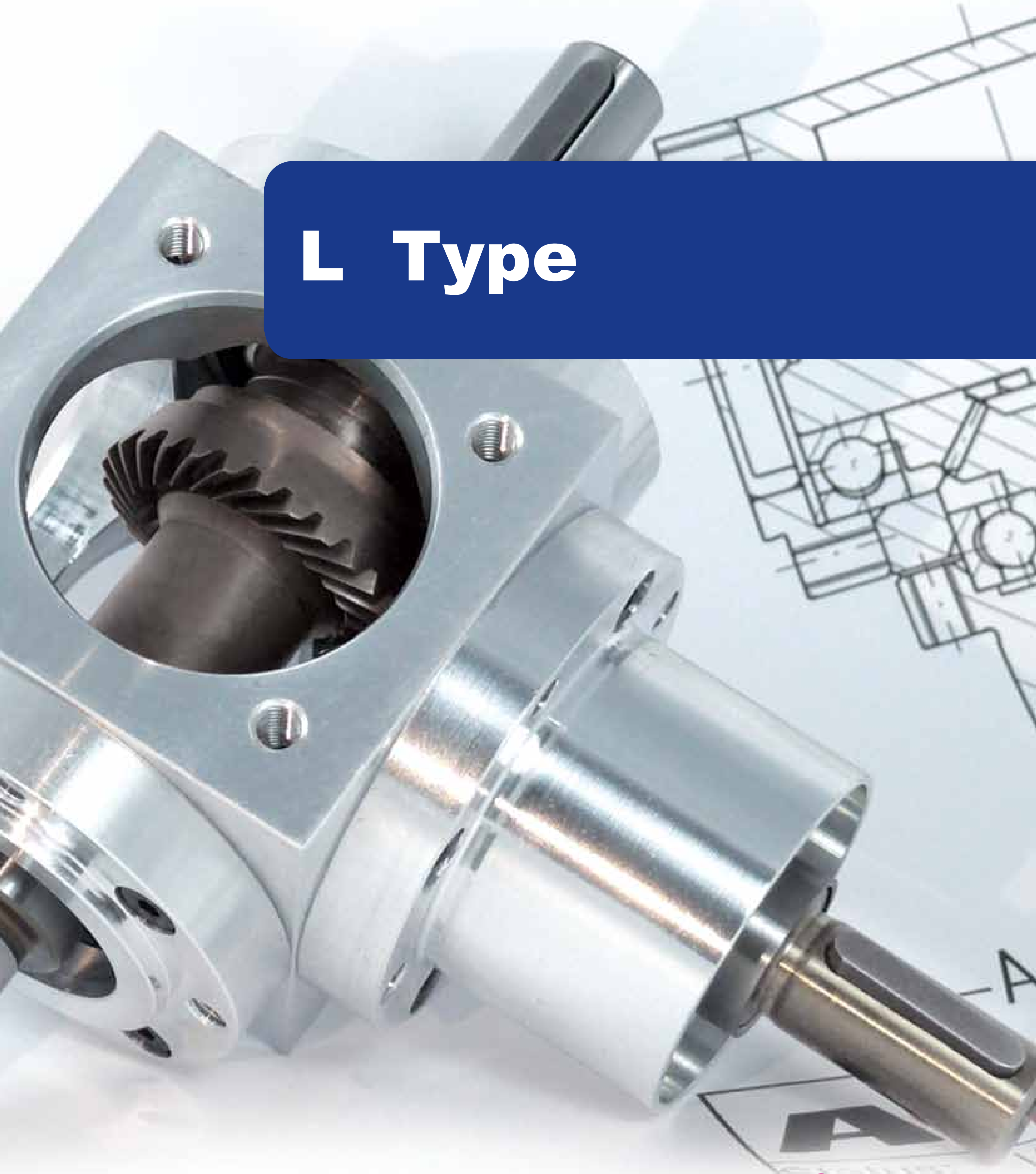
Produktkatalog | *Product-Catalogue*

# L Type



ATEK
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Miniature bevel gearboxes

ATEK ANTRIEBSTECHNIK

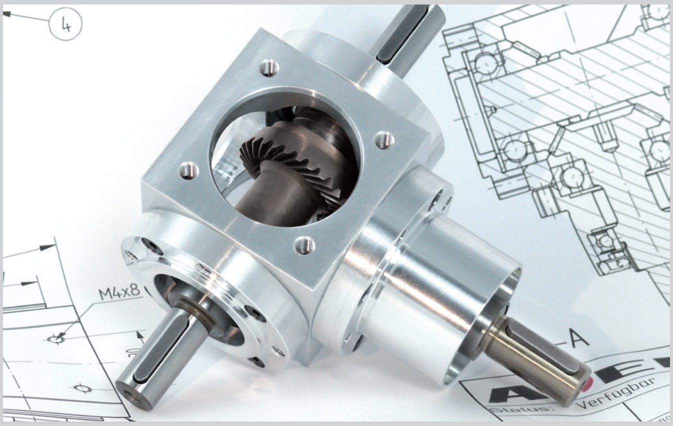
Gear ratios: $i$ = 1:1 to 4:1
Maximum output torque: 16 Nm
2 gearbox sizes with edge lengths of 035 to 045 mm
Speeds up to $n_1$ = 3000 rpm
Low-backlash construction < 10 angular minutes possible

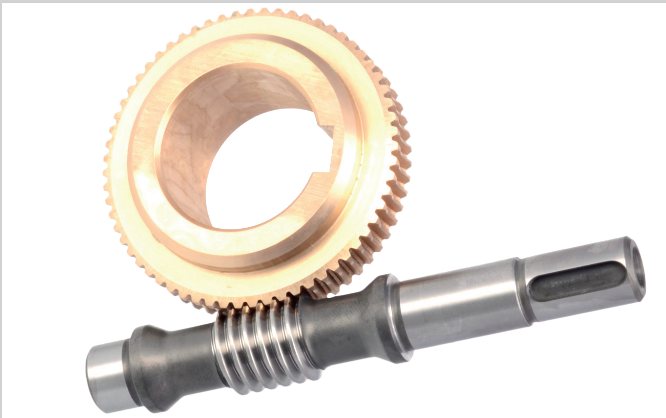
Small, lightweight, space-saving,
Aluminium design
Housing made of aluminium
Spiral-toothed gear sets
Maintenance-free

S



ATEK ANTRIEBSTECHNIK




**Legal information:**
We give no warranty for the correctness of the contents, in spite of thorough processing. With the publishing of this catalogue, all previous catalogues are rendered invalid. We reserve the right to change the design, weight, and dimensions of our angular gearboxes. Deliveries and services are provided according to our “General Terms and Conditions”.

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## ATEK Antriebstechnik

As a medium-sized gearbox manufacturer, today we look back on over 75 years of tradition. For more than 30 years, everything for us has “revolved” around right-angle power transmission.

Today, as from the beginning, we are driven by one thing: solving your drive-engineering problems. – technically competent, economical, reliable and fast!

Developed and assembled in the Hamburg metropolitan region and distributed throughout the world, our range of products comprising single-stage angular gearboxes has allowed us to secure a large market share which has been steadily growing for the past number of years.

The modularly structured product range primarily comprises bevel gears and worm gears and the servo series which can be combined with modern servo-motors. Our angular gearboxes stand out thanks to their compact build, extensive performance spectrum and variety of feasible step-up/down ratios. Thanks to our enormous warehouse we can often supply our standard series within a matter of hours.
Be it for application-specific drive train solutions for special machine construction or series products for general machine construction: The ATEK modular system leaves nothing to be desired.

Our customers benefit from well-engineered drive train solutions, top-quality products and processes, established know-how and very reasonable value for money.

In addition to a worldwide distribution network which guarantees competent, on-site support, round-the-clock contact and communication can also be established over the Internet. A gearbox configurator is available via our www.atek.de homepage, from which customers and interested parties can download the 3D CAD data of all ATEK bevel gearboxes, worm gearboxes and servo gearboxes, thus allowing them to be more effectively integrated into the construction and supply process.


**1939**
Formation of Willi Glapiak turnery in Hamburg

**1978**
Change of legal form into a GmbH (limited liability company)

**1983**
Merger of Willi Glapiak GmbH and ATEK Ingenieurbüro f. Antriebstechnik to today’s ATEK Antriebstechnik Willi Glapiak GmbH and transfer of the company seat to Rellingen

**1985**
Focussing on single-stage bevel gearboxes and worm gearboxes

# Our motto is Vmax…
# and not only with regard to the rotational speed of our products

## Drive
Our hallmark:
Excellent ability to supply

Efficient logistics:
High parts availability at our locations and those of our partners

Fast and almost constant reachability

## Know-how
Realisation of our high quality standards through selected, highly specialised suppliers and a qualified and experienced staff team

Our processes are subject to continuous monitoring

Our management system is certified

## Performance
Whether standard or special manufacture, maintenance or advisory service...
Your drive-engineering task definition is our challenge!

We set benchmarks as to reliability, dynamics, and high precision

We stand for long-standing partnerships, loyalty and confidence

**1995**
Inclusion of servo gearboxes (Ad-Servo series) into the product range

**1997**
Relocation to Prisdorf / Expansion of production capacities

**Since 2002**
Internationalisation / Development / extension of foreign markets

**2009**
Inclusion of miniature gearboxes (L series) into the product range

**2012**
Inclusion of hypoid gears (HC series) into the product range

**2013**
Relocation to Rellingen with renewed expansion of production capacities

# 4 General

## 4.1 Gearboxes

“A gearbox is a machine element used to change movement parameters. Sometimes, the change of a force or a torque plays the decisive role. The movement to be changed is often a rotary movement.” (Wikipedia)
ATEK offers angular gearboxes of the following types that deflect the direction of a rotary movement by 90° and, if desired, also change the rotational speed and the torque.

**Bevel gearboxes – types**

| | |
|---|---|
| L | miniature |
| LC | prepared for the mounting of a servo-motor |
| V | with free shaft ends |
| HDV | Hygiene-design bevel gearboxes |
| VS | the through-shaft is fast-running |
| VL | prepared for the mounting of an IEC standard motor |
| VLM | complete with IEC motor |
| VC | prepared for the mounting of a servo-motor |

**Hypoid gearboxes – types**

| | |
|---|---|
| H | with free shaft ends |
| HC | prepared for the mounting of a servo-motor |

**Worm gearboxes – types**

| | |
|---|---|
| S | with free shaft ends |
| SL | prepared for the mounting of an IEC standard motor |
| SLM | complete with IEC motor |
| SC | prepared for the mounting of a servo-motor |

## 4.2 Legal classification

The gearboxes are “incomplete machines” within the meaning of the Machinery Directive. They are designed for the European market. In non-EU countries, the respective provisions must be observed. The gearbox must not be put into service until it has been ascertained, if appropriate, that the machine into which the gearbox is to be installed complies with the Directive 3006/42/EC.

## 4.3 Designations

### 4.3.1 Designations used

#### Drive
The shaft of the gearbox that is supplied with energy is designated as drive shaft.

#### Output
The shaft(s) of the gearbox from which energy is taken is/are designated as output shaft(s).

#### Designation of gearbox sides
The 6 surfaces of the gearbox housing are designated with the numbers 1–6.
They indicate the fixing side and the installation position.

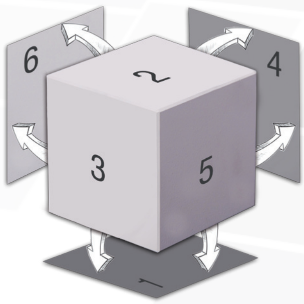


Figure **4.3.1-1; Gearbox sides**

#### Threaded mounting hole
All gearboxes provide many mounting options on all sides.
For details, please refer to the type-specific information.

#### Fixing side
The fixing side is the side of the gearbox on which it is connected to the machine rack. It is important, among other things, for the determination of the arrangement of the vent filters. For details, please refer to the type-specific information.

#### Installation position
The installation position defines the gearbox side which is directed downwards during operation. In the above Figure, the installation position 1 is shown. The information on the installation position is needed for assessing the lubricating conditions, the determination of the vent filter arrangement, and the design of the roller bearings.

## Gear ratio

"In engineering, an apparatus with a gear/transmission ratio is a device which transforms the value of a physical variable into another value of the same variable where both values are in a constructively determined ratio to each other." (Wikipedia)

For the gearboxes, the gear ratio (transmission ratio) [i] is defined as:

$$i = \frac{\text{teeth number}_{\text{output}}}{\text{teeth number}_{\text{drive}}}$$

The transmitted variables are rotational speed [n] and torque [T]

$$i = \frac{n_{\text{drive}}}{n_{\text{output}}} \quad \text{and} \quad i = \frac{T_{\text{output}}}{T_{\text{drive}}} * \frac{1}{\eta}$$

## Efficiency

The efficiency [η] is the ratio of power output to power input. The efficiencies specified in the tables can be achieved at maximum permissible rated output during continuous operation. They are guidance values for run-in gearboxes at operating temperature with standard sealing.

## Rotational direction of the shaft

The shaft's rotational direction is always seen from the shaft end face towards the gearbox centre.
It is indicated as "clockwise" = CW or "counterclockwise" = CCW

# 4.4 Corrosion protection

## 4.4.1 Prime-coated C1 (standard)

If no additional information is given, ATEK gearboxes are delivered with a prime coat of epoxy-resin based two-component paint base.

Example of order code: V 090 1:1 E0 -9.9- 700/0000

| Gearbox part | Material | Protection | Application |
|---|---|---|---|
| **Housing** | Grey cast iron | 1x prime coat | Layer thickness > 40 µm |
| **Flanges** | Grey cast iron or steel | 1x prime coat | Layer thickness > 40 µm |
| **Shafts** | C45 | greased | |

Table **4.4.1-1**

**The layer thickness of the surface protection alters the fits defined in the dimensional sketches.**
**If fits are not to receive corrosion protection, please notify us thereof.**

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## 4.4.2 Varnished C2

Upon request, ATEK gearboxes can be varnished in standard and special colour shades. Please contact us.
Example of order code: V 090 1:1 E0 -9.9- 700/C2

| Gearbox part | Material | Protection | Application |
|---|---|---|---|
| **Housing** | Grey cast iron | 1x prime coat, 1x covering varnish | Layer thickness > 80 µm |
| **Flanges** | Grey cast iron or steel | 1x prime coat, 1x covering varnish | Layer thickness > 80 µm |
| **Shafts** | C45 | greased | |

Table **4.4.2-1**

**The layer thickness of the surface protection alters the fits defined in the dimensional sketches.**
**If fits are not to receive corrosion protection, please notify us thereof.**

## 4.4.3 Varnished C3

Upon request, ATEK gearboxes can be equipped with a paint system for the use in an environment exposed to sulphur dioxide. Please contact us. Example of order code: V 090 1:1 E0 -9.9- 700/C3

| Gearbox part | Material | Protection | Application |
|---|---|---|---|
| **Housing** | Grey cast iron | 2x prime coat, 1x covering varnish<br>1x covering varnish | Layer thickness > 120 µm |
| **Flanges** | Grey cast iron or steel | 2x prime coat, 1x covering varnish<br>1x covering varnish | Layer thickness > 120 µm |
| **Shafts** | C45 | greased | |

Table **4.4.3-1**

**The layer thickness of the surface protection alters the fits defined in the dimensional sketches.**
**If fits are not to receive corrosion protection, please notify us thereof.**

## 4.4.4 Varnished C4

Upon request, ATEK gearboxes can be equipped with a paint system for the use in an industrial environment exposed to salt. Please contact us. Example of order code: V 090 1:1 E0 -9.9- 700/C4

| Gearbox part | Material | Protection | Application |
|---|---|---|---|
| **Housing** | Grey cast iron | 1x zinc protection, 1x prime coat<br>1x covering varnish | Layer thickness > 160 µm |
| **Flanges** | Grey cast iron or steel | 1x zinc protection, 1x prime coat<br>1x covering varnish | Layer thickness > 160 µm |
| **Shafts** | C45 | greased | |

Table **4.4.4-1**

**The layer thickness of the surface protection alters the fits defined in the dimensional sketches.**
**If fits are not to receive corrosion protection, please notify us thereof.**

## 4.4.5 Electroplated

Chemically plated with nickel. Example of order code: V 090 1:1 E0 -9.9- 700/KB

| Gearbox part | Material | Protection | Application |
|---|---|---|---|
| **Housing** | Grey cast iron | Ni | ~30 µm |
| **Flanges** | Grey cast iron or steel | Ni | ~30 µm |
| **Shafts** | Stainless steel | greased | |

Table **4.4.5-1**

## 4.4.6 Aluminium

Valid for all miniature gearboxes
Example of order code: L 045 1:1 E0 -9.9- 700/0000

| Gearbox part | Material | Protection | Application |
|---|---|---|---|
| **Housing** | Aluminium | - | - |
| **Flanges** | Aluminium | - | - |
| **Shafts** | C45 | greased | |

Table **4.4.6-1**

## 4.4.7 Coated (anodised)

Aluminium anodised
Example of order code: L 045 1:1 E0 -9.9- 700/EL

| Gearbox part | Material | Protection | Application |
|---|---|---|---|
| **Housing** | Aluminium | Anodised coating | ~10 µm |
| **Flanges** | Aluminium | Anodised coating | ~10 µm |
| **Shafts** | C45 | greased | |

Table **4.4.7-1**

### 4.4.8 Stainless steel

ATEK gearboxes with the “HD” type designation as a prefix will be delivered in a stainless-steel design.
See chapter 7 “Hygiene-design gearboxes”

## 4.5 Protection classes

| Protection class | Seal |
|---|---|
| **IP 54 (standard)** | Standard seal NBR, form A |
| **IP 56** | Special seal, form AS |

Table **4.5-1**

**Other protection classes are available on request.**

## 4.6 Shaft types

### 4.6.1 Construction types

The construction types are classified by rotational direction and design of the output shaft.

| | | |
|---|---|---|
| **Overhung**-mounted output shaft | A0 | F0 |
| Drive shaft and output shaft have the **same direction of rotation** | B0 | G0 |
| Drive shaft and output shaft have **opposite directions of rotation** | C0 | H0 |
| One **continuous output shaft** made of solid material | D0 | J0 |
| One **continuous hollow shaft** at the output | E0 | K0 |

### 4.6.2 Solid shaft

In the standard design, a shaft fit with the ISO tolerance field 6 is provided.
The parallel keyways of the individual shafts are aligned with each other during the assembly. Due to the gear meshing, positional deviations may occur.

### 4.6.3 Hollow shaft

The order code of the hollow shaft design is coded with 4 characters. The first two characters define the construction type. The third character defines the type of force transmission, and the fourth character defines the gearbox side with the selected force transmission.

| 1st numeral | 2nd numeral | 3rd numeral | 4th numeral |
|---|---|---|---|
| Construction types | | Force transmission | On gearbox side |
| E | 0 | K (splined shaft) | 5 |
| K | 1 | N (groove) | 6 |
| | 2 | S (clamping hub) | 0 (5+6) |
| | | P (polygon shaft) | |

#### Standard hollow shaft E0N* (K0N*) *- Gearbox sides

The output shaft will be constructed as a hollow shaft with the ISO tolerance field 7. It will then be delivered with a parallel keyway: according to DIN 6885, Sheet 1. (Order code E0N, K0N) Many gearbox sizes can also be delivered with an enlarged hollow shaft bore (order code /SH).

#### Hollow shaft with splined hub profile E0K* (K0K*) *- Gearbox sides

The hollow shaft gearboxes can also be delivered with a hollow shaft with splined shaft profile according to DIN ISO 14.
(Order code E0K, K0K)

### Hollow shaft with shrink disc EOS* (KOS*) *- Gearbox sides
The hollow shaft with shrink disc enables non-positive (frictional) transmission of the torque. The bore of the hollow shafts is stepped for easier mounting and has a bronze bushing on the guide side. (Order code EOS, KOS)

### Hollow shaft with polygon profile (EOP*, KOP*) *- Gearbox sides
The hollow shaft gearboxes can also be delivered with a hollow shaft with polygon profile according to DIN 32711. (Order code EOP, KOP)

## 4.7 Lubricants

ATEK gearboxes are factory-filled with synthetic oils. Especially for applications in machines of the food industry and pharmaceutical industry, the gearboxes can optionally be delivered with NOTOX lubricants (order code /NT) that meet the requirements according to NSF H-1. All lubricant designations and alternatives can be gathered from the lubricant table on page 423.
No oil change will be necessary during the gearbox lifetime if the mechanical and thermal limit ratings are observed.
The lifetime of the bearings can be increased by the factor 1.5 if the oil is changed after the first 500 service hours and then every 5000 service hours.

## 4.8 Radial shaft seal rings

The rotating shafts are sealed by radial shaft seal rings according to DIN3761.
In the standard application, the type A made of NBR material (nitrile butadiene rubber) is used. In a dust-bearing environment, the type AS with an additional dust lip is used. For oil temperatures up to 130°C, shaft seal rings made of FCR (fluorocarbon rubber) can be used.

## 4.9 Gearbox data and layout

### 4.9.1 Lifetime
In case of intended use, the lifetime of all gearbox elements will be more than 15,000 hours. The precondition is that the layout and the operation are according to the guidelines of the catalogue.

### 4.9.2 Noise generation
The noise generation depends on many factors. Examples are gearbox size, speed, direction of rotation, lubrication, and installation position. Other important influences result from the installation conditions.

### 4.9.3 Output and torque values
The values in the performance tables are valid for the lubrication with synthetic oils. A lubricant temperature of 90°C is taken as a basis for the thermal limit rating. If an exceeding of the permissible oil temperature is safely prevented by special measures (e.g. oil cooler) examination of the thermal limit rating may be refrained from.

In special cases, e.g. in case of very short operating time or only static load, an increase of the permissible torques is possible, if appropriate.

The permissible rated power inputs $\mathbf{P_{1N}}$ and rated output torques $\mathbf{T_{2N}}$, which are listed in the performance tables, are valid for shock-free operation, 10 hours of daily operation period, 10 run-ups per hour. The rated thermal outputs $\mathbf{P_{1Nt}}$ and output torques $\mathbf{T_{2Nt}}$, respectively, are valid for an ambient temperature of 20°C and continuous operation. The maximum output torque $\mathbf{T_{2max}}$ may be achieved during short-time load peaks, but must not be exceeded. The operating conditions according to the design factors are presupposed. (see 4.8.6.2)

### 4.9.4 On-period ED
The on-period (ED, abbrev. for German term Einschaltdauer) designates a maximum permissible operating interval of a piece of equipment after which a rest period is required in order not to damage or destroy the piece of equipment. The rated modes are specified, inter alia, in the DIN VDE 0530-1. The on-period can be indicated dimensionless as a percentage value (ratio of useful life to the observation period). Generally, the utilisation period is indicated in addition to the percentage value. If not, the utilisation period is considered to be 10 minutes. (Wikipedia)

| VDE 0530-1 | Operating mode |
|---|---|
| **S1** | Continuous operation, constant load |
| **S2** | Short-time operation, constant load |
| **S3** | Intermittent operation without influence of starting on the temperature |
| **S4** | Intermittent operation with influence of starting on the temperature |
| **S5** | Intermittent operation with influence of starting and braking on the temperature |
| **S6** | Continuous operation with intermittent load |
| **S7** | Continuous operation with starting and braking |
| **S8** | Continuous operation with load change |

## 4.9.5 Abbreviations used

| Abbreviation | [Unit] | Designation |
|---|---|---|
| $F_r$ | [N] | Radial force |
| $F_a$ | [N] | Axial force |
| $i_{ist}$ | [-] | Actual gear ratio |
| $i$ | [-] | Nominal gear ratio |
| $P_1$ | [kW] | effective input power |
| $P_2$ | [kW] | effective output power |
| $P_{1N}$ | [kW] | permissible nominal input power, mechanical |
| $P_{1Nt}$ | [kW] | permissible nominal input power, thermal |
| $P_{1m}$ | [kW] | corrected input power, mechanical |
| $P_{1t}$ | [kW] | corrected input power, thermal |
| $T_1$ | [Nm] | input torque |
| $T_{1B}$ | [Nm] | permissible acceleration torque at the input drive (servo gearbox) |
| $T_{1NOT}$ | [Nm] | permissible input torque in case of emergency shut-off (servo gearbox) |
| $T_2$ | [Nm] | effective output torque |
| $T_{2B}$ | [Nm] | permissible acceleration torque at the output drive |
| $T_{2N}$ | [Nm] | permissible nominal output torque, mechanical |
| $T_{2NOT}$ | [Nm] | permissible output torque in case of emergency shut-off |
| $T_{2Nt}$ | [Nm] | permissible nominal output torque, thermal |
| $T_{2m}$ | [Nm] | corrected output torque, mechanical |
| $T_{2max}$ | [Nm] | maximum permissible output torque |
| $T_{2t}$ | [Nm] | corrected output torque, thermal |
| $T_A$ | [Nm] | starting torque |
| $J$ | [$kgcm^2$] | inertia moment |
| $J_1$ | [$kgcm^2$] | inertia moment related to the fast-rotating shaft |
| $J_{ex. red.}$ | [$kgcm^2$] | external inertia moments reduced to drive shaft |
| $J_{mot}$ | [$kgcm^2$] | inertia moment of the motor |
| $N_1$ | | fast-rotating shaft |
| $N_2$ | | slowly rotating shaft |
| $f_1$ | [-] | operating factor |
| $f_2$ | [-] | starting factor |
| $f_3$ | [-] | lubrication factor |
| $f_4$ | [-] | temperature factor |
| $f_5$ | [-] | duty-cycle factor |
| $f_{MB}$ | [-] | mass acceleration factor |
| $n_1$ | [rpm] | speed of fast-rotating shaft |
| $n_2$ | [rpm] | speed of slowly rotating shaft |
| $t_u$ | [°C] | ambient temperature |
| $\eta$ | [-] | efficiency |
| $\eta'$ | [-] | efficiency in case of driving worm gear |

## 4.9.6 Layout

### Calculation of power and torque

The following relations exist between the power (P), the torque (T) and the rotational speed (n):

$P_1=T_1*n_1$
$n_1=n_2*i$
$P_2=T_2*n_2$

$P_1$: Power is input to the shaft (torque and rotational direction have the same sense of rotation)
$P_2$: Power is taken off (torque and rotational direction have an opposite sense of rotation)
$n_1$: speed of fast-rotating shaft
$n_2$: speed of slowly rotating shaft
The following formulas apply to the (normal) case where power is input to the fast-rotating shaft (the shaft $N_1$ is driven): $P_2=P_1*\eta$

**Required** input power with **given** output torque and output speed of the **driven machine**

$$P_1\,[kW]=\frac{T_2\,[Nm]*n_2\,[rpm]}{\eta*9550}$$

Formula 1

**Available** output torque with **given** input power and input speed of the **driving machine**

$$T_2\,[Nm]=\frac{P_1\,[kW]*i*\eta*9550}{n_1\,[rpm]}$$

Formula 2

When selecting the gearbox size, it is necessary to consider the influences that the gearbox will be exposed to later.
This is done through the design factors specified below.
The transmittable power, or the torque, may be reduced by these factors!
In order to determine the gearbox size, the required input power or the output torque must be calculated by means of the operating factors.
Mechanical and thermal influences are taken account of by the formulas.

Mechanical:
$P_{1m}=P_1*f_1*f_2*f_3$
$T_{2m}=T_2*f_1*f_2*f_3$

The following conditions apply:
$P_{1m}<P_{1N}$
$T_{2m}<T_{2N}$

Thermal:
$P_{1t}=P_1*f_3*f_4*f_5$
$T_{2t}=T_2*f_3*f_4*f_5$

The following conditions apply:
$P_{1t}<P_{1Nt}$
$T_{2t}<T_{2Nt}$

### Design factors (f1, f2, f3, f4, f5, f6)

*Operating factor $f_1$*
Determination of load group $f_{MB}$

$$f_{MB}=\frac{J_{ex.red.}}{J_{mot}}$$

| $f_{MB}$ | Group | Examples |
|---|---|---|
| < 0.25 | G<br>low load / without shocks | Filling machines, elevators, light conveyor spirals, light conveyor belts, blowers, small agitators, inspection machines, assembly lines, machine tool auxiliary drives, centrifuges, packaging machines. |
| < 3.00 | M<br>medium load / slight shocks | Reels, agitators, slat conveyors, calendering machines, cargo lifts, mixers, balancing machines, heavy conveyor belts, sheet-metal bending machines, road construction machines, planing machines, shears, extruders, machine tool main drives, kneading machines, weaving looms, light roller beds. |
| < 10.00 | S<br>high load / severe shocks | Excavators, heavy mixers, presses, edge mills, rolling mills, heavy roller beds, cold-rolling mills, stone crushers, eccentric presses, cutting heads, edge-forming machines, belt conveyors (parcelled cargo/goods), barking drums, running gears, punching machines, piston pumps, rotary furnaces, mills/pulverisers, plate turnover devices. |

Table **4.9.6-1**

*Determination of operating factor $f_1$*

| Driving machine | Load group | Operating hours / day | | | |
|---|---|---|---|---|---|
| | fMB | < 0.5 | 3 | 10 | 24 |
| **Electric motor** | G | 0.80 | 0.90 | 1.00 | 1.25 |
| **Hydraulic motor** | M | 0.90 | 1.00 | 1.25 | 1.50 |
| **Turbine** | S | 1.00 | 1.25 | 1.50 | 1.75 |
| **Combustion engine** | G | 0.90 | 1.00 | 1.25 | 1.50 |
| **4-6-cylinder engine** | M | 1.00 | 1.25 | 1.50 | 1.75 |
| | S | 1.25 | 1.50 | 1.75 | 2.00 |
| **Combustion engine** | G | 1.00 | 1.25 | 1.50 | 1.75 |
| **1-2-cylinder engine** | M | 1.25 | 1.50 | 1.75 | 2.00 |
| | S | 1.50 | 1.75 | 2.00 | 2.25 |

Table **4.9.6-2**

*Starting factor $f_2$*

| Starts per hour | up to 10 | 10-60 | 60-500 | 500-1500 |
|---|---|---|---|---|
| $f_2$ | 1.0 | 1.1 | 1.2 | 1.3 |

Table **4.9.6-3**

*Lubrication factor $f_3$*

| | Synthetic oil | Mineral oil | Mineral oil |
|---|---|---|---|
| | Bevel gearboxes, worm gearboxes | Worm gearboxes | Worm gearboxes |
| | All sizes | Size 040-080 | Size 100-200 |
| $f_3$ | 1.0 | 1.2 | 1.25 |

Table **4.9.6-4**

*Temperature factor $f_4$*

The factor $f_4$ considers the influence of the ambient temperature

| $t_u$ [°C] | 10 | 20 | 30 | 40 | 50 |
|---|---|---|---|---|---|
| $f_4$ | 0.9 | 1 | 1.15 | 1.4 | 1.7 |

Table **4.9.6-5**

*Operating mode / duty-cycle factor $f_5$*

The operating mode is defined via the duty cycle (on-period). The on-period can be indicated dimensionless as a percentage value.

$$ED = \frac{\text{Loading time}}{\text{Observation period}} * 100\%$$

Generally, the utilisation period is indicated in addition to the percentage value. If not, the utilisation period is considered to be 10 minutes.

| | Operating mode | On-period |
|---|---|---|
| **S1** | Continuous operation | more than 60% of the cycle time or longer than 20 minutes |
| **S5** | Cyclic operation | Here, the on-period is less than 60% of the process procedure and less than 20 minutes |

Table **4.9.6-6**

Principally, the limit values for speed, torque, acceleration and temperature must be observed in all operating modes.

| On-period in % | 100 | 80 | 60 | 40 | 20 |
|---|---|---|---|---|---|
| $f_5$ | 1.0 | 0.95 | 0.86 | 0.75 | 0.56 |

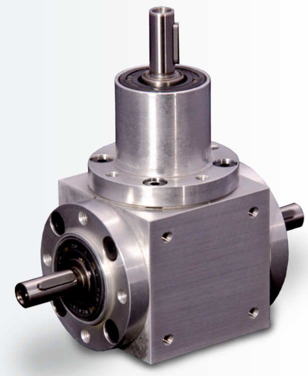
Table **4.9.6-7**

## 4.10 Maintenance and starting-up

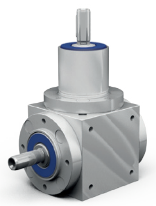
For information on starting-up and maintenance, please refer to the operating instructions. They can be found on the Internet by accessing www.atek.de/download. There you can also find information on the Machinery Directive 2006/42 EC.

## 4.11 Ordering

ATEK gearboxes are available in many variants. When a gearbox is first ordered, we will define a unique article number. In case of follow-up orders, it is enough to specify our article number to reorder exactly the same gearbox type.



## 5.1 Type overview



### Type L – Miniature bevel gearboxes

Gear ratios: i = 1:1 to 4:1
Maximum output torque: 16 Nm
2 gearbox sizes with edge lengths of 035 to 045 mm
Low-backlash construction < 10 angular minutes possible
Housing made of aluminium

# 5.2 General construction

The axles intersect in the gearbox in an angle of 90°.
Housing and cover(s) are made of aluminium. Upon request, the aluminium parts can be anodised.
The edge length of the housing is reflected in the gearbox size (example: L 035 – housing edge length 35 mm).

### Toothing

ATEK bevel gearboxes have gear sets with high-quality spiral toothing made of hardened carburised steel. A gear set comprises one bevel pinion (small number of teeth / small diameter) and one bevel gear (large number of teeth / large diameter).

Gear sets with spiral toothing offer the advantage of very favourable engagement factors (high meshing ratio). Therefore they are predestined for usage with high loads, combined with optimal running smoothness and high transmission accuracy.

## 5.2.1 Construction types

Due to the modular system, different gearbox construction types can be configured.
The construction types vary in:

| Construction type | consists of: | |
|---|---|---|
| **A0 through E0** | 1 gear set | |
| **F0 through K0** | 1 gear set | + 1 bevel pinion or bevel gear |
| **Branch-off gearbox** | 1 gear set | + 2–3 bevel pinions/gears |

Table **5.2.1-1**

The variants differ in type and number of the shafts, the rotational direction of the shafts and their support by bearings.

## 5.2.2 Threaded mounting holes

All 6 sides of the gearboxes are machined and may be used as mounting surfaces. All flanges always have threaded mounting holes. You have the following available ordering options:

| Order code | Threaded mounting holes are in the housing surfaces on the gearbox side | Threaded mounting holes are in the flanges on the gearbox side |
|---|---|---|
| **0** | - | 3, 5, 6 |
| **1, 2, 3, 4, 5, 6** | 1, 2, 4 | 3, 5, 6 |
| **9** | 1, 2, 4 | 3, 5, 6 |

Table **5.2.2-1**

The standard version of the mounting / fastening has the order code 9.
Example of order code: L 045 1:1 D0 9
Please enquire other mounting options.

## 5.2.3 Installation position

The gearboxes can be used in all installation positions. The recommended installation position is the position in which the shafts are horizontal. These are the installation positions 1 and 2. The installation position is defined by the gearbox side directed downwards during operation and will be indicated by the corresponding gearbox side. Please contact us for consultation if the angle of the gearbox side directed downwards deviates more than 15° from the horizontal position.

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## 5.2.4 Shaft designation – allocation to the gearbox sides

The fast-rotating shaft has the speed $n_1$ and is identified by $N_1$. The bevel pinion is located on this shaft.
The slowly rotating shaft has the speed $n_2$ and is identified by $N_2$. The bevel gear is located on this shaft.
The gearbox sides are identified by the numerals 1 to 6. (See Figure 4.3.1-1; Gearbox sides)

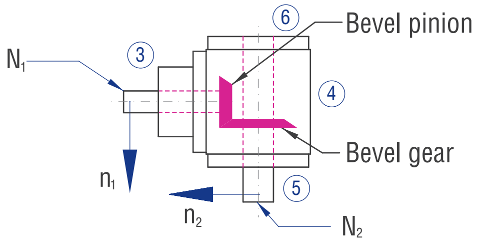



Figure **5.2.4-1; Shaft designations**

## 5.2.5 Preferred direction of rotation

If the clockwise (CW) direction of rotation (viewing direction from shaft end face of the fast-rotating shaft towards the gearbox centre) is selected, a 1 to 2 dB(A) lower noise level is generated.

## 5.2.6 Efficiency

The achievable efficiency depends on rotational speed, torque, installation position, sealing, and lubricant type. With gearboxes having only one gear set, an efficiency of 97% can be achieved. With gearboxes having several gear meshings, an efficiency of 94% can be achieved. The efficiencies specified in the tables relate to the permissible nominal load and are guidance values for run-in gearboxes at operating temperature with standard sealing and filled with oil of viscosity grade 220.

## 5.2.7 Lubrication

The L-series gearboxes have lifetime lubrication.

## 5.2.8 Vent filter

No venting is provided for the miniature gearboxes.

## 5.2.9 Low-backlash construction

For low-friction running, the tooth space in the gear set is manufactured larger than the tooth. When the direction of rotation is changed, this results in a rotation angle until the counter-rotating tooth flanks contact each other. This rotation angle is called circumferential backlash.

### Circumferential backlash, measuring method

The circumferential backlash is measured after the drive shaft ($N_1$) has been fixed. A force of around 2% of the nominal torque is applied to the output shaft ($N_2$) in both rotational directions. A tooth backlash will result between the two final positions. This can be measured as rotation angle and is indicated in minutes of arc [arcmin].

### Circumferential backlash, type

| Ordering option | Gear set | 1:1; 2:1 | 3:1; 4:1 |
|---|---|---|---|
| /0000 | Standard | <=30 arcmin | <=30 arcmin |
| /S2 | Standard | <=10 arcmin | <=12 arcmin |
| /S1 | Standard | u.r. | u.r. |
| /S0 | Special gear set | u.r. | u.r. |

Table **5.2.9-1**

Abbreviation: u.r. = upon request

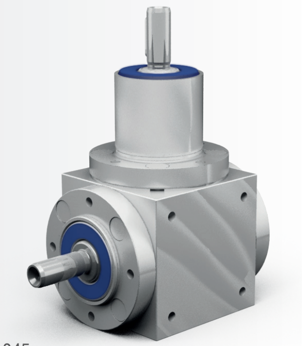
## 5.2.10 Corrosion protection

A coloured anodic coating can be applied to the housing and flanges (See chapter 4.4.7).
Please enquire the possible colours.

# 5.3 Type L – Miniature bevel gearboxes

## 5.3.1 Features

Gear ratios: i = 1:1 to 4:1
Maximum output torque: 16 Nm
2 gearbox sizes with edge lengths of 035 to 045 mm
Low-backlash construction < 8 angular minutes possible
Housing made of aluminium



035 – 045 mm

## 5.3.2 Models

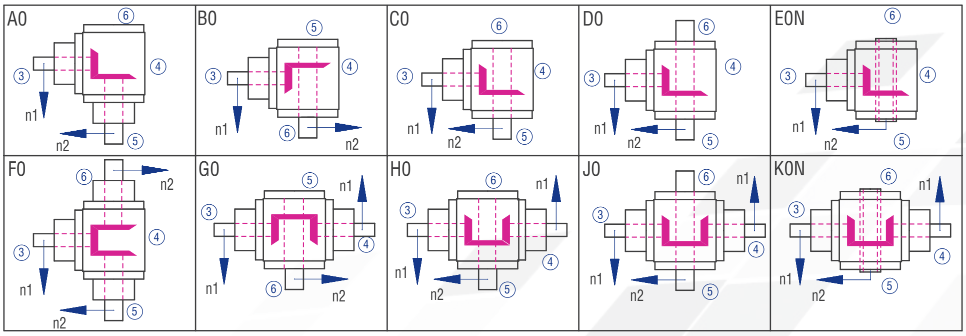



Figure **5.3.2-1; Models**

## 5.3.3 Gearbox sides

The example shows the Model C0

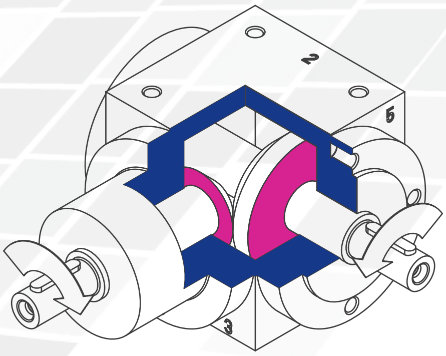


Figure **5.3.3-2; Gearbox sides**

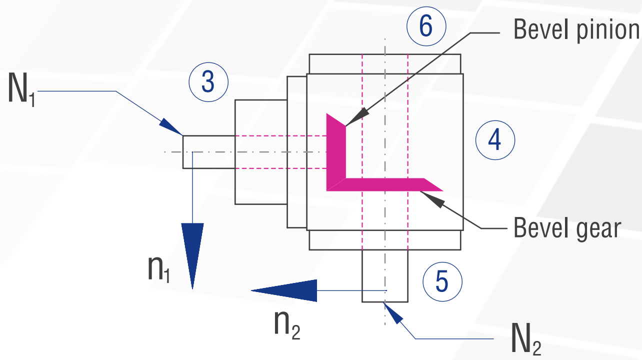



Figure **5.3.3-1; Shaft designations**

## 5.3.4 Order code

The order code reflects the customer specifications. Example:

| Type | Size | Gear ratio | Model | Fixing side | Installation position | Speed $n_2$ | Design |
|---|---|---|---|---|---|---|---|
| **L** | 045 | 1:1 | C0- | 1. | 1- | 1500 | /0000 |
| **Description** | Housing edge length; Table 5.3.5-1 | Table 5.3.5-1 | Figure 5.3.2-1; Models | Gearbox side on which fixing is made; Table 5.2.2-1; Figure 4.3.1-1; Gearbox sides | Gearbox side directed downwards; Figure 4.3.1-1; Gearbox sides | slowly rotating shaft; Table 5.3.5-1 | Standard |

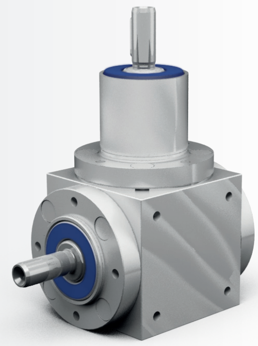
Table **5-4**

## 5.3.5 Overview of performance data

| Size | $n_1$ [rpm] | 1:1 $n_2$ [rpm] | 1:1 $P_{1N}$ [kW] | 1:1 $T_{2N}$ [Nm] | 2:1 $n_2$ [rpm] | 2:1 $P_{1N}$ [kW] | 2:1 $T_{2N}$ [Nm] | 3:1 $n_2$ [rpm] | 3:1 $P_{1N}$ [kW] | 3:1 $T_{2N}$ [Nm] | 4:1 $n_2$ [rpm] | 4:1 $P_{1N}$ [kW] | 4:1 $T_{2N}$ [Nm] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 035 | 3000 | 3000 | 0.66 | 2.0 | | | | | | | | | |
| | 2400 | 2400 | 0.63 | 2.4 | | | | | | | | | |
| | 1500 | 1500 | 0.50 | 3.0 | | | | | | | | | |
| | 1000 | 1000 | 0.39 | 3.5 | | | | | | | | | |
| | 750 | 750 | 0.30 | 3.6 | | | | | | | | | |
| | 500 | 500 | 0.22 | 4.0 | | | | | | | | | |
| | 250 | 250 | 0.12 | 4.5 | | | | | | | | | |
| | 50 | 50 | 0.03 | 4.5 | | | | | | | | | |
| 045 | 3000 | 3000 | 1.32 | 4.0 | 1500 | 0.74 | 4.5 | 1000 | 0.33 | 3.0 | 750 | 0.29 | 3.5 |
| | 2400 | 2400 | 1.19 | 4.5 | 1200 | 0.63 | 4.8 | 800 | 0.30 | 3.4 | 600 | 0.24 | 3.6 |
| | 1500 | 1500 | 0.99 | 6.0 | 750 | 0.41 | 5.0 | 500 | 0.19 | 3.5 | 375 | 0.16 | 3.8 |
| | 1000 | 1000 | 0.77 | 7.0 | 500 | 0.30 | 5.5 | 333 | 0.15 | 4.0 | 250 | 0.11 | 4.0 |
| | 750 | 750 | 0.60 | 7.3 | 375 | 0.24 | 5.7 | 250 | 0.12 | 4.2 | 188 | 0.09 | 4.2 |
| | 500 | 500 | 0.44 | 8.0 | 250 | 0.17 | 6.0 | 167 | 0.08 | 4.5 | 125 | 0.06 | 4.3 |
| | 250 | 250 | 0.25 | 9.0 | 125 | 0.09 | 6.5 | 83 | 0.05 | 5.0 | 63 | 0.03 | 4.5 |
| | 50 | 50 | 0.05 | 9.0 | 25 | 0.02 | 7.0 | 17 | 0.01 | 5.5 | 13 | 0.01 | 4.5 |

Table **5.3.5-1**

# 5.3.6 Type L 035 – Miniature bevel gearboxes



## Characteristics

| Characteristic | Standard | Option |
|---|---|---|
| **Toothing** | Bevel gear set, spiral-toothed | See chapter 5.2 |
| **Gear ratio** | 1:1 | |
| **Housing / Flanges** | Aluminium | See chapter 5.2 |
| **Threaded mounting hole** | On all housing surfaces without flange and on all flanges. | See chapter 5.2.2 |
| **Shaft** | Material 1 C45, shaft ends greased<br>Fit with ISO 6 tolerance with parallel keyway: according to DIN 6885 Sheet 1 | See chapter 4.6.2 |
| **Hollow shaft** | Material 1 C45, shafts greased<br>Fit with ISO 7 tolerance with parallel keyway according to DIN 6885 Sheet 1 | See chapter 4.6.3 |
| **Radial shaft seal ring** | NBR, form A | See chapter 4.8 |
| **Ambient temperature** | - 10°C to + 90°C. The values of the performance tables are valid for +20°C | See chapter 4.9.3 |
| **Circumferential backlash** | < 30 arcmin | See chapter 5.2.9 |
| **Protection class** | IP 54 | See chapter 4.5 |
| **Corrosion protection** | - | See chapter 5.2.10 |
| **Bearing life L10h** | more than 15,000h | See chapter 4.9.1 |
| **Oil change intervals** | Not required | See chapter 5.2.7 |
| **Lubricant** | Synthetic lubricants | See chapter 5.2.7 |

## Performance data

| $n_1$ [rpm] | 1:1 | | | 2:1 | | | 3:1 | | | 4:1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $n_2$ [rpm] | $P_{1N}$ [kW] | $T_{2N}$ [Nm] | $n_2$ [rpm] | $P_{1N}$ [kW] | $T_{2N}$ [Nm] | $n_2$ [rpm] | $P_{1N}$ [kW] | $T_{2N}$ [Nm] | $n_2$ [rpm] | $P_{1N}$ [kW] | $T_{2N}$ [Nm] |
| **3000** | 3000 | 0.66 | 2.0 | | | | | | | | | |
| **2400** | 2400 | 0.63 | 2.4 | | | | | | | | | |
| **1500** | 1500 | 0.50 | 3.0 | | | | | | | | | |
| **1000** | 1000 | 0.39 | 3.5 | | | | | | | | | |
| **750** | 750 | 0.30 | 3.6 | | | | | | | | | |
| **500** | 500 | 0.22 | 4.0 | | | | | | | | | |
| **250** | 250 | 0.12 | 4.5 | | | | | | | | | |
| **50** | 50 | 0.03 | 4.5 | | | | | | | | | |

| | 1:1 | 2:1 | 3:1 | 4:1 |
|---|---|---|---|---|
| $P_{1Nt}$ [kW] | 0.35 | | | |
| $T_{2max}$ [Nm] | 8.00 | | | |

## Permissible radial force $F_{r1}$ and axial force $F_{a1}$ on shaft $N_1$

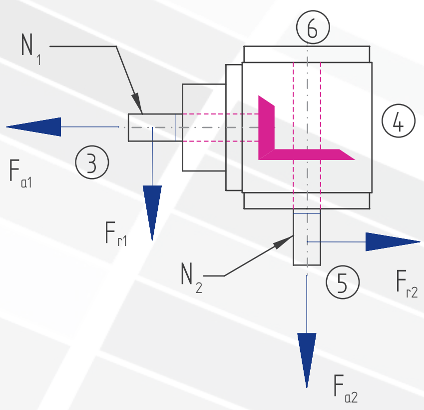
| $n_1$ [rpm] | 3000 | | 1000 | | 500 | | 250 | | 100 | | 50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $T_2$ [Nm] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] |
| | 10 | 5 | 20 | 10 | 30 | 15 | 50 | 25 | 70 | 35 | 90 | 45 |

## Permissible radial force $F_{r2}$ and axial force $F_{a2}$ on shaft $N_2$

| $n_1$ [rpm] | 3000 | | 1000 | | 500 | | 250 | | 100 | | 50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $T_2$ [Nm] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] |
| | 30 | 15 | 50 | 25 | 80 | 40 | 120 | 60 | 150 | 75 | 220 | 110 |

## Inertia moments/mass

| Model | Inertia moment [kgcm$^2$] | | | | Mass ca.[g] |
|---|---|---|---|---|---|
| | 1:1 | 2:1 | 3:1 | 4:1 | |
| A0 | 0.0204 | | | | 230 |
| B0 | 0.0219 | | | | 225 |
| C0 | 0.0219 | | | | 225 |
| D0 | 0.0224 | | | | 230 |
| E0N | 0.0149 | | | | 210 |
| F0 | 0.0306 | | | | 290 |
| G0 | 0.0321 | | | | 285 |
| H0 | 0.0321 | | | | 285 |
| J0 | 0.0326 | | | | 290 |
| K0N | 0.0251 | | | | 270 |




The mass of the gearbox may deviate depending on the gear ratio.

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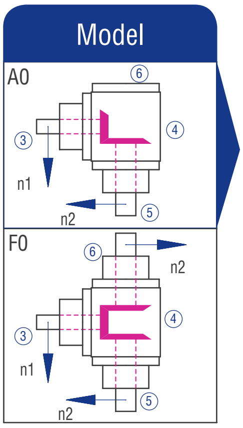
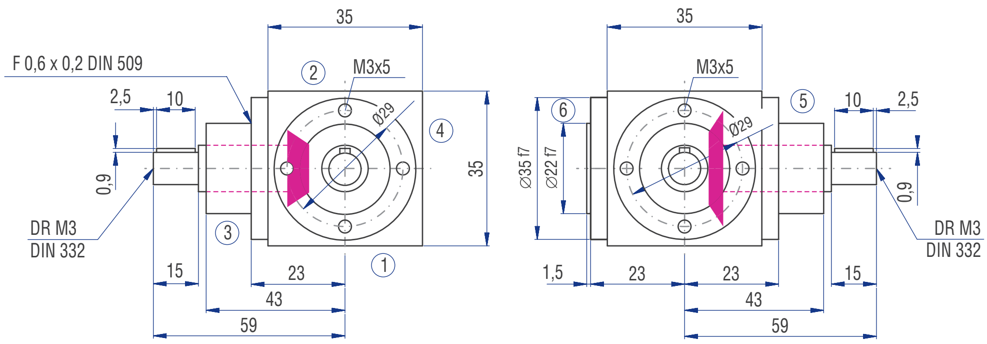
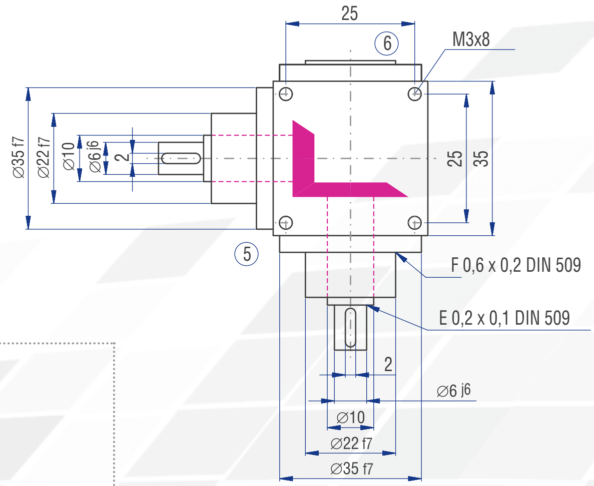
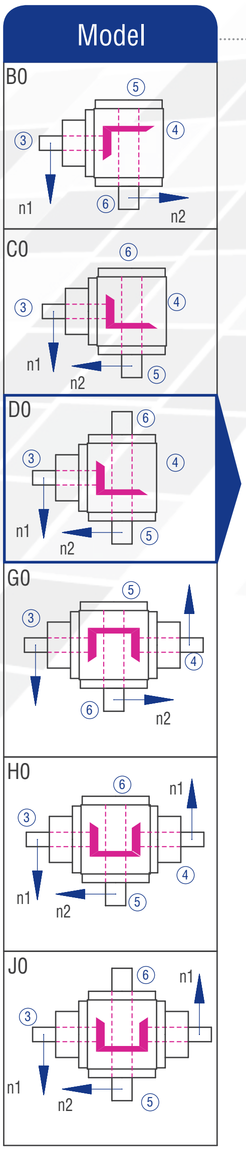
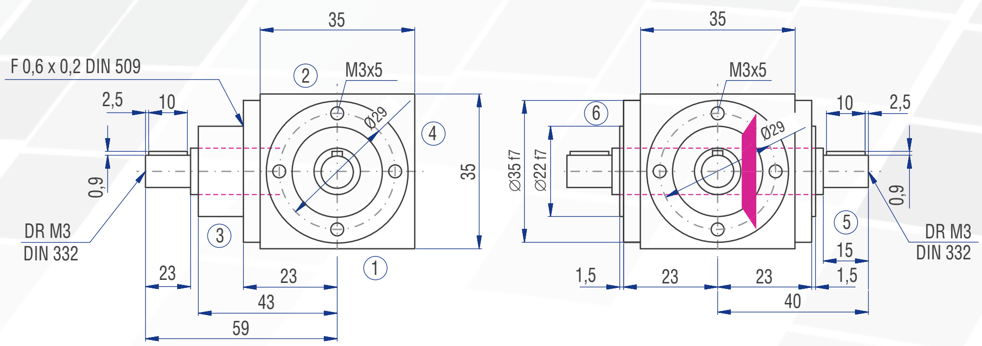
# 5.3.6 Type L 035 – Miniature bevel gearboxes

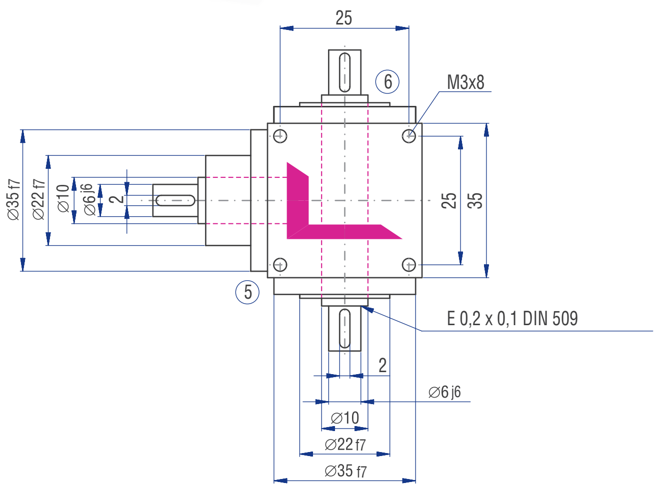
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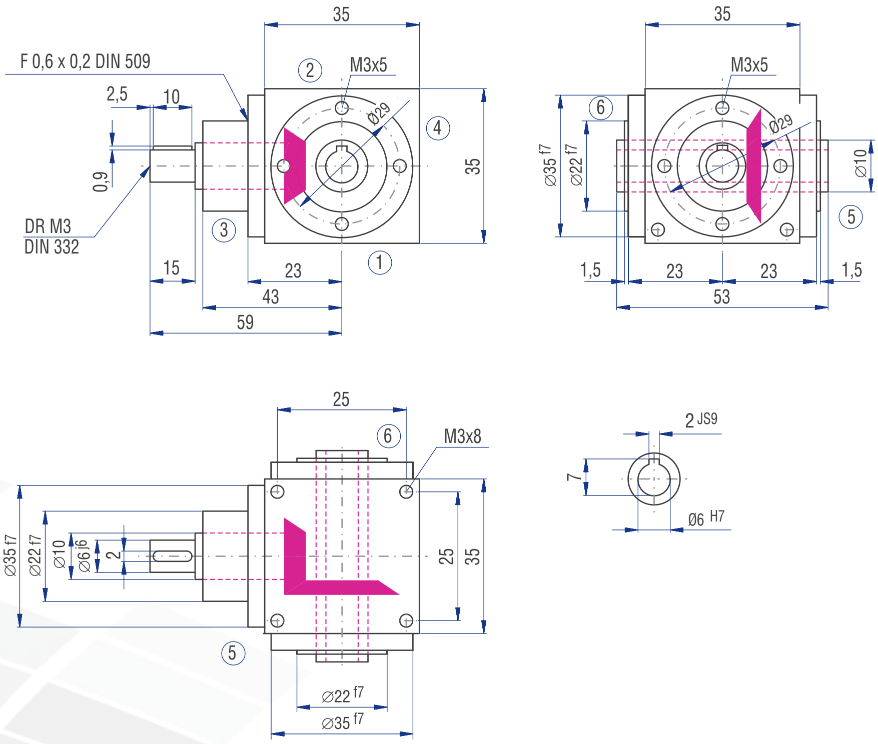
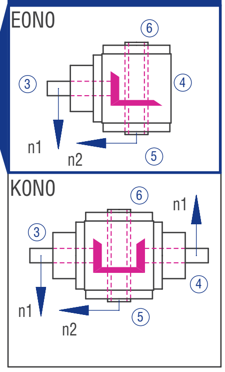
The dimensions of the Models not shown can be figured by mirroring available dimensions.




## Model

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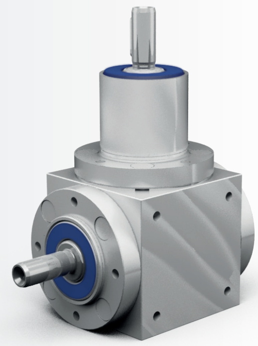
# 5.3.7 Type L 045 – Miniature bevel gearboxes



## Characteristics

| Characteristic | Standard | Option |
|---|---|---|
| **Toothing** | Bevel gear set, spiral-toothed | See chapter 5.2 |
| **Gear ratio** | 1:1 to 4:1 | |
| **Housing / Flanges** | Aluminium | See chapter 5.2 |
| **Threaded mounting hole** | On all housing surfaces without flange and on all flanges. | See chapter 5.2.2 |
| **Shaft** | Material 1 C45, shaft ends greased<br>Fit with ISO 6 tolerance with parallel keyway: according to DIN 6885 Sheet 1 | See chapter 4.6.2 |
| **Hollow shaft** | Material 1 C45, shafts greased<br>Fit with ISO 7 tolerance with parallel keyway according to DIN 6885 Sheet 1 | See chapter 4.6.3 |
| **Radial shaft seal ring** | NBR, form A | See chapter 4.8 |
| **Ambient temperature** | - 10°C to + 90°C. The values of the performance tables are valid for +20°C | See chapter 4.9.3 |
| **Circumferential backlash** | < 30 arcmin | See chapter 5.2.9 |
| **Protection class** | IP 54 | See chapter 4.5 |
| **Corrosion protection** | - | See chapter 5.2.10 |
| **Bearing life L10h** | more than 15,000h | See chapter 4.9.1 |
| **Oil change intervals** | Not required | See chapter 5.2.7 |
| **Lubricant** | Synthetic lubricants | See chapter 5.2.7 |

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## Performance data

| $n_1$ [rpm] | 1:1 | | | 2:1 | | | 3:1 | | | 4:1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $n_2$ [rpm] | $P_{1N}$ [kW] | $T_{2N}$ [Nm] | $n_2$ [rpm] | $P_{1N}$ [kW] | $T_{2N}$ [Nm] | $n_2$ [rpm] | $P_{1N}$ [kW] | $T_{2N}$ [Nm] | $n_2$ [rpm] | $P_{1N}$ [kW] | $T_{2N}$ [Nm] |
| **3000** | 3000 | 1.32 | 4.0 | 1500 | 0.74 | 4.5 | 1000 | 0.33 | 3.0 | 750 | 0.29 | 3.5 |
| **2400** | 2400 | 1.19 | 4.5 | 1200 | 0.63 | 4.8 | 800 | 0.30 | 3.4 | 600 | 0.24 | 3.6 |
| **1500** | 1500 | 0.99 | 6.0 | 750 | 0.41 | 5.0 | 500 | 0.19 | 3.5 | 375 | 0.16 | 3.8 |
| **1000** | 1000 | 0.77 | 7.0 | 500 | 0.30 | 5.5 | 333 | 0.15 | 4.0 | 250 | 0.11 | 4.0 |
| **750** | 750 | 0.60 | 7.3 | 375 | 0.24 | 5.7 | 250 | 0.12 | 4.2 | 188 | 0.09 | 4.2 |
| **500** | 500 | 0.44 | 8.0 | 250 | 0.17 | 6.0 | 167 | 0.08 | 4.5 | 125 | 0.06 | 4.3 |
| **250** | 250 | 0.25 | 9.0 | 125 | 0.09 | 6.5 | 83 | 0.05 | 5.0 | 63 | 0.03 | 4.5 |
| **50** | 50 | 0.05 | 9.0 | 25 | 0.02 | 7.0 | 17 | 0.01 | 5.5 | 13 | 0.01 | 4.5 |

| | 1:1 | 2:1 | 3:1 | 4:1 |
|---|---|---|---|---|
| $P_{1Nt}$ [kW] | 0.60 | 0.60 | 0.60 | 0.60 |
| $T_{2max}$ [Nm] | 16.00 | 12.00 | 10.00 | 8.00 |

## Permissible radial force $F_{r1}$ and axial force $F_{a1}$ on shaft $N_1$

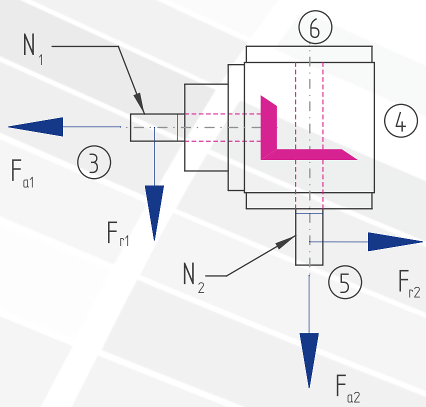
| $n_1$ [rpm] | 3000 | | 1000 | | 500 | | 250 | | 100 | | 50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $T_2$ [Nm] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] |
| | 80 | 40 | 100 | 50 | 120 | 60 | 150 | 75 | 200 | 100 | 250 | 125 |

## Permissible radial force $F_{r2}$ and axial force $F_{a2}$ on shaft $N_2$

| $n_1$ [rpm] | 3000 | | 1000 | | 500 | | 250 | | 100 | | 50 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $T_2$ [Nm] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] | $F_r$ [N] | $F_a$ [N] |
| | 100 | 50 | 170 | 85 | 220 | 110 | 300 | 150 | 400 | 200 | 500 | 250 |

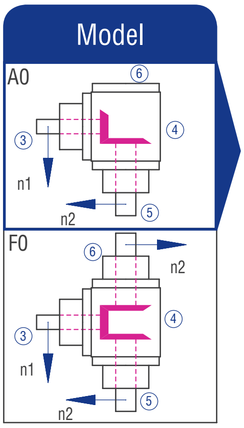
## Inertia moments/mass

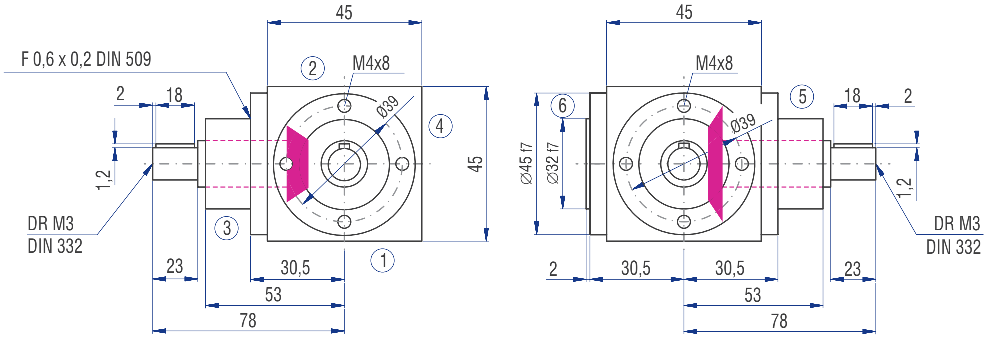
| Model | Inertia moment [kgcm$^2$] | | | | Mass ca.[g] |
|---|---|---|---|---|---|
| | 1:1 | 2:1 | 3:1 | 4:1 | |
| **A0** | 0.0630 | 0.0340 | 0.0310 | 0.0300 | 510 |
| **B0** | 0.1380 | 0.0550 | 0.0390 | 0.0350 | 500 |
| **C0** | 0.1380 | 0.0550 | 0.0390 | 0.0350 | 500 |
| **D0** | 0.1400 | 0.0550 | 0.0390 | 0.0350 | 530 |
| **E0N** | 0.1310 | 0.0530 | 0.0380 | 0.0350 | 460 |
| **F0** | 0.0630 | 0.0340 | 0.0310 | 0.0300 | 700 |
| **G0** | 0.2010 | 0.0870 | 0.0700 | 0.0660 | 660 |
| **H0** | 0.2010 | 0.0870 | 0.0700 | 0.0660 | 660 |
| **J0** | 0.2030 | 0.0880 | 0.0700 | 0.0660 | 690 |
| **K0N** | 0.1940 | 0.0860 | 0.0690 | 0.0650 | 620 |

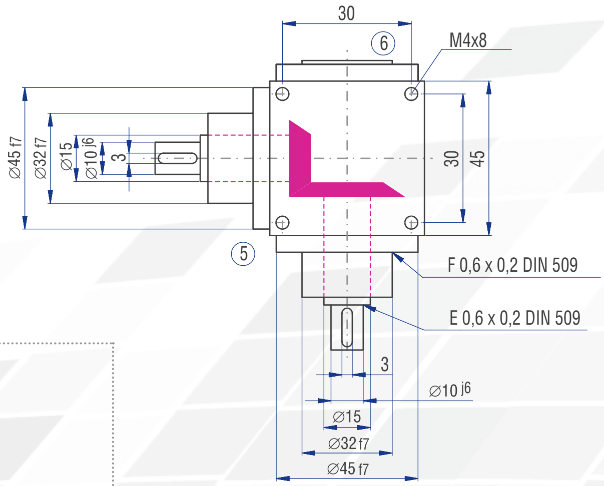


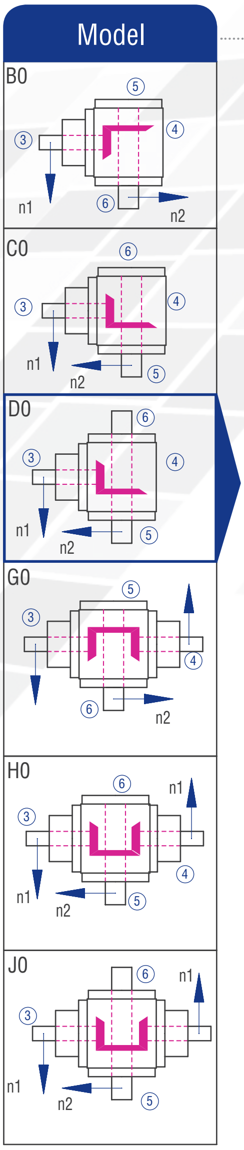

The mass of the gearbox may deviate depending on the gear ratio.

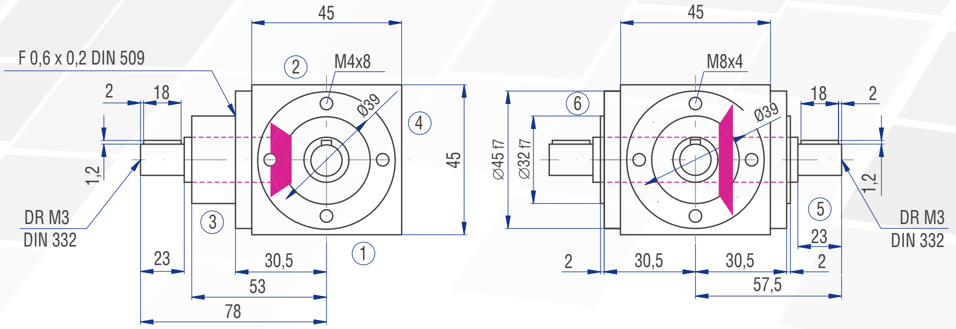
# 5.3.7 Type L 045 – Miniature bevel gearboxes

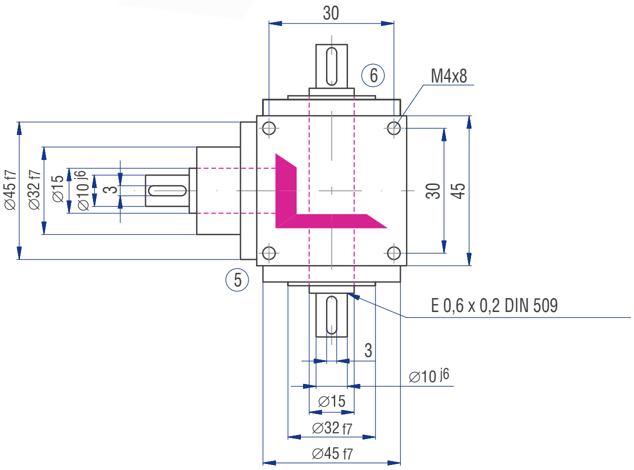


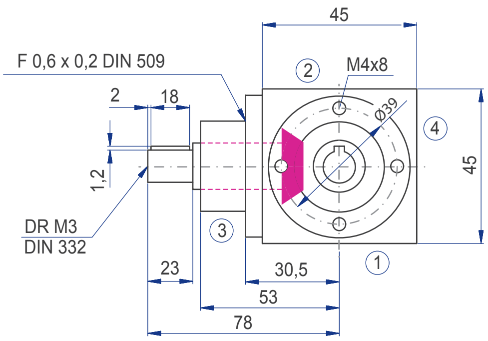



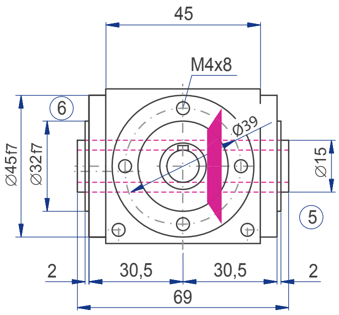



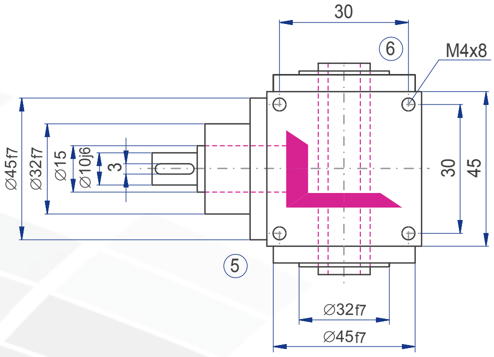



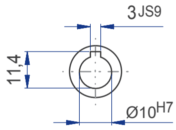




The dimensions of the Models not shown can be figured by mirroring available dimensions.

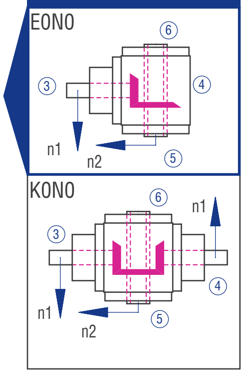

45
F 0,6 x 0,2 DIN 509
2
18
M4x8
Ø39
45
1,2
DR M3
DIN 332
23
30,5
53
78


45
M4x8
Ø45f7
Ø32f7
Ø39
Ø15
2
30,5
30,5
2
69


30
M4x8
Ø45f7
Ø32f7
Ø15
Ø10j6
3
30
45
Ø32f7
Ø45f7


3 JS9
11,4
Ø10H7

Model


E0N0
n1
n2
K0N0
n1
n1
n2

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