



SEW
EURODRIVE

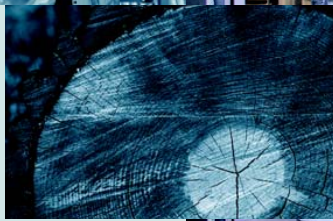
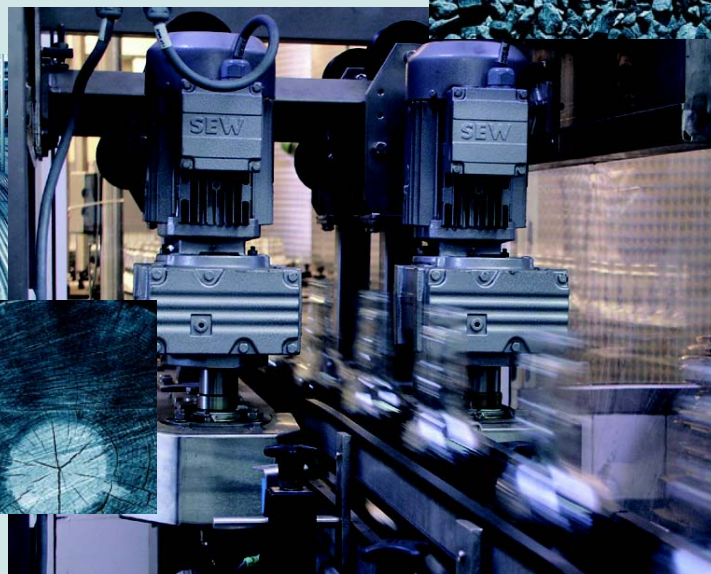


Servo Gear Units

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Catalog



SEW
EURODRIVE



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1 Introduction

1.1 The SEW-EURODRIVE group of companies

Global presence

Driving the world with innovative drive solutions for all branches and for every application. Products and systems from SEW-EURODRIVE are used in a multitude of applications worldwide. Be it in the automotive, building materials, food and beverage or metal-processing industry the decision to use drive technology 'made by SEW-EURODRIVE' stands for reliability for both functionality and investment.

We are represented in the most important branches of industry all over the world: with 12 manufacturing plants, 67 assembly plants in 47 countries and our comprehensive range of services, which we consider an integrative service that continues our commitment to outstanding quality.

Always the right drive

The SEW-EURODRIVE modular concept offers millions of combinations. This wide selection enables you to choose the correct drive for all applications, each based on the required speed and torque range, space available and the ambient conditions. Gear units and gearmotors offering a unique and finely tuned performance range and the best economic prerequisites to face your drive challenges.

The gearmotors are powered by MOVITRAC[®] frequency inverters, MOVIDRIVE[®] inverters and MOVIAXIS[®] multi-axis servo inverters, a combination that blends perfectly with the existing SEW-EURODRIVE program. As in the case for mechanical systems, the development, production and assembly is also carried out completely by SEW-EURODRIVE. In combination with our drive electronics, these drives will provide the utmost in flexibility.

Products of the servo drive system, such as low backlash servo gear units, compact servomotors or MOVIAXIS[®] multi-axis servo inverters provide precision and dynamics. From single-axis or multi-axis applications all the way to synchronized process sequences, servo drive systems by SEW-EURODRIVE offer a flexible and customized implementation of your application.

For economical, decentralized installations, SEW-EURODRIVE offers components from its decentralized drive system, such as MOVIMOT[®], the gearmotor with integrated frequency inverter or MOVI-SWITCH[®], the gearmotor with integrated switching and protection function. SEW-EURODRIVE hybrid cables have been designed specifically to ensure cost-effective solutions, independent of the philosophy behind or the size of the system. The latest developments from SEW-EURODRIVE: MOVITRANS[®] system components for contactless energy transfer, MOVIPRO[®], the decentralized drive control and MOVIFIT[®], the new decentralized intelligence.

Power, quality and sturdy design combined in one standard product: With high torque levels, industrial gear units from SEW-EURODRIVE realize major movements. The modular concept will once again provide optimum adaptation of industrial gear units to meet a wide range of different applications.

Your ideal partner

Its global presence, extensive product range and broad spectrum of services make SEW-EURODRIVE the ideal partner for the machinery and plant construction industry when it comes to providing drive systems for demanding applications in all branches of industries and applications.



1.2 Products and systems from SEW-EURODRIVE

The products and systems from SEW-EURODRIVE are divided into four product groups. These 4 product groups are:

1. Gearmotors and frequency inverters
2. Servo drive systems
3. Decentralized drive systems
4. Industrial gear units

Products and systems used in several group applications are listed in a separate group "Products and systems covering several product groups". Consult the following tables to locate the products and systems included in the respective product group:

1. Gearmotors and frequency inverters		
Gear units/gearmotors	Motors	Frequency inverters
<ul style="list-style-type: none"> • Helical gear units/helical gearmotors • Parallel shaft helical gear units/parallel shaft helical gearmotors • Helical-bevel gear units/helical-bevel gearmotors • Helical-worm gear units/helical-worm gearmotors • SPIROPLAN® right-angle gearmotors • Drives for electrified monorail systems • Geared torque motors • Pole-changing gearmotors • Variable speed gear units/variable speed gearmotors • Aseptic gearmotors • ATEX compliant gear units/gearmotors • ATEX compliant variable speed gear units/variable speed gearmotors 	<ul style="list-style-type: none"> • Asynchronous AC motors/AC brakemotors • Multi-speed AC motors/AC brakemotors • Energy-efficient motors • Explosion-proof AC motors/AC brakemotors • Torque motors • Single-phase motors/single-phase brakemotors • Asynchronous linear motors 	<ul style="list-style-type: none"> • MOVITRAC® frequency inverters • MOVIDRIVE® inverters • Control, technology and communication options for inverters

2. Servo drive systems		
Servo gear units/servo gearmotors	Servomotors	Servo drive inverters/servo inverters
<ul style="list-style-type: none"> • Low backlash servo planetary gear units/planetary gearmotors • Low backlash helical-bevel servo gear units / helical-bevel gearmotors • R, F, K, S, W gear units/gearmotors • Explosion-proof servo gear units/servo gearmotors 	<ul style="list-style-type: none"> • Asynchronous servomotors/servo brakemotors • Synchronous servo motors/servo brakemotors • Explosion-proof servomotors/servo brakemotors • Synchronous linear motors 	<ul style="list-style-type: none"> • MOVIDRIVE® servo inverters • MOVIAxis® multi-axis servo inverters • Control, technology and communication options for servo drive inverters and servo inverters



3. Decentralized drive systems		
Decentralized drives	Communication and installation	Contactless energy transfer
<ul style="list-style-type: none"> • MOVIMOT[®] gearmotors with integrated frequency inverter • MOVIMOT[®] motors/brakemotors with integrated frequency inverter • MOVI-SWITCH[®] gearmotors with integrated switching and protection function • MOVI-SWITCH[®] motors/brakemotors with integrated switching and protection function • Explosion-proof MOVIMOT[®] and MOVI-SWITCH[®] gearmotors 	<ul style="list-style-type: none"> • Fieldbus interfaces • Field distributors for decentralized installation • MOVIFIT[®] product range <ul style="list-style-type: none"> – MOVIFIT[®]-MC to control MOVIMOT[®] drives – MOVIFIT[®]-SC with integrated electronic motor switch – MOVIFIT[®]-FC with integrated frequency inverter 	<ul style="list-style-type: none"> • MOVITRANS[®] system <ul style="list-style-type: none"> – Stationary components for energy supply – Mobile components for energy consumption – Line cables and installation material

4. Industrial gear units

- Helical gear units
- Bevel-helical gear units
- Planetary gear units

Products and systems covering several product groups

- Operator terminals
- MOVI-PLC[®] drive-based control system

In addition to products and systems, SEW-EURODRIVE offers a comprehensive range of services. These include:

- Technical consulting
- Application software
- Seminars and training
- Extensive technical documentation
- International customer service

The website provides comprehensive information and services.



1.3 Additional documentation

Contents of this publication

This "Servo Gear Units" catalog provides a detailed description of the following product groups from SEW-EURODRIVE:

- The following gear units in combination with the AQ adapter:
 - R, F, K, S, W gear units
- The following gear units in combination with the adapters:
 - BS.F gear units with EBH adapter
 - PS.F gear units with EPH adapter
 - PS.C gear units with ECH or EPH adapter

The descriptions include:

- Product descriptions
- Type overviews
- Project planning information
- Description of mounting positions
- Explanation on the order information
- Combination overviews and technical data
- Dimension sheets

For information on the motor options, refer to the "DT/DV/CT/CV Series AC Motors" and "DR, CMP Motors" catalogs/price catalogs.

For information on the options of R, F, K, S, W gear units, AM, AT and AR adapters, and AD input shaft assembly, refer to the "Gear Units" catalog/price catalog.

Additional documentation

The following price catalogs and catalogs are available from SEW-EURODRIVE in addition to this "Servo Gear Units" catalog:

- Gear units
- Synchronous servo gearmotors
- Asynchronous servo gearmotors
- DR, CMP motors

These price catalogs and catalogs offer the following information:

- Product descriptions
- Technical data and inverter assignments
- Important information about tables and dimension sheets
- Description of the different types
- Selection tables
- Dimension sheets
- Technical data
- Notes on adapter mounting

**1.4 Copyright**

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2 Product Description of the Gear Units

2.1 General information

Paint

Gear units from SEW-EURODRIVE are painted as follows:

Gear units	Painted according to DIN 1843
BS.F / PS.F / PS.C gear units	RAL 9005 black
R, F, K, S, W gear units (with AQ adapters)	

Special paints are available on request.

2.2 Surface protection

General information

SEW-EURODRIVE offers the following optional protective measure for operating gear units under special environmental conditions.

- Surface protection OS for motors and gear units

In addition, special optional protective measures for the output shafts are also available.

OS surface protection

In addition to standard surface protection, motors and gear units also available with surface protection OS1 to OS4. The special procedure "Z" is also available. Special procedure "Z" means that large surface recesses are sprayed with a rubber filling prior to painting.

Surface protection	Layers		Regular coating thickness [µm]	Suitable for
	Variant 1 ¹	Variant 2 ¹⁾		
Standard	<ul style="list-style-type: none"> • 1 × dip primer • 1 × one-component top coat 		70	<ul style="list-style-type: none"> • Normal ambient conditions • Relative humidity below 90% • Max. surface temperature 120 °C • Corrosivity category C1²
OS1	<ul style="list-style-type: none"> • 1 × dip primer • 1 × two-component base coat • 1 × two-component top coat 	<ul style="list-style-type: none"> • 1 × dip primer • 1 × two-component high-solid top coat 	120 - 180	<ul style="list-style-type: none"> • Low environmental impact • Relative humidity max. 95% • Max. surface temperature 120 °C • Corrosivity category C2²⁾
OS2	<ul style="list-style-type: none"> • 1 × dip primer • 1 × two-component high-solid base coat • 1 × two-component base coat • 1 × two-component top coat 	<ul style="list-style-type: none"> • 1 × dip primer • 1 × two-component high-solid base coat • 1 × two-component high-solid top coat 	160 - 250	<ul style="list-style-type: none"> • Medium environmental impact • Relative humidity up to 100% • Max. surface temperature 120 °C • Corrosivity category C3²⁾
OS3	<ul style="list-style-type: none"> • 1 × dip primer • 1 × two-component high-solid base coat • 2 × two-component base coat • 1 × two-component top coat 	<ul style="list-style-type: none"> • 1 × dip primer • 1 × two-component high-solid base coat • 1 × two-component base coat • 1 × two-component high-solid top coat 	210 - 320	<ul style="list-style-type: none"> • High environmental impact • Relative humidity up to 100% • Max. surface temperature 120 °C • Corrosivity category C4²⁾
OS4	<ul style="list-style-type: none"> • 1 × dip primer • 2 × two-component epoxy base coat • 2 × two-component top coat 	<ul style="list-style-type: none"> • 1 × dip primer • 2 × two-component epoxy base coat • 1 × two-component high-solid top coat 	260 - 380	<ul style="list-style-type: none"> • Very high environmental impact • Relative humidity up to 100% • Max. surface temperature 120 °C • Corrosivity category C5-1²⁾

¹ The variant used currently depends on the color of the top coating.

² In accordance with DIN EN ISO 12944-2



Special protective measures

Gearmotor output shafts can be treated with special optional protective measures for operation subject to severe environmental pollution or in particularly demanding applications.

Gear unit type	Measure	Protection principle	Suitable for
R, F, K, S, W	FKM oil seal (Viton)	High quality material	Drives subject to chemical contamination
	Surface coating of the contact surface of the oil seal	Protective layer	Severe environmental impact and in conjunction with FKM oil seal (Viton)
	Stainless steel output shaft	Surface protection with high-quality material	Particularly demanding applications in terms of surface protection

NOCO[®] fluid

As standard, SEW-EURODRIVE supplies NOCO[®] fluid corrosion protection and lubricant with every hollow shaft gear unit. Use NOCO[®] fluid when installing hollow shaft gear units. Using this fluid can help prevent contact corrosion and makes it easier to disassemble the drive at a later time.

NOCO[®] fluid is also suitable for protecting machined metal surfaces that do not have corrosion protection, such as parts of shaft ends or flanges. You can order larger quantities of NOCO[®] fluid from SEW-EURODRIVE.

NOCO[®] fluid is a food grade substance according to USDA-H1. You can tell that NOCO[®] fluid is a food grade oil by the USDA-H1 identification label on its packaging.



2.3 Explosion protection according to ATEX

Validity

EU directive 94/9/EC or ATEX specifies new regulations for explosion protection for all types of devices for the European market. This directive applies to gearmotors and motors as well. Since July 1, 2003, EU directive 94/9/EC has been applicable without restrictions to the use of gearmotors and motors within the European Union. Other European countries, such as Switzerland, have also adopted this regulation.

2

Scope

SEW-EURODRIVE now only supplies explosion-proof gear units in accordance with the corresponding ATEX directive. This also applies to options and accessories in explosion-proof design.

Depending on their features and dimensions, explosion-proof gear units are suitable for:

- Potentially explosive gas atmospheres, zone 1 or 2.
- Potentially explosive dust atmospheres, zone 21 or 22.

SEW-EURODRIVE offers gearmotors and motors of categories

- II2G
- II2D
- II3GD
- II3D

for use in zones 1, 21, 2 and 22.

Stand-alone gear units with components on the input side are available in the following categories:

- Gear units with adapters AQA, EBH, and EPH for use in zones 1, 21, 2 and 22
 - II2GD

Adapters AQH according to ATEX directive are not available.

Other documentation

The "Explosion-Proof Drives to EU Directive 94/9/EC" system description and the volume of the same name in the "Drive Engineering - Practical Implementation" series provide you with basic information about this topic.

Please refer to the "Explosion-Proof Drives" catalog and the "Variable Speed Gearmotors" catalog for detailed information on explosion-proof SEW-EURODRIVE products.



Product Description of the Gear Units

Extended storage of R, F, K, S, W gear units

2.4 Extended storage of R, F, K, S, W gear units

Type

You can also order gear units prepared for "extended storage." SEW-EURODRIVE recommends the "extended storage" type for storage periods longer than 9 months.

In this case, a VCI corrosion inhibitor (volatile corrosion inhibitor) is added to the lubricant in these gear units. Please note that this VCI corrosion inhibitor is only effective in a temperature range of -25 °C to +50 °C. The flange contact surfaces and shaft ends are also treated with an anti-corrosion agent. If not specified otherwise in your order, the gear unit with "extended storage" option will be supplied with OS1 surface protection. You can order OS2, OS3 or OS4 instead of OS1.

Surface protection	Suitable for
OS1	Low environmental impact
OS2	Medium environmental impact
OS3	High environmental impact
OS4	Very high environmental impact

	INFORMATION
	<p>The gear units must remain tightly sealed until taken into operation to prevent the VCI corrosion protection agent from evaporating.</p> <p>Gear units will be supplied with an oil fill according to the mounting position (M1 ... M6) and are ready for operation. Check the oil level before you start operating the gear unit for the first time!</p>



Storage conditions

Observe the storage conditions specified in the following table for extended storage:

Climate zone	Packaging ¹	Storage location ²	Storage duration
Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap.	Under roof, protected against rain and snow, no shock loads.	Up to 3 years with regular checks of the packaging and moisture indicator (rel. humidity < 50%).
	Open	Under roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60 °C, < 50% relative humidity). No sudden temperature fluctuations. Controlled ventilation with filter (free from dust and dirt). Protected against aggressive vapors and shocks.	2 years or more with regular inspections. Check for cleanliness and mechanical damage during inspection. Check corrosion protection.
Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap. Protected against insect damage and mildew by chemical treatment.	Under roof, protected against rain and shocks.	Up to 3 years with regular checks of the packaging and moisture indicator (rel. humidity < 50%).
	Open	Under roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 50 °C, < 50% relative humidity). No sudden temperature fluctuations. Controlled ventilation with filter (free from dust and dirt). Protected against aggressive vapors and shocks. Protected against insect damage.	2 years or more with regular inspections. Check for cleanliness and mechanical damage during inspection. Check corrosion protection.

- 1 Packaging must be carried out by an experienced company using the packaging materials that have been explicitly specified for the particular application.
- 2 SEW-EURODRIVE recommends to store the gear units according to the mounting position.



Product Description of the Gear Units

General product description R, F, K, S, W gear units

2.5 General product description R, F, K, S, W gear units

Ambient temperature

Gear units and gearmotors from SEW-EURODRIVE can be operated in a wide ambient temperature range. The following standard temperature ranges are permitted for filling the gear units according to the lubricant table:

Gear unit	Filled with	Permitted standard temperature range
R, F, and K	CLP(CC) VG220	-10 °C ... +40 °C
S	CLP(CC) VG680	0 °C ... +40 °C
W	CLP(SEW-PG) VG460	-10 °C ... +40 °C

The rated data of the gear units and gearmotors specified in the catalog/price catalog refer to an ambient temperature of +25 °C.

Gear units and gearmotors from SEW-EURODRIVE can be operated outside the standard temperature range if project planning is adapted to ambient temperatures from as low as up to -40 °C in the intensive cooling range until up to +60 °C. Project planning must take special operating conditions into account and adapt the drive to the ambient conditions by selecting suitable lubricants and seals. This kind of project planning is generally recommended for increased ambient temperatures as of size 97 and for helical-worm gear units with small gear ratios. SEW-EURODRIVE will gladly perform this project planning for you.

If the drive is to be operated on a frequency inverter, you must also consider the project planning notes of the inverter and take into account the thermal effects of inverter operation.

Installation altitude

Due to the low air density at high installation altitudes, heat dissipation on the surface of motors and gear units decreases. The rated data listed in the catalog/price catalog applies to an installation altitude of maximum 1000 m above sea level. Installation altitudes of more than 100 m asl must be taken into account for project planning of gear units and gearmotors.

Power and torque

The power and torque ratings listed in the catalogs refer to mounting position M1 and similar mounting positions in which the input stage is not completely submerged in oil. In addition, the gearmotors are assumed to be standard versions with standard lubrication and under normal ambient conditions.

Please note that the motor power shown in the selection tables for gearmotors is subject to selection. However, the output torque and the desired output speed are essential for the application and need to be checked.

Speeds

The quoted output speeds of the gearmotors are recommended values. You can calculate the rated output speed based on the rated motor speed and the gear unit ratio. Please note that the actual output speed depends on the motor load and the supply system conditions.



Noise The noise levels of all SEW-EURODRIVE gear units, motors and gearmotors are well within the maximum permitted noise levels set forth in the VDI guideline 2159 for gear units and IEC/EN 60034 for motors.

Weight Please note that all weights shown in the catalogs exclude the oil fill for the gear units and gearmotors. The weights vary according to gear unit type and gear unit size. The lubricant fill depends on the mounting position which means no universally applicable information can be given. Please refer to "Lubricants" in the "Design and Operating Notes" section for recommended lubricant fill quantities depending on the mounting position. For the exact weight, refer to the order confirmation.

Air admission and accessibility The gearmotors/brakemotors must be mounted on the driven machine in such a way that both axially and radially there is enough space left for unimpeded air admission, for maintenance work on the brake and, if required, for the MOVIMOT® inverter. Please also refer to the notes in the motor dimension sheets.

Multi-stage gearmotors You can achieve particularly low output speeds by using multi-stage gear units or multi-stage gearmotors. Such a setup requires a helical gear unit or gearmotor on the input end as a second gear unit.

It may be necessary to limit the motor power to match the maximum permitted output torque of the gear unit.

Reduced backlash version Helical, parallel shaft helical and helical-bevel gear units with reduced backlash are available as of gear unit size 37. The circumferential backlash of these gear units is considerably less than that of the standard versions so that positioning tasks can be solved with great precision. The circumferential backlash is specified in angular minutes ['] in the technical data. The circumferential backlash for the output shaft is specified without load (max. 1% of the rated output torque); the gear unit input end is blocked. The dimension sheets for standard versions are applicable.

RM gear units, RM gearmotors RM gear units and RM gearmotors are a special type of helical gear units with an extended output bearing hub. They were designed especially for agitating applications and allow for high overhung and axial loads and bending moments. The other data are the same as for standard helical gear units and standard helical gearmotors.



Product Description of the Gear Units

General product description R, F, K, S, W gear units

SPIROPLAN® right-angle gear units

SPIROPLAN® right-angle gear units are robust, single- and two-stage right-angle gear units with SPIROPLAN® gearing. The difference to the helical-worm gear units is the material combination of the steel-on-steel gearing, the special tooth meshing relationships and the aluminum housing. As a result, SPIROPLAN® right-angle gear units are wear-free, very quiet-running and lightweight.

The particularly short design and the aluminum housing make for very compact and lightweight drive solutions.

The wear-free gearing and the life-long lubrication facilitate long periods of maintenance-free operation. The oil filling being independent of the mounting position, except for SPIROPLAN® W..37 and W..47 in mounting position M4 makes any position possible for SPIROPLAN® right-angle gear units without altering the quantity of oil. Identical hole spacing in the foot and face, as well as the equal shaft height to both, provides you with diverse mounting options.

Two different flange diameters are available. On request, SPIROPLAN® right-angle gearmotors can be equipped with a torque arm.

Components on the input side

The following components on the input side are available for the gear units from SEW-EURODRIVE:

- **Input covers with input shaft extension, optionally with**
 - Centering shoulder
 - Backstop
 - Motor mounting platform
- **Adapter**
 - For mounting IEC or NEMA motors with the option of a backstop
 - For mounting servomotors with a square flange
 - With torque limiting safety couplings and speed or slip monitor
 - With hydraulic centrifugal coupling, also with disk brake or backstop



2.5.1 AQ adapter for servomotors

The following figure shows a helical gear unit with AQ adapter:

2



04595AXX

An adapter with square flange is used for mounting servomotors to R, F, K, S, and W gear units.

The torque is transmitted via a dog clutch. Possible vibrations and shocks occurring during operation are effectively attenuated and dissipated by an inserted polyurethane ring gear.

Design versions

The clutch half on the motor side can be configured either with a clamping ring hub (non-positive, for smooth motor shafts) or a keyway (positive) as required.

Designation	
AQH	with clamping ring hub
AQA	with keyway



2.6 General product description BS.F, PS.F, PS.C gear units

Ambient temperature

Gear units/gearmotors can be used at ambient temperatures between - 20 °C and + 40 °C. It is essential that you contact SEW-EURODRIVE if ambient temperatures exceed this temperature range.

Installation altitude

Due to the low air density at high installation altitudes, heat dissipation on the surface of motors and gear units decreases. The rated data listed in the catalog/price catalog applies to an installation altitude of maximum 1000 m above sea level. Installation altitudes of more than 100 m asl must be taken into account for project planning of gear units and gearmotors.

Power and torque

The power and torque values listed in the catalogs apply to normal environmental conditions.

Please note that the motor torques in the selection tables for gear units and gearmotors are subject to selection. However, the output torque and the desired output speed are essential for the application and need to be checked.

Noise

The noise levels of all gear units and gearmotors are well within the maximum permitted noise levels set forth in the VDI guideline 2159 for gear units and EN 60034 for motors.

Heat dissipation and accessibility

Gear units/gearmotors and brakes can reach surface temperatures of > 100 °C during operation. Make sure to maintain adequate distance from heat-sensitive components when installing gear units/gearmotors and gear unit brakemotors to the driven machine.

Direct motor mounting

The gearmotors from SEW-EURODRIVE make it possible to mount gear units directly to the synchronous servomotors from SEW-EURODRIVE without an adapter. These integrated servo gearmotors offer shaft-hub connections that are all positive and free from backlash.

Motor mounting with adapter

Use the modular motor adapters to connect all other commercial servomotors in a simple and time-efficient manner to the gear units from SEW-EURODRIVE.

Low backlash and positioning accuracy

The optimum gearing geometry paired with precisely manufactured components and careful assembly make for low circumferential backlash.

The BS.F and PS.F gear units ensure low backlash already for standard designs. The circumferential backlash can be further reduced for all types and even minimized for PS.F gear units. Circumferential backlash will remain constantly low for the entire gear unit life due to the wear-free operating performance and high-endurance design of the running gears.



Extensive ratio range with fine graduation

All gear ratios from $i = 3$ to $i = 100$ are integers and finely graduated. This means that the gear units are especially suitable for use with controllers that require integer resolution ratios.

2

Reliable, long service life, and low maintenance

The high reliability of gear units from SEW-EURODRIVE in the system is ensured by the use of high-strength materials, high-quality anti-friction bearings, long-lived oil seals and synthetic lubricants.

High overload capacity

Exactly matched components as well as backlash-free and positively connected drive elements ensure that highest torques can be transferred and that large axial and radial forces can be absorbed.

Torsionally rigid

The special design of SEW-EURODRIVE gear units in conjunction with large shaft diameters ensures high torsional rigidity.



3 Overview of Types and Unit Designations

3.1 Variants and options of R, F, K, S, W gear units

Below an overview of unit designations for R, F, K, S, and W gear units and their options.

Helical gear units

Designation	
RX..	Single-stage foot-mounted design
RXF..	Single-stage B5 flange-mounted design
R..	Foot-mounted design
R..F	Foot and B5-flange mounted design
RF..	B5 flange-mounted design
RZ..	B14 flange-mounted design
RM..	B5 flange-mounted design with extended bearing hub

Parallel shaft helical gear units

Designation	
F..	Foot-mounted design
FA..B	Foot-mounted, hollow shaft
FH..B	Foot-mounted, hollow shaft with shrink disk
FV..B	Foot-mounted, hollow shaft with splined hollow shaft to DIN 5480
FF..	B5 flange-mounted design
FAF..	B5 flange-mounted design and hollow shaft
FHF..	B5 flange-mounted and hollow shaft with shrink disk
FVF..	B5 flange-mounted design and hollow shaft with splined hollow shaft to DIN 5480
FA..	Hollow shaft
FH..	Hollow shaft with shrink disk
FT..	Hollow shaft with TorqLOC [®] hollow shaft mounting system
FV..	Hollow shaft with splining to DIN 5480
FAZ..	B14 flange-mounted design and hollow shaft
FHZ..	B14 flange-mounted design and hollow shaft with shrink disk
FVZ..	B14 flange-mounted design and hollow shaft with splined hollow shaft to DIN 5480



Helical-bevel gear units

Designation	
K..	Foot-mounted design
KA..B	Foot-mounted, hollow shaft
KH..B	Foot-mounted, hollow shaft with shrink disk
KV..B	Foot-mounted, hollow shaft with splined hollow shaft to DIN 5480
KF..	B5 flange-mounted design
KAF..	B5 flange-mounted design and hollow shaft
KHF..	B5 flange-mounted design and hollow shaft with shrink disk
KVF..	B5 flange-mounted design and hollow shaft with splined hollow shaft to DIN 5480
KA..	Hollow shaft
KH..	Hollow shaft with shrink disk
KT..	Hollow shaft with TorqLOC® hollow shaft mounting system
KV..	Hollow shaft with splining to DIN 5480
KAZ..	B14 flange-mounted design and hollow shaft
KHZ..	B14 flange-mounted design and hollow shaft with shrink disk
KVZ..	B14 flange-mounted design and hollow shaft with splined hollow shaft to DIN 5480

3

Helical-worm gear units

Designation	
S..	Foot-mounted design
SF..	B5 flange-mounted design
SAF..	B5 flange-mounted design and hollow shaft
SHF..	B5 flange-mounted design and hollow shaft with shrink disk
SA..	Hollow shaft
SH..	Hollow shaft with shrink disk
ST..	Hollow shaft with TorqLOC® hollow shaft mounting system
SAZ..	B14 flange-mounted design and hollow shaft
SHZ..	B14 flange-mounted design and hollow shaft with shrink disk



Overview of Types and Unit Designations

Variants and options of R, F, K, S, W gear units

SPIROPLAN® gear units

Designation	
W..	Foot-mounted design
WF..	Flange-mounted design
WAF..	Flange-mounted design and hollow shaft
WA..	Hollow shaft
WA..B	Foot-mounted, hollow shaft
WH..B	Foot-mounted, hollow shaft with shrink disk
WHF..	Flange-mounted, hollow shaft with shrink disk
WH..	Hollow shaft with shrink disk
WT..	Hollow shaft with TorqLOC® hollow shaft mounting system

Options

R, F and K gear units:

Designation	
/R	Reduced backlash

K, S and W gear units:

Designation	
/T	With torque arm

F gear units:

Designation	
/G	With rubber buffer

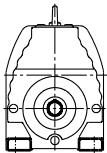
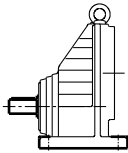
Condition monitoring

Designation	Option
/DUO	Diagnostic Unit Oil = Oil aging sensor
/DUV	Diagnostic Unit Vibration = Vibration sensor



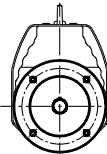
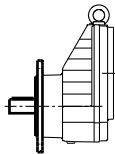
Helical gear units

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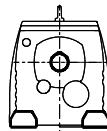
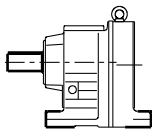


RX..
 Foot-mounted single stage helical gear unit

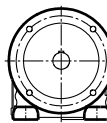
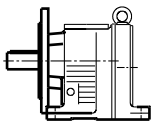
3



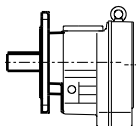
RXF.
 B5 flange-mounted single-stage helical gear unit



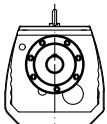
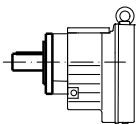
R..
 Foot-mounted helical gear unit



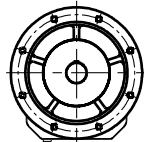
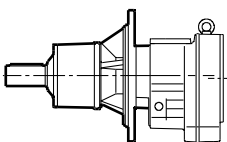
R..F
 Foot and B5-flange mounted helical gear unit



RF.
 B5 flange-mounted helical gear unit



RZ..
 B14 flange-mounted helical gear unit



RM..
 B5 flange-mounted design with extended bearing hub

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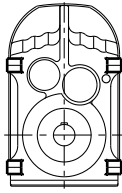
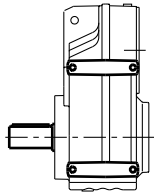


Overview of Types and Unit Designations

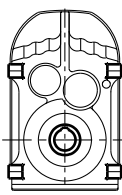
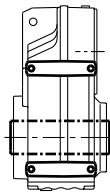
Variants and options of R, F, K, S, W gear units

Parallel shaft helical gear units

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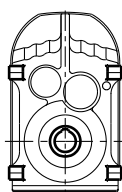
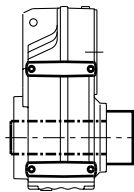


F..
Foot-mounted parallel shaft helical gear unit

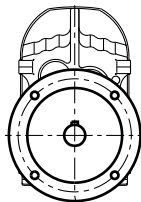
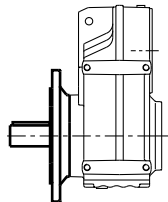


FA..B
Foot-mounted parallel shaft helical gear unit with hollow shaft

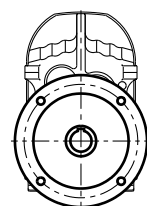
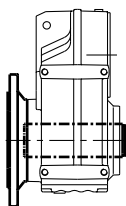
FV..B
Foot-mounted parallel shaft gear unit with hollow shaft and splining according to DIN 5480



FH..B
Foot-mounted parallel shaft helical gear unit with hollow shaft and shrink disk



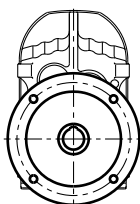
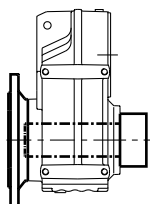
FF..
B5 flange-mounted parallel shaft helical gear unit



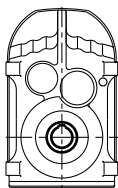
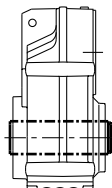
FAF..
B5 flange-mounted parallel shaft helical gear unit with hollow shaft

FVF..
B5 flange-mounted parallel shaft gear unit with hollow shaft and splining according to DIN 5480

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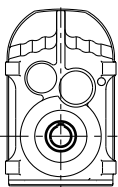
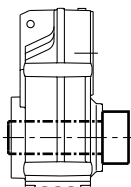


FHF..
 B5 flange-mounted parallel shaft helical gear unit with hollow shaft and shrink disk



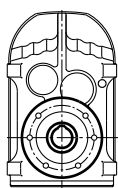
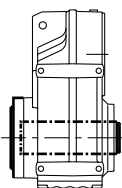
FA..
 Parallel shaft helical gear unit with hollow shaft

FV..
 Parallel shaft helical gear unit with hollow shaft and splining according to DIN 5480



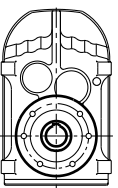
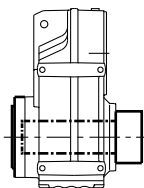
FH..
 Parallel shaft helical gear unit with hollow shaft and shrink disk

FT..
 Parallel shaft helical gear unit with hollow shaft and TorqLOC® hollow shaft mounting system



FAZ..
 B14 flange-mounted parallel shaft helical gear unit with hollow shaft

FVZ..
 B14 flange-mounted parallel shaft gear unit with hollow shaft and splining according to DIN 5480



FHZ..
 B14 flange-mounted parallel shaft helical gear unit with hollow shaft and shrink disk

52184axx

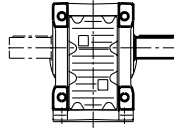
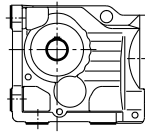


Overview of Types and Unit Designations

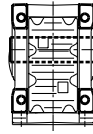
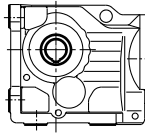
Variants and options of R, F, K, S, W gear units

Helical-bevel gear units

The following types of helical-bevel gear units are available:

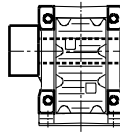
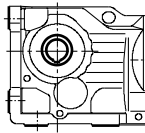


K..
Foot-mounted helical-bevel gear unit

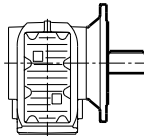
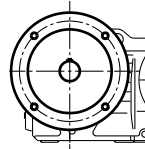


KA..B
Foot-mounted helical-bevel gear unit with hollow shaft

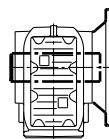
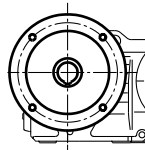
KV..B
Foot-mounted helical-bevel gear unit with hollow shaft and splining according to DIN 5480



KH..B
Foot-mounted helical-bevel gear unit with hollow shaft and shrink disk



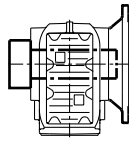
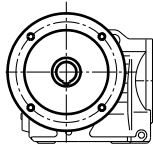
KF..
Helical-bevel gear unit in B5 flange-mounted version



KAF..
B5 flange-mounted helical-bevel gear unit with hollow shaft

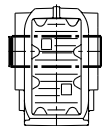
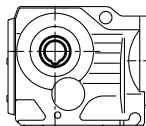
KVF..
B5 flange-mounted helical-bevel gear unit with hollow shaft and splining according to DIN 5480

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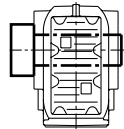
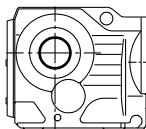
KHF..
 B5 flange-mounted helical-bevel gear unit with hollow shaft and shrink disk

3



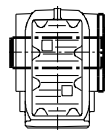
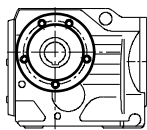
KA..
 Helical-bevel gear unit with hollow shaft

KV..
 Helical-bevel gear unit with hollow shaft and splining according to DIN 5480



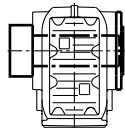
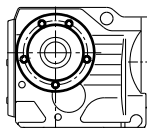
KH..
 Helical-bevel gear unit with hollow shaft and shrink disk

KT..
 Helical-bevel gearmotor with hollow shaft and TorqLOC® hollow shaft mounting system



KAZ..
 B14 flange-mounted helical-bevel gear unit with hollow shaft

KVZ..
 B14 flange-mounted helical-bevel gear unit with hollow shaft and splining according to DIN 5480



KHZ..
 B14 flange-mounted helical-bevel gear unit with hollow shaft and shrink disk

52187axx

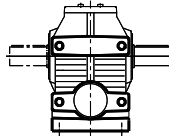
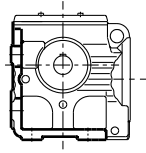


Overview of Types and Unit Designations

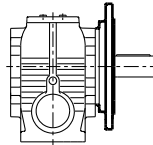
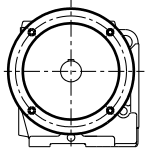
Variants and options of R, F, K, S, W gear units

Helical-worm gear units

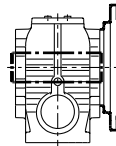
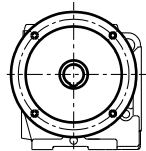
The following types of helical-worm gear units are available:



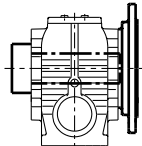
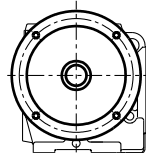
S..
Foot-mounted helical-worm gear unit



SF..
B5 flange-mounted helical-worm gear unit



SAF..
B5 flange-mounted helical-worm gear unit with hollow shaft



SHF..
B5 flange-mounted helical-worm gear unit with hollow shaft and shrink disk

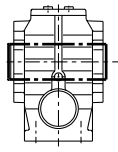
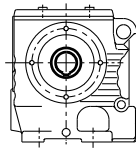
52188axx

Overview of Types and Unit Designations

Variants and options of R, F, K, S, W gear units

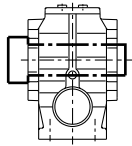
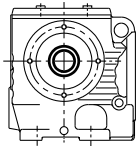


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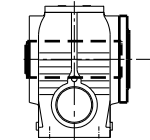
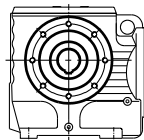
SA..
Helical-worm gear unit with hollow shaft

3

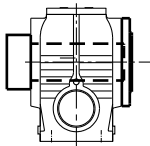
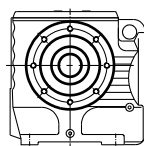


SH..
Helical-worm gear unit with hollow shaft and shrink disk

ST..
Helical-worm gear unit with hollow shaft and TorqLOC® hollow shaft mounting system



SAZ..
B14 flange-mounted helical-worm gear unit with hollow shaft



SHZ..
B14 flange-mounted helical-worm gear unit with hollow shaft and shrink disk

52189axx

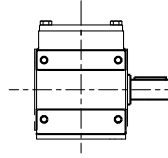
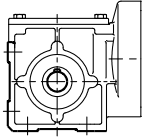


Overview of Types and Unit Designations

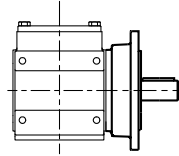
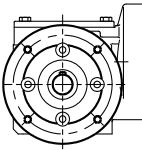
Variants and options of R, F, K, S, W gear units

SPIROPLAN® gear units

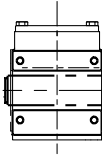
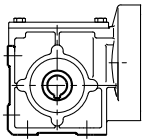
The following types of SPIROPLAN® gear units are available:



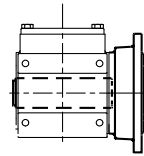
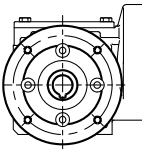
W..
Foot-mounted SPIROPLAN® gear units



WF..
Flange-mounted SPIROPLAN® gear units

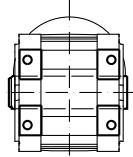
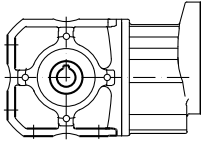


WA..
SPIROPLAN® gear units with hollow shaft



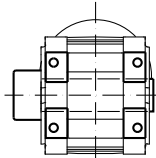
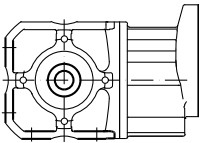
WAF..
Flange-mounted SPIROPLAN® gear unit with hollow shaft

63666axx

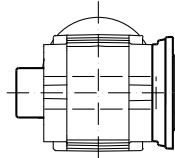
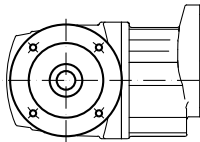


WA..B
 Foot-mounted SPIROPLAN® gear unit with hollow shaft

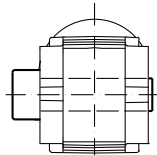
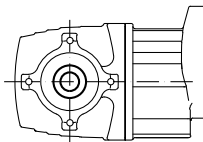
3



WH..B
 Foot-mounted SPIROPLAN® gear unit with hollow shaft and shrink disk



WHF..
 Flange-mounted SPIROPLAN® gear unit with hollow shaft and shrink disk



WH..
 SPIROPLAN® gear unit with hollow shaft and shrink disk

WT..
 SPIROPLAN® gear unit with hollow shaft and TorqLOC® hollow shaft mounting system

63667axx



3.2 Variants and options of BS.F, PS.F and PS.C gear units

Helical-bevel gear units BS.F

Designation	
BSF..	Solid shaft without key
BSKF..	Solid shaft with key
BSBF..	Solid shaft with flange block shaft
BSHF..	Hollow shaft with shrink disk
BSAF..	Hollow shaft with keyway
BSKF..B	Solid shaft with key and foot/front-end mounting
BSBF..B	Solid shaft with flange block shaft and foot/front-end mounting
BSHF..B	Hollow shaft with shrink disk and foot/front-end mounting
BSAF..B	Hollow shaft with key and foot/front-end mounting

PS..F planetary gear units

Designation	
PSF..	Solid shaft without key
PSKF..	Solid shaft with key
PSBF..	Solid shaft with flange block shaft

PS.C planetary gear units

Designation	
PSC..	Solid shaft without key
PSKC..	B5 output flange, solid shaft with key
PSCZ..	B14 output flange, solid shaft
PSKCZ..	B14 output flange, solid shaft with key

Options

BS.F gear units

Designation	
../R	Reduced backlash
../T	Torque arm
../I	Hollow shaft and shrink disk at the output end

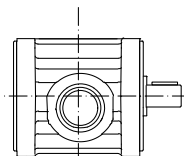
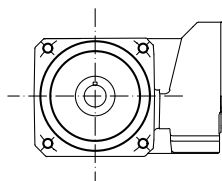
PS.F gear units

Designation	
../R	Reduced backlash
../M	Minimized backlash



BS.F helical-bevel gear units

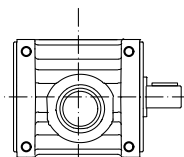
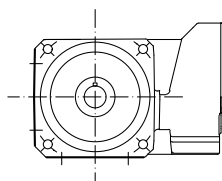
The following types of BS.F helical-bevel gear units are available:



BSF.
 Gear unit with solid shaft, B5 output flange

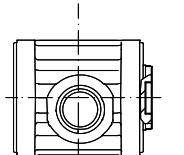
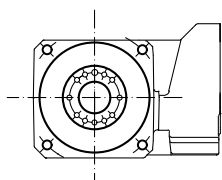
BSKF..
 Gear unit with solid shaft and key, B5 output flange

3

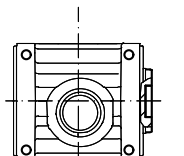
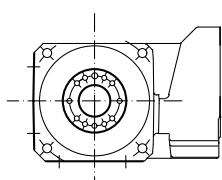


BSF..B
 Gear unit with solid shaft, foot/front-end mounting

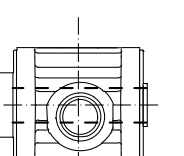
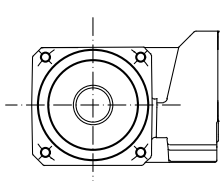
BSKF..B
 Gear unit with solid shaft and key, foot/front-end mounting



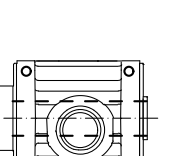
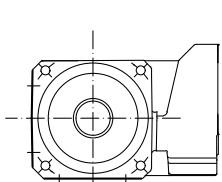
BSBF..
 Gear unit with flange block shaft, B5 output flange



BSBF..B
 Gear unit with flange block shaft, foot/front-end mounting



BSHF..
 Gear unit with hollow shaft and shrink disk, B5 output flange



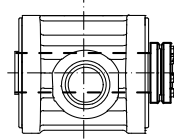
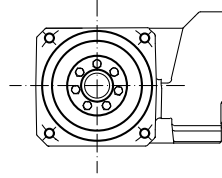
BSHF..B
 Gear unit with solid shaft and shrink disk, foot/front-end mounting

63668axx



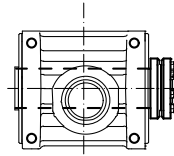
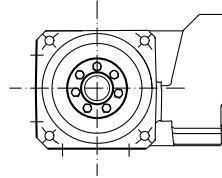
Overview of Types and Unit Designations

Variants and options of BS.F, PS.F and PS.C gear units



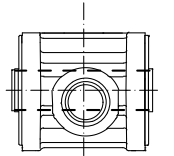
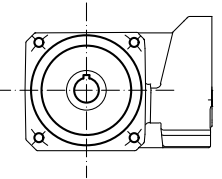
BSHF..I

Gear unit with hollow shaft and shrink disk at the output end



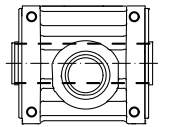
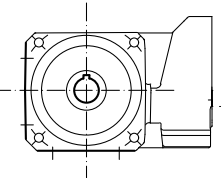
BSHF..B I

Gear unit with hollow shaft and shrink disk at the output end, foot/front-end mounting



BSAF..

Gear unit with hollow shaft and keyway, B5 output flange



BSAF..B

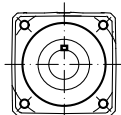
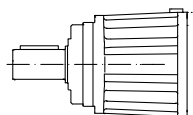
Gear unit with hollow shaft and key, B5 output flange and foot/front-end mounting

63669axx



PS..F planetary gear units

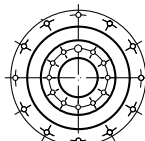
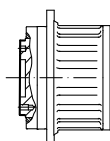
The following variants of PS.F.. planetary gear units are available:



PSF
 Gear unit with solid shaft, B5 output flange

PSKF
 Gear unit with solid shaft and key, B5 output flange

3

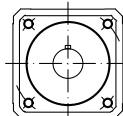
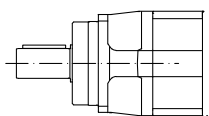


PSBF
 Gear unit with flange block shaft, B5 output flange

63670axx

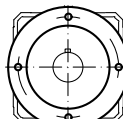
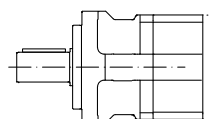
PS.C planetary gear units

The following types of PS.C.. planetary gear units are available:



PSC
 Gear unit with solid shaft, B5 output flange

PSKC
 Gear unit with solid shaft and key, B5 output flange



PSCZ
 Gear unit with solid shaft, B14 output flange

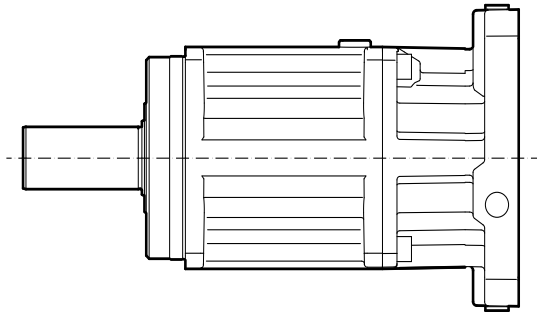
PSKCZ
 Gear unit with solid shaft and key, B14 output flange

63671axx



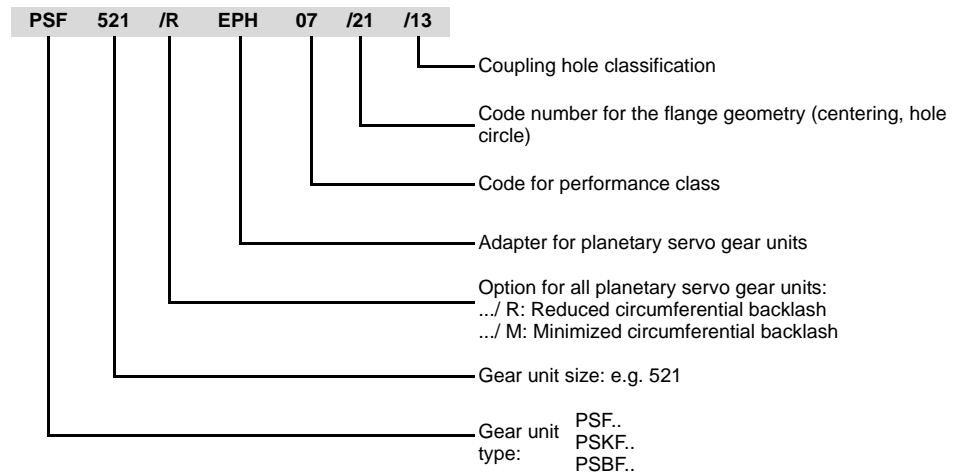
3.3 Unit designation

Examples:

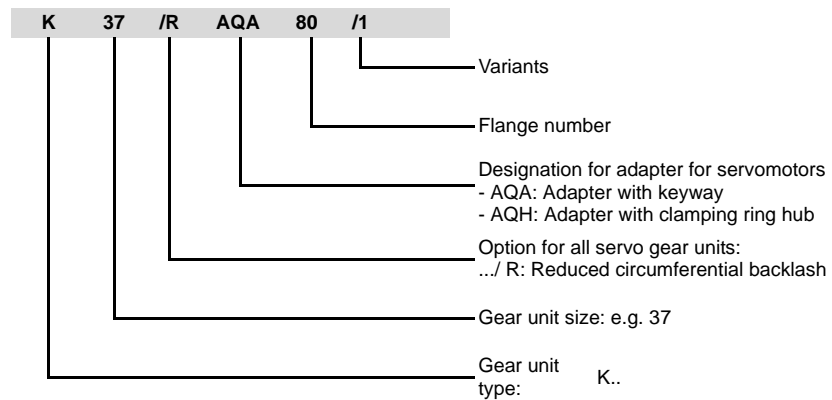


54011AXX

A planetary gear unit with adapter has, for example, the following unit designation:



A helical-bevel gear unit with adapter has, for example, the following unit designation:



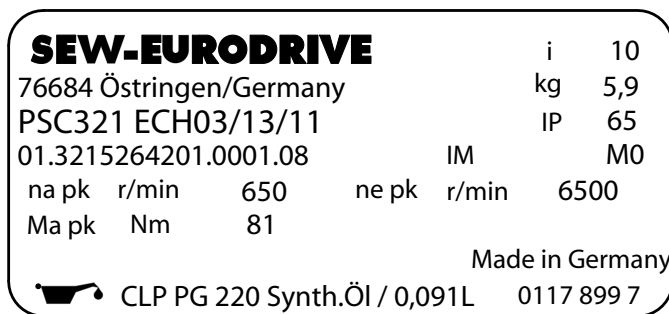


3.4 Nameplate for servo gear units

Example 1: Nameplate for a PS.C.. planetary gear unit with adapter

The following figure shows an example of a nameplate for a PS.C.. planetary gear unit with ECH adapter:

3

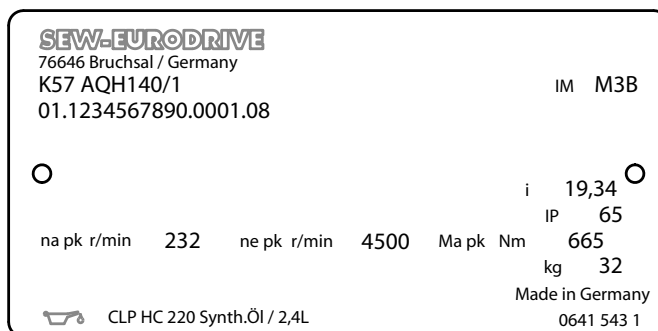


64338axx

i		Gear unit reduction ratio
IM		Mounting position
IP		Degree of protection
n_{epk}	[rpm]	Maximum permitted input speed
n_{apk}	[rpm]	Maximum permitted output speed
M_{apk}	[Nm]	Maximum permitted output torque

Example 2: Nameplate for a helical-bevel gear unit with adapter

The following figure shows an example of a nameplate for a helical-bevel gear unit with AQ adapter:








64339axx

i		Gear unit reduction ratio
IM		Mounting position
IP		Degree of protection
n_{epk}	[rpm]	Maximum permitted input speed
n_{apk}	[rpm]	Maximum permitted output speed
M_{apk}	[Nm]	Maximum permitted output torque




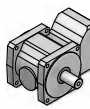


3.5 Overview of servo gear units

Axially parallel gear units

Gear unit type For details, refer to		RX.. page 145	R.. page 168	F.. page 228	PS.C.. page 538	PS.F.. page 477
						
Technical data						
Peak torque	M_{apk} [Nm]	54-1150	46-4360	130-8860	37-427	26-4200
Max. continuous torque	M_{amax} [Nm]	36-830	31-4300	87-7840	29-347	20-3000
Max. input speed	n_{epk} [rpm]	Up to 4500	Up to 4500	Up to 4500	Up to 7000	Up to 8000
Peak overhung load	F_{rapk} [N]	3970-30000	1220-32100	4500-65000	2000-11000	1900-83000
Gear ratio range	i	1.3-8.23	3.21-216.28	3.77-276.77	3-100	3-100
Option with reduced backlash	/R	x	x	x	-	x
Option with minimized backlash	/M	-	-	-	-	x
Mechanical data						
Hollow shaft		-	-	x	-	-
Flange-mounting		x	x	x	x	x
Foot-mounting		x	x	-	-	-
Flange block		-	-	-	-	x
B5 flange		x	x	x	x	x
B14 flange		-	x	x	x	-

Right-angle gear units

Gear unit type For details, refer to		K.. page 308	S.. page 378	W.7 page 408	BS.F.. page 426	
						
Technical data						
Peak torque	M_{apk} [Nm]	187-9090	60-655	91-270	51-1910	
Max. continuous torque	M_{amax} [Nm]	125-8000	43-480	70-180	40-1500	
Max. input speed	n_{epk} [rpm]	4500	4500	4500	4500	
Peak overhung load	F_{rapk} [N]	5140-65000	300-12000	2950-7600	2380-36000	
Gear ratio range	i	3.98-176.05	6.8-75.06	3.2- 74.98	3-40	
Option with reduced backlash	/R	x	x	-	x	
Option with minimized backlash	/M	-	-	-	-	
Mechanical data						
Hollow shaft		x	x	x	x	
Flange-mounting		x	x	x	x	
Foot-mounting		x	x	x	x	
Flange block		-	-	-	x	
B5 flange		x	x	x	x	
B14 flange		x	x	-	-	

For information on all available options and variants, see page 22 and subsequent.



4 Project Planning Information for Servo Gear Units

Project planning has to be carried out for all gear units. The data specified in this catalog only applies if project planning was carried out correctly. Project planning is particularly important for gear units with increased ambient temperatures as of size 97 and for helical-worm gear units with small gear ratios.

SEW-EURODRIVE will gladly perform this project planning for you.

4.1 Drive and gear unit selection data

Certain data of the application have to be provided to being able to precisely define the components for your drive. The abbreviations used for project planning are summarized in the following table:

Designation	Meaning	Unit
φ	Circumferential backlash	[°]
h	Gear unit efficiency for M_{apk}	
a, b, f	Gear unit constants as regards the overhung load conversion	[mm]
c	Gear unit constants as regards the overhung load conversion	[Nmm]
a₀, a₁, a₂	Gear unit constants as regards the rise in temperature in the gear unit	
F_A	Axial load (tension and compression) on the output shaft	[N]
f_k	Speed ratio	
F_R	Overhung load on the output shaft	[N]
F_{Rapk}	Maximum permitted overhung load at the output shaft for short-time duty (load application point is the middle of the shaft end)	[N]
F_{Ramax}	Maximum permitted overhung load at the output shaft for continuous duty (load application point is the middle of the shaft end)	[N]
F_{Repk}	Maximum permitted overhung load at the input shaft for short-time duty (load application point is the middle of the shaft end)	[N]
F_{Remax}	Maximum permitted overhung load at the input shaft for continuous duty (load application point is the middle of the shaft end)	[N]
H	Installation altitude	[m above sea level]
I₀	Current consumption of the motor at M_0	[A]
I_{max}	Maximum permitted motor current (root-mean-square value)	[A]
Ins.cl.	Thermal classification of the motor	
i	Gear unit reduction ratio	
IM	Mounting position of the gear unit (international mounting position) M1 - M6	
IP..	Degree of protection according to IEC60034-5	
J_A	Mass moment of inertia of the adapter	[kgm ²]
J_G	Mass moment of inertia of the gear unit with reference to the input shaft	[kgm ²]
J_{GA}	Mass moment of inertia of the gear unit including adapter with reference to the input shaft	[kgm ²]
J_{ext}	Mass moment of inertia (external) reduced on motor shaft	[kgm ²]
J_{Mot}	Mass moment of inertia of the motor	[kgm ²]
J_L	Mass moment of inertia of the load	[kgm ²]
k	Inertia ratio J_{ext} / J_{Mot}	
l	Length of output shaft	[mm]
M₁ M_n	Output torque in time period t_1 to t_n	[Nm]
M₀	Thermally permitted output torque of the motor in continuous duty at low speed (not to be confused with standstill torque)	[Nm]

Table continued on next page.



Project Planning Information for Servo Gear Units

Drive and gear unit selection data

Designation	Meaning	Unit
M_a^{DYN}	Dynamic output torque assumed for the drive in project planning	[Nm]
$M_{a\text{eff}}$	Effective torque for component testing calculated in project planning	[Nm]
M_{akub}	Effective torque for bearing testing calculated in project planning	[Nm]
M_{amax}	Maximum permitted output torque for continuous duty	[Nm]
M_{apk}	Maximum permitted output torque for short-time duty	[Nm]
$M_{aNOTAUS}$	Maximum permitted output emergency stop torque, max. 1000 emergency stops	[Nm]
M_{ath}	Effective torque for thermal testing calculated in project planning	[Nm]
M_B	Rated brake torque	[Nm]
M_{pk}	Dynamic limit torque of the servomotor	[Nm]
M_{eff}	Effective torque requirement (in relation to the motor)	[Nm]
M_{max}	Maximum output torque assumed for the drive in project planning	[Nm]
ML	Mounting location (UL)	
n_{apk}	Maximum permitted output speed for short-time duty	[rpm]
n_{epk}	Maximum permitted input speed for short-time duty	[rpm]
n_{em}	Mean input speed	[rpm]
n_{am}	Mean output speed	[rpm]
n_{ak}	Breakpoint speed (output)	[rpm]
n_N	Rated speed	[rpm]
$n_1 \dots n_n$	Output speed in time period t_1 to t_n	[rpm]
$n_{\text{etn_pk}}$	Maximum input speed in time period n	[rpm]
P_{Br}	Braking power	[W]
P_{Br_pk}	Peak braking power	[W]
P_{Br_eff}	Effective braking power	[W]
P_{Br_tn}	Braking power in time period t_n	[W]
$S_{\dots} \dots \% \text{ cdf}$	Duty type and cyclic duration factor cdf in %; the exact load cycle can be entered instead.	
$t_1 \dots t_n$	Time period 1 to n	[s]
t_z	Cycle time	[s]
T_{Amb}	Ambient temperature	[°C]
U_{sys}	System voltage, voltage of the supplying inverter	[V]
U_{Br}	Operating voltage of the brake	[V]
x	Distance between overhung load application point and shaft shoulder	[mm]
$F_{R\text{max}}$	Calculated auxiliary value	
$F_{R\text{kub}}$	Calculated auxiliary value	



Determining the application data

It is necessary to have data on the machine to be driven (mass, speed, setting range, etc.) to project the drive correctly.

These data help determine the required power, torque and speed. Refer to the SEW publication "Drive Engineering - Practical Implementation / Drive Planning" or the SEW project planning tool SEW Workbench for assistance.

4

Selecting the proper drive

The appropriate drive can be selected once the power and speed of the drive have been calculated and with regard to mechanical requirements.

Required motor data

As the dimensions of servomotors are not standardized, the following motor data must be known to select the appropriate adapter:

- Shaft diameter and length
- Flange dimensions (edge length, diameter, centering shoulder and hole circle)
- Maximum torque

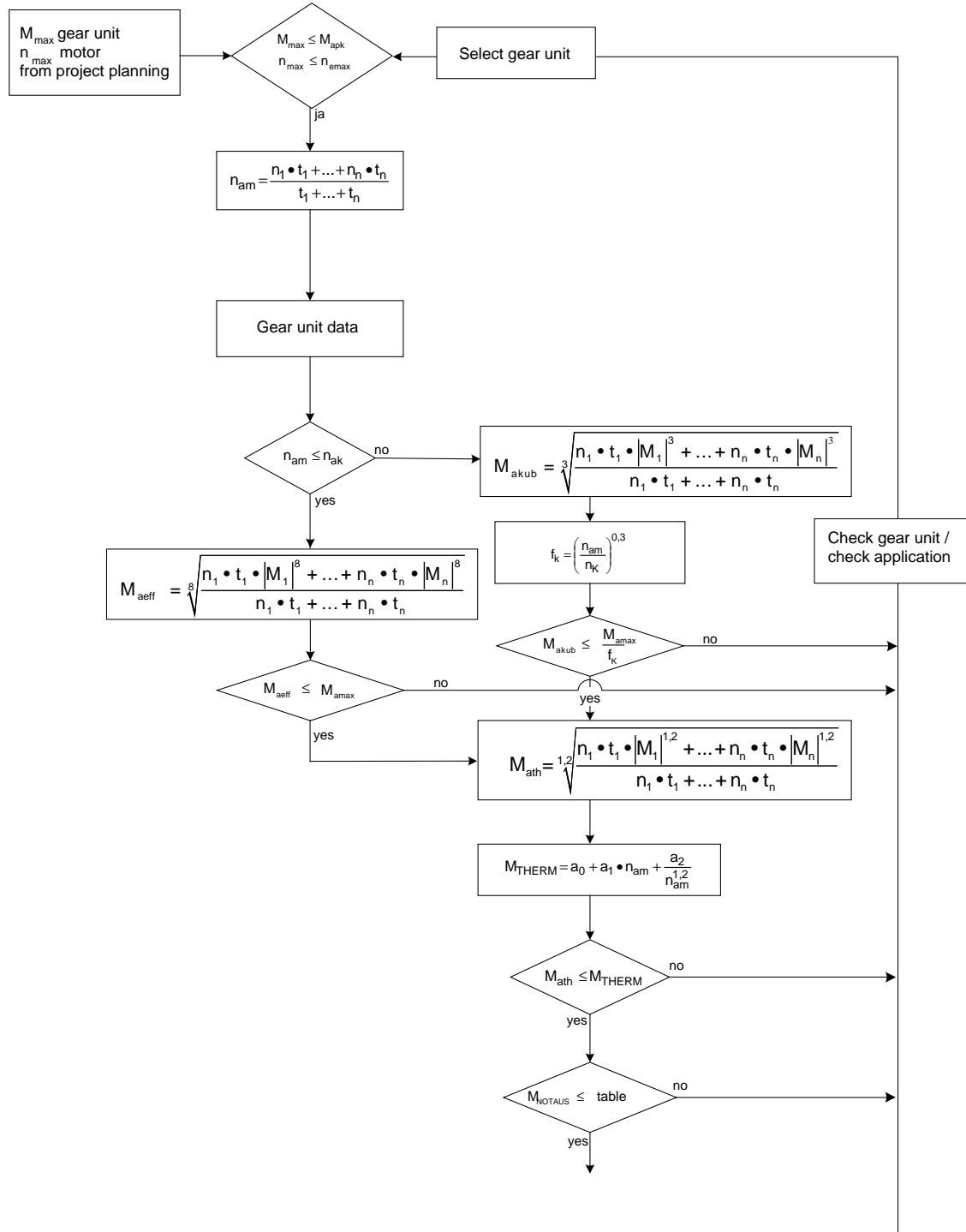
Do not hesitate to contact us if you have questions on selection and project planning.

4.2 Project planning procedure

The following flow diagrams illustrate the project planning procedure for a servo gear unit.



Project planning procedure part 1, servo gear units

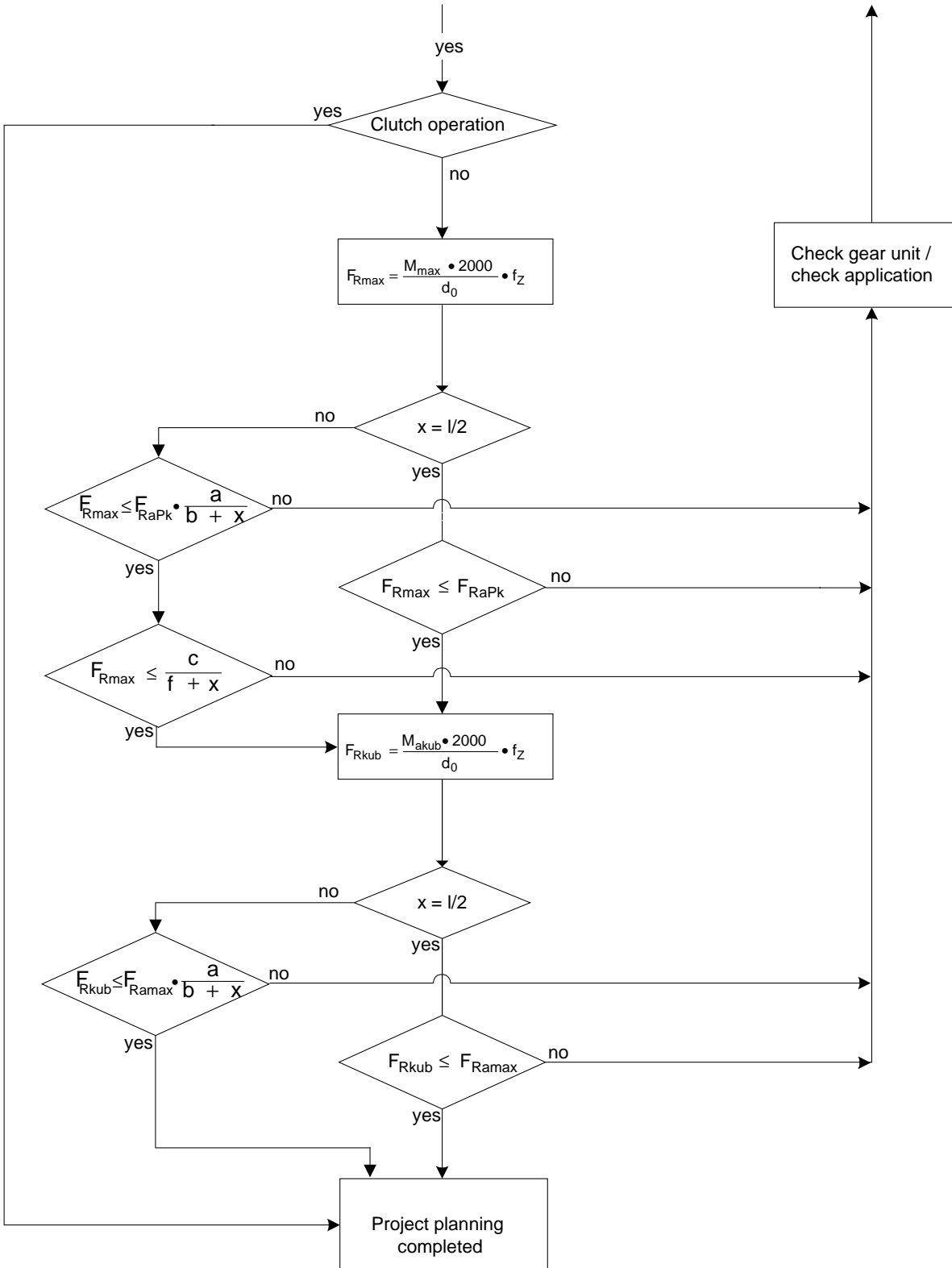


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* For thermal project planning of R, F, K, S, W gear units, please contact SEW-EURODRIVE.



Project planning procedure part 2, servo gear units



4

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4.3 Project planning information for R, F, K, S, W gear units

Efficiency of gear units

General information

The efficiency of gear units is mainly determined by the gearing and bearing friction. Keep in mind that the starting efficiency of a gear unit is always less than its efficiency at operating speed. This factor is particularly true for helical-worm and SPIROPLAN® right-angle gear units.

R, F, K gear units

The efficiency of helical, parallel shaft and helical-bevel gear units varies with the number of gear stages, between 96% (3-stage), 97% (2-stage) and 98% (1-stage).

S and W gear units

The gearing in helical-worm and SPIROPLAN® gear units produces a high proportion of sliding friction. As a result, these gear units have higher gearing losses than R, F or K gear units and therefore be less efficient.

The efficiency depends on the following factors:

- Gear ratio of the helical-worm or SPIROPLAN® stage
- Input speed
- Gear unit temperature

Helical-worm gear units from SEW-EURODRIVE are helical gear/worm combinations that are significantly more efficient than plain worm gear units.

The efficiency may reach $\eta < 0.5$ if the helical-worm gear stage has a very high gear ratio.

The SPIROPLAN® gear unit W37/W47 from SEW-EURODRIVE has an efficiency of more than 90%, which drops only slightly even for large gear unit ratios.

Self-locking

Retrodriving torques on helical-worm or SPIROPLAN® gear units produce an efficiency of $\eta' = 2 - 1/\eta$, which is significantly less favorable than the forward efficiency η . The helical-worm or SPIROPLAN® gear unit is self-locking if the forward efficiency $\eta \leq 0.5$. Some SPIROPLAN® gear units are dynamically self-locking. Contact SEW-EURODRIVE if you wish to make technical use of the braking effect of self-locking characteristics.

	INFORMATION
	Note that the self-locking effect of helical-worm and SPIROPLAN® gear units is not permitted as the sole safety function for hoists.



Run-in phase

The tooth flanks of new helical-worm and SPIROPLAN® gear units are not yet completely smooth. That fact makes for a greater friction angle and less efficiency than during later operation. This effect intensifies with increasing gear unit ratio. Subtract the following values from the listed efficiency during the running-in phase:

	Worm	
	i range	η reduction
1-start	approx. 50 ... 280	approx. 12 %
2-start	approx. 20 ... 75	approx. 6 %
3-start	approx. 20 ... 90	approx. 3%
5-start	approx. 6 ... 25	approx. 3%
6-start	approx. 7 ... 25	approx. 2 %

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i range	SPIROPLAN® W.. η reduction
approx. 30 ... 75	approx. 8 %
approx. 10 ... 30	approx. 5 %
approx. 3 ... 10	approx. 3%

The run-in phase usually lasts 48 hours. Helical-worm and SPIROPLAN® gear units achieve their listed rated efficiency values when:

- the gear unit has been completely run-in,
- the gear unit has reached nominal operating temperature,
- the recommended lubricant has been filled in, and
- the gear unit is operating in the rated load range.

Churning losses

In certain gear unit mounting positions (see chapter "Gear Unit Mounting Positions"), the first gearing stage is completely immersed in the lubricant. When the circumferential velocity of the input stage is high, considerable churning losses occur in larger gear units that must be taken into account. Contact SEW-EURODRIVE if you wish to use gear units of this type.

To reduce churning losses to a minimum, use gear units in M1 mounting position.



Overhung and axial loads

Determining overhung load

An important factor for determining the resulting overhung load is the type of transmission element mounted to the shaft end. The following transmission element factors f_z have to be considered for various transmission elements.

Transmission element	Transmission element factor f_z	Comments
Gears	1.15	< 17 teeth
Chain sprockets	1.40	< 13 teeth
Chain sprockets	1.25	< 20 teeth
Narrow V-belt pulleys	1.75	Influence of the pre-tensioning
Flat belt pulleys	2.50	Influence of the pre-tensioning
Toothed belt pulleys	2.00 - 2.50	Influence of the pre-tensioning
Gear rack pinion, prestressed	2.00	Influence of the pre-tensioning

Permitted overhung load

The basis for determining the permitted overhung loads is the computation of the rated bearing service life L_{10h} of the anti-friction bearings (according to ISO 281).
For special operating conditions, the permitted overhung loads can be determined with regard to the modified service life on request.

	INFORMATION
	<p>The values refer to force applied to the center of the shaft end (in right-angle gear units as viewed onto drive end). The values for the force application angle α and direction of rotation are based on the most unfavorable conditions.</p>

	INFORMATION
	<p>Reduction of overhung loads</p> <ul style="list-style-type: none"> Only 50 % of the $F_{R_{max}}$ and $F_{R_{apk}}$ values specified in the selection tables are permitted in mounting positions M1 and M3 with wall attachment on the front face for K and S gear units. Helical-bevel gearmotors K167 and K187 in mounting positions M1 to M4: A maximum of 50 % of the overhung load $F_{R_{max}}$ specified in the selection tables in the case of gear unit mounting other than as shown in the mounting position sheets. Foot and flange-mounted helical gearmotors (R..F): A maximum of 50 % of the overhung load $F_{R_{max}}$ specified in the selection tables in the case of torque transmission via the flange mounting.

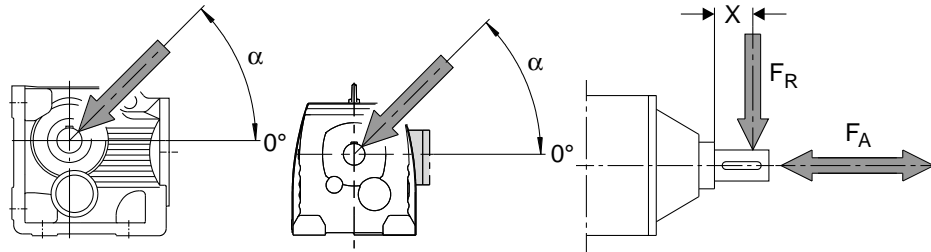
Higher permitted overhung loads

Exactly considering the force application angle α and the direction of rotation makes it possible to achieve a higher overhung load than listed in the selection tables.
Higher output shaft loads are permitted if heavy duty bearings are installed, especially with R, F and K gear units.
Contact SEW-EURODRIVE in such cases.



Definition of force application point

The force application is defined according to the following figure:



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Figure 1: Definition of the force application

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Permitted axial loads

If there is no overhung load, then an axial load F_A (tension or compression) amounting to 50 % of the overhung load given in the selection tables is permitted. This condition applies to the following gearmotors:

- Helical gearmotors except for R..137... to R..167...
- Parallel shaft and helical-bevel gearmotors with solid shaft except for F97...
- Helical-worm gearmotors with solid shaft



INFORMATION

Contact SEW-EURODRIVE for all other types of gear units and in the event of significantly greater axial loads or combinations of overhung load and axial load.

On the output side:
Overhung load conversion for off-center force application

The permitted overhung loads F_{Rmax} and F_{Rapk} listed in the data tables apply for force application at Iβ2 (solid shaft) or for force application at the shaft end face (hollow shaft). If the distance between the force application point on the gear unit is different, the overhung loads must be determined anew according to the project planning procedure, page 44. The following conditions must be met:

$$F_R \leq F_{Ra\max} \frac{a}{b+x} [N] \quad F_R \leq \frac{c}{f+x} [N]$$

- F_{Rmax} = Permitted overhung load [N]
- x = Distance from the shaft shoulder to the force application point in [mm]
- a, b, f = Gear unit constants for overhung load conversion [mm]
- c = Gear unit constant for overhung load conversion [Nmm]

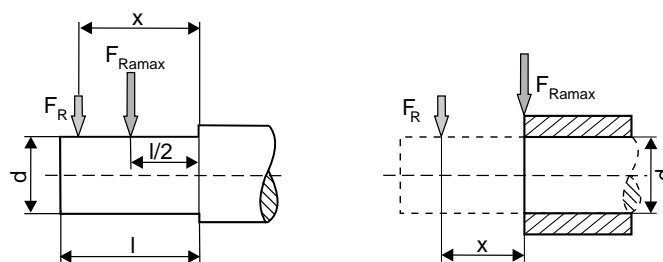


Figure 2: Overhung load F_R with increased distance x to the gear unit

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Project Planning Information for Servo Gear Units

Project planning information for R, F, K, S, W gear units

Gear unit constants for overhung load conversion

Gear unit type	a [mm]	b [mm]	c [Nmm]	f [mm]	d [mm]	l [mm]
RX57	43.5	23.5	1.51×10^5	34.2	20	40
RX67	52.5	27.5	2.42×10^5	39.7	25	50
RX77	60.5	30.5	1.95×10^5	0	30	60
RX87	73.5	33.5	7.69×10^5	48.9	40	80
RX97	86.5	36.5	1.43×10^6	53.9	50	100
RX107	102.5	42.5	2.47×10^6	62.3	60	120
R07	72.0	52.0	4.67×10^4	11	20	40
R17	88.5	68.5	6.527×10^4	17	20	40
R27	106.5	81.5	1.56×10^5	11.8	25	50
R37	118	93	1.24×10^5	0	25	50
R47	137	107	2.44×10^5	15	30	60
R57	147.5	112.5	3.77×10^5	18	35	70
R67	168.5	133.5	2.65×10^5	0	35	70
R77	173.7	133.7	3.97×10^5	0	40	80
R87	216.7	166.7	8.47×10^5	0	50	100
R97	255.5	195.5	1.06×10^6	0	60	120
R107	285.5	215.5	2.06×10^6	0	70	140
R137	343.5	258.5	4.58×10^6	0	90	170
R147	402	297	8.65×10^6	33	110	210
R167	450	345	1.26×10^7	0	120	210
F27	109.5	84.5	1.13×10^5	0	25	50
F37	123.5	98.5	1.07×10^5	0	25	50
F47	153.5	123.5	1.40×10^5	0	30	60
F57	170.7	135.7	2.70×10^5	0	35	70
F67	181.3	141.3	4.12×10^5	0	40	80
F77	215.8	165.8	7.87×10^5	0	50	100
F87	263	203	1.06×10^6	0	60	120
F97	350	280	2.09×10^6	0	70	140
F107	373.5	288.5	4.23×10^6	0	90	170
F127	442.5	337.5	9.45×10^6	0	110	210
F157	512	407	1.05×10^7	0	120	210
K37	123.5	98.5	1.30×10^5	0	25	50
K47	153.5	123.5	1.40×10^5	0	30	60
K57	169.7	134.7	2.70×10^5	0	35	70
K67	181.3	141.3	4.12×10^5	0	40	80
K77	215.8	165.8	7.69×10^5	0	50	100
K87	252	192	1.64×10^6	0	60	120
K97	319	249	2.80×10^6	0	70	140
K107	373.5	288.5	5.53×10^6	0	90	170
K127	443.5	338.5	8.31×10^6	0	110	210
K157	509	404	1.18×10^7	0	120	210
K167	621.5	496.5	1.88×10^7	0	160	250
K187	720.5	560.5	3.04×10^7	0	190	320
W10	84.8	64.8	3.6×10^4	0	16	40
W20	98.5	78.5	4.4×10^4	0	20	40
W30	109.5	89.5	6.0×10^4	0	20	40
W37	121.1	101.1	6.95×10^4	0	20	40
W47	145.5	115.5	4.26×10^5	35.6	30	60
S37	118.5	98.5	6.0×10^4	0	20	40
S47	130	105	1.33×10^5	0	25	50
S57	150	120	2.14×10^5	0	30	60
S67	184	149	3.04×10^5	0	35	70
S77	224	179	5.26×10^5	0	45	90
S87	281.5	221.5	1.68×10^6	0	60	120
S97	326.3	256.3	2.54×10^6	0	70	140

Values for types not listed are available on request.



4.4 Project planning information for BS.F, PS.F, PS.C gear units

Efficiency of gear units

General information The efficiency of gear units is mainly determined by the gearing and bearing friction. Keep in mind that the starting efficiency of a gear unit is always less than its efficiency at operating speed.

BS.F gear units The efficiency of BS.F gear units is up to 94 % (2-stage).

PS.F, PS.C gear units The efficiency of planetary gear units varies with the number of gear stages, between 98 % (2-stage) and 99 % (1-stage).

4

	INFORMATION
	For PS.F gear units with circumferential backlash option "M" used in S1 duty cycle, please contact SEW-EURODRIVE.

	INFORMATION
	When input and output elements are mounted on servo gear units , the shaft shoulder can be used as a stop for transmission elements (belt pulley, pinion gear, etc.).

Overhung and axial loads

Determining overhung load

An important factor for determining the resulting overhung load is the type of transmission element mounted to the shaft end. The following transmission element factors f_z also have to be considered for various transmission elements according to the following formula:

$$f_z = f_{z1} \times f_{z2}$$

Transmission element	Transm. eement factor f_{z1}	Comments
Gears	1.15	< 17 teeth
Chain sprockets	1.40	< 13 teeth
Chain sprockets	1.25	< 20 teeth
Narrow V-belt pulleys	1.75	Influence of the pre-tensioning
Flat belt pulleys	2.50	Influence of the pre-tensioning
Toothed belt pulleys	2.00 - 2.50	Influence of the pre-tensioning
Gear rack pinion, prestressed	2.00	Influence of the pre-tensioning

	INFORMATION
	Factor f_{z2} only applies to helical output elements.



Helical output elements		
Gear units	Helix angle $\beta^{1) 2)}$	f_{z2}
BS.F502-802 PS.F621-922, PSBF321-521	$\leq 11^\circ$	1.00
PS.C221 - PS.C622	20°	1.20

- 1) When $11^\circ < \beta < 20^\circ$, then f_z must be interpolated linearly.
- 2) For helix angles $> 20^\circ$, please contact SEW-EURODRIVE.

Permitted overhung load

The basis for determining the permitted overhung loads is the computation of the rated bearing service life L_{H10} of the anti-friction bearings (according to ISO 281).

For special operating conditions, the permitted overhung loads can be determined with regard to the modified service life on request.

	INFORMATION
	<p>The values refer to force applied to the center of the shaft end (in right-angle gear units as viewed onto drive end). The values for the force application angle α and direction of rotation are based on the most unfavorable conditions.</p>

	INFORMATION
	<p>Reduction of overhung loads</p> <ul style="list-style-type: none"> • Only 50 % of the F_{Rmax} and F_{Rapk} values specified in the selection tables are permitted in mounting positions M1 and M3 with wall attachment on the front face for BS.F gear units.

Higher permitted overhung loads

Exactly considering the force application angle α and the direction of rotation makes it possible to achieve a higher overhung load than listed in the selection tables.

Contact SEW-EURODRIVE in such cases.

Definition of force application point

The force application is defined according to the following figure:

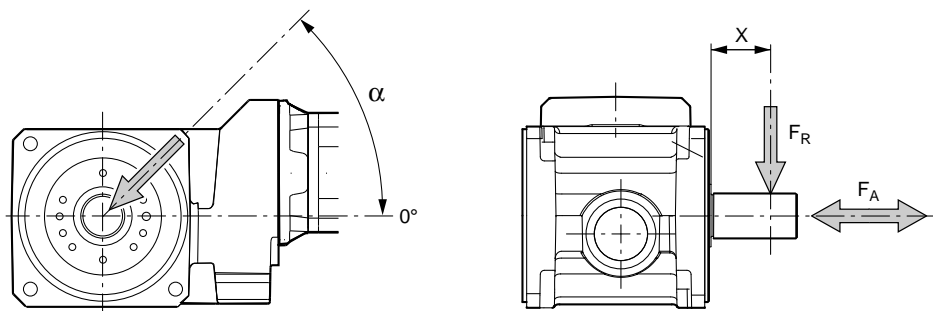


Figure 3: Definition of the force application

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Permitted axial loads

If there is no overhung load, then an axial load F_A (tension or compression) amounting to 50 % of the overhung load given in the selection tables is permitted.



*On the output side:
 Overhung load
 conversion for off-
 center force
 application*

The permitted overhung loads F_{Rmax} and F_{Rapk} listed in the data tables apply for force application at Iβ2 (solid shaft) or for force application at the shaft end face (hollow shaft, flange block). If the distance between the force application point and the gear unit is different, the overhung loads must be determined anew according to the project planning procedure page 44 New. The following conditions must be met:

$$F_R \leq F_{Rmax} \frac{a}{b+x} [N] \qquad F_R \leq \frac{c}{f+x} [N]$$

4

- F_{Rmax} = Permitted overhung load [N]
- x = Distance from the shaft shoulder to the force application point in [mm]
- a, b, f = Gear unit constants for overhung load conversion [mm]
- c = Gear unit constant for overhung load conversion [Nmm]

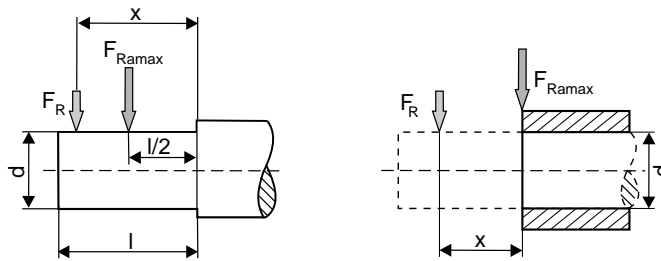


Figure 4: Overhung load F_R with increased distance x to the gear unit

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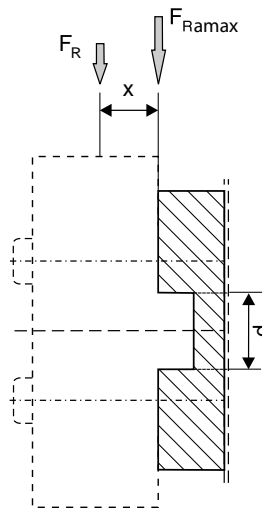


Figure 5: Overhung load F_R with increased distance x to the gear unit

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Project Planning Information for Servo Gear Units

Project planning information for BS.F, PS.F, PS.C gear units

Gear unit constants for overhung load conversion

Gear unit	a [mm]	b [mm]	c [Nmm]	f [mm]	d [mm]	l [mm]
BSF / BSKF202	113.1	95.6	7.35×10^4	0	20	35
BSHF / BSAF202	116.6	116.6	--	--	--	--
BSBF202	101.5	101.5	--	--	--	--
BSF / BSKF302	122.6	104.6	8.61×10^4	0	22	36
BSHF / BSAF302	126.6	126.6	--	--	--	--
BSBF302	111.0	111.0	--	--	--	--
BSF / BSKF402	152.2	123.2	2.56×10^5	0	32	58
BSHF / BSAF402	143.7	143.7	--	--	--	--
BSBF402	132.0	132.0	--	--	--	--
BSF / BSKF502	175.4	134.4	4.92×10^5	0	40	82
BSHF / BSAF502	162.4	162.4	--	--	--	--
BSBF502	145.3	145.3	--	--	--	--
BSF / BSKF602	195.9	154.9	9.84×10^5	0	55	82
BSHF / BSAF602	189.9	189.9	--	--	--	--
BSBF602	170.8	170.8	--	--	--	--
BSF / BSKF802	242.7	190.2	1.89×10^6	0	75	105
BSHF / BSAF802	243.2	243.2	--	--	--	--
BSBF802	206.0	206.0	--	--	--	--

Gear unit	a [mm]	b [mm]	c [Nmm]	f [mm]	d [mm]	l [mm]
PSF / PSKF121/122	47.6	36.6	2.08×10^4	0	14	22
PSF / PSKF221/222	53.6	39.6	2.41×10^4	0	16	28
PSBF221/222	64.1	64.1	--	--	--	--
PSF / PSKF321/322	65.0	47.0	7.97×10^4	0	22	36
PSBF321/322	72.5	72.5	--	--	--	--
PSF / PSKF521/522	83.1	54.1	2.52×10^5	0	32	58
PSBF521/522	87.5	87.5	--	--	--	--
PSF / PSKF621/622	113.6	72.3	5.48×10^5	0	40	82
PSBF621/622	105.0	105.0	--	--	--	--
PSF / PSKF721/722	126.6	85.6	1.42×10^6	0	55	82
PSBF721/722	138.5	138.5	--	--	--	--
PSF / PSKF821/822	153.2	100.7	3.21×10^6	0	75	105
PSBF821/822	156.0	156.0	--	--	--	--
PSF / PSKF921/922	170.7	105.7	5.30×10^6	0	85	130

Gear unit	a [mm]	b [mm]	c [Nmm]	f [mm]	d [mm]	l [mm]
PS.C221/222	57	43	3.41×10^4	0	16	28
PS.C321/322	63.5	45.5	7.55×10^4	0	22	36
PS.C521/522	95.5	66.5	2.13×10^5	0	32	58
PS.C621/622	107.5	66.5	3.68×10^5	0	40	82

Values for types not listed are available on request.



4.5 Project planning example: Gantry with servo drives

X-axis planning (travel axis)

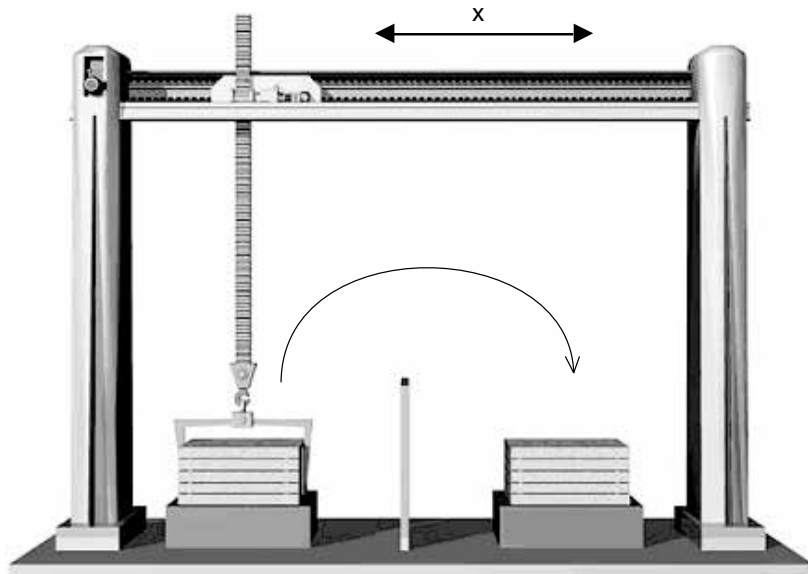


Figure 6: Project planning example: Gantry with servo drives travel axis

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Reference data:

- Total moved mass: $m_L = 50$ kg
- Diameter of the belt pulley: $d_0 = 75$ mm
- Friction coefficient of the axis: $\mu = 0.01$
- Traveling velocity: $v_{\max} = 2$ m/s
- Maximum occurring acceleration/deceleration: $a_{\max} = 10$ m/s²
- Cycle time: $t_z = 3$ s
- Rest period: $t_p = 1.8$ s
- Load efficiency: $h_L = 0.9$
- Mounting position of the gear unit: IM = M1

A PS.C gear unit with ECH adapter is provided for the drive.

The overhung load is to act on the shaft center.

Power is transmitted via belt and belt pulley.



Travel sections

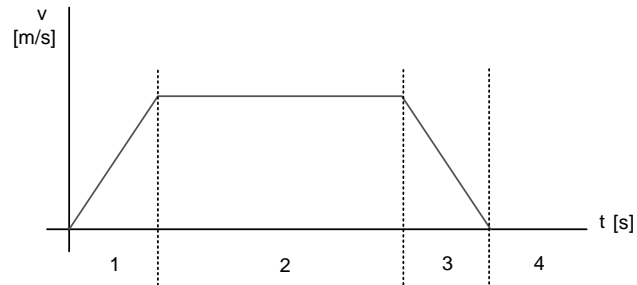


Figure 7: Travel sections 1 - 4

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Acceleration time in travel section 1, deceleration time in travel section 3

$$t_1 = t_3 = \frac{v_{max}}{a_{max}} = \frac{2 \text{ m/s}}{10 \text{ m/s}^2} = 0.2 \text{ s}$$

Travel time for constant travel in travel section 2

$$t_2 = t_z \quad t_p \quad t_1 \quad t_3$$

$$t_2 = 3 \text{ s} \quad 1.8 \text{ s} \quad 0.2 \text{ s} \quad 0.2 \text{ s}$$

$$t_2 = 0.8 \text{ s}$$

M_{stat} for all travel sections

$$M_{stat} = \frac{(m \cdot g \cdot \mu) \cdot \frac{d_0}{2}}{\eta_L}$$

$$M_{stat} = \frac{50 \text{ kg} \cdot 9.81 \frac{\text{m}}{\text{s}^2} \cdot 0.01 \cdot \frac{0.075 \text{ m}}{2}}{0.9}$$

$$M_{stat} = 0.2043 \text{ Nm}$$

M_{dyn} during acceleration in travel section 1

$$M_{dyn} = \frac{(m \cdot a) \cdot \frac{d_0}{2}}{\eta_L}$$

$$M_{dyn} = \frac{50 \text{ kg} \cdot 10 \frac{\text{m}}{\text{s}^2} \cdot \frac{0.075 \text{ m}}{2}}{0.9}$$

$$M_{dyn} = 20.83 \text{ Nm}$$



M_{dyn} during deceleration in travel section 3

$$M_{dyn} = m \cdot a \cdot \frac{d_0}{2} \cdot \eta_L$$

$$M_{dyn} = 50\text{kg} \cdot \left(10 \frac{\text{m}}{\text{s}^2} \right) \cdot \frac{0.075\text{m}}{2} \cdot 0.9$$

$$M_{dyn} = 16.875\text{Nm}$$

4

M_{max} during acceleration in travel section 1

$$M_{max} = M_{stat} + M_{dyn1}$$

$$M_{max} = 0.2043\text{Nm} + 20.8333\text{Nm}$$

$$M_{max} = 21.04\text{Nm}$$

M_{max} during deceleration in travel section 3

$$M_{max} = M_{stat} + M_{dyn3}$$

$$M_{max} = 0.2043\text{Nm} + (16.87\text{Nm})$$

$$M_{max} = 16.6657\text{Nm}$$

Output speed

$$n_{a\max} = \frac{v_{\max}}{d_0 \cdot \pi} \cdot 60$$

$$n_{a\max} = \frac{2 \frac{\text{m}}{\text{s}}}{0.075\text{m} \cdot \pi} \cdot 60$$

$$n_{a\max} = 509.295 \frac{1}{\text{min}}$$

Gear ration including 10 % motor speed reserve
 $n_N = 4500$ rpm is an assumption.

$$i = \frac{n_N \cdot 0.9}{n_{a\max}}$$

$$i = \frac{4500 \frac{1}{\text{min}} \cdot 0.9}{509.295 \frac{1}{\text{min}}}$$

$$i = 7.95$$

Gear ratio $i = 7$ is selected.



Project Planning Information for Servo Gear Units

Project planning example: Gantry with servo drives

Maximum input speed

$$n_{\max} = n_{a\max} \cdot i$$

$$n_{\max} = 509.295 \frac{1}{\min} \cdot 7$$

$$n_{\max} = 3565.065 \frac{1}{\min}$$


Servo gear unit project planning


Project planning follows the project planning procedure on page 44 and subsequent pages.

Selection conditions:

$$M_{\max} \leq M_{\text{apk}}$$

$$n_{\max} \leq n_{\text{epk}}$$

ECH / EPH	i	n _{epk} [1/min]	? [%]	M1;M3;M5-6			M2			M4			φ [°]
				a ₀	a ₁	a ₂	a ₀	a ₁	a ₂	a ₀	a ₁	a ₂	
PSC221  1	3	7000	98	104.00	-0.073	0	111.00	-0.084	0	114.00	-0.089	0	10
	5	7000	98	153.00	-0.121	0	159.00	-0.130	0	164.00	-0.139	0	10
	7	7000	98	170.00	-0.152	0	175.00	-0.160	0	180.00	-0.170	0	10
	10	7000	98	172.00	-0.182	0	175.00	-0.188	0	179.00	-0.198	0	10

ECH02	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	c _T PSC [Nm/°]	F _{Ramax} PSC [N]	F _{Rapk} PSC [N]
PSC221  1	3	29	40	60	1500	0.38	3.11	1170	2000
	5	34	42	63	720	0.27	3.42	1390	2000
	7	32	39	59	800	0.24	3.41	1550	2000
	10	30	37	56	700	0.22	3.0	1750	2000

Selection condition:

$$M_{\max} \leq M_{\text{apk}}$$

$$21.04Nm \leq 39Nm$$

$$n_{\max} \leq n_{\text{epk}}$$

$$3565 \frac{1}{\min} \leq 7000 \frac{1}{\min}$$

Condition is fulfilled.



Mean output speed

$$n_{am} = \frac{n_1 t_1 + \dots + n_n t_n}{t_1 + \dots + t_n}$$

$$n_{am} = \frac{\frac{509.295}{2} \frac{1}{\text{min}} \cdot 0.2s + 509.295 \frac{1}{\text{min}} \cdot 0.8s + \frac{509.295}{2} \frac{1}{\text{min}} \cdot 0.2s}{0.2s + 0.8s + 0.2s + 1.8s}$$

$$n_{am} = 169.765 \frac{1}{\text{min}}$$

4

Selection condition:

$$n_{am} \leq n_{ak}$$

ECH02	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	c _T PSC [Nm/']	F _{Ramax} PSC [N]	F _{Rapk} PSC [N]
PSC221 1	3	29	40	60	1500	0.38	3.11	1170	2000
	5	34	42	63	720	0.27	3.42	1390	2000
	7	32	39	59	800	0.24	3.41	1550	2000
	10	30	37	56	700	0.22	3.0	1750	2000

$$169.765 \frac{1}{\text{min}} \leq 800 \frac{1}{\text{min}}$$

Condition is fulfilled.

Effective torque of servo gear unit

$$M_{aeff} = \sqrt[8]{\frac{n_1 t_1 |M_1|^8 + \dots + n_n t_n |M_n|^8}{n_1 t_1 + \dots + n_n t_n}}$$

$$M_{aeff} = \sqrt[8]{\frac{\frac{509.295}{2} \frac{1}{\text{min}} \cdot 0.2s |21.04Nm|^8 + 509.295 \frac{1}{\text{min}} \cdot 0.8s |0.2043Nm|^8 + \frac{509.295}{2} \frac{1}{\text{min}} \cdot 0.2s |16.67Nm|^8}{0.2s \cdot 254.64 \frac{1}{\text{min}} + 0.8s \cdot 509.295 \frac{1}{\text{min}} + 0.2s \cdot 254.64 \frac{1}{\text{min}}}}$$

$$M_{aeff} = 16.065Nm$$

Selection condition:

$$M_{aeff} \leq M_{amax}$$

ECH02	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	c _T PSC [Nm/']	F _{Ramax} PSC [N]	F _{Rapk} PSC [N]
PSC221 1	3	29	40	60	1500	0.38	3.11	1170	2000
	5	34	42	63	720	0.27	3.42	1390	2000
	7	32	39	59	800	0.24	3.41	1550	2000
	10	30	37	56	700	0.22	3.0	1750	2000



Project Planning Information for Servo Gear Units

Project planning example: Gantry with servo drives

$$16.065 Nm \leq 32 Nm$$

Condition is fulfilled.


Thermal torque of servo gear unit

$$M_{ath} = \sqrt[1.2]{\frac{n_1 t_1 |M_1|^{1.2} + \dots + n_n t_n |M_n|^{1.2}}{n_1 t_1 + \dots + n_n t_n}}$$

$$M_{ath} = \sqrt[1.2]{\frac{509.295 \frac{1}{\text{min}} \cdot 0.2s \cdot |21.04 Nm|^{1.2} + 509.295 \frac{1}{\text{min}} \cdot 0.8s \cdot |0.2043 Nm|^{1.2} + \frac{509.29 \frac{1}{\text{min}} \cdot 0.2s \cdot |16.67 Nm|^{1.2}}{2}}{0.2s \cdot 254.64 \frac{1}{\text{min}} + 0.8s \cdot 509.295 \frac{1}{\text{min}} + 0.2s \cdot 254.64 \frac{1}{\text{min}}}}$$

$$M_{ath} = 5.009 Nm$$

Thermal factors for mounting position M1:

ECH / EPH	i	n _{epk} [1/min]	? [%]	M1;M3;M5-6			M2			M4			φ [°]
				a ₀	a ₁	a ₂	a ₀	a ₁	a ₂	a ₀	a ₁	a ₂	
PSC221  1	3	7000	98	104.00	-0.073	0	111.00	-0.084	0	114.00	-0.089	0	10
	5	7000	98	153.00	-0.121	0	159.00	-0.130	0	164.00	-0.139	0	10
	7	7000	98	170.00	-0.152	0	175.00	-0.160	0	180.00	-0.170	0	10
	10	7000	98	172.00	-0.182	0	175.00	-0.188	0	179.00	-0.198	0	10

$$M_{Therm} = a_0 + a_1 n_{am} + \frac{a_2}{n_{am}^{1.2}}$$

$$M_{Therm} = 172 + (0.182 \cdot 169.765 \frac{1}{\text{min}}) + \frac{0}{169.765^{1.2}}$$

$$M_{Therm} = 141.102 Nm$$

Selection condition:

$$M_{ath} \leq M_{Therm}$$

$$5.009 Nm \leq 141.102 Nm$$

Condition is fulfilled.

Overhung load calculation

For transmission element factors for overhung loads of different transmission elements at the output shaft, refer to page 48 and 50.

Without coupling operation:

$$F_{Rmax} = \frac{M_{max} \cdot 2000}{d_0} \cdot f_z$$



$$F_{Rmax} = \frac{M_{max}}{\frac{d_0}{2}} f_z$$

$$F_{Rmax} = \frac{21.04 Nm}{\frac{0.075 m}{2}} \cdot 2.5$$

$$F_{Rmax} = 1402 N$$

4

The force application point is the center of the output shaft.

Selection condition:

When $x = l/2$, then:

$$F_{Rmax} \leq F_{Rapk}$$

ECH02	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	c _T PSC [Nm/']	F _{Ramax} PSC [N]	F _{Rapk} PSC [N]
PSC221 1	3	29	40	60	1500	0.38	3.11	1170	2000
	5	34	42	63	720	0.27	3.42	1390	2000
	7	32	39	59	800	0.24	3.41	1550	2000
	10	30	37	56	700	0.22	3.0	1750	2000

$$1402 N \leq 2000 N$$

Condition is fulfilled.

Calculating the bearing force

$$M_{akub} = \sqrt[3]{\frac{n_1 t_1 |M_1|^3 + \dots + n_n t_n |M_n|^3}{n_1 t_1 + \dots + n_n t_n}}$$

$$M_{akub} = \sqrt[3]{\frac{509.295 \frac{1}{min} \cdot 0.2s \cdot |21.04 Nm|^3 + 509.295 \frac{1}{min} \cdot 0.8s \cdot |0.2043 Nm|^3 + \frac{506.295 \frac{1}{min}}{2} \cdot 0.2s \cdot |16.67 Nm|^3}{0.2s \cdot 254.64 \frac{1}{min} + 0.8s \cdot 509.295 \frac{1}{min} + 0.2s \cdot 254.64 \frac{1}{min}}}$$

$$M_{akub} = 11.172 Nm$$

$$F_{Rkub} = \frac{M_{akub}}{\frac{d_0}{2}} f_z$$

$$F_{Rkub} = \frac{11.12 Nm}{\frac{0.075 m}{2}} \cdot 2.5$$

$$F_{Rkub} = 744.8 N$$




Project Planning Information for Servo Gear Units

Additional documentation

Selection conditions:

$$F_{Rkub} \leq F_{Ramax}$$

$$x = 1/2$$

ECH02	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	c _T PSC [Nm/°]	F _{Ramax} PSC [N]	F _{Rapk} PSC [N]
PSC221  1	3	29	40	60	1500	0.38	3.11	1170	2000
	5	34	42	63	720	0.27	3.42	1390	2000
	7	32	39	59	800	0.24	3.41	1550	2000
	10	30	37	56	700	0.22	3.0	1750	2000

$$744.8 N \leq 1550 N$$

Condition is fulfilled.

4.6 Additional documentation

In addition to the information in this manual, SEW-EURODRIVE offers extensive documentation covering the entire topic of electrical drive engineering. These are mainly the publications in the "Drive Engineering & Practical Implementation" series as well as the manuals and catalogs for gear units and electronically controlled drives.

You will find additional links to a wide selection of our documentation in many languages for download on the SEW-EURODRIVE homepage. The list below includes other documents that are of interest in terms of project planning. You can order these publications from SEW-EURODRIVE.

Technical data for motors and gear units

The following price catalogs and catalogs are available from SEW-EURODRIVE in addition to this "Servo Gear Units" catalog:

- AC motors
- Gear unit catalog
- Synchronous servo gearmotors

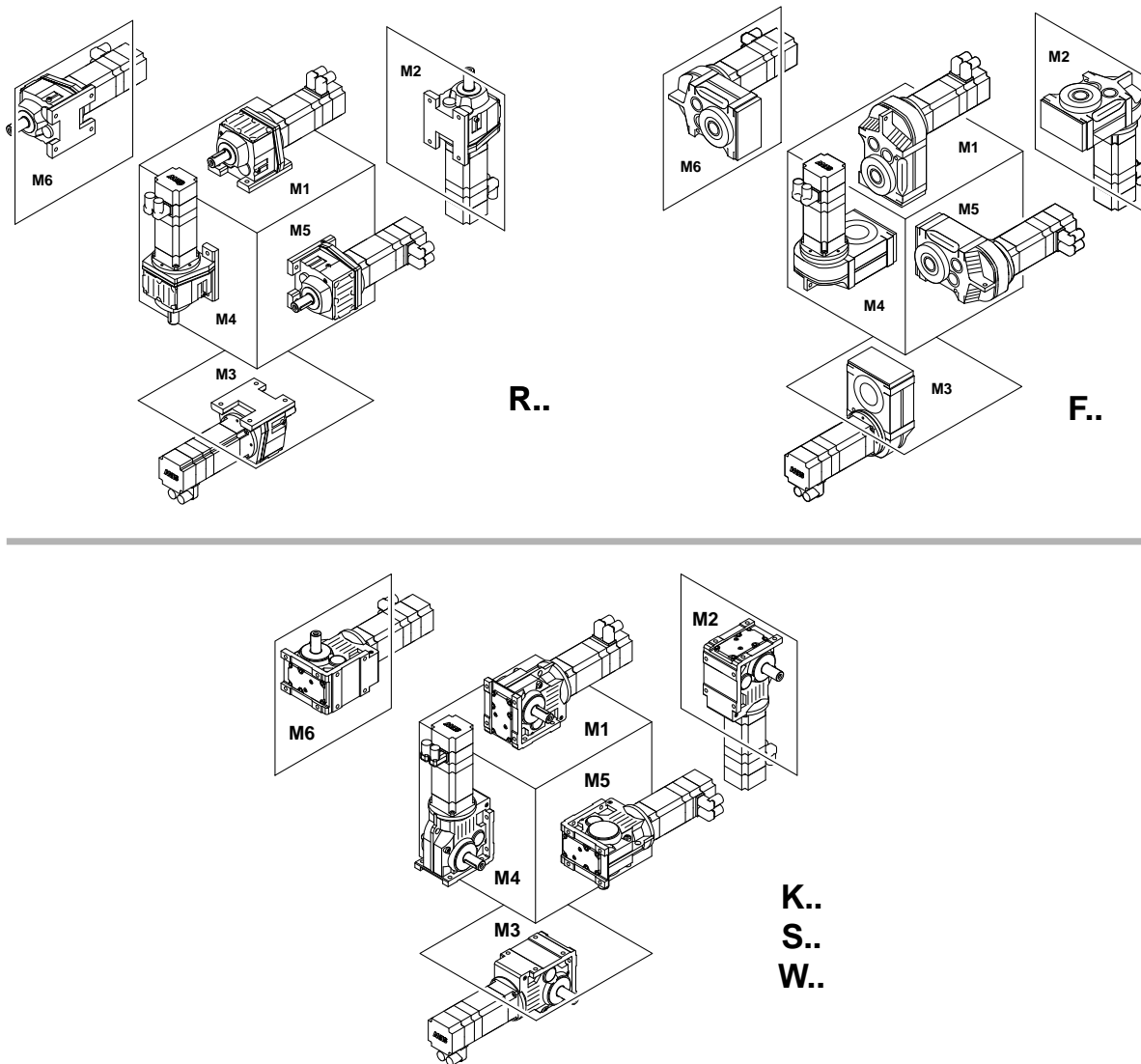
Drive Engineering - Practical Implementation

- Drive Planning
- Servo Technology.
- Explosion-proof drives in accordance with EU Directive 94/9/EC.

5 Mounting Positions of Gear Units

5.1 General information on the mounting positions of R, F, K, S, W gear units

SEW-EURODRIVE distinguishes between the six gear unit mounting positions M1 to M6. The following figure shows the position of the gear unit in mounting positions M1 to M6:



5


Figure 8: Depiction of mounting positions M1 - M6

63232axx

Mounting Positions of Gear Units

Order information for R, F, K, S, W servo gear units

5.2 Order information for R, F, K, S, W servo gear units

	INFORMATION
	The following order information is required in addition to the mounting position for R, F, K, S and W gear units to enable the configuration of the drive to be defined exactly.

Direction of rotation of the output shaft

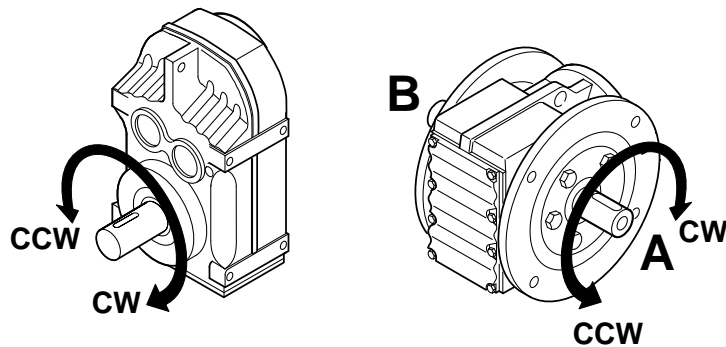


Figure 9: Output direction of rotation

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As viewed at the output shaft: Clockwise (CW) = Rotating clockwise
Counterclockwise (CCW) = Rotating counterclockwise

Position of output shaft and output flange

In right-angle gear units, you also have to indicate the position of the output shaft and the output flange:

- A or B or AB

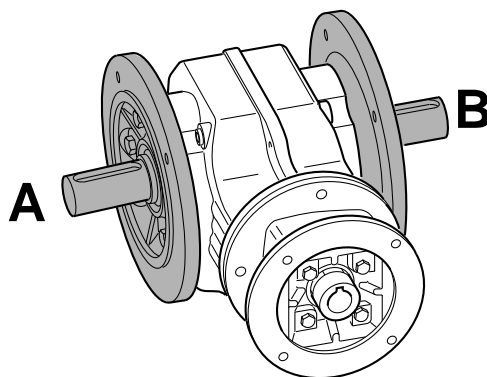


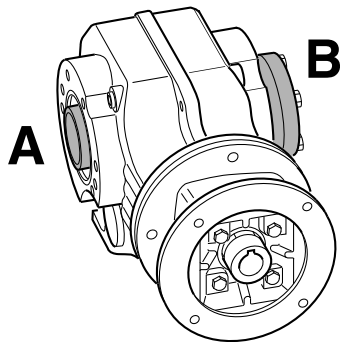
Figure 10: Position of the output shaft and output flange

50296AXX

Position of the output end in right-angle gear units

In shaft mounted right-angle gear units with a shrink disk, you also have to indicate whether the A or B end is the output end. In Figure 11, the A end is the output end. The shrink disk is located opposite the output end, here on the B side.


In shaft mounted right-angle gear units, the "output end" is equivalent to the "shaft position" of right-angle gear units with solid shaft.



63855axx

Figure 11: Example: Position of the output end

5

	INFORMATION
	<p>You will find the permitted mounting surfaces (= hatched area) in the mounting position sheets (page 70 and subsequent pages).</p> <p>Example: Only the mounting surface at the bottom is possible with helical-bevel gear units K167/K187 in mounting positions M5 and M6.</p>

Changing the mounting position

Make sure to read the following information when you operate the gearmotor in a mounting position other than the one indicated in the order:

- Adjust lubricant fill quantity to match the new mounting position
- Adjust position of breather valve
- For helical-bevel gearmotors: Contact the SEW-EURODRIVE customer service prior to changing to mounting position M5 or M6 and when changing from M5 to M6 or vice versa.
- For helical-worm gear units: Contact the SEW-EURODRIVE customer service when changing to mounting position M2 or M3.

Mounting Positions of Gear Units

General information on the mounting positions of BS.F, PS.F, PS.C gear

5.3 General information on the mounting positions of BS.F, PS.F, PS.C gear units

Mounting position designations of BS.F helical-bevel gear units

SEW-EURODRIVE distinguishes between the gear unit mounting positions M1 to M6. The following figure shows the spatial orientation of the gear unit in mounting positions M1 to M6 with the output end A.

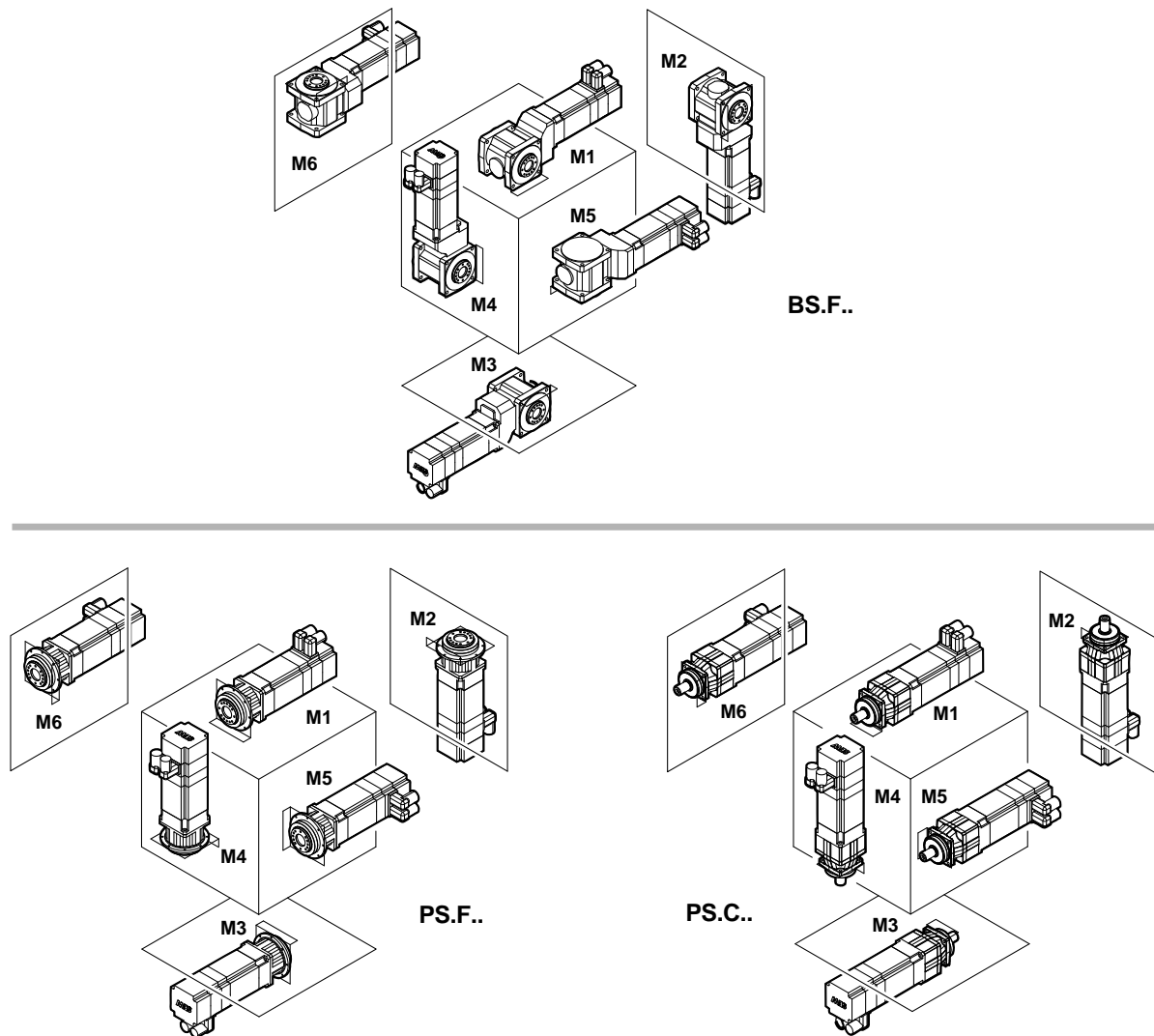


Figure 12: Description of mounting positions

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5.4 Order information for BS.F, PS.F, PS.C servo gear units

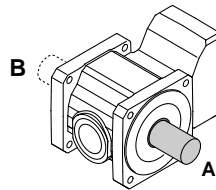
Definition of A and B ends of output shafts

When installing the gear unit via one of the output flanges, the gear unit must be attached to the shaft output side via the B5 output flange.

Gear unit type	Position		Mounting
	of the output shaft	of the shrink disk	
BSF.. / BSKF.. / BSBF	A end	-	Mounting via B5 flange on the A end
	B end	-	Mounting via B5 flange on the B end
BSHF..	-	B end	Mounting via B5 flange on the A end
	-	A end	Mounting via B5 flange on the B end
BSHF.. /I	-	A end	Mounting via B5 flange on the A end
	-	B end	Mounting via B5 flange on the B end
BSAF..	A end		Mounting via B5 flange on the A end
	B end		Mounting via B5 flange on the B end
BSF../BSKF..	AB	-	Mounting via B5 flange on the A end and/or B end

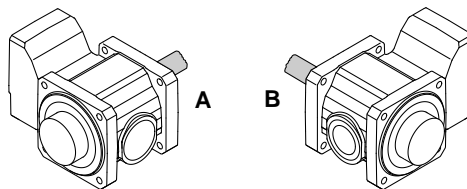
5

For BS.F. gear units, the position of the output shaft A, B or AB must be specified:



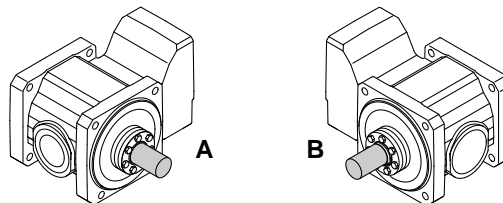
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Figure 13: Position of the output shaft of BSF.., BSKF.., BSAF.., BSBF.. helical-bevel gear units



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Figure 14: Position of the output shaft and output flange of BSHF.. helical-bevel gear units



64347AXX

Figure 15: Position of the output shaft and output flange of BSHF../I helical-bevel gear units


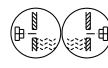


Direction of rotation of the output shaft

For a definition of the output shaft, see page 64.




5.5 Key to the mounting position sheets

Symbols used

The following table shows the symbols used in the mounting position sheets and their meaning:

Symbol	Meaning
	Breather valve
	Oil level plug ¹⁾
	Oil drain plug
	Cable entry position "3"

1) Does not apply to the first gear unit (larger gear unit) of multi-stage gear units

	INFORMATION
	<p>Notes on the shafts displayed in the mounting position sheets</p> <p>Note the following information regarding the way in which shafts are depicted in the mounting position sheets:</p> <ul style="list-style-type: none"> • For gear units with solid shaft: The displayed shaft is always on the A end. • For shaft mounted gear units: The shaft with dashed lines represents the customer shaft. The output end (= shaft position) is always shown on the A end.
	INFORMATION
	<p>SPIROPLAN[®] gear units are not dependant on the mounting position, except for W..37 and W47 in mounting position M4. However, mounting positions M1 to M6 are also shown for SPIROPLAN[®] gear units to assist you in working with this documentation.</p> <p>Important! Please note:</p> <p>SPIROPLAN[®] gear units W..10 to W..30 cannot be equipped with breather valves, oil level plugs or drain plugs.</p> <p>SPIROPLAN[®] gear units W..37 and W..47 can be equipped with breather valves in mounting position M4 and with oil drain plugs in mounting position M2.</p>
	INFORMATION
	<p>Notes on the displayed motors.</p> <p>Motors are only represented symbolically in the mounting position sheets.</p>

Churning losses

* → Page XX

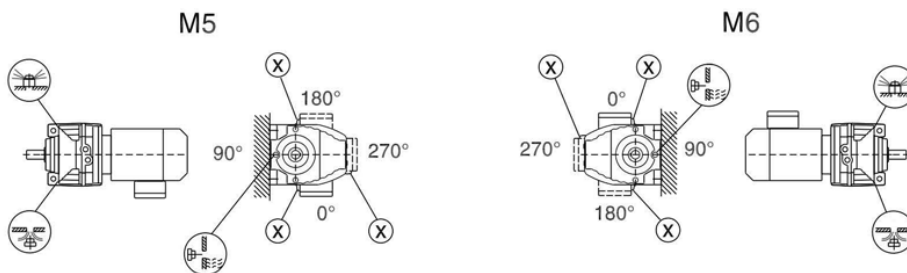
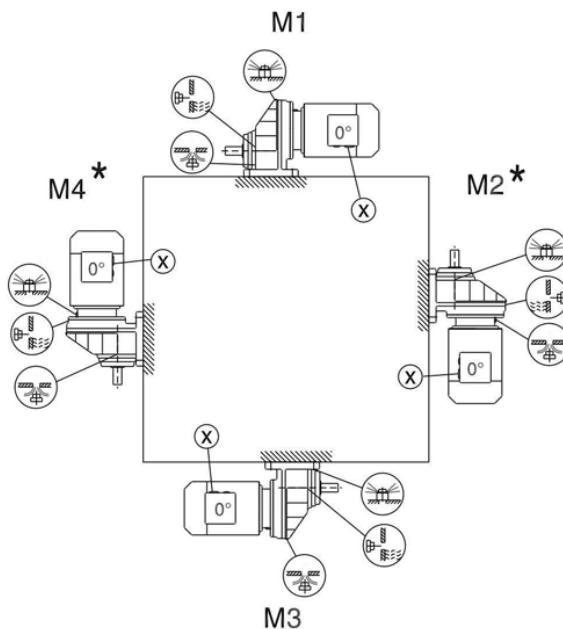
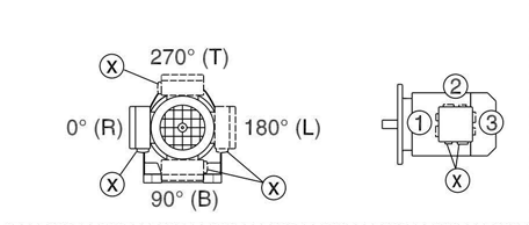
Churning losses may occur in some mounting positions. Contact SEW-EURODRIVE in case of the following combinations:

Mounting position	Gear unit type	Gear unit size	Input speed [rpm]
M2, M4	R	97 ... 107	> 2500
		> 107	>1500
M2, M3, M4, M5, M6	F	97 ... 107	> 2500
		> 107	> 1500
	K	77 ... 107	> 2500
		> 107	> 1500
	S	77 ... 97	> 2500

5.6 Mounting positions of helical gear units

RX57...RX107

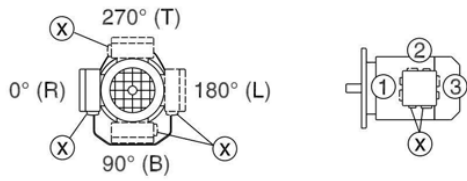
04 043 02 00



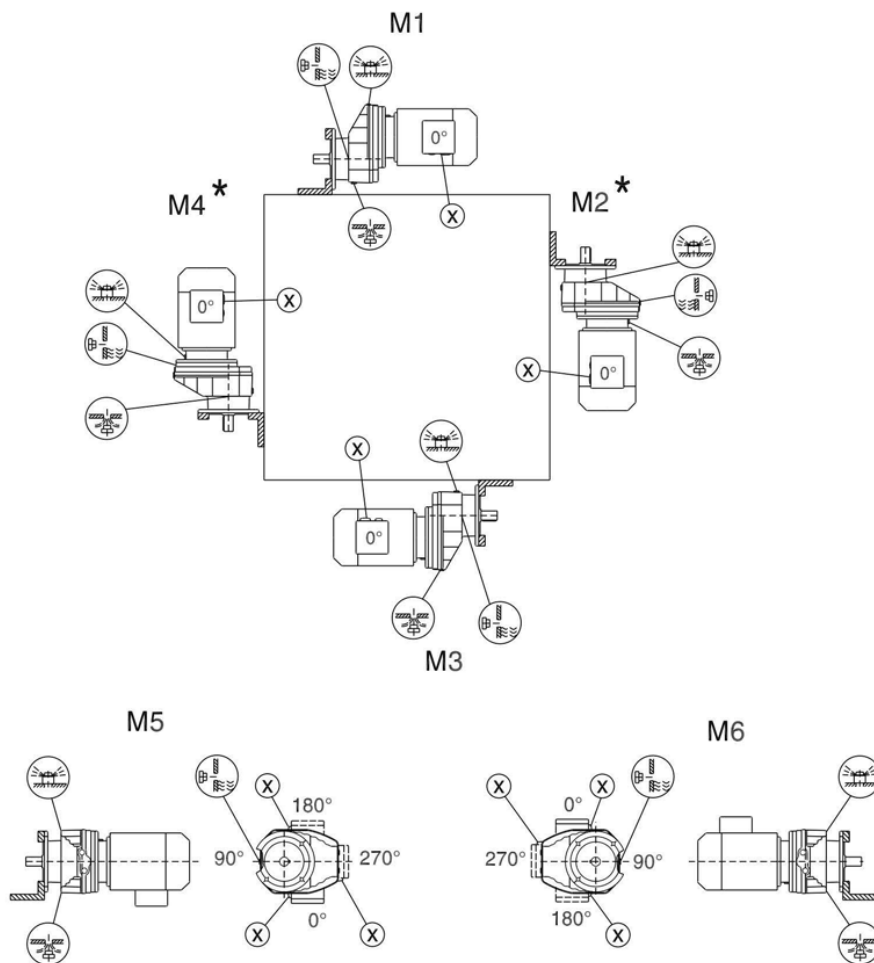
* → page 69

RXF57...RXF107

04 044 02 00



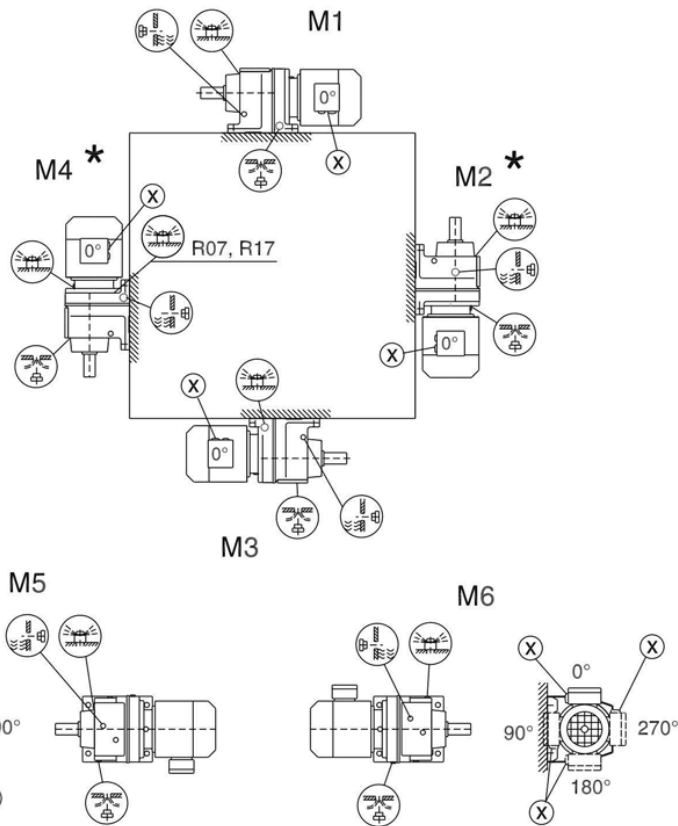
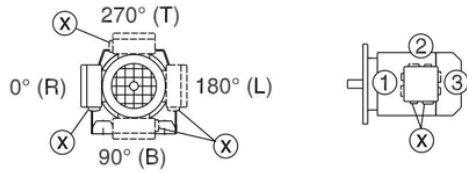
5



* → page 69

R07...R167

04 040 03 00

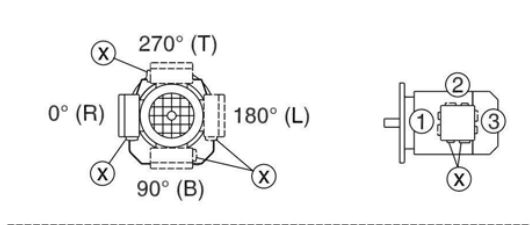


R07		M1, M2, M3, M5, M6
R17, R27		M1, M3, M5, M6
R07, R17, R27		
R47, R57		M5

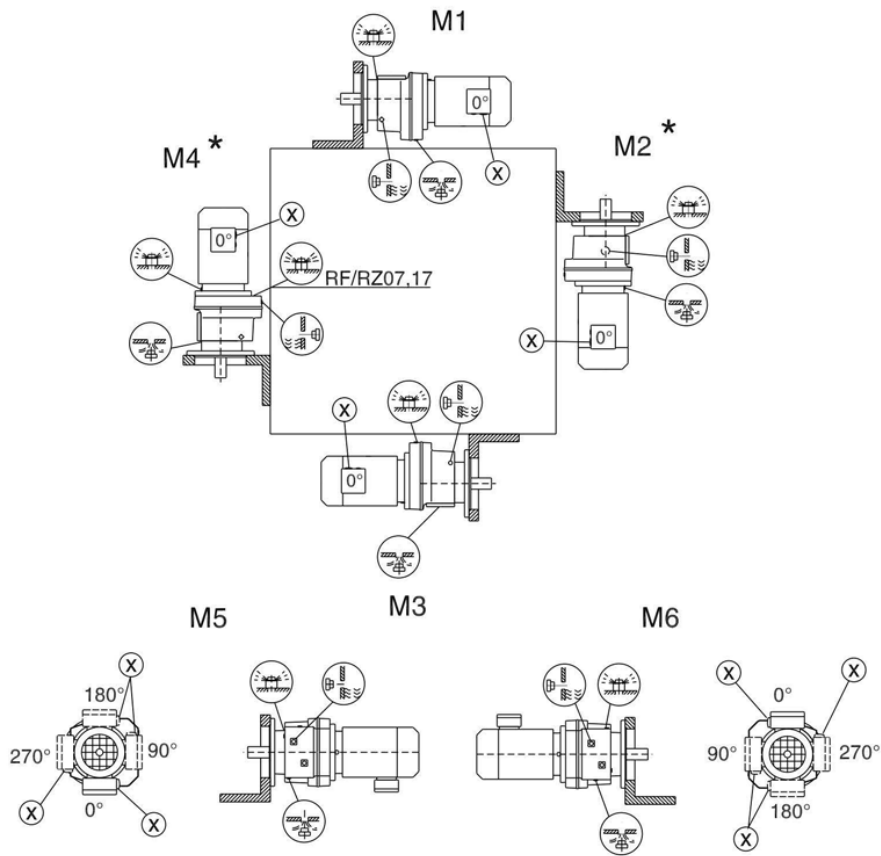
* → page 69

RF07...RF167, RZ07...RZ87

04 041 03 00



5

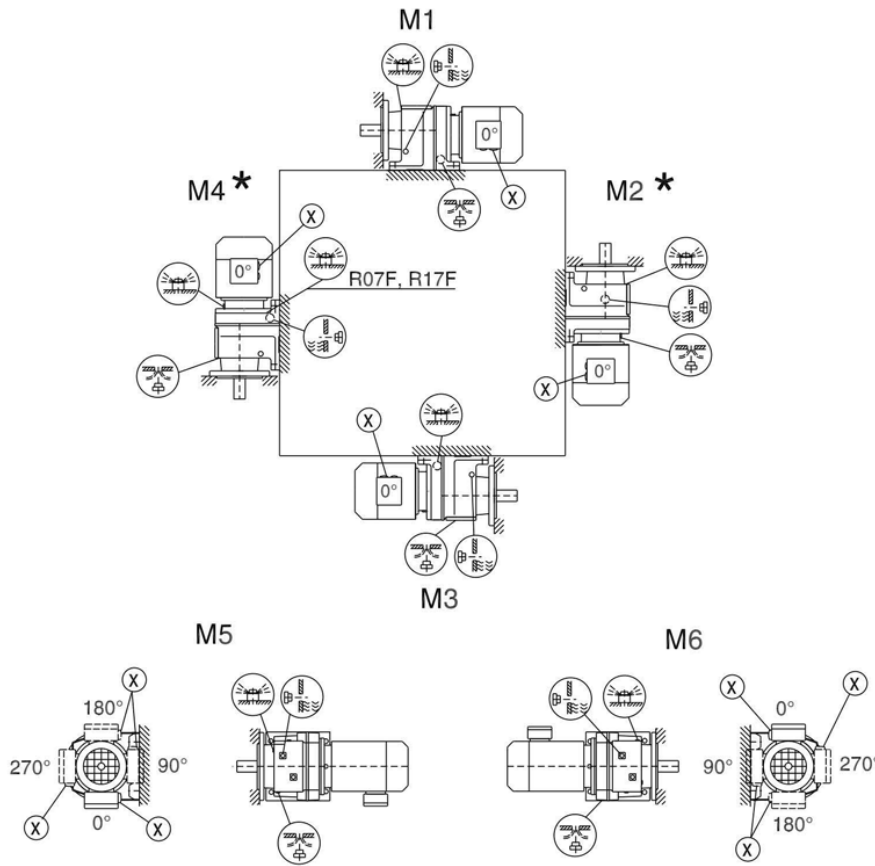
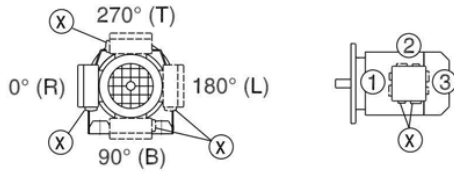


RF/RZ07		M1, M2, M3, M5, M6
RF/RZ17,27		M1, M3, M5, M6
RF/RZ07, 17, 27		
RF/RZ47, 57		M5

* → page 69

R07F...R87F

04 042 03 00



R07F		M1, M2, M3, M5, M6
R17F, R27F		M1, M3, M5, M6
R07F, R17F, R27F		
R47F, R57F		M5

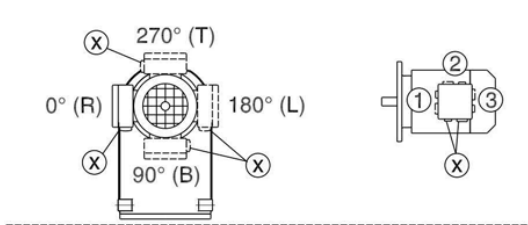
* → page 69

Important: See the notes in the "Project planning / Overhung and axial loads" chapter (page 48).

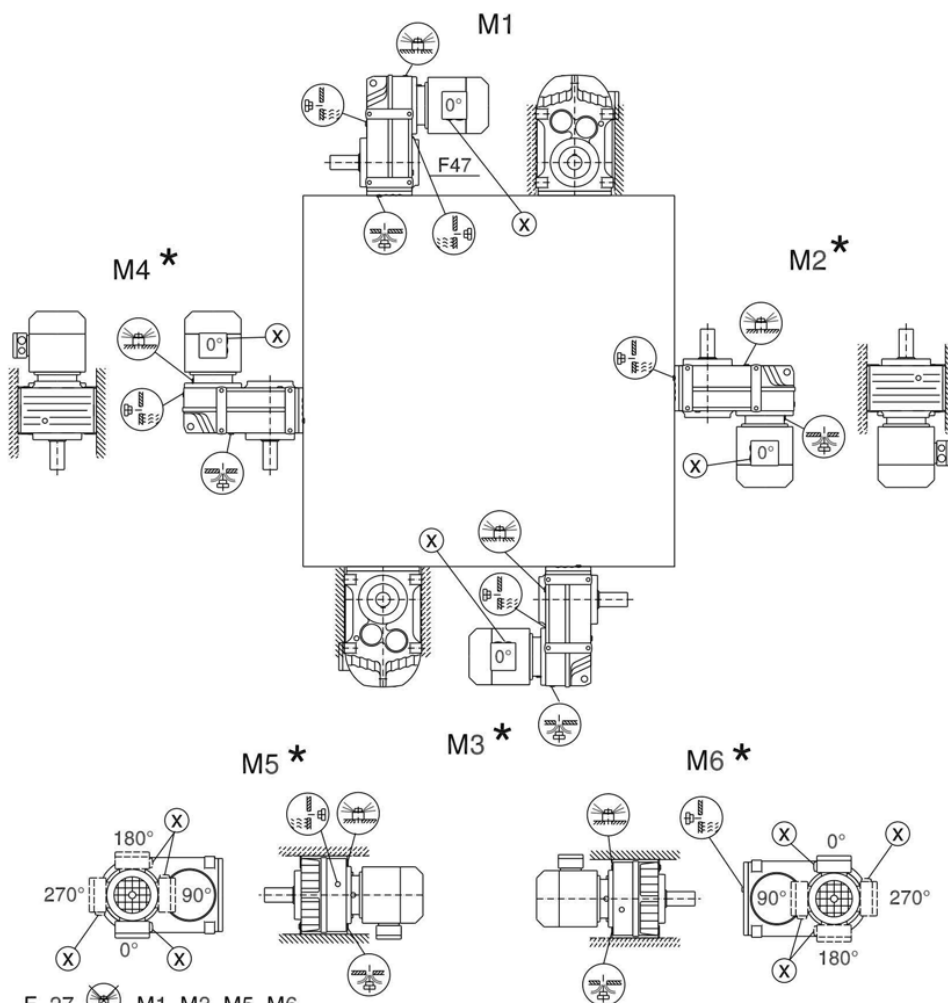
5.7 Mounting positions of parallel shaft helical gear units

F/FA..B/FH27B...157B, FV27B...107B

42 042 03 00



5



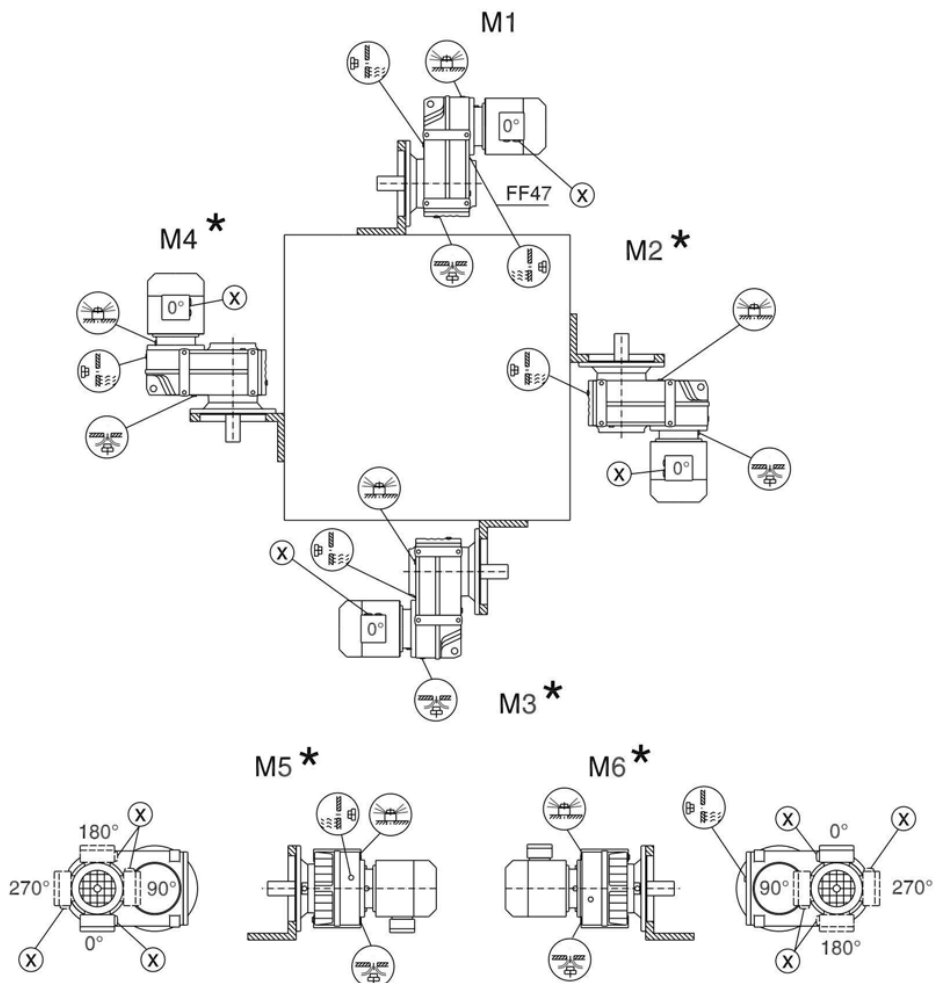
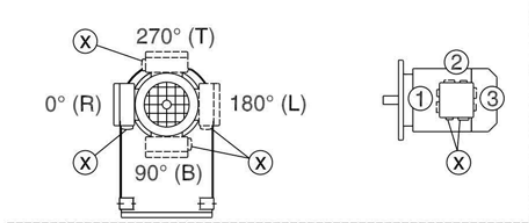
- F..27 M1, M3, M5, M6
- F..27 M1 - M6
- F..27 M1, M3, M5, M6

* → page 69

Mounting Positions of Gear Units
Mounting positions of parallel shaft helical gear units

FF/FAF/FHF/FAZ/FH227...157, FVF/FVZ27...107

42 043 03 00

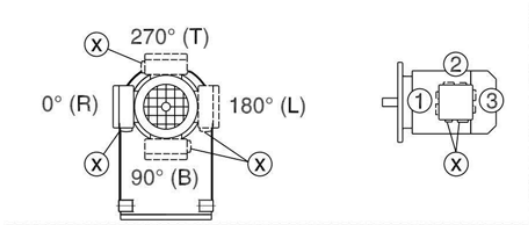


- F..27 M1, M3, M5, M6
- F..27 M1 - M6
- F..27 M1, M3, M5, M6

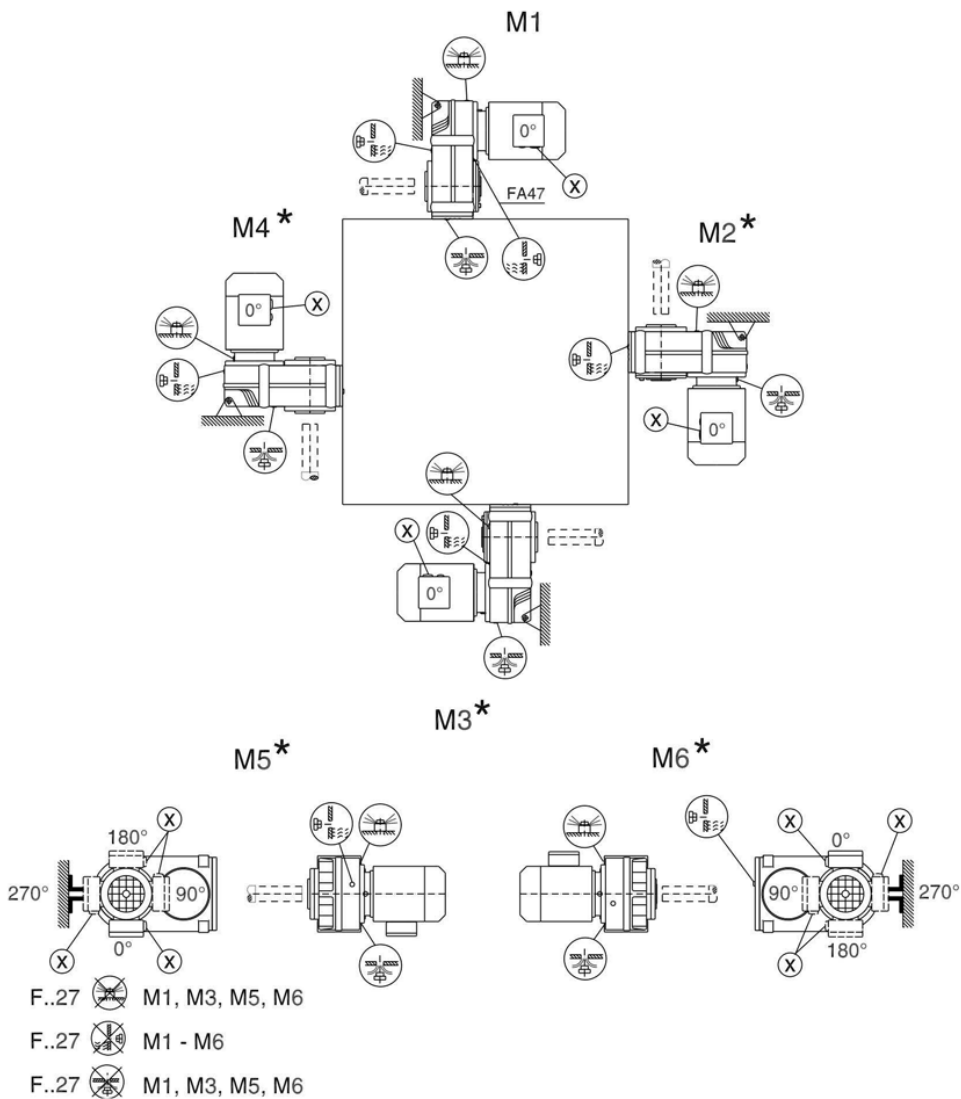
* → page 69

FA/FH27...157, FV27...107, FT37...97

42 044 03 00



5

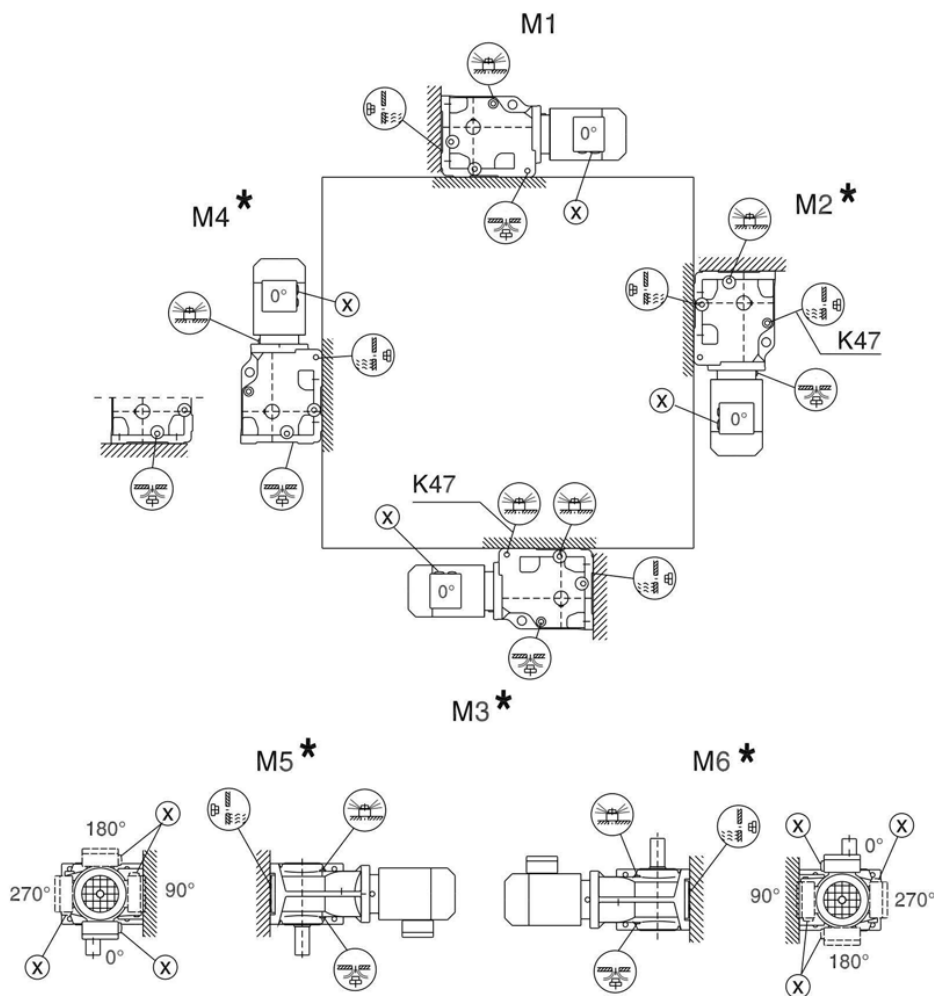
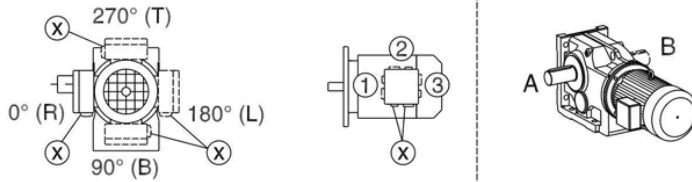


* → page 69

5.8 Mounting positions of helical-bevel gear units

K/KA..B/KH37B...157B, KV37B...107B

34 025 03 00

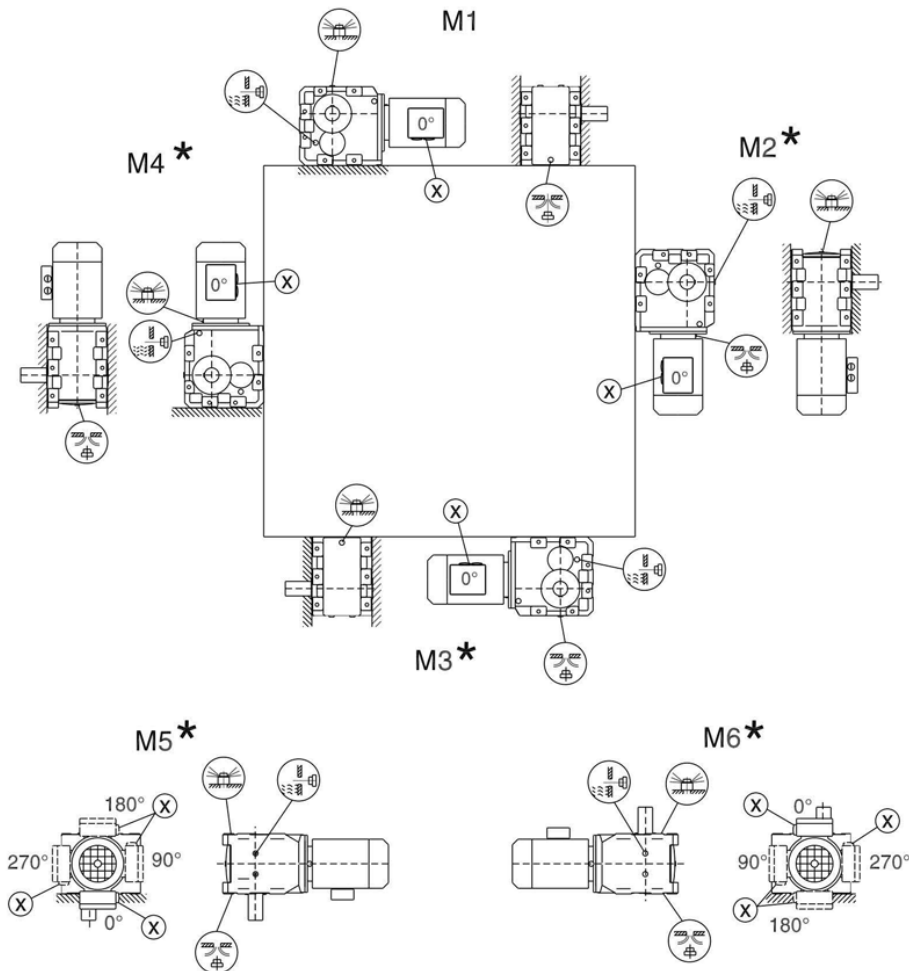
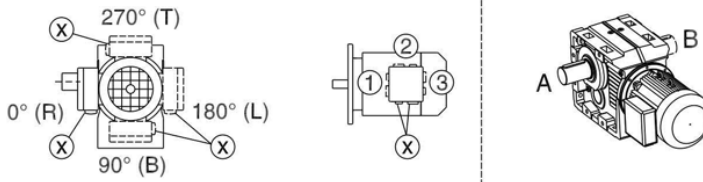


* → page 69


Important: See the **i** notes in the "Project planning / Overhung and axial loads" chapter (page 48).

K167...187, KH167B...187B

34 026 03 00



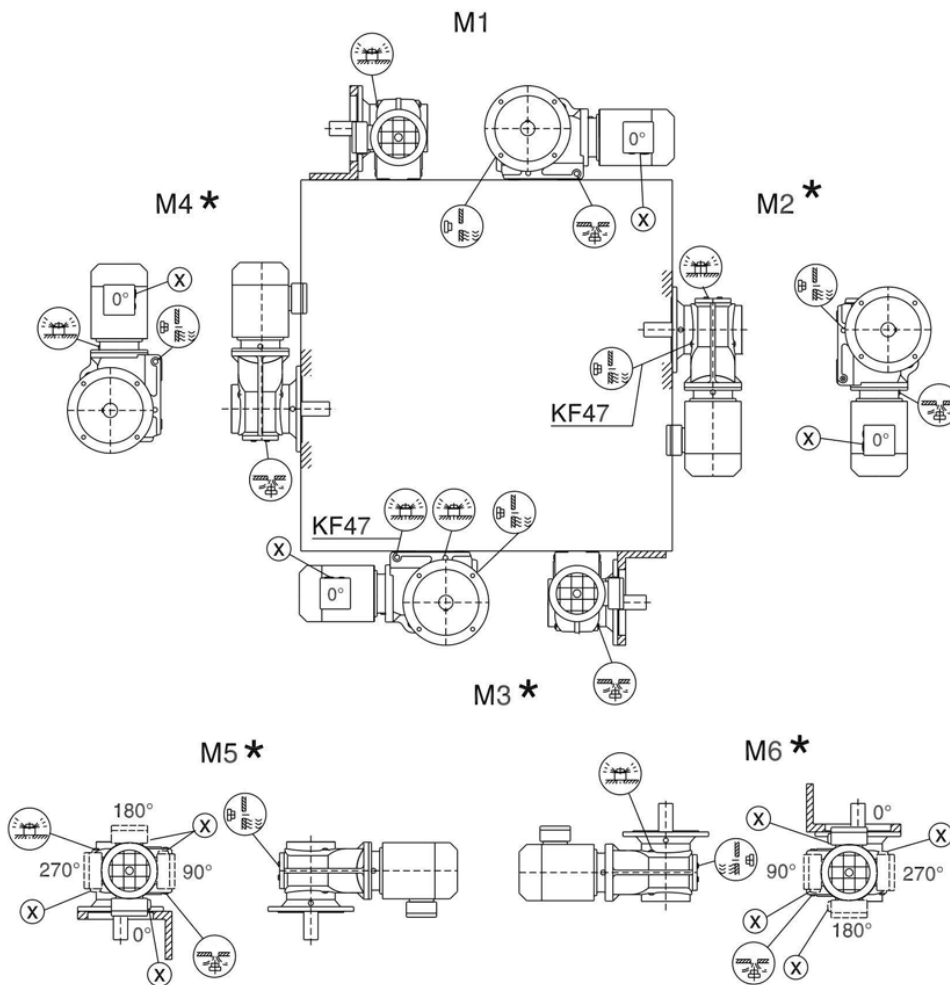
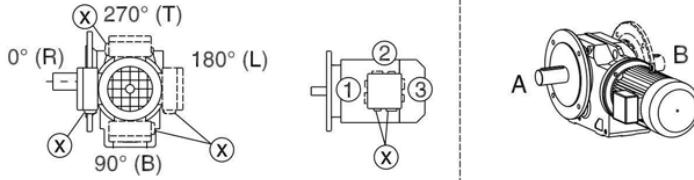
* → page 69

Important: See the  notes in the "Project planning / Overhung and axial loads" chapter (page 48).

Mounting Positions of Gear Units
Mounting positions of helical-bevel gear units

KF/KAF/KHF/KAZ/KHZ37...157, KVF/KVZ37...107

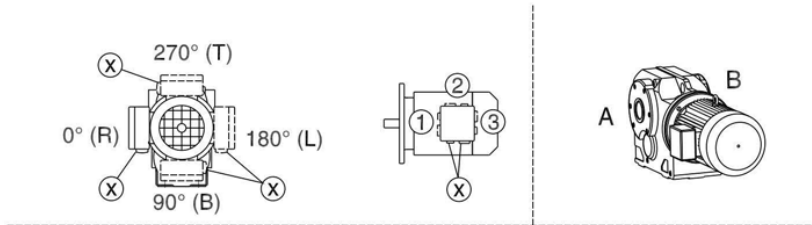
34 027 03 00



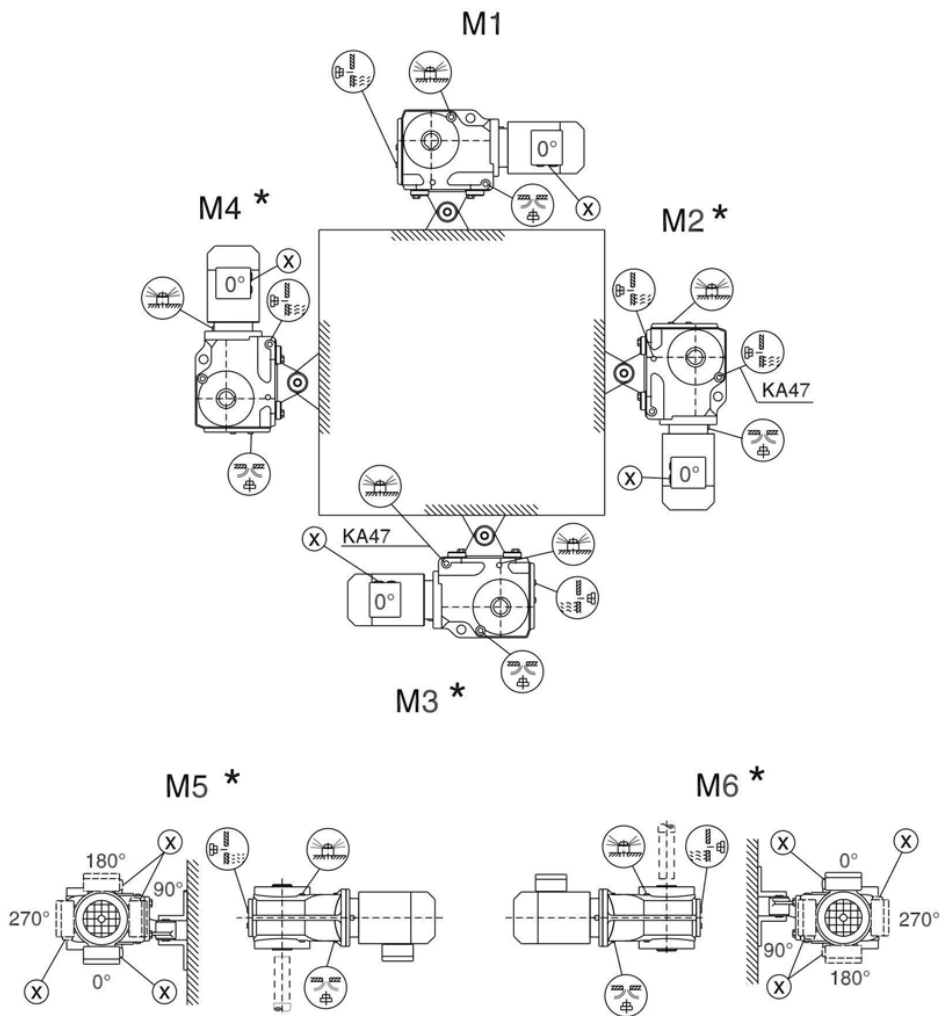
* → page 69

KA/KH37...157, KV37...107, KT37...97

39 025 04 00



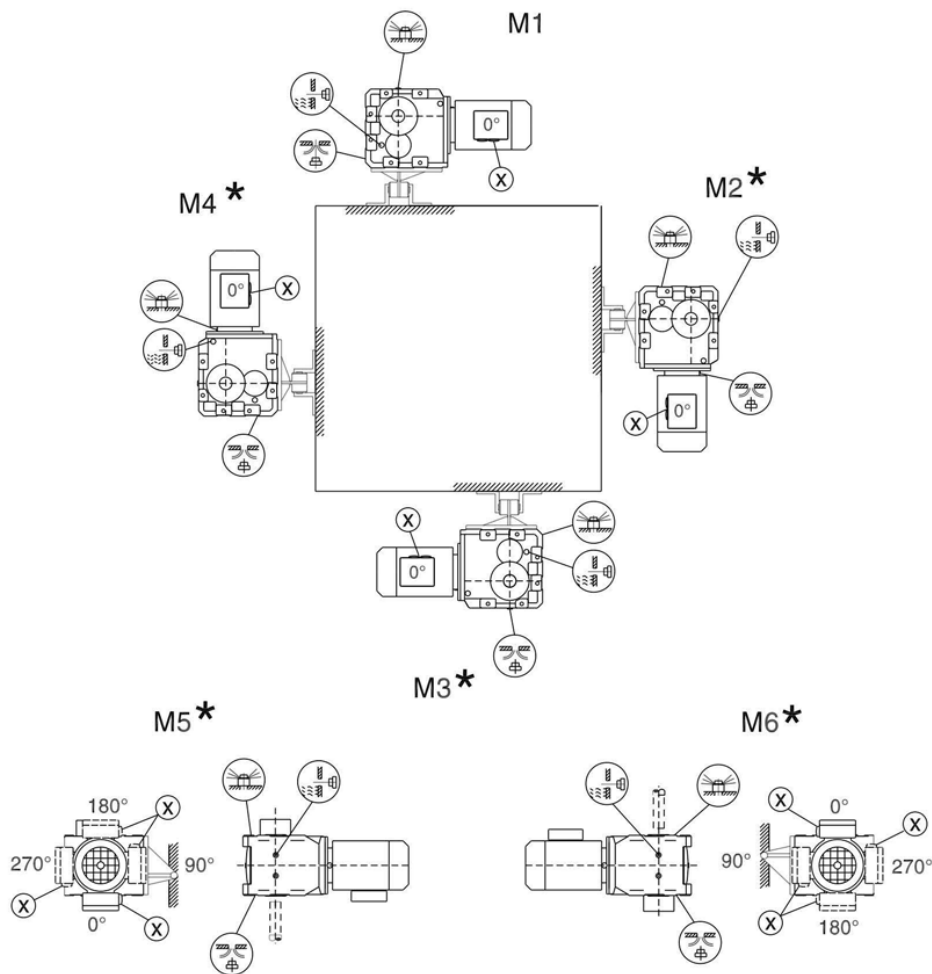
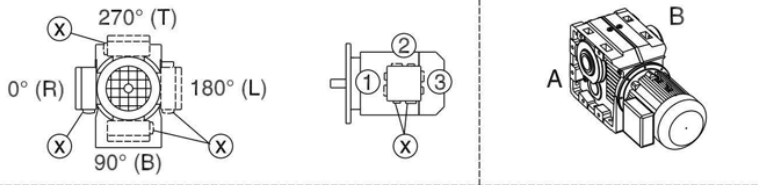
5



* → page 69

KH167...187

39 026 04 00

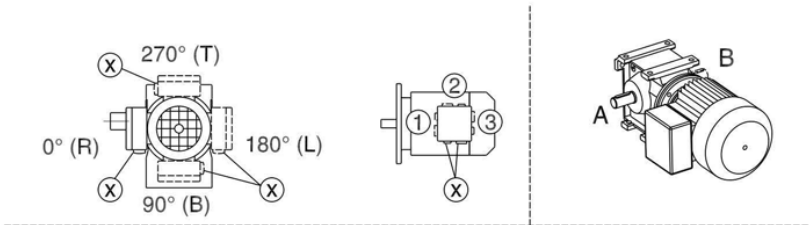


* → page 69

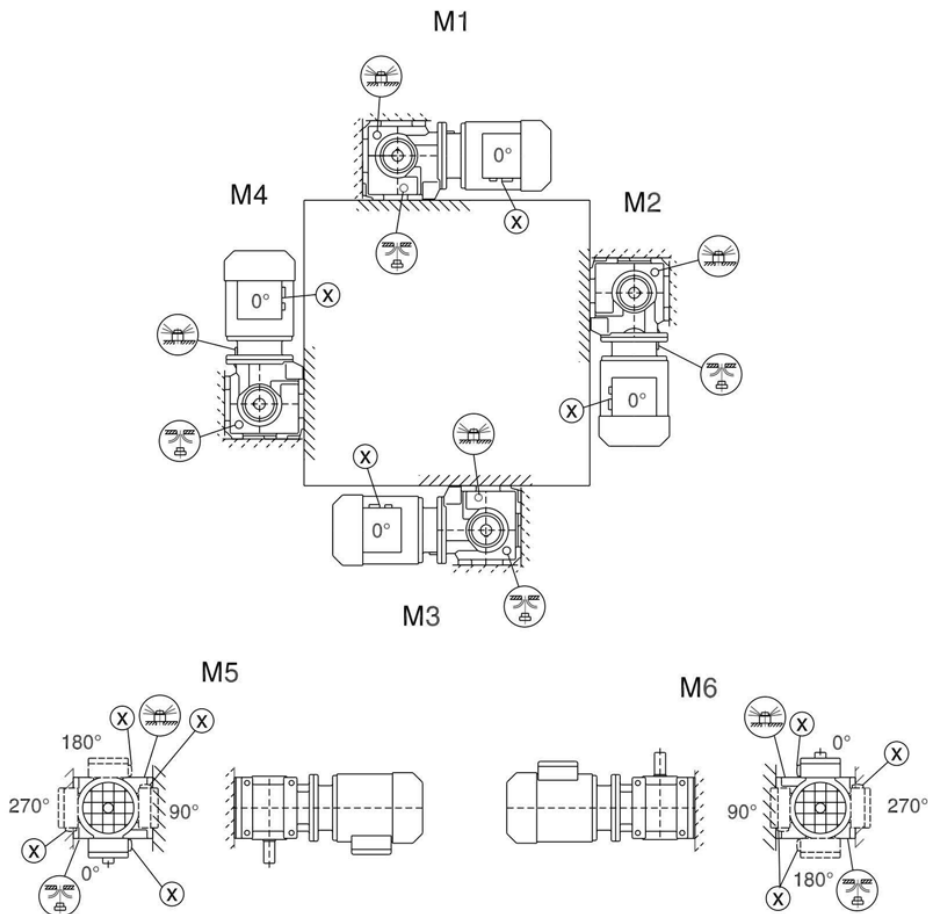
5.9 Mounting positions of helical-worm gear units

S37


05 025 03 00



5

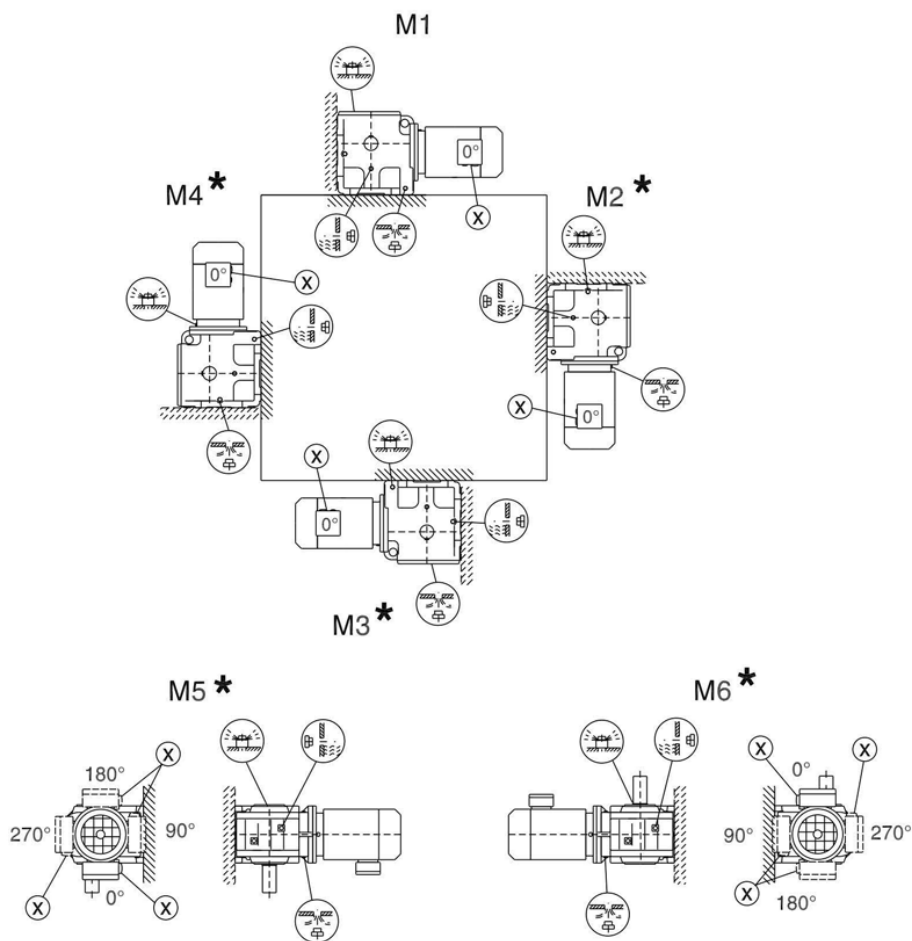
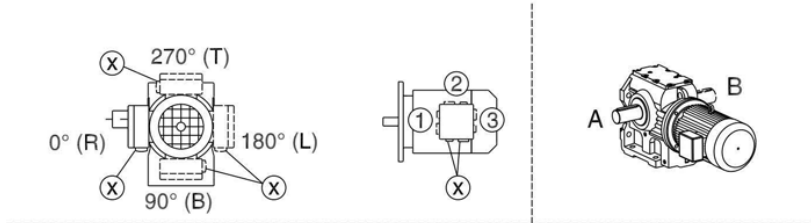


* → page 69

Important: See the  notes in the "Project planning / Overhung and axial loads" chapter (page 48).

S47...S97

05 026 03 00

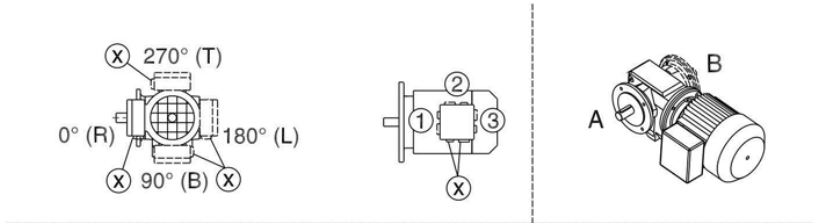


* → page 69

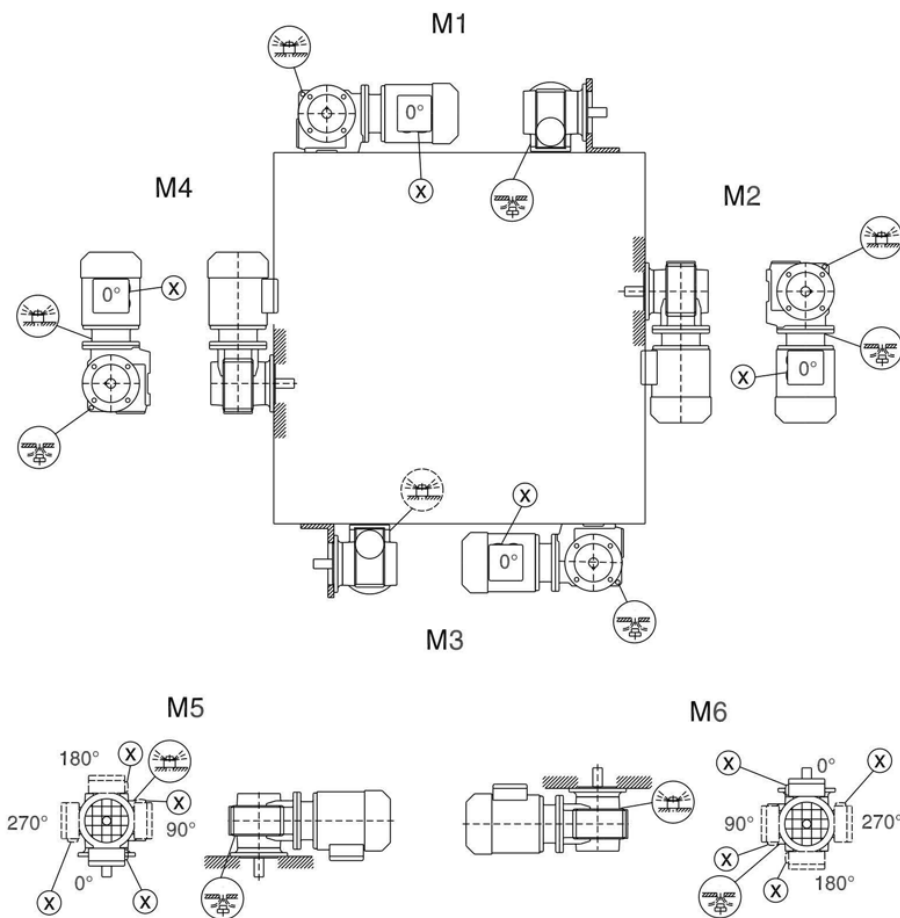
Important: See the **i** notes in the "Project planning / Overhung and axial loads" chapter (page 48).

SF/SAF/SHF37

05 027 03 00



5

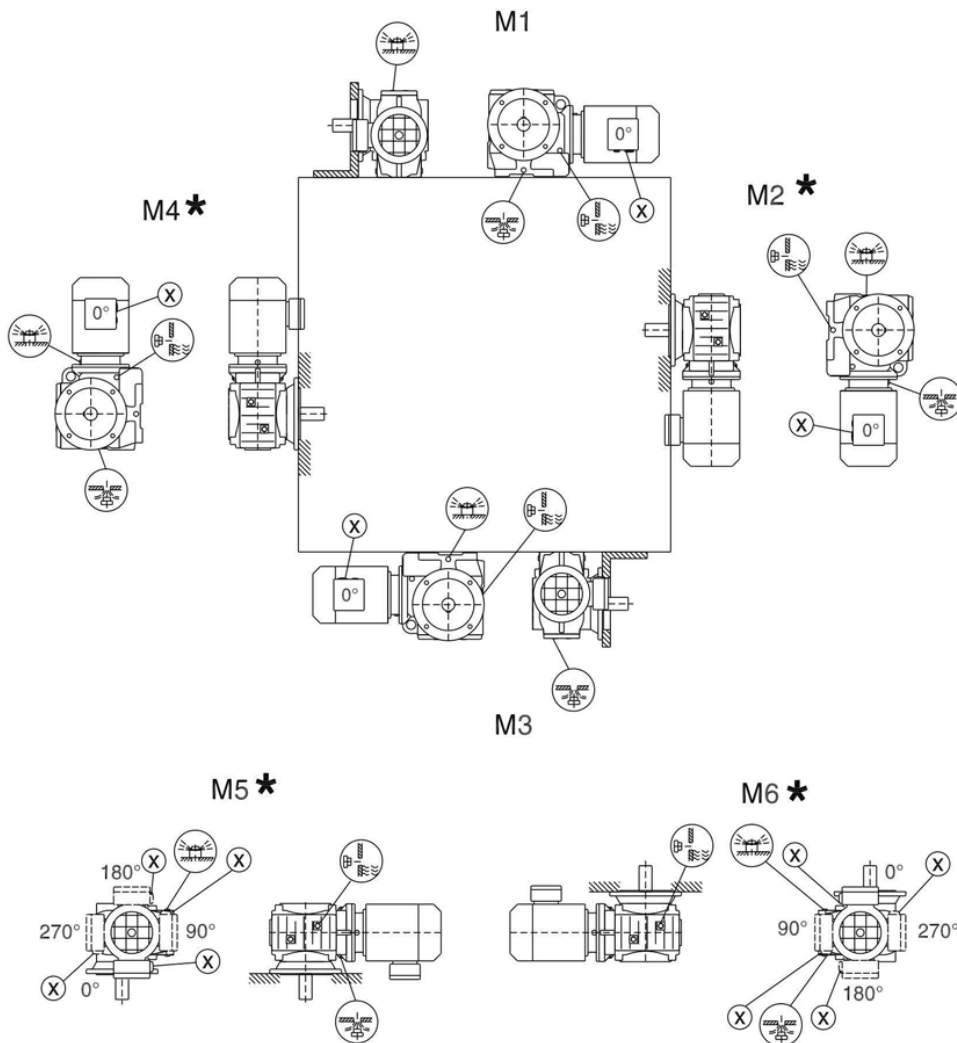
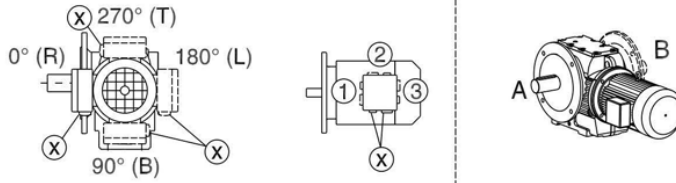


* → page 69

Mounting Positions of Gear Units
Mounting positions of helical-worm gear units

SF/SAF/SHF/SAZ/SHZ47...97

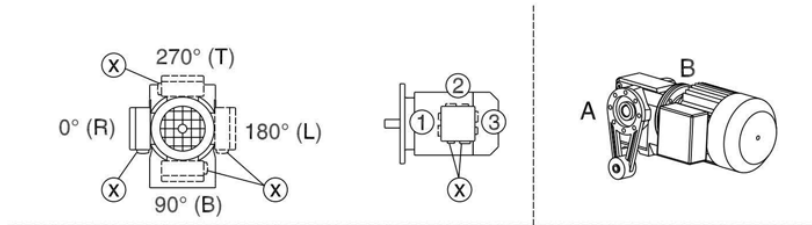
05 028 03 00



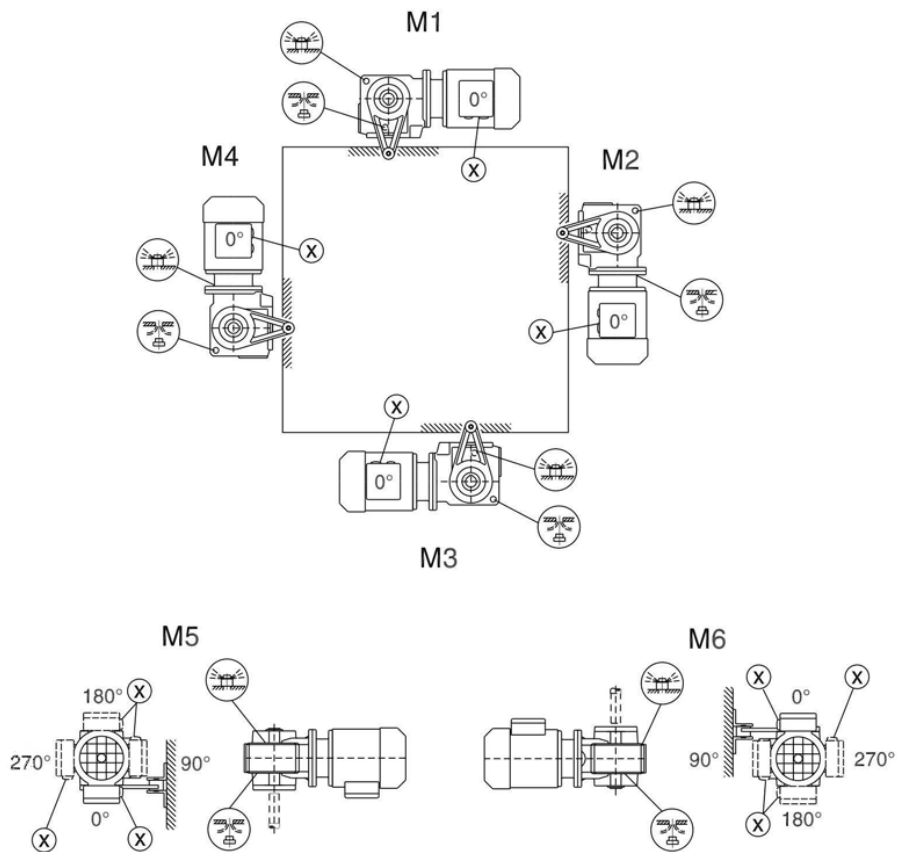
* → page 69

SA/SH/ST37

28 020 04 00



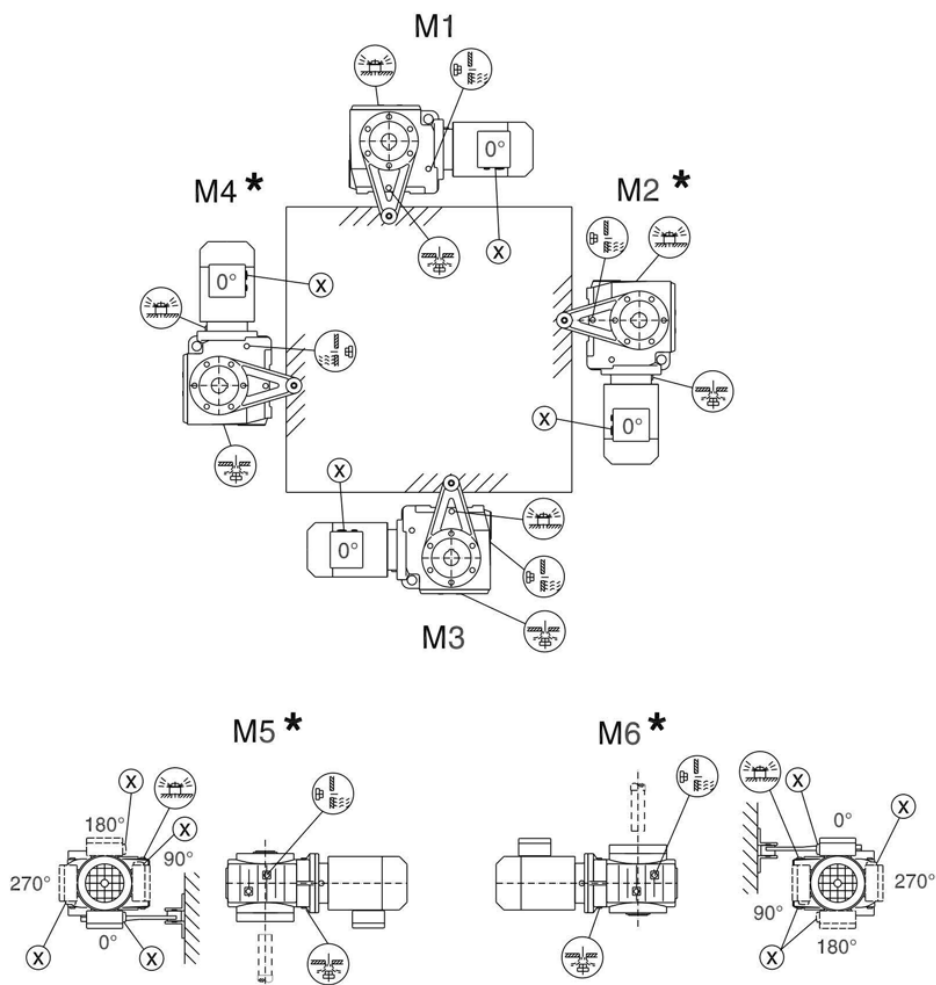
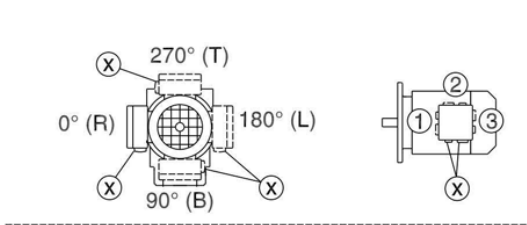
5



* → page 69

SA/SH/ST47...97

28 021 03 00

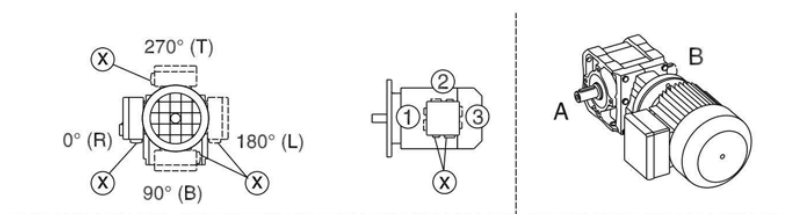


* → page 69

5.10 Mounting positions of SPIROPLAN® gear units

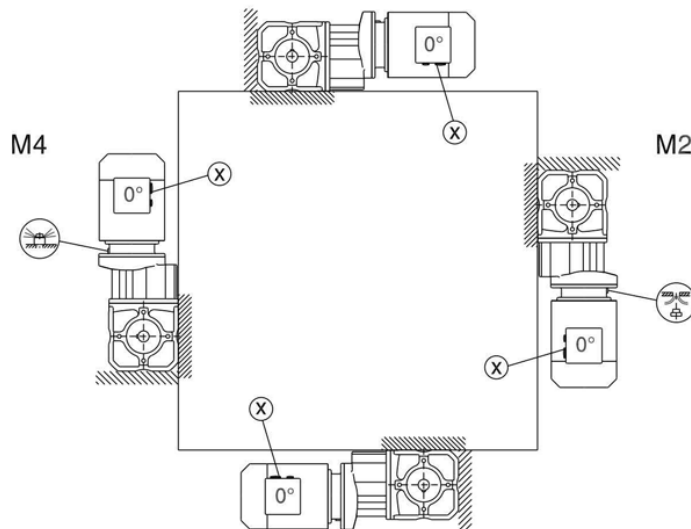
W/WA.7B/WH.7B

20 012 01 07

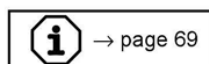
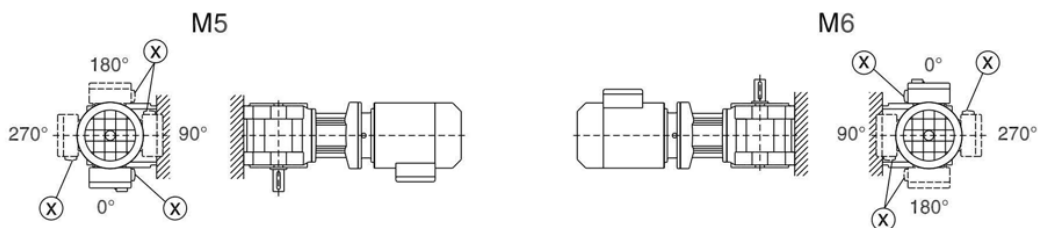


5

M1

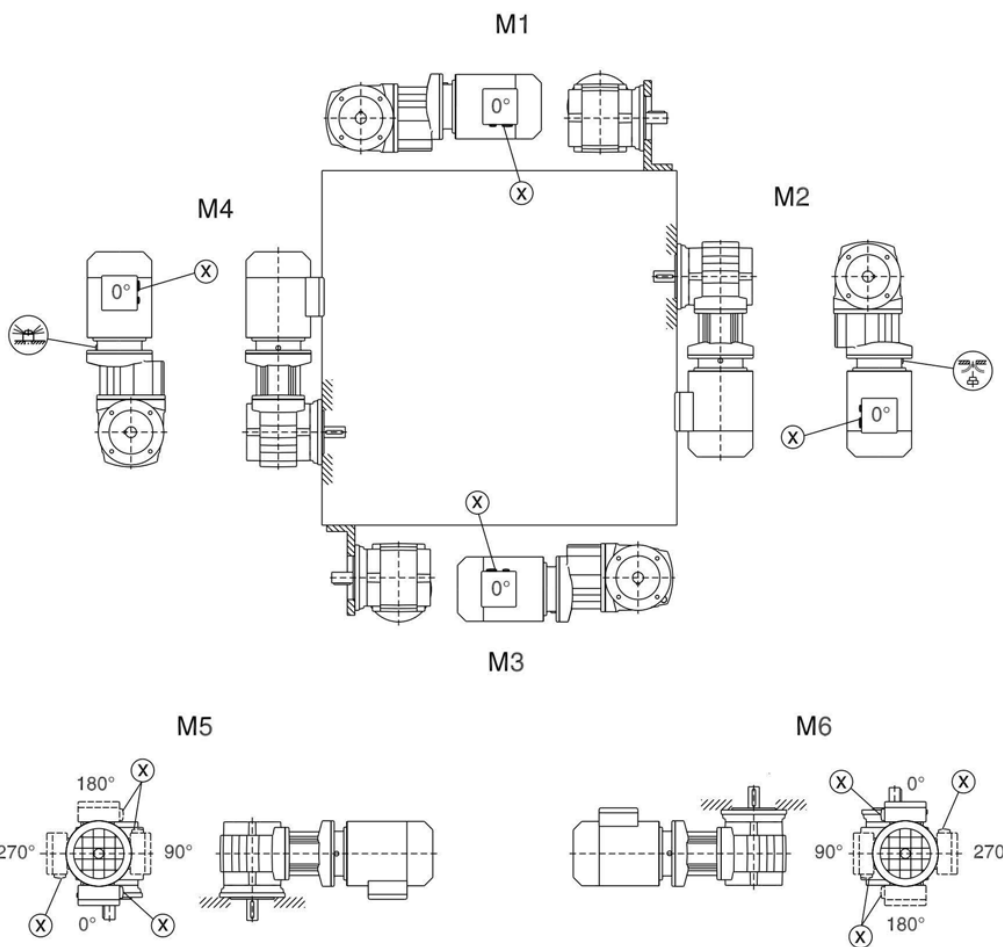
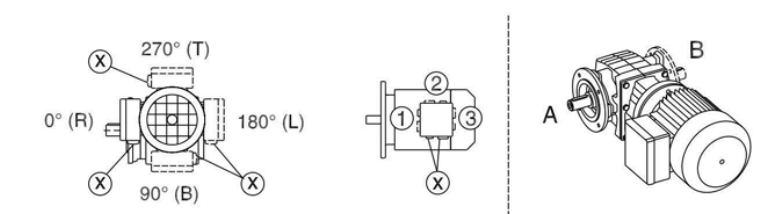


M3



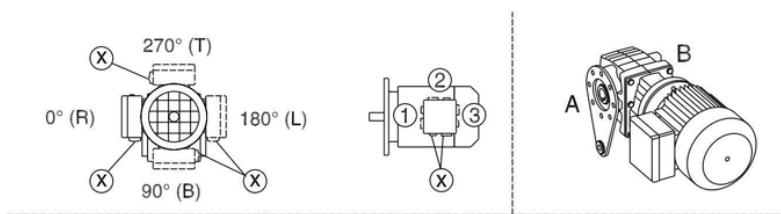
WF/WAF/WHF.7

20 013 01 07



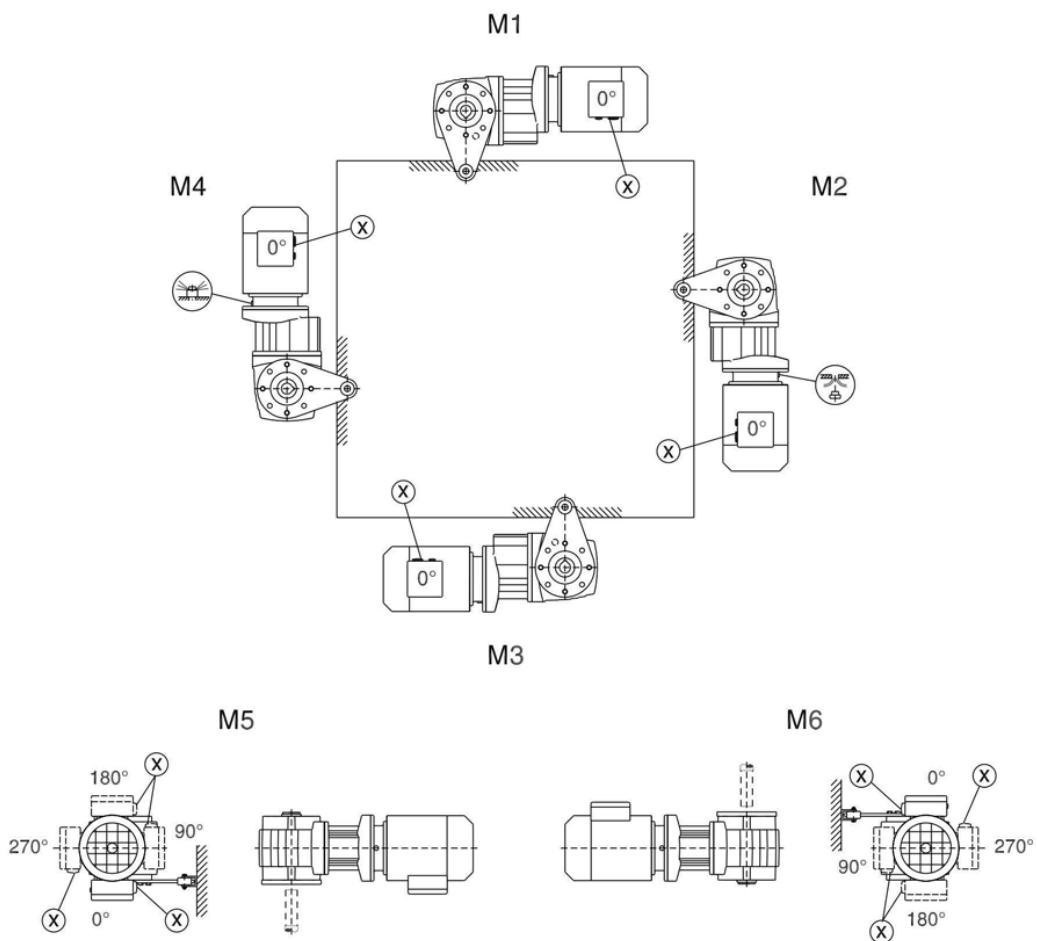
i → page 69

WA/WH/WT.7



20 014 01 07

5

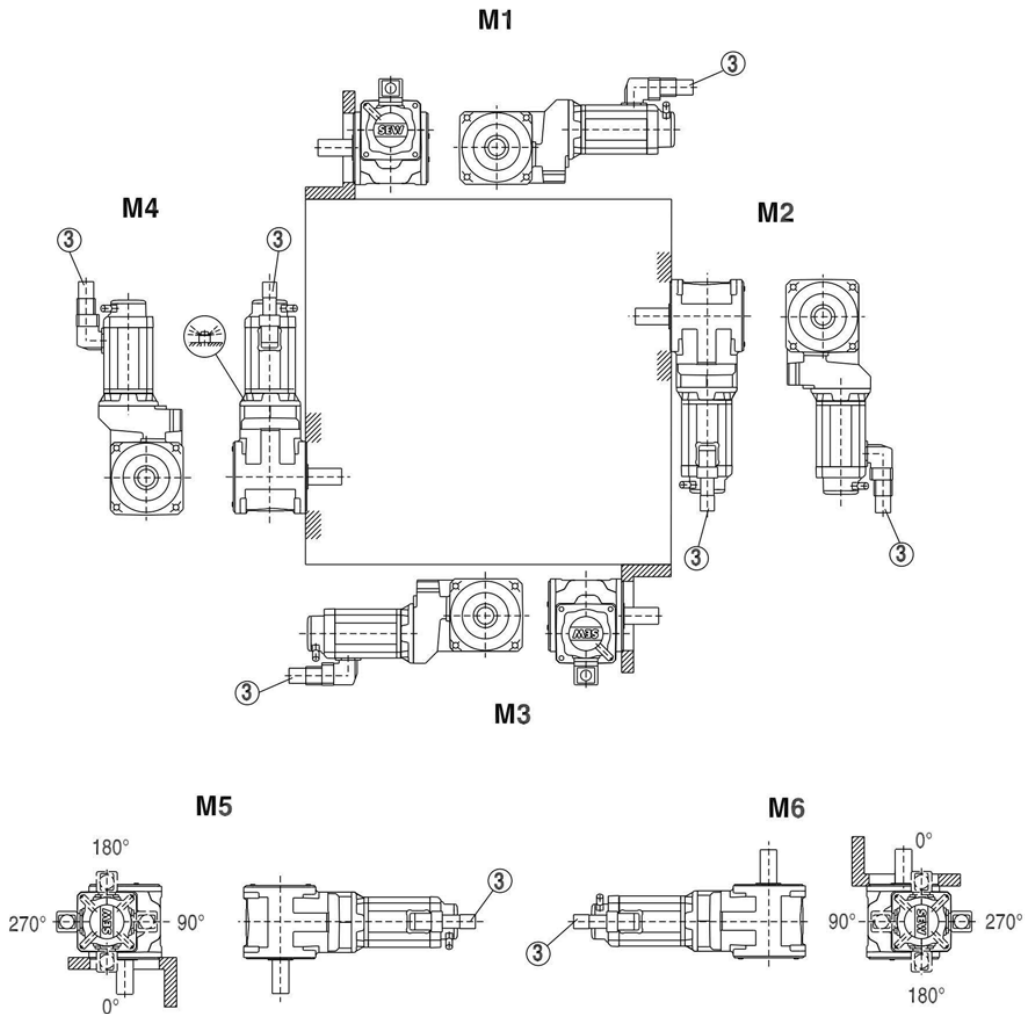
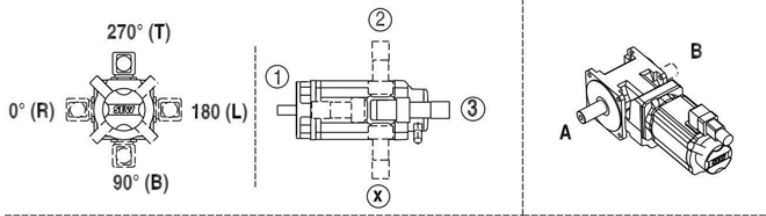


i → page 69

5.11 Mounting positions of BS.F helical-bevel gear units

BS.F202...802

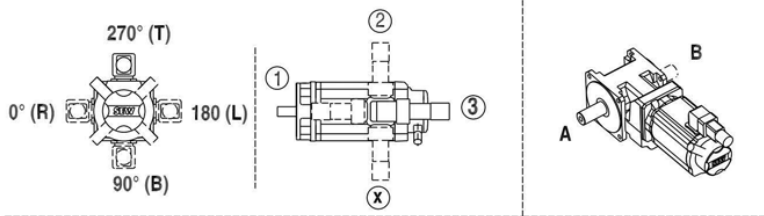
56 037 00 03



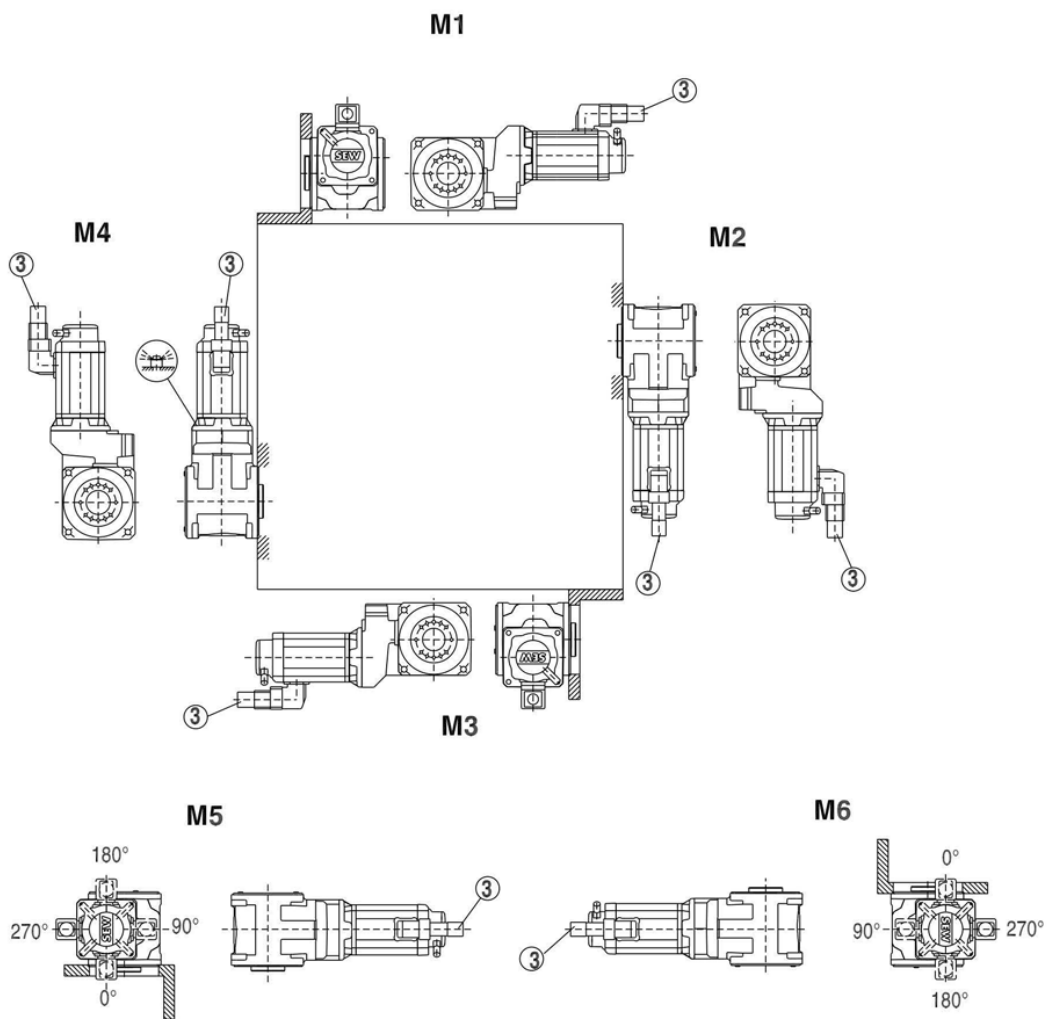
3 → page 68

BSBF202...802

56 038 00 03



5

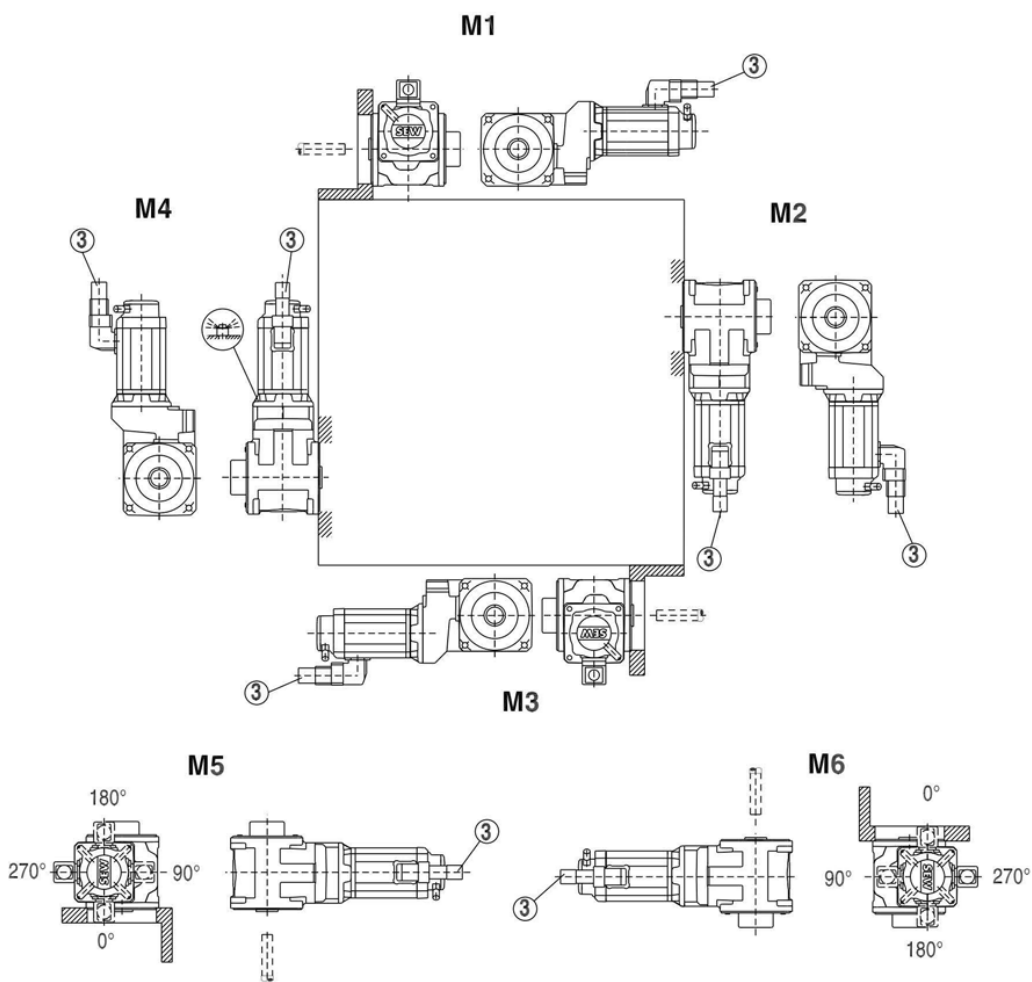
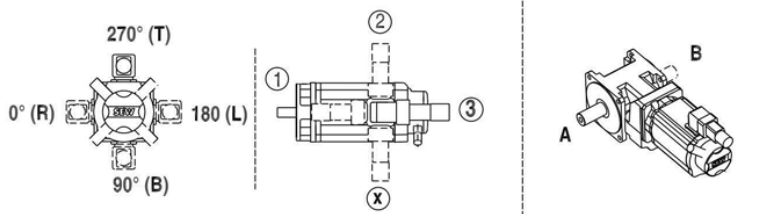


3 → page 68

Mounting Positions of Gear Units
 Mounting positions of BS.F helical-bevel gear units

BSHF202...802

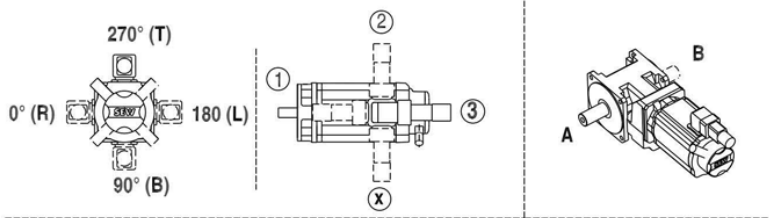
56 056 00 03



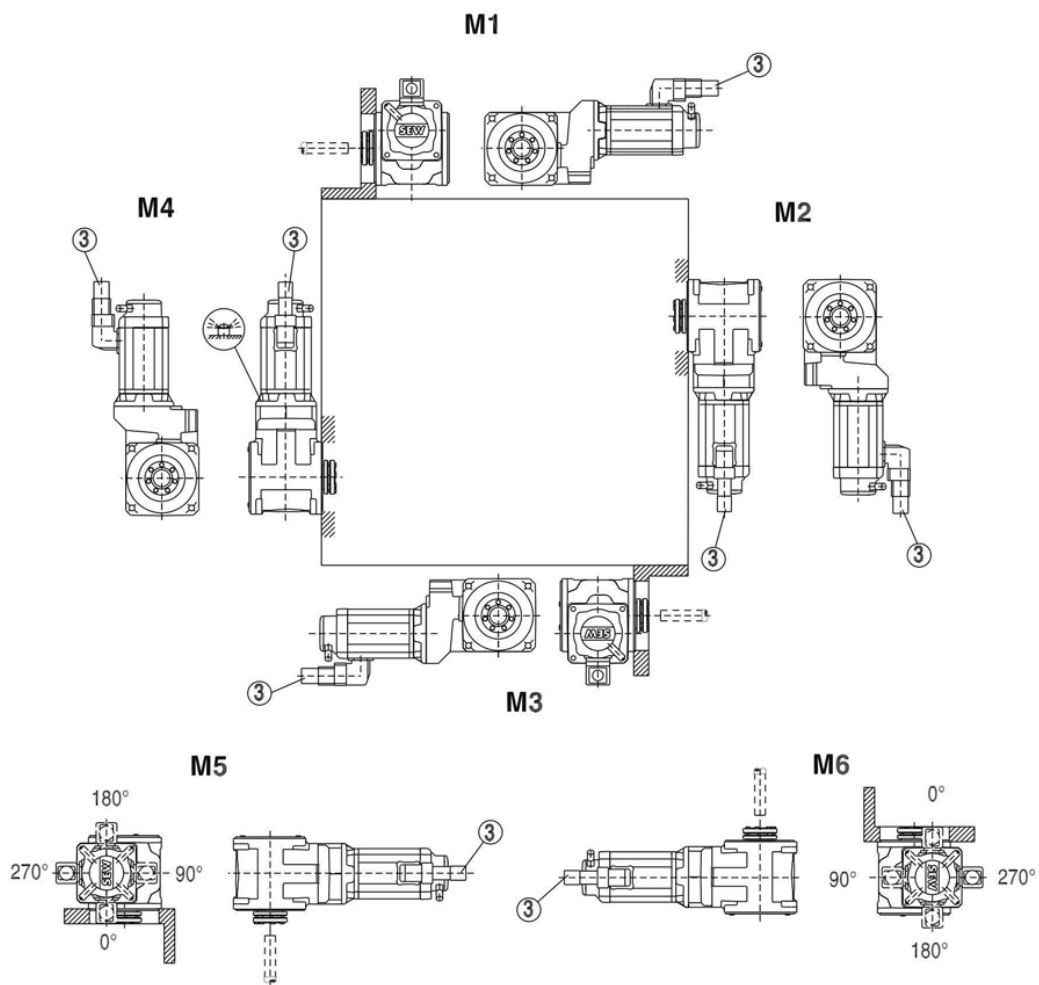
3 → page 68

BSHF202...802 /1

56 039 00 03



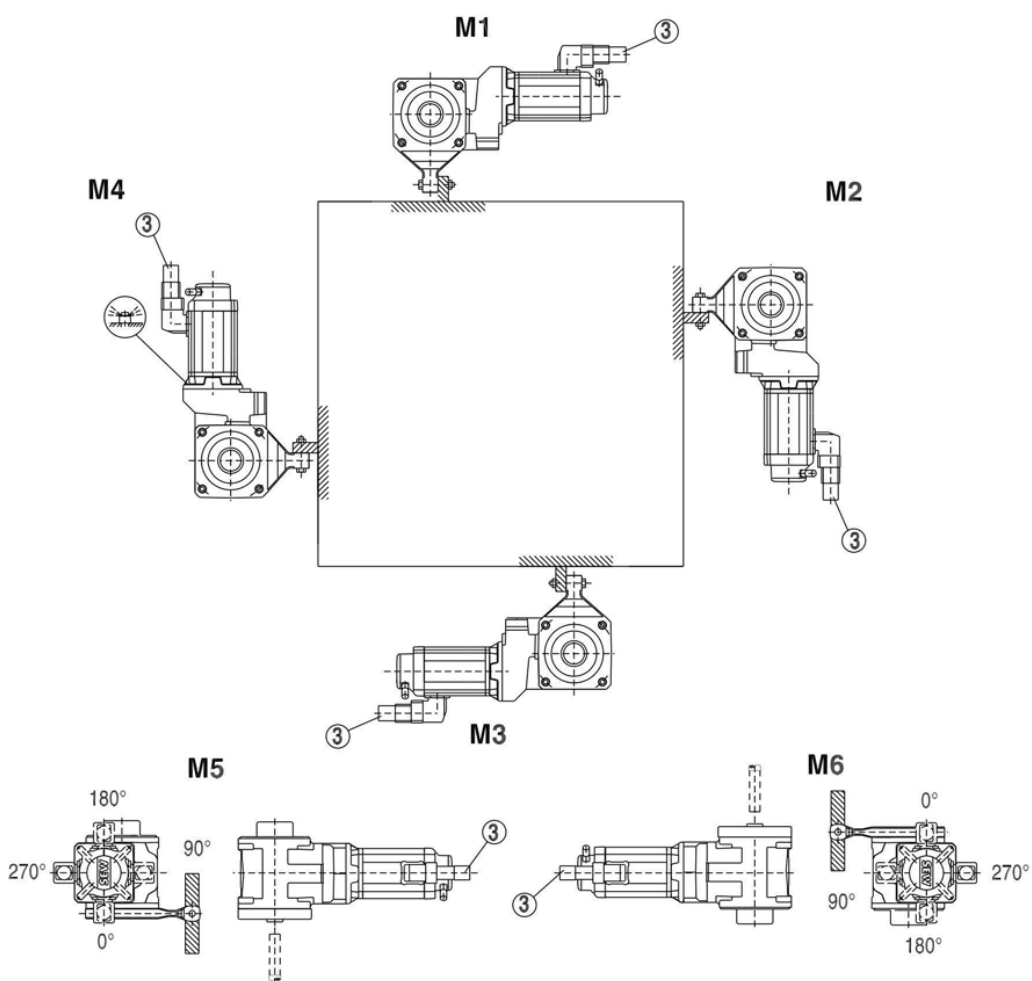
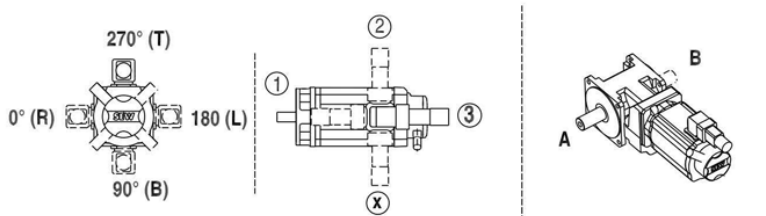
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3 → page 68

BSHF202...802 /T

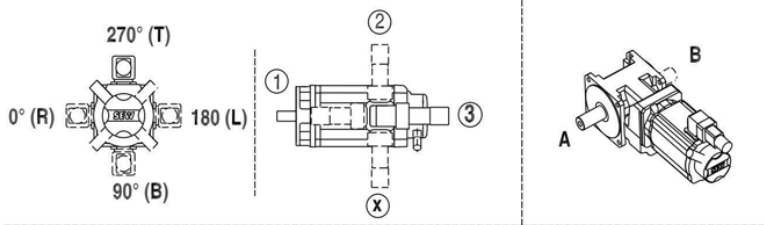
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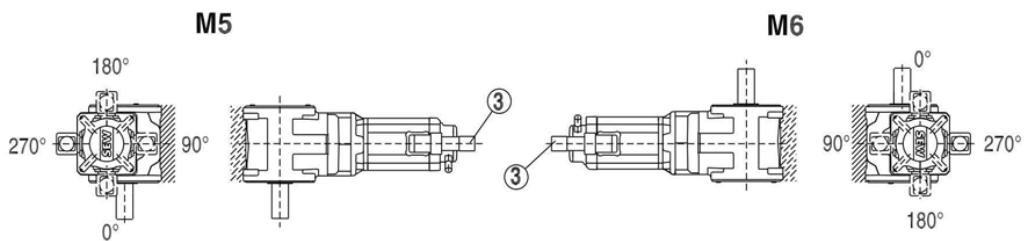
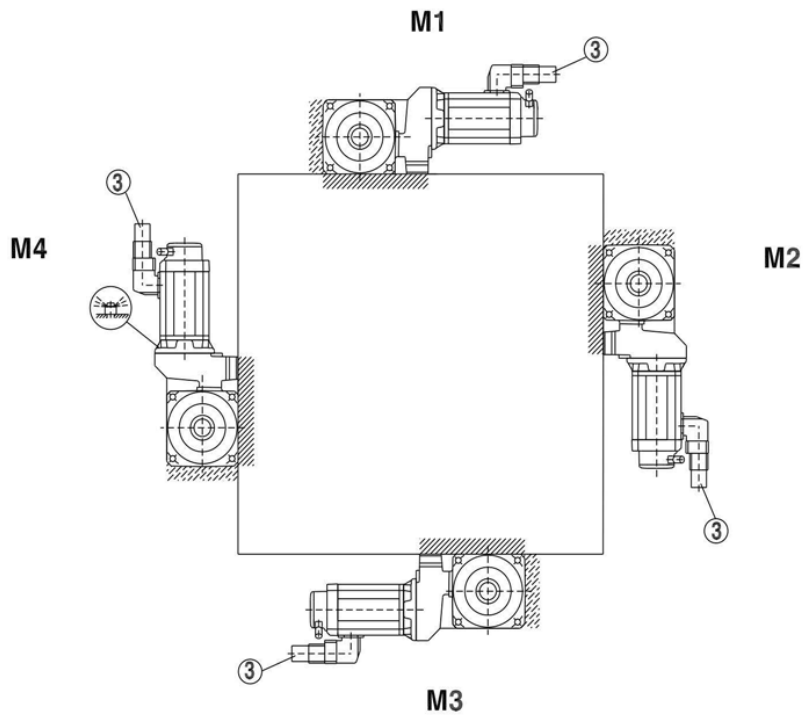
3 → page 68

BS.F202...802B

56 040 00 03



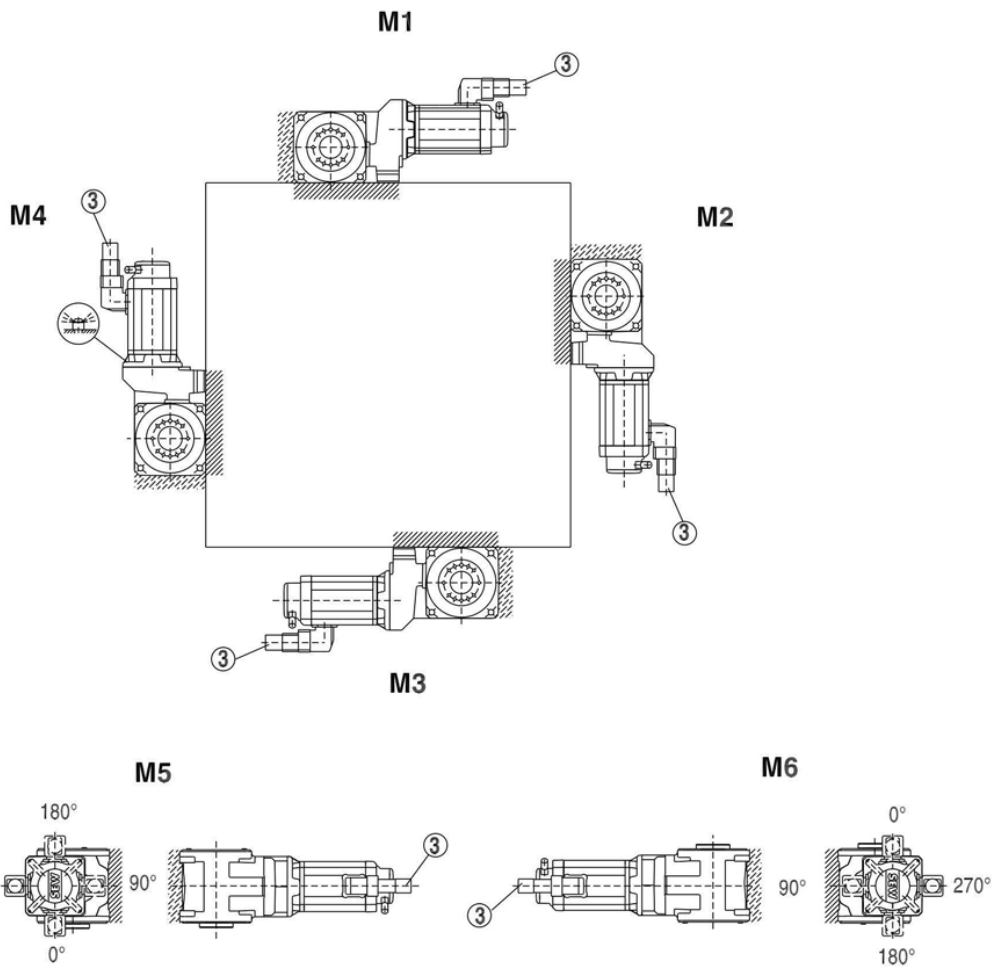
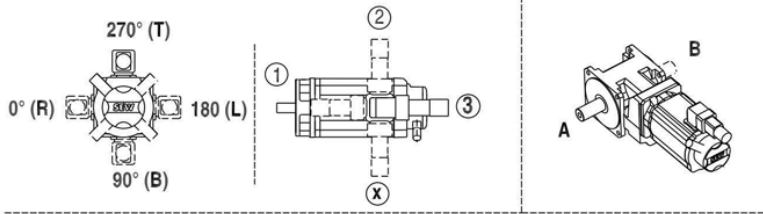
5



3 → page 68

BSBF202...802B

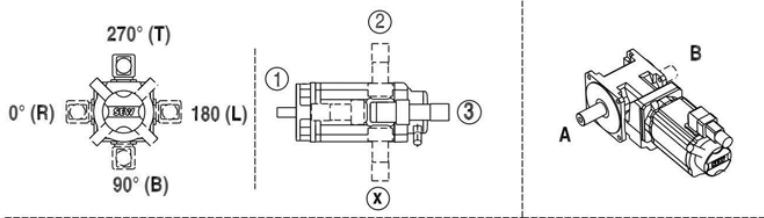
56 041 00 03



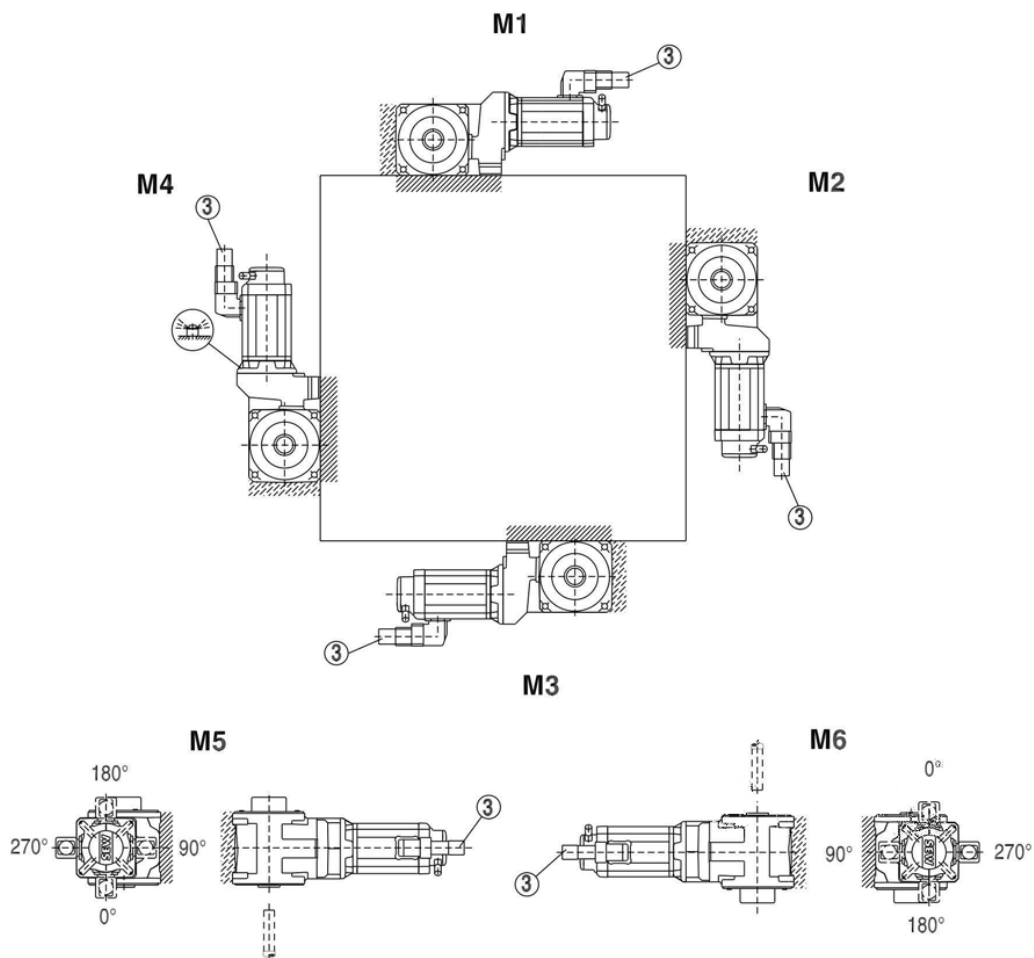
3 → page 68

BSHF202...802B

56 057 00 03



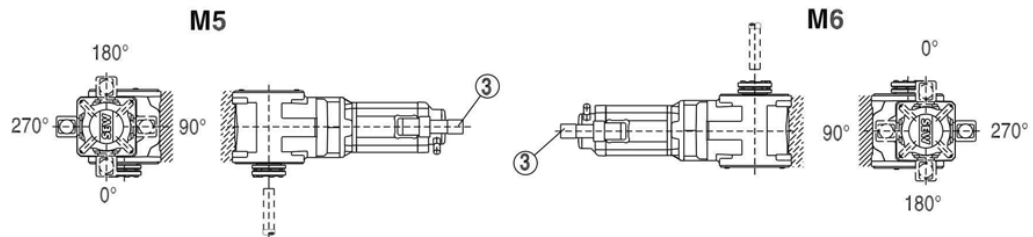
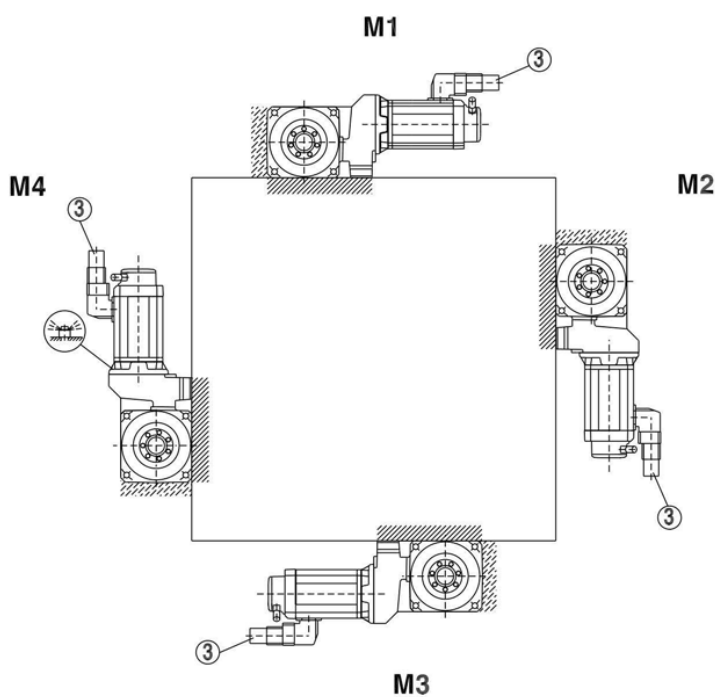
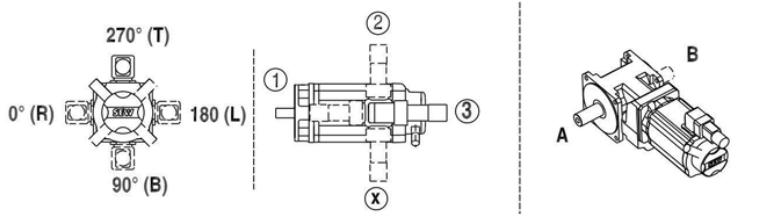
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3 → page 68

BSHF202...802B /I

56 042 00 03

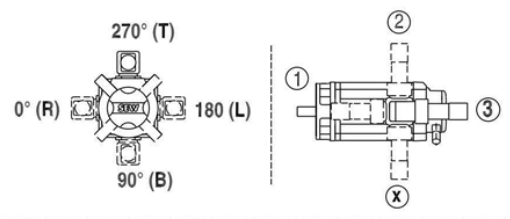


3 → page 68

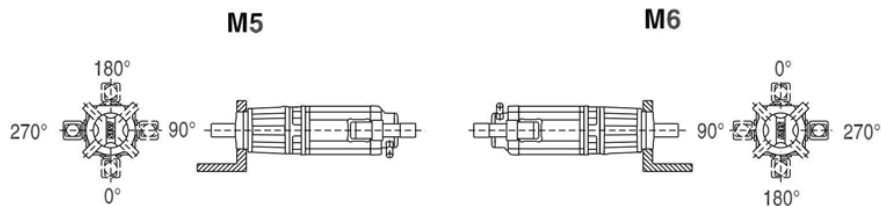
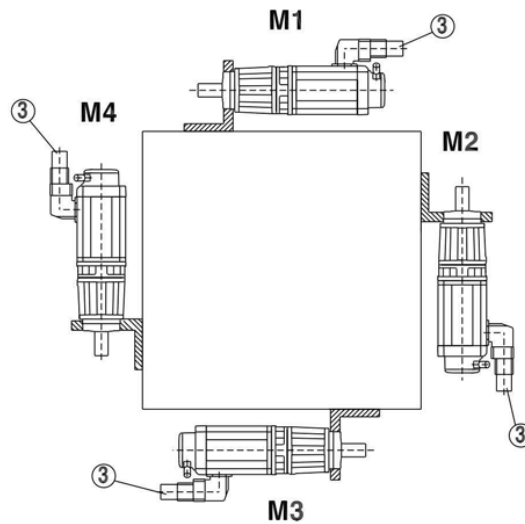
5.12 Mounting positions of PS.F, PS.C planetary gear units

PS.F121...922,
 PS.C221...622

58 001 00 03



5

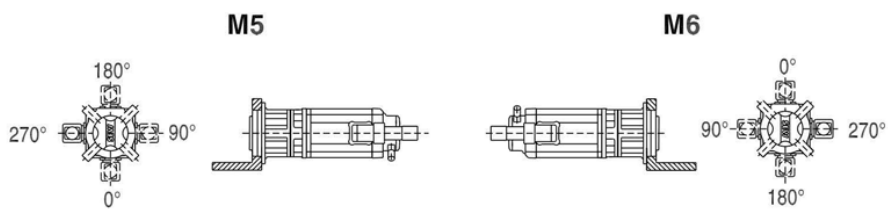
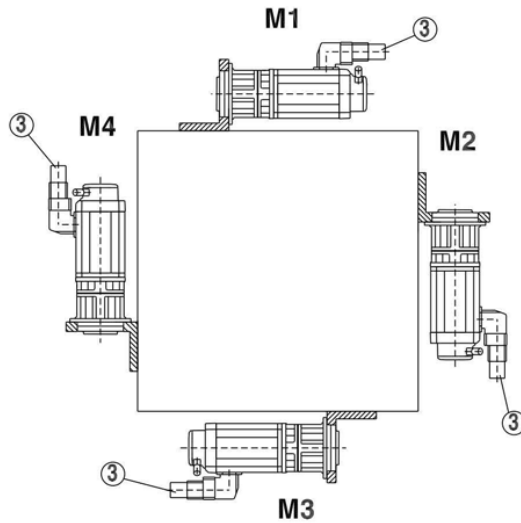
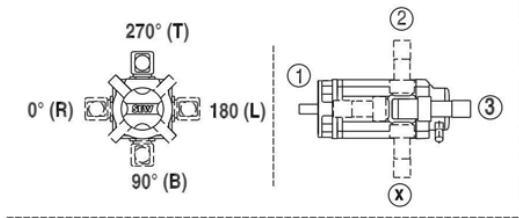


3 → page 68

Mounting Positions of Gear Units
 Mounting positions of PS.F, PS.C planetary gear units

PSBF221-822

58 002 00 03



3 → page 68



6 Design and Operating Notes

6.1 Mounting/removing gear units with hollow shaft and key



INFORMATION

- Always use the supplied NOCO® fluid for assembly. The fluid prevents contact corrosion and facilitates subsequent disassembly.
- The key dimension X is specified by the customers, but $X > DK$ must apply, see Figure 16.

Assembly

SEW-EURODRIVE recommends 2 variants for installing gear units with hollow shaft and key onto the input shaft of the driven machine (= customer shaft):

1. Use the provided fastening parts for installation.
2. Use the optional installation/removal kit for installation.

6

1. Supplied fastening parts

The following fastening parts are supplied as standard:

- Retaining screw with washer (2)
- Retaining ring (3)

Note the following points concerning the customer shaft:

- The installation length of the customer shaft with contact shoulder (A) must be $L8 - 1$ mm.
- The installation length of the customer shaft without contact shoulder (B) must equal $L8$.

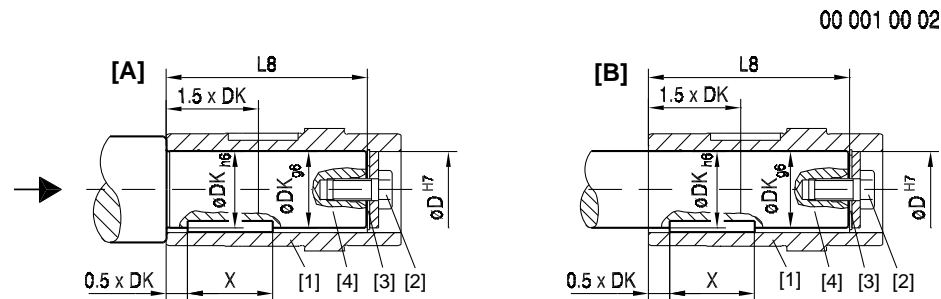


Figure 16: Customer shaft with contact shoulder (A) and without contact shoulder (B)

- | | | | |
|-----|-----------------------------|-----|----------------|
| [1] | Hollow shaft | [3] | Retaining ring |
| [2] | Retaining screw with washer | [4] | Customer shaft |



Design and Operating Notes

Mounting/removing gear units with hollow shaft and key

Dimensions and tightening torque:

The retaining screw (2) must be tightened to the tightening torque MS given in the following table:

Gear unit type	D ^{H7} [mm]	DK [mm]	L8 [mm]	MS [Nm]
WA..10	16	16	69	8
WA..20	18	18	8484	
WA..20	20	20		
FA..27	25	25	88	20
WA..30, WA..37	20	20	105	8
SA..37, BSAF202			104	
FA..37, KA..37, SA..47	30	30	105	20
BSAF302	25	25	118	
SA..47, WA..37			105	
SAF402	30	30	138	
FA..47, KA..47, SA..57	35	35	132	
WA..47	30	30	122	
SA..57			132	
FA..57, KA..57	40	40	142	40
BSAF502			158	
FA..67, KA..67			156	
SA..67			144	
SA..67	45	45	144	80
BSAF602	55	55	179	
FA..77, KA..77, SA..77	50	50	183	40
SA..77	60	60	180	80
FA..87, KA..87			210	
SA..87			220	
SA..87			220	
BSAF802	60	60	222	70
FA..97, KA..97	70	70	270	
SA..97			260	
SA..97	90	90	255	200
FA..107			313	
KA..107			313	
FA..127, KA..127	100	100	373	120
FA..157, KA..157	120	120	460	

2. Installation/ removal kit

You can also use the optional installation/removal kit for installation. You can order the kit for the specific gear unit type(s) by quoting the part numbers in the table below. The delivery includes:

- Spacer tube for installation without contact shoulder (5)
- Retaining screw for installation (2)
- Forcing washer for removal (7)
- Locked nut for removal (8)

The short retaining screw delivered as standard is not required.



Note the following points concerning the customer shaft:

- The installation length of the customer shaft must be LK2. Do not use the spacer if the customer shaft **has a contact shoulder (A)**.
- The installation length of the customer shaft must be LK2. Use the spacer if the customer shaft **has a contact shoulder (B)**.

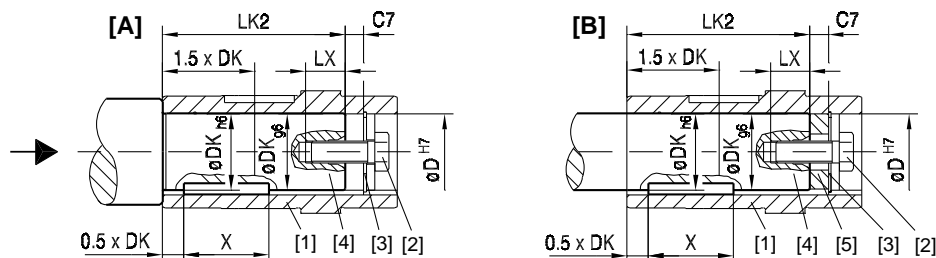


Figure 17: Customer shaft with contact shoulder (A) and without contact shoulder (B)

- | | | | |
|-----|-----------------------------|-----|----------------|
| [1] | Hollow shaft | [4] | Customer shaft |
| [2] | Retaining screw with washer | [5] | Spacer tube |
| [3] | Retaining ring | | |

Dimensions, tightening torque and part numbers:

The retaining screw (2) must be tightened to the tightening torque MS given in the following table.

Type	D ^{H7} [mm]	DK [mm]	LK2 [mm]	LX ⁺² [mm]	C7 [mm]	MS [Nm]	Part number of installation/removal kit
WA..10	16	16	57	12.5	11	8	643 712 5
WA..20	18	18	72	16	12		643 682 X
WA..20, WA..30, WA..37	20	20	72, 93	22	16	20	643 683 8
SA..37	20	20	92				16
FA..27	25	25	72	22	16	20	643 684 6
SA..47			89				
WA..47	30	30	106	36	18	40	643 685 4
FA..37, KA..37			89				
SA..47			89				
SA..57			116				
FA..47, KA..47, SA..57	35	35	114	28	18	40	643 686 2
FA..57, KA..57	40	40	124	36			18
FA..67			138				
KA..67			138				
SA..67			126				
SA..67	45	45	126	42	22	80	643 688 9
FA..77, KA..77, SA..77	50	50	165				50
FA..87, KA..87	60	60	188	42	22	80	
SA..77			158				
SA..87			198				
FA..97, KA..97			248				
SA..87	70	70	198	50	26	200	643 691 9
SA..97	238						
FA..107, KA..107	90	90	287	50	26	200	643 692 7
SA..97			229				
FA..127, KA..127	100	100	347	50	26	200	643 693 5
FA..157, KA..157	120	120	434				643 694 3



Design and Operating Notes

Mounting/removing gear units with hollow shaft and key

Removal

Applies only if installation/removal kit was previously used for installation (see Figure 17).

Proceed as follows to remove the gear unit:

1. Loosen the retaining screw (6).
2. Remove the circlip (3) and, if used, the spacer tube (5).
3. According to Figure 18 place the forcing washer (7) and the locked nut (8) between the customer shaft (4) and circlip (3).
4. Re-install the circlip (3).
5. Re-install the retaining screw (6). Now you can force the gear unit off the shaft.

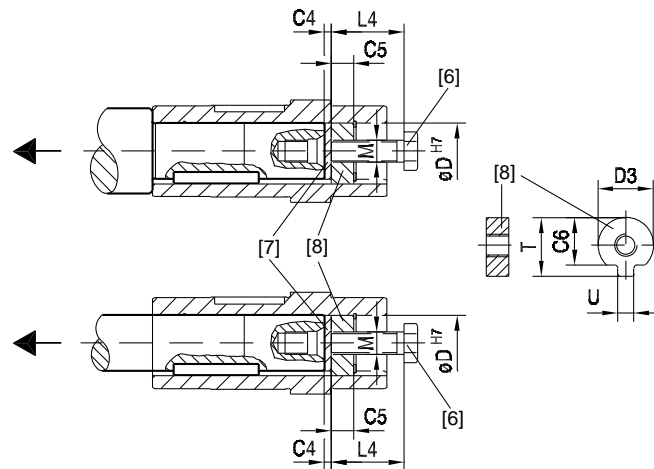


Figure 18: Removal

[6] Retaining screw
[7] Forcing washer

[8] Locked nut for removal

Dimensions and part numbers:

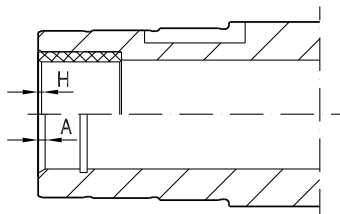
Type	D_{H7} [mm]	M	C4 [mm]	C5 [mm]	C6 [mm]	$U^{-0.5}$ [mm]	$T^{-0.5}$ [mm]	$D3^{-0.5}$ [mm]	L4 [mm]	Part number of installation/removal kit	
WA..10	16	M5	5	5	12	4.5	18	15.7	50	643 712 5	
WA..20	18	M6		6	13.5	5.5	20.5	17.7	25	643 682 X	
WA..20, WA..30, WA..37, SA..37	20				15.5	5.5	22.5	19.7		643 683 8	
FA27.., SA..47	25	M10		10	20	7.5	28	24.7	35	643 684 6	
FA..37, KA..37, SA..47, SA..57, WA..47	30				25	7.5	33	29.7		643 685 4	
FA..47, KA..47, SA..57	35	M12		12	5	29	9.5	38	34.7	45	643 686 2
FA..57, KA..57, FA..67, KA..67, SA..67	40	M16				34	11.5	41.9	39.7	50	643 687 0
SA..67	45					38.5	13.5	48.5	44.7		643 688 9
FA..77, KA..77, SA..77	50					43.5	13.5	53.5	49.7		643 689 7
FA..87, KA..87, SA..77, SA..87	60	M20		16	5	56	17.5	64	59.7	60	643 690 0
FA..97, KA..97, SA..87, SA..97	70					65.5	19.5	74.5	69.7	643 691 9	
FA..107, KA..107, SA..97	90	M24		20	5	80	24.5	95	89.7	70	643 692 7
FA..127, KA..127	100		89			27.5	106	99.7	643 693 5		
FA..157, KA..157	120		107			31	127	119.7	643 694 3		



6.2 Gear units with hollow shaft

Chamfers on hollow shafts

The following illustration shows the chamfers on parallel shaft helical, helical-bevel, helical-worm and SPIROPLAN® gear units with hollow shaft:



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Figure 19: Chamfers on hollow shafts

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Gear units	Type	
	with hollow shaft (A)	with hollow shaft and shrink disk (H)
W..10 - W..30	2 × 30û	-
F..27	2 × 30û	0.5 × 45û
BS.F202	2 × 30û	0.5 × 45û
F./K../S../W..37	2 × 30û	0.5 × 45û
BS.F302	2 × 30û	0.5 × 45û
F./K../S../W..47	2 × 30û	0.5 × 45û
BS.F402	2 × 30û	0.5 × 45û
S..57	2 × 30û	0.5 × 45û
F./K../57	2 × 30û	3 × 2û
BS.F502	2 × 30û	3 × 2û
F./K../S../67	2 × 30û	3 × 2û
BS.F602	2 × 30û	3 × 2û
F./K../S../77	2 × 30û	3 × 2û
BS.F702	2 × 30û	3 × 2û
F./K../S../87	3 × 30û	3 × 2û
BS.F802	2 × 30û	3 × 2û
F./K../S../97	3 × 30û	3 × 2û
F./K../107	3 × 30û	3 × 2û
F./K../127	5 × 30û	1.5 × 30û
F./K../157	5 × 30û	1.5 × 30û
KH167	-	1.5 × 30û
KH187	-	1.5 × 30û

Special motor/gear unit combinations

Please note for parallel shaft helical gearmotors with hollow shaft (FA..B, FV..B, FH..B, FAF, FVF, FHF, FA, FV, FH, FT, FAZ, FVZ, FHZ):

- If you are using a customer shaft pushed through on the motor end, there may be a collision when a "small gear unit" is used in combination with a "large motor".
- Check the motor dimension AC to decide whether there will be a collision with a pushed-through customer shaft.



6.3 TorqLOC® mounting system for gear units with hollow shaft

Description of TorqLOC®

The TorqLOC® hollow shaft mounting system is used for achieving a non-positive connection between customer shaft and the hollow shaft in the gear unit. As a result, the TorqLOC® hollow shaft mounting system is an alternative to the hollow shaft with shrink disk, the hollow shaft with key and the splined hollow shaft.

The TorqLOC® hollow shaft mounting system consists of the following components:

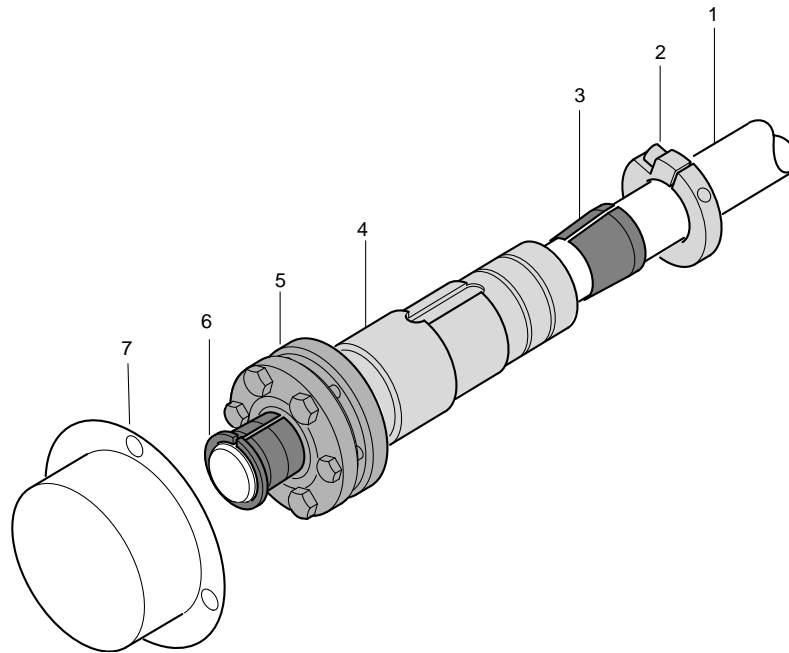


Figure 20: Components of the TorqLOC® hollow shaft mounting system

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[1]	Customer shaft	[5]	shrink disk
[2]	Clamping ring	[6]	Conical steel bushing
[3]	Conical bronze bushing	[7]	Fixed cover
[4]	Hollow shaft in gear unit		

Advantages of TorqLOC®

The TorqLOC® hollow shaft mounting system provides the following advantages:

- Cost saving as the customer shaft can be made from drawn material up to quality h11.
- Cost saving as different customer shaft diameters can be realized with one hollow shaft diameter and different bushings.
- Simple installation as there is no need to accommodate any shaft connections.
- Simple removal even after many hours of operation as the formation of contact corrosion has been reduced and the conical connections can easily be released.



Technical data The TorqLOC® hollow shaft mounting system is approved for input torques of 92 Nm to 18000 Nm.

The following gear units are available with TorqLOC® hollow shaft mounting system:


- Parallel shaft helical gear units in gear unit sizes 37 to 157 (FT37 ... FT157)
- Helical-bevel gear units in gear unit sizes 37 to 157 (KT37 ... KT157)
- Helical-worm gear units in gear unit sizes 37 to 97 (ST37 ... ST97)
- SPIROPLAN® gear unit sizes 37 and 47 (WT.7)

Available options The following options are available for gear units with a TorqLOC® hollow shaft mounting system:

- Helical-bevel, helical-worm and SPIROPLAN® gear units with TorqLOC® (KT..., ST..., WT.7..): The "torque arm" (./T) option is available.
- Parallel shaft helical gear units with TorqLOC® (FT..): The "rubber buffer" (./G) option is available.

6

6.4 Gear unit with flange block shaft

	INFORMATION
	Only use screws in strength class 12.9 to fasten the output elements onto the flange block shaft of the gear unit.



Design and Operating Notes

Option, shouldered hollow shaft with shrink disk

6.5 Option, shouldered hollow shaft with shrink disk

As an option, gear units with a hollow shaft and shrink disk (parallel shaft helical gear units FH/FHF/FHZ37-157, helical-bevel gear units KH/KHF/KHZ37-157 and helical-worm gear units SH/SHF47-97) can be supplied with a larger bore diameter D' .

$D' = D$ as standard.

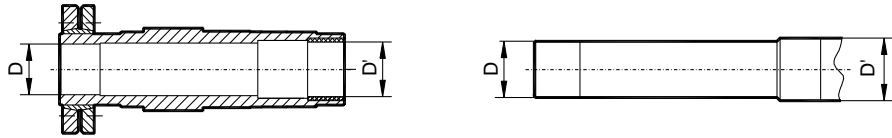


Figure 21: Optional hole diameter D'

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Gear unit	Bore diameter D / optional D' [mm]
FH/FHF/FHZ37, KH/KHF/KHZ37, SH/SHF/SHZ47	30 / 32
FH/FHF/FHZ47, KH/KHF/KHZ47, SH/SHF/SHZ57	35 / 36
FH/FHF/FHZ57, KH/KHF/KHZ57	40 / 42
FH/FHF/FHZ67, KH/KHF/KHZ67, SH/SHF/SHZ67	40 / 42
FH/FHF/FHZ77, KH/KHF/KHZ77, SH/SHF/SHZ77	50 / 52
FH/FHF/FHZ87, KH/KHF/KHZ87, SH/SHF/SHZ87	65 / 66
FH/FHF/FHZ97, KH/KHF/KHZ97, SH/SHF/SHZ97	75 / 76
FH/FHF/FHZ107, KH/KHF/KHZ107	95 / 96
FH/FHF/FHZ127, KH/KHF/KHZ127	105 / 106
FH/FHF/FHZ157, KH/KHF/KHZ157	125 / 126

Diameter D / D' must be specified when ordering gear units with a shouldered hollow shaft (optional bore diameter D').

Sample order FH37 DRS80M4 with hollow shaft 30/32 mm



Parallel shaft helical gear units with shouldered hollow shaft (dimensions in mm):

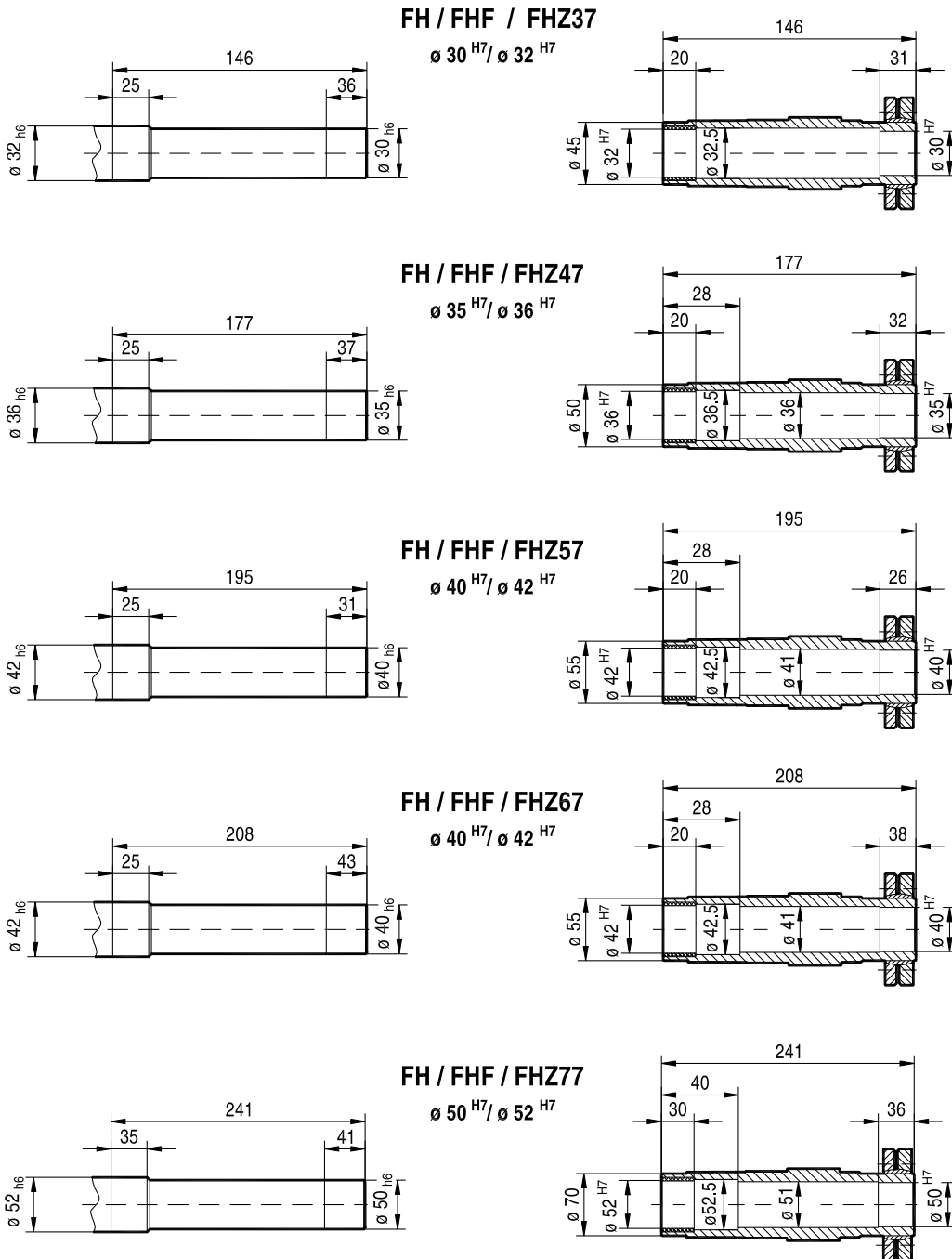


Figure 22: Shouldered hollow shaft FH/FHF/FHZ37...77

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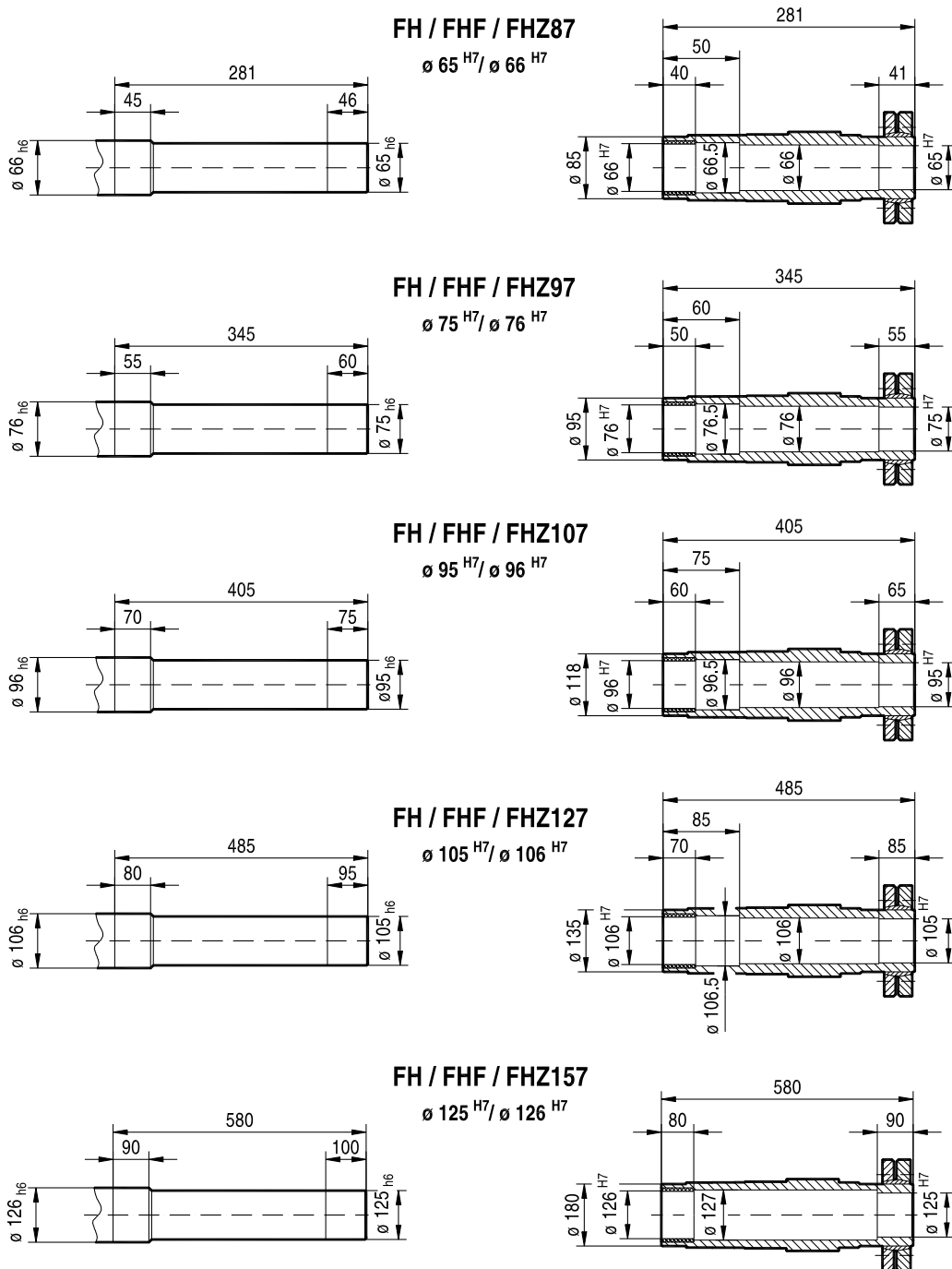
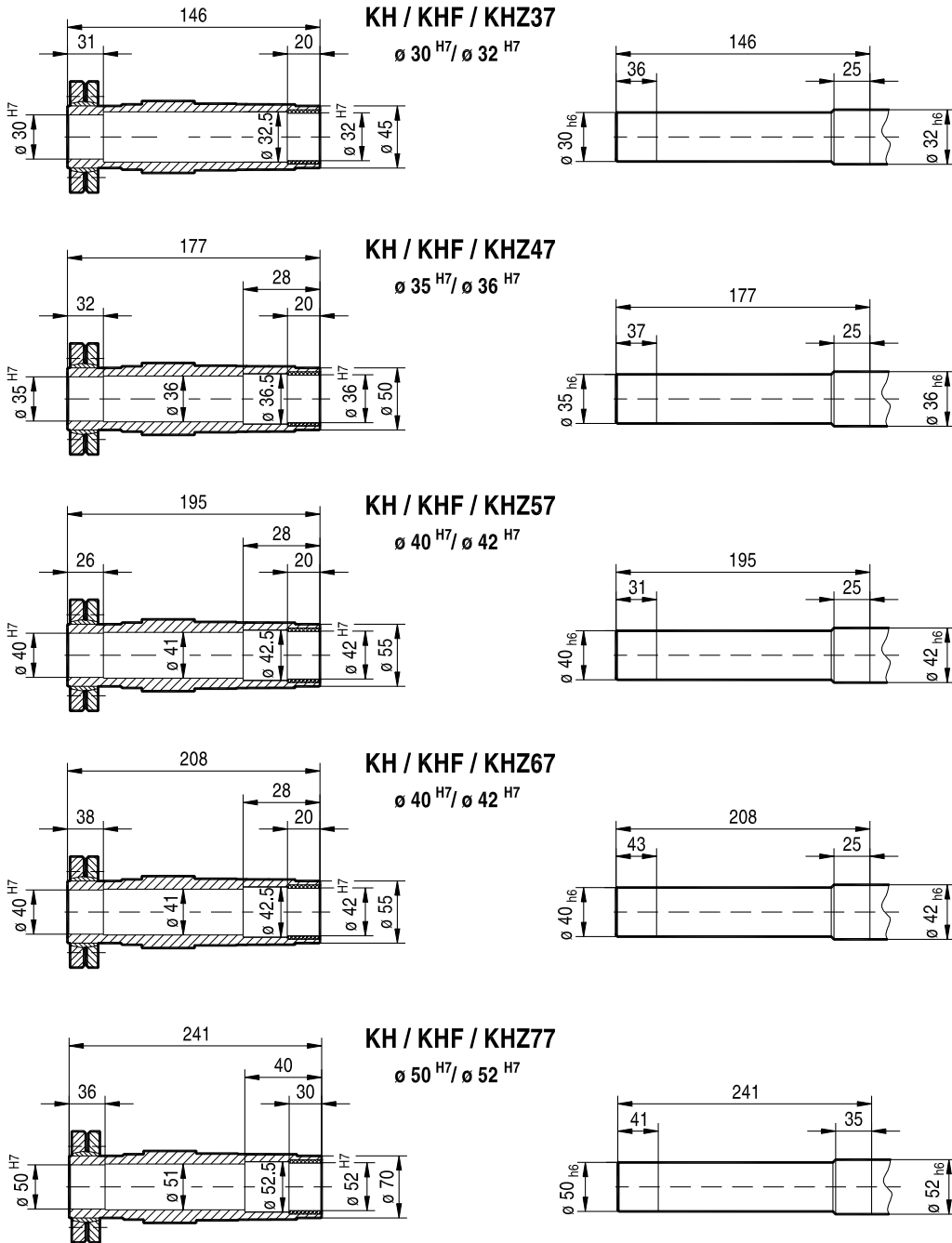


Figure 23: Shouldered hollow shaft FH/FHF/FHZ87...157

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Helical-bevel gear units with shouldered hollow shaft (dimensions in mm):



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Figure 24: Shouldered hollow shaft KH/KHF/KHZ37...77

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Design and Operating Notes
Option, shouldered hollow shaft with shrink disk

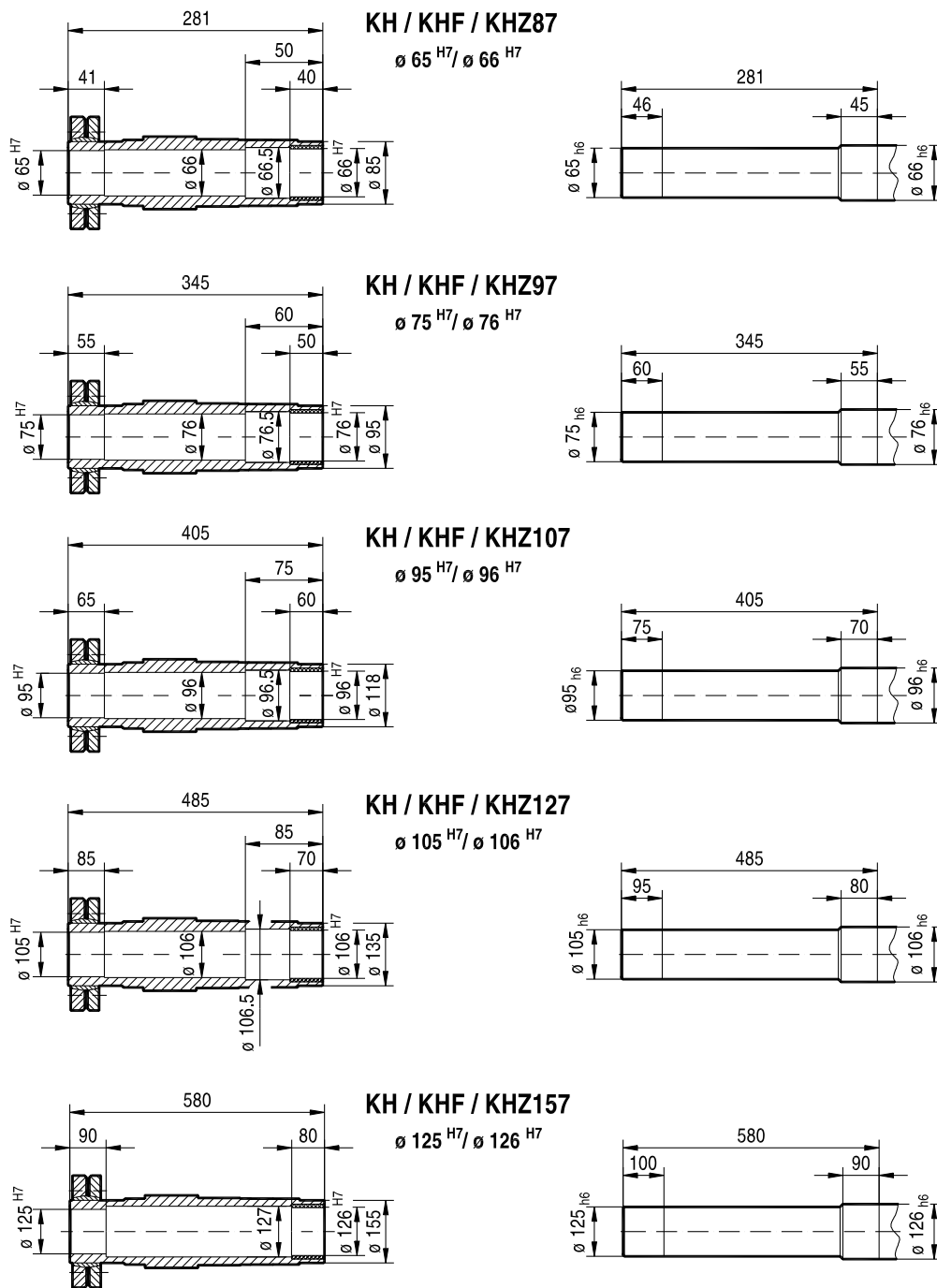


Figure 25: Shouldered hollow shaft KH/KHF/KHZ87...157

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Helical-worm gear units with shouldered hollow shaft (dimensions in mm):

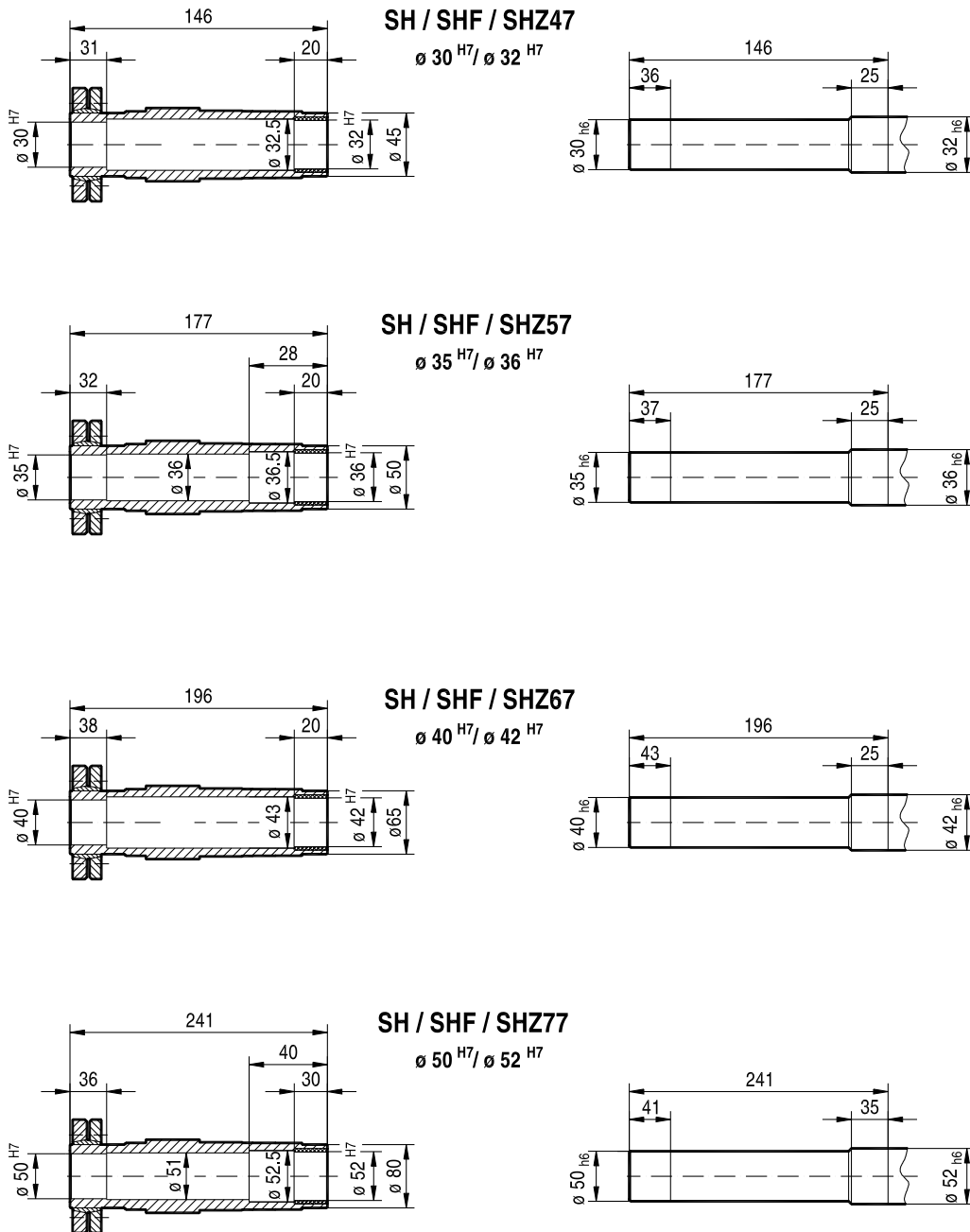


Figure 26: Shouldered hollow shaft SH/SHF/SHZ47...77

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Design and Operating Notes

Option, shouldered hollow shaft with shrink disk

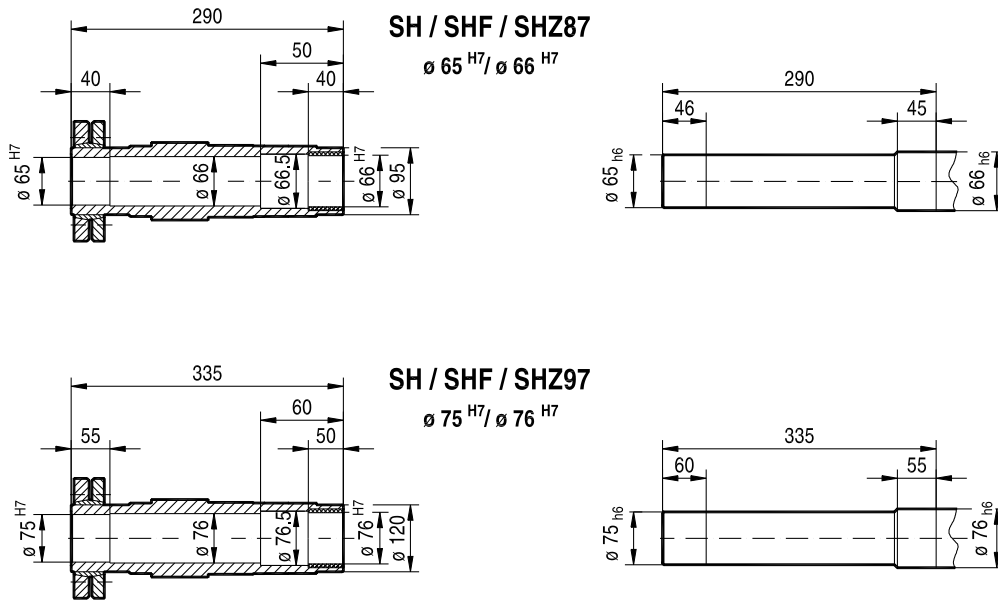


Figure 27: Shouldered hollow shaft SH/SHF/SHZ87...97

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6.6 Gear unit mounting

Use bolts of quality 8.8 to fasten gear units.

Exception

Use bolts of **quality 10.9** to fasten the customer flange to transmit the rated torques for the following flange-mounted gear units (RF ../RZ..) and foot/flange-mounted versions (R..F, BS.F..B):

- RF37, R37F with flange Ø 120 mm
- RF47, R47F with flange Ø 140 mm
- RF57, R57F with flange Ø 160 mm
- RZ37 ... RZ87
- BS.F502B ... BS.F802B

6.7 Torque arms

Available torque arms

Gear unit	Size					
	27	37	47	57	67	77
KA, KH, KV, KT	-	643 425 8	643 428 2	643 431 2	643 431 2	643 434 7
SA, SH, ST	-	126 994 1	644 237 4	644 240 4	644 243 9	644 246 3
FA, FH, FV, FT Rubber buffer (2 pieces)	013 348 5	013 348 5	013 348 5	013 348 5	013 348 5	013 349 3

Gear unit	Size				
	87	97	107	127	157
KA, KH, KV, KT	643 437 1	643 440 1	643 443 6	643 294 8	-
SA, SH, ST	644 249 8	644 252 8	-	-	-
FA, FH, FV, FT Rubber buffer (2 pieces)	013 349 3	013 350 7	013 350 7	013 351 5	013 347 7

Gear unit	Size				
	10	20	30	37	47
WA	1 061 021 9	1 68 073 0	1 68 011 0	1 061 129 0	1 061 187 8

Gear unit	Size					
	202	302	402	502	602	802
BSHF, BSAF	1 063 098 8	1 063 100 3	1 063 103 8	1 063 105 4	1 063 107 0	1 063 109 7

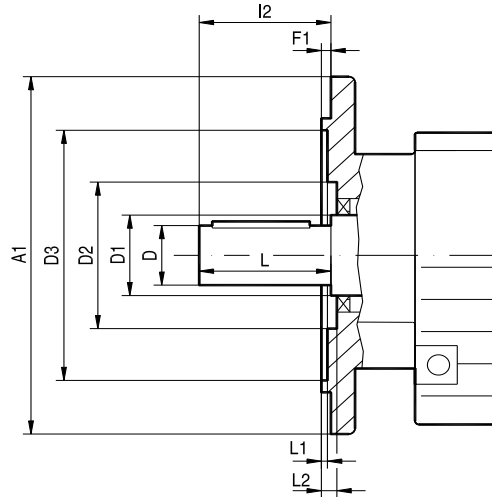
Torque arms for KH167.., KH187..

As standard, torque arms are not available for gear unit sizes KH167.. and KH187... Consult SEW-EURODRIVE for design proposals if you require torque arms for these gear units.



6.8 Flange contours of RF.. and R..F gear units

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Check dimensions L1 and L2 for selection and installation of output elements.

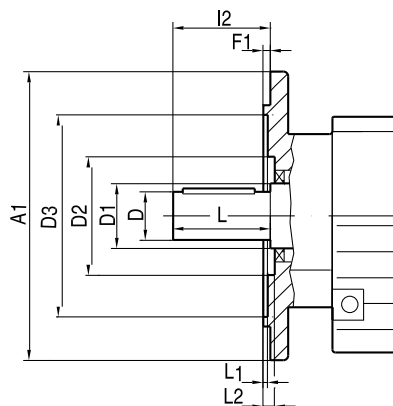
Type	Dimensions in mm											
	A1	D	D1	D2		D3	F1	I2	L	L1		L2
				RF	R..F					RF	R..F	
RF07, R07F	120	20	22	38	38	72	3	40	40	2	2	6
	140 ¹⁾				-	85	3			2	-	6
	160 ¹⁾				-	100	3.5			2.5	-	6.5
RF17, R17F	120	20	25	46	46	65	3	40	40	1	1	5
	140				-	78	3			1	-	5
	160 ¹⁾				-	95	3.5			1	-	6
RF27, R27F	120	25	30	54	54	66	3	50	50	1	1	6
	140				-	79	3			3	-	7
	160				-	92	3.5			3	-	7
RF37, R37F	120	25	35	60	63	70	3	50	50	5	4	7
	160				-	96	3.5			1	-	7.5
	200 ¹⁾				-	119	3.5			1	-	7.5
RF47, R47F	140	30	35	72	64	82	3	60	60	4	1	6
	160				-	96	3.5			0.5	-	6.5
	200				-	116	3.5			0.5	-	6.5
RF57, R57F	160	35	40	76	75	96	3.5	70	70	4	2.5	5
	200				-	116	3.5			0	-	5
	250 ¹⁾				-	160	4			0.5	-	5.5
RF67, R67F	200	35	50	90	90	118	3.5	70	70	2	4	7
	250				-	160	4			1	-	7.5
RF77, R77F	250	40	52	112	100	160	4	80	80	0.5	2.5	7
	300 ¹⁾				-	210	4			0.5	-	7
RF87, R87F	300	50	62	123	122	210	4	100	100	0	1.5	8
	350				-	226	5			1	-	9
RF97	350	60	72	136	236	5	120	120	0			9
	450				320							
RF107	350	70	82	157	232	5	140	140	0			11
	450			186	316							
RF137	450	90	108	180	316	5	170	170	0			10
	550				416							
RF147	450	110	125	210	316	5	210	210	0			10
	550				416							
RF167	550	120	145	290	416	5	210	210	1			10
	660				517	6			2			11

1) The flange contour protrudes from under the base surface.



6.9 Flange contours of FF., KF., SF. and WF. gear units

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6

Check dimensions L1 and L2 for selection and installation of output elements.

Type	Dimensions in mm									
	A1	D	D1	D2	D3	F1	I2	L	L1	L2
FF27	160	25	40	66	96	3.5	50	50	3	18.5
FF37	160	25	30	70	94	3.5	50	50	2	6
FF47	200	30	40	72	115	3.5	60	60	3.5	7.5
FF57	250	35	40	84	155	4	70	70	4	9
FF67	250	40	50	84	155	4	80	80	4	9
FF77	300	50	55	82	205	4	100	100	5	9
FF87	350	60	65	115	220	5	120	120	5	9
FF97	450	70	75	112	320	5	140	140	8	10
FF107	450	90	100	159	318	5	170	170	16	9
FF127	550	110	118	-	420	5	210	210	10	-
FF157	660	120	135	190	520	6	210	210	8	14
KF37	160	25	30	70	94	3.5	50	50	2	6
KF47	200	30	40	72	115	3.5	60	60	3.5	7.5
KF57	250	35	40	84	155	4	70	70	4	9
KF67	250	40	50	84	155	4	80	80	4	9
KF77	300	50	55	82	205	4	100	100	5	9
KF87	350	60	65	115	220	5	120	120	5	9
KF97	450	70	75	112	320	5	140	140	8	10
KF107	450	90	100	159	318	5	170	170	16	9
KF127	550	110	118	-	420	5	210	210	10	-
KF157	660	120	135	190	520	6	210	210	8	14
SF37	120	20	25	-	68	3	40	40	6	-
SF37	160	20	25	-	96	3.5	40	40	5.5	-
SF47	160	25	30	70	94	3.5	50	50	2	6
SF57	200	30	40	72	115	3.5	60	60	3.5	7.5
SF67	200	35	45	-	115	3.5	70	70	8.5	-
SF77	250	45	55	108	160	4	90	90	8	9
SF87	350	60	65	130	220	5	120	120	6	10
SF97	450	70	75	150	320	5	140	140	8.5	10
WF10	80	16	25	-	39	2.5	40	40	30	-
WF10	120	16	25	39	74	3	40	40	5	30
WF20	110	20	30	44	53	-4	40	40	27	35
WF20	120	20	30	-	45	2.5	40	40	37.5	-
WF30	120	20	30	48	63	2.5	40	40	18	27
WF30	160	20	30	48	63	2.5	40	40	33	42
WF37	120	20	30	-	70	2.5	40	40	-	10.5
WF37	160	20	30	-	70	2.5	40	40	-	25.5
WF47	160	30	35	-	92	3.5	10	60	6	-

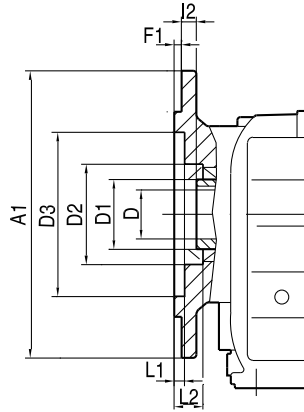


Design and Operating Notes

Flange contours of FAF.., KAF.., SAF.. and WAF.. gear units

6.10 Flange contours of FAF.., KAF.., SAF.. and WAF.. gear units

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Check dimensions L1 and L2 for selection and installation of output elements.

Type	Dimensions in mm								
	A1	D	D1	D2	D3	F1	I2	L1	L2
FAF27	160	40	25	66	96	3.5	20	3	18.5
FAF37	160	45	30	62	94	3.5	24	2	30
FAF47	200	50	35	70	115	3.5	25	3.5	31.5
FAF57	250	55	40	76	155	4	23.5	4	31
FAF67	250	55	40	76	155	4	23	4	31
FAF77	300	70	50	95	205	4	37	5	45
FAF87	350	85	60	120	220	5	30	5	39
FAF97	450	95	70	135	320	5	41.5	5.5	51
FAF107	450	118	90	224	320	5	41	16	52
FAF127	550	135	100	185	420	5	51	6	63
FAF157	660	155	120	200	520	6	60	10	74
KAF37	160	45	30	62	94	3.5	24	2	30
KAF47	200	50	35	70	115	3.5	25	3.5	8.5
KAF57	250	55	40	76	155	4	23.5	4	31
KAF67	250	55	40	76	155	4	23	4	31
KAF77	300	70	50	95	205	4	37	5	45
KAF87	350	85	60	120	220	5	30	5	39
KAF97	450	95	70	135	320	5	41.5	5.5	51
KAF107	450	118	90	224	320	5	41	16	52
KAF127	550	135	100	185	420	5	51	6	63
KAF157	660	155	120	200	520	6	60	10	74
SAF37	120	35	20	-	68	3	15	6	-
SAF37	160	35	20	-	96	3.5	15	5.5	-
SAF47	160	45	30 / 25	62	94	3.5	24	2	30
SAF57	200	50	35 / 30	70	115	3.5	25	3.5	31.5
SAF67	200	65	45 / 40	91	115	3.5	42.5	4	48.5
SAF77	250	80	60 / 50	112	164	4	45.5	5	53.5
SAF87	350	95	70 / 60	131	220	5	52.5	6	62.5
SAF97	450	120	90 / 70	160	320	5	60	6.5	69
WAF10	80	25	16	-	39	2.5	23	30	-
WAF10	120	25	16	39	74	3	23	5	30
WAF20	110	30	18 / 20	44	53	-4	30	27	35
WAF20	120	30	18 / 20	-	45	2.5	30	37.5	-
WAF30	120	30	20	48	63	2.5	19.5	18	27
WAF30	160	30	20	48	63	2.5	34.5	33	42
WAF37	120	35	20 / 25	54	70	2.5	19.5	10.5	27
WAF37	160	35	20 / 25	54	70	2.5	34.5	25.5	42
WAF47	160	45	25 / 30	72	92	3.5	10	6	45



6.11 Fixed covers

Parallel shaft helical gear units, helical-bevel gear units, helical-worm and SPIROPLAN® gear units with hollow shafts and shrink disks of size 37 up to size 97 come equipped with a rotating cover as standard. If, for safety reasons, fixed covers are required for these gear units, you can order them for the respective gear unit types by quoting the part numbers in the following tables. As standard, size 107 parallel shaft helical gear units and helical-bevel gear units with hollow shafts and shrink disks and size 27 parallel shaft helical gear units come equipped with a fixed cover.

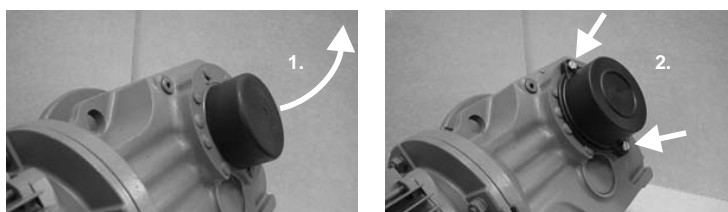
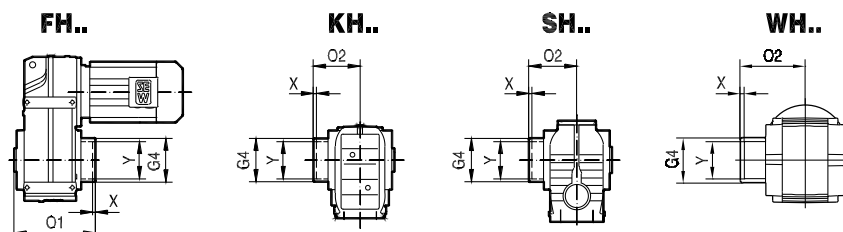


Figure 28: Replacing a rotating cover with a fixed cover

03190AXX

- [1] Pull off the rotating cover
- [2] Install and fasten fixed cover

Part numbers and dimensions



62664AXX

Parallel-shaft helical gearmotors	FH..37	FH..47	FH..57	FH..67	FH..77	FH..87	FH..97
Part number	643 513 0	643 514 9	643 515 7	643 515 7	643 516 5	643 517 3	643 518 1
G4	78	88	100	100	121	164	185
O1	157	188.5	207.5	221.5	255	295	363.5
X	2	4.5	7.5	6	6	4	6.5
Y	75	83	83	93	114	159	174



Helical-bevel gearmotors ¹⁾	KH..37	KH..47	KH..57	KH..67	KH..77	KH..87	KH..97
Part number	643 513 0	643 514 9	643 515 7	643 515 7	643 516 5	643 517 3	643 518 1
G4 [mm]	78	88	100	100	121	164	185
O2 [mm]	95	111.5	122.5	129	147	172	210.5
X [mm]	0	1.5	5.5	3	1	2	4.5
Y [mm]	75	83	83	93	114	159	174

1) Not possible in foot-mounted helical-bevel gear units with hollow shaft and shrink disk (KH..B).

Helical-worm gearmotors	SH..37	SH..47	SH..57	SH..67	SH..77	SH..87	SH..97
Part number	643 512 2	643 513 0	643 514 9	643 515 7	643 516 5	643 517 3	643 518 1
G4 [mm]	59	78	88	100	121	164	185
O2 [mm]	88	95	111.5	123	147	176	204.5
X [mm]	1	0	1.5	3	1	0	0.5
Y [mm]	53	75	83	93	114	159	174

SPIROPLAN® gearmotors	WH..37	WH..47
Part number	1 061 136 3	1 061 194 0
G4 [mm]	68	80.5
O2 [mm]	95.5	109.5
X [mm]	11	12.5
Y [mm]	50	72



6.12 Condition monitoring: Oil-aging and vibration sensor for R, F, K, S gear units

Technical data of oil aging sensor

DUO10A
diagnostic unit

DUO10A	Technical data	
Preset oil grades	OIL1	CLP mineral oil. $T_{max} = 100\text{ °C}$
		Bio oil $T_{max} = 100\text{ °C}$
	OIL2	CLP HC synthetic oil: $T_{max} = 130\text{ °C}$
		CLP PAO oil $T_{max} = 130\text{ °C}$
	OIL3	CLP PG polyglycol $T_{max} = 130\text{ °C}$
OIL4	Food grade oil $T_{max} = 100\text{ °C}$	
Switch outputs	1: Early warning (time to next oil change can be set to between 2 and 100 days) 2: Main alarm (time to oil change 0 days) 3: Exceeded temperature T_{max} 4: DUO10A is ready for operation	
Permitted oil temperature	-40 °C to +130 °C	
Permitted temperature sensor	PT1000	
EMC	IEC1000-4-2/3/4/6	
Ambient temperature	-25 °C to +70 °C	
Operating voltage	DC 18-28 V	
Current consumption at DC 24 °C	< 90 mA	
Protection class	III	
Degree of protection	IP67 (optionally IP69K)	
Housing materials	Evaluation unit: V2A, EPDM/X, PBT, FPM Temperature sensor: V4A	
Electrical connection	Evaluation unit: M12 plug connector PT1000 temperature sensor: M12 plug connector	

Designations and part numbers



Designation	Description	Part number
DUO10A	Evaluation unit (basic unit)	1 343 875 1
DUO10A-PUR-M12-5m	5 m PUR cable with 1 connector	1 343 877 8
DUO10A-PVC-M12-5m	5 m PVC cable with 1 connector	1 343 878 6
DUO10A	Angle bracket	1 343 880 8
DUO10A D = 34	Mounting clamp	1 343 879 4





Design and Operating Notes

Condition monitoring: Oil-aging and vibration sensor for R, F, K, S gear units

Designation	Description	Part number
W4843 PT1000 	PT1000 temperature sensor	1 343 881 6
W4843_4x0,34-2m-PUR	2 m PUR cable for PT1000 ¹⁾	1 343 882 4
W4843_4x0,34-2m-PVC	2 m PVC cable for PT1000 ²⁾	1 343 883 2
DUO10A 	Protection cap (for aseptic design, IP69K)	1 343 902 2

- 1) PUR cables are particularly suited for use in oil-contaminated environments.
- 2) PVC cables are particularly suited for use in wet environments.

*Mounting on
standard gear units
(R, F, K, S)*

Adapter for mounting the PT1000 temperature sensor in screw plug holes:

Complete adapter for PT1000 sensor	Part number
M10 × 1	1 343 903 0
M12 × 1.5	1 343 904 9
M22 × 1.5	1 343 905 7
M33 × 2	1 343 906 5
M42 × 2	1 343 907 3

Mounting base for installing the diagnostic unit at the gear unit with an angle bracket:

Mounting base with sealing ring	Part number
M10 × 1	1 343 441 1
M12 × 1.5	1 343 827 1
M22 × 1.5	1 343 829 8
M33 × 2	1 343 830 1
M42 × 2	1 343 832 8




Technical data of vibration sensor

The DUV10A and DUV30A vibration sensors are suited for early detection of gearmotor damage, which can be detected using vibration diagnostics, such as bearing damage or imbalance. The highest load of the drives at constant speed must be present to being able to use the full functionality of the diagnostic unit. Drives in which the maximum load is present during acceleration are suitable for monitoring using vibration sensors to a limited degree only.

Diagnostic unit
DUV10A /
DUV30A

	Technical data	
	DUV10A	DUV30A
Measuring range	± 20 g	± 20 g
Frequency range	0.125 to 500 Hz	0.125 to 500 Hz / 0.125 to 5000 Hz
Spectral resolution	0.125 Hz	0.125 Hz / 1.25 Hz
Diagnostic methods	FFT, envelope-FFT, trend analysis	
Minimum measuring period	8.0 s	8.0 s / 0.8 s
Speed range	12 to 3500 rpm	12 to 3500 rpm / 120 to 12000 rpm
Switch outputs	1: Early warning 2: Main alarm	
Operating voltage	DC 10-32 V	
Current consumption at DC 24 °C	100 mA	
Protection class	III	
EMC	IEC1000-4-2/3/4/6	
Overload capacity	100 g	
Ambient temperature	-30 °C to +60 °C	-30 °C to +70 °C
Degree of protection	IP67	
Housing materials	Zinc die-casting, coating based on epoxy finish, polyester membrane keypad	
Electrical connection for supply and switching output	M12 plug connector	
Electrical connection RS-232 for communication	M8 plug connector	
Certificates and standards	CE, UL	

Designations and part numbers

Designation	Description	Part number
 DUV10A / DUV30A	Diagnostic unit (basic unit)	DUV10A: 1 406 629 7 DUV30A: 1 328 969 1
DUV.0A-S	Configuration software	1 406 630 0
DUV.0A-K-RS232-M8	Communication cable	1 406 631 9
DUV.0A-N24DC	DC 24 V power supply unit	1 406 632 7
DUV.0A-I	Pulse tester	1 406 633 5



Design and Operating Notes

Lubricants and fill quantities for R, F, K, S, W gear units

Designation	Description	Part number
DUV.0A-K-M12-2m PUR	2 m PUR cable with 1 connector ¹⁾	1 406 634 3
DUV.0A-K-M12-5m PUR	5 m PUR cable with 1 connector ¹⁾	1 406 635 1
DUV.0A-K-M12-2m PVC	2 m PVC cable with 1 connector ²⁾	1 326 620 9
DUV.0A-K-M12-5m PVC	5 m PVC cable with 1 connector ²⁾	1 326 621 7

1) PUR cables are particularly suited for use in oil-contaminated environments.

2) PVC cables are particularly suited for use in wet environments.

Mounting on standard gear units (R, F, K, S)


Mounting base for installing the diagnostic unit:

Mounting base with sealing ring for gear unit	Part number
M10 × 1	1 343 441 1
M12 × 1.5	1 343 827 1
M22 × 1.5	1 343 829 8
M33 × 2	1 343 830 1
M42 × 2	1 343 832 8
G 3/4	1 343 833 6
G 1	1 343 834 4
G 1 1/4	1 343 835 2
G 1 1/2	1 343 836 0
Mounting base for motors	Part number
M 8	1 362 261 7
M 12	1 343 842 5
M 16	1 343 844 1
M 20	1 362 262 5

6.13 Lubricants and fill quantities for R, F, K, S, W gear units

General information

Unless a special arrangement is made, SEW-EURODRIVE supplies the drives with a lubricant fill adapted for the specific gear unit and mounting position. The decisive factor is the mounting position (M1 - M6, see chapter "Gear Unit Mounting Positions") specified when ordering the drive. You must adapt the lubricant fill in case of any subsequent changes made to the mounting position (→ Lubricant fill quantities).

	INFORMATION
	SEW-EURODRIVE fills the gear units with the amount of oil specified for the specific mounting positions. If the mounting position is changed, the amount of oil must be adapted as required. Consequently, a mounting position may only be changed after consultation with SEW-EURODRIVE, otherwise your right to claim under warranty no longer applies .


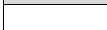




Lubricant table

The lubricant table on the following page shows the permitted lubricants for SEW-EURODRIVE gear units. Observe the following legend with regards to the lubricant table.



Key to the lubricant table

Abbreviations, meaning of shading and notes:


- CLP = Mineral oil
- CLP PG = Polyglycol (W gear units, conforms to USDA-H1)
- CLP HC = Synthetic hydrocarbons
- E = Ester oil (water hazard class 1 (German regulation))
- HCE = Synthetic hydrocarbons + ester oil (USDA - H1 certification)
- HLP = Hydraulic oil
-  = Synthetic lubricant (= synthetic-based roller bearing grease)
-  = Mineral lubricant (= mineral-based rolling bearing grease)
- 1) Helical-worm gear units with PG oil: consult SEW-EURODRIVE.
- 2) Special lubricant for SPIROPLAN® gear units only
- 3) SEW-f_B ≥ 1.2 required
- 4) Pay attention to critical starting behavior at low temperatures!
- 5) Low-viscosity grease
- 6) Ambient temperature
-  Lubricant for the food industry (food grade oil)
-  Biodegradable oil (lubricant for agriculture, forestry, and fisheries)

Rolling bearing greases

The rolling bearings in gear units and motors are given a factory-fill with the greases listed below. SEW-EURODRIVE recommends regreasing rolling bearings with a grease fill at the same time as changing the oil and replacing the rolling bearings.

	Ambient temperature	Manufacturer	Type
Gear unit rolling bearings	-40 °C ... +80 °C	Fuchs	Renolit CX-TOM15 ¹⁾
Motor rolling bearings²⁾	-20 °C ... +80 °C	Esso	Polyrex EM
	+20 °C ... +100 °C	Klüber	Barrierta L55/2
	-40 °C ... +60 °C	Kyodo Yushi	Multemp SRL ³⁾
Special greases for gear unit rolling bearings:			
	-30 °C ... +40 °C	Aral	Aral Eural Grease EP 2
	-20 °C ... +40 °C	Aral	Aral Aralube BAB EP2

- 1) Rolling bearing grease based on semi-synthetic base oil.
- 2) The motor rolling bearings are covered on both sides and cannot be regreased.
- 3) Recommended for continuous operation at ambient temperatures below 0 °C, for example in a cold storage.

	INFORMATION
	<p>The following grease quantities are required:</p> <ul style="list-style-type: none"> • For fast-running bearings (gear unit input end): Fill the cavities between the rolling elements one-third full with grease. • For slow-running bearings (in gear units and at gear unit output end): Fill the cavities between the rolling elements two-thirds full with grease.



Design and Operating Notes

Lubricants and fill quantities for R, F, K, S, W gear units

Lubricant table

The following table shows the assignment of lubricants to gear units:

01 805 12 92

	6)	DIN (ISO)	ISO/NLGI	Mobil®	Shell	ARAL	bp	TEJICO	Castrol	FUCHS	TOTAL	
R... 	Standard -10 0 +40 °C -50 0 +100	CLP (CC)	VG 220	Mobilgear 600 XP 220	Shell Omala 220	Aral Degol BG 220	BP Energol GR-XP 220	Meropa 220	Tribol 1100/220	Renolin CLP 220	Carter EP 220	
		CLP PG	VG 220	Glygoyle 220	Shell Tivela S 220	Aral Degol GS 220	BP Energol SG-XP 220	Synlube CLP 220	Tribol 800/220	Renolin PG 220	Carter SY 220	
		CLP HC	VG 220	Mobil SHC 630	Shell Omala HD 220	Aral Degol PAS 220		Pinnacle EP 220		Tribol 1510/220	Renolin Unisyn CLP 220	
		CLP HC	VG 150	Mobil SHC 629	Shell Omala HD 150			Pinnacle EP 150			Renolin Unisyn CLP 150	
		CLP (CC)	VG 150	Mobilgear 600 XP 100	Shell Omala 100	Aral Degol BG 100	BP Energol GR-XP 100	Meropa 150	Tribol 1100/100	Alpha SP 100/150 Optigear BM 100	Renolin CLP 150	Carter EP 100
		HLP (HM)	VG 68-46	Mobil D.T.E. 13M	Shell Tellus T 32	Aral Degol BG 46		Rando EP Ashless 46		Hyspan AWS 32 Optigear 32	Renolin B 46 HVI	Equivis ZS 46
		CLP HC	VG 68	Mobil SHC 626							Renolin Unisyn CLP 68	
		CLP HC	VG 32	Mobil SHC 624						Alphasyn T32 Optileb HY 32	Renolin Unisyn OL 32	Dacnis SH 32
		HLP (HM)	VG 15	Mobil D.T.E. 11M	Shell Tellus T 15					Hyspan AWS 22	Renolin MR 310	Equivis ZS 15
		CLP (CC)	VG 680	Mobilgear 600 XP 680	Shell Omala 680	Aral Degol BG 680	BP Energol GR-XP 680	Meropa 680	Tribol 1100/680	Alpha SP 680 Optigear BM 680	Renolin SEW 680	Carter EP 680
S...(HS...) 	Standard 0 +40 -20 +60 -30 +80 -40 +10 -20 +10 -25 +20 -40 +20 -40 0 Standard -20 +40	CLP PG	VG 680 1)		Shell Tivela GH 6-680		BP Energol CLP 680		Tribol 800/680	Renolin PG 680		
		CLP HC	VG 460	Mobil SHC 634	Shell Omala HD 460		Pinnacle EP 460			Optitex A 680	Renolin Unisyn CLP 460	
		CLP HC	VG 150	Mobil SHC 629	Shell Omala HD 150			Pinnacle EP 150		Optigear Synthetic X 460	Renolin Unisyn CLP 150	
		CLP (CC)	VG 150	Mobilgear 600 XP 100	Shell Omala 100	Aral Degol BG 100	BP Energol GR-XP 100	Meropa 150	Tribol 1100/100	Alpha SP 100/150 Optigear BM 100	Renolin CLP 150	Carter EP 100
		CLP PG	VG 220 1)	Glygoyle 220	Shell Tivela S 220	Aral Degol GS 220	BP Energol SG-XP 220			Optitex X 150	Renolin Unisyn CLP 220	Carter SY 220
		CLP HC	VG 68	Mobil SHC 626							Renolin Unisyn CLP 68	
		CLP HC	VG 32	Mobil SHC 624						Alphasyn T32	Renolin Unisyn OL 32	Dacnis SH 32
		CLPHC NSF H1	VG 460		Shell Cassida Fluid GL 460					Optileb GT 460	Gerallyn SF 460	
			VG 220		Shell Cassida Fluid GL 220					Optileb GT 220		
			VG 68		Shell Cassida Fluid HF 68					Optilab HY 68		
R...K...(HK...) F...S...(HS...)	Standard -20 +40 -40 +10 -20 +40 -25 +60 Standard -15 +40	E	VG 460			Aral Degol BAB 460			Tribol Bio Top 1418/460	Plantogear 460 S		
		SEW PG	VG 460 2)									
		API GL5 (-VG 100)	SAE 75W90	Mobil Synthetic Gear Oil 75 W90								
		H1 PG	VG 460 2)									
W...(HW...) 	Standard -20 +40 -40 +10 -20 +40 -25 +60 Standard -15 +40	DIN 51 818 5)	00	Glygoyle Grease 00	Shell Tivela GL 00							
			000 - 0	Mobilux EP 004	Shell Alvania GL 00	Aralub MFL 00	BP Energol LS-EP 00	Multifak EP 000		Renolin SF 7-041	Multis EP 00	
R32 R302												



Lubricant fill quantities

The specified fill quantities are **recommended values**. The precise values vary depending on the number of stages and gear ratio. When filling, it is essential to check the **oil level plug since it indicates the precise oil volume**.

The following tables show guide values for lubricant fill quantities in relation to the mounting position M1 - M6.

Helical (R) gear units

RX..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
RX57	0.60	0.80	1.30	1.30	0.90	0.90
RX67	0.80	0.80	1.70	1.90	1.10	1.10
RX77	1.10	1.50	2.60	2.70	1.60	1.60
RX87	1.70	2.50	4.80	4.80	2.90	2.90
RX97	2.10	3.40	7.4	7.0	4.80	4.80
RX107	3.90	5.6	11.6	11.9	7.7	7.7

6

RXF..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
RXF57	0.50	0.80	1.10	1.10	0.70	0.70
RXF67	0.70	0.80	1.50	1.40	1.00	1.00
RXF77	0.90	1.30	2.40	2.00	1.60	1.60
RXF87	1.60	1.95	4.90	3.95	2.90	2.90
RXF97	2.10	3.70	7.1	6.3	4.80	4.80
RXF107	3.10	5.7	11.2	9.3	7.2	7.2

R.., R..F

Gear unit	Fill quantity in liters					
	M1 ¹⁾	M2	M3	M4	M5	M6
R07	0.12	0.20	0.20	0.20	0.20	0.20
R17	0.25	0.55	0.35	0.55	0.35	0.40
R27	0.25/0.40	0.70	0.50	0.70	0.50	0.50
R37	0.30/0.95	0.85	0.95	1.05	0.75	0.95
R47	0.70/1.50	1.60	1.50	1.65	1.50	1.50
R57	0.80/1.70	1.90	1.70	2.10	1.70	1.70
R67	1.10/2.30	2.40	2.80	2.90	1.80	2.00
R77	1.20/3.00	3.30	3.60	3.80	2.50	3.40
R87	2.30/6.0	6.4	7.2	7.2	6.3	6.5
R97	4.60/9.8	11.7	11.7	13.4	11.3	11.7
R107	6.0/13.7	16.3	16.9	19.2	13.2	15.9
R137	10.0/25.0	28.0	29.5	31.5	25.0	25.0
R147	15.4/40.0	46.5	48.0	52.0	39.5	41.0
R167	27.0/70.0	82.0	78.0	88.0	66.0	69.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.



Design and Operating Notes

Lubricants and fill quantities for R, F, K, S, W gear units

RF..

Gear unit	Fill quantity in liters					
	M1 ¹⁾	M2	M3	M4	M5	M6
RF07	0.12	0.20	0.20	0.20	0.20	0.20
RF17	0.25	0.55	0.35	0.55	0.35	0.40
RF27	0.25/0.40	0.70	0.50	0.70	0.50	0.50
RF37	0.35/0.95	0.90	0.95	1.05	0.75	0.95
RF47	0.65/1.50	1.60	1.50	1.65	1.50	1.50
RF57	0.80/1.70	1.80	1.70	2.00	1.70	1.70
RF67	1.20/2.50	2.50	2.70	2.80	1.90	2.10
RF77	1.20/2.60	3.10	3.30	3.60	2.40	3.00
RF87	2.40/6.0	6.4	7.1	7.2	6.3	6.4
RF97	5.1/10.2	11.9	11.2	14.0	11.2	11.8
RF107	6.3/14.9	15.9	17.0	19.2	13.1	15.9
RF137	9.5/25.0	27.0	29.0	32.5	25.0	25.0
RF147	16.4/42.0	47.0	48.0	52.0	42.0	42.0
RF167	26.0/70.0	82.0	78.0	88.0	65.0	71.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

*Parallel shaft
helical (F) gear
units*

F.., FA..B, FH..B, FV..B

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
F..27	0.60	0.80	0.65	0.70	0.60	0.60
F..37	0.95	1.25	0.70	1.25	1.00	1.10
F..47	1.50	1.80	1.10	1.90	1.50	1.70
F..57	2.60	3.50	2.10	3.50	2.80	2.90
F..67	2.70	3.80	1.90	3.80	2.90	3.20
F..77	5.9	7.3	4.30	8.0	6.0	6.3
F..87	10.8	13.0	7.7	13.8	10.8	11.0
F..97	18.5	22.5	12.6	25.2	18.5	20.0
F..107	24.5	32.0	19.5	37.5	27.0	27.0
F..127	40.5	54.5	34.0	61.0	46.3	47.0
F..157	69.0	104.0	63.0	105.0	86.0	78.0

FF..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
FF27	0.60	0.80	0.65	0.70	0.60	0.60
FF37	1.00	1.25	0.70	1.30	1.00	1.10
FF47	1.60	1.85	1.10	1.90	1.50	1.70
FF57	2.80	3.50	2.10	3.70	2.90	3.00
FF67	2.70	3.80	1.90	3.80	2.90	3.20
FF77	5.9	7.3	4.30	8.1	6.0	6.3
FF87	10.8	13.2	7.8	14.1	11.0	11.2
FF97	19.0	22.5	12.6	25.6	18.9	20.5
FF107	25.5	32.0	19.5	38.5	27.5	28.0
FF127	41.5	55.5	34.0	63.0	46.3	49.0
FF157	72.0	105.0	64.0	106.0	87.0	79.0



FA.., FH.., FV.., FAF.., FAZ.., FHF.., FHZ.., FVF.., FVZ.., FT..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
F..27	0.60	0.80	0.65	0.70	0.60	0.60
F..37	0.95	1.25	0.70	1.25	1.00	1.10
F..47	1.50	1.80	1.10	1.90	1.50	1.70
F..57	2.70	3.50	2.10	3.40	2.90	3.00
F..67	2.70	3.80	1.90	3.80	2.90	3.20
F..77	5.9	7.3	4.30	8.0	6.0	6.3
F..87	10.8	13.0	7.7	13.8	10.8	11.0
F..97	18.5	22.5	12.6	25.2	18.5	20.0
F..107	24.5	32.0	19.5	37.5	27.0	27.0
F..127	39.0	54.5	34.0	61.0	45.0	46.5
F..157	68.0	103.0	62.0	104.0	85.0	77.0

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*Helical-bevel (K)
gear units*

K.., KA..B, KH..B, KV..B

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
K..37	0.50	1.00	1.00	1.25	0.95	0.95
K..47	0.80	1.30	1.50	2.00	1.60	1.60
K..57	1.10	2.20	2.20	2.80	2.30	2.10
K..67	1.10	2.40	2.60	3.45	2.60	2.60
K..77	2.20	4.10	4.40	5.8	4.20	4.40
K..87	3.70	8.0	8.7	10.9	8.0	8.0
K..97	7.0	14.0	15.7	20.0	15.7	15.5
K..107	10.0	21.0	25.5	33.5	24.0	24.0
K..127	21.0	41.5	44.0	54.0	40.0	41.0
K..157	31.0	62.0	65.0	90.0	58.0	62.0
K..167	33.0	95.0	105.0	123.0	85.0	84.0
K..187	53.0	152.0	167.0	200	143.0	143.0

KF..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
KF37	0.50	1.10	1.10	1.50	1.00	1.00
KF47	0.80	1.30	1.70	2.20	1.60	1.60
KF57	1.20	2.20	2.40	3.15	2.50	2.30
KF67	1.10	2.40	2.80	3.70	2.70	2.70
KF77	2.10	4.10	4.40	5.9	4.50	4.50
KF87	3.70	8.2	9.0	11.9	8.4	8.4
KF97	7.0	14.7	17.3	21.5	15.7	16.5
KF107	10.0	21.8	25.8	35.1	25.2	25.2
KF127	21.0	41.5	46.0	55.0	41.0	41.0
KF157	31.0	66.0	69.0	92.0	62.0	62.0



Design and Operating Notes

Lubricants and fill quantities for R, F, K, S, W gear units

KA.., KH.., KV.., KAF.., KHF.., KVF.., KAZ.., KHZ.., KVZ.., KT..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
K..37	0.50	1.00	1.00	1.40	1.00	1.00
K..47	0.80	1.30	1.60	2.15	1.60	1.60
K..57	1.20	2.20	2.40	3.15	2.70	2.40
K..67	1.10	2.40	2.70	3.70	2.60	2.60
K..77	2.10	4.10	4.60	5.9	4.40	4.40
K..87	3.70	8.2	8.8	11.1	8.0	8.0
K..97	7.0	14.7	15.7	20.0	15.7	15.7
K..107	10.0	20.5	24.0	32.4	24.0	24.0
K..127	21.0	41.5	43.0	52.0	40.0	40.0
K..157	31.0	66.0	67.0	87.0	62.0	62.0

Helical-worm (S)
gear units

S

Gear unit	Fill quantity in liters					
	M1	M2	M3 ¹⁾	M4	M5	M6
S..37	0.25	0.40	0.50	0.55	0.40	0.40
S..47	0.35	0.80	0.70/0.90	1.00	0.80	0.80
S..57	0.50	1.20	1.00/1.20	1.45	1.30	1.30
S..67	1.00	2.00	2.20/3.10	3.10	2.60	2.60
S..77	1.90	4.20	3.70/5.4	5.9	4.40	4.40
S..87	3.30	8.1	6.9/10.4	11.3	8.4	8.4
S..97	6.8	15.0	13.4/18.0	21.8	17.0	17.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

SF..

Gear unit	Fill quantity in liters					
	M1	M2	M3 ¹⁾	M4	M5	M6
SF37	0.25	0.40	0.50	0.55	0.40	0.40
SF47	0.40	0.90	0.90/1.05	1.05	1.00	1.00
SF57	0.50	1.20	1.00/1.50	1.55	1.40	1.40
SF67	1.00	2.20	2.30/3.00	3.20	2.70	2.70
SF77	1.90	4.10	3.90/5.8	6.5	4.90	4.90
SF87	3.80	8.0	7.1/10.1	12.0	9.1	9.1
SF97	7.4	15.0	13.8/18.8	22.6	18.0	18.0

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.

SA.., SH.., SAF.., SHZ.., SAZ.., SHF.., ST..

Gear unit	Fill quantity in liters					
	M1	M2	M3 ¹⁾	M4	M5	M6
S..37	0.25	0.40	0.50	0.50	0.40	0.40
S..47	0.40	0.80	0.70/0.90	1.00	0.80	0.80
S..57	0.50	1.10	1.00/1.50	1.50	1.20	1.20
S..67	1.00	2.00	1.80/2.60	2.90	2.50	2.50
S..77	1.80	3.90	3.60/5.0	5.8	4.50	4.50
S..87	3.80	7.4	6.0/8.7	10.8	8.0	8.0
S..97	7.0	14.0	11.4/16.0	20.5	15.7	15.7

1) The larger gear unit of multi-stage gear units must be filled with the larger oil volume.



**SPIROPLAN® (W)
gear units**

The fill quantity of SPIROPLAN® gear units W..10 to W..30 does not vary, irrespective of their mounting position. Only the fill quantities of SPRIOPLAN® gear units W..37 and W..47 in mounting position M4 are different from that of other mounting positions.

W.., WF.., WA..B, WH..B

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
W..10	0.16					
W..20	0.24					
W..30	0.40					
W..37		0.50		0.70		0.50
W..47		0.90		1,40		0.90

WA.., WAF.., WT.., WH.., WHF..

Gear unit	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
W..10	0.16					
W..20	0.24					
W..30	0.40					
W..37		0.50		0.70		0.50
W..47		0.80		1,25		0.80

6.14 Lubricants and fill quantities of BS.F, PS.F gear units

General information

Unless a special arrangement is made, SEW-EURODRIVE supplies the gear units with a lubricant fill adapted for the specific mounting position. The decisive factor is the mounting position (M1 to M6) specified when ordering the drive. The standard synthetic lubricant has a service life of approximately 5 years under normal operating conditions.

	INFORMATION
	SEW-EURODRIVE fills the gear units with the amount of oil specified for the specific mounting positions. If the mounting position is changed, the amount of oil must be adapted as required. Consequently, a mounting position may only be changed after consultation with SEW-EURODRIVE, otherwise your right to claim under warranty no longer applies .

	INFORMATION
	BS.F helical-bevel and PS.F planetary gear units from SEW-EURODRIVE are supplied exclusively with synthetic lubricants. Drives for the food industry are available from SEW-EURODRIVE on request.

The following lubricant tables show the permitted standard lubricants for BS.F.. helical-bevel gear units and PS.F planetary gear units from SEW-EURODRIVE.



Design and Operating Notes

Lubricants and fill quantities of BS.F, PS.F gear units

Lubricant table for gear unit oil for BS.F helical-bevel gear units

	Umgebungstemperatur ° C -20 0 +20 +40 +60	 API-Klasse	 ISO	Öl	Wälzlager-fett
	-20 +40	GL5	VG ~ 100	Mobil synthetic gear oil 75W-90	Fuchs Renolit CX TOM 15-OEM

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Lubricant table for the food industry

	Umgebungstemperatur ° C -20 0 +20 +40 +60	 ISO	Öl	Wälzlager-fett
	-20 +40	VG 460	Klübersynth UH1 6-460	Castrol Obeem FS2

65174ADE

Fill quantities dependent on mounting position

The following tables show guide values for lubricant fill quantities in relation to the mounting position M1 - M6.

Fill quantities of BS.F helical-bevel gear units

BSF. helical-bevel gear units	Fill quantity in liters					
	M1	M2	M3	M4	M5	M6
BSF202	0.15	0.25	0.25	0.30	0.25	0.25
BSF302	0.25	0.50	0.50	0.55	0.35	0.35
BSF402	0.45	0.80	0.80	1.05	0.65	0.65
BSF502	1.00	1.80	1.80	2.50	1.50	1.50
BSF602	1.60	2.50	2.80	4.10	2.00	2.60
BSF802	3.30	5.30	5.70	7.90	4.50	4.50

Fill quantity tolerance for BSF.

Fill quantity in liters [l]	Tolerance
up to 1 l	0.01 l
> 1 l	1% of the fill quantity



Lubricant table for gear unit oil for PS.F planetary gear units

PS.F.	Umgebungstemperatur ° C -20 0 +20 +40 +60			Öl	Wälzlagerfett
	-20 0 +20 +40 +60	CLP PG 220 ¹⁾	VG 220	Klübersynth GH6-220	Klüber Petamo GHY 133 N

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1) CLP PG = Polyglycol

Lubricant table for the food industry

PS.F.	Umgebungstemperatur ° C -20 0 +20 +40 +60		Öl	Wälzlagerfett
	-20 0 +20 +40 +60	VG 460	Klübersynth UH1 6-460	Castrol Obeon FS2

65189ADE

Fill quantities dependent on mounting position

The following tables show guide values for lubricant fill quantities in relation to the mounting position M1 - M6.

Fill quantities of PS..F planetary gear units

PSF.. planetary gear units	Adapter mounting - Fill quantity in liters [l]		
	M1 (M3, M5, M6)	M2	M4
PSF121	0.023	0.025	0.023
PSF122	0.035	0.056	0.054
PSF221	0.035	0.052	0.035
PSF222	0.045	0.075	0.085
PSF321	0.070	0.100	0.070
PSF322	0.095	0.170	0.190
PSF521	0.140	0.215	0.150
PSF522	0.200	0.360	0.395
PSF621	0.300	0.465	0.320
PSF622	0.410	0.680	0.780
PSF721	0.600	0.930	0.650
PSF722	0.750	1.230	1.645
PSF821	1.000	1.750	1.350
PSF822	1.550	2.550	3.350
PSF921	1.400	2.450	1.900
PSF922	2.050	3.500	4.350



Design and Operating Notes

Lubricants and fill quantities of BS.F, PS.F gear units

PSBF.. planetary gear unit	Adapter mounting - Fill quantity in liters [l]		
	M1 (M3, M5, M6)	M2	M4
PSBF221	0.025	0.040	0.025
PSBF222	0.035	0.061	0.060
PSBF321	0.045	0.068	0.050
PSBF322	0.070	0.135	0.130
PSBF521	0.093	0.143	0.103
PSBF522	0.143	0.288	0.273
PSBF621	0.198	0.318	0.188
PSBF622	0.298	0.538	0.498
PSBF721	0.474	0.684	0.314
PSBF722	0.564	0.884	1.004
PSBF821	0.495	0.995	0.695
PSBF822	0.995	1.795	1.995

*) Fill quantities for direct mounting of CFM90 servomotors

*Fill quantity
tolerance for PS.F*

Planetary gear units	Fill quantity in liters [l]
PS.F121/122	± 0.001
PS.F221/222	± 0.001
PS.F321/322	± 0.002
PS.F521/522	± 0.005
PS.F621/622	± 0.005
PS.F721/722	± 0.010
PS.F821/822	± 0.010
PS.F921/922	± 0.010



6.15 Restriction of permitted torques when using EBH / EPH with coupling sleeve

Type	D1	M _{zul} ¹⁾
EPH03	9	18
EPH02	8	14
EPH02	9	18
EPH02	10	24
EPH02	11	30
EPH02	12	37
EPH03 / EBH03	8	14
EPH03 / EBH03	9	18
EPH03 / EBH03	10	24
EPH03 / EBH03	11	30
EPH03 / EBH03	12	37
EPH04 / EBH04	11	30
EPH04 / EBH04	12	37
EPH04 / EBH04	14	54
EPH04 / EBH04	16	74
EPH05 / EBH05	14	54
EPH05 / EBH05	16	74
EPH05 / EBH05	17	86
EPH05 / EBH05	18	99
EPH05 / EBH05	19	113
EPH07 / EBH07	22	160
EPH07 / EBH07	24	198
EPH07 / EBH07	28	287
EPH08 / EBH08	32	396
EPH08 / EBH08	35	492
EPH09 / EBH09	32	396
EPH09 / EBH09	35	492
EPH09 / EBH09	38	501
EPH10 / EBH10	48	1053

1) Maximum permitted input torque



Important Information on Selection Tables and Dimension Sheets

Information on the selection tables for R, F, K, S, W gear units

7 Important Information on Selection Tables and Dimension Sheets

7.1 Information on the selection tables for R, F, K, S, W gear units

Adapter sizes

[Nm]		AQ. M _{amax} M _{apk} M _{aNotaus}											
	i	80/1-3			100/1-4			115/1-2			115/3		
FA27 2	4.16	70	70	137	70	70	141	70	70	141	87	130	148
	4.93	83	83	162	83	83	163	83	83	163	96	144	163
	5.27	89	89	170	89	89	170	89	89	170	100	150	170

Gear unit reduction ratio

Gear unit size with number of gear unit stages

m [kg]		AQA			
	s	80/1-3	100/1-4	115/1-2	115/3
FA27	2	9.0	9.6	10	10
FA27	3	9.2	9.9	10	10

FAF: + 0.7 kg / F: + 0.5 kg / FF: + 1.3 kg

m Mass of the drive
s Number of gear unit stages

		AQA			
		80/1-3	100/1-4	115/1-2	115/3
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1
c _{TA}	[Nm/°]	0.25	0.25	0.25	0.625

J_A Mass moment of inertia of the adapter
c_{TA} Torsional rigidity of the adapter

FA27 n _e = 1400							F _{Ramax}				F _{Rapk}			
	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	FA [N]	FAF [N]	F [N]	FF [N]	FA [N]	FAF [N]	F [N]	FF [N]
FA27 2	4.16	87	130	148	361	1.4	1810	1810	1380	1180	4500	4500	4500	4500
	4.93	96	144	163	304	1.0	1860	1860	1420	1210	4500	4500	4500	4500
	5.27	100	150	170	266	0.90	1880	1880	1440	1220	4500	4500	4500	4500

n_e Reference speed at continuous duty
i Gear unit reduction ratio
M_{amax} Maximum permitted output torque for continuous duty
M_{apk} Maximum permitted output torque for short-time duty
M_{aNotaus} Maximum permitted output emergency stop torque, max. 1000 emergency stops
n_{ak} Breakpoint speed (output)
J_G Mass moment of inertia of the gear unit with reference to the input shaft
F_{Ramax} Maximum permitted overhung load at the output shaft at M_{amax}, load application point at the center of the shaft end
F_{Rapk} Maximum permitted overhung load at the output shaft at M_{apk}, load application point at the center of the shaft end



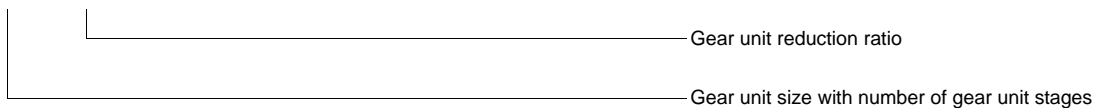
AQ.	i	n_{epk} [1/min]	η [%]	FA [Nm/']	FAF [Nm/']	c_{TG} F [Nm/']	FF [Nm/']
FA27 2	4.16	4120	97	46	46	21	18
	4.93	4500	97	46	46	21	18
	5.27	4500	97	46	46	21	18

- i Gear unit reduction ratio
- n_{epk} Maximum permitted input speed for short-time duty
- η Efficiency of the gear unit (at M_{amax} , $n_e=1400$ rpm, mounting position M1, continuous duty)
- c_{TG} Torsional rigidity of the gear unit

7.2 Information on the selection tables for BS.F, PS.F, PS.C gear units

Adapter sizes

[Nm]	i	EBH $M_{amax} M_{apk} M_{aNotaus}$					
		03			04		
BSF202 2	3.00	40	60	90	40	60	90
	4.00	40	60	90	40	60	90
	6.00	40	60	90	40	60	90



m [kg]	s	EBH	
		03	04
BSF202 2		5.3	5.3

BSBF: + 0.0 kg / BSHF: + 0.0 kg

- m Mass of the drive
- s Number of gear unit stages



Important Information on Selection Tables and Dimension Sheets

Information on the selection tables for BS.F, PS.F, PS.C gear units

EBH03 $n_e = 1500$	i	M_{amax} [Nm]	M_{apk} [Nm]	$M_{aNotaus}$ [Nm]	n_{ak} [1/min]	$J_{GA} 10^{-4}$ [kgm ²]	c_T			F_{Ramax}			F_{Rapk}		
							BSF [Nm/']	BSBF [Nm/']	BSHF [Nm/']	BSF [N]	BSBF [N]	BSHF [N]	BSF [N]	BSBF [N]	BSHF [N]
BSF202 2	3.00	40	60	90	667	1.8	1.8	2.0	2.0	2680	2970	2600	4200	4200	4200
	4.00	40	60	90	650	1.5	2.1	2.3	2.2	3000	3330	2900	4200	4200	4200
	6.00	40	60	90	650	1.3	2.3	2.6	2.5	3500	3880	3390	4200	4200	4200

- n_e Reference speed at continuous duty
- i Gear unit reduction ratio
- M_{amax} Maximum permitted output torque for continuous duty
- M_{apk} Maximum permitted output torque for short-time duty
- $M_{aNotaus}$ Maximum permitted output emergency stop torque, max. 1000 emergency stops
- n_{ak} Breakpoint speed (output)
- J_{GA} Mass moment of inertia of the gear unit including adapter with reference to the input shaft
- c_T Torsional rigidity of the gear unit / gear unit with adapter
- F_{Ramax} Maximum permitted overhung load at the output shaft at M_{amax} , load application point at the center of the shaft end
- F_{Rapk} Maximum permitted overhung load at the output shaft at M_{apk} , load application point at the center of the shaft end



EBH	i	n_{epk} [1/min]	η [%]	M1			M2;M4			M3;M5-6			ϕ		
				a_0	a_1	a_2	a_0	a_1	a_2	a_0	a_1	a_2	[°]	/R [°]	/M [°]
BSF202 2	3.00	4500	93.7	4.10	-0.011	77457	14.47	-0.020	66498	6.12	-0.013	75323	6	3	-
	4.00	4500	93.7	4.26	-0.014	76815	20.11	-0.028	60846	7.52	-0.017	73532	6	3	-
	6.00	4500	93.7	4.50	-0.019	75905	30.66	-0.042	51203	10.05	-0.024	70662	6	3	-

- i Gear unit reduction ratio
- n_{epk} Maximum permitted input speed for short-time duty
- η Efficiency of the gear unit (at M_{amax} , $n_e=1500$ rpm, mounting position M1, continuous duty)
- ϕ Circumferential backlash
- a_0, a_1, a_2 Gear unit constants as regards the rise in temperature in the gear unit



7.3 Information about the dimension sheets

Scope of delivery

-  = Standard parts supplied by SEW-EURODRIVE.
-  = Standard parts not supplied by SEW-EURODRIVE.

Tolerances

Shaft heights

The following tolerances apply to the indicated dimensions:

- h ≤ 250 mm → -0.5 mm
- h > 250 mm → -1 mm

Foot-mounted gear units: Check the mounted motor because it may project below the mounting surface.

Shaft ends

Diameter tolerance:

- ∅ ≤ 50 mm → ISO k6
- ∅ > 50 mm → ISO m6

Center bores according to DIN 332, shape DR:

- | | | | |
|----------------|-------|-----------------|-------|
| ∅ = 7...10 mm | → M3 | ∅ > 30...38 mm | → M12 |
| ∅ > 10...13 mm | → M4 | ∅ > 38...50 mm | → M16 |
| ∅ > 13...16 mm | → M5 | ∅ > 50...85 mm | → M20 |
| ∅ > 16...21 mm | → M6 | ∅ > 85...130 mm | → M24 |
| ∅ > 21...24 mm | → M8 | ∅ > 130 mm | → M30 |
| ∅ > 24...30 mm | → M10 | | |

Keys: according to DIN 6885 (domed type)

Hollow shafts

Diameter tolerance:

- ∅ → ISO H7 measured with plug gauge

Keys: according to DIN 6885 (domed type)

Exception: Key for WA37 with shaft ∅ 25 mm according to DIN 6885-3 (low form)

Multiple-spline shafts

- Dm = Measuring roller diameter
- Me = Check gauge

Flanges

Centering shoulder tolerance:

- ∅ ≤ 230 mm (flange sizes A120...A300) → ISO j6
- ∅ > 230 mm (flange sizes A350...A660) → ISO h6

Up to 3 different flange dimensions are available for each size of helical gear unit, SPIROPLAN® gear unit, AC (brake) motor and explosion-proof AC (brake) motor. The dimension sheets show the possible flanges for the respective sizes.



Important Information on Selection Tables and Dimension Sheets

Information about the dimension sheets

Eyebolts, lifting eyes

R07...R27 helical gear units and SPIROPLAN® gearmotors W..10 to W..30 are delivered without special transportation fixtures. All other gear units and motors are equipped with cast-on suspension eye lugs, screw-on suspension eye lugs or screw-on lifting eyebolts.

Gear unit/motor type	screw-on,		cast-on eyebolts
	lifting eyebolts	eyebolts	
R..37-R..57	-	•	-
R..67-R..167	•	-	-
RX57-RX67	-	•	-
RX77-RX107	•	-	-
F..27-F..157	-	-	•
K..37-K..157	-	-	•
K..167-K..187	•	-	-
W..37, W..47	-	•	-
S..37-S..47	-	•	-
S..57-S..97	-	-	•
BS.F502..802	-	•	-
PS.F621..921	-	•	-
PS.F622..922	-	•	-

Breather valves

The gear unit dimension drawings always show the screw plugs. The corresponding screw plug is replaced by an activated breather valve at the factory depending on the ordered mounting position M1 to M6. Contour dimensions might be slightly different as a result.

Shrink disk connection

Hollow shaft gear unit with shrink disk connection: If required, please request a detailed data sheet on shrink disks, data sheet no. 33 753 ..95.

Splined hollow shaft

FV.. hollow shaft gear unit sizes 27 to 107 and KV.. sizes 37 to 107 are supplied with splining according to DIN 5480.

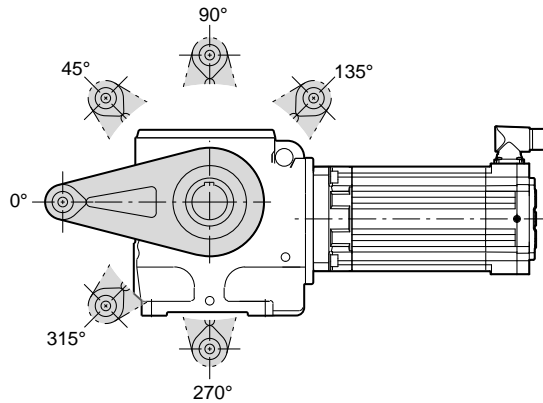
Rubber buffer for FA/FH/FV/FT

Preload rubber buffer by the indicated value mL. The characteristic curve of spring for the rubber buffers is available at SEW-EURODRIVE on request.



Torque arm position

The following illustration shows the possible torque arm positions for helical-worm gear units and SPIROPLAN® gear units (135° position not possible with SPIROPLAN® gear units) as well as the respective angles:



7

Figure 29: Position of the torque arm for S and W gear units

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For information on torque arms for helical-worm gear units, refer to the dimension sheets from page 380, for specifications on torque arms for SPIROPLAN® gear units, refer to the dimension sheets from page 410.

The following illustration shows the possible torque arm positions for BS.F gear units:

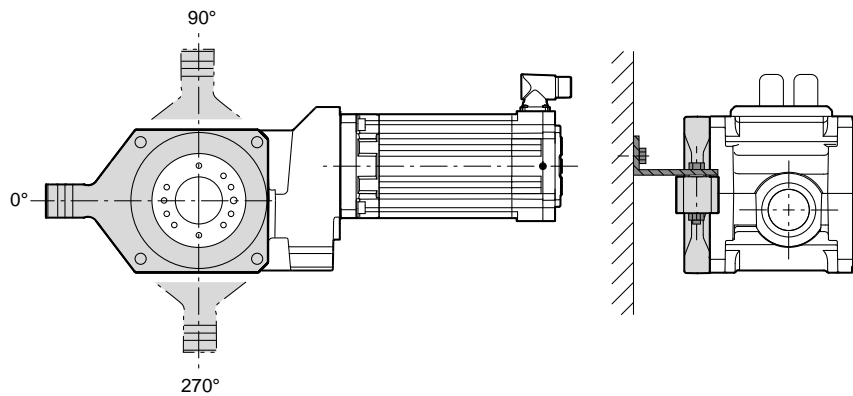


Figure 30: Position of the torque arm for BS.F gear units

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For specifications regarding torque arms for helical-bevel gear units, refer to page 474.

Tolerances and chamfers for flange block gear units

For detailed information, refer to page 475 or page 536.

Front and foot end mounting of BS.F..B gear units

For detailed information, refer to page 473.



7.4 Gearmotor dimensions

Motor options

The motor dimensions may change due to motor options. Refer to the dimension drawings of the motor options.

Special designs

The terminal box dimensions in special designs might vary from the standard.

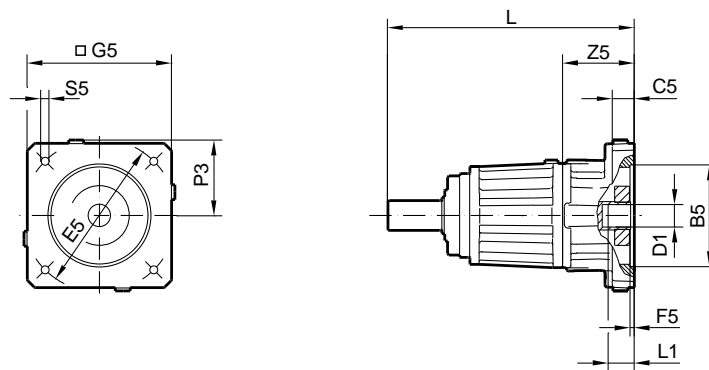
EN 50347

European standard EN 50347 became effective in August 2001. This standard adopts the dimension designations for three-phase AC motors of size 56 to 315M and flange size 65 to 740 from the IEC 72-1 standard.

The new dimension designations given in EN 50347 / IEC 72-1 are used for the relevant dimensions in the dimension sheet tables.

Dimension designations of gearmotors

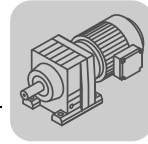
Below an overview of dimension designations for gearmotors:



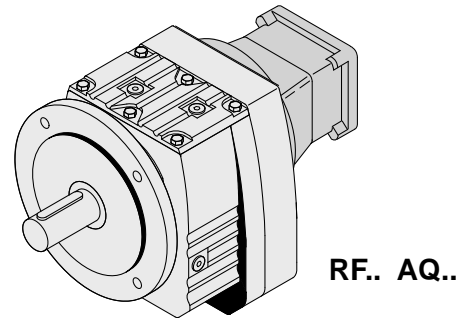
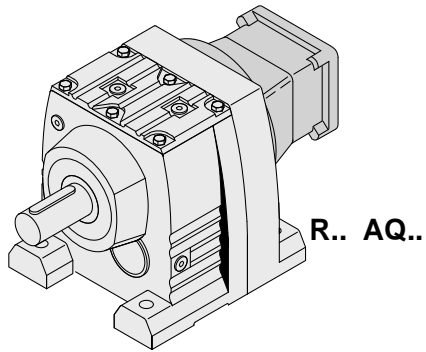
64749axx

G5	Square dimension	C5	Flange thickness
S5	Threaded hole	B5	Centering diameter
P3	Projecting length of closing plug	D1	Coupling bore diameter
E5	Hole circle diameter	F5	Centering depth
L	Total length of the gear unit with adapter	L1	Maximum insertion depth of motor shaft
Z5	Adapter length		

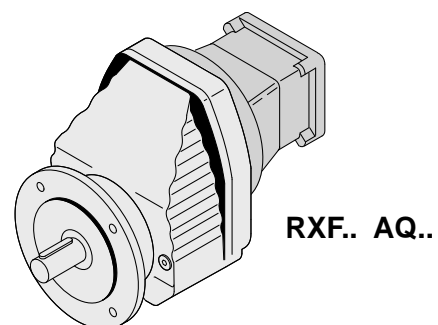
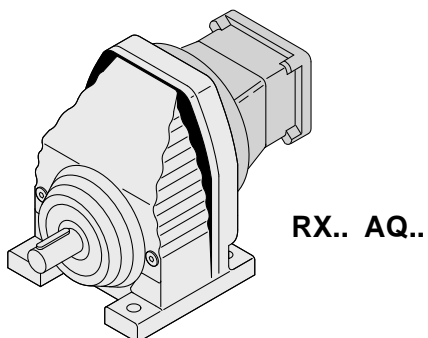
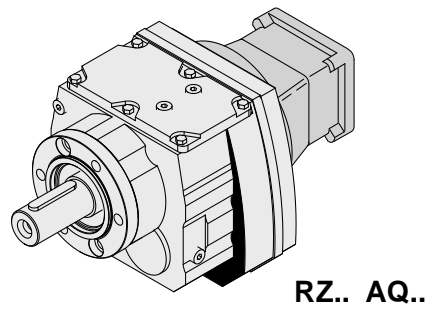
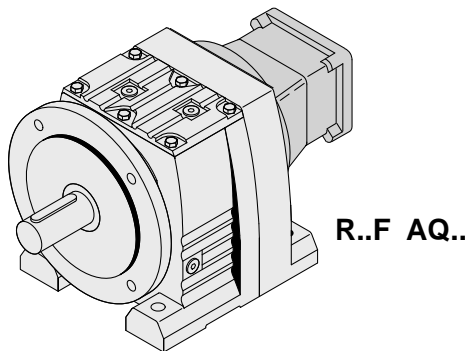
	INFORMATION
	For motors with other feedback systems than resolvers, possible additional lengths must be considered.



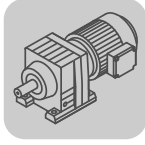
8 R..
8.1 R.. AQ..



8



63937axx



8.2 RX.. AQ..

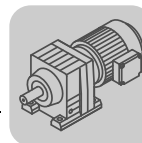
8.2.1 RX 57 AQ.. [Nm]


[Nm]	i	AQ.																							
		$M_{amax} M_{apk} M_{aNotaus}$																							
		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
RX57 1	1.30	22	22	42	22	22	44	22	22	44	59	59	59	63	78	107	63	90	107	63	90	107	63	90	107
	1.48	25	25	48	25	25	50	25	25	50	68	68	68	68	88	116	68	90	116	68	90	116	68	90	116
	1.65	28	28	54	28	28	56	28	28	56	69	75	75	69	90	117	69	90	117	69	90	117	69	90	117
	1.92	32	32	63	32	32	65	32	32	65	69	88	88	69	90	117	69	90	117	69	90	117	69	90	117
	2.04	34	34	67	34	34	69	34	34	69	69	90	93	69	90	117	69	90	117	69	90	117	69	90	117
	2.37	40	40	78	40	40	80	40	40	80	69	90	109	69	90	117	69	90	117	69	90	117			
	2.64	44	44	87	44	44	89	44	44	89	69	90	117	69	90	117	69	90	117	69	90	117			
	2.91	49	49	96	49	49	98	49	49	98	67	90	114												
	3.14	53	53	103	53	53	106	53	53	106	65	90	111	65	90	111	65	90	111	65	90	111			
	3.55	60	60	117	60	60	117	60	60	117	69	90	117												
	3.79	64	64	117	64	64	117	64	64	117	69	90	117												
	4.35	68	73	116	68	73	116	68	73	116	68	90	116												
	5.07	36	54	61	36	54	61	36	54	61	36	54	61												
5.50	39	58	66	39	58	66	39	58	66	39	58	66													

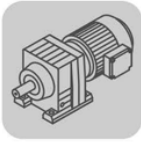
m [kg]		AQ.							
m	s	80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
RX57		14	14	15	15	19	19	19	28
RXF: + 1.9 kg									

		AQ.							
$J_A 10^{-4}$	[kgm ²]	80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
$J_A 10^{-4}$	[kgm ²]	0.77	1.4	1.4	3.1	5.1	10.0	10.0	25.0
c_{TA}	[Nm/°]	0.25	0.25	0.25	0.625	0.625	1.0	1.0	2.08

RX57							F_{Ramax}		F_{Rapk}	
$n_e = 1400$	i	M_{amax} [Nm]	M_{apk} [Nm]	$M_{aNotaus}$ [Nm]	n_{ak} [1/min]	$J_G 10^{-4}$ [kgm ²]	RX [N]	RXF [N]	RX [N]	RXF [N]
RX57 1	1.30	63	90	107	1154	1.9	132	132	3940	3940
	1.48	68	90	116	1014	1.4	112	112	3950	3950
	1.65	69	90	117	1091	1.2	430	430	3960	3960
	1.92	69	90	117	1250	0.94	880	880	3970	3970
	2.04	69	90	117	1324	0.85	1070	1070	3970	3970
	2.37	69	90	117	1477	0.64	1500	1500	3980	3980
	2.64	69	90	117	1629	0.55	1810	1810	3980	3980
	2.91	67	90	114	1856	0.44	2170	2170	3980	3980
	3.14	65	90	111	2197	0.42	2320	2320	3990	3990
	3.55	69	90	117	1972	0.35	2420	2420	3990	3990
	3.79	69	90	117	1847	0.32	2480	2480	3990	3990
	4.35	68	90	116	1609	0.26	2640	2640	4000	4000
	5.07	36	54	61	1381	0.21	3030	3030	4210	4210
5.50	39	58	66	1273	0.18	3100	3100	4190	4190	



AQ.		n _{epk} [1/min]	η [%]	CTG	
i	RX [Nm/']			RXF [Nm/']	
RX57  1	1.30	2483	98	4.2	4.2
	1.48	2827	98	4.2	4.2
	1.65	3151	98	4.2	4.2
	1.92	3667	98	4.2	4.2
	2.04	3896	98	4.2	4.2
	2.37	4500	98	4.2	4.2
	2.64	4500	98	4.2	4.2
	2.91	4500	98	4.2	4.2
	3.14	4500	98	4.2	4.2
	3.55	4500	98	4.2	4.2
	3.79	4500	98	4.2	4.2
	4.35	4500	98	4.2	4.2
	5.07	4500	98	4.2	4.2
	5.50	4500	98	4.2	4.2

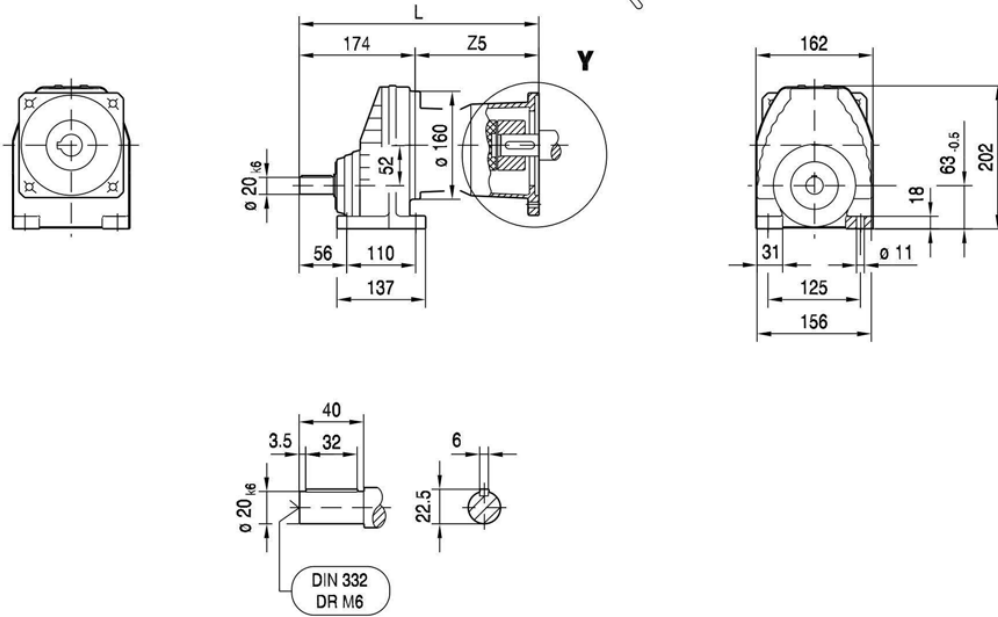


8.2.2 RX 57 AQ.. [mm]

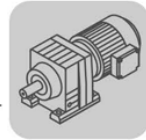
01 064 00 08^L

RX57..

Y → 227

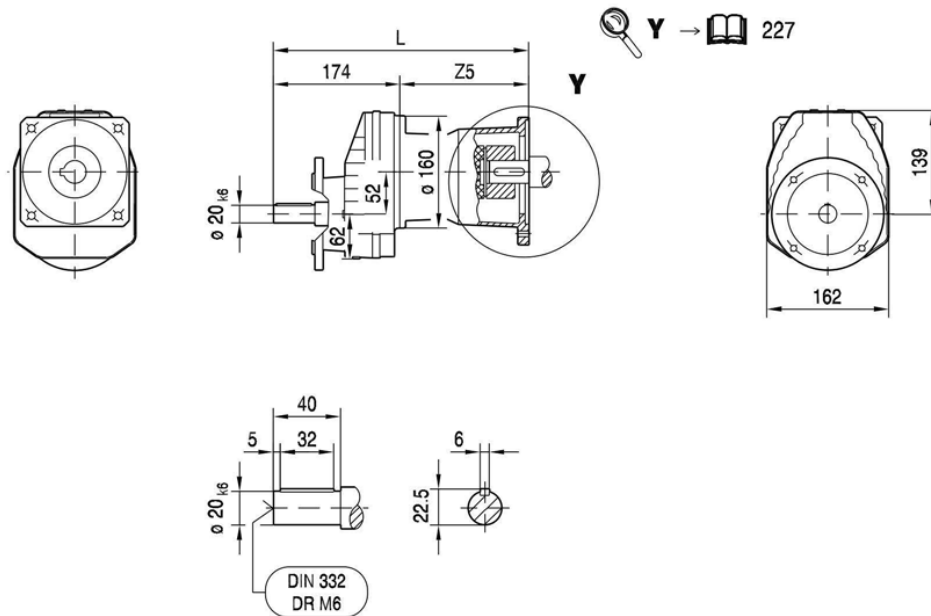


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	272	297	311	320	349	362	362	412	436
Z5	98	123	137	146	175	188	188	237.5	261.5

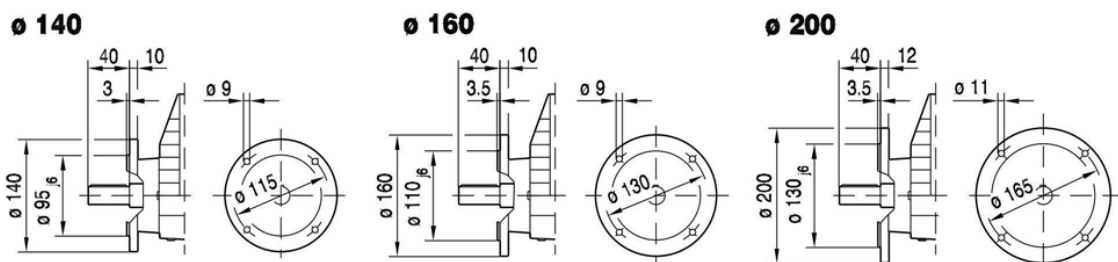


01 065 00 08^L

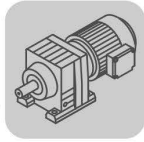
RXF57..




8




(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	272	297	311	320	349	362	362	412	436
Z5	98	123	137	146	175	188	188	237.5	261.5





8.2.3 RX 67 AQ.. [Nm]

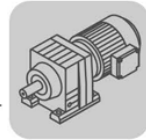
[Nm]		AQ.																							
		M _{amax} M _{apk} M _{aNotaus}																							
i		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
RX67  1	1.40	23	23	46	23	23	47	23	23	47	64	64	64	84	84	140	104	140	140	104	140	140	104	156	177
	1.61	27	27	53	27	27	54	27	27	54	74	74	74	96	96	161	114	161	161	114	161	161	114	171	194
	1.86	31	31	61	31	31	63	31	31	63	85	85	85	111	111	186	126	186	186	126	186	186	126	187	210
	2.04	34	34	67	34	34	69	34	34	69	93	93	93	122	122	200	134	186	200	134	186	200	134	186	225
	2.40	40	40	79	40	40	81	40	40	81	110	110	110	123	144	205	123	163	205	123	163	205	123	163	205
	2.54	43	43	83	43	43	86	43	43	86	116	116	116	118	152	200	118	162	200	118	162	200	118	162	200
	2.89	49	49	95	49	49	98	49	49	98	106	132	132	106	142	180	106	142	180	106	142	180			
	3.20	54	54	105	54	54	108	54	54	108	100	142	147	100	142	170	100	142	170	100	142	170			
	3.77	64	64	124	64	64	128	64	64	128	87	130	148	87	130	148	87	130	148	87	130	148			
	4.30	73	73	136	73	73	136	73	73	136	80	109	136												
	4.53	77	77	139	77	77	139	77	77	139	82	110	139												
5.18	75	88	128	75	88	128	75	88	128	75	110	128													
6.07	43	64	73	43	64	73	43	64	73	43	64	73													

m [kg]		AQ.							
s		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
RX67		16	17	17	17	22	22	22	31
RXF: + 4.0 kg									

		AQ.							
		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1	5.1	10.0	10.0	25.0
c _{TA}	[Nm/']	0.25	0.25	0.25	0.625	0.625	1.0	1.0	2.08

RX67 n _e = 1400							F _{Ramax}		F _{Rapk}	
i		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	RX [N]	RXF [N]	RX [N]	RXF [N]
RX67  1	1.40	104	156	177	1071	3.2	205	205	5450	5450
	1.61	114	171	194	932	2.6	245	245	5380	5380
	1.86	126	187	214	806	2.1	225	225	5300	5300
	2.04	134	186	228	735	1.8	230	230	5310	5310
	2.40	123	163	209	1125	1.4	1530	1530	5460	5460
	2.54	118	162	201	1339	1.3	2000	2000	5470	5470
	2.89	106	142	180	1972	1.0	2640	2640	5590	5590
	3.20	100	142	170	2188	0.88	2800	2800	5590	5590
	3.77	87	130	148	1857	0.69	3090	3090	5660	5660
	4.30	80	109	136	1628	0.47	3300	3300	5770	5770
	4.53	82	110	139	1545	0.42	3350	3350	5760	5760
5.18	75	110	128	1351	0.34	3580	3580	5760	5760	
6.07	43	64	73	1153	0.28	4000	4000	5970	5970	

AQ.					c _{TG}	
i		n _{epk} [1/min]	η [%]	RX [Nm/']	RXF [Nm/']	
RX67  1	1.40	2507	99	8.1	8.1	
	1.61	2883	99	8.1	8.1	
	1.86	3330	99	8.1	8.1	
	2.04	3653	99	8.1	8.1	
	2.40	4297	99	8.1	8.1	
	2.54	4500	99	8.1	8.1	
	2.89	4500	98	8.1	8.1	
	3.20	4500	98	8.1	8.1	
	3.77	4500	98	8.1	8.1	
	4.30	4500	98	8.1	8.1	
	4.53	4500	98	8.1	8.1	
5.18	4500	98	8.1	8.1		
6.07	4500	98	8.1	8.1		

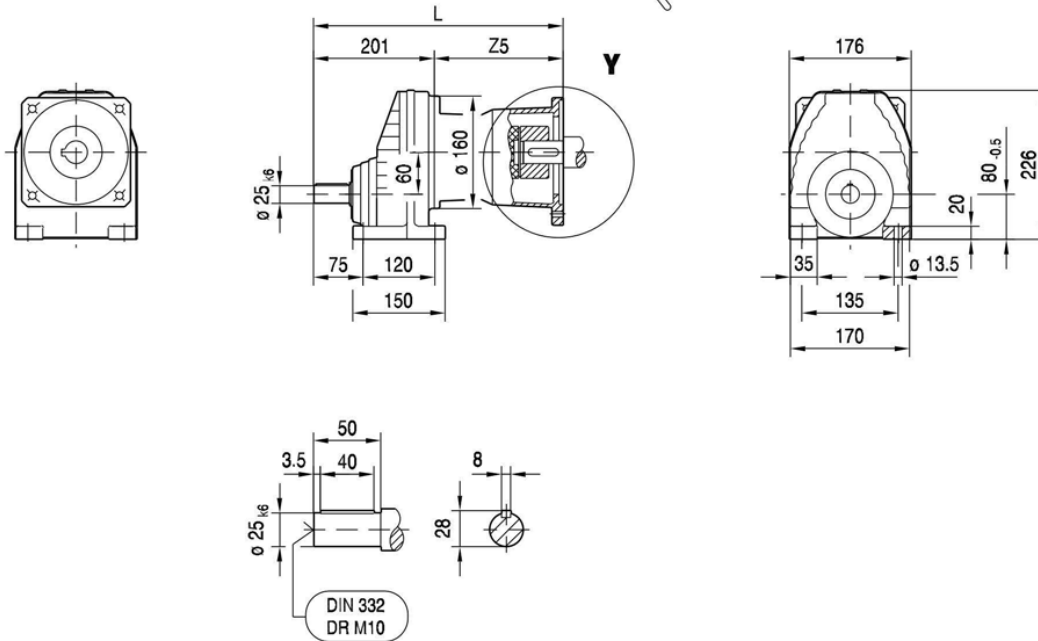


8.2.4 RX 67 AQ.. [mm]

01 066 00 08^L

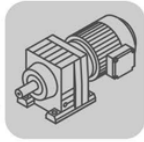
RX67..

Y → 227

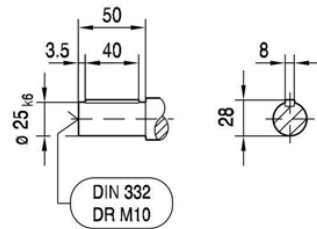
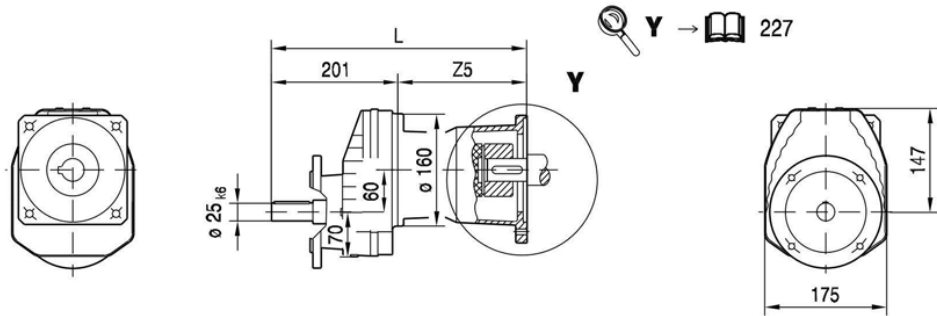


8

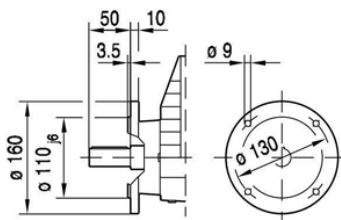
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	299	324	338	347	376	389	389	439	463
Z5	98	123	137	146	175	188	188	237.5	261.5



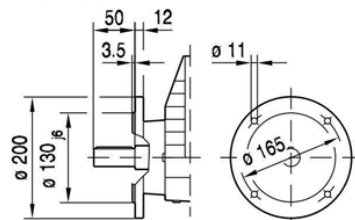
RXF67..



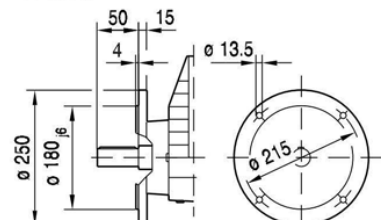
ø 160



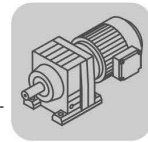
ø 200




ø 250




(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	299	324	338	347	376	389	389	439	463
Z5	98	123	137	146	175	188	188	237.5	261.5




8.2.5 RX 77 AQ.. [Nm]

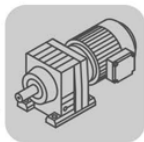
[Nm]	i	AQ.																							
		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
RX77 	1.42	24	24	46	24	24	48	24	24	48	65	65	65	85	85	142	142	142	142	142	142	155	225	225	
	1.67	28	28	55	28	28	56	28	28	56	76	76	76	100	100	167	167	167	167	167	167	173	255	265	
	1.88	31	31	62	31	31	63	31	31	63	86	86	86	112	112	188	187	188	188	187	188	188	187	280	300
	2.13	36	36	70	36	36	72	36	36	72	97	97	97	127	127	210	200	210	210	200	210	210	200	300	340
	2.43	41	41	80	41	41	82	41	41	82	111	111	111	145	145	240	215	240	240	215	240	240	215	305	365
	2.70	45	45	89	45	45	91	45	45	91	124	124	124	162	162	270	215	270	270	215	270	270	215	285	365
	3.08	52	52	101	52	52	104	52	52	104	141	141	141	184	184	305	193	260	305	193	260	305	193	260	325
	3.25	55	55	107	55	55	110	55	55	110	149	149	149	182	195	305	182	260	305	182	260	305	182	260	305
	3.70	62	62	122	62	62	125	62	62	125	153	170	170	153	215	260	153	215	260	153	215	260			
	4.04	68	68	133	68	68	137	68	68	137	143	185	185	143	210	240	143	210	240	143	210	240			
	4.73	80	80	156	80	80	160	80	80	160	123	184	205	123	184	205	123	184	205	123	184	205			
	5.35	90	90	175	90	90	175	90	90	175	103	154	175												
	5.63	95	95	185	95	95	187	95	95	187	110	165	187												
	6.41	103	108	175	103	108	175	103	108	175	103	154	175												
7.47	53	79	90	53	79	90	53	79	90	53	79	90													
8.00	57	85	97	57	85	97	57	85	97	57	85	97													


8

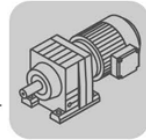
m [kg]		AQ.							
s		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
RX77		26	26	27	27	31	31	31	40
RXF: + 2.3 kg									

		AQ.							
		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1	5.1	10.0	10.0	25.0
c _{TA}	[Nm/°]	0.25	0.25	0.25	0.625	0.625	1.0	1.0	2.08

RX77							F _{Ramax}		F _{Rapk}	
n _e = 1400	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	RX [N]	RXF [N]	RX [N]	RXF [N]
RX77 	1.42	155	232	264	1056	7.6	315	315	10000	10000
	1.67	173	259	294	898	6.0	315	315	10000	10000
	1.88	187	280	318	798	5.0	335	335	10000	10000
	2.13	200	300	340	704	4.1	435	435	10000	10000
	2.43	215	305	366	658	3.4	510	510	10000	10000
	2.70	215	285	366	741	3.0	1110	1110	10000	10000
	3.08	193	260	328	1104	2.5	2560	2560	10000	10000
	3.25	182	260	309	1385	2.3	3200	3200	10000	10000
	3.70	153	215	260	1892	1.9	4290	4290	10000	10000
	4.04	143	214	243	1733	1.6	4500	4500	10000	10000
	4.73	123	184	209	1480	1.3	4900	4900	10000	10000
	5.35	103	154	175	1308	0.90	5240	5240	10000	10000
	5.63	110	165	187	1243	0.81	5300	5300	10000	10000
	6.41	103	154	175	1092	0.66	5600	5600	10000	10000
7.47	53	79	90	937	0.53	6200	6200	10000	10000	
8.00	57	85	97	875	0.46	6330	6330	10000	10000	



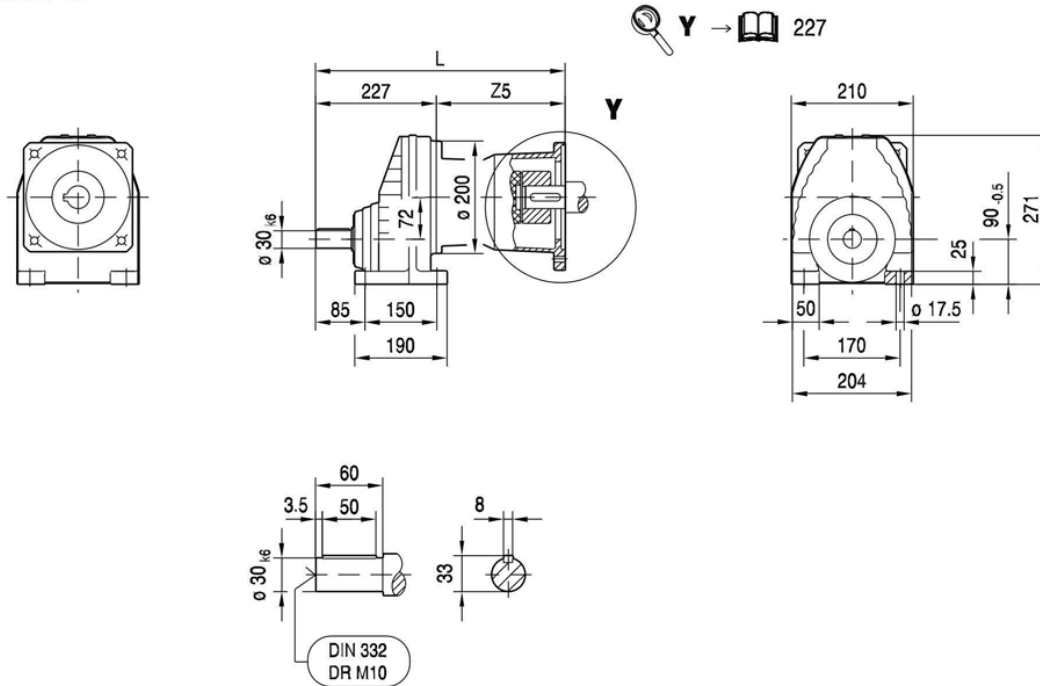
AQ.		n_{epk} [1/min]	η [%]	c_{TG}	
	i			RX [Nm/']	RXF [Nm/']
RX77  1	1.42	2164	98	17	17
	1.67	2545	99	17	17
	1.88	2865	99	17	17
	2.13	3246	99	17	17
	2.43	3703	99	17	17
	2.70	4114	99	17	17
	3.08	4500	99	17	17
	3.25	4500	98	17	17
	3.70	4500	98	17	17
	4.04	4500	98	17	17
	4.73	4500	98	17	17
	5.35	4500	98	17	17
	5.63	4500	98	17	17
	6.41	4500	98	17	17
	7.47	4500	97	17	17
8.00	4500	97	17	17	



8.2.6 RX 77 AQ.. [mm]

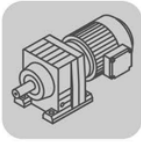
01 068 00 08^L

RX77..

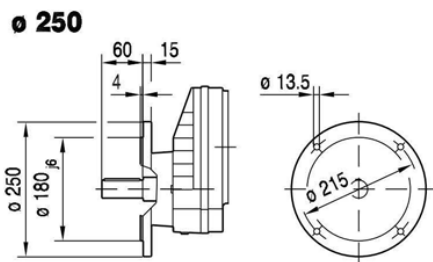
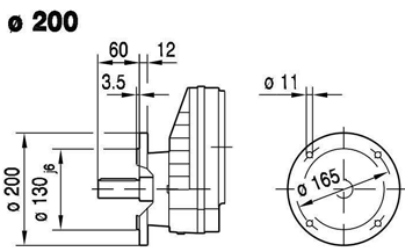
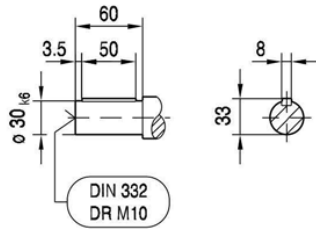
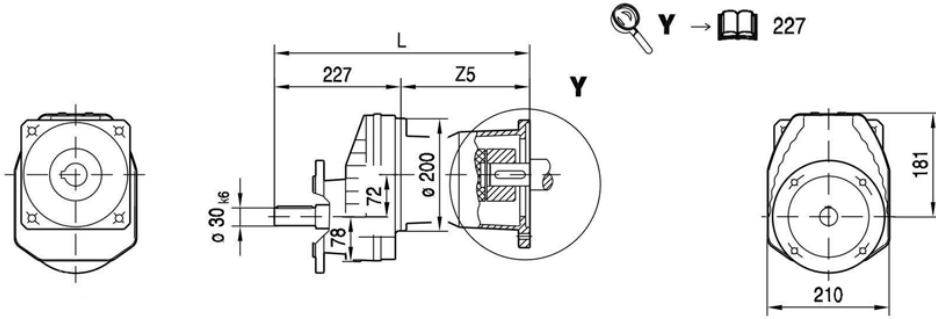


8

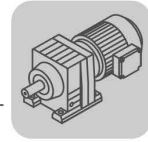
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	319	343	357	366	394	407	407	453	477
Z5	92	116	130	139	167	180	180	225.5	249.5




RXF77..




(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	319	343	357	366	394	407	407	453	477
Z5	92	116	130	139	167	180	180	225.5	249.5




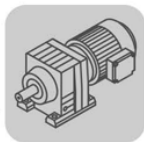
8.2.7 RX 87 AQ.. [Nm]


[Nm]	i	AQ.																				
		100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
RX87  1	1.39	27	27	54	27	27	54	73	73	73	83	83	139	139	139	139	139	139	139	220	220	220
	1.60	32	32	65	32	32	65	88	88	88	96	96	160	160	160	160	160	160	160	255	255	255
	1.93	36	36	73	36	36	73	98	98	98	129	129	215	215	215	215	215	215	215	340	340	340
	2.48	42	42	84	42	42	84	114	114	114	148	148	245	245	245	245	245	245	245	395	395	395
	2.76	46	46	93	46	46	93	126	126	126	165	165	275	275	275	275	275	275	275	405	440	440
	3.09	52	52	105	52	52	105	142	142	142	185	185	305	305	305	305	305	305	305	405	490	490
	3.48	59	59	118	59	59	118	160	160	160	205	205	345	345	345	345	345	345	345	405	540	555
	3.78	64	64	128	64	64	128	173	173	173	225	225	375	305	375	375	305	375	375	305	455	515
	4.50	76	76	153	76	76	153	205	205	205	270	270	450	290	435	450	290	435	450	290	435	490
	5.07	86	86	172	86	86	172	230	230	230	250	300	425	250	375	425	250	375	425			
	5.56	94	94	189	94	94	189	225	255	255	225	330	380	225	335	380	225	335	380			
	6.45	109	109	215	109	109	215	192	285	295	192	285	325	192	285	325	192	285	325			
	7.20	122	122	235	122	122	235	140	210	235												
	7.63	129	129	250	129	129	250	149	220	250												
8.65	139	147	235	139	147	235	139	205	235													

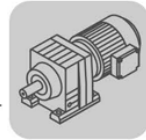
m [kg]		AQ.						
s		100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
RX87		42	43	43	48	48	48	57
RXF: + 5.0 kg								

		AQ.						
		100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
J _A 10 ⁻⁴	[kgm ²]	1.4	1.4	3.1	5.1	10.0	10.0	25.0
c _{TA}	[Nm/']	0.25	0.25	0.625	0.625	1.0	1.0	2.08

RX87							F _{Ramax}		F _{Rapk}	
n _e = 1400	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	RX [N]	RXF [N]	RX [N]	RXF [N]
RX87  1	1.39	290	435	493	1007	25	74	74	12700	12700
	1.60	315	472	536	875	19	74	74	12500	12500
	1.93	355	532	604	725	15	185	185	12300	12300
	2.15	385	540	655	651	13	42	42	12300	12300
	2.48	405	540	689	605	11	470	470	12300	12300
	2.76	405	535	689	652	9.4	1200	1200	12400	12400
	3.09	405	540	689	744	8.1	1950	1950	12400	12400
	3.48	405	540	689	805	6.9	2730	2730	12400	12400
	3.78	305	457	519	1852	6.2	5030	5030	12700	12700
	4.50	290	435	493	1556	4.8	5500	5500	12800	12800
	5.07	250	375	425	1381	3.9	5980	5980	13000	13000
	5.56	225	337	383	1259	3.4	6320	6320	13000	13000
	6.45	192	288	326	1085	2.7	6850	6850	13000	13000
	7.20	140	210	238	972	1.8	7380	7380	13000	13000
7.63	149	223	253	917	1.6	7490	7490	13000	13000	
8.65	139	208	236	809	1.3	7890	7890	13000	13000	



AQ.		n_{epk} [1/min]	η [%]	c_{TG}	
	i			RX [Nm/']	RXF [Nm/']
RX87  1	1.39	2170	99	34	34
	1.60	2498	99	34	34
	1.93	3013	99	34	34
	2.15	3356	99	34	34
	2.48	3871	99	34	34
	2.76	4308	99	34	34
	3.09	4500	99	34	34
	3.48	4500	99	34	34
	3.78	4500	99	34	34
	4.50	4500	98	34	34
	5.07	4500	98	34	34
	5.56	4500	98	34	34
	6.45	4500	98	34	34
	7.20	4500	98	34	34
	7.63	4500	98	34	34
8.65	4500	98	34	34	

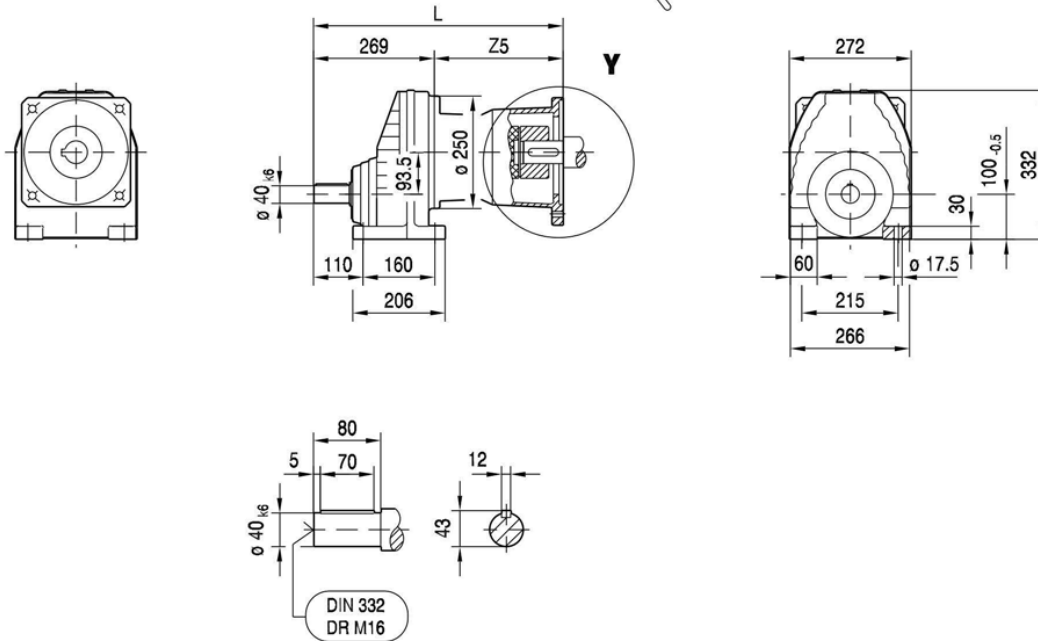


8.2.8 RX 87 AQ.. [mm]

01 070 00 08^L

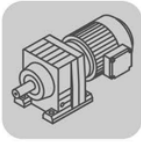
RX87..

Y → 227

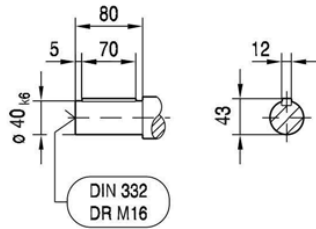
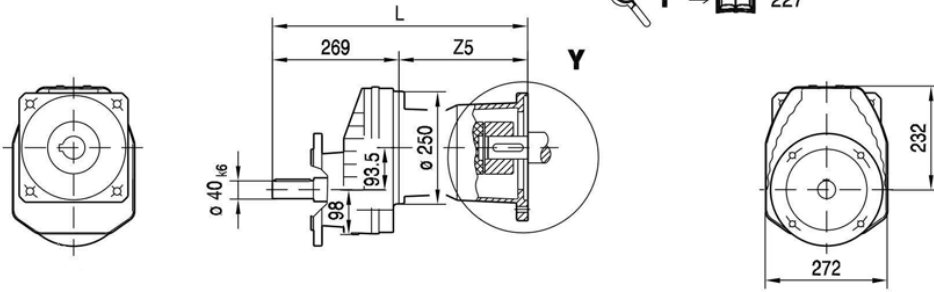
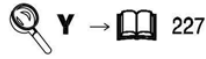


8

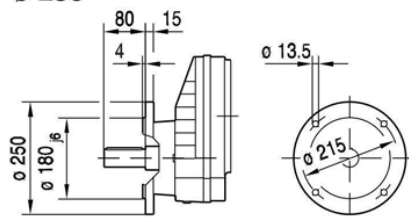
(→ 144)	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	380	394	403	431	444	444	490	514
Z5	111	125	134	162	175	175	220.5	244.5



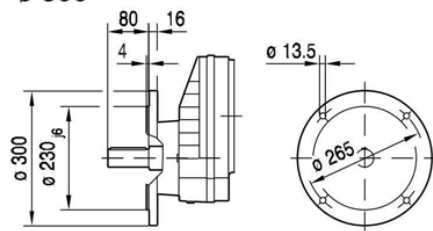
RXF87..



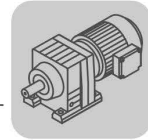
ø 250



ø 300




(→ 144)	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	380	394	403	431	444	444	490	514
Z5	111	125	134	162	175	175	220.5	244.5




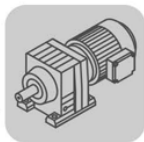
8.2.9 RX 97 AQ.. [Nm]


[Nm]		AQ. M _{amax} M _{apk} M _{aNotaus}											
i		140/1			140/2-4			160/1			190/1-3		
RX97 	1.42	85	85	142	142	142	142	142	142	142	225	225	225
	1.64	98	98	164	164	164	164	164	164	164	260	260	260
	1.96	117	117	196	196	196	196	196	196	196	310	310	310
	2.24	134	134	220	220	220	220	220	220	220	355	355	355
	2.64	158	158	260	260	260	260	260	260	260	420	420	420
	2.92	175	175	290	290	290	290	290	290	290	465	465	465
	3.30	198	198	330	330	330	330	330	330	330	525	525	525
	3.64	215	215	360	360	360	360	360	360	360	580	580	580
	4.04	240	240	400	400	400	400	400	400	400	595	645	645
	4.52	270	270	450	450	450	450	450	450	450	595	720	720
	4.91	290	290	490	395	490	490	395	490	490	395	590	670
	5.79	345	345	575	420	575	575	420	575	575	420	630	710
	6.56	300	390	510	300	450	510	300	450	510			
7.16	260	390	440	260	390	440	260	390	440				
8.23	225	335	380	225	335	380	225	335	380				

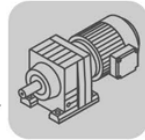
m [kg]		AQ.											
s		140/1			140/2-4			160/1			190/1-3		
RX97		73			73			73			81		
RXF: + 8.6 kg													

		AQ.											
		140/1			140/2-4			160/1			190/1-3		
J _A 10 ⁻⁴	[kgm ²]	5.1			10.0			10.0			25.0		
c _{TA}	[Nm/']	0.625			1.0			1.0			2.08		

RX97 n _e = 1400							F _{Ramax}		F _{Rapk}	
i		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	RX [N]	RXF [N]	RX [N]	RXF [N]
RX97 	1.42	455	682	774	986	61	132	132	20000	20000
	1.64	505	757	859	854	51	51	51	20000	20000
	1.96	570	800	969	714	41	19	19	20000	20000
	2.24	595	800	1012	670	33	495	495	20000	20000
	2.64	595	800	1012	795	28	1980	1980	20000	20000
	2.92	595	800	1012	856	24	2810	2810	20000	20000
	3.30	595	800	1012	909	20	3730	3730	20000	20000
	3.64	595	800	1012	962	18	4530	4530	20000	20000
	4.04	595	800	1012	1015	15	5380	5380	20000	20000
	4.52	595	800	1012	1062	13	6180	6180	20000	20000
	4.91	395	592	672	1426	12	7220	7220	20000	20000
	5.79	420	630	714	1209	9.2	7630	7630	20000	20000
	6.56	300	450	510	1067	5.8	8500	8500	20000	20000
7.16	260	390	442	978	5.1	8950	8950	20000	20000	
8.23	225	337	383	851	4.0	9560	9560	20000	20000	



AQ.		n_{epk} [1/min]	η [%]	c_{TG}	
	i			RX [Nm/']	RXF [Nm/']
RX97  1	1.42	2187	98	58	58
	1.64	2526	98	58	58
	1.96	3019	98	58	58
	2.24	3450	99	58	58
	2.64	4066	99	58	58
	2.92	4497	99	58	58
	3.30	4500	99	58	58
	3.64	4500	99	58	58
	4.04	4500	99	58	58
	4.52	4500	99	58	58
	4.91	4500	98	58	58
	5.79	4500	98	58	58
	6.56	4500	98	58	58
	7.16	4500	98	58	58
8.23	4500	98	58	58	

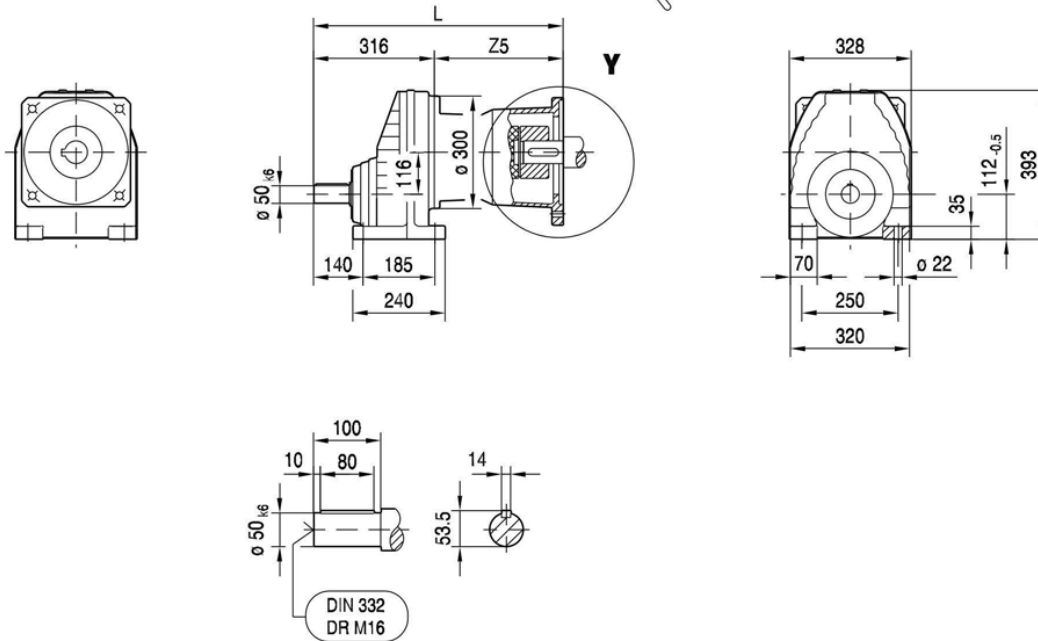


8.2.10 RX 97 AQ.. [mm]

01 072 00 08^L

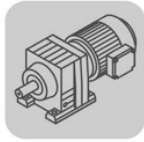
RX97..

Y → 227

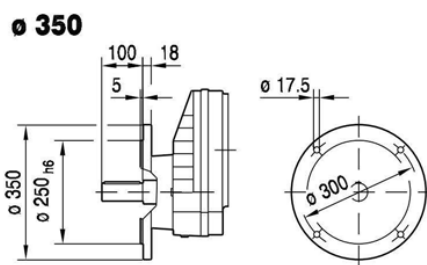
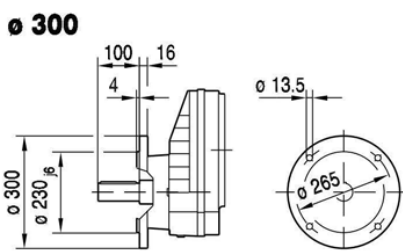
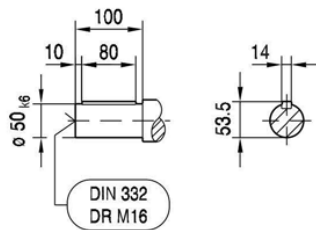
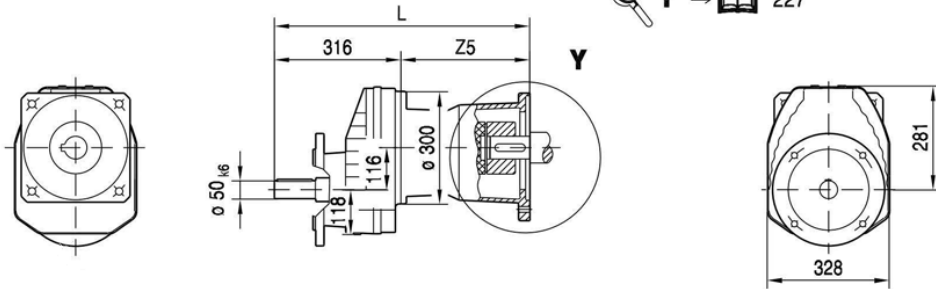
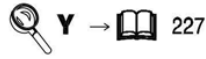


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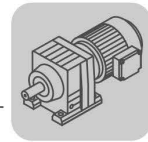
(→ 144)	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3			
L	473	486	486	532	556			
Z5	157	170	170	215.5	239.5			



RXF97..



(→ 144)	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3			
L	473	486	486	532	556			
Z5	157	170	170	215.5	239.5			



8.2.11 RX 107 AQ.. [Nm]

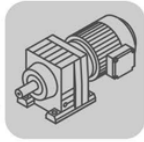
[Nm]		AQ. M _{amax} M _{apk} M _{aNotaus}											
i		140/1			140/2-4			160/1			190/1-3		
RX107 1	1.44										230	230	230
	1.71	102	102	171	171	171	171	171	171	171	270	270	270
	1.95	117	117	195	195	195	195	195	195	195	310	310	310
	2.30	138	138	230	230	230	230	230	230	230	365	365	365
	2.64	158	158	260	260	260	260	260	260	260	420	420	420
	3.07	184	184	305	305	305	305	305	305	305	490	490	490
	3.38	200	200	335	335	335	335	335	335	335	540	540	540
	3.81	225	225	380	380	380	380	380	380	380	605	605	605
	4.20	250	250	420	420	420	420	420	420	420	670	670	670
	4.65	275	275	465	465	465	465	465	465	465	695	740	740
	5.19	310	310	515	515	515	515	515	515	515	695	830	830
5.61	335	335	560	455	560	560	455	560	560	455	680	770	
6.63	395	395	660	460	660	660	460	660	660	460	690	780	

m [kg]		AQ.			
s		140/1	140/2-4	160/1	190/1-3
RX107	1	105	105	105	115
RXF: + 16.8 kg					

		AQ.			
		140/1	140/2-4	160/1	190/1-3
J _A 10 ⁻⁴	[kgm ²]	5.1	10.0	10.0	25.0
c _{TA}	[Nm/']	0.625	1.0	1.0	2.08

RX107 n _e = 1400							F _{Ramax}		F _{Rapk}	
i		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	RX [N]	RXF [N]	RX [N]	RXF [N]
RX107 1	1.44	645	967	1097	972	111	315	315	30000	30000
	1.71	705	1057	1199	819	84	480	480	30000	30000
	1.95	765	1090	1301	769	70	555	555	30000	30000
	2.30	830	1110	1411	696	57	900	900	30000	30000
	2.64	830	1120	1411	720	47	2160	2160	30000	30000
	3.07	830	1130	1411	814	39	3600	3600	30000	30000
	3.38	830	1130	1411	858	34	4490	4490	30000	30000
	3.81	830	1140	1411	919	29	5550	5550	30000	30000
	4.20	830	1150	1411	952	25	6420	6420	30000	30000
	4.65	695	1042	1182	1505	19	7450	7450	30000	30000
	5.19	695	1042	1182	1349	17	7850	7850	30000	30000
5.61	455	682	774	1248	15	9080	9080	30000	30000	
6.63	460	690	782	1056	12	9700	9700	30000	30000	

AQ.					c _{TG}	
i		n _{epk} [1/min]	η [%]	RX [Nm/']	RXF [Nm/']	
RX107 1	1.44	2101	98	93	93	
	1.71	2495	98	93	93	
	1.95	2845	98	93	93	
	2.30	3356	98	93	93	
	2.64	3852	99	93	93	
	3.07	4479	99	93	93	
	3.38	4500	99	93	93	
	3.81	4500	99	93	93	
	4.20	4500	99	93	93	
	4.65	4500	99	93	93	
	5.19	4500	99	93	93	
5.61	4500	98	93	93		
6.63	4500	98	93	93		

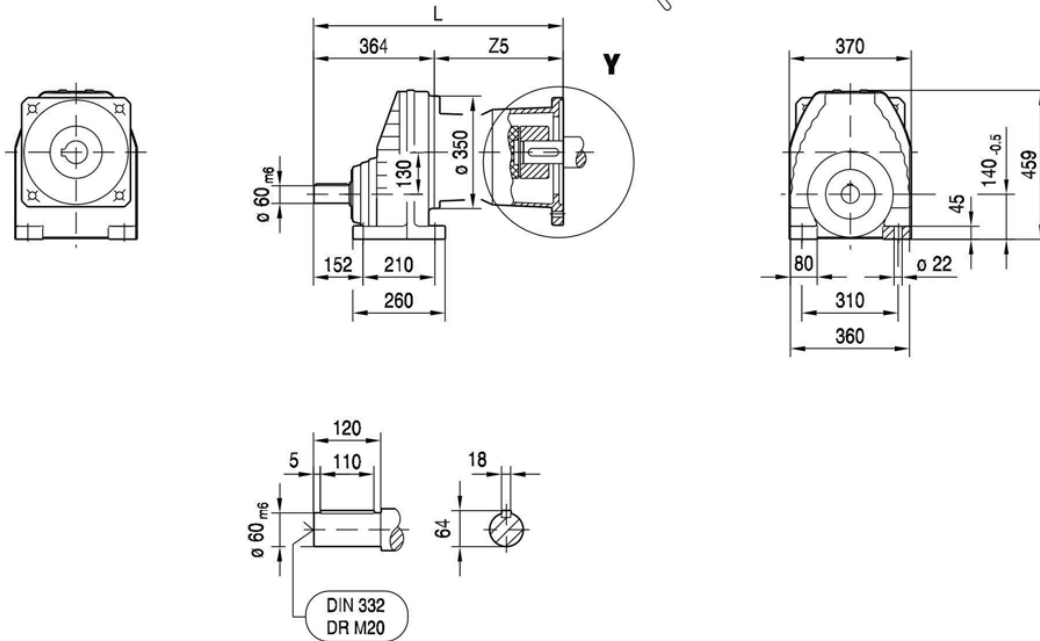


8.2.12 RX 107 AQ.. [mm]

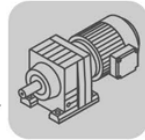
01 074 00 08^L

RX107..

Y → 227

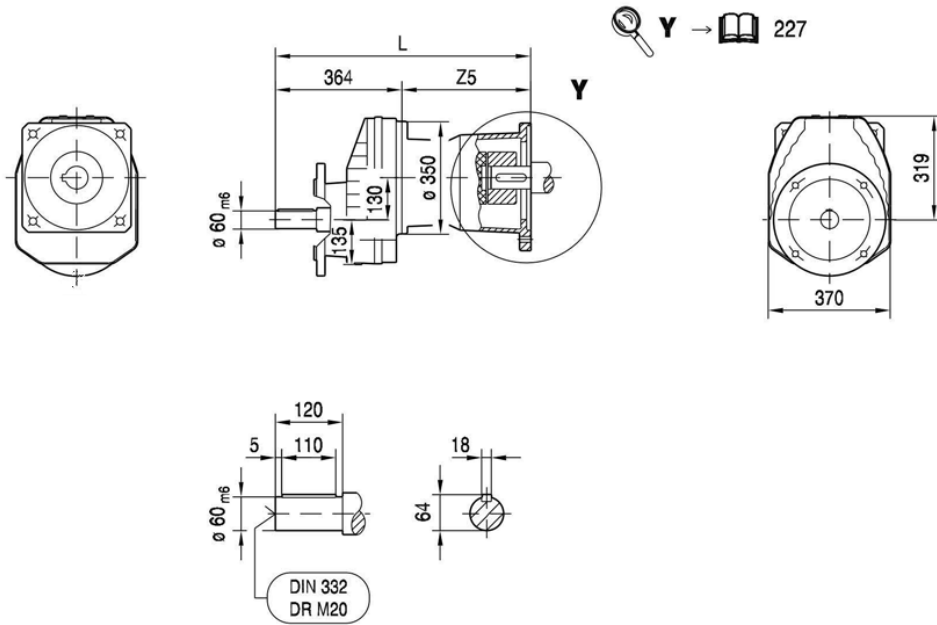


(→ 144)	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3			
L	515	528	528	574	598			
Z5	151	164	164	209.5	233.5			



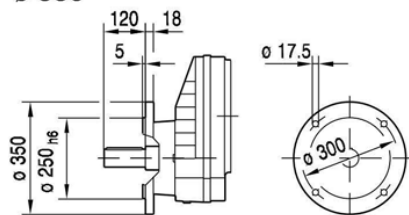
01 075 00 08^L

RXF107..

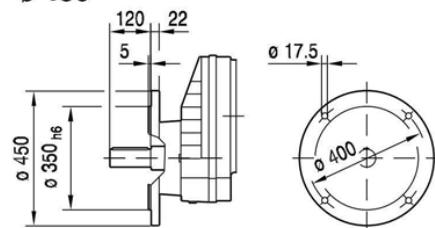


8

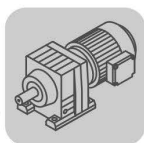
ø 350



ø 450







(→ 144)	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3			
L	515	528	528	574	598			
Z5	151	164	164	209.5	233.5			



8.3 R.. AQ..

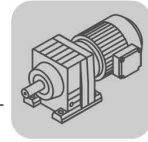
8.3.1 R 27 AQ.. [Nm]

[Nm]		AQ.											
		M _{amax} M _{apk} M _{aNotaus}											
i		80/1-3			100/1-4			115/1-2			115/3		
R27 	3.37	57	57	111	57	57	114	57	57	114	79	118	134
	4.00	68	68	132	68	68	136	68	68	136	85	127	145
	4.27	72	72	140	72	72	145	72	72	145	87	130	148
	5.00	85	85	162	85	85	162	85	85	162	95	142	162
	5.60	95	95	168	95	95	168	95	95	168	99	144	168
	6.59	106	112	180	106	112	180	106	112	180	106	145	180
	7.63	112	129	190	112	129	190	112	129	190	112	148	190
	8.16	116	138	197	116	138	197	116	138	197	116	148	197
	9.41	122	149	205	122	149	205	122	149	205	122	149	205
	10.13	122	136	205	122	136	205	122	136	205	122	136	205
	11.86	129	136	215	129	136	215	129	136	215	129	136	215
	13.28	130	136	220	130	136	220	130	136	220	130	136	220
	15.63	130	136	220	130	136	220	130	136	220	130	136	220
	18.08	130	136	220	130	136	220	130	136	220	130	136	220
	19.35	130	136	220	130	136	220	130	136	220	130	136	220
22.32	130	136	220	130	136	220	130	136	220	130	136	220	
26.09	130	136	220	130	136	220	130	136	220	130	136	220	
28.37	130	136	220	130	136	220	130	136	220	130	136	220	
R27 	24.47	130	136	220	130	136	220	130	136	220	130	136	220
	28.78	130	136	220	130	136	220	130	136	220	130	136	220
	32.47	130	136	220	130	136	220	130	136	220	130	136	220
	36.79	130	136	220	130	136	220	130	136	220	130	136	220
	39.25	130	136	220	130	136	220	130	136	220	130	136	220
	44.90	130	136	220	130	136	220	130	136	220	130	136	220
	48.17	130	136	220	130	136	220	130	136	220	130	136	220
	55.87	130	136	220	130	136	220	130	136	220	130	136	220
	61.30	130	136	220	130	136	220	130	136	220	130	136	220
	69.47	130	136	220	130	136	220	130	136	220	130	136	220
	74.11	130	136	220	130	136	220	130	136	220	130	136	220
	84.78	130	136	220	130	136	220	130	136	220	130	136	220
	90.96	130	136	220	130	136	220	130	136	220	130	136	220
	105.49	130	136	220	130	136	220	130	136	220	130	136	220
	123.91	130	136	220	130	136	220	130	136	220	130	136	220
135.09	130	136	220	130	136	220	130	136	220	130	136	220	

m [kg]		AQ.			
s		80/1-3	100/1-4	115/1-2	115/3
R27		7.3	8.0	8.5	8.5
R27		7.6	8.3	8.8	8.8

RF: + -0.1 kg

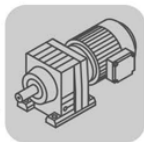
		AQ.			
		80/1-3	100/1-4	115/1-2	115/3
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1
c _{TA}	[Nm/']	0.25	0.25	0.25	0.625




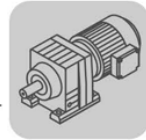
R27 n _e = 1400		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	F _{Ramax}		F _{Rapk}	
i							R [N]	RF [N]	R [N]	RF [N]
R27 	3.37	79	118	134	415	1.1	900	790	4290	3690
	4.00	85	127	145	350	0.85	900	800	4250	3660
	4.27	87	130	148	328	0.76	920	810	4230	3640
	5.00	95	142	162	280	0.58	860	760	4180	3590
	5.60	99	144	168	250	0.48	880	775	4170	3580
	6.59	106	145	180	212	0.36	880	775	4160	3580
	7.63	112	148	190	183	0.29	900	795	4150	3570
	8.16	116	148	197	172	0.26	870	770	4150	3570
	9.41	122	149	207	149	0.21	900	795	4140	3560
	10.13	122	136	207	138	0.61	1890	1670	4210	3620
	11.86	129	136	219	118	0.47	1980	1750	4210	3620
	13.28	130	136	221	120	0.39	2140	1910	4210	3620
	15.63	130	136	221	122	0.29	2290	2170	4210	3620
	18.08	130	136	221	122	0.24	2440	2310	4210	3620
	19.35	130	136	221	124	0.22	2510	2380	4210	3620
	22.32	130	136	221	125	0.18	2660	2520	4210	3620
	26.09	130	136	221	126	0.14	2840	2690	4210	3620
28.37	130	136	221	130	0.12	2940	2780	4210	3620	
24.47	130	136	221	98	0.49	2760	2620	4210	3620	
28.78	130	136	221	97	0.37	2950	2800	4210	3620	
32.47	130	136	221	99	0.31	3100	2940	4210	3620	
36.79	130	136	221	98	0.25	3260	3090	4210	3620	
39.25	130	136	221	97	0.22	3350	3170	4210	3620	
44.90	130	136	221	98	0.18	3530	3340	4210	3620	
48.17	130	136	221	98	0.16	3630	3430	4210	3620	
55.87	130	136	221	98	0.13	3840	3640	4210	3620	
61.30	130	136	221	106	0.26	3980	3640	4210	3620	
69.47	130	136	221	101	0.22	4180	3640	4210	3620	
74.11	130	136	221	94	0.20	4230	3640	4210	3620	
84.78	130	136	221	83	0.16	4230	3640	4210	3620	
90.96	130	136	221	77	0.15	4230	3640	4210	3620	
105.49	130	136	221	66	0.12	4230	3640	4210	3620	
123.91	130	136	221	56	0.090	4230	3640	4210	3620	
135.09	130	136	221	52	0.080	4230	3640	4210	3620	

8

AQ.		n _{epk} [1/min]	η [%]	C _{TG}	
i				R [Nm/']	RF [Nm/']
R27 	3.37	4500	97	7.2	7.1
	4.00	4500	97	7.2	7.1
	4.27	4500	97	7.2	7.1
	5.00	4500	97	7.2	7.1
	5.60	4500	97	7.2	7.1
	6.59	4500	97	7.2	7.1
	7.63	4500	97	7.2	7.1
	8.16	4500	97	7.2	7.1
	9.41	4500	97	7.2	7.1
	10.13	4500	97	9.0	8.8
	11.86	4500	97	9.0	8.8
	13.28	4500	97	9.0	8.8
	15.63	4500	97	9.0	8.8
	18.08	4500	97	9.0	8.8
	19.35	4500	97	9.0	8.8
	22.32	4500	97	9.0	8.8
	26.09	4500	96	9.0	8.8
28.37	4500	96	9.0	8.8	



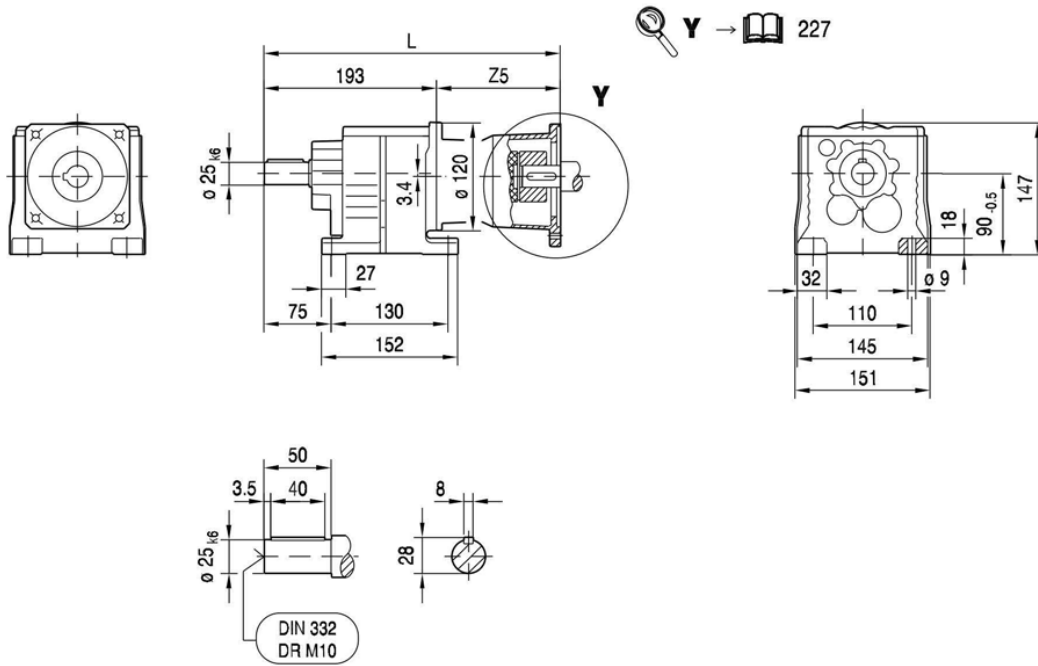
AQ.		n_{epk} [1/min]	η [%]	c_{TG}	
	i			R [Nm/']	RF [Nm/']
R27  3	24.47	4500	94	9.0	8.8
	28.78	4500	94	9.0	8.8
	32.47	4500	94	9.0	8.8
	36.79	4500	94	9.0	8.8
	39.25	4500	94	9.0	8.8
	44.90	4500	94	9.0	8.8
	48.17	4500	94	9.0	8.8
	55.87	4500	94	9.0	8.8
	61.30	4500	92	9.1	8.8
	69.47	4500	92	9.1	8.8
	74.11	4500	92	9.1	8.8
	84.78	4500	92	9.1	8.8
	90.96	4500	92	9.1	8.8
	105.49	4500	92	9.1	8.8
	123.91	4500	91	9.1	8.8
	135.09	4500	91	9.1	8.8



8.3.2 R 27 AQ.. [mm]

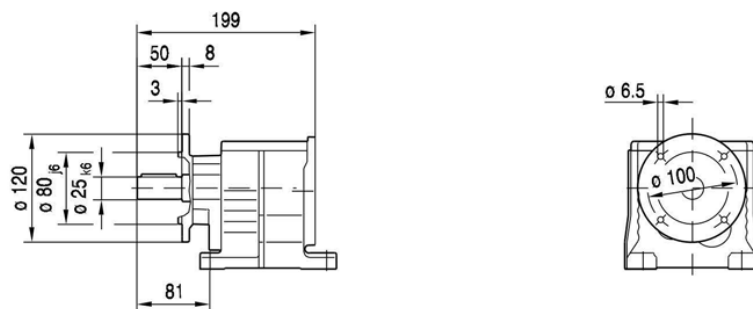
01 076 00 08^L

R27..

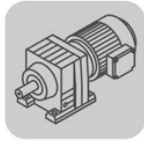


8

R27F..



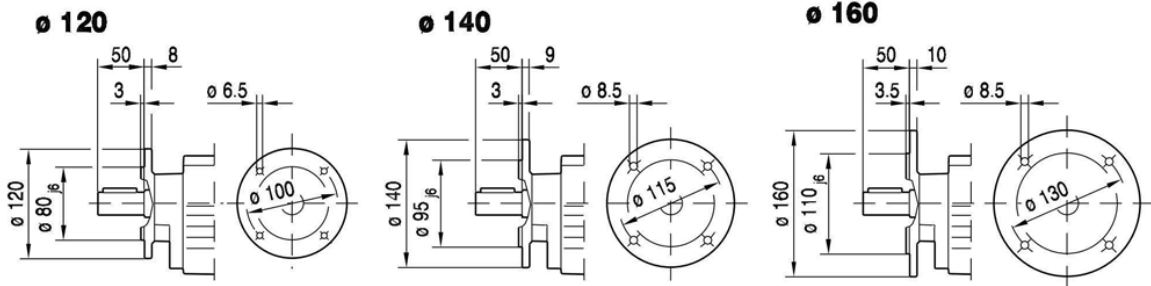
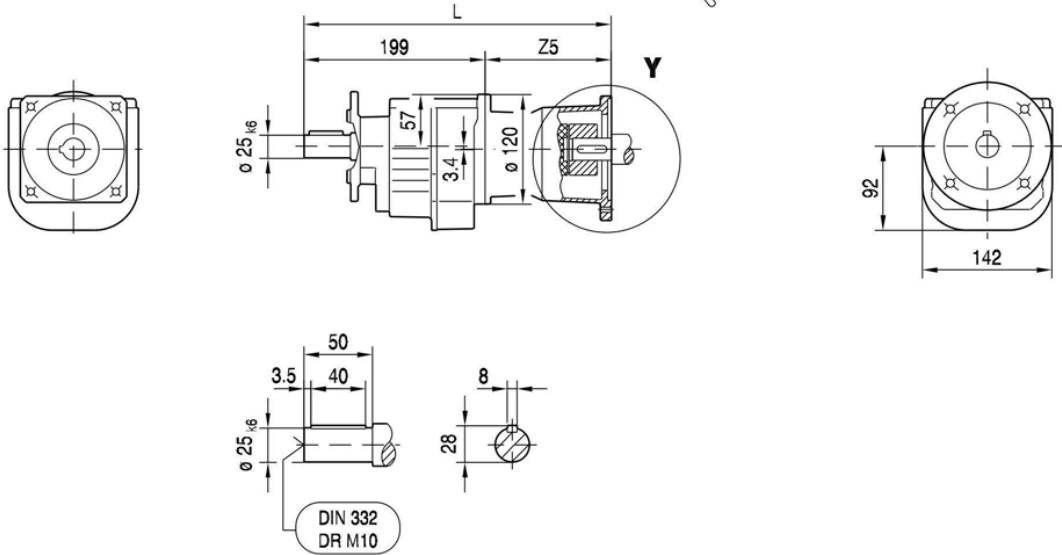
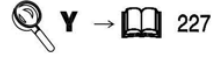
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3				
L	298	323	337	346				
Z5	104.5	129.5	143.5	152.5				



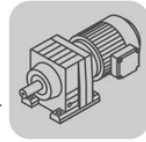
R..
R.. AQ..

01 077 00 08

RF27..

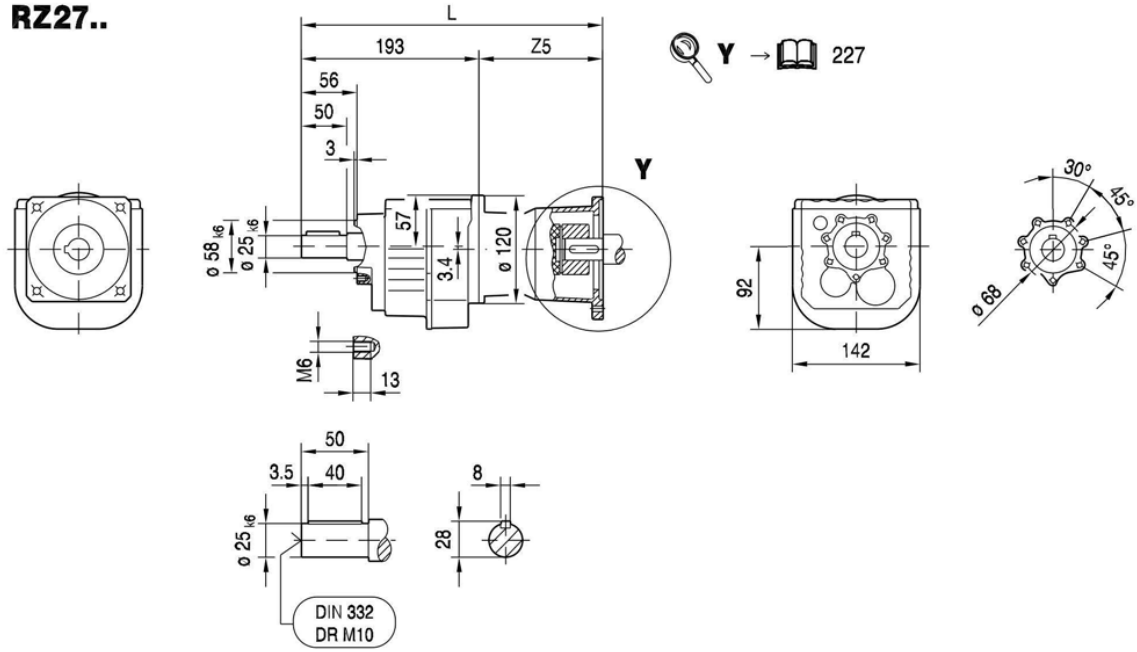


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3			
L	304	329	343	352			
Z5	104.5	129.5	143.5	152.5			



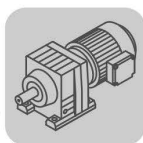
01 078 00 08^L

RZ27..







8

(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3				
L	298	323	337	346				
Z5	104.5	129.5	143.5	152.5				

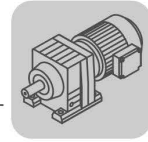



8.3.3 R 37 AQ.. [Nm]

[Nm]		AQ. M _{amax} M _{apk} M _{aNotaus}											
	i	80/1-3			100/1-4			115/1-2			115/3		
R37 	3.41	57	57	112	57	57	115	57	57	115	112	147	156
	4.05	68	68	133	68	68	137	68	68	137	122	153	186
	4.32	73	73	142	73	73	146	73	73	146	126	155	198
	5.06	86	86	166	86	86	172	86	86	172	135	156	230
	5.67	96	96	187	96	96	192	96	96	192	142	156	240
	6.67	113	113	220	113	113	225	113	113	225	144	166	245
	7.97	135	135	260	135	135	265	135	135	265	156	205	265
	9.47	160	160	280	160	160	280	160	160	280	167	205	280
	10.11	170	171	285	170	171	285	170	171	285	170	205	285
	11.83	183	200	310	183	200	310	183	200	310	183	205	310
	13.25	190	205	320	190	205	320	190	205	320	190	205	320
	15.60	200	205	340	200	205	340	200	205	340	200	205	340
	18.05	200	205	340	200	205	340	200	205	340	200	205	340
	19.31	200	205	340	200	205	340	200	205	340	200	205	340
	22.27	200	205	340	200	205	340	200	205	340	200	205	340
26.03	185	205	315	185	205	315	185	205	315	185	205	315	
28.32	200	205	340	200	205	340	200	205	340	200	205	340	
R37 	24.42	200	205	340	200	205	340	200	205	340	200	205	340
	28.73	200	205	340	200	205	340	200	205	340	200	205	340
	32.40	200	205	340	200	205	340	200	205	340	200	205	340
	36.72	200	205	340	200	205	340	200	205	340	200	205	340
	39.17	200	205	340	200	205	340	200	205	340	200	205	340
	44.81	200	205	340	200	205	340	200	205	340	200	205	340
	48.08	200	205	340	200	205	340	200	205	340	200	205	340
	55.76	200	205	340	200	205	340	200	205	340	200	205	340
	61.18	200	205	340	200	205	340	200	205	340	200	205	340
	69.33	200	205	340	200	205	340	200	205	340	200	205	340
	73.96	200	205	340	200	205	340	200	205	340	200	205	340
	84.61	200	205	340	200	205	340	200	205	340	200	205	340
	90.77	200	205	340	200	205	340	200	205	340	200	205	340
	105.28	200	205	340	200	205	340	200	205	340	200	205	340
	123.66	200	205	340	200	205	340	200	205	340	200	205	340
134.82	200	205	340	200	205	340	200	205	340	200	205	340	


m [kg]		AQ.			
	s	80/1-3	100/1-4	115/1-2	115/3
R37		13	14	14	14
R37		13	14	15	15
RF: + 1.5 kg					

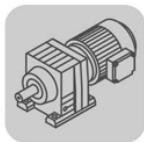
		AQ.			
		80/1-3	100/1-4	115/1-2	115/3
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1
c _{TA}	[Nm/°]	0.25	0.25	0.25	0.625




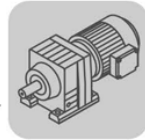
R37 n _e = 1400		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	F _{Ramax}		F _{Rapk}	
i							R [N]	RF [N]	R [N]	RF [N]
R37  2	3.41	112	147	190	411	1.4	900	800	5500	5500
	4.05	122	153	207	346	1.1	840	750	5440	5440
	4.32	126	155	214	324	0.95	820	725	5430	5430
	5.06	135	156	230	277	0.72	790	700	5420	5420
	5.67	142	156	241	247	0.59	760	675	5420	5420
	6.67	144	166	245	210	0.43	1000	890	5320	5320
	7.97	156	205	265	176	0.96	1720	1520	4880	4880
	9.47	167	205	284	148	0.74	1760	1560	4880	4880
	10.11	170	205	289	138	0.66	1820	1620	4880	4880
	11.83	183	205	311	118	0.51	1810	1610	4880	4880
	13.25	190	205	323	106	0.43	1880	1670	4880	4880
	15.60	200	205	340	90	0.31	2010	1780	4880	4880
	18.05	200	205	340	94	0.26	2390	2120	4880	4880
	19.31	200	205	340	93	0.23	2570	2280	4880	4880
	22.27	200	205	340	99	0.19	2970	2640	4880	4880
	26.03	185	205	315	127	0.15	3860	3420	4880	4880
	28.32	200	205	340	99	0.13	3690	3270	4880	4880
	24.42	200	205	340	70	0.53	3240	2870	4880	4880
28.73	200	205	340	70	0.39	3740	3310	4880	4880	
32.40	200	205	340	71	0.31	4120	3650	4880	4880	
36.72	200	205	340	71	0.25	4540	4020	4880	4880	
39.17	200	205	340	71	0.23	4760	4220	4880	4880	
44.81	200	205	340	71	0.19	4940	4640	4880	4880	
48.08	200	205	340	73	0.17	4940	4870	4880	4880	
55.76	200	205	340	74	0.13	4940	4940	4880	4880	
61.18	200	205	340	75	0.26	4940	4940	4880	4880	
69.33	200	205	340	75	0.22	4940	4940	4880	4880	
73.96	200	205	340	76	0.20	4940	4940	4880	4880	
84.61	200	205	340	76	0.16	4940	4940	4880	4880	
90.77	200	205	340	76	0.15	4940	4940	4880	4880	
105.28	200	205	340	66	0.12	4940	4940	4880	4880	
123.66	200	205	340	57	0.090	4940	4940	4880	4880	
134.82	200	205	340	52	0.080	4940	4940	4880	4880	

8

AQ.		n _{epk} [1/min]	η [%]	R [Nm/']	CTG RF [Nm/']	φ /R [']
i						
R37  2	3.41	3587	97	9.7	9.5	14
	4.05	4261	97	9.7	9.5	13
	4.32	4500	97	9.7	9.5	13
	5.06	4500	97	9.7	9.5	13
	5.67	4500	97	9.7	9.5	12
	6.67	4500	97	9.7	9.5	12
	7.97	4500	97	13	12	8
	9.47	4500	97	13	12	8
	10.11	4500	97	13	12	8
	11.83	4500	97	13	12	8
	13.25	4500	97	13	12	8
	15.60	4500	97	13	12	8
	18.05	4500	97	13	12	8
	19.31	4500	97	13	12	7
	22.27	4500	97	13	12	7
	26.03	4500	97	13	12	7
	28.32	4500	97	13	12	7



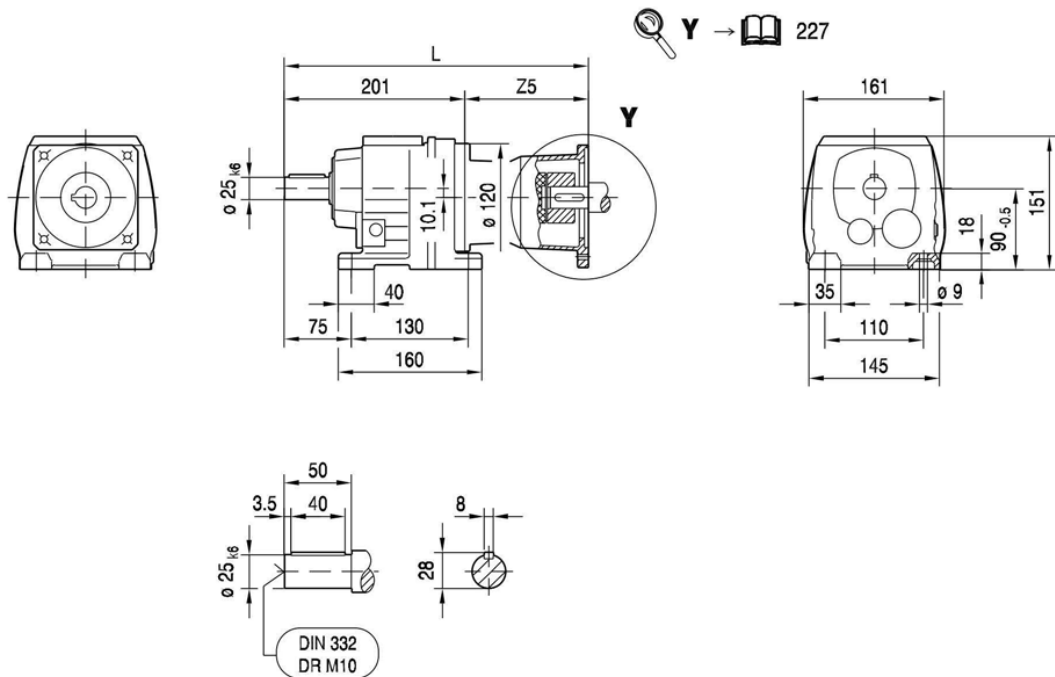
AQ.		n_{epk} [1/min]	η [%]	R [Nm/']	c_{TG}	RF [Nm/']	φ /R [']
R37  3	24.42	4500	95	13		12	9
	28.73	4500	95	13		12	9
	32.40	4500	95	13		12	9
	36.72	4500	95	13		12	9
	39.17	4500	95	13		12	9
	44.81	4500	95	13		12	9
	48.08	4500	95	13		12	9
	55.76	4500	95	13		12	9
	61.18	4500	94	13		13	8
	69.33	4500	94	13		13	8
	73.96	4500	94	13		13	8
	84.61	4500	93	13		13	8
	90.77	4500	93	13		13	8
	105.28	4500	93	13		13	8
	123.66	4500	93	13		13	8
	134.82	4500	93	13		13	8



8.3.4 R 37 AQ.. [mm]

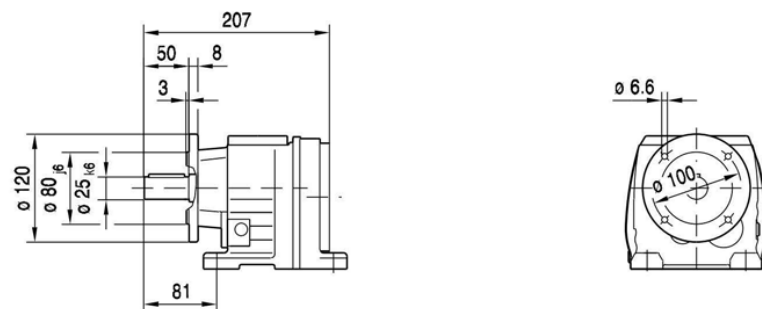
R37..

01 079 00 08^L

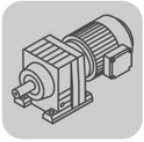


8

R37F..



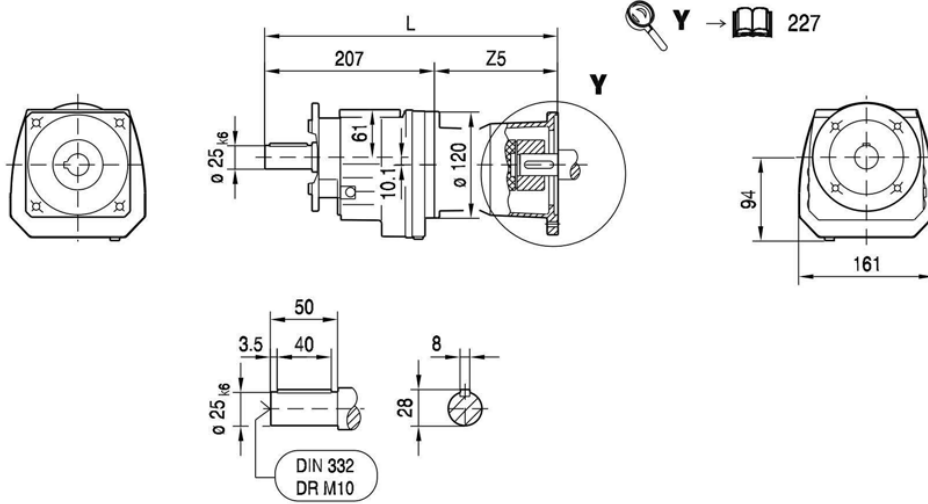
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3				
L	306	331	345	354				
Z5	104.5	129.5	143.5	152.5				



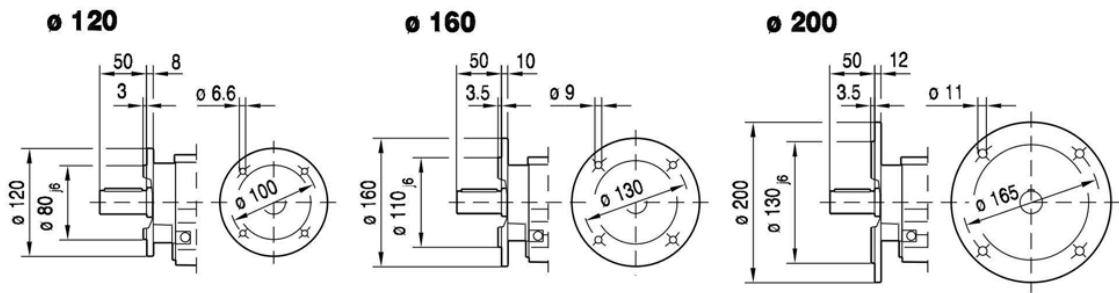
R..
R.. AQ..

01 080 00 08^L

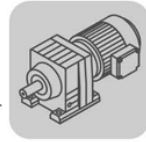
RF37..



Y → 227

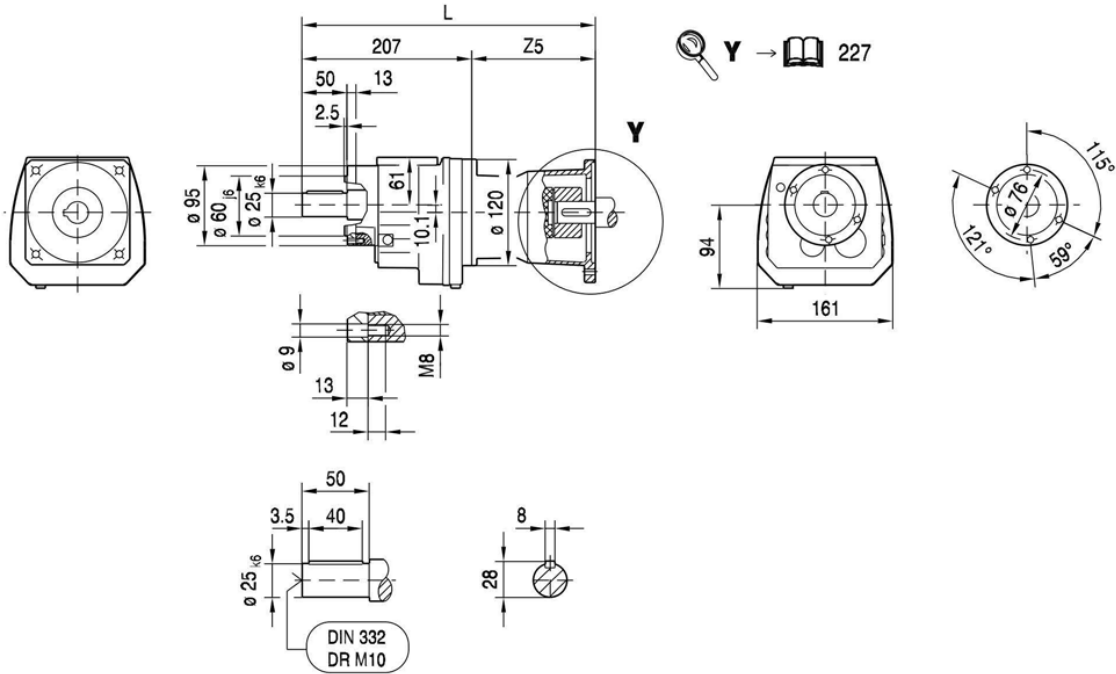


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3			
L	312	337	351	360			
Z5	104.5	129.5	143.5	152.5			



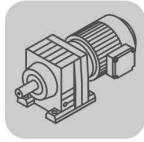
01 081 00 08^L

RZ37..







8

(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3			
L	312	337	351	360			
Z5	104.5	129.5	143.5	152.5			



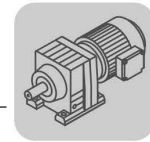
8.3.5 R 47 AQ.. [Nm]

[Nm]		AQ.																							
		M _{amax} M _{apk} M _{aNotaus}																							
i		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
R47 	3.83	65	65	126	65	65	130	65	65	130	144	166	176	144	166	245	144	166	245	144	166	245	144	166	245
	4.34	73	73	143	73	73	147	73	73	147	146	170	199	146	170	245	146	170	245	146	170	245	146	170	245
	4.85	82	82	160	82	82	164	82	82	164	150	175	220	150	175	255	150	175	255	150	175	255	150	175	255
	5.64	95	95	186	95	95	191	95	95	191	155	180	255	155	180	260	155	180	260	155	180	260	155	180	260
	6.00	102	102	198	102	102	200	102	102	200	156	182	265	156	182	265	156	182	265	156	182	265	156	182	265
	6.96	118	118	225	118	118	235	118	118	235	159	187	270	159	187	270	159	187	270	159	187	270			
	7.76	131	131	255	131	131	260	131	131	260	163	190	275	163	190	275	163	190	275	163	190	275			
	8.01	136	136	260	136	136	270	136	136	270	205	300	345	205	300	345	205	300	345	205	300	345	205	300	345
	9.07	154	154	295	154	154	305	154	154	305	220	305	370	220	305	370	220	305	370	220	305	370	220	305	370
	10.15	172	172	330	172	172	345	172	172	345	230	305	390	230	305	390	230	305	390	230	305	390	230	305	390
	11.79	200	200	385	200	200	400	200	200	400	245	305	415	245	305	415	245	305	415	245	305	415	245	305	415
	12.54	210	210	410	210	210	425	210	210	425	250	305	425	250	305	425	250	305	425	250	305	425	250	305	425
	14.56	245	245	450	245	245	450	245	245	450	265	305	450	265	305	450	265	305	450	265	305	450			
	16.22	275	275	465	275	275	465	275	275	465	275	305	465	275	305	465	275	305	465	275	305	465			
	17.89	290	300	490	290	300	490	290	300	490	290	305	490												
	19.27	295	305	500	295	305	500	295	305	500	295	305	500	295	305	500	295	305	500	295	305	500			
	21.81	300	305	510	300	305	510	300	305	510	300	305	510												
	23.28	300	305	510	300	305	510	300	305	510	300	305	510												
	26.74	300	305	510	300	305	510	300	305	510	300	305	510												
	31.12	220	305	370	220	305	370	220	305	370	220	305	370												
33.79	240	305	405	240	305	405	240	305	405	240	305	405													
R47 	23.59	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510
	26.70	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510
	29.88	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510
	34.73	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510
	36.93	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510
	42.87	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510
	47.75	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510
	52.69	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	56.73	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510
	64.21	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	68.54	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	76.23	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	84.90	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	93.68	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	100.86	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	114.17	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	121.87	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	139.99	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	162.94	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									
	176.88	300	305	510	300	305	510	300	305	510	300	305	510	300	305	510									

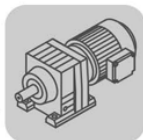
m [kg]		AQ.															
s		80/1-3		100/1-4		115/1-2		115/3		140/1		140/2-4		160/1		190/1-3	
R47		17	18	18	18	18	18	23	23	23	32						
R47		18	18	19	19	19	19	24	24	24	32						



RF: + 0.1 kg

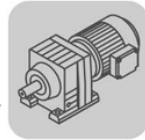
		AQ.															
		80/1-3		100/1-4		115/1-2		115/3		140/1		140/2-4		160/1		190/1-3	
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1	5.1	10.0	10.0	25.0								
c _{TA}	[Nm/°]	0.25	0.25	0.25	0.625	0.625	1.0	1.0	2.08								



R47 n _e = 1400	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	F _{Ramax}		F _{Rapk}	
							R [N]	RF [N]	R [N]	RF [N]
R47 2	3.83	144	166	245	392	2.6	2080	2080	5960	5960
	4.34	146	170	248	415	2.0	2190	2190	5940	5940
	4.85	150	175	255	392	1.7	2280	2280	5930	5930
	5.64	155	180	264	372	1.3	2410	2410	5920	5920
	6.00	156	182	265	383	1.2	2470	2470	5910	5910
	6.96	159	187	270	374	0.93	2620	2620	5890	5890
	7.76	163	190	277	361	0.77	2720	2720	5880	5880
	8.01	205	300	349	200	2.0	2690	2690	5420	5420
	9.07	220	305	374	165	1.6	2780	2780	5390	5390
	10.15	230	305	391	158	1.3	2880	2880	5390	5390
	11.79	245	305	417	136	1.0	3020	3020	5390	5390
	12.54	250	305	425	128	0.95	3080	3080	5390	5390
	14.56	265	305	451	110	0.74	3230	3230	5390	5390
	16.22	275	305	468	99	0.63	3350	3350	5390	5390
	17.89	290	305	493	84	0.51	3390	3390	5390	5390
	19.27	295	305	502	83	0.48	3530	3530	5390	5390
	21.81	300	305	510	78	0.39	3710	3710	5390	5390
	23.28	300	305	510	82	0.36	3820	3820	5390	5390
	26.74	300	305	510	82	0.29	4050	4050	5390	5390
	31.12	220	305	374	212	0.23	4610	4610	5390	5390
33.79	240	305	408	163	0.20	4680	4680	5390	5390	
R47 3	23.59	300	305	510	85	1.7	3840	3840	5390	5390
	26.70	300	305	510	86	1.4	4050	4050	5390	5390
	29.88	300	305	510	84	1.2	4240	4240	5390	5390
	34.73	300	305	510	84	0.93	4520	4520	5390	5390
	36.93	300	305	510	84	0.85	4630	4630	5390	5390
	42.87	300	305	510	86	0.67	4930	4930	5390	5390
	47.75	300	305	510	86	0.56	5140	5140	5390	5390
	52.69	300	305	510	85	0.47	5350	5350	5390	5390
	56.73	300	305	510	85	0.44	5420	5420	5390	5390
	64.21	300	305	510	86	0.37	5420	5420	5390	5390
	68.54	300	305	510	86	0.33	5420	5420	5390	5390
	76.23	300	305	510	89	0.60	5420	5420	5390	5390
	84.90	300	305	510	82	0.52	5420	5420	5390	5390
	93.68	300	305	510	75	0.43	5420	5420	5390	5390
	100.86	300	305	510	69	0.41	5420	5420	5390	5390
	114.17	300	305	510	61	0.34	5420	5420	5390	5390
	121.87	300	305	510	57	0.31	5420	5420	5390	5390
	139.99	300	305	510	50	0.25	5420	5420	5390	5390
	162.94	300	305	510	43	0.20	5420	5420	5390	5390
	176.88	300	305	510	40	0.18	5420	5420	5390	5390



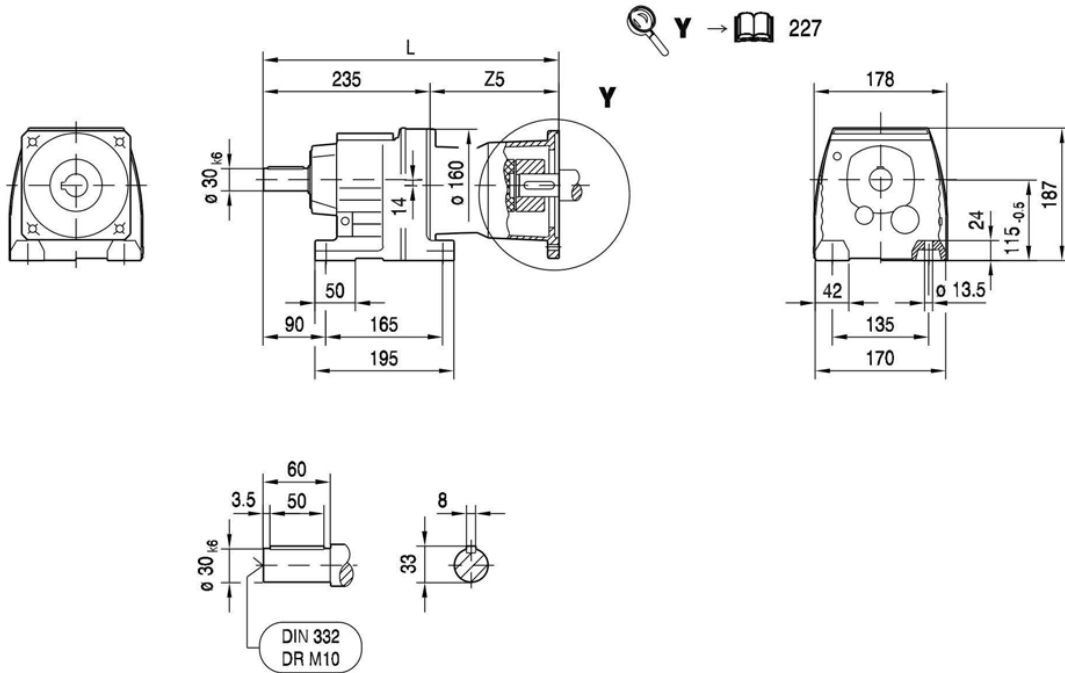
AQ.		n _{epk} [1/min]	η [%]	C _{TG}		φ /R [°]
i	R [Nm/']			RF [Nm/']		
R47  2	3.83	3657	97	11	11	11
	4.34	4144	97	11	11	11
	4.85	4500	97	11	11	10
	5.64	4500	97	11	11	10
	6.00	4500	97	11	11	10
	6.96	4500	97	11	11	10
	7.76	4500	97	11	11	10
	8.01	4500	97	15	15	8
	9.07	4500	97	15	15	8
	10.15	4500	97	15	15	7
	11.79	4500	97	15	15	7
	12.54	4500	97	15	15	7
	14.56	4500	97	15	15	7
	16.22	4500	97	15	15	7
	17.89	4500	97	15	15	7
	19.27	4500	97	15	15	7
	21.81	4500	97	15	15	7
	23.28	4500	97	15	15	7
	26.74	4500	97	15	15	7
	31.12	4500	97	15	15	7
33.79	4500	97	15	15	7	
R47  3	23.59	4500	95	15	15	8
	26.70	4500	95	15	15	8
	29.88	4500	95	15	15	8
	34.73	4500	95	15	15	8
	36.93	4500	95	15	15	8
	42.87	4500	95	15	15	8
	47.75	4500	95	15	15	8
	52.69	4500	95	15	15	8
	56.73	4500	95	15	15	8
	64.21	4500	95	15	15	8
	68.54	4500	95	15	15	8
	76.23	4500	94	15	15	7
	84.90	4500	94	15	15	7
	93.68	4500	94	15	15	7
	100.86	4500	93	15	15	7
	114.17	4500	93	15	15	7
	121.87	4500	93	15	15	7
139.99	4500	93	15	15	7	
162.94	4500	93	15	15	7	
176.88	4500	93	15	15	7	



8.3.6 R 47 AQ.. [mm]

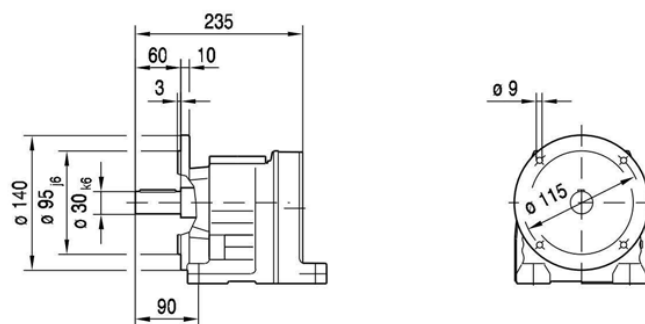
01 082 00 08^L

R47..

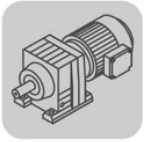


8

R47F..



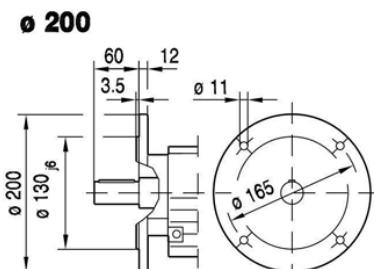
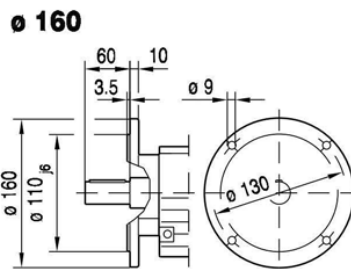
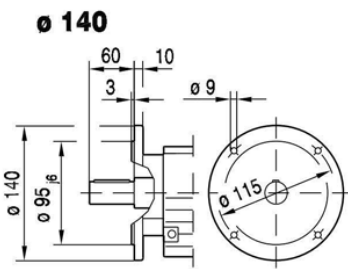
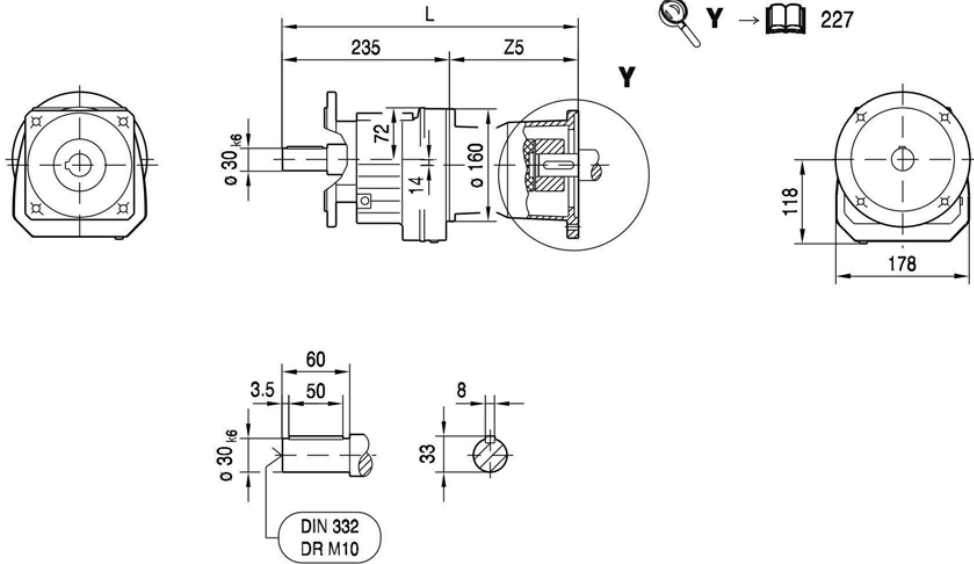
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	333	358	372	381	410	423	423	473	497
Z5	98	123	137	146	175	188	188	237.5	261.5



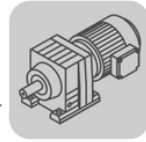
R..
R.. AQ..

01 083 00 08^L

RF47..

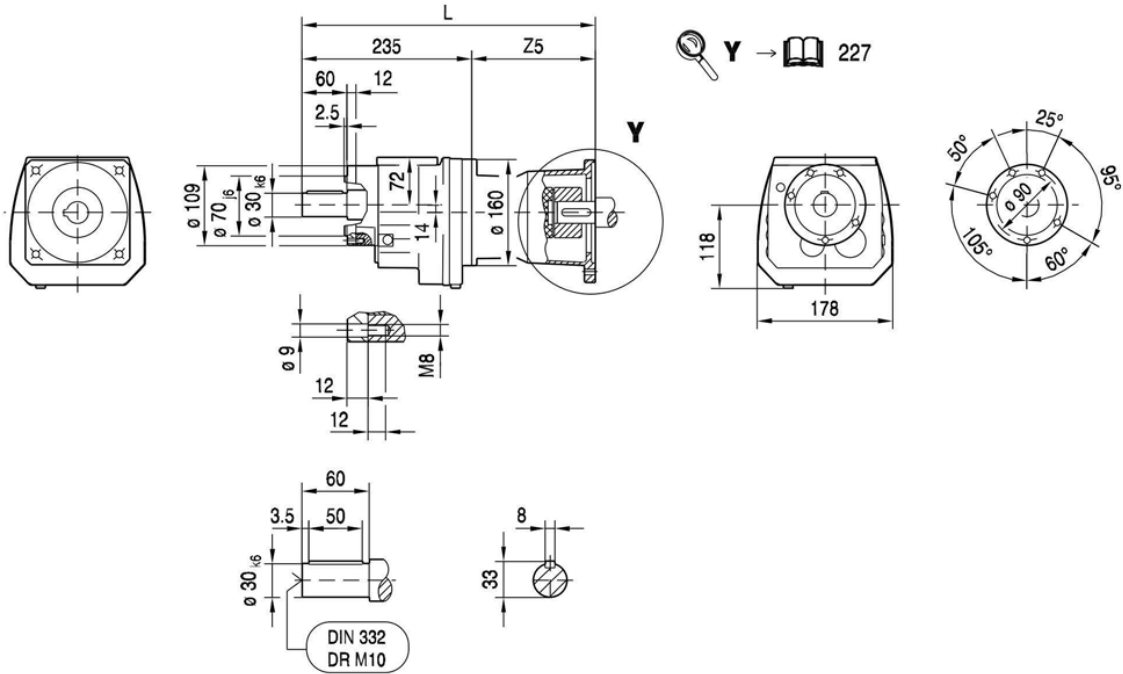


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	333	358	372	381	410	423	423	473	497
Z5	98	123	137	146	175	188	188	237.5	261.5



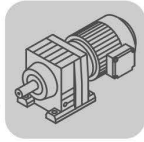
01 084 00 08^L

RZ47..







8

(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	333	358	372	381	410	423	423	473	497
Z5	98	123	137	146	175	188	188	237.5	261.5



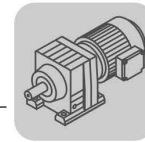
8.3.7 R 57 AQ.. [Nm]

[Nm]		AQ.																							
		M _{amax} M _{apk} M _{aNotaus}																							
i		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
R57 	4.39	74	74	144	74	74	149	74	74	149	200	200	200	260	260	435	280	420	435	280	420	435	280	420	475
	5.05	85	85	166	85	85	171	85	85	171	230	230	230	300	300	505	305	425	505	305	425	505	305	425	515
	5.82	98	98	192	98	98	197	98	98	197	265	265	265	320	345	540	320	425	540	320	425	540	320	425	540
	6.41	108	108	210	108	108	215	108	108	215	290	290	290	335	380	570	335	425	570	335	425	570	335	425	570
	7.53	128	128	245	128	128	255	128	128	255	345	345	345	350	425	595	350	425	595	350	425	595	350	425	595
	7.97	135	135	260	135	135	270	135	135	270	355	365	365	355	425	600	355	425	600	355	425	600	355	425	600
	9.06	154	154	295	154	154	305	154	154	305	375	415	415	375	425	635	375	425	635	375	425	635	375	425	635
	9.35	158	158	305	158	158	315	158	158	315	370	430	430	370	455	625	370	455	625	370	455	625	370	455	625
	10.79	183	183	355	183	183	365	183	183	365	390	455	495	390	455	660	390	455	660	390	455	660	390	455	660
	11.88	200	200	390	200	200	400	200	200	400	405	455	545	405	455	685	405	455	685	405	455	685	405	455	685
	13.95	235	235	460	235	235	470	235	235	470	430	455	640	430	455	730	430	455	730	430	455	730	430	455	730
	14.77	250	250	485	250	250	500	250	250	500	435	455	675	435	455	740	435	455	740	435	455	740	435	455	740
	16.79	285	285	550	285	285	570	285	285	570	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
	18.60	315	315	610	315	315	630	315	315	630	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
	21.93	370	370	720	370	370	745	370	370	745	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
	24.99	420	420	765	420	420	765	420	420	765	450	455	765												
	26.31	445	445	765	445	445	765	445	445	765	450	455	765												
	R57 	26.97	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455
30.18		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
35.07		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
37.30		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
43.30		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
48.23		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
53.22		450	455	765	450	455	765	450	455	765	450	455	765												
57.29		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
64.85		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765									
69.23		450	455	765	450	455	765	450	455	765	450	455	765												
80.55		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
89.71		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
98.99		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765									
106.58		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765
120.63		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765									
128.77		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765									
147.92		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765									
172.17		450	455	765	450	455	765	450	455	765	450	455	765	450	455	765									
186.89	450	455	765	450	455	765	450	455	765	450	455	765	450	455	765										

m [kg]		AQ.								
s		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3	
R57		22	23	23	23	28	28	28	37	
R57		23	24	24	24	29	29	29	38	

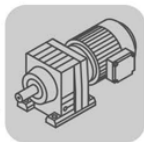
RF: + 3.4 kg / RM: + 15.4 kg


		AQ.							
J _A 10 ⁻⁴	[kgm ²]	80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
c _{TA}	[Nm/°]	0.77	1.4	1.4	3.1	5.1	10.0	10.0	25.0
		0.25	0.25	0.25	0.625	0.625	1.0	1.0	2.08

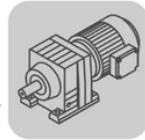


R57 n _e = 1400		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	R [N]	F _{Ramax} RF [N]	RM [N]	R [N]	F _{Rapk} RF [N]	RM [N]
i												
R57 	4.39	280	420	476	319	4.3	1900	1900	4000	7230	7230	4000
	5.05	305	425	519	277	3.4	1730	1730	4000	7210	7210	4000
	5.82	320	425	544	241	2.7	1820	1820	4000	7210	7210	4000
	6.41	335	425	570	218	2.3	1770	1770	4000	7210	7210	4000
	7.53	350	425	595	226	1.8	1950	1950	4000	7210	7210	4000
	7.97	355	425	604	213	1.6	2020	2020	4000	7210	7210	4000
	9.06	375	425	638	188	1.3	2010	2010	4000	7210	7210	4000
	9.35	370	455	629	193	2.8	3180	3180	4000	7080	7080	4000
	10.79	390	455	663	167	2.2	3330	3330	4000	7080	7080	4000
	11.88	405	455	689	143	1.9	3430	3430	4000	7080	7080	4000
	13.95	430	455	731	122	1.6	3610	3610	4000	7080	7080	4000
	14.77	435	455	740	115	1.4	3690	3690	4000	7080	7080	4000
	16.79	450	455	765	107	1.1	3860	3860	4000	7080	7080	4000
	18.60	450	455	765	108	0.94	4050	4050	4000	7080	7080	4000
	21.93	450	455	765	109	0.73	4370	4370	4000	7080	7080	4000
	24.99	450	455	765	108	0.51	4640	4640	4000	7080	7080	4000
	26.31	450	455	765	110	0.45	4750	4750	4000	7080	7080	4000
	26.97	450	455	765	63	1.5	4800	4800	4000	7080	7080	4000
	30.18	450	455	765	63	1.3	5040	5040	4000	7080	7080	4000
	35.07	450	455	765	66	0.97	5390	5390	4000	7080	7080	4000
37.30	450	455	765	64	0.89	5530	5530	4000	7080	7080	4000	
43.30	450	455	765	65	0.70	5900	5900	4000	7080	7080	4000	
48.23	450	455	765	64	0.60	6170	6170	4000	7080	7080	4000	
53.22	450	455	765	66	0.49	6430	6430	4000	7080	7080	4000	
57.29	450	455	765	65	0.46	6630	6630	4000	7080	7080	4000	
64.85	450	455	765	65	0.38	6980	6980	4000	7080	7080	4000	
69.23	450	455	765	65	0.35	7100	7100	4000	7080	7080	4000	
80.55	450	455	765	56	0.62	7100	7100	4000	7080	7080	4000	
89.71	450	455	765	56	0.54	7100	7100	4000	7080	7080	4000	
98.99	450	455	765	56	0.45	7100	7100	4000	7080	7080	4000	
106.58	450	455	765	55	0.42	7100	7100	4000	7080	7080	4000	
120.63	450	455	765	56	0.35	7100	7100	4000	7080	7080	4000	
128.77	450	455	765	54	0.32	7100	7100	4000	7080	7080	4000	
147.92	450	455	765	47	0.26	7100	7100	4000	7080	7080	4000	
172.17	450	455	765	41	0.21	7100	7100	4000	7080	7080	4000	
186.89	450	455	765	37	0.18	7100	7100	4000	7080	7080	4000	

AQ.		n _{epk} [1/min]	η [%]	R [Nm/']	C _{TG} RF [Nm/']	RM [Nm/']	φ /R [']
i							
R57 	4.39	4500	97	21	21	17	10
	5.05	4500	97	21	21	17	10
	5.82	4500	97	21	21	17	10
	6.41	4500	97	21	21	17	9
	7.53	4500	97	21	21	17	9
	7.97	4500	97	21	21	17	9
	9.06	4500	97	21	21	17	9
	9.35	4500	97	25	25	20	7
	10.79	4500	97	25	25	20	7
	11.88	4500	97	25	25	20	7
	13.95	4500	97	25	25	20	7
	14.77	4500	97	25	25	20	7
	16.79	4500	97	25	25	20	7
	18.60	4500	97	25	25	20	7
	21.93	4500	97	25	25	20	7
	24.99	4500	97	25	25	20	6
26.31	4500	97	25	25	20	6	



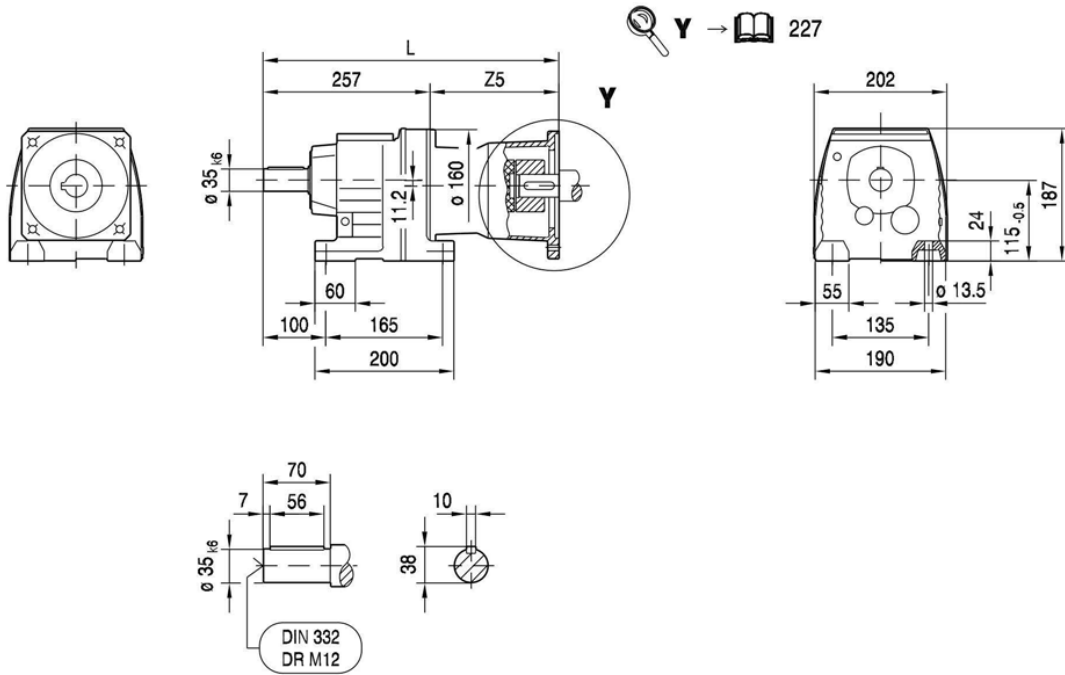
AQ.		n_{epk} [1/min]	η [%]	R [Nm/']	C_{TG} RF [Nm/']	RM [Nm/']	φ /R [']	
R57  3	i							
		26.97	4500	95	26	26	20	8
		30.18	4500	95	26	26	20	8
		35.07	4500	95	26	26	20	8
		37.30	4500	95	26	26	20	8
		43.30	4500	95	26	26	20	8
		48.23	4500	95	26	26	20	8
		53.22	4500	95	26	26	20	8
		57.29	4500	95	26	26	20	8
		64.85	4500	95	26	26	20	8
		69.23	4500	95	26	26	20	7
		80.55	4500	94	26	26	20	7
		89.71	4500	94	26	26	20	7
		98.99	4500	94	26	26	20	7
		106.58	4500	94	26	26	20	7
		120.63	4500	94	26	26	20	7
		128.77	4500	94	26	26	20	7
		147.92	4500	94	26	26	20	7
	172.17	4500	93	26	26	20	7	
	186.89	4500	93	26	26	20	7	



8.3.8 R 57 AQ.. [mm]

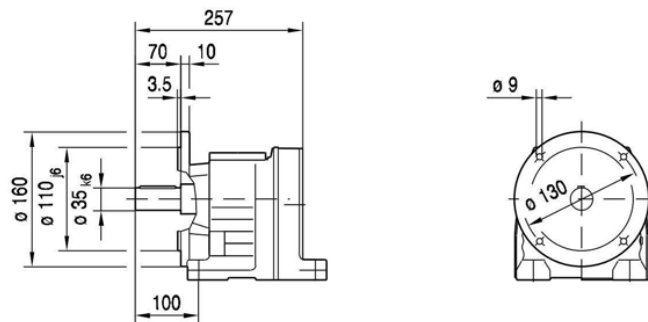
01 085 00 08^L

R57..

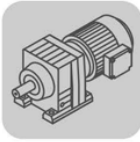


8

R57F..

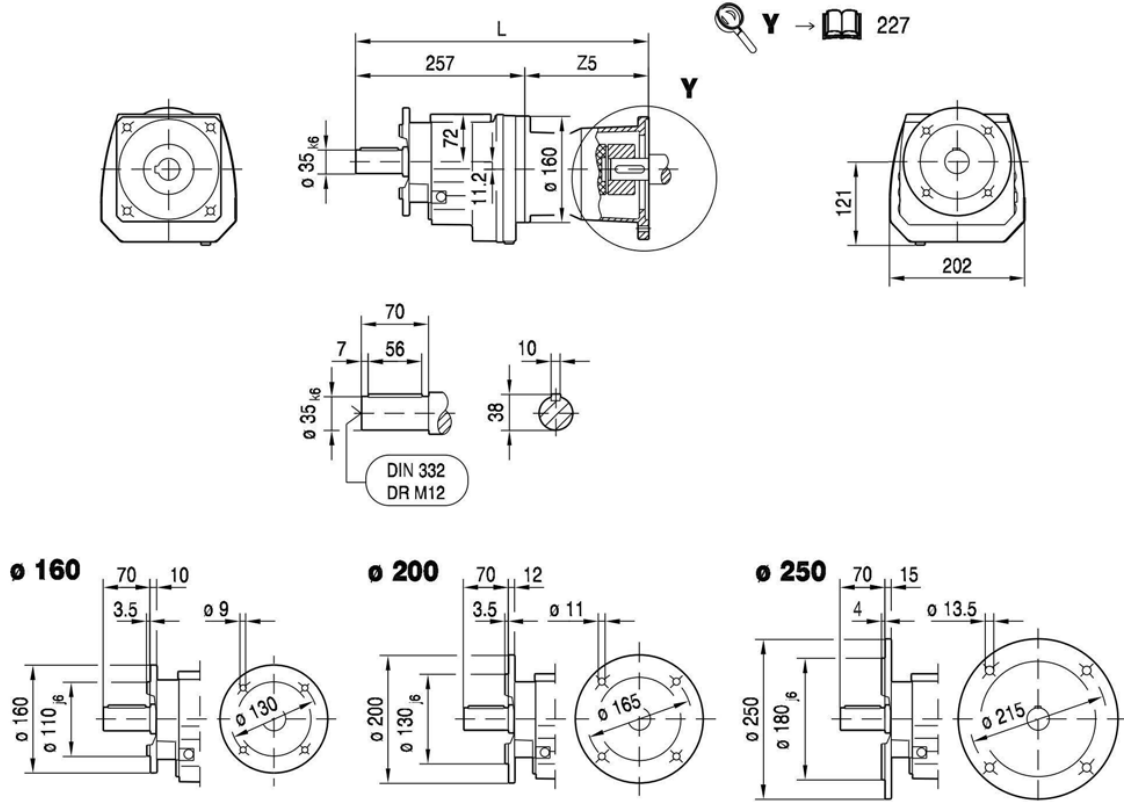


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	355	380	394	403	432	445	445	495	519
Z5	98	123	137	146	175	188	188	237.5	261.5

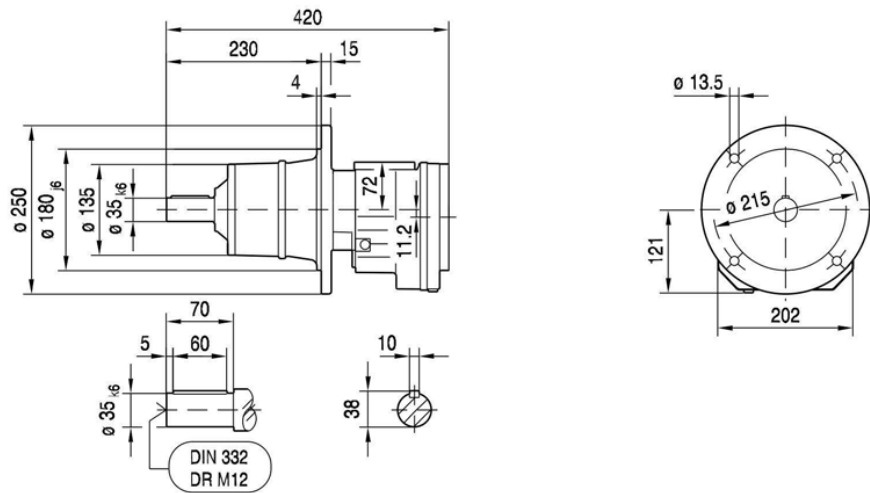


RF57..

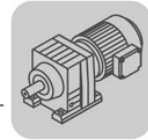
01 086 00 08 ^L



RM57..

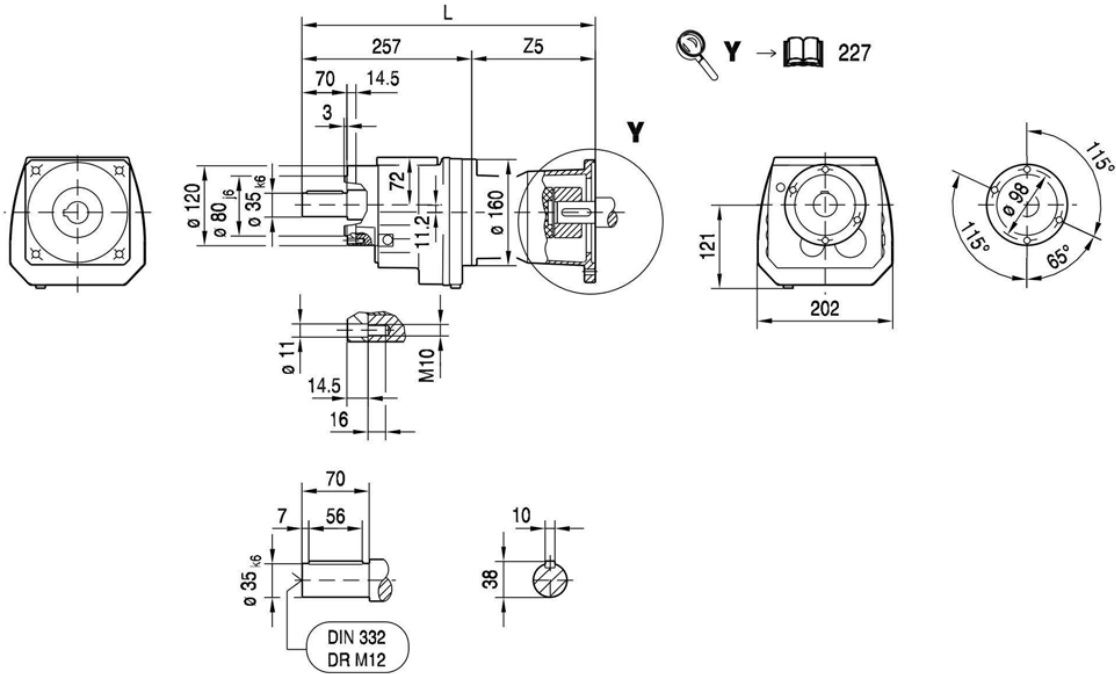


(→) 144	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	355	380	394	403	432	445	445	495	519
Z5	98	123	137	146	175	188	188	237.5	261.5



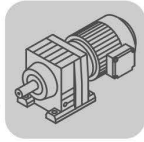
01 087 00 08^L

RZ57..



8

(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	355	380	394	403	432	445	445	495	519
Z5	98	123	137	146	175	188	188	237.5	261.5

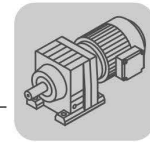



8.3.9 R 67 AQ.. [Nm]


[Nm]		AQ.																							
		M _{amax} M _{apk} M _{aNotaus}																							
i		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
R67 	4.29	72	72	141	72	72	145	72	72	145	197	197	197	255	255	425	270	405	425	270	405	425	270	405	455
	4.93	83	83	162	83	83	167	83	83	167	225	225	225	290	295	490	290	435	490	290	435	490	290	435	490
	5.70	96	96	188	96	96	193	96	96	193	260	260	260	310	340	525	310	465	525	310	465	525	310	465	525
	6.27	106	106	205	106	106	210	106	106	210	285	285	285	330	375	560	330	485	560	330	485	560	330	485	560
	7.36	125	125	240	125	125	250	125	125	250	335	335	335	370	440	625	370	485	625	370	485	625	370	485	625
	7.79	132	132	255	132	132	260	132	132	260	355	355	355	380	465	645	380	485	645	380	485	645	380	485	645
	8.70	147	147	285	147	147	295	147	147	295	400	400	400	440	520	745	440	660	745	440	660	745	440	660	745
	10.00	170	170	330	170	170	340	170	170	340	460	460	460	470	600	795	470	665	795	470	665	795	470	665	795
	11.54	196	196	380	196	196	390	196	196	390	500	530	530	500	665	850	500	665	850	500	665	850	500	665	850
	12.70	215	215	415	215	215	430	215	215	430	520	580	580	520	665	880	520	665	880	520	665	880	520	665	880
	14.91	250	250	490	250	250	505	250	250	505	550	665	685	550	665	930	550	665	930	550	665	930	550	665	930
	15.79	265	265	520	265	265	535	265	265	535	560	665	725	560	665	950	560	665	950	560	665	950	560	665	950
	17.95	305	305	590	305	305	610	305	305	610	590	665	820	590	665	1000	590	665	1000	590	665	1000			
	19.89	335	335	655	335	335	675	335	335	675	600	665	910	600	665	1020	600	665	1020	600	665	1020			
	23.44	395	395	770	395	395	795	395	395	795	560	665	950	560	665	950	560	665	950	560	665	950			
	26.72	450	450	880	450	450	900	450	450	900	540	665	910												
	28.13	475	475	910	475	475	910	475	475	910	540	665	910												
28.83	490	490	880	490	490	880	490	490	880	520	595	880	520	595	880	520	595	880	520	595	880	520	595	880	
32.27	540	545	910	540	545	910	540	545	910	540	595	910	540	595	910	540	595	910	540	595	910	540	595	910	
37.50	570	595	960	570	595	960	570	595	960	570	595	960	570	595	960	570	595	960	570	595	960	570	595	960	
39.88	580	595	980	580	595	980	580	595	980	580	595	980	580	595	980	580	595	980	580	595	980	580	595	980	
46.29	600	600	1020	600	600	1020	600	600	1020	600	600	1020	600	600	1020	600	600	1020	600	600	1020				
51.56	600	600	1020	600	600	1020	600	600	1020	600	600	1020	600	600	1020	600	600	1020	600	600	1020				
56.89	600	600	1020	600	600	1020	600	600	1020	600	600	1020													
61.26	600	600	1020	600	600	1020	600	600	1020	600	600	1020	600	600	1020	600	600	1020	600	600	1020				
69.75	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	
74.17	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	
86.11	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020				
95.91	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020				
105.83	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020										
113.94	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020				
128.97	600	660	1020	600	660	1020	600	660	1020	600	660	1020													
137.67	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020										
158.14	600	660	1020	600	660	1020	600	660	1020	600	660	1020	600	660	1020										
184.07	600	660	1020	600	660	1020	600	660	1020	600	660	1020													
199.81	600	660	1020	600	660	1020	600	660	1020	600	660	1020													

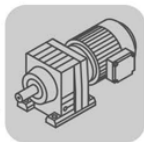
m [kg]		AQ.								
s		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3	
R67		29	29	30	30	35	35	35	43	
R67		30	30	31	31	36	36	36	44	
RF: + 3.2 kg / RM: + 19.0 kg										


		AQ.								
		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3	
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1	5.1	10.0	10.0	25.0	
c _{TA}	[Nm/°]	0.25	0.25	0.25	0.625	0.625	1.0	1.0	2.08	

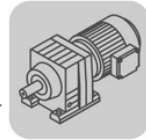


R67 n _e = 1400		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	R [N]	F _{Ramax} RF [N]	RM [N]	R [N]	F _{Rapk} RF [N]	RM [N]
i												
R67  2	4.29	270	405	459	326	5.9	5000	5000	8720	9300	9300	9800
	4.93	290	435	493	284	4.6	5210	5210	9120	9100	9100	9760
	5.70	310	465	527	246	3.6	5450	5450	9560	8870	8870	9710
	6.27	330	485	561	223	3.0	5590	5590	9850	8710	8710	9680
	7.36	370	485	629	190	2.4	5790	5790	9850	8710	8710	9680
	7.79	380	485	646	180	2.1	5830	5830	9840	8710	8710	9680
	8.70	440	660	748	161	4.0	5960	5960	9750	5350	5350	9330
	10.00	470	665	799	140	3.2	6220	6220	9700	4700	4700	9320
	11.54	500	665	850	130	2.5	6500	6500	9660	4700	4700	9320
	12.70	520	665	884	118	2.2	6640	6640	9620	4700	4700	9320
	14.91	550	665	935	101	1.7	6980	6980	9560	4700	4700	9320
	15.79	560	665	952	95	1.6	7130	7130	9540	4700	4700	9320
	17.95	590	665	1003	84	1.2	7330	7330	9480	4700	4700	9320
	19.89	600	665	1020	75	1.0	7560	7560	9460	4700	4700	9320
	23.44	560	665	952	94	0.80	8010	8010	9540	4700	4700	9320
	26.72	540	665	918	105	0.56	8210	8210	9580	4700	4700	9320
28.13	540	665	918	103	0.50	8210	8210	9580	4700	4700	9320	
28.83	520	595	884	49	1.5	8400	8400	9620	7620	7620	9470	
32.27	540	595	918	43	1.3	8210	8210	9580	7620	7620	9470	
37.50	570	595	969	37	1.0	7900	7900	9520	7620	7620	9470	
39.88	580	595	986	35	0.93	7790	7790	9500	7620	7620	9470	
46.29	600	600	1020	32	0.72	7560	7560	9460	7620	7620	9470	
51.56	600	600	1020	33	0.61	7560	7560	9460	7620	7620	9470	
56.89	600	600	1020	33	0.50	7560	7560	9460	7620	7620	9470	
61.26	600	600	1020	33	0.47	7560	7560	9460	7620	7620	9470	
69.75	600	660	1020	29	0.88	7560	7560	9460	5350	5350	9330	
74.17	600	660	1020	28	0.81	7560	7560	9460	5350	5350	9330	
86.11	600	660	1020	29	0.63	7560	7560	9460	5350	5350	9330	
95.91	600	660	1020	29	0.54	7560	7560	9460	5350	5350	9330	
105.83	600	660	1020	29	0.45	7560	7560	9460	5350	5350	9330	
113.94	600	660	1020	30	0.42	7560	7560	9460	5350	5350	9330	
128.97	600	660	1020	29	0.36	7560	7560	9460	5350	5350	9330	
137.67	600	660	1020	30	0.32	7560	7560	9460	5350	5350	9330	
158.14	600	660	1020	30	0.26	7560	7560	9460	5350	5350	9330	
184.07	600	660	1020	30	0.21	7560	7560	9460	5350	5350	9330	
199.81	600	660	1020	30	0.19	7560	7560	9460	5350	5350	9330	

AQ.		n _{epk} [1/min]	η [%]	R [Nm/']	C _{TG} RF [Nm/']	RM [Nm/']	φ /R [°]
i							
R67  2	4.29	3700	97	24	24	22	10
	4.93	4252	97	24	24	22	9
	5.70	4500	97	24	24	22	9
	6.27	4500	97	24	24	22	9
	7.36	4500	97	24	24	22	8
	7.79	4500	97	24	24	22	8
	8.70	4500	97	32	32	28	7
	10.00	4500	97	32	32	28	7
	11.54	4500	97	32	32	28	7
	12.70	4500	97	32	32	28	6
	14.91	4500	97	32	32	28	6
	15.79	4500	97	32	32	28	6
	17.95	4500	97	32	32	28	6
	19.89	4500	97	32	32	28	6
	23.44	4500	97	32	32	28	6
26.72	4500	97	32	32	28	6	
28.13	4500	97	32	32	28	6	



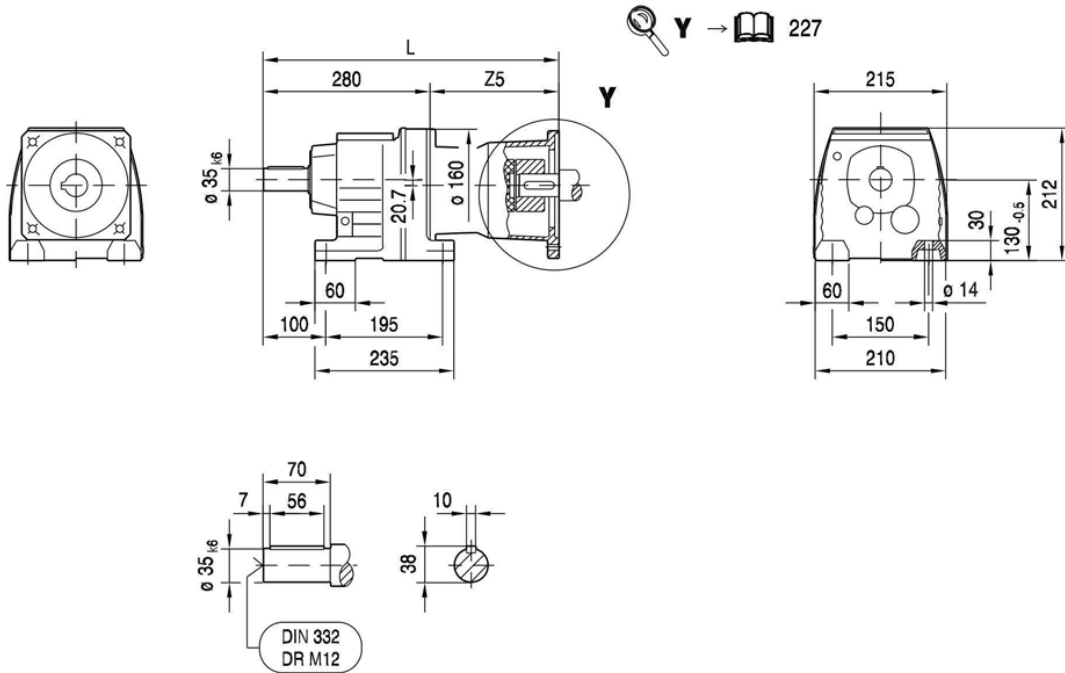
AQ.		n_{epk} [1/min]	η [%]	R [Nm/']	C_{TG} RF [Nm/']	RM [Nm/']	φ /R [']	
R67  3	i							
		28.83	4500	95	33	33	29	7
		32.27	4500	95	33	33	29	7
		37.50	4500	95	33	33	29	7
		39.88	4500	95	33	33	29	7
		46.29	4500	95	33	33	29	7
		51.56	4500	95	33	33	29	7
		56.89	4500	95	33	33	29	7
		61.26	4500	95	33	33	29	7
		69.75	4500	95	33	33	29	7
		74.17	4500	95	33	33	29	7
		86.11	4500	95	33	33	29	6
		95.91	4500	95	33	33	29	6
		105.83	4500	95	33	33	29	6
		113.94	4500	95	33	33	29	6
		128.97	4500	95	33	33	29	6
		137.67	4500	94	33	33	29	6
		158.14	4500	94	33	33	29	6
		184.07	4500	94	33	33	29	6
	199.81	4500	93	33	33	29	6	



8.3.10 R 67 AQ.. [mm]

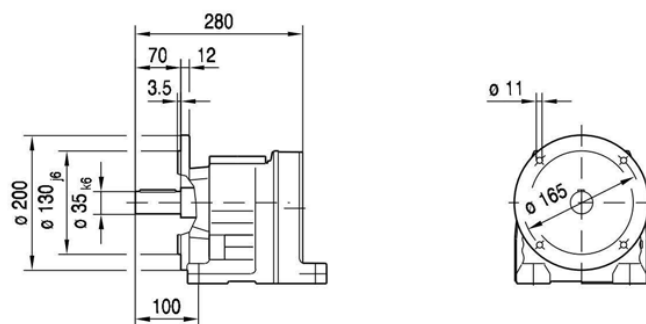
01 088 00 08^L

R67..

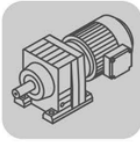


8

R67F..

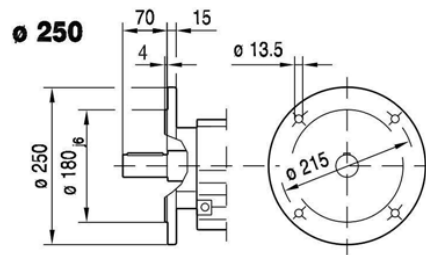
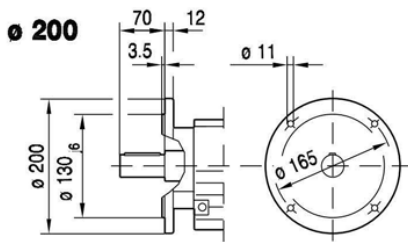
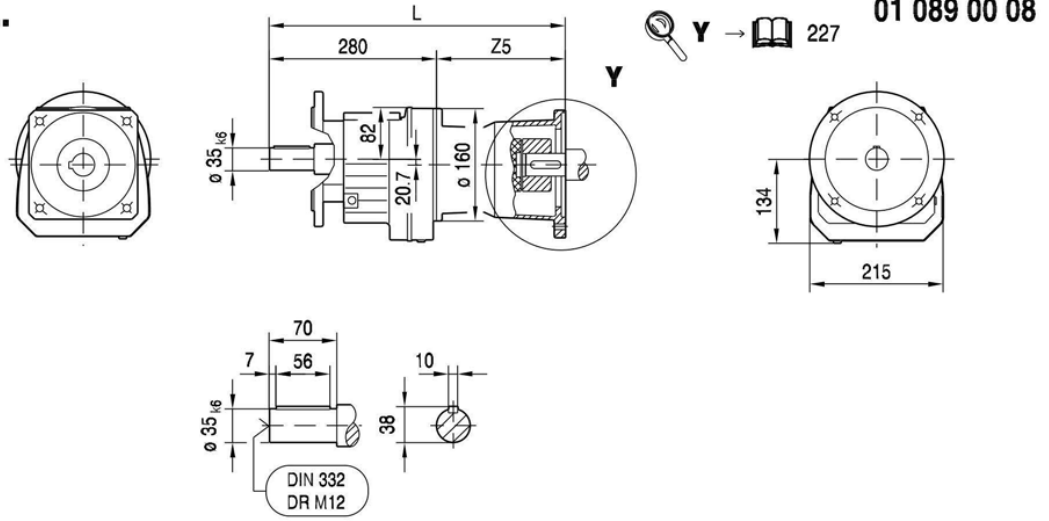


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	378	403	417	426	455	468	468	518	542
Z5	98	123	137	146	175	188	188	237.5	261.5

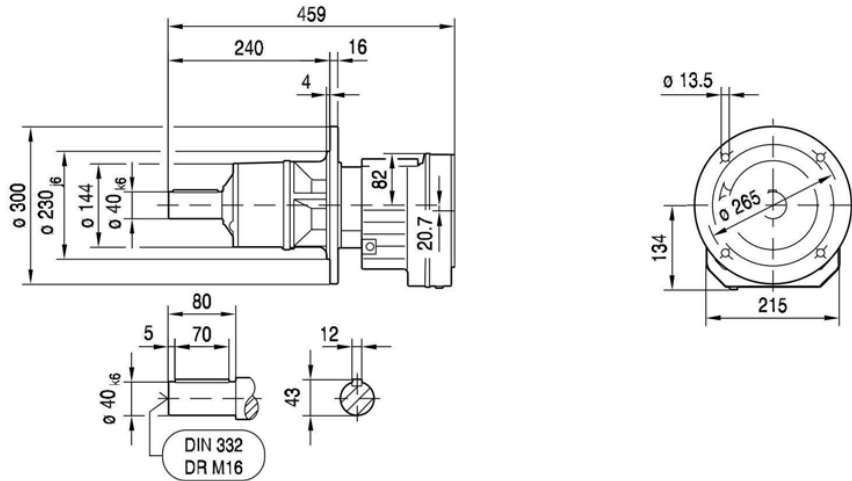


R..
R.. AQ..

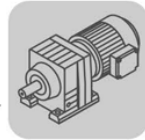
RF67..



RM67..

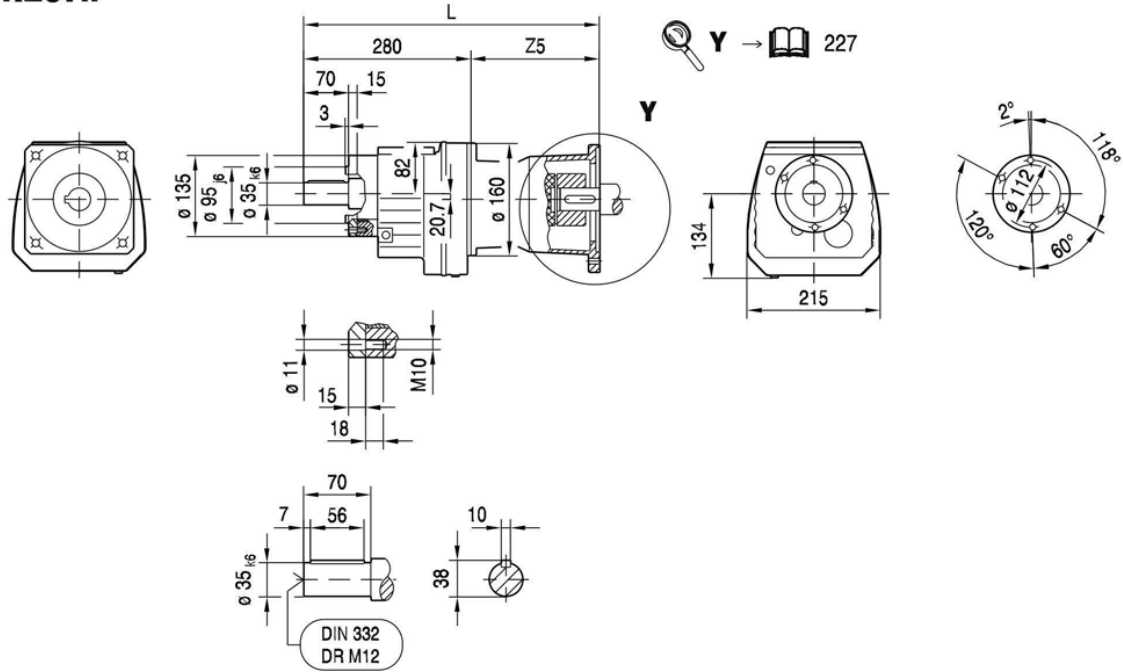


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	378	403	417	426	455	468	468	518	542
Z5	98	123	137	146	175	188	188	237.5	261.5



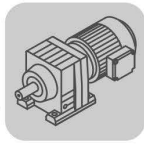
01 090 00 08

RZ67..



8

(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	378	403	417	426	455	468	468	518	542
Z5	98	123	137	146	175	188	188	237.5	261.5



R..
R.. AQ..

8.3.11 R 77 AQ.. [Nm]

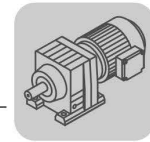
[Nm]		AQ.																							
		M _{amax} M _{apk} M _{aNotaus}																							
i		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
R77 	5.31	90	90	175	90	90	180	90	90	180	240	240	240	315	315	530	510	530	530	510	530	530	510	765	840
	5.99	101	101	197	101	101	200	101	101	200	275	275	275	355	355	595	540	595	595	540	595	595	540	810	910
	6.79	115	115	220	115	115	230	115	115	230	310	310	310	405	405	675	580	675	675	580	675	675	580	840	980
	7.74	131	131	255	131	131	260	131	131	260	355	355	355	460	460	770	610	770	770	610	770	770	610	840	1030
	8.59	146	146	280	146	146	290	146	146	290	440	440	440	515	515	850	630	840	850	630	840	850	630	840	1070
	9.64	163	163	315	163	163	325	163	163	325	500	500	500	650	650	1080	660	900	1080	660	900	1080	660	900	1120
	10.88	184	184	355	184	184	365	184	184	365	565	565	565	690	735	1170	690	900	1170	690	900	1170	690	900	1170
	12.33	205	205	405	205	205	415	205	205	415	645	645	645	720	840	1220	720	900	1220	720	900	1220	720	900	1220
	14.05	235	235	460	235	235	475	235	235	475	715	715	715	740	900	1250	740	900	1250	740	900	1250	740	900	1250
	15.60	265	265	510	265	265	530	265	265	530	780	810	810	780	900	1320	780	900	1320	780	900	1320	780	900	1320
	17.82	300	300	585	300	300	605	300	300	605	820	860	860	780	900	1320	780	900	1320	780	900	1320	780	900	1320
	18.80	315	315	620	315	315	635	315	315	635	820	900	980	820	900	1390	820	900	1390	820	900	1390	820	900	1390
	21.43	360	360	705	360	360	725	360	360	725	820	900	1070	820	900	1390	820	900	1390	820	900	1390			
	23.37	395	395	770	395	395	790	395	395	790	820	900	1070	820	900	1390	820	900	1390	820	900	1390			
	25.23	425	425	830	425	425	850	425	425	850	780	900	1160	780	900	1320	780	900	1320	780	900	1320	780	900	1320
29.00	490	490	950	490	490	980	490	490	980	820	900	1330	820	900	1390	820	900	1390	820	900	1390	820	900	1390	
33.47	565	565	1100	565	565	1130	565	565	1130	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	
36.83	625	625	1210	625	625	1250	625	625	1250	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	
43.26	735	735	1390	735	735	1390	735	735	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	
45.81	775	775	1390	775	775	1390	775	775	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	
52.07	820	880	1390	820	880	1390	820	880	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390				
57.68	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390				
65.77	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	
77.24	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	
81.80	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	
92.97	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390				
102.99	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390				
121.42	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390	820	900	1390				
138.39	820	900	1390	820	900	1390	820	900	1390	820	900	1390													
145.67	820	900	1390	820	900	1390	820	900	1390	820	900	1390													
166.59	820	900	1390	820	900	1390	820	900	1390	820	900	1390													
195.24	820	900	1390	820	900	1390	820	900	1390	820	900	1390													


m [kg]		AQ.							
s		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
R77		34	35	35	35	40	40	40	49
R77		36	36	37	37	41	41	41	50



RF: + 5.7 kg / RM: + 30.7 kg

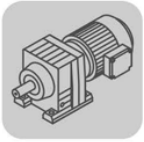
		AQ.							
		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1	5.1	10.0	10.0	25.0
c _{TA}	[Nm/']	0.25	0.25	0.25	0.625	0.625	1.0	1.0	2.08

R77 n _e = 1400		M _{amax}	M _{apk}	M _{aNotaus}	n _{ak}	J _G 10 ⁻⁴	R	F _{Ramax}	RM	R	F _{Rapk}	RM
i		[Nm]	[Nm]	[Nm]	[1/min]	[kgm ²]	[N]	RF [N]	[N]	[N]	RF [N]	[N]
R77 	5.31	510	765	867	264	7.7	3990	3990	12700	10400	10400	13000
	5.99	540	810	918	234	6.4	3990	3990	13000	10000	10000	13000
	6.79	580	840	986	206	5.2	3850	3850	13000	9730	9730	13000
	7.74	610	840	1037	181	4.2	3940	3940	13000	9730	9730	13000
	8.59	630	840	1071	175	3.7	4110	4110	13000	9730	9730	13000
	9.64	630	900	1071	145	6.6	6300	6300	13000	9110	9110	13000
	10.88	660	900	1122	129	5.5	6490	6490	13000	9110	9110	13000
	12.33	690	900	1173	114	4.5	6740	6740	13000	9110	9110	13000
	14.05	720	900	1224	100	3.7	7050	7050	13000	9110	9110	13000
	15.60	740	900	1258	90	3.3	7390	7390	13000	9110	9110	13000
	17.82	780	900	1326	79	2.7	7620	7620	13000	9110	9110	13000
	18.80	780	900	1326	74	2.5	7980	7980	13000	9110	9110	13000
	21.43	820	900	1394	65	2.0	8250	8250	13000	9110	9110	13000
	23.37	820	900	1394	64	1.7	8870	8870	13000	9110	9110	13000



R77 n _e = 1400		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	R [N]	F _{Ramax} RF [N]	RM [N]	R [N]	F _{Rapk} RF [N]	RM [N]
i												
R77  3	25.23	780	900	1326	59	3.7	10100	10100	13000	9110	9110	13000
	29.00	820	900	1394	52	3.0	9920	9920	13000	9110	9110	13000
	33.47	820	900	1394	51	2.2	9920	9920	13000	9110	9110	13000
	36.83	820	900	1394	52	1.9	9920	9920	13000	9110	9110	13000
	43.26	820	900	1394	53	1.6	9920	9920	13000	9110	9110	13000
	45.81	820	900	1394	52	1.4	9920	9920	13000	9110	9110	13000
	52.07	820	900	1394	54	1.1	9920	9920	13000	9110	9110	13000
	57.68	820	900	1394	54	0.97	9920	9920	13000	9110	9110	13000
	65.77	820	900	1394	38	1.6	9920	9920	13000	9110	9110	13000
	77.24	820	900	1394	38	1.3	9920	9920	13000	9110	9110	13000
	81.80	820	900	1394	38	1.2	9920	9920	13000	9110	9110	13000
	92.97	820	900	1394	39	0.99	9920	9920	13000	9110	9110	13000
	102.99	820	900	1394	38	0.86	9920	9920	13000	9110	9110	13000
	121.42	820	900	1394	39	0.68	9920	9920	13000	9110	9110	13000
	138.39	820	900	1394	38	0.46	9920	9920	13000	9110	9110	13000
	145.67	820	900	1394	38	0.42	9920	9920	13000	9110	9110	13000
166.59	820	900	1394	38	0.34	9920	9920	13000	9110	9110	13000	
195.24	820	900	1394	36	0.27	9920	9920	13000	9110	9110	13000	

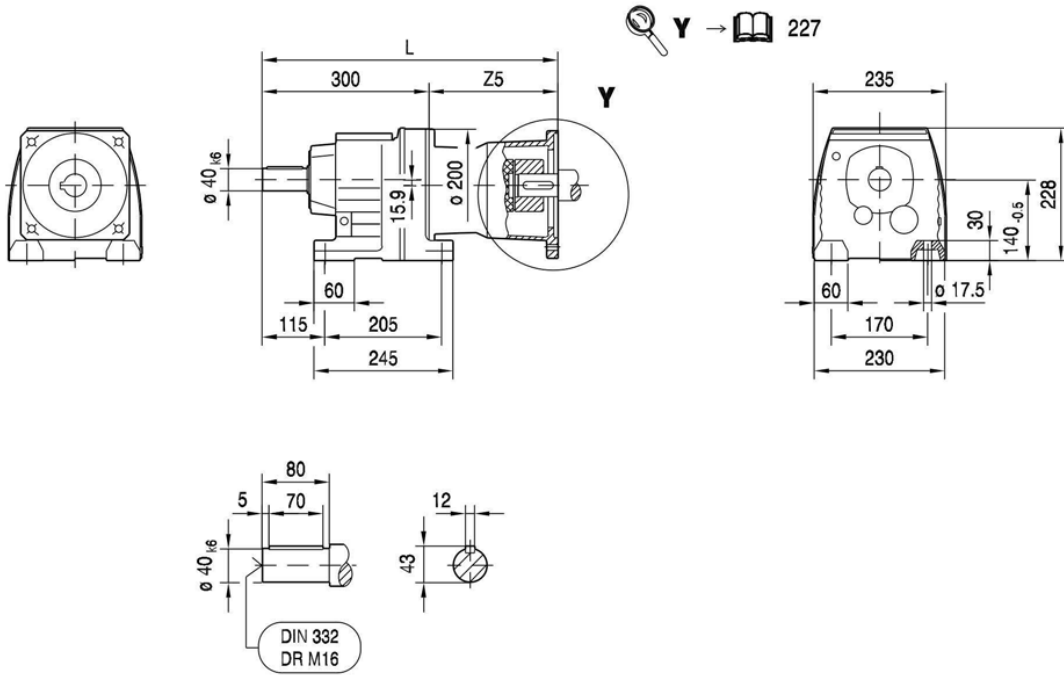
AQ.		n _{epk} [1/min]	η [%]	R [Nm/']	c _{TG} RF [Nm/']	RM [Nm/']	φ /R [']
i							
R77  2	5.31	4500	97	42	42	46	8
	5.99	4500	97	42	42	46	8
	6.79	4500	97	42	42	46	8
	7.74	4500	97	42	42	46	8
	8.59	4500	97	42	42	46	7
	9.64	4500	97	51	51	58	7
	10.88	4500	97	51	51	58	7
	12.33	4500	97	51	51	58	6
	14.05	4500	97	51	51	58	6
	15.60	4500	97	51	51	58	6
	17.82	4500	97	51	51	58	6
	18.80	4500	97	51	51	58	6
	21.43	4500	97	51	51	58	6
	23.37	4500	97	51	51	58	6
R77  3	25.23	4500	96	53	53	61	7
	29.00	4500	96	53	53	61	7
	33.47	4500	96	53	53	61	7
	36.83	4500	95	53	53	61	7
	43.26	4500	95	53	53	61	7
	45.81	4500	95	53	53	61	7
	52.07	4500	95	53	53	61	7
	57.68	4500	95	53	53	61	7
	65.77	4500	95	53	53	61	7
	77.24	4500	95	53	53	61	7
	81.80	4500	95	53	53	61	6
	92.97	4500	95	53	53	61	6
	102.99	4500	95	53	53	61	6
	121.42	4500	94	53	53	61	6
	138.39	4500	94	53	53	61	6
	145.67	4500	94	53	53	61	6
166.59	4500	94	53	53	61	6	
195.24	4500	93	53	53	61	6	



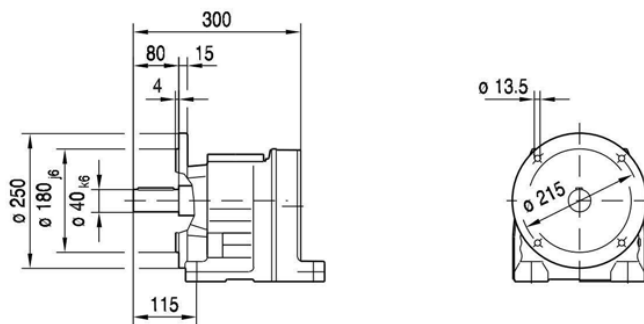
8.3.12 R 77 AQ.. [mm]

01 091 00 08^L

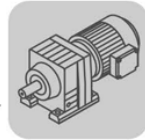
R77..



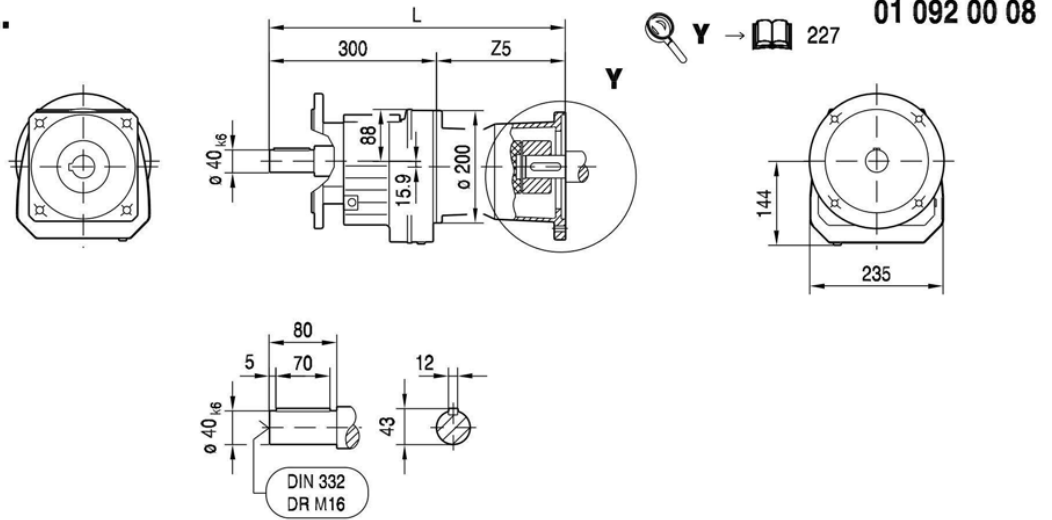
R77F..



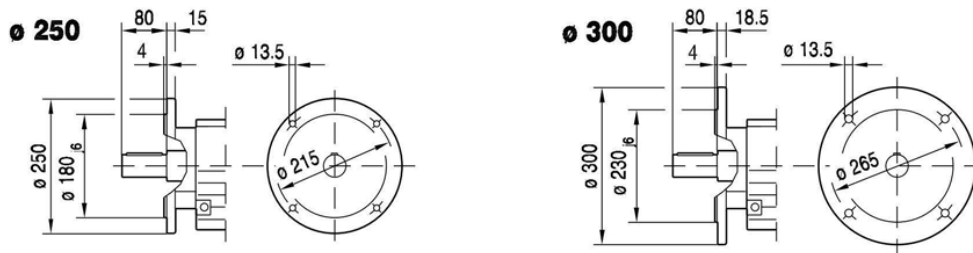
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	392	416	430	439	467	480	480	526	550
Z5	92	116	130	139	167	180	180	225.5	249.5



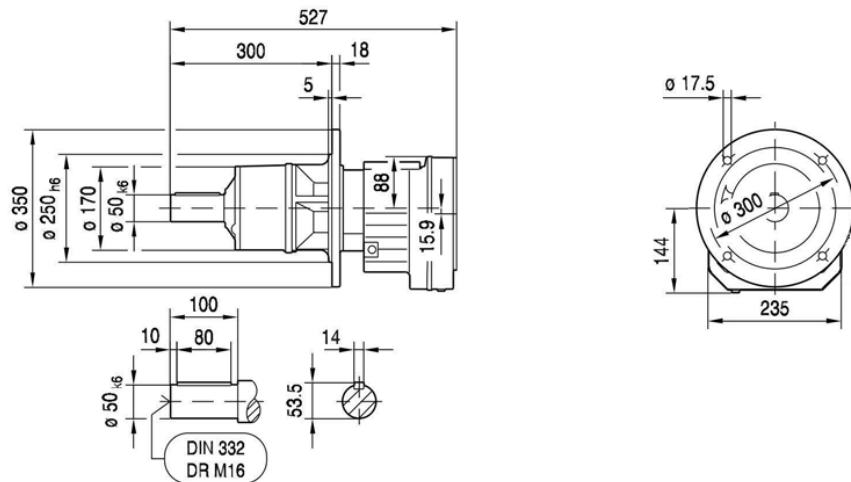
RF77..



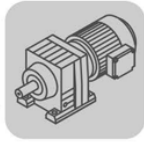
8



RM77..

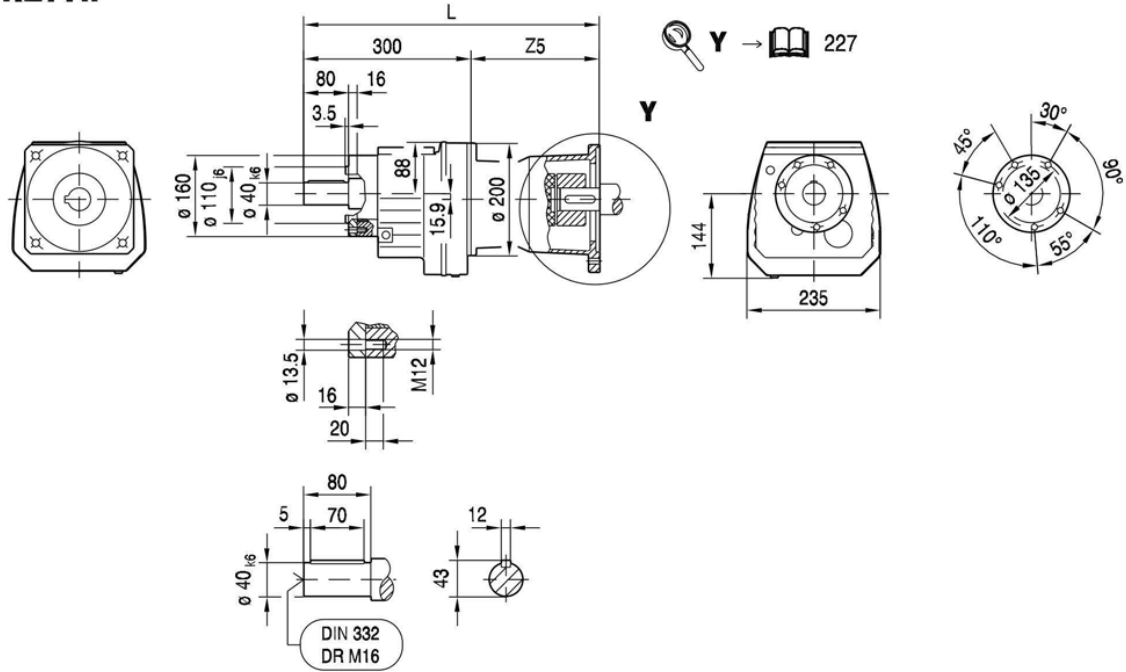


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	392	416	430	439	467	480	480	526	550
Z5	92	116	130	139	167	180	180	225.5	249.5

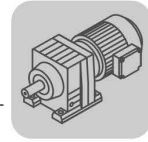


01 093 00 08


RZ77..





(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	392	416	430	439	467	480	480	526	550
Z5	92	116	130	139	167	180	180	225.5	249.5



8.3.13 R 87 AQ.. [Nm]

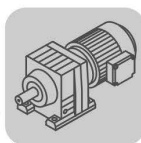
[Nm]	AQ.																							
	M _{amax} M _{apk} M _{aNotaus}																							
i	100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3					
R87 	5.30	90	90	180	90	90	180	240	240	240	315	315	530	530	530	530	530	530	840	840	840			
	6.39	108	108	215	108	108	215	290	290	290	380	380	635	635	635	635	635	635	1020	1020	1020			
	7.13	121	121	240	121	121	240	325	325	325	425	425	710	710	710	710	710	710	1070	1140	1140			
	8.22	139	139	275	139	139	275	375	375	375	490	490	820	820	820	820	820	820	1160	1270	1310			
	9.14	155	155	310	155	155	310	420	420	420	545	545	910	910	910	910	910	910	1210	1270	1460			
	9.90	168	168	335	168	168	335	455	455	455	590	590	990	990	990	990	990	990	1180	1550	1580			
	11.93	200	200	405	200	200	405	545	545	545	715	715	1190	1190	1190	1190	1190	1190	1230	1550	1900			
	13.33	225	225	450	225	225	450	610	610	610	795	795	1330	1280	1330	1330	1280	1330	1280	1550	2130			
	15.35	260	260	520	260	260	520	705	705	705	920	920	1530	1340	1530	1530	1340	1530	1340	1550	2270			
	17.08	290	290	580	290	290	580	785	785	785	1020	1020	1700	1390	1550	1700	1390	1550	1700	1390	1550	2360		
	19.10	320	320	645	320	320	645	870	870	870	1140	1140	1910	1440	1550	1910	1440	1550	1910	1440	1550	2440		
	21.51	365	365	730	365	365	730	980	980	980	1290	1290	2150	1500	1550	2150	1500	1550	2150	1500	1550	2550		
	23.40	395	395	795	395	395	795	1070	1070	1070	1400	1400	2340	1550	1550	2340	1550	1550	2340	1550	1550	2630		
	27.84	470	470	940	470	470	940	1280	1280	1280	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630		
	31.40	530	530	1060	530	530	1060	1440	1440	1440	1550	1550	2630	1550	1550	2630	1550	1550	2630					
	34.40	580	580	1160	580	580	1160	1500	1550	1580	1500	1550	2550	1500	1550	2550	1500	1550	2550					
	27.88	470	470	940	470	470	940	1280	1280	1280	1500	1550	2550	1500	1550	2550	1500	1550	2550	1500	1550	2550		
	32.66	555	555	1110	555	555	1110	1500	1500	1500	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630		
36.84	625	625	1250	625	625	1250	1550	1550	1690	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
41.74	705	705	1410	705	705	1410	1550	1550	1920	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
47.58	800	800	1610	800	800	1610	1550	1550	2180	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
52.82	890	890	1790	890	890	1790	1550	1550	2420	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
60.35	1020	1020	2050	1020	1020	2050	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
63.68	1080	1080	2160	1080	1080	2160	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
72.57	1230	1230	2460	1230	1230	2460	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
81.92	1390	1390	2630	1390	1390	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
93.38	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
103.65	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
118.43	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
124.97	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
142.41	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
155.34	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
181.77	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
205.71	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
216.54	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			
246.54	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630	1550	1550	2630			



8


m [kg]		AQ.						
s		100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
R87		61	61	61	67	67	67	76
R87		62	63	63	68	68	68	77

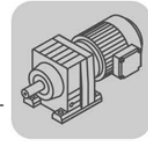
RF: + 7.1 kg / RM: + 36.8 kg


		AQ.						
J _A 10 ⁻⁴	[kgm ²]	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3
c _{TA}	[Nm/°]	0.25	0.25	0.625	0.625	1.0	1.0	2.08

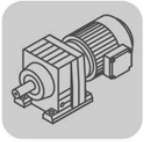


R87 $n_e = 1400$		M_{amax} [Nm]	M_{apk} [Nm]	$M_{aNotaus}$ [Nm]	n_{ak} [1/min]	$J_G \cdot 10^{-4}$ [kgm ²]	F_{Ramax}			F_{Rapk}		
i							R [N]	RF [N]	RM [N]	R [N]	RF [N]	RM [N]
R87  2	5.30	910	1270	1547	264	25	8980	8980	16600	18600	18600	20000
	6.39	1020	1270	1734	219	19	9450	9450	17700	18600	18600	20000
	7.13	1070	1270	1819	196	16	9780	9780	18300	18600	18600	20000
	8.22	1160	1270	1972	170	13	10200	10200	19200	18600	18600	20000
	9.14	1210	1270	2057	153	11	10500	10500	19800	18600	18600	20000
	9.90	1180	1550	2006	141	21	10400	10400	20000	16900	16900	20000
	11.93	1230	1550	2091	117	17	11200	11200	20000	16900	16900	20000
	13.33	1280	1550	2176	105	14	11600	11600	20000	16900	16900	20000
	15.35	1340	1550	2278	91	12	12100	12100	20000	16900	16900	20000
	17.08	1390	1550	2363	82	10	12600	12600	19900	16900	16900	20000
	19.10	1440	1550	2448	79	8.7	13000	13000	19900	16900	16900	20000
	21.51	1500	1550	2550	70	7.3	13600	13600	19800	16900	16900	20000
	23.40	1550	1550	2635	60	6.6	13900	13900	19700	16900	16900	20000
	27.84	1550	1550	2635	61	5.1	15000	15000	19700	16900	16900	20000
	31.40	1550	1550	2635	61	4.1	7820	7820	19700	16900	16900	20000
34.40	1500	1550	2550	70	3.6	9480	9480	19800	16900	16900	20000	
R87  3	27.88	1500	1550	2550	54	9.8	15100	15100	19800	16900	16900	20000
	32.66	1550	1550	2635	49	7.6	16000	16000	19700	16900	16900	20000
	36.84	1550	1550	2635	49	6.2	16800	16800	19700	16900	16900	20000
	41.74	1550	1550	2635	50	5.1	16900	16900	19700	16900	16900	20000
	47.58	1550	1550	2635	50	4.1	16900	16900	19700	16900	16900	20000
	52.82	1550	1550	2635	51	3.6	13500	13500	19700	16900	16900	20000
	60.35	1550	1550	2635	51	2.9	15200	15200	19700	16900	16900	20000
	63.68	1550	1550	2635	50	2.7	15800	15800	19700	16900	16900	20000
	72.57	1550	1550	2635	51	2.2	16900	16900	19700	16900	16900	20000
	81.92	1550	1550	2635	51	4.0	16900	16900	19700	16900	16900	20000
	93.38	1550	1550	2635	51	3.3	16900	16900	19700	16900	16900	20000
	103.65	1550	1550	2635	52	3.0	16900	16900	19700	16900	16900	20000
	118.43	1550	1550	2635	52	2.4	16900	16900	19700	16900	16900	20000
	124.97	1550	1550	2635	52	2.3	16900	16900	19700	16900	16900	20000
	142.41	1550	1550	2635	49	1.9	16900	16900	19700	16900	16900	20000
155.34	1550	1550	2635	45	1.6	16900	16900	19700	16900	16900	20000	
181.77	1550	1550	2635	39	1.3	16900	16900	19700	16900	16900	20000	
205.71	1550	1550	2635	34	0.90	16900	16900	19700	16900	16900	20000	
216.54	1550	1550	2635	32	0.81	16900	16900	19700	16900	16900	20000	
246.54	1550	1550	2635	28	0.66	16900	16900	19700	16900	16900	20000	

AQ.		n_{epk} [1/min]	η [%]	R [Nm/']	c_{TG} RF [Nm/']	RM [Nm/']	φ /R [']
i							
R87  2	5.30	4500	97	76	76	78	7
	6.39	4500	97	76	76	78	7
	7.13	4500	97	76	76	78	7
	8.22	4500	97	76	76	78	7
	9.14	4500	97	76	76	78	6
	9.90	4500	97	93	93	96	6
	11.93	4500	97	93	93	96	6
	13.33	4500	97	93	93	96	6
	15.35	4500	97	93	93	96	6
	17.08	4500	97	93	93	96	6
	19.10	4500	97	93	93	96	6
	21.51	4500	97	93	93	96	6
	23.40	4500	97	93	93	96	6
	27.84	4500	97	93	93	96	6
	31.40	4500	97	93	93	96	5
34.40	4500	97	93	93	96	5	



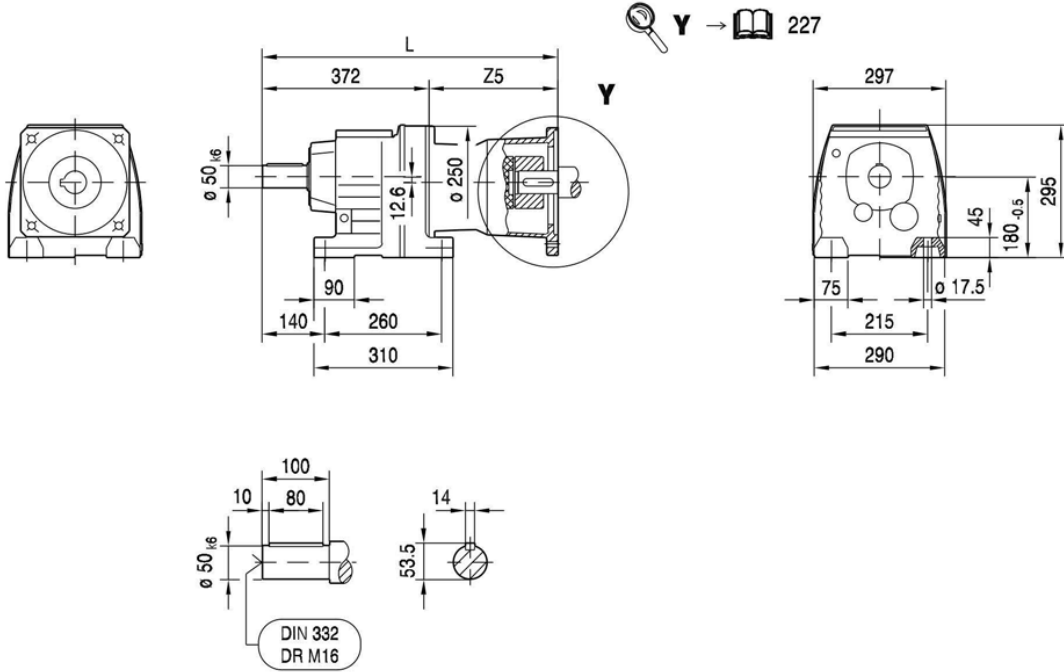
AQ.		n_{epk} [1/min]	η [%]	R [Nm/']	C_{TG} RF [Nm/']	RM [Nm/']	φ /R [']
R87  3	27.88	4500	96	97	97	99	7
	32.66	4500	96	97	97	99	7
	36.84	4500	96	97	97	99	7
	41.74	4500	96	97	97	99	7
	47.58	4500	96	97	97	99	7
	52.82	4500	96	97	97	99	6
	60.35	4500	96	97	97	99	6
	63.68	4500	96	97	97	99	6
	72.57	4500	96	97	97	99	6
	81.92	4500	95	97	97	100	6
	93.38	4500	95	97	97	100	6
	103.65	4500	95	97	97	100	6
	118.43	4500	95	97	97	100	6
	124.97	4500	95	97	97	100	6
	142.41	4500	95	97	97	100	6
	155.34	4500	94	97	97	100	6
	181.77	4500	94	97	97	100	6
	205.71	4500	94	97	97	100	6
	216.54	4500	94	97	97	100	6
	246.54	4500	93	97	97	100	6



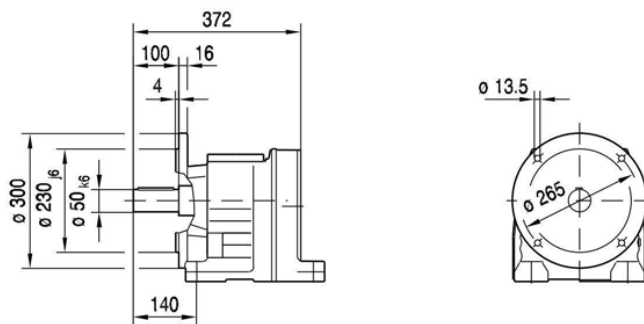
8.3.14 R 87 AQ.. [mm]

01 094 00 08^L

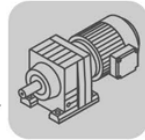
R87..



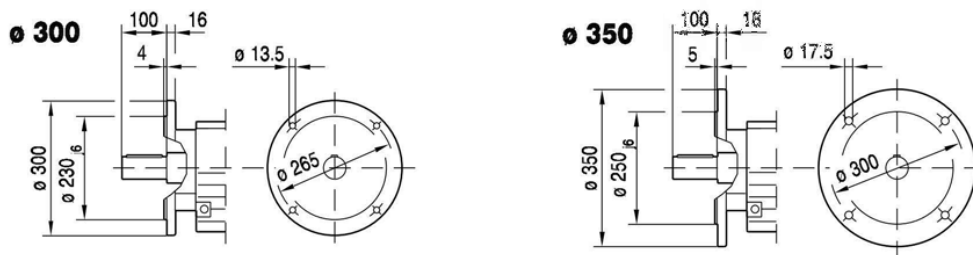
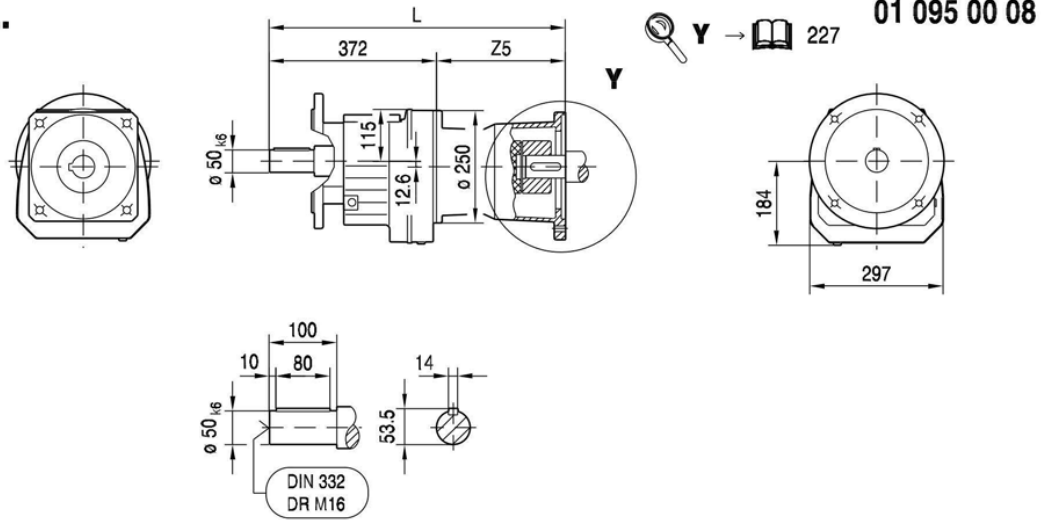
R87F..



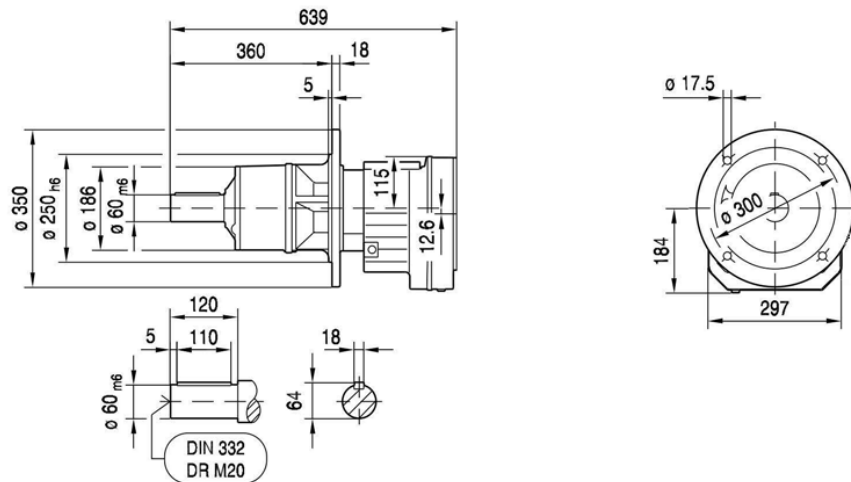
(→ 144)	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	483	497	506	534	547	547	593	617
Z5	111	125	134	162	175	175	220.5	244.5



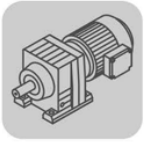
RF87..



RM87..



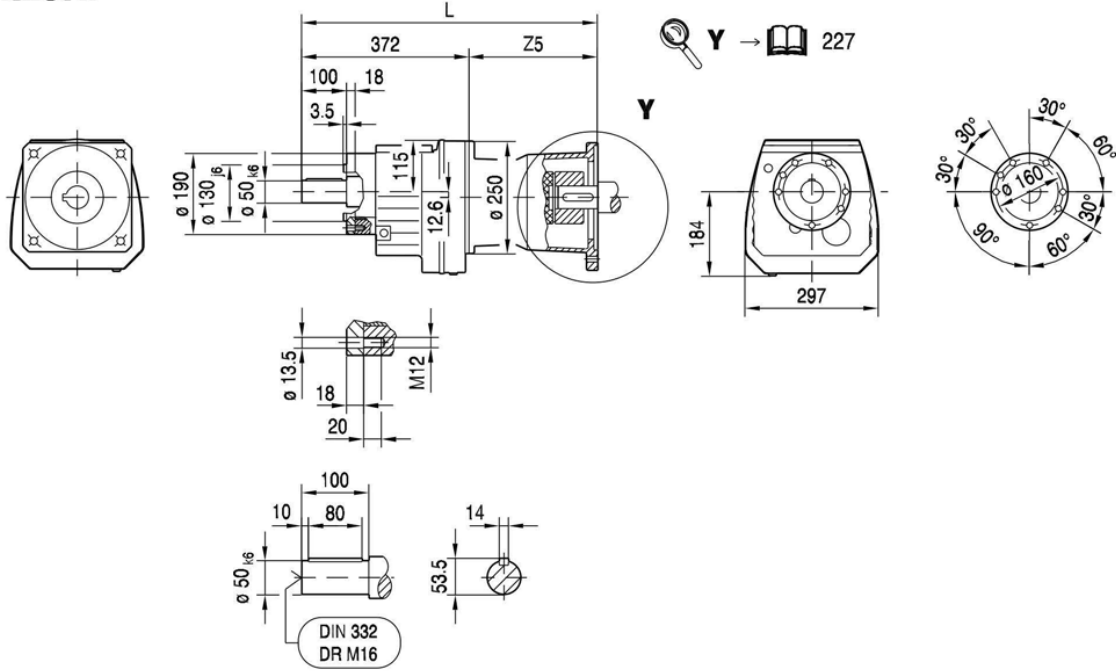
(→ 144)	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	483	497	506	534	547	547	593	617
Z5	111	125	134	162	175	175	220.5	244.5



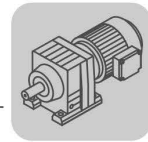
R..
R.. AQ..

01 096 00 08


RZ87..





(→ 144)	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	483	497	506	534	547	547	593	617
Z5	111	125	134	162	175	175	220.5	244.5



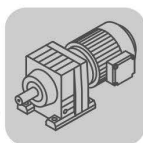
8.3.15 R 97 AQ.. [Nm]


[Nm]		AQ.											
		M _{amax} M _{apk} M _{aNotaus}											
i		140/1			140/2-4			160/1			190/1-3		
R97 	4.50	270	270	450	450	450	450	450	450	450	720	720	720
	5.20	310	310	520	520	520	520	520	520	520	830	830	830
	6.21	370	370	620	620	620	620	620	620	620	990	990	990
	7.12	425	425	710	710	710	710	710	710	710	1130	1130	1130
	8.39	500	500	830	830	830	830	830	830	830	1340	1340	1340
	9.29	555	555	920	920	920	920	920	920	920	1480	1480	1480
	10.83	645	645	1080	1080	1080	1080	1080	1080	1080	1730	1730	1730
	12.39	740	740	1230	1230	1230	1230	1230	1230	1230	1980	1980	1980
	14.62	870	870	1460	1460	1460	1460	1460	1460	1460	2300	2330	2330
	16.17	970	970	1610	1610	1610	1610	1610	1610	1610	2400	2580	2580
	18.24	1090	1090	1820	1820	1820	1820	1820	1820	1820	2500	2910	2910
	20.14	1200	1200	2010	2010	2010	2010	2010	2010	2010	2610	3090	3220
	22.37	1340	1340	2230	2230	2230	2230	2230	2230	2230	2720	3090	3570
	25.03	1500	1500	2500	2500	2500	2500	2500	2500	2500	2830	3090	4000
	27.19	1630	1630	2710	2560	2710	2710	2560	2710	2710	2560	3090	4350
	32.05	1920	1920	3200	2560	3090	3200	2560	3090	3200	2560	3090	4350
37.13	2220	2220	3710	3000	3090	3710	3000	3090	3710	3000	3090	5100	
42.78	2560	2560	4270	3000	3090	4270	3000	3090	4270	3000	3090	5100	
47.58	2850	2850	4750	3000	3090	4750	3000	3090	4750	3000	3090	5100	
53.21	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
59.92	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
65.21	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
72.17	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
83.15	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
92.48	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
103.44	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
116.48	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
126.75	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
150.78	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	
170.02	3000	3090	5100	3000	3090	5100	3000	3090	5100				
186.30	3000	3090	5100	3000	3090	5100	3000	3090	5100				
216.28	3000	3090	5100	3000	3090	5100	3000	3090	5100				
241.25													
255.71													
289.74													


8

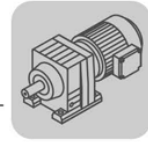
m [kg]		AQ.											
s		140/1			140/2-4			160/1			190/1-3		
R97		105			105			105			115		
R97		110			110			110			120		
RF: + 17.2 kg / RM: + 68.5 kg													


		AQ.											
		140/1			140/2-4			160/1			190/1-3		
J _A 10 ⁻⁴	[kgm ²]	5.1			10.0			10.0			25.0		
c _{TA}	[Nm/°]	0.625			1.0			1.0			2.08		

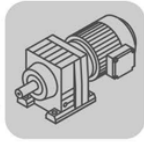


R97 $n_e = 1400$		M_{amax} [Nm]	M_{apk} [Nm]	$M_{aNotaus}$ [Nm]	n_{ak} [1/min]	$J_G \cdot 10^{-4}$ [kgm ²]	F_{Ramax}			F_{Rapk}		
i							R [N]	RF [N]	RM [N]	R [N]	RF [N]	RM [N]
R97  2	4.50	1630	2445	2771	244	80	9500	9500	17900	24400	24400	26300
	5.20	1780	2560	3026	192	65	9850	9850	18700	23800	23800	26100
	6.21	1890	2560	3213	161	51	10500	10500	19900	23800	23800	26100
	7.12	2000	2560	3400	140	41	10900	10900	20800	23800	23800	26100
	8.39	2030	2560	3451	131	33	11700	11700	22000	23800	23800	26100
	9.29	2030	2560	3451	129	28	12200	12200	22800	23800	23800	26100
	10.83	2090	3090	3553	129	46	12100	12100	23700	16000	16000	24500
	12.39	2190	3090	3723	113	37	12700	12700	24800	16000	16000	24500
	14.62	2300	3090	3910	103	30	13400	13400	26200	16000	16000	24500
	16.17	2400	3090	4080	87	26	13800	13800	26200	16000	16000	24500
	18.24	2500	3090	4250	77	22	14400	14400	26100	16000	16000	24500
	20.14	2610	3090	4437	70	19	14800	14800	26000	16000	16000	24500
	22.37	2720	3090	4624	63	16	15300	15300	25800	16000	16000	24500
	25.03	2830	3090	4811	56	14	15900	15900	25700	16000	16000	24500
27.19	2560	3090	4352	74	13	8380	8380	26000	16000	16000	24500	
32.05	2560	3090	4352	75	9.8	10600	10600	26000	16000	16000	24500	
27.58	2670	3090	4539	54	24	16900	16900	25900	16000	16000	24500	
33.25	2890	3090	4913	45	19	17900	17900	25600	16000	16000	24500	
37.13	3000	3090	5100	40	16	18600	18600	25400	16000	16000	24500	
42.78	3000	3090	5100	37	13	19800	19800	25400	16000	16000	24500	
47.58	3000	3090	5100	38	11	19800	19800	25400	16000	16000	24500	
53.21	3000	3090	5100	39	9.5	19800	19800	25400	16000	16000	24500	
59.92	3000	3090	5100	40	8.0	19800	19800	25400	16000	16000	24500	
65.21	3000	3090	5100	40	7.1	19800	19800	25400	16000	16000	24500	
72.17	3000	3090	5100	35	14	18000	18000	25400	16000	16000	24500	
83.15	3000	3090	5100	35	11	19800	19800	25400	16000	16000	24500	
92.48	3000	3090	5100	35	9.8	19800	19800	25400	16000	16000	24500	
103.44	3000	3090	5100	35	8.4	19800	19800	25400	16000	16000	24500	
116.48	3000	3090	5100	35	7.0	19800	19800	25400	16000	16000	24500	
126.75	3000	3090	5100	36	6.3	19800	19800	25400	16000	16000	24500	
150.78	3000	3090	5100	35	4.9	19800	19800	25400	16000	16000	24500	
170.02	3000	3090	5100	35	4.0	19800	19800	25400	16000	16000	24500	
186.30	3000	3090	5100	35	3.5	19800	19800	25400	16000	16000	24500	
216.28	3000	3090	5100	32	2.8	19800	19800	25400	16000	16000	24500	
241.25	3000	3090	5100	29	1.8	19800	19800	25400	16000	16000	24500	
255.71	3000	3090	5100	27	1.6	19800	19800	25400	16000	16000	24500	
289.74	3000	3090	5100	24	1.3	19800	19800	25400	16000	16000	24500	

AQ.		n_{epk} [1/min]	η [%]	R [Nm/']	C_{TG} RF [Nm/']	RM [Nm/']	φ /R [']
i							
R97  2	4.50	3597	97	127	127	112	6
	5.20	3924	97	127	127	112	6
	6.21	4378	97	127	127	112	6
	7.12	4500	97	127	127	112	6
	8.39	4500	97	127	127	112	6
	9.29	4500	97	127	127	112	6
	10.83	4500	97	155	155	132	6
	12.39	4500	97	155	155	132	6
	14.62	4500	97	155	155	132	6
	16.17	4500	97	155	155	132	6
	18.24	4500	97	155	155	132	6
	20.14	4500	97	155	155	132	5
	22.37	4500	97	155	155	132	5
	25.03	4500	97	155	155	132	5
27.19	4500	97	155	155	132	5	
32.05	4500	97	155	155	132	5	



AQ.		n_{epk} [1/min]	η [%]	R [Nm/']	C_{TG} RF [Nm/']	RM [Nm/']	φ /R [']
R97  3	i						
	27.58	4500	96	163	163	138	6
	33.25	4500	96	163	163	138	6
	37.13	4500	96	163	163	138	6
	42.78	4500	96	163	163	138	6
	47.58	4500	96	163	163	138	6
	53.21	4500	96	163	163	138	6
	59.92	4500	96	163	163	138	6
	65.21	4500	96	163	163	138	6
	72.17	4500	95	164	164	139	6
	83.15	4500	95	164	164	139	6
	92.48	4500	95	164	164	139	6
	103.44	4500	95	164	164	139	6
	116.48	4500	95	164	164	139	6
	126.75	4500	95	164	164	139	6
	150.78	4500	95	164	164	139	6
	170.02	4500	95	164	164	139	6
	186.30	4500	95	164	164	139	6
	216.28	4500	94	164	164	139	6
	241.25	4500	94	164	164	139	6
255.71	4500	94	164	164	139	6	
289.74	4500	93	164	164	139	6	



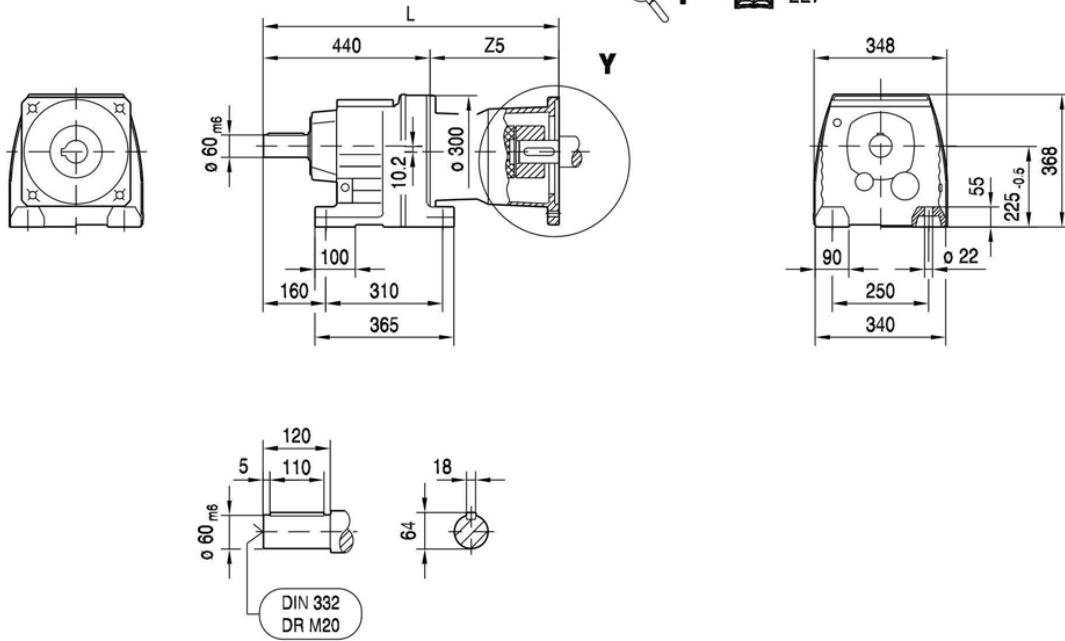
R..
R.. AQ..

8.3.16 R 97 AQ.. [mm]

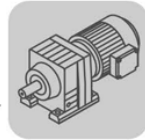
01 097 00 08^L

R97..

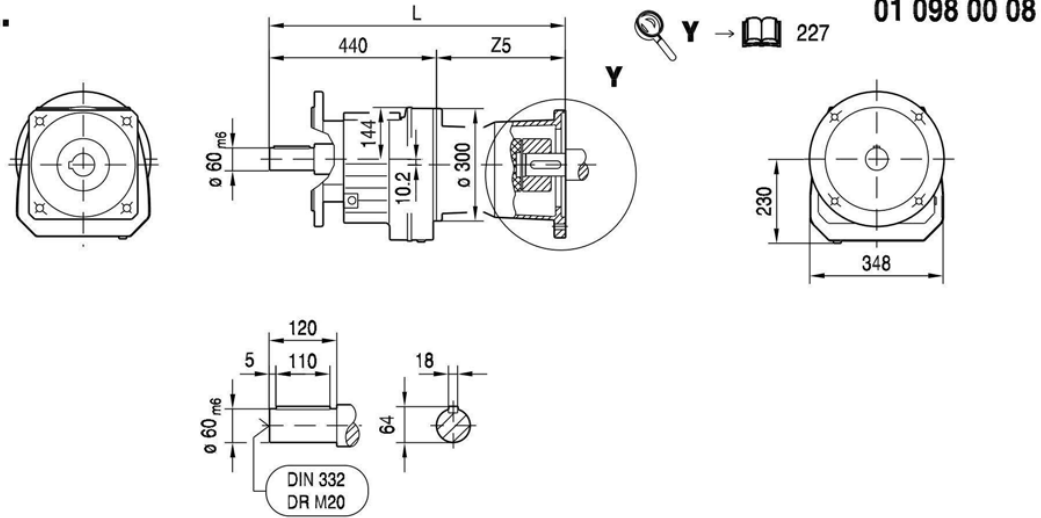
Y → 227



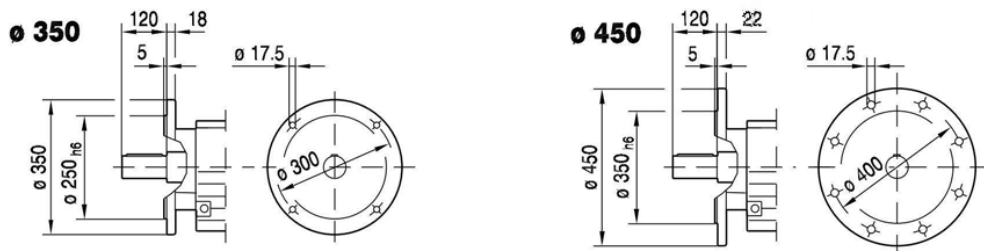
(→ 144)	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3			
L	597	610	610	656	680			
Z5	157	170	170	215.5	239.5			



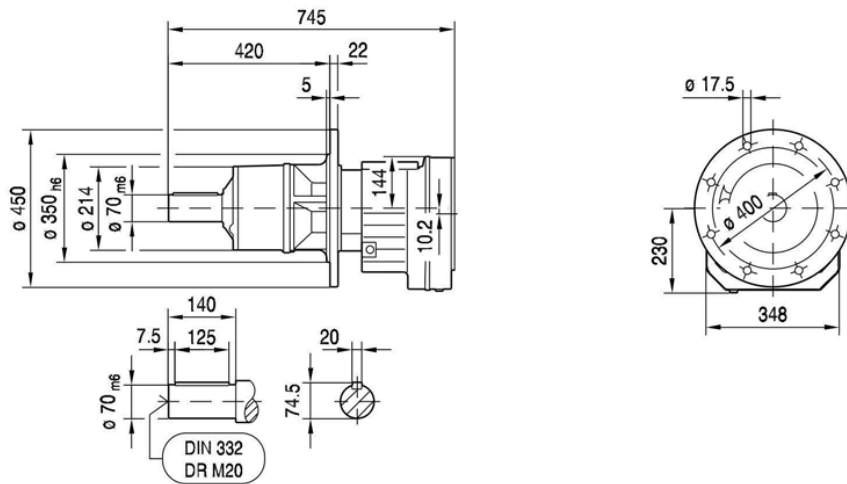
RF97..



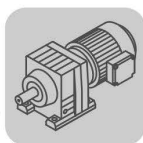
8



RM97..



(→) 144	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3			
L	597	610	610	656	680			
Z5	157	170	170	215.5	239.5			

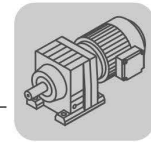




8.3.17 R 107 AQ.. [Nm]

[Nm]		AQ. M _{amax} M _{apk} M _{aNotaus}											
i		140/1			140/2-4			160/1			190/1-3		
R107 	4.92										785	785	785
	5.82	345	345	580	580	580	580	580	580	580	930	930	930
	6.66	395	395	665	665	665	665	665	665	665	1060	1060	1060
	7.86	470	470	785	785	785	785	785	785	785	1250	1250	1250
	8.56										1360	1360	1360
	10.13	605	605	1010	1010	1010	1010	1010	1010	1010	1620	1620	1620
	11.59	695	695	1150	1150	1150	1150	1150	1150	1150	1850	1850	1850
	13.66	810	810	1360	1360	1360	1360	1360	1360	1360	2180	2180	2180
	15.65	930	930	1560	1560	1560	1560	1560	1560	1560	2500	2500	2500
	18.21	1090	1090	1820	1820	1820	1820	1820	1820	1820	2910	2910	2910
	20.07	1200	1200	2000	2000	2000	2000	2000	2000	2000	3210	3210	3210
	22.62	1350	1350	2260	2260	2260	2260	2260	2260	2260	3610	3610	3610
	24.90	1490	1490	2490	2490	2490	2490	2490	2490	2490	3980	3980	3980
	27.58	1650	1650	2750	2750	2750	2750	2750	2750	2750	4300	4360	4410
	30.77	1840	1840	3070	3070	3070	3070	3070	3070	3070	4300	4360	4920
	R107 	29.49	1760	1760	2940	2940	2940	2940	2940	2940	2940	4300	4360
35.26		2110	2110	3520	3520	3520	3520	3520	3520	3520	4300	4360	5640
40.37		2420	2420	4030	4030	4030	4030	4030	4030	4030	4300	4360	6450
47.63		2850	2850	4760	4300	4360	4760	4300	4360	4760	4300	4360	7310
52.68		3160	3160	5260	4300	4360	5260	4300	4360	5260	4300	4360	7310
59.41		3560	3560	5940	4300	4360	5940	4300	4360	5940	4300	4360	7310
65.60		3930	3930	6560	4300	4360	6560	4300	4360	6560	4300	4360	7310
72.88		4300	4360	7280	4300	4360	7280	4300	4360	7280	4300	4360	7310
78.57		4300	4360	7310	4300	4360	7310	4300	4360	7310	4300	4360	7310
92.70		4300	4360	7310	4300	4360	7310	4300	4360	7310	4300	4360	7310
102.53		4300	4360	7310	4300	4360	7310	4300	4360	7310	4300	4360	7310
115.63		4300	4360	7310	4300	4360	7310	4300	4360	7310	4300	4360	7310
127.68		4300	4360	7310	4300	4360	7310	4300	4360	7310	4300	4360	7310
141.83		4300	4360	7310	4300	4360	7310	4300	4360	7310	4300	4360	7310
158.68		4300	4360	7310	4300	4360	7310	4300	4360	7310	4300	4360	7310
172.34		4300	4360	7310	4300	4360	7310	4300	4360	7310	4300	4360	7310
203.16	4300	4360	7310	4300	4360	7310	4300	4360	7310	4300	4360	7310	
229.95	4300	4360	7310	4300	4360	7310	4300	4360	7310				
251.15	4300	4360	7310	4300	4360	7310	4300	4360	7310				


m [kg]		AQ.											
s		140/1			140/2-4			160/1			190/1-3		
R107		160			160			160			170		
R107		170			170			170			175		
RF: + 6.0 kg / RM: + 94.0 kg													

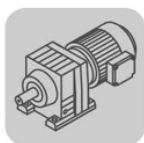
		AQ.											
		140/1			140/2-4			160/1			190/1-3		
J _A 10 ⁻⁴	[kgm ²]	5.1			10.0			10.0			25.0		
c _{TA}	[Nm/']	0.625			1.0			1.0			2.08		




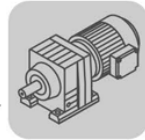
R107 n _e = 1400		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	R [N]	F _{Ramax} RF [N]	RM [N]	R [N]	F _{Rapk} RF [N]	RM [N]
i												
R107  2	4.92	2900	3820	4930	467	144	11300	11300	21100	31800	31800	33500
	5.82	2970	3820	5049	515	108	12100	12100	22400	31800	31800	33500
	6.66	2970	3820	5049	586	88	12800	12800	23500	31800	31800	33500
	7.86	2970	3820	5049	700	70	13800	13800	24900	31800	31800	33500
	8.56	4300	4360	7310	245	129	11300	11300	24400	29100	29100	32100
	10.13	4300	4360	7310	237	97	12400	12400	26000	29100	29100	32100
	11.59	4300	4360	7310	242	80	13300	13300	27300	29100	29100	32100
	13.66	4300	4360	7310	242	64	14400	14400	29000	29100	29100	32100
	15.65	4300	4360	7310	236	52	15400	15400	30500	29100	29100	32100
	18.21	4300	4360	7310	236	43	16600	16600	32300	29100	29100	32100
	20.07	4300	4360	7310	234	37	17300	17300	32800	29100	29100	32100
	22.62	4300	4360	7310	234	31	18300	18300	32800	29100	29100	32100
	24.90	4300	4360	7310	237	27	19200	19200	32800	29100	29100	32100
	27.58	4300	4360	7310	232	21	20100	20100	32800	29100	29100	32100
30.77	4300	4360	7310	227	18	21100	21100	32800	29100	29100	32100	
R107  3	29.49	4300	4360	7310	85	60	20700	20700	32800	29100	29100	32100
	35.26	4300	4360	7310	88	47	22400	22400	32800	29100	29100	32100
	40.37	4300	4360	7310	87	38	23800	23800	32800	29100	29100	32100
	47.63	4300	4360	7310	88	31	25500	25500	32800	29100	29100	32100
	52.68	4300	4360	7310	89	27	26600	26600	32800	29100	29100	32100
	59.41	4300	4360	7310	89	22	28000	28000	32800	29100	29100	32100
	65.60	4300	4360	7310	90	19	29200	29200	32800	29100	29100	32100
	72.88	4300	4360	7310	89	17	29500	29500	32800	29100	29100	32100
	78.57	4300	4360	7310	46	34	29500	29500	32800	29100	29100	32100
	92.70	4300	4360	7310	47	28	29500	29500	32800	29100	29100	32100
	102.53	4300	4360	7310	48	25	29500	29500	32800	29100	29100	32100
	115.63	4300	4360	7310	48	20	29500	29500	32800	29100	29100	32100
	127.68	4300	4360	7310	49	18	29500	29500	32800	29100	29100	32100
	141.83	4300	4360	7310	49	15	29500	29500	32800	29100	29100	32100
	158.68	4300	4360	7310	44	13	29500	29500	32800	29100	29100	32100
	172.34	4300	4360	7310	41	12	29500	29500	32800	29100	29100	32100
203.16	4300	4360	7310	34	9.2	29500	29500	32800	29100	29100	32100	
229.95	4300	4360	7310	30	5.9	29500	29500	32800	29100	29100	32100	
251.15	4300	4360	7310	28	5.1	29500	29500	32800	29100	29100	32100	

8

AQ.		n _{epk} [1/min]	η [%]	R [Nm/']	C _{TG} RF [Nm/']	RM [Nm/']	φ /R [']
i							
R107  2	4.92	3197	97	208	208	175	9
	5.82	3597	97	208	208	175	9
	6.66	3924	97	208	208	175	9
	7.86	4378	97	208	208	175	9
	8.56	4500	97	250	250	203	7
	10.13	4500	97	250	250	203	7
	11.59	4500	97	250	250	203	7
	13.66	4500	97	250	250	203	7
	15.65	4500	97	250	250	203	7
	18.21	4500	97	250	250	203	7
	20.07	4500	97	250	250	203	7
	22.62	4500	97	250	250	203	7
	24.90	4500	97	250	250	203	7
	27.58	4500	97	250	250	203	7
30.77	4500	97	250	250	203	7	



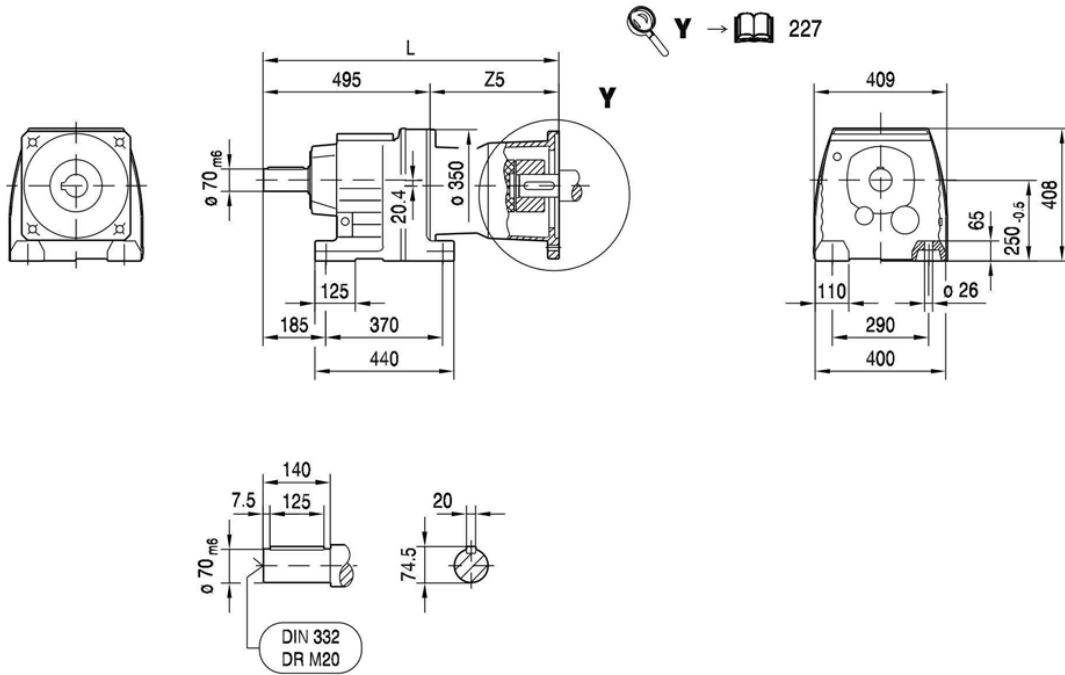
AQ.		n_{epk} [1/min]	η [%]	R [Nm/']	C_{TG} RF [Nm/']	RM [Nm/']	φ /R [']
R107  3	i						
	29.49	4500	95	259	259	210	7
	35.26	4500	96	259	259	210	7
	40.37	4500	96	259	259	210	7
	47.63	4500	96	259	259	210	7
	52.68	4500	96	259	259	210	7
	59.41	4500	96	259	259	210	7
	65.60	4500	96	259	259	210	7
	72.88	4500	96	259	259	210	7
	78.57	4500	95	260	260	210	7
	92.70	4500	95	260	260	210	7
	102.53	4500	95	260	260	210	7
	115.63	4500	95	260	260	210	7
	127.68	4500	95	260	260	210	7
	141.83	4500	95	260	260	210	7
	158.68	4500	95	260	260	210	7
	172.34	4500	95	260	260	210	7
	203.16	4500	94	260	260	210	7
	229.95	4500	94	260	260	210	7
251.15	4500	94	260	260	210	7	



8.3.18 R 107 AQ.. [mm]

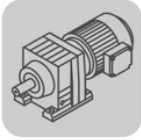
01 099 00 08^L

R107..

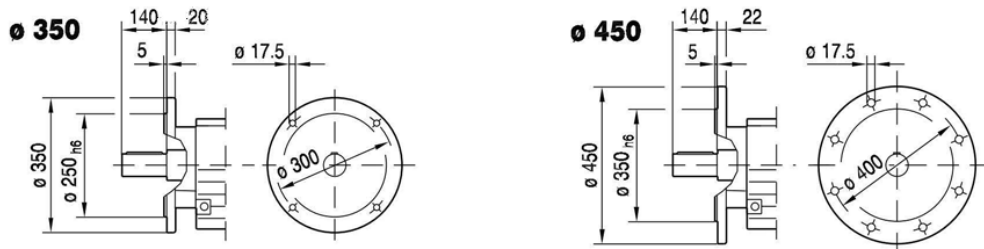
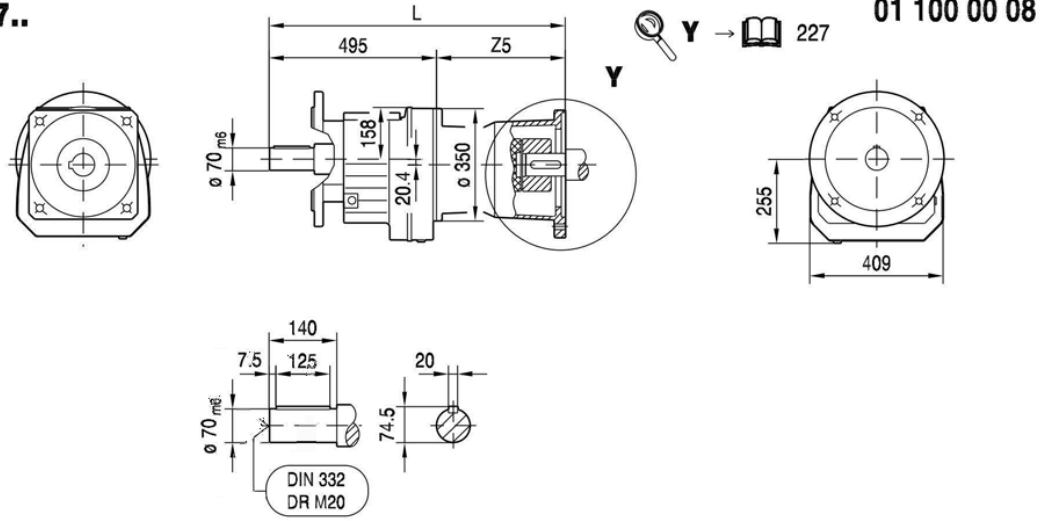


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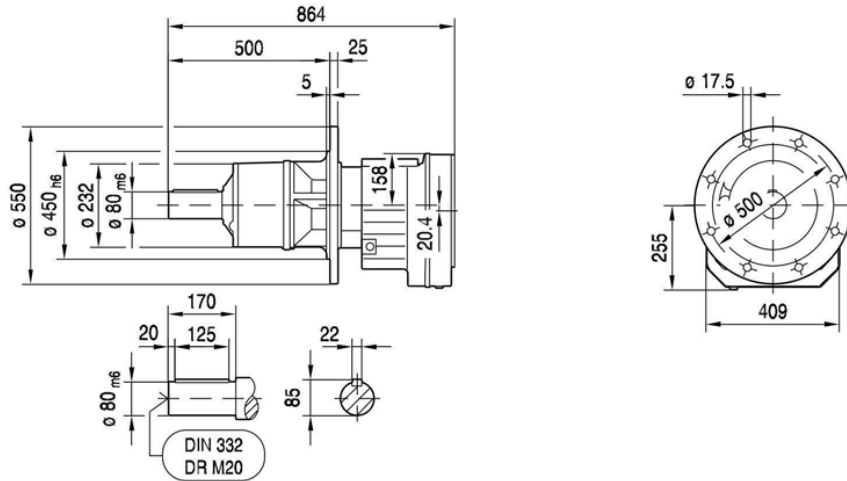
(→ 144)	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3			
L	646	659	659	705	729			
Z5	151	164	164	209.5	233.5			



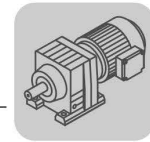
RF107..



RM107..



(→ 144)	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3			
L	646	659	659	705	729			
Z5	151	164	164	209.5	233.5			

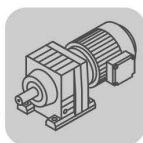



8.3.19 R 137 AQ.. [Nm]



[Nm]		AQ. M _{amax} M _{apk} M _{aNotaus}		
	i	190/1-3		
R137 	5.15			
	6.38	1020	1020	1020
	7.59	1210	1210	1210
	8.71			
	10.79	1720	1720	1720
	12.83	2050	2050	2050
	14.51	2320	2320	2320
	16.80	2680	2680	2680
	19.04	3040	3040	3040
	22.00	3520	3520	3520
R137 	24.12	3850	3850	3850
	29.57	4730	4730	4730
	27.83	4450	4450	4450
	32.91	5260	5260	5260
	37.65	6020	6020	6020
	44.39	7100	7100	7100
	50.86	8000	8130	8130
	59.17	8000	8160	9460
	65.20	8000	8160	10400
	73.49	8000	8160	11700
	80.91	8000	8160	12900
	88.70	8000	8160	13600
	103.20	8000	8160	13600
	113.72	8000	8160	13600
	128.18	8000	8160	13600
	141.12	8000	8160	13600
	156.31	8000	8160	13600
	174.40	8000	8160	13600
	188.45	8000	8160	13600
	222.60	8000	8160	13600
m [kg]		AQ. 190/1-3		
R137	s	250		
R137	s	260		
RF: + 23.3 kg / RM: + 134.4 kg				
		AQ. 190/1-3		
J _A 10 ⁻⁴	[kgm ²]	25.0		
c _{TA}	[Nm/']	2.08		

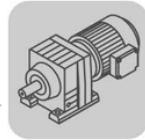
8

R137 n _e = 1400		M _{amax}	M _{apk}	M _{aNotaus}	n _{ak}	J _G 10 ⁻⁴	R	F _{Ramax}	RF	RM	R	F _{Rapk}	RF	RM
i		[Nm]	[Nm]	[Nm]	[1/min]	[kgm ²]	[N]	[N]	[N]	[N]	[N]	[N]	[N]	[N]
R137 	5.15	4600	6150	7820	1359	304	34500	34500	38800	56800	56800	56800	56600	56600
	6.38	5110	6150	8687	1097	223	35900	35900	41400	56800	56800	56800	56600	56600
	7.59	5110	6150	8687	922	173	39000	39000	44300	56800	56800	56800	56600	56600
	8.71	7840	8160	13328	161	289	27600	27600	42200	53000	53000	53000	51000	51000
	10.79	8000	8160	13600	148	213	31100	31100	45900	53000	53000	53000	51000	51000
	12.83	8000	8160	13600	140	161	34700	34700	49300	53000	53000	53000	51000	51000
	14.51	8000	8160	13600	138	136	37300	37300	51800	53000	53000	53000	51000	51000
	16.80	8000	8160	13600	131	110	40600	40600	54400	53000	53000	53000	51000	51000
	19.04	8000	8160	13600	126	91	43500	43500	54400	53000	53000	53000	51000	51000
	22.00	8000	8160	13600	123	75	47100	47100	54400	53000	53000	53000	51000	51000
24.12	8000	8160	13600	124	66	49400	49400	54400	53000	53000	53000	51000	51000	
29.57	7780	8160	13226	132	42	53900	53900	55000	53000	53000	53000	51000	51000	



R137 n _e = 1400		M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	F _{Ramax}			F _{Rapk}		
i							R [N]	RF [N]	RM [N]	R [N]	RF [N]	RM [N]
R137  3	27.83	7680	8160	13056	54	125	54100	54100	55100	53000	53000	51000
	32.91	8000	8160	13600	46	94	53400	53400	54400	53000	53000	51000
	37.65	8000	8160	13600	50	78	53400	53400	54400	53000	53000	51000
	44.39	8000	8160	13600	54	62	53400	53400	54400	53000	53000	51000
	50.86	8000	8160	13600	55	51	53400	53400	54400	53000	53000	51000
	59.17	8000	8160	13600	59	42	53400	53400	54400	53000	53000	51000
	65.20	8000	8160	13600	60	37	53400	53400	54400	53000	53000	51000
	73.49	8000	8160	13600	63	31	53400	53400	54400	53000	53000	51000
	80.91	8000	8160	13600	63	27	53400	53400	54400	53000	53000	51000
	88.70	8000	8160	13600	70	47	53400	53400	54400	53000	53000	51000
	103.20	8000	8160	13600	68	39	53400	53400	54400	53000	53000	51000
	113.72	8000	8160	13600	62	34	53400	53400	54400	53000	53000	51000
	128.18	8000	8160	13600	55	28	53400	53400	54400	53000	53000	51000
	141.12	8000	8160	13600	50	25	53400	53400	54400	53000	53000	51000
	156.31	8000	8160	13600	45	19	53400	53400	54400	53000	53000	51000
	174.40	8000	8160	13600	40	16	53400	53400	54400	53000	53000	51000
188.45	8000	8160	13600	37	15	53400	53400	54400	53000	53000	51000	
222.60	8000	8160	13600	31	12	53400	53400	54400	53000	53000	51000	

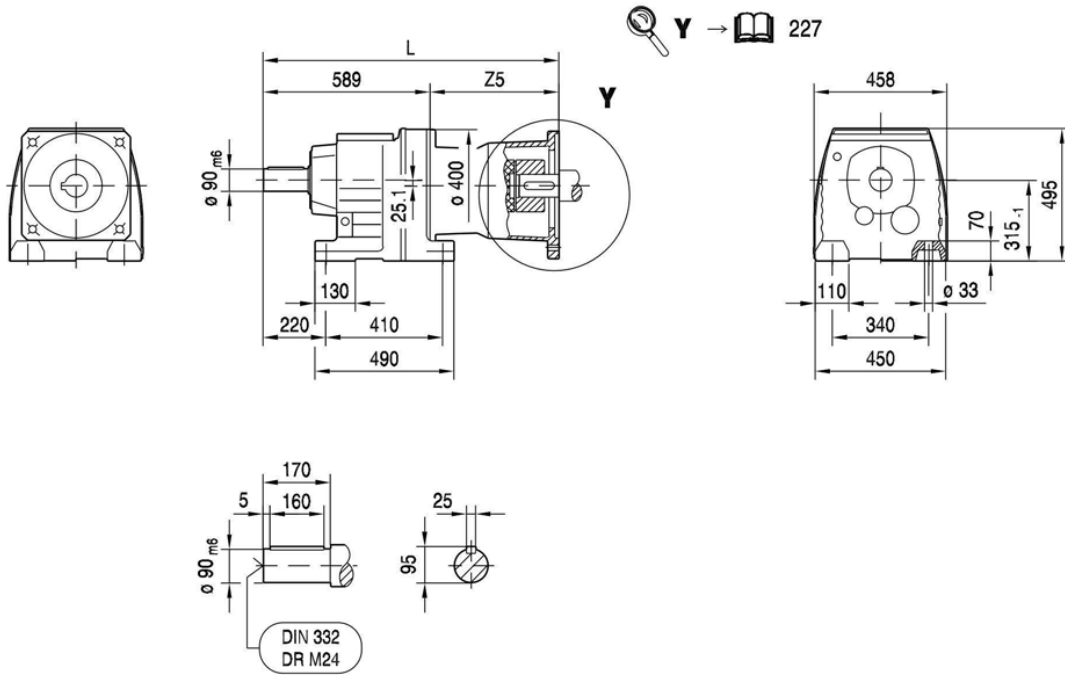
AQ.		n _{epk} [1/min]	η [%]	R [Nm/']	c _{TG} RF [Nm/']	RM [Nm/']	φ /R [']
i							
R137  2	5.15	2797	97	433	433	351	8
	6.38	3197	97	433	433	351	8
	7.59	3597	97	433	433	351	8
	8.71	2797	97	524	524	409	6
	10.79	4500	97	524	524	409	6
	12.83	4500	97	524	524	409	6
	14.51	4500	97	524	524	409	6
	16.80	4500	97	524	524	409	6
	19.04	4500	97	524	524	409	6
	22.00	4500	97	524	524	409	6
R137  3	24.12	4500	97	524	524	409	6
	29.57	4500	97	524	524	409	6
	27.83	4500	96	546	546	422	7
	32.91	4500	96	546	546	422	6
	37.65	3924	96	546	546	422	6
	44.39	4378	96	546	546	422	6
	50.86	4500	96	546	546	422	6
	59.17	4500	96	546	546	422	6
	65.20	4500	96	546	546	422	6
	73.49	4500	96	546	546	422	6
	80.91	4500	96	546	546	422	6
	88.70	4500	95	548	548	423	6
	103.20	4500	95	548	548	423	6
	113.72	4500	95	548	548	423	6
	128.18	4500	95	548	548	423	6
	141.12	4500	95	548	548	423	6
	156.31	4500	95	548	548	423	6
	174.40	4500	95	548	548	423	6
188.45	4500	95	548	548	423	6	
222.60	4500	95	548	548	423	6	



8.3.20 R 137 AQ.. [mm]

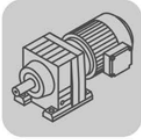
01 101 00 08^L

R137..



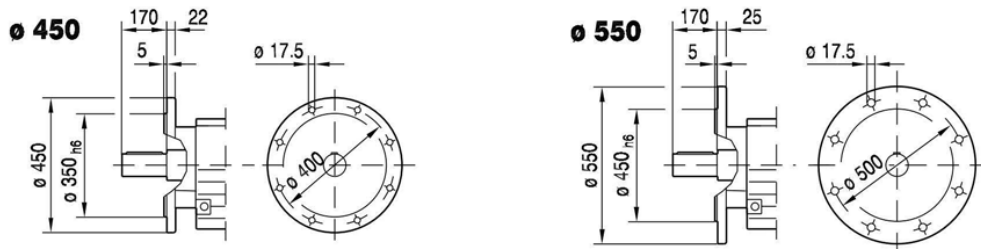
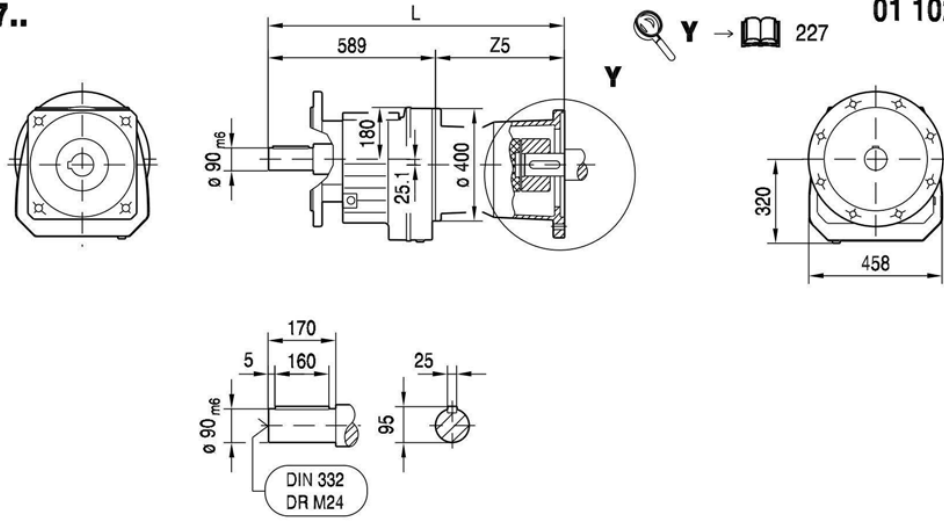
8

(→ 144)	AQ190/1-2	AQ190/3					
L	792	816					
Z5	202.5	226.5					

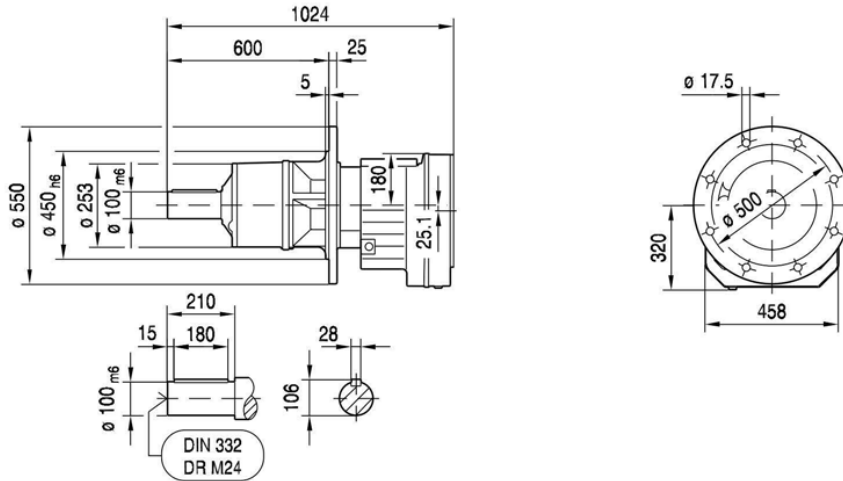


RF137..

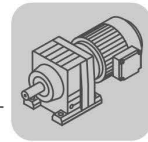
01 102 00 08^L



RM137..



(→ 144)	AQ190/1-2	AQ190/3					
L	792	816					
Z5	202.5	226.5					

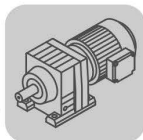



8.3.21 R 147 AQ.. [Nm]



[Nm]		AQ. M _{amax} M _{apk} M _{aNotaus}		
i		190/1-3		
R147 	5.00			
	5.89			
	7.25	1160	1160	1160
	8.26			
	9.74			
	11.99	1910	1910	1910
	13.91	2220	2220	2220
	15.64	2500	2500	2500
	18.04	2880	2880	2880
	20.44	3270	3270	3270
R147 	24.19			
	29.95	4790	4790	4790
	35.64	5700	5700	5700
	40.29	6440	6440	6440
	46.65	7460	7460	7460
	52.87	8450	8450	8450
	61.09	9770	9770	9770
	66.99	10700	10700	10700
	72.09	11500	11500	11500
	83.47	13000	13000	13300
	94.60	13000	13000	15100
	109.31	13000	13000	17400
	119.86	13000	13000	19100
	146.91	13000	13000	22100
	163.31	13000	13000	22100
m [kg]		AQ. 190/1-3		
s				
R147 		380		
R147 		395		
RF: + 8.3 kg / RM: + 175.7 kg				
		AQ. 190/1-3		
J _A 10 ⁻⁴	[kgm ²]	25.0		
c _{TA}	[Nm/°]	2.08		

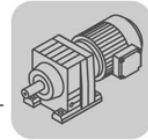
8

R147 n _e = 1400	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	F _{Ramax}			F _{Rapk}		
							R [N]	RF [N]	RM [N]	R [N]	RF [N]	RM [N]
R147 	5.00	8670	10500	14739	280	642	49300	49300	38300	67000	67000	73900
	5.89	8670	10500	14739	323	491	53200	53200	41000	67000	67000	73900
	7.25	8670	10500	14739	372	358	58400	58400	44600	67000	67000	73900
	8.26	13000	13000	22100	182	591	49900	49900	42700	62700	62700	64300
	9.74	13000	13000	22100	205	454	54400	54400	45900	62700	62700	64300
	11.99	13000	13000	22100	200	334	60400	60400	50200	62700	62700	64300
	13.91	12600	13000	21420	216	250	63400	63400	53800	62700	62700	64300
	15.64	13000	13000	22100	185	210	62700	62700	56000	62700	62700	64300
	18.04	10500	13000	17850	371	168	67000	67000	62100	62700	62700	64300
	20.44	12000	13000	20400	230	140	64600	64600	63600	62700	62700	64300



R147 $n_e = 1400$		M_{amax} [Nm]	M_{apk} [Nm]	$M_{aNotaus}$ [Nm]	n_{ak} [1/min]	$J_G \cdot 10^{-4}$ [kgm ²]	R [N]	F_{Ramax} RF [N]	RM [N]	R [N]	F_{Rapk} RF [N]	RM [N]
i												
R147  3	24.19	11900	13000	20230	62	291	64700	64700	68100	62700	62700	64300
	29.95	13000	13000	22100	50	214	62700	62700	64300	62700	62700	64300
	35.64	13000	13000	22100	51	166	62700	62700	64300	62700	62700	64300
	40.29	13000	13000	22100	52	136	62700	62700	64300	62700	62700	64300
	46.65	13000	13000	22100	54	110	62700	62700	64300	62700	62700	64300
	52.87	13000	13000	22100	55	91	62700	62700	64300	62700	62700	64300
	61.09	13000	13000	22100	57	75	62700	62700	64300	62700	62700	64300
	66.99	13000	13000	22100	58	66	62700	62700	64300	62700	62700	64300
	72.09	13000	13000	22100	40	118	62700	62700	64300	62700	62700	64300
	83.47	13000	13000	22100	41	97	62700	62700	64300	62700	62700	64300
	94.60	13000	13000	22100	41	81	62700	62700	64300	62700	62700	64300
	109.31	13000	13000	22100	41	68	62700	62700	64300	62700	62700	64300
	119.86	13000	13000	22100	42	60	62700	62700	64300	62700	62700	64300
	146.91	13000	13000	22100	42	38	62700	62700	64300	62700	62700	64300
163.31	13000	13000	22100	42	34	62700	62700	64300	62700	62700	64300	

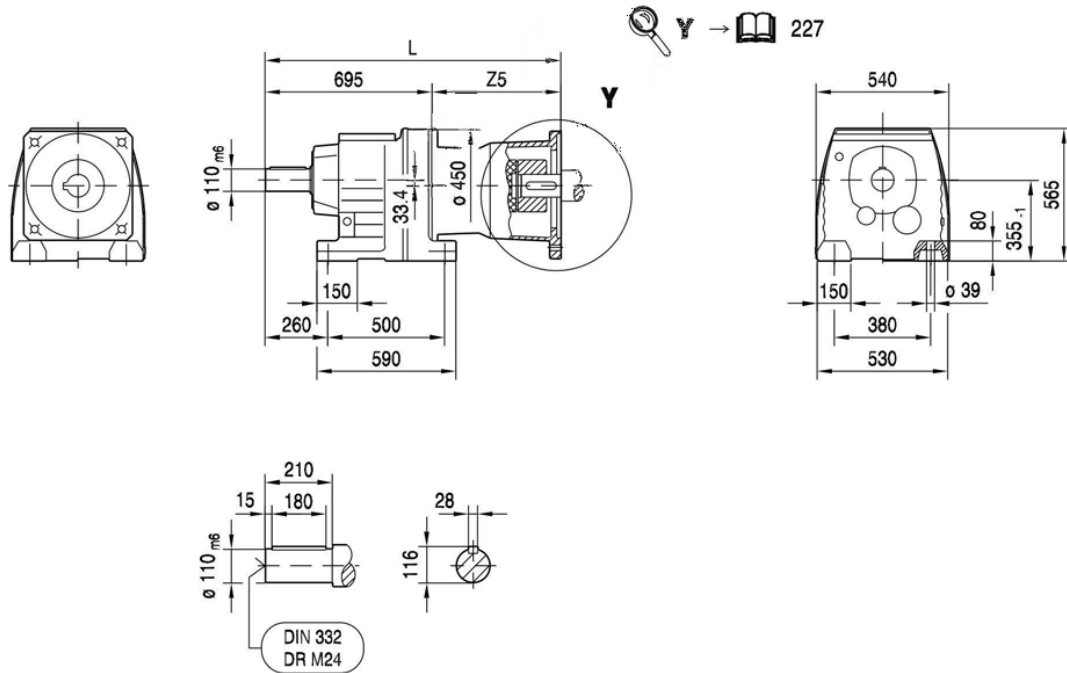
AQ.		n_{epk} [1/min]	η [%]	R [Nm/']	C_{TG} RF [Nm/']	RM [Nm/']	φ /R [']
i							
R147  2	5.00	2518	97	665	665	461	8
	5.89	2797	97	665	665	461	8
	7.25	3197	97	665	665	461	8
	8.26	2518	97	873	873	551	6
	9.74	2797	97	873	873	551	6
	11.99	4500	97	873	873	551	5
	13.91	4500	97	873	873	551	5
	15.64	4500	97	873	873	551	5
	18.04	4500	97	873	873	551	5
	20.44	4500	97	873	873	551	5
R147  3	24.19	4500	96	913	913	567	6
	29.95	4500	96	913	913	567	6
	35.64	4500	96	913	913	567	6
	40.29	4500	96	913	913	567	6
	46.65	4378	96	913	913	567	6
	52.87	4500	96	913	913	567	6
	61.09	4500	96	913	913	567	6
	66.99	4500	96	913	913	567	6
	72.09	3924	96	917	917	568	6
	83.47	4378	96	917	917	568	6
	94.60	4500	96	917	917	568	6
	109.31	4500	96	917	917	568	5
	119.86	4500	96	917	917	568	5
	146.91	4500	96	917	917	568	5
163.31	4500	96	917	917	568	5	



8.3.22 R 147 AQ.. [mm]

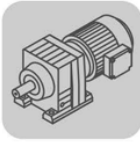
01 103 00 08^L

R147..



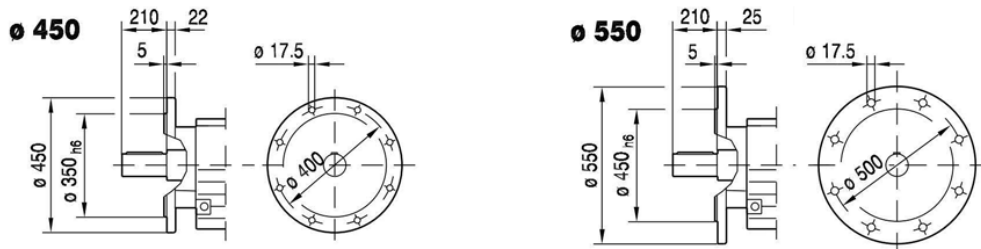
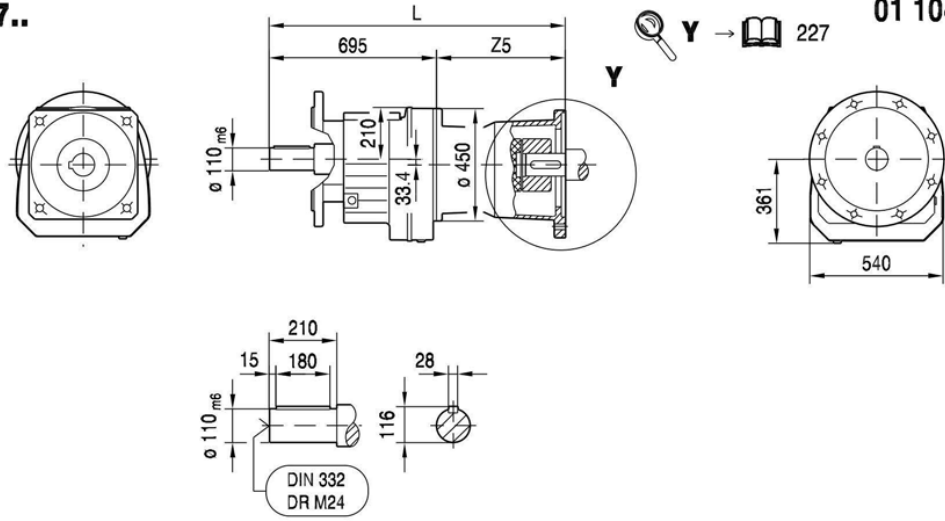
8

(→ 144)	AQ190/1-2	AQ190/3					
L	890	914					
Z5	194.5	218.5					

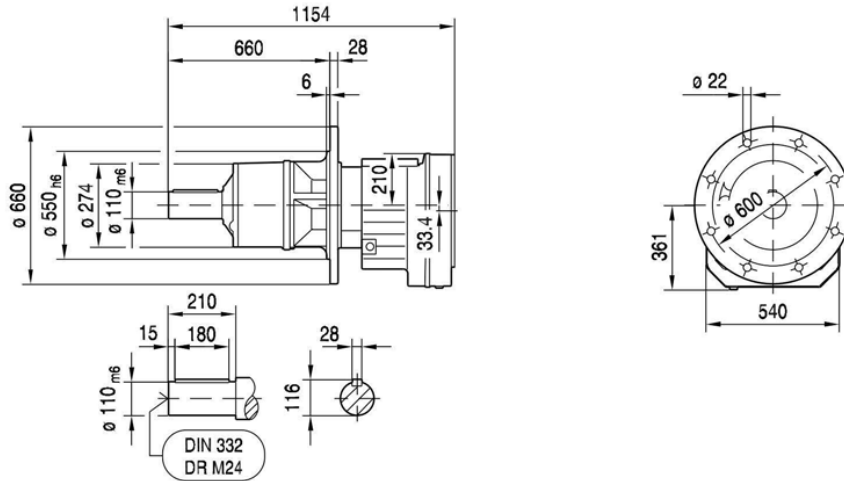


RF147..

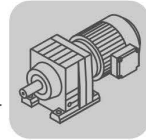
01 104 00 08^L



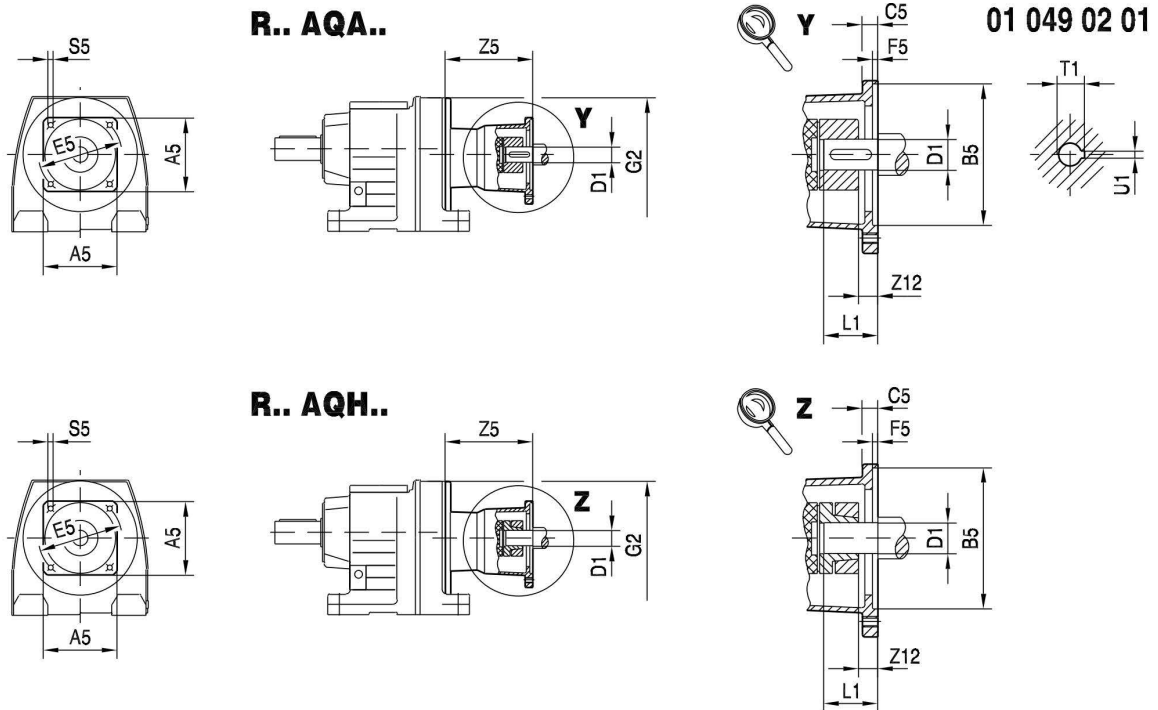
RM147..



(→ 144)	AQ190/1-2	AQ190/3						
L	890	914						
Z5	194.5	218.5						



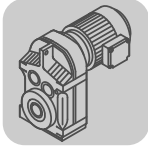
8.4 R.. AQ.. [mm]



8

	Square dimension A5	Centering \varnothing B5	Flange thickness C5	Hole circle \varnothing E5	Centering depth F5	Threaded hole S5	Z12 (AQA)	Z12 (AQH)	Coupling bore \varnothing D1	Max. motor shaft insertion depth L1	T1	U1
AQ_80/1	82	60	8	75	3.5	M5	5.5	5.5	11	23	12.8	4
AQ_80/2	82	60	8	75	3.5	M5	5.5	5.5	14	30	16.3	5
AQ_80/3	82	50	8	95	3	M6	5.5	5.5	14	30	16.3	5
AQ_100/1	100	80	10	100	4	M6	0	0	14	30	16.3	5
AQ_100/2	100	95	12	115	4	M8	0	0	14	30	16.3	5
AQ_100/3	100	80	10	100	4	M6	2	14	19	40	21.8	6
AQ_100/4	100	95	12	115	4	M8	2	14	19	40	21.8	6
AQ_115/1	115	95	12	130	5	M8	11	23	19	40	21.8	6
AQ_115/2	115	110	12	130	5	M8	11	23	19	40	21.8	6
AQ_115/3	115	110	12	130	5	M8	16	16	24	50	27.3	8
AQ_140/1	140	110	15	165	5	M10	16	16	24	50	27.3	8
AQ_140/2	140	130	15	165	5	M10	16	16	24	50	27.3	8
AQ_140/3	140	130	15	165	5	M10	22	22	32	60	35.3	10
AQ_140/4	140	130	15	165	5	M10	22	22	28	60	31.3	8
AQ_160/1	162	155	15	190	5	M10	22	22	32	60	35.3	10
AQ_190/1	190	130	16	215	5	M12	24	24	32	60	35.3	10
AQ_190/2	190	180	16	215	5	M12	24	24	32	60	35.3	10
AQ_190/3	190	180	16	215	5	M12	34	34	38	80	41.3	10

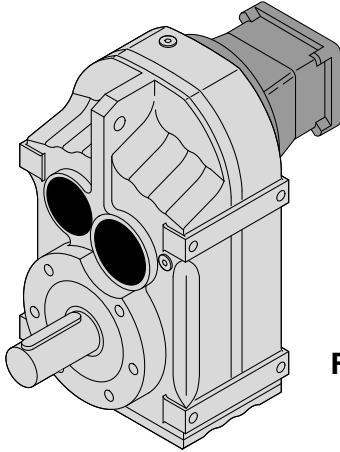
9



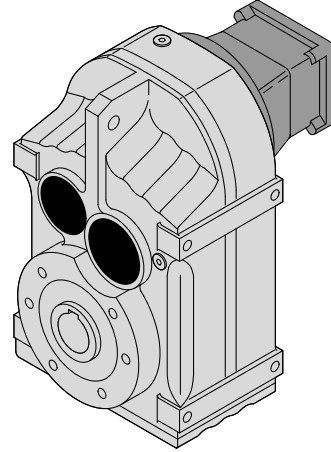
F..
F.. AQ..

9 F..

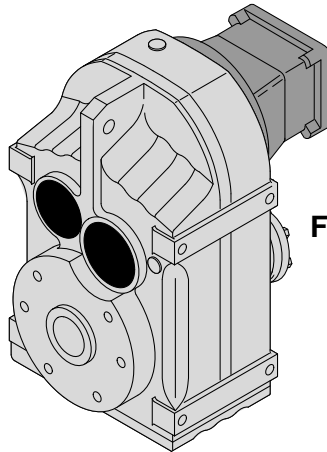
9.1 F.. AQ..



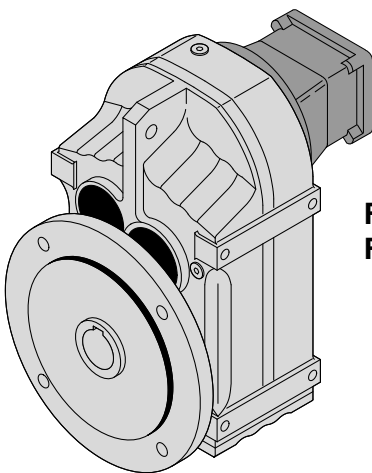
F.. AQ..



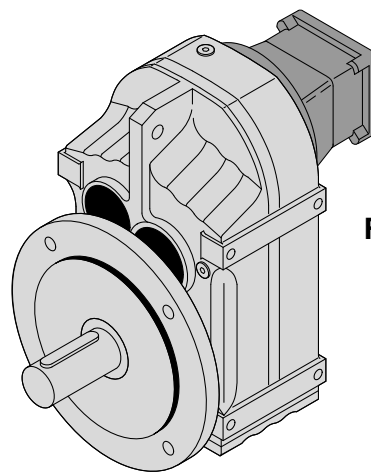
FA..B AQ..
FV..B AQ..



FH..B AQ..

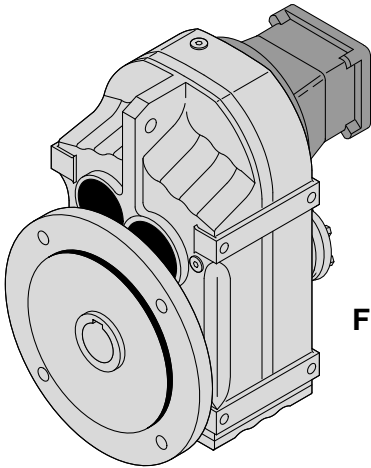
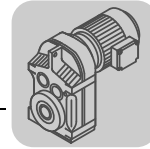


FAF.. AQ..
FVF.. AQ ..

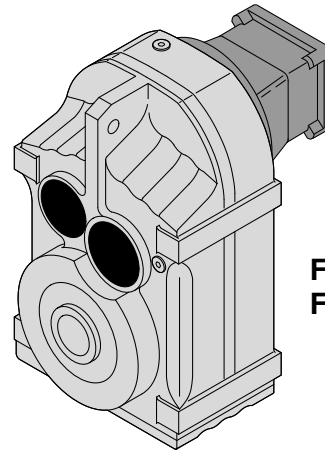


FF.. AQ..

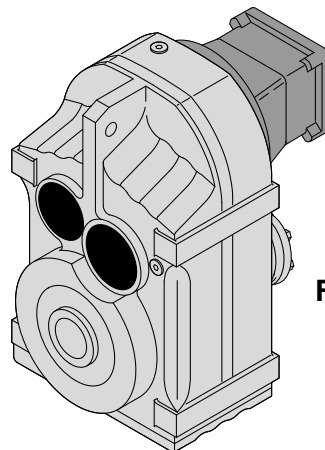
50399AXX



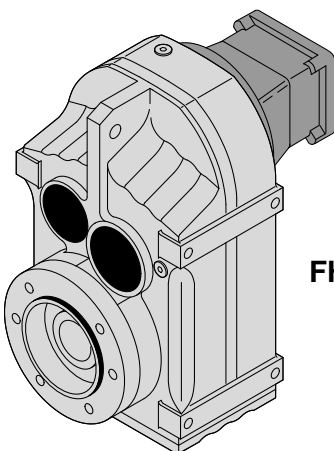
FHF .. AQ..



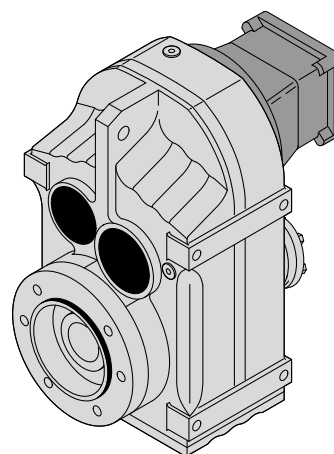
FA.. AQ..
FV.. AQ..



FH.. AQ..



FHZ.. AQ..





FAZ.. AQ..
FVZ.. AQ..



52495AXX



9.2 F.. AQ..

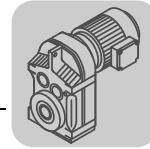
9.2.1 F 27 AQ.. [Nm]

[Nm]		AQ.											
		M _{amax} M _{apk} M _{aNotaus}											
		80/1-3			100/1-4			115/1-2			115/3		
i													
FA27 	4.16	70	70	137	70	70	141	70	70	141	87	130	148
	4.93	83	83	162	83	83	163	83	83	163	96	144	163
	5.27	89	89	170	89	89	170	89	89	170	100	150	170
	6.17	104	104	185	104	104	185	104	104	185	109	163	185
	6.91	114	117	194	114	117	194	114	117	194	114	163	194
	8.13	123	138	205	123	138	205	123	138	205	123	163	205
	9.40	130	159	220	130	159	220	130	159	220	130	163	220
	9.88	130	157	220	130	157	220	130	157	220	130	157	220
	10.55	130	157	220	130	157	220	130	157	220	130	157	220
	12.35	130	157	220	130	157	220	130	157	220	130	157	220
	13.84	130	157	220	130	157	220	130	157	220	130	157	220
	16.28	130	157	220	130	157	220	130	157	220	130	157	220
	18.84	130	157	220	130	157	220	130	157	220	130	157	220
	20.15	130	157	220	130	157	220	130	157	220	130	157	220
23.25	130	157	220	130	157	220	130	157	220	130	157	220	
27.18	130	157	220	130	157	220	130	157	220	130	157	220	
29.56	130	157	220	130	157	220	130	157	220	130	157	220	
FA27 	33.83	130	157	220	130	157	220	130	157	220	130	157	220
	38.33	130	157	220	130	157	220	130	157	220	130	157	220
	40.89	130	157	220	130	157	220	130	157	220	130	157	220
	46.78	130	157	220	130	157	220	130	157	220	130	157	220
	50.19	130	157	220	130	157	220	130	157	220	130	157	220
	56.62	130	157	220	130	157	220	130	157	220	130	157	220
	63.86	130	157	220	130	157	220	130	157	220	130	157	220
	72.37	130	157	220	130	157	220	130	157	220	130	157	220
	77.21	130	157	220	130	157	220	130	157	220	130	157	220
	88.32	130	157	220	130	157	220	130	157	220	130	157	220
	94.76	130	157	220	130	157	220	130	157	220	130	157	220
	109.90	130	157	220	130	157	220	130	157	220	130	157	220
	129.09	130	157	220	130	157	220	130	157	220	130	157	220
	140.74	130	157	220	130	157	220	130	157	220	130	157	220

m [kg]		AQ.			
s		80/1-3	100/1-4	115/1-2	115/3
FA27 		9.0	9.6	10	10
FA27 		9.2	9.9	10	10

FAF: + 0.7 kg / F: + 0.5 kg / FF: + 1.3 kg

		AQ.			
		80/1-3	100/1-4	115/1-2	115/3
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1
c _{TA}	[Nm/l]	0.25	0.25	0.25	0.625




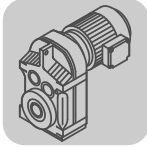
FA27 n _e = 1400	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	F _{Ramax}				F _{Rapk}			
							FA [N]	FAF [N]	F [N]	FF [N]	FA [N]	FAF [N]	F [N]	FF [N]
FA27 2	4.16	87	130	148	361	1.4	1810	1810	1380	1180	4500	4500	4500	4500
	4.93	96	144	163	304	1.0	1860	1860	1420	1210	4500	4500	4500	4500
	5.27	100	150	170	266	0.90	1880	1880	1440	1220	4500	4500	4500	4500
	6.17	109	163	185	227	0.68	1940	1940	1480	1260	4500	4500	4500	4500
	6.91	114	163	194	217	0.56	2000	2000	1530	1300	4500	4500	4500	4500
	8.13	123	163	209	172	0.42	2080	2080	1580	1350	4500	4500	4500	4500
	9.40	130	163	221	160	0.33	2170	2170	1660	1410	4500	4500	4500	4500
	9.88	130	157	221	202	0.74	2400	2400	1830	1560	4500	4500	4500	4500
	10.55	130	157	221	209	0.67	2490	2490	1900	1620	4500	4500	4500	4500
	12.35	130	157	221	211	0.51	2700	2700	2060	1760	4500	4500	4500	4500
	13.84	130	157	221	210	0.43	2860	2860	2180	1860	4500	4500	4500	4500
	16.28	130	157	221	209	0.32	3110	3110	2370	2020	4500	4500	4500	4500
	18.84	130	157	221	212	0.26	3340	3340	2550	2170	4500	4500	4500	4500
	20.15	130	157	221	213	0.23	3450	3450	2630	2240	4500	4500	4500	4500
	23.25	130	157	221	215	0.19	3690	3690	2820	2400	4500	4500	4500	4500
27.18	130	157	221	217	0.15	3970	3970	3030	2580	4500	4500	4500	4500	
29.56	130	157	221	220	0.13	4120	4120	3140	2680	4500	4500	4500	4500	
FA27 3	33.83	130	157	221	166	0.31	4380	4380	3340	2850	4500	4500	4500	4500
	38.33	130	157	221	167	0.26	4500	4500	3530	3010	4500	4500	4500	4500
	40.89	130	157	221	166	0.23	4500	4500	3640	3100	4500	4500	4500	4500
	46.78	130	157	221	150	0.18	4500	4500	3860	3290	4500	4500	4500	4500
	50.19	130	157	221	139	0.17	4500	4500	3980	3390	4500	4500	4500	4500
	56.62	130	157	221	124	0.31	4500	4500	4180	3570	4500	4500	4500	4500
	63.86	130	157	221	110	0.26	4500	4500	4400	3750	4500	4500	4500	4500
	72.37	130	157	221	97	0.22	4500	4500	4500	3960	4500	4500	4500	4500
	77.21	130	157	221	91	0.20	4500	4500	4500	4060	4500	4500	4500	4500
	88.32	130	157	221	79	0.16	4500	4500	4500	4290	4500	4500	4500	4500
	94.76	130	157	221	74	0.15	4500	4500	4500	4420	4500	4500	4500	4500
	109.90	130	157	221	64	0.12	4500	4500	4500	4500	4500	4500	4500	4500
	129.09	130	157	221	54	0.090	4500	4500	4500	4500	4500	4500	4500	4500
	140.74	130	157	221	50	0.080	4500	4500	4500	4500	4500	4500	4500	4500

9

AQ.	i	n _{epk} [1/min]	η [%]	C _{TG}			
				FA [Nm/']	FAF [Nm/']	F [Nm/']	FF [Nm/']
FA27 2	4.16	4120	97	46	46	21	18
	4.93	4500	97	46	46	21	18
	5.27	4500	97	46	46	21	18
	6.17	4500	97	46	46	21	18
	6.91	4500	97	46	46	21	18
	8.13	4500	97	46	46	21	18
	9.40	4500	97	46	46	21	18
	9.88	4500	97	83	83	26	22
	10.55	4500	97	83	83	26	22
	12.35	4500	97	83	83	26	22
	13.84	4500	97	83	83	26	22
	16.28	4500	97	83	83	26	22
	18.84	4500	97	83	83	26	22
	20.15	4500	97	83	83	26	22
	23.25	4500	97	83	83	26	22
27.18	4500	96	83	83	26	22	
29.56	4500	96	83	83	26	22	



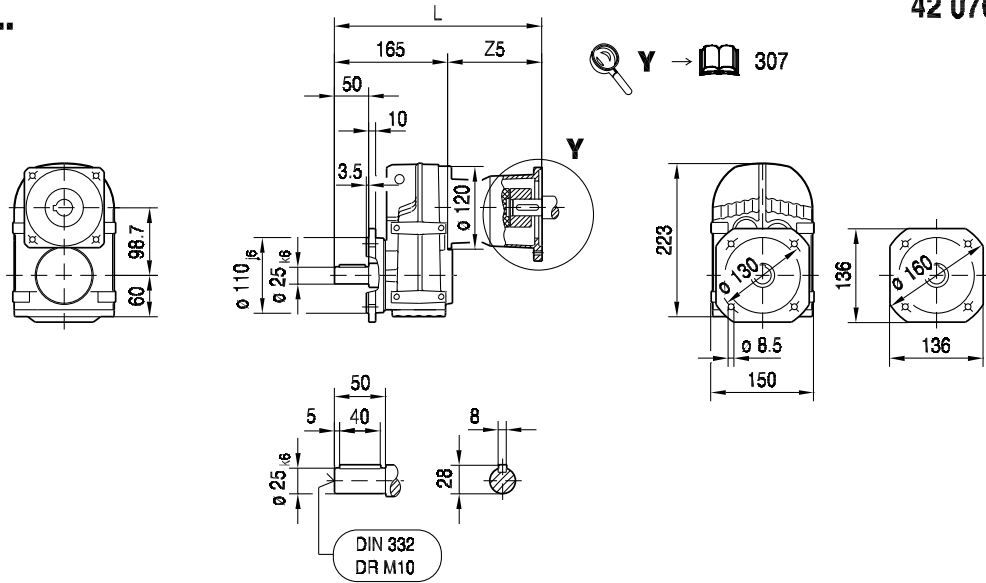
AQ.		n_{epk} [1/min]	η [%]	FA [Nm/']	FAF [Nm/']	^{CTG}	
i	F [Nm/']					FF [Nm/']	
FA27  3	33.83	4500	95	95	95	27	23
	38.33	4500	95	95	95	27	23
	40.89	4500	95	95	95	27	23
	46.78	4500	94	95	95	27	23
	50.19	4500	94	95	95	27	23
	56.62	4500	94	99	99	27	23
	63.86	4500	94	99	99	27	23
	72.37	4500	93	99	99	27	23
	77.21	4500	93	99	99	27	23
	88.32	4500	93	99	99	27	23
	94.76	4500	92	99	99	27	23
	109.90	4500	92	99	99	27	23
	129.09	4500	91	99	99	27	23
	140.74	4500	90	99	99	27	23



F..
F.. AQ..

FF27..

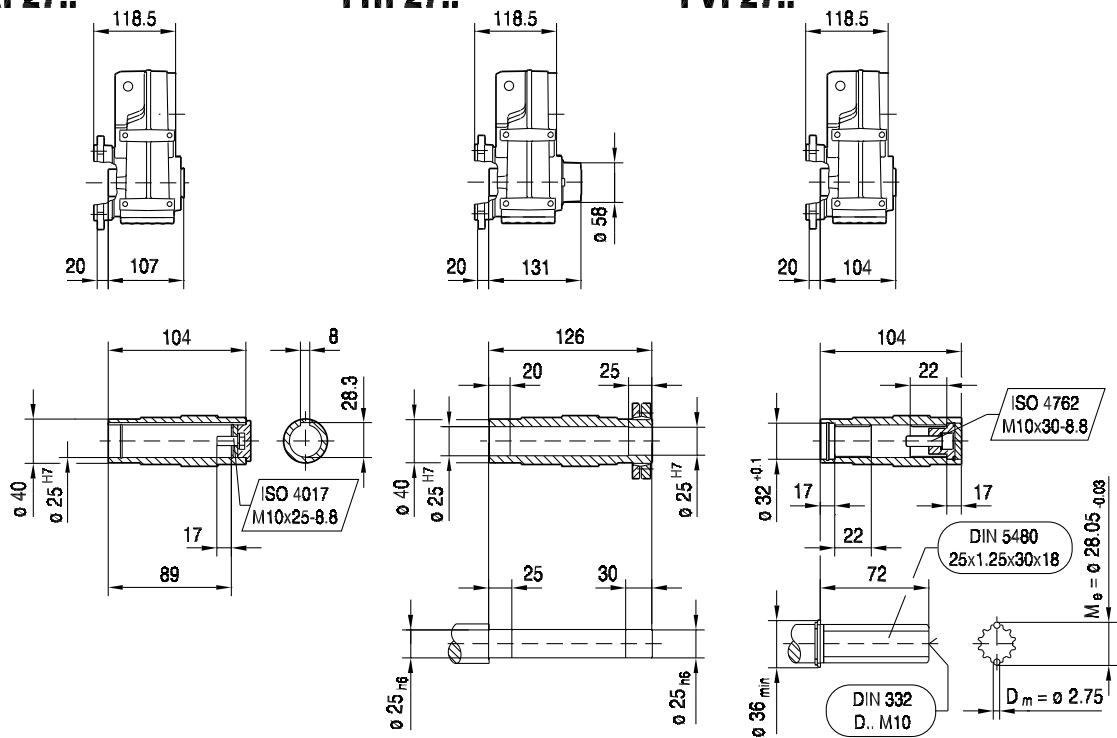
42 076 00 08^L



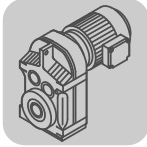
FAF27..

FHF27..

FVF27..



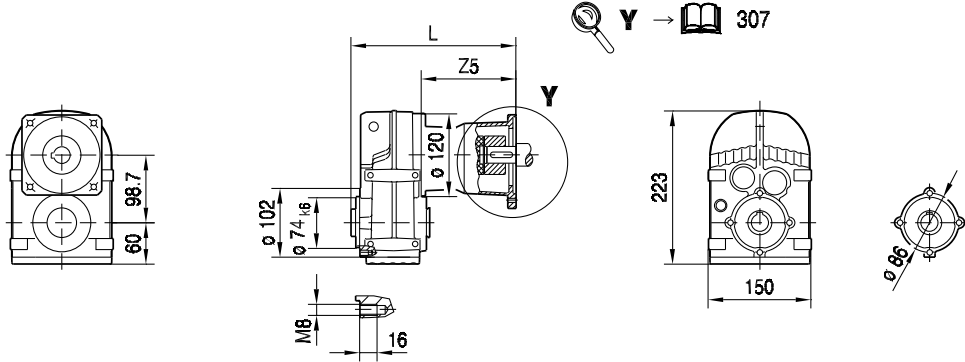
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3				
L	270	295	309	318				
Z5	104.5	129.5	143.5	152.5				



F..
F.. AQ..

FAZ27..

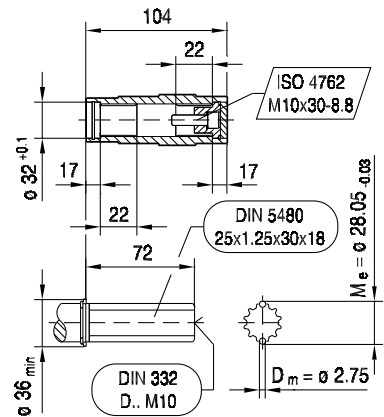
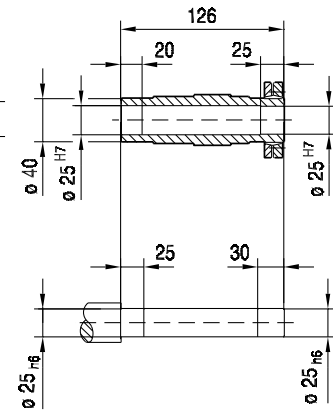
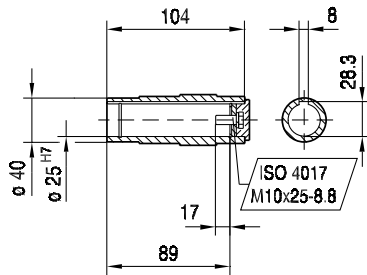
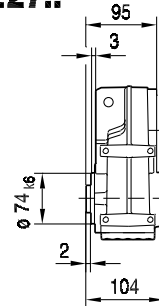
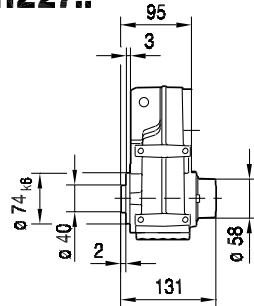
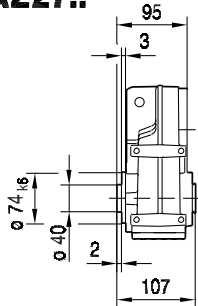
42 078 00 08



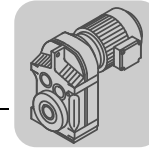
FAZ27..

FHZ27..



FVZ27..





(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3				
L	200	225	239	248				
Z5	104.5	129.5	143.5	152.5				



9.2.3 F 37 AQ.. [Nm]

[Nm]	AQ. M _{amax} M _{apk} M _{aNotaus}												
	i	80/1-3			100/1-4			115/1-2			115/3		
FA37 	3.77	64	64	124	64	64	128	64	64	128	105	157	173
	4.22	71	71	139	71	71	143	71	71	143	110	165	187
	4.90	83	83	161	83	83	166	83	83	166	120	180	200
	5.21	88	88	171	88	88	177	88	88	177	125	187	210
	6.05	102	102	199	102	102	205	102	102	205	135	188	230
	6.74	114	114	220	114	114	225	114	114	225	140	188	235
	7.44	126	126	245	126	126	245	126	126	245	145	188	245
	8.01	136	136	260	136	136	270	136	136	270	170	240	285
	8.97	152	152	295	152	152	295	152	152	295	175	240	295
	10.42	177	177	315	177	177	315	177	177	315	185	240	315
	11.08	188	188	320	188	188	320	188	188	320	190	240	320
	12.87	200	215	340	200	215	340	200	215	340	200	240	340
	14.33	200	240	340	200	240	340	200	240	340	200	240	340
	15.81	200	240	340	200	240	340	200	240	340	200	240	340
	17.03	200	240	340	200	240	340	200	240	340	200	240	340
19.27	200	240	340	200	240	340	200	240	340	200	240	340	
20.57	200	240	340	200	240	340	200	240	340	200	240	340	
23.63	200	240	340	200	240	340	200	240	340	200	240	340	
FA37 	23.88	200	240	340	200	240	340	200	240	340	200	240	340
	28.09	200	240	340	200	240	340	200	240	340	200	240	340
	31.69	200	240	340	200	240	340	200	240	340	200	240	340
	35.91	200	240	340	200	240	340	200	240	340	200	240	340
	38.31	200	240	340	200	240	340	200	240	340	200	240	340
	43.83	200	240	340	200	240	340	200	240	340	200	240	340
	47.02	200	240	340	200	240	340	200	240	340	200	240	340
	51.70	200	240	340	200	240	340	200	240	340	200	240	340
	54.54	200	240	340	200	240	340	200	240	340	200	240	340
	58.32	200	240	340	200	240	340	200	240	340	200	240	340
	66.09	200	240	340	200	240	340	200	240	340	200	240	340
	70.50	200	240	340	200	240	340	200	240	340	200	240	340
	80.65	200	240	340	200	240	340	200	240	340	200	240	340
	86.53	200	240	340	200	240	340	200	240	340	200	240	340
	100.36	200	240	340	200	240	340	200	240	340	200	240	340
117.88	200	240	340	200	240	340	200	240	340	200	240	340	
128.51	200	240	340	200	240	340	200	240	340	200	240	340	

m [kg]		AQ.			
s		80/1-3	100/1-4	115/1-2	115/3
FA37 		15	16	16	16
FA37 		15	16	17	17
FAF: + 1.5 kg / F: + 0.5 kg / FF: + 2.3 kg					


		AQ.			
		80/1-3	100/1-4	115/1-2	115/3
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1
c _{TA}	[Nm/°]	0.25	0.25	0.25	0.625



FA37 n _e = 1400	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	F _{Ramax}				F _{Rapk}			
							FA [N]	FAF [N]	F [N]	FF [N]	FA [N]	FAF [N]	F [N]	FF [N]
FA37 2	3.77	105	157	179	451	2.8	2470	2470	1970	2220	7000	7000	4810	5860
	4.22	110	165	187	427	2.3	2550	2550	2030	2300	7000	7000	4730	5820
	4.90	120	180	204	367	1.8	2630	2630	2100	2380	7000	7000	4560	5740
	5.21	125	187	213	326	1.6	2660	2660	2120	2410	7000	7000	4470	5700
	6.05	135	188	230	281	1.2	2750	2750	2190	2510	7000	7000	4460	5700
	6.74	140	188	238	267	1.0	2850	2850	2270	2600	7000	7000	4460	5700
	7.44	145	188	247	242	0.83	2940	2940	2350	2680	7000	7000	4460	5700
	8.01	170	240	289	200	1.5	2960	2960	2360	2710	7000	7000	3610	4100
	8.97	175	240	298	190	1.3	3080	3080	2460	2820	7000	7000	3610	4100
	10.42	185	240	315	163	1.0	3230	3230	2580	2960	7000	7000	3610	4100
	11.08	190	240	323	144	0.94	3290	3290	2620	3020	7000	7000	3610	4100
	12.87	200	240	340	124	0.74	3450	3450	2750	3170	7000	7000	3610	4100
	14.33	200	240	340	126	0.63	3650	3650	2910	3330	7000	7000	3610	4100
	15.81	200	240	340	127	0.52	3840	3840	3070	3490	7000	7000	3610	4100
	17.03	200	240	340	129	0.48	3990	3990	3180	3610	7000	7000	3610	4100
	19.27	200	240	340	130	0.40	4250	4250	3390	3820	7000	7000	3610	4100
	20.57	200	240	340	131	0.36	4390	4390	3500	3940	7000	7000	3610	4100
	23.63	200	240	340	135	0.29	4690	4690	3740	4190	7000	7000	3610	4100
	23.88	200	240	340	96	0.60	4720	4720	3760	4210	7000	7000	3610	4100
	28.09	200	240	340	96	0.45	5090	5090	4060	4520	7000	7000	3610	4100
31.69	200	240	340	95	0.35	5380	5380	4290	4760	7000	7000	3610	4100	
35.91	200	240	340	97	0.29	5700	5700	4290	5020	7000	7000	3610	4100	
38.31	200	240	340	97	0.26	5870	5870	4290	5160	7000	7000	3610	4100	
43.83	200	240	340	96	0.21	6240	6240	4290	5460	7000	7000	3610	4100	
47.02	200	240	340	96	0.19	6430	6430	4290	5620	7000	7000	3610	4100	
51.70	200	240	340	95	0.34	6710	6710	4290	5670	7000	7000	3610	4100	
54.54	200	240	340	97	0.15	6860	6860	4290	5670	7000	7000	3610	4100	
58.32	200	240	340	96	0.27	7000	7000	4290	5670	7000	7000	3610	4100	
66.09	200	240	340	95	0.23	7000	7000	4290	5670	7000	7000	3610	4100	
70.50	200	240	340	95	0.21	7000	7000	4290	5670	7000	7000	3610	4100	
80.65	200	240	340	87	0.17	7000	7000	4290	5670	7000	7000	3610	4100	
86.53	200	240	340	81	0.15	7000	7000	4290	5670	7000	7000	3610	4100	
100.36	200	240	340	70	0.12	7000	7000	4290	5670	7000	7000	3610	4100	
117.88	200	240	340	59	0.10	7000	7000	4290	5670	7000	7000	3610	4100	
128.51	200	240	340	54	0.080	7000	7000	4290	5670	7000	7000	3610	4100	

AQ.	i	n _{epk} [1/min]	η [%]	FA [Nm/']	FAF [Nm/']	c _{TG}		φ /R [°]
						F [Nm/']	FF [Nm/']	
FA37 2	3.77	4500	97	41	41	20	15	12
	4.22	4500	97	41	41	20	15	11
	4.90	4500	97	41	41	20	15	11
	5.21	4500	97	41	41	20	15	10
	6.05	4500	97	41	41	20	15	10
	6.74	4500	97	41	41	20	15	10
	7.44	4500	97	41	41	20	15	10
	8.01	4500	97	84	84	26	19	7
	8.97	4500	97	84	84	26	19	7
	10.42	4500	97	84	84	26	19	7
	11.08	4500	97	84	84	26	19	7
	12.87	4500	97	84	84	26	19	7
	14.33	4500	97	84	84	26	19	7
	15.81	4500	97	84	84	26	19	6
	17.03	4500	97	84	84	26	19	6
	19.27	4500	97	84	84	26	19	6
	20.57	4500	97	84	84	26	19	6
23.63	4500	97	84	84	26	19	6	



AQ.	i	n _{epk} [1/min]	η [%]	c _{TG}				φ /R [°]
				FA [Nm/°]	FAF [Nm/°]	F [Nm/°]	FF [Nm/°]	
FA37  3	23.88	4500	96	94	94	27	19	8
	28.09	4500	96	94	94	27	19	8
	31.69	4500	96	94	94	27	19	8
	35.91	4500	95	94	94	27	19	8
	38.31	4500	95	94	94	27	19	8
	43.83	4500	95	94	94	27	19	8
	47.02	4500	95	94	94	27	19	8
	51.70	4500	95	97	97	27	19	7
	54.54	4500	95	94	94	27	19	8
	58.32	4500	95	97	97	27	19	7
	66.09	4500	95	97	97	27	19	7
	70.50	4500	94	97	97	27	19	7
	80.65	4500	94	97	97	27	19	7
	86.53	4500	94	97	97	27	19	7
	100.36	4500	94	97	97	27	19	7
	117.88	4500	93	97	97	27	19	7
128.51	4500	93	97	97	27	19	7	

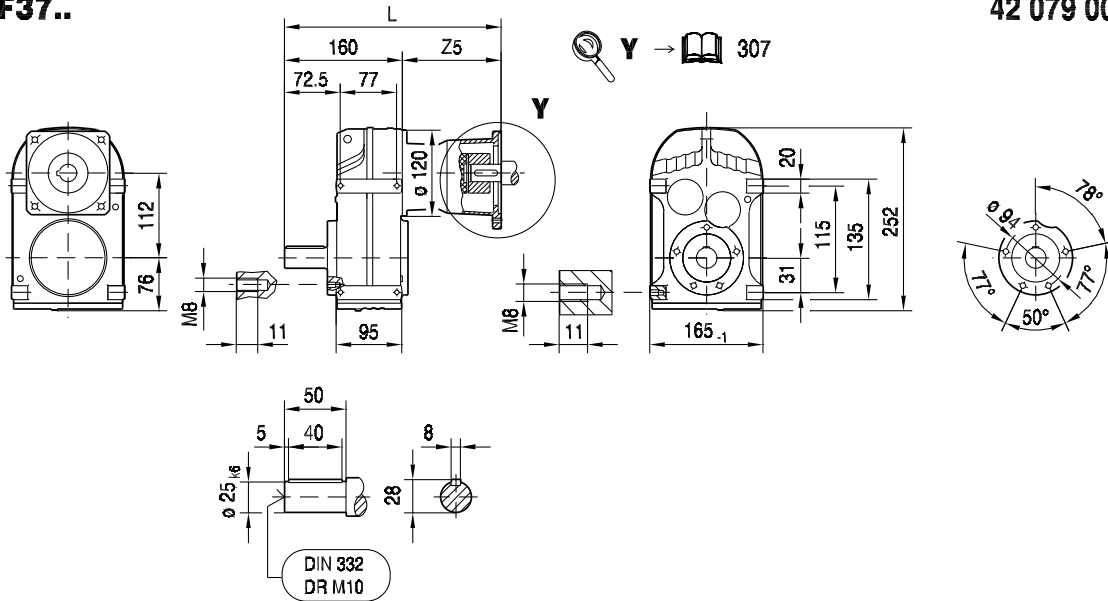


F..
F.. AQ..

9.2.4 F 37 AQ.. [mm]

F37..

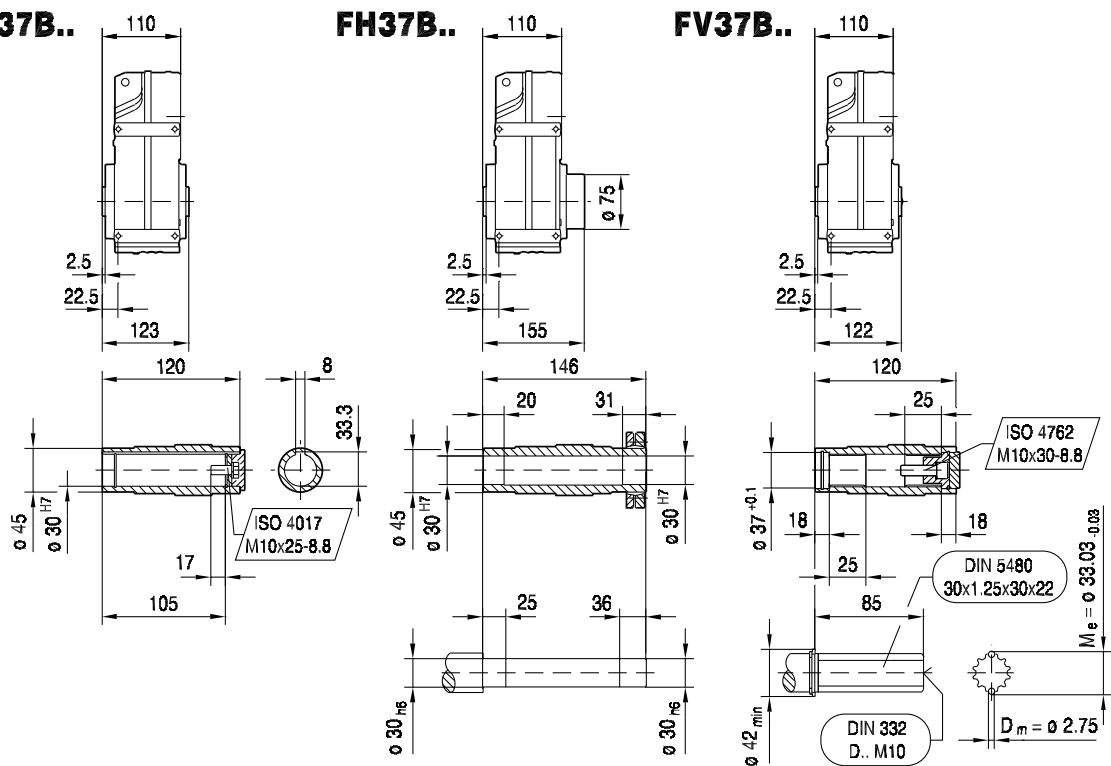
42 079 00 08^L



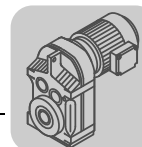
FA37B..

FH37B..

FV37B..

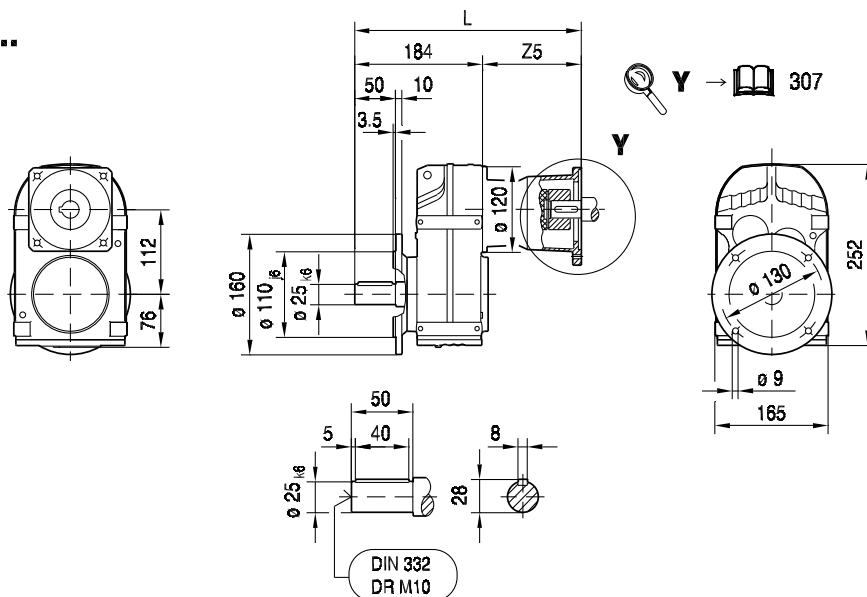


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3			
L	265	290	304	313			
Z5	104.5	129.5	143.5	152.5			



FF37..

42 080 00 08^L

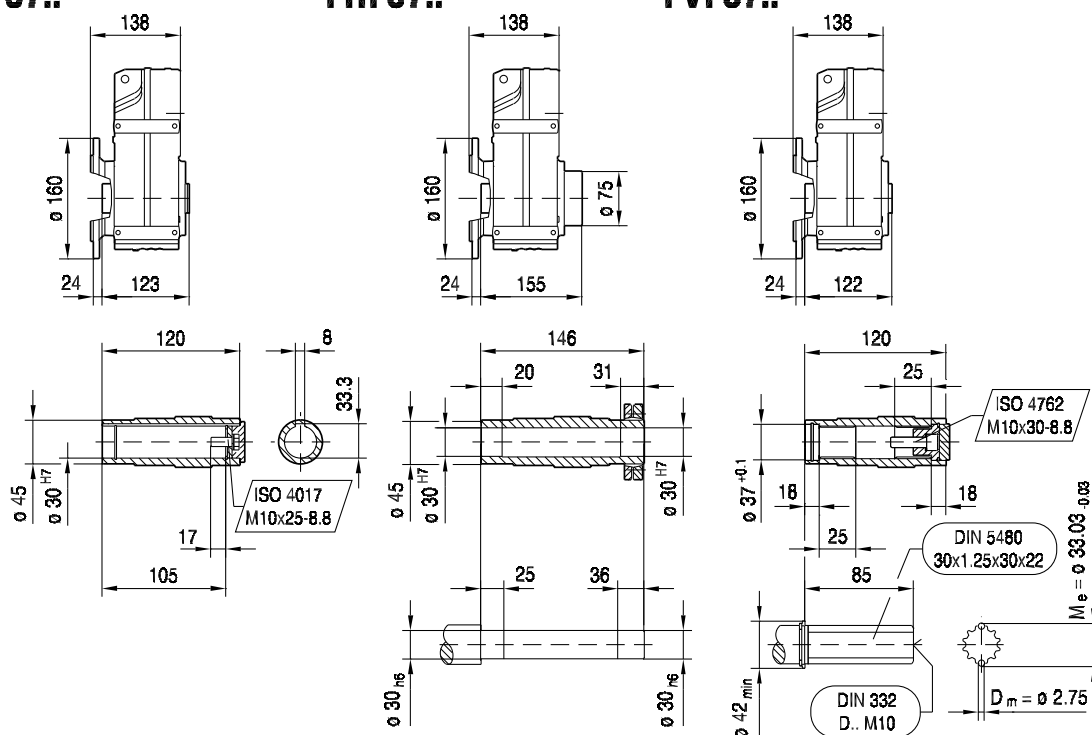


9

FAF37..

FHF37..

FVF37..



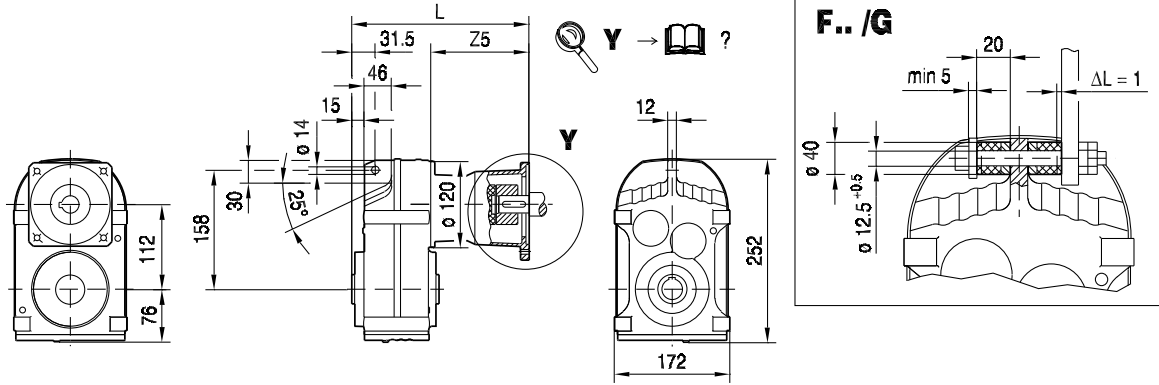
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3			
L	289	314	328	337			
Z5	104.5	129.5	143.5	152.5			



F..
F.. AQ..

FA37..

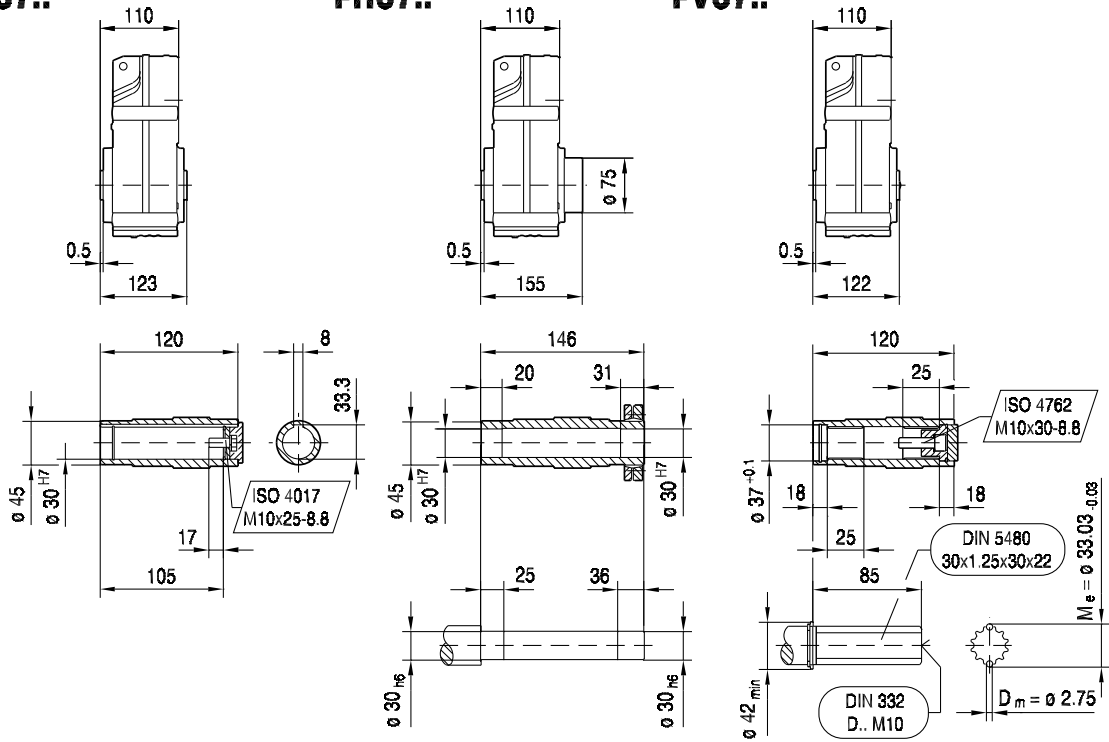
42 081 00 08



FA37..

FH37..

FV37..

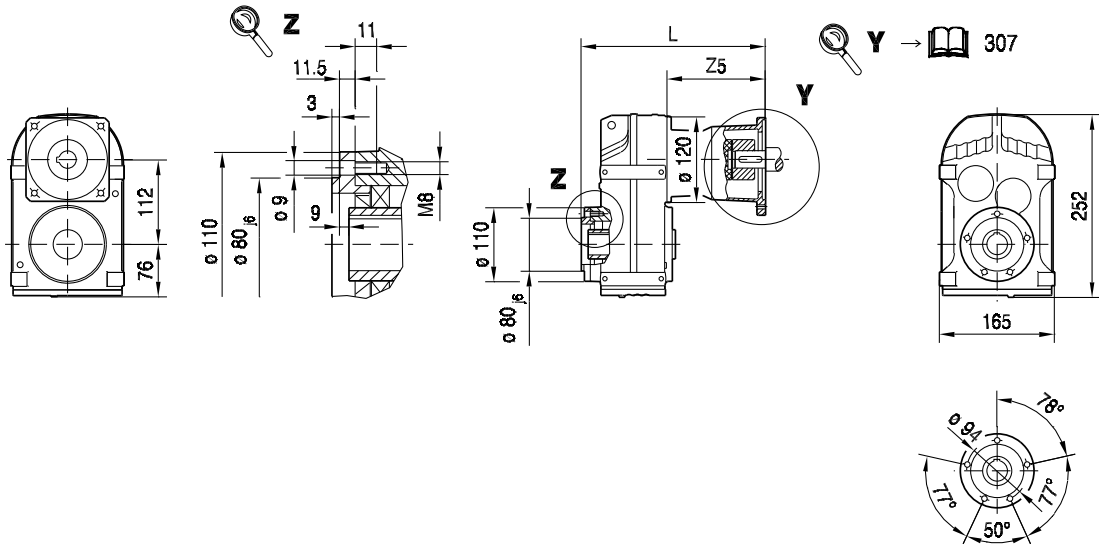


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3				
L	215	240	254	263				
Z5	104.5	129.5	143.5	152.5				



FAZ37..

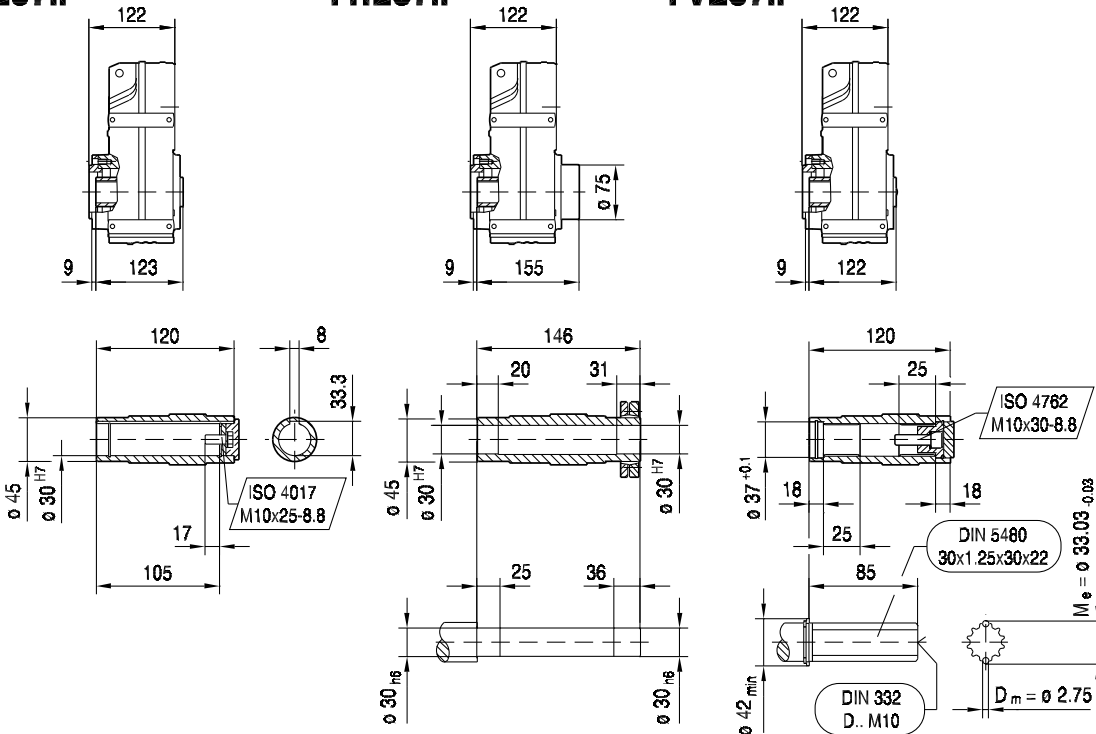
42 083 00 08^L



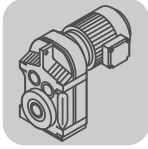
FAZ37..

FHZ37..

FVZ37..



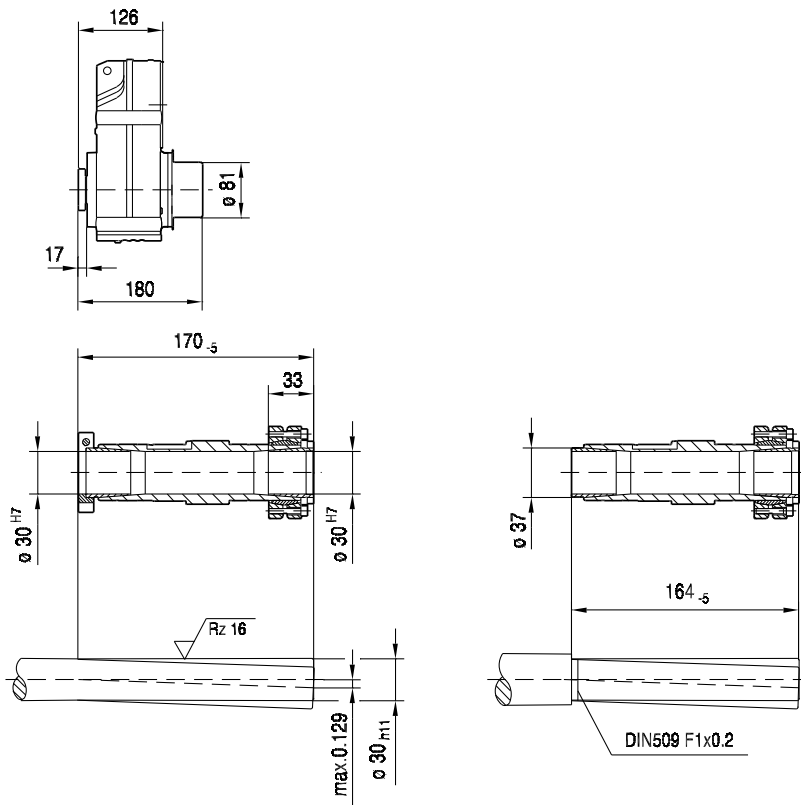
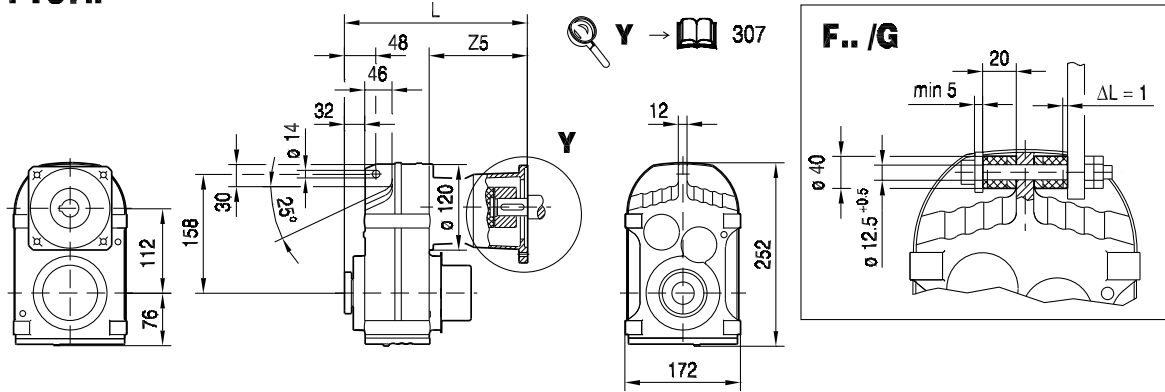
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3			
L	227	252	266	275			
Z5	104.5	129.5	143.5	152.5			



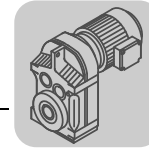
F..
F.. AQ..

FT37..



42 082 00 08





(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3				
L	231	256	270	279				
Z5	104.5	129.5	143.5	152.5				



9.2.5 F 47 AQ.. [Nm]

[Nm]	i	AQ. M _{amax} M _{apk} M _{aNotaus}											
		80/1-3			100/1-4			115/1-2			115/3		
FA47  2	4.99	84	84	164	84	84	169	84	84	169	225	225	225
	5.76	97	97	190	97	97	195	97	97	195	260	260	260
	6.34	107	107	205	107	107	215	107	107	215	290	290	290
	7.44	126	126	245	126	126	250	126	126	250	340	340	340
	7.88	133	133	260	133	133	265	133	133	265	360	360	360
	8.96	152	152	295	152	152	300	152	152	300	330	410	410
	10.97	186	186	360	186	186	370	186	186	370	400	435	500
	12.66	215	215	415	215	215	430	215	215	430	400	435	580
	13.93	235	235	455	235	235	470	235	235	470	400	435	640
	16.36	275	275	535	275	275	555	275	275	555	400	435	680
	17.33	290	290	570	290	290	585	290	290	585	400	435	680
	19.70	330	330	650	330	330	665	330	330	665	400	435	680
	21.82	370	370	680	370	370	680	370	370	680	400	435	680
	25.72	400	435	680	400	435	680	400	435	680	400	435	680
29.32	400	435	680	400	435	680	400	435	680	400	435	680	
30.86	400	435	680	400	435	680	400	435	680	400	435	680	
FA47  3	28.88	400	435	680	400	435	680	400	435	680	400	435	680
	34.29	400	435	680	400	435	680	400	435	680	400	435	680
	36.61	400	435	680	400	435	680	400	435	680	400	435	680
	42.86	400	435	680	400	435	680	400	435	680	400	435	680
	48.00	400	435	680	400	435	680	400	435	680	400	435	680
	56.49	400	435	680	400	435	680	400	435	680	400	435	680
	65.36	400	435	680	400	435	680	400	435	680	400	435	680
	68.09	400	435	680	400	435	680	400	435	680	400	435	680
	79.72	400	435	680	400	435	680	400	435	680	400	435	680
	89.29	400	435	680	400	435	680	400	435	680	400	435	680
	105.09	400	435	680	400	435	680	400	435	680	400	435	680
	121.57	400	435	680	400	435	680	400	435	680	400	435	680
	130.07	400	435	680	400	435	680	400	435	680	400	435	680
	150.06	400	435	680	400	435	680	400	435	680	400	435	680
175.38	400	435	680	400	435	680	400	435	680	400	435	680	
190.76	400	435	680	400	435	680	400	435	680	400	435	680	



9


m [kg]		AQ.			
	s	80/1-3	100/1-4	115/1-2	115/3
FA47		19	20	21	21
FA47		20	21	21	21

FAF: + 2.7 kg / F: + 0.8 kg / FF: + 3.9 kg


		AQ.			
		80/1-3	100/1-4	115/1-2	115/3
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1
c _{TA}	[Nm/°]	0.25	0.25	0.25	0.625

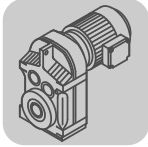


FA47 $n_e = 1400$	i	M_{amax} [Nm]	M_{apk} [Nm]	$M_{aNotaus}$ [Nm]	n_{ak} [1/min]	$J_G \cdot 10^{-4}$ [kgm ²]	F_{Rmax}				F_{Rapk}			
							FA [N]	FAF [N]	F [N]	FF [N]	FA [N]	FAF [N]	F [N]	FF [N]
FA47 	4.99	320	435	544	341	4.4	1160	1160	2310	2410	10000	10000	900	900
	5.76	340	435	578	295	3.4	1180	1180	2390	2500	10000	10000	900	900
	6.34	350	435	595	284	2.9	1230	1230	2470	2580	10000	10000	900	900
	7.44	380	435	646	242	2.3	1190	1190	2530	2660	10000	10000	900	900
	7.88	380	435	646	254	2.1	1280	1280	2630	2750	10000	10000	900	900
	8.96	330	435	561	424	1.6	1970	1970	3250	3310	10000	10000	900	900
	10.97	400	435	680	346	2.6	2060	2060	3440	3510	10000	10000	900	900
	12.66	400	435	680	371	2.1	2320	2320	3740	3790	10000	10000	900	900
	13.93	400	435	680	388	1.8	2510	2510	3950	3990	10000	10000	900	900
	16.36	400	435	680	403	1.5	2840	2840	4320	4340	10000	10000	900	900
	17.33	400	435	680	398	1.4	2960	2960	4450	4470	10000	10000	900	900
	19.70	400	435	680	355	1.1	3230	3230	4770	4770	10000	10000	900	900
	21.82	400	435	680	321	0.96	3460	3460	5030	5020	10000	10000	900	900
	25.72	400	435	680	272	0.75	3850	3850	5460	5430	10000	10000	900	900
	29.32	400	435	680	239	0.52	4170	4170	5830	5780	10000	10000	900	900
30.86	400	435	680	227	0.46	4300	4300	5920	5920	10000	10000	900	900	
FA47 	28.88	400	435	680	111	1.1	4130	4130	5790	5740	10000	10000	900	900
	34.29	400	435	680	111	0.85	4580	4580	5920	5920	10000	10000	900	900
	36.61	400	435	680	112	0.76	4750	4750	5920	5920	10000	10000	900	900
	42.86	400	435	680	112	0.58	5190	5190	5920	5920	10000	10000	900	900
	48.00	400	435	680	113	0.48	5520	5520	5920	5920	10000	10000	900	900
	56.49	400	435	680	113	0.36	6020	6020	5920	5920	10000	10000	900	900
	65.36	400	435	680	107	0.29	6490	6490	5920	5920	10000	10000	900	900
	68.09	400	435	680	103	0.61	6620	6620	5920	5920	10000	10000	900	900
	79.72	400	435	680	88	0.48	7160	7160	5920	5920	10000	10000	900	900
	89.29	400	435	680	78	0.40	7570	7570	5920	5920	10000	10000	900	900
	105.09	400	435	680	67	0.30	8180	8180	5920	5920	10000	10000	900	900
	121.57	400	435	680	58	0.25	8760	8760	5920	5920	10000	10000	900	900
	130.07	400	435	680	54	0.23	9040	9040	5920	5920	10000	10000	900	900
	150.06	400	435	680	47	0.18	9640	9640	5920	5920	10000	10000	900	900
	175.38	400	435	680	40	0.14	10000	10000	5920	5920	10000	10000	900	900
190.76	400	435	680	37	0.13	10000	10000	5920	5920	10000	10000	900	900	

AQ.	i	n_{epk} [1/min]	η [%]	c_{TG}				ϕ /R [°]	
				FA [Nm/']	FAF [Nm/']	F [Nm/']	FF [Nm/']		
FA47 	4.99	4500	97	99	99	34	30	9	
	5.76	4500	97	99	99	34	30	9	
	6.34	4500	97	99	99	34	30	8	
	7.44	4500	97	99	99	34	30	8	
	7.88	4500	97	99	99	34	30	8	
	8.96	4500	97	99	99	34	30	8	
	10.97	4500	97	99	125	125	37	32	6
	12.66	4500	97	99	125	125	37	32	6
	13.93	4500	97	99	125	125	37	32	6
	16.36	4500	97	99	125	125	37	32	6
	17.33	4500	97	99	125	125	37	32	6
	19.70	4500	97	99	125	125	37	32	6
	21.82	4500	97	99	125	125	37	32	6
	25.72	4500	97	99	125	125	37	32	6
	29.32	4500	97	99	125	125	37	32	6
30.86	4500	97	99	125	125	37	32	6	



AQ.	i	n _{epk} [1/min]	η [%]	c _{TG}				φ /R [°]
				FA [Nm/']	FAF [Nm/']	F [Nm/']	FF [Nm/']	
FA47  3	28.88	4500	96	136	136	38	33	7
	34.29	4500	96	136	136	38	33	7
	36.61	4500	96	136	136	38	33	7
	42.86	4500	96	136	136	38	33	7
	48.00	4500	95	136	136	38	33	7
	56.49	4500	95	136	136	38	33	7
	65.36	4500	95	136	136	38	33	7
	68.09	4500	95	138	138	38	33	6
	79.72	4500	95	138	138	38	33	6
	89.29	4500	95	138	138	38	33	6
	105.09	4500	94	138	138	38	33	6
	121.57	4500	94	138	138	38	33	6
	130.07	4500	94	138	138	38	33	6
	150.06	4500	93	138	138	38	33	6
	175.38	4500	93	138	138	38	33	6
190.76	4500	92	138	138	38	33	6	

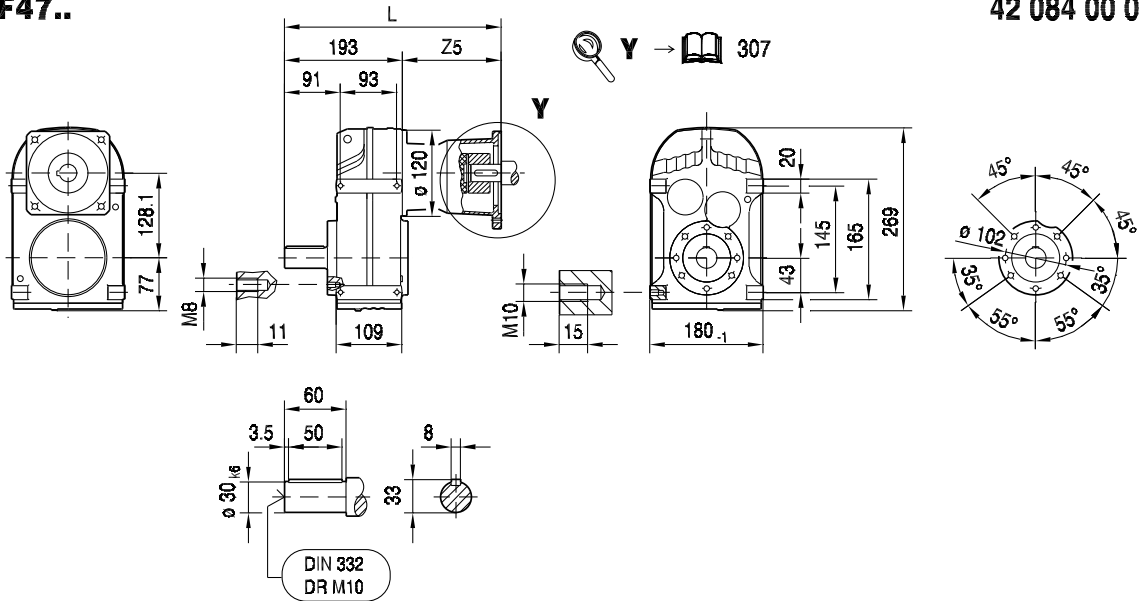


F..
F.. AQ..

9.2.6 F 47 AQ.. [mm]

F47..

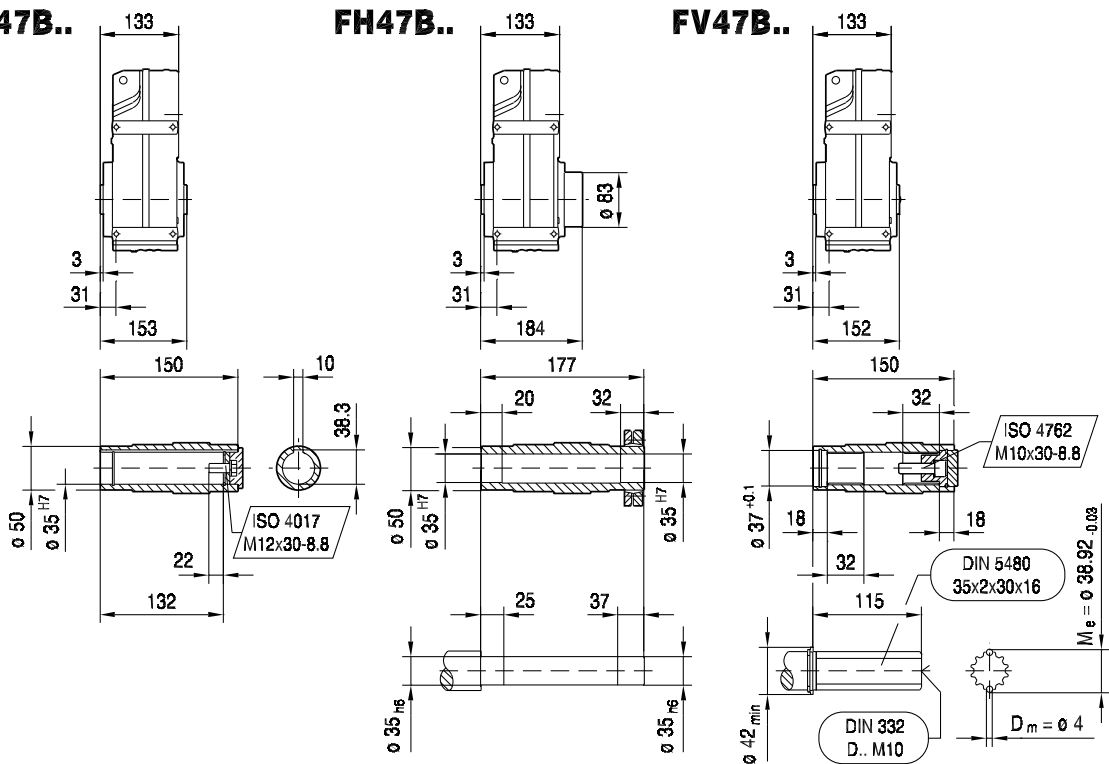
42 084 00 08 ^L



FA47B..

FH47B..

FV47B..

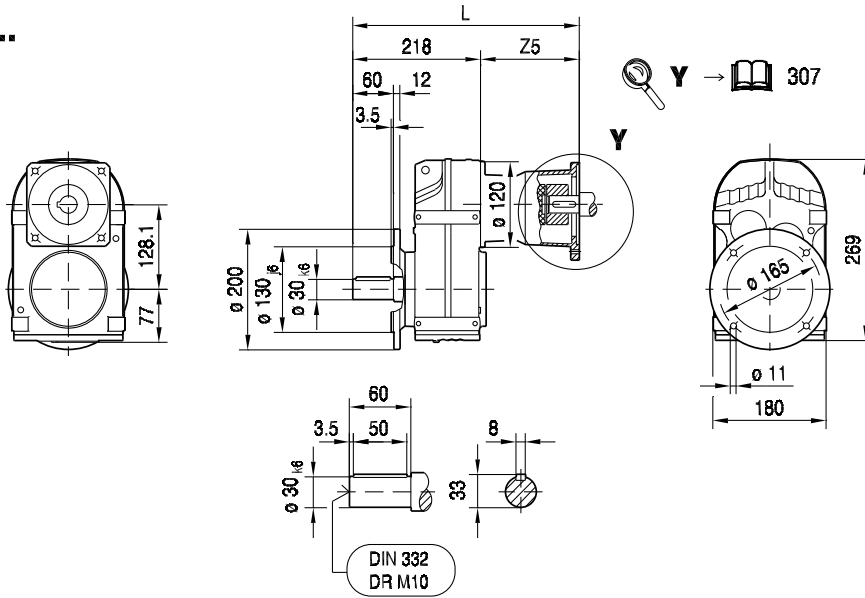


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3			
L	298	323	337	346			
Z5	104.5	129.5	143.5	152.5			



FF47..

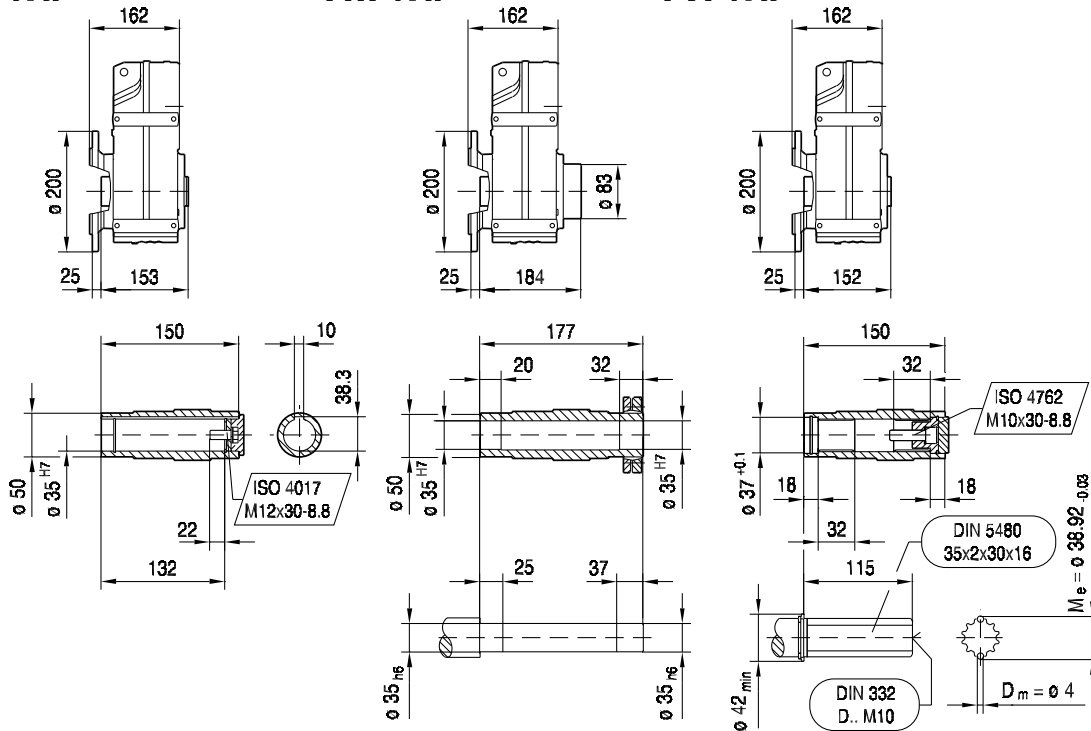
42 085 00 08^L



FAF47..

FHF47..

FVF47..

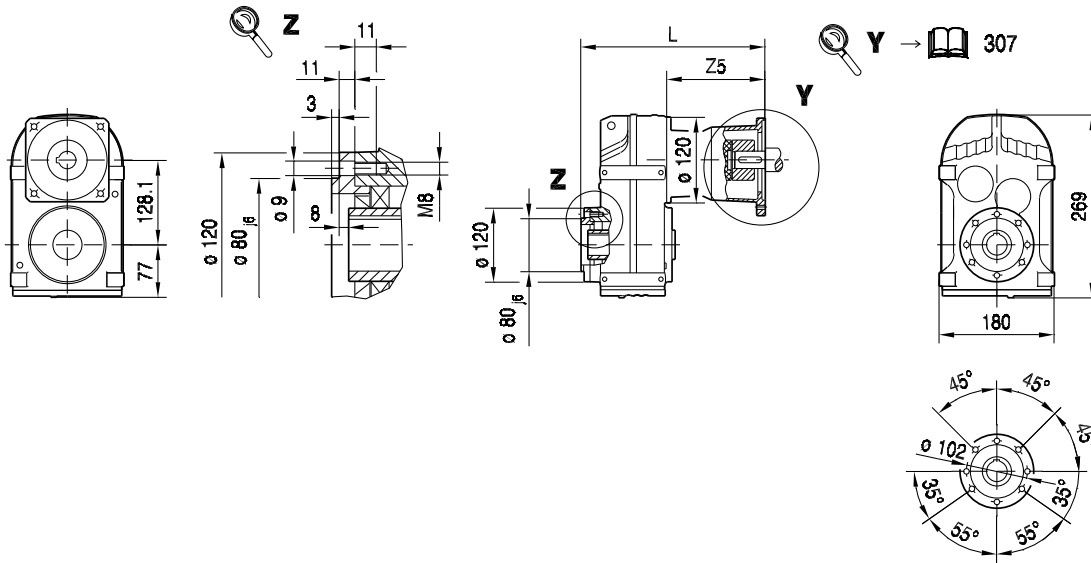


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3			
L	323	348	362	371			
Z5	104.5	129.5	143.5	152.5			



FAZ47..

42 088 00 08

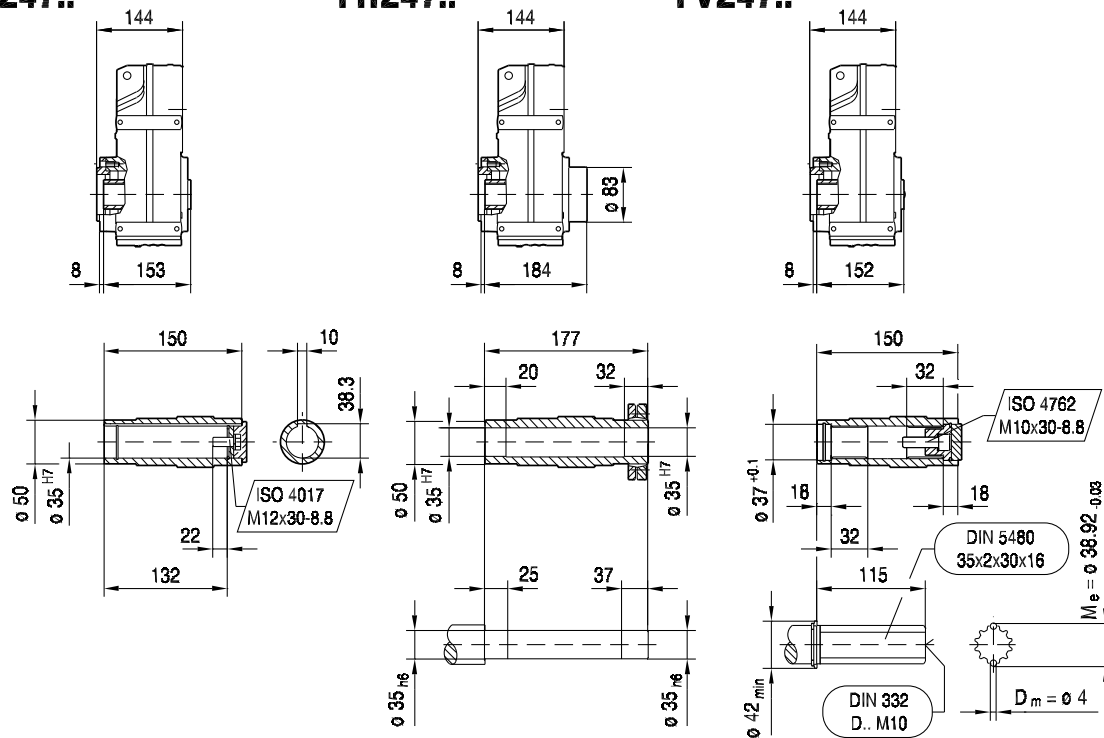


9

FAZ47..

FHZ47..

FVZ47..



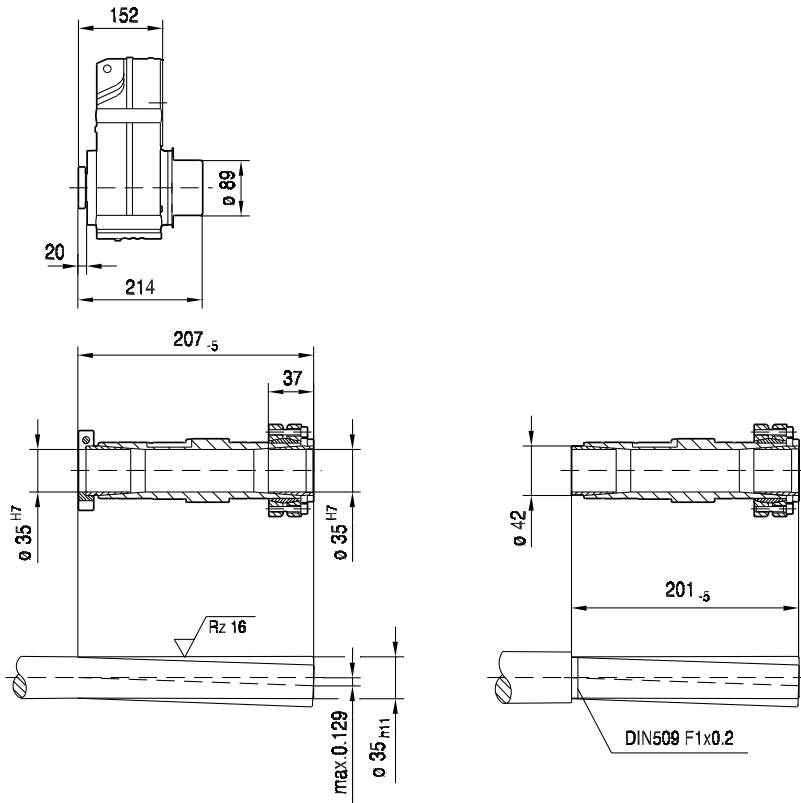
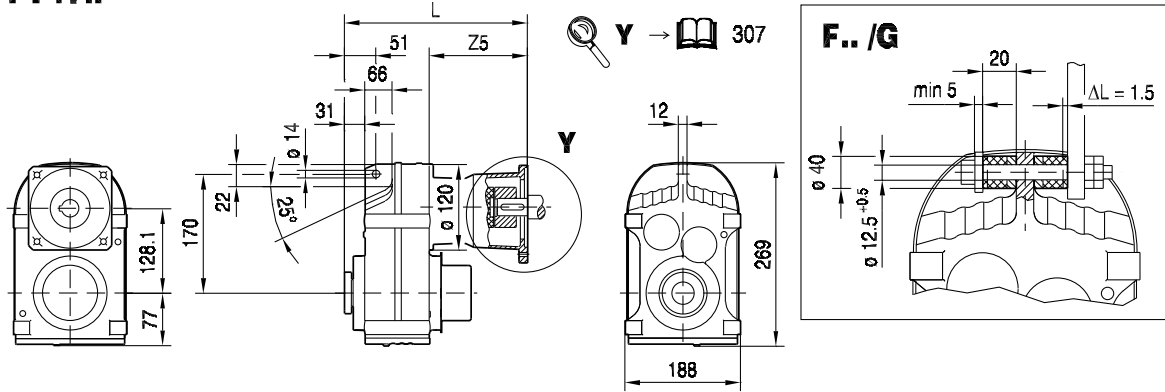
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3				
L	249	274	288	297				
Z5	104.5	129.5	143.5	152.5				



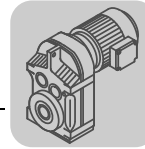
F..
F.. AQ..

FT47..

42 087 00 08



(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3			
L	257	282	296	305			
Z5	104.5	129.5	143.5	152.5			



9.2.7 F 57 AQ.. [Nm]

[Nm]	i	AQ. M _{amax} M _{apk} M _{aNotaus}																								
		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3			
FA57 2	5.18	88	88	170	88	88	176	88	88	176	235	235	235	310	310	515	415	475	515	415	475	515	415	475	705	
	5.98	101	101	197	101	101	200	101	101	200	275	275	275	355	355	595	420	475	595	420	475	595	420	475	710	
	6.58	111	111	215	111	111	220	111	111	220	300	300	300	390	390	655	420	480	655	420	480	655	420	480	710	
	7.73	131	131	255	131	131	260	131	131	260	355	355	355	420	460	710	420	480	710	420	480	710	420	480	710	
	8.19	139	139	270	139	139	275	139	139	275	375	375	375	420	485	710	420	485	710	420	485	710	420	485	710	
	9.31	158	158	305	158	158	315	158	158	315	420	425	425	420	460	710	420	460	710	420	460	710				
	10.64	180	180	350	180	180	360	180	180	360	485	485	485	600	635	1020	600	645	1020	600	645	1020	600	645	1020	
	12.29	205	205	405	205	205	415	205	205	415	565	565	565	600	645	1020	600	645	1020	600	645	1020	600	645	1020	
	13.52	225	225	445	225	225	455	225	225	455	600	620	620	600	645	1020	600	645	1020	600	645	1020	600	645	1020	
	15.88	265	265	520	265	265	535	265	265	535	600	645	730	600	645	1020	600	645	1020	600	645	1020	600	645	1020	
	16.81	285	285	550	285	285	570	285	285	570	600	645	770	600	645	1020	600	645	1020	600	645	1020	600	645	1020	
	19.11	320	320	630	320	320	645	320	320	645	600	645	870	600	645	1020	600	645	1020	600	645	1020				
	21.17	355	355	695	355	355	715	355	355	715	600	645	970	600	645	1020	600	645	1020	600	645	1020				
	24.96	420	420	820	420	420	840	420	420	840	575	645	970	575	645	970	575	645	970	575	645	970				
	28.45	480	480	910	480	480	910	480	480	910	535	645	910													
	29.94	505	505	920	505	505	920	505	505	920	545	645	920													
	34.24	500	580	850	500	580	850	500	580	850	500	645	850													
	40.13	290	435	490	290	435	490	290	435	490	290	435	490													
	FA57 3	30.15	510	510	990	510	510	1000	510	510	1000	590	645	1000	590	645	1000	590	645	1000	590	645	1000	590	645	1000
		35.79	600	605	1020	600	605	1020	600	605	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020
38.21		600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	
44.73		600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020				
50.10		600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020				
58.97		600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020				
68.22		600	645	1020	600	645	1020	600	645	1020	600	645	1020													
72.98		600	645	1020	600	645	1020	600	645	1020	600	645	1020													
83.46		600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020				
93.47		600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020				
110.01		600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020	600	645	1020				
127.27		600	645	1020	600	645	1020	600	645	1020	600	645	1020													
136.16		600	645	1020	600	645	1020	600	645	1020	600	645	1020													
157.09		600	645	1020	600	645	1020	600	645	1020	600	645	1020													
183.60		600	645	1020	600	645	1020	600	645	1020	600	645	1020													
199.70		600	645	1020	600	645	1020	600	645	1020	600	645	1020													



9


m [kg]		AQ.																							
s		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
FA57	2	27			28			28			28			33			33			33			42		
FA57	3	28			28			29			29			34			34			34			43		

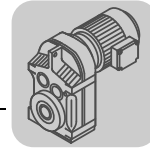
FAF: + 5.5 kg / F: + 0.2 kg / FF: + 6.6 kg


		AQ.																							
		80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3		
J _A 10 ⁻⁴	[kgm ²]	0.77			1.4			1.4			3.1			5.1			10.0			10.0			25.0		
c _{TA}	[Nm/°]	0.25			0.25			0.25			0.625			0.625			1.0			1.0			2.08		

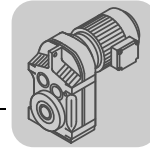


FA57 $n_e = 1400$	i	M_{amax} [Nm]	M_{apk} [Nm]	$M_{aNotaus}$ [Nm]	n_{ak} [1/min]	$J_G \cdot 10^{-4}$ [kgm ²]	F_{Ramax}				F_{Rapk}				
							FA [N]	FAF [N]	F [N]	FF [N]	FA [N]	FAF [N]	F [N]	FF [N]	
FA57 	5.18	415	475	706	405	5.8	2020	2020	3460	3670	11500	11500	9910	8490	
	5.98	420	475	714	452	4.5	2240	2240	3730	3940	11500	11500	9910	8490	
	6.58	420	480	714	502	3.8	2430	2430	3940	4140	11500	11500	9880	8460	
	7.73	420	480	714	595	2.9	2760	2760	4310	4500	11500	11500	9880	8460	
	8.19	420	485	714	623	2.6	2880	2880	4450	4640	11500	11500	9840	8440	
	9.31	420	460	714	666	2.0	3170	3170	4760	4950	11500	11500	10000	8580	
	10.64	600	645	1020	207	3.2	2470	2470	4320	4590	11500	11500	6930	6930	
	12.29	600	645	1020	212	2.6	2810	2810	4710	4970	11500	11500	6930	6930	
	13.52	600	645	1020	207	2.2	3050	3050	4980	5230	11500	11500	6930	6930	
	15.88	600	645	1020	214	1.8	3470	3470	5450	5690	11500	11500	6930	6930	
	16.81	600	645	1020	214	1.6	3630	3630	5620	5860	11500	11500	6930	6930	
	19.11	600	645	1020	215	1.3	3980	3980	6020	6260	11500	11500	6930	6930	
	21.17	600	645	1020	217	1.1	4280	4280	6350	6580	11500	11500	6930	6930	
	24.96	575	645	978	252	0.84	4970	4970	7060	7260	11500	11500	6930	6930	
	28.45	535	645	910	246	0.59	5690	5690	7760	7930	11500	11500	6930	6930	
	29.94	545	645	927	234	0.53	5790	5790	7890	8060	11500	11500	6930	6930	
	34.24	500	645	850	204	0.43	6580	6580	8670	8500	11500	11500	6930	6930	
	40.13	290	435	493	174	0.34	8750	8750	10500	9550	11500	11500	10400	8850	
	FA57 	30.15	590	645	1003	50	1.3	5460	5460	7650	7850	11500	11500	6930	6930
		35.79	600	645	1020	47	0.94	5980	5980	8250	7900	11500	11500	6930	6930
38.21		600	645	1020	50	0.84	6210	6210	8510	7900	11500	11500	6930	6930	
44.73		600	645	1020	49	0.64	6790	6790	9160	7900	11500	11500	6930	6930	
50.10		600	645	1020	50	0.52	7230	7230	9200	7900	11500	11500	6930	6930	
58.97		600	645	1020	51	0.38	7890	7890	9200	7900	11500	11500	6930	6930	
68.22		600	645	1020	51	0.31	8510	8510	9200	7900	11500	11500	6930	6930	
72.98		600	645	1020	51	0.28	8810	8810	9200	7900	11500	11500	6930	6930	
83.46		600	645	1020	42	0.51	9420	9420	9200	7900	11500	11500	6930	6930	
93.47		600	645	1020	42	0.42	9960	9960	9200	7900	11500	11500	6930	6930	
110.01		600	645	1020	42	0.31	10800	10800	9200	7900	11500	11500	6930	6930	
127.27		600	645	1020	42	0.26	11500	11500	9200	7900	11500	11500	6930	6930	
136.16		600	645	1020	43	0.23	11500	11500	9200	7900	11500	11500	6930	6930	
157.09		600	645	1020	43	0.19	11500	11500	9200	7900	11500	11500	6930	6930	
183.60		600	645	1020	38	0.15	11500	11500	9200	7900	11500	11500	6930	6930	
199.70		600	645	1020	35	0.13	11500	11500	9200	7900	11500	11500	6930	6930	

AQ.	i	n_{epk} [1/min]	η [%]	c_{TG}				ϕ /R [°]
				FA [Nm/°]	FAF [Nm/°]	F [Nm/°]	FF [Nm/°]	
FA57 	5.18	4468	97	120	120	43	38	9
	5.98	4500	97	120	120	43	38	9
	6.58	4500	97	120	120	43	38	8
	7.73	4500	97	120	120	43	38	8
	8.19	4500	97	120	120	43	38	8
	9.31	4500	97	120	120	43	38	8
	10.64	4500	97	150	150	47	40	6
	12.29	4500	97	150	150	47	40	6
	13.52	4500	97	150	150	47	40	6
	15.88	4500	97	150	150	47	40	6
	16.81	4500	97	150	150	47	40	6
	19.11	4500	97	150	150	47	40	6
	21.17	4500	97	150	150	47	40	6
	24.96	4500	97	150	150	47	40	6
	28.45	4500	97	150	150	47	40	6
	29.94	4500	97	150	150	47	40	6
	34.24	4500	97	150	150	47	40	6
40.13	4500	96	150	150	47	40	6	

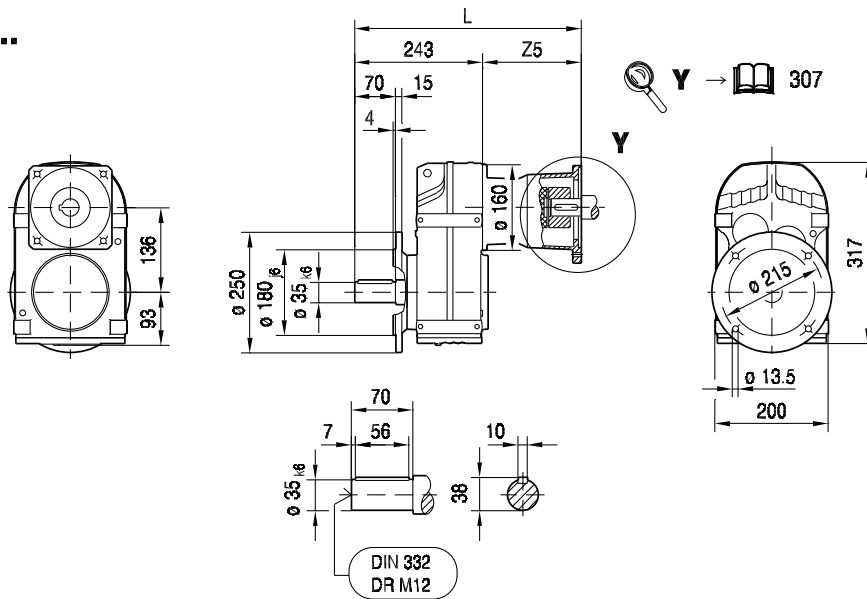


AQ.	i	n _{epk} [1/min]	η [%]	c _{TG}				φ /R [°]
				FA [Nm/']	FAF [Nm/']	F [Nm/']	FF [Nm/']	
FA57  3	30.15	4500	96	169	169	49	41	7
	35.79	4500	96	169	169	49	41	7
	38.21	4500	96	169	169	49	41	7
	44.73	4500	96	169	169	49	41	7
	50.10	4500	96	169	169	49	41	7
	58.97	4500	95	169	169	49	41	7
	68.22	4500	95	169	169	49	41	6
	72.98	4500	95	169	169	49	41	6
	83.46	4500	95	171	171	49	42	6
	93.47	4500	95	171	171	49	42	6
	110.01	4500	94	171	171	49	42	6
	127.27	4500	94	171	171	49	42	6
	136.16	4500	94	171	171	49	42	6
	157.09	4500	94	171	171	49	42	6
	183.60	4500	93	171	171	49	42	6
199.70	4500	93	171	171	49	42	6	



FF57..

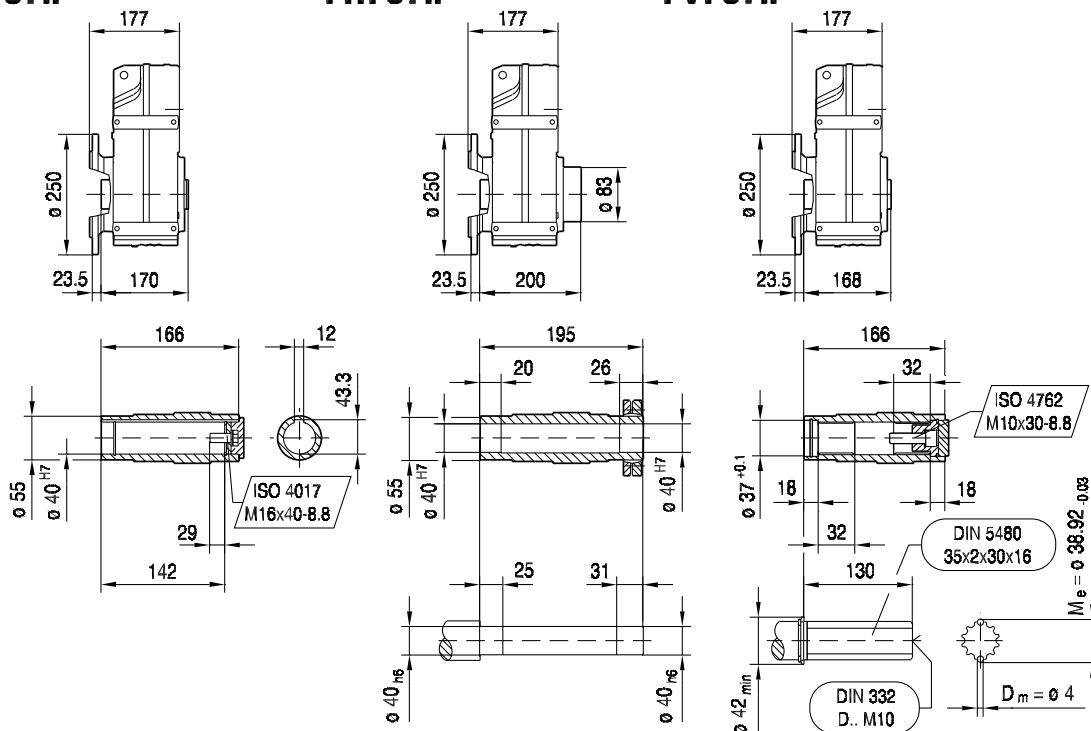
42 090 00 08^L



FAF57..

FHF57..

FVF57..

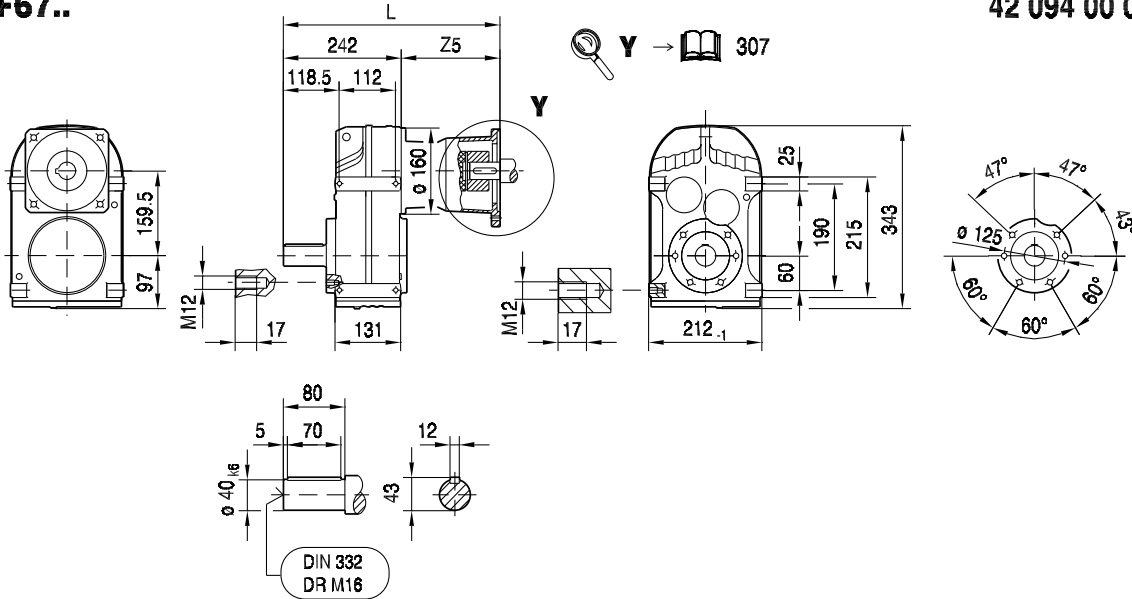


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	341	366	380	389	418	431	431	481	505
Z5	98	123	137	146	175	188	188	237.5	261.5



F67..

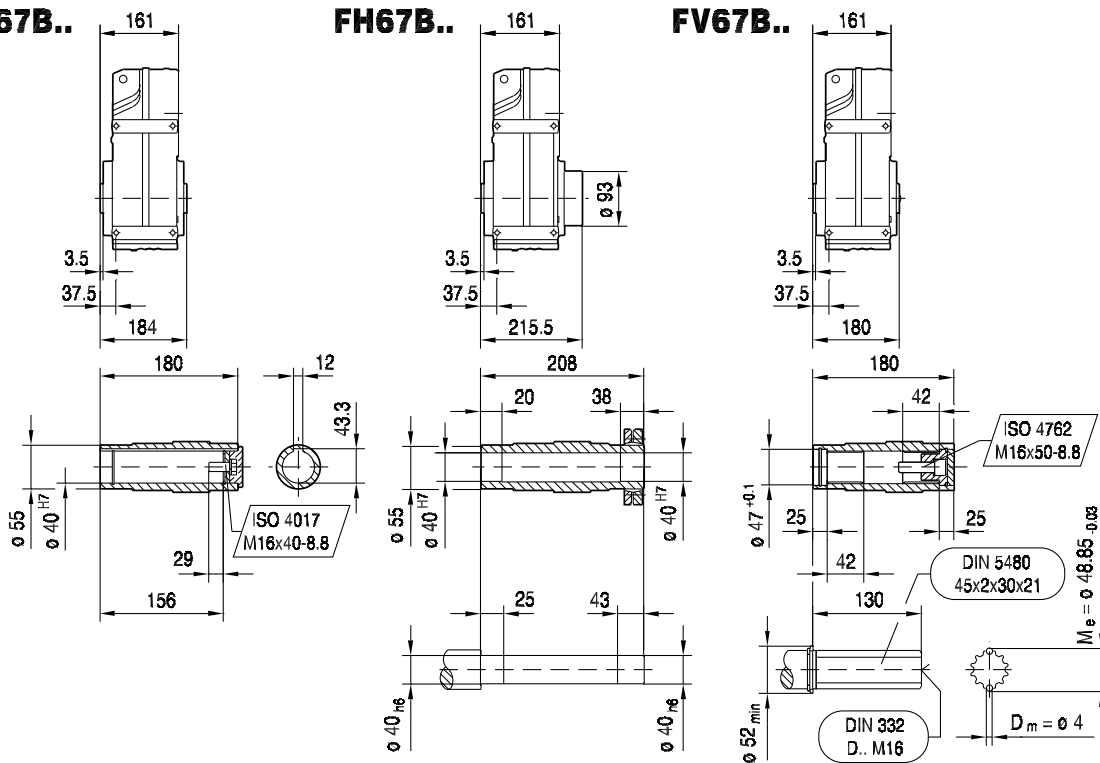
42 094 00 08^L



FA67B..

FH67B..

FV67B..



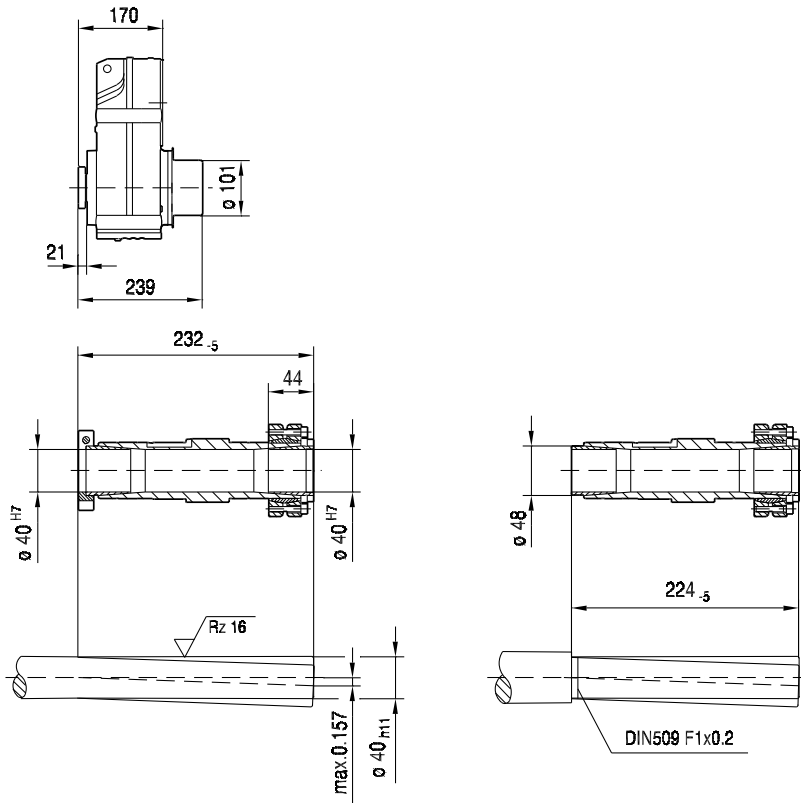
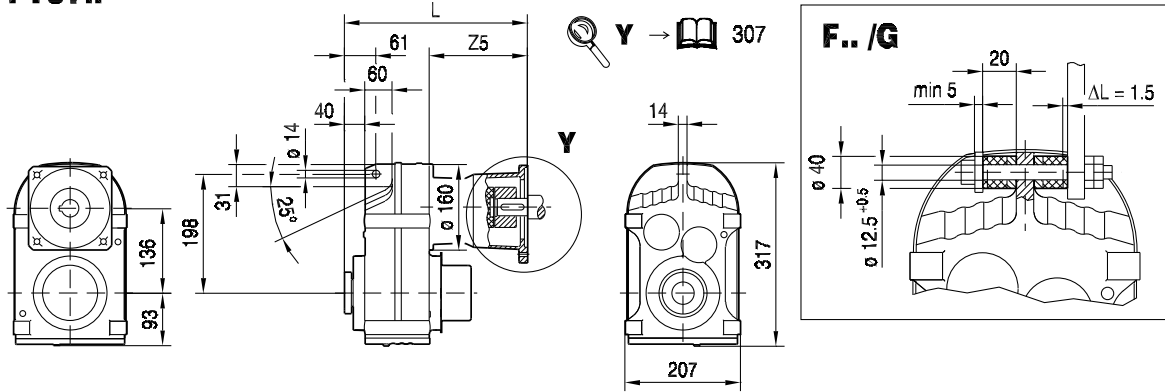
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	260	285	299	308	337	350	350	400	424
Z5	98	123	137	146	175	188	188	237.5	261.5



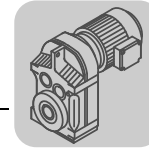
F..
F.. AQ..

FT57..

42 092 00 08



(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	268	293	307	316	345	358	358	408	432
Z5	98	123	137	146	175	188	188	237.5	261.5



9.2.9 F 67 AQ.. [Nm]

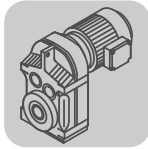
[Nm]	AQ.																								
	M _{amax} M _{apk} M _{aNotaus}																								
i	80/1-3			100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3			
3.97	67	67	131	67	67	134	67	67	134	182	182	182	235	235	395	395	395	395	395	395	395	395	500	635	635
4.66	79	79	153	79	79	158	79	79	158	210	210	210	275	275	465	465	465	465	465	465	465	465	465	465	465
5.25	89	89	173	89	89	178	89	89	178	240	240	240	315	315	525	525	525	525	525	525	525	525	525	525	525
5.95	101	101	196	101	101	200	101	101	200	270	270	270	355	355	595	595	595	595	595	595	595	595	595	595	595
6.78	115	115	220	115	115	230	115	115	230	310	310	310	405	405	675	620	675	675	620	675	675	620	675	675	620
7.53	128	128	245	128	128	255	128	128	255	345	345	345	450	450	750	610	715	750	610	715	750	610	715	750	610
8.60	146	146	280	146	146	290	146	146	290	395	395	395	515	515	860	570	715	860	570	715	860	570	715	860	570
9.08	154	154	295	154	154	305	154	154	305	415	415	415	530	540	900	530	715	900	530	715	900	530	715	900	530
9.66	164	164	315	164	164	325	164	164	325	440	440	440	575	575	960	820	960	960	820	960	960	820	960	960	820
11.31	192	192	370	192	192	380	192	192	380	520	520	520	675	675	1130	820	920	1130	820	920	1130	820	920	1130	820
12.76	215	215	420	215	215	430	215	215	430	585	585	585	765	765	1270	820	920	1270	820	920	1270	820	920	1270	820
14.46	245	245	475	245	245	490	245	245	490	665	665	665	820	860	1390	820	920	1390	820	920	1390	820	920	1390	820
16.48	280	280	540	280	280	560	280	280	560	755	755	755	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
18.29	310	310	600	310	310	620	310	310	620	820	840	840	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
20.90	355	355	685	355	355	710	355	355	710	820	920	960	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
22.05	370	370	725	370	370	745	370	370	745	820	920	1010	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
25.13	425	425	820	425	425	850	425	425	850	820	920	1150	820	920	1390	820	920	1390	820	920	1390				
27.41	465	465	900	465	465	930	465	465	930	820	920	1260	820	920	1390	820	920	1390	820	920	1390				
32.08	545	545	1050	545	545	1090	545	545	1090	820	920	1390	820	920	1390	820	920	1390	820	920	1390				
36.30	615	615	1190	615	615	1230	615	615	1230	820	920	1390													
34.01	575	575	1120	575	575	1150	575	575	1150	740	920	1250	740	920	1250	740	920	1250	740	920	1250	740	920	1250	740
39.26	665	665	1290	665	665	1320	665	665	1320	780	920	1320	780	920	1320	780	920	1320	780	920	1320	780	920	1320	780
43.20	730	730	1390	730	730	1390	730	730	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
50.74	820	860	1390	820	860	1390	820	860	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
53.73	820	910	1390	820	910	1390	820	910	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
61.07	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390				
67.65	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390				
79.76	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390				
90.59	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
95.94	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
109.04	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820
120.79	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390				
142.40	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390				
162.31	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390										
170.85	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390										
195.39	820	920	1390	820	920	1390	820	920	1390	820	920	1390	820	920	1390										
228.99	820	920	1390	820	920	1390	820	920	1390	820	920	1390													



9

m [kg]		AQ.									
s		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3		
FA67		31	31	32	32	37	37	37	45		
FA67		32	32	33	33	38	38	38	46		



FAF: + 6.3 kg / F: + 2.8 kg / FF: + 8.9 kg

		AQ.									
		80/1-3	100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3		
J _A 10 ⁻⁴	[kgm ²]	0.77	1.4	1.4	3.1	5.1	10.0	10.0	25.0		
c _{TA}	[Nm/°]	0.25	0.25	0.25	0.625	0.625	1.0	1.0	2.08		



FA67 $n_e = 1400$	i	M_{amax} [Nm]	M_{apk} [Nm]	$M_{aNotaus}$ [Nm]	n_{ak} [1/min]	$J_G \cdot 10^{-4}$ [kgm ²]	F_{Rmax}				F_{Rapk}			
							FA [N]	FAF [N]	F [N]	FF [N]	FA [N]	FAF [N]	F [N]	FF [N]
FA67  2	3.97	500	695	850	403	16	1220	1220	8390	8620	13000	13000	11300	11300
	4.66	560	700	952	322	12	1020	1020	8590	8860	13000	13000	11300	11300
	5.25	590	705	1003	286	10.0	1010	1010	8850	9140	13000	13000	11200	11200
	5.95	610	705	1037	286	8.0	1090	1090	9200	9500	13000	13000	11200	11200
	6.78	620	710	1054	295	6.3	1280	1280	9660	9950	13000	13000	11200	11200
	7.53	610	715	1037	332	5.5	1570	1570	10100	10400	13000	13000	11200	11200
	8.60	570	715	969	442	4.4	2180	2180	10900	11200	13000	13000	11200	11200
	9.08	530	715	901	573	4.0	2620	2620	11400	11600	13000	13000	11200	11200
	9.66	820	920	1394	186	8.5	1580	1580	10300	10300	13000	13000	9310	9310
	11.31	820	920	1394	203	6.7	1960	1960	10300	10300	13000	13000	9310	9310
	12.76	820	920	1394	212	5.6	2260	2260	10300	10300	13000	13000	9310	9310
	14.46	820	920	1394	228	4.6	2580	2580	10300	10300	13000	13000	9310	9310
	16.48	820	920	1394	237	3.8	2940	2940	10300	10300	13000	13000	9310	9310
	18.29	820	920	1394	252	3.4	3230	3230	10300	10300	13000	13000	9310	9310
	20.90	820	920	1394	263	2.7	3620	3620	10300	10300	13000	13000	9310	9310
	22.05	820	920	1394	268	2.5	3780	3780	10300	10300	13000	13000	9310	9310
	25.13	820	920	1394	275	2.0	4190	4190	10300	10300	13000	13000	9310	9310
	27.41	820	920	1394	255	1.7	4470	4470	10300	10300	13000	13000	9310	9310
32.08	820	920	1394	218	1.4	5000	5000	10300	10300	13000	13000	9310	9310	
36.30	820	920	1394	193	0.98	5440	5440	10300	10300	13000	13000	9310	9310	
FA67  3	34.01	740	920	1258	44	2.8	5730	5730	11000	11000	13000	13000	9310	9310
	39.26	780	920	1326	38	2.2	5980	5980	10700	10700	13000	13000	9310	9310
	43.20	820	920	1394	35	1.9	6080	6080	10300	10300	13000	13000	9310	9310
	50.74	820	920	1394	34	1.6	6710	6710	10300	10300	13000	13000	9310	9310
	53.73	820	920	1394	34	1.4	6940	6940	10300	10300	13000	13000	9310	9310
	61.07	820	920	1394	34	1.1	7480	7480	10300	10300	13000	13000	9310	9310
	67.65	820	920	1394	35	0.97	7930	7930	10300	10300	13000	13000	9310	9310
	79.76	820	920	1394	36	0.76	8680	8680	10300	10300	13000	13000	9310	9310
	90.59	820	920	1394	56	1.4	9290	9290	10300	10300	13000	13000	9310	9310
	95.94	820	920	1394	56	1.2	9570	9570	10300	10300	13000	13000	9310	9310
	109.04	820	920	1394	57	0.98	10200	10200	10300	10300	13000	13000	9310	9310
	120.79	820	920	1394	57	0.85	10800	10800	10300	10300	13000	13000	9310	9310
	142.40	820	920	1394	49	0.68	11700	11700	10300	10300	13000	13000	9310	9310
	162.31	820	920	1394	43	0.47	12400	12400	10300	10300	13000	13000	9310	9310
	170.85	820	920	1394	41	0.42	12700	12700	10300	10300	13000	13000	9310	9310
	195.39	820	920	1394	36	0.34	13000	13000	10300	10300	13000	13000	9310	9310
	228.99	820	920	1394	31	0.27	13000	13000	10300	10300	13000	13000	9310	9310



AQ.	i	n _{epk} [1/min]	η [%]	C _{TG}				φ /R [°]
				FA [Nm/°]	FAF [Nm/°]	F [Nm/°]	FF [Nm/°]	
FA67  2	3.97	4500	97	129	129	68	62	10
	4.66	4500	97	129	129	68	62	9
	5.25	4500	97	129	129	68	62	9
	5.95	4500	98	129	129	68	62	9
	6.78	4500	97	129	129	68	62	9
	7.53	4500	97	129	129	68	62	8
	8.60	4500	97	129	129	68	62	8
	9.08	4500	97	129	129	68	62	8
	9.66	4500	97	173	173	79	71	6
	11.31	4500	97	173	173	79	71	6
	12.76	4500	97	173	173	79	71	6
	14.46	4500	97	173	173	79	71	6
	16.48	4500	97	173	173	79	71	6
	18.29	4500	97	173	173	79	71	6
	20.90	4500	97	173	173	79	71	5
	22.05	4500	97	173	173	79	71	5
	25.13	4500	97	173	173	79	71	5
	27.41	4500	97	173	173	79	71	5
32.08	4500	97	173	173	79	71	5	
36.30	4500	97	173	173	79	71	5	
FA67  3	34.01	4500	96	187	187	82	74	6
	39.26	4500	96	187	187	82	74	6
	43.20	4500	96	187	187	82	74	6
	50.74	4500	96	187	187	82	74	6
	53.73	4500	96	187	187	82	74	6
	61.07	4500	95	187	187	82	74	6
	67.65	4500	95	187	187	82	74	6
	79.76	4500	95	187	187	82	74	6
	90.59	4500	95	189	189	82	74	6
	95.94	4500	95	189	189	82	74	6
	109.04	4500	95	189	189	82	74	6
	120.79	4500	94	189	189	82	74	6
	142.40	4500	94	189	189	82	74	6
	162.31	4500	94	189	189	82	74	6
	170.85	4500	93	189	189	82	74	6
195.39	4500	93	189	189	82	74	6	
228.99	4500	93	189	189	82	74	6	

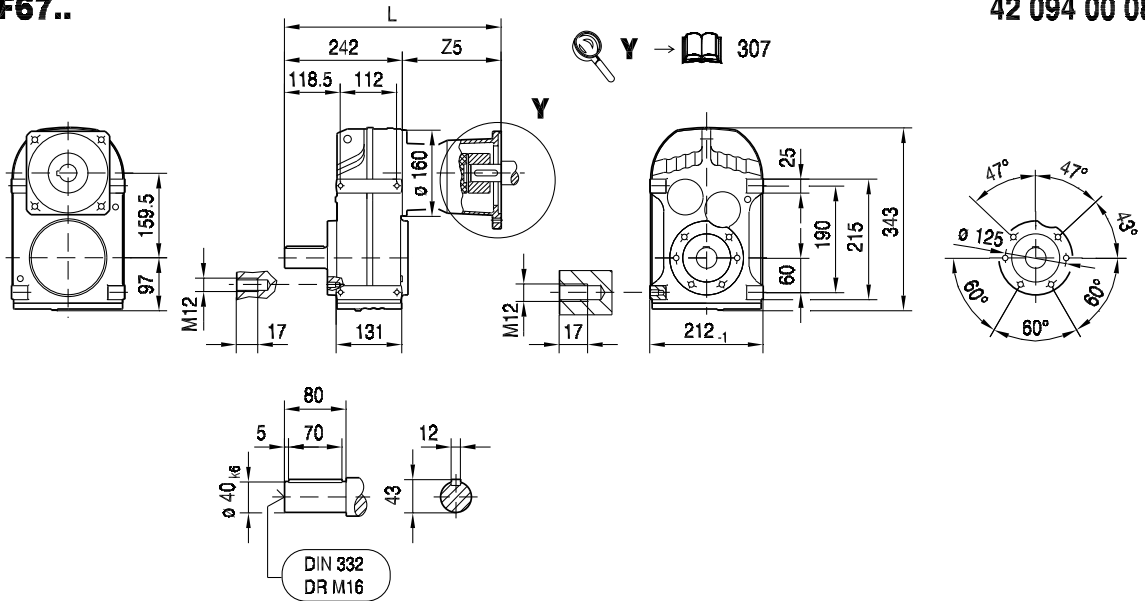


F..
F.. AQ..

9.2.10 F 67 AQ.. [mm]

F67..

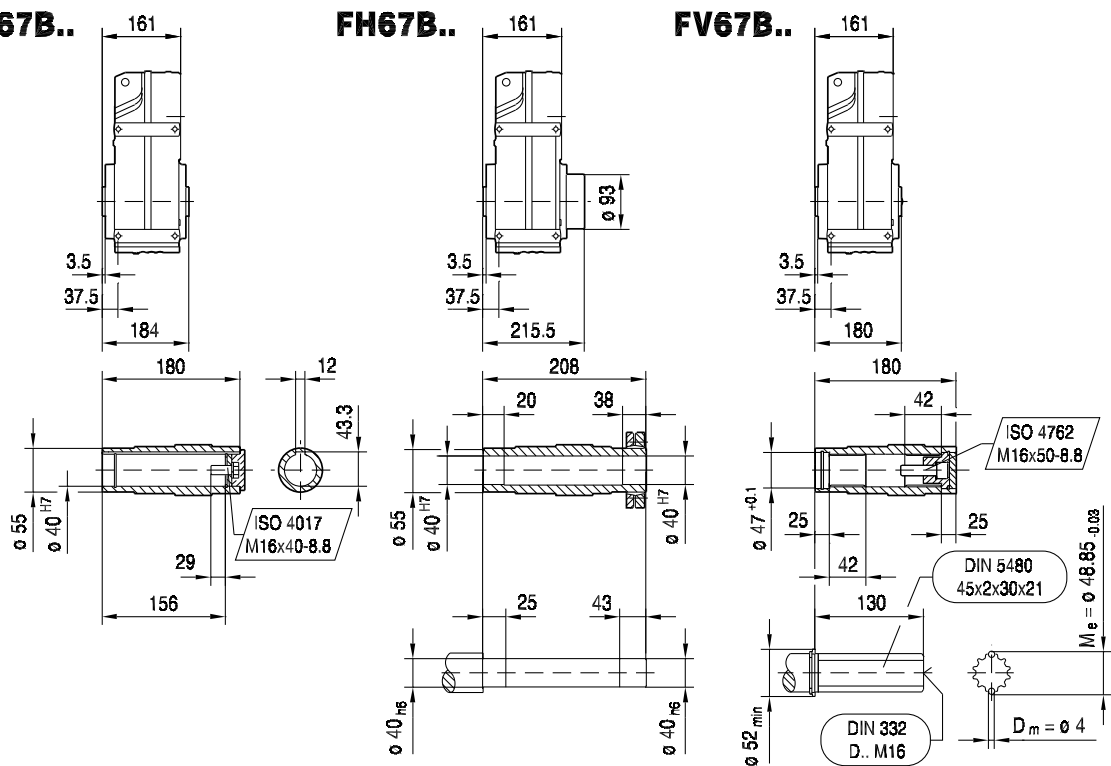
42 094 00 08



FA67B..

FH67B..

FV67B..

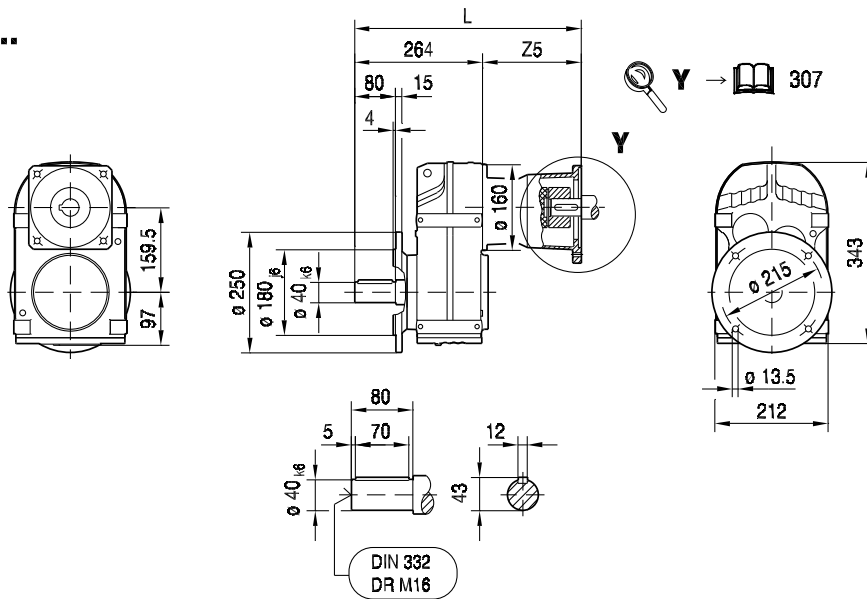


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	340	365	379	388	417	430	430	480	504
Z5	98	123	137	146	175	188	188	237.5	261.5



FF67..

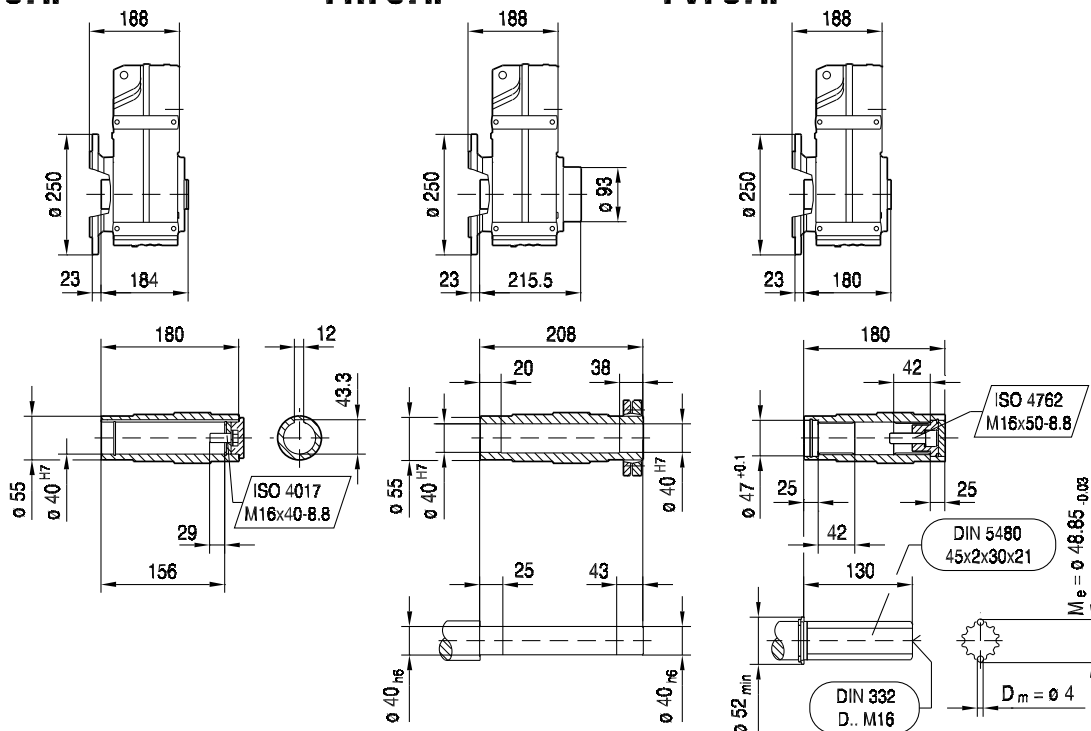
42 095 00 08^L



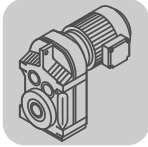
FAF67..

FHF67..

FVF67..



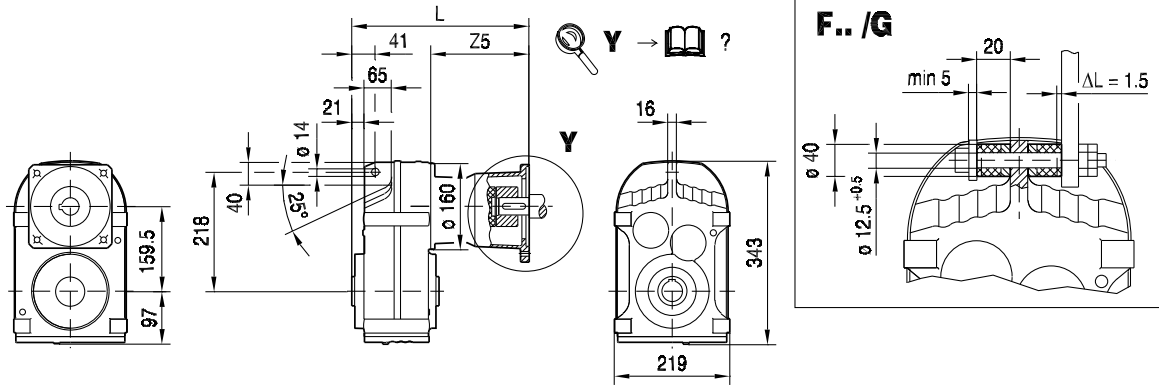
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	362	387	401	410	439	452	452	502	526
Z5	98	123	137	146	175	188	188	237.5	261.5



F..
F.. AQ..

FA67..

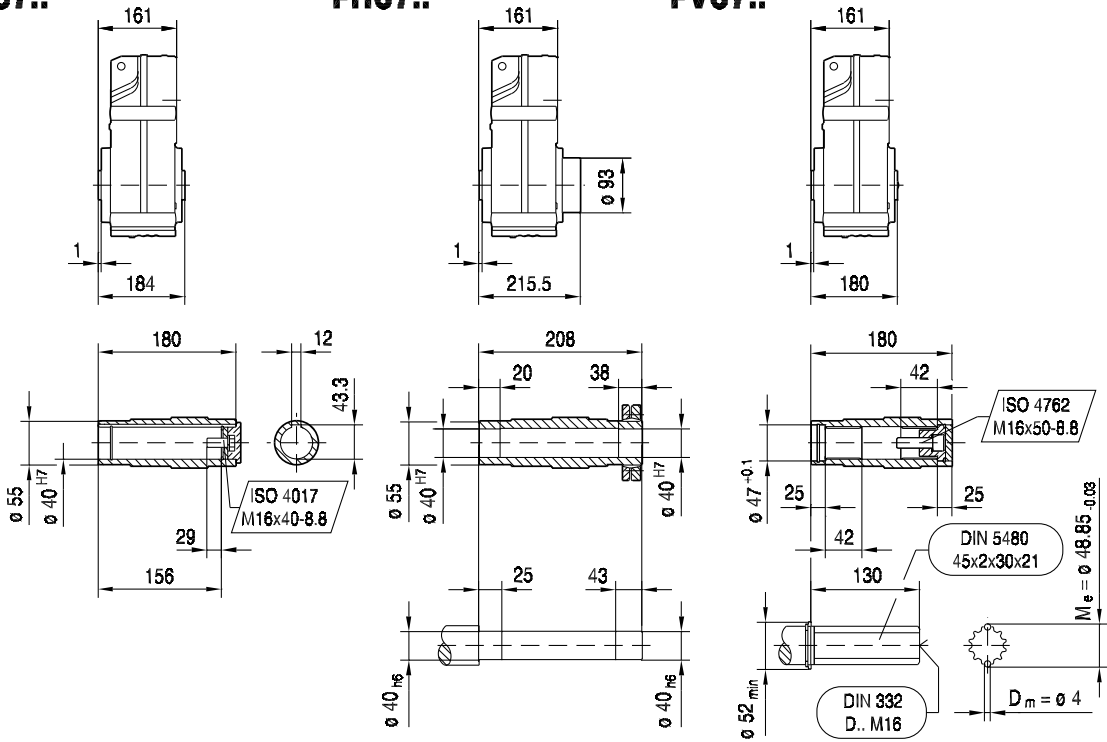
42 096 00 08



FA67..

FH67..

FV67..

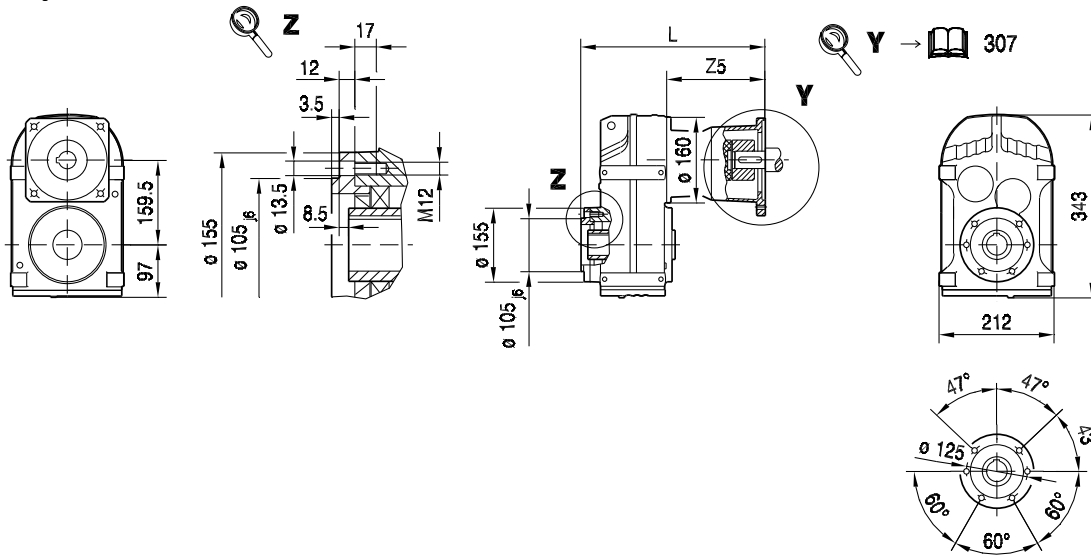


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	259	284	298	307	336	349	349	399	423
Z5	98	123	137	146	175	188	188	237.5	261.5



FAZ67..

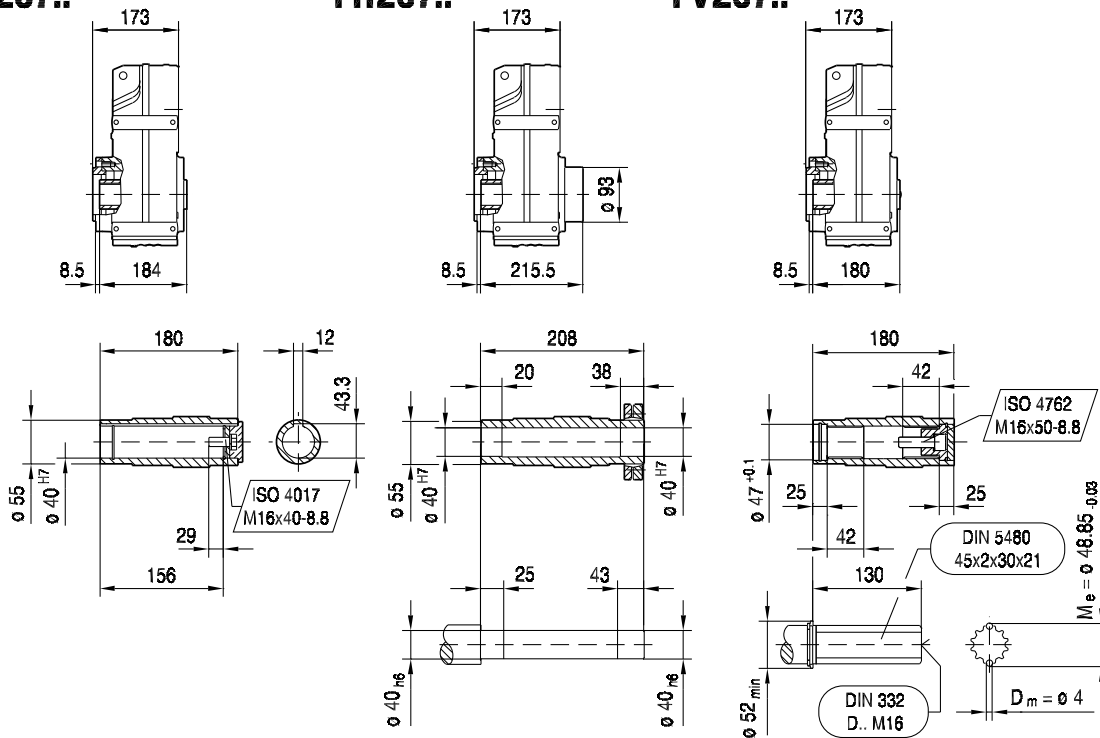
42 098 00 08



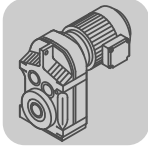
FAZ67..

FHZ67..

FVZ67..



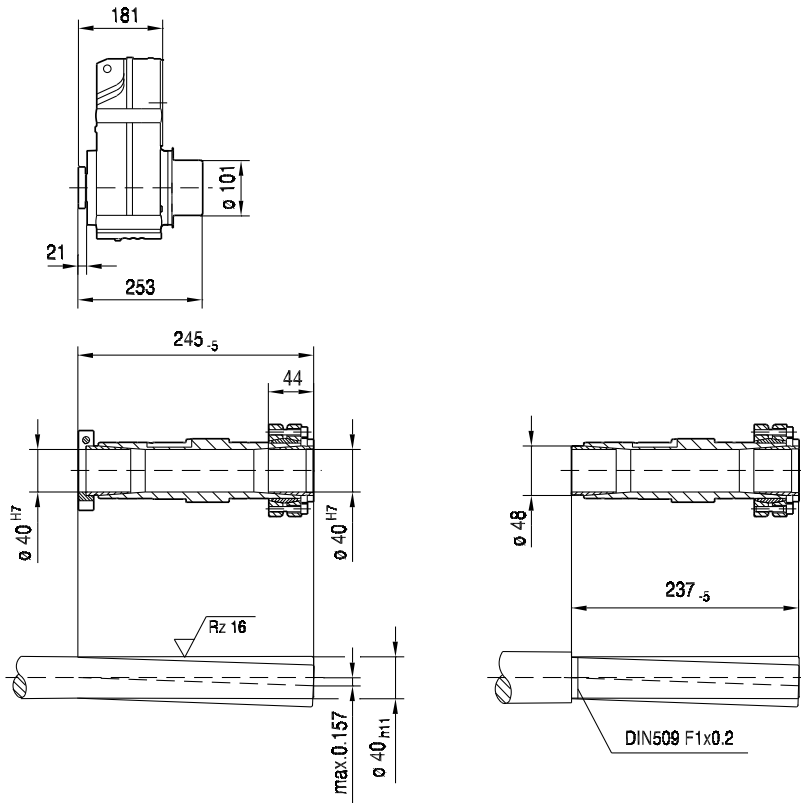
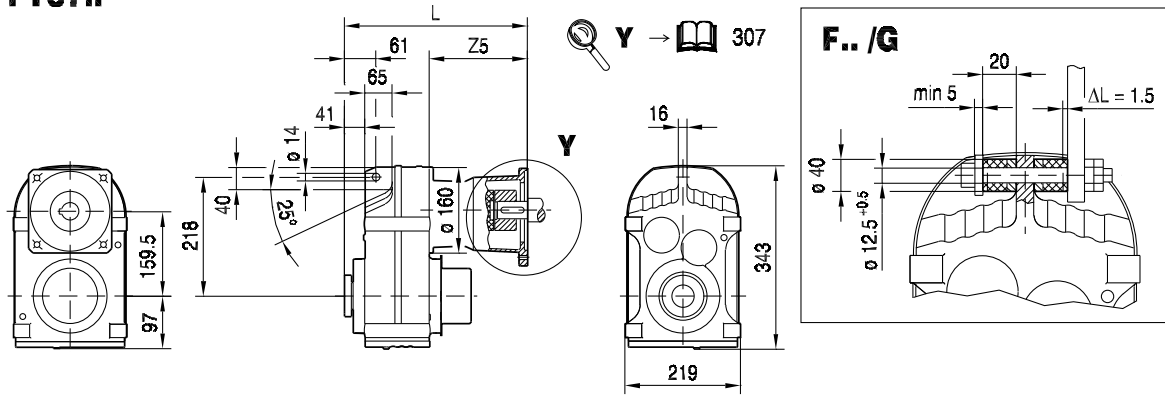
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	271	296	310	319	348	361	361	411	435
Z5	98	123	137	146	175	188	188	237.5	261.5



F..
F.. AQ..



FT67..

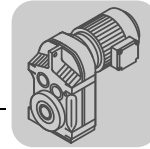
42 097 00 08



(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	280	305	319	328	357	370	370	419	443
Z5	98	123	137	146	175	188	188	237.5	261.5

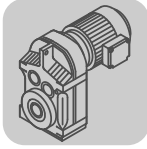


FA77 n _e = 1400	i	M _{amax} [Nm]	M _{apk} [Nm]	M _{aNotaus} [Nm]	n _{ak} [1/min]	J _G 10 ⁻⁴ [kgm ²]	F _{Ramax}				F _{Rapk}			
							FA [N]	FAF [N]	F [N]	FF [N]	FA [N]	FAF [N]	F [N]	FF [N]
FA77 	4.28	1010	1310	1717	327	42	630	630	10200	10900	20000	20000	16900	17400
	5.16	1080	1320	1836	271	31	640	640	10700	11500	20000	20000	16800	17400
	5.76	1080	1320	1836	295	26	930	930	11300	12000	20000	20000	16800	17400
	6.64	1080	1320	1836	346	20	1310	1310	12000	12700	20000	20000	16800	17400
	7.39	1080	1330	1836	365	17	1610	1610	12500	13300	20000	20000	16800	17400
	8.26	1080	1330	1836	400	14	1940	1940	13100	13900	20000	20000	16800	17400
	9.30	1080	1330	1836	430	12	2300	2300	13800	14600	20000	20000	16800	17400
	10.93	1500	1530	2550	183	19	2080	2080	14200	15100	20000	20000	15500	17000
	12.20	1500	1530	2550	205	16	2450	2450	14900	15800	20000	20000	15500	17000
	14.06	1500	1530	2550	220	13	2940	2940	15700	16700	20000	20000	15500	17000
	15.64	1500	1530	2550	237	11	3330	3330	15700	17100	20000	20000	15500	17000
	17.49	1500	1530	2550	252	9.5	3750	3750	15700	17100	20000	20000	15500	17000
	19.70	1500	1530	2550	264	7.9	4220	4220	15700	17100	20000	20000	15500	17000
	21.43	1500	1530	2550	275	7.1	4560	4560	15700	17100	20000	20000	15500	17000
	25.50	1500	1530	2550	275	5.5	5300	5300	15700	17100	20000	20000	15500	17000
	28.75	1430	1530	2431	243	4.4	6190	6190	16200	17300	20000	20000	15500	17000
	31.51	1380	1530	2346	222	3.8	6870	6870	16500	17500	20000	20000	15500	17000
	36.58	1110	1530	1887	191	3.0	8990	8990	17900	18300	20000	20000	15500	17000
	FA77 	25.54	1450	1530	2465	59	10	5560	5560	16100	17300	20000	20000	15500
29.91		1500	1530	2550	50	7.8	6010	6010	15700	17100	20000	20000	15500	17000
33.74		1500	1530	2550	50	6.4	6580	6580	15700	17100	20000	20000	15500	17000
38.23		1500	1530	2550	50	5.2	7190	7190	15700	17100	20000	20000	15500	17000
43.58		1500	1530	2550	50	4.3	7850	7850	15700	17100	20000	20000	15500	17000
48.37		1500	1530	2550	52	3.8	8410	8410	15700	17100	20000	20000	15500	17000
55.27		1500	1530	2550	52	3.0	9140	9140	15700	17100	20000	20000	15500	17000
58.32		1500	1530	2550	51	2.8	9450	9450	15700	17100	20000	20000	15500	17000
66.46		1500	1530	2550	53	2.2	10200	10200	15700	17100	20000	20000	15500	17000
72.50		1500	1530	2550	52	1.9	10700	10700	15700	17100	20000	20000	15500	17000
75.02		1500	1530	2550	53	4.0	11000	11000	15700	17100	20000	20000	15500	17000
85.52		1500	1530	2550	53	3.3	11800	11800	15700	17100	20000	20000	15500	17000
94.93		1500	1530	2550	54	3.0	12500	12500	15700	17100	20000	20000	15500	17000
108.46		1500	1530	2550	53	2.5	13400	13400	15700	17100	20000	20000	15500	17000
114.45		1500	1530	2550	54	2.3	13800	13800	15700	17100	20000	20000	15500	17000
130.42		1500	1530	2550	54	1.9	14800	14800	15700	17100	20000	20000	15500	17000
142.27		1500	1530	2550	49	1.6	15400	15400	15700	17100	20000	20000	15500	17000
166.47		1500	1530	2550	42	1.3	16700	16700	15700	17100	20000	20000	15500	17000
188.40		1500	1530	2550	37	0.91	17700	17700	15700	17100	20000	20000	15500	17000
198.31		1500	1530	2550	35	0.82	18100	18100	15700	17100	20000	20000	15500	17000
225.79	1500	1530	2550	31	0.67	19300	19300	15700	17100	20000	20000	15500	17000	
262.93	1500	1530	2550	27	0.54	20000	20000	15700	17100	20000	20000	15500	17000	
281.71	1500	1530	2550	25	0.47	20000	20000	15700	17100	20000	20000	15500	17000	



AQ.	i	n _{epk} [1/min]	η [%]	C _{TG}				φ /R [°]
				FA [Nm/']	FAF [Nm/']	F [Nm/']	FF [Nm/']	
FA77 2	4.28	4500	97	263	263	132	106	8
	5.16	4500	97	263	263	132	106	8
	5.76	4500	97	263	263	132	106	8
	6.64	4500	97	263	263	132	106	8
	7.39	4500	97	263	263	132	106	7
	8.26	4500	97	263	263	132	106	7
	9.30	4500	97	263	263	132	106	7
	10.93	4500	97	351	351	151	118	6
	12.20	4500	97	351	351	151	118	5
	14.06	4500	97	351	351	151	118	5
	15.64	4500	97	351	351	151	118	5
	17.49	4500	97	351	351	151	118	5
	19.70	4500	97	351	351	151	118	5
	21.43	4500	97	351	351	151	118	5
	25.50	4500	97	351	351	151	118	5
28.75	4500	97	351	351	151	118	5	
31.51	4500	97	351	351	151	118	5	
36.58	4500	97	351	351	151	118	5	
FA77 3	25.54	4500	96	388	388	157	122	6
	29.91	4500	96	388	388	157	122	6
	33.74	4500	96	388	388	157	122	6
	38.23	4500	96	388	388	157	122	6
	43.58	4500	96	388	388	157	122	6
	48.37	4500	96	388	388	157	122	6
	55.27	4500	96	388	388	157	122	6
	58.32	4500	96	388	388	157	122	6
	66.46	4500	95	388	388	157	122	6
	72.50	4500	95	388	388	157	122	6
	75.02	4500	95	394	394	158	123	6
	85.52	4500	95	394	394	158	123	6
	94.93	4500	95	394	394	158	123	5
	108.46	4500	95	394	394	158	123	5
	114.45	4500	95	394	394	158	123	5
	130.42	4500	95	394	394	158	123	5
	142.27	4500	94	394	394	158	123	5
	166.47	4500	94	394	394	158	123	5
	188.40	4500	94	394	394	158	123	5
	198.31	4500	94	394	394	158	123	5
225.79	4500	93	394	394	158	123	5	
262.93	4500	93	394	394	158	123	5	
281.71	4500	92	394	394	158	123	5	

9

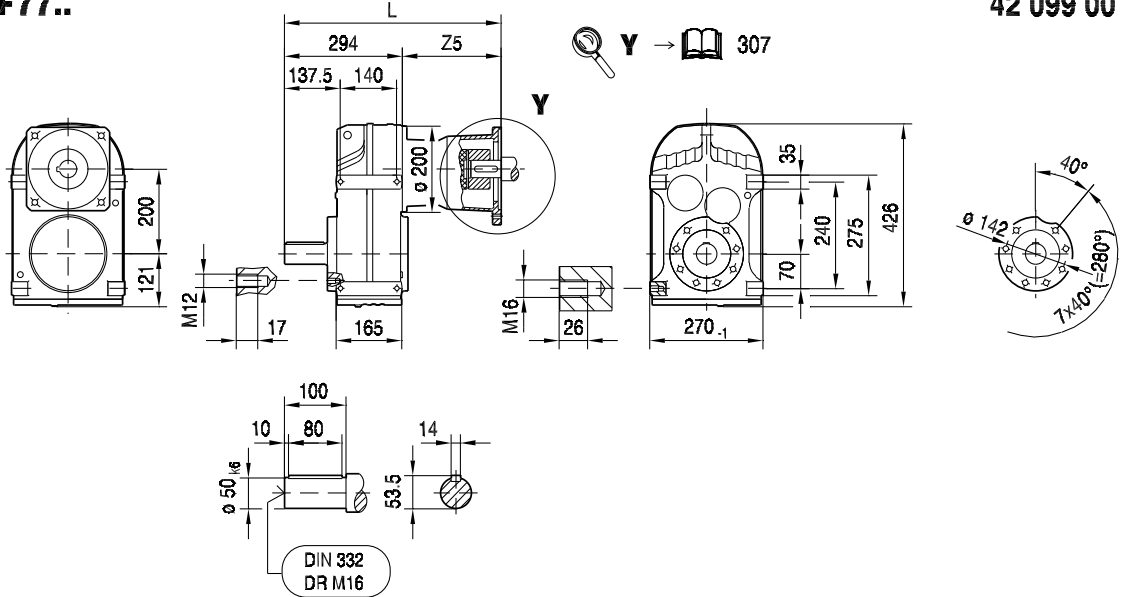


F..
F.. AQ..

9.2.12 F 77 AQ.. [mm]

F77..

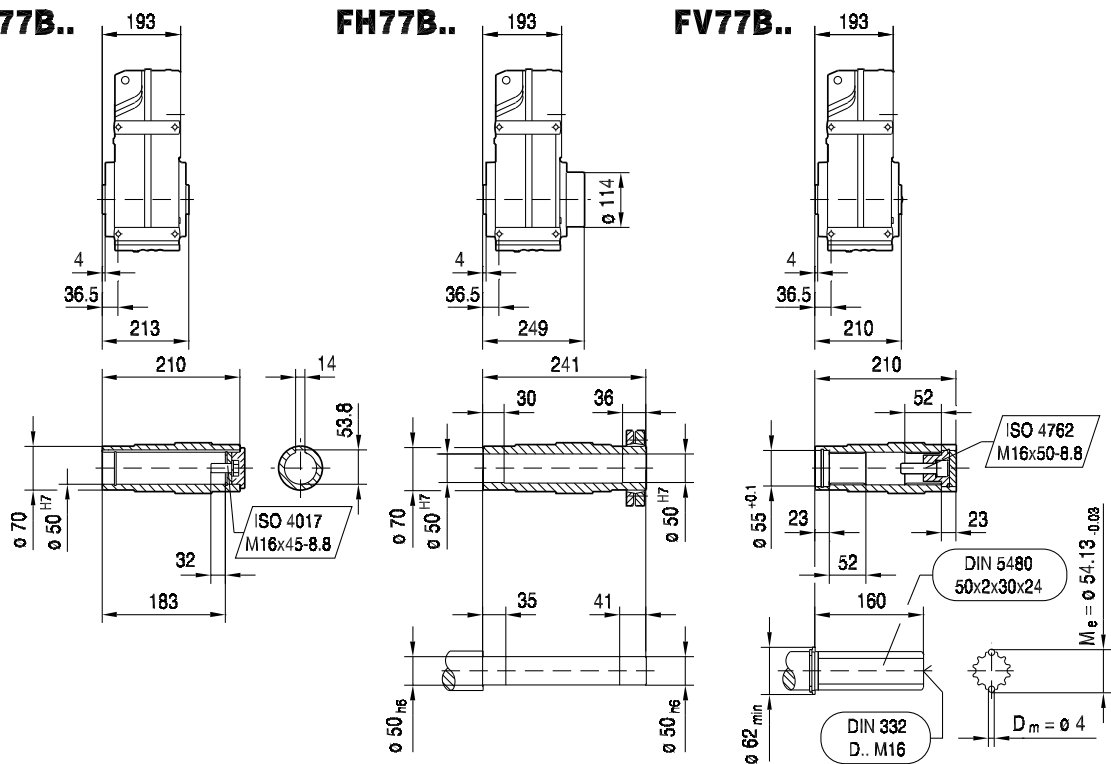
42 099 00 08



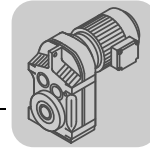
FA77B..

FH77B..

FV77B..

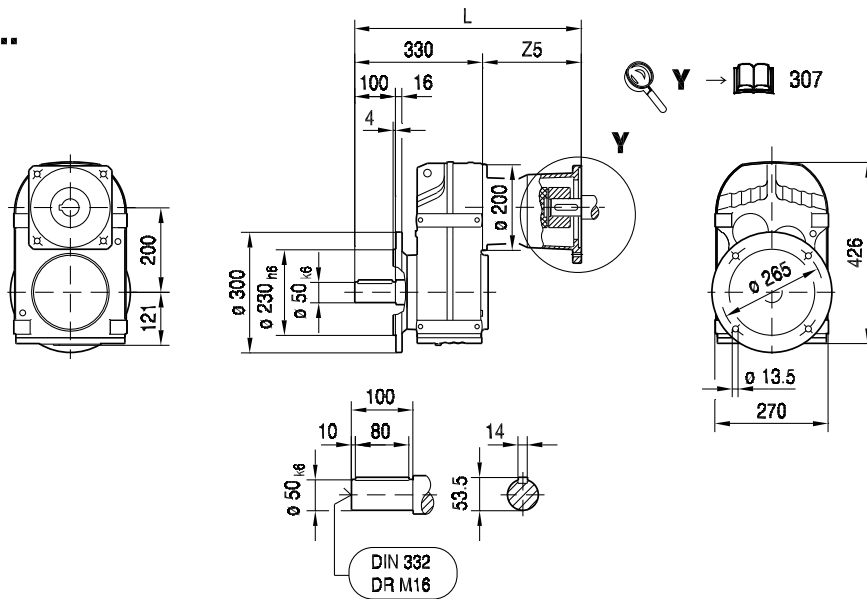


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	386	410	424	433	461	474	474	520	544
Z5	92	116	130	139	167	180	180	225.5	249.5



FF77..

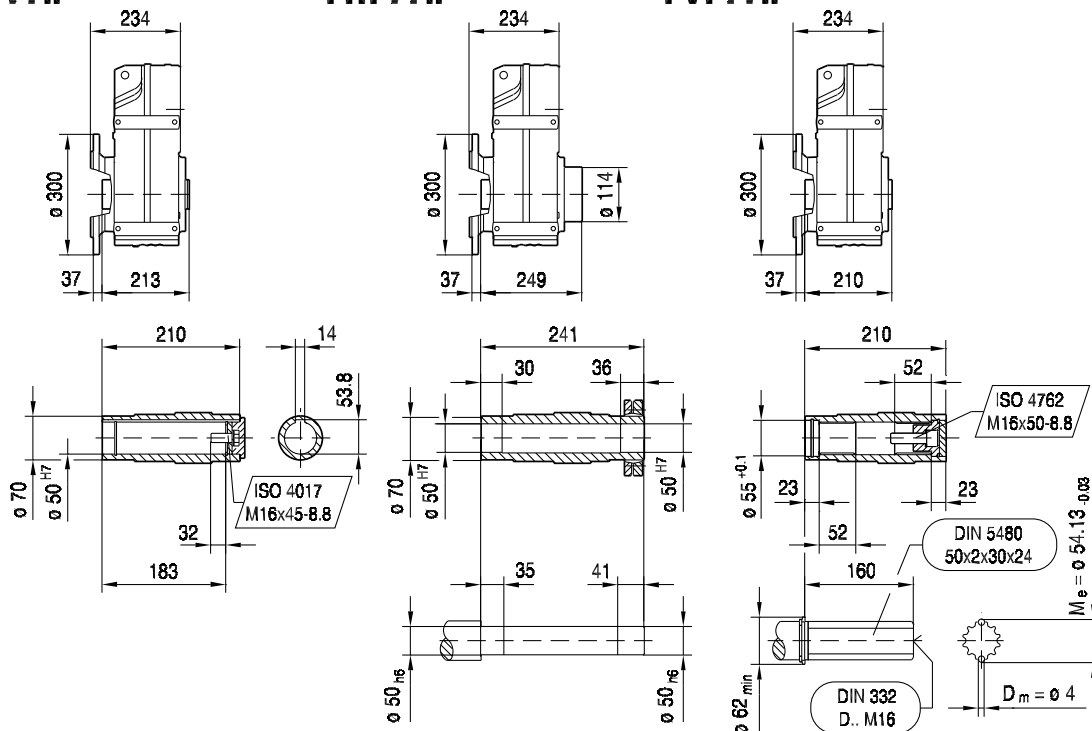
42 100 00 08^L



FAF77..

FHF77..

FVF77..



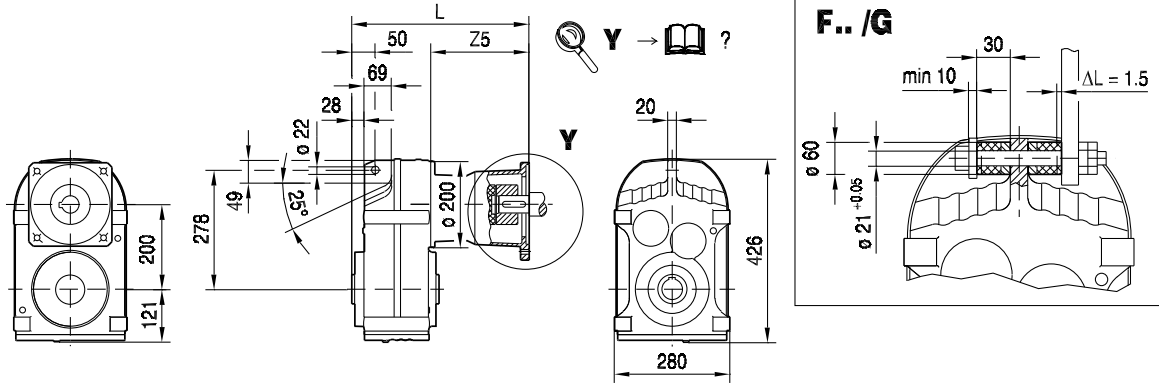
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	422	446	460	469	497	510	510	556	580
Z5	92	116	130	139	167	180	180	225.5	249.5



F..
F.. AQ..

FA77..

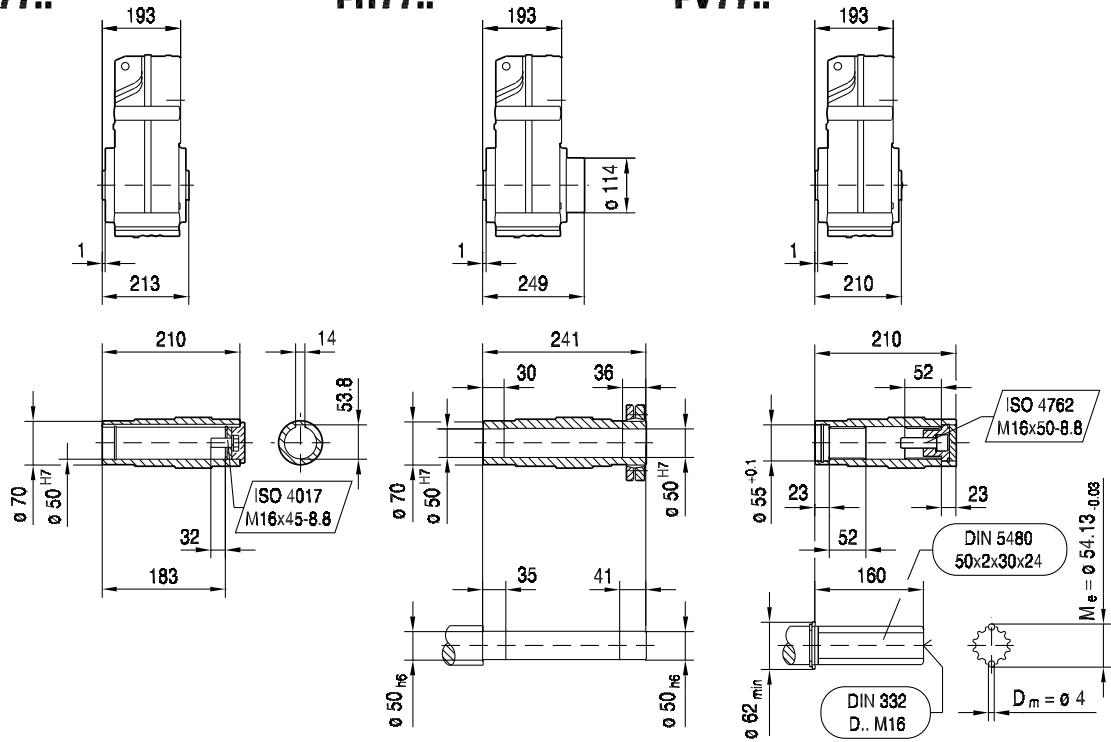
42 101 00 08



FA77..

FH77..

FV77..

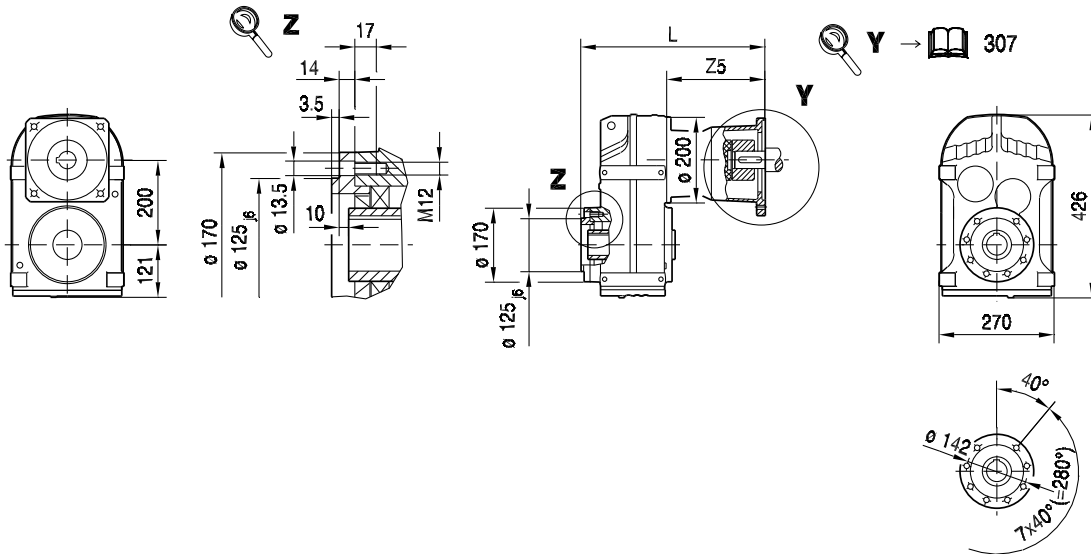


(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	285	309	323	332	360	373	373	419	443
Z5	92	116	130	139	167	180	180	225.5	249.5



FAZ77..

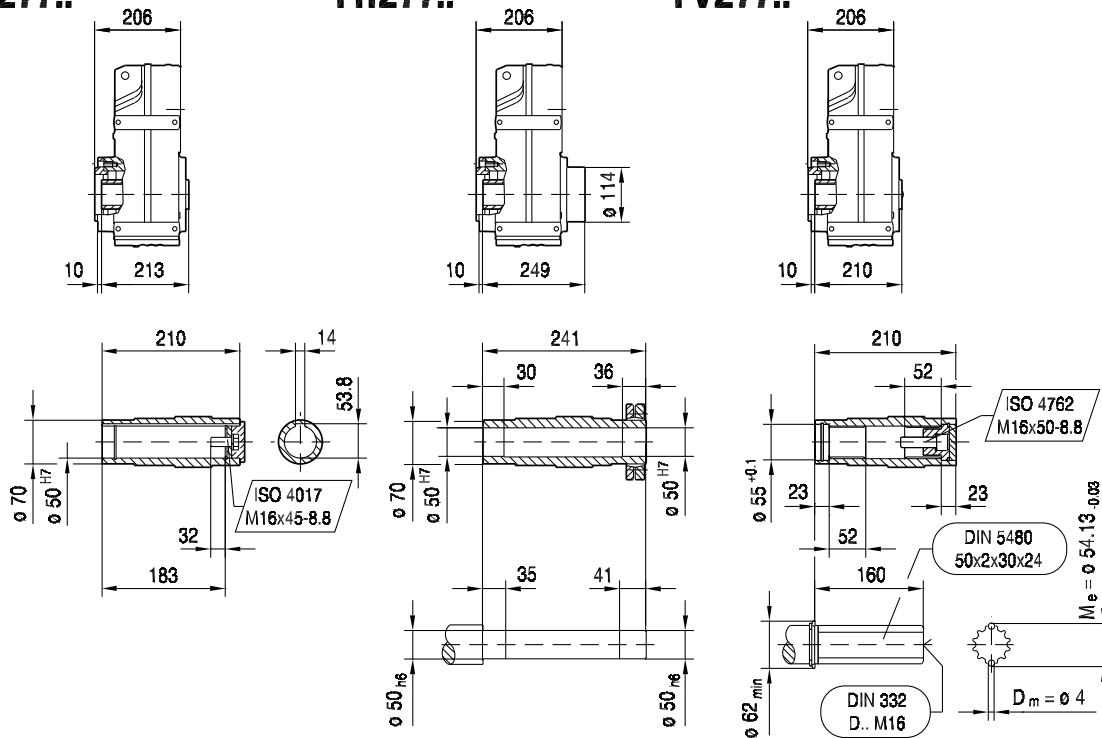
42 103 00 08^L



FAZ77..

FHZ77..

FVZ77..



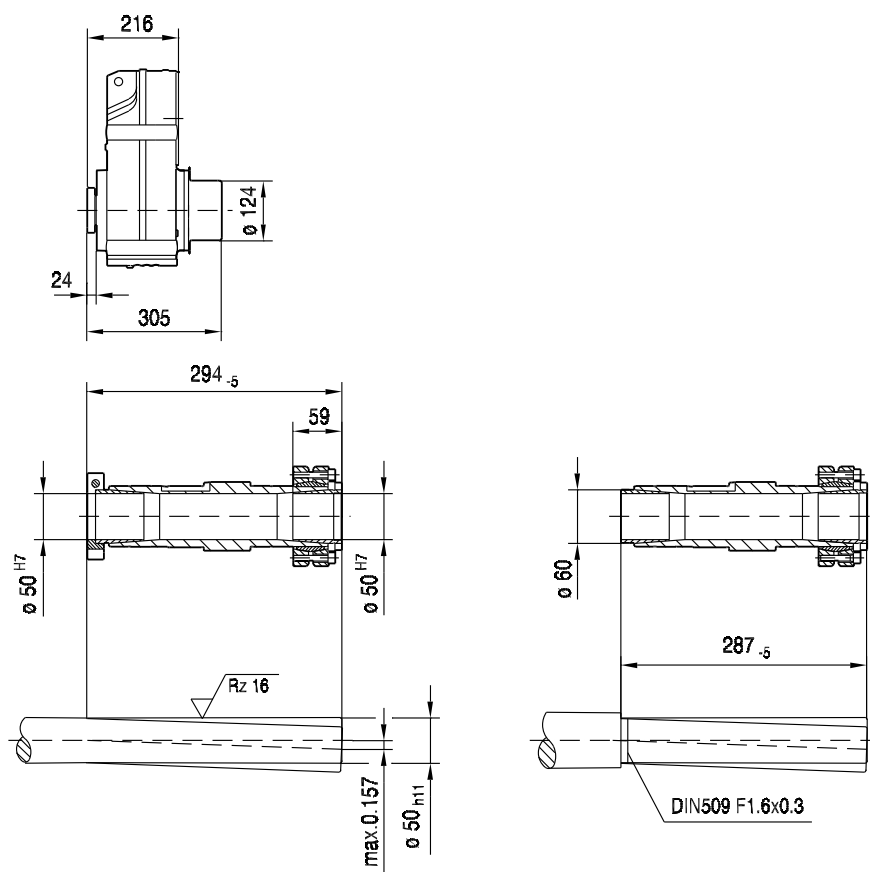
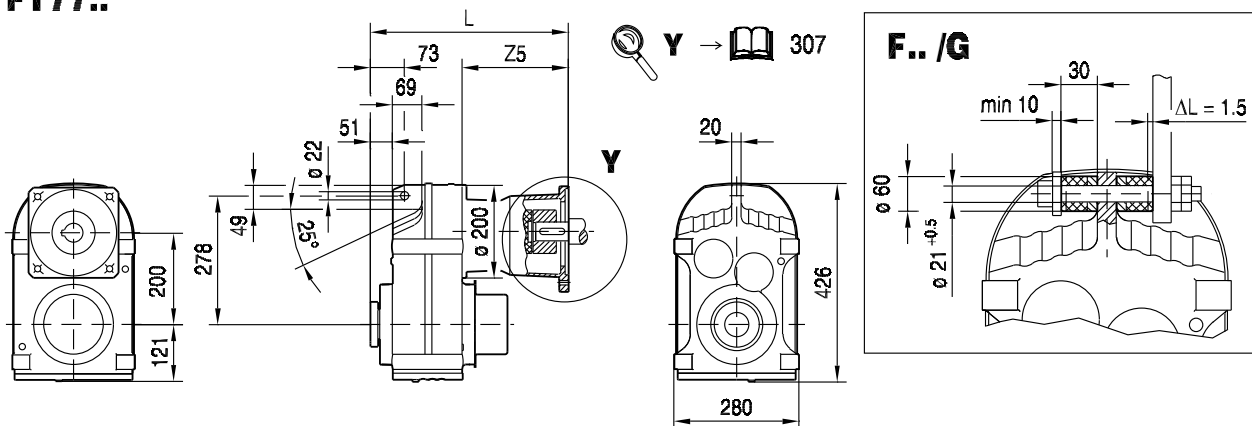
(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	298	322	336	345	373	386	386	432	456
Z5	92	116	130	139	167	180	180	225.5	249.5



F..
F.. AQ..

FT77..



42 102 00 08





(→ 144)	AQ80/1-3	AQ100/1-2	AQ100/3-4	AQ115/1-3	AQ140/1-2	AQ140/3-4	AQ160/1	AQ190/1-2	AQ190/3
L	308	332	346	355	383	396	396	442	466
Z5	92	116	130	139	167	180	180	225.5	249.5



9.2.13 F 87 AQ.. [Nm]

[Nm]	i	AQ.																							
		M _{amax} M _{apk} M _{aNotaus}																							
		100/1-4			115/1-2			115/3			140/1			140/2-4			160/1			190/1-3					
FA87 	4.12										245	245	410	410	410	410	410	410	410	655	655	655			
	4.92										295	295	490	490	490	490	490	490	490	785	785	785			
	5.63	95	95	191	95	95	191	255	255	255	335	335	560	560	560	560	560	560	560	900	900	900			
	6.65	113	113	225	113	113	225	305	305	305	395	395	665	665	665	665	665	665	665	1060	1060	1060			
	7.35	124	124	245	124	124	245	335	335	335	440	440	735	735	735	735	735	735	735	1170	1170	1170			
	8.29	140	140	280	140	140	280	380	380	380	495	495	820	820	820	820	820	820	820	1320	1320	1320			
	9.58										570	570	950	950	950	950	950	950	950	1530	1530	1530			
	11.46										685	685	1140	1140	1140	1140	1140	1140	1140	1830	1830	1830			
	13.12	220	220	445	220	220	445	600	600	600	785	785	1310	1310	1310	1310	1310	1310	1310	2090	2090	2090			
	15.48	260	260	525	260	260	525	710	710	710	920	920	1540	1540	1540	1540	1540	1540	1540	2470	2470	2470			
	17.12	290	290	580	290	290	580	785	785	785	1020	1020	1710	1710	1710	1710	1710	1710	1710	2730	2730	2730			
	19.31	325	325	655	325	325	655	880	880	880	1150	1150	1930	1930	1930	1930	1930	1930	1930	3000	3080	3080			
	21.32	360	360	720	360	360	720	980	980	980	1270	1270	2130	2130	2130	2130	2130	2130	2130	3000	3090	3410			
	23.68	400	400	800	400	400	800	1080	1080	1080	1420	1420	2360	2360	2360	2360	2360	2360	2360	3000	3090	3780			
	26.50	450	450	900	450	450	900	1210	1210	1210	1590	1590	2650	2650	2650	2650	2650	2650	2650	3000	3090	4240			
	28.78	485	485	970	485	485	970	1320	1320	1320	1720	1720	2870	2450	2870	2870	2450	2870	2870	2450	3090	4160			
	33.92	575	575	1150	575	575	1150	1560	1560	1560	2030	2030	3390	2610	3090	3390	2610	3090	3390	2610	3090	4430			
	FA87 	29.20	495	495	990	495	495	990	1340	1340	1340	1750	1750	2920	2510	2920	2920	2510	2920	2920	2510	3090	4260		
35.19		595	595	1190	595	595	1190	1610	1610	1610	2110	2110	3510	2610	3090	3510	2610	3090	3510	2610	3090	4430			
39.30		665	665	1330	665	665	1330	1800	1800	1800	2350	2350	3930	2720	3090	3930	2720	3090	3930	2720	3090	4620			
45.28		765	765	1530	765	765	1530	2080	2080	2080	2710	2710	4520	2820	3090	4520	2820	3090	4520	2820	3090	4790			
50.36		850	850	1710	850	850	1710	2310	2310	2310	2940	3020	4990	2940	3090	4990	2940	3090	4990	2940	3090	4990			
56.75		960	960	1920	960	960	1920	2610	2610	2610	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100			
68.40		1160	1160	2320	1160	1160	2320	3000	3090	3140	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100			
76.39		1290	1290	2590	1290	1290	2590	3000	3090	3510	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100			
88.01		1490	1490	2990	1490	1490	2990	3000	3090	4040	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100			
97.89		1660	1660	3320	1660	1660	3320	3000	3090	4500	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100			
109.49		1860	1860	3720	1860	1860	3720	3000	3090	5030	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100			
123.29		2090	2090	4190	2090	2090	4190	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100			
134.16		2280	2280	4560	2280	2280	4560	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100			
159.61		2710	2710	5100	2710	2710	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100			
179.97		3000	3050	5100	3000	3050	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100						
197.20		3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100						
228.93		3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100	3000	3090	5100						
255.37		3000	3090	5100	3000	3090	5100	3000	3090	5100															
270.68	3000	3090	5100	3000	3090	5100	3000	3090	5100																

m [kg]		AQ.							
s		100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3	
FA87 		91	92	92	97	97	97	105	
FA87 		94	95	95	100	100	100	110	
FAF: + 12.7 kg / F: + 5.7 kg / FF: + 21.3 kg									

		AQ.							
J _A 10 ⁻⁴ [kgm ²]		100/1-4	115/1-2	115/3	140/1	140/2-4	160/1	190/1-3	
		1.4	1.4	3.1	5.1	10.0	10.0	25.0	
c _{TA} [Nm/°]		0.25	0.25	0.625	0.625	1.0	1.0	2.08	