

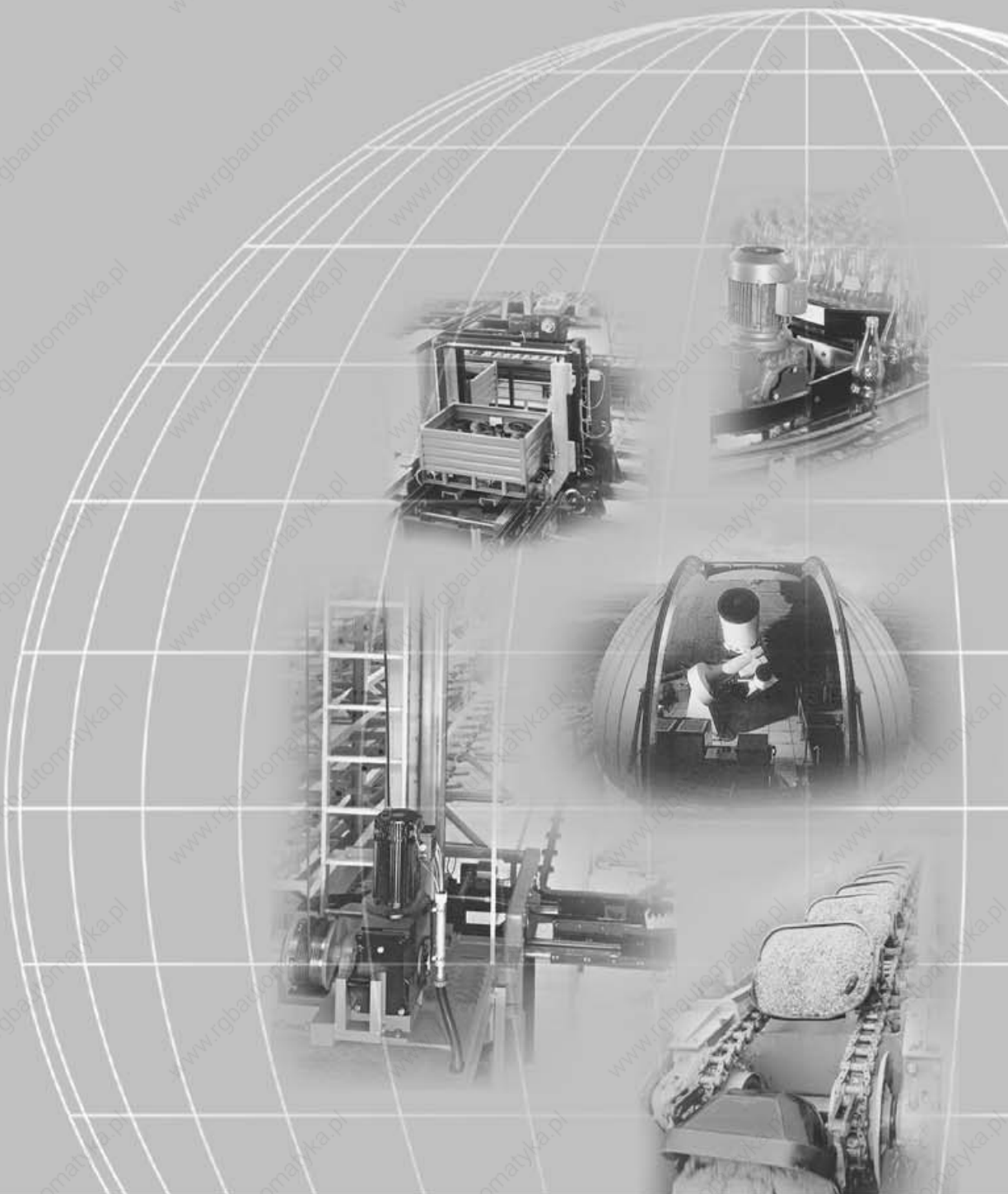


Low Backlash Planetary Gear Units

Edition

07/2002





SEW-EURODRIVE





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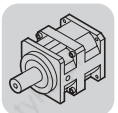


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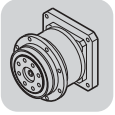
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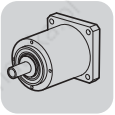
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1 The SEW-EURODRIVE Group of Companies

What is SEW?

SEW-EURODRIVE is a leading company in the global market for electrical drive engineering. SEW's global presence, extensive product range and broad spectrum of services mean it is the ideal partner for the machinery and plant construction industry when it comes to providing drive systems for demanding applications.

SEW possesses many years of experience in drive engineering which it puts to good use when developing, producing and selling all its drives with components drawn from mechanical and electrical engineering and electronics.

The headquarters of the group of companies is located in Bruchsal, Germany. Components for SEW's modular drive system are manufactured to the highest quality standards in production plants sited in Germany, France, the USA, Brazil and China. These stocked components are utilized in assembly plants in over 30 industrialized countries all over the world. The assembly plants offer close proximity to customers and particularly short delivery times for individual drive systems – with a constantly high standard of quality. SEW's sales, consulting, customer and spare parts services are to be found in more than 50 countries all over the world.

The product range

- Geared motors, gear units and motors
 - Helical gear units/geared motors
 - Parallel shaft helical gear units/geared motors
 - Helical-bevel gear units/geared motors
 - Helical-worm gear units/geared motors
 - Spiroplan® right-angle geared motors
 - Planetary geared motors
 - Industrial gear units
 - Low backlash gear units/geared motors
 - Brake motors
 - Drives for trolley drive systems
 - Geared torque motors
 - Pole-changing geared motors

- Electronically controlled drives with
 - MOVITRAC® frequency inverters
 - MOVIDRIVE® drive inverters
 - MOVIDYN® servo controllers
 - Technology and communications options for the inverters
 - Asynchronous AC motors and AC geared motors
 - Asynchronous and synchronous servomotors and geared servomotors
 - DC motors, brake motors and geared motors
 - Synchronous and asynchronous linear motors

- Components for decentralized installation
 - MOVIMOT® geared motors with integrated frequency inverter
 - MOVI-SWITCH® geared motors with integrated switching and protection function
 - Field distributors, fieldbus interfaces



- Mechanical variable speed drives
 - VARIBLOC® wide V-belt variable speed geared motors
 - VARIMOT® friction disk variable speed geared motors
- Explosion-proof drives acc. to ATEX 100a
- Services
 - Technical consulting
 - Application software
 - Seminars and training courses
 - Extensive technical documentation
 - Worldwide customer service

Content of the catalog

This catalog describes PSF, PSB and PSE low backlash planetary gear units. It contains project planning notes, mounting positions, technical data, selection tables and dimension sheets.

Please refer to the separate catalogs for further information about servomotors, gear units and geared motors.

Other catalogs

- Gear units
- Geared motors
- Geared servomotors
- MOVIMOT® geared motors
- Pole-changing geared motors



2 Product Description and Overview of Types

2.1 General description

Low backlash planetary and planetary right-angle gear units in the PSF, PSB and PSE series are single and double stage gear units with rated output torques from 55 to 3000 Nm. The distribution of load between several planet wheels results in a power-to-weight ratio which is significantly higher than in helical gear units, meaning that the units are more compact.

PSF, PSB and PSE planetary gear units are available as geared motors with mounted SEW servomotors. Adapters with couplings are available for mounting of commercial motors.

These combinations let us create drives for demanding applications with the following characteristics:

Low backlash

Optimized gearing geometry and the closest possible production tolerances ensure circumferential backlash values between 3 and 6 angular minutes (< 1' available on request).

Precise gradings

All gear ratios between $i = 4$ and $i = 100$ are whole number ratios and mathematically accurate. This means the gear units are particularly suited to applications in controllers in which it is important to have divisible resolution values in terms of encoder increments.

Accurate positioning

The special design guarantees very high levels of torsional rigidity.

Compact

The high power-to-weight ratio means the units are as small as possible.

Low-noise

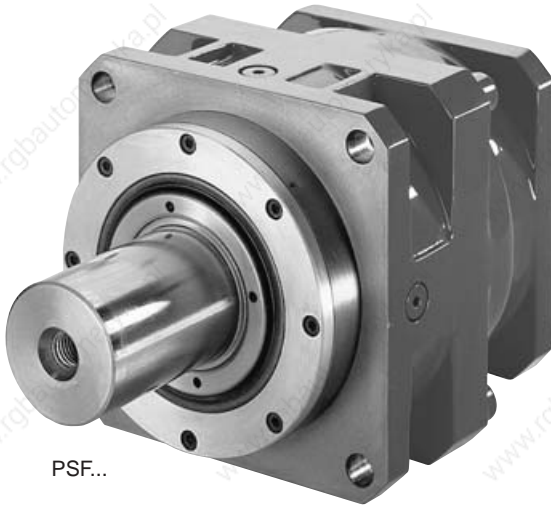
All PSF, PSB and PSE planetary gear units operate below the permitted noise levels as defined in VDI directive 2159.

Low-maintenance

PSF, PSB and PSE planetary gear units are supplied with lubrication for life employing a synthetic lubricant.



2.2 Overview of types



PSF...



PSB...



PSE...

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Fig. 1: Overview of types of low backlash planetary gear units



2.3 Low backlash planetary gear unit designations

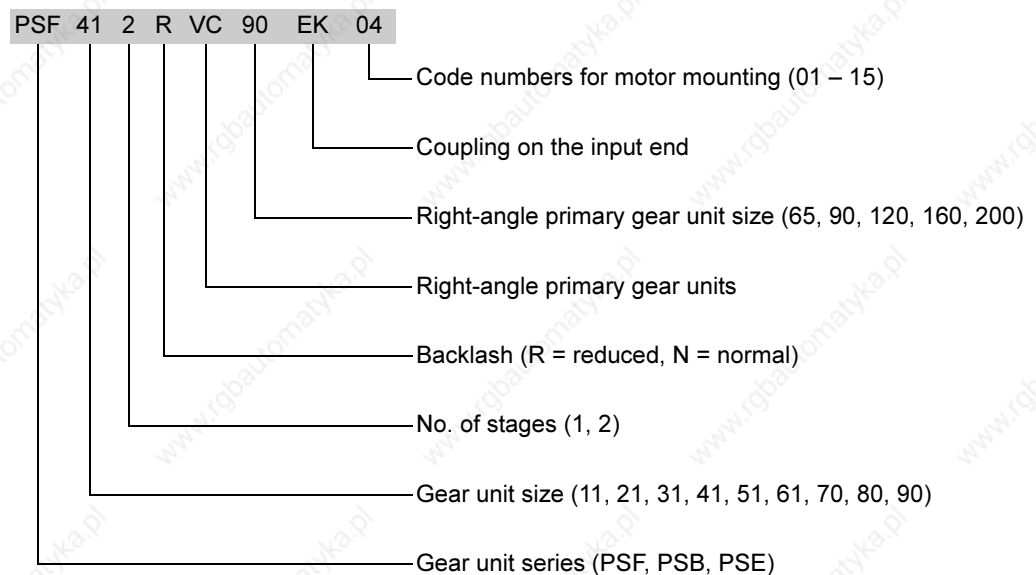
- PSF... Planetary gear unit, low backlash, B5 flange-mounted
- PSB... Planetary gear unit, low backlash, B5 flange-mounted and flange block shaft
- PSE... Planetary gear unit, low backlash, B14 flange-mounted

Options

- VC... Right-angle primary gear unit
- N Normal backlash
- R Reduced backlash
- EK.. Adapter with coupling on the input end, with code number for motor mounting
- ED Free shaft end on the input end

2.4 Order information

The following example illustrates the pattern for order information which always starts from the output end.



Example of a complete order:

- Type: PSF412 R VC90 EK04
- Mounting position: M1
- Ratio: 80
- Output shaft: Smooth



2.5 Gear ratios and circumferential backlash values

Single and double stage planetary gear units

Gear unit type	i whole number	Circumferential backlash α	
		Normal N	Reduced R ¹⁾
PSF211 – PSF901	4, 5, 7, 10	< 6'	< 3'
PSB311 – PSB611			
PSE211 – PSE611			
PSF212 – PSF902	16, 20, 25, 28, 35, 40, 49, 70, 100		
PSB312 – PSB612			
PSE212 – PSE612			

1) < 1' on request

Planetary right-angle gear units

Gear unit type	i whole number	Circumferential backlash α	
		Normal N	Reduced R ¹⁾
PSF211 VC..	8, 10, 14, 20	< 10'	< 5'
PSE211 VC..			
PSF311 VC.. – PSF801 VC..	7, 10, 14, 21, 28, 35, 40, 50, 60		
PSB311 VC.. – PSB611 VC..			
PSE311 VC.. – PSE611 VC..			

1) < 3' on request



3 Project Planning

3.1 Additional documentation

In addition to this catalog, SEW-EURODRIVE offers an extensive range of 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 electronically controlled drives.

The SEW homepage (<http://www.sew-eurodrive.com>) provides links to the current documentation in various languages which you can order or download. The list below includes other documents which are of interest in terms of project planning. You can order these publications from SEW-EURODRIVE.

Geared servomotors catalog

The "Geared Servomotors" catalog provides information on

- Project planning notes
- Technical data
- Selection tables
- Dimension sheets.

It contains detailed information on the selection as well as the functional principles of servomotors and their accessories.

Operating instructions

The "Low Backlash Planetary Gear Units" operating instructions contain extensive safety information as well as information on

- Installation
- Mounting
- Disassembly
- Startup
- Inspection
- Maintenance
- Troubleshooting

Drive Engineering - Practical Implementation

The "Drive Engineering - Practical Implementation, Project Planning - Drives" publication contains extensive information about the properties, differentiating characteristics and fields of application of SEW drives. This publication contains an extensive library of the most important drive calculation formulae as well as detailed examples of the most frequent applications. This information means the publication is an important tool for project planning and an essential complement to SEW product catalogs.

The "Drive Engineering - Practical Implementation, Servo Drives" booklet provides comprehensive information about highly dynamic servo drives.

The following chapters also contain important information about rating of low backlash planetary gear units. In addition, SEW-EURODRIVE will be glad to offer additional advice.



3.2 Drive selection data

Certain data are essential to specify the components for your drive. These are:

Drive selection data			Your entry
$n_{a \max}$	Maximum output speed	[1/min]	
n_{am}	Average output speed	[1/min]	
$M_{a \max}$	Maximum output torque assumed for the drive in project planning	[Nm]	
M_{am}	Average output torque	[Nm]	
M_N	Rated torque (→ Sec. Selection tables)	[Nm]	
M_B	Maximum acceleration torque (→ Sec. Selection tables)	[Nm]	
$M_{em. off}$	Maximum braking torque in emergency off braking	[Nm]	
i	Gear unit reduction ratio		
F_{Aa}	Axial load at the gear unit output (central axial load)	[N]	
F_{Ra}	Overhung load on the gear unit output (Load applied to the middle of the shaft end. Otherwise, the precise point of application of force is required in order to adjust the calculation.)	[N]	
F_{RxL}	Permitted overhung load at point x based on bearing service life	[N]	
F_{RxW}	Permitted overhung load at point x based on shaft strength	[N]	
α	Circumferential backlash	[°]	
n_e	Input speed	[1/min]	
J	Mass moment of inertia to be driven	[10 ⁻⁴ kgm ²]	
$M1 - M6$	Mounting position (→ Sec. Mounting Positions)	-	
ϑ_{amb}	Ambient temperature	[°C]	
H	Altitude	[m above sea level]	
$S_{..}$, ..%cdf	Operating mode and intermittency factor cdf; alternatively, exact load cycle can be specified	-	

Design and operating notes



When mounting large motor masses

- single stage: $m_{\text{motor}} / m_{\text{gear unit}} \geq 4$
- double stage: $m_{\text{motor}} / m_{\text{gear unit}} \geq 2.5$

it is necessary to support the motor. Please contact us for information.



When input and output elements are mounted on **PSF gear units**, the **shaft nut** on the input and output shaft **must not be used as a stop** for transmission elements (belt pulley, pinion gear, etc.).

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



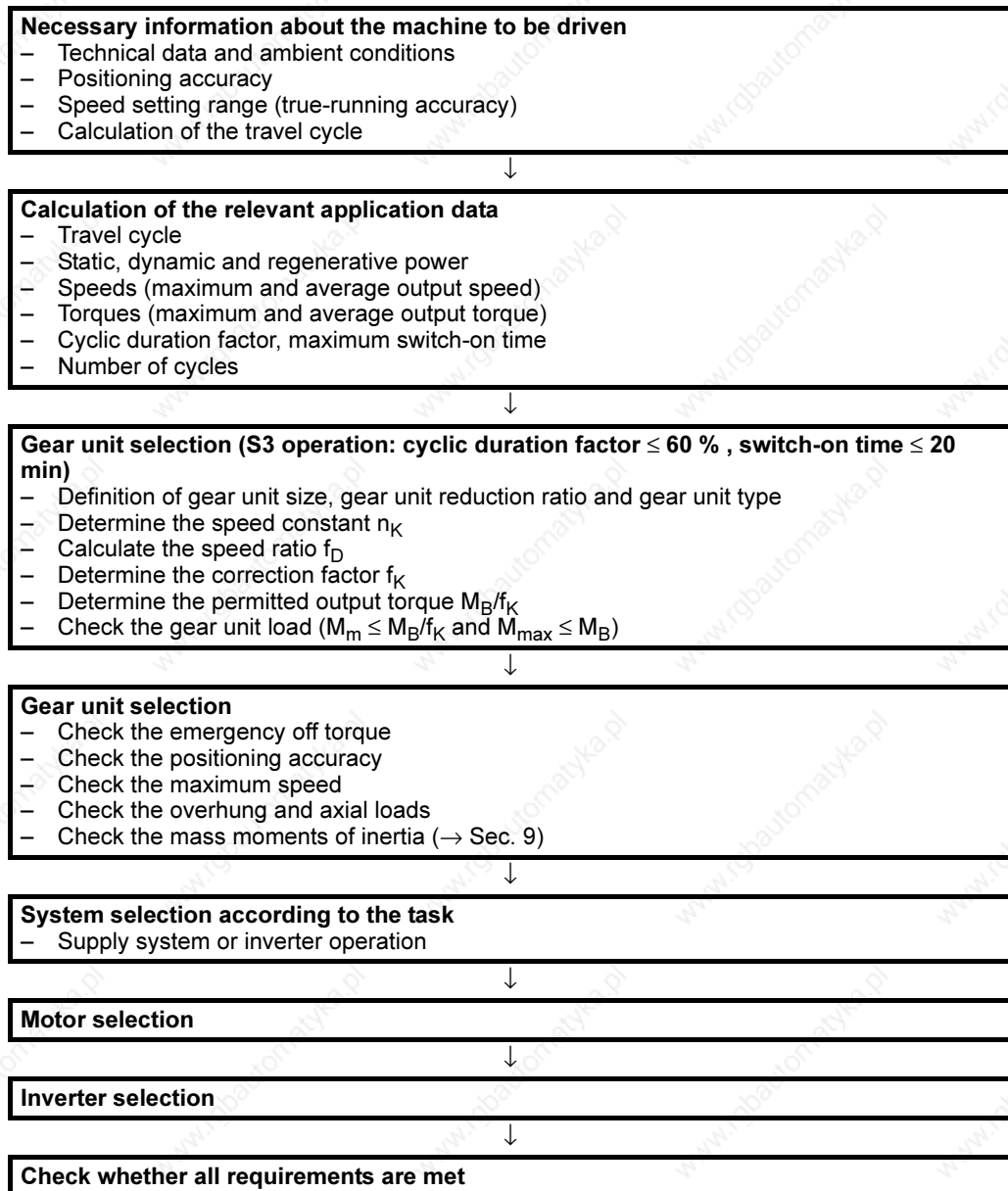
High quality double-sealed (2RS) bearings are used on the output end of **PSE gear units**. Avoid splash water and abrasives!

Low backlash planetary gear units can be used at ambient temperatures between -10 °C and +60 °C. They have lubrication for life employing a high quality synthetic lubricant (applies to normal operating conditions).



3.3 Project planning sequence

The following flowchart shows a schematic view of the project planning procedure of a low backlash planetary gear unit for a positioning drive in S3 operation.



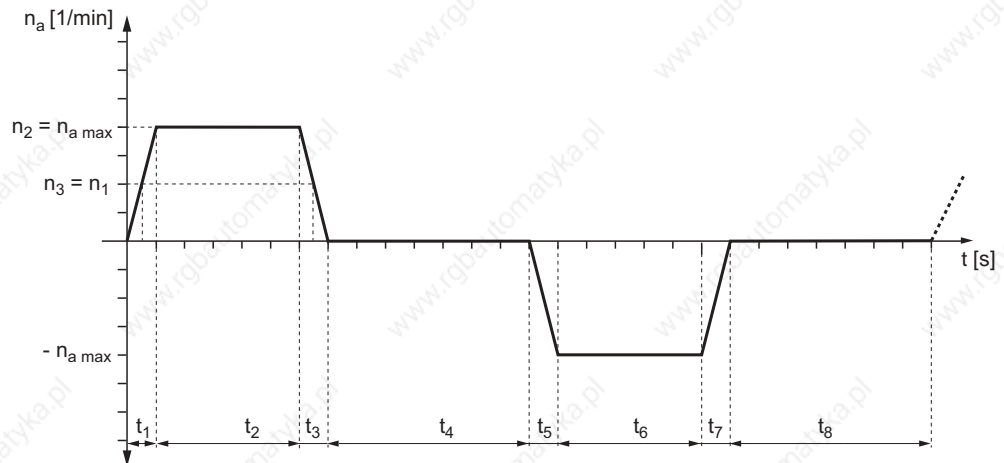
Please contact SEW-EURODRIVE if project planning for a cyclic duration factor > 60 %.



3.4 Project planning of a planetary gear unit in S3 operation

Depending on their gear ratio and starting frequency, planetary gear units can be loaded in excess of their rated torque M_N up to the maximum acceleration torque M_B . Furthermore, the average torque M_m must be checked using a travel cycle as part of project planning.

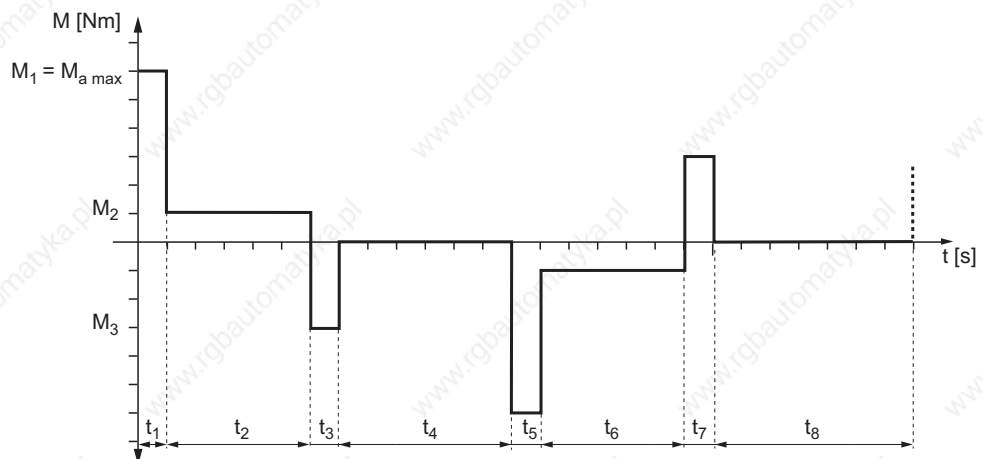
Travel cycle



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The travel cycle is used to determine the corresponding torque diagram.

Torque diagram



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Selecting the planetary gear unit

Refer to the torque diagram and read off the maximum torque $M_{a \max}$ which can occur. Use this value to determine the appropriate planetary gear unit from the selection tables. The following condition must be met:

$$M_{a \max} \leq M_B$$

Key

$M_{a \max}$ [Nm] = Maximum torque which can occur (\rightarrow torque diagram)

M_B [Nm] = Maximum acceleration torque (\rightarrow selection tables)



Average output speed

Calculate the average output speed n_{am} :

$$n_{am} = \frac{n_1 \cdot t_1 + \dots + n_n \cdot t_n}{t_1 + \dots + t_n} \quad (1)$$

Key

n_{am} [1/min] = Average output speed
 $n_1 - n_n$ [1/min] = Output speed in time period $t_1 - t_n$
 $t_1 - t_n$ [s] = Time period 1 to n

Speed ratio

Determine the speed ratio f_D :

$$f_D = n_{am}/n_K \quad (2)$$

Key

n_{am} [1/min] = Average output speed
 n_K [1/min] = Speed constant (→ following table)

Gear unit type	Size	$M_B^{1)}$ [Nm]		n_K [1/min]		
		$i = 4, 5, 7, 16 - 70$	$i = 10, 100$	$i = 4, 5, 7$	$i = 10$	$i = 16 - 100$
PSF/PSE/PSB	211/212	85	60	110	300	110
PSF/PSE/PSB	311/312	165	120	100	250	50
PSF/PSE/PSB	411/412	210	160	100	220	100
PSF/PSE/PSB	511/512	370	270	100	220	100
PSF/PSE/PSB	611/612	670	500	180	400	180
PSF	701/702	1200	1000	25	35	25
PSF	801/802	2300	2300	50	40	10
PSF	901/902	4200	3200	80	190	25

1) See selection tables

Checking:

- If $f_D \leq 1$, then the project planning of the planetary gear unit is complete.
- If $f_D > 1$, then read off the correction factor f_K from the following diagram and calculate the average output torque.

Correction factor



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Average output torque

Calculate the average output torque M_{am} :

$$M_{am} = \sqrt[3]{\frac{n_1 \cdot t_1 \cdot M_1^3 + \dots + n_n \cdot t_n \cdot M_n^3}{n_1 \cdot t_1 + \dots + n_n \cdot t_n}} \quad (3)$$

Key

M_{am} [Nm] = Average output torque

$n_1 - n_n$ [1/min] = Output speed in time period $t_1 - t_n$

$M_1 - M_n$ [Nm] = Output torque in time period $t_1 - t_n$

$t_1 - t_n$ [s] = Time period 1 to n

Checking:

$$M_{am} \leq M_B / f_K$$

If the condition is met, then the selected planetary gear unit is an appropriate choice.

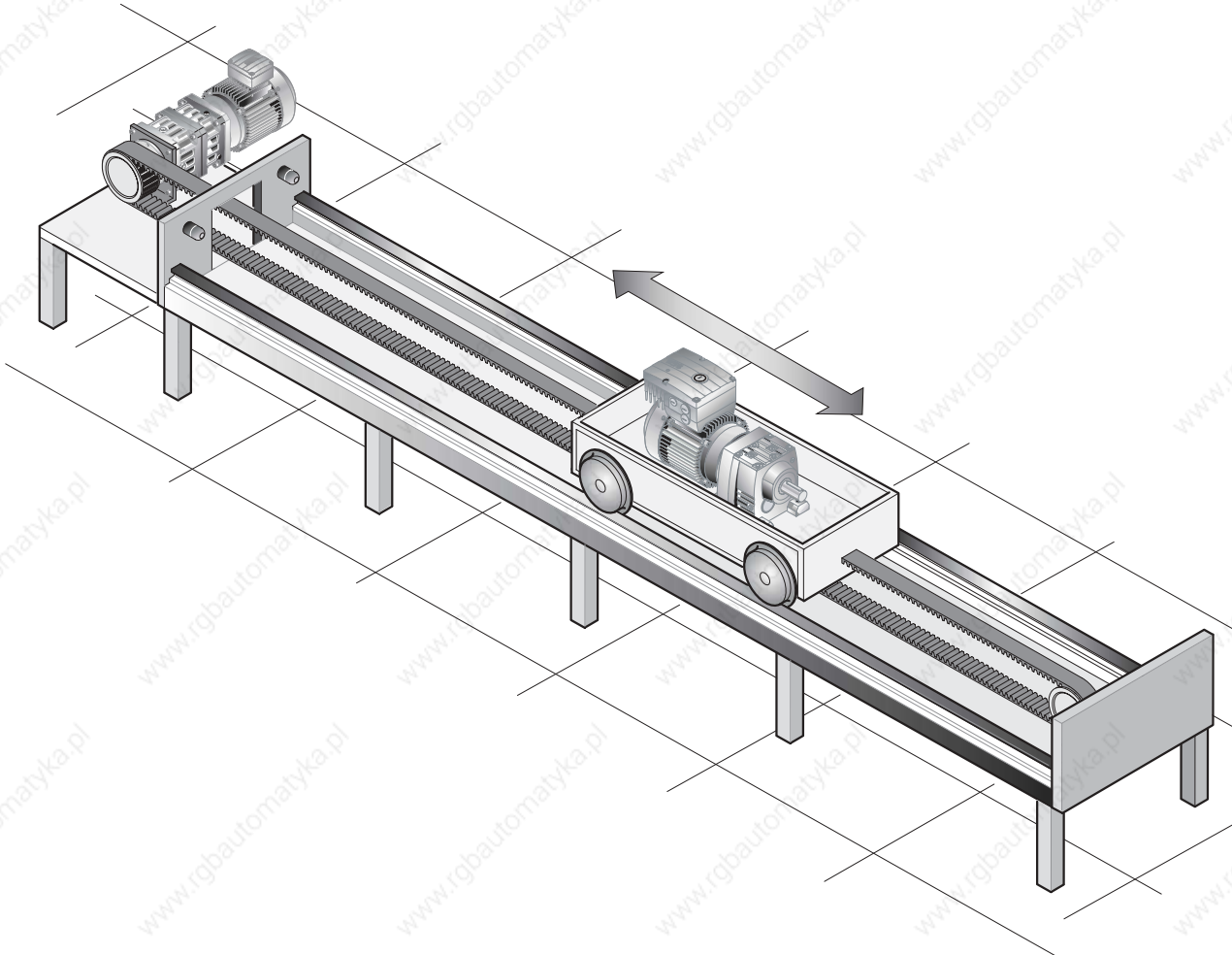
Overhung and axial loads

Check the permitted overhung and axial loads on the output shaft (→ Sec. Overhung and axial loads).



3.5 Project planning example

Project planning of a travel drive in S3 operation



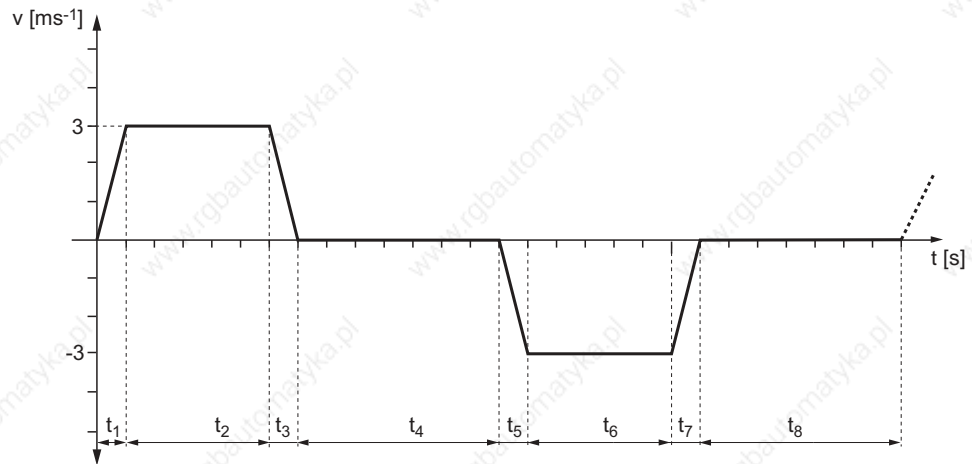
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The following data are given:

- Servomotor with 3000 1/min
- Weight of the load: 140 kg
- Weight of the carriage: 100 kg
- Traveling velocity: 3.0 ms^{-1}
- Acceleration: 10 ms^{-2}
- Deceleration: 10 ms^{-2}
- Efficiency of the machine: 90 %
- Resistance to motion: 90 N/t
- Diameter of the toothed belt pulley: 150 mm (drive via toothed belt)



Travel cycle



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The travel cycle produces the following time periods:

$$t_1 = t_3 = t_5 = t_7 = 0.3 \text{ s switch-on time}$$

$$t_2 = t_6 = 1.5 \text{ s switch-on time}$$

$$t_4 = t_8 = 1.9 \text{ s pause time}$$

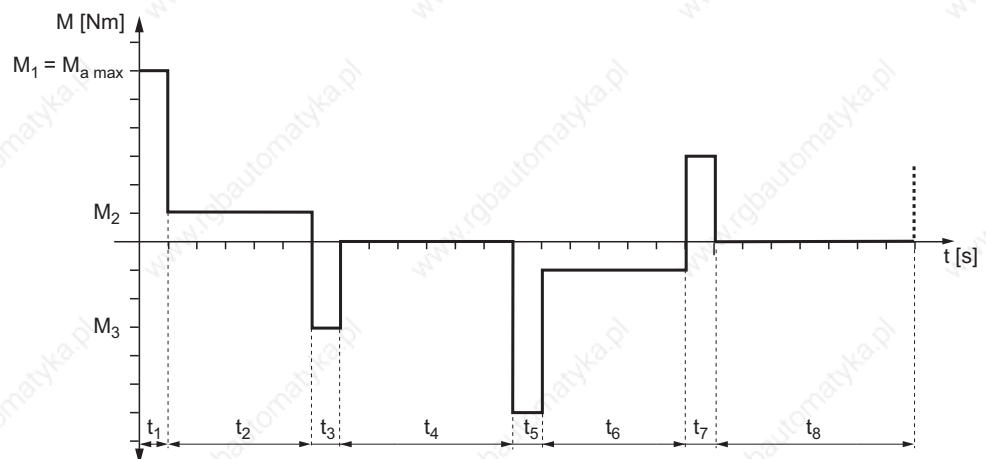
$$n_2 = n_{a \text{ max}} = 381 \text{ 1/min at traveling velocity } 3.0 \text{ ms}^{-1}$$

$$n_1 = n_3 = -n_5 = -n_7 = n_2/2 = 191 \text{ 1/min}$$

$$n_2 = n_6 = 381 \text{ 1/min}$$

$$n_4 = n_8 = 0$$

Torque diagram



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Derived from the torque diagram:

$$M_1 = -M_5 = M_{a \text{ max}} = 202 \text{ Nm}$$

$$M_2 = -M_6 = 2 \text{ Nm}$$

$$M_3 = -M_7 = -160 \text{ Nm}$$

$$M_4 = M_8 = 0$$



Selecting the planetary gear unit

The torque diagram indicates that the maximum torque $M_{a \max}$ which can occur is 202 Nm. The following condition must be met to select a planetary gear unit with a suitable acceleration torque (→ selection tables):

$$M_{a \max} \leq M_B$$

A PSF411 ($M_B = 210$ Nm) with a gear unit reduction ratio $i = 7$ is selected from the selection tables.

Average output speed

Calculate the average output speed according to formula (1):

$$n_{am} = 171 \text{ 1/min}$$

Speed ratio

Determine the speed ratio f_D according to formula (2):

$$f_D = 1.71$$

Gear unit type	Size	$M_B^{1)}$ [Nm]		n_K [1/min]		
		$i = 4, 5, 7, 16 - 70$	$i = 10, 100$	$i = 4, 5, 7$	$i = 10$	$i = 16 - 100$
PSF/PSE/PSB	211/212	85	60	110	300	110
PSF/PSE/PSB	311/312	165	120	100	250	50
PSF/PSE/PSB	411/412	210	160	100	220	100
PSF/PSE/PSB	511/512	370	270	100	220	100
PSF/PSE/PSB	611/612	670	500	180	400	180
PSF	701/702	1200	1000	25	35	25
PSF	801/802	2300	2300	50	40	10
PSF	901/902	4200	3200	80	190	25

1) See selection tables

Checking:

Since $f_D > 1$, the correction factor f_K must be read off the following diagram and the average output torque calculated.

Correction factor

The correction factor f_K is read off as 1.18.



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Permitted emergency off torques

Average output torque

Calculate the average output torque M_{am} according to formula (3):

$$M_{am} = 70.2 \text{ Nm}$$

Checking:

$$M_{am} \leq M_B / f_K$$

$$70.2 \text{ Nm} \leq 210 \text{ Nm} / 1.18$$

$$70.2 \text{ Nm} \leq 178 \text{ Nm}$$

This means the project planning is complete.

Overhung and axial loads

Check the permitted overhung and axial loads (\rightarrow Sec. Overhung and axial loads).

3.6 Permitted emergency off torques

A maximum torque as stated in the following formula is permitted in emergency off braking:

$$M_{\text{Not-Aus}} = M_N \cdot f$$

i	f
4, 5, 7, 16, 20, 25, 28, 30, 35, 40, 49, 70	2.5
10, 100	1.5

Key

$M_{em. off}$ [Nm] = Maximum braking torque in emergency off braking

M_N [Nm] = Rated torque (\rightarrow selection tables)

f = Transmission element factor



3.7 Overhung and axial loads on the output shaft

Determining the overhung load

When determining the overhung load, you must consider the type of transmission element mounted on the shaft end. The following transmission element factors f_z also have to be considered for various transmission elements:

Transmission elements	Transmission element factor f_z	Remarks
Gears	1.15	< 17 teeth
Toothed belt pulleys	-	Pre-tensioning value
Chain sprockets	1.4	< 13 teeth
Chain sprockets	1.25	< 20 teeth

The overhung load acting on the gear shaft is then calculated as follows:

$$F_{Ra2} = \frac{M_d \cdot 2000}{d_0} \cdot f_z$$

$$F_{Ra2} \leq F_{Ra1}$$

Key

M_d [Nm]= Torque

d_0 [mm]= Average diameter of the mounted transmission element

f_z = Transmission element factor

Converting the permitted overhung loads

If the force is applied other than at the shaft extension's midpoint, the permitted overhung loads F_{Rx} [N] must be converted using the following correction formulae:

Overhung load conversion	Based on bearing service life	Based on shaft strength
PSF, PSE	$F_{RxL} = F_{Ra} \cdot \frac{a}{b+x}$ ¹⁾	$F_{RxW} = \frac{c}{f+x}$ ¹⁾
PSB	$F_{RxL} = \frac{1000K_1}{n_a \exp \cdot (a+x)}$	Not used

¹⁾ The lower of the two values F_{RxL} and F_{RxW} is permitted

Key

x [mm] = Distance between overhung load application and shaft shoulder

F_{RxL} [N] = Permitted overhung load at point x based on bearing service life

F_{RxW} [N] = Permitted overhung load at point x based on shaft strength

Higher permitted overhung loads

Higher overhung loads on the output shaft are permitted if reinforced bearings are installed.

Please contact SEW-EURODRIVE in this case.



Overhung and axial loads on the output shaft

Determining the permitted axial load F_{Ax} [N] with simultaneous overhung load application at point x

Gear unit type	Conversion formula
PSF21. / 31. PSE21. – PSE61.	$F_{Ax} = F_{Aa1}$
PSF41. / 51.	$F_{Ax} = F_{Aa1} + 1,06 \cdot F_{Ra1} - \left(0,57 + 0,017 \cdot x \cdot \frac{1}{\text{mm}}\right) \cdot F_{Rx2}$
PSF61.	$F_{Ax} = F_{Aa1} + 0,83 \cdot F_{Ra1} - \left(0,44 + 0,0096 \cdot x \cdot \frac{1}{\text{mm}}\right) \cdot F_{Rx2}$
PSF70. / 80. / 90.	On request
PSB31. – PSB61.	$F_{Ax} = \frac{\frac{1000K_1}{\exp} - (x + e) \cdot F_{Rx2}}{b}$ <p style="text-align: right;">1)</p>

1) The formula applies under the following conditions:

Distance from shaft shoulder $x \geq 0$, existing overhung load $F_{Rx2} \leq F_{RXL}$ and axial load $F_{Ax} \leq F_{Aa1}$

Gear unit constants for overhung and axial load conversion

Type	a [mm]	b [mm]	c [Nmm]	e [mm] ¹⁾	e [mm] ²⁾	f [mm]	exp	K_1 [Nm]
PSF21.	47	33	3.70×10^4	–	–	0.5	–	–
PSF31.	53	35	1.25×10^5	–	–	9.2	–	–
PSF41.	77	48	3.36×10^5	–	–	10.4	–	–
PSF51	77	48	2.83×10^5	–	–	10.4	–	–
PSF61.	111	70	5.23×10^5	–	–	0.5	–	–
PSF70.	73	32	1.57×10^6	–	–	16.7	–	–
PSF80.	86	33.5	3.39×10^6	–	–	0.5	–	–
PSF90.	91.5	39	5.37×10^6	–	–	22	–	–
PSB31.	83	62	–	24	51	–	1/3	1636
PSB41.	98	93	–	23	58	–	1/3	2765
PSB51.								
PSB61.	90	124	–	45	52	–	0.3	5989
PSE21.	41.5	27.5	3.09×10^4	–	–	–	–	–
PSE31.	58	40	8.26×10^4	–	–	–	–	–
PSE41.	78	49	2.93×10^5	–	–	–	–	–
PSE51.	78	49	2.27×10^5	–	–	–	–	–
PSE61.	103.5	62.5	3.45×10^5	–	–	–	–	–

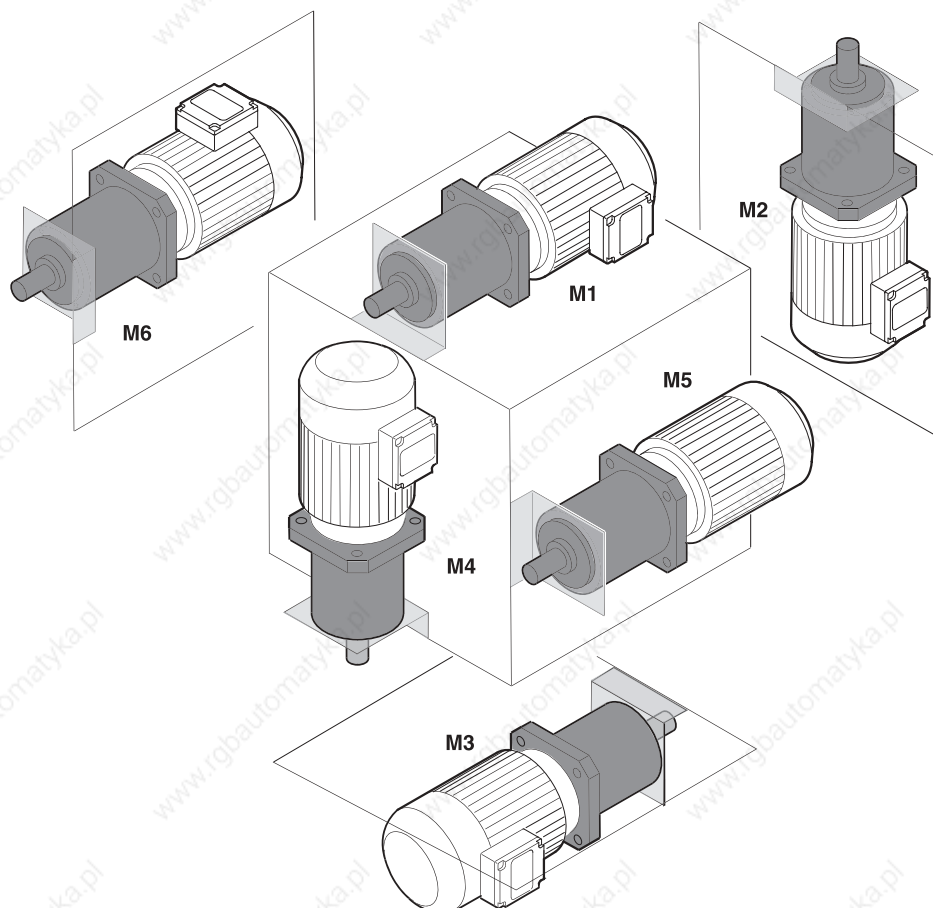
1) F_A = Compression

2) F_A = Tension

4 Mounting Positions

4.1 General information about mounting positions

In the case of planetary gear units, SEW-EURODRIVE distinguishes between mounting positions M1 to M6. The following figure shows the spatial arrangement of the gear unit in mounting positions M1 to M6.



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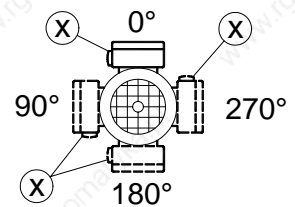
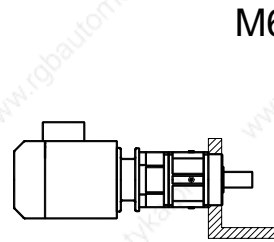
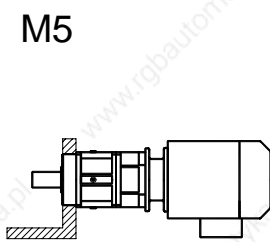
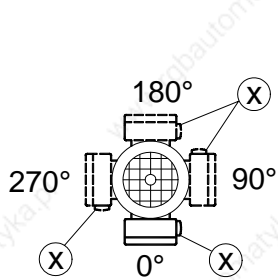
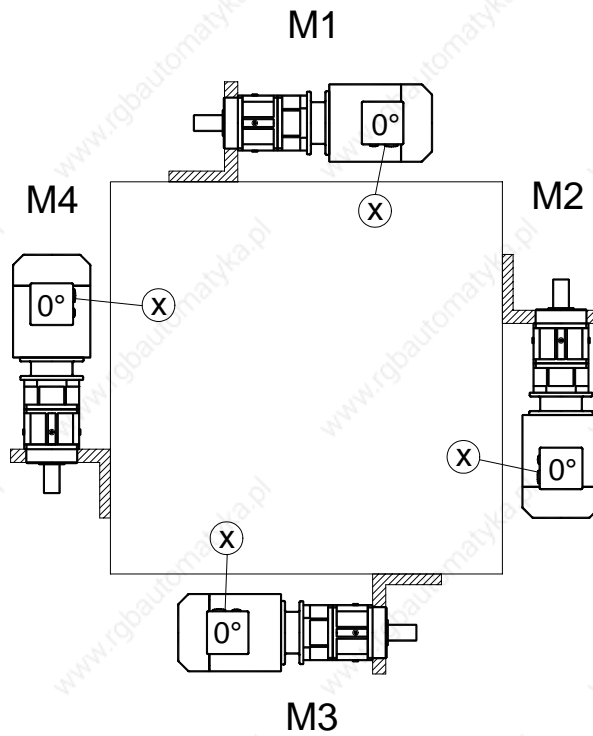
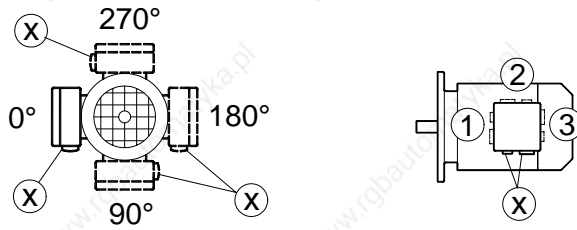
Symbols used




The following table shows which symbols are used in the mounting position sheets and what they mean:

Symbol	Meaning
	No breather valve
	No oil level plug
	No oil drain plug
X, 1, 2, 3	Possible position of the cable entry (X = normal position)

4.2 PSF211 – PSF902

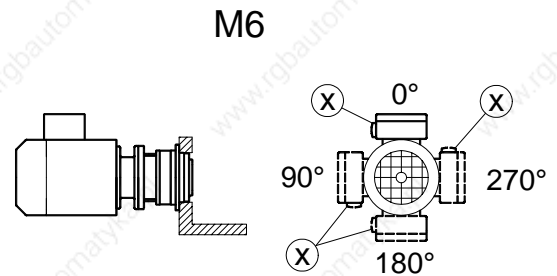
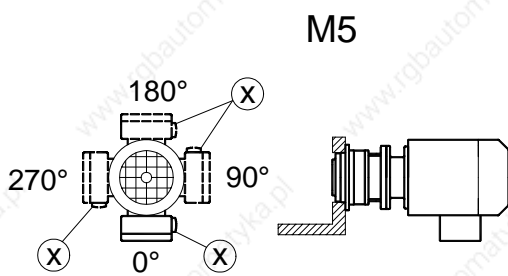
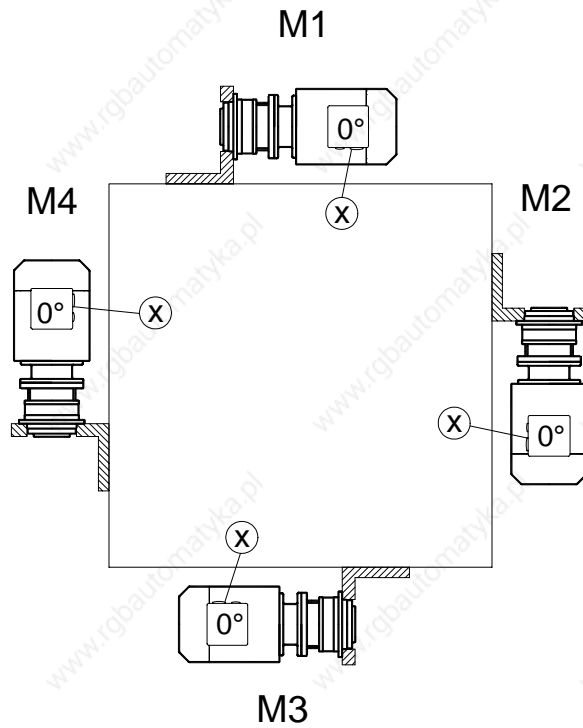
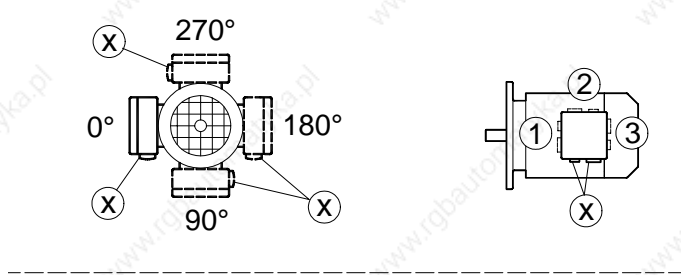
44 001 000






-  M1 - M6
-  M1 - M6
-  M1 - M6

4.3 PSB311 – PSB612

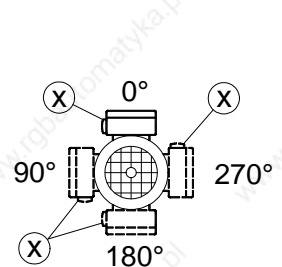
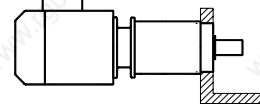
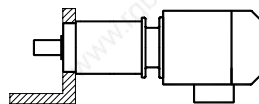
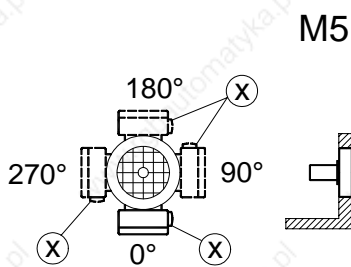
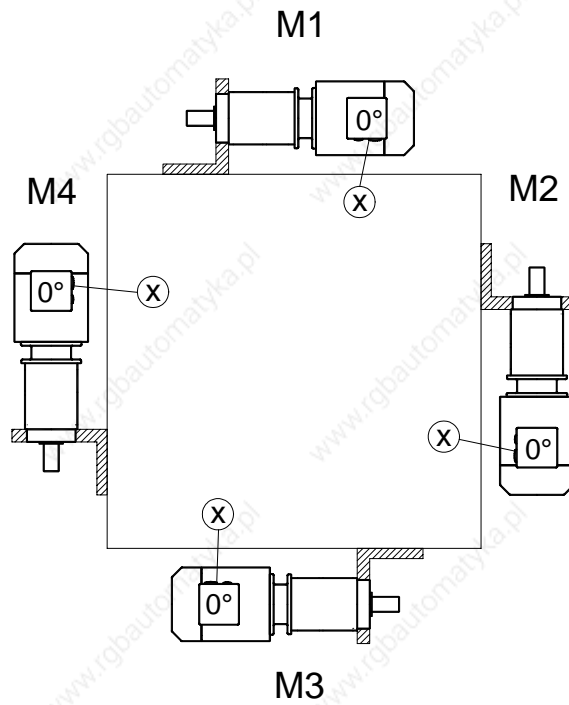
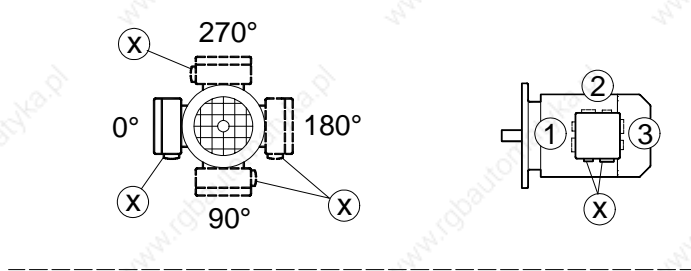
44 002 000






-  M1 - M6
-  M1 - M6
-  M1 - M6

4.4 PSE211 – PSE612

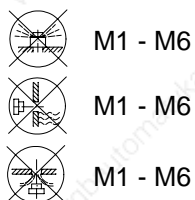
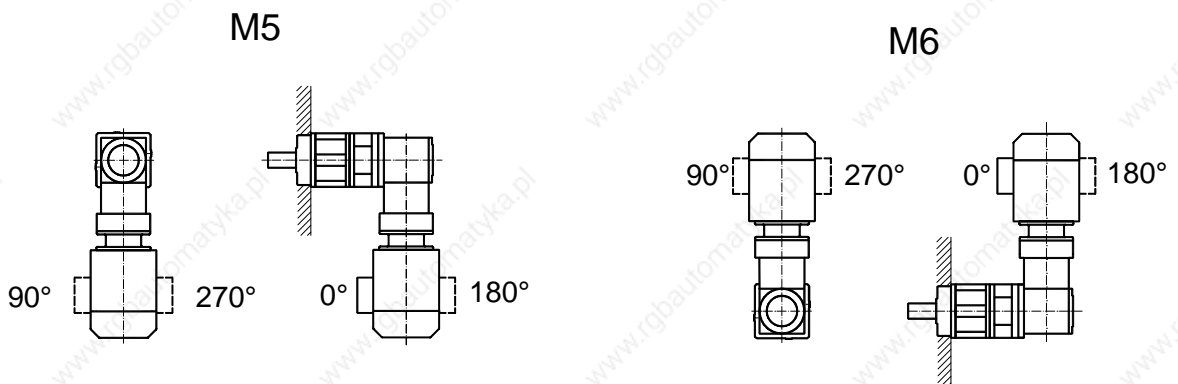
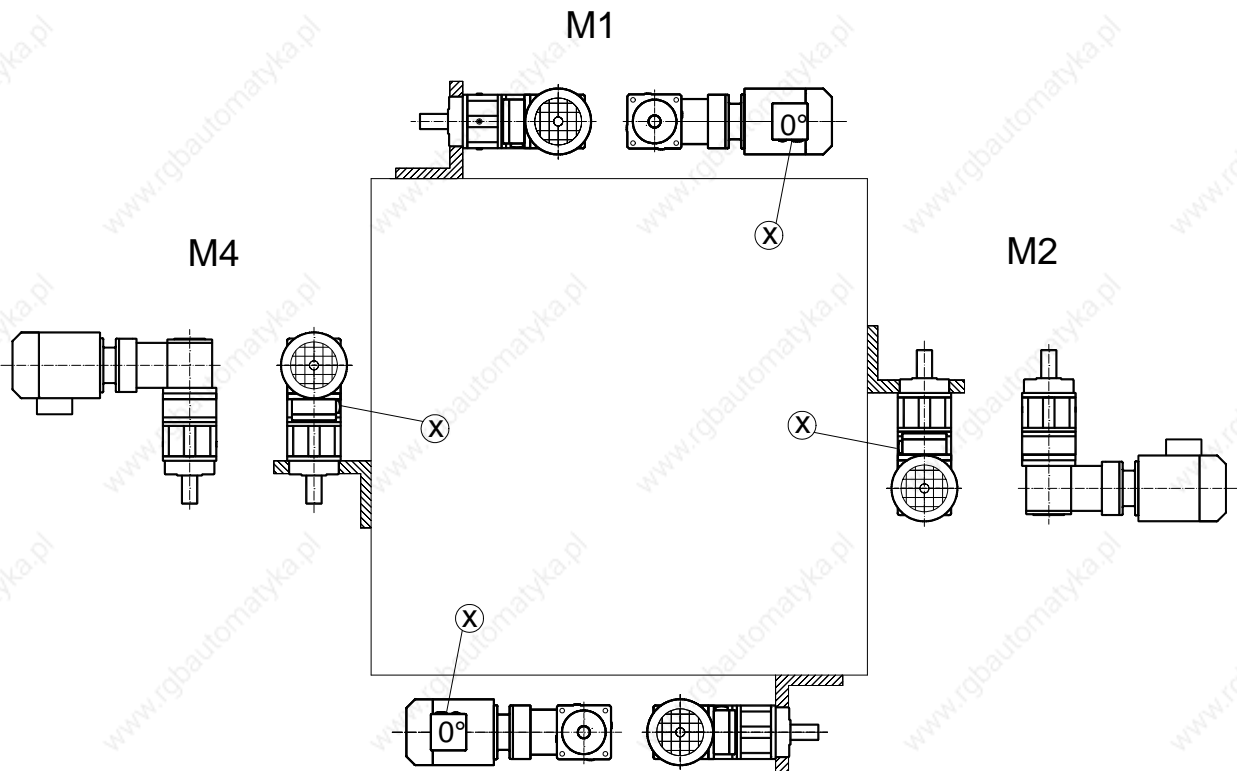
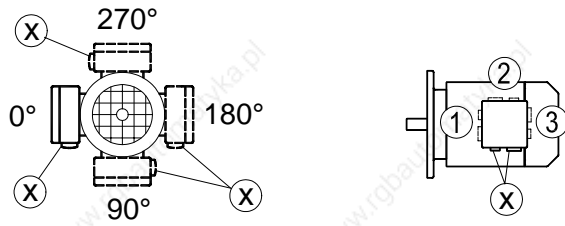
44 001 001



-  M1 - M6
-  M1 - M6
-  M1 - M6

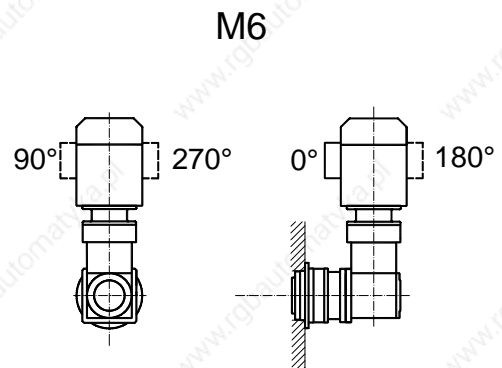
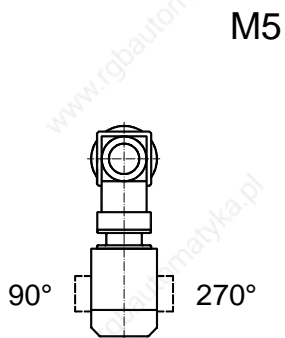
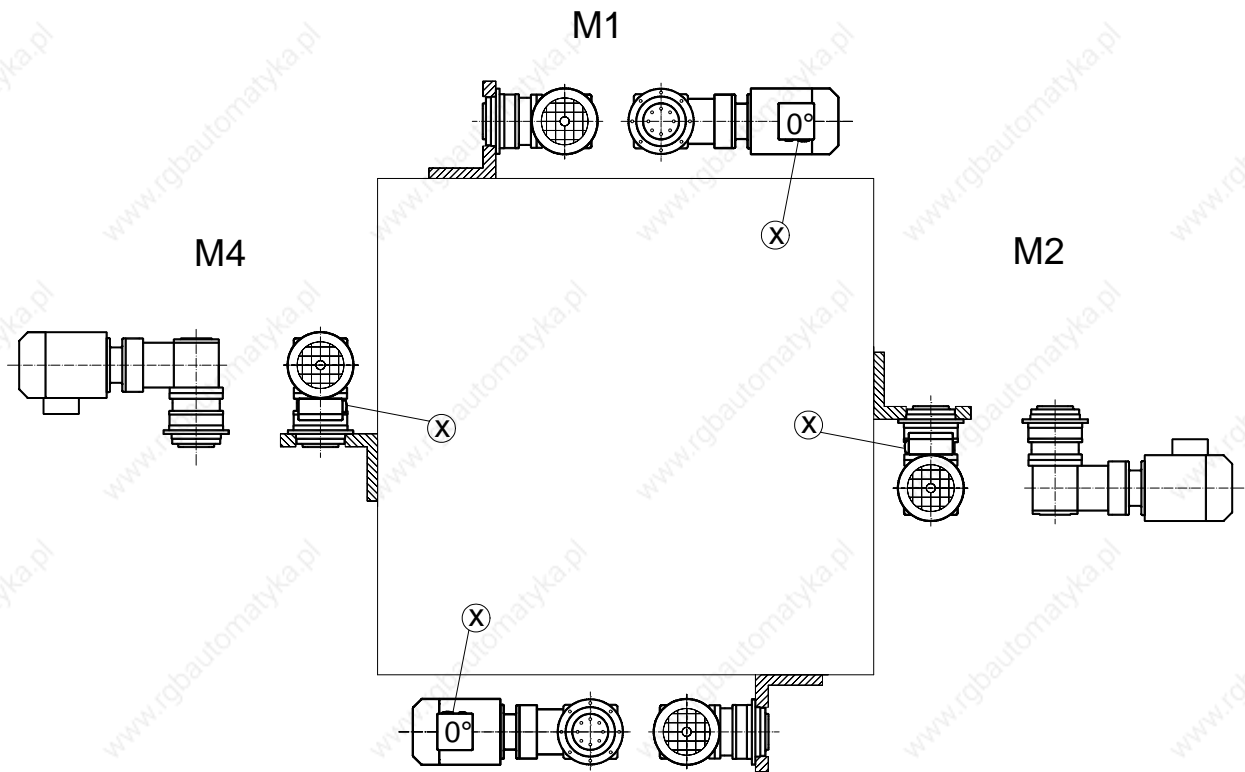
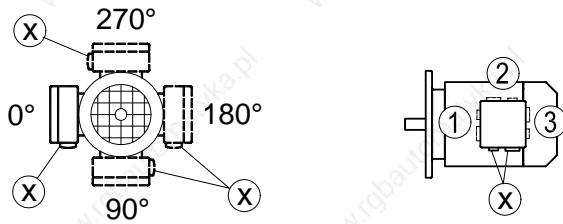
4.5 PSF211 VC.. – PSF802 VC..

44 001 002



4.6 PSB311 VC.. – PSB 612 VC..

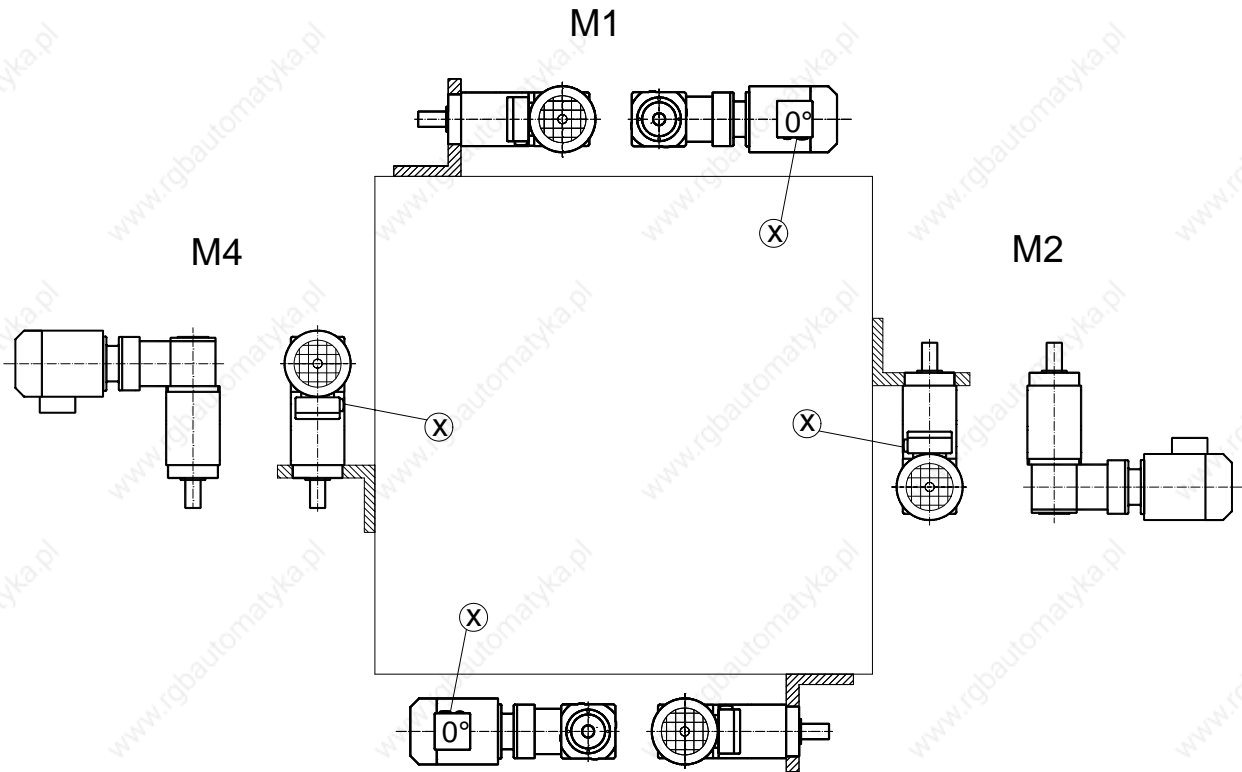
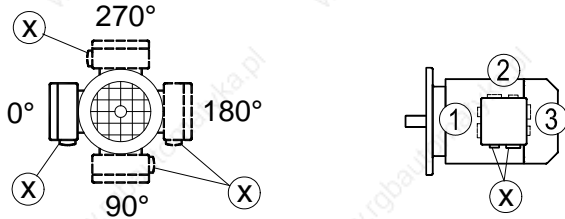
44 002 002



- M1 - M6
- M1 - M6
- M1 - M6

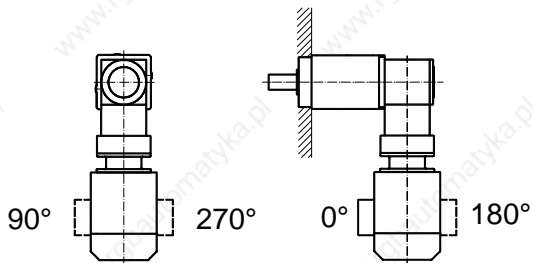
4.7 PSE211 VC.. – PSE612 VC..




44 003 002



M5

M6

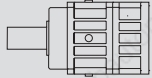



-  M1 - M6
-  M1 - M6
-  M1 - M6





5 Important Information on Selection Tables and Dimensions Sheets

5.1 Structure of the PSF...EK.. and PSE...EK.. selection tables

PSF211 EK., $n_e = 1000$ 1/min										55 Nm
i	$n_{e \max}$ [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/']		m [kg]		
1	2	3	4	5	6	7	8	9	10	11

- 1 Gear unit reduction ratio
- 2 Maximum input speed (permitted briefly)
- 3 Rated torque in S3 operation (60 % cdf at $n_e = 1000$ 1/min)
- 4 Acceleration torque
- 5 Overhung load at $n_e = 1000$ 1/min with overhung load and axial load acting simultaneously
- 6 Axial load at $n_e = 1000$ 1/min with overhung load and axial load acting simultaneously In the case of PSF 70./80./90., the values only apply if the specified maximum overhung load is also acting at the same time. The reduction in permitted axial load is directly proportional to the reduction in overhung load.
- 7 Torsional rigidity
- 8 Series and size
- 9 Weight
- 10 Dimension sheet page number
- 11 Torque class

5.2 Structure of the PSB..EK.. selection tables

PSB311 EK., $n_e = 1000$ 1/min										110 Nm	
i	$n_{e \max}$ [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/']	c_T [Nm/']		m [kg]		
1	2	3	4	5	6	7	8	9	10	11	12

- 1 Gear unit reduction ratio
- 2 Maximum input speed (permitted briefly)
- 3 Rated torque in S3 operation (60 % cdf at $n_e = 1000$ 1/min)
- 4 Acceleration torque
- 5 Overhung load at $n_e = 1000$ 1/min with overhung load and axial load acting simultaneously
- 6 Axial load at $n_e = 1000$ 1/min with overhung load and axial load acting simultaneously In the case of PSF 70./80./90., the values only apply if the specified maximum overhung load is also acting at the same time. The reduction in permitted axial load is directly proportional to the reduction in overhung load.
- 7 Tilting rigidity
- 8 Torsional rigidity
- 9 Series and size
- 10 Weight
- 11 Dimension sheet page number
- 12 Torque class



5.3 Information about dimension sheets

Scope of delivery



= Standard parts are supplied by SEW.



= Standard parts are not supplied by SEW.

Tolerances

Shaft ends

Type of shaft ends:

PSF, PSB → Smooth shaft end for shrink disk connection

PSE → Flange shaft acc. to EN ISO 9409 with additional tapped holes

Diameter tolerance PSF, PSE → ISO k6

Maximum concentricity deviation between internal centering and external centering in PSB → 0.02 mm

Center holes in accordance with DIN 332, shape DR:

∅	= 7 – 10 mm	→ M3
∅	> 10 – 13 mm	→ M4
∅	> 13 – 16 mm	→ M5
∅	> 16 – 21 mm	→ M6
∅	> 21 – 24 mm	→ M8
∅	> 24 – 30 mm	→ M10
∅	> 30 – 38 mm	→ M12
∅	> 38 – 50 mm	→ M16
∅	> 50 – 85 mm	→ M20

Keys: In accordance with DIN 6885 (domed type)

Flanges

Centering shoulder tolerance → ISO h6

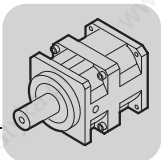
Internal centering

PSB (B5 flange) → ISO H7

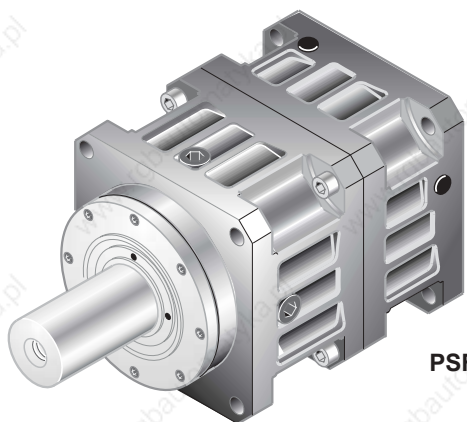
External centering

PSF → ISO g6

PSB → ISO h7



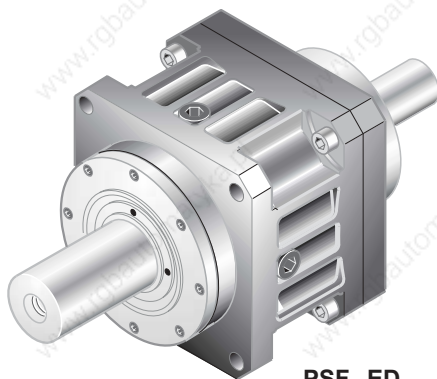
6 Low Backlash Planetary Gear Units PSF...



PSF...EK..

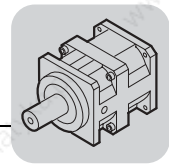


PSF...VC..EK..



PSF...ED

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6.1 PSF...EK.. [Nm]

PSF211 EK.., $n_e = 1000$ 1/min								55 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]		
4	6000	55	85	1050	1000	3.4	PSF	211EK	2.2	43
5	6000	55	85	1150	1100					
7	6000	55	85	1300	1250					
10	6000	55	60	1450	1400					

PSF212 EK.., $n_e = 1000$ 1/min								55 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]		
16	6000	55	85	1700	1700	2.8	PSF	212EK	2.6	43
20	6000	55	85	1800	1900					
25	6000	55	85	1900	2100					
28	6000	55	85	2000	2200					
35	6000	55	85	2200	2400					
40	6000	55	85	2300	2600					
49	6000	55	85	2400	2800					
70	6000	55	85	2550	3300					
100	6000	55	60	2550	3300					

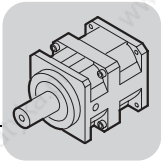
PSF311 EK.., $n_e = 1000$ 1/min								110 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]		
4	6000	110	165	1180	1100	9	PSF	311EK	3.3	44
5	6000	110	165	1280	1200					
7	6000	110	165	1430	1350					
10	6000	110	120	1600	1500					

PSF312 EK.., $n_e = 1000$ 1/min								110 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]		
16	6000	110	165	1800	1880	7	PSF	312EK	4.1	44
20	6000	110	165	1900	2070					
25	6000	110	165	2030	2290					
28	6000	110	165	2150	2400					
35	6000	110	165	2250	2650					
40	6000	110	165	2300	2800					
49	6000	110	165	2450	3060					
70	6000	110	165	2780	3580					
100	6000	110	120	3250	3900					

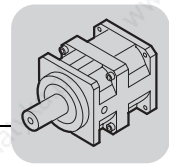
PSF411 EK.., $n_e = 1000$ 1/min								160 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]		
4	4500	160	210	6500	2500	28	PSF	411EK	6.7	45
5	4500	160	210	6900	2750					
7	4500	160	210	7650	3250					
10	4500	150	160	8500	3800					

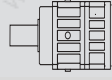

PSF412 EK.., $n_e = 1000$ 1/min								160 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]		
16	4500	160	210	8520	3980	23	PSF	412EK	8.7	45
20	4500	160	210	8520	4880					
25	4500	160	210	8520	5840					
28	4500	160	210	8520	6360					
35	4500	160	210	8520	7430					
40	4500	160	210	8520	8100					
49	4500	160	210	8520	9180					
70	4500	160	210	8520	11200					
100	4500	150	160	8520	13500					

PSF511 EK.., $n_e = 1000$ 1/min								300 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]		
4	4500	300	370	6500	2500	31	PSF	511EK	7.0	46
5	4500	300	370	6900	2750					
7	4500	300	370	7180	3250					
10	4500	270	270	7180	3800					

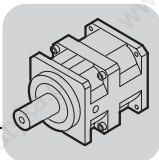


PSF512 EK., $n_e = 1000$ 1/min							300 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]	
16	4500	300	370	7180	5400	27		PSF 512EK	
20	4500	300	370	7180	6300				
25	4500	300	370	7180	7270				
28	4500	300	370	7180	7780				
35	4500	300	370	7180	8850				
40	4500	300	370	7180	9520				
49	4500	300	370	7180	10600				
70	4500	300	370	7180	12700				
100	4500	270	270	7180	14900				
PSF611 EK., $n_e = 1000$ 1/min							600 Nm		
4	4500	600	670	12600	6410	59	PSF 611EK	15	47
5	4500	600	670	12600	7570				
7	4500	600	670	12600	9460				
10	4500	500	500	12600	11700				
PSF612 EK., $n_e = 1000$ 1/min							600 Nm		
16	4500	600	670	12600	15000	48	PSF 612EK	19	47
20	4500	600	670	12600	16800				
25	4500	600	670	12600	18600				
28	4500	600	670	12600	19600				
35	4500	600	670	12600	21700				
40	4500	600	670	12600	23000				
49	4500	600	670	12600	25100				
70	4500	600	670	12600	29100				
100	4500	500	500	12600	33500				
PSF701 EK., $n_e = 1000$ 1/min							800 Nm		
4	3000	800	1200	20900	11600	149	PSF 701EK	28	48
5	3000	800	1200	19000	16500				
7	3000	800	1200	18000	15700				
10	3000	800	1000	20300	17600				
PSF702 EK., $n_e = 1000$ 1/min							800 Nm		
16	3000	800	1200	27300	20300	126	PSF 702EK	38	48
20	3000	800	1200	27300	20300				
25	3000	800	1200	27300	20300				
28	3000	800	1200	27300	20300				
35	3000	800	1200	27300	20300				
40	3000	800	1200	27300	20300				
49	3000	800	1200	27300	20300				
70	3000	800	1200	27300	20300				
100	3000	800	1000	27300	20300				
PSF801 EK., $n_e = 1000$ 1/min							1500 Nm		
4	3000	1500	2300	25000	12500	350	PSF 801EK	40	49
5	3000	1500	2300	27000	13500				
7	3000	1500	2300	30500	15300				
10	3000	1500	2300	34000	17000				
PSF802 EK., $n_e = 1000$ 1/min							1500 Nm		
16	3000	1500	2300	40000	20000	290	PSF 802EK	57	49
20	3000	1500	2300	43000	21500				
25	3000	1500	2300	45000	27500				
28	3000	1500	2300	48500	24300				
35	3000	1500	2300	52500	26300				
40	3000	1500	2300	54500	27300				
49	3000	1500	2300	57000	28500				
70	3000	1500	2300	64000	32500				
100	3000	1500	2300	64000	37000				

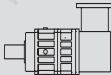





PSF901 EK., $n_e = 1000$ 1/min							3000 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]	
4	3000	3000	4200	33500	16800	510	PSF 901EK	66	50
5	3000	3000	4200	36500	18300				
7	3000	3000	4200	40500	20300				
10	3000	3000	3200	46000	23000				



PSF902 EK., $n_e = 1000$ 1/min							3000 Nm		
16	3000	3000	4200	53500	26800	420	PSF 902EK	75	50
20	3000	3000	4200	56000	28000				
25	3000	3000	4200	61800	30700				
28	3000	3000	4200	61800	30700				
35	3000	3000	4200	61800	30700				
40	3000	3000	4200	61800	30700				
49	3000	3000	4200	61800	30700				
70	3000	3000	4200	61800	30700				
100	3000	3000	3200	61800	30700				

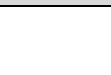



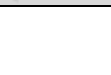

6.2 PSF...VC..EK.. [Nm]

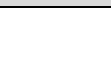

PSF211 VC65 EK..., $n_e = 1000$ 1/min							55 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]		m [kg]	
8	6000	55	85	1350	1300	PSF 211VC65EK	4.7	51
10	6000	55	60	1450	1400			
14	6000	55	85	1500	1450			
20	6000	55	85	1800	1900			

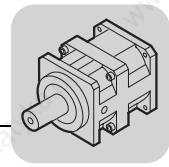
PSF311 VC90 EK..., $n_e = 1000$ 1/min							110 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]		m [kg]	
7	6000	110	165	1430	1350	PSF 311VC90EK	8.8	52
10	6000	110	120	1600	1500			
14	6000	110	165	1750	1650			
21	6000	110	165	1950	2090			
28	6000	110	165	2150	2400			
35	6000	110	165	2250	2650			
40	6000	110	120	2300	2800			
50	6000	110	120	2490	3090			
60	6000	110	120	2690	2280			

PSF411 VC90 EK..., $n_e = 1000$ 1/min							160 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]		m [kg]	
7	4500	160	210	7650	3250	PSF 411VC90EK	12	53
10	4500	150	160	8500	3800			
14	4500	160	210	8520	3880			
21	4500	160	210	8520	4890			
28	4500	160	210	8520	6360			
35	4500	160	210	8520	7430			
40	4500	150	160	8520	8100			
50	4500	150	160	8520	9200			
60	4500	150	160	8520	10000			

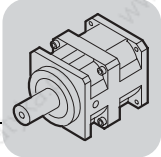
PSF511 VC120 EK..., $n_e = 1000$ 1/min							300 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]		m [kg]	
7	4500	300	370	7180	3250	PSF 511VC120EK	19	54
10	4500	270	270	7180	3800			
14	4500	300	370	7180	4000			
21	4500	300	370	7180	6350			
28	4500	300	370	7180	7780			
35	4500	300	370	7180	8850			
40	4500	270	270	7180	9520			
50	4500	270	270	7180	10700			

PSF611 VC160 EK..., $n_e = 1000$ 1/min							600 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]		m [kg]	
7	4500	600	670	12600	9460	PSF 611VC160EK	27	55
10	4500	500	500	12600	11700			
14	4500	600	670	12600	14000			
21	4500	600	670	12600	16900			
28	4500	600	670	12600	19600			
35	4500	600	670	12600	21700			
40	4500	500	500	12600	23000			
50	4500	500	500	12600	25200			
60	4500	500	500	12600	26800			

PSF701 VC160 EK..., $n_e = 1000$ 1/min							800 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]		m [kg]	
7	3000	800	1200	18000	15700	PSF 701VC160EK	52	56
10	3000	800	1000	20300	17600			
14	3000	800	1200	27300	20000			
21	3000	800	1200	27300	20300			
28	3000	800	1200	27300	20300			
35	3000	800	1200	27300	20300			
40	3000	800	1000	27300	20300			
50	3000	800	1000	27300	20300			

PSF801 VC200 EK.., $n_e = 1000$ 1/min

i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	1500 Nm			
						m [kg]			
7	3000	1500	2300	30500	15300				
10	3000	1500	2300	34000	17000				
14	3000	1500	2300	38500	18500				
21	3000	1500	2300	43200	21600				
28	3000	1500	2300	48500	24300				
35	3000	1500	2300	52500	26300				
40	3000	1500	2300	54500	27300				
50	3000	1500	2300	57000	28500				
						PSF	801VC200EK	88	57

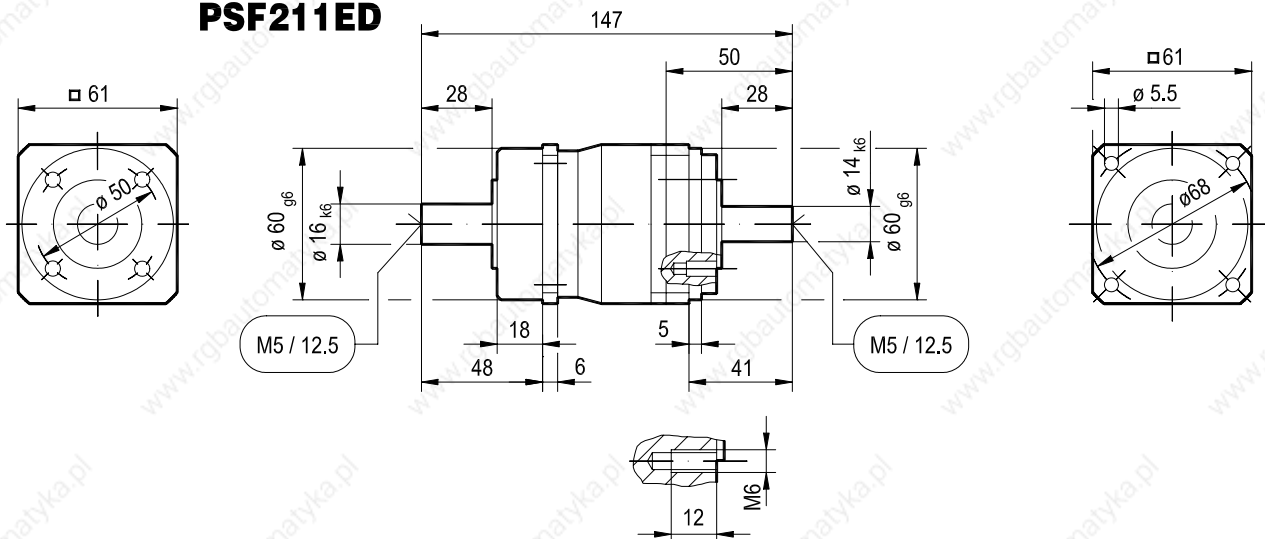


PSF211/212 ED [mm]

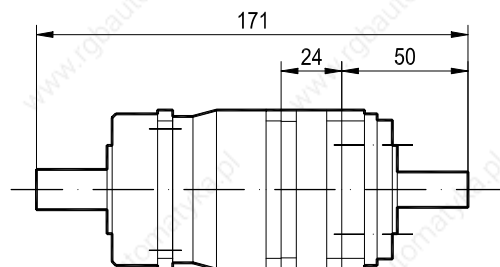
6.3 PSF211/212 ED [mm]

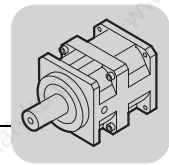
43 001 101

PSF211ED



PSF212ED

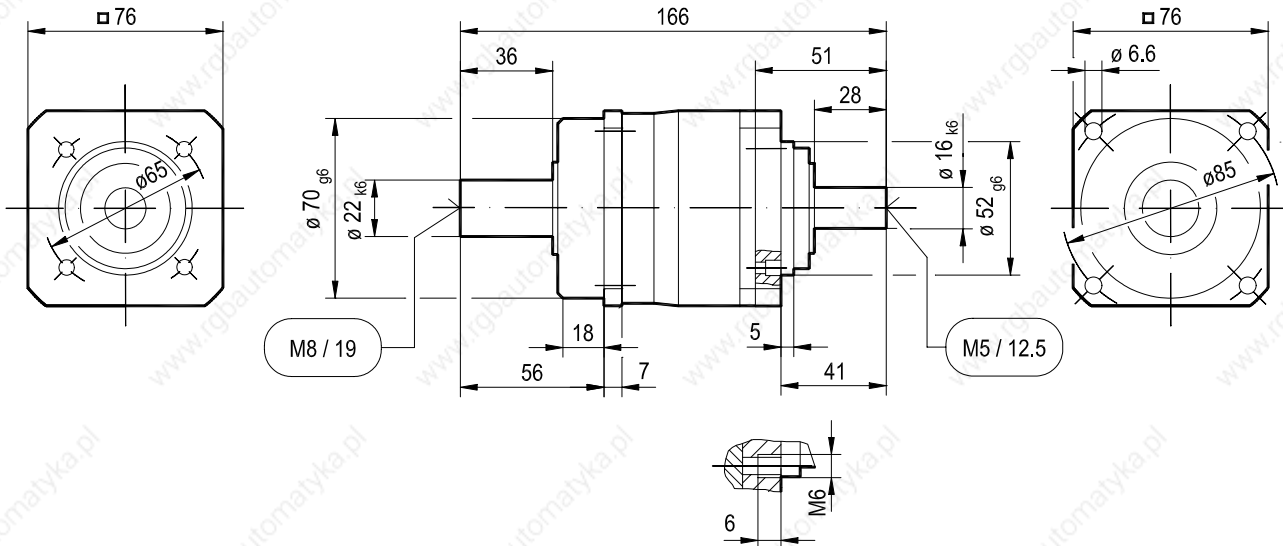




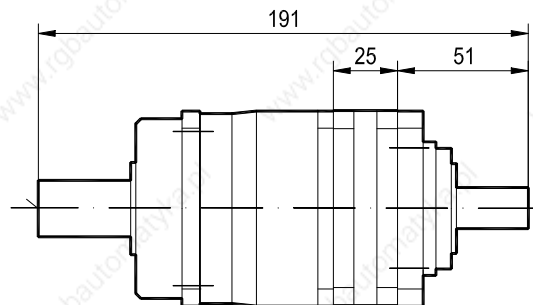
6.4 PSF311/312 ED [mm]

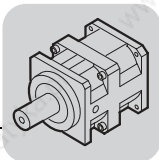
43 002 101

PSF311ED



PSF312ED



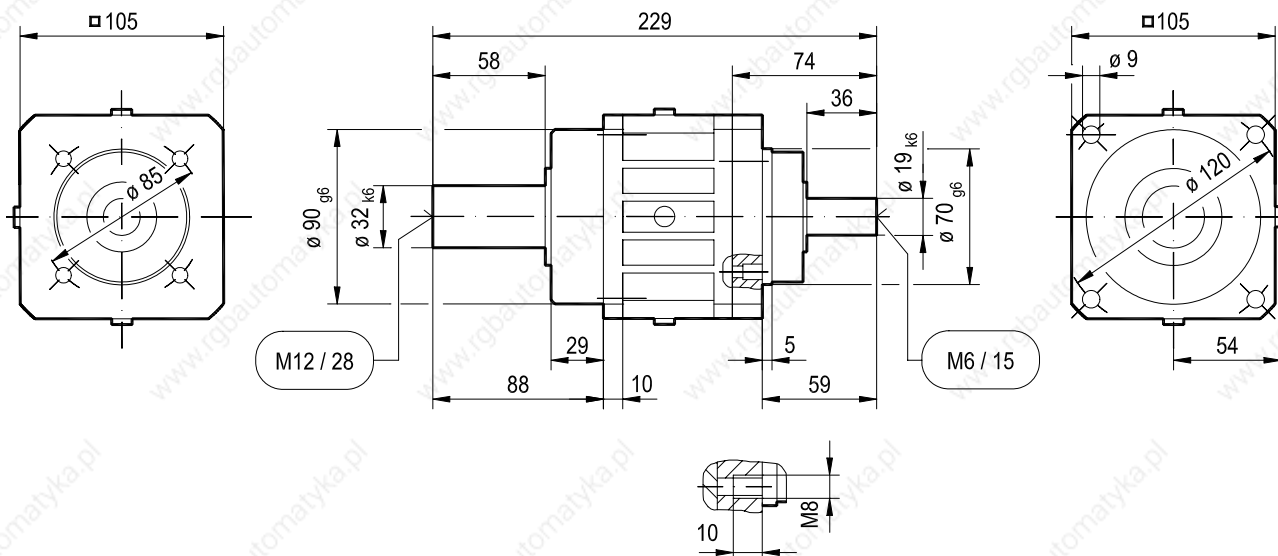


PSF411/412 ED [mm]

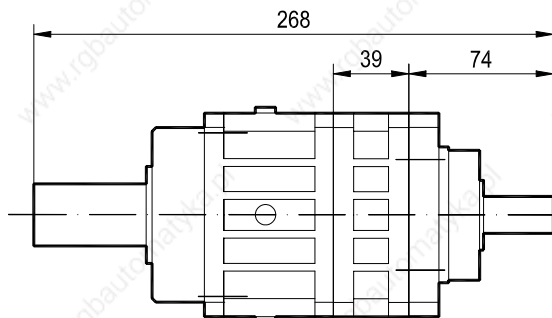
6.5 PSF411/412 ED [mm]

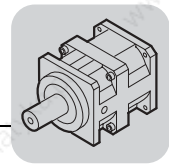
43 003 101

PSF411ED



PSF412ED

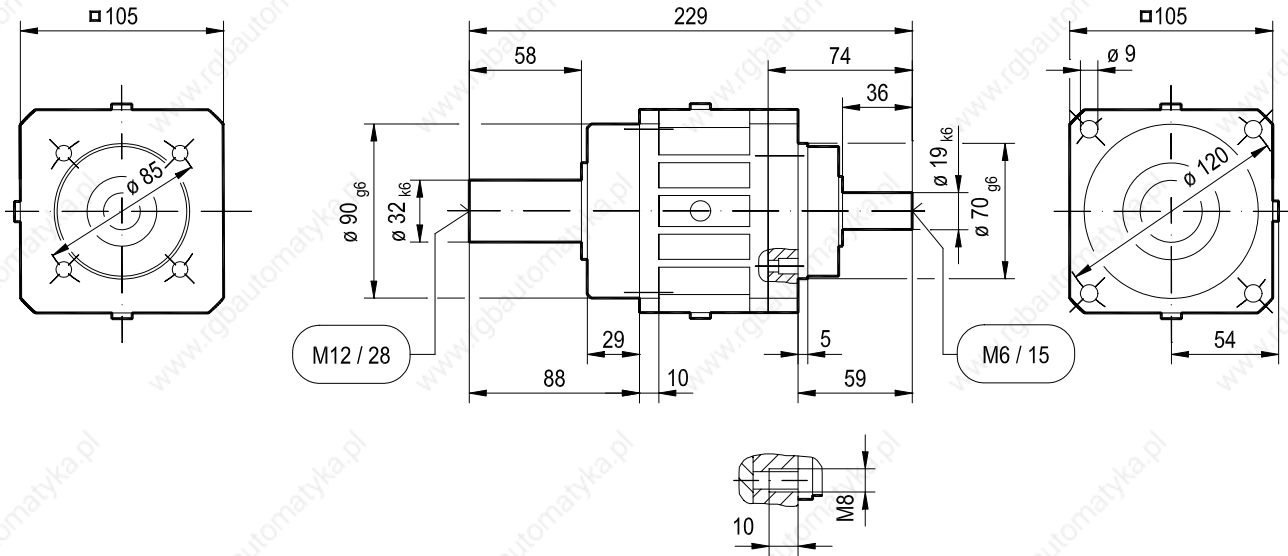




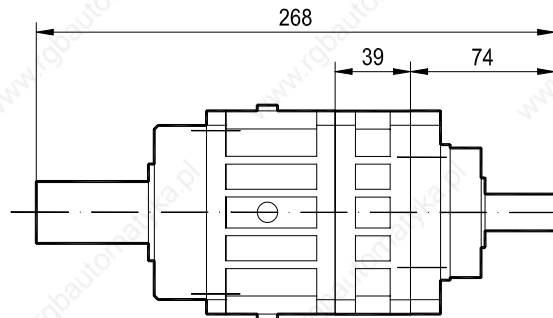
6.6 PSF511/512 ED [mm]

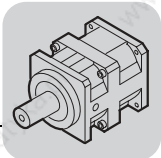
43 004 101

PSF511ED



PSF512ED

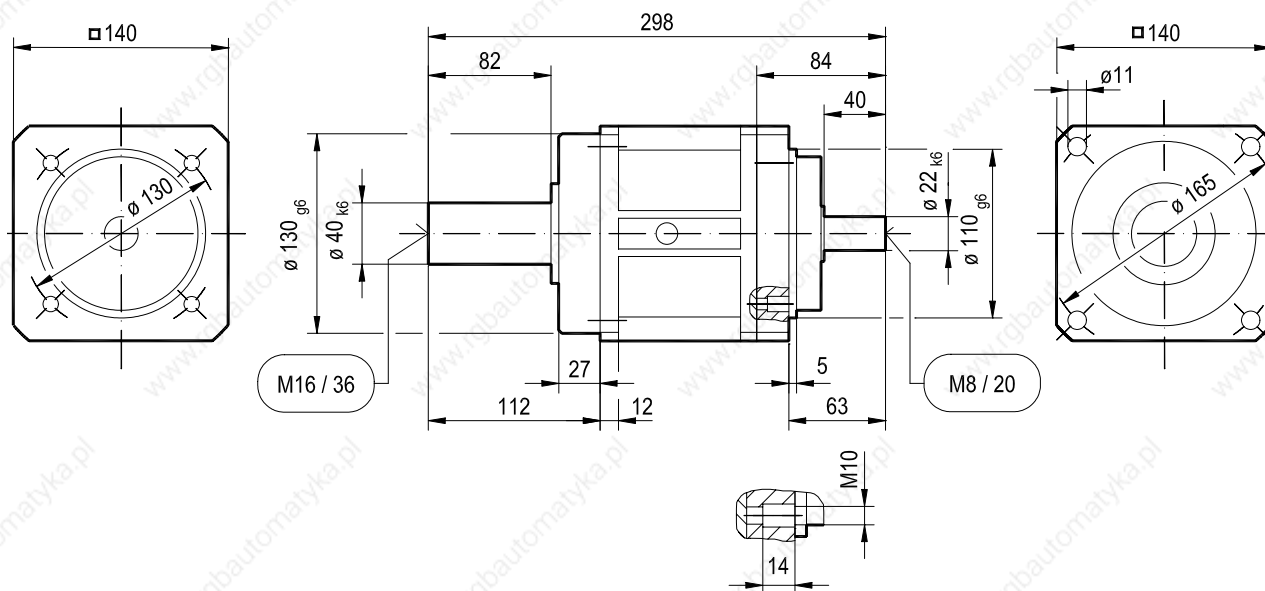




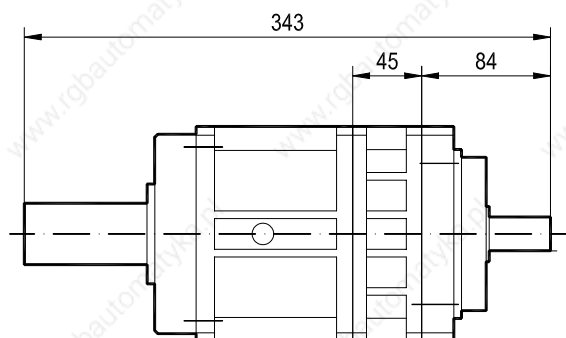
6.7 PSF611/612 ED [mm]

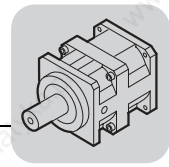
43 005 101

PSF611ED



PSF612ED

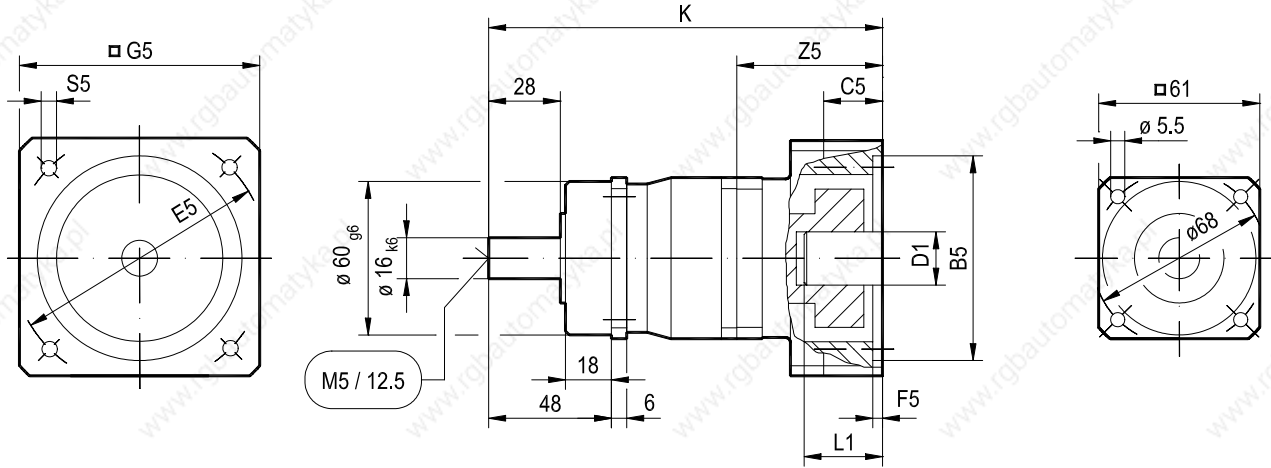




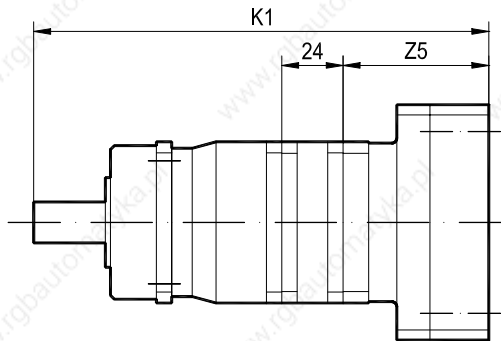
6.8 PSF211/212 EK.. [mm]

43 009 001

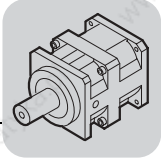
PSF211EK..



PSF212EK..



	EK01	EK02	EK12	EK03	EK05	EK18	EK17	EK13	EK04				
B5	40	60	60	80	95	60	50	80	95				
C5	23	23	23	23	23	23	23	23	23				
E5	63	75	75	100	115	90	95	100	115				
F5	5	5	5	5	5	5	5	5	5				
G5	82	82	82	92	105	82	82	92	105				
S5	M4	M5	M5	M6	M8	M5	M6	M6	M8				
Z5	57	57	57	57	57	57	57	57	57				
D1	9	11	14	14	14	14	14	19	19				
L1	20	23	30	30	30	30	30	40	40				
K	154	154	154	154	154	154	154	154	154				
K1	178	178	178	178	178	178	178	178	178				

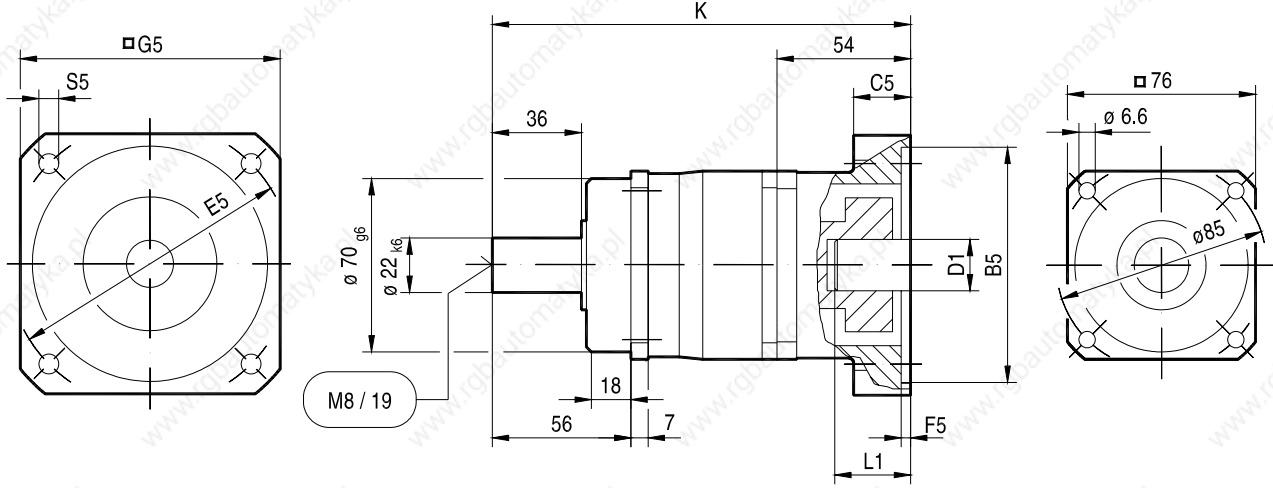


PSF311/312 EK.. [mm]

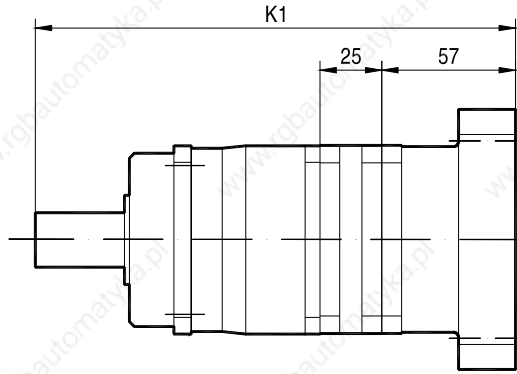
6.9 PSF311/312 EK.. [mm]

43 010 001

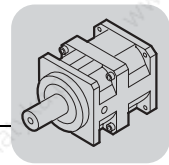
PSF311EK..



PSF312EK..



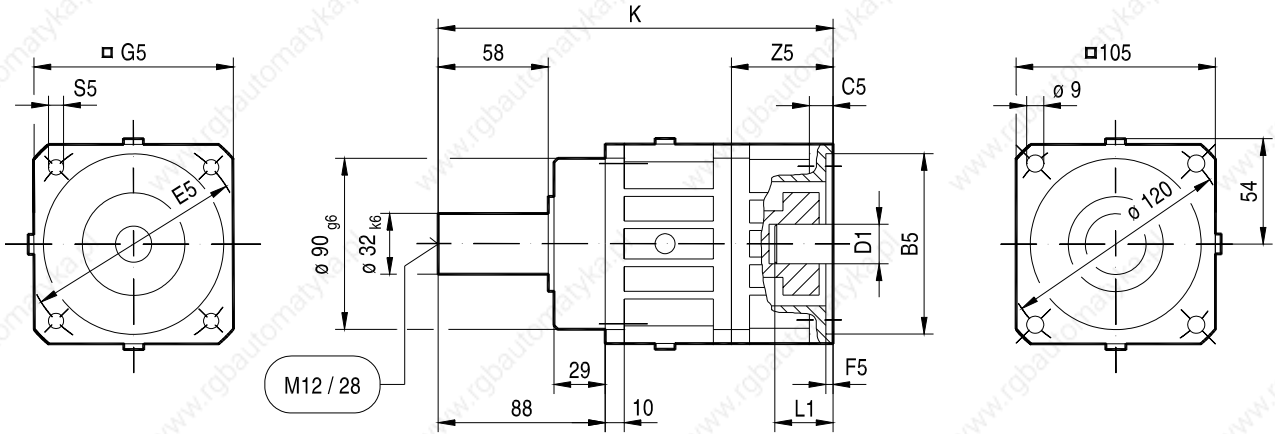
	EK02	EK18	EK17	EK12	EK03	EK05	EK13	EK04	EK07	EK06	EK19	EK14	EK08	EK09
B5	60	60	50	60	80	95	80	95	95	110	110	110	110	130
C5	23	23	23	23	23	23	23	23	23	23	23	23	23	23
E5	75	90	95	75	100	115	100	115	130	130	145	130	165	165
F5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
G5	82	82	82	82	92	105	92	105	115	115	120	115	140	140
S5	M5	M5	M6	M5	M6	M8	M6	M8	M8	M8	M8	M8	M10	M10
D1	11	14	14	14	14	14	19	19	19	19	19	24	24	24
L1	23	30	30	30	30	30	40	40	40	40	50	50	50	50
K	169	169	169	169	169	169	169	169	169	169	169	169	169	169
K1	197	197	197	197	197	197	197	197	197	197	197	197	197	197



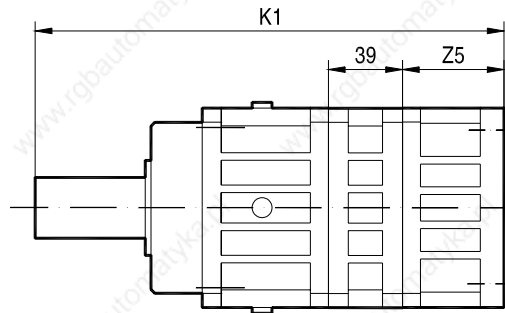
6.10 PSF411/412 EK.. [mm]

43 011 001

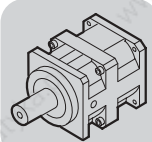
PSF411EK..



PSF412EK..



	EK12	EK03	EK05	EK13	EK04	EK07	EK06	EK14	EK08	EK09	EK15	EK11	EK10
B5	60	80	95	80	95	95	110	110	110	130	130	130	180
C5	12	13	13	13	13	13	13	13	13	13	24	24	24
E5	75	100	115	100	115	130	130	130	165	165	165	215	215
F5	5	5	5	5	5	5	5	5	5	5	5	5	5
G5	105	105	105	105	105	115	115	115	140	140	140	190	190
S5	M5	M6	M8	M6	M8	M8	M8	M8	M10	M10	M10	M12	M12
Z5	59	54	54	54	54	54	54	54	54	54	65	65	65
D1	14	14	14	19	19	19	19	24	24	24	32	32	32
L1	30	30	30	40	40	40	40	50	50	50	60	60	60
K	213	208	208	208	208	208	208	208	208	208	220	220	220
K1	252	247	247	247	247	247	247	247	247	247	259	259	259

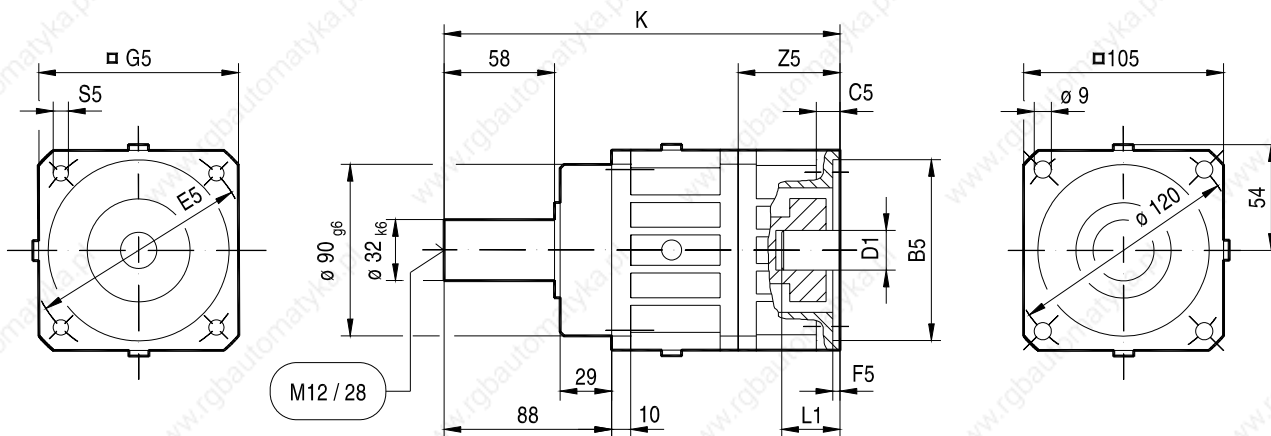


PSF511/512 EK.. [mm]

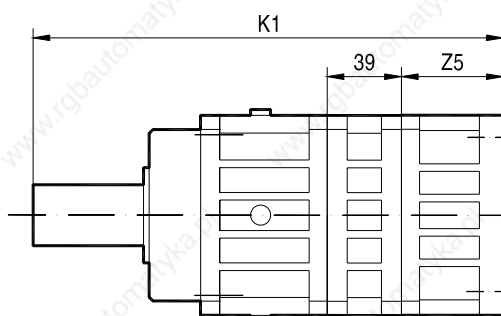
6.11 PSF511/512 EK.. [mm]

43 012 001

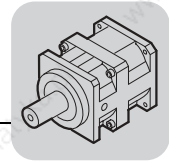
PSF511EK..



PSF512EK..



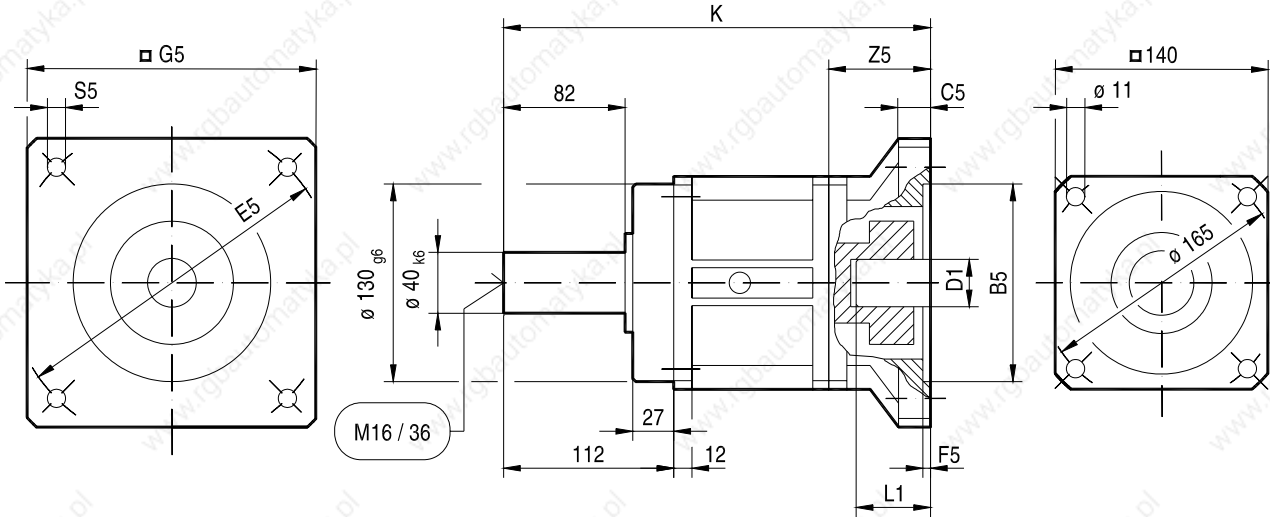
	EK12	EK03	EK05	EK13	EK04	EK07	EK06	EK14	EK08	EK09	EK15	EK11	EK10
B5	60	80	95	80	95	95	110	110	110	130	130	130	180
C5	12	13	13	13	13	13	13	13	13	13	24	24	24
E5	75	100	115	100	115	130	130	130	165	165	165	215	215
F5	5	5	5	5	5	5	5	5	5	5	5	5	5
G5	105	105	105	105	105	115	115	115	140	140	140	190	190
S5	M5	M6	M8	M6	M8	M8	M8	M8	M10	M10	M10	M12	M12
Z5	59	54	54	54	54	54	54	54	54	54	65	65	65
D1	14	14	14	19	19	19	19	24	24	24	32	32	32
L1	30	30	30	40	40	40	40	50	50	50	60	60	60
K	213	208	208	208	208	208	208	208	208	208	220	220	220
K1	252	247	247	247	247	247	247	247	247	247	259	259	259



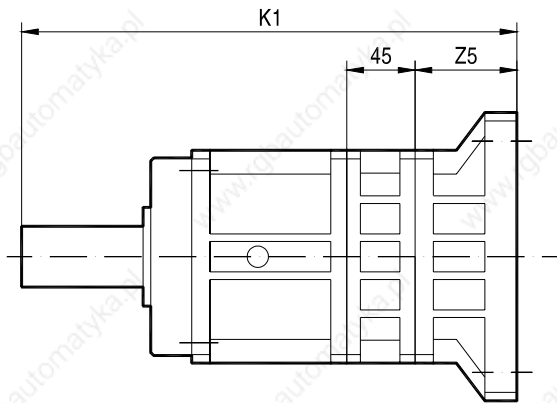
6.12 PSF611/612 EK.. [mm]

43 013 001

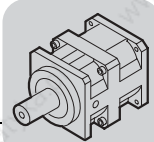
PSF611EK..



PSF612EK..

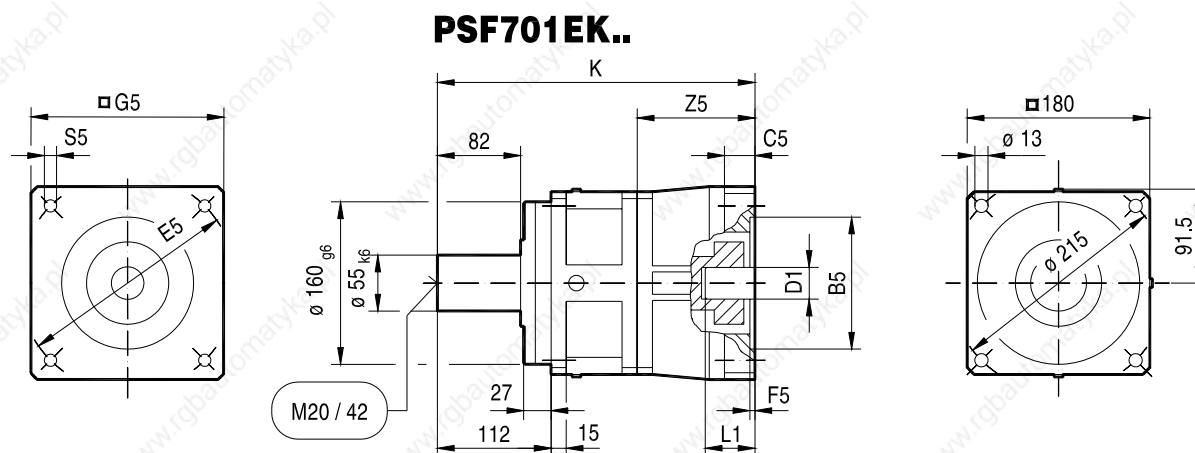
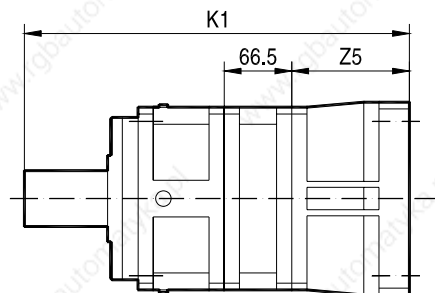


	EK04	EK06	EK14	EK08	EK09	EK15	EK11	EK10	EK16				
B5	95	110	110	110	130	130	130	180	180				
C5	12	12	12	12	12	21	21	21	30				
E5	115	130	130	165	165	165	215	215	215				
F5	5	5	5	5	5	5	5	5	5				
G5	115	115	115	140	140	140	190	190	190				
S5	M8	M8	M8	M10	M10	M10	M12	M12	M12				
Z5	58	58	58	58	58	67	67	67	88				
D1	19	19	24	24	24	32	32	32	38				
L1	40	40	50	50	50	60	60	60	80				
K	272	272	272	272	272	281	281	281	302				
K1	317	317	317	317	317	326	326	326	347				

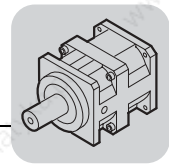


6.13 PSF701/702 EK.. [mm]

43 014 001

**PSF702EK..**

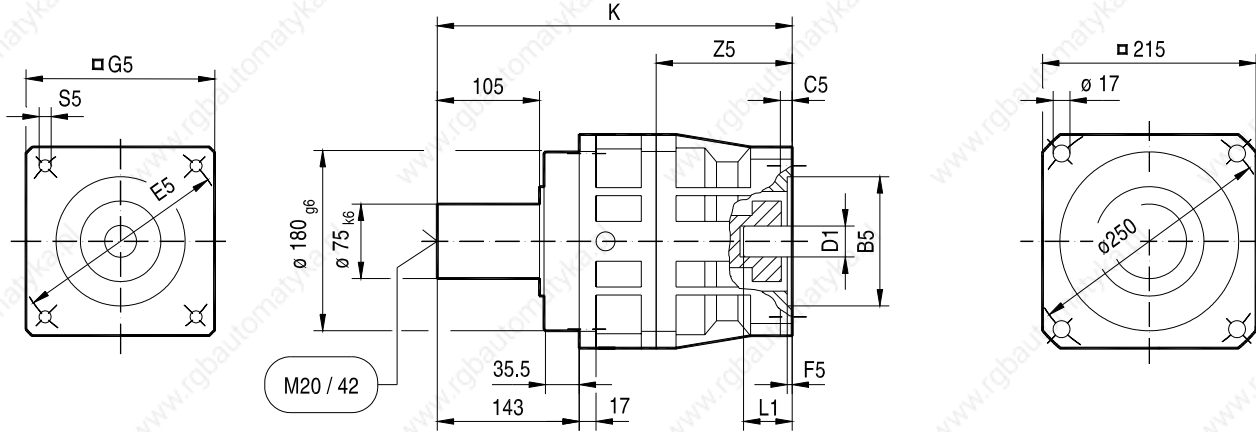
	EK14	EK08	EK09	EK15	EK11	EK10	EK16						
B5	110	110	130	130	130	180	180						
C5	18	40	30	30	30	30	30						
E5	130	165	165	165	215	215	215						
F5	5	5	5	5	5	5	5						
G5	140	140	140	140	190	190	190						
S5	M8	M10	M10	M10	M12	M12	M12						
Z5	134	126	116	116	116	116	116						
D1	24	24	24	32	32	32	38						
L1	50	50	50	60	60	60	80						
K	331	323	313	313	313	313	313						
K1	398	390	380	380	380	380	380						



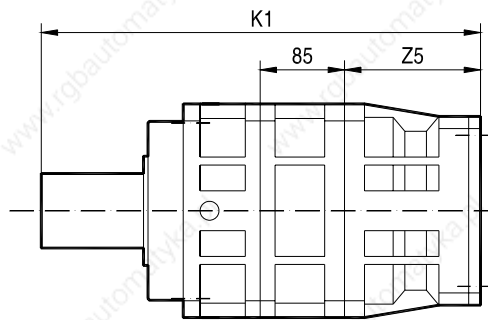
6.14 PSF801/802 EK.. [mm]

43 015 001

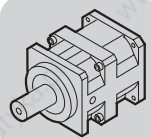
PSF801EK..



PSF802EK..



	EK09	EK15	EK11	EK10	EK16	EK22	EK23	EK24	EK25	EK26			
B5	130	130	130	180	180	180	230	250	250	300			
C5	23	23	12	30	30	30	30	30	30	30			
E5	165	165	215	215	215	215	265	300	300	350			
F5	5	5	5	5	5	5	5	5	5	5			
G5	190	190	190	190	190	190	240	260	260	310			
S5	M10	M10	M12	M12	M12	M12	M12	M16	M16	M16			
Z5	148	148	137	125	125	125	155	155	155	155			
D1	24	32	32	32	38	42	42	42	48	55			
L1	50	60	60	60	80	82	85	110	85	110			
K	368	368	357	345	345	345	376	376	376	376			
K1	453	453	442	430	430	430	461	461	461	461			

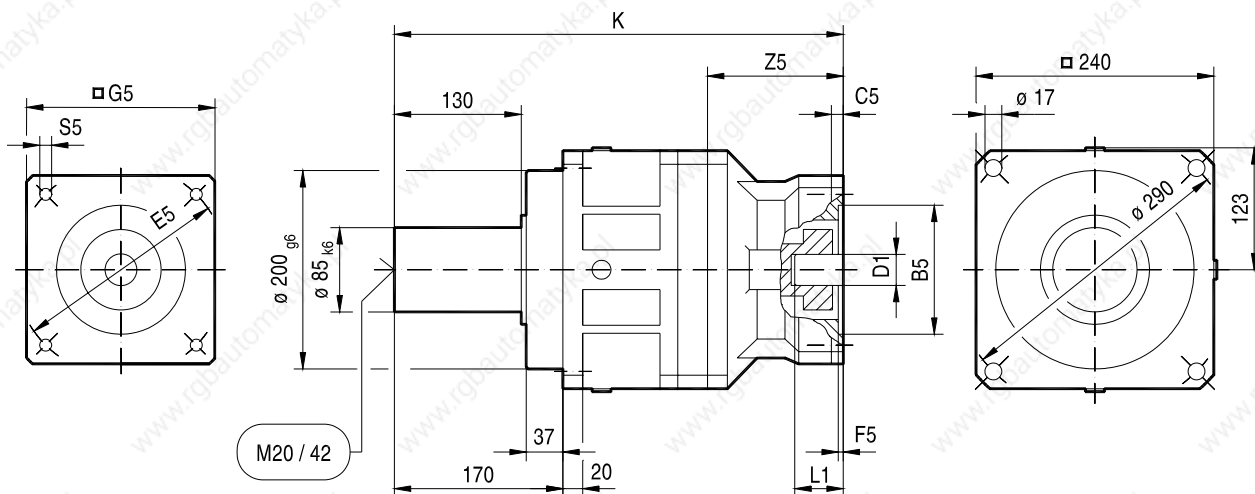


PSF901/902 EK.. [mm]

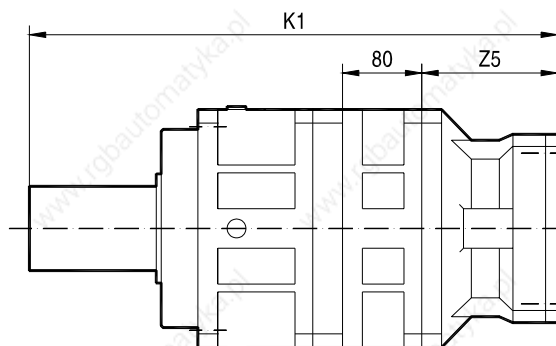
6.15 PSF901/902 EK.. [mm]

43 016 001

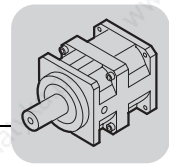
PSF901EK..



PSF902EK..



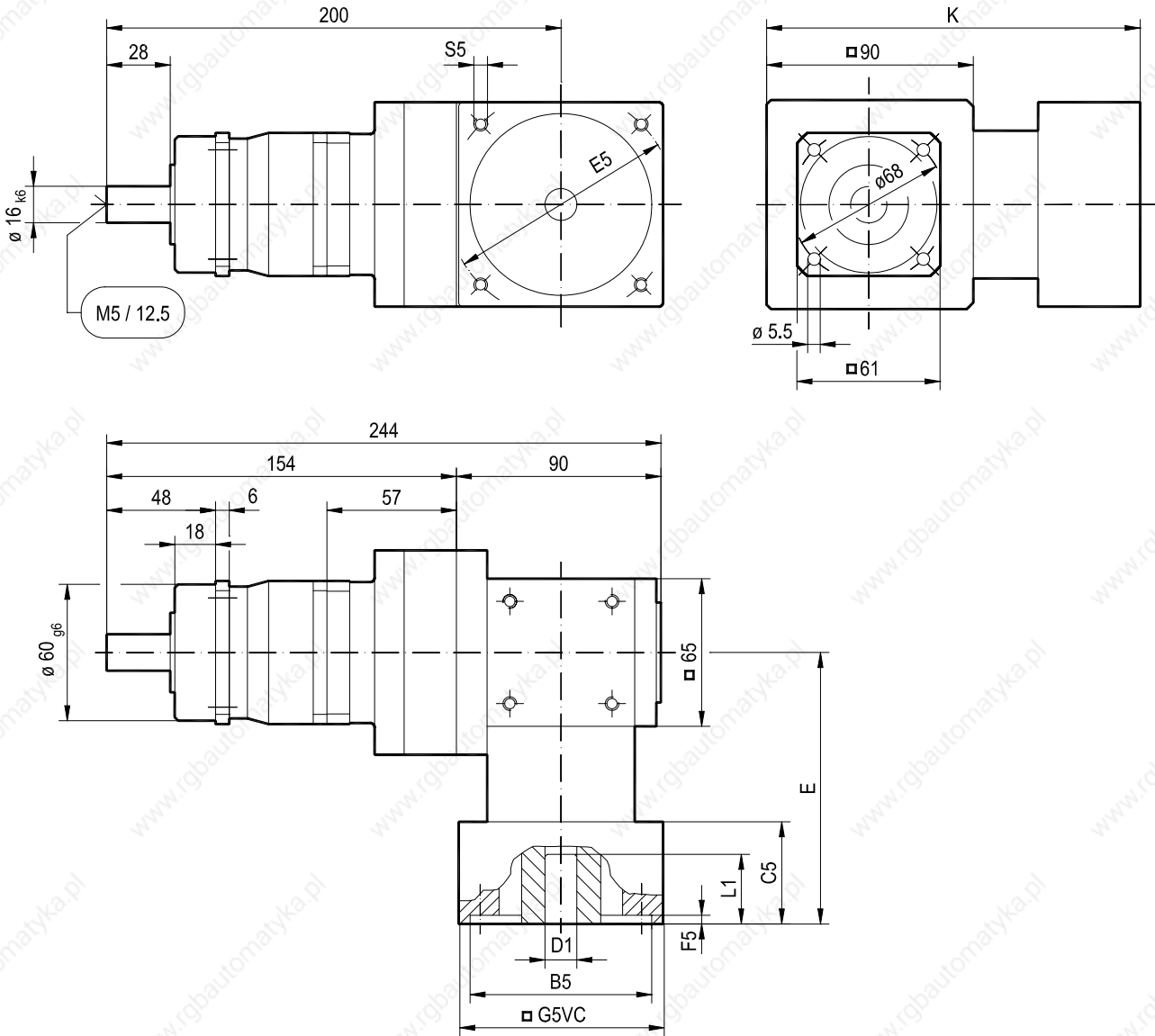
	EK15	EK11	EK10	EK16	EK22	EK23	EK24	EK25	EK26				
B5	130	130	180	180	180	230	250	250	300				
C5 (901/902)	23	12	33/30	33/30	33/30	33/30	33/30	33/30	33/30				
E5	165	215	215	215	215	265	300	300	350				
F5	5	5	5	5	5	5	5	5	5				
G5	190	190	190	190	190	240	260	260	310				
S5	M10	M12	M12	M12	M12	M12	M16	M16	M16				
Z5	148	137	125	125	125	155	155	155	155				
D1	32	32	32	38	42	42	42	48	55				
L1	60	60	60	80	82	85	110	85	110				
K	434	423	411	411	411	441	441	441	441				
K1	514	503	491	491	491	521	521	521	521				



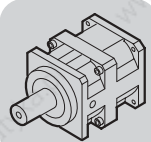
6.16 PSF211 VC65 EK.. [mm]

43 001 002

PSF211VC65EK..



	EK01	EK02	EK12	EK03	EK05								
B5	40	60	60	80	95								
C5	26.5	26.5	45	45	45								
E5	63	75	75	100	115								
F5	4	4	4	4	4								
G5VC	65	65	70	90	100								
S5	M4	M5	M5	M6	M8								
D1	9	11	14	14	14								
L1	20	23	30	30	30								
E	101	101	119.5	119.5	119.5								
K	146	146	164.5	164.5	164.5								

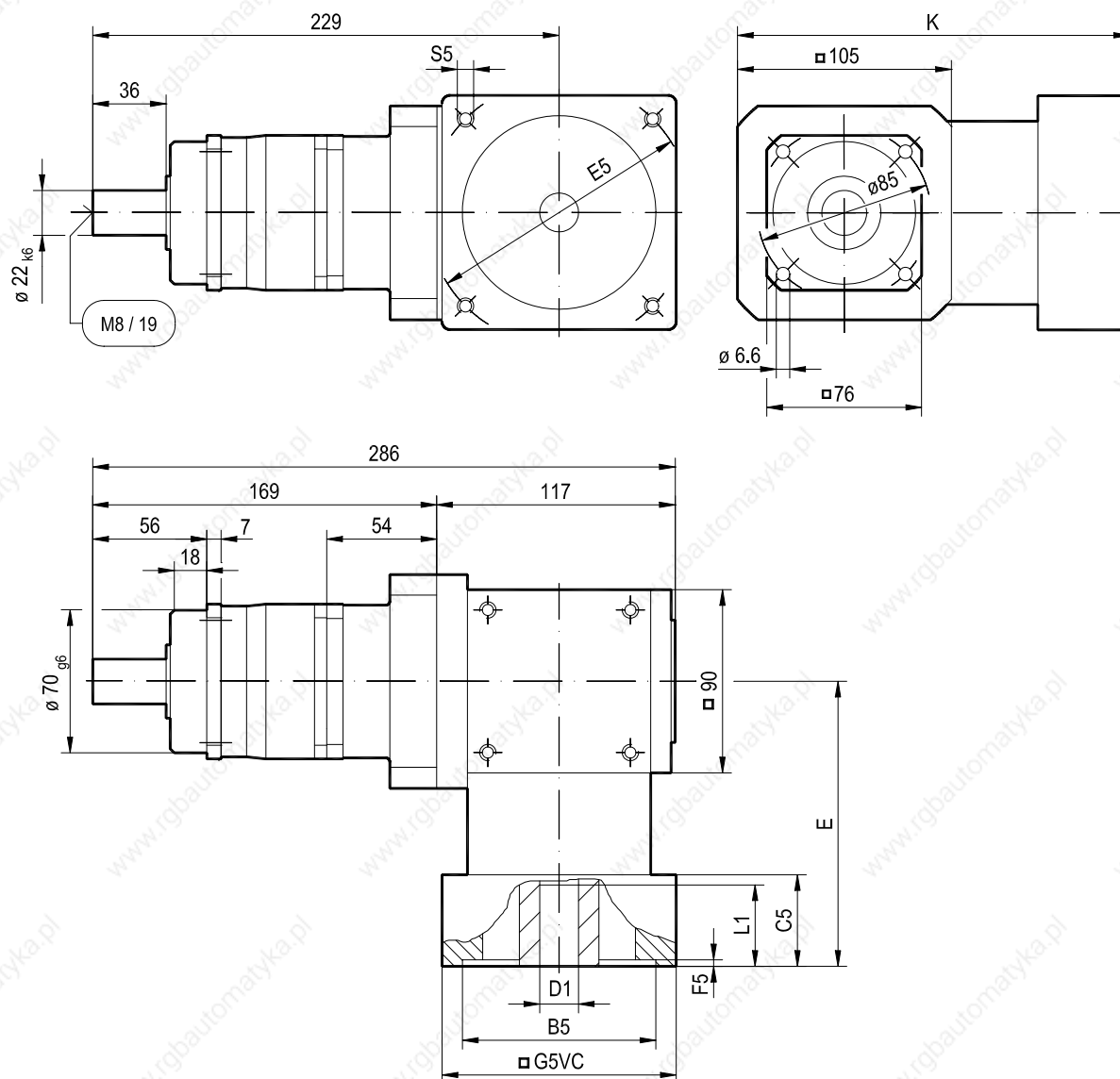


PSF311 VC90 EK.. [mm]

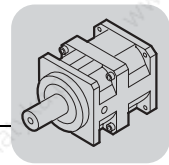
6.17 PSF311 VC90 EK.. [mm]

43 002 002

PSF311VC90EK..



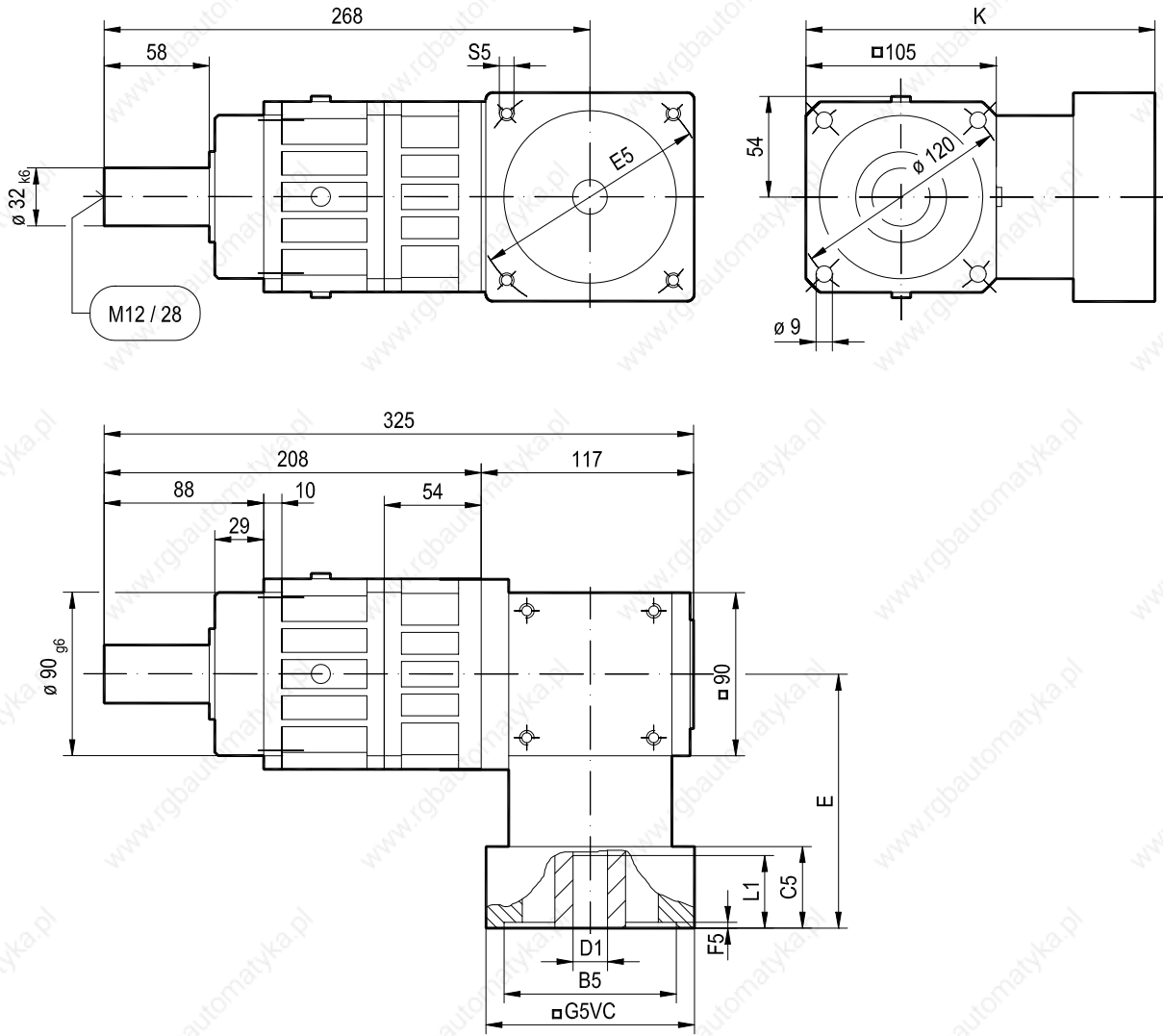
	EK12	EK03	EK05	EK13	EK04	EK07	EK06						
B5	60	80	95	80	95	95	110						
C5	45	45	45	45	45	45	45						
E5	75	100	115	100	115	130	130						
F5	4	4	4	4	4	4	4						
G5VC	90	90	100	95	105	115	115						
S5	M5	M6	M8	M6	M8	M8	M8						
D1	14	14	14	19	19	19	19						
L1	30	30	30	40	40	40	40						
E	140	140	140	140	140	140	140						
K	192.5	192.5	192.5	192.5	192.5	192.5	192.5						



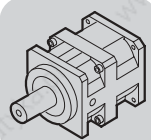
6.18 PSF411 VC90 EK.. [mm]

43 003 002

PSF411VC90EK..



	EK12	EK03	EK05	EK13	EK04	EK07	EK06						
B5	60	80	95	80	95	95	110						
C5	45	45	45	45	45	45	45						
E5	75	100	115	100	115	130	130						
F5	4	4	4	4	4	4	4						
G5VC	90	90	100	95	105	115	115						
S5	M5	M6	M8	M6	M8	M8	M8						
D1	14	14	14	19	19	19	19						
L1	30	30	30	40	40	40	40						
E	140	140	140	140	140	140	140						
K	192.5	192.5	192.5	192.5	192.5	192.5	192.5						

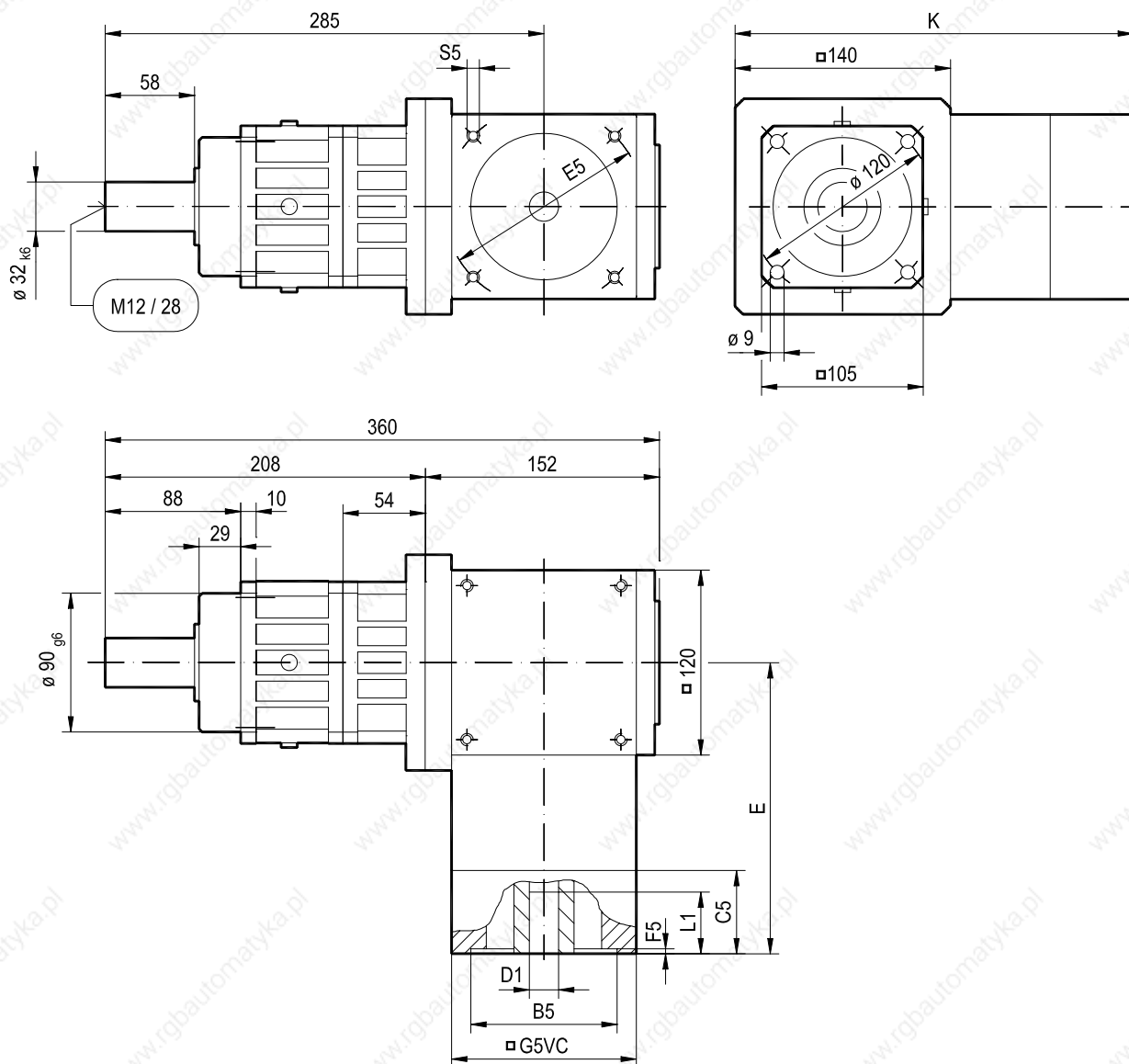


PSF511 VC120 EK.. [mm]

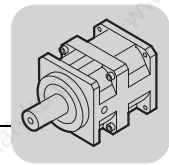
6.19 PSF511 VC120 EK.. [mm]

43 004 002

PSF511VC120EK..



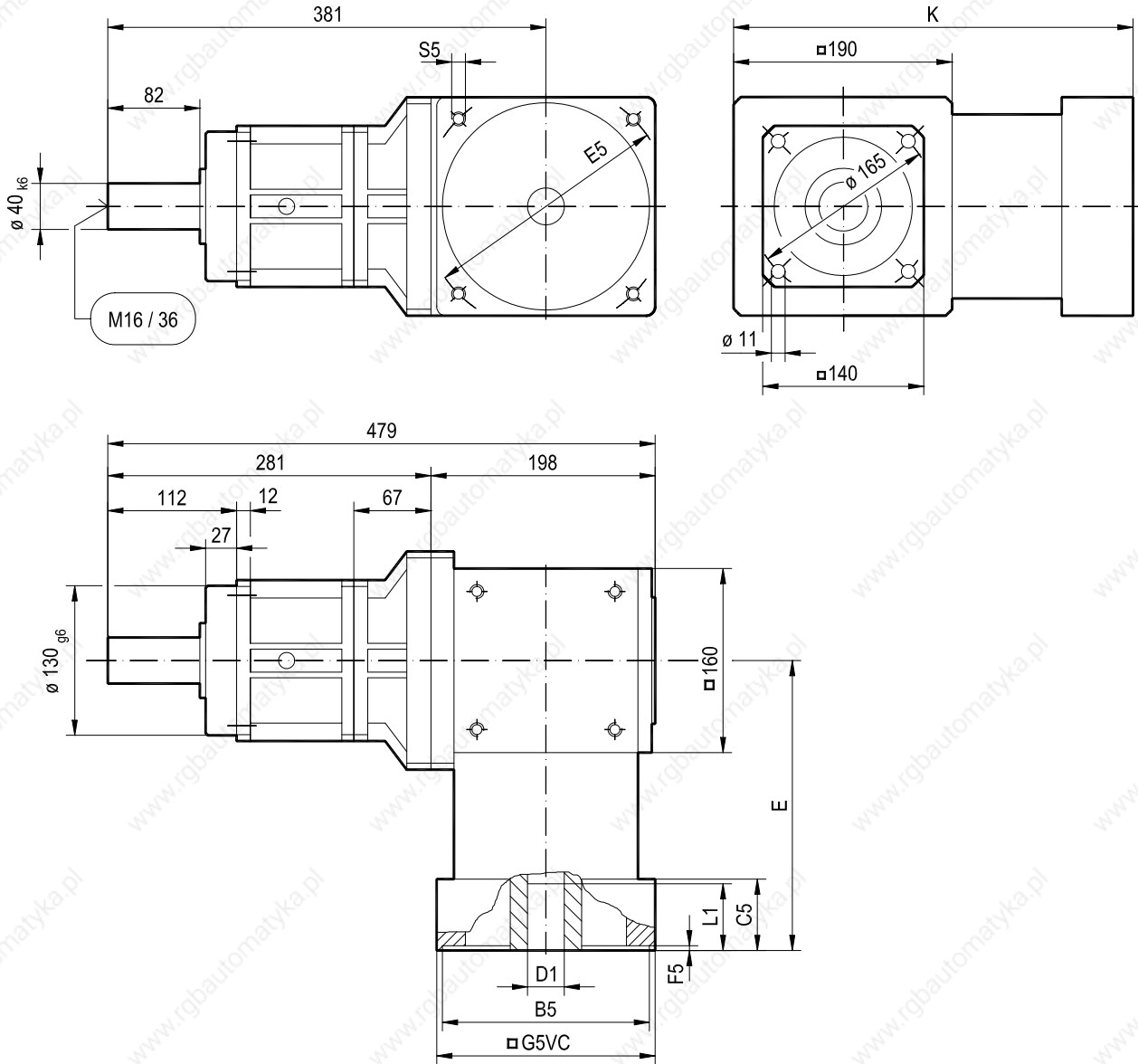
	EK12	EK03	EK05	EK13	EK04	EK07	EK06	EK14	EK08	EK09			
B5	60	80	95	80	95	95	110	110	110	130			
C5	54	54	54	54	54	54	54	54	54	54			
E5	75	100	115	100	115	130	130	130	165	165			
F5	5	5	5	5	5	5	5	5	5	5			
G5VC	120	120	120	120	120	120	120	120	140	140			
S5	M5	M6	M8	M6	M8	M8	M8	M8	M10	M10			
D1	14	14	14	19	19	19	19	24	24	24			
L1	30	30	30	40	40	40	40	50	50	50			
E	170	170	170	170	170	170	170	170	170	170			
K	240	240	240	240	240	240	240	240	240	240			



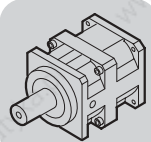
6.20 PSF611 VC160 EK.. [mm]

43 005 002

PSF611VC160EK..



	EK13	EK04	EK07	EK06	EK14	EK08	EK09	EK15	EK11	EK10			
B5	80	95	95	110	110	110	130	130	130	180			
C5	62	62	62	62	62	62	62	62	62	62			
E5	100	115	130	130	130	165	165	165	215	215			
F5	5	5	5	5	5	5	5	5	5	5			
G5VC	160	160	160	160	160	160	160	160	190	190			
S5	M6	M8	M8	M8	M8	M10	M10	M10	M12	M12			
D1	19	19	19	19	24	24	24	32	32	32			
L1	40	40	40	40	50	50	50	60	60	60			
E	215	215	215	215	215	215	215	215	215	215			
K	310	310	310	310	310	310	310	310	310	310			

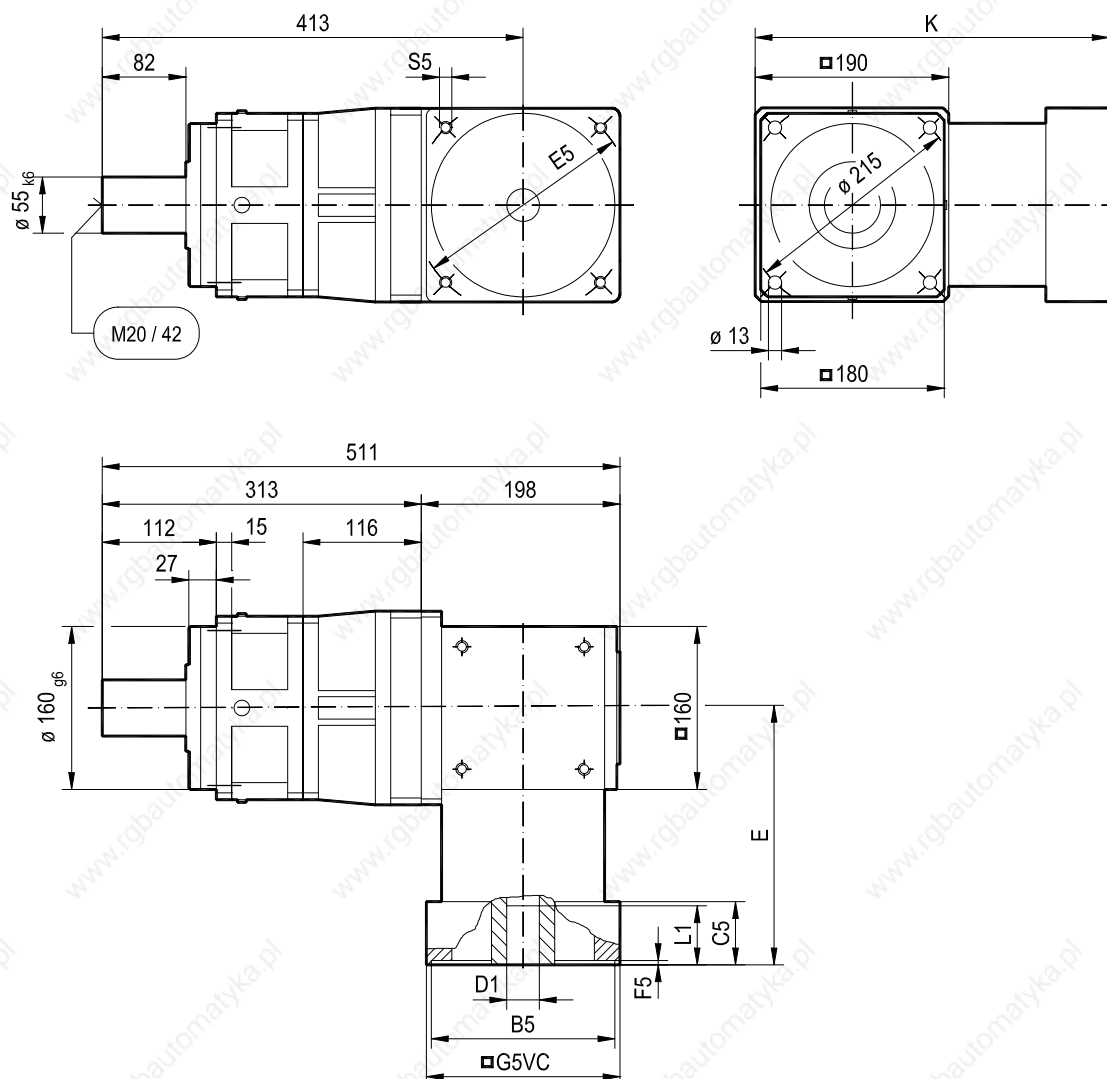


PSF701 VC160 EK.. [mm]

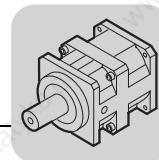
6.21 PSF701 VC160 EK.. [mm]

43 006 002

PSF701VC160EK..



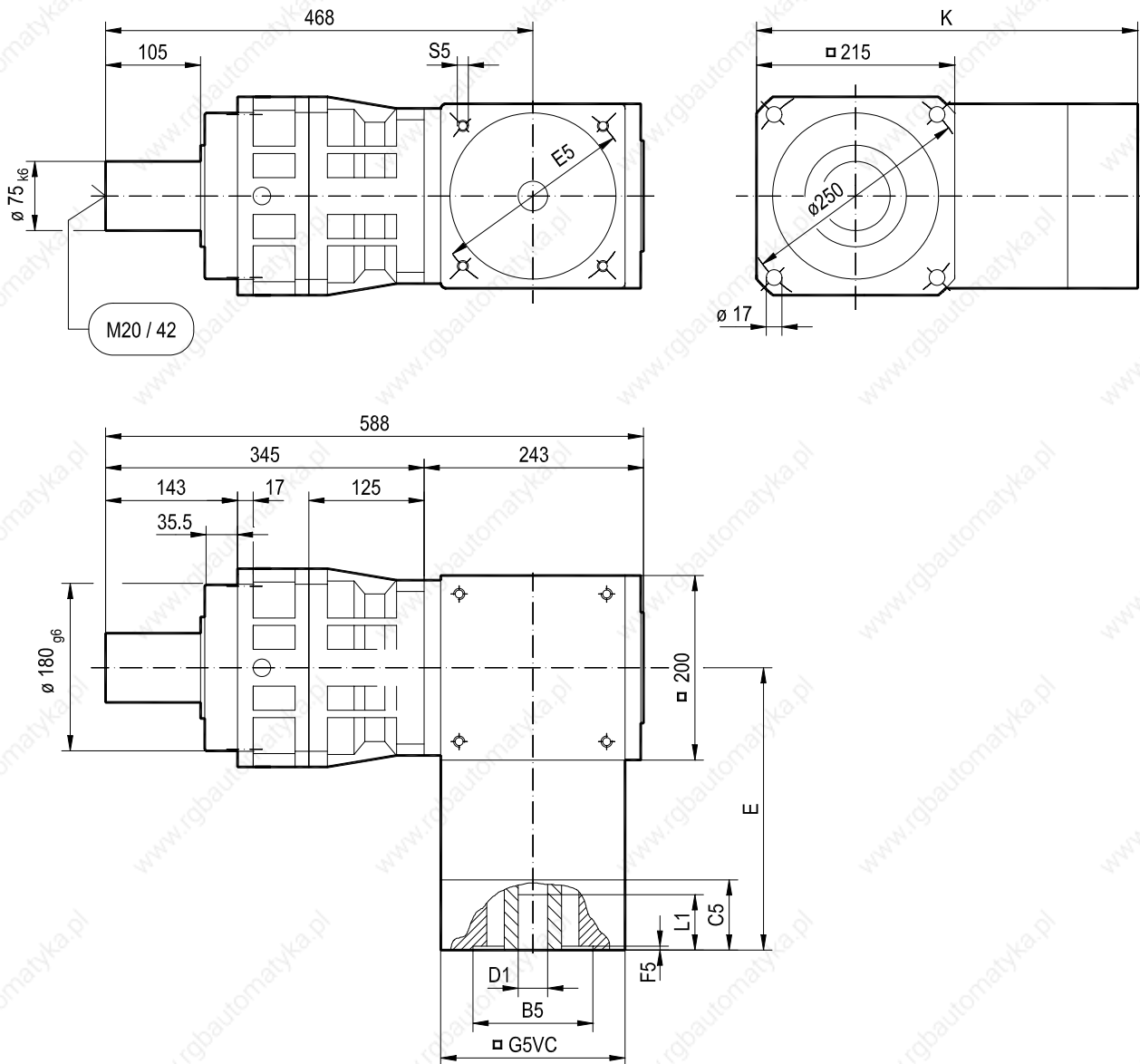
	EK13	EK04	EK07	EK06	EK14	EK08	EK09	EK15	EK11	EK10			
B5	80	95	95	110	110	110	130	130	130	180			
C5	62	62	62	62	62	62	62	62	62	62			
E5	100	115	130	130	130	165	165	165	215	215			
F5	5	5	5	5	5	5	5	5	5	5			
G5VC	160	160	160	160	160	160	160	160	190	190			
S5	M6	M8	M8	M8	M8	M10	M10	M10	M12	M12			
D1	19	19	19	19	24	24	24	32	32	32			
L1	40	40	40	40	50	50	50	60	60	60			
E	215	215	215	215	215	215	215	215	215	215			
K	310	310	310	310	310	310	310	310	310	310			



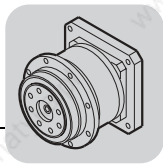
6.22 PSF801 VC200 EK.. [mm]

43 007 002

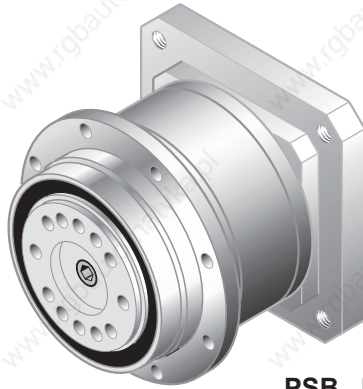
PSF801VC200EK..



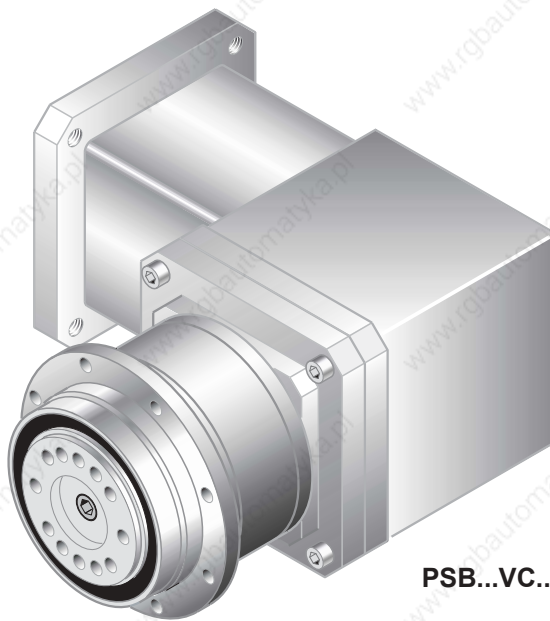
	EK14	EK08	EK09	EK15	EK11	EK10	EK16						
B5	110	110	130	130	130	180	180						
C5	76	76	76	76	76	76	88						
E5	130	165	165	165	215	215	215						
F5	5	5	5	5	5	5	5						
G5VC	200	200	200	200	200	200	200						
S5	M8	M10	M10	M10	M12	M12	M12						
D1	24	24	24	32	32	32	38						
L1	50	50	50	60	60	60	80						
E	262	262	262	262	262	262	274						
K	369.5	369.5	369.5	369.5	369.5	369.5	381.5						



7 Low Backlash Planetary Gear Units PSB...

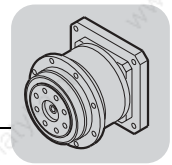


PSB...EK..



PSB...VC..EK..

50776AXX



7.1 PSB...EK.. [Nm]

PSB311 EK.., $n_e = 1000$ 1/min										110 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/ ']	c_T [Nm/ ']		PSB 311EK	m [kg]	
4	6000	110	165	3500	1770						
5	6000	110	165	3800	1920						
7	6000	110	165	4200	2120	330	21			3.8	62
10	6000	110	120	5100	2200						

PSB312 EK.., $n_e = 1000$ 1/min										110 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/ ']	c_T [Nm/ ']		PSB 312EK	m [kg]	
16	6000	110	165	5500	2200						
20	6000	110	165	5900	2200						
25	6000	110	165	6300	2200						
28	6000	110	165	6600	2200						
35	6000	110	165	7000	2200	330	18			4.1	62
40	6000	110	165	7300	2200						
49	6000	110	165	7800	2200						
70	6000	110	165	8700	2200						
100	6000	110	120	9700	2200						

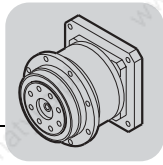
PSB411 EK.., $n_e = 1000$ 1/min										160 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/ ']	c_T [Nm/ ']		PSB 411EK	m [kg]	
4	4500	160	210	4900	2070						
5	4500	160	210	5200	2190						
7	4500	160	210	5800	2450	565	36			5.9	63
10	4500	150	160	6500	2740						

PSB412 EK.., $n_e = 1000$ 1/min										160 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/ ']	c_T [Nm/ ']		PSB 412EK	m [kg]	
16	4500	160	210	7500	3160						
20	4500	160	210	8100	3410						
25	4500	160	210	8600	3630						
28	4500	160	210	9000	3790						
35	4500	160	210	9600	4050	565	29			7.7	63
40	4500	160	210	10000	4200						
49	4500	160	210	10600	4200						
70	4500	160	210	12500	4200						
100	4500	150	160	13300	4200						



PSB511 EK.., $n_e = 1000$ 1/min										300 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/ ']	c_T [Nm/ ']		PSB 511EK	m [kg]	
4	4500	300	370	4900	2070						
6	4500	300	370	5200	2190						
7	4500	300	370	5800	2450	565	39			6.1	64
10	4500	270	270	6500	2740						

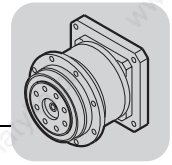
PSB512 EK.., $n_e = 1000$ 1/min										300 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/ ']	c_T [Nm/ ']		PSB 512EK	m [kg]	
16	4500	300	370	7500	3160						
20	4500	300	370	8100	3410						
25	4500	300	370	8600	3630						
28	4500	300	370	9000	3790						
35	4500	300	370	9600	4050	565	32			7.9	64
40	4500	300	370	10000	4200						
49	4500	300	370	10600	4200						
70	4500	300	370	12500	4200						
100	4500	270	270	13300	4200						

PSB611 EK.., $n_e = 1000$ 1/min										600 Nm	
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/ ']	c_T [Nm/ ']		PSB 611EK	m [kg]	
4	4500	600	670	7100	6130						
5	4500	600	670	8600	6130						
7	4500	600	670	11000	6130	830	66			14	65
10	4500	500	500	14100	6130						



PSB612 EK..., $n_e = 1000$ 1/min

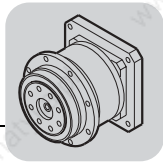
600 Nm

i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/ ']	c_T [Nm/ ']		m [kg]	
16	4500	600	670	18400	6130					
20	4500	600	670	20300	6130					
25	4500	600	670	21700	6130					
28	4500	600	670	22400	6130					
35	4500	600	670	24000	6130	830	54	PSB 612EK	18	65
40	4500	600	670	25000	6130					
49	4500	600	670	26700	6130					
70	4500	600	670	29600	6130					
100	4500	500	500	33000	6130					



7.2 PSB...VC..EK.. [Nm]

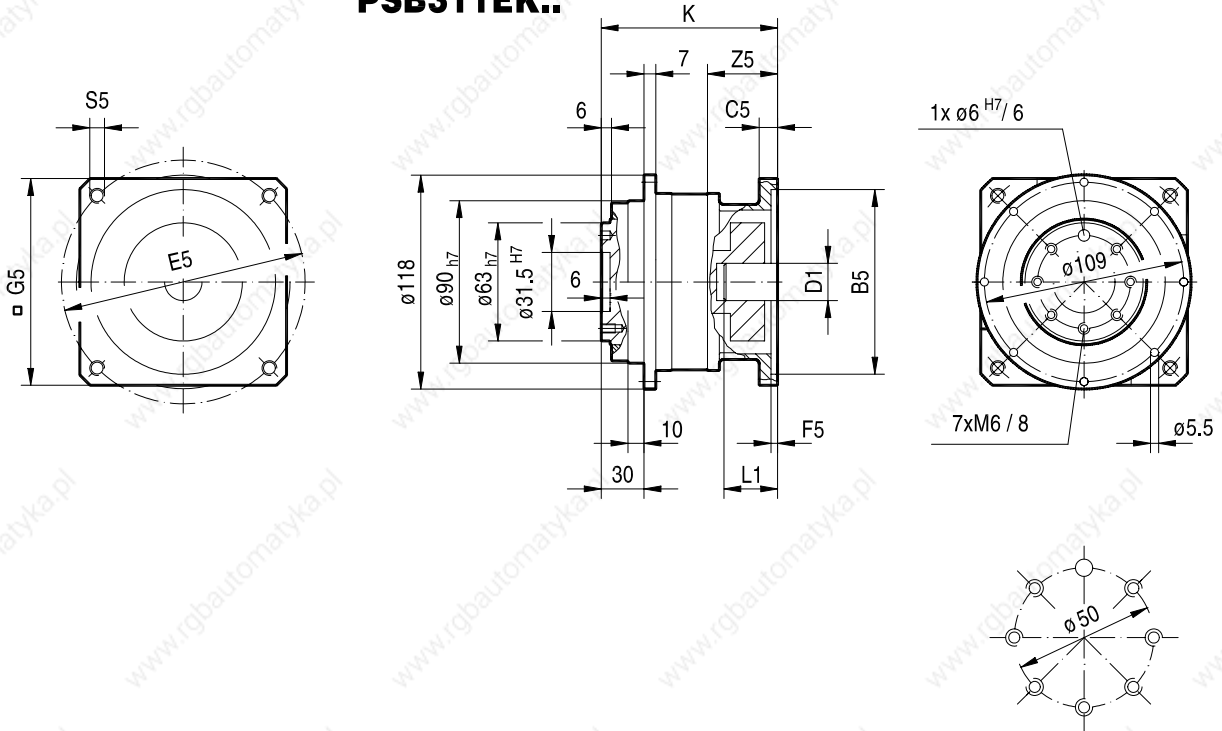
PSB311 VC90 EK..., $n_e = 1000$ 1/min							110 Nm					
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_K [Nm/ ']		m [kg]				
7	6000	110	165	4200	2120	330	PSB 311VC90EK	9.3	66			
10	6000	110	120	5100	2200							
14	6000	110	165	5200	2200							
21	6000	110	165	5900	2200							
28	6000	110	165	6600	2200							
35	6000	110	165	7000	2200							
40	6000	110	120	7300	2200							
50	6000	110	120	7800	2200							
60	6000	110	120	8100	2200							
PSB411 VC90 EK..., $n_e = 1000$ 1/min										160 Nm		
7	4500	160	210	5800	2450	565	PSB 411VC90EK	11	67			
10	4500	150	160	6500	2740							
14	4500	160	210	6800	4200							
21	4500	160	210	7800	4200							
28	4500	160	210	9000	3790							
35	4500	160	210	9600	4050							
40	4500	150	160	10000	4200							
50	4500	150	160	10700	4200							
60	4500	150	160	11100	4200							
PSB511 VC120 EK..., $n_e = 1000$ 1/min										300 Nm		
7	4500	300	370	5800	2450	565	PSB 511VC120EK	18	68			
10	4500	270	270	6500	2740							
14	4500	300	370	6800	4200							
21	4500	300	370	7800	4200							
28	4500	300	370	9000	3790							
35	4500	300	370	9600	4050							
40	4500	270	270	10000	4200							
50	4500	270	270	10700	4200							
PSB611 VC160 EK..., $n_e = 1000$ 1/min										600 Nm		
7	4500	600	670	11000	6130					830	PSB 611VC160EK	26
10	4500	500	500	14100	6130							
14	4500	600	670	17400	6130							
21	4500	600	670	20800	6130							
28	4500	600	670	22400	6130							
35	4500	600	670	24000	6130							
40	4500	500	500	25000	6130							
50	4500	500	500	27000	6130							
60	4500	500	500	28500	6130							



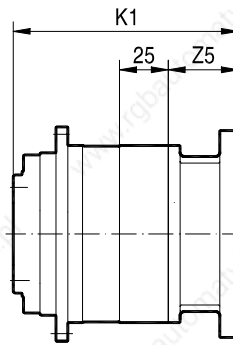
7.3 PSB311/312 EK.. [mm]

43 017 001

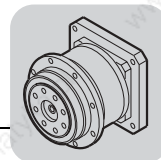
PSB311EK..



PSB312EK..



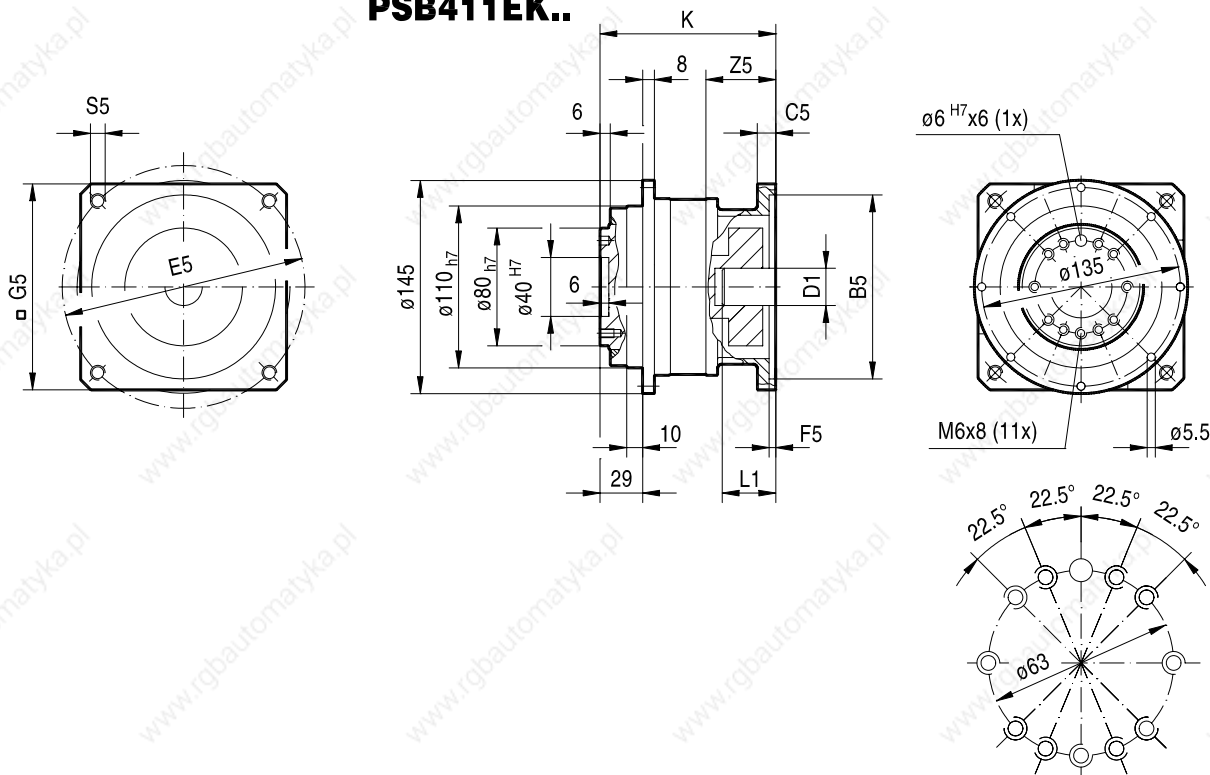
	EK02	EK18	EK17	EK12	EK03	EK05	EK13	EK04	EK07	EK06	EK19	EK14	EK08	EK09
B5	60	60	50	60	80	95	80	95	95	110	110	110	110	130
C5	23	23	23	23	23	23	23	23	23	23	23	23	23	23
E5	75	90	95	75	100	115	100	115	130	130	145	130	165	165
F5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
G5	82	82	82	82	92	105	92	105	115	115	120	115	140	140
S5	M5	M5	M6	M5	M6	M8	M6	M8	M8	M8	M8	M8	M10	M10
Z5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5
D1	11	14	14	14	14	14	19	19	19	19	19	24	24	24
L1	23	30	30	30	30	30	40	40	40	40	50	50	50	50
K	111.5	111.5	111.5	111.5	111.5	111.5	111.5	111.5	111.5	111.5	111.5	111.5	111.5	111.5
K1	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5	136.5



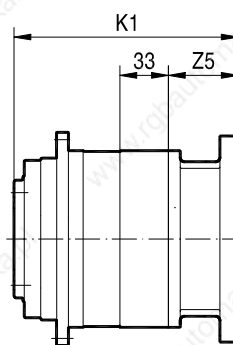
7.4 PSB411/412 EK.. [mm]

43 018 001

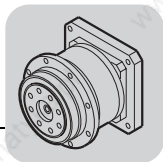
PSB411EK..



PSB412EK..



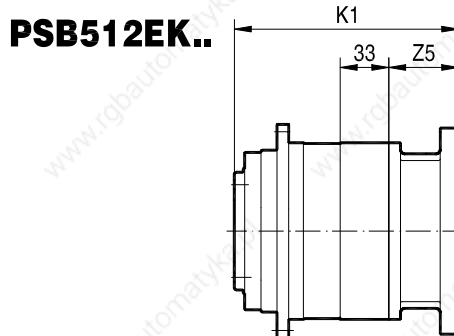
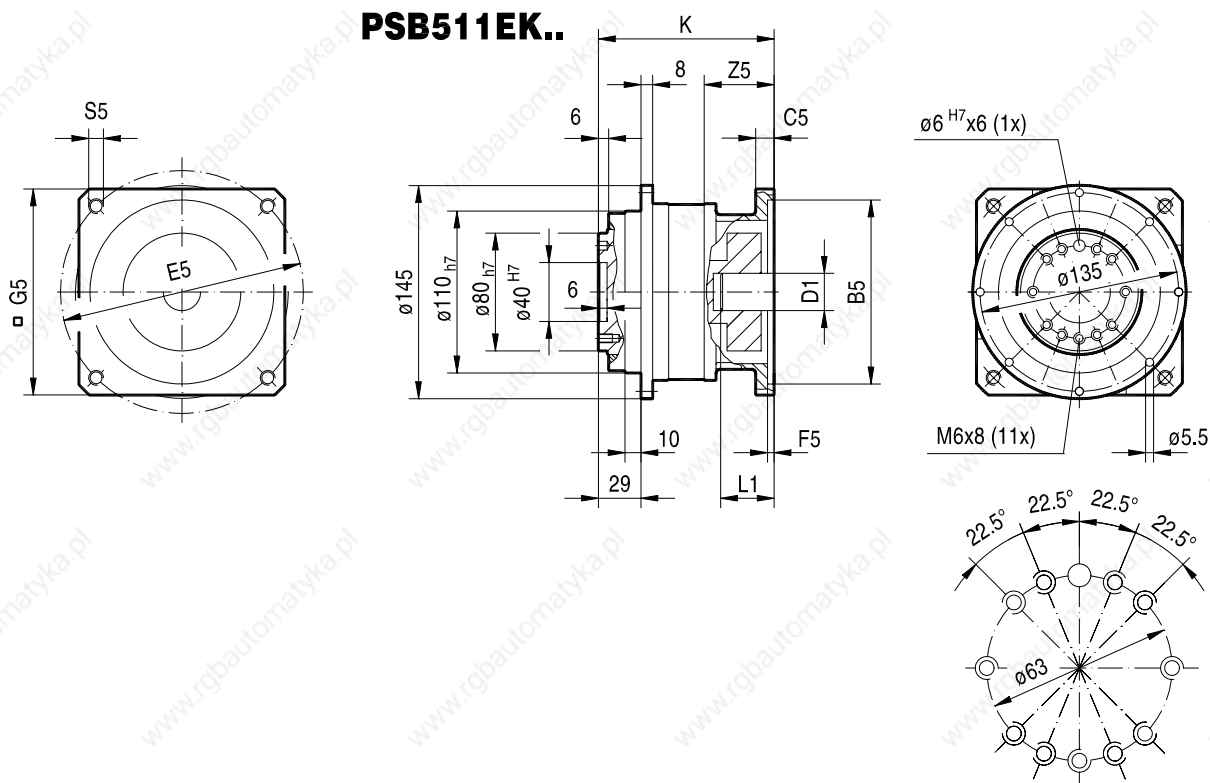
	EK03	EK05	EK13	EK04	EK07	EK06	EK14	EK08	EK09	EK15	EK11	EK10	
B5	80	95	80	95	95	110	110	110	130	130	130	180	
C5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12	22	22	
E5	100	115	100	115	130	130	130	165	165	165	215	215	
F5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5	5	
G5	105	105	105	105	115	115	115	140	140	140	190	190	
S5	M6	M8	M6	M8	M8	M8	M8	M10	M10	M10	M12	M12	
Z5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	59.5	69.5	69.5	
D1	14	14	19	19	19	19	24	24	24	32	32	32	
L1	30	30	40	40	40	40	50	50	50	60	60	60	
K	119.5	119.5	119.5	119.5	119.5	119.5	119.5	119.5	119.5	131.5	141.5	141.5	
K1	152.5	152.5	152.5	152.5	152.5	152.5	152.5	152.5	152.5	164.5	174.5	174.5	



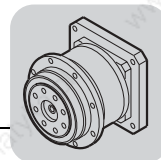
PSB511/512 EK.. [mm]

7.5 PSB511/512 EK.. [mm]

43 019 001

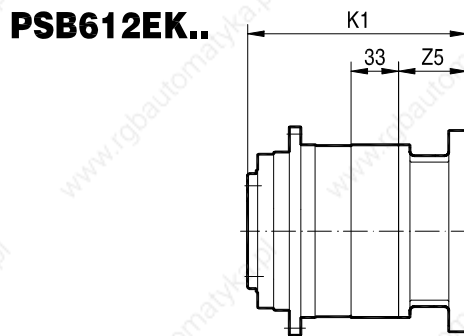
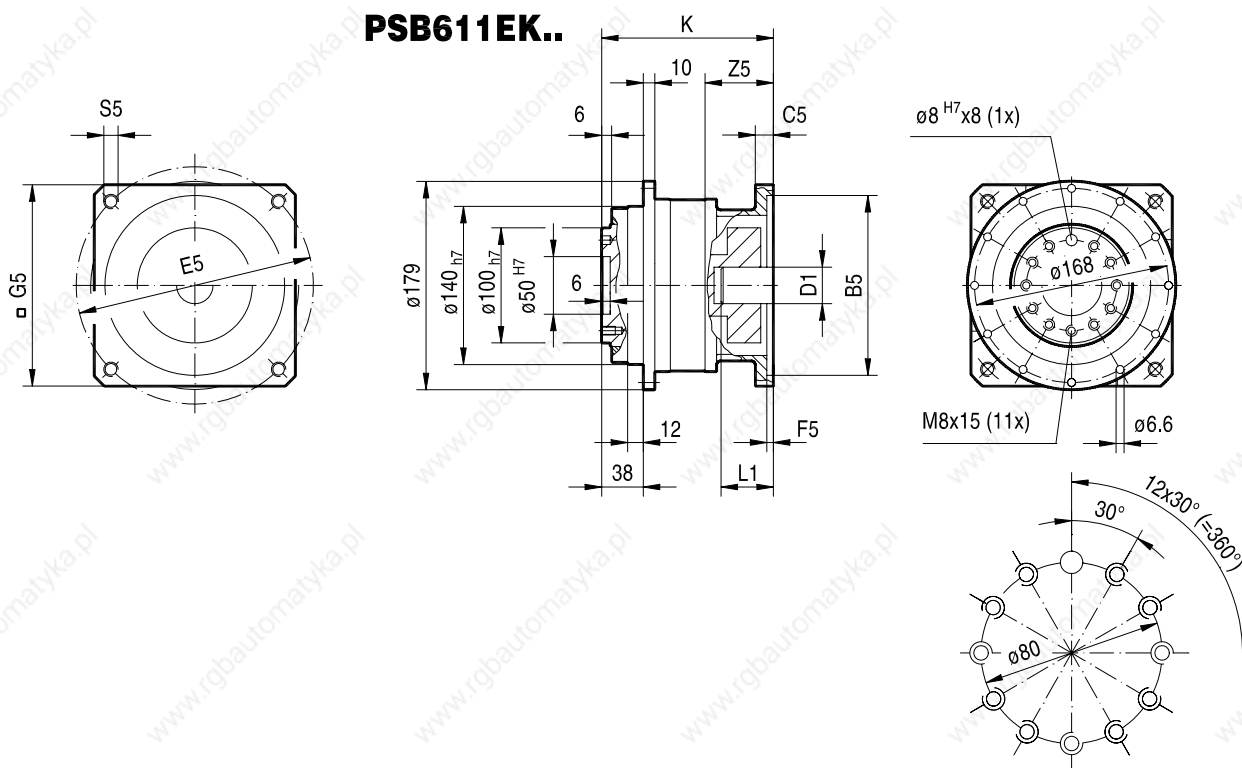


	EK03	EK05	EK13	EK04	EK07	EK06	EK14	EK08	EK09	EK15	EK11	EK10	
B5	80	95	80	95	95	110	110	110	130	130	130	180	
C5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12	22	22	
E5	100	115	100	115	130	130	130	165	165	165	215	215	
F5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5	5	5	
G5	105	105	105	105	115	115	115	140	140	140	190	190	
S5	M6	M8	M6	M8	M8	M8	M8	M10	M10	M10	M12	M12	
Z5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	59.5	69.5	69.5	
D1	14	14	19	19	19	19	24	24	24	32	32	32	
L1	30	30	40	40	40	40	50	50	50	60	60	60	
K	119.5	119.5	119.5	119.5	119.5	119.5	119.5	119.5	119.5	131.5	141.5	141.5	
K1	152.5	152.5	152.5	152.5	152.5	152.5	152.5	152.5	152.5	164.5	174.5	174.5	

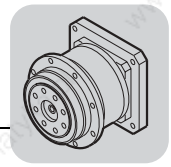


7.6 PSB611/612 EK.. [mm]

43 020 001



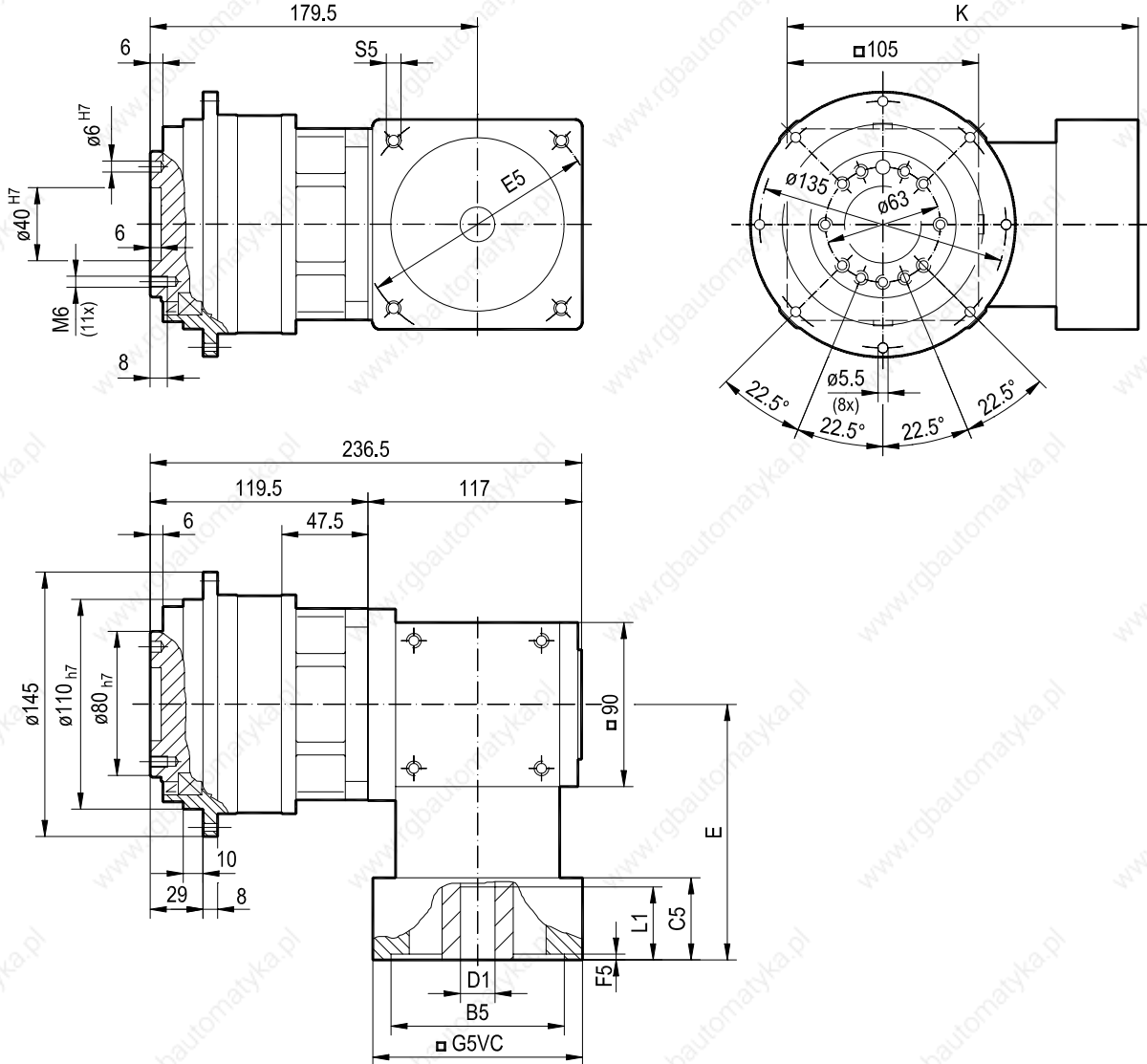
	EK04	EK06	EK14	EK08	EK09	EK15	EK11	EK10	EK16				
B5	95	110	110	110	130	130	130	150	150				
C5	12	12	12	12	12	21	21	21	30				
E5	115	130	130	165	165	165	215	215	215				
F5	5	5	5	5	5	5	5	5	5				
G5	115	115	115	140	140	140	190	190	190				
S5	M8	M8	M8	M10	M10	M10	M12	M12	M12				
Z5	52	52	52	52	52	61	61	61	61				
D1	19	19	24	24	24	32	32	32	38				
L1	40	40	50	50	50	60	60	60	80				
K	142	142	142	142	142	151	151	151	172				
K1	192	192	192	192	192	201	201	201	222				



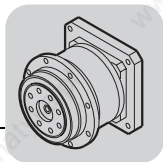
7.8 PSB411 VC90 EK.. [mm]

43 009 002

PSB411VC90EK..

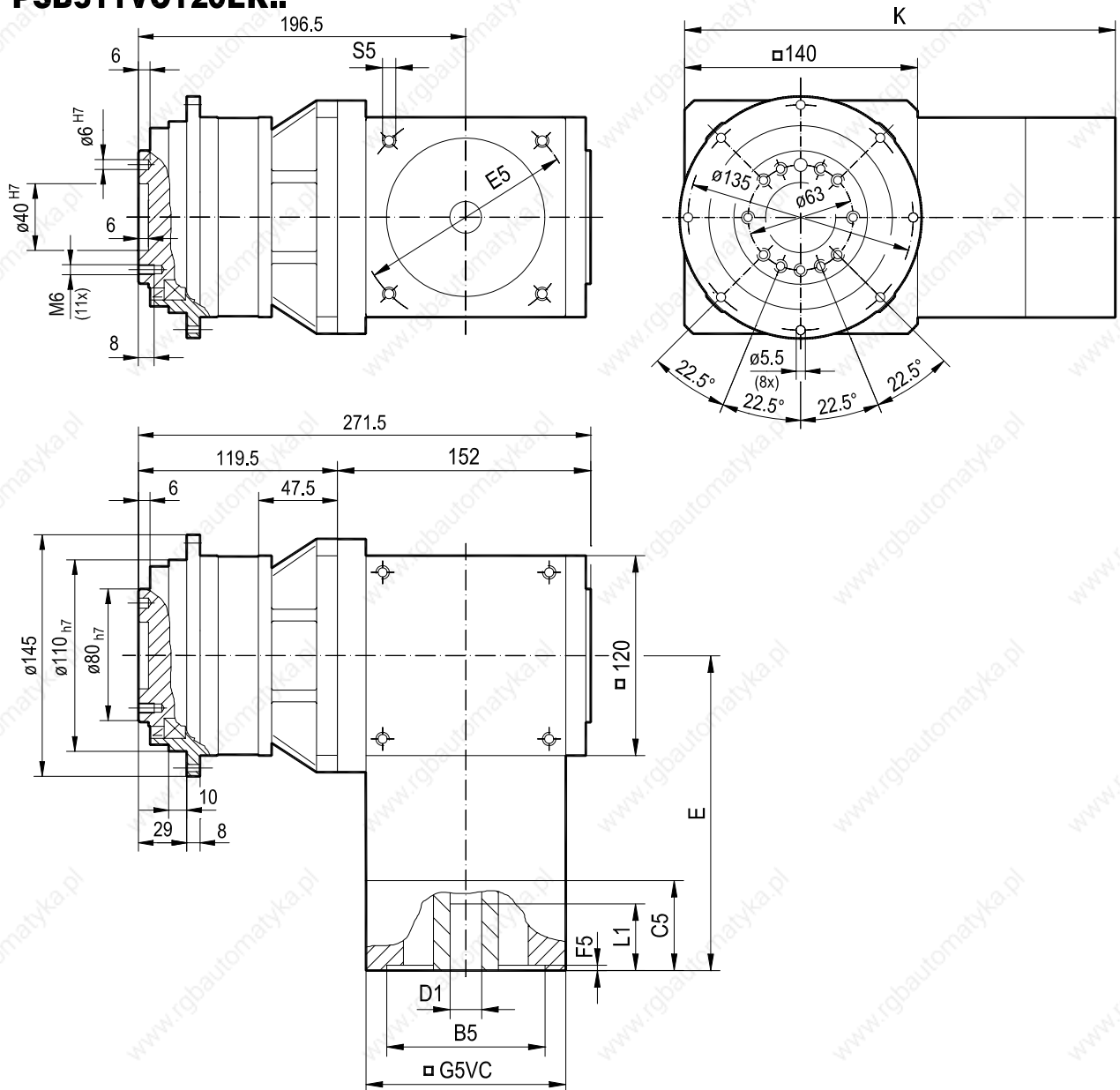


	EK12	EK03	EK05	EK13	EK04	EK07	EK06						
B5	60	80	95	80	95	95	110						
C5	45	45	45	45	45	45	45						
E5	75	100	115	100	115	130	130						
F5	4	4	4	4	4	4	4						
G5VC	90	90	100	95	105	115	115						
S5	M5	M6	M8	M6	M8	M8	M8						
D1	14	14	14	19	19	19	19						
L1	30	30	30	40	40	40	40						
E	140	140	140	140	140	140	140						
K	192.5	192.5	192.5	192.5	192.5	192.5	192.5						

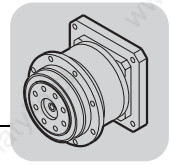


7.9 PSB511 VC120 EK.. [mm]

43 010 002

PSB511VC120EK..

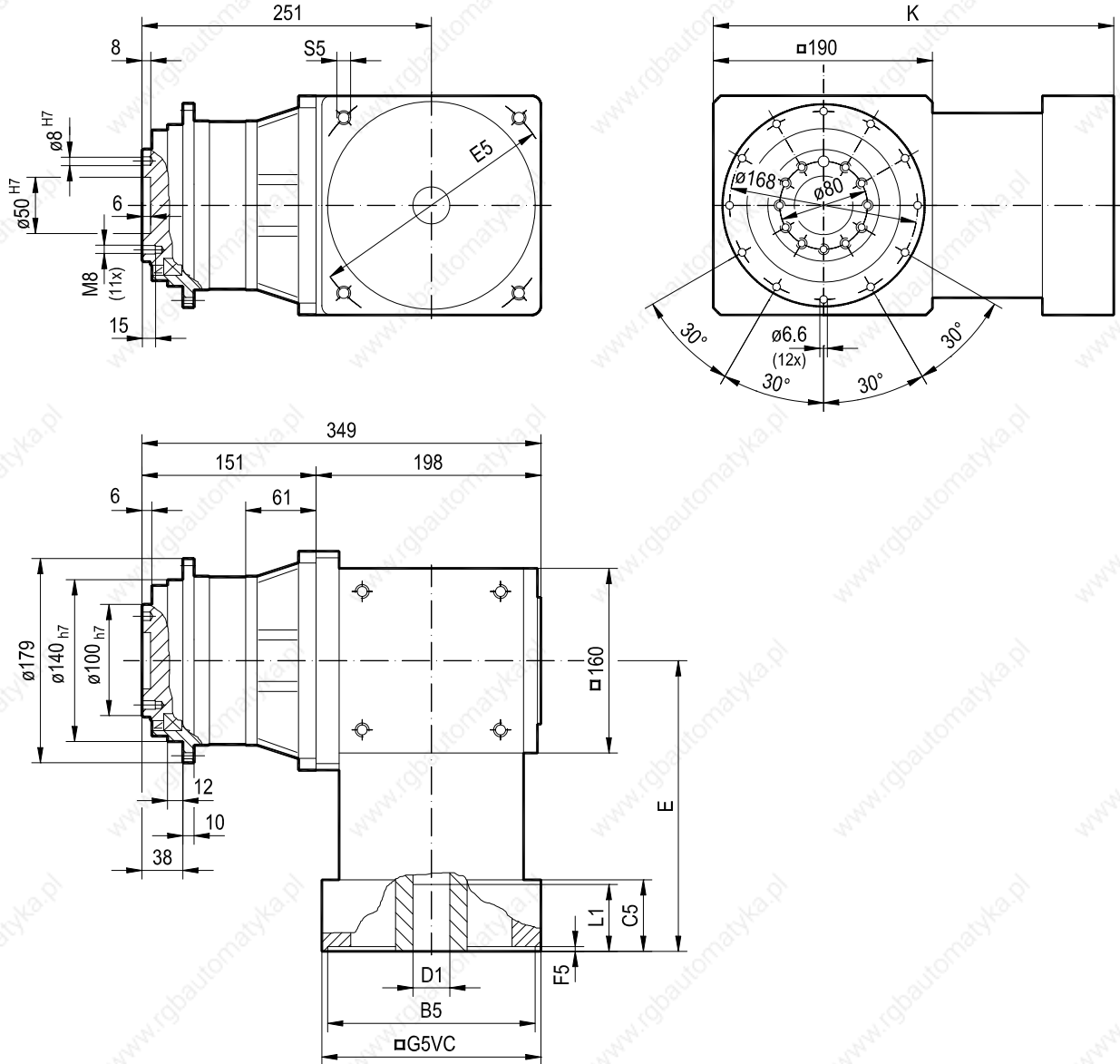
	EK12	EK03	EK05	EK13	EK04	EK07	EK06	EK14	EK08	EK09			
B5	60	80	95	80	95	95	110	110	110	130			
C5	54	54	54	54	54	54	54	54	54	54			
E5	75	100	115	100	115	130	130	130	165	165			
F5	5	5	5	5	5	5	5	5	5	5			
G5VC	120	120	120	120	120	120	120	120	140	140			
S5	M5	M6	M8	M6	M8	M8	M8	M8	M10	M10			
D1	14	14	14	19	19	19	19	24	24	24			
L1	30	30	30	40	40	40	40	50	50	50			
E	170	170	170	170	170	170	170	170	170	170			
K	240	240	240	240	240	240	240	240	240	240			



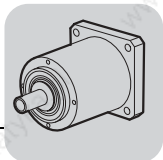
7.10 PSB611 VC160 EK.. [mm]

43 011 002

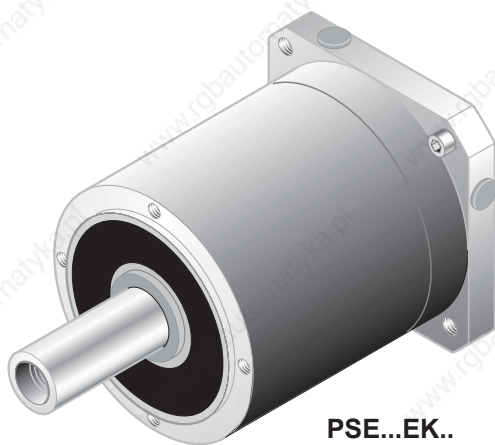
PSB611VC160EK..



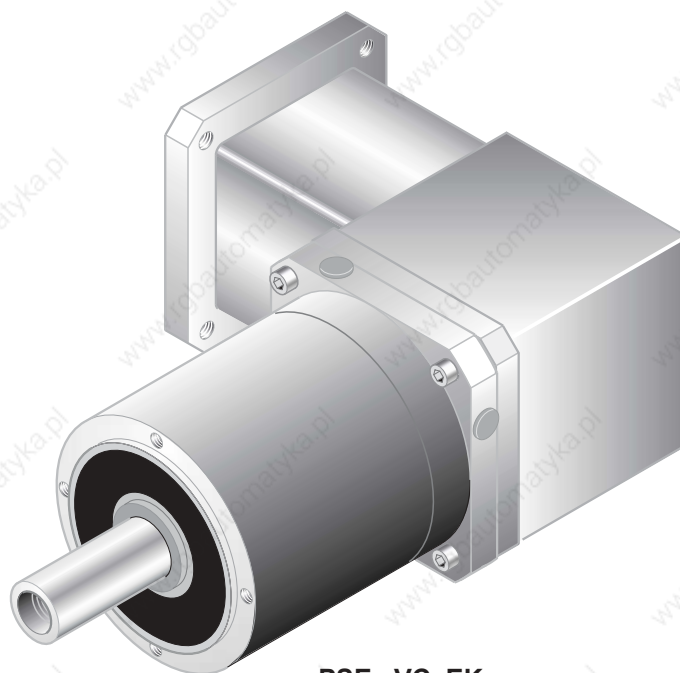
	EK13	EK04	EK7	EK06	EK14	EK08	EK09	EK15	EK11	EK10			
B5	80	95	95	110	110	110	130	130	130	180			
C5	62	62	62	62	62	62	62	62	62	62			
E5	100	115	130	130	130	165	165	165	215	215			
F5	5	5	5	5	5	5	5	5	5	5			
G5VC	160	160	160	160	160	160	160	160	190	190			
S5	M6	M8	M8	M8	M8	M10	M10	M10	M12	M12			
D1	19	19	19	19	24	24	24	32	32	32			
L1	40	40	40	40	50	50	50	60	60	60			
E	215	215	215	215	215	215	215	215	215	215			
K	310	310	310	310	310	310	310	310	310	310			



8 Low Backlash Planetary Gear Units PSE...

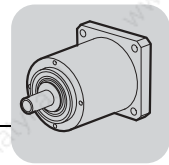


PSE...EK..





PSE...VC..EK..

50777AXX



8.1 PSE...EK.. [Nm]

PSE211 EK.., $n_e = 1000$ 1/min							55 Nm		
i	$n_{e \max}$ [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]		m [kg]	
4	6000	55	85	1300	1000	3	PSE 211EK	3.3	74
5	6000	55	85	1400	1100				
7	6000	55	85	1600	1300				
10	6000	55	60	1800	1500				

PSE212 EK.., $n_e = 1000$ 1/min							55 Nm		
16	6000	55	85	2200	1850	2.6	PSE 212EK	4.3	74
20	6000	55	85	2200	2150				
25	6000	55	85	2200	2600				
28	6000	55	85	2200	2900				
35	6000	55	85	2200	3500				
40	6000	55	85	2200	3900				
49	6000	55	85	2200	3900				
70	6000	55	85	2200	3900				
100	6000	55	60	2200	3900				

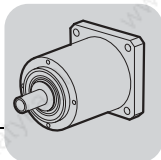
PSE311 EK.., $n_e = 1000$ 1/min							110 Nm		
4	6000	110	165	1850	1160	12	PSE 311EK	4.5	75
5	6000	110	165	1990	1280				
7	6000	110	165	2230	1480				
10	6000	110	120	2510	1730				

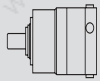

PSE312 EK.., $n_e = 1000$ 1/min							110 Nm		
16	6000	110	165	2940	2120	10	PSE 312EK	5.4	75
20	6000	110	165	3160	2330				
25	6000	110	165	3410	2570				
28	6000	110	165	3540	2700				
35	6000	110	165	3810	2970				
40	6000	110	165	3980	3150				
49	6000	110	165	4260	3440				
70	6000	110	165	4590	4300				
100	6000	110	120	4590	5800				



PSE411 EK.., $n_e = 1000$ 1/min							160 Nm		
4	4500	160	210	3450	2460	26	PSE 411EK	9.6	76
5	4500	160	210	3710	2710				
7	4500	160	210	4150	3130				
10	4500	150	160	4680	3660				



PSE412 EK.., $n_e = 1000$ 1/min							160 Nm		
16	4500	160	210	5470	4480	21	PSE 412EK	13	76
20	4500	160	210	5890	4940				
25	4500	160	210	6350	5440				
28	4500	160	210	6590	5710				
35	4500	160	210	7100	6300				
40	4500	160	210	7430	6670				
49	4500	160	210	7840	7440				
70	4500	160	210	7840	10300				
100	4500	150	160	7840	11600				

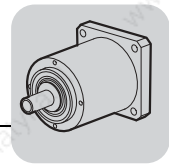
PSE511 EK.., $n_e = 1000$ 1/min							300 Nm		
4	4500	300	370	3450	2460	30	PSE 511EK	9.7	77
6	4500	300	370	3710	2710				
7	4500	300	370	4150	3130				
10	4500	270	270	4680	3660				



PSE512 EK., $n_e = 1000$ 1/min							300 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]	 PSE 512EK	 m [kg]	
16	4500	300	370	5470	4480	25			12
20	4500	300	370	5890	4940				
25	4500	300	370	6350	5440				
28	4500	300	370	6590	5710				
35	4500	300	370	7100	6300				
40	4500	300	370	7430	6670				
49	4500	300	370	7840	7440				
70	4500	300	370	7840	10300				
100	4500	270	270	7840	11600				

PSE611 EK., $n_e = 1000$ 1/min							600 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]	 PSE 611EK	 m [kg]	
4	4500	600	670	5570	3810	55			19
5	4500	600	670	6000	4200				
7	4500	600	670	6710	4850				
10	4500	500	500	7560	5660				

PSE612 EK., $n_e = 1000$ 1/min							600 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	c_T [Nm/°]	 PSE 612EK	 m [kg]	
16	4500	600	670	8610	7240	47			22
20	4500	600	670	8610	8870				
25	4500	600	670	8610	10700				
28	4500	600	670	8610	11700				
35	4500	600	670	8610	13900				
40	4500	600	670	8610	15400				
49	4500	600	670	8610	17700				
70	4500	600	670	8610	20300				
100	4500	500	500	8610	20300				



8.2 PSE...VC..EK.. [Nm]

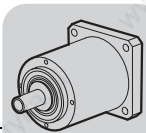
PSE211 VC65 EK..., $n_e = 1000$ 1/min						55 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	 PSE 211VC65EK	m [kg]	
8	6000	55	85	1650	1350			5.8
10	6000	55	60	1800	1500			
14	6000	55	85	1950	1700			
20	6000	55	85	2200	2150			

PSE311 VC90 EK..., $n_e = 1000$ 1/min						110 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	 PSE 311VC90EK	10	80
7	6000	110	165	2230	1480			
10	6000	110	120	2510	1730			
14	6000	110	165	2800	2000			
21	6000	110	165	3200	2380			
28	6000	110	165	3540	2700			
35	6000	110	165	3810	2970			
40	6000	110	120	3980	3150			
50	6000	110	120	4300	3470			
60	6000	110	120	4500	3750			

PSE411 VC90 EK..., $n_e = 1000$ 1/min						160 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	 PSE 411VC90EK	15	81
7	4500	160	210	4150	3130			
10	4500	150	160	4680	3660			
14	4500	160	210	5200	4230			
21	4500	160	210	5950	5000			
28	4500	160	210	6590	5710			
35	4500	160	210	7100	6300			
40	4500	150	160	7430	6670			
50	4500	150	160	7840	7550			
60	4500	150	160	7840	8950			

PSE511 VC120 EK..., $n_e = 1000$ 1/min						300 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	 PSE 511VC120EK	22	82
7	4500	300	370	4150	3130			
10	4500	270	270	4680	3660			
14	4500	300	370	5200	4230			
21	4500	300	370	5950	5000			
28	4500	300	370	6590	5710			
35	4500	300	370	7100	6300			
40	4500	270	270	7430	6670			
50	4500	270	270	7840	7550			

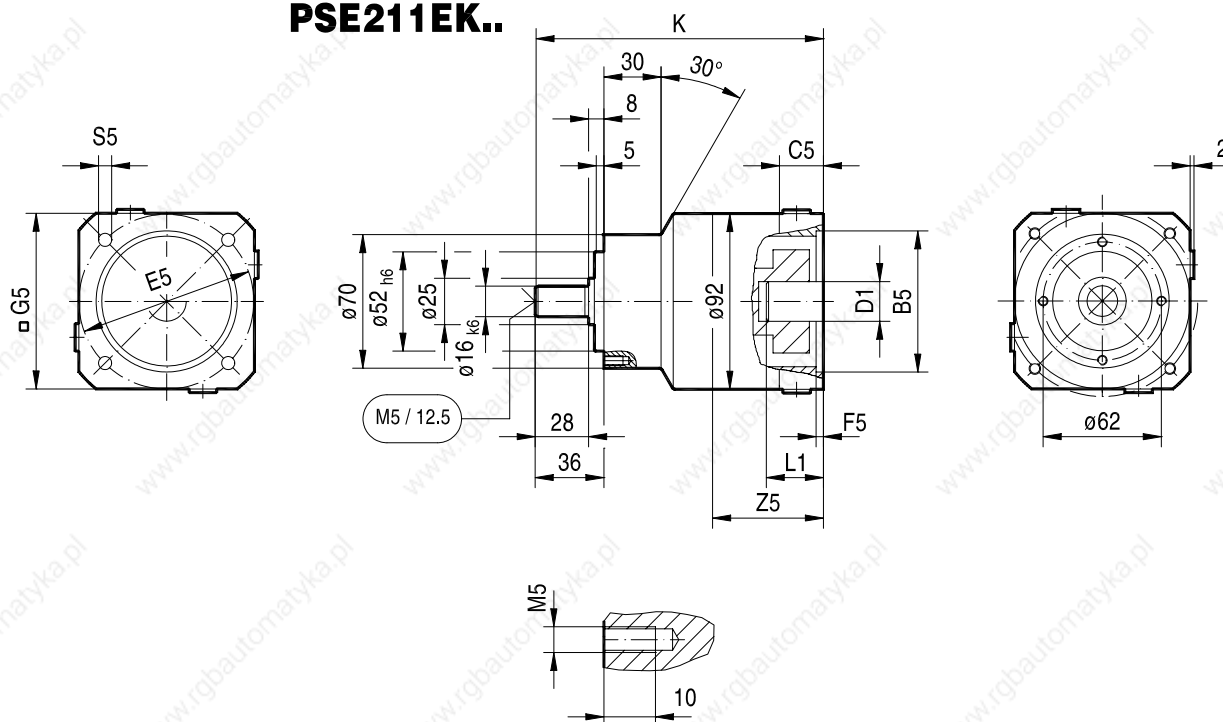
PSE611 VC160 EK..., $n_e = 1000$ 1/min						600 Nm		
i	n_e max [1/min]	M_N [Nm]	M_B [Nm]	F_{Ra} [N]	F_{Aa} [N]	 PSE 611VC160EK	31	83
7	4500	600	670	6710	4850			
10	4500	500	500	7560	5660			
14	4500	600	670	8400	6550			
21	4500	600	670	8610	9200			
28	4500	600	670	8610	11700			
35	4500	600	670	8610	13900			
40	4500	500	500	8610	15400			
50	4500	500	500	8610	18000			
60	4500	500	500	8610	20300			



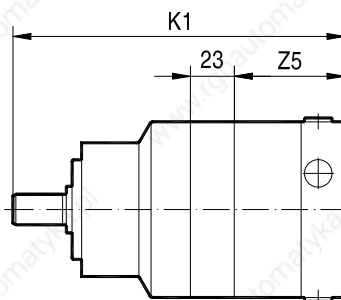
8.3 PSE211/212 EK.. [mm]

43 021 001

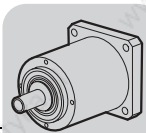
PSE211EK..



PSE212EK..

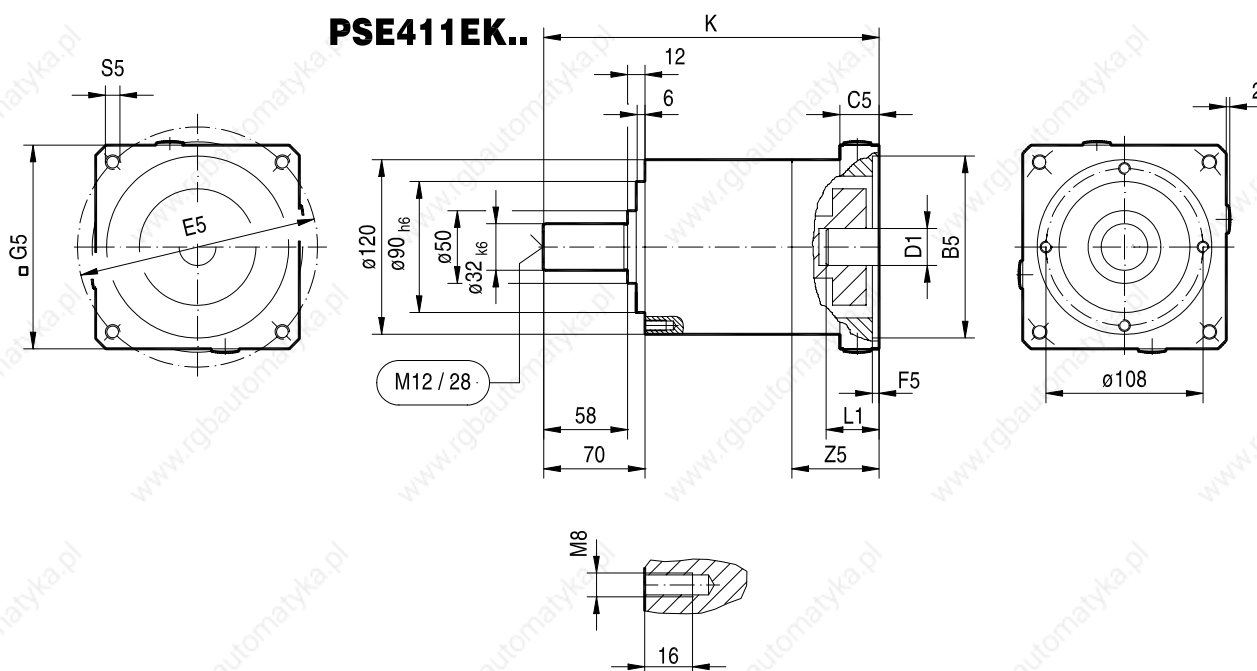


	EK01	EK02	EK12	EK03	EK05	EK18	EK17	EK13	EK04				
B5	40	60	60	80	95	60	50	80	95				
C5	23	23	23	23	23	23	23	23	23				
E5	63	75	75	100	115	90	95	100	115				
F5	4	4	4	4	4	4	4	4	4				
G5	82	82	82	92	105	82	82	92	105				
S5	M4	M5	M5	M6	M8	M5	M6	M6	M8				
Z5	58	58	58	58	58	58	58	58	58				
D1	9	11	14	14	14	14	14	19	19				
L1	20	23	30	30	30	30	30	40	40				
K	151	151	151	151	151	151	151	151	151				
K1	174	174	174	174	174	174	174	174	174				

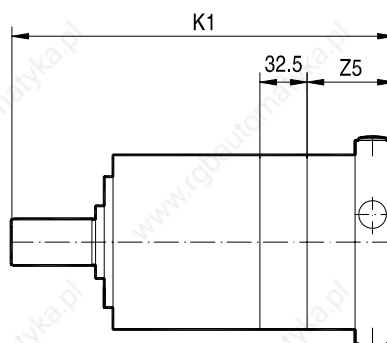


8.5 PSE411/412 EK.. [mm]

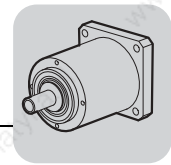
43 023 001



PSE412EK..

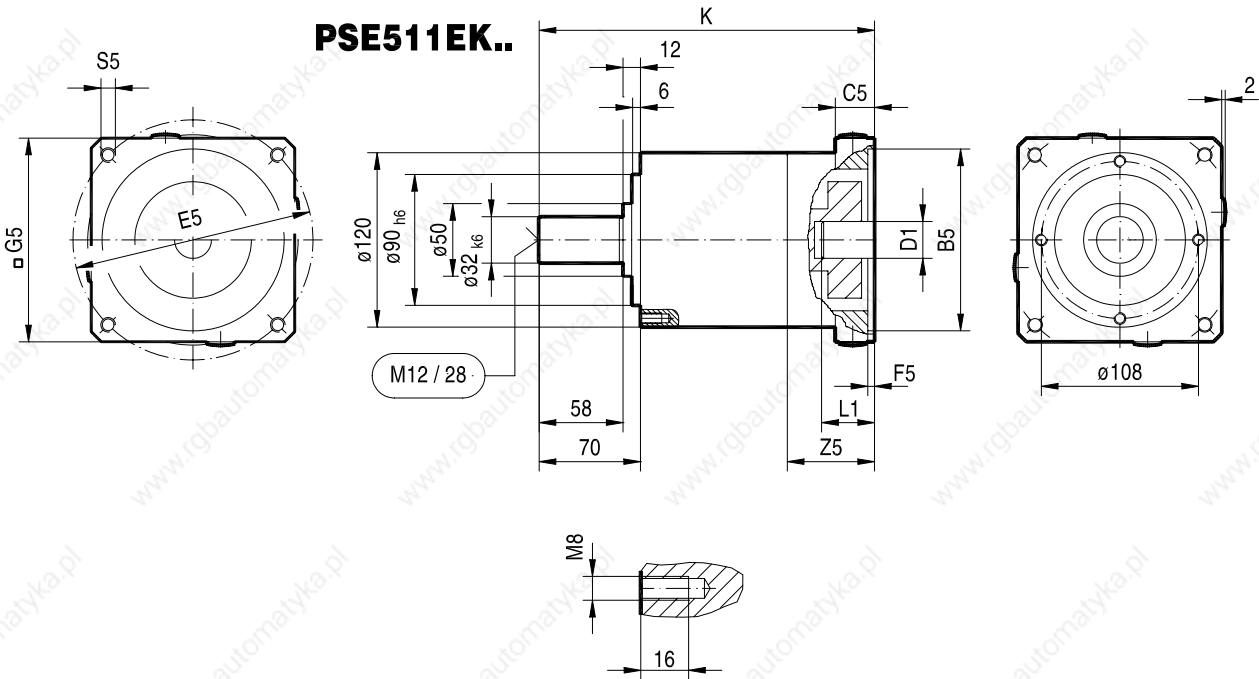


	EK12	EK03	EK05	EK13	EK04	EK07	EK06	EK14	EK08	EK09	EK15	EK11	EK10
B5	60	80	95	80	95	95	110	110	110	130	130	130	180
C5	27	27	27	27	27	27	27	27	27	27	39	39	39
E5	75	100	115	100	115	130	130	130	165	165	165	215	215
F5	5	5	5	5	5	5	5	5	5	5	6	6	6
G5	120	120	120	120	120	120	120	120	140	140	140	190	190
S5	M5	M6	M8	M6	M8	M8	M8	M8	M10	M10	M10	M12	M12
Z5	60	60	60	60	60	60	60	60	60	60	72	72	72
D1	14	14	14	19	19	19	19	24	24	24	32	32	32
L1	30	30	30	40	40	40	40	50	50	50	60	60	60
K	231	231	231	231	231	231	231	231	231	231	243	243	243
K1	263.5	263.5	263.5	263.5	263.5	263.5	263.5	263.5	263.5	263.5	275.5	275.5	275.5

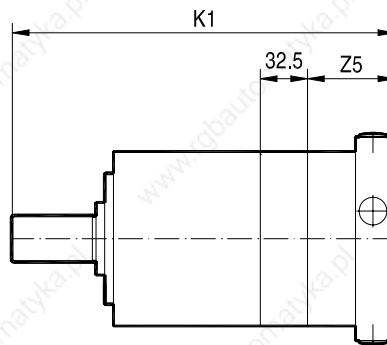


8.6 PSE511/512 EK.. [mm]

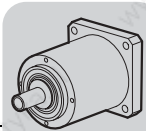
43 024 001



PSE512EK..

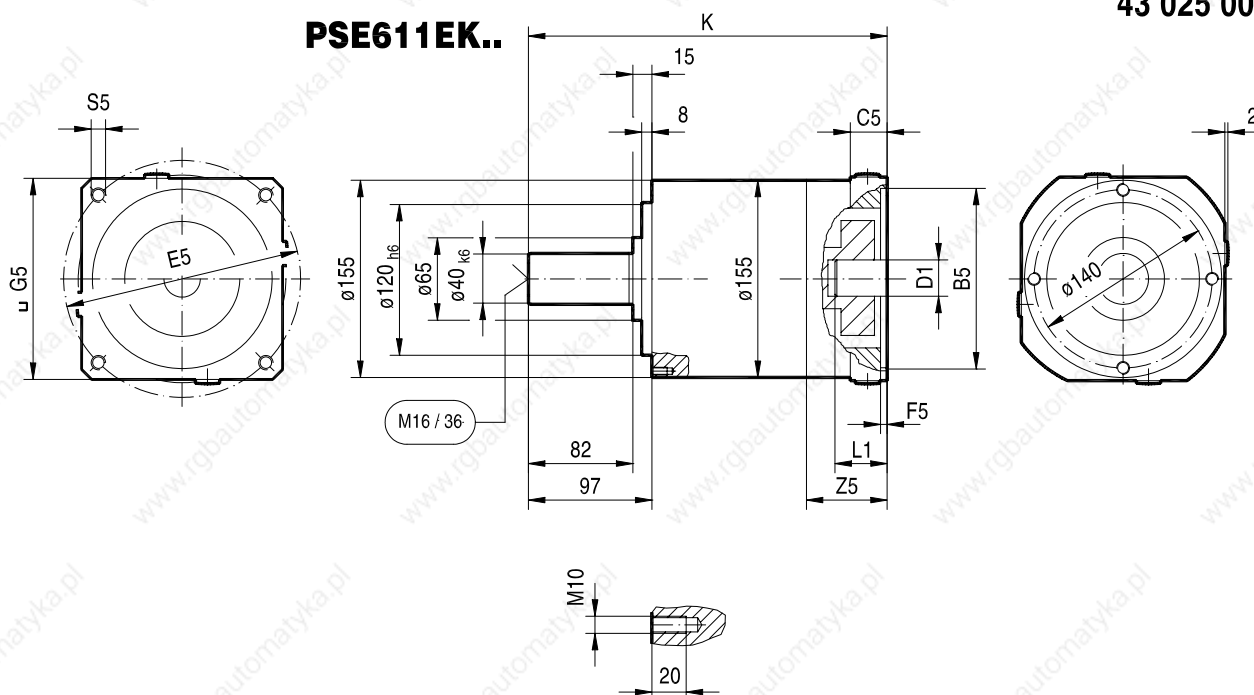
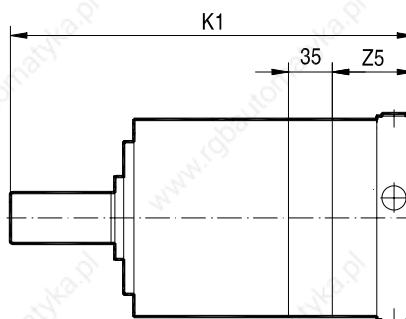


	EK12	EK03	EK05	EK13	EK04	EK07	EK06	EK14	EK08	EK09	EK15	EK11	EK10
B5	60	80	95	80	95	95	110	110	110	130	130	130	180
C5	27	27	27	27	27	27	27	27	27	27	39	39	39
E5	75	100	115	100	115	130	130	130	165	165	165	215	215
F5	5	5	5	5	5	5	5	5	5	5	6	6	6
G5	120	120	120	120	120	120	120	120	140	140	140	190	190
S5	M5	M6	M8	M6	M8	M8	M8	M8	M10	M10	M10	M12	M12
Z5	60	60	60	60	60	60	60	60	60	60	72	72	72
D1	14	14	14	19	19	19	19	24	24	24	32	32	32
L1	30	30	30	40	40	40	40	50	50	50	60	60	60
K	231	231	231	231	231	231	231	231	231	231	243	243	243
K1	263.5	263.5	263.5	263.5	263.5	263.5	263.5	263.5	263.5	263.5	275.5	275.5	275.5

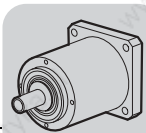


8.7 PSE611/612 EK.. [mm]

43 025 001

**PSE612EK..**

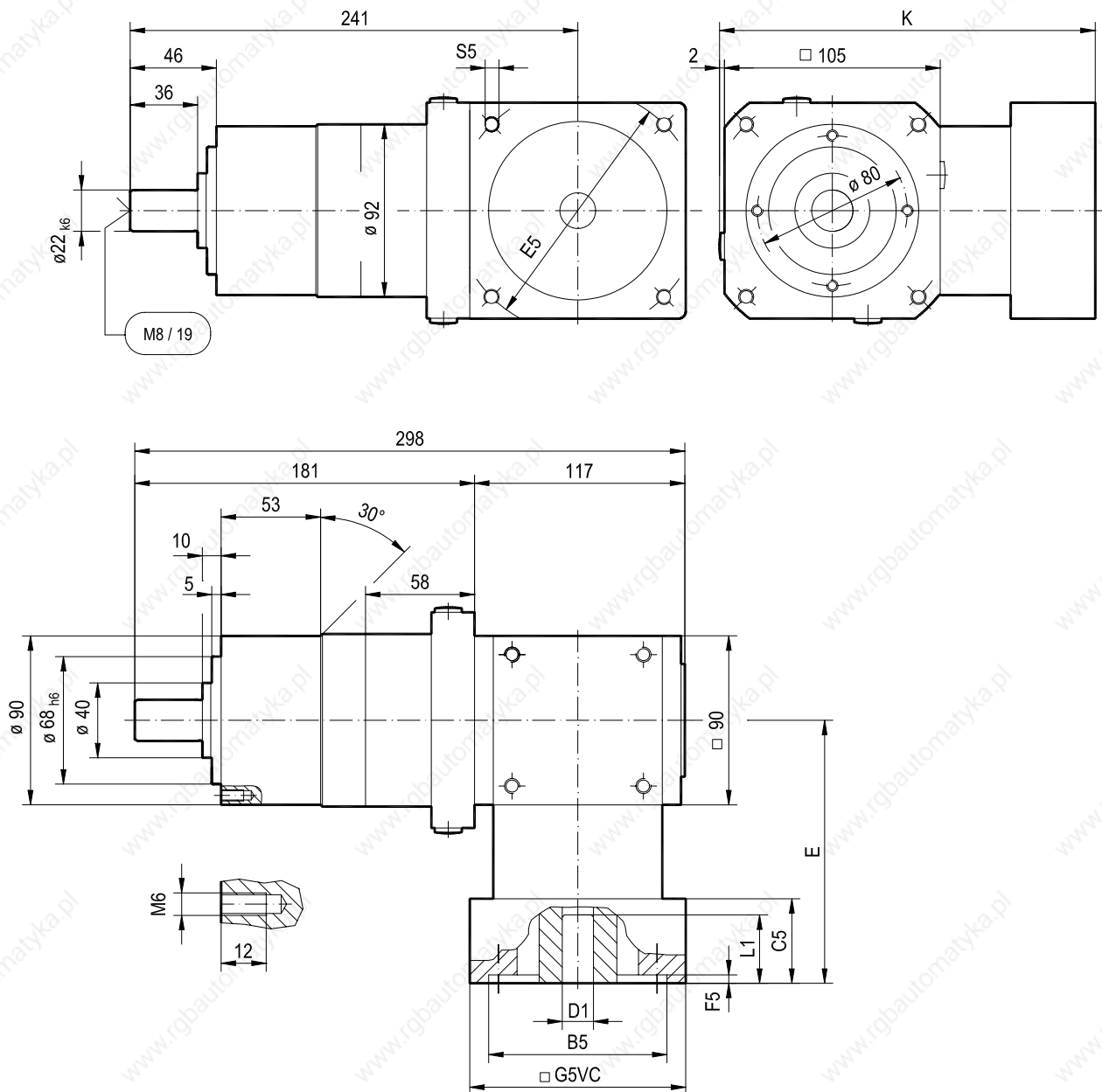
	EK04	EK06	EK14	EK08	EK09	EK15	EK11	EK10	EK16				
B5	95	110	110	110	130	130	130	180	180				
C5	29	29	29	29	29	39	39	39	61				
E5	115	130	130	165	165	165	215	215	215				
F5	5	5	5	5	5	5	5	5	5				
G5	160	160	160	160	160	160	190	190	190				
S5	M8	M8	M8	M10	M10	M10	M12	M12	M12				
Z5	63.5	63.5	63.5	63.5	63.5	73.5	73.5	73.5	95.5				
D1	19	19	24	24	24	32	32	32	38				
L1	40	40	50	50	50	60	60	60	80				
K	282	282	282	282	282	292	292	292	314				
K1	317	317	317	317	317	327	327	327	349				



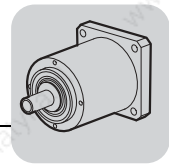
8.9 PSE311 VC90 EK.. [mm]

43 013 002

PSE311VC90EK..



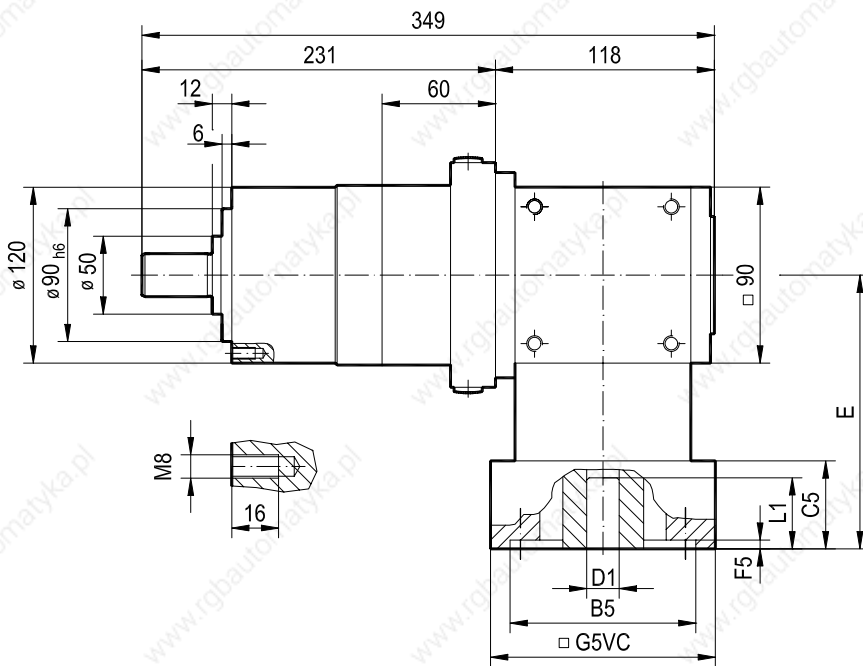
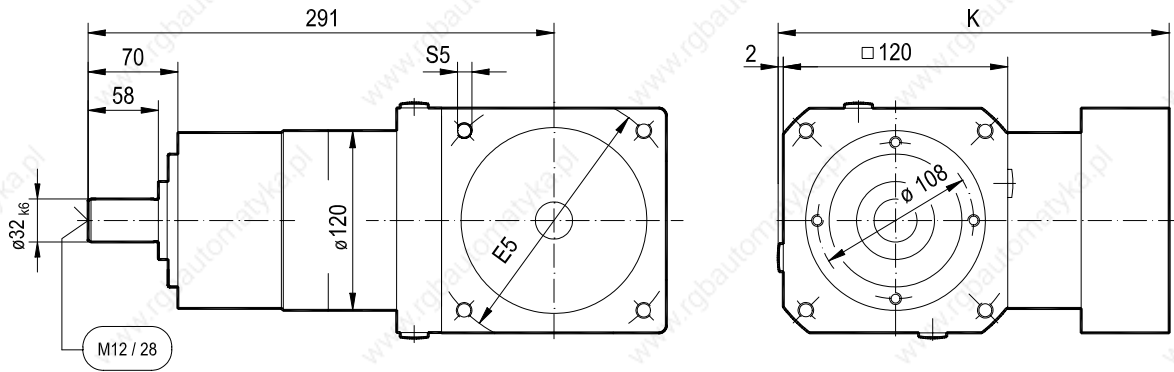
	EK12	EK03	EK05	EK13	EK04	EK07	EK06						
B5	60	80	95	80	95	95	110						
C5	45	45	45	45	45	45	45						
E5	75	100	115	100	115	130	130						
F5	4	4	4	4	4	4	4						
G5VC	90	90	100	95	105	115	115						
S5	M5	M6	M8	M6	M8	M8	M8						
D1	14	14	14	19	19	19	19						
L1	30	30	30	40	40	40	40						
E	140	140	140	140	140	140	140						
K	194.5	194.5	194.5	194.5	194.5	194.5	194.5						



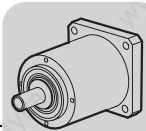
8.10 PSE411 VC90 EK.. [mm]

43 014 002

PSE411VC90EK..



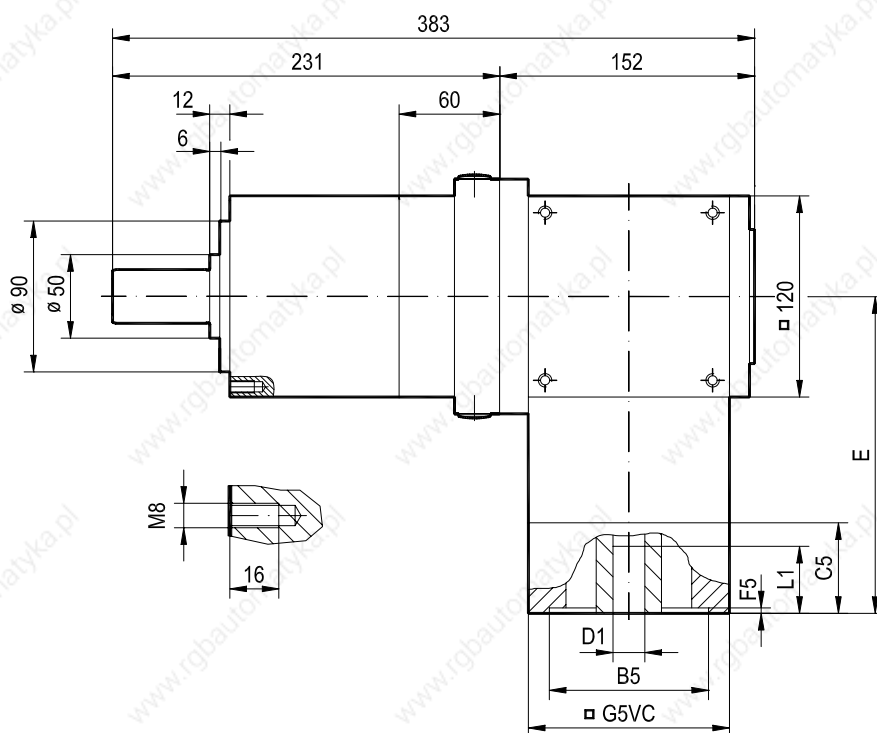
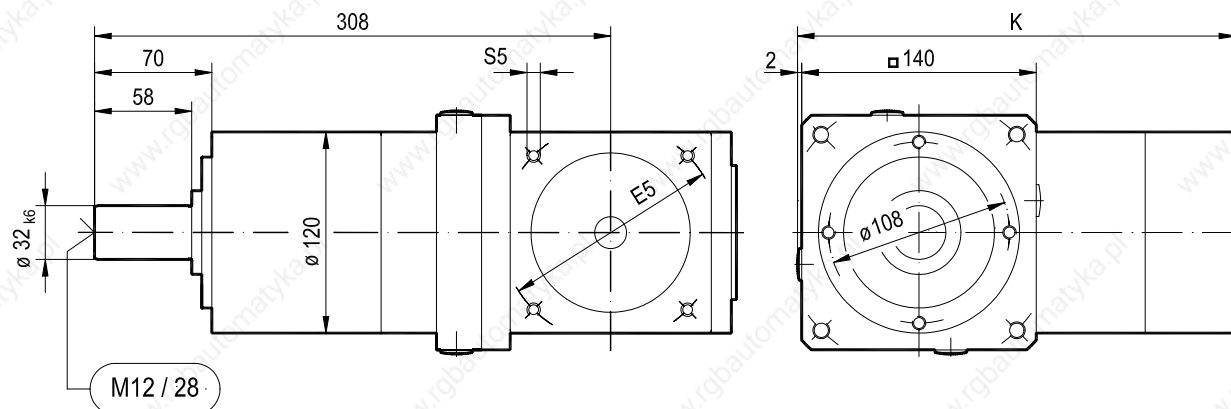
	EK12	EK03	EK05	EK13	EK04	EK07	EK06						
B5	60	80	95	80	95	95	110						
C5	45	45	45	45	45	45	45						
E5	75	100	115	100	115	130	130						
F5	4	4	4	4	4	4	4						
G5VC	90	90	100	95	105	115	115						
S5	M5	M6	M8	M6	M8	M8	M8						
D1	14	14	14	19	19	19	19						
L1	30	30	30	40	40	40	40						
E	140	140	140	140	140	140	140						
K	202	202	202	202	202	202	202						



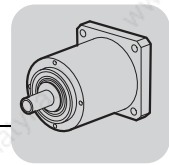
8.11 PSE511 VC120 EK.. [mm]

43 015 002

PSE511VC120EK..



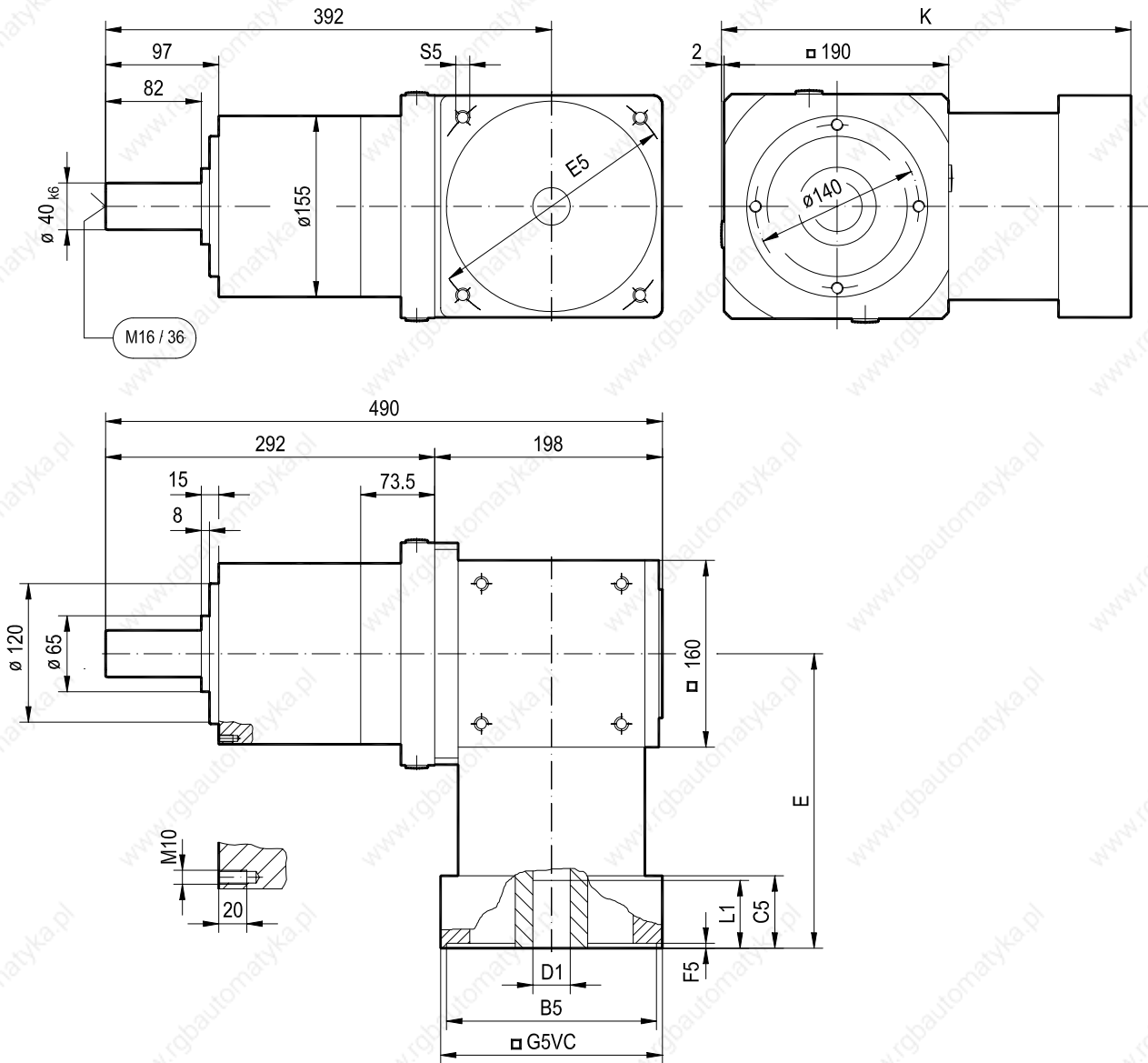
	EK12	EK03	EK05	EK13	EK04	EK07	EK06	EK14	EK08	EK09			
B5	60	80	95	80	95	95	110	110	110	130			
C5	54	54	54	54	54	54	54	54	54	54			
E5	75	100	115	100	115	130	130	130	165	165			
F5	5	5	5	5	5	5	5	5	5	5			
G5VC	120	120	120	120	120	120	120	120	140	140			
S5	M5	M6	M8	M6	M8	M8	M8	M8	M10	M10			
D1	14	14	14	19	19	19	19	24	24	24			
L1	30	30	30	40	40	40	40	50	50	50			
E	170	170	170	170	170	170	170	170	170	170			
K	242	242	242	242	242	242	242	242	242	242			



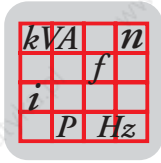
8.12 PSE611 VC160 EK.. [mm]

PSE611VC160EK..

43 016 002



	EK13	EK04	EK07	EK06	EK14	EK08	EK09	EK15	EK11	EK10			
B5	80	95	95	110	110	110	130	130	130	180			
C5	62	62	62	62	62	62	62	62	62	62			
E5	100	115	130	130	130	165	165	165	215	215			
F5	5	5	5	5	5	5	5	5	5	5			
G5VC	160	160	160	160	160	160	160	160	190	190			
S5	M6	M8	M6	M8	M8	M10	M10	M10	M12	M12			
D1	19	19	19	19	24	24	24	32	32	32			
L1	40	40	40	40	50	50	50	60	60	60			
E	215	215	215	215	215	215	215	215	215	215			
K	312	312	312	312	312	312	312	312	312	312			



9 Technical Data

9.1 PSF mass moments of inertia, in relation to the input shaft

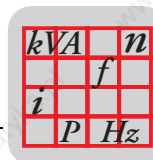
PSF...EK..
single stage

i	$J \cdot 10^{-4} [\text{kgm}^2]$							
	PSF 211				PSF 311			
	EK 01	EK 02	EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 13	EK 02	EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 06 EK 07 EK 13 EK 19	EK 08 EK 09 EK 14
4	0.453	0.455	0.475	1.407	0.633	0.627	1.565	2.195
5	0.444	0.441	0.461	1.394	0.560	0.553	1.492	2.122
7	0.435	0.432	0.452	1.384	0.506	0.500	1.439	2.069
10	0.430	0.426	0.447	1.379	0.477	0.471	1.410	2.040

i	$J \cdot 10^{-4} [\text{kgm}^2]$							
	PSF 411				PSF 511			
	EK 03 EK 05 EK 12	EK 04 EK 06 EK 07 EK 13	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 03 EK 05 EK 12	EK 04 EK 06 EK 07 EK 13	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15
4	2.701	2.681	3.708	5.449	2.804	2.783	3.811	5.552
5	2.442	2.422	3.450	5.190	2.505	2.485	3.513	5.253
7	2.237	2.217	3.245	4.985	2.284	2.264	3.291	5.032
10	2.128	2.108	3.135	4.876	2.165	2.145	3.172	4.913

i	$J \cdot 10^{-4} [\text{kgm}^2]$							
	PSF 611				PSF 701			
	EK 04 EK 06	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 16	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 16	
4	6.380	6.333	7.735	7.666	18.648	20.462	25.505	
5	5.186	5.139	6.541	6.472	14.592	16.406	21.450	
7	4.265	4.218	5.620	5.551	11.467	13.282	18.325	
10	3.807	3.760	5.162	5.092	10.396	12.210	17.253	

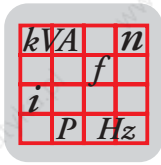
i	$J \cdot 10^{-4} [\text{kgm}^2]$									
	PSF 801					PSF 901				
	EK 10 EK 11 EK 15	EK 16	EK 22 EK 23 EK 24	EK 25	EK 26	EK 10 EK 11 EK 15	EK 16	EK 22 EK 23 EK 24	EK 25	EK 26
4	60.340	64.994	66.802	67.786	70.204	97.454	98.857	98.582	97.978	96.879
5	48.908	53.563	55.370	56.354	58.772	67.949	69.352	69.077	68.473	67.391
7	40.511	45.166	46.973	47.958	50.375	47.081	48.484	48.209	47.605	46.523
10	36.454	41.108	42.916	43.900	46.318	36.947	38.350	38.075	37.471	36.389



**PSF..EK..
double stage**

i	J · 10 ⁻⁴ [kgm ²]							
	PSF 212				PSF 312			
	EK 01	EK 02	EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 13	EK 02	EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 06 EK 07 EK 13 EK 19	EK 08 EK 09 EK 14
16	0.460	0.456	0.472	1.409	0.518	0.514	1.453	2.082
20	0.451	0.448	0.464	1.401	0.482	0.498	1.437	2.047
25	0.441	0.438	0.454	1.390	0.478	0.474	1.413	2.043
28	0.447	0.444	0.460	1.397	0.456	0.489	1.428	2.021
35	0.437	0.434	0.449	1.386	0.469	0.465	1.404	2.034
40	0.431	0.428	0.444	1.381	0.458	0.453	1.392	2.022
49	0.429	0.426	0.441	1.378	0.453	0.448	1.387	2.017
70	0.427	0.424	0.440	1.377	0.450	0.446	1.385	2.015
100	0.423	0.420	0.436	1.373	0.442	0.438	1.377	2.007

i	J · 10 ⁻⁴ [kgm ²]							
	PSF 412				PSF 512			
	EK 03 EK 05 EK 12	EK 04 EK 06 EK 07 EK 13	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 03 EK 05 EK 12	EK 04 EK 06 EK 07 EK 13	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15
16	2.494	2.474	3.502	5.242	2.501	2.481	3.508	5.249
20	2.422	2.402	3.429	5.170	2.428	2.408	3.436	5.176
25	2.262	2.242	3.270	5.010	2.264	2.244	3.272	5.012
28	2.382	2.362	3.399	5.130	2.388	2.368	3.396	5.136
35	2.222	2.202	3.230	4.970	2.225	2.204	3.232	4.973
40	2.132	2.112	3.140	4.880	2.132	2.112	3.140	4.880
49	2.118	2.098	3.125	4.886	2.118	2.098	3.126	4.866
70	2.103	2.083	3.110	4.851	2.103	2.083	3.111	4.851
100	2.050	2.030	3.058	4.798	2.050	2.030	3.058	4.798

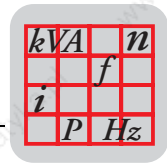


PSF mass moments of inertia, in relation to the input shaft

PSF..EK..
double stage

i	J · 10 ⁻⁴ [kgm ²]						
	PSF 612				PSF 702		
	EK 04 EK 06	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 16	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 16
16	4.720	4.673	6.075	6.006	15.594	17.408	22.451
20	4.509	4.462	5.864	5.795	14.023	15.837	20.880
25	4.136	4.089	5.491	5.422	12.406	14.220	19.263
28	4.394	4.347	5.749	5.680	12.765	14.579	19.622
35	4.021	3.974	5.376	5.307	11.148	12.962	18.005
40	3.759	3.712	5.114	5.044	11.427	13.242	18.285
49	3.714	3.667	5.068	4.999	10.350	12.164	17.207
70	3.669	3.622	5.023	4.954	10.214	12.028	17.071
100	3.529	3.482	4.884	4.815	9.846	11.660	16.703

i	J · 10 ⁻⁴ [kgm ²]									
	PSF 802					PSF 902				
	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 16	EK 22 EK 23 EK 24	EK 25	EK 26	EK 10 EK 11 EK 15	EK 16	EK 22 EK 23 EK 24	EK 25 EK 26
16	34.919	36.695	41.303	43.115	44.108	46.540	46.232	47.635	47.36	46.756
20	32.233	34.010	38.618	40.430	41.422	43.854	42.961	44.364	44.089	43.485
25	30.034	31.811	36.419	38.231	39.233	41.656	37.42	38.822	38.547	37.944
28	31.000	32.776	37.384	39.196	40.189	42.621	41.221	42.624	42.349	41.745
35	28.801	30.578	35.186	36.997	37.990	40.422	35.679	37.082	36.801	36.203
40	28.512	30.289	34.897	36.709	40.053	42.485	40.538	41.941	41.666	41.062
49	27.545	29.322	33.930	35.742	36.734	39.167	31.993	33.396	33.121	32.517
70	27.409	29.186	33.794	35.605	36.598	39.030	31.31	32.713	32.438	32.095
100	26.878	28.654	33.263	35.074	36.067	38.499	29.662	31.065	30.79	30.186



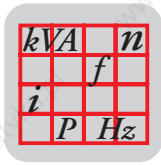
9.2 PSB mass moments of inertia, in relation to the input shaft

**PSB...EK..
single stage**

i	J · 10 ⁻⁴ [kgm ²]								
	PSB 311			PSB 411/511			PSB 611		
	EK 02 EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 06 EK 07 EK 13 EK 19	EK 08 EK 09 EK 14	EK 03 EK 04 EK 05 EK 06 EK 07 EK 13	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 04 EK 06 EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 16
4	0.932	1.88	2.51	4.94	5.97	7.71	7.58	8.99	8.92
5	0.752	1.69	2.32	3.86	4.89	6.63	5.94	7.34	7.27
7	0.602	1.54	2.17	2.97	3.99	5.74	4.63	6.03	5.96
10	0.522	1.46	2.09	2.49	3.52	5.26	3.96	5.36	5.29

**PSB...EK..
double stage**

i	J · 10 ⁻⁴ [kgm ²]								
	PSB 312			PSB 412/512			PSB 612		
	EK 02 EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 06 EK 07 EK 13 EK 19	EK 08 EK 09 EK 14	EK 03 EK 04 EK 05 EK 06 EK 07 EK 13	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 04 EK 06 EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 16
16	0.522	1.46	2.09	2.58	3.61	5.35	4.75	6.15	6.08
20	0.512	1.45	2.05	2.51	3.53	5.27	4.54	5.94	5.87
25	0.482	1.42	2.05	2.29	3.32	5.06	4.12	5.52	5.45
28	0.502	1.44	2.02	2.47	3.49	5.23	4.43	5.83	5.76
35	0.472	1.41	2.04	2.25	3.28	5.02	4.01	5.41	5.34
40	0.462	1.44	2.01	2.24	3.48	5.22	4.38	5.78	5.31
49	0.452	1.39	2.02	2.11	3.14	4.88	3.67	5.08	5.01
70	0.442	1.38	2.01	2.05	3.12	4.86	3.63	5.03	4.96
100	0.432	1.37	2.01	2.03	3.06	4.80	3.48	4.89	4.82



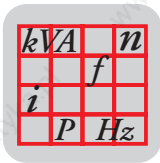
9.3 PSE mass moments of inertia, in relation to the input shaft

PSE...EK..

single stage

i	$J \cdot 10^{-4} \text{ [kgm}^2\text{]}$							
	PSE 211				PSE 311			
	EK 01	EK 02	EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 13	EK 02	EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 06 EK 07 EK 13 EK 19	EK 08 EK 09 EK 14
4	0.60	0.59	0.57	1.41	0.73	0.71	1.60	2.63
5	0.58	0.57	0.55	1.39	0.63	0.61	1.50	2.53
7	0.57	0.56	0.54	1.38	0.56	0.54	1.43	2.45
10	0.57	0.56	0.54	1.38	0.51	0.49	1.38	2.41

i	$J \cdot 10^{-4} \text{ [kgm}^2\text{]}$							
	PSE 411/511				PSE 611			
	EK 03 EK 05 EK 12	EK 04 EK 06 EK 07 EK 13	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 04 EK 06	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 16
4	2.12	2.96	3.99	5.73	6.72	6.67	8.07	8.01
5	1.76	2.60	3.63	5.37	5.40	5.35	6.75	6.69
7	1.48	2.32	3.35	5.09	4.38	4.33	5.73	5.66
10	1.33	2.17	3.20	4.94	3.86	3.81	5.21	5.15



**PSE...EK..
double stage**

i	J · 10 ⁻⁴ [kgm ²]							
	PSE 212				PSE 312			
	EK 01	EK 02	EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 13	EK 02	EK 03 EK 05 EK 12 EK 17 EK 18	EK 04 EK 06 EK 07 EK 13 EK 19	EK 08 EK 09 EK 14
16	0.60	0.59	0.57	1.41	0.53	0.51	1.41	2.43
20	0.59	0.58	0.56	1.40	0.51	0.49	1.38	2.41
25	0.58	0.57	0.55	1.39	0.49	0.47	1.36	2.38
28	0.59	0.58	0.56	1.40	0.50	0.48	1.37	2.40
35	0.58	0.57	0.55	1.39	0.48	0.46	1.35	2.37
40	0.59	0.58	0.56	1.40	0.50	0.48	1.37	2.39
49	0.57	0.56	0.54	1.39	0.46	0.44	1.33	2.36
70	0.57	0.56	0.54	1.38	0.46	0.44	1.33	2.35
100	0.56	0.55	0.53	1.37	0.45	0.43	1.32	2.35

i	J · 10 ⁻⁴ [kgm ²]							
	PSE 412/512				PSE 612			
	EK 03 EK 05 EK 12	EK 04 EK 06 EK 07 EK 13	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 04 EK 06	EK 08 EK 09 EK 14	EK 10 EK 11 EK 15	EK 16
16	1.60	2.44	3.47	5.21	4.92	4.87	6.27	6.20
20	1.53	2.37	3.40	5.14	4.71	4.66	6.06	6.01
25	1.40	2.24	3.26	5.00	4.26	4.21	5.61	5.54
28	1.49	2.33	3.36	5.10	4.59	4.54	5.95	5.88
35	1.36	2.20	3.22	4.96	4.14	4.09	5.50	5.43
40	1.44	2.32	3.34	5.08	4.55	4.50	5.90	5.83
49	1.25	2.09	3.12	4.86	3.79	3.74	5.14	5.07
70	1.24	2.08	3.11	4.85	3.74	3.69	5.10	5.03
100	1.19	2.03	3.05	4.80	3.57	3.52	4.92	4.85



10 Abbreviation Legend and Index

10.1 Abbreviation legend

a, b, e, f	Constants for overhung load conversion	[mm]
c	Constant for overhung load conversion	[Nmm]
c_K	Tilting rigidity	[Nm/°]
c_T	Torsional rigidity	[Nm/°]
d₀	Average diameter of mounted transmission element	[mm]
cdf	Cyclic duration factor	%
f_D	Speed constant	[1/min]
f_K	Correction factor	-
f_Z	Transmission element factor	-
F_{Aa1}	Permitted axial load on the output end, central axial load	[N]
F_{Aa2}	Required axial load on the output end, central axial load	[N]
F_{Aax}	Calculated axial load given simultaneous overhung load at point x	[N]
F_{Ra1}	Permitted overhung load on the output end (given axial load F _{Aa1}), overhung load at midpoint of shaft extension	[N]
F_{Ra2}	Required overhung load on the output end, overhung load at midpoint of shaft extension	[N]
F_{RxL}	Permitted overhung load at point x based on bearing service life	[N]
F_{RxW}	Permitted overhung load at point x based on shaft strength	[N]
H	Altitude	[m above sea level]
i	Gear unit reduction ratio	-
J	Mass moment of inertia of the gear unit referenced to the input speed	[10 ⁻⁴ kgm ²]
ϑ_{amb}	Ambient temperature	[°C]
α	Circumferential backlash	[']
m	Mass of the gear unit without lubricant fill	[kg]
M_{a max}	Maximum output torque assumed for the drive in project planning	[Nm]
M_{am}	Average output torque	[Nm]
M_B	Maximum acceleration torque	[Nm]
M_N	Rated torque (→ selection tables)	[Nm]
M_{em. off}	Maximum braking torque in emergency off braking	[Nm]
n_{a max}	Maximum output speed	[1/min]
n_{am}	Average output speed	[1/min]
n_{e max}	Maximum input speed	[1/min]
S3	Cyclic operating mode	-
η	Efficiency	-



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Denmark			
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Estonia			
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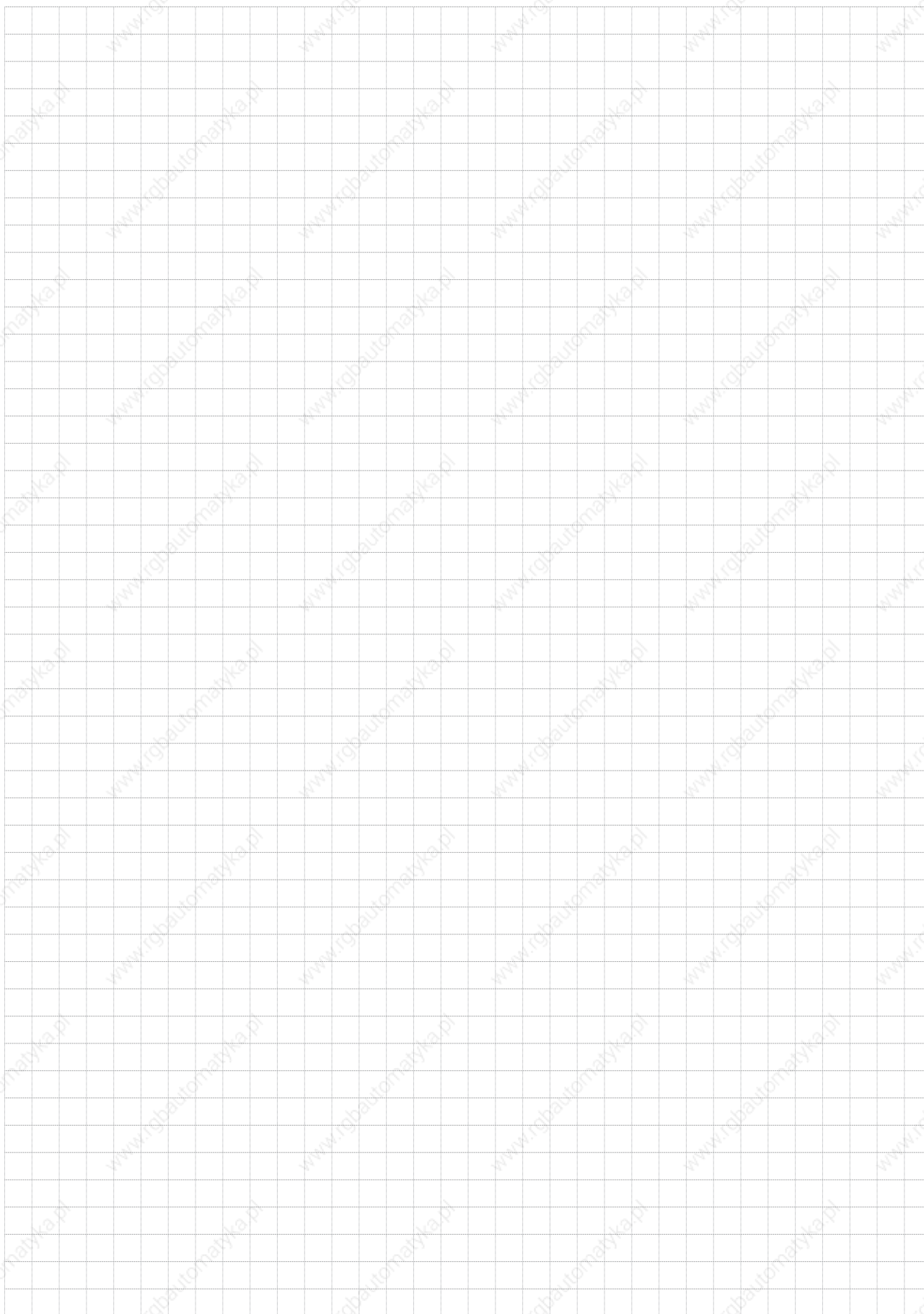


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