8.8	7.8	6.8	5.9	5.2	3.6	3.1	2.1	1.5
Torsion and forces										
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1.5									
Maximum torsional rigidity C_{t21} [arcmin]	1200									
Maximum axial force F_{2AMax} [N] *In relation to output shaft center*	33000									
Maximum breakdown torque M_{2Max} [Nm]	3900	6500								
Tilting rigidity C_{2K} [Nm/arcmin]	5560									
Temperature [°C]										
Maximum housing temperature	+ 90									
Ambient temperature	-15 to +40									
Housing										
Properties	Heat-treated steel									
Color	Anthracite gray; RAL 7016									
Seal	Sealed bearing disks									

TP500 MF

Mechanical data	1-stage			
Ratio	5	7	8	10
Efficiency under full load η [%]	95			
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 64			
Service life L_h [h]	> 20000			
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	82			
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*				
O = 60 mm	182	142	142	120
Torques and speeds				
Maximum torque T_{2a} [Nm]	9600	6790	4000	4000
Nominal output torque T_{2N} [Nm] *At n_{1N}*	3131	2857	2830	2840
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	7200	6000	4000	4000
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	15000			
Nominal input speed n_{1N} [min^{-1}]	900	1300	1300	1500
Maximum input speed n_{1Max} [min^{-1}]	3000			
Idle torque T_{012} [Nm] *Based on the drive*	27	19	19	12
Torsion and forces				
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1			
Maximum torsional rigidity C_{t21} [arcmin]	1450	1300	1100	1100
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	50000			
Maximum breakdown torque M_{2Max} [Nm]	5500			
Tilting rigidity C_{2K} [Nm/arcmin]	9480			
Temperature [°C]				
Maximum housing temperature	+ 90			
Ambient temperature	-15 to +40			
Housing				
Properties	Heat-treated steel			
Color	Anthracite gray; RAL 7016			
Seal	Sealed bearing disks			

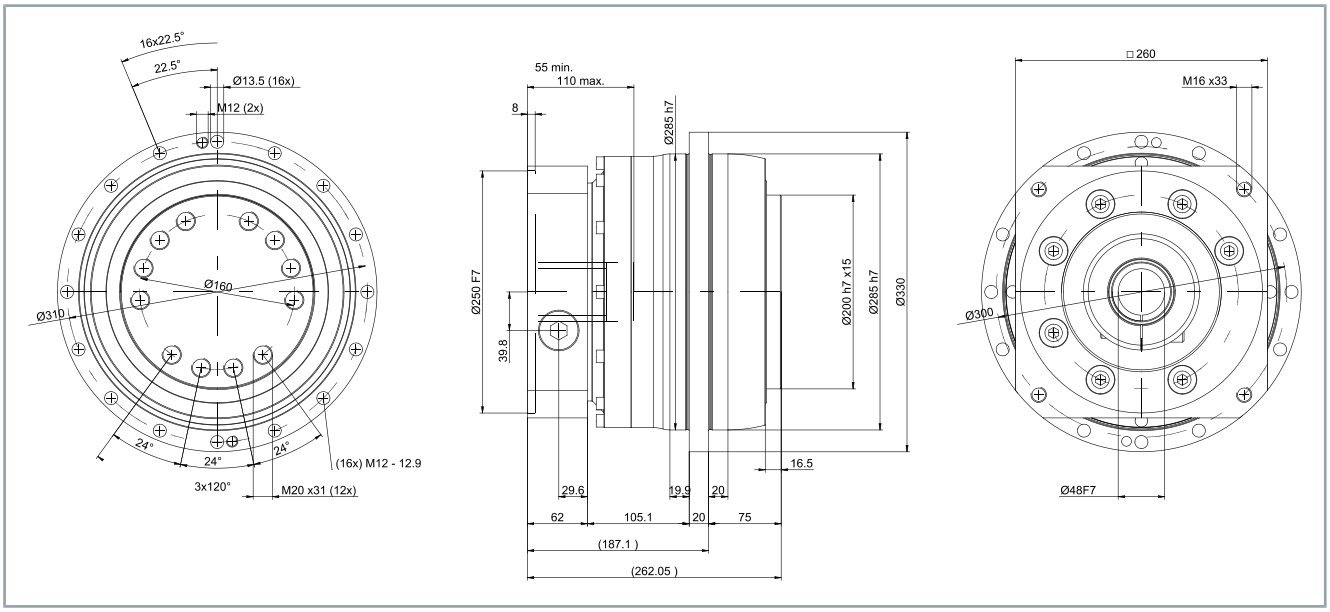
Mechanical data	**2-stage**							
Ratio	20	21	25	31	32	35	50	61
Efficiency under full load η [%]	94							
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 60							
Service life L_h [h]	> 20000							
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	77.5							
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*								
M = 48 mm	24.8	35.9	40.2	33.7	27.4	27.4	25.4	25.8
Torques and speeds								
Maximum torque T_{2a} [Nm]	5446	5718	6808	6354	5500	6808	4975	5280
Nominal output torque T_{2N} [Nm] *At n_{1N}*	3026	3270	3729	4086	4376	3828	3697	4224
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	5446	5718	6808	6324	5500	6808	4975	5280
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	15000	13928	15000	10854	15000	15000	15000	10678
Nominal input speed n_{1N} [min^{-1}]	1500	1500	1500	1500	1500	1500	2000	2100
Maximum input speed n_{1Max} [min^{-1}]	4375							
Idle torque T_{012} [Nm] *Based on the drive*	10.4	9.6	9.2	7	9.2	7	5.8	3.4
Torsion and forces								
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 2							
Maximum torsional rigidity C_{t21} [arcmin]	1400	1200	1450	1200	1450	1400	1300	1100
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	50000							
Maximum breakdown torque M_{2Max} [Nm]	8800							
Tilting rigidity C_{2K} [Nm/arcmin]	9480							
Temperature [°C]								
Maximum housing temperature	+ 90							
Ambient temperature	-15 to +40							
Housing								
Properties	Heat-treated steel							
Color	Anthracite gray; RAL 7016							
Seal	Sealed bearing disks							

Mechanical data	**2-stage**			
Ratio	64	70	91	100
Efficiency under full load η [%]	94			
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 60			
Service life L_h [h]	> 20000			
Weight [kg] *Depending on the clamping hub diameter and selected adapter plate*	77.5			
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*				
M = 48 mm	25.8	31	25	25.2
Torques and speeds				
Maximum torque T_{2a} [Nm]	4800	5500	4800	4800
Nominal output torque T_{2N} [Nm] *At n_{1N}*	3840	4400	3840	3840
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	4800	5500	4800	4800
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	15000	15000	15000	15000
Nominal input speed n_{1N} [min^{-1}]	2000	2100	2200	2200
Maximum input speed n_{1Max} [min^{-1}]	4375			
Idle torque T_{012} [Nm] *Based on the drive*	5.8	4.5	3.5	3.6
Torsion and forces				
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 2			
Maximum torsional rigidity C_{t21} [arcmin]	1300	1250	950	1050
Maximum axial force F_{2AMax} [N] *In relation to the shaft center at the output*	50000			
Maximum breakdown torque M_{2Max} [Nm]	8800			
Tilting rigidity C_{2K} [Nm/arcmin]	9480			
Temperature [°C]				
Maximum housing temperature	+ 90			
Ambient temperature	-15 to +40			
Housing				
Properties	Heat-treated steel			
Color	Anthracite gray; RAL 7016			
Seal	Sealed bearing disks			

Dimensional drawing

1-stage

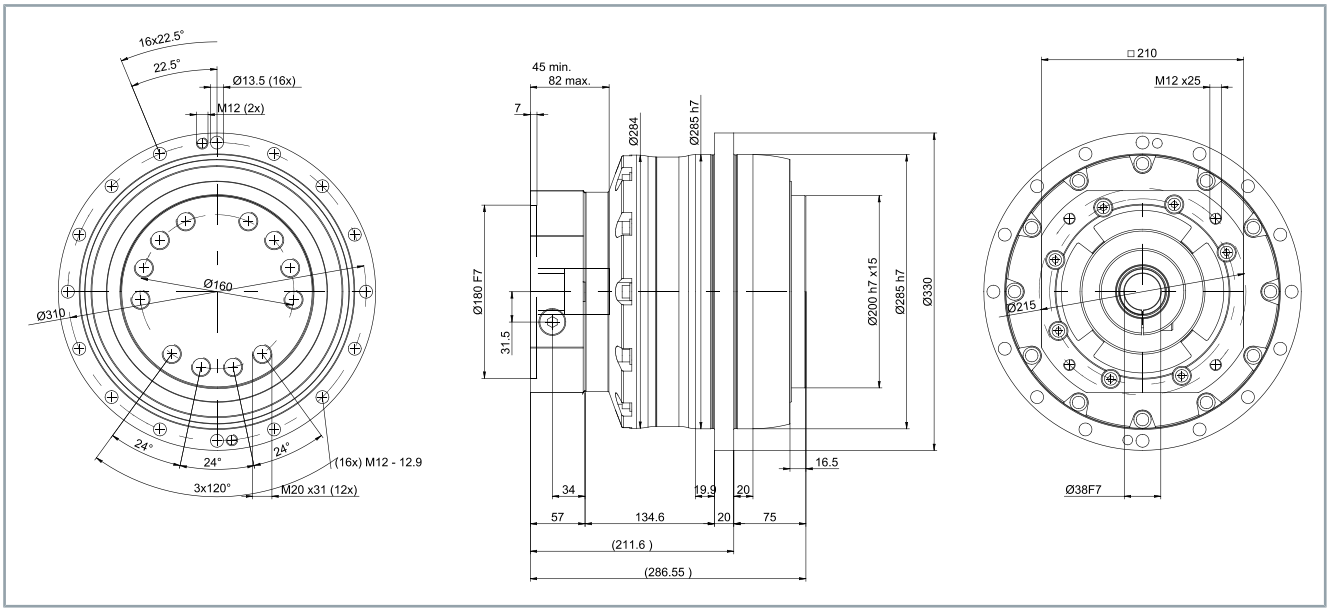
- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to M = 48 mm

2-stage

- All figures in millimeters
- Dimensions without tolerance ± 1 mm



- Clamping hub diameter up to K = 38 mm

TP500 MA

Mechanical data	1-stage	2-stage				3-stage				
Ratio	5.5	22	27.5	38.5	55	66	88	110	154	220
Efficiency under full load η [%]	95	93								
Running noise L_{PA} [dB] *at n1 = 3000 rpm without load*	≤ 70	≤ 63				≤ 60				
Service life L_h [h]	> 20000									
Weight [kg] *Depending on the clamping hub diameter and adapter plate*	80	80				89				
Mass moment of inertia J_1 [kgcm²] *Based on the drive* *Letters = specification of the clamping hub diameter*										
K = 38 mm	---	---	---	---	---	17.9	13.5	11.9	10.5	9.7
M = 48 mm	---	43.8	36.9	30.5	27	32.7	28.3	26.7	25.2	34.4
O = 60 mm	175	---	---	---	---	---	---	---	---	---
Torques and speeds										
Maximum torque T_{2a} [Nm]	10450									
Nominal output torque T_{2N} [Nm]; *At n_{1N}*	4313	5068	4980	5057	5325	4941	7464	7396	7546	7907
Maximum acceleration torque T_{2B} [Nm] *Maximum 1000 cycles per hour*	9600	10450								
EMERGENCY STOP torque $T_{2Em.stop}$ [Nm] *Possible 1000 times during the service life of the gear unit*	18750	25000								
Nominal input speed n_{1N} [min^{-1}]	900	1500								
Maximum input speed n_{1Max} [min^{-1}]	3125	4375								
Idle torque T_{012} [Nm] *Based on the drive*	27	11	10	8.9	7.8	6.8	5	4.7	3.6	3
Torsion and forces										
Maximum torsional backlash j_t [arcmin]	Standard ≤ 3 / Reduced ≤ 1.5									
Maximum torsional rigidity C_{t21} [arcmin]	2000	2000	2000	1950	1900	1800	1800	1800	1800	1800
Maximum axial force F_{2AMax} [N] *In relation to output shaft center*	50000									
Maximum breakdown torque M_{2Max} [Nm]	6600	9500								
Tilting rigidity C_{2K} [Nm/arcmin]	9480									
Temperature [°C]										
Maximum housing temperature	+ 90									
Ambient temperature	-15 to +40									
Housing										
Properties	Heat-treated steel									
Color	Anthracite gray; RAL 7016									
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.

Check the shipment for the following contents:

- Gear units from the AG2400 series with packaging
- Short information

Screws 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 AG2400 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: 0 °C to +40 °C, maximum fluctuation 20 K/hour
- Air humidity: 15 % 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.

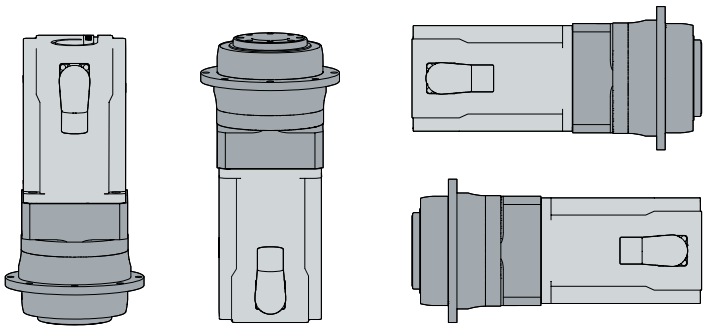
Prevent the formation of condensation
Ensure a constant ambient temperature in the range from 0°C to +40°C at the storage location. Avoid high humidity.
Failure to comply may result in the formation of condensation. Condensation can cause damage in later operation or rust formation on the gear unit.

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 units is the motor attachment "M". You can use the gear units in any other installation position.



IM V1 (V1) IM V3 (V3) IM B5 (B5)

Do not use compressed air and do not spray inside 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.

Leaks on gear units with grease lubrication
Seal the surfaces of the adapter plates, the drive housing and the motor with a surface sealing adhesive.
Leaks may occur on the drive with gear units with grease lubrication. This so-called sweating can negatively affect the lifecycle of the gear unit.

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 μ = 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:

Screw size	Quality of the screws		
	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 in aluminum

The specified tightening torques for stainless steel bolts in aluminum apply in conjunction with the matching Beckhoff servomotors.

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

Quality of the bolts = strength class A2-70		
Servomotor	**Screw size**	**Tightening torque in Nm**
AM801x	M4	2.1
AM802x		
AM803x	M5	4.3
AM853x		
AM804x	M6	7.3
AM854x		
AM805x	M8	17.8
AM855x		
AM806x	M10	35
AM856x		
AM807x	M12	62
AM857x		
AM808x	M14	115

Stainless steel in steel

The specified tightening torques for stainless steel bolts in steel apply in conjunction with the matching Beckhoff servomotors.

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

Quality of the bolts = strength class A2-70		
Servomotor	**Screw size**	**Tightening torque in Nm**
AM801x	M4	2.3
AM802x		
AM803x	M5	4.6
AM853x		
AM804x	M6	7.7
AM854x		
AM805x	M8	18.7
AM855x		
AM806x	M10	37
AM856x		
AM807x	M12	65
AM857x		
AM808x	M14	120

Motor on gear unit

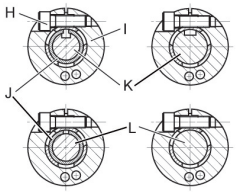
If a motor is included in the scope of delivery:
Motors included in the scope of delivery are pre-mounted.
For optimum performance, we recommend installation on Beckhoff AM8xxx synchronous servomotors.

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

- The design of the motors is B5
- The concentricity tolerance or axial run-out tolerance is available according to DIN 50347
- The motor has a cylindrical shaft end with tolerance class h6 up to k6
- Motor attachment if possible in a vertical position

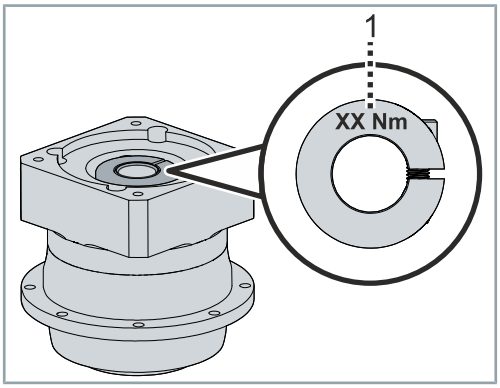
Clamping hub

The following table provides a description of the clamping hub:

Infographic	Position	Name
	H	Clamping bolt
	I	Clamping ring
	J	Spacer sleeve
	K	Grooved motor shaft
	L	Smooth motor shaft

- Clamping screw according to ISO 4762

Tightening torques



The value for the tightening torque [1] of the clamping screw is punched into the clamping hub from above.

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

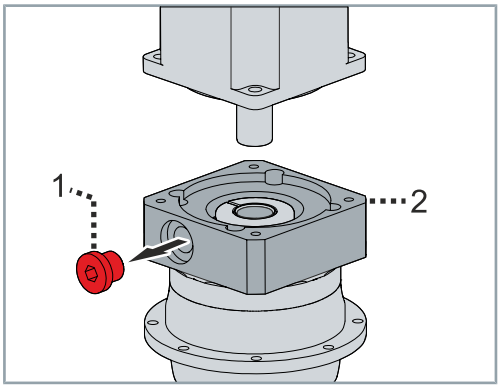
Clamping hub diameter [mm]	Identifying letter	Width across flats [mm]	Tightening torque [Nm]
8	Z	2.5	2
9	A	2.5	2
11	B	3	4.1
14	C	4	9.5
16	D	5	14
19	E	5	14
24	G	6	35
28	H	5	14
32	I	8	79
38	K	8	79
48	M	10	135
55	N	10	135
60	O	14	330

Mounting

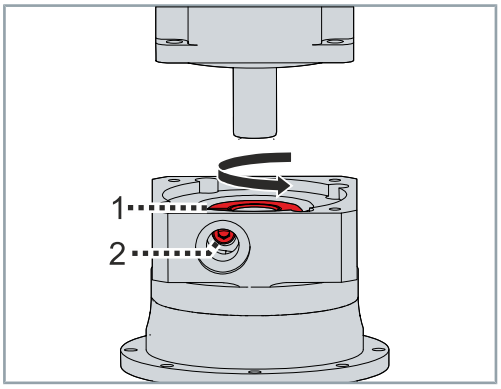
► Carefully degrease the following components with a cloth:
- Contact surfaces with adjacent components
- Centering and motor shaft
- Internal diameter of the clamping hub
- Spacer sleeve inside and outside

In case of motor with feather key [+]

► Remove feather key [+] and insert half wedge



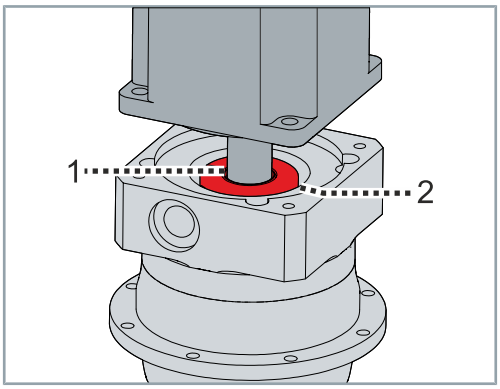
► Remove the screw plug [1] from the adapter plate [2]



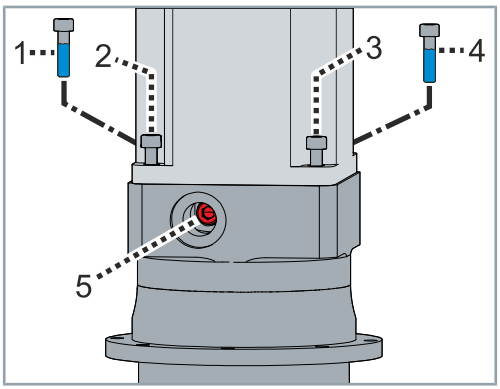
► Turn the clamping hub [1] until the screw [2] can be seen above the mounting hole

► Loosen the screw [2] by one turn

Do not exceed the permissible axial forces
If the motor shaft cannot be inserted easily, the 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.



- ► Insert the motor shaft [1] into the clamping hub [2]
- ► 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 screws [1], [2], [3] and [4] with threadlocker
- ► Insert bolts [1], [2], [3] and [4] and tighten evenly
- ► Tighten bolt [5]. Refer to the chapter "Clamping hub", [Page 76].
- ► 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 screw 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

For planetary gear units from the AG2400 series no attachment by press fitting or shrink fitting is provided.

Information on the attachment

In the following you will find supplementary information regarding the attachment of the gear unit to the output side:

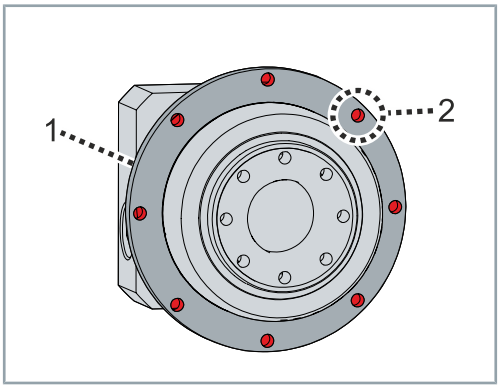
Standard variant

Quality of the screws = strength class 12.9			
Gear unit	**Pitch circle diameter [mm]**	**Number x thread x depth of engagement**	**Tightening torque [Nm]**
004	31.5	8 x M5 x 7	9
010	50	8 x M6 x 10	15.4
025	63	12 x M6 x 12	15.4
050	80	12 x M8 x 15	37.5
110	125	12 x M10 x 20	73.5
300	140	12 x M16 x 31	310
500	160	12 x M20 x 31	605

High-torque version

Quality of the screws = strength class 12.9			
Gear unit	**Pitch circle diameter [mm]**	**Number x thread x depth of engagement**	**Tightening torque [Nm]**
010	50	12 x M6 x 10	15.4
025	63	12 x M8 x 12	37.5
050	80	12 x M10 x 15	73.5
110	125	12 x M12 x 19	126
300	145	12 x M20 x 31	605
500	166	12 x M24 x 37	1040

Mounting



► Carefully degrease the following components with a cloth:

- Contact surfaces with adjacent components
- Flange

In this example, there are eight threaded holes [2] in the gear unit housing [1] for the bolted connection with your machine

► Coat suitable screws 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

Tightening torques

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

Standard variant

Quality of the screws = strength class 12.9				
Gear unit	**Pitch circle diameter [mm]**	**Number x diameter**	**Screw size**	**Tightening torque [Nm]**
004	79	8 x 4.5	M4	4.55
010	109	8 x 5.5	M5	9
025	135	8 x 5.5	M5	9
050	168	12 x 6.6	M6	15.4
110	233	12 x 9	M8	37.5
300	280	16 x 13.5	M12	126
500	310	16 x 13.5	M12	126

High-torque version

Quality of the screws = strength class 12.9				
Gear unit	**Pitch circle diameter [mm]**	**Number x diameter**	**Screw size**	**Tightening torque [Nm]**
010	109	16 x 5.5	M5	9
025	135	16 x 5.5	M5	9
050	168	24 x 6.6	M6	15.4
110	233	24 x 9	M8	37.5
300	280	32 x 13.5	M12	126
500	310	32 x 13.5	M12	126

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 Nm x 10 = **10 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 gearbox: 20 Nm

Output torque of the gear unit with a transmission ratio i of 10:
5 Nm x 10 = **50 Nm**

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

Relevant parameters

Servo drive	Rated 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 the 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 lines for dirt, leakages, 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.

Do not immerse or hose down the gear unit
Wipe the gear unit only with cleaning agent and a cloth.
Due to impermissible solutions, cleaning by immersion can lead to damage to the surface and the gear unit as well as to leak-tightness 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 **Thereafter:** 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 **Thereafter:** Every three months	Check tightening torques
Fastening screw Gear unit housing	During commissioning **Thereafter:** Every three months	Check tightening torques

Lubrication

Notes on lubrication
Beckhoff gear units from the AG2400 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 lubricated for life in the factory with a synthetic polyglycol gear oil or with a high-performance grease.

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 equipment must be disposed of properly. The national regulations for the disposal of electrical and electronic equipment must be observed.

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.
Send your request to: *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
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:
www.beckhoff.com/ag2400

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