

Documentation

Planetary gears AG2400-+TP0xx

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BECKHOFF

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1 Foreword

1.1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with the applicable national standards.

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.

It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement. No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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1.2 Documentation issue status

Version	Comment
1.0	First edition
0.0.1	Internal version

1.3 Intended use

Planetary gear units of the AG2400 series from Beckhoff are used for the transmission of torques and speeds. They are suitable for all industrial applications that are not covered by Article II of EC Directive 2002/95/EC (restriction of the use of certain hazardous substances in electrical and electronic equipment).

The gear unit is intended for mounting on motors that:

- match type B5 (if different, please contact Beckhoff Service);
- have a radial or axial runout tolerance compliant with or better than DIN EN 50347;
- have a cylindrical shaft end with tolerance class h6 up to k6.

Reasonably foreseeable misuse

Any use that deviates from the approved technical data (e.g. speed, force, temperature) is not use as intended and is therefore not permitted.

Improper use

Planetary gear units of the AG2400 series from Beckhoff are **not** suitable for use in the following areas:

- in ATEX zones without a suitable housing
- in areas with aggressive environments (e.g. aggressive gases or chemicals)

In the food industry, the planetary gear unit may only be used beside or below the food area.

 CAUTION	Damage from improper use: Any use that goes beyond the intended purpose will result in damage to the planetary gear unit and/or components of the machine or system. Any improper use is therefore not permitted.
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2 Guidelines and Standards

**CAUTION****Personal injuries!**

Gear units of the AG2400 series from Beckhoff are **not** products within the meaning of the EC Machinery Directive 2006/42/EC. The intended use of the gear units in machines or systems is prohibited until proof of the CE conformity of the entire machine or system has been provided.

2.1 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 provides an overview of the percentage quantities of pollutants.

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.

3 For your safety

Read the section on safety and heed the notices to protect yourself against personal injury and material damages.

Limitation of liability

All components of the AG2400 planetary gear unit series are delivered in certain hardware configurations, depending on the application requirements. Unauthorized modifications and changes to the hardware configuration, which go beyond the documented options, are prohibited and nullify the liability of Beckhoff Automation GmbH & Co. KG.

In addition, the following actions are excluded from the liability of Beckhoff Automation GmbH & Co. KG:

- Failure to comply with this documentation
- Improper use
- Untrained personnel
- Use of unauthorized spare parts

3.1 Staff qualification

All work steps shown on Beckhoff hardware, in particular on the AG2400 planetary gear unit, may only be carried out by specialist personnel with knowledge of control and automation technology.

The technical personnel must have knowledge of drive technology and electrical systems and must also know how to work safely on electrical equipment and machines.

This also includes:

- production planning and
- securing of the working environment (e.g. securing the control cabinet against being switched on again).

The technical personnel must be familiar with the current and necessary standards and directives for the automation and drive environment.

3.2 Description of symbols

In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

Symbols that warn of personal injury:

 DANGER	Serious risk of injury! This is an extremely dangerous situation. Disregarding the safety notice will lead to serious permanent injuries or even death.
 WARNING	Risk of injury! This is a dangerous situation. Disregarding the safety notice may lead to serious injuries.
 CAUTION	Personal injuries! This is a dangerous situation. Disregarding the safety notice may lead to minor injuries.

Symbols that warn of damage to property or equipment:

 Attention	Warning of damage to property or the environment! This notice indicates disturbances in the operational procedure that could damage the product or the environment.
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Symbols indicating further information or tips:

 Note	Tip or pointer! This notice provides important information that will be of assistance in dealing with the product or software. There is no immediate danger to product, people or environment.
	UL note! This symbol indicates important information regarding UL certification.

3.3 Notes on the AG2400 planetary gear unit

The notes are intended to avert danger and facilitate the handling of the AG2400 planetary gear unit. They must be followed during installation, commissioning, production, troubleshooting, maintenance and trial or test assemblies.

The planetary gear units of the AG2400 series cannot run independently. They must always be installed in a machine or system. After installation the additional documentation and safety instructions provided by the machine manufacturer must be read and followed.

 WARNING	Severe injuries to body parts and limbs caused by rotating components! When starting up the AG2400 planetary gear unit, serious injuries can occur due to rotating components. Take the following precautions to avert danger before commissioning: <ul style="list-style-type: none">• Remove objects and tools in your working environment and from the gear unit.• Remove the feather key (if present) if the planetary gear unit is operated without attachments (output side or drive side).• When the machine is running, keep a safety distance of at least 1.5 m from rotating components.• Secure the machine and control cabinet against restart and uncontrolled movements.• Wear PPE.
 WARNING	Severe burns due to hot surfaces on the gear units! During operation, the surface temperature of the gear units can may exceed 50 °C. There is an acute risk of sustaining burns to parts of the body and limbs. Take the following measures to avert danger: <ul style="list-style-type: none">• Do not touch any components (housing, etc.) shortly after or during operation.• Wait until all components have cooled sufficiently. At least 15 minutes.• Check the surface temperature with a thermometer.• DO NOT wear work gloves with a rubber coating. These can fuse with the skin on account of the high temperature and cause serious injuries.
 Note	Notes on operating the AG2400 planetary gear units: <ul style="list-style-type: none">• Please read this manual thoroughly before using the planetary gear units. Notify the responsible sales office immediately if any passages are not understandable. Refrain from working on the component.• When installing the gear unit, make sure to check all bolted connections. Use a calibrated torque wrench for fastening the bolts. Make sure that the tightening torque is correct.
 Attention	Damage to the environment or devices <ul style="list-style-type: none">• Solvents and lubricants may cause skin irritation if used improperly. Avoid direct skin contact.• Solvents and lubricants can pollute soil and water. Use and dispose of solvents properly. Further information can be found in chapter: Disposal.

4 Handling

4.1 Transport

- No special mode of transport is prescribed for the gear unit.
- Only by qualified personnel
- Only in the manufacturer's original packaging
- Avoid hard shocks.
- If the packaging is damaged check the gear unit and any accessories for visible damage. Inform the transport company and, if necessary, the manufacturer.

 WARNING	Suspended loads may fall and cause serious injury or death. <ul style="list-style-type: none">• Never stand under suspended loads.• Secure the gear unit with suitable fastenings (e.g. straps) prior to transport.
 Attention	Hard impacts, e.g. due to falling or dropping, may damage the gear unit. <ul style="list-style-type: none">• Use only lifting gear and load handling devices with sufficient load-bearing capacity.• Do not exceed the permitted lifting weight.• Set the gear unit down slowly.

4.1.1 Transporting gear units up to size TP050

No special mode of transport is prescribed for the gear unit.

4.1.2 Transporting of gear units size TP110 or above

For gear units size TP110 or above we recommend using lifting gear.

4.2 Packaging

- Recyclable cardboard with inserts
- Dispose of the packaging materials at designated disposal sites.
Observe the relevant national disposal regulations

4.3 Storage

- The gear units must not be stored outdoors. The storage space must be adequately ventilated and dry.
- The gear units may only be stored in the original recyclable manufacturer's packaging.
- The gear units may only be stored in a horizontal position.
- Storage temperature: 0 °C to +40 °C in the original packaging
- Storage time: 2 years max.

 Note	Possible damage to the gear unit seals <p>If the gear units are stored at temperature ranges above 40°C or subjected to direct sunlight or ultraviolet light, the gear unit seals may become damaged. Storage temperatures of up to +35°C are permitted for a maximum of 2 weeks. However, please note that even short-term storage at such temperatures will result in premature ageing of the seals. Therefore, please check the seals before commissioning the gear unit.</p>
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4.4 Maintenance / Cleaning

4.4.1 Maintenance schedule

Maintenance tasks	During commissioning	For the first time, after 500 operating hours or 3 months	Every 3 months	Annually
Visual inspection	x	x	x	-
Check the tightening torques	x	x	-	x
Lubrication	x	-	x	x

4.4.2 Maintenance tasks

4.4.2.1 Visual inspection

- Check the entire gear unit for external damage.
- Check the entire gear unit for leaks.
 - In the installation position, check that no foreign media (e.g. oil) accumulate on the drive and output shaft.
- Check the entire gear unit for corrosion.



Note

Further information regarding maintenance!

For further information regarding maintenance of bearings or wearing parts please contact the Beckhoff applications department.

4.4.2.2 Check the tightening torques

Check the tightening torque:

- of the clamping bolt on the motor attachment and
- of the mounting bolt on the gear housing.



Note

Tightening torque for the clamping bolt on the motor attachment:

If you find that the clamping bolt can still be turned when checking the tightening torques, tighten it with the tightening torque specified in chapter 7: "Mechanical installation".

Reinstalling the mounting bolts on the gear unit housing

If you find that one or more mounting bolts can still be turned when checking the tightening torques, follow the instructions in this chapter and reinstall the mounting bolts.

Disassembly and assembly sequence for reinstalling the bolts:

1. Release the affected bolts.
2. Remove adhesive residue from the thread and the bolts.
3. Clean and degrease the bolts.
4. Coat the bolts with a threadlocker (e.g. Loctite® 243).
5. Screw in the bolts by hand and tighten them with the specified tightening torque.

 Attention	Damage to the gear unit or the entire machine due to incorrect installation: Make sure that it is possible to reinstall the bolts on the gear unit without damaging the machine.
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4.4.2.3 Lubrication

 CAUTION	Damage to the gear unit due to overheating of the components Inadequate lubrication of the components may lead to damage to the gear unit due to overheating. <ul style="list-style-type: none">• Calculate the usable life of the lubricant used• Relubricate all relevant components as required
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4.4.2.3.1 Notes on the lubricant used

 Note	Lubricant used All gear units are lubricated for life in the factory with a synthetic gear oil (polyglycol) of viscosity class ISO VG100 or ISO VG220, or with a high-performance grease (see name plate). All bearings are lubricated for life at the factory.
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Further information on the lubricants is available directly from the manufacturer:

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

4.4.3 Commissioning after maintenance

- Clean the gear unit externally.
- Attach all safety devices.
- Perform a test run before releasing the gear unit again for operation.

4.4.4 Cleaning agents and cleaning procedures

4.4.4.1 Important notes

 Note	Cleaning the gear unit! During operation, the pumping action of the gear unit can result in cleaning agent entering the inside of the gear unit. The gear unit may only be cleaned at standstill!
 Note	Unsuitable cleaning agents may cause corrosion! The gear unit may only be cleaned with commercial cleaning agents. The cleaning agents may be fat-dissolving but must be non-aggressive! An overview of suitable cleaning agents can be found in section " Overview of materials [▶ 15] ".
 Note	Damage to seals! Cleaning the gear unit with a high-pressure water jet or a permanent present medium may damage the gear seals. <ul style="list-style-type: none">• Use a water jet with a maximum pressure of 28 bar.• Removal media from the seal within 30 minutes.
 Note	Residue-free cleaning Roughened surfaces cannot be cleaned without residues! <ul style="list-style-type: none">• Avoid scratching the gear unit or damaging the surface. It may no longer be possible to guarantee the effect of the HD design! Bacteria or similar matter may attach themselves to the surface!

4.4.4.2 Overview of materials

This section contains a list of cleaning materials. During cleaning, the gear unit may be subjected to the substances listed below, in concentrations of up to 3%.

Overview of permitted cleaning materials:

Medium	Chemical formula
Acetyl chloride	<chem>CH3COCl</chem>
Aluminum chloride	<chem>AlCl3·6H2O</chem>
Ammonium chloride	<chem>NH4Cl</chem>
Antimony trichloride	<chem>SbCl3</chem>
Barium chloride	<chem>BaCl2·2H2O</chem>
Chlorine (including chlorine water, chloride of lime and chlorobenzene)	<chem>Cl2</chem>
Chlorosulfuric acid	<chem>HSO3Cl</chem>
Hydrogen chloride gas	<chem>HCl</chem>
Chromic acid	<chem>CrO3</chem>
Iron(III) chloride	<chem>FeCl3</chem>
Hydrogen fluoride	<chem>HF</chem>
Carnallite	<chem>KCIMgCl2·6H2O</chem>
Aqua regia	<chem>HCl + HNO3</chem>
Magnesium chloride	<chem>MgCl2·6H2O</chem>
Monochloroacetic acid	<chem>CH2ClCOOH</chem>
Sodium chloride (common salt)	<chem>NaCl</chem>
Sodium hydroxide	<chem>NaOH</chem>
Sodium peroxide	<chem>Na2O2</chem>
Sulfuric acid	<chem>H2SO4</chem>
Tartaric acid	<chem>COOH(CHOH)2COOH</chem>
Tin II (IV) chloride	<chem>SnCl2·2H2O(SnCl4)</chem>

Overview of non-permitted cleaning materials:

The substances listed below may **not** be used for cleaning the gear unit!

Medium	Chemical formula
Aniline hydrochloride	<chem>C6H5NH2HCl</chem>
Bromine	<chem>Br2</chem>
Sodium hypochlorite (bleaching solution)	<chem>NaClO</chem>
Mercury (II) chloride	<chem>HgCl2</chem>
Hydrochloric acid	<chem>HCl</chem>

4.5 Disposal

**Note****National regulations**

Observe the relevant national disposal regulations.

Supplementary information on replacing the adapter plate and disassembly and disposal of the gear unit is available from our service department:

- The device should be disposed of by a certified disposal company. Addresses can be obtained from our service department.
- Metal parts can be sent for metal recycling.

In accordance with the WEEE 2012/96/EC Directives we take old devices and accessories back for professional disposal, provided the transport costs are taken over by the sender. Send the devices with the note "For disposal" to:

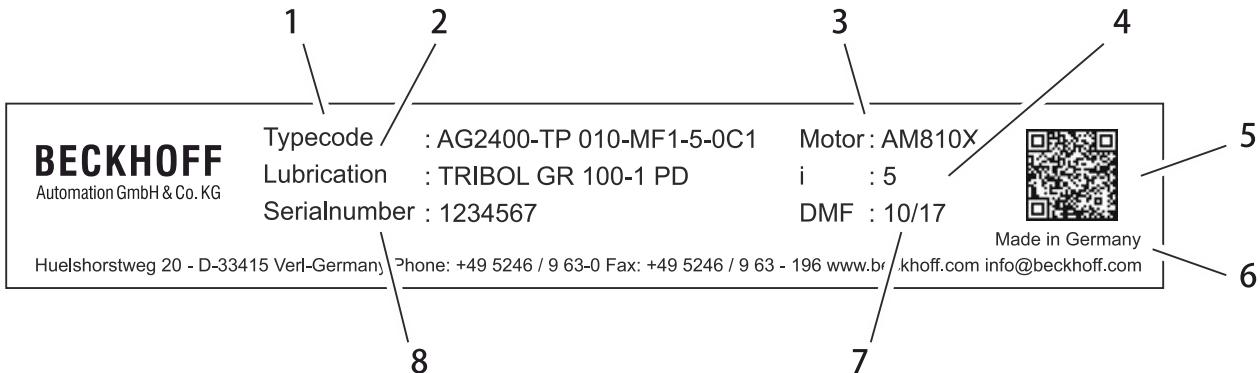
Beckhoff Automation GmbH & Co. KG
Hülsorstweg 20
33415 Verl, Germany

5 Product overview

5.1 AG2400 scope of delivery

- Check the completeness of the delivery against the delivery note.
- Missing parts or damage should be reported immediately in writing to the carrier, the insurance company and / or Beckhoff Automation.

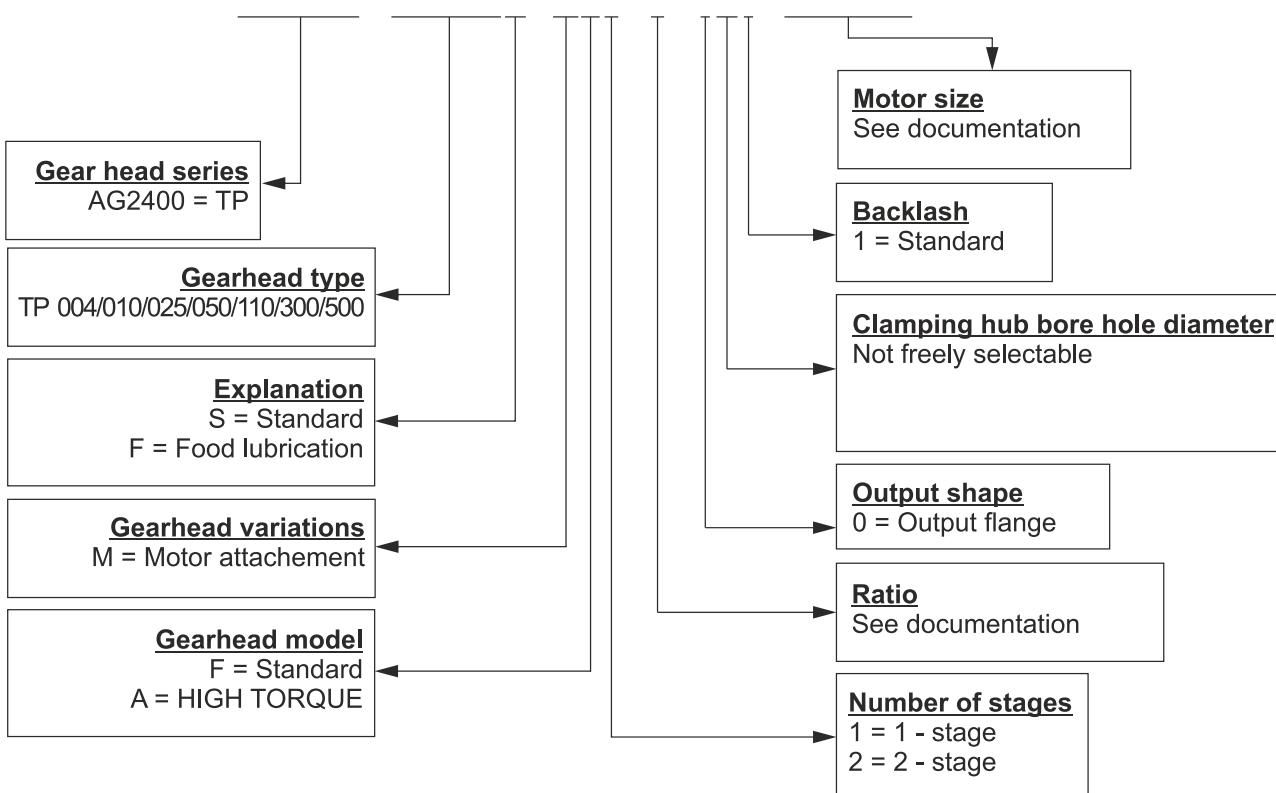
5.2 AG2400 name plate



Number	Explanation
1	Date of manufacture
2	Ratio
3	Lubrication
4	Serial number
5	Type designation
6	Barcode
7	Country of manufacture

5.3 AG2400 type key

AG2400 - TP 010S - MF1 - 5 - 0C1 - AM810x

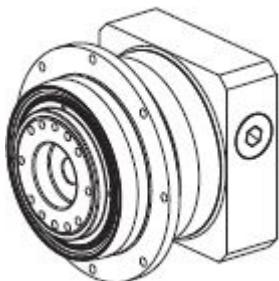


6 Technical description

6.1 Gear unit configuration

Gear units of the AG2400-+TPxxx series are single- or multi-stage, low-backlash planetary gear units. The gear unit series is manufactured as version "M" (motor mounting) and can be used in any installation position.

Infographic

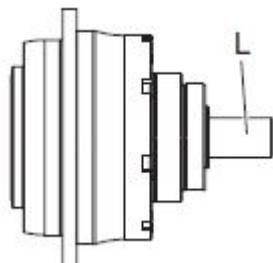


Motor centering of the motor-mounted gear unit:

- use the clamping hub (sleeve or coupling) up to gear unit size TP025 and a motor shaft diameter of 28 mm;
- use the centering collar of the motor from gear unit size TP050 and a motor shaft diameter > 28 mm.

Radial distortion of the motor is avoided. Adaptation to various motors is done through an adapter plate and a sleeve. The output flange bearing is designed such that it can absorb high breakdown torques and axial forces. Optionally, the gear unit can be equipped with a coupling for thermal length compensation.

Infographic



"S"(separate gear unit)

The separate gear unit is based on the motor-mounted gear unit and features additional components such as a drive housing and a drive shaft (L). The drive shaft offers the option to drive the gear unit directly, e.g. via a pulley.

The drive shaft bearing and the output flange bearing are designed such that they can absorb high breakdown torques and axial forces.

6.2 Overview of gear components

Technical drawing	Pos.	Gear components
	A	Gear housing
	B	Output bearing
	C	Output flange
	D	Planetary gear stage
	E	Radial shaft-sealing ring
	F	Radial shaft-sealing ring
	G	Clamping hub (sleeve / coupling)
	H	Spacer sleeve
	I	Adapter plate
	J	Drive bearing
	K	Drive housing

6.3 General technical data

**Note**

The maximum permissible speeds and torques can be found in our catalog or on our website at <http://www.beckhoff.de>.

6.3.1 Weight

The table below shows the gear unit weights with a medium-sized adapter plate. If a different adapter plate is used, the weight of the gear unit may differ by up to 10%.

Gear size AG2400-+TP	004	010	025	050	110	300	500
1-stage (in kg)	1.4	3.8	6.5	14.0	30.0	60.0	82.0
2-stage (in kg)	1.5	3.6	6.7	14.1	34.0	58.5	77.5

6.3.2 Noise emission

The continuous sound pressure level may be up to 68 dB(A), depending on the gear type and size.

Please pay attention to the total sound pressure level of the machine!

7 Mechanical installation

7.1 Important notes

The gear unit can be used in any installation position.

 Attention	Assembly sequence Always follow the assembly sequence described below in order to avoid damage.
---	---

The fastening screws are not included and must be provided by the customer. Pertinent information can be found in the individual assembly steps.

 Attention	Compressed air may damage gear unit seals. Do not use compressed air for cleaning the gear unit.
 Attention	In rare cases, leaks ("sweating") may occur at the drive in gear units with grease lubrication (see name plate). <ul style="list-style-type: none">• To avoid "sweating", we recommend sealing the areas between<ul style="list-style-type: none">⇒ adapter plate and drive housing (gear unit) and⇒ adapter plate and motor⇒ with a surface seal adhesive (e.g. Loctite® 573 or 574).⇒ For further information please contact Beckhoff Service.

Before the installation, make sure that the motor you select meets the requirements for the intended use.

Clean / degrease the following components with a clean, lint-free cloth and a grease-dissolving, non-aggressive cleaning agent. Further information can be found in chapter "Cleaning agents and cleaning procedures":

- all surfaces in contact with adjacent components
- Centering
- the motor shaft
- the internal diameter of the clamping hub
- the spacer sleeve inside and outside

In addition, check the contact surfaces for damage and foreign particles.

7.2 Mounting the motor on the gear unit

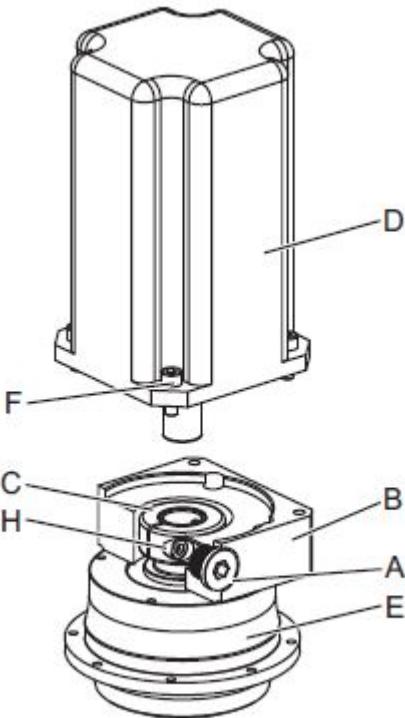
The standard scope of supply of a AG2400-TP0xx series planetary gear unit does not include a motor.

If a motor is to be mounted on the gear unit it must:

- be a B5 type
- have a radial and axial run-out tolerance according to DIN EN 50347
- and have a smooth shaft.

Instructions for mounting the motor on the gear unit

For mounting a gear unit at a motor, we recommend Beckhoff servomotors of the series AM8000 and AM8500 (including fan version).

Infographic	Assembly sequence
	<ul style="list-style-type: none"> • Clean all components to ensure they are grease-free and check the motor and gear unit for damage prior to assembly. • Mount the motor in vertical direction, if possible. <p>Note: If the motor shaft has a feather key, remove it.</p> <p>Note: Insert a half wedge, if recommended by the manufacturer.</p> <ul style="list-style-type: none"> • Remove the plug (A) from the mounting hole in the adapter plate (B). • Turn the clamping hub (C) until the clamping screw (H) is accessible via the mounting hole. • Release the clamping bolt (H) of the clamping hub (C) by one turn. • Push the motor shaft into the clamping hub of the gear unit (E).
<p>Note: The maximum permitted axial forces must not be exceeded. The motor shaft must slide easily. If this is not the case, the clamping screw (H) should be loosened further.</p>	
<p>Note: For certain motor shaft diameters and uses an additional slotted spacer sleeve has to be installed.</p>	
<p>The slot the spacer sleeve must align with the groove (if present) of the motor shaft.</p>	
<p>Note: There must be no gap between the motor (D) and the adapter plate (B).</p>	
<p>Note: Motor centering of the motor-mounted gear unit:</p>	
<ul style="list-style-type: none"> • use the clamping hub (sleeve or coupling) up to gear unit size TP025 and a motor shaft diameter of 28 mm; • use the centering collar of the motor from gear unit size TP050 and a motor shaft diameter > 28 mm. • Coat the four screws (F) with a threadlocker (e.g. Loctite® 243). • Attach the motor (D) to the adapter plate (B) with the four screws (F). Tighten the bolts uniformly and crosswise with increasing torque. • Tighten the clamping screw (H) of the clamping hub (C). • Push the plug (A) into the mounting hole of the adapter plate (B). • Please refer to the following table regarding the bolt sizes and the specified tightening torques. 	

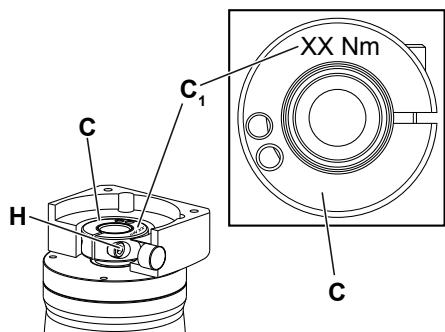
Additional information for fastening and installing the clamping bolt

Infographic	Pos.	Name
	H	Clamping bolt
	I	Clamping ring [part of the clamping hub (C)]
	J	Spacer sleeve
	K	Grooved motor shaft
	L	Smooth motor shaft

Width across flats [mm]	5	8	10	12	14
Tightening torque [Nm]	10	35	50	70	140

Gear unit		Clamping hub inside diameter	Clamping bolt	Size	Tightening torque [Nm]	Max. axial force clamping hub [N]	
TP		"x" [mm]	DIN ISO 4762	[mm]	Strength 12.9	Sleeve	Coupling
004	1-stage	x ≤ 11	M4	3	4.1	100	10
		11 < x ≤ 14	M5	4	9.5		
		14 < x ≤ 19	M6	5	14		
	2-stage	x ≤ 11	M4	3	4.1	80	---
		11 < x ≤ 14	M5	4	9.5		
		14 < x ≤ 19	M6	5	14		
010	1-stage	x ≤ 14	M5	4	9.5	120	20
		14 < x ≤ 19	M6	5	14		
		19 < x ≤ 24	M8	6	35		
	2-stage	x ≤ 11	M4	3	4.1	100	10
		11 < x ≤ 14	M5	4	9.5		
		14 < x ≤ 19	M6	5	14		
025	3-stage	x ≤ 14	M5	4	9.5	100	10
		14 < x ≤ 19	M6	5	14		
		19 < x ≤ 24	M8	6	35		
	2-stage	24 < x ≤ 28	M6	5	14		
		28 < x ≤ 38	M10	8	79		
		x ≤ 14	M5	4	9.5	120	20
050	1-stage	14 < x ≤ 19	M6	5	14		
		19 < x ≤ 24	M8	6	35		
		24 < x ≤ 28	M6	5	14		
	3-stage	x ≤ 19	M6	5	14	120	20
		14 < x ≤ 19	M6	5	14		
		19 < x ≤ 24	M8	6	35		
135	2-stage	24 < x ≤ 28	M6	5	14	150	30
		28 < x ≤ 48	M12	10	135		
		x ≤ 24	M6	5	14	150	30
	3-stage	19 < x ≤ 24	M8	6	35		
		24 < x ≤ 318	M10	8	79		
		35x14 9.5≤ 24	M8	6	35	150	30
110	1-stage	x ≤ 38	M10	8	79	250	200
		38 < x ≤ 48	M12	10	135		
		x ≤ 24	M8	6	35	200	50
	2-stage	24 < x ≤ 38	M10	8	79		
		38 < x ≤ 48	M12	10	135		
		x ≤ 38	M10	8	79	200	50
300	1-stage	x ≤ 55	M12	10	135	300	---
		x ≤ 48	M12	10	135	250	---
		x ≤ 38	M10	8	79	250	---
	2-stage	x ≤ 60	M16	14	330	300	---
		x ≤ 48	M12	10	135	250	---
		x ≤ 38	M10	8	79	250	---
		38 < x ≤ 48	M12	10	135		

Identification of the tightening torque



The value of the tightening torque (C_1) for the clamping bolt (H) is punched onto the clamping hub (C) from above (see diagram on the left).

Also see about this

- ▀ Notes on the AG2400 planetary gear unit [▶ 10]

7.3 Mounting the gear unit at the machine

Preparation

Infographic	Pos.	Centering
	A	output side (standard)
	B	motor side (option)

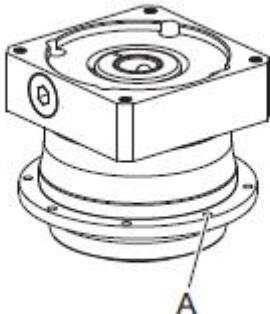
- 1.) Make sure the motor meets the specifications stipulated in chapter: "Intended use [▶ 6]".
- 2.) Clean and/or degrease and dry the following components with a clean, lint-free cloth and a grease-dissolving, non-aggressive cleaning agent:
 - all surfaces in contact with adjacent components
 - Centering
 - the motor shaft
 - the internal diameter of the clamping hub
 - the spacer sleeve inside and outside
- 3.) Dry all contact surfaces with adjacent components, in order to maintain the correct friction coefficients of the screw connections.
- 4.) In addition, check the contact surfaces for damage and foreign particles.
- 5.) Take into account the minimum screw-in depth depending on the strength class of the bolt (see following table).

Strength class of motor mounting screws	8.8	10.9
Minimum screw-in depth	1.5 x d	1.8 x d
d = screw diameter		

Fittings on the output side

 Note	The gear unit may be damaged by distortion! Distortion may occur during installation of the gear unit, which may damage the gear unit. <ul style="list-style-type: none"> • Mount gearwheels and toothed belt pulleys on the output shaft without using force. • Never use a reaming or hitting action for mounting! • Only use suitable tools for the installation! • Ensure that the static axial forces permitted for the output bearings are not exceeded.
---	--

Procedure

	Center the gear unit in the machine bed. Coat the four fastening screws with a threadlocker (e.g. Loctite 243). Attach the gear unit to the machine with the fastening screws through the through-holes Install the gear unit such that the name plate remains readable. Do not use washers or toothed washers.
--	---

Supplementary information on attaching the gear unit to a machine

Thread in the output flange			
Gear size AG2400-+TP	Pitch circle Ø [mm]	Number x thread x depth [] x [mm] x [mm]	Tightening torque [Nm] Strength class 12.9
004 MF	31.5	8 x M5 x 7	9
010 MF	50	8 x M6 x 10	15.4
025 MF	63	12 x M6 x 12	15.4
050 MF	80	12 x M8 x 15	37.3
110 MF	125	12 x M10 x 20	73.4
300 MF	140	12 x M16 x 31	310
60500 MF	160	12 x M20 x 31	604
010 MA	50	12 x M6 x 10	15.4
025 MA	63	12 x M8 x 12	31.3
050 MA	80	12 x M10 x 15	73.4
110 MA	125	12 x M12 x 19	126
300 MA	145	12 x M20 x 31	604
500 MA	166	12 x M24 x 37	1042
MA = HIGH TORQUE			

Through-holes in the gear housing				
Gear size AG2400-+TP	Pitch circle Ø [mm]	Number x diam- eter [] x [mm]	For bolt size / strength class	Tightening torque [Nm]
004 MF	79	8 x 4.5	M4 / 12.9	4.55
010 MF	109	8 x 5.5	M5 / 12.9	9
025 MF	135	8 x 5.5	M5 / 12.9	9
050 MF	168	12 x 6.6	M6 / 12.9	15.4
110 MF	233	12 x 9.0	M8 / 12.9	37.3
300 MF	280	16 x 13.5	M12 / 12.9	126
60500 MF	310	16 x 13.5	M12 / 12.9	126
010 MA	109	16 x 5.5	M5 / 12.9	9
025 MA	135	16 x 5.5	M5 / 12.9	9
050 MA	168	24 x 6.6	M6 / 12.9	15.4
110 MA	233	24 x 9.0	M8 / 12.9	37.3
300 MA	280	32 x 13.5	M12 / 12.9	126
500 MA	285	32 x 13.5	M12 / 12.9	126
MA = HIGH TORQUE				

7.4 Tightening torques for common thread sizes

The specified tightening torques for stud bolts and nuts are book values based on the following conditions:

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

The settings are rounded to commercial scaling or setting options

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

8 Technical data

Definition	
Equivalent force on the output (F_{2_eq})	The equivalent force on the output (F_{2_eq}) describes the force that is relevant for dimensioning the gear unit.
Equivalent application torque (T_{2_eq})	The equivalent application torque (T_{2_eq}) describes the torque that is relevant for dimensioning the gear unit.
Dimensioning factor (f_a)	The dimensioning factor (f_a) 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 (K_M) describes the influence of duty cycle, number of cycles and dynamics on the application torque.
Mass moment of inertia (based on the drive)	The mass moment of inertia J is a measure for the tendency of a body to maintain its motion state (whether at rest or in motion).
Running noise (L_{PA})	Low running noise (L_{PA}) of an application is becoming increasingly important for environmental and health reasons. The gear ratio and speed affect the running noise. In general, the following rule applies: Higher speed = higher running noise Higher gear ratio = lower running noise
Max. radial force (F_{2R})	The radial force (F_{2R}) is the force component that acts at right angles to the output shaft or 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.
Max. torque at the output (T_{2a})	(T_{2a}) represents the maximum torque that can be transferred by the gear unit. This value may be lower, depending on application-specific boundary conditions.
EMERGENCY STOP torque ($T_{2Em.stop}$)	The EMERGENCY STOP torque ($T_{2Em.stop}$) is the maximum permitted torque at the gear unit output. It may be reached up to 1000 times during the service life of the gear unit and must never be exceeded.

Maximum drive speed (n_{1max}) and permitted mean drive speed (n_{1N})

The two speeds that are relevant for gear unit dimensioning are the maximum and the rated speed at the drive. The maximum permitted speed (n_{1max}) must not be exceeded. Cycle operation is dimensioned based on this value.

The permitted mean drive speed (n_{1N}) must not be exceeded during continuous operation. The rated speed is limited by the housing temperature, which may not exceed 90 °C. The value specified in the technical data applies at an ambient temperature of + 20 °C.

This means: For higher ambient temperatures the rated input speed must be reduced.

8.1 TP004

TP004		1-stage			
Ratio ^{a)}	i	4	5	7	10
Max. acceleration torque	T _{2B} Nm		55		35
Nominal output torque	T _{2N} Nm		28		18
EMERGENCY STOP torque	T _{2Em.stop} Nm		100		
Nominal input speed ^{b)}	n _{1N} min ⁻¹	3300		4000	
Max. continuous speed	n _{1Max} min ⁻¹		6000		
Average no-load running torque	T ₀₁₂ Nm	0.95	0.80	0.60	0.45
Max. torsional backlash	j _t arcmin	Standard ≤ 4 / Reduced ≤ 2			
Torsional rigidity ^{c)}	Nm/arcmin	12		11	8
Tilting rigidity	Nm/arcmin		---		
Max. axial force ^{d)}	F _{2AMax} N		1630		
Max. breakdown torque	M2K _{max} Nm		110		
Efficiency	μ %		97		
Service life	L _h		> 20,000		
Weight	m kg		1.4		
Running noise	L _{PA} dB(A)		≤ 58		
Max. perm. housing temperature	°C		+ 90		
Ambient temperature	°C		- 15 ... + 40		
Lubrication		lubricated for life			
Paint finish		Grey			
Direction of rotation		Input and output side in the same direction			
Protection class		IP 65			

TP004		Ratio			
Mass moment of inertia (based on the drive)		4	5	7	10
B 11	J ₁ kgcm ²	0.17	0.14	0.11	0.09
C 14	J ₁ kgcm ²	0.25	0.21	0.18	0.17
E 19	J ₁ kgcm ²	0.57	0.54	0.51	0.49

- a) Other ratios available on request.
- b) Please reduce the speed at higher ambient temperatures.
- c) Applies to a clamping hub diameter of 14 mm.
- d) Based on shaft or flange center from output.

TP004		2-stage												
Ratio ^{a)}	i	16	20	21	25	28	31	35	40	50	61	70	91	100
Max. acceleration torque	T _{2B} Nm	55	40	55	40		55		45	55	32	35		
Nominal output torque	T _{2N} Nm	40	30	40	30		40		30	40	15	18		
EMERGENCY STOP torque	T _{2Em.stop} Nm						100							
Nominal input speed ^{b)}	n _{IN} min ⁻¹						4000		4800		5500			
Max. continuous speed	n _{1Max} min ⁻¹						6000							
Average no-load running torque	T ₀₁₂ Nm	0.55		0.45			0.35	0.30	0.25		0.20			
Max. torsional backlash	j _t arcmin						Standard ≤ 4 / Reduced ≤ 2							
Torsional rigidity ^{c)}	Nm/arcmin	12		10	12		9	12	11	12	9	11	7	8
Tilting rigidity	Nm/arcmin						---							
Max. axial force ^{d)}	F _{2AMax} N						1630							
Max. breakdown torque	M _{2K_{max}} Nm						110							
Efficiency	μ %						94							
Service life	L _h						> 20,000							
Weight	m kg						1.5							
Running noise	L _{PA} dB(A)						≤ 58							
Max. perm. housing temperature	°C						+ 90							
Ambient temperature	°C						-15 ... + 40							
Lubrication							lubricated for life							
Paint finish							Grey							
Direction of rotation							Input and output side in the same direction							
Protection class							IP 65							

TP004		Ratio												
Mass moment of inertia (based on the drive)		16	20	21	25	28	31	35	40	50	61	70	91	100
B 11	J ₁ kgcm ²	0.078	0.070	0.074	0.068	0.062	0.072	0.061	0.057	0.058	0.056	0.057	0.056	
C 14	J ₁ kgcm ²		0.17		0.16		0.17	0.16		0.15				
E 19	J ₁ kgcm ²						---							

a) Other ratios available on request.

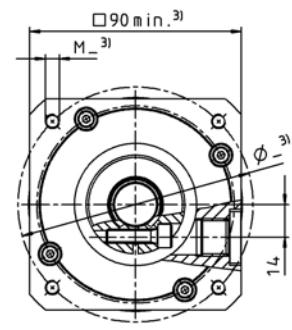
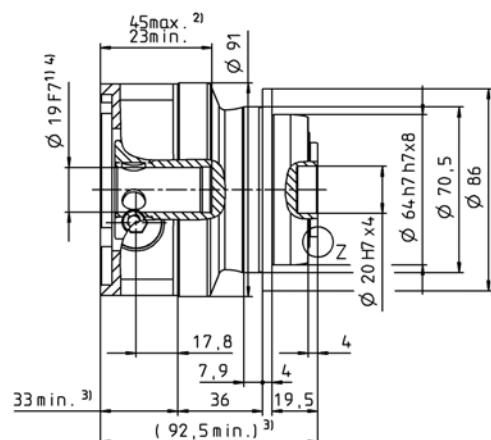
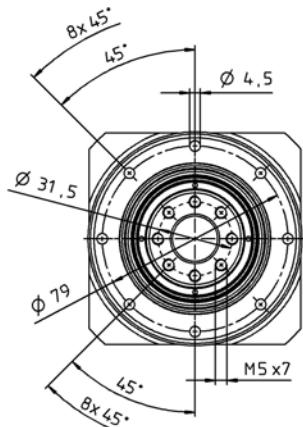
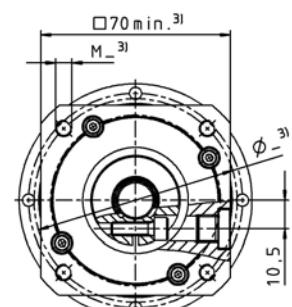
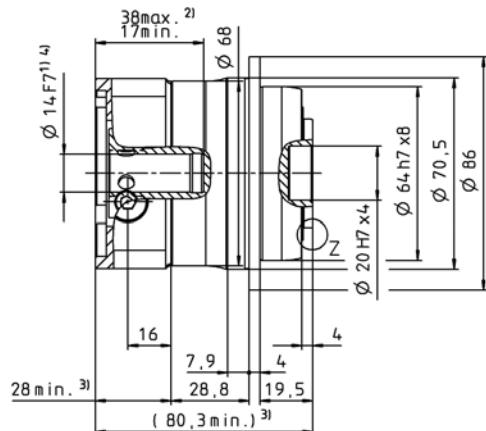
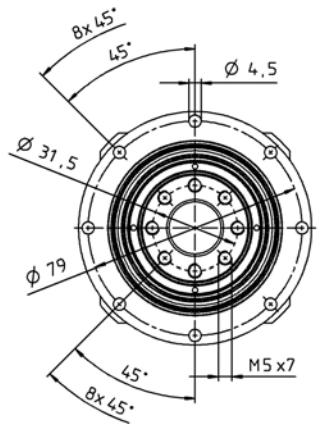
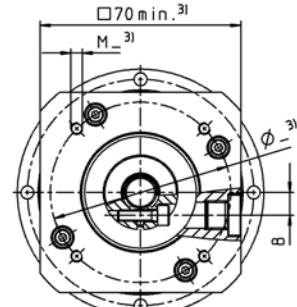
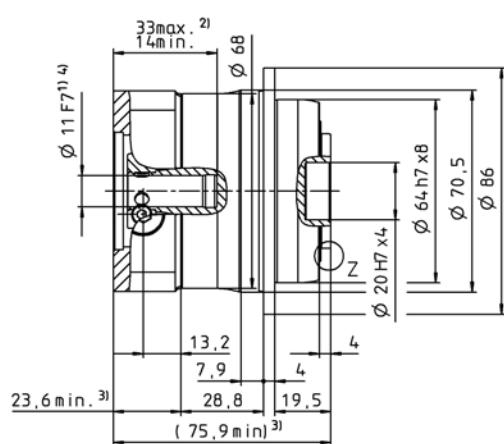
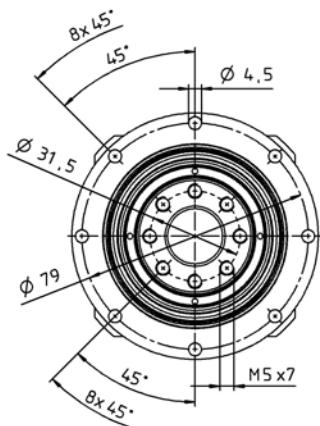
b) Please reduce the speed at higher ambient temperatures.

c) Applies to a clamping hub diameter of 11 mm.

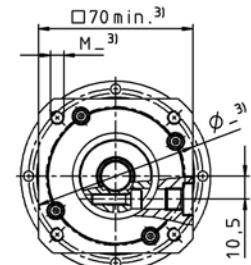
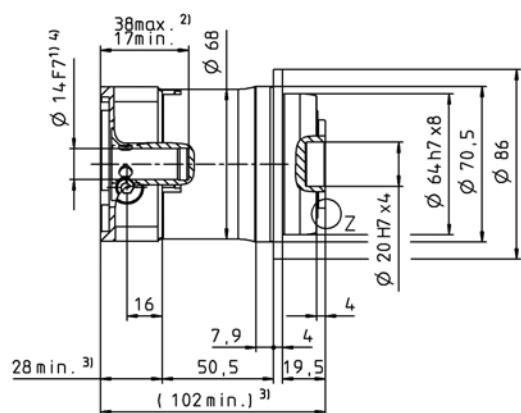
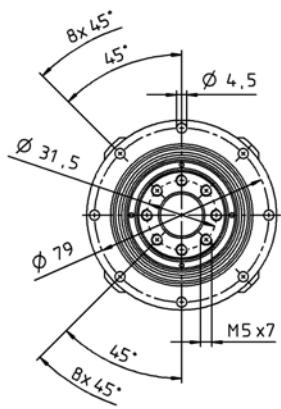
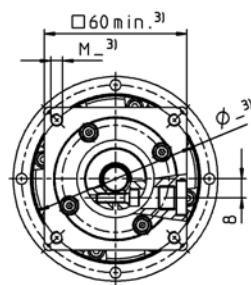
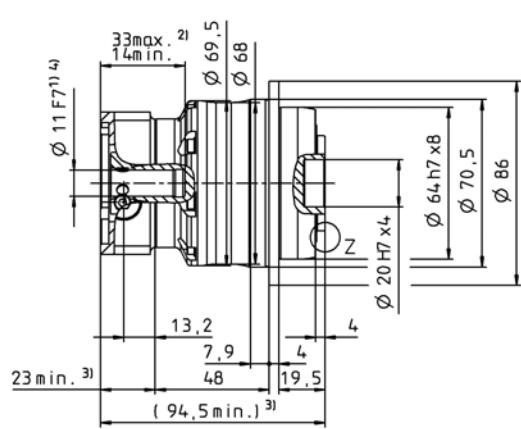
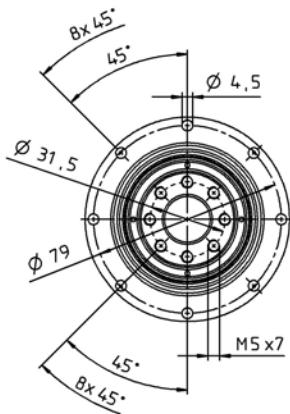
d) Based on shaft or flange center from output.

8.1.1 Dimensional drawing TP004

1-stage



2-stage



8.2 TP010

TP010		1-stage			
Ratio ^{a)}	i	4	5	7	10
Max. acceleration torque	T _{2B} Nm		143		105
Nominal output torque	T _{2N} Nm		75		60
EMERGENCY STOP torque	T _{2Em.stop} Nm		250		
Nominal input speed ^{b)}	n _{1N} min ⁻¹	2600	2900	3100	
Max. continuous speed	n _{1Max} min ⁻¹		6000		
Average no-load running torque	T ₀₁₂ Nm	1.6	1.3	1.0	0.7
Max. torsional backlash	j _t arcmin	Standard ≤ 3 / Reduced ≤ 1			
Torsional rigidity ^{c)}	Nm/arcmin	32	33	30	23
Tilting rigidity	Nm/arcmin		225		
Max. axial force ^{d)}	F _{2AMax} N		2150		
Max. breakdown torque	M _{2K_{max}} Nm		270		
Efficiency	μ %		97		
Service life	L _h		> 20,000		
Weight	m kg		3.8		
Running noise	L _{PA} dB(A)		≤ 59		
Max. perm. housing temperature	°C		+ 90		
Ambient temperature	°C		- 15 ... + 40		
Lubrication		lubricated for life			
Paint finish		Grey			
Direction of rotation		Input and output side in the same direction			
Protection class		IP 65			

TP010		Ratio			
Mass moment of inertia (based on the drive)		4	5	7	10
C 14	J ₁ kgcm ²	0.78	0.62	0.48	0.40
E 19	J ₁ kgcm ²	0.95	0.79	0.64	0.57
G 24	J ₁ kgcm ²	2.32	2.16	2.02	1.94

- a) Other ratios available on request.
- b) Please reduce the speed at higher ambient temperatures.
- c) Applies to a clamping hub diameter of 19 mm.
- d) Based on shaft or flange center from output.

TP010		2-stage												
Ratio ^{a)}	i	16	20	21	25	28	31	35	40	50	61	70	91	100
Max. acceleration torque	T _{2B} Nm	143	100	143	110	143	140	143	110	143	80	143	80	105
Nominal output torque	T _{2N} Nm	90	80	90	70	90	80	90	70	90	35	60		
EMERGENCY STOP torque	T _{2Em.stop} Nm						250							
Nominal input speed ^{b)}	n _{IN} min ⁻¹				3500			3800			4500			
Max. continuous speed	n _{INmax} min ⁻¹						6000							
Average no-load running torque	T ₀₁₂ Nm	0.90	0.75	0.70	0.65	0.55	0.50	0.40	0.35		0.30			
Max. torsional backlash	j _t arcmin						Standard ≤ 3 / Reduced ≤ 1							
Torsional rigidity ^{c)}	Nm/arcmin	32	26	32	31	24	32	30	24	28	21	22		
Tilting rigidity	Nm/arcmin						225							
Max. axial force ^{d)}	F _{2Amax} N						2150							
Max. breakdown torque	M _{2Kmax} Nm						270							
Efficiency	μ %						94							
Service life	L _h						> 20,000							
Weight	m kg						3.6							
Running noise	L _{PA} dB(A)						≤ 58							
Max. perm. housing temperature	°C						+ 90							
Ambient temperature	°C						-15 ... + 40							
Lubrication							lubricated for life							
Paint finish							Grey							
Direction of rotation							Input and output side in the same direction							
Protection class							IP 65							

TP010		Ratio												
Mass moment of inertia (based on the drive)		16	20	21	25	28	31	35	40	50	61	70	91	100
B 11	J ₁ kgcm ²	0.17	0.14	0.15	0.13	0.11	0.13	0.10			0.09			
C 14	J ₁ kgcm ²	0.24	0.21	0.22	0.20	0.18	0.21	0.18		0.17		0.16		
E 19	J ₁ kgcm ²	0.56	0.53	0.55	0.53	0.51	0.53	0.50			0.49			

a) Other ratios available on request.

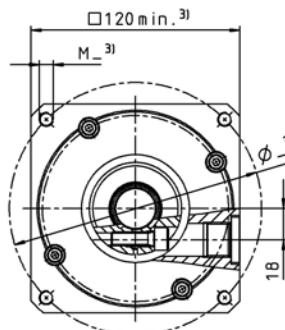
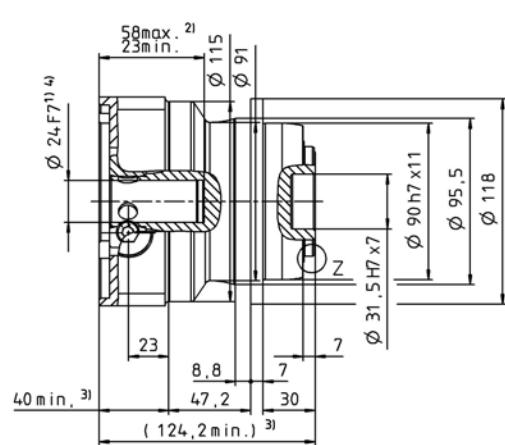
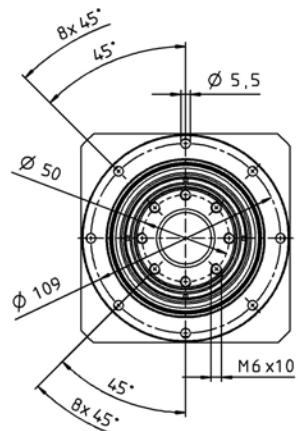
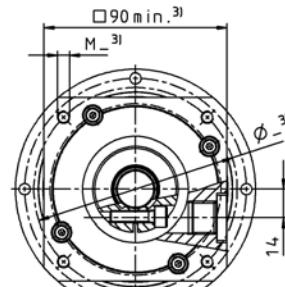
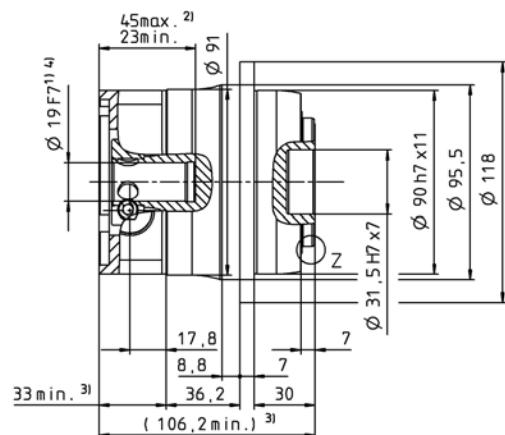
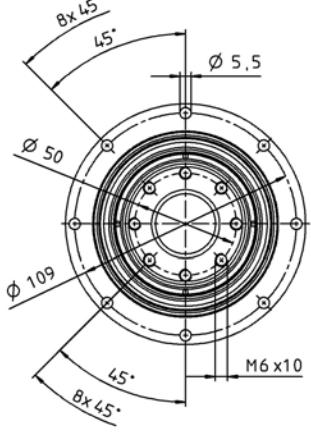
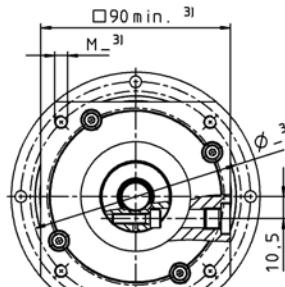
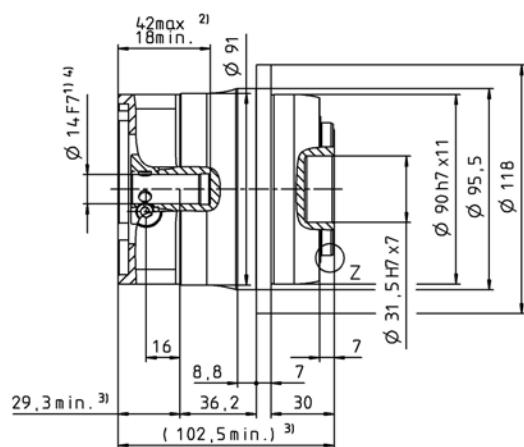
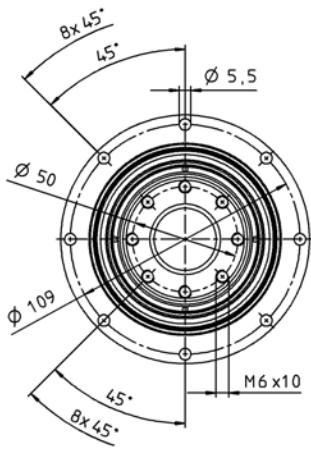
b) Please reduce the speed at higher ambient temperatures.

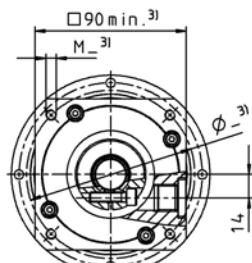
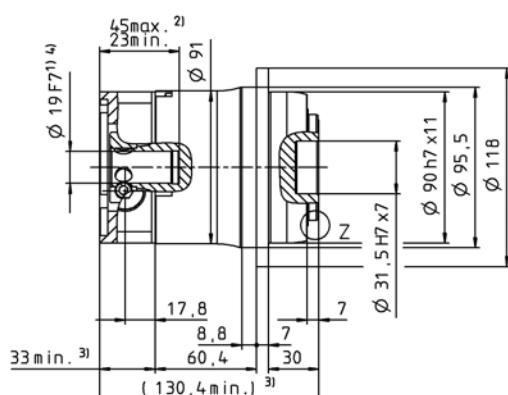
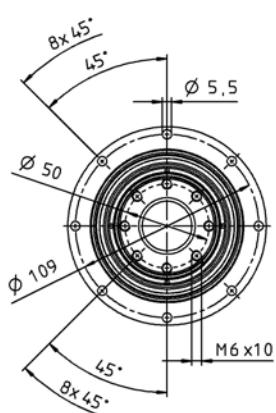
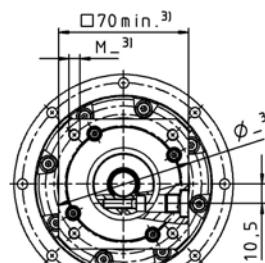
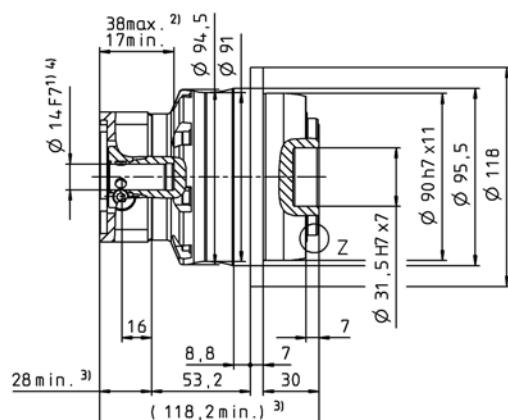
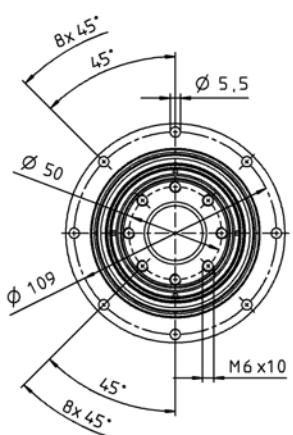
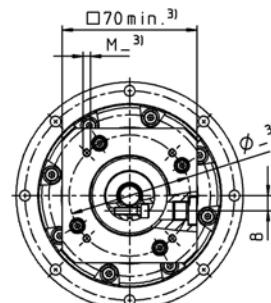
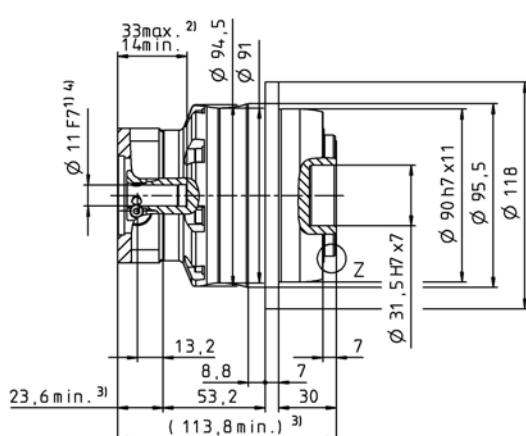
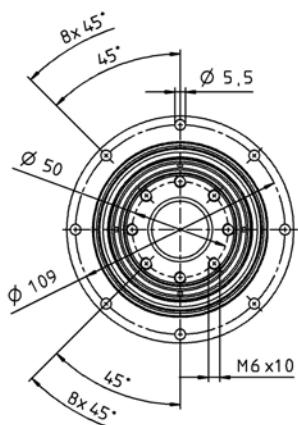
c) Applies to a clamping hub diameter of 14 mm.

d) Based on shaft or flange center from output.

8.2.1 Dimensional drawing TP010

1-stage



2-stage

8.3 TP025

TP025		1-stage			
Ratio ^{a)}	i	4	5	7	10
Max. acceleration torque	T _{2B} Nm	350	380	330	264
Nominal output torque	T _{2N} Nm		170		120
EMERGENCY STOP torque	T _{2Em.stop} Nm		625		
Nominal input speed ^{b)}	n _{1N} min ⁻¹	2300		2500	
Max. continuous speed	n _{1Max} min ⁻¹		4500		
Average no-load running torque	T ₀₁₂ Nm	3.3	2.7	2.0	1.4
Max. torsional backlash	j _t arcmin		Standard ≤ 3 / Reduced ≤ 1		
Torsional rigidity ^{c)}	Nm/arcmin	80	86	76	62
Tilting rigidity	Nm/arcmin		550		
Max. axial force ^{d)}	F _{2Amax} N		4150		
Max. breakdown torque	M _{2K_{max}} Nm		440		
Efficiency	μ %		97		
Service life	L _h		> 20,000		
Weight	m kg		6.5		
Running noise	L _{PA} dB(A)		≤ 59		
Max. perm. housing temperature	°C		+ 90		
Ambient temperature	°C		-15 ... + 40		
Lubrication			lubricated for life		
Paint finish			Grey		
Direction of rotation			Input and output side in the same direction		
Protection class			IP 65		

TP025		Ratio			
Mass moment of inertia (based on the drive)		4	5	7	10
E 19	J ₁ kgcm ²	2.59	2.11	1.69	1.45
G 24	J ₁ kgcm ²	3.28	2.80	2.38	2.14
H 28	J ₁ kgcm ²	2.89	2.41	1.99	1.75
K 38	J ₁ kgcm ²	10.3	9.87	9.45	9.21

a) Other ratios available on request.

b) Please reduce the speed at higher ambient temperatures.

c) Applies to a clamping hub diameter of 24 mm and 28 mm.

d) Based on shaft or flange center from output.

TP025		2-stage												
Ratio ^{a)}	i	16	20	21	25	28	31	35	40	50	61	70	91	100
Max. acceleration torque	T _{2B} Nm	350	300	380	350	300	380	350	380	280	320	250	265	
Nominal output torque	T _{2N} Nm	200	210	170	200	210	190	220	200	220	170	200	100	120
EMERGENCY STOP torque	T _{2Em.stop} Nm												625	
Nominal input speed ^{b)}	n _{IN} min ⁻¹						2800			3100		3500		4200
Max. continuous speed	n _{1Max} min ⁻¹									6000				
Average no-load running torque	T ₀₁₂ Nm	1.8	1.5	1.4		1.1	1.0	0.8		0.7		0.6		
Max. torsional backlash	j _t arcmin						Standard ≤ 3 / Reduced ≤ 1							
Torsional rigidity ^{c)}	Nm/arcmin	81	70	83	80	54	82	76	80	61	71	55	60	
Tilting rigidity	Nm/arcmin									550				
Max. axial force ^{d)}	F _{2Amax} N									4150				
Max. breakdown torque	M _{2K_{max}} Nm									440				
Efficiency	μ %									94				
Service life	L _h									> 20,000				
Weight	m kg									6.7				
Running noise	L _{PA} dB(A)									≤ 58				
Max. perm. housing temperature	°C									+ 90				
Ambient temperature	°C									-15 ... + 40				
Lubrication											lubricated for life			
Paint finish											Grey			
Direction of rotation											Input and output side in the same direction			
Protection class											IP 65			

TP025		Ratio												
Mass moment of inertia (based on the drive)		16	20	21	25	28	31	35	40	50	61	70	91	100
C 14	J1 kgcm ²	0.66	0.55	0.60	0.53	0.44	0.55	0.43	0.38	0.38	0.39	0.37	0.38	0.37
E 19	J1 kgcm ²	0.83	0.71	0.77	0.69	0.61	0.72	0.60	0.55	0.54	0.55		0.54	
G 24	J1 kgcm ²	2.20	2.08	2.14	2.06	1.98	2.09	1.97			1.92		1.91	1.92

a) Other ratios available on request.

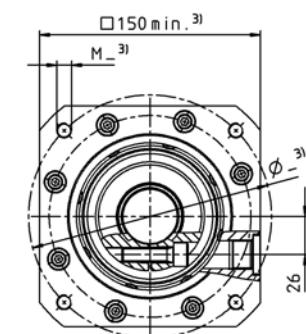
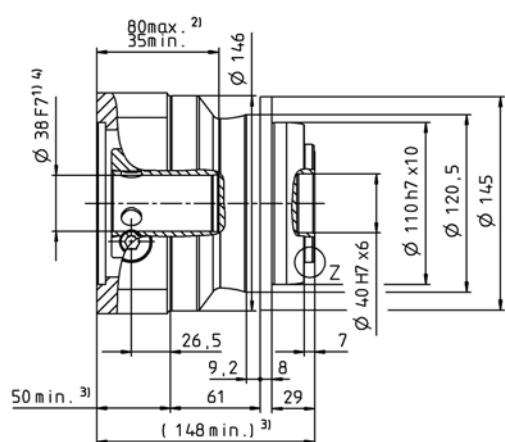
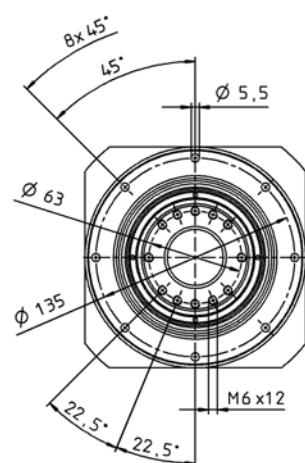
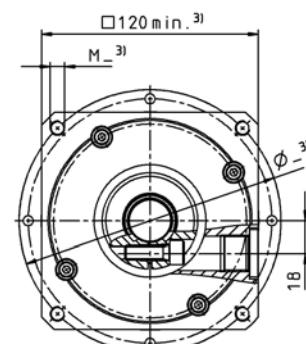
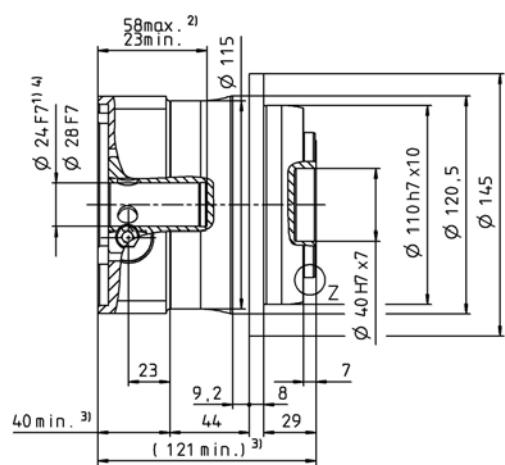
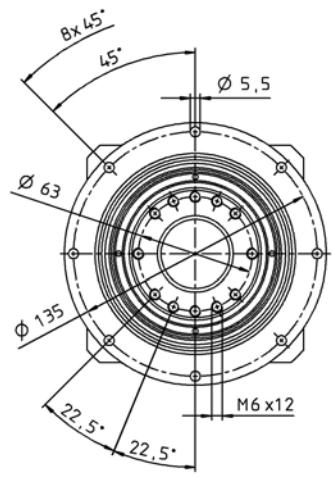
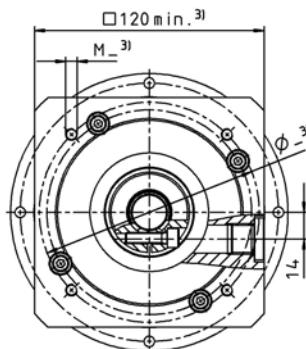
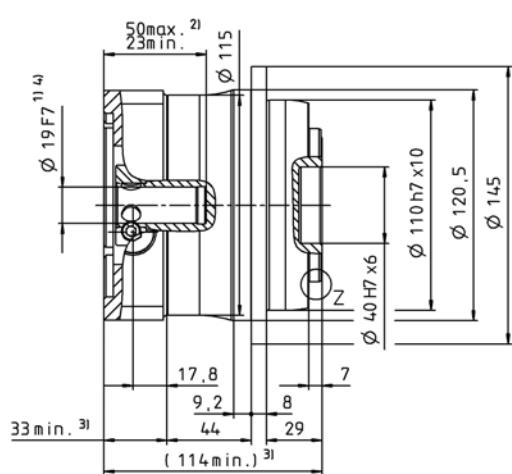
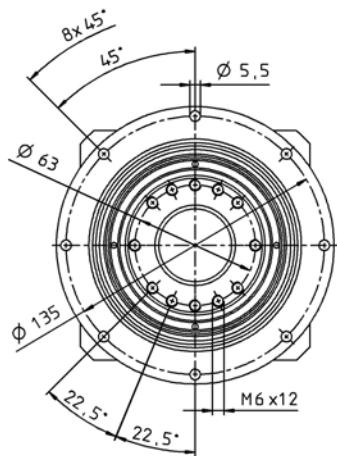
b) Please reduce the speed at higher ambient temperatures.

c) Applies to a clamping hub diameter of 19 mm.

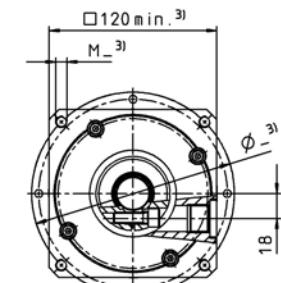
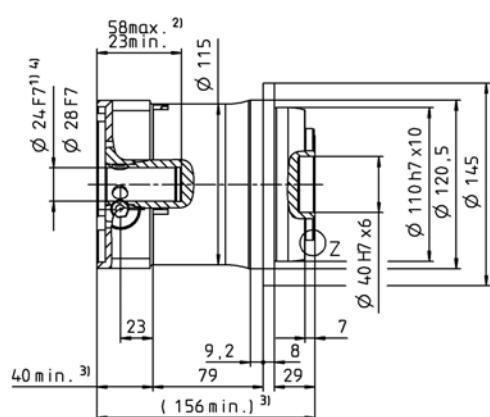
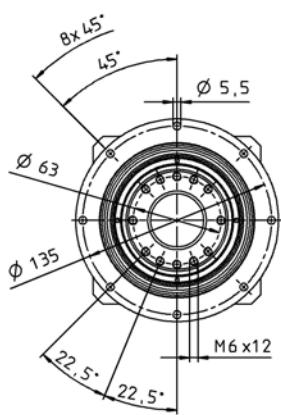
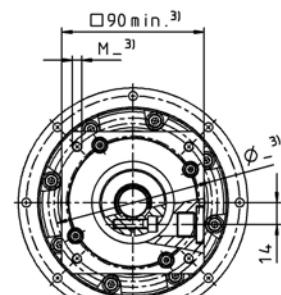
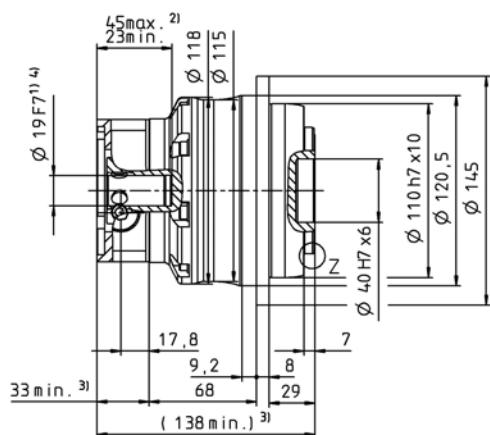
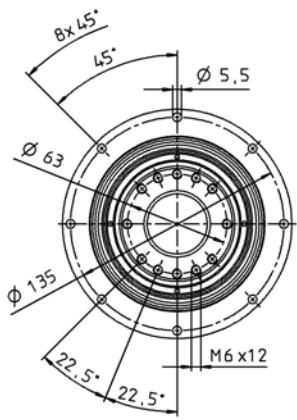
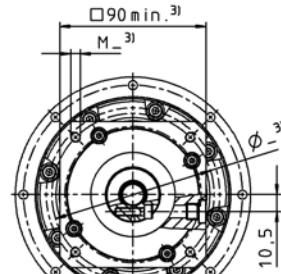
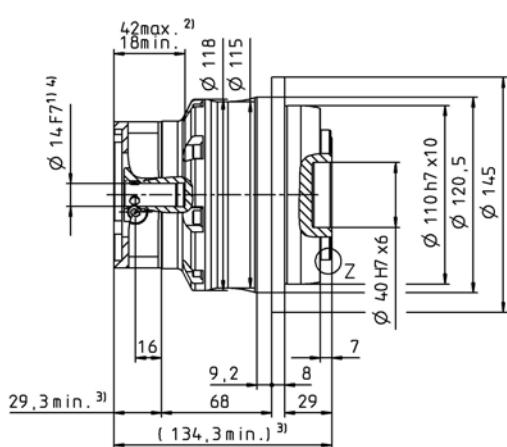
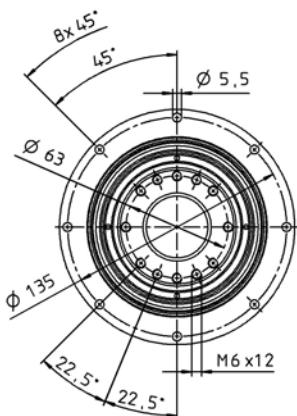
d) Based on shaft or flange center from output.

8.3.1 Dimensional drawing TP025

1-stage



2-stage



8.4 TP050

TP050		1-stage			
Ratio ^{a)}	i	4	5	7	10
Max. acceleration torque	T _{2B} Nm		700		540
Nominal output torque	T _{2N} Nm		370		240
EMERGENCY STOP torque	T _{2Em.stop} Nm		1250		
Nominal input speed ^{b)}	n _{1N} min ⁻¹	1900	2000	2500	
Max. continuous speed	n _{1Max} min ⁻¹		4000		
Average no-load running torque	T ₀₁₂ Nm	8.1	6.6	4.8	3.5
Max. torsional backlash	j _t arcmin		Standard ≤ 3 / Reduced ≤ 1		
Torsional rigidity ^{c)}	Nm/arcmin	190	187	159	123
Tilting rigidity	Nm/arcmin		560		
Max. axial force ^{d)}	F _{2Amax} N		6130		
Max. breakdown torque	M _{2K_{max}} Nm		1335		
Efficiency	μ %		97		
Service life	L _h		> 20,000		
Weight	m kg		14.0		
Running noise	L _{PA} dB(A)		≤ 59		
Max. perm. housing temperature	°C		+ 90		
Ambient temperature	°C		-15 ... + 40		
Lubrication			lubricated for life		
Paint finish			Grey		
Direction of rotation			Input and output side in the same direction		
Protection class			IP 65		

TP050		Ratio			
Mass moment of inertia (based on the drive)		4	5	7	10
G 24	J ₁ kgcm ²	9.47	7.85	6.39	5.54
I 32	J ₁ kgcm ²	12.6	11.0	9.55	8.71
K 38	J ₁ kgcm ²	13.7	12.1	10.6	9.78
M 48	J ₁ kgcm ²	28.3	26.7	25.3	24.4

a) Other ratios available on request.

b) Please reduce the speed at higher ambient temperatures.

c) Applies to a clamping hub diameter of 32 mm and 38 mm.

d) Based on shaft or flange center from output.

TP050		2-stage												
Ratio ^{a)}	i	16	20	21	25	28	31	35	40	50	61	70	91	100
Max. acceleration torque	T _{2B} Nm	750	600	750	620	750	550	700	500	540				
Nominal output torque	T _{2N} Nm	400	350			400	350	400	350	400	220	240		
EMERGENCY STOP torque	T _{2Em.stop} Nm						1250							
Nominal input speed ^{b)}	n _{IN} min ⁻¹					2900				3200		3900		
Max. continuous speed	n _{1Max} min ⁻¹						5000							
Average no-load running torque	T ₀₁₂ Nm	4.2	3.4	3.3	3.1	2.5	2.4	2.3	1.8	1.7	1.5	1.4	1.3	
Max. torsional backlash	j _t arcmin						Standard ≤ 3 / Reduced ≤ 1							
Torsional rigidity ^{c)}	Nm/arcmin	180	185	145	180	130	175	123	145	100	115			
Tilting rigidity	Nm/arcmin						560							
Max. axial force ^{d)}	F _{2Amax} N						6130							
Max. breakdown torque	M2K _{max} Nm						1335							
Efficiency	μ %						94							
Service life	L _h						> 20,000							
Weight	m kg						14.1							
Running noise	L _{PA} dB(A)						≤ 58							
Max. perm. housing temperature	°C						+ 90							
Ambient temperature	°C						-15 ... + 40							
Lubrication							lubricated for life							
Paint finish							Grey							
Direction of rotation							Input and output side in the same direction							
Protection class							IP 65							

TP050		Ratio												
Mass moment of inertia (based on the drive)		16	20	21	25	28	31	35	40	50	61	70	91	100
E 19	J1 kgcm ²	2.53	2.07	2.30	2.01	1.67	2.12	1.64	1.44	1.42	1.46	1.41	1.43	1.40
G 24	J1 kgcm ²	3.22	2.77	2.99	2.70	2.36	2.81	2.33	2.13	2.12	2.15	2.10	2.12	2.09
K 38	J1 kgcm ²	10.3	9.83	10.1	9.77	9.43	9.88	9.40	9.20	9.18	9.22	9.17	9.19	9.16

a) Other ratios available on request.

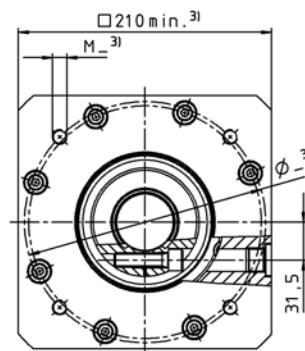
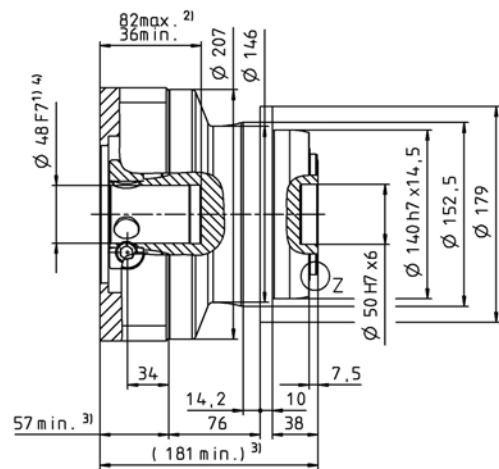
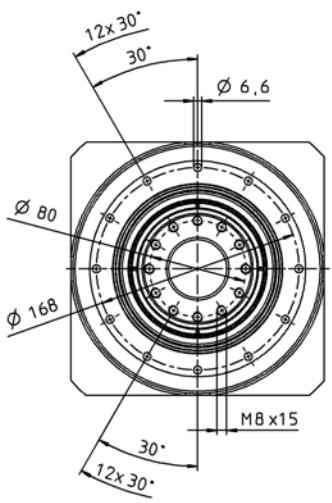
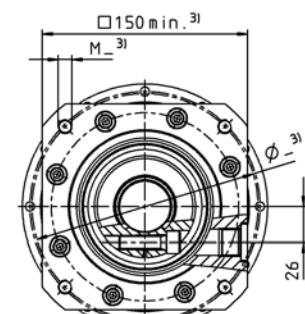
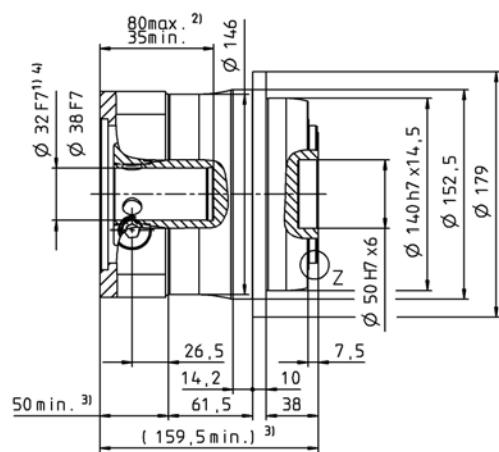
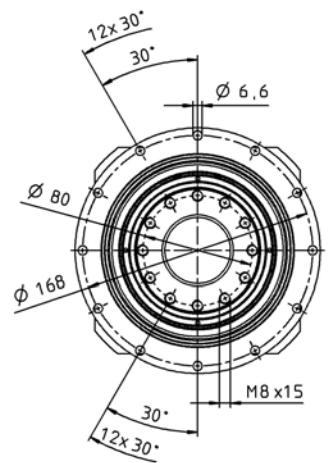
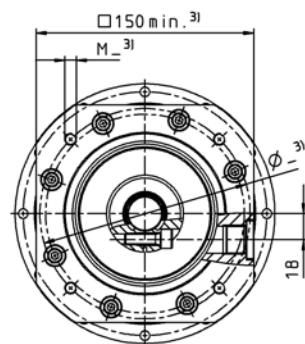
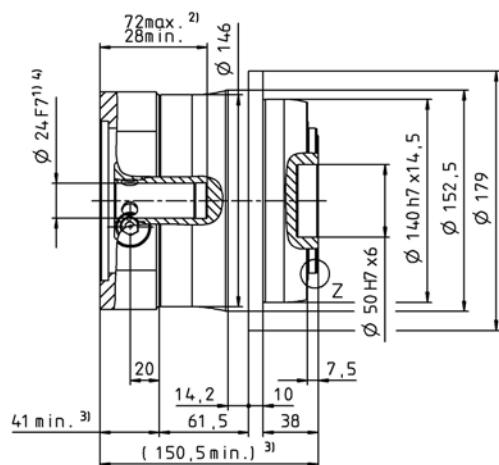
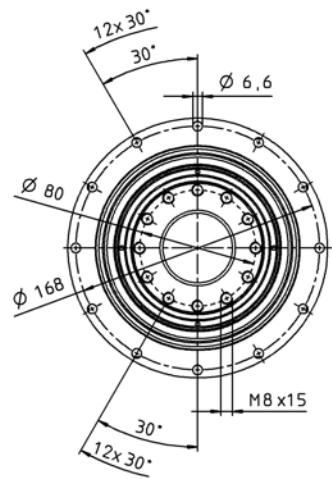
b) Please reduce the speed at higher ambient temperatures.

c) Applies to a clamping hub diameter of 24 mm.

d) Based on shaft or flange center from output.

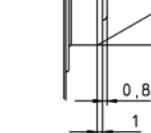
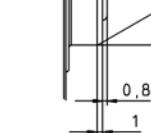
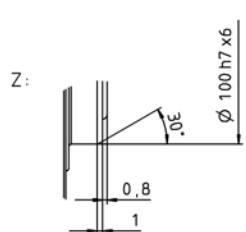
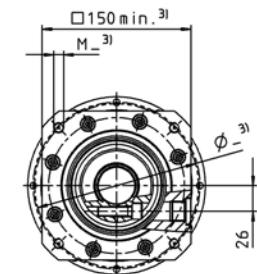
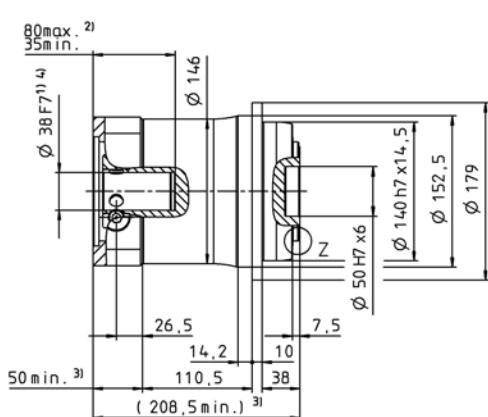
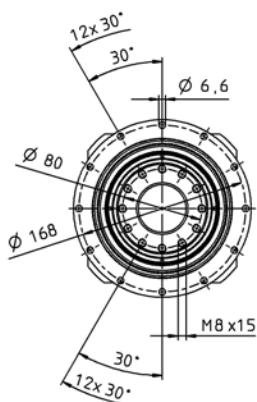
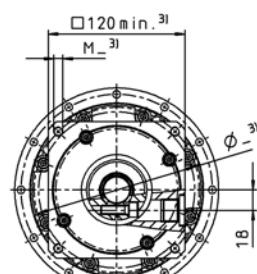
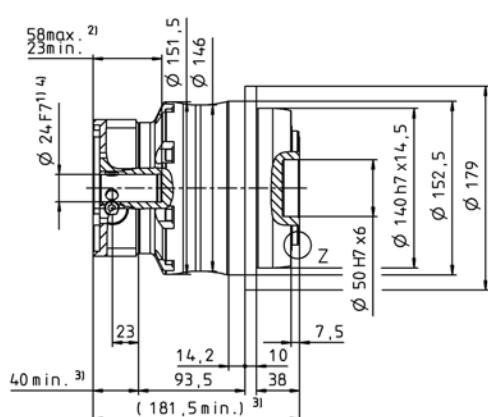
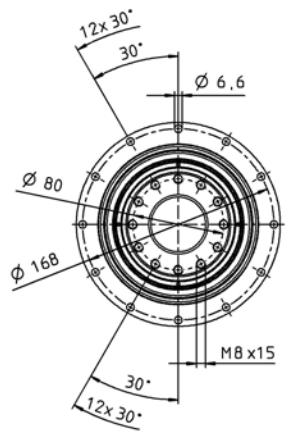
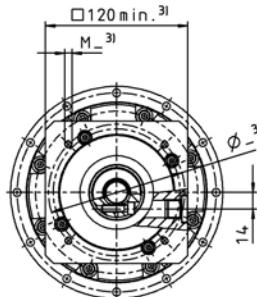
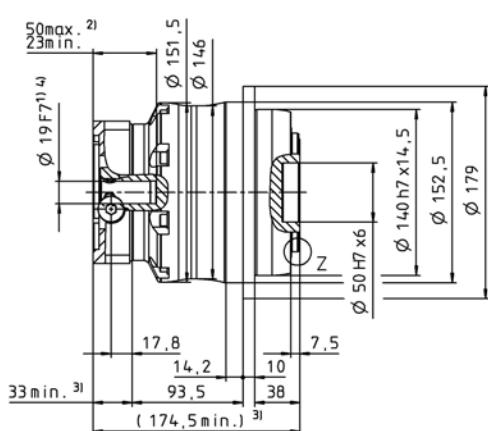
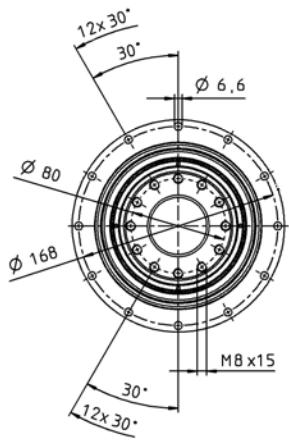
8.4.1 Dimensional drawing TP050

1-stage



2-stage

TP 0505-MF2 2091-D032529_02



8.5 TP110

TP110		1-stage			
Ratio ^{a)}	i	4	5	7	10
Max. acceleration torque	T _{2B} Nm	1600			1400
Nominal output torque	T _{2N} Nm	700	750		
EMERGENCY STOP torque	T _{2Em.stop} Nm	2750			
Nominal input speed ^{b)}	n _{1N} min ⁻¹	1400	1500	2000	
Max. continuous speed	n _{1Max} min ⁻¹	3500			
Average no-load running torque	T ₀₁₂ Nm	15.6	12.7	9.4	7.0
Max. torsional backlash	j _t arcmin	Standard ≤ 3 / Reduced ≤ 1			
Torsional rigidity ^{c)}	Nm/arcmin	610		550	445
Tilting rigidity	Nm/arcmin	1452			
Max. axial force ^{d)}	F _{2Amax} N	10050			
Max. breakdown torque	M _{2K_{max}} Nm	3280			
Efficiency	μ %	97			
Service life	L _h	> 20,000			
Weight	m kg	30.0			
Running noise	L _{PA} dB(A)	≤ 66			
Max. perm. housing temperature	°C	+ 90			
Ambient temperature	°C	-15 ... + 40			
Lubrication		lubricated for life			
Paint finish		Grey			
Direction of rotation		Input and output side in the same direction			
Protection class		IP 65			

TP110		Ratio			
Mass moment of inertia (based on the drive)		4	5	7	10
K 38	J ₁ kgcm ²	44.5	34.6	25.5	20.6
M 48	J ₁ kgcm ²	51.8	41.9	32.9	28.0
N 55	J ₁ kgcm ²	61.5	51.5	42.3	37.3

a) Other ratios available on request.

b) Please reduce the speed at higher ambient temperatures.

c) Applies to a clamping hub diameter of 48 mm.

d) Based on shaft or flange center from output.

TP110		2-stage												
Ratio ^{a)}	i	16	20	21	25	28	31	35	40	50	61	70	91	100
Max. acceleration torque	T _{2B} Nm	1600	1400	1600				140	160	130	140	0	0	0
Nominal output torque	T _{2N} Nm	980	850	1050	1250	850	105	110	900	700	800	0	0	0
EMERGENCY STOP torque	T _{2Em.stop} Nm	2750				2500				290	3200	3400		
Nominal input speed ^{b)}	n _{1N} min ⁻¹	2500				4500				0	3200			3400
Max. continuous speed	n _{1Max} min ⁻¹	4500				4500				4500				4500
Average no-load running torque	T ₀₁₂ Nm	6.9	5.6	5.5	5.0	4.1	3.9	3.7	3.0	2.7	2.5	2.4	2.2	2.2
Max. torsional backlash	j _t arcmin	Standard ≤ 3 / Reduced ≤ 1				Standard ≤ 3 / Reduced ≤ 1				Standard ≤ 3 / Reduced ≤ 1				Standard ≤ 3 / Reduced ≤ 1
Torsional rigidity ^{c)}	Nm/arcmin	585	580	465	570	560	440	560	520	525	415	480	360	395
Tilting rigidity	Nm/arcmin	1452				1452				1452				1452
Max. axial force ^{d)}	F _{2AMax} N	10050				10050				10050				10050
Max. breakdown torque	M2K _{max} Nm	3280				3280				3280				3280
Efficiency	μ %	94				94				94				94
Service life	L _h	> 20,000				> 20,000				> 20,000				> 20,000
Weight	m kg	34.0				34.0				34.0				34.0
Running noise	L _{PA} dB(A)	≤ 66				≤ 66				≤ 66				≤ 66
Max. perm. housing temperature	°C	+ 90				+ 90				+ 90				+ 90
Ambient temperature	°C	-15 ... 40°C				-15 ... 40°C				-15 ... 40°C				-15 ... 40°C
Lubrication		lubricated for life				lubricated for life				lubricated for life				lubricated for life
Paint finish		Grey				Grey				Grey				Grey
Direction of rotation		Input and output side in the same direction				Input and output side in the same direction				Input and output side in the same direction				Input and output side in the same direction
Protection class		IP 65				IP 65				IP 65				IP 65

TP110		Ratio												
Mass moment of inertia (based on the drive)		16	20	21	25	28	31	35	40	50	61	70	91	100
G 24	J ₁ kgcm ²	8.51	8.21	8.98	7.82	6.57	8.09	6.37	5.63	5.54	5.63	5.44	5.50	5.39
I 32	J ₁ kgcm ²	11.7	11.4	12.1	11.0	9.73	11.3	9.54	8.80	8.70	8.79	8.61	8.67	8.56
K 38	J ₁ kgcm ²	12.7	12.5	13.2	12.1	10.8	12.3	10.6	9.87	9.77	9.87	9.68	9.74	9.63
M 48	J ₁ kgcm ²	27.4	27.1	27.8	26.7	25.4	26.9	25.3	24.5	24.4	24.5	24.3	24.4	24.3

a) Other ratios available on request.

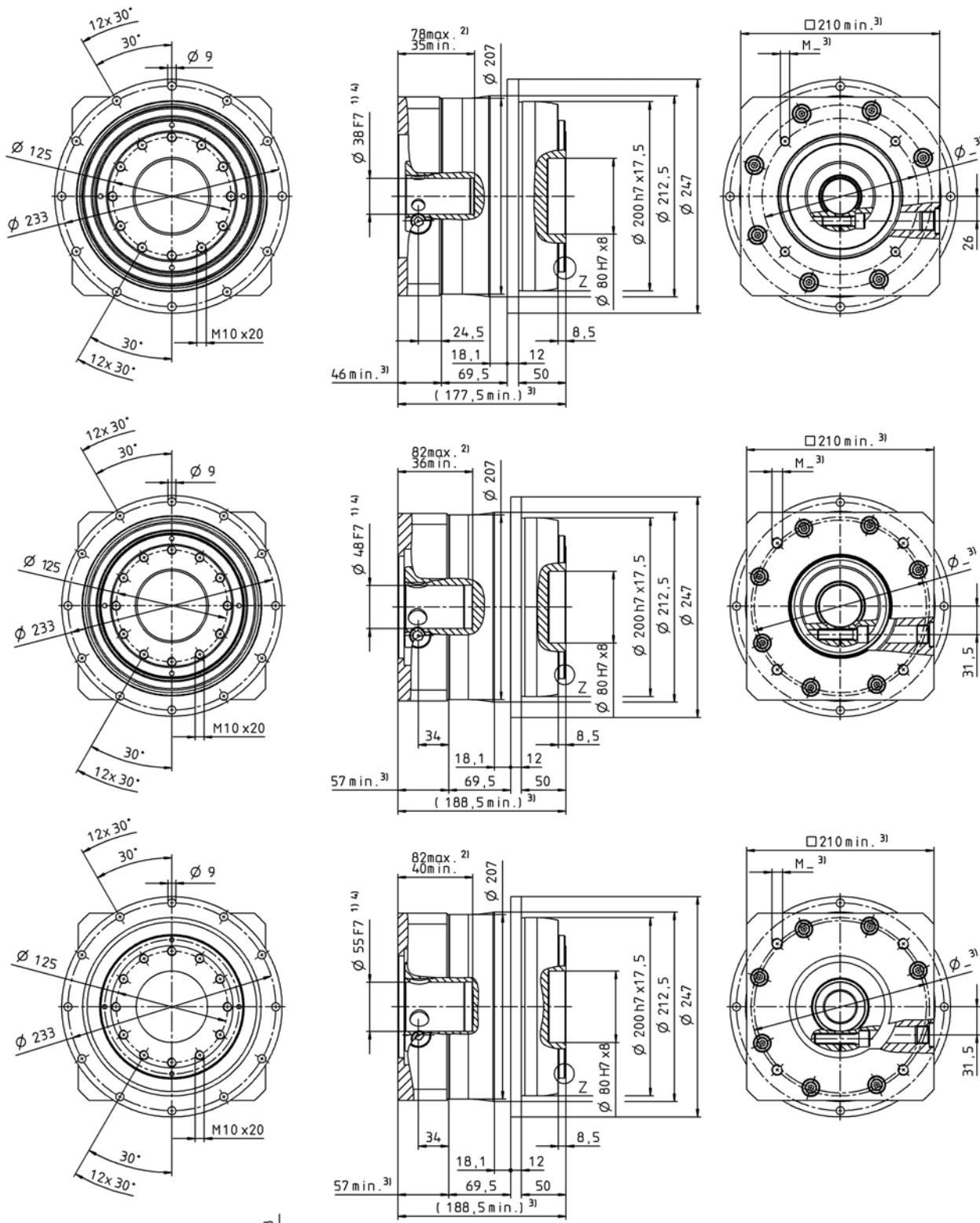
b) Please reduce the speed at higher ambient temperatures.

c) Applies to a clamping hub diameter of 32 mm and 38 mm.

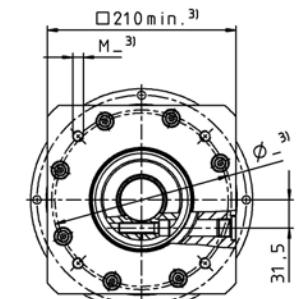
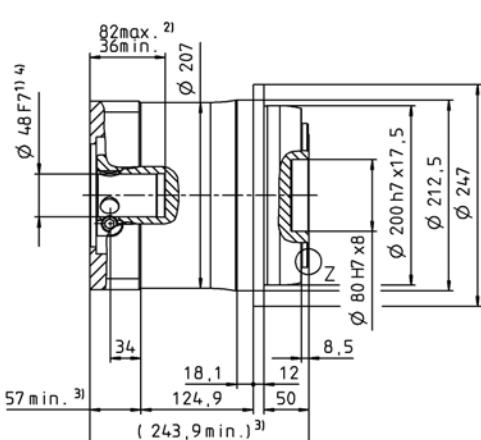
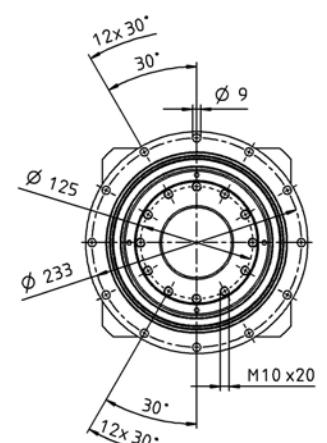
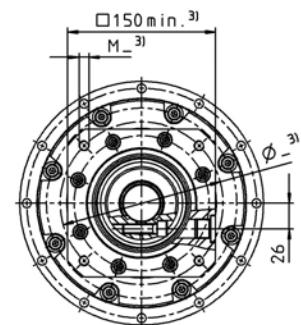
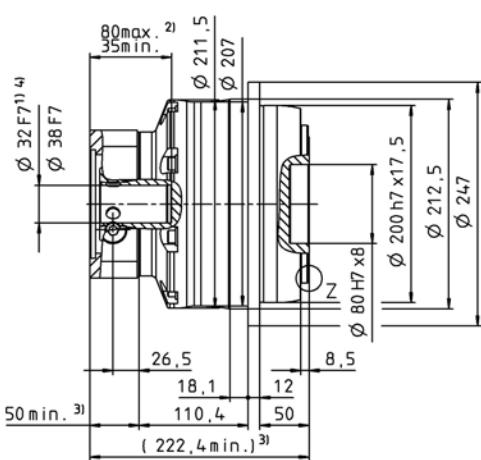
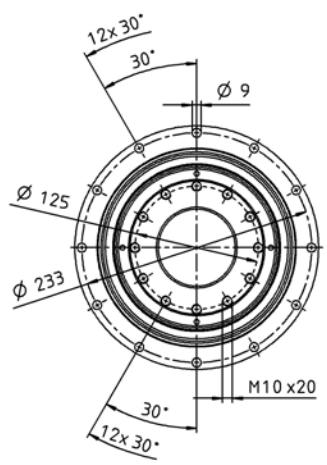
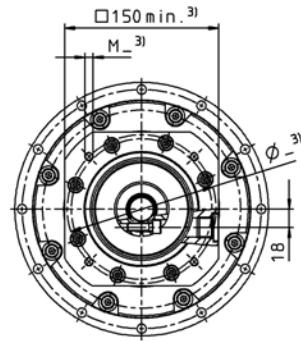
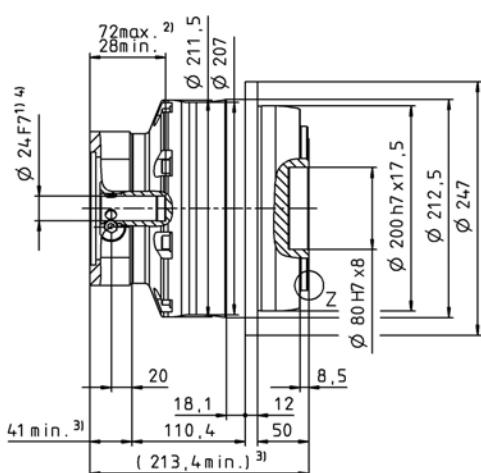
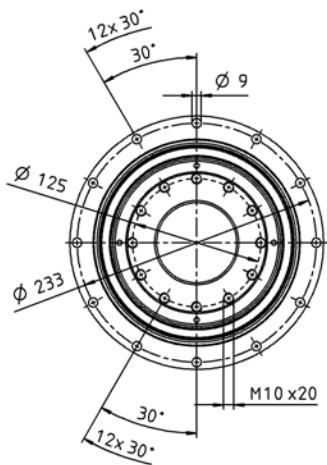
d) Based on shaft or flange center from output.

8.5.1 Dimensional drawing TP110

1-stage



2-stage



8.6 TP300

TP300	i	1-stage						2-stage							
		5	7	10	20	21	25	31	35	50	61	70	91	100	
Max. acceleration torque	T _{2B} Nm	3500	3300	1900	3500	3400		3500		3000	2800	3300		2800	
Nominal output torque	T _{2N} Nm	2200	1800	1000	2300	2100	2400	2200	2500	1900	1600	1800		1600	
EMERGENCY STOP torque	T _{2Em.stop} Nm									8750					
Nominal input speed ^{b)}	n _{1N} min ⁻¹	1000	1400	1700			2000		2300		2400		2500		
Max. continuous speed	n _{1Max} min ⁻¹		2500						3500						
Average no-load running torque	T ₀₁₂ Nm	23	17	11	10	9.5	9.0	7.0	6.0	5.0	4.0		3.5		
Max. torsional backlash	j _t arcmin											Standard ≤ 3 / Reduced ≤ 1			
Torsional rigidity ^{c)}	Nm/arcmin	1000	900	700	850	800	950	750	900	800	700	800	600	650	
Tilting rigidity	Nm/arcmin									5560					
Max. axial force ^{d)}	F _{2AMax} N									33000					
Max. breakdown torque	M _{2K_{max}} Nm		3900							5900					
Efficiency	μ %	95								93					
Service life	L _h									> 20,000					
Weight	m kg		60							58.5					
Running noise	L _{PA} dB(A)									≤ 64					
Max. perm. housing temperature	°C									+ 90					
Ambient temperature	°C									-15 ... + 40					
Lubrication										lubricated for life					
Paint finish										Grey					
Direction of rotation										Input and output side in the same direction					
Protection class										IP 65					
Mass moment of inertia (based on the drive)	M 48	J1 kgcm ²	---	---	---	31.6	27.7	26.6	26.1	25.0	24.1	24.0	23.9	23.8	
	N 55	J1 kgcm ²	86.6	63.8	51.4	---	---	---	---	---	---	---	---	---	---

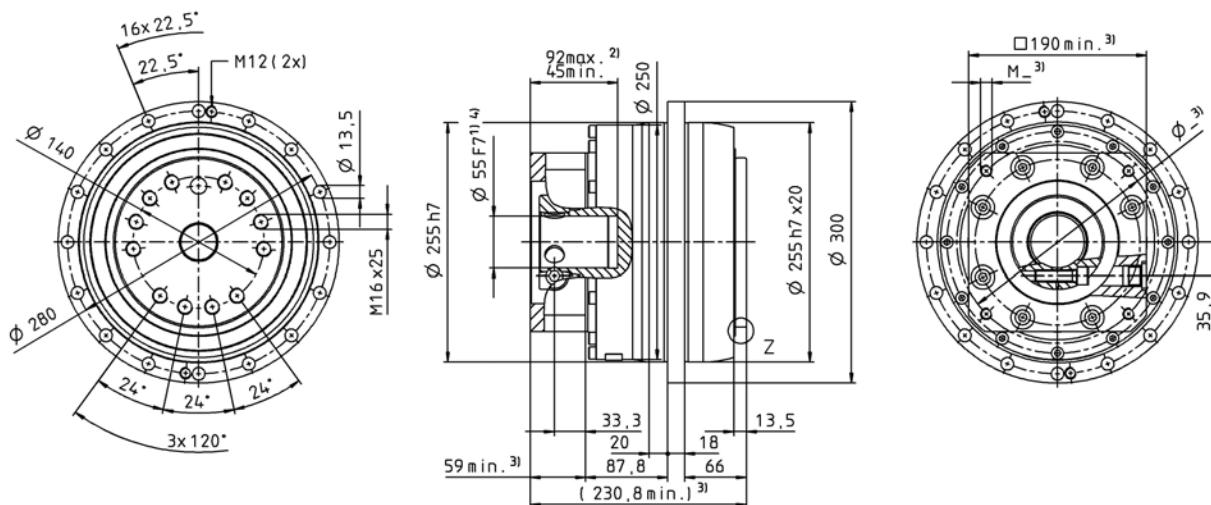
a) Other ratios available on request.

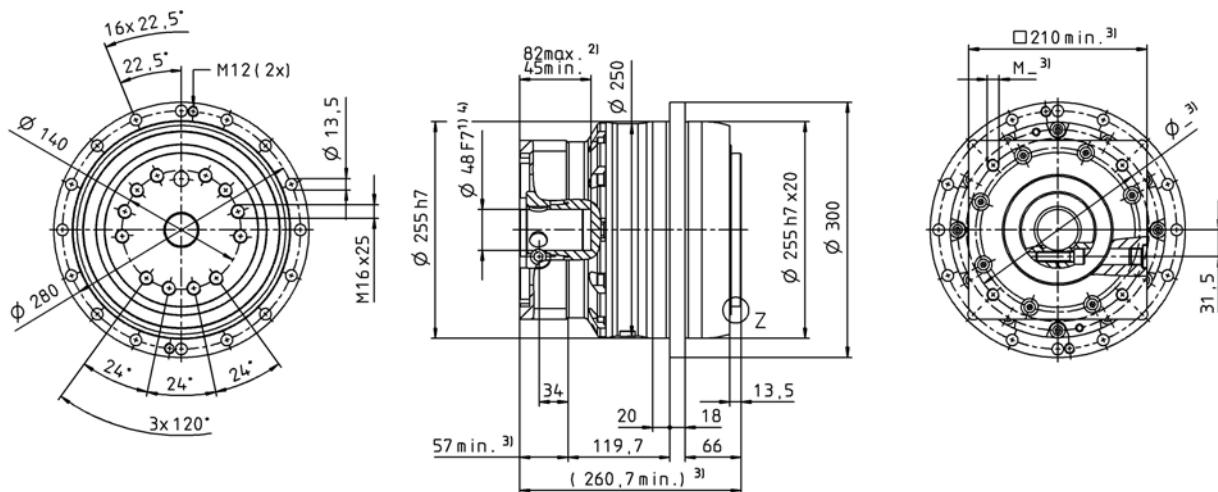
b) Please reduce the speed at higher ambient temperatures.

c) Based on shaft or flange center from output.

8.6.1 Dimensional drawing TP300

1-stage



2-stage**8.7 TP500**

TP500	Ratio ^{a)}	i	1-stage				2-stage								
			5	7	10	20	21	25	31	35	50	61	70	91	100
Max. acceleration torque	T _{2B} Nm		6000	5000	3400	6000	5000		6000		4500	4800	5000		4800
Nominal output torque	T _{2N} Nm		3250	2800	1700	3350	3200	3800	3700	3800		2900	2800		2900
EMERGENCY STOP torque	T _{2Em.stop} Nm									15000					
Nominal input speed ^{b)}	n _{1N} min ⁻¹		900	1300			1500			2000		2100		2200	
Max. continuous speed	n _{1Max} min ⁻¹			2500					3500						
Average no-load running torque	T ₀₁₂ Nm		30	22	14	13	12	10	8.0	7.0	6.0		5.0		4.5
Max. torsional backlash	j _t arcmin					Standard	≤ 3 / Reduced	≤ 1							
Torsional rigidity ^{c)}	Nm/arcmin		1450	1300	1100	1400	1200	1450	1200	1400	1300	1100	1250	950	1050
Tilting rigidity	Nm/arcmin								9480						
Max. axial force ^{d)}	F _{2Amax} N								50000						
Max. breakdown torque	M2K _{max} Nm			5500						8800					
Efficiency	μ %			95						93					
Service life	L _h								> 20,000						
Weight	m kg			82						77.5					
Running noise	L _{PA} dB(A)								≤ 66						
Max. perm. housing temperature	°C								+ 90						
Ambient temperature	°C								-15 ... + 40						
Lubrication									lubricated for life						
Paint finish									Grey						
Direction of rotation									Input and output side in the same direction						
Protection class									IP 65						
Mass moment of inertia (based on the drive)	M 48	J1 kgcm ²	---	---	---	35.9	40.2	33.7	35.4	27.4	25.4	25.8	25.0	25.2	24.8
	O 60	J1 kgcm ²	181. 9	142. 0	119. 8	---	---	---	---	---	---	---	---	---	---

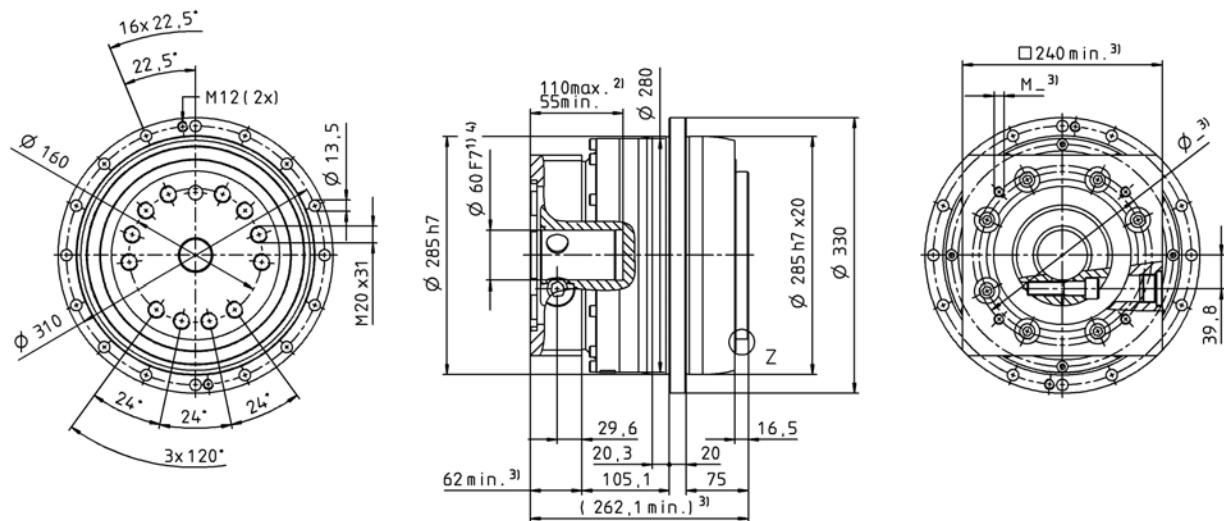
a) Other ratios available on request.

b) Please reduce the speed at higher ambient temperatures.

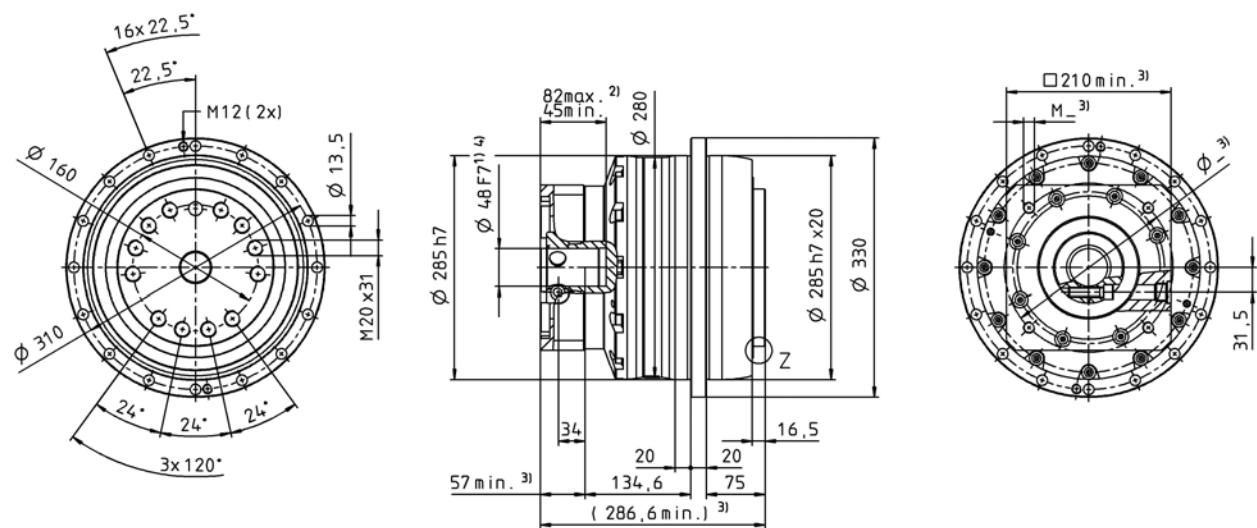
c) Based on shaft or flange center from output.

8.7.1 Dimensional drawing TP500

1-stage



2-stage



9 Commissioning

9.1 Important notes

	Improper operation may result in damage to the gear unit. <ul style="list-style-type: none">• Please ensure that<ul style="list-style-type: none">⇒ the ambient temperature is not below -15 °C and not above +40 °C, and⇒ the operating temperature does not exceed +90 °C.• Avoid icing, which can damage the seals.• For other operating conditions please contact our customer service.• Do not exceed the operational limit values for the gear unit• Only use the gear unit in a clean, dust-free and dry environment.
	Serious risk of injury! <ul style="list-style-type: none">• Only specialist personnel with extensive knowledge in the areas of electrical engineering / drive technology are allowed to install and commission the equipment.• Check that all live connection points are protected against accidental contact. Dangerous voltages can occur, up to 875 V_{DC}.• The surface temperature of the motor can exceed 100 °C in operation. Check (measure) the temperature of the motor. Wait until the motor has cooled down below 40 °C before touching it.• Make sure that, even if the drive starts to move unintentionally, no danger can result for personnel or machinery.
	Overload of the gear unit! <p>In the case of motor/gear unit combinations, the gear unit may be overloaded in the event of a fault (mechanical blockage of the drivetrain) due to high gear ratios.</p> <p>To prevent this, make sure that the rated and peak motor torque is limited in the servo drive.</p> <p>Example:</p> <ul style="list-style-type: none">• Rated / peak motor torque: 1 Nm / 5 Nm• Rated / peak gear unit torque: 15 Nm / 24 Nm• Gear ratio: i = 10• The rated motor torque is not limited. The peak motor torque is limited to 2.4 Nm.

9.2 Guide for commissioning the gear units

The procedure for commissioning is described as an example.

A different method may be appropriate or necessary, depending on the application of the equipment.

- Check the assembly and alignment of the motor and the gear unit.
- Check the drive components such as clutch, gear unit, belt pulley and gear unit for correct seating and setting (observe the permissible radial and axial forces).
- Check the wiring and connections at the motor, servo drive and gear unit. Check that the earthing is correct.
- Test the function of the holding brake, if used. (Apply 24V_{DC}, the brake must release).
- Check whether the rotor of the motor revolves freely (release the brake, if necessary). Listen out for grinding noises from the motor and the gear unit.
- Check that all the required measures against accidental contact with live and moving parts have been carried out.
- Carry out any further checks which are specifically required for your system.
- Now commission the drive according to the commissioning instructions for the servo drive.
- In multi-axis systems, individually commission each drive unit (servo drive/motor(s)).
- During the installation and commissioning look out for chips or similar contaminants that may penetrate into the gear unit. Keep the work area clean and protect the gear unit from foreign objects. Penetration of dirt reduces the service life of the gear unit.



Note

Destruction of the gear unit due to excessively high motor torque!

Before commissioning, check that your configured maximum motor torque does not destroy the gear unit. Further information can be found in chapter "[Important notes ▶ 52](#)".

9.3 Troubleshooting

	Changed operating behavior
Attention	A change in operating behavior may indicate existing damage of the gear unit or result in damage to the gear unit. <ul style="list-style-type: none">• Do not recommission the gear unit until the fault has been rectified.
	Personal injuries
CAUTION	Troubleshooting may only be performed by trained personnel.

Error	Possible cause	Remedy
Increased operating temperature	The gear unit is not suitable for the purpose.	Check the technical data.
	Motor heats up the gear unit.	Check the wiring of the motor. Ensure adequate cooling. Change the motor.
	Ambient temperature too high.	Ensure adequate cooling.
		Contact our service department.
Increased operating noises	Distorted motor mounting	
	Bearing damage	
	Gear tooth damage	
	Toothed belt tension too high	
Lubricant loss	Lubricant quantity too high	Wipe off the leaking lubricant and continue to monitor the gear unit. Lubricant discharge should stop after a short time.
	Leaks	Please contact Beckhoff Service.

10 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

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