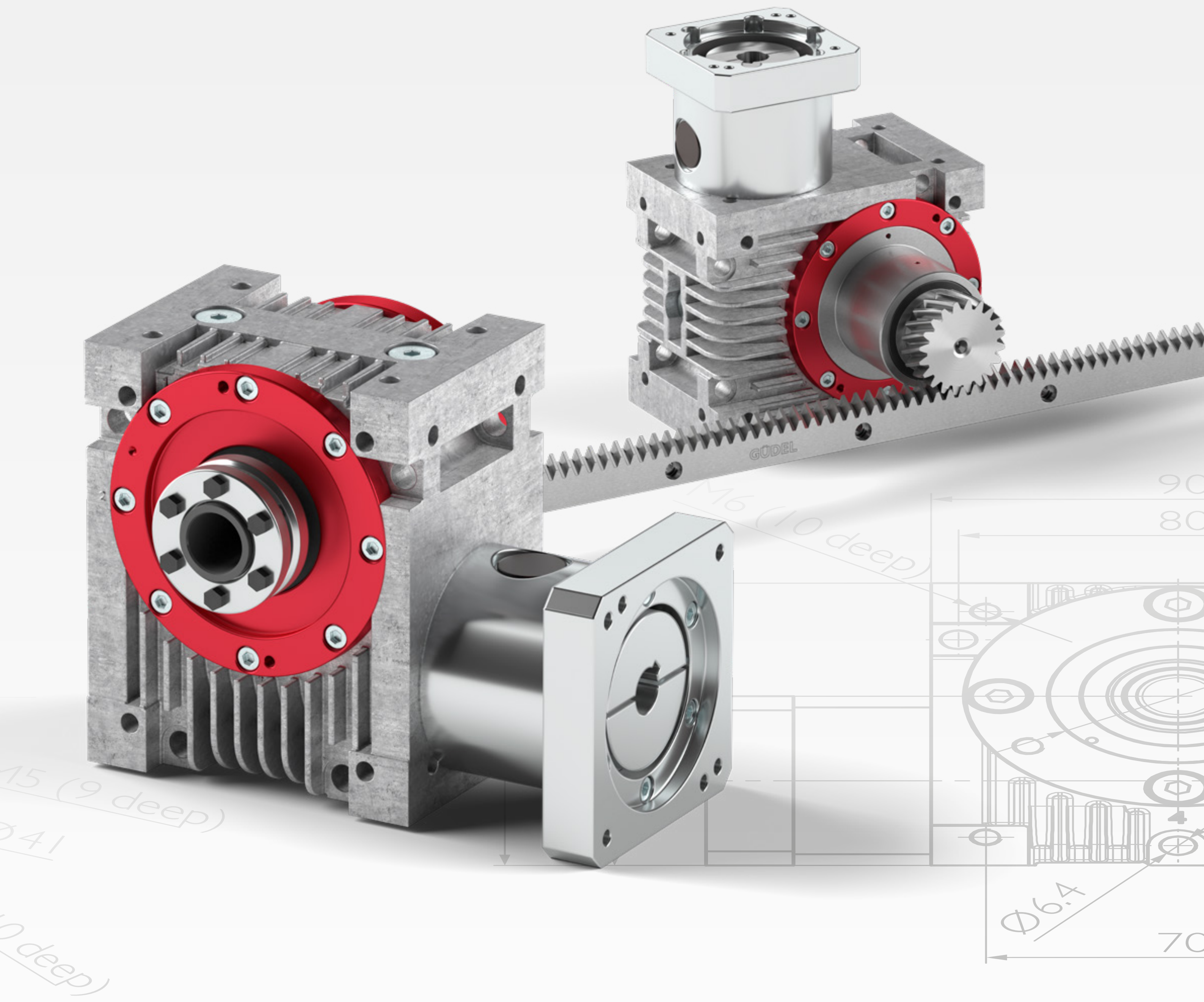
GÜDEL

High performance angle gearboxes



High performance angle gearboxes

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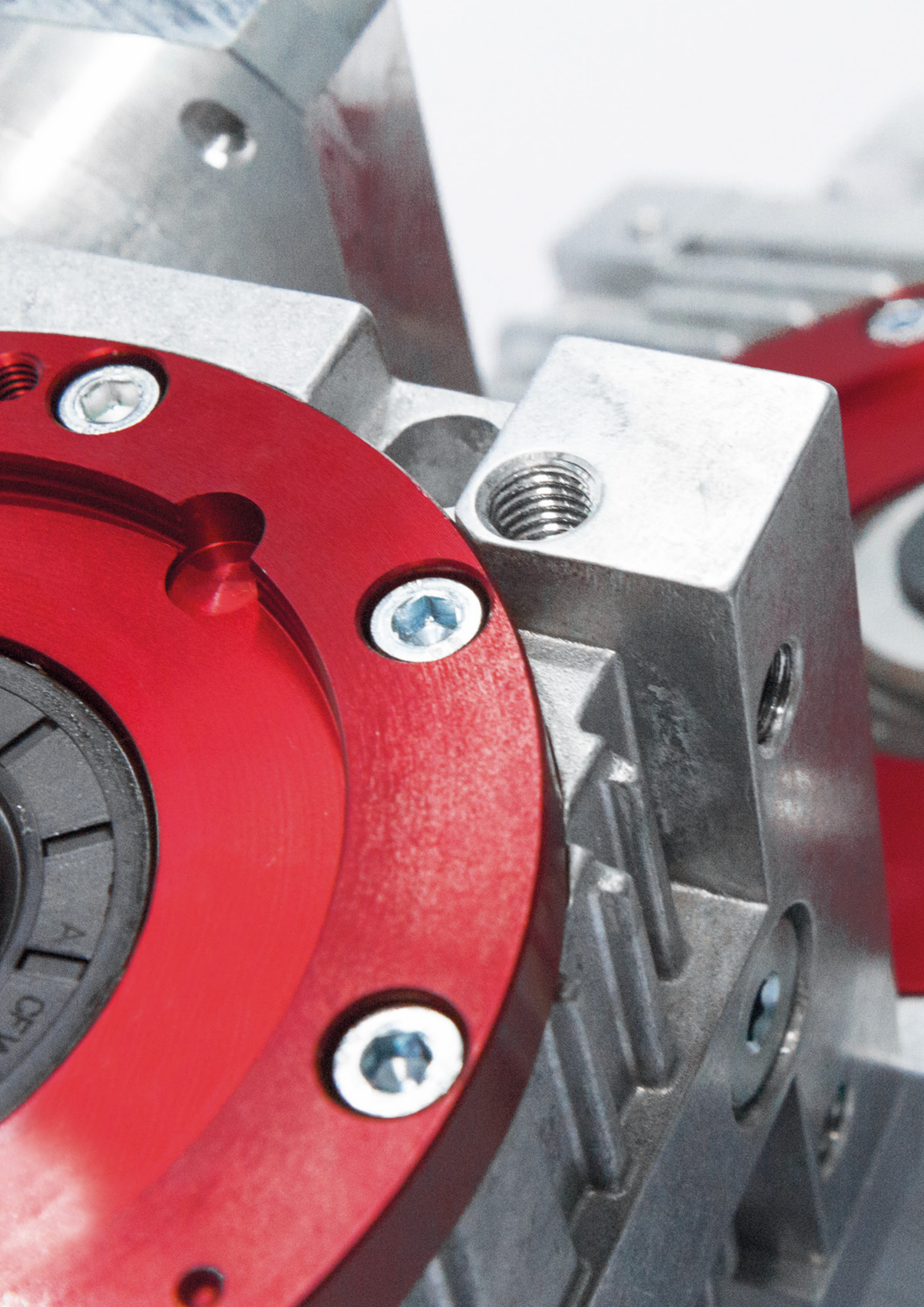

Content

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Güdel worldwide

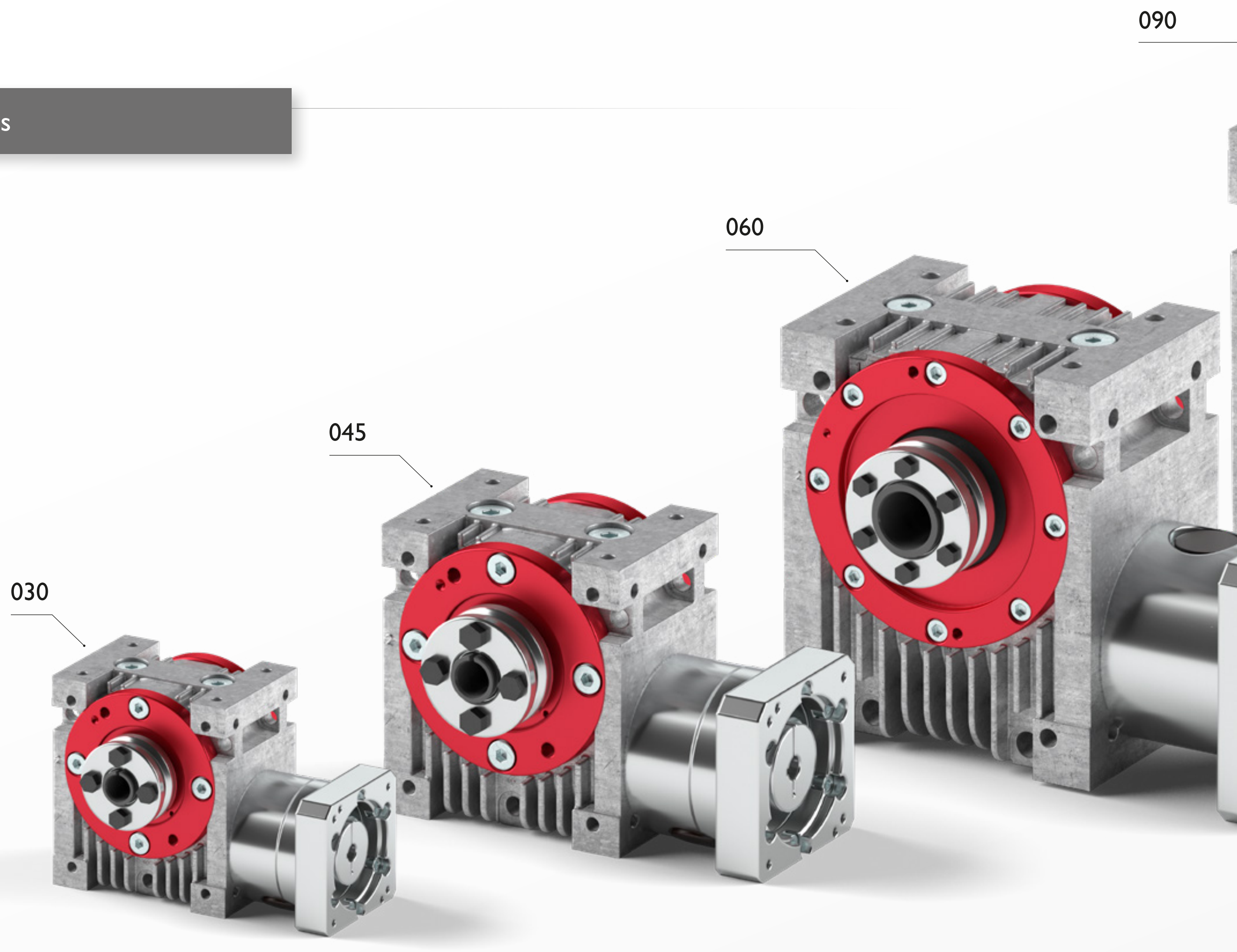
All about five –
All sizes at a glance

Our portfolio of high-performance angle gearboxes covers five different sizes. The names for the different sizes correspond to the center distance (in mm) between the input and output shafts: 030, 045, 060, 090 and 120. An extremely broad choice of gear ratios – thirteen in total, ranging from 2 to 60 – enables you to cover the most common areas of application.

Our high-performance angle gearboxes are ideal for all types of angular drives. They are used in mechanical engineering, handling technology and various process applications, and are characterized by their high quality, long service life and minimal maintenance requirements. Our high-performance angle gearboxes are ideally suited for harsh working environments. They are dirt-resistant and can also cope with applications that use very long strokes. Their cooling fins guarantee optimal heat dissipation.

We always have a sufficient quantity of all parts for all sizes of our high-performance angle gearboxes in stock so that we can guarantee quick delivery even at short notice.

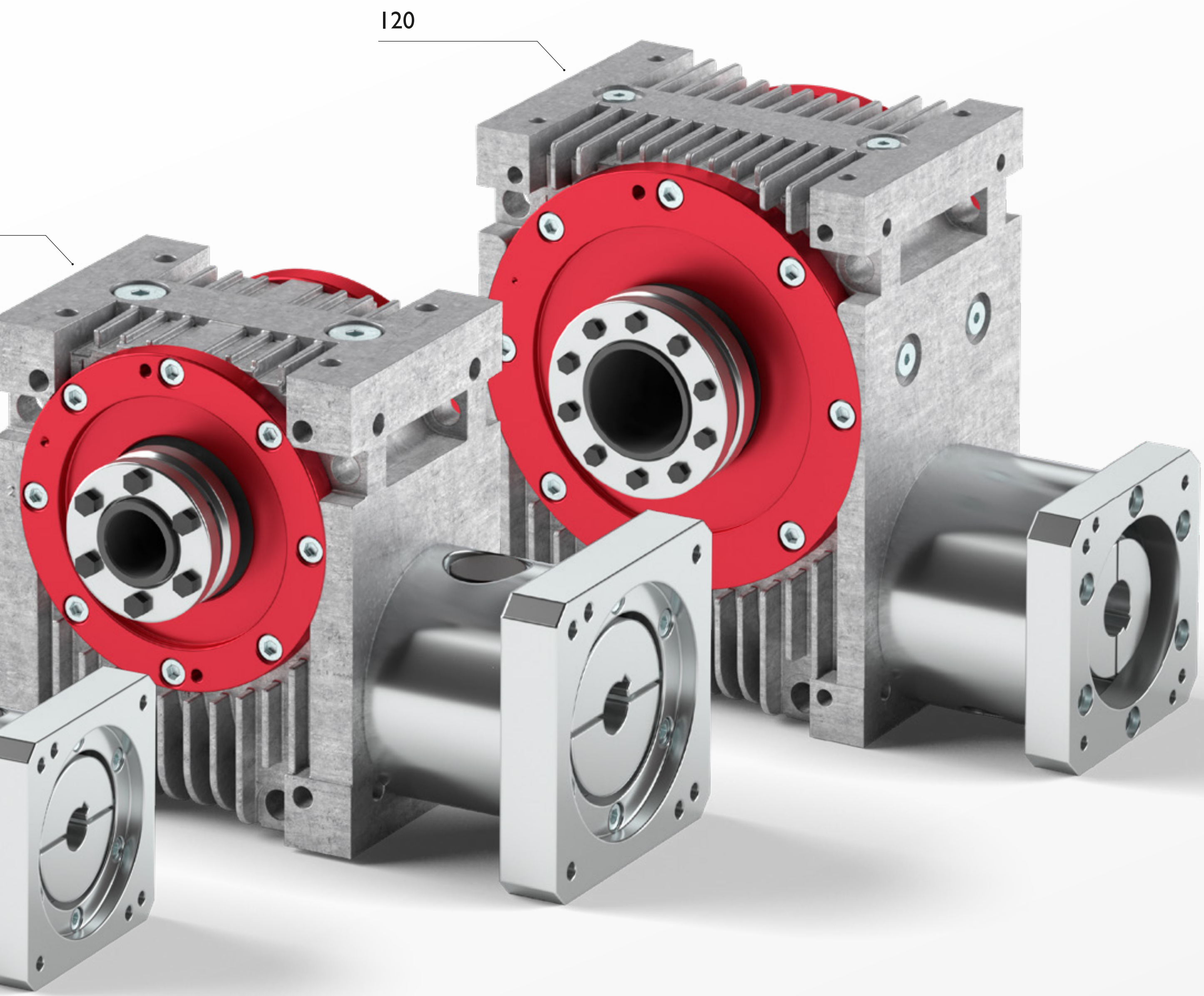
Sizes



Our modular principle allows all the input and output variants within a given size to be combined however you want, in order to achieve a result that is perfectly tuned to your specific application needs. Depending on the gear ratio, you can use the self-locking or no self-locking properties, or the transition area for your requirements.

In addition to their high availability and universal build, our high-performance angle gearboxes also boast special design features such as: closed casing for a range of installation positions, the option to adjust the precision (backlash), great flexibility as regards the motor choice and coupling (motor – gearbox), lubrication, a range of mounting options on all sides, centering at the output and options for centering at the input. All these design features help you to perfectly integrate the angle gearboxes into your machinery or equipment.

We manufacture and assemble the gearboxes in-house, using state-of-the-art production equipment. They are then thoroughly tested in accordance with our rigorous quality standards.



Precise or extra-precise – A choice of two grades

Our high-performance angle gearboxes are available in two precision grades. Precision grade PS stands for standard backlash and precision grade PR for reduced backlash.

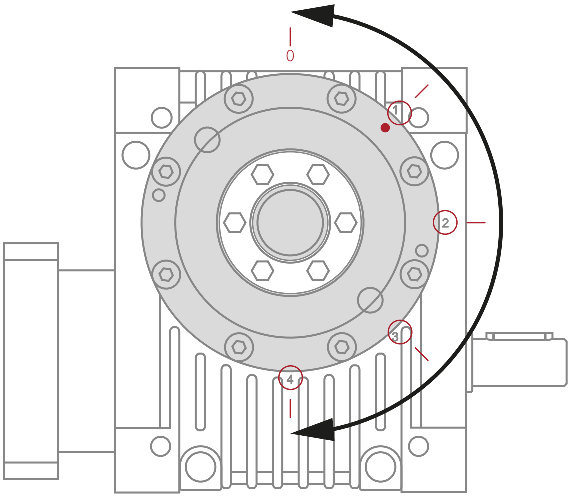
On the higher-precision gearbox (PR), the backlash can be more finely adjusted, with the backlash corresponding to the output shaft's angle of twist (arcmin). To allow for precision re-adjustments, an easy-to-use eccentric system in the output shaft area is standard on all gearboxes, making it possible to set and re-adjust the backlash quickly and easily.

The gearboxes are preset in the factory to the selected precision grade. No re-adjustment is necessary under normal operating conditions, as the increase in backlash should be minimal for gearboxes that are correctly dimensioned and maintained. Nevertheless, with our re-adjustment mechanism you can reset the backlash quickly, easily and safely over the entire service life – guaranteed. And there is no need to open up the gearbox to do this. You can easily make the re-adjustment yourself using the symmetric rotation of the eccentric flanges on either side of the output bearing. The position markings on the casing help you to define the eccentric position.

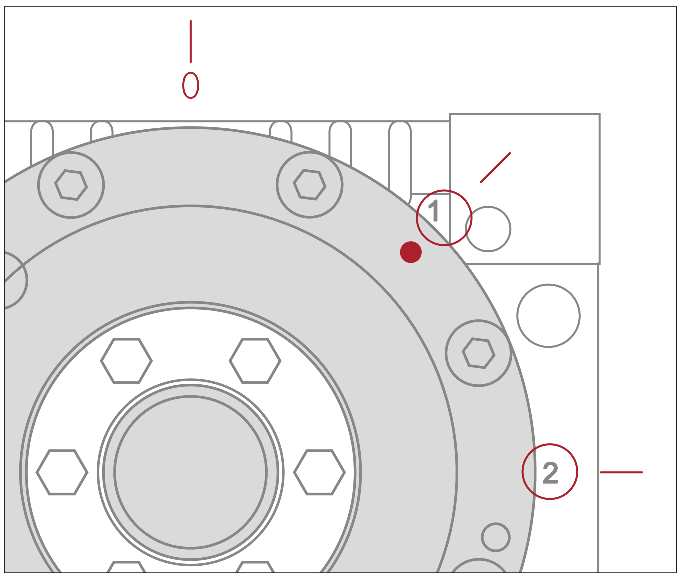
Adjustment backlash

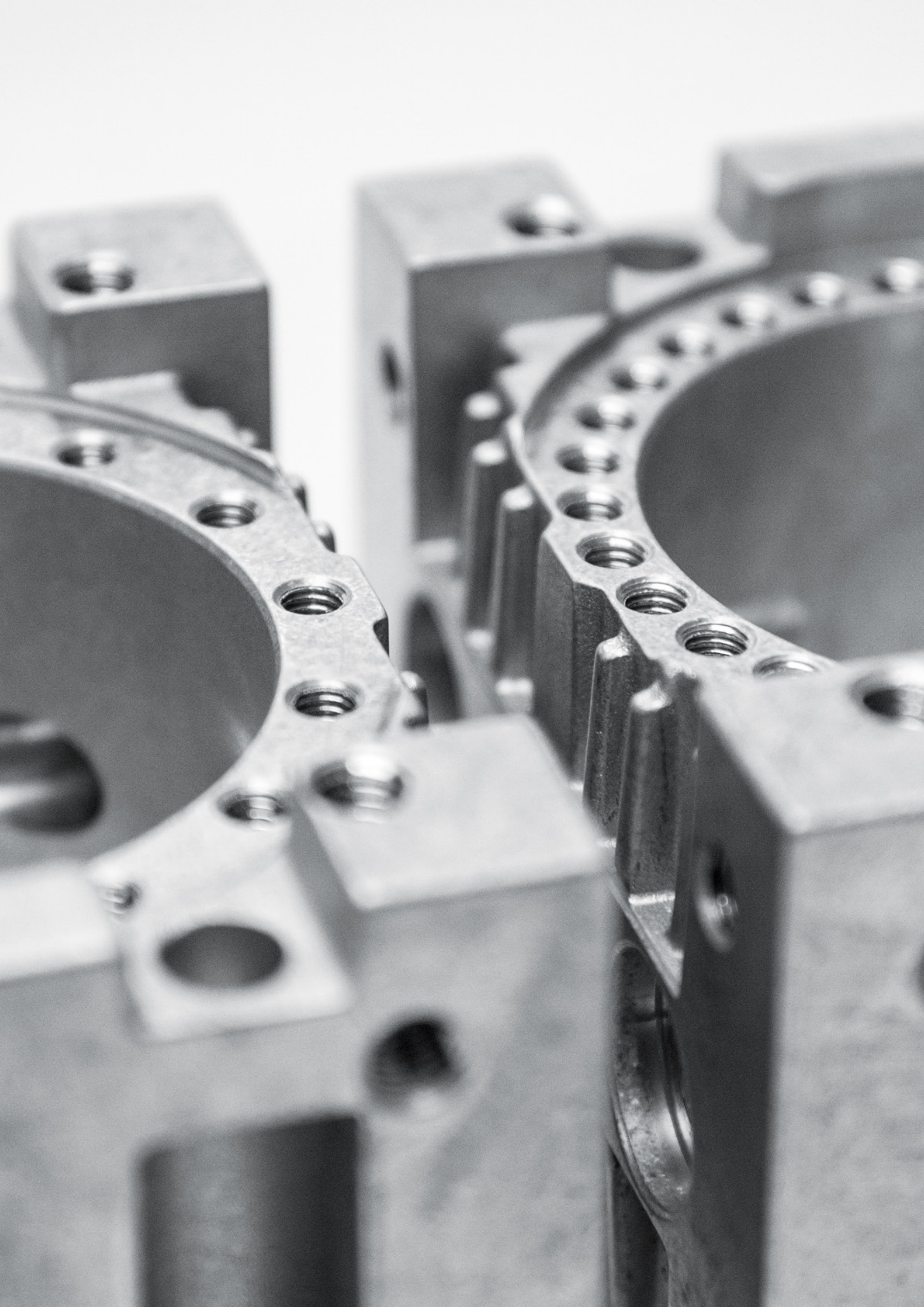
The backlash can be re-adjusted via the eccentric cover. Rotate both covers synchronously in the direction of the next higher number, (marked in red). Intermediate positions are possible.

Standard precision (higher backlash)



High precision (smaller backlash)





Make your decision – Speed & torque

On this double page you can narrow down your choice between our highperformance angle gearboxes. Make a selection based on your key requirements – speed and torque – to find the correct gearbox for your application.

Ratio & precision grades

Precision grade PS – standard backlash [arcmin]

PS

Size	Ratio i: no self-locking 2	3	4	5	6	8	10	13.33	16	transition area 24	30	self-locking 47	60
030	22	18	16	16	14	12	12	12	12	12	11	11	11
045	15	12	11	11	9	8	8	8	8	8	7	7	7
060	13	10	9	9	8	7	7	7	7	7	6	6	6
090	10	8	7	7	6	6	6	6	6	6	5	5	5
120	8	7	6	6	5	5	5	5	5	5	4	4	4

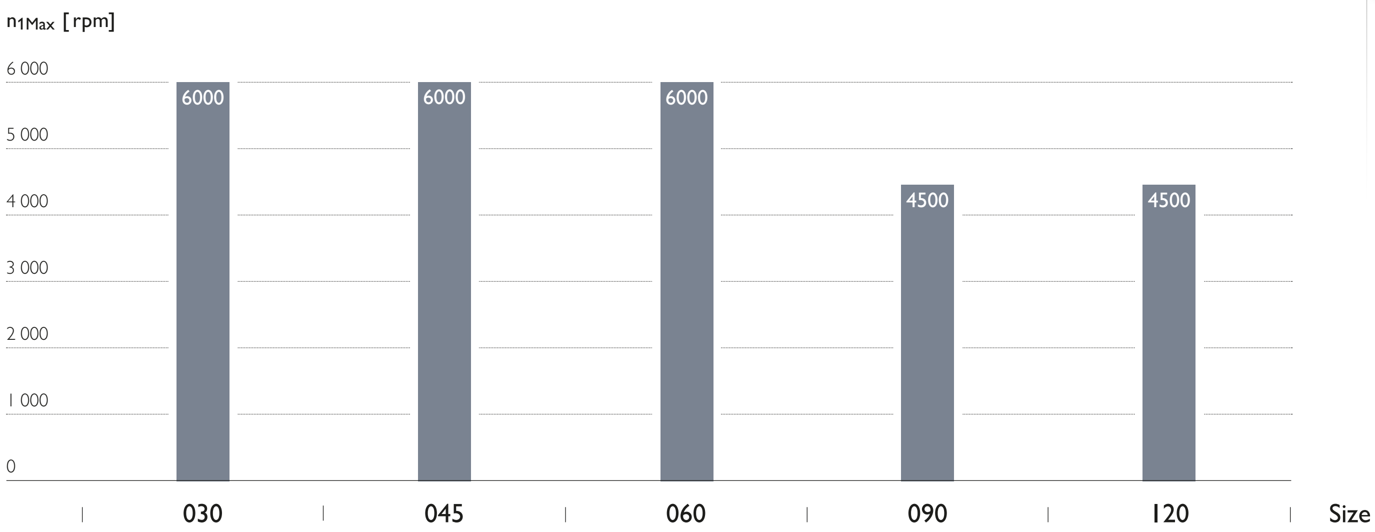
Precision grade PR – reduced backlash [arcmin]

PR

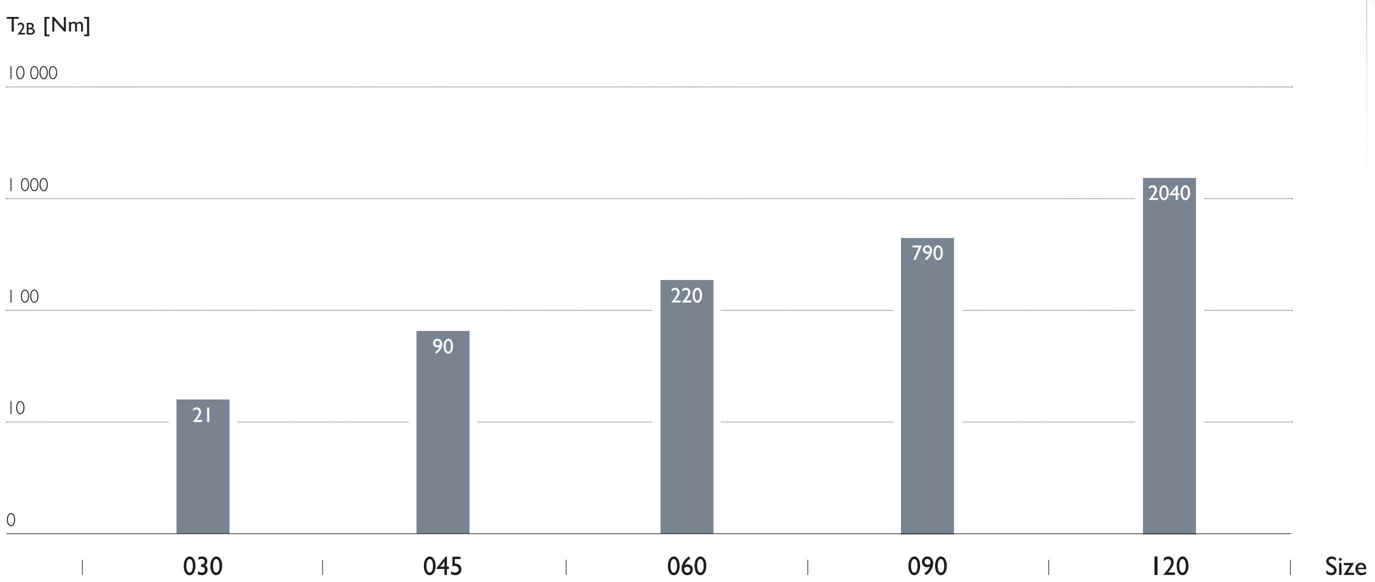
Size	Ratio i: no self-locking 2	3	4	5	6	8	10	13.33	16	transition area 24	30	self-locking 47	60
045	10	8	7	7	6	5.5	5.5	5.5	5.5	5.5	5	5	5
060	9	7	6	6	5	4.5	4.5	4.5	4.5	4.5	4	4	4
090	6.5	5	4.5	4	4	3.5	3.5	3.5	3.5	3.5	3	3	3
120	5.5	4.5	4	3.5	3	3	3	3	3	3	2.5	2.5	2.5

The following diagrams offer you a preselection of sizes based on the most important performance parameters, maximum speed and maximum torque. The values apply for a sample ratio i = 24.

Maximum rotation speed



Maximum torque

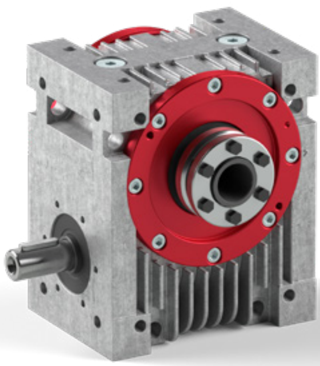


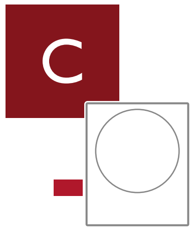
Standard inputs

Choose between two different input varieties. Our two standard inputs come with either a motor flange or a drive shaft.

On the input side of the gearbox there is a drive shaft with keyway, and on the output there is a shrink disc coupling. Optional, an maintenance free elastomer coupling together with a motor flange is available. These guarantee a backlash-free power train and make it possible to attach a variety of motors. Their dimensions are determined by the mounting dimensions of the motors.

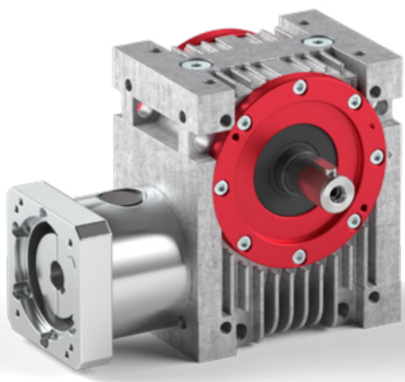
Inputs with drive shaft

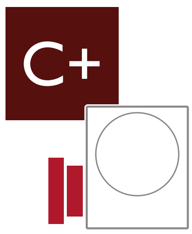




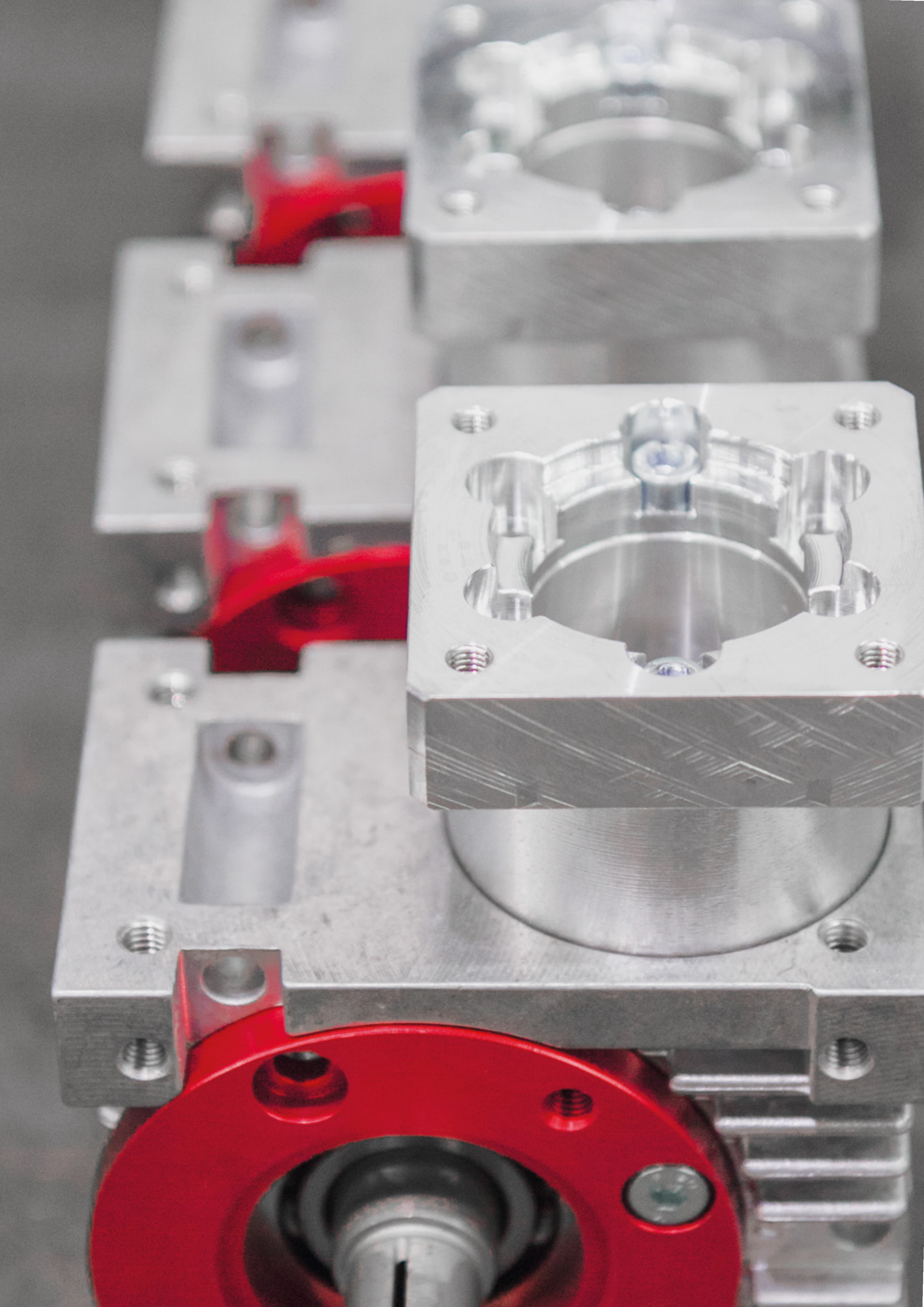
Drive shaft

Optional motor flange





Motor flange

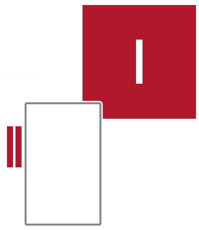


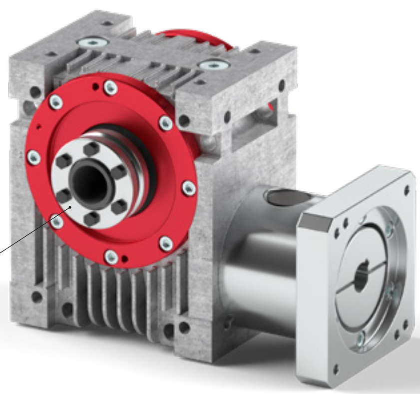
Meeting all your needs – We offer the appropriate outputs

With our comprehensive range of outputs, you are ideally equipped for every application. Our standard outputs allow you to choose whether you prefer the shrink disc on the right, or left-hand side, or even on both sides.

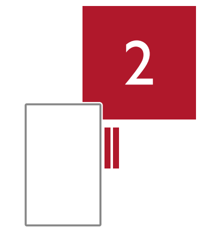
We offer three standard outputs and four optional outputs. The standard outputs include a hollow shaft with shrink disc on the left, hollow shaft with output on the right, and a hollow shaft with shrink disc on both sides of the output. The optional outputs include a shaft on the left of the output, on the right of the output, on both sides of the output, and a hollow shaft on both sides of the output.

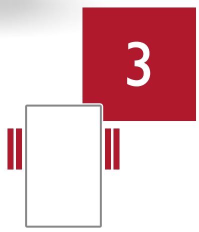
Outputs with shrink disc





Shrink disc
to the left (1),
to the right (2)* or
on both sides (3)

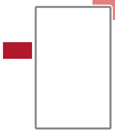




* Position right and left is defined by the motor view.

Outputs with shaft

4



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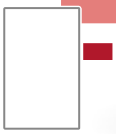
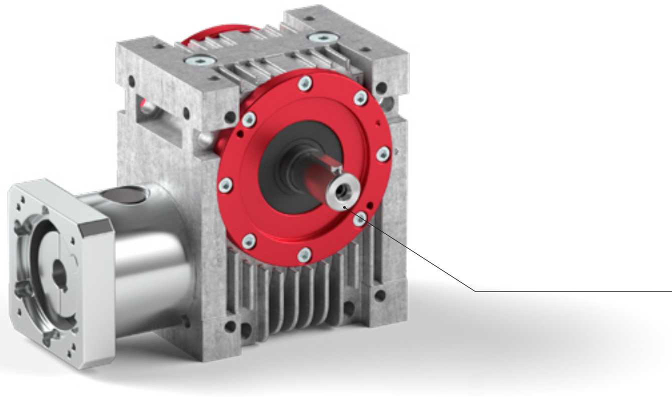
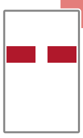


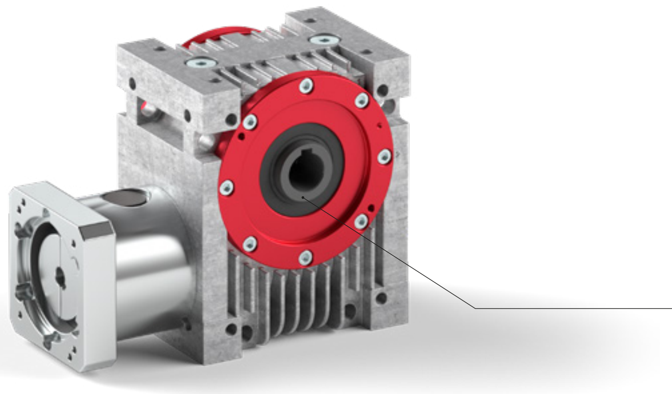


Shaft on the output
to the left (4),
to the right (5)* or
on both sides (6)

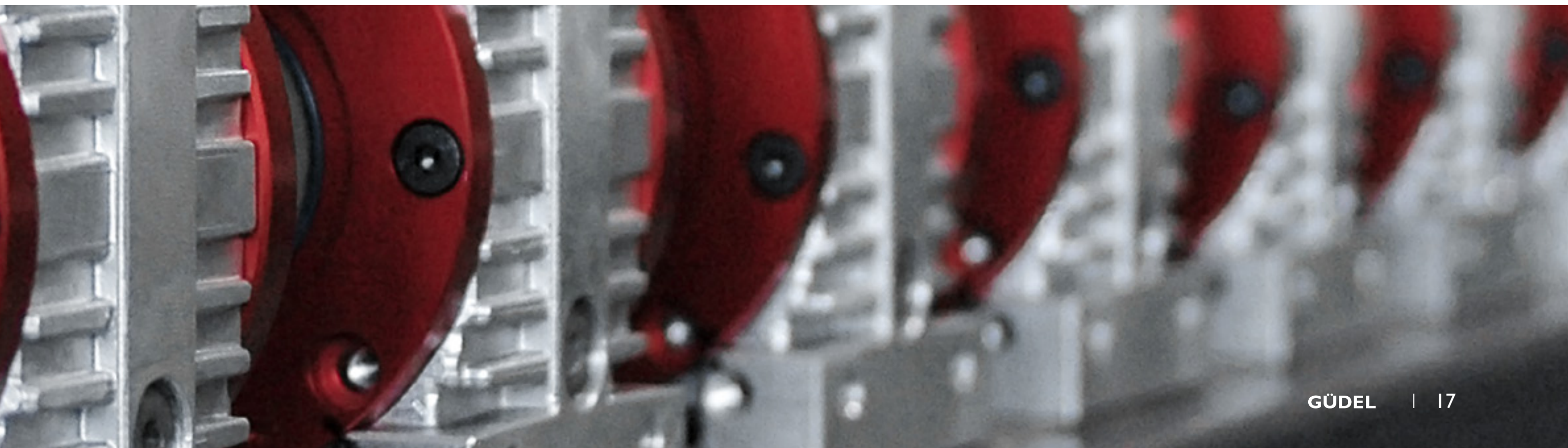
6

7





Hollow shaft on the output
on both sides (7)

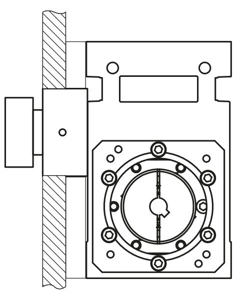


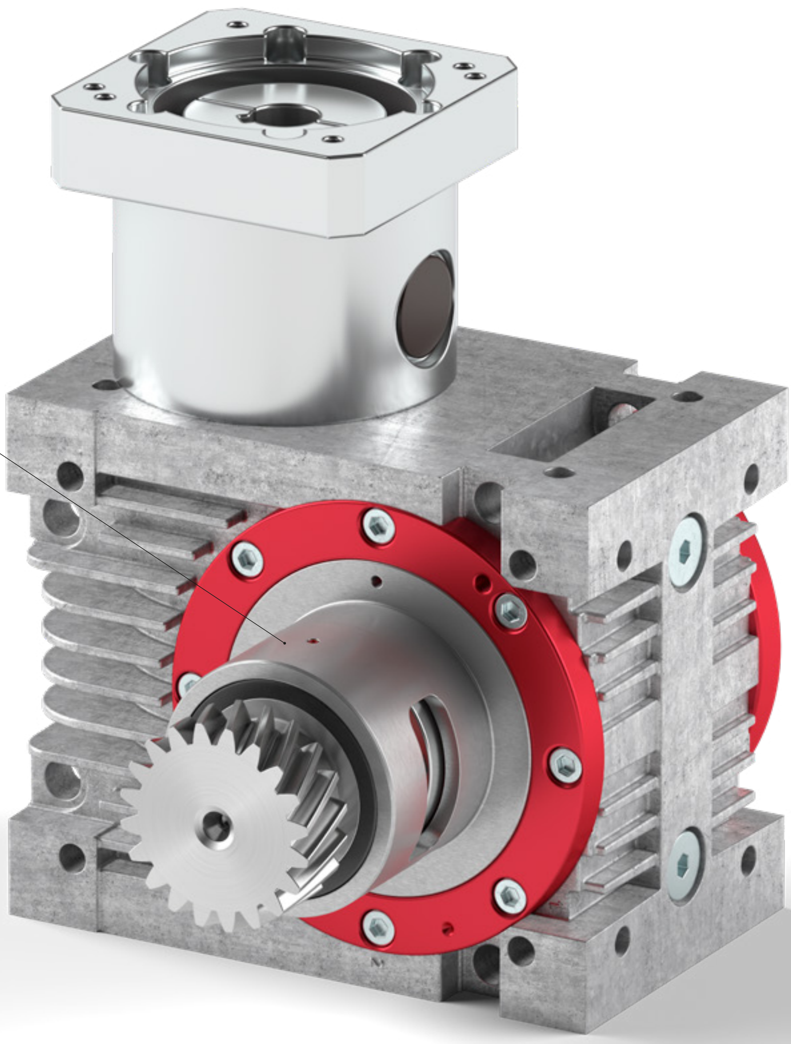
Adaptation options –
Preferably as a package

Standard outputs can easily be expanded to packages with our pinion and our output flange. The following choices are available: Shrink disc on the left with pinion and output flange, shrink disc on the right with pinion and output flange. In gearboxes with shrink discs on both sides of the output, an output flange can be positioned on either the left or the right side.

Package

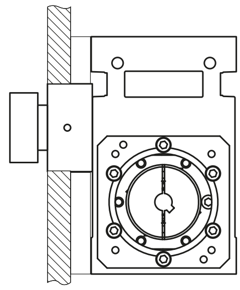
Good support for the
output bearing must be ensured.





Spacer elements

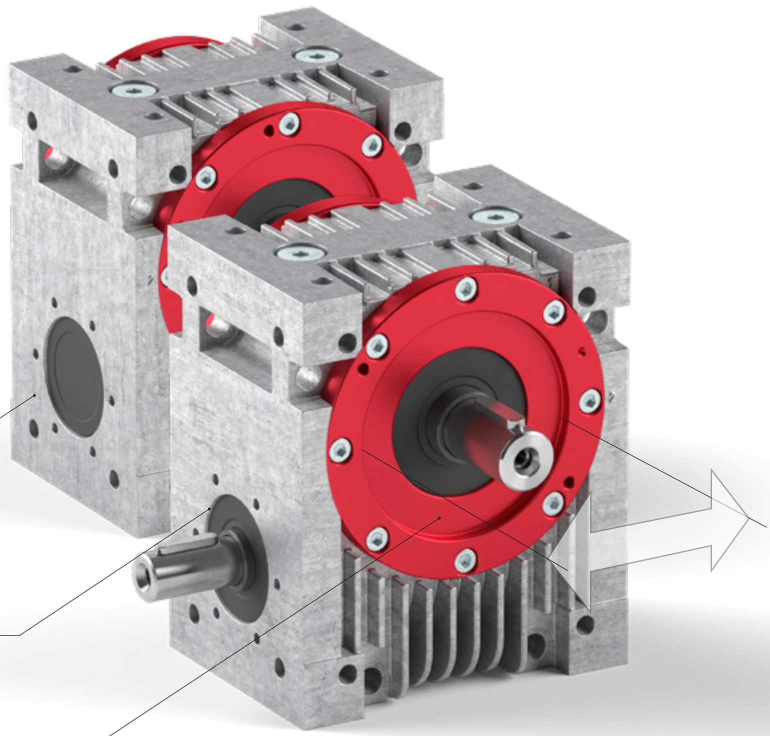
The optional distance elements enable you to attach large, powerful motors to your gearbox easily and without having to carry out any complex additional work on your existing component structure. Depending on the size, we provide spacing strips or plates as assembly elements.



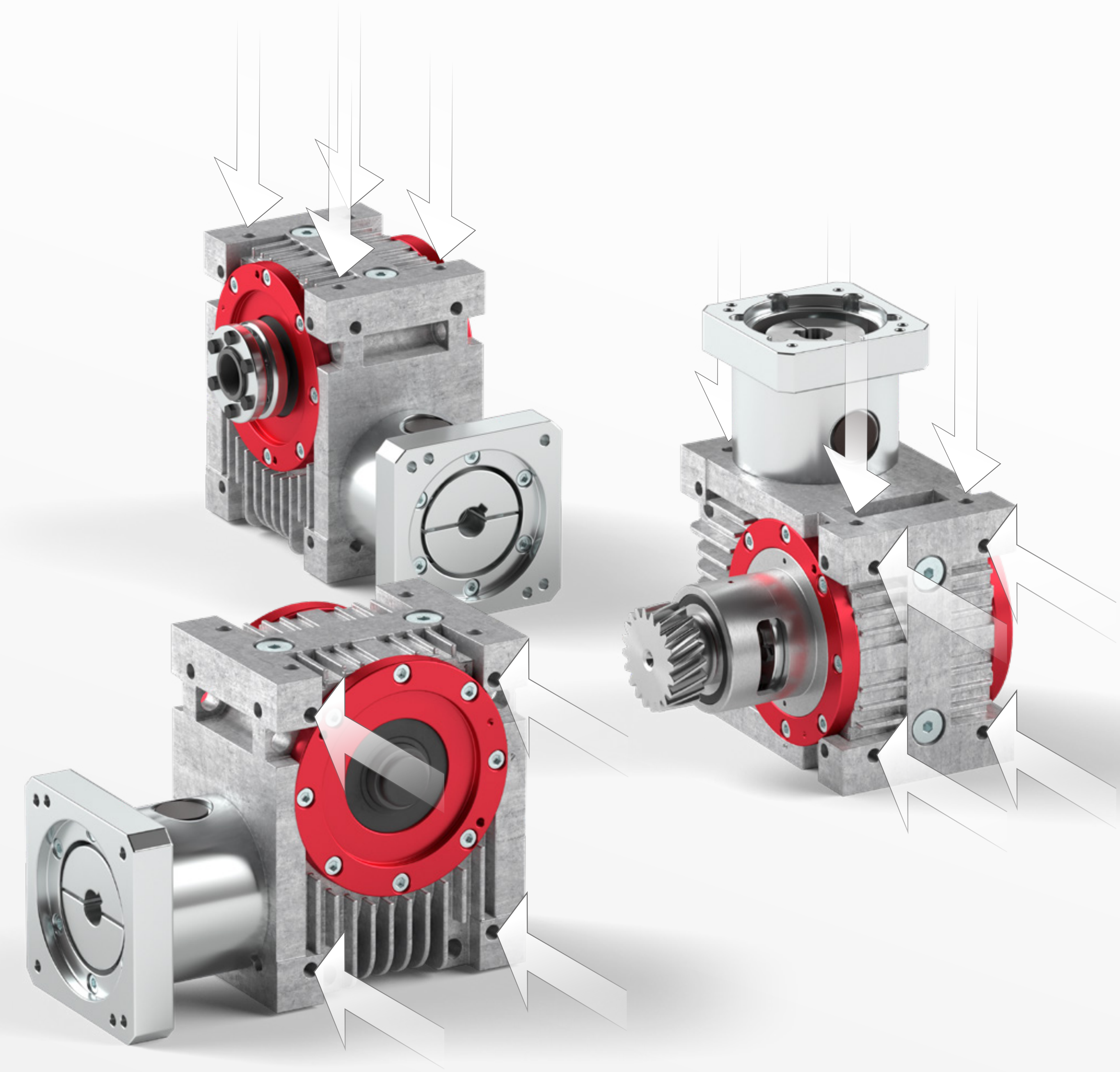
Additional benefits

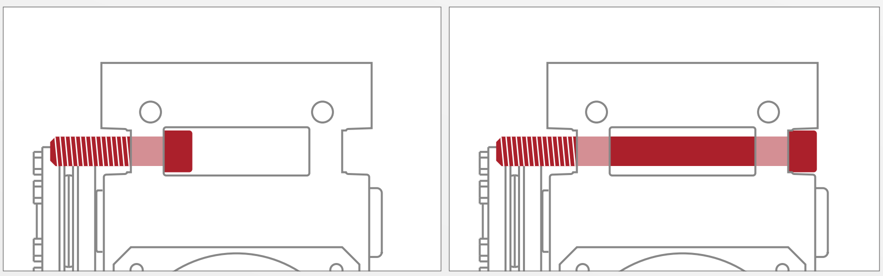
Precision centering option thanks to an additional function

Our high-performance angle gearboxes have a precise centering collar in the eccentric cover on the output side. This centering collar enables you to accurately align and mount the gearbox onto a shaft or bore hole on the output side.



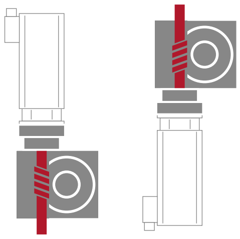
Universal fastening methods & positioning of your gearbox

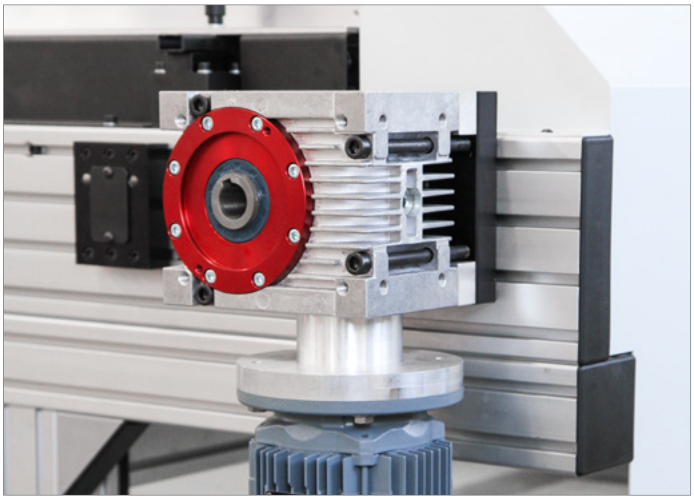




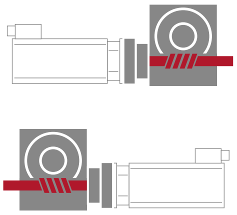
A huge range of fastening methods is possible, for example with long or short screws, as well as as through the multi-directional thread in the casing.

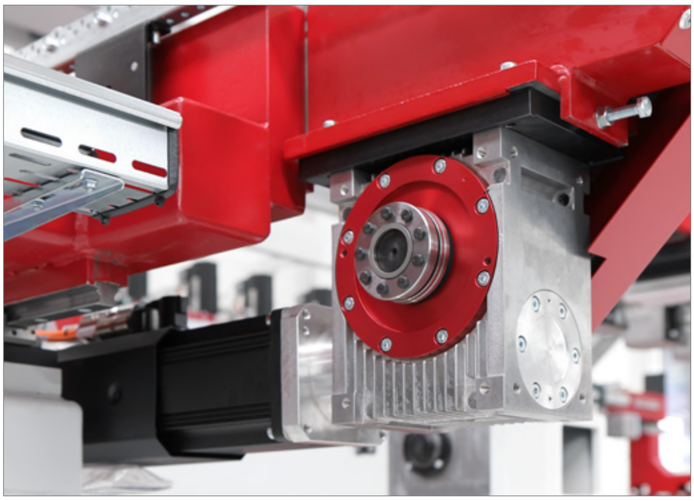
SS vertical worm standing



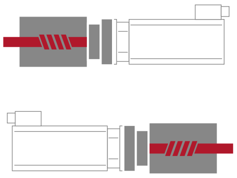


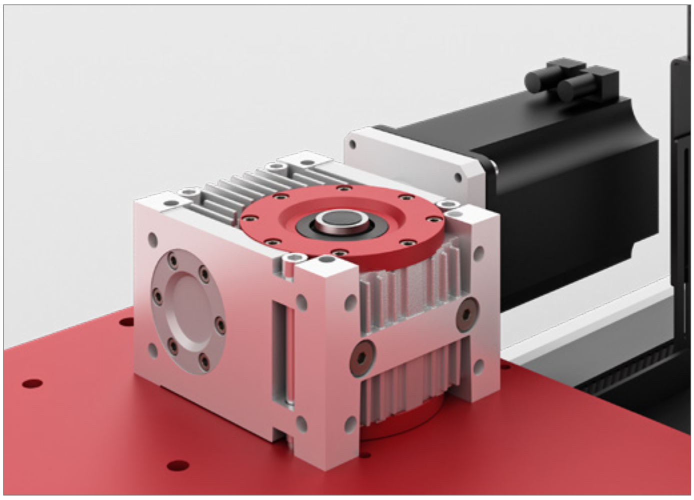
SU horizontal worm below



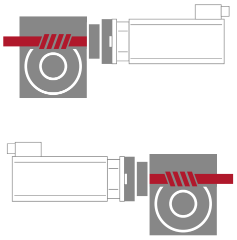


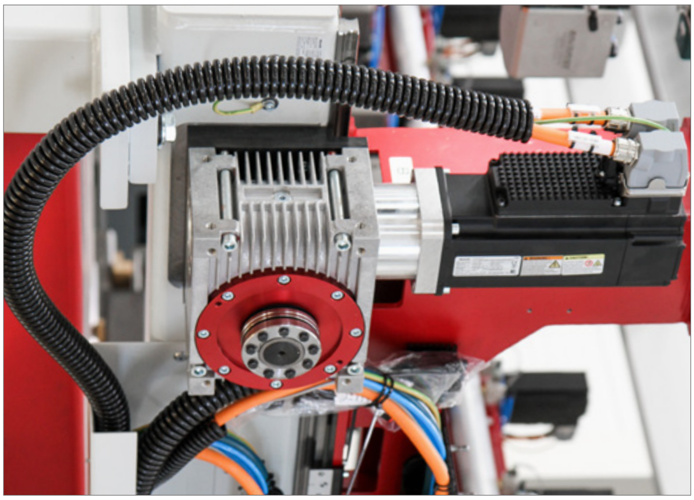
SL horizontal worm side





SO horizontal worm top





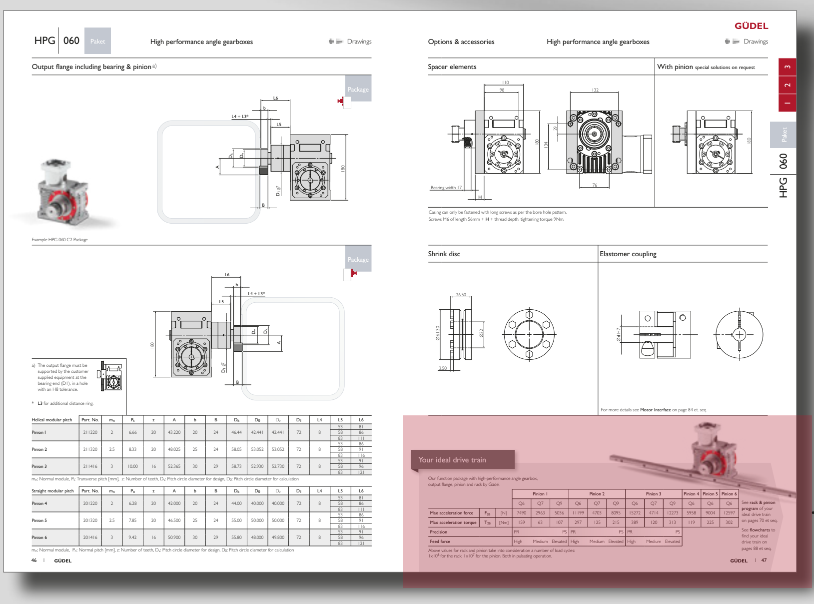
Your ideal drive train – Gearbox, rack & pinion

Our gearboxes can be easily combined with our racks and pinions into complete functional packages. The components from our product portfolio are ideal for your high-performance drive train.

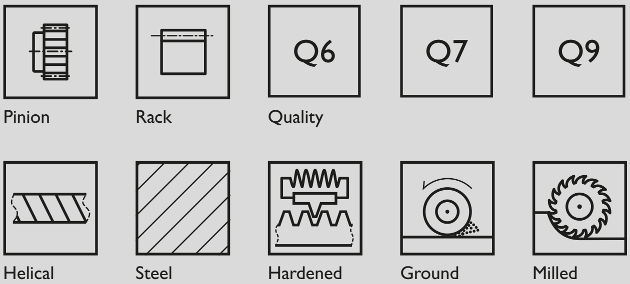
For linear systems with a rack-and-pinion drive, you can integrate high-precision, powerful drive pinions directly into our high-performance angle gearbox. The pinions are connected to the output with no backlash via non-positive tensioning elements.

For particularly demanding drive trains which are subject to high stresses, the integrated pinion can be given additional support from a output flange. There is an additional strong bearing in this output flange. This enables you to significantly increase the load-bearing capacity, service life, and rigidity of the pinion bearing. We recommend that the output flange be supported in a precision bore hole.

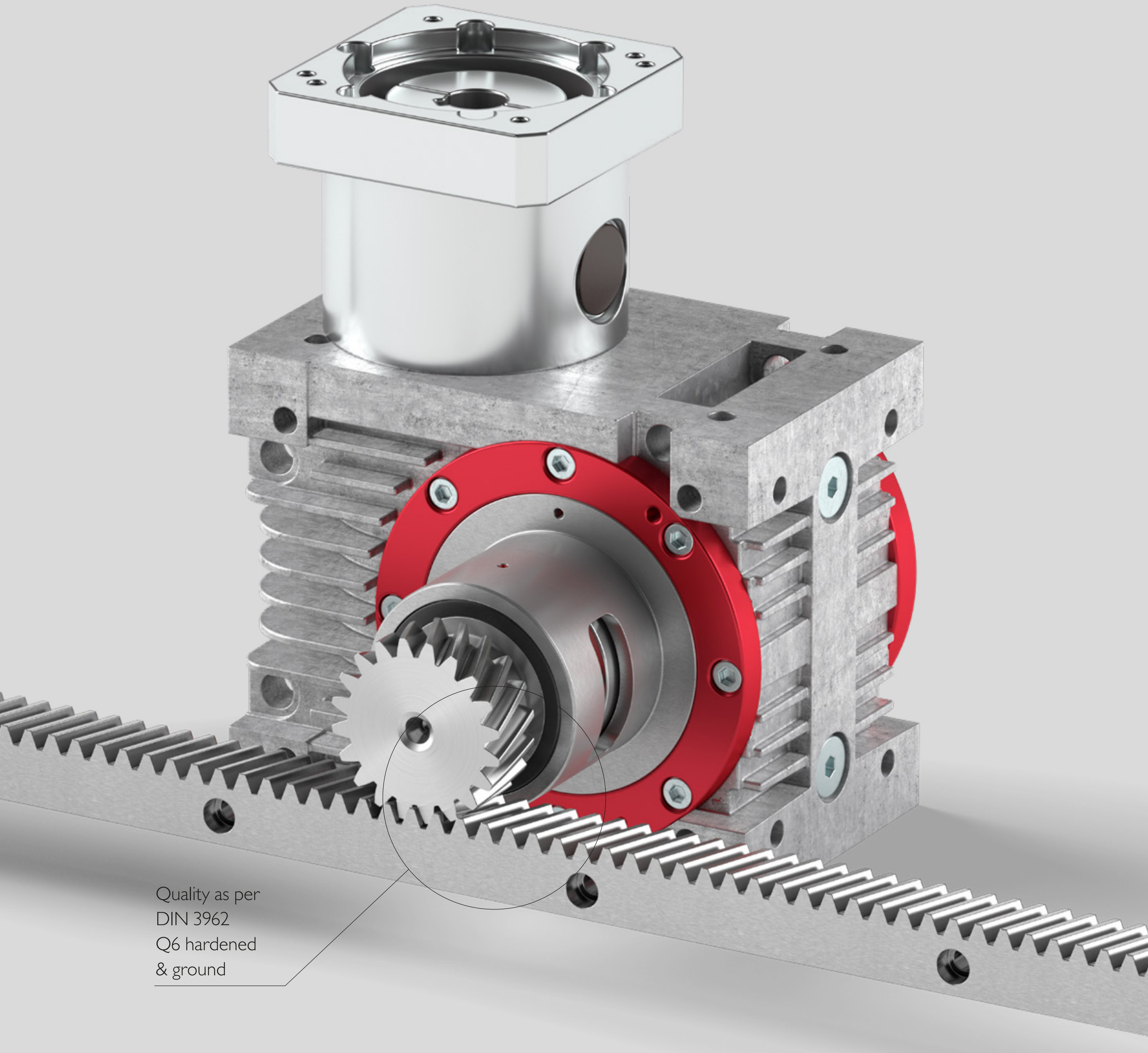
We offer our modular pinion and rack portfolio in different materials so that they can also be used in the food and chemical industry. You can also combine your selected gearbox with other Güdel products.



Detailed information on the technical data sheets **package, options & accessoires.**

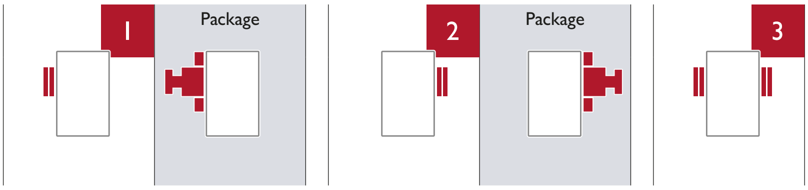


	High-end applications	Standard applications		Basic applications
Rack	Q6	Q7		Q9
Gearbox	PR	PR	PS	PS
Precision	High			Standard
Feed force	High	Medium		Elevated

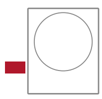


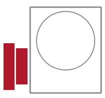
Find your appropriate size & configuration

Hollow shaft with shrink disc



Standard inputs with motor flange

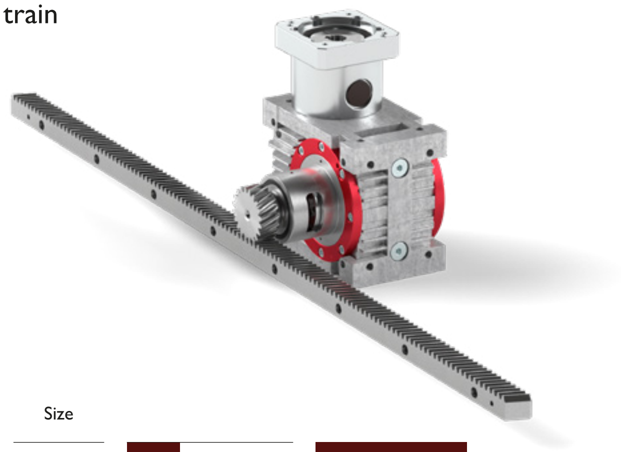




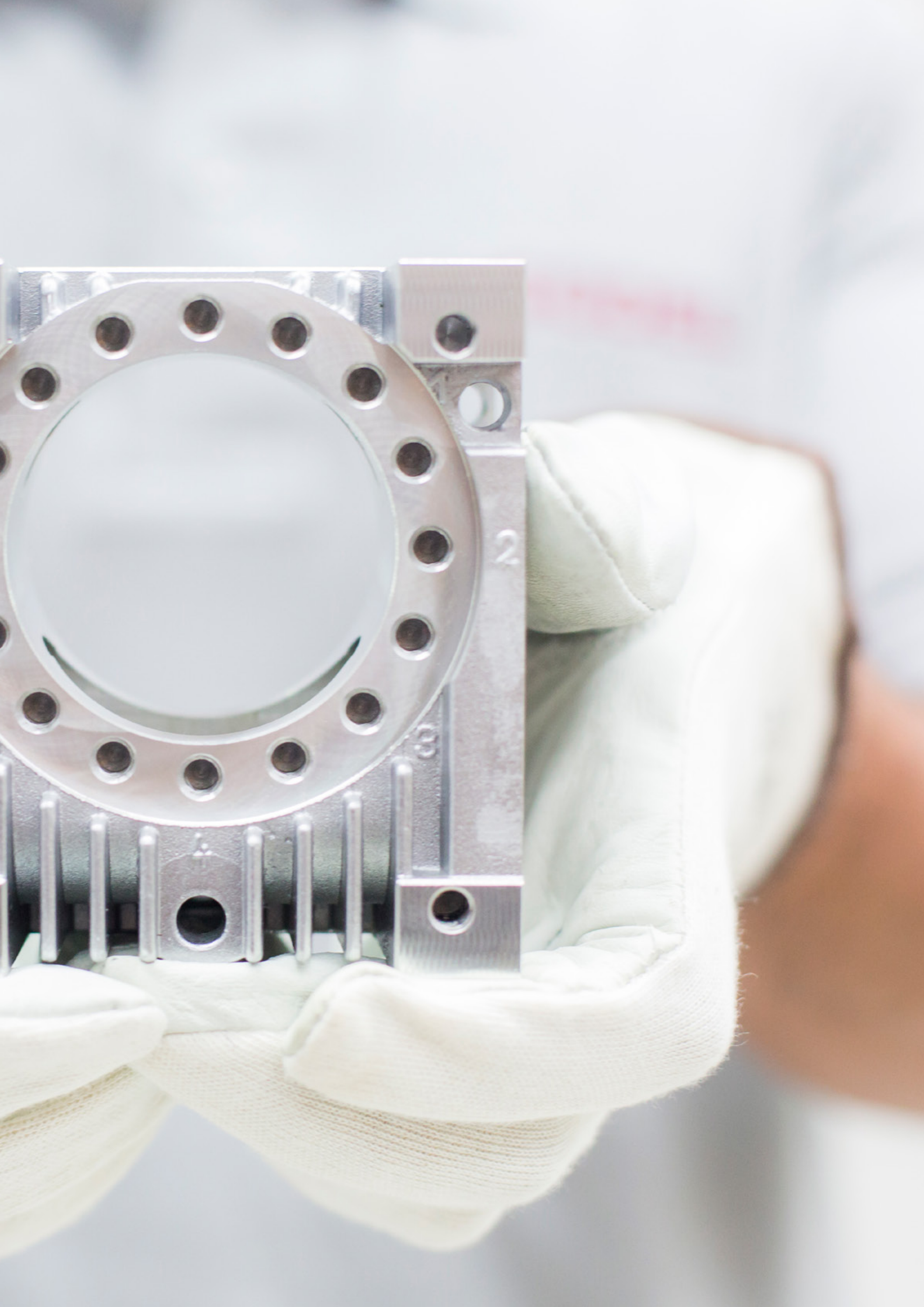
Input		Size	left: 1 Page	left: 1 Package Page	right: 2 Page	right: 2 Package Page	both sides: 3 Page
Drive shaft	C	030	28–29	30–31	28–29	30–31	28–29
		045	36–37	38–39	36–37	38–39	36–37
		060	44–45	46–47	44–45	46–47	44–45
		090	52–53	54–55	52–53	54–55	52–53
		120	60–61	62–63	60–61	62–63	60–61
Option with motor flange	C+	030	28–29	30–31	28–29	30–31	28–29
		045	36–37	38–39	36–37	38–39	36–37
		060	44–45	46–47	44–45	46–47	44–45
		090	52–53	54–55	52–53	54–55	52–53
		120	60–61	62–63	60–61	62–63	60–61

Output shaft

Your ideal drive train



	left	right	both sides	both sides	Rack & pinion program			
	4	5	6	7				
	Page	Page	Page	Page	Page	Size		
Standard inputs with motor flange	32–33	32–33	32–33	34–35	70–78	030	C	Drive shaft
	40–41	40–41	40–41	42–43		045		
	48–49	48–49	48–49	50–51		060		
	56–57	56–57	56–57	58–59		090		
	64–65	64–65	64–65	66–67		120		
	32–33	32–33	32–33	34–35		030	C+	Option with motor flange
	40–41	40–41	40–41	42–43		045		
	48–49	48–49	48–49	50–51		060		
	56–57	56–57	56–57	58–59		090		
	64–65	64–65	64–65	66–67		120		



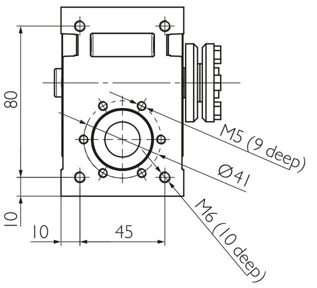
Technical data sheets

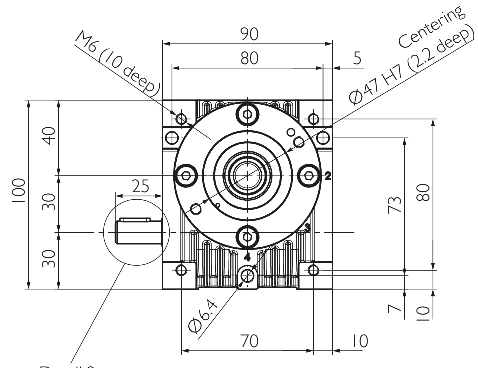
GÜDEL

Input

C

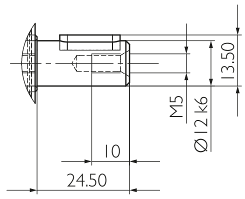
View y

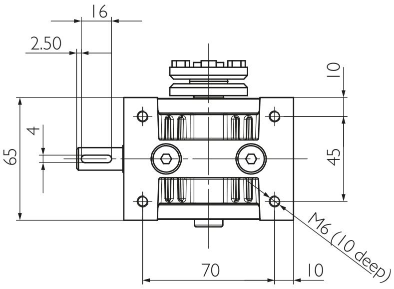


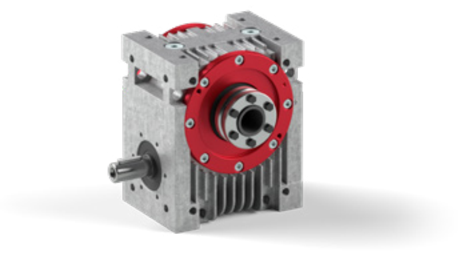


Detail 2

Detail 2

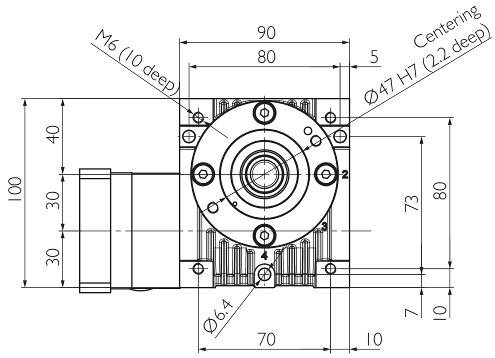


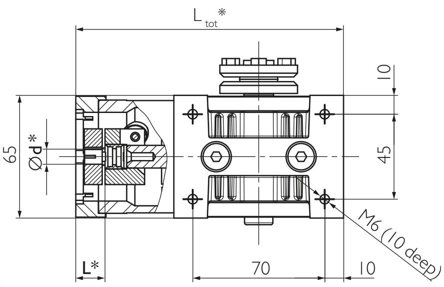


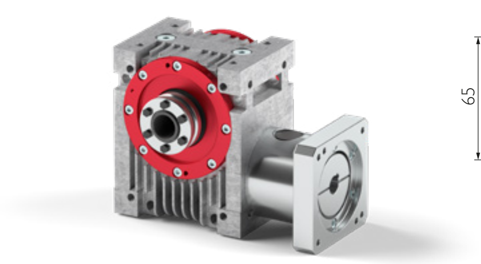


Example HPG 030 C2

C with option motor flange







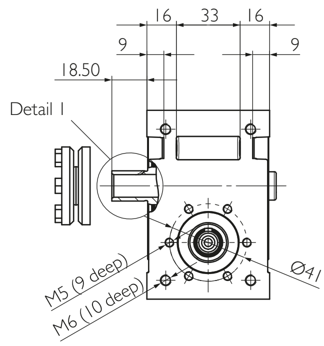
Example HPG 030 C1

* Motor-specific gearbox dimensions

Output

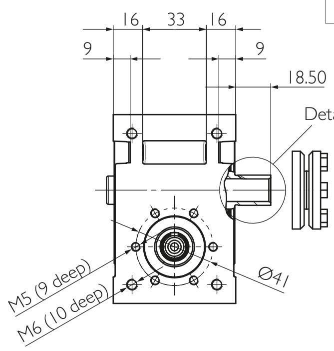
1

View x



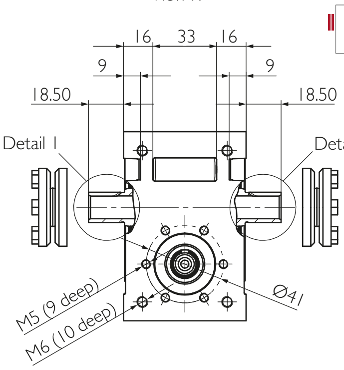
2

View x

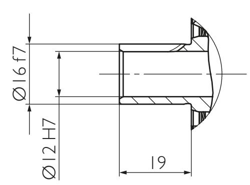


3

View x



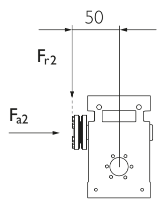
Detail 1



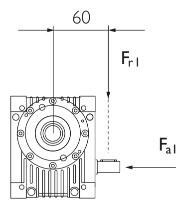
Ratio	i			2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	12.9	17.9	20.1	19.2	16.9	19.4	17.9	17.5	19.5	19.0	8.6	18.8	8.6
		η	[%]	85	84	83	81	80	76	74	67	63	54	48	40	30
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	11.3	16.0	18.3	17.5	15.5	17.9	16.6	16.2	18.1	17.6	8.6	17.5	8.6
		η	[%]	86	86	85	83	81	77	74	68	65	55	50	44	40
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	10.0	14.4	16.7	16.2	14.3	16.6	15.4	15.1	16.9	16.4	8.6	16.3	8.6
		η	[%]	86	86	85	83	80	77	73	68	64	54	49	45	40
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	7.4	11.2	13.3	13.1	11.7	13.7	12.8	12.6	14.0	13.7	8.6	13.6	8.6
		η	[%]	84	84	83	81	77	74	71	67	62	53	48	44	40
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	5.9	9.2	11.0	11.0	9.9	11.6	10.9	10.8	12.0	11.8	10.0	11.7	10.0
		η	[%]	81	82	81	78	76	73	69	65	60	51	47	42	37
	n_{1N} = 6000 rpm	T_{2N}	[Nm]	4.9	7.8	9.4	9.4	8.6	10.1	9.5	9.4	10.5	10.3	10.0	10.2	10.0
		η	[%]	79	79	78	77	75	72	68	62	56	47	42	37	33
Max. acceleration torque		T_{2B}	[Nm]	13	21									10	21	10
Emergency stop torque		T_{2Not}	[Nm]	35										20	35	20
Idling torque[a)]		T_{012}	[Nm]	0.65			0.6				0.5					
Max. input speed		n_{1Max}	[rpm]	6000												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<22	<18	<16	<16	<14	<12					<11		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	0.3	0.45	0.58	0.63	0.66	0.68	0.72	0.74	0.78	0.8	0.75	0.85	0.75
Stability at the output		C_{2K}	[Nm/arcmin]	27												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	910	1200	1500	1800	2200	2100	2300	2500	2700	2900	3100	2900	3100
Max. radial force[c)e)] at the output		F_{r2max}	[N]	640	740	850	970	1100	980	1000	1000	1100	1200	1300	1300	1300
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	32	37	42	48	54	49	50	52	54	60	67	65	67
Max. axial force[c)d)] at the input		F_{a1max}	[N]	890	740	700	780	890	820	890	910	860	880	1100	890	1100
Max. radial force[c)f)] at the input		F_{r1max}	[N]	280	270	280	300	320	320	330	340	330	340	360	340	360
Mass moment of inertia[g)]		J_1	$[10^{-7}\ kg\ m^2]$	230	110	68	49	38	28	23	19	18	16	15	15	15
Mass moment of inertia[g) h)]		J_1	$[10^{-7}\ kg\ m^2]$	280	161	119	100	89	79	74	70	69	67	66	66	65
Mass moment of inertia[g) i)]		J_1	$[10^{-7}\ kg\ m^2]$	510	390	348	329	318	308	303	299	298	296	295	295	295
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	1.7												
Weight with motor components		m	[kg]	≈ 2.2												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000 rpm and operating temperature.
b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
c) Bearing forces: Values valid at n_1 = 3000 rpm; ⅔ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
 c) d) in relation to shaft center.
 c) e) at a distance of 50 mm from the middle of the casing.
 c) f) at a distance of 60 mm from the middle of the casing.
g) in relation to the input, including shrink disc at the output (output 1 & 2), with two shrink discs (output 3) increase values by $360/i^2$.
 g) h) including elastomer coupling 5103-14 (calculated with drilled hole for motor shaft-Ø15)
 g) i) including elastomer coupling 5103-19 (calculated with drilled hole for motor shaft-Ø15)

Bearing forces



at the output

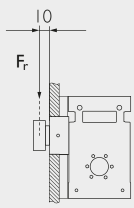


at the input

Package

			Output flange including bearing & pinion				
Radial rigidity	C_3	[N/mm]	22000				
Speed	n_{2N}	[rpm]	1500	750	400	150	100
Max. radial force[j)]	F_{rmax}	[N]	1100	1350	1500	1600	1700

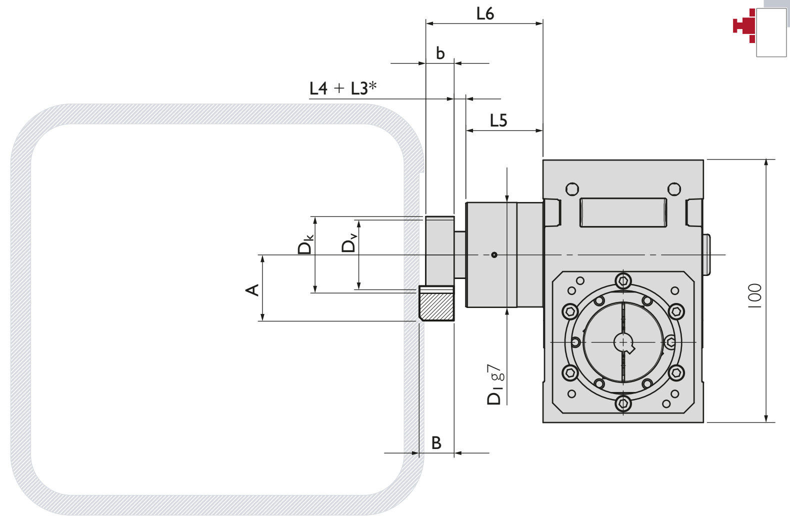
j) Bearing forces: Values valid at duty cycle of 40% at a distance of 10mm from the end of the bearing.



Detailed information about the package, options & accessories on pages 30 and 31.

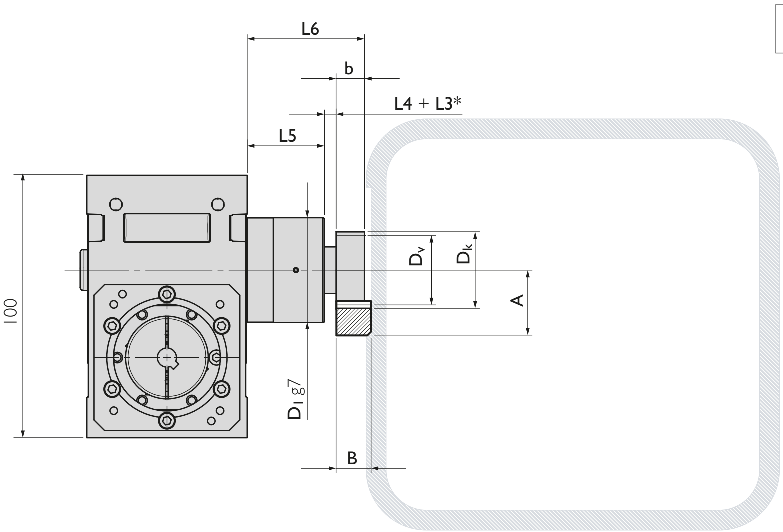
Output flange including bearing & pinion a)

Package

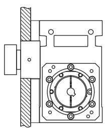


Example HPG 030 C2 Package

Package



a) The output flange must be supported by the customer supplied equipment at the bearing end (D1), in a hole with an H8 tolerance.



* **L3** for additional distance ring.

Geometric information

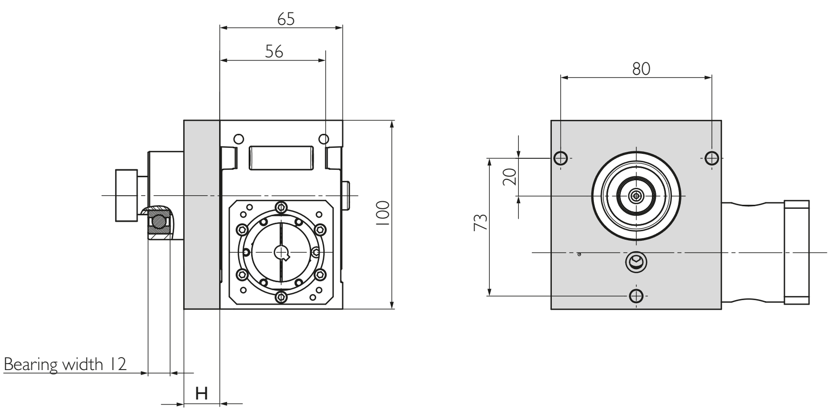
Helical mudolar pitch	Part. No.	m_n	P_t	z	A	b	B	D_k	D_0	D_v	D_1	L4	L5	L6
Pinion 1	211116	1.5	5.00	16	30.680	20	19	29.36	25.465	26.365	47	4.5	38	62.5
													43	67.5

m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

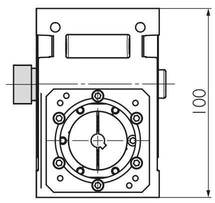
Straight modular pitch	Part. No.	m_n	P_n	z	A	b	B	D_k	D_0	D_v	D_1	L4	L5	L6
Pinion 2	201116	1.5	4.72	16	29.95	20	19	27.90	24.000	24.900	47	4.5	38	62.5
													43	67.5

m_n: Normal module, P_n: Normal pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

Spacer elements

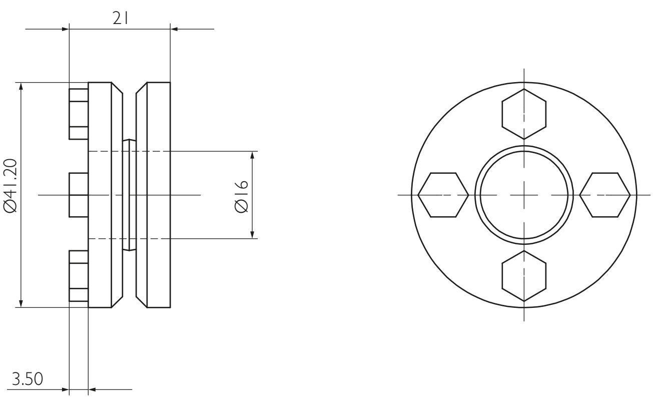


With pinion special solutions on request

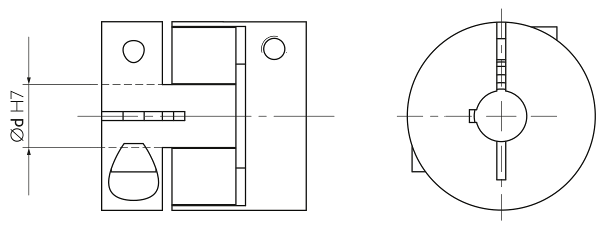


Casing can only be fastened with long screws as per the bore hole pattern.
Screws M6 of length 56mm + **H** + thread depth, tightening torque 9Nm.

Shrink disc

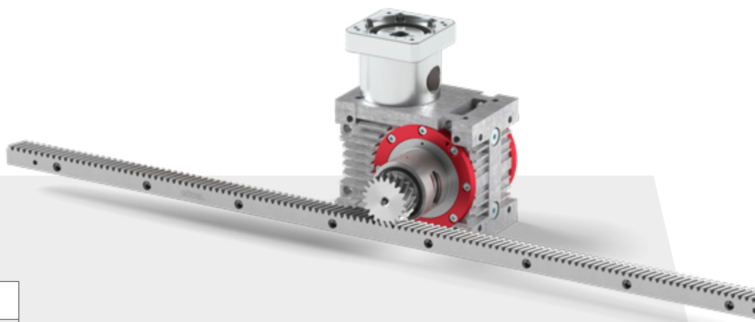


Elastomer coupling



For more details see **Motor Interface** on page 84 et. seq.

Your ideal drive train



Our function package with high-performance angle gearbox, output flange, pinion and rack by Güdel.

			Pinion 1			Pinion 2
			Q6	Q7	Q9	Q6
Max acceleration force	F_{2B}	[N]	4724	1221	2352	2888
Max acceleration torque	T_{2B}	[Nm]	60	16	30	35
Precision			PR		PS	
Feed force			High	Medium	Elevated	

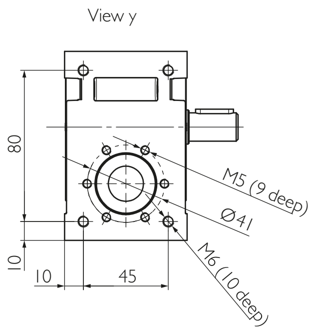
Above values for rack and pinion take into consideration a number of load cycles:
1×10^6 for the rack; 1×10^7 for the pinion. Both in pulsating operation.

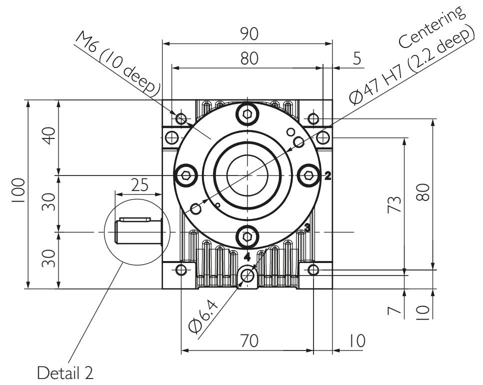
See **rack & pinion program** of your ideal drive train on pages 70 et seq.

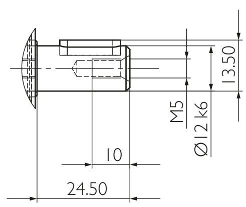
See **flowcharts** to find your ideal drive train on pages 88 et seq.

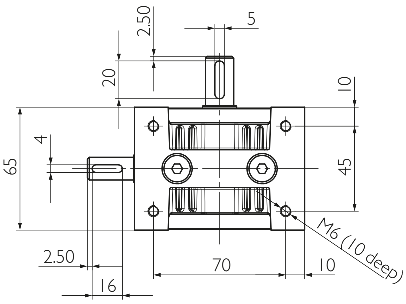
Input

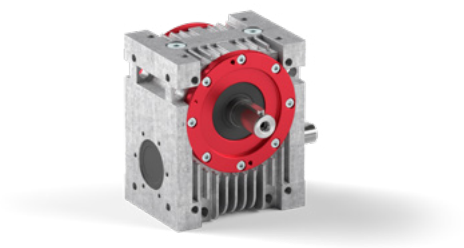
C





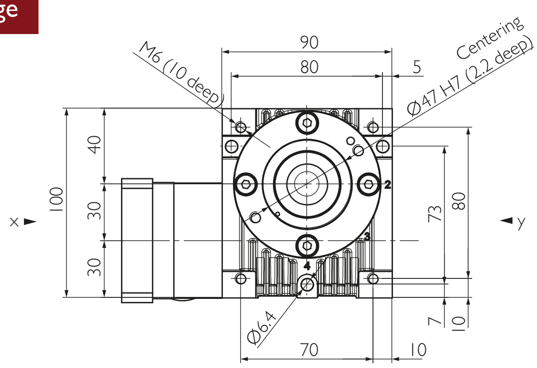


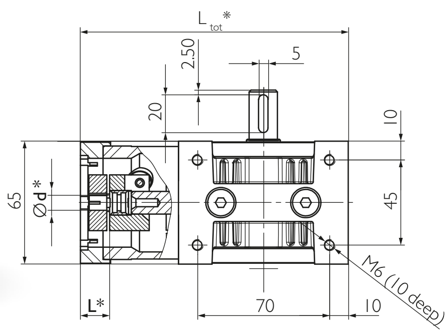


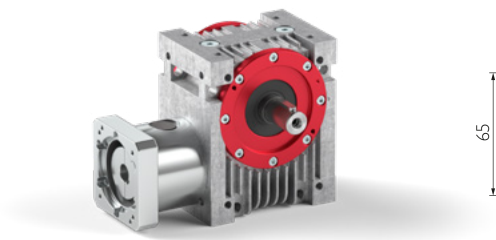


Example HPG 030 C4

C with option motor flange





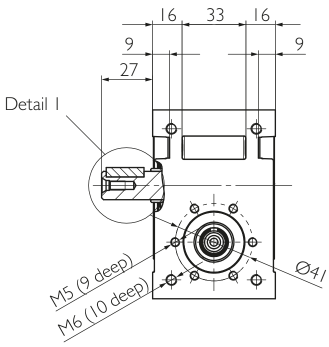


Example HPG 030 C6

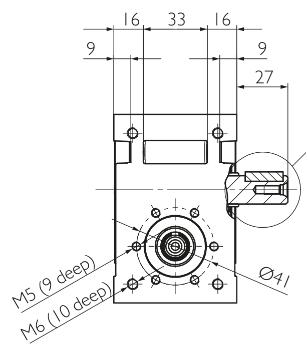
* Motor-specific gearbox dimensions

Output

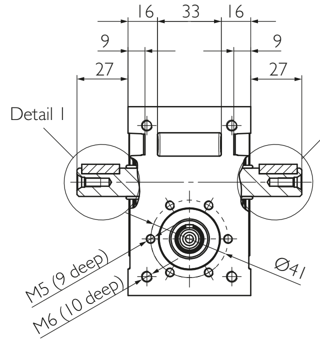
4

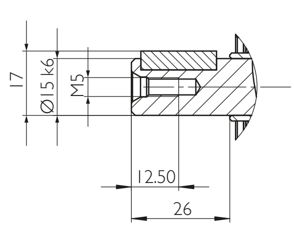


5



6

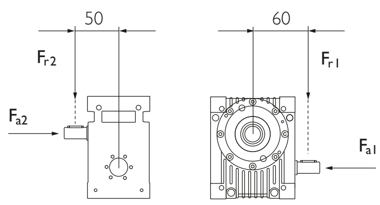




Ratio	i			2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	12.9	17.9	20.1	19.2	16.9	19.4	17.9	17.5	19.5	19.0	8.6	18.8	8.6
		η	[%]	85	84	83	81	80	76	74	67	63	54	48	40	30
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	11.3	16.0	18.3	17.5	15.5	17.9	16.6	16.2	18.1	17.6	8.6	17.5	8.6
		η	[%]	86	86	85	83	81	77	74	68	65	55	50	44	40
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	10.0	14.4	16.7	16.2	14.3	16.6	15.4	15.1	16.9	16.4	8.6	16.3	8.6
		η	[%]	86	86	85	83	80	77	73	68	64	54	49	45	40
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	7.4	11.2	13.3	13.1	11.7	13.7	12.8	12.6	14.0	13.7	8.6	13.6	8.6
		η	[%]	84	84	83	81	77	74	71	67	62	53	48	44	40
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	5.9	9.2	11.0	11.0	9.9	11.6	10.9	10.8	12.0	11.8	10.0	11.7	10.0
		η	[%]	81	82	81	78	76	73	69	65	60	51	47	42	37
	n_{1N} = 6000 rpm	T_{2N}	[Nm]	4.9	7.8	9.4	9.4	8.6	10.1	9.5	9.4	10.5	10.3	10.0	10.2	10.0
		η	[%]	79	79	78	77	75	72	68	62	56	47	42	37	33
Max. acceleration torque		T_{2B}	[Nm]	13	21									10	21	10
Emergency stop torque		T_{2Not}	[Nm]	35										20	35	20
Idling torque[a)]		T_{012}	[Nm]	0.65			0.6				0.5					
Max. input speed		n_{1Max}	[rpm]	6000												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<22	<18	<16	<16	<14	<12					<11		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	0.3	0.45	0.58	0.63	0.66	0.68	0.72	0.74	0.78	0.8	0.75	0.85	0.75
Stability at the output		C_{2K}	[Nm/arcmin]	27												
Max. axial force[c) d)] at the output		F_{a2max}	[N]	910	1200	1500	1800	2200	2100	2300	2500	2700	2900	3100	2900	3100
Max. radial force[c) e)] at the output		F_{r2max}	[N]	640	740	850	970	1100	980	1000	1000	1100	1200	1300	1300	1300
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	32	37	42	48	54	49	50	52	54	60	67	65	67
Max. axial force[c) d)] at the input		F_{a1max}	[N]	890	740	700	780	890	820	890	910	860	880	1100	890	1100
Max. radial force[c) f)] at the input		F_{r1max}	[N]	280	270	280	300	320	320	330	340	330	340	360	340	360
Mass moment of inertia[g)]		J_1	[10^{-7} kg m^2]	230	110	68	49	38	28	23	19	18	16	15	15	15
Mass moment of inertia[g) h)]		J_1	[10^{-7} kg m^2]	280	161	119	100	89	79	74	70	69	67	66	66	65
Mass moment of inertia[g) i)]		J_1	[10^{-7} kg m^2]	510	390	348	329	318	308	303	299	298	296	295	295	295
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	1.7												
Weight with motor components		m	[kg]	≈ 2.2												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000 rpm and operating temperature.
b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
c) Bearing forces: Values valid at n_1 = 3000 rpm; ⅔ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
 c) d) in relation to shaft center.
 c) e) at a distance of 50 mm from the middle of the casing.
 c) f) at a distance of 60 mm from the middle of the casing.
g) in relation to the input.
 g) h) including elastomer coupling 5103-14 (calculated with drilled hole for motor shaft-Ø15)
 g) i) including elastomer coupling 5103-19 (calculated with drilled hole for motor shaft-Ø15)

Bearing forces

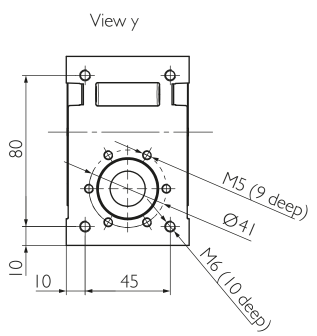


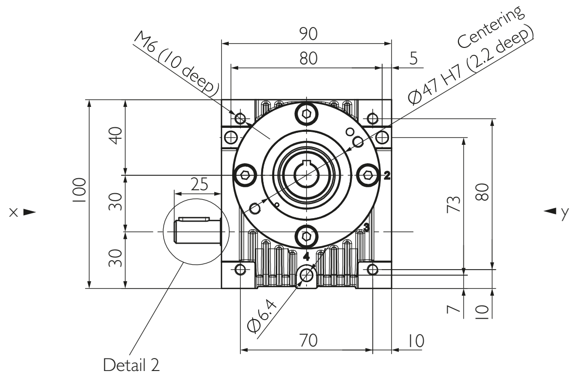
at the output at the input

Input

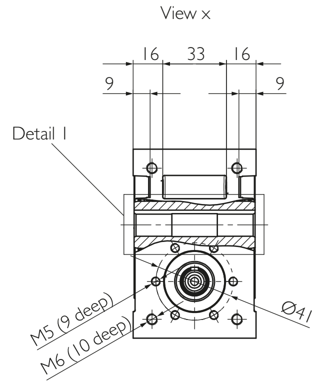
Output

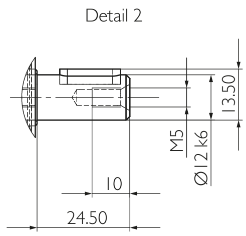
C

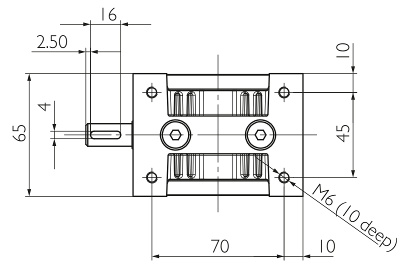


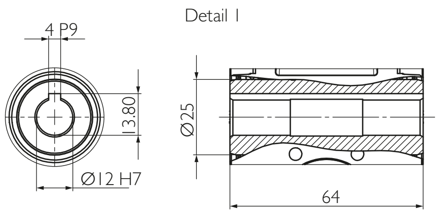


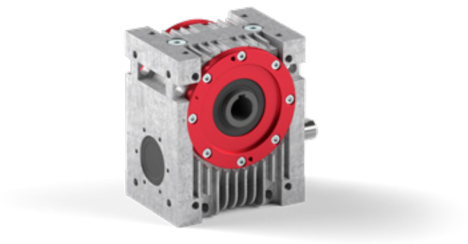
7





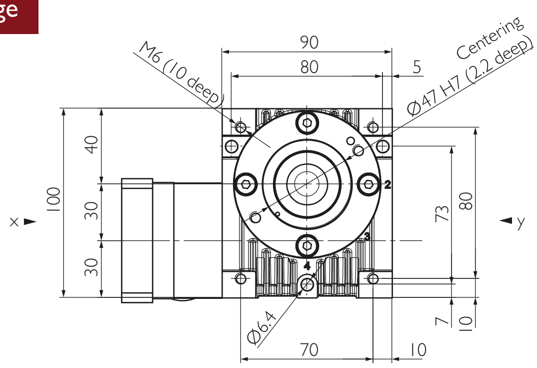


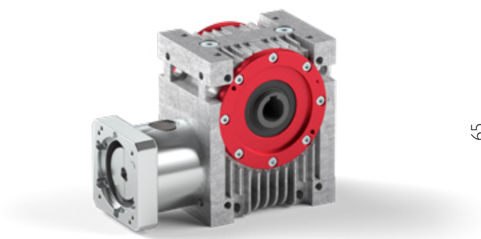


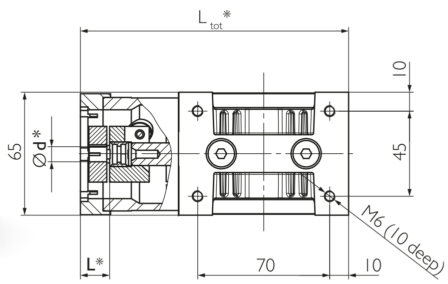


Example HPG 030 C7

C with option motor flange







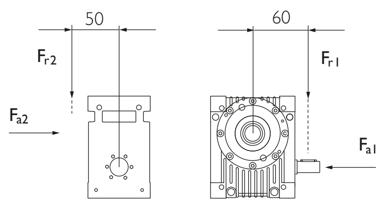
Example HPG 030 C7

* Motor-specific gearbox dimensions

Ratio		i		2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	12.9	17.9	20.1	19.2	16.9	19.4	17.9	17.5	19.5	19.0	8.6	18.8	8.6
		η	[%]	85	84	83	81	80	76	74	67	63	54	48	40	30
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	11.3	16.0	18.3	17.5	15.5	17.9	16.6	16.2	18.1	17.6	8.6	17.5	8.6
		η	[%]	86	86	85	83	81	77	74	68	65	55	50	44	40
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	10.0	14.4	16.7	16.2	14.3	16.6	15.4	15.1	16.9	16.4	8.6	16.3	8.6
		η	[%]	86	86	85	83	80	77	73	68	64	54	49	45	40
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	7.4	11.2	13.3	13.1	11.7	13.7	12.8	12.6	14.0	13.7	8.6	13.6	8.6
		η	[%]	84	84	83	81	77	74	71	67	62	53	48	44	40
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	5.9	9.2	11.0	11.0	9.9	11.6	10.9	10.8	12.0	11.8	10.0	11.7	10.0
		η	[%]	81	82	81	78	76	73	69	65	60	51	47	42	37
	n_{1N} = 6000 rpm	T_{2N}	[Nm]	4.9	7.8	9.4	9.4	8.6	10.1	9.5	9.4	10.5	10.3	10.0	10.2	10.0
		η	[%]	79	79	78	77	75	72	68	62	56	47	42	37	33
Max. acceleration torque		T_{2B}	[Nm]	13	21									10	21	10
Emergency stop torque		T_{2Not}	[Nm]	35										20	35	20
Idling torque[a)]		T_{012}	[Nm]	0.65			0.6			0.5						
Max. input speed		n_{1Max}	[rpm]	6000												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<22	<18	<16	<16	<14	<12					<11		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	0.3	0.45	0.58	0.63	0.66	0.68	0.72	0.74	0.78	0.8	0.75	0.85	0.75
Stability at the output		C_{2K}	[Nm/arcmin]	27												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	560	770	1000	1300	1600	1600	1700	1900	2000	2400	2700	2600	2700
Max. radial force[c)e)] at the output		F_{r2max}	[N]	510	570	660	770	860	800	810	850	880	990	1100	1100	1100
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	26	29	33	38	43	40	41	43	44	49	55	53	55
Max. axial force[c)d)] at the input		F_{a1max}	[N]	890	740	700	780	890	820	890	910	860	880	1100	890	1100
Max. radial force[c)f)] at the input		F_{r1max}	[N]	280	270	280	300	320	320	330	340	330	340	360	340	360
Mass moment of inertia[g)]		J_1	[10^{-7} kg m^2]	138	69	45	34	28	22	19	17	16	15	15	15	15
Mass moment of inertia[g)h)]		J_1	[10^{-7} kg m^2]	189	120	96	85	79	73	70	68	67	66	66	65	65
Mass moment of inertia[g)i)]		J_1	[10^{-7} kg m^2]	418	349	325	314	308	302	299	297	296	295	295	295	295
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	1.6												
Weight with motor components		m	[kg]	≈ 2.2												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000 rpm and operating temperature.
b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
c) Bearing forces: Values valid at n_1 = 3000 rpm; ⅔ T_{2N} and duty cycle of 40%. Consult with Güdel for composite bearing forces, axial and radial forces.
   c) d) in relation to shaft center.
   c) e) at a distance of 50 mm from the middle of the casing.
   c) f) at a distance of 60 mm from the middle of the casing.
g) in relation to the input.
   g) h) including elastomer coupling 5103-14 (calculated with drilled hole for motor shaft-Ø15)
   g) i) including elastomer coupling 5103-19 (calculated with drilled hole for motor shaft-Ø15)

Bearing forces



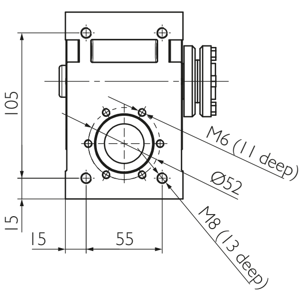
at the output at the input

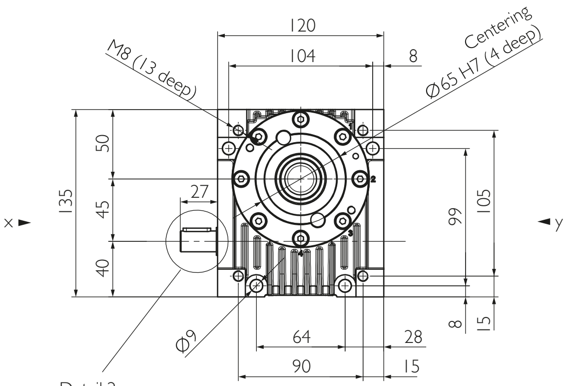
Input

Output

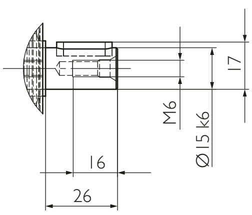
C

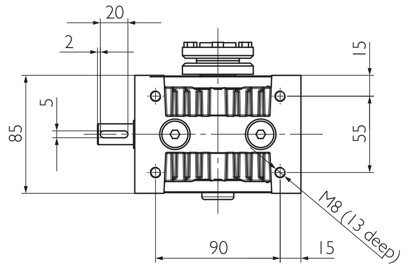
View y

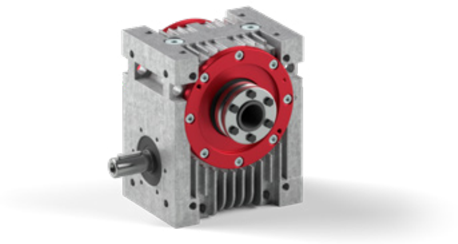




Detail 2



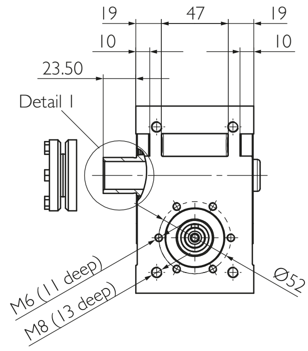




Example HPG 045 C2

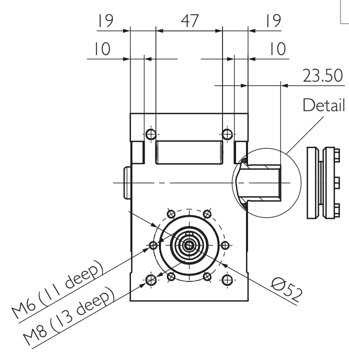
1

View x



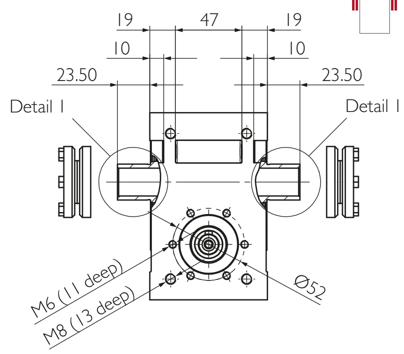
2

View x

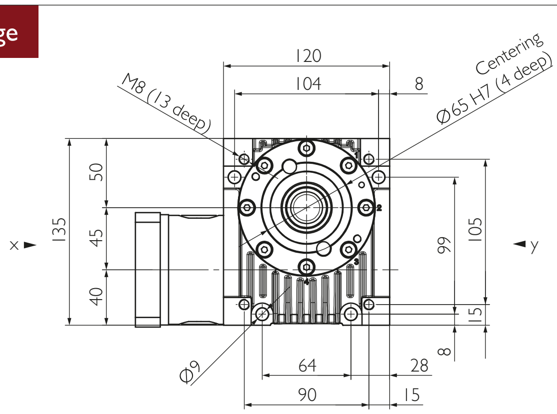


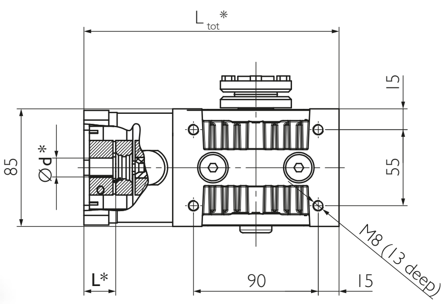
3

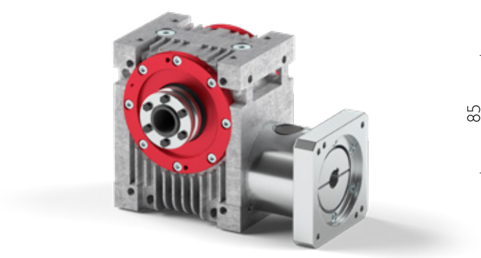
View x



C with option motor flange



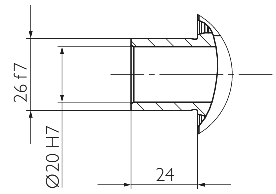




Example HPG 045 C1

* Motor-specific gearbox dimensions

Detail I



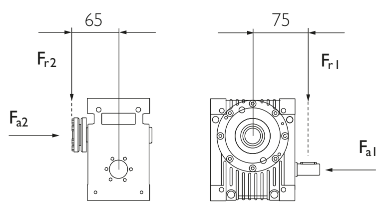
Ratio		i		2	3	4	5	6	8	10
Nominal torque at the output / Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	52.7	73.9	83.9	80.5	70.8	81.7	75.5
		η	[%]	88	88	87	86	85	82	79
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	43.8	63.3	73.1	71.0	62.9	72.9	67.7
		η	[%]	89	89	88	87	86	84	81
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	37.4	55.4	64.8	63.4	56.5	65.8	61.3
		η	[%]	89	89	89	88	86	84	81
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	26.0	40.3	48.3	48.1	43.4	51.0	47.8
		η	[%]	88	89	88	87	85	83	80
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	20.0	31.6	38.5	38.7	35.2	41.6	39.2
		η	[%]	87	87	87	85	83	81	77
	n_{1N} = 6000 rpm	T_{2N}	[Nm]	16.2	26.0	32.0	32.4	29.6	35.2	33.2
		η	[%]	85	86	85	84	81	79	75
Max. acceleration torque		T_{2B}	[Nm]	60	90					
Emergency stop torque		T_{2Not}	[Nm]	120						
Idling torque[a]		T_{012}	[Nm]	1.05			0.95			
Max. input speed		n_{1Max}	[rpm]	6000						
Max. backlash[b] at the output	PS	j_t	[arcmin]	<15	<12	<11	<11	<9	<8	
	PR	j_t	[arcmin]	<10	<8	<7	<7	<6	<5.5	
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	1.6	2.8	3.6	4	4.3	4.5	4.9
Stability at the output		C_{2K}	[Nm/arcmin]	30						
Max. axial force[c)d)] at the output		F_{a2max}	[N]	720	1000	1600	2200	2800	2900	3300
Max. radial force[c)e)] at the output		F_{r2max}	[N]	700	820	1200	1400	1600	1600	1600
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	45	53	76	91	110	100	110
Max. axial force[c)d)] at the input		F_{a1max}	[N]	1400	980	860	1000	1300	1100	1300
Max. radial force[c)f)] at the input		F_{r1max}	[N]	510	470	430	510	590	550	610
Mass moment of inertia[g)]		J_1	[10^{-6} kg m²]	120	57	34	24	19	13	10
Mass moment of inertia[g)h)]		J_1	[10^{-6} kg m²]	148	85	62	52	47	41	38
Mass moment of inertia[g)i)]		J_1	[10^{-6} kg m²]	235	172	149	139	134	128	125
Service life		L_h	[h]	25000						
Weight without motor components		m	[kg]	4						
Weight with motor components		m	[kg]	≈ 5						
Max. permissible housing temperature			[°C]	+90						
Ambient temperature			[°C]	-15 up to +50						
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)								
Painting		None								
Protection class		IP65								

Ratio		13.33	16	24	30	47	60
Nominal torque / Efficiency	n_{1N} = 500 rpm, T_{2N} [Nm]	73.9	75.0	77.9	54.5	79.4	54.5
	η [%]	75	71	63	59	50	43
	n_{1N} = 1000 rpm, T_{2N} [Nm]	66.4	74.0	72.2	54.5	71.5	55.5
	η [%]	77	73	65	60	53	45
	n_{1N} = 1500 rpm, T_{2N} [Nm]	60.3	67.2	65.6	55.5	65.1	55.5
	η [%]	77	74	66	60	53	45
	n_{1N} = 3000 rpm, T_{2N} [Nm]	47.2	52.7	51.6	51.8	51.3	51.8
	η [%]	75	72	64	58	52	45
	n_{1N} = 4500 rpm, T_{2N} [Nm]	38.8	43.3	42.5	42.7	42.3	42.7
	η [%]	73	70	62	54	50	43
	n_{1N} = 6000 rpm, T_{2N} [Nm]	33.0	36.8	36.1	36.4	36.0	36.4
	η [%]	70	66	58	51	46	40
Max. acceleration torque	T_{2B} [Nm]	90 (continued)			60	90	60
Emergency stop torque	T_{2Not} [Nm]	120 (continued)			80	120	80
Idling torque[a]	T_{012} [Nm]	0.8					
Max. backlash PS	j_t [arcmin]	<8 (continued)			<7		
Max. backlash PR	j_t [arcmin]	<5.5 (continued)			<5		
Torsional rigidity	C_{t21} [Nm/arcmin]	5.3	5.5	5.8	5.5	6	5.5
Max. axial force at the output	F_{a2max} [N]	3700	3900	4700	4700	4800	4800
Max. radial force at the output	F_{r2max} [N]	1700	1800	2000	2100	2200	2200
Max. overturning torque	M_{2max} [Nm]	110	110	130	140	140	140
Max. axial force at the input	F_{a1max} [N]	1300	1200	1200	1200	1200	1200
Max. radial force at the input	F_{r1max} [N]	630	580	610	600	620	600
Mass moment of inertia[g)]	J_1	9	8	7	6	6	6
Mass moment of inertia[g)h)]	J_1	37	36	35	34	34	34
Mass moment of inertia[g)i)]	J_1	124	123	122	121	121	121

a) approximate, at n_1 = 3000 rpm and operating temperature.
b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.
c) Bearing forces: Values valid at n_1 = 3000 rpm; ⅔ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
- c) d) in relation to shaft center.
- c) e) at a distance of 65 mm from the middle of the casing.
- c) f) at a distance of 75 mm from the middle of the casing.

g) in relation to the input, including shrink disc at the output (output 1 & 2), with two shrink discs (output 3) increase values by 90/ i2 .
- g) h) including elastomer coupling 5103-19 (calculated with drilled hole for motor shaft-Ø15)
- g) i) including elastomer coupling 5103-24 (calculated with drilled hole for motor shaft-Ø20)

Bearing forces

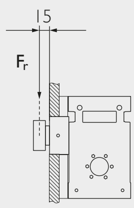


at the output at the input

Package

			Output flange including bearing & pinion				
Radial rigidity	C_3	[N/mm]	23000				
Speed	n_{2N}	[rpm]	1500	750	400	150	100
Max. radial force[j)]	F_{rmax}	[N]	1900	2400	2900	3200	3500

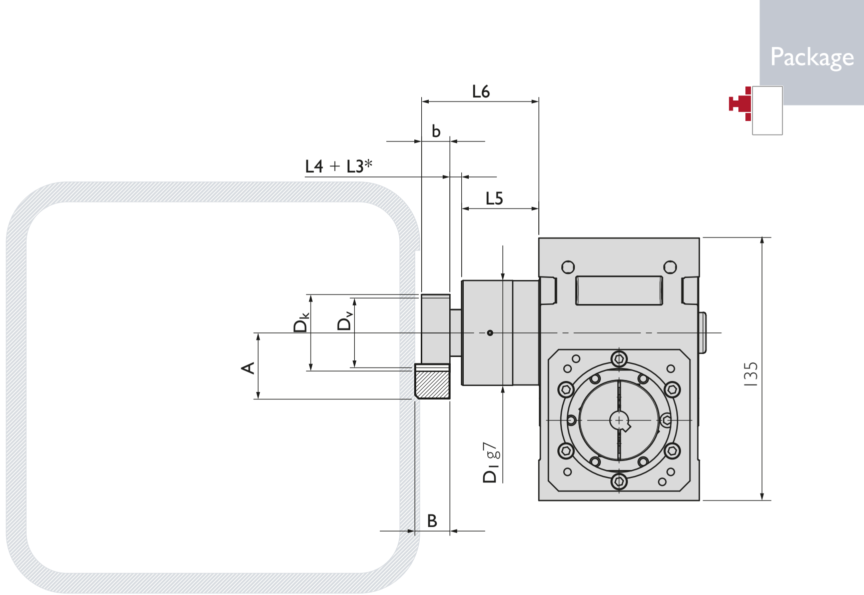
j) Bearing forces: Values valid at duty cycle of 40% at a distance of 15mm from the end of the bearing.

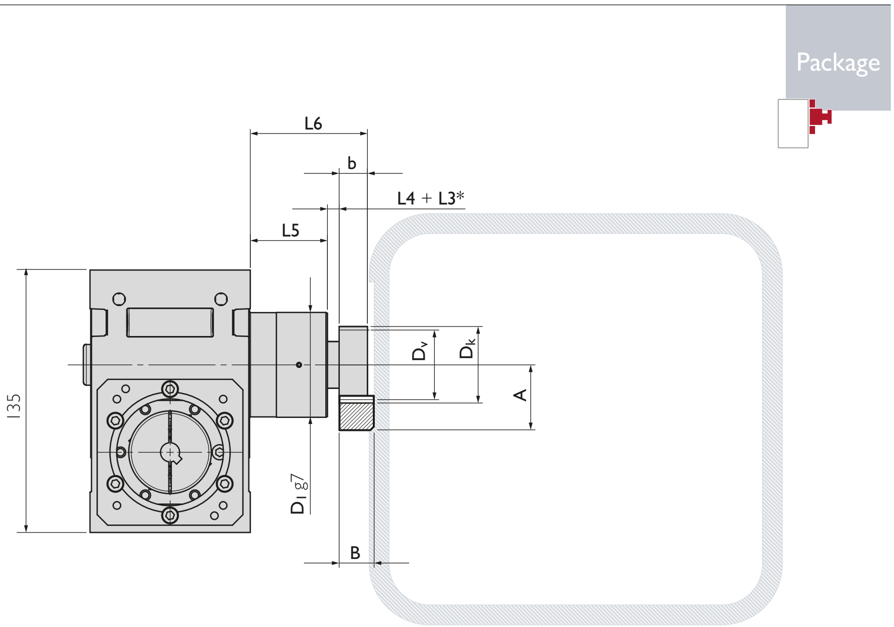


Detailed information about the package, options & accessories on pages 38 and 39.

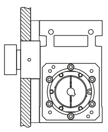
Output flange including bearing & pinion a)

Example HPG 045 C2 Package





a) The output flange must be supported by the customer supplied equipment at the bearing end (D1), in a hole with an H8 tolerance.



* **L3** for additional distance ring.

Geometric information

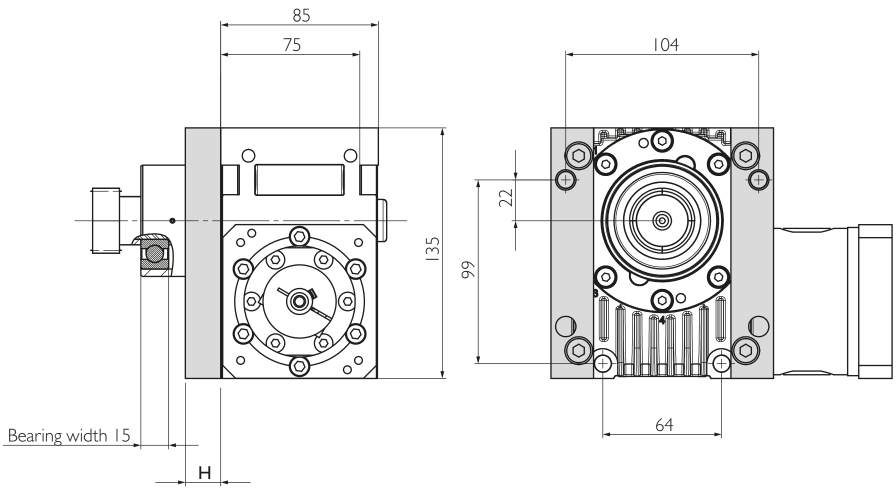
Helical modular pitch	Part. No.	m_n	P_t	z	A	b	B	D_k	D_0	D_v	D_1	L4	L5	L6
Pinion 1	211120	1.5	5.00	20	33.415	20	19	34.83	31.831	31.830	60	4.5	43	67.5
													53	77.5
Pinion 2	211216	2	6.66	16	39.575	20	24	39.15	33.953	35.153	60	8.0	43	71.0
													53	81.0

m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

Straight modular pitch	Part. No.	m_n	P_n	z	A	b	B	D_k	D_0	D_v	D_1	L4	L5	L6
Pinion 3	201120	1.5	4.72	20	32.500	20	19	33.00	30.000	30.000	60	4.5	43	67.5
													53	77.5
Pinion 4	201216	2	6.28	16	38.600	20	24	37.20	32.000	33.200	60	8.0	43	71.0
													53	81.0

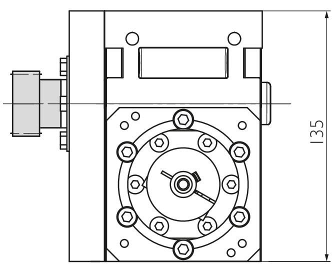
m_n: Normal module, P_n: Normal pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

Spacer elements

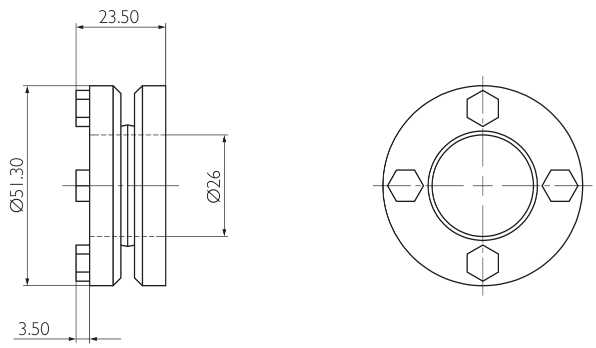


Casing can only be fastened with long screws as per the bore hole pattern.
Screws M6 of length 56mm + **H** + thread depth, tightening torque 9Nm.

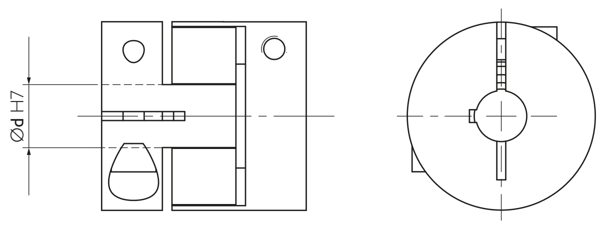
With pinion special solutions on request



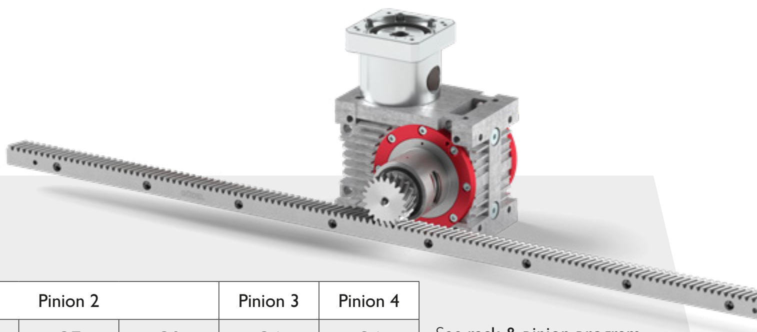
Shrink disc



Elastomer coupling



For more details see **Motor Interface** on page 84 et. seq.



Your ideal drive train

Our function package with high-performance angle gearbox, output flange, pinion and rack by Güdel.

			Pinion 1			Pinion 2			Pinion 3	Pinion 4
			Q6	Q7	Q9	Q6	Q7	Q9	Q6	Q6
Max acceleration force	F_{2B}	[N]	5004	1654	2510	7075	1760	4752	3638	4810
Max acceleration torque	T_{2B}	[Nm]	80	26	40	120	30	81	55	77
Precision			PR		PS	PR		PS		
Feed force			High	Medium	Elevated	High	Medium	Elevated		

Above values for rack and pinion take into consideration a number of load cycles:
1x10⁶ for the rack; 1x10⁷ for the pinion. Both in pulsating operation.

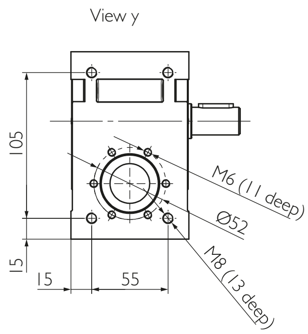
See **rack & pinion program** of your ideal drive train on pages 70 et seq.

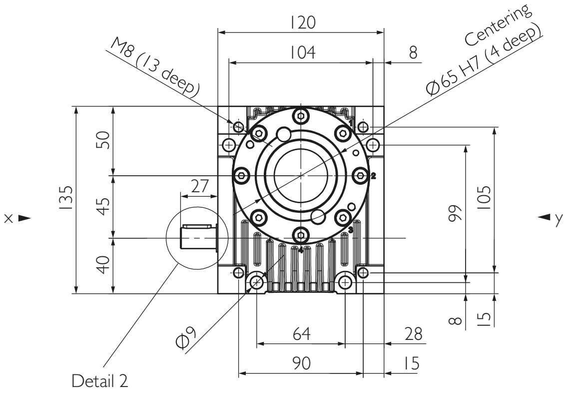
See **flowcharts** to find your ideal drive train on pages 88 et seq.

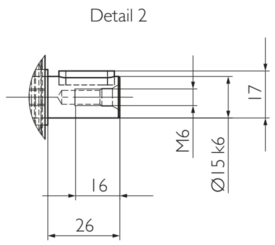
Input

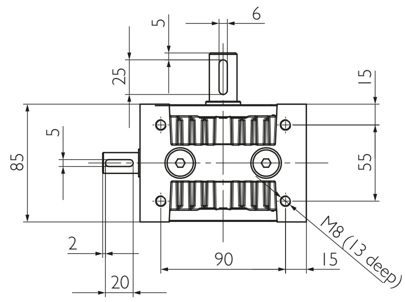
Output

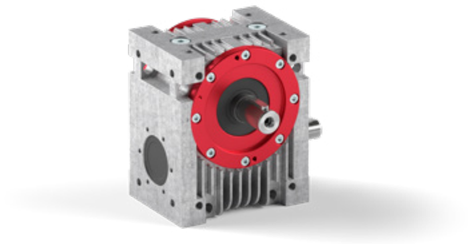
C





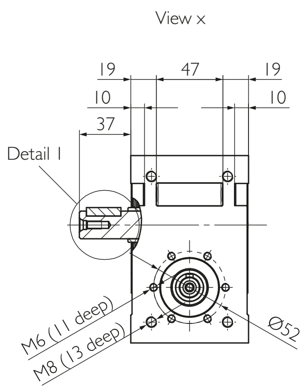




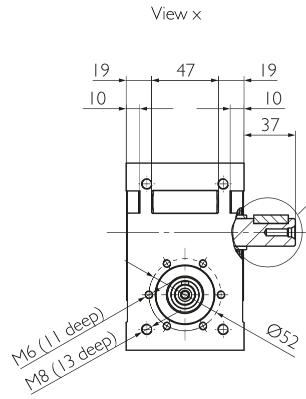


Example HPG 045 C4

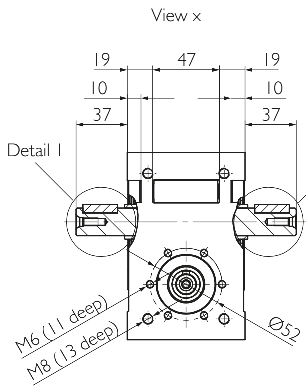
4



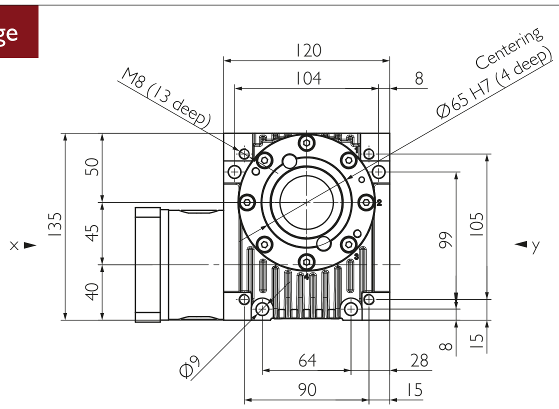
5

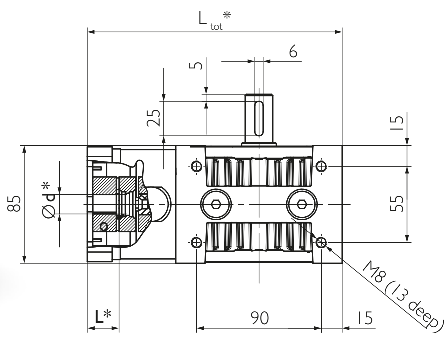


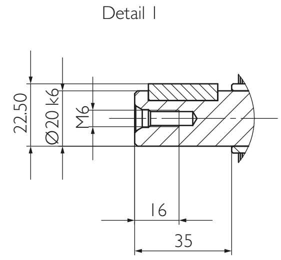
6

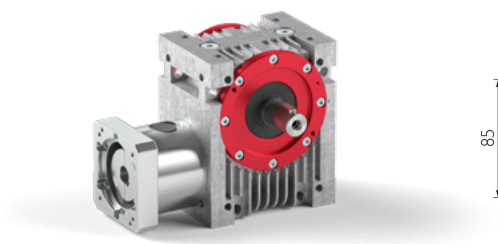


C with option motor flange









Example HPG 045 C5

* Motor-specific gearbox dimensions

Ratio	i			2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	52.7	73.9	83.9	80.5	70.8	81.7	75.5	73.9	75.0	77.9	54.5	79.4	54.5
		η	[%]	88	88	87	86	85	82	79	75	71	63	59	50	43
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	43.8	63.3	73.1	71.0	62.9	72.9	67.7	66.4	74.0	72.2	54.5	71.5	55.5
		η	[%]	89	89	88	87	86	84	81	77	73	65	60	53	45
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	37.4	55.4	64.8	63.4	56.5	65.8	61.3	60.3	67.2	65.6	55.5	65.1	55.5
		η	[%]	89	89	89	88	86	84	81	77	74	66	60	53	45
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	26.0	40.3	48.3	48.1	43.4	51.0	47.8	47.2	52.7	51.6	51.8	51.3	51.8
		η	[%]	88	89	88	87	85	83	80	75	72	64	58	52	45
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	20.0	31.6	38.5	38.7	35.2	41.6	39.2	38.8	43.3	42.5	42.7	42.3	42.7
		η	[%]	87	87	87	85	83	81	77	73	70	62	54	50	43
	n_{1N} = 6000 rpm	T_{2N}	[Nm]	16.2	26.0	32.0	32.4	29.6	35.2	33.2	33.0	36.8	36.1	36.4	36.0	36.4
		η	[%]	85	86	85	84	81	79	75	70	66	58	51	46	40
Max. acceleration torque		T_{2B}	[Nm]	60	90									60	90	60
Emergency stop torque		T_{2Not}	[Nm]	120										80	120	80
Idling torque[a)]		T_{012}	[Nm]	1.05			0.95				0.8					
Max. input speed		n_{1Max}	[rpm]	6000												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<15	<12	<11	<11	<9	<8					<7		
	PR	j_t	[arcmin]	<10	<8	<7	<7	<6	<5.5					<5		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	1.6	2.8	3.6	4	4.3	4.5	4.9	5.3	5.5	5.8	5.5	6	5.5
Stability at the output		C_{2K}	[Nm/arcmin]	30												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	720	1000	1600	2200	2800	2900	3300	3700	3900	4700	4700	4800	4800
Max. radial force[c)e)] at the output		F_{r2max}	[N]	700	820	1200	1400	1600	1600	1600	1700	1800	2000	2100	2200	2200
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	45	53	76	91	110	100	110	110	110	130	140	140	140
Max. axial force[c)d)] at the input		F_{a1max}	[N]	1400	980	860	1000	1300	1100	1300	1300	1200	1200	1200	1200	1200
Max. radial force[c)f)] at the input		F_{r1max}	[N]	510	470	430	510	590	550	610	630	580	610	600	620	600
Mass moment of inertia[g)]		J_1	[10^{-6} kg m^2]	120	57	34	24	19	13	10	9	8	7	6	6	6
Mass moment of inertia[g)h)]		J_1	[10^{-6} kg m^2]	148	85	62	52	47	41	38	37	36	35	34	34	34
Mass moment of inertia[g)i)]		J_1	[10^{-6} kg m^2]	235	172	149	139	134	128	125	124	123	122	121	121	121
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	4												
Weight with motor components		m	[kg]	≈ 5												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

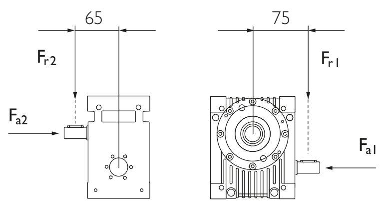
a) approximate, at n_1 = 3000 rpm and operating temperature.

b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.

c) Bearing forces: Values valid at n_1 = 3000 rpm; ⅔ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
- c) d) in relation to shaft center.
- c) e) at a distance of 65 mm from the middle of the casing.
- c) f) at a distance of 75 mm from the middle of the casing.

g) in relation to the input.
- g) h) including elastomer coupling 5103-19 (calculated with drilled hole for motor shaft-Ø15)
- g) i) including elastomer coupling 5103-24 (calculated with drilled hole for motor shaft-Ø20)

Bearing forces

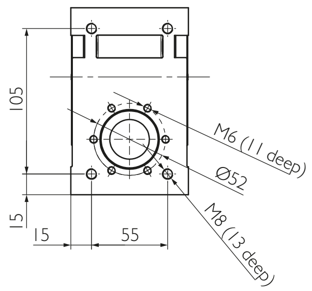


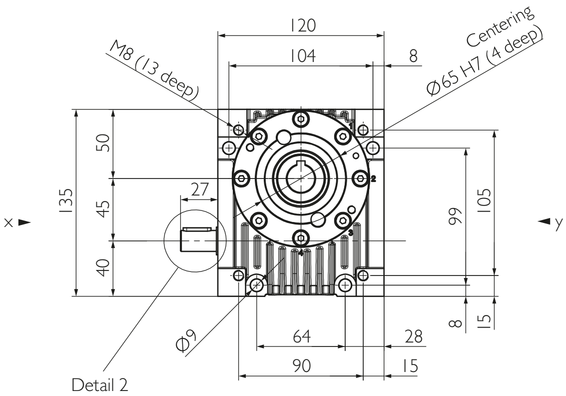
at the output at the input

Input

C

View y



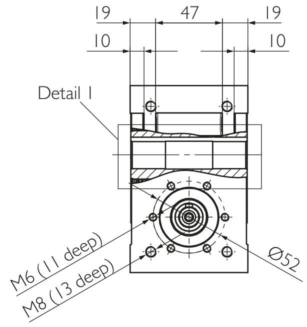


Detail 2

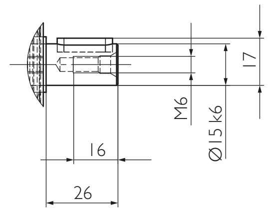
Output

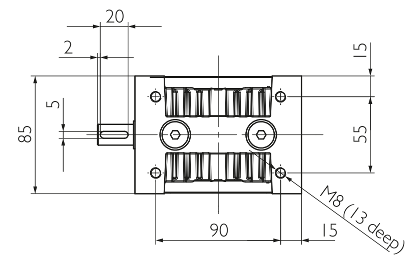
7

View x

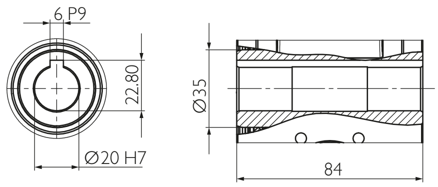


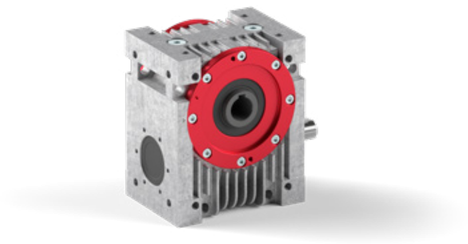
Detail 2





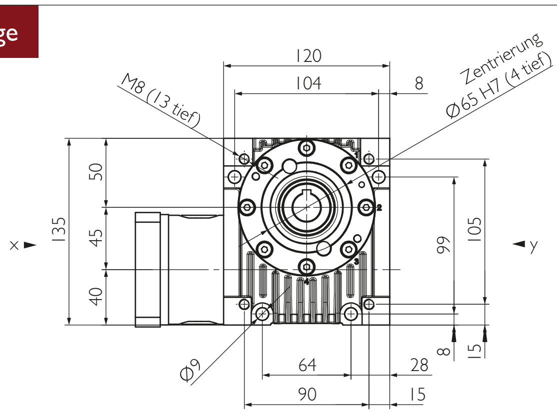
Detail I

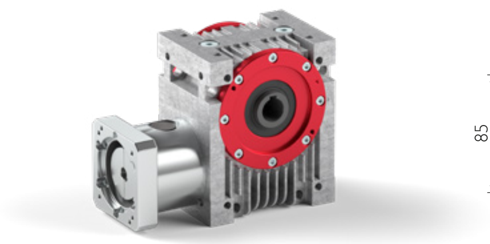


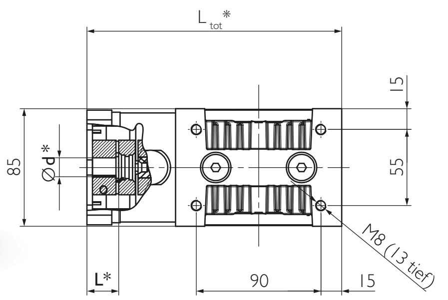


Example HPG 045 C7

C with option motor flange







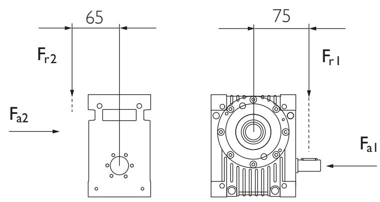
Example HPG 045 C7

* Motor-specific gearbox dimensions

Ratio		i		2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	52.7	73.9	83.9	80.5	70.8	81.7	75.5	73.9	75.0	77.9	54.5	79.4	54.5
		η	[%]	88	88	87	86	85	82	79	75	71	63	59	50	43
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	43.8	63.3	73.1	71.0	62.9	72.9	67.7	66.4	74.0	72.2	54.5	71.5	55.5
		η	[%]	89	89	88	87	86	84	81	77	73	65	60	53	45
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	37.4	55.4	64.8	63.4	56.5	65.8	61.3	60.3	67.2	65.6	55.5	65.1	55.5
		η	[%]	89	89	89	88	86	84	81	77	74	66	60	53	45
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	26.0	40.3	48.3	48.1	43.4	51.0	47.8	47.2	52.7	51.6	51.8	51.3	51.8
		η	[%]	88	89	88	87	85	83	80	75	72	64	58	52	45
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	20.0	31.6	38.5	38.7	35.2	41.6	39.2	38.8	43.3	42.5	42.7	42.3	42.7
		η	[%]	87	87	87	85	83	81	77	73	70	62	54	50	43
	n_{1N} = 6000 rpm	T_{2N}	[Nm]	16.2	26.0	32.0	32.4	29.6	35.2	33.2	33.0	36.8	36.1	36.4	36.0	36.4
		η	[%]	85	86	85	84	81	79	75	70	66	58	51	46	40
Max. acceleration torque		T_{2B}	[Nm]	60	90									60	90	60
Emergency stop torque		T_{2Not}	[Nm]	120										80	120	80
Idling torque[a]		T_{012}	[Nm]	1.05			0.95				0.8					
Max. input speed		n_{1Max}	[rpm]	6000												
Max. backlash[b] at the output	PS	j_t	[arcmin]	<15	<12	<11	<11	<9	<8					<7		
	PR	j_t	[arcmin]	<10	<8	<7	<7	<6	<5.5					<5		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	1.6	2.8	3.6	4	4.3	4.5	4.9	5.3	5.5	5.8	5.5	6	5.5
Stability at the output		C_{2K}	[Nm/arcmin]	30												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	360	600	1100	1600	2200	2400	2700	3100	3200	4000	4300	4400	4400
Max. radial force[c)e)] at the output		F_{r2max}	[N]	370	580	780	1200	1400	1400	1400	1500	1500	1700	1900	1900	1900
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	24	38	51	75	89	88	91	96	98	110	120	120	120
Max. axial force[c)d)] at the input		F_{a1max}	[N]	1400	980	860	1000	1300	1100	1300	1300	1200	1200	1200	1200	1200
Max. radial force[c)f)] at the input		F_{r1max}	[N]	510	470	430	510	590	550	610	630	580	610	600	620	600
Mass moment of inertia[g)]		J_1	[10^{-6} kg m^2]	97	47	29	21	16	12	10	8	7	7	6	6	6
Mass moment of inertia[g)h)]		J_1	[10^{-6} kg m^2]	125	75	57	49	44	40	38	36	35	35	34	34	34
Mass moment of inertia[g)i)]		J_1	[10^{-6} kg m^2]	212	162	144	136	131	127	125	123	122	122	121	121	121
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	4												
Weight with motor components		m	[kg]	≈ 5												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000 rpm and operating temperature.
b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.
c) Bearing forces: Values valid at n_1 = 3000 rpm; ⅔ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
c) d) in relation to shaft center.
c) e) at a distance of 65 mm from the middle of the casing.
c) f) at a distance of 75 mm from the middle of the casing.
g) in relation to the input.
g) h) including elastomer coupling 5103-19 (calculated with drilled hole for motor shaft-Ø15)
g) i) including elastomer coupling 5103-24 (calculated with drilled hole for motor shaft-Ø20)

Bearing forces

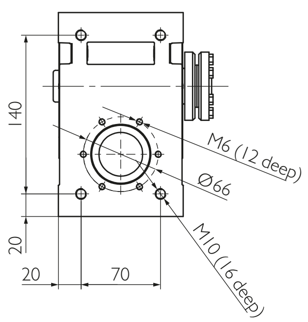


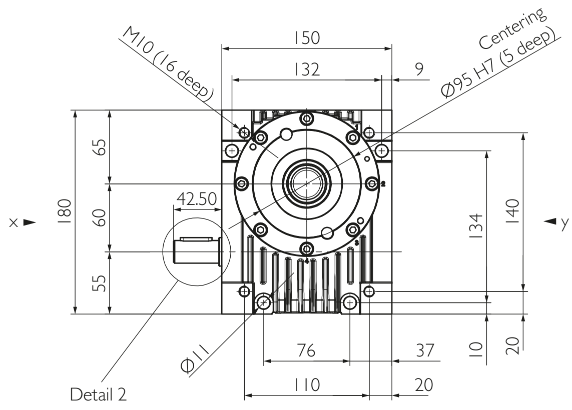
at the output at the input

Input

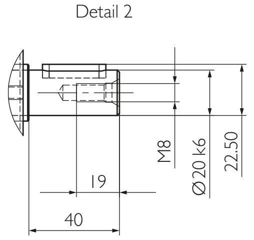
C

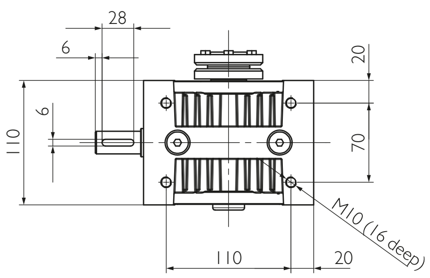
View y

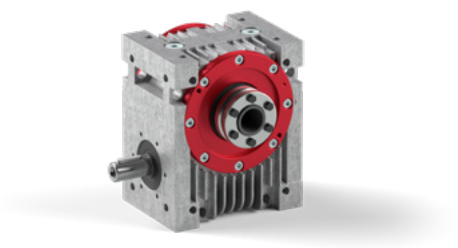




Detail 2

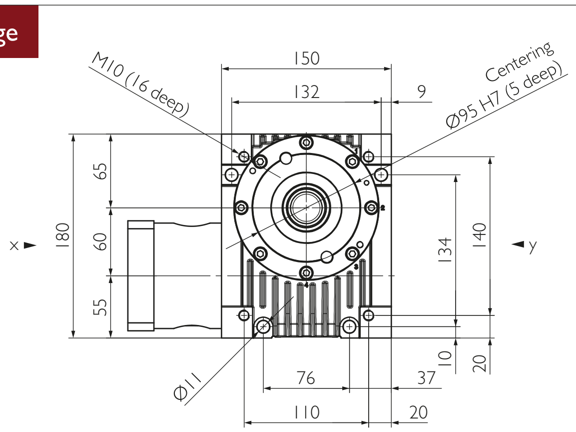


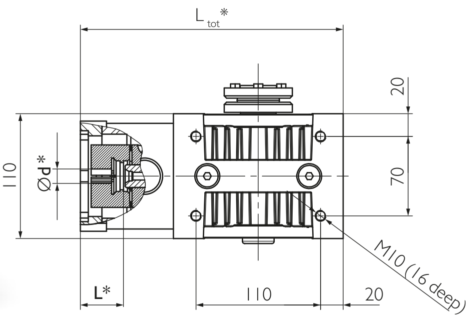


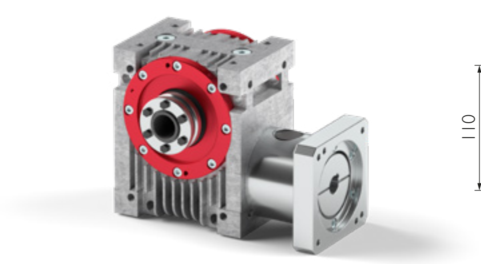


Example HPG 060 C2

C with option motor flange







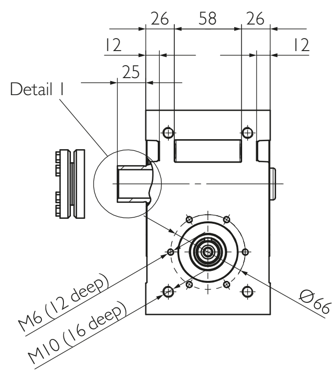
Example HPG 060 C3

* Motor-specific gearbox dimensions

Output

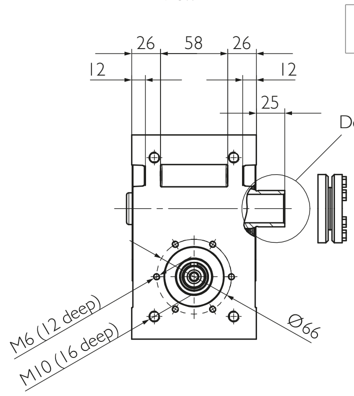
I

View x



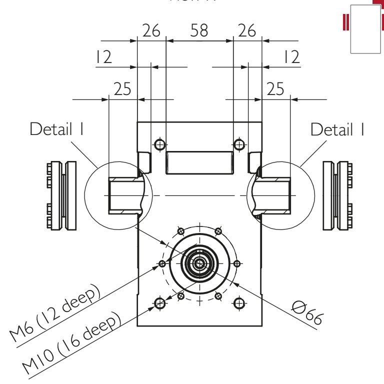
2

View x

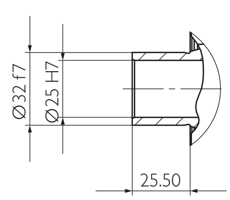


3

View x



Detail I



Ratio	i			2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	135	192	219	211	186	215	199	195	195	202	144	209	144
		η	[%]	89	89	88	88	87	84	82	78	74	67	64	54	50
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	107	158	184	180	160	186	173	170	190	185	144	184	144
		η	[%]	90	90	90	89	88	86	84	81	77	70	65	56	53
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	89	135	159	157	140	164	153	151	168	165	144	163	144
		η	[%]	90	91	90	89	89	86	84	81	78	70	65	56	52
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	59	93	113	113	103	121	114	113	126	124	126	123	126
		η	[%]	90	90	90	89	88	86	83	80	77	69	64	55	50
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	44	71	88	89	81	96	91	90	101	99	101	98	101
		η	[%]	89	89	89	88	87	84	82	78	75	67	61	52	47
	n_{1N} = 6000 rpm	T_{2N}	[Nm]	35	58	71	73	67	80	75	75	84	82	84	82	84
		η	[%]	88	88	88	87	85	83	80	75	72	64	58	48	44
Max. acceleration torque		T_{2B}	[Nm]	140	220									150	220	150
Emergency stop torque		T_{2Not}	[Nm]	300										200	300	200
Idling torque[a]		T_{012}	[Nm]	1.45			1.3				1.1					
Max. input speed		n_{1Max}	[rpm]	6000												
Max. backlash[b] at the output	PS	j_t	[arcmin]	<13	<10	<9	<9	<8	<7					<6		
	PR	j_t	[arcmin]	<9	<7	<6	<6	<5	<4.5					<4		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	2.5	4.8	7.6	8.6	10	11	12.1	13.3	14.5	15.4	15	16	15
Stability at the output		C_{2K}	[Nm/arcmin]	42												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	1300	1700	2600	3600	4400	4100	4500	5100	5300	6500	7300	7500	7500
Max. radial force[c)e)] at the output		F_{r2max}	[N]	1300	1500	2100	2500	2800	2400	2500	2600	2700	3100	3300	3300	3300
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	110	120	170	200	220	190	200	210	220	250	270	270	270
Max. axial force[c)d)] at the input		F_{a1max}	[N]	1700	990	750	1000	1400	1100	1400	1600	1200	1400	1300	1500	1300
Max. radial force[c)f)] at the input		F_{r1max}	[N]	690	510	390	520	720	560	710	760	610	650	620	690	630
Mass moment of inertia[g)]		J_1	[10^{-6} kg m²]	467	221	135	95	74	52	42	34	31	27	26	25	25
Mass moment of inertia[g)h)]		J_1	[10^{-6} kg m²]	582	336	250	210	189	167	157	149	146	142	141	140	140
Mass moment of inertia[g)i)]		J_1	[10^{-6} kg m²]	721	475	389	349	328	306	296	288	285	281	280	279	279
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	9												
Weight with motor components		m	[kg]	≈ 11												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000 rpm and operating temperature.

b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.

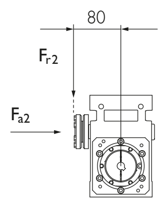
c) Bearing forces: Values valid at n_1 = 3000 rpm; ⅔ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.

- c) d) in relation to shaft center.
- c) e) at a distance of 80 mm from the middle of the casing.
- c) f) at a distance of 95 mm from the middle of the casing.

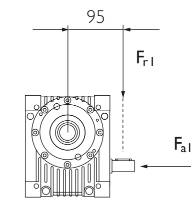
g) in relation to the input, including shrink disc at the output (output 1 & 2),
with two shrink discs (output 3) increase values by 200/i².

- g) h) including elastomer coupling 5103-24 (calculated with drilled hole for motor shaft-Ø20)
- g) i) including elastomer coupling 5103-28 (calculated with drilled hole for motor shaft-Ø25)

Bearing forces



at the output

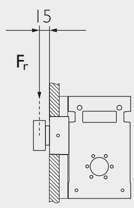


at the input

Package

			Output flange including bearing & pinion				
Radial rigidity	C_3	[N/mm]	24000				
Speed	n_{2N}	[rpm]	1500	750	400	150	100
Max. radial force[j)]	F_{rmax}	[N]	2500	3200	4000	4500	5000

j) Bearing forces: Values valid at duty cycle of 40% at a distance of 15 mm from the end of the bearing.

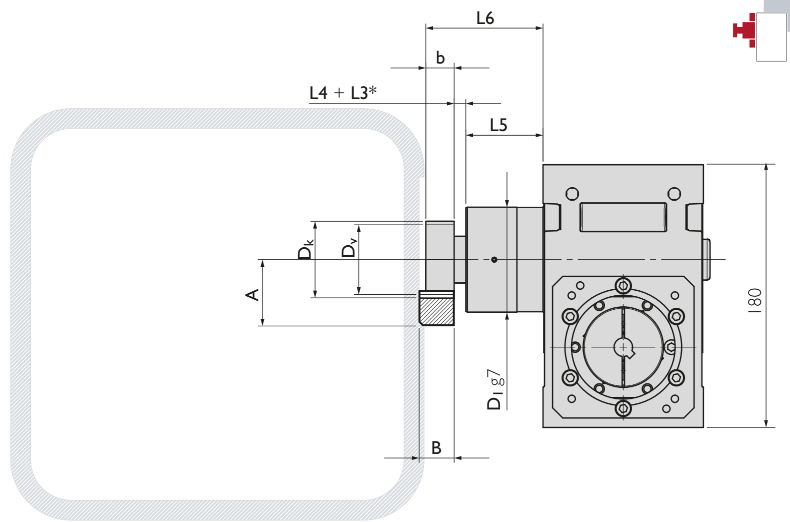


Detailed information about the **package, options & accessories** on pages 46 and 47.

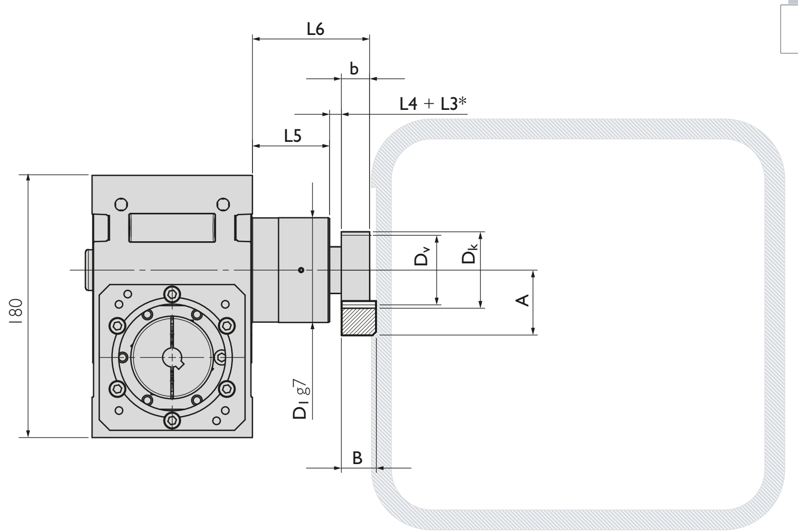
Output flange including bearing & pinion a)

Package

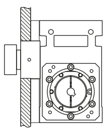
Example HPG 060 C2 Package



Package



a) The output flange must be supported by the customer supplied equipment at the bearing end (D1), in a hole with an H8 tolerance.



* **L3** for additional distance ring.

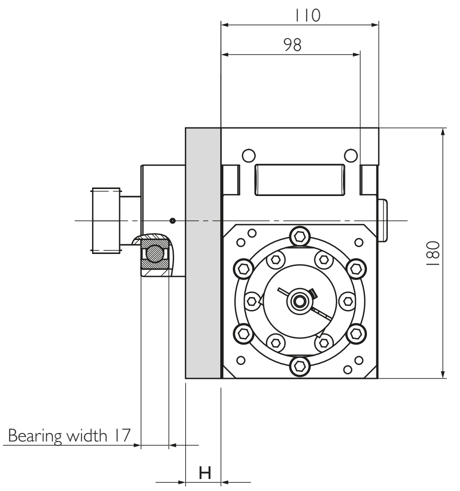
Helical modular pitch	Part. No.	m_n	P_t	z	A	b	B	D_k	D_0	D_v	D_1	L4	L5	L6
Pinion 1	211220	2	6.66	20	43.220	20	24	46.44	42.441	42.441	72	8	53	81
													58	86
													83	111
Pinion 2	211320	2.5	8.33	20	48.025	25	24	58.05	53.052	53.052	72	8	53	86
													58	91
													83	116
Pinion 3	211416	3	10.00	16	52.365	30	29	58.73	52.930	52.730	72	8	53	91
													58	96
													83	121

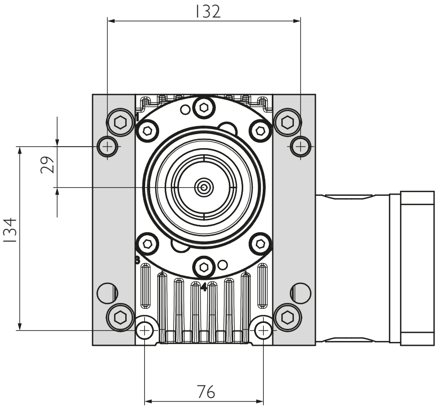
m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

Straight modular pitch	Part. No.	m_n	P_n	z	A	b	B	D_k	D_0	D_v	D_1	L4	L5	L6
Pinion 4	201220	2	6.28	20	42.000	20	24	44.00	40.000	40.000	72	8	53	81
													58	86
													83	111
Pinion 5	201320	2.5	7.85	20	46.500	25	24	55.00	50.000	50.000	72	8	53	86
													58	91
													83	116
Pinion 6	201416	3	9.42	16	50.900	30	29	55.80	48.000	49.800	72	8	53	91
													58	96
													83	121

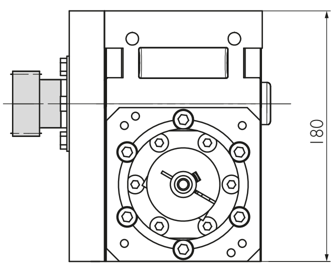
m_n: Normal module, P_n: Normal pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

Spacer elements



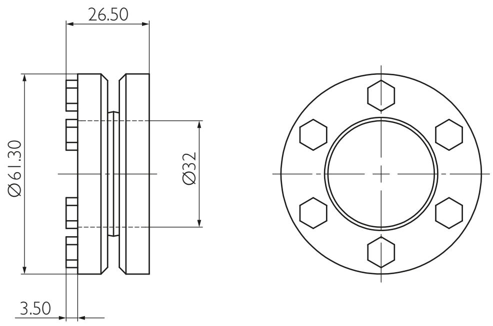


With pinion special solutions on request

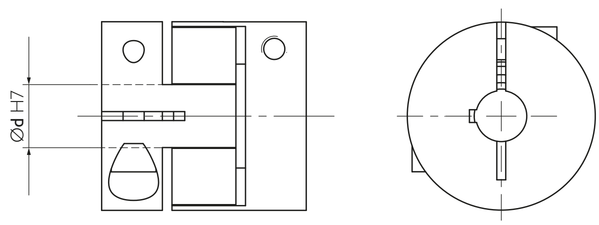


Casing can only be fastened with long screws as per the bore hole pattern.
Screws M6 of length 56mm + **H** + thread depth, tightening torque 9Nm.

Shrink disc

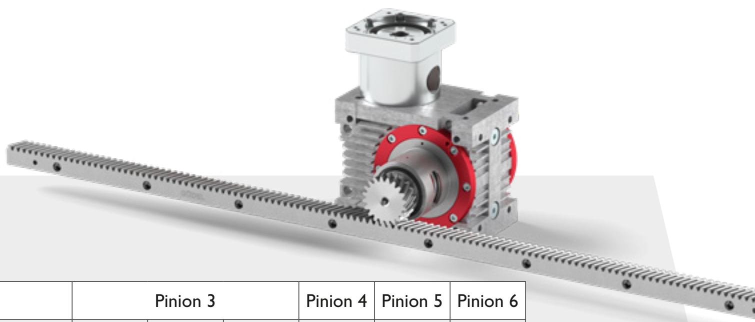


Elastomer coupling



For more details see **Motor Interface** on page 84 et. seq.

Your ideal drive train



Our function package with high-performance angle gearbox, output flange, pinion and rack by Güdel.

			Pinion 1			Pinion 2			Pinion 3			Pinion 4	Pinion 5	Pinion 6
			Q6	Q7	Q9	Q6	Q7	Q9	Q6	Q7	Q9	Q6	Q6	Q6
Max acceleration force	F_{2B}	[N]	7490	2963	5036	11199	4703	8095	15272	4714	12273	5958	9004	12597
Max acceleration torque	T_{2B}	[Nm]	159	63	107	297	125	215	389	120	313	119	225	302
Precision			PR		PS	PR		PS	PR		PS			
Feed force			High	Medium	Elevated	High	Medium	Elevated	High	Medium	Elevated			

Above values for rack and pinion take into consideration a number of load cycles:
1x10[6] for the rack; 1x10[7] for the pinion. Both in pulsating operation.

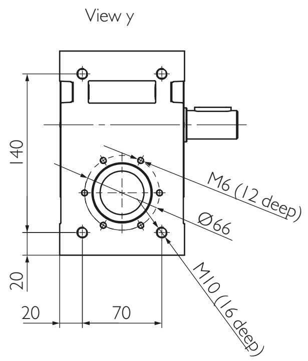
See **rack & pinion program** of your ideal drive train on pages 70 et seq.

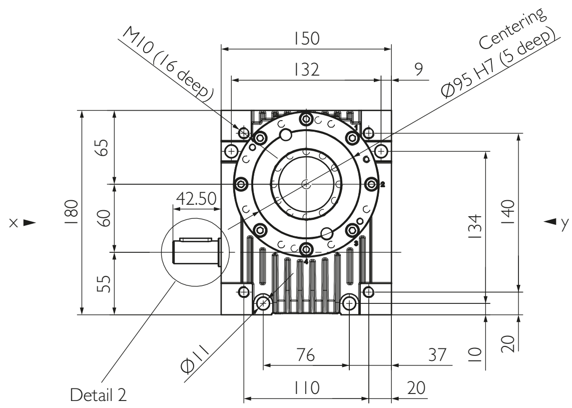
See **flowcharts** to find your ideal drive train on pages 88 et seq.

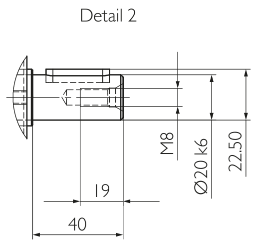
Input

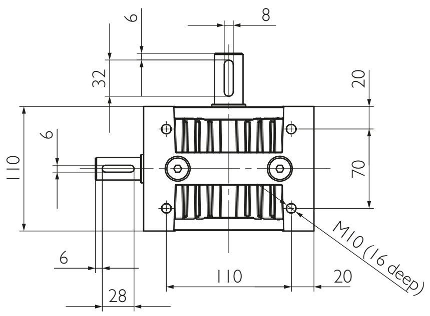
Output

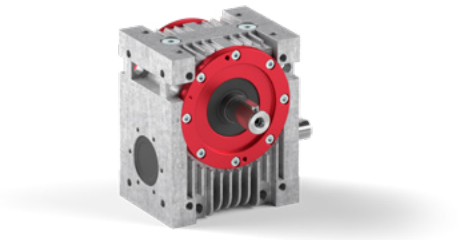
C





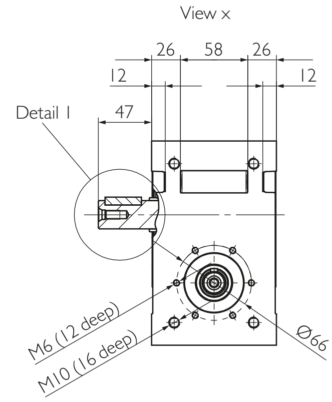






Example HPG 060 C4

4



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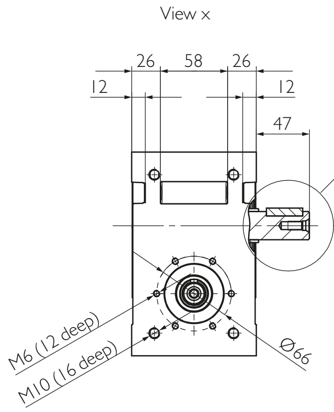

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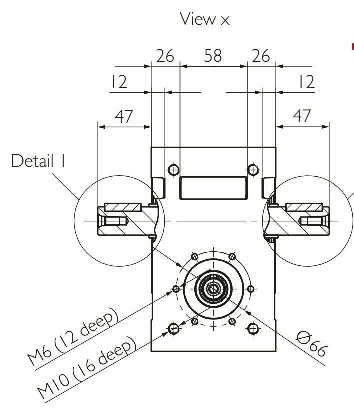
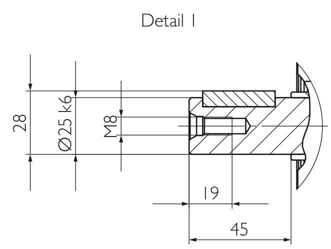
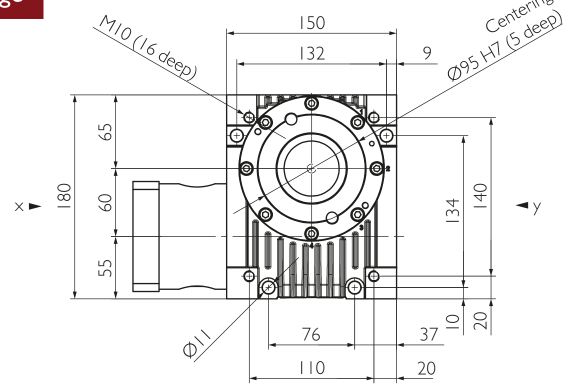
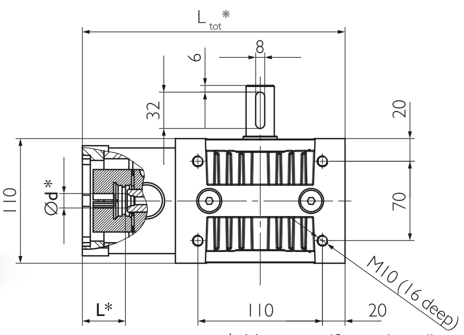
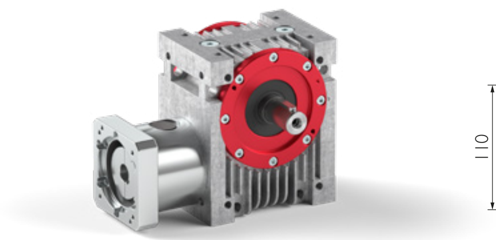




C with option motor flange







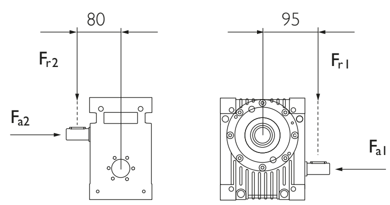
Example HPG 060 C6

* Motor-specific gearbox dimensions

Ratio		i		2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	135	192	219	211	186	215	199	195	195	202	144	209	144
		η	[%]	89	89	88	88	87	84	82	78	74	67	64	54	50
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	107	158	184	180	160	186	173	170	190	185	144	184	144
		η	[%]	90	90	90	89	88	86	84	81	77	70	65	56	53
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	89	135	159	157	140	164	153	151	168	165	144	163	144
		η	[%]	90	91	90	89	89	86	84	81	78	70	65	56	52
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	59	93	113	113	103	121	114	113	126	124	126	123	126
		η	[%]	90	90	90	89	88	86	83	80	77	69	64	55	50
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	44	71	88	89	81	96	91	90	101	99	101	98	101
		η	[%]	89	89	89	88	87	84	82	78	75	67	61	52	47
	n_{1N} = 6000 rpm	T_{2N}	[Nm]	35	58	71	73	67	80	75	75	84	82	84	82	84
		η	[%]	88	88	88	87	85	83	80	75	72	64	58	48	44
Max. acceleration torque		T_{2B}	[Nm]	140	220									150	220	150
Emergency stop torque		T_{2Not}	[Nm]	300										200	300	200
Idling torque[a)]		T_{012}	[Nm]	1.45			1.3			1.1						
Max. input speed		n_{1Max}	[rpm]	6000												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<13	<10	<9	<9	<8	<7					<6		
	PR	j_t	[arcmin]	<9	<7	<6	<6	<5	<4.5					<4		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	2.5	4.8	7.6	8.6	10	11	12.1	13.3	14.5	15.4	15	16	15
Stability at the output		C_{2K}	[Nm/arcmin]	42												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	1300	1700	2600	3600	4400	4100	4500	5100	5300	6500	7300	7500	7500
Max. radial force[c)e)] at the output		F_{r2max}	[N]	1300	1500	2100	2500	2800	2400	2500	2600	2700	3100	3300	3300	3300
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	110	120	170	200	220	190	200	210	220	250	270	270	270
Max. axial force[c)d)] at the input		F_{a1max}	[N]	1700	990	750	1000	1400	1100	1400	1600	1200	1400	1300	1500	1300
Max. radial force[c)f)] at the input		F_{r1max}	[N]	690	510	390	520	720	560	710	760	610	650	620	690	630
Mass moment of inertia[g)]		J_1	[10^{-6} kg m^2]	467	221	135	95	74	52	42	34	31	27	26	25	25
Mass moment of inertia[g)h)]		J_1	[10^{-6} kg m^2]	582	336	250	210	189	167	157	149	146	142	141	140	140
Mass moment of inertia[g)i)]		J_1	[10^{-6} kg m^2]	721	475	389	349	328	306	296	288	285	281	280	279	279
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	9												
Weight with motor components		m	[kg]	≈ 11												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000 rpm and operating temperature.
b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.
c) Bearing forces: Values valid at n_1 = 3000 rpm; ⅔ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
c) d) in relation to shaft center.
c) e) at a distance of 80 mm from the middle of the casing.
c) f) at a distance of 95 mm from the middle of the casing.
g) in relation to the input.
g) h) including elastomer coupling 5103-24 (calculated with drilled hole for motor shaft-Ø20)
g) i) including elastomer coupling 5103-28 (calculated with drilled hole for motor shaft-Ø25)

Bearing forces

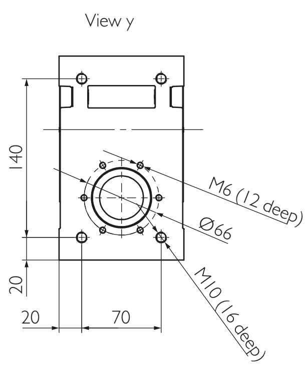


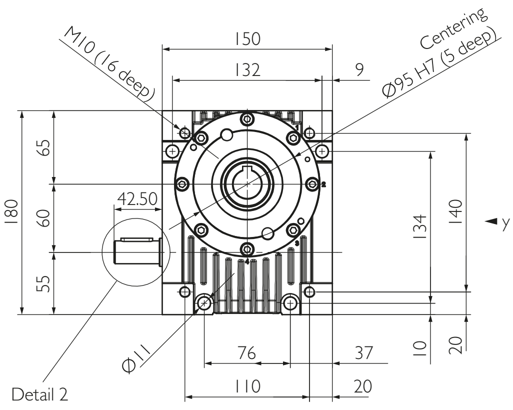
at the output at the input

Input

Output

C





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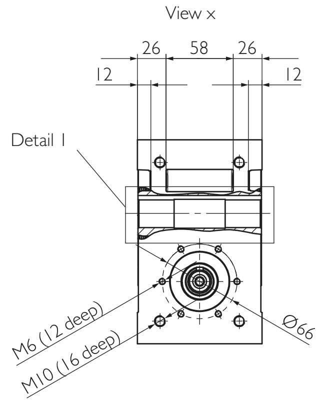
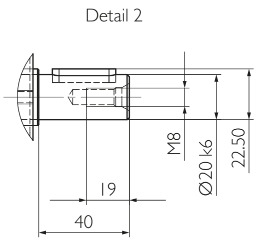
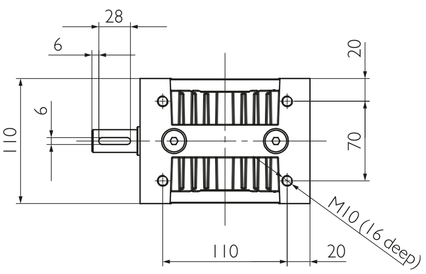
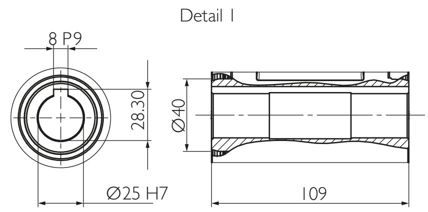
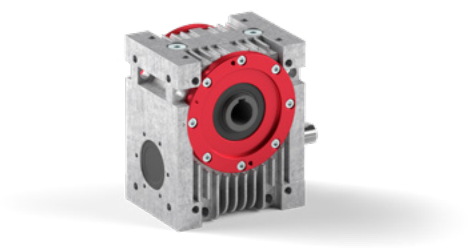




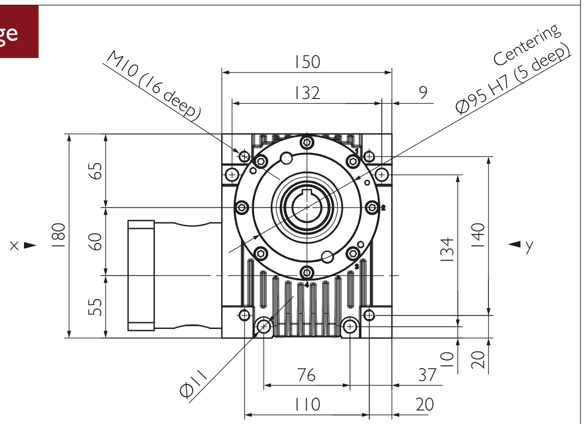


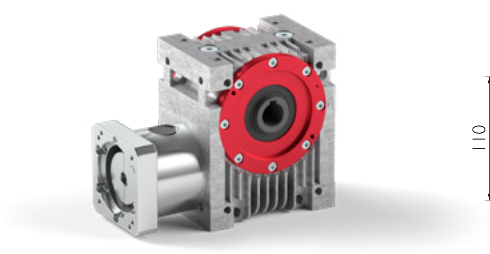


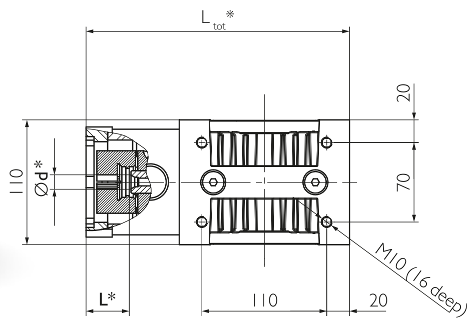


Example HPG 060 C7

C with option motor flange







Example HPG 060 C7

* Motor-specific gearbox dimensions

Ratio	i			2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	135	192	219	211	186	215	199	195	195	202	144	209	144
		η	[%]	89	89	88	88	87	84	82	78	74	67	64	54	50
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	107	158	184	180	160	186	173	170	190	185	144	184	144
		η	[%]	90	90	90	89	88	86	84	81	77	70	65	56	53
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	89	135	159	157	140	164	153	151	168	165	144	163	144
		η	[%]	90	91	90	89	89	86	84	81	78	70	65	56	52
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	59	93	113	113	103	121	114	113	126	124	126	123	126
		η	[%]	90	90	90	89	88	86	83	80	77	69	64	55	50
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	44	71	88	89	81	96	91	90	101	99	101	98	101
		η	[%]	89	89	89	88	87	84	82	78	75	67	61	52	47
	n_{1N} = 6000 rpm	T_{2N}	[Nm]	35	58	71	73	67	80	75	75	84	82	84	82	84
		η	[%]	88	88	88	87	85	83	80	75	72	64	58	48	44
Max. acceleration torque		T_{2B}	[Nm]	140	220									150	220	150
Emergency stop torque		T_{2Not}	[Nm]	300										200	300	200
Idling torque a)		T_{012}	[Nm]	1.45			1.3				1.1					
Max. input speed		n_{1Max}	[rpm]	6000												
Max. backlash b) at the output	PS	j_t	[arcmin]	<13	<10	<9	<9	<8	<7					<6		
	PR	j_t	[arcmin]	<9	<7	<6	<6	<5	<4.5					<4		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	2.5	4.8	7.6	8.6	10	11	12.1	13.3	14.5	15.4	15	16	15
Stability at the output		C_{2K}	[Nm/arcmin]	42												
Max. axial force c)d) at the output		F_{a2max}	[N]	780	1100	1900	2800	3600	3300	3800	4300	4500	5600	6300	6400	6400
Max. radial force c)e) at the output		F_{r2max}	[N]	840	1200	1500	2200	2400	2000	2100	2300	2300	2700	2900	2900	2900
Max. overturning torque c) at the output		M_{2max}	[Nm]	67	95	120	170	190	160	170	180	190	220	230	240	230
Max. axial force c)d) at the input		F_{a1max}	[N]	1700	990	750	1000	1400	1100	1400	1600	1200	1400	1300	1500	1300
Max. radial force c)f) at the input		F_{r1max}	[N]	690	510	390	520	720	560	710	760	610	650	620	690	630
Mass moment of inertia g)		J_1	[10^{-6} kg m^2]	416	199	122	87	68	49	40	33	30	27	26	25	25
Mass moment of inertia g) h)		J_1	[10^{-6} kg m^2]	531	314	237	202	183	164	155	148	145	142	141	140	140
Mass moment of inertia g) i)		J_1	[10^{-6} kg m^2]	670	453	376	341	322	303	294	287	284	281	280	279	279
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	8												
Weight with motor components		m	[kg]	≈ 10												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000 rpm and operating temperature.

b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.

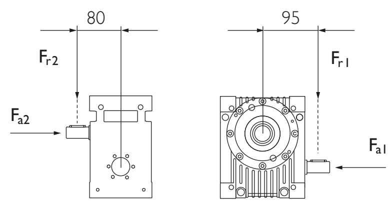
c) Bearing forces: Values valid at n_1 = 3000 rpm; ⅔ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.

- c) d) in relation to shaft center.
- c) e) at a distance of 80 mm from the middle of the casing.
- c) f) at a distance of 95 mm from the middle of the casing.

g) in relation to the input.

- g) h) including elastomer coupling 5103-24 (calculated with drilled hole for motor shaft-Ø20)
- g) i) including elastomer coupling 5103-28 (calculated with drilled hole for motor shaft-Ø25)

Bearing forces

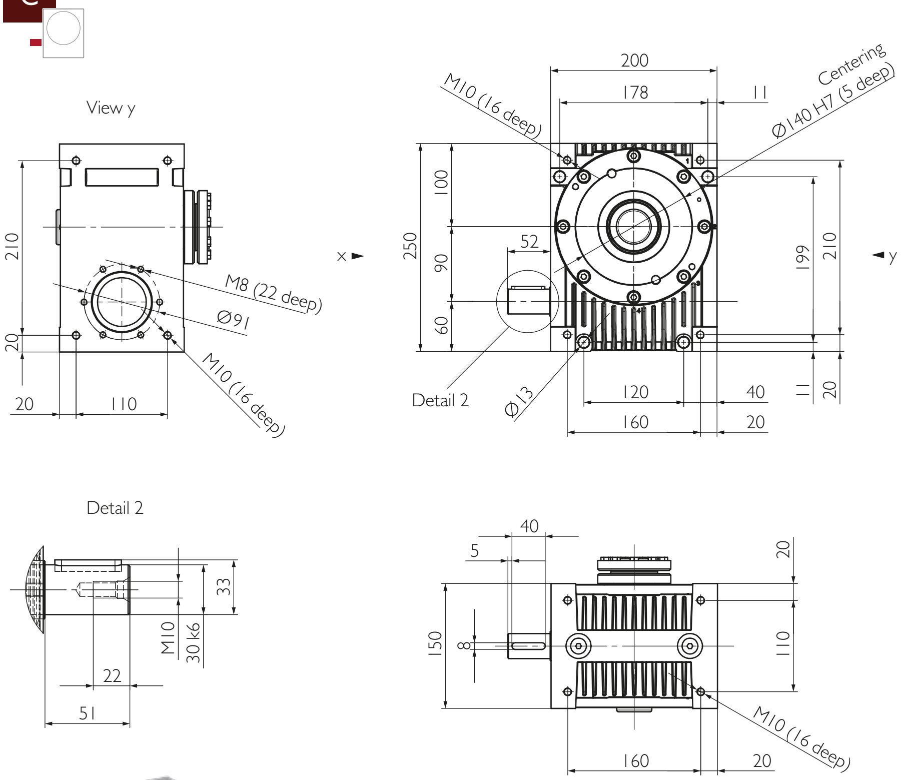


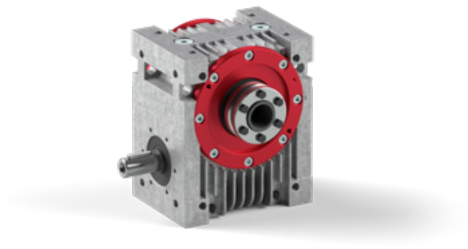
at the output at the input

Input

Output

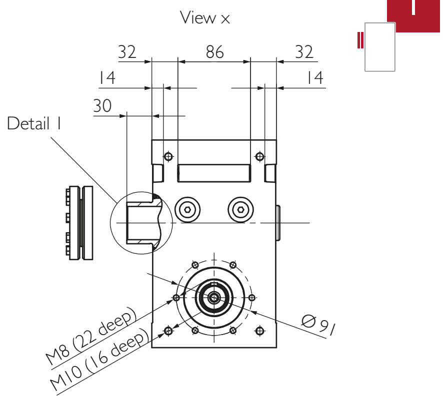
C



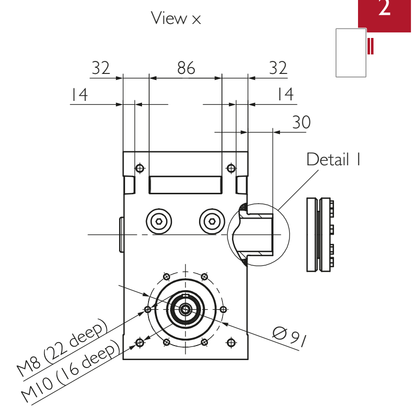


Example HPG 090 C2

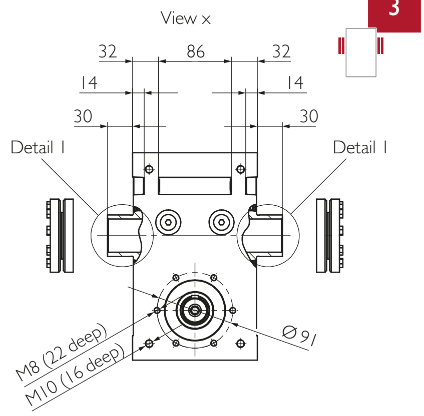
I



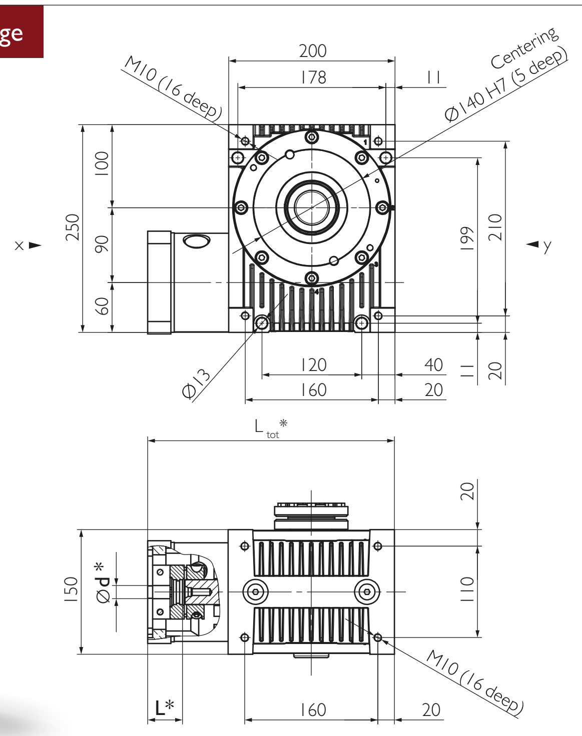
2

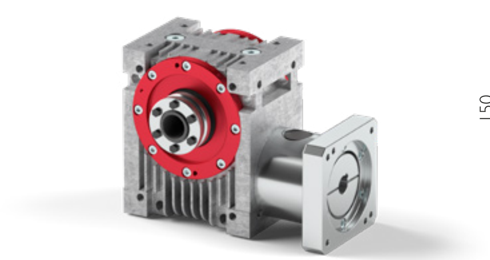


3

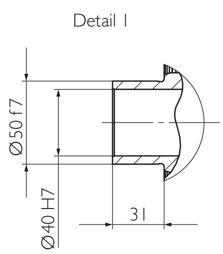


C with option motor flange





Example HPG 090 C1

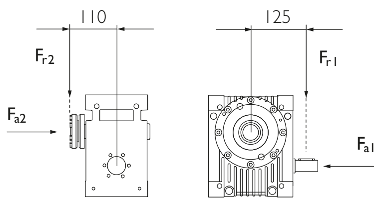


* Motor-specific gearbox dimensions

Ratio	i			2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	469	679	784	761	674	782	726	712	700	727	527	752	527
		η	[%]	92	92	91	91	90	88	87	84	80	74	71	61	50
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	350	528	624	615	551	644	601	592	660	645	527	640	527
		η	[%]	92	92	92	92	91	89	88	85	82	76	72	63	57
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	279	432	518	516	466	547	513	507	565	553	527	550	527
		η	[%]	92	93	92	92	91	90	88	85	83	77	72	64	57
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	174	279	343	348	318	377	356	354	395	388	396	386	396
		η	[%]	92	92	92	92	91	89	88	85	82	76	70	62	55
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	126	206	257	262	241	288	273	272	303	298	305	297	305
		η	[%]	91	92	92	91	90	88	86	83	81	74	68	60	53
Max. acceleration torque		T_{2B}	[Nm]	470	790									530	790	530
Emergency stop torque		T_{2not}	[Nm]	900										700	900	700
Idling torque[a)]		T_{012}	[Nm]	2.8			2.5				2					
Max. input speed		n_{1Max}	[rpm]	4500												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<10	<8	<7	<7	<6	<6					<5		
	PR	j_t	[arcmin]	<6.5	<5	<4.5	<4	<4	<3.5					<3		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	5.5	10.8	15.9	18.3	20.8	23.3	25.8	28.3	31.3	33.2	32	35	32
Stability at the output		C_{2K}	[Nm/arcmin]	95												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	6200	8200	7800	9200	11000	12000	14000	17000	18000	18000	18000	19000	19000
Max. radial force[c)e)] at the output		F_{r2max}	[N]	5300	6400	5500	5800	6500	6800	7500	8400	8600	8700	8800	8800	8800
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	590	700	600	640	710	750	830	920	940	960	970	970	970
Max. axial force[c)d)] at the input		F_{a1max}	[N]	3100	1600	1100	1700	2800	2000	2700	2900	2300	2500	2700	2600	2800
Max. radial force[c)f)] at the input		F_{r1max}	[N]	1500	910	640	990	1600	1200	1500	1700	1300	1400	1600	1500	1600
Mass moment of inertia[g)]		J_1	[10^{-5} kg m^2]	336	160	98	70	54	39	32	26	24	21	20	19	19
Mass moment of inertia[g)h)]		J_1	[10^{-5} kg m^2]	362	185	124	95	80	64	57	51	49	46	46	45	45
Mass moment of inertia[g)i)]		J_1	[10^{-5} kg m^2]	403	227	165	136	121	105	98	93	90	88	87	86	86
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	23												
Weight with motor components		m	[kg]	≈ 27												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000 rpm and operating temperature.
b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.
c) Bearing forces: Values valid at n_1 = 1500 rpm; ½ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
c) d) in relation to shaft center.
c) e) at a distance of 110 mm from the middle of the casing.
c) f) at a distance of 125 mm from the middle of the casing.
g) in relation to the input, including shrink disc at the output (output 1 & 2),
with two shrink discs (output 3) increase values by $115/i^2$.
g) h) including elastomer coupling 5103-28 (calculated with drilled hole for motor shaft-Ø25)
g) i) including elastomer coupling 5103-38 (calculated with drilled hole for motor shaft-Ø45)

Bearing forces

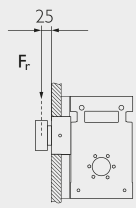


at the output at the input

Package

			Output flange including bearing & pinion				
Radial rigidity	C_3	[N/mm]	45000				
Speed	n_{2N}	[rpm]	1500	750	400	150	100
Max. radial force[j)]	F_{rmax}	[N]	4800	5900	7200	8800	9700

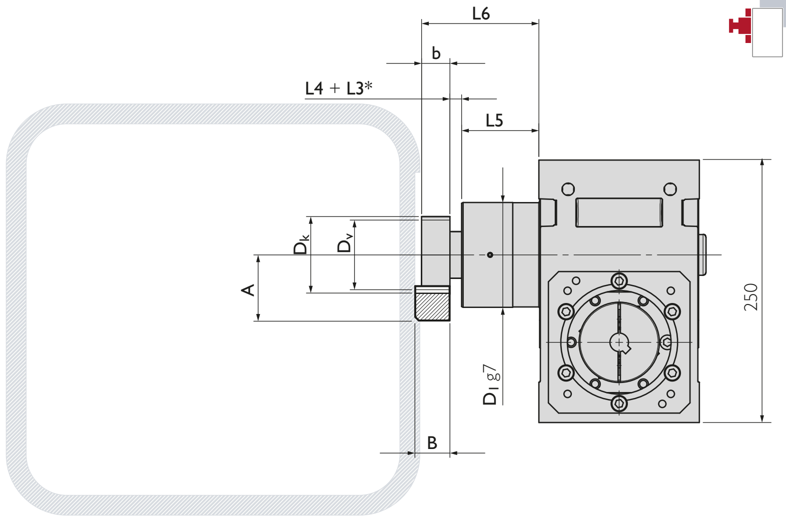
j) Bearing forces: Values valid at duty cycle of 40% at a distance of 25mm from the end of the bearing.



Detailed information about the **package, options & accessories** on pages 54 and 55.

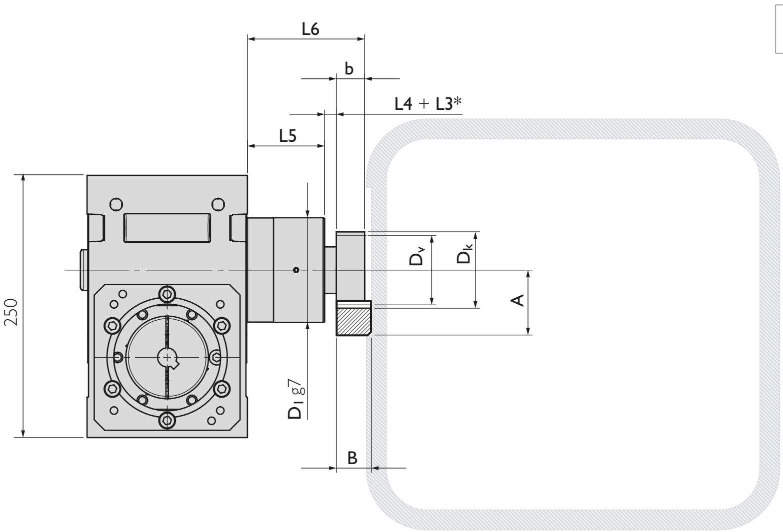
Output flange including bearing & pinion a)

Package

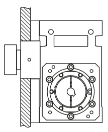


Example HPG 090 C2 Package

Package



a) The output flange must be supported by the customer supplied equipment at the bearing end (D1), in a hole with an H8 tolerance.



* **L3** for additional distance ring.

Geometric information

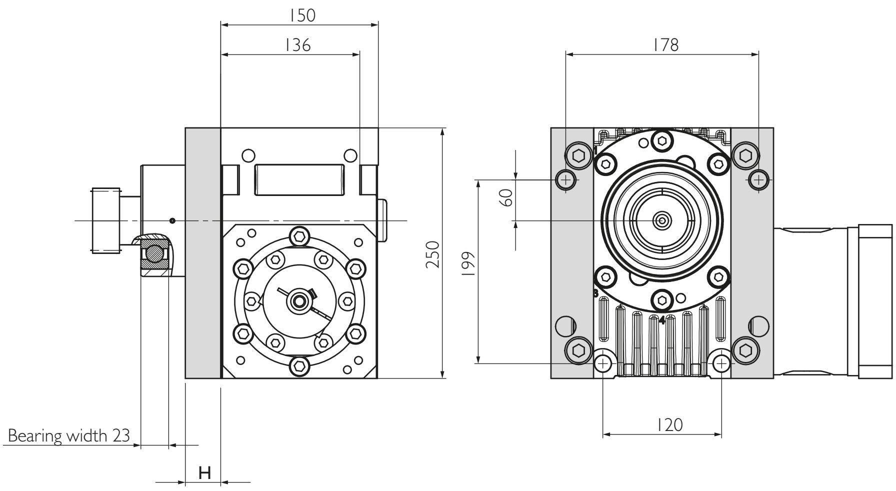
Helical modular pitch	Part. No.	m_n	P_t	z	A	b	B	D_k	D_0	D_v	D_I	L4	L5	L6
Pinion 1	211420	3	10.00	20	57.83	30	29	69.66	63.662	63.662	98	12.5	63.0	105.5
													104.5	147.0
Pinion 2	211520	4	13.33	20	77.44	40	39	92.88	84.883	84.883	98	18.0	63.0	121.0
													104.5	162.5

m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

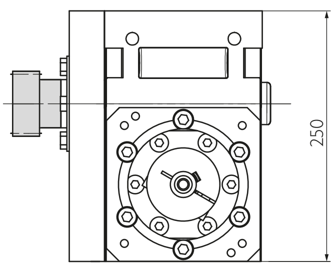
Straight modular pitch	Part. No.	m_n	P_n	z	A	b	B	D_k	D_0	D_v	D_I	L4	L5	L6
Pinion 3	201420	3	9.42	20	56.00	30	29	66.00	60.000	60.000	98	12.5	63.0	105.5
													104.5	147.0
Pinion 4	201520	4	12.57	20	75.00	40	39	88.00	80.000	80.000	98	18.0	63.0	121.0
													104.5	162.5

m_n: Normal module, P_n: Normal pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

Spacer elements

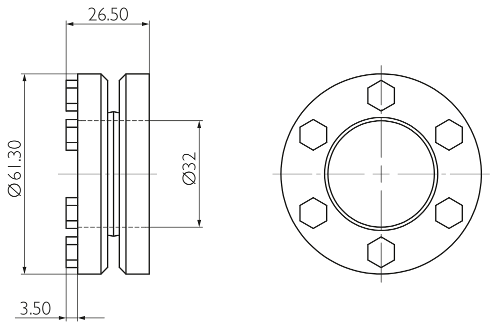


With pinion special solutions on request

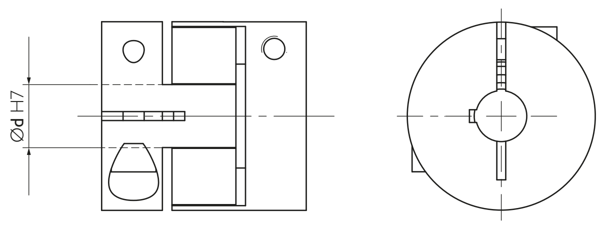


Casing can only be fastened with long screws as per the bore hole pattern.
Screws M6 of length 56mm + **H** + thread depth, tightening torque 9Nm.

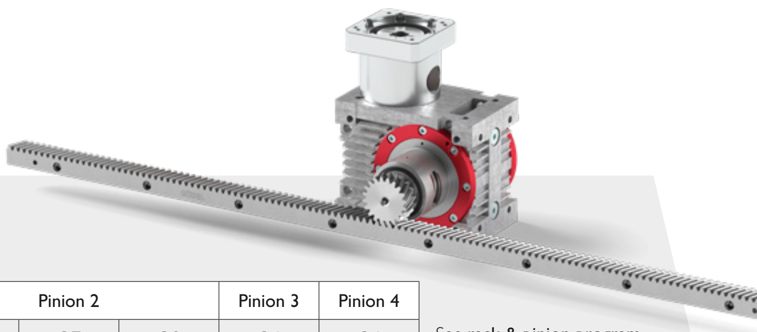
Shrink disc



Elastomer coupling



For more details see **Motor Interface** on page 84 et. seq.



Your ideal drive train

Our function package with high-performance angle gearbox, output flange, pinion and rack by Güdel.

			Pinion 1			Pinion 2			Pinion 3	Pinion 4
			Q6	Q7	Q9	Q6	Q7	Q9	Q6	Q6
Max acceleration force	F_{2B}	[N]	16163	7565	12980	28585	14084	24045	13697	24068
Max acceleration torque	T_{2B}	[Nm]	515	241	413	1213	598	1021	411	963
Precision			PR		PS	PR		PS		
Feed force			High	Medium	Elevated	High	Medium	Elevated		

Above values for rack and pinion take into consideration a number of load cycles:
1×10^6 for the rack; 1×10^7 for the pinion. Both in pulsating operation.

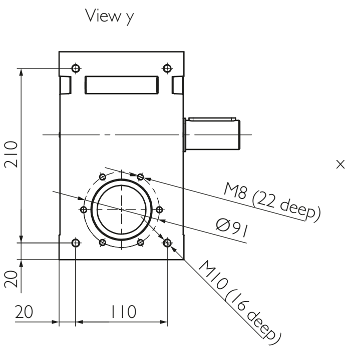
See **rack & pinion program** of your ideal drive train on pages 70 et seq.

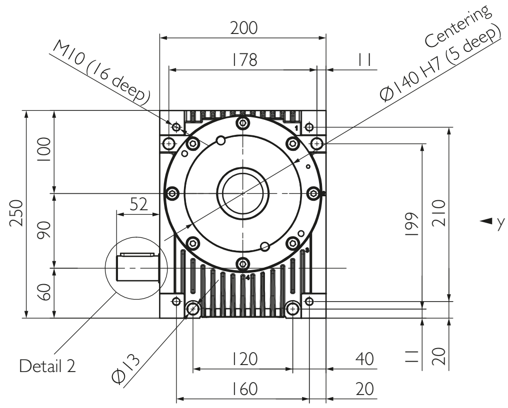
See **flowcharts** to find your ideal drive train on pages 88 et seq.

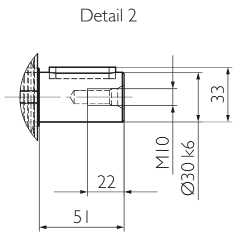
Input

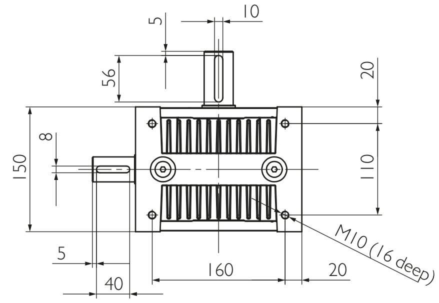
Output

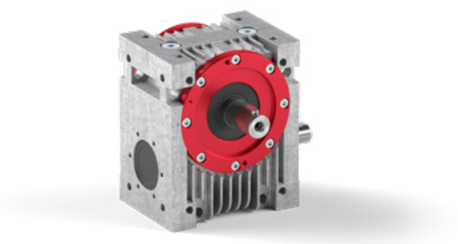
C





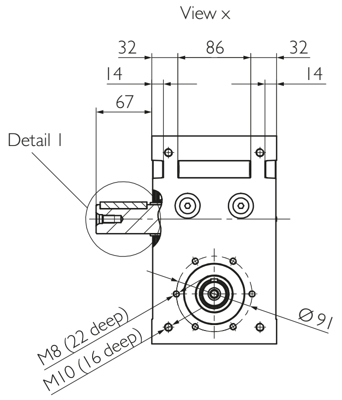




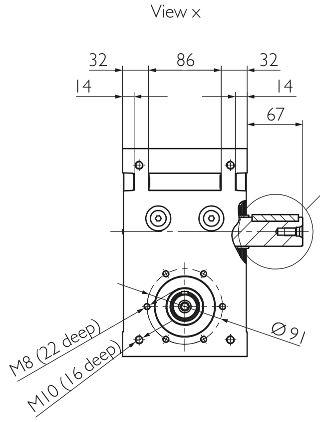


Example HPG 090 C4

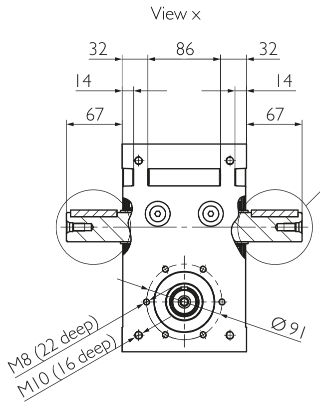
4



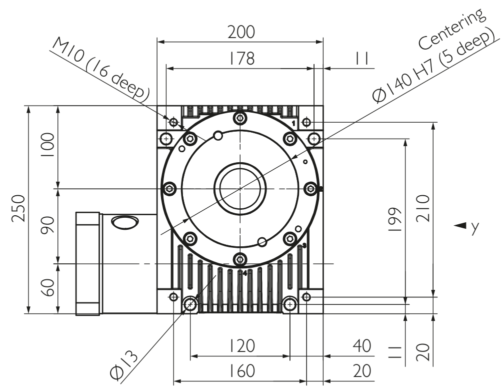
5

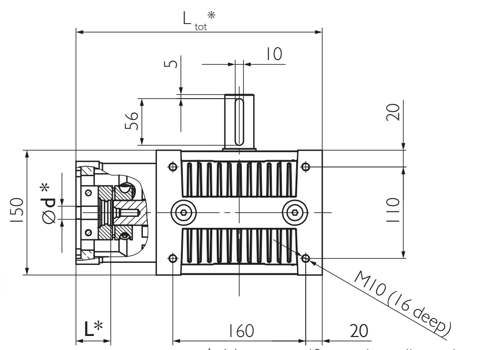


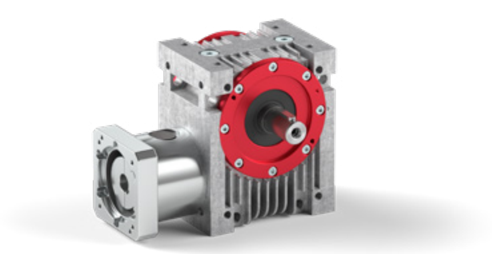
6



C with option motor flange

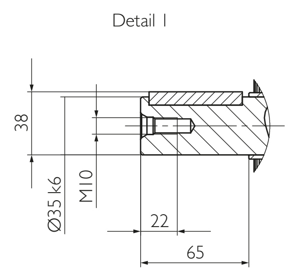






Example HPG 090 C6

* Motor-specific gearbox dimensions



Ratio	i			2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	469	679	784	761	674	782	726	712	700	727	527	752	527
		η	[%]	92	92	91	91	90	88	87	84	80	74	71	61	50
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	350	528	624	615	551	644	601	592	660	645	527	640	527
		η	[%]	92	92	92	92	91	89	88	85	82	76	72	63	57
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	279	432	518	516	466	547	513	507	565	553	527	550	527
		η	[%]	92	93	92	92	91	90	88	85	83	77	72	64	57
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	174	279	343	348	318	377	356	354	395	388	396	386	396
		η	[%]	92	92	92	92	91	89	88	85	82	76	70	62	55
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	126	206	257	262	241	288	273	272	303	298	305	297	305
		η	[%]	91	92	92	91	90	88	86	83	81	74	68	60	53
Max. acceleration torque		T_{2B}	[Nm]	470	790									530	790	530
Emergency stop torque		T_{2Not}	[Nm]	900										700	900	700
Idling torque[a]		T_{012}	[Nm]	2.8			2.5				2					
Max. input speed		n_{1Max}	[rpm]	4500												
Max. backlash[b] at the output	PS	j_t	[arcmin]	<10	<8	<7	<7	<6	<6					<5		
	PR	j_t	[arcmin]	<6.5	<5	<4.5	<4	<4	<3.5					<3		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	5.5	10.8	15.9	18.3	20.8	23.3	25.8	28.3	31.3	33.2	32	35	32
Stability at the output		C_{2K}	[Nm/arcmin]	73												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	820	1400	1400	2800	4400	5000	6600	8300	8100	8700	9100	9200	9400
Max. radial force[c)e)] at the output		F_{r2max}	[N]	800	930	1000	1400	3000	3100	3700	4200	4300	4400	4500	4500	4600
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	88	100	110	160	330	350	400	460	470	490	500	500	500
Max. axial force[c)d)] at the input		F_{a1max}	[N]	3100	1600	1100	1700	2800	2000	2700	2900	2300	2500	2700	2600	2800
Max. radial force[c)f)] at the input		F_{r1max}	[N]	1500	910	640	990	1600	1200	1500	1700	1300	1400	1600	1500	1600
Mass moment of inertia[g)]		J_1	[10^{-5} kg m^2]	336	160	98	70	54	39	32	26	24	21	20	19	19
Mass moment of inertia[g)h)]		J_1	[10^{-5} kg m^2]	362	185	124	95	80	64	57	51	49	46	46	45	45
Mass moment of inertia[g)i)]		J_1	[10^{-5} kg m^2]	403	227	165	136	121	105	98	93	90	88	87	86	86
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	22												
Weight with motor components		m	[kg]	≈ 26												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000 rpm and operating temperature.

b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.

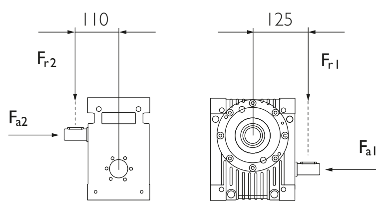
c) Bearing forces: Values valid at n_1 = 1500 rpm; ½ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.

- c) d) in relation to shaft center.
- c) e) at a distance of 110 mm from the middle of the casing.
- c) f) at a distance of 125 mm from the middle of the casing.

g) in relation to the input.

- g) h) including elastomer coupling 5103-28 (calculated with drilled hole for motor shaft-Ø25)
- g) i) including elastomer coupling 5103-38 (calculated with drilled hole for motor shaft-Ø45)

Bearing forces

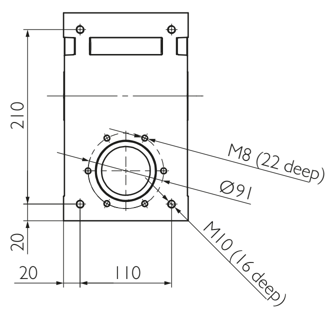


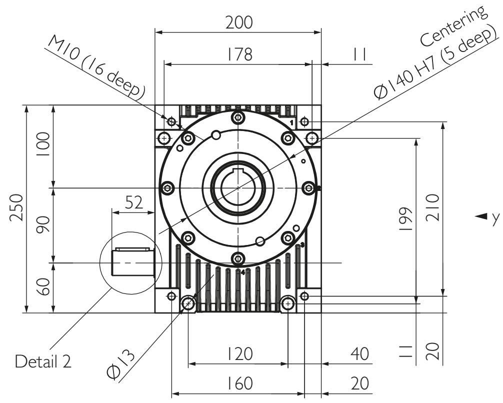
at the output at the input

Input

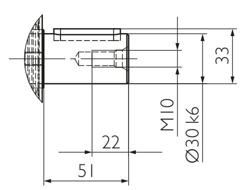
C

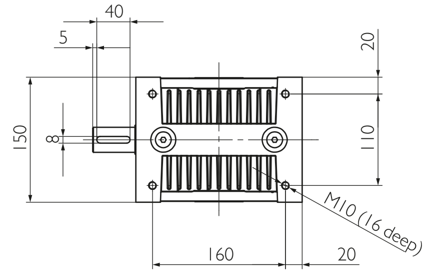
View y

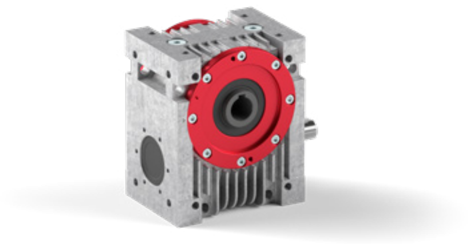




Detail 2





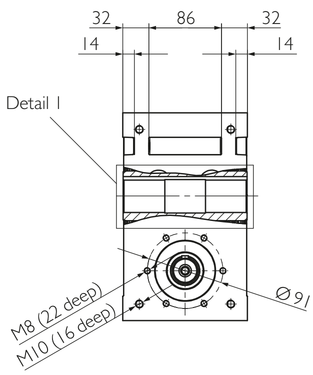


Example HPG 090 C7

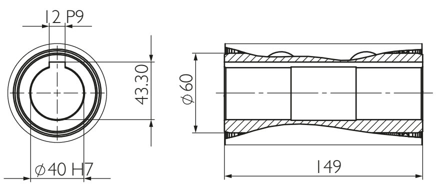
Output

7

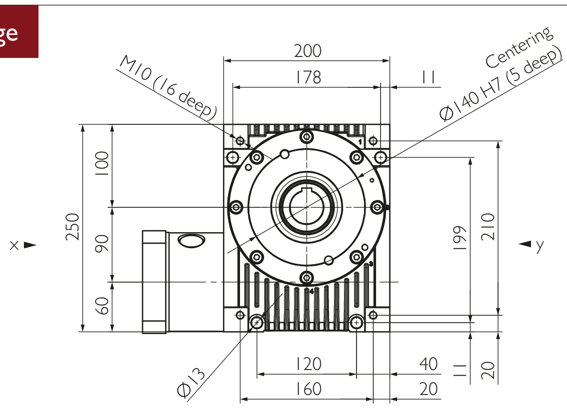
View x

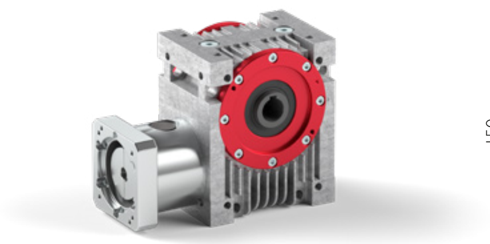


Detail I

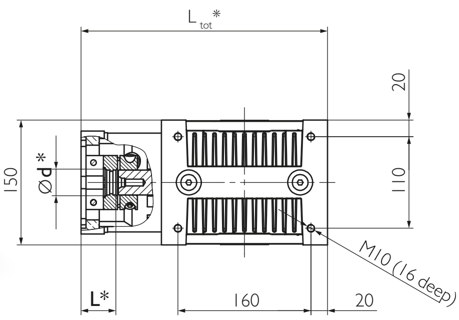


C with option motor flange





Example HPG 090 C7



* Motor-specific gearbox dimensions

Ratio		i		2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500rpm	T_{2N}	[Nm]	469	679	784	761	674	782	726	712	700	727	527	752	527
		η	[%]	92	92	91	91	90	88	87	84	80	74	71	61	50
	n_{1N} = 1000rpm	T_{2N}	[Nm]	350	528	624	615	551	644	601	592	660	645	527	640	527
		η	[%]	92	92	92	92	91	89	88	85	82	76	72	63	57
	n_{1N} = 1500rpm	T_{2N}	[Nm]	279	432	518	516	466	547	513	507	565	553	527	550	527
		η	[%]	92	93	92	92	91	90	88	85	83	77	72	64	57
	n_{1N} = 3000rpm	T_{2N}	[Nm]	174	279	343	348	318	377	356	354	395	388	396	386	396
		η	[%]	92	92	92	92	91	89	88	85	82	76	70	62	55
	n_{1N} = 4500rpm	T_{2N}	[Nm]	126	206	257	262	241	288	273	272	303	298	305	297	305
		η	[%]	91	92	92	91	90	88	86	83	81	74	68	60	53
Max. acceleration torque		T_{2B}	[Nm]	470	790									530	790	530
Emergency stop torque		T_{2not}	[Nm]	900										700	900	700
Idling torque[a)]		T_{012}	[Nm]	2.8			2.5				2					
Max. input speed		n_{1Max}	[rpm]	4500												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<10	<8	<7	<7	<6	<6					<5		
	PR	j_t	[arcmin]	<6.5	<5	<4.5	<4	<4	<3.5					<3		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	5.5	10.8	15.9	18.3	20.8	23.3	25.8	28.3	31.3	33.2	32	35	32
Stability at the output		C_{2K}	[Nm/arcmin]	95												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	6200	8200	7800	9200	11000	12000	14000	17000	18000	18000	18000	19000	19000
Max. radial force[c)e)] at the output		F_{r2max}	[N]	5300	6400	5500	5800	6500	6800	7500	8400	8600	8700	8800	8800	8800
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	590	700	600	640	710	750	830	920	940	960	970	970	970
Max. axial force[c)d)] at the input		F_{a1max}	[N]	3100	1600	1100	1700	2800	2000	2700	2900	2300	2500	2700	2600	2800
Max. radial force[c)f)] at the input		F_{r1max}	[N]	1500	910	640	990	1600	1200	1500	1700	1300	1400	1600	1500	1600
Mass moment of inertia[g)]		J_1	[10^{-5} kg m^2]	308	147	91	65	51	37	30	25	23	21	20	19	19
Mass moment of inertia[g)h)]		J_1	[10^{-5} kg m^2]	333	173	116	90	76	62	56	51	49	46	46	45	45
Mass moment of inertia[g)i)]		J_1	[10^{-5} kg m^2]	374	214	158	132	118	103	97	92	90	87	87	86	86
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	22												
Weight with motor components		m	[kg]	≈ 26												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

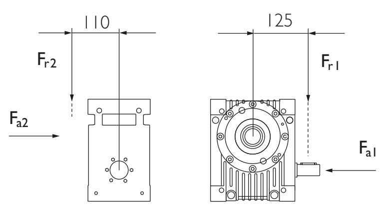
a) approximate, at n_1 = 3000 rpm and operating temperature.

b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.

c) Bearing forces: Values valid at n_1 = 1500 rpm; ½ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
- c) d) in relation to shaft center.
- c) e) at a distance of 110 mm from the middle of the casing.
- c) f) at a distance of 125 mm from the middle of the casing.

g) in relation to the input.
- g) h) including elastomer coupling 5103-28 (calculated with drilled hole for motor shaft-Ø25)
- g) i) including elastomer coupling 5103-38 (calculated with drilled hole for motor shaft-Ø45)

Bearing forces

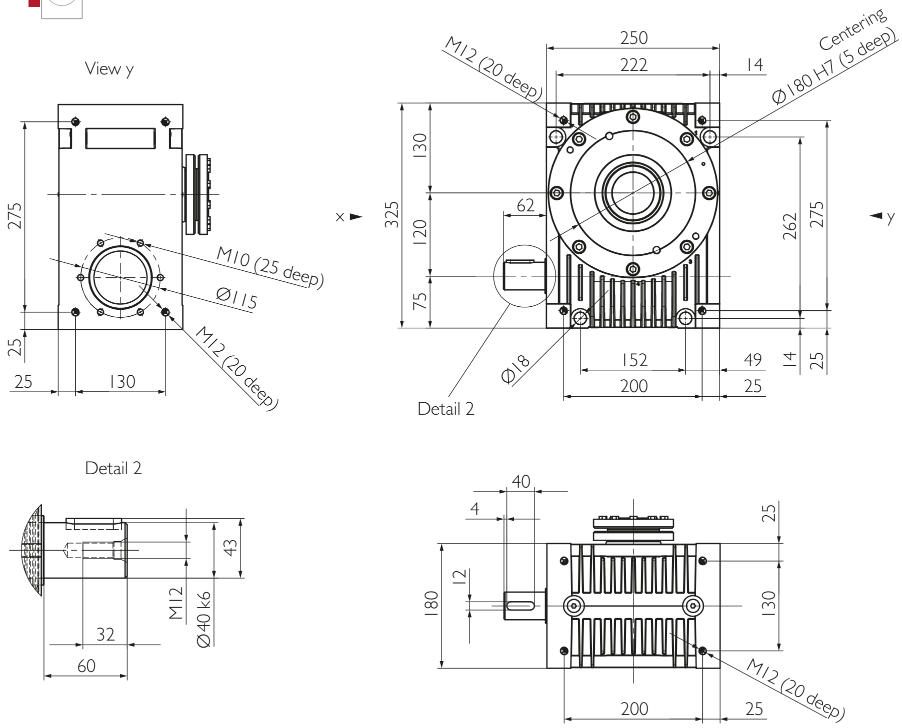


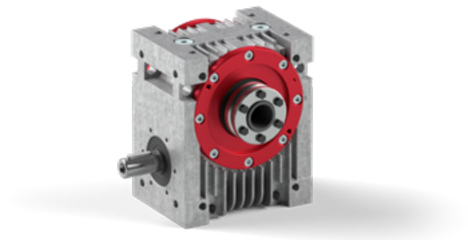
at the output at the input

Input

Output

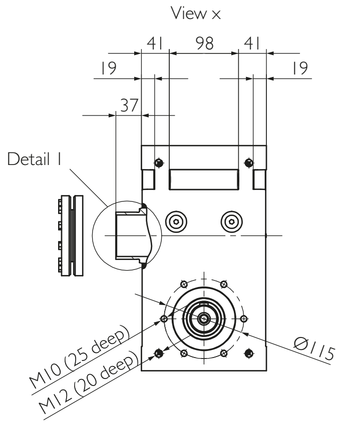
C



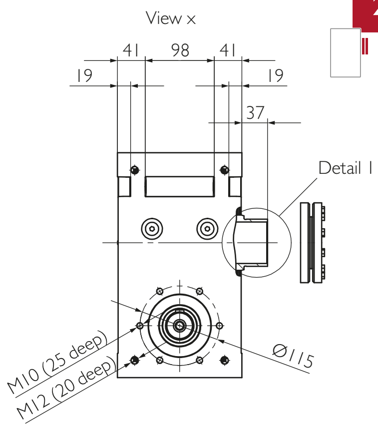


Example HPG 120 C2

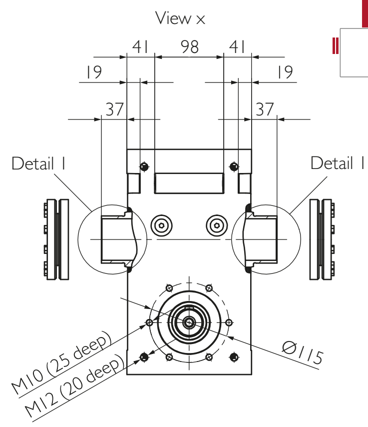
I



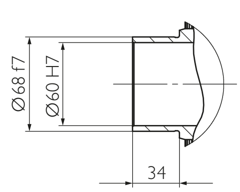
2



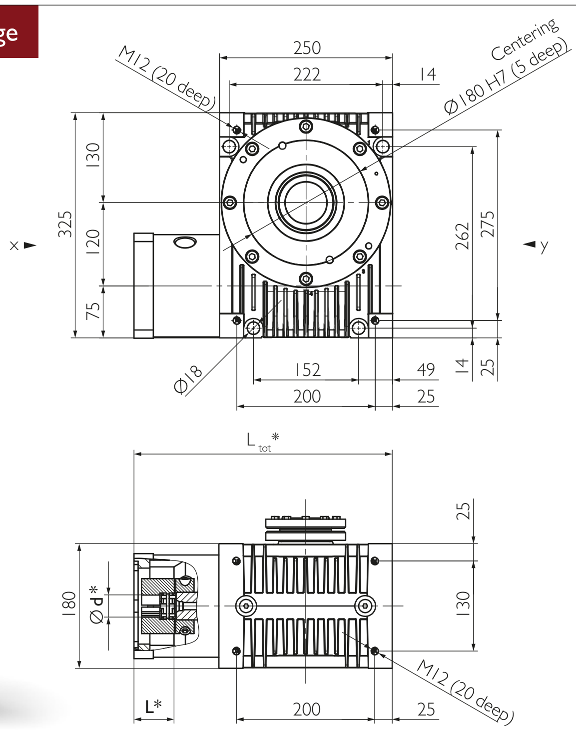
3

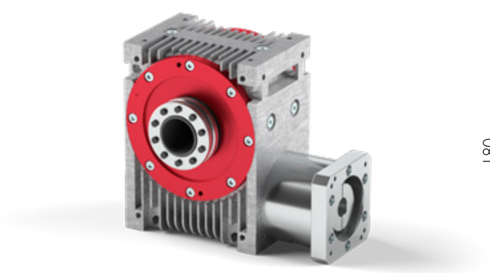


Detail I



C with option motor flange





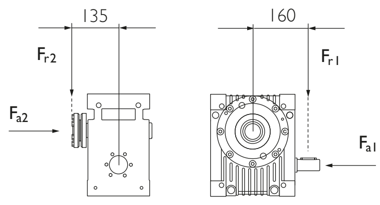
Example HPG 120 C1

* Motor-specific gearbox dimensions

Ratio	i			2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500 rpm	T_{2N}	[Nm]	1177	1732	2018	1969	1752	2038	1895	1863	1824	1900	1364	1970	1364
		η	[%]	93	93	93	93	92	90	89	87	84	78	75	66	61
	n_{1N} = 1000 rpm	T_{2N}	[Nm]	836	1284	1534	1523	1371	1609	1505	1487	1658	1622	1364	1612	1364
		η	[%]	94	94	94	93	93	91	90	88	85	80	76	68	62
	n_{1N} = 1500 rpm	T_{2N}	[Nm]	648	1020	1237	1241	1126	1329	1248	1237	1380	1353	1364	1345	1364
		η	[%]	94	94	94	93	93	91	90	88	86	80	76	69	62
	n_{1N} = 3000 rpm	T_{2N}	[Nm]	387	631	783	798	733	873	826	822	918	903	921	899	921
		η	[%]	93	94	93	93	93	91	90	88	85	80	74	68	60
	n_{1N} = 4500 rpm	T_{2N}	[Nm]	276	457	573	588	543	650	617	616	688	677	689	675	689
		η	[%]	93	93	93	93	92	91	89	87	84	79	73	66	58
Max. acceleration torque		T_{2B}	[Nm]	1200	2040									1400	2040	1400
Emergency stop torque		T_{2not}	[Nm]	2300										1600	2300	1600
Idling torque[a)]		T_{012}	[Nm]	4.5			4				3					
Max. input speed		n_{1Max}	[rpm]	4500												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<8	<7	<6	<6	<5	<5					<4		
	PR	j_t	[arcmin]	<5.5	<4.5	<4	<3.5	<3	<3					<2.5		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	11.5	19	24.5	26.5	29	31.5	34	36.5	38.5	40.5	39	42.5	39
Stability at the output		C_{2K}	[Nm/arcmin]	165												
Max. axial force[c) d)] at the output		F_{a2max}	[N]	7000	9600	9500	12000	16000	17000	21000	25000	26000	27000	27000	27000	28000
Max. radial force[c) e)] at the output		F_{r2max}	[N]	7700	8100	7300	8800	9900	10000	12000	13000	13000	14000	14000	14000	14000
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	1000	1100	980	1200	1300	1400	1600	1800	1800	1800	1800	1900	1900
Max. axial force[c) d)] at the input		F_{a1max}	[N]	3600	1800	730	1700	3600	2100	3300	3700	2500	2900	2700	3100	2700
Max. radial force[c) f)] at the input		F_{r1max}	[N]	1900	950	390	930	1900	1200	1800	2000	1300	1600	1400	1700	1500
Mass moment of inertia[g)]		J_1	[10^{-5} kg m^2]	1392	660	403	285	220	156	127	103	94	83	80	76	75
Mass moment of inertia[g) h)]		J_1	[10^{-5} kg m^2]	1459	726	470	351	287	223	193	170	161	150	146	143	142
Mass moment of inertia[g) i)]		J_1	[10^{-5} kg m^2]	1574	842	585	467	402	338	309	285	276	265	262	258	257
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	48												
Weight with motor components		m	[kg]	≈ 53												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximately, at n_1 = 3000 rpm and operating temperature.
b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.
c) Bearing forces: Values valid at n_1 = 1500 rpm; ½ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
c) d) in relation to shaft center.
c) e) at a distance of 135 mm from the middle of the casing.
c) f) at a distance of 160 mm from the middle of the casing.
g) in relation to the input, including shrink disc at the output (output 1 & 2),
with two shrink discs (output 3) increase values by 340/i².
g) h) including elastomer coupling 5103-38 (calculated with drilled hole for motor shaft-Ø45)
g) i) including elastomer coupling 5103-42 (calculated with drilled hole for motor shaft-Ø44)

Bearing forces

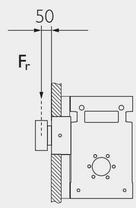


at the output at the input

Package

			Output flange including bearing & pinion				
Radial rigidity	C_3	[N/mm]	47000				
Speed	n_{2N}	[rpm]	1500	750	400	150	100
Max. radial force[j)]	F_{rmax}	[N]	11500	13000	17000	21000	24000

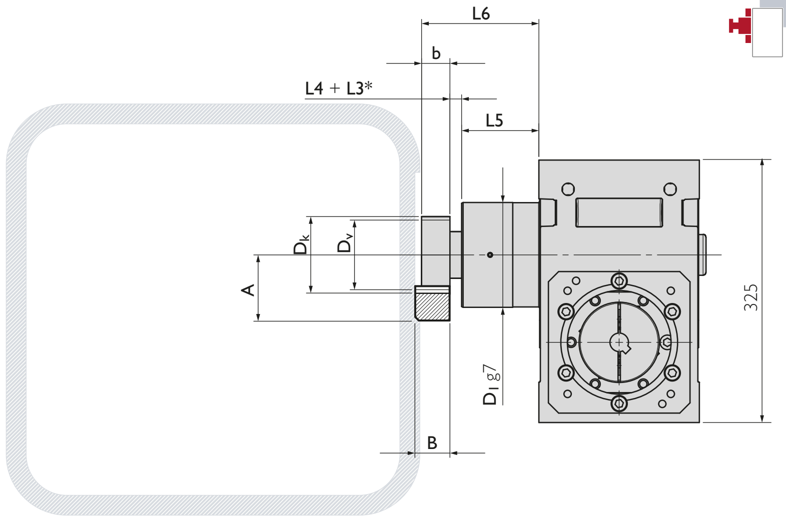
j) Bearing forces: Values valid at duty cycle of 40% at a distance of 50 mm from the end of the bearing.



Detailed information about the **package, options & accessories** on pages 62 and 63.

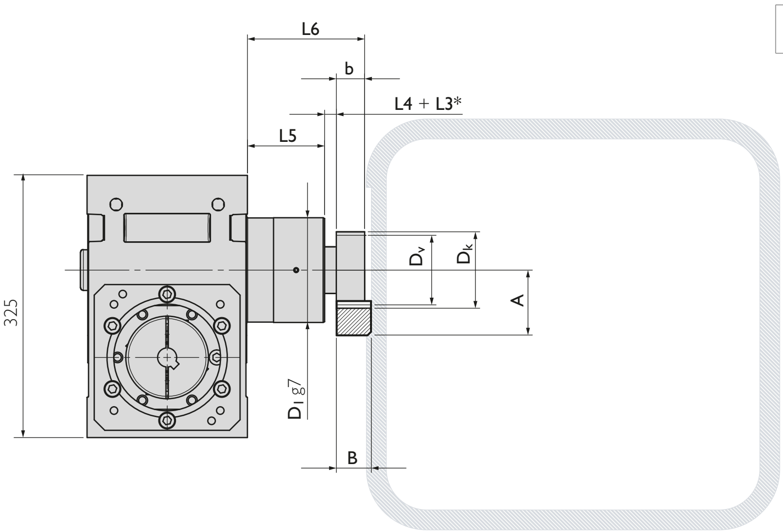
Output flange including bearing & pinion a)

Package

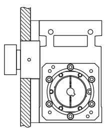


Example HPG 120 C2 Package

Package



a) The output flange must be supported by the customer supplied equipment at the bearing end (D1), in a hole with an H8 tolerance.



* **L3** for additional distance ring.

Geometric information

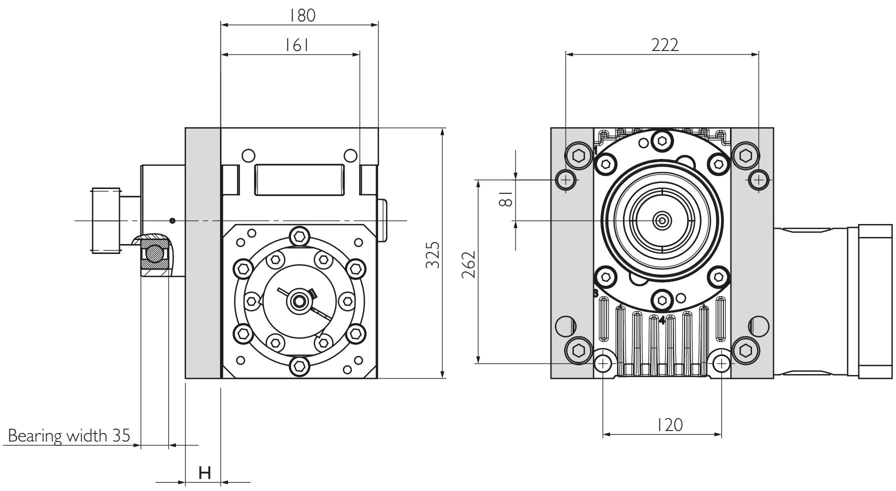
Helical modular pitch	Part. No.	m_n	P_t	z	A	b	B	D_k	D_0	D_v	D_1	L4	L5	L6
Pinion 1	211521	4	13.33	20	77.44	40	39	92.88	84.883	84.883	180	14.5	123	177.5
Pinion 2	211620	5	16.66	20	87.05	50	49	116.10	106.103	106.103	180	35	123	208.0

m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

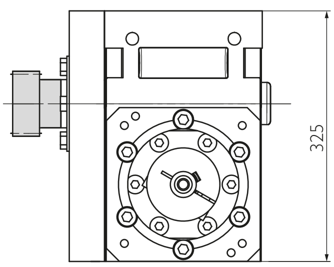
Straight modular pitch	Part. No.	m_n	P_n	z	A	b	B	D_k	D_0	D_v	D_1	L4	L5	L6
Pinion 3	201620	5	15.71	20	84.0	50	49	110.0	100.000	100.000	180	35	123	208.0
Pinion 4	201720	6	18.85	20	103.0	60	60	132.0	120.000	120.000	180	35	123	218.0
Pinion 5	201820	8	25.13	20	151.0	80	79	176.0	160.000	160.000	180	35	123	238.0

m_n: Normal module, P_n: Normal pitch [mm], z: Number of teeth, D_v: Pitch circle diameter for design, D_0: Pitch circle diameter for calculation

Spacer elements

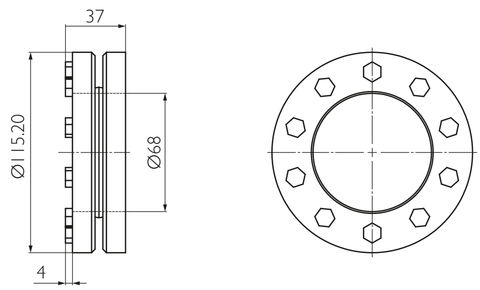


With pinion special solutions on request

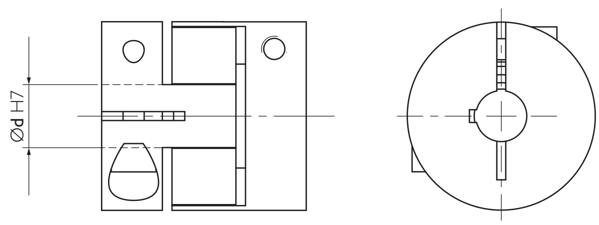


Casing can only be fastened with long screws as per the bore hole pattern.
Screws M6 of length 56mm + **H** + thread depth, tightening torque 9Nm.

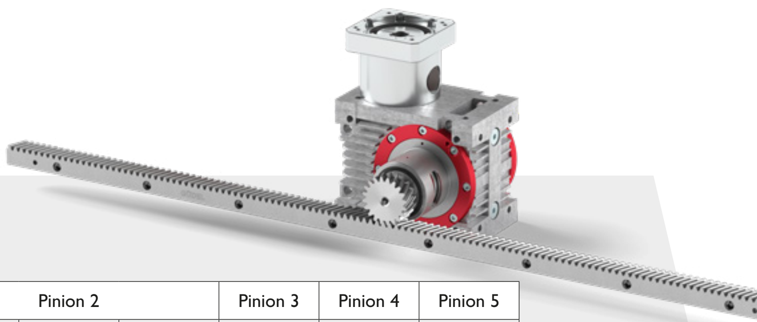
Shrink disc



Elastomer coupling



For more details see **Motor Interface** on page 84 et. seq.



Your ideal drive train

Our function package with high-performance angle gearbox, output flange, pinion and rack by Güdel.

			Pinion 1			Pinion 2			Pinion 3	Pinion 4	Pinion 5
			Q6	Q7	Q9	Q6	Q7	Q9	Q6	Q6	Q6
Max acceleration force	F_{2B}	[N]	28585	14084	24045	44505	23785	40048	37317	52880	91220
Max acceleration torque	T_{2B}	[Nm]	1213	598	1021	2361	1262	2125	1866	3173	7298
Precision			PR		PS	PR		PS			
Feed force			High	Medium	Elevated	High	Medium	Elevated			

Above values for rack and pinion take into consideration a number of load cycles:
1×10^6 for the rack; 1×10^7 for the pinion. Both in pulsating operation.

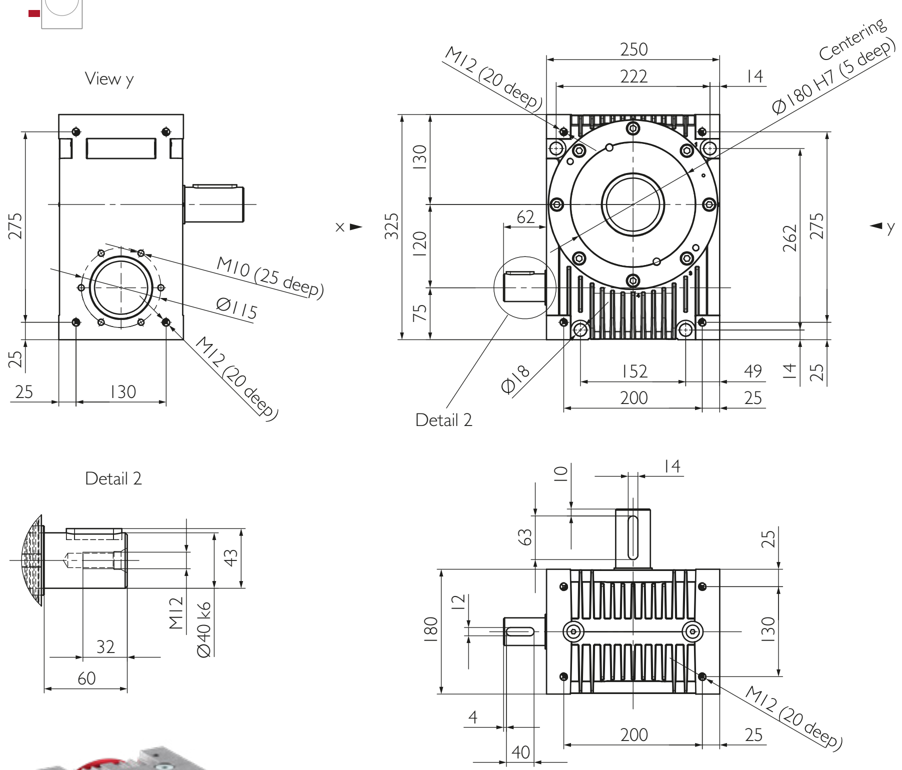
See **rack & pinion program** of your ideal drive train on pages 70 et seq.

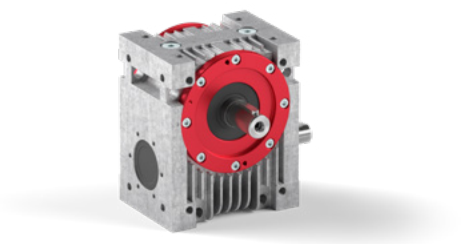
See **flowcharts** to find your ideal drive train on pages 88 et seq.

Input

Output

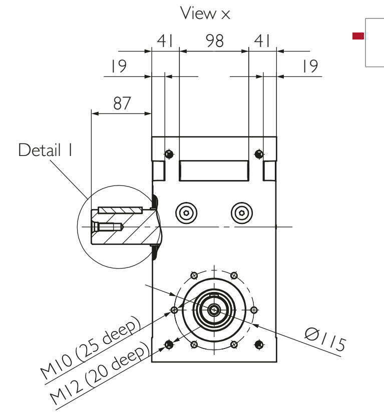
C



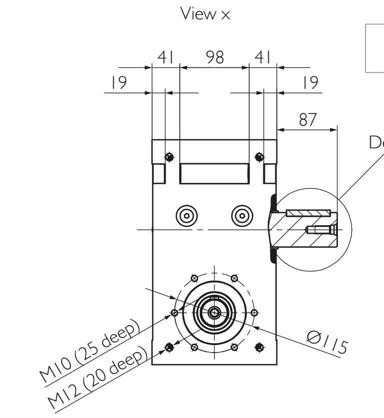


Example HPG 120 C4

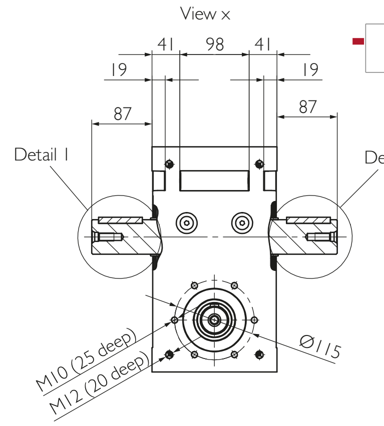
4



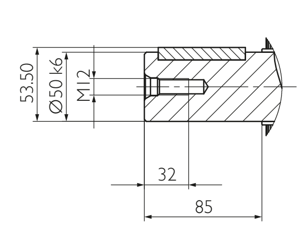
5



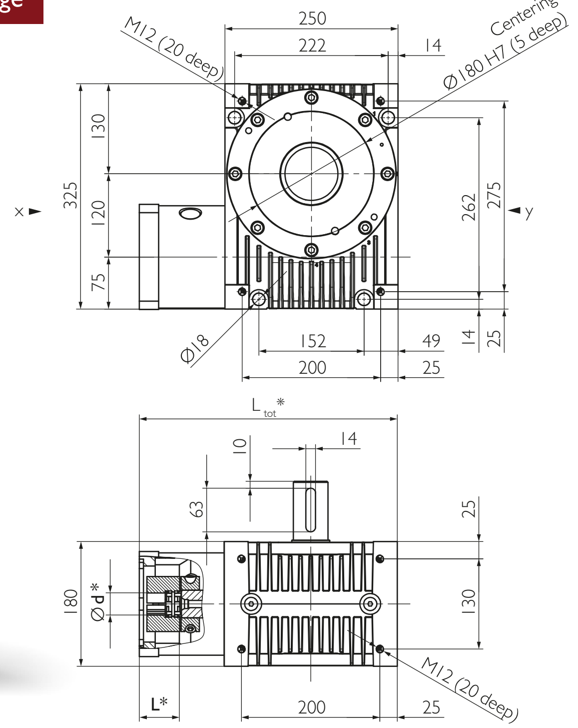
6

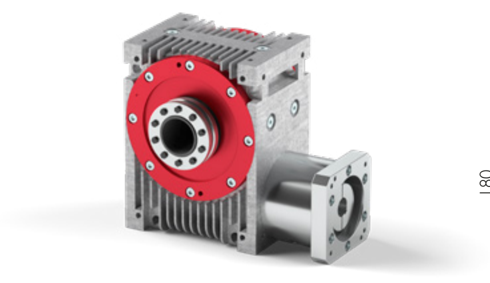


Detail I



C with option motor flange





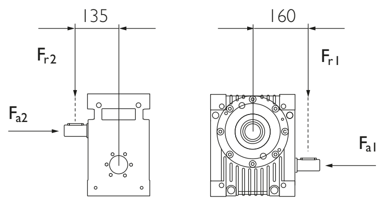
Example HPG 120 C3

* Motor-specific gearbox dimensions

Ratio		i		2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output / Efficiency	n_{1N} = 500rpm	T_{2N}	[Nm]	1177	1732	2018	1969	1752	2038	1895	1863	1824	1900	1364	1970	1364
		η	[%]	93	93	93	93	92	90	89	87	84	78	75	66	61
	n_{1N} = 1000rpm	T_{2N}	[Nm]	836	1284	1534	1523	1371	1609	1505	1487	1658	1622	1364	1612	1364
		η	[%]	94	94	94	93	93	91	90	88	85	80	76	68	62
	n_{1N} = 1500rpm	T_{2N}	[Nm]	648	1020	1237	1241	1126	1329	1248	1237	1380	1353	1364	1345	1364
		η	[%]	94	94	94	93	93	91	90	88	86	80	76	69	62
	n_{1N} = 3000rpm	T_{2N}	[Nm]	387	631	783	798	733	873	826	822	918	903	921	899	921
		η	[%]	93	94	93	93	93	91	90	88	85	80	74	68	60
	n_{1N} = 4500rpm	T_{2N}	[Nm]	276	457	573	588	543	650	617	616	688	677	689	675	689
		η	[%]	93	93	93	93	92	91	89	87	84	79	73	66	58
Max. acceleration torque		T_{2B}	[Nm]	1200	2040									1400	2040	1400
Emergency stop torque		T_{2not}	[Nm]	2300										1600	2300	1600
Idling torque[a)]		T_{012}	[Nm]	4.5			4				3					
Max. input speed		n_{1Max}	[rpm]	4500												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<8	<7	<6	<6	<5	<5					<4		
	PR	j_t	[arcmin]	<5.5	<4.5	<4	<3.5	<3	<3					<2.5		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	11.5	19	24.5	26.5	29	31.5	34	36.5	38.5	40.5	39	42.5	39
Stability at the output		C_{2K}	[Nm/arcmin]	138												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	2400	3900	3600	6200	9100	10000	13000	16000	17000	18000	18000	19000	19000
Max. radial force[c)e)] at the output		F_{r2max}	[N]	2500	2500	2700	3600	6200	6500	7500	8600	8700	9000	9100	9200	9200
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	340	340	360	480	830	880	1000	1200	1200	1200	1200	1200	1200
Max. axial force[c)d)] at the input		F_{a1max}	[N]	3600	1800	730	1700	3600	2100	3300	3700	2500	2900	2700	3100	2700
Max. radial force[c)f)] at the input		F_{r1max}	[N]	1900	950	390	930	1900	1200	1800	2000	1300	1600	1400	1700	1500
Mass moment of inertia[g)]		J_1	[10^{-5} kg m^2]	1392	660	403	285	220	156	127	103	94	83	80	76	75
Mass moment of inertia[g)h)]		J_1	[10^{-5} kg m^2]	1459	726	470	351	287	223	193	170	161	150	146	143	142
Mass moment of inertia[g)i)]		J_1	[10^{-5} kg m^2]	1574	842	585	467	402	338	309	285	276	265	262	258	257
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	46												
Weight with motor components		m	[kg]	≈ 51												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximately, at n_1 = 3000rpm and operating temperature.
b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.
c) Bearing forces: Values valid at n_1 = 1500rpm; ½ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.
c) d) in relation to shaft center.
c) e) at a distance of 135 mm from the middle of the casing.
c) f) at a distance of 160 mm from the middle of the casing.
g) in relation to the input.
g) h) including elastomer coupling 5103-38 (calculated with drilled hole for motor shaft-Ø45)
g) i) including elastomer coupling 5103-42 (calculated with drilled hole for motor shaft-Ø44)

Bearing forces

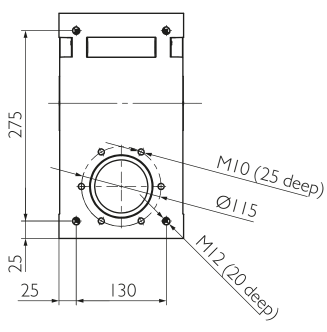


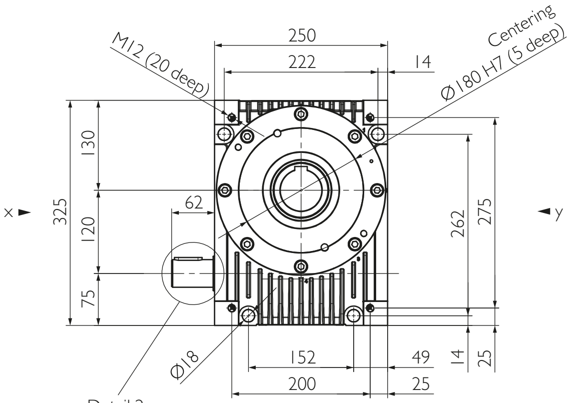
at the output at the input

Input

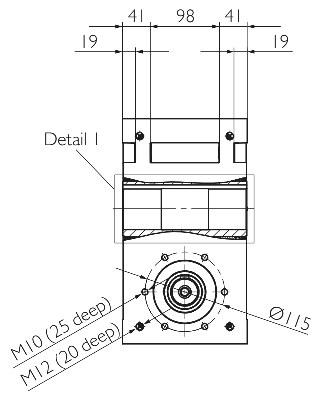
Output

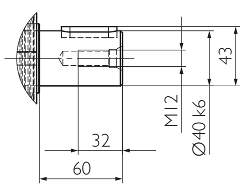
C

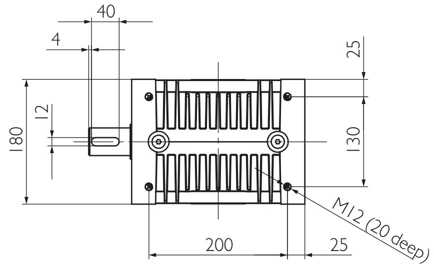


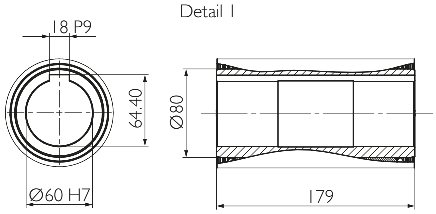


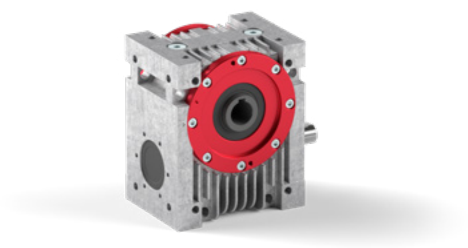
7





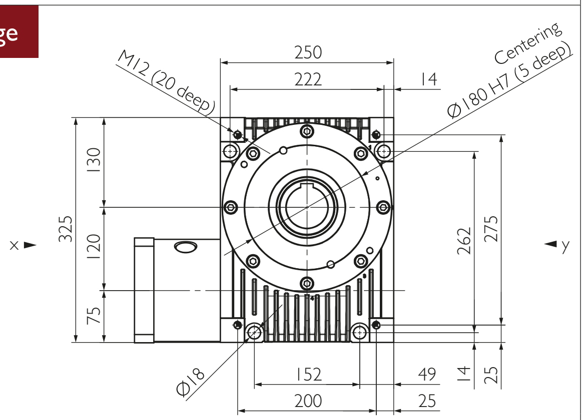


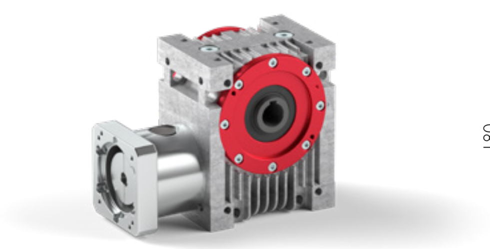


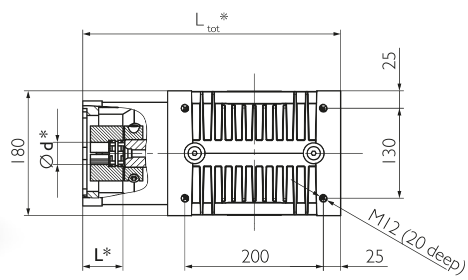


Example HPG 120 C7

C with option motor flange







Example HPG 120 C7

* Motor-specific gearbox dimensions

Ratio	i			2	3	4	5	6	8	10	13.33	16	24	30	47	60
Nominal torque at the output Efficiency	n_{1N} = 500rpm	T_{2N}	[Nm]	1177	1732	2018	1969	1752	2038	1895	1863	1824	1900	1364	1970	1364
		η	[%]	93	93	93	93	92	90	89	87	84	78	75	66	61
	n_{1N} = 1000rpm	T_{2N}	[Nm]	836	1284	1534	1523	1371	1609	1505	1487	1658	1622	1364	1612	1364
		η	[%]	94	94	94	93	93	91	90	88	85	80	76	68	62
	n_{1N} =1500rpm	T_{2N}	[Nm]	648	1020	1237	1241	1126	1329	1248	1237	1380	1353	1364	1345	1364
		η	[%]	94	94	94	93	93	91	90	88	86	80	76	69	62
	n_{1N} = 3000rpm	T_{2N}	[Nm]	387	631	783	798	733	873	826	822	918	903	921	899	921
		η	[%]	93	94	93	93	93	91	90	88	85	80	74	68	60
	n_{1N} = 4500rpm	T_{2N}	[Nm]	276	457	573	588	543	650	617	616	688	677	689	675	689
		η	[%]	93	93	93	93	92	91	89	87	84	79	73	66	58
Max. acceleration torque		T_{2B}	[Nm]	1200	2040									1400	2040	1400
Emergency stop torque		T_{2not}	[Nm]	2300										1600	2300	1600
Idling torque[a)]		T_{012}	[Nm]	4.5			4				3					
Max. input speed		n_{1Max}	[rpm]	4500												
Max. backlash[b)] at the output	PS	j_t	[arcmin]	<8	<7	<6	<6	<5	<5					<4		
	PR	j_t	[arcmin]	<5.5	<4.5	<4	<3.5	<3	<3					<2.5		
Torsional rigidity from output to input		C_{t21}	[Nm/arcmin]	11.5	19	24.5	26.5	29	31.5	34	36.5	38.5	40.5	39	42.5	39
Stability at the output		C_{2K}	[Nm/arcmin]	165												
Max. axial force[c)d)] at the output		F_{a2max}	[N]	7000	9600	9500	12000	16000	17000	21000	25000	26000	27000	27000	27000	28000
Max. radial force[c)e)] at the output		F_{r2max}	[N]	7700	8100	7300	8800	9900	10000	12000	13000	13000	14000	14000	14000	14000
Max. overturning torque[c)] at the output		M_{2max}	[Nm]	1000	1100	980	1200	1300	1400	1600	1800	1800	1800	1800	1900	1900
Max. axial force[c)d)] at the input		F_{a1max}	[N]	3600	1800	730	1700	3600	2100	3300	3700	2500	2900	2700	3100	2700
Max. radial force[c)f)] at the input		F_{r1max}	[N]	1900	950	390	930	1900	1200	1800	2000	1300	1600	1400	1700	1500
Mass moment of inertia[g)]		J_1	[10^{-5} kg m^2]	1307	622	382	271	211	151	123	102	93	82	79	76	75
Mass moment of inertia[g)h)]		J_1	[10^{-5} kg m^2]	1373	688	449	338	277	217	190	168	160	149	146	143	142
Mass moment of inertia[g)i)]		J_1	[10^{-5} kg m^2]	1489	804	564	453	393	333	305	284	275	264	261	258	257
Service life		L_h	[h]	25000												
Weight without motor components		m	[kg]	46												
Weight with motor components		m	[kg]	≈ 51												
Max. permissible housing temperature			[°C]	+90												
Ambient temperature			[°C]	-15 up to +50												
Lubrication		synthetic gear oil (as per DIN 51502: CLP PG 460)														
Painting		None														
Protection class		IP65														

a) approximate, at n_1 = 3000rpm and operating temperature.

b) Precision grade PS (standard backlash) for classic mechanical engineering applications.
Precision grade PR (reduced backlash) for precise process applications.

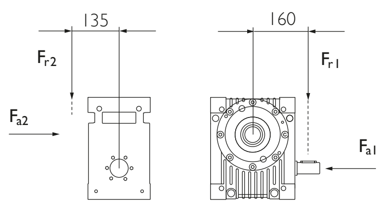
c) Bearing forces: Values valid at n_1 = 1500rpm; ½ T_{2N} and duty cycle of 40%.
Consult with Güdel for composite bearing forces, axial and radial forces.

- c) d) in relation to shaft center.
- c) e) at a distance of 135 mm from the middle of the casing.
- c) f) at a distance of 160 mm from the middle of the casing.

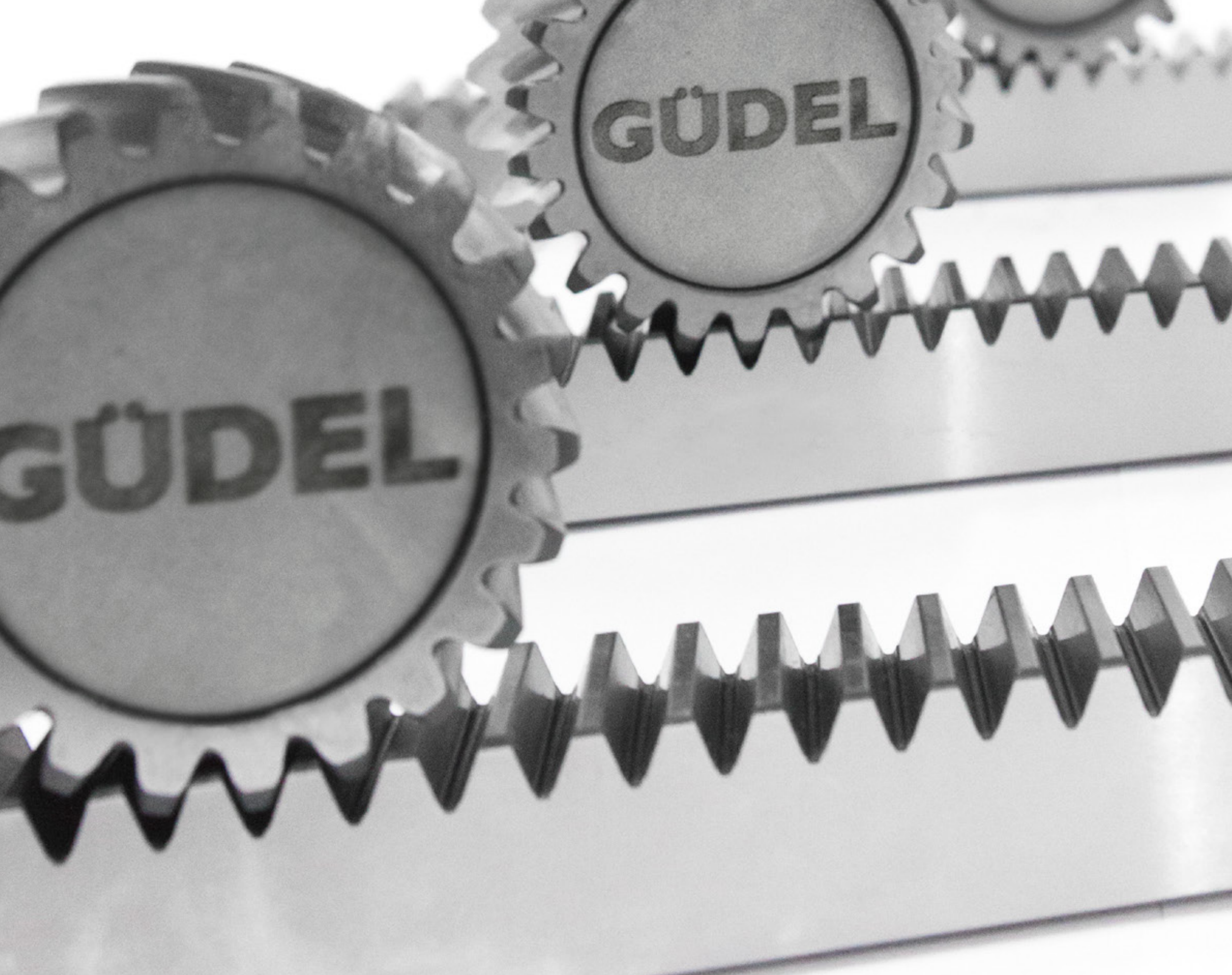
g) in relation to the input.

- g) h) including elastomer coupling 5103-38 (calculated with drilled hole for motor shaft-Ø45)
- g) i) including elastomer coupling 5103-42 (calculated with drilled hole for motor shaft-Ø44)

Bearing forces



at the output at the input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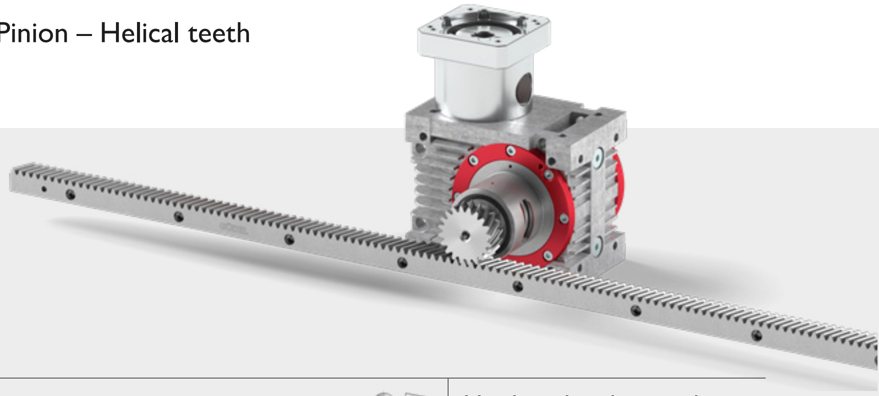
Your ideal drive train

Rack & pinon program

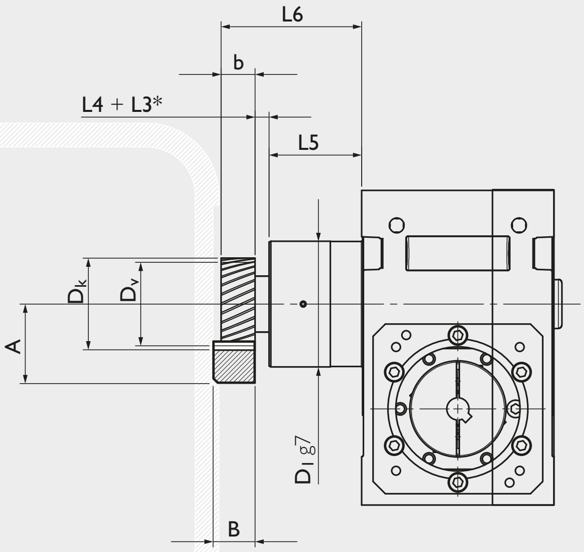
Our function package for your ideal drive train with gearbox, rack and pinion from Güdel.

Pinion – Helical teeth



Pinion

Helical teeth, modular pitch



Hardened and ground

Material
16MnCr5 DIN 1.7131
shaft / bore soft

Teeth
pressure angle α = 20°
helical tooth system left
helix angle ß =19° 31'42''
hardened (58^{+4}_{0} HRC)
ground, crowned

Quality
6f24 DIN 3962/63/67

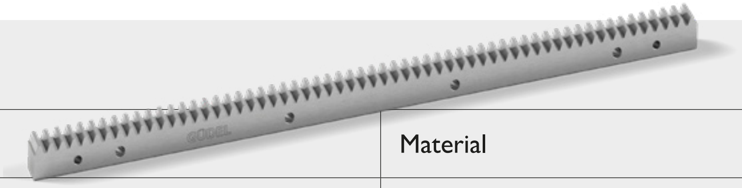
Geometrical informations

Size	m_n	P_t	z	A	b	D_k	D_0	D_v	L4	L5	L6	M	Part. Nr.
030	1.5	5.00	16	30.680	20	29.36	25.465	26.365	4.5	38	62.5	0.14	211116
										43	67.5		
045	1.5	5.00	20	33.415	20	34.83	31.831	31.831	4.5	43	67.5	0.34	211120
										53	77.5		
	2	6.66	16	39.575		39.15	33.953	35.153	8.0	43	71.0	0.39	211216
										53	81.0		
060	2	6.66	20	43.220	20	46.44	42.441	42.441	8.0	53	81.0	0.70	211220
										58	86.0		
										83	111.0		
	2.5	8.33		48.025	25	58.05	53.052	53.052		53	86.0	0.91	211320
										58	91.0		
										83	116.0		
	3	10.00	16	52.365	30	58.73	50.930	52.730		53	91.0	0.99	211416
										58	96.0		
										83	121.0		
090	3	10.00	20	57.830	30	69.66	63.662	63.662	12.5	63	105.5	2.38	211420
										104.5	147.0		
	4	13.33		77.440	40	92.88	84.883	84.883	18.0	63	121.0	3.43	211520
										104.5	162.5		
120	4	13.33	20	77.440	40	92.88	84.883	84.883	14.5	123	177.5	7.89	211521
	5	16.66		87.050	50	116.10	106.103	106.103	35.0	123	208.0	9.96	211620

m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth, D_0: Pitch circle diameter for calculation, D_v: Pitch circle diameter for design, M: Weight [kg]
*L3 for additional distance ring

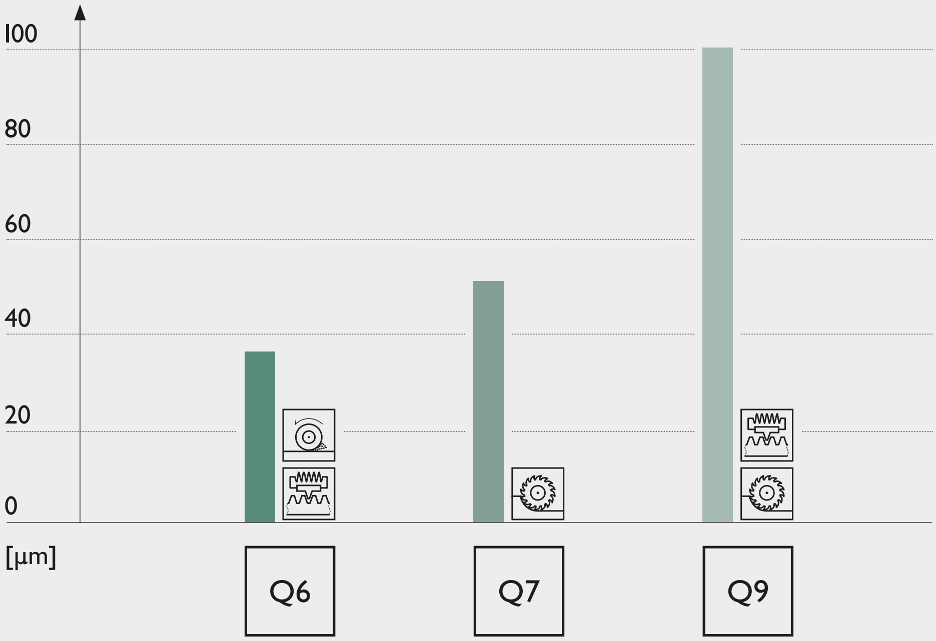
Your ideal drive train

Rack – Helical teeth



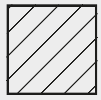
Rack

F_P



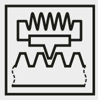
Example of the cumulative pitch deviation F_P for module 4 based on length 1000mm. Quality DIN 3962.

Material

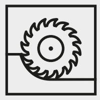


Steel

Processes

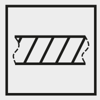


Hardened



Milled

Ground



Helical teeth

Geometrical informations

Size	m_n	P_t	L	z	b	h	Q6 Part No.	Q7 Part No.	Q9 Part No.
030 045	1.5	5.00	500.00	100	19	19	246012	155012	158012
			1000.00	200			246013	155013	158013
045 060	2	6.66	500.00	75	24	24	246022	155022	158022
			1000.00	150			246023	155023	158023
			2000.00	300			246024	155024	158024
060	2.5	8.33	500.00	60	24	24	246032	155032	158032
			1000.00	120			246033	155033	158033
			2000.00	240			246034	155034	158034
060 090	3	10.00	500.00	50	29	29	246042	155042	158042
			1000.00	100			246043	155043	158043
			2000.00	200			246044	155044	158044
090 120	4	13.33	506.67	38	39	39	246055	155052	158052
			1000.00	75			246056	155053	158053
			2000.00	150			246057	155054	158054
120	5	16.66	500.00	30	49	39	246062	155062	158062
			1000.00	60			246063	155063	158063
			2000.00	120			246064	155064	158064

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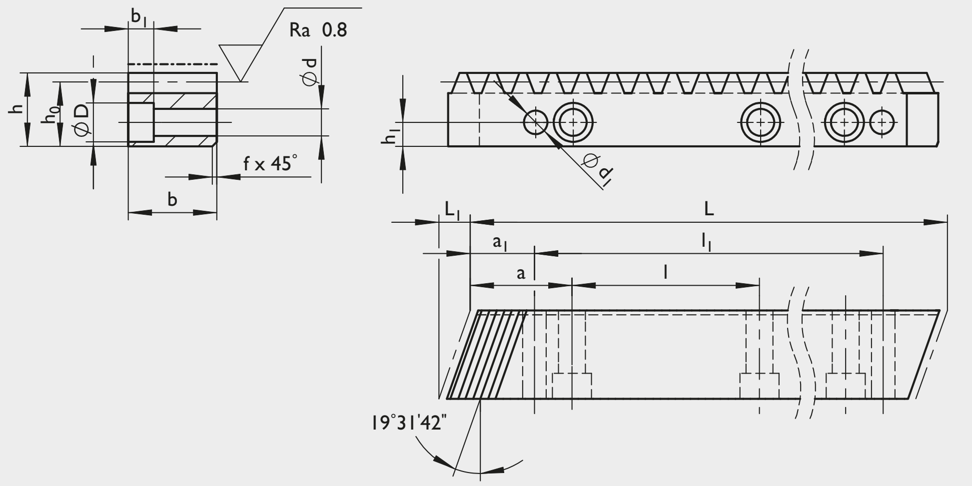
m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth

Helical teeth, modular pitch



–·–· hardened

Hardened and ground

Material
C45E DIN 1.1191

Profile
all faces ground

Teeth
pressure angle α = 20°
helical tooth system right
helix angle ß = 19° 31'42"
hardened (54^{+4}_{0} HRC)
and ground

Quality
6h23 DIN 3962/63/67

p_f [mm]
cut-to-length tolerance for
continuous mounting -0.05/-0.50

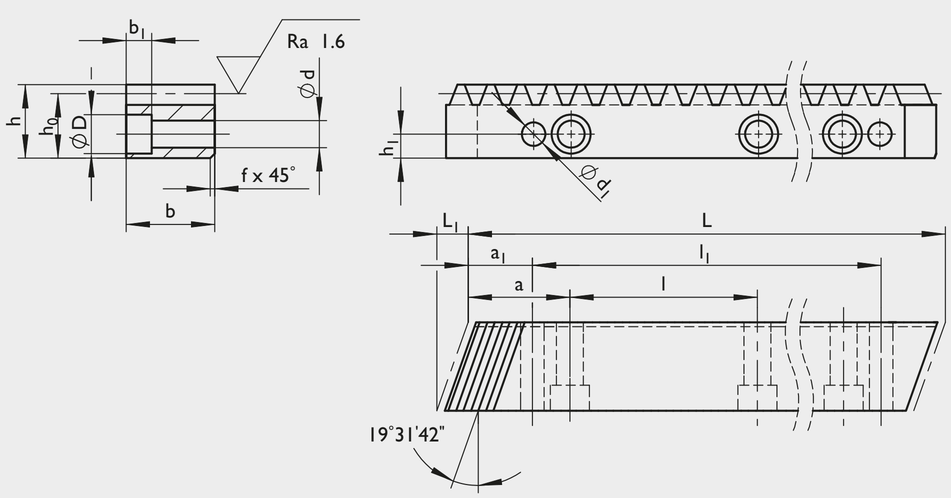
F_{pL} [mm]
cumulative pitch deviation
based on length L

Geometrical information

Size	m_n	p_t	L	L_l	z	b	h	h_0	f+0.5	a	l	h_l	d	D	b_l	a_l	l_l	d_l	F_{pL}	M	Part. No.
030 045	1.5	5	500	6.7	100	19	19	17.50	2	62.5	125.00	8	7	11	7	31.7	436.6	5.7	0.029	1.3	246012
			1000		200												936.6		0.043	2.6	246013
045 060	2	6.66	500	8.5	75	24	24	22.00	2	62.5	125.00	8	7	11	7	31.7	436.6	5.7	0.025	2.1	246022
			1000		150												936.6		0.036	4.1	246023
			2000		300												1936.6		0.058	8.2	246024
060	2.5	8.33	500	8.5	60	24	24	21.50	2	62.5	125.00	9	7	11	7	31.7	436.6	5.7	0.027	2.0	246032
			1000		120												936.6		0.036	4.1	246033
			2000		240												1936.6		0.053	8.2	246034
060 090	3	10.00	500	10.3	50	29	29	26.00	2	62.5	125.00	9	10	15	9	35.0	430.0	7.7	0.028	3.0	246042
			1000		100												930.0		0.037	5.9	246043
			2000		200												1930.0		0.054	11.2	246044
090 120	4	13.33	506.67	13.8	38	39	39	35.00	2	62.5	125.00	12	12	18	11	33.3	433.0	9.7	0.030	5.4	246055
			1000		75												933.4		0.036	10.7	246056
			2000		150												1933.4		0.050	20.5	246057
120	5	16.66	500	17.4	30	49	39	34.00	3	62.5	125.00	12	14	20	13	37.5	425.0	11.7	0.028	6.5	246062
			1000		60												925.0		0.034	13.1	246063
			2000		120												1925.0		0.045	24.5	246064

m_n: Normal module, P_t: Transverse pitch [mm], z: number of teeth, d_l: predrilled, M: Weight [kg]

Helical teeth, modular pitch



Milled

Material
42CrMo4 DIN 1.7225I

Profile
all faces milled

Teeth
pressure angle α = 20°
helical tooth system right
helix angle ß = 19° 31'42''
milled

Quality
7h25 DIN 3962/63/67

p_f [mm]
cut-to-length tolerance for continuous mounting -0.05/-0.50

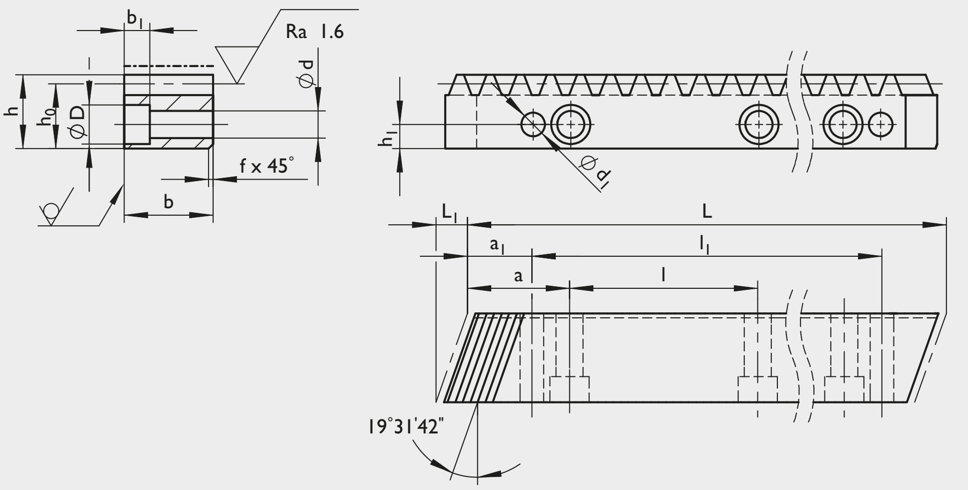
F_{pL} [mm]
cumulative pitch deviation based on length L

Geometrical information

Size	m_n	p_t	L	L_l	z	b	h	h_0	f+0.5	a	l	h_l	d	D	b_l	a_l	l_l	d_l	F_{pL}	M	Part. No.
030 045	1.5	5.00	500.00	6.7	100	19	19	17.5	1	62.5	125	8	7	11	7	31.7	436.6	5.7	0.041	1.2	155012
			1000.00		200												936.6		0.059	2.5	155013
045 060	2	6.66	500.00	8.5	75	24	24	22.0	1	62.5	125	8	7	11	7	31.7	436.6	5.7	0.036	2.0	155022
			1000.00		150												936.6		0.050	4.0	155023
			2000.00		300												1936.6		0.077	8.0	155024
060	2.5	8.33	500.00	8.5	60	24	24	21.5	1	62.5	125	9	7	11	7	31.7	436.6	5.7	0.038	1.9	155032
			1000.00		120												936.6		0.050	3.9	155033
			2000.00		240												1936.6		0.075	7.7	155034
060 090	3	10.00	500.00	10.3	50	29	29	26.0	1	62.5	125	9	10	15	9	35.0	430.0	7.7	0.040	2.8	155042
			1000.00		100												930.0		0.051	5.6	155043
			2000.00		200												1930.0		0.073	11.2	155044
090 120	4	13.33	506.67	13.8	38	39	39	35.0	1	62.5	125	12	12	18	11	33.3	433.0	9.7	0.042	5.1	155052
			1000.00		75												933.4		0.051	10.1	155053
			2000.00		150												1933.4		0.070	20.2	155054
120	5	16.66	500.00	17.4	30	49	39	34.0	1	62.5	125	12	14	20	13	37.5	425.0	11.7	0.040	6.0	155062
			1000.00		60												925.0		0.048	12.0	155063
			2000.00		120												1925.0		0.062	24.1	155064

m_n: Normal module, P_t: Transverse pitch [mm], z: number of teeth, d_l: predrilled, M: Weight [kg]

Helical teeth, modular pitch



Milled and hardened

Material
C45E DIN 1.1191

Profile
all faces milled

Teeth
pressure angle α = 20°
helical tooth system right
helix angle ß = 19° 31'42''
hardened (54^{+4}_{0} HRC)
milled

Quality
9h27 DIN 3962/63/67

p_f [mm]
cut-to-length tolerance for continuous mounting -0.05/-0.50

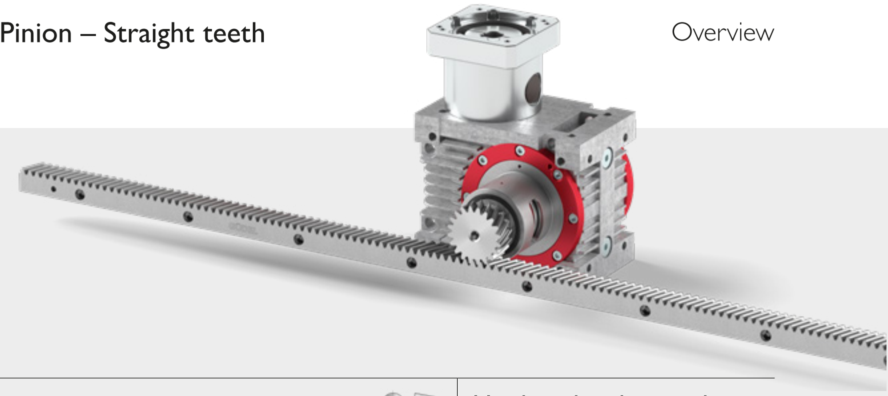
F_{pL} [mm]
cumulative pitch deviation based on length L

Geometrical information

Size	m_n	p_t	L	L_1	z	b	h	h_0	f+0.5	a	l	h_1	d	D	b_1	a_1	l_1	d_1	F_{pL}	M	Part. No.
030 045	1.5	5.00	500.00	6.7	100	19	19	17.50	2	62.5	125.00	8	7	11	7	31.7	436.6	5.7	0.082	1.2	158012
			1000.00		200												936.6		0.118	2.5	158013
045 060	2	6.66	500.00	8.5	75	24	24	22.00	2	62.5	125.00	8	7	11	7	31.7	436.6	5.7	0.073	2.0	158022
			1000.00		150												936.6		0.100	4.0	158023
			2000.00		300												1936.6		0.155	8.0	158024
060	2.5	8.33	500.00	8.5	60	24	24	21.50	2	62.5	125.00	9	7	11	7	31.7	436.6	5.7	0.076	1.9	158032
			1000.00		120												936.6		0.101	3.9	158033
			2000.00		240												1936.6		0.150	7.7	158034
060 090	3	10.00	500.00	10.3	50	29	29	26.00	2	62.5	125.00	9	10	15	9	35.0	430.0	7.7	0.080	2.8	158042
			1000.00		100												930.0		0.103	5.6	158043
			2000.00		200												1930.0		0.147	11.2	158044
090 120	4	13.33	506.67	13.8	38	39	39	35.00	3	62.5	125.00	12	12	18	11	33.3	433.0	9.7	0.083	5.1	158052
			1000.00		75												933.4		0.101	10.1	158053
			2000.00		150												1933.4		0.136	20.2	158054
120	5	16.66	500.00	17.4	30	49	39	34.00	3	62.5	125.00	12	14	20	13	37.5	425.0	11.7	0.080	6.0	158062
			1000.00		60												925.0		0.094	12.0	158063
			2000.00		120												1925.0		0.122	24.1	158064

m_n: Normal module, P_t: Transverse pitch [mm], z: number of teeth, d_1: predrilled, M: Weight [kg]


GÜDEL

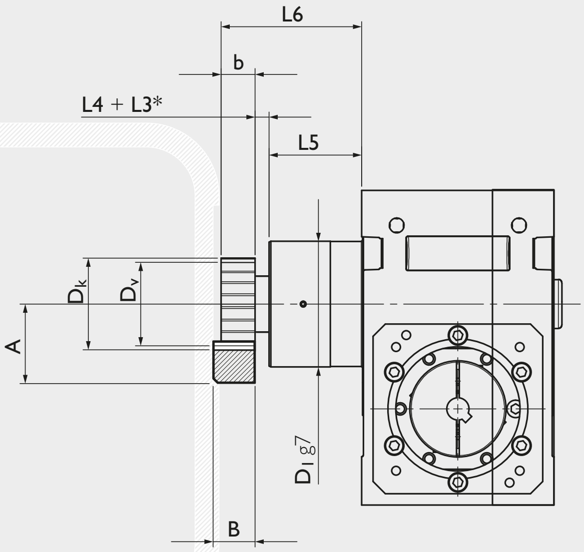


Rack & pinon program

Our function package for your ideal drive train with gearbox, rack and pinion from Güdel.

Pinion

Straight teeth, modular pitch



Hardened and ground

Material
16MnCr5 DIN 1.7131
shaft/bore soft

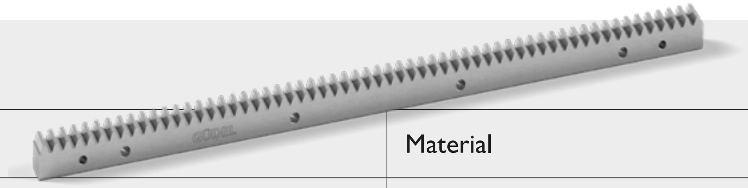
Teeth
pressure angle α = 20°
straight teeth
hardened (58^{+4}_{0} HRC)
ground, crowned

Quality
6f24 DIN 3962/63/67

Geometrical informations

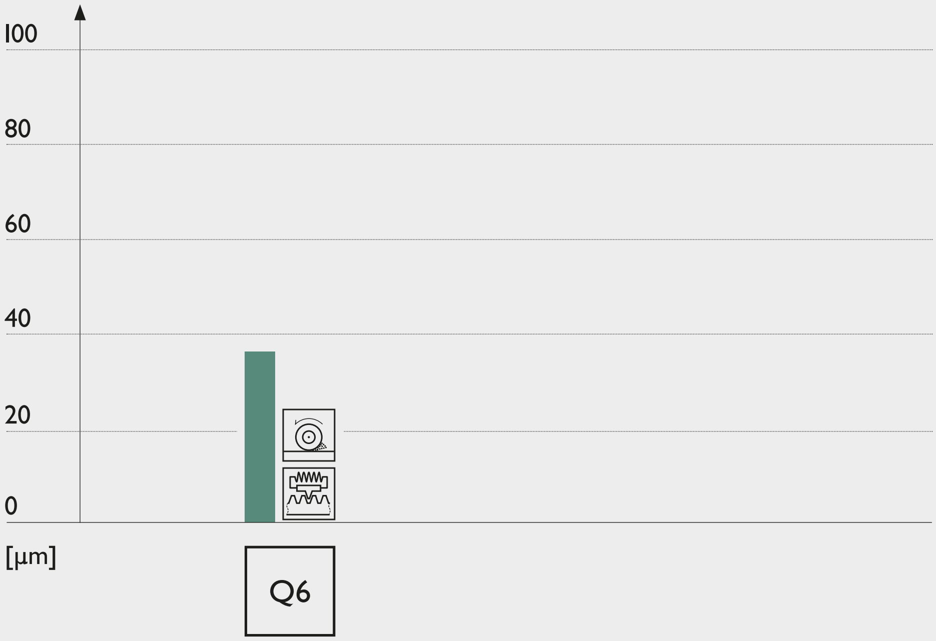
Size	m_n	P_n	z	A	b	D_k	D_0	D_v	L4	L5	L6	M	Part. No.
030	1.5	4.72	16	29.95	20	27.90	24.000	24.900	4.5	38.0	82.5	0.14	201116
										43.0	67.5		
045	1.5	4.72	20	32.50	20	33.00	30.000	30.000	4.5	43.0	67.5	0.34	201120
										53.0	77.5		
	2	6.28	16	38.60		37.20	32.000	33.200	8.0	43.0	71.0	0.37	201216
										53.0	81.0		
060	2	6.28	20	42.00	20	44.00	40.000	40.000	8.0	53.0	81.0	0.68	201220
										58.0	86.0		
										83.0	111.0		
	2.5	7.85		46.00	25	55.00	50.000	50.000		53.0	86.0	0.86	201320
										58.0	91.0		
										83.0	116.0		
	3	9.42	16	50.90	30	55.80	48.000	49.800		53.0	91.0	0.93	201416
										58.0	96.0		
										83.0	121.0		
090	3	9.42	20	56.00	30	66.00	60.000	60.000	12.5	63.0	105.5	2.30	201420
										104.5	147.0		
	4	12.57		75.00	40	88.00	80.000	80.000	18.0	63.0	121.0	3.24	201520
										104.5	162.5		
120	5	15.71	20	84.00	50	110.00	100.000	100.000	35.0	123.0	208.0	9.57	201620
	6	18.85		103.00	60	132.00	120.000	120.000			218.0	11.8	201720
	8	25.13		151.00	80	176.00	160.000	160.000			238.0	28.31	201820

m_n: Normal module, P_n: Normal pitch, z: Number of teeth, D_0: Pitch circle diameter for calculation, D_v: Pitch circle diameter for design, M: Weight [kg]
*L3 for additional distance ring



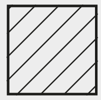
Rack

F_P



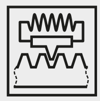
Example of the cumulative pitch deviation F_P for module 4 based on length 1000mm. Quality DIN 3962.

Material

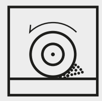


Steel

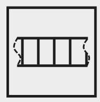
Processes



Hardened



Ground



Straight teeth

Geometrical informations

Size	m_n	P_n	L	z	b	h	Q6 Part. Nr.
030 045	1.5	4.72	499.51	106	19	19	240012
			999.03	212			240013
045 060	2	6.28	502.65	80	24	24	240022
			1005.31	160			240023
			2010.62	320			240024
060	2.5	7.85	502.65	64	24	24	240032
			1005.31	128			240033
			2010.62	256			240034
060 090	3	9.42	508.94	54	29	29	240042
			1017.88	108			240043
			2035.75	216			240044
90	4	12.57	502.65	40	39	39	240052
			1005.31	80			240053
			2010.62	160			240054
120	5	15.71	502.65	32	49	39	240062
			1005.31	64			240063
			2010.62	128			240064

m_n: Normal module, P_n: Normal pitch [mm], z: Number of teeth

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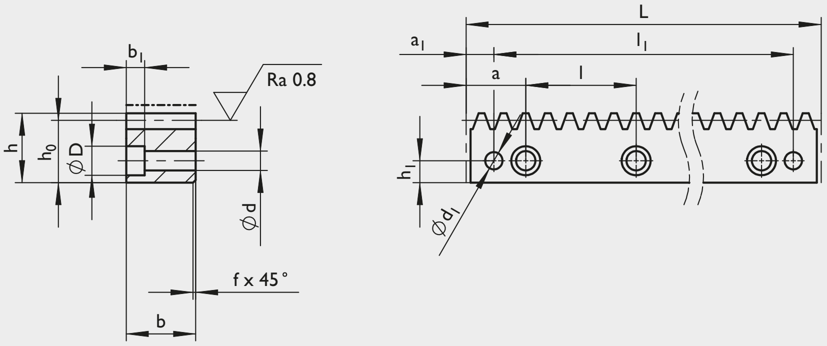
Straight teeth, modular pitch



–·–· hardened

Hardened and ground

Material
C45E DIN 1.1191
On request: 1.7131 (16MnCr5)

Profile
all faces ground

Teeth
pressure angle α = 20°
hardened (54^{+4}_{0} HRC)
and ground

Quality
6h23 DIN 3962/63/67

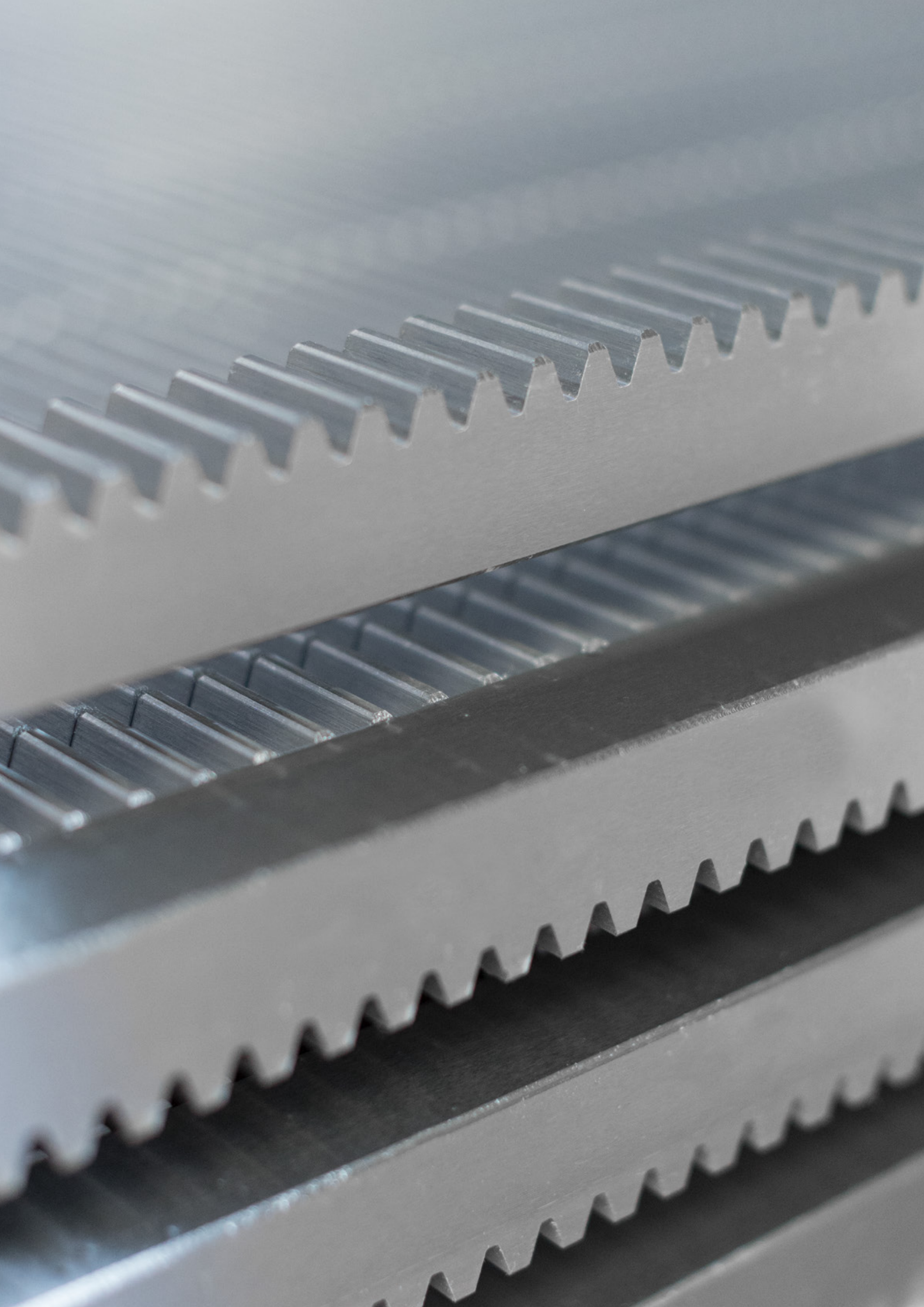
pf [mm]
cut-to-length tolerance for
continuous mounting -0.05/-0.50

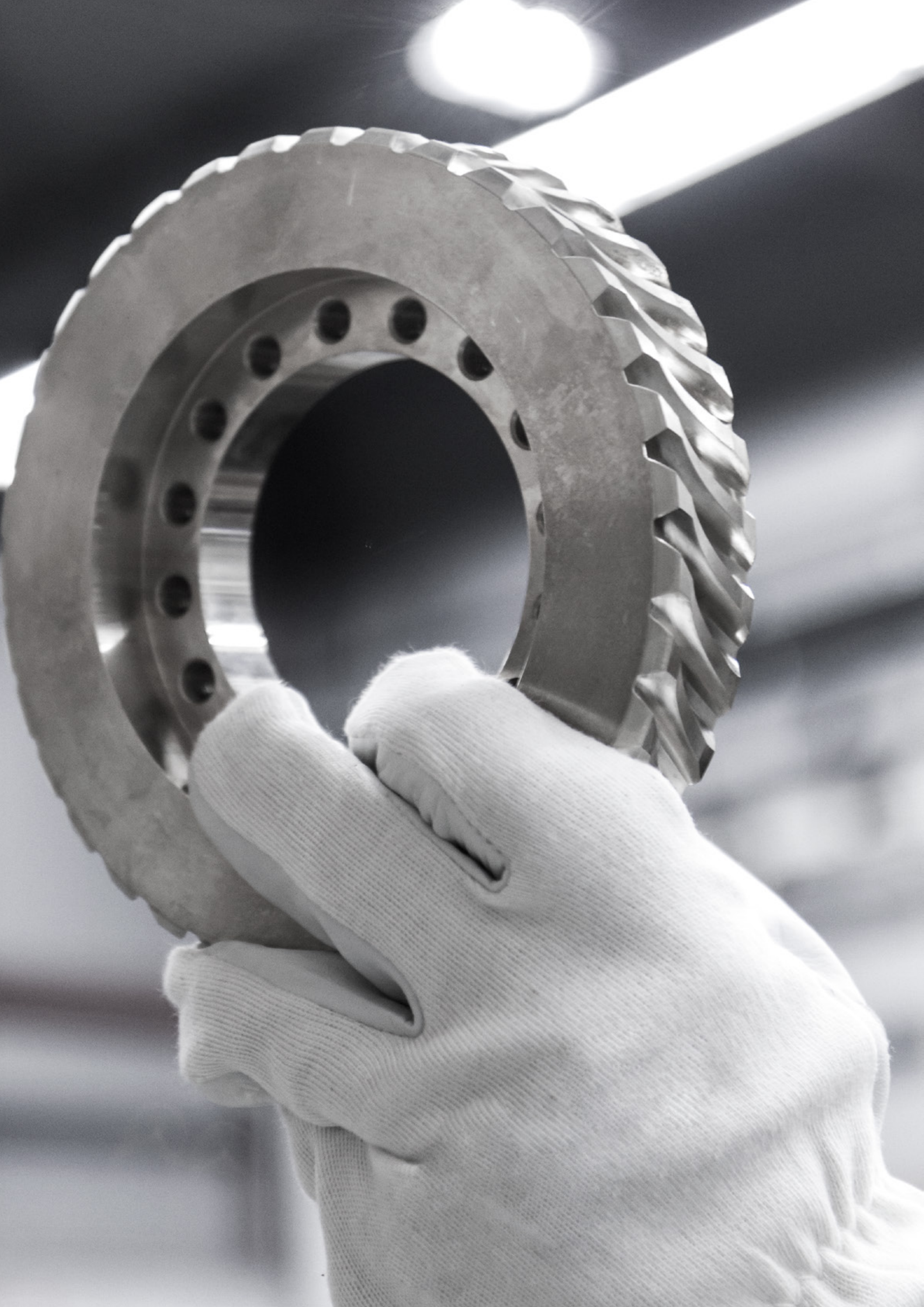
F_{pL} [mm]
cumulative pitch deviation
based on length L

Geometrical information

Size	m_n	p_n	L	z	B	H	H_0	f+0,5	a	l	h_l	d	D	b_l	a_l	l_l	d_l	F_{pL}	M	Part No.
030 045	1.5	4.712	499.51	106	19	19	17.50	2	62.44	124.88	8	7	11	7	29	441.5	5.7	0.029	1.3	240012
			999.03	212												941.0		0.043	2.6	240013
045 060	2	6.283	502.65	80	24	24	22.00	2	62.83	125.66	8	7	11	7	31.3	440.1	5.7	0.025	2.1	240022
			1005.31	160												942.7		0.036	4.2	240023
			2010.62	320												1948.0		0.058	8.0	240024
060	2.5	7.854	502.65	64	24	24	21.50	2	62.83	125.66	9	7	11	7	31.3	440.1	5.7	0.027	2.0	240032
			1005.31	128												942.7		0.036	4.1	240033
			2010.62	256												1948.0		0.053	8.0	240034
060 090	3	9.425	508.94	54	29	29	26.00	2	63.62	127.23	9	10	15	9	34.4	440.1	7.7	0.029	3.0	240042
			1017.88	108												949.1		0.037	6.0	240043
			2035.75	216												1967.0		0.055	11.5	240044
090	4	12.566	502.65	40	39	39	35.00	2	62.83	125.66	12	10	15	9	37.5	427.7	7.7	0.030	5.40	240052
			1005.31	80												930.3		0.037	10.8	240053
			2010.62	160												1935.6		0.050	21.0	240054
120	5	15.708	502.65	32	49	39	34.00	3	62.83	125.66	12	14	20	13	30.2	442.3	11.7	0.028	6.6	240062
			1005.31	64												944.9		**0.034**	13.1	240063
			2010.62	128												1950.2		0.045	24.7	240064
120	6	18.850	508.94	27	59	49	43.00	3	63.62	127.23	16	18	26	17	31.4	446.1	15.7	0.031	10.1	240072
			1017.88	54												955.0		0.036	20.3	240073
			2035.75	108												1973.0		0.047	37.5	240074
120	8	25.133	502.65	20	79	79	71.00	3	62.83	125.66	25	22	33	21	26.7	449.3	19.7	0.029	22.1	240082
			1005.31	40												952.0		0.033	44.3	240083
			2010.62	80												1957.3		0.041	82.5	240084

m_n: Normal module, P_n: Normal pitch [mm], z: number of teeth, d_l: predrilled, M: Weight [kg]





Technical information

GÜDEL

Order reference

Generate the code of your gearbox

Type	Size	Configuration		Ratio	Precision
HPG	060	C	I	5	PS

HPG
High Performance Angle Gearbox

030
045
060
090
120

Input
C

Output
I
2
3
4
5
6
7

i =
2
3
4
5
6
8
10
13.33
16
24
30
47
60

PS Standard backlash

PR Reduced backlash *

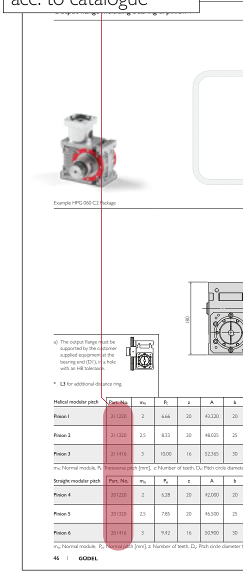
* PR can not be selected in size 030

Package
(Output flange including bearing & pinion)

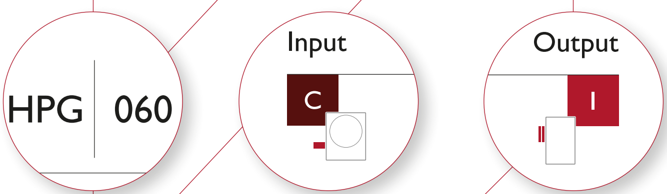
Güdel pinion

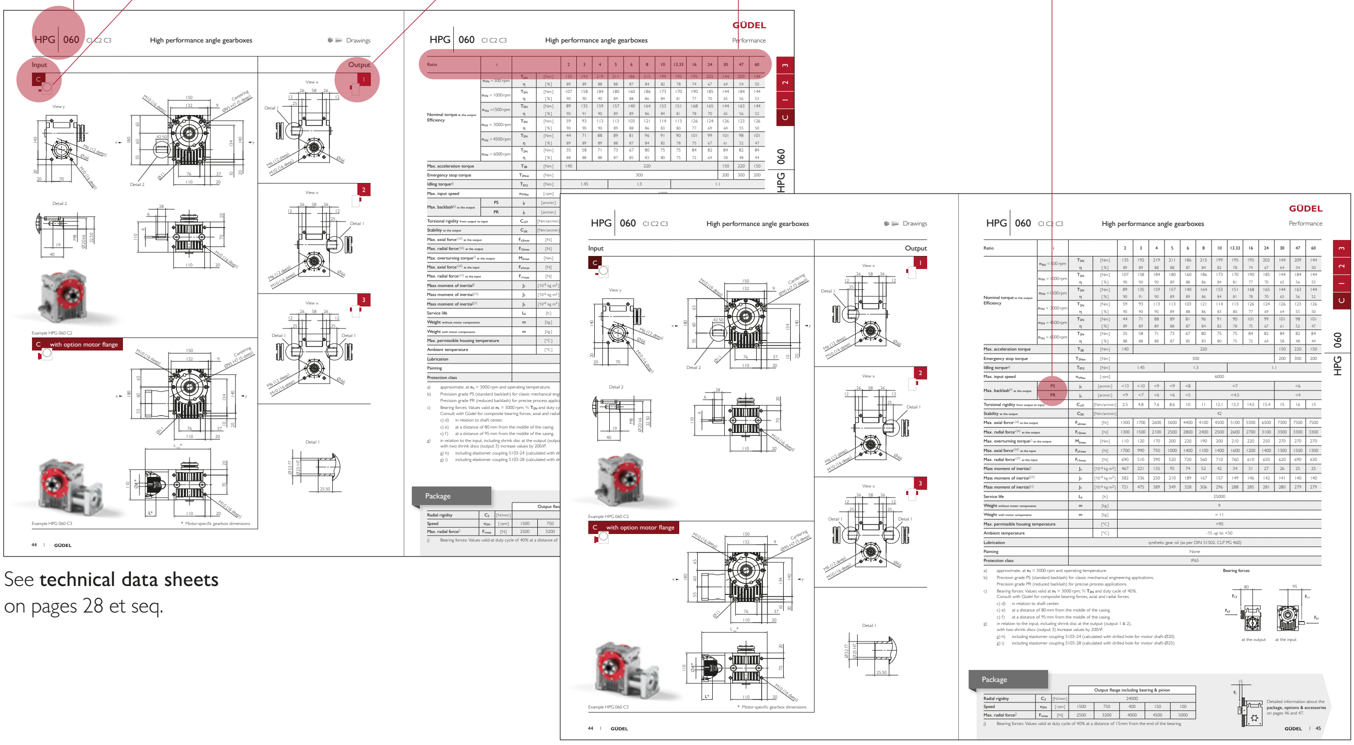
211320

Part. No. acc. to catalogue



Unless a pinion is required





See technical data sheets on pages 28 et seq.

Request of the output flange | Assembly | Spacer elements (optional)

_ 86 _ 53 _ L _ 22 ……

Example

HPG 060_C1_5_PS_211320_86_53_22

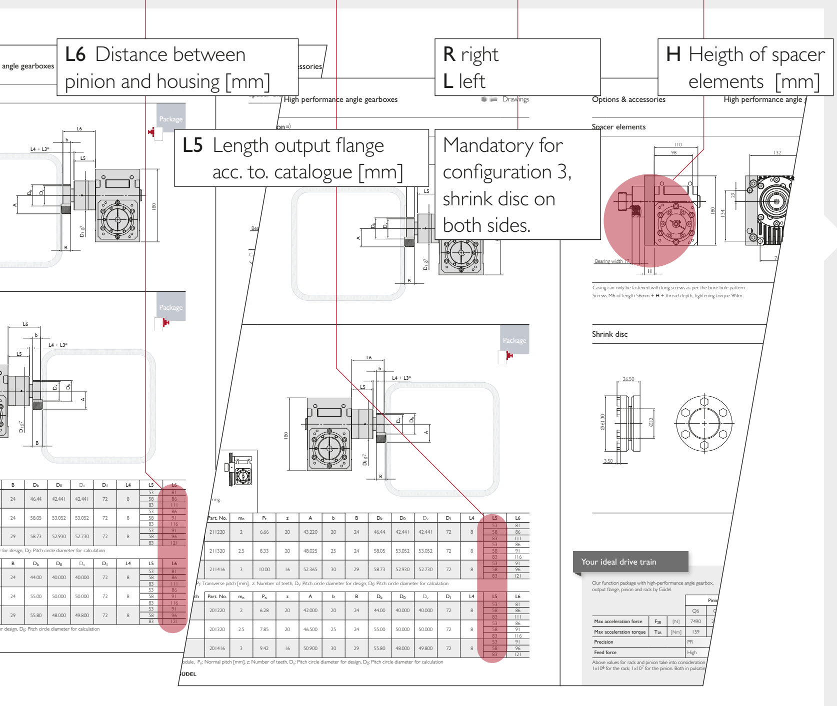
L6 Distance between pinion and housing [mm]

L5 Length output flange acc. to. catalogue [mm]

R right
L left

Mandatory for configuration 3, shrink disc on both sides.

H Heigth of spacer elements [mm]

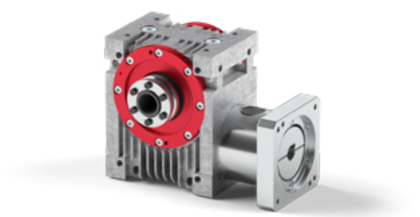


…… _ Motor

_ _ _ _ ……

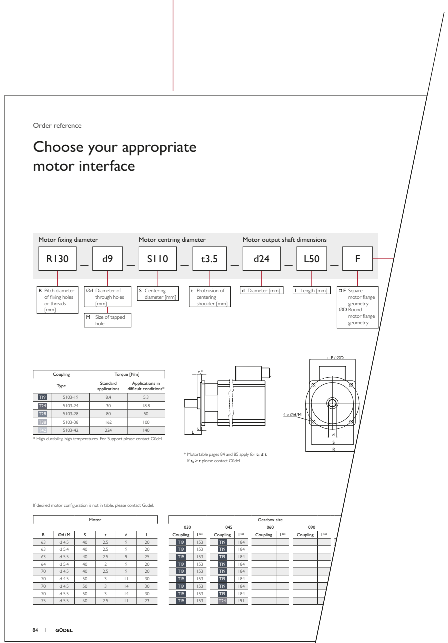
Unless a package is required (Output flange including bearing & pinion)

Unless spacer elements are required



Example

HPG 060_C1_5_PS



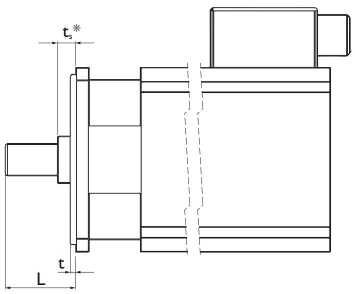
See order reference of the **motor interfaces** on pages 84 et seq.

Choose your appropriate motor interface

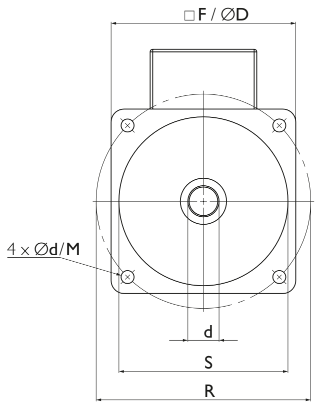
Motor fixing diameter		Motor centring diameter		Motor output shaft dimensions		
R130	d9	S110	t3.5	d24	L50	F
R Pitch diameter of fixing holes or threads [mm]	**Ød** Diameter of through holes [mm] **M** Size of tapped hole	**S** Centering diameter [mm]	**t** Protrusion of centering shoulder [mm]	**d** Diameter [mm]	**L** Length [mm]	**□F** Square motor flange geometry **ØD** Round motor flange geometry

Coupling	Type	Torque [Nm] Standard applications	Applications in difficult conditions*
T19	5103-19	8.4	5.3
T24	5103-24	30	18.8
T28	5103-28	80	50
T38	5103-38	162	100
T42	5103-42	224	140

* High durability, high temperatures. For Support please contact Güdel.



* Motortable pages 84 and 85 apply for $t_s \leq t$.
If $t_s > t$ please contact Güdel.

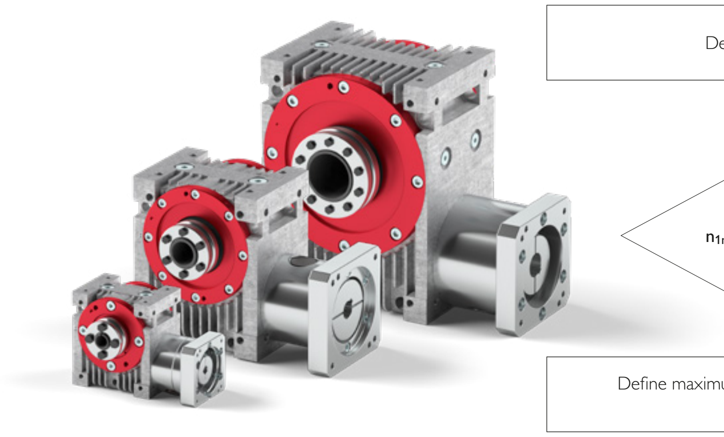


If desired motor configuration is not in table, please contact Güdel.

Motor						Gearbox size 030		045		060		090		120	
R	Ød/M	S	t	d	L	Coupling	L^{tot}	Coupling	L^{tot}	Coupling	L^{tot}	Coupling	L^{tot}	Coupling	L^{tot}
63	d 4.5	40	2.5	9	20	T19	153	T19	184						
63	d 5.4	40	2.5	9	20	T19	153	T19	184						
63	d 5.5	40	2.5	9	25	T19	153	T19	184						
64	d 5.4	40	2	9	20	T19	153	T19	184						
70	d 4.5	40	2.5	9	20	T19	153	T19	184						
70	d 4.5	50	3	11	30	T19	153	T19	184						
70	d 4.5	50	3	14	30	T19	153	T19	184						
70	d 5.5	50	3	14	30	T19	153	T19	184						
75	d 5.5	60	2.5	11	23	T19	153	T24	191						

Motor						Gearbox size									
						030		045		060		090		120	
R	Ød/M	S	t	d	L	Coupling	Ltot	Coupling	Ltot	Coupling	Ltot	Coupling	Ltot	Coupling	Ltot
75	d 5.5	60	2.5	14	30	T19	153	T24	191	T24	232				
75	d 5.5	60	3	14	30	T19	153	T24	191	T24	232				
75	d 5.8	60	2.5	11	23	T19	153	T24	191						
75	d 6.5	60	3	14	30	T19	153	T24	191	T24	232				
90	d 6	70	3	19	35			T24	191	T28	236				
90	d 7	70	3	14	30	T19	153	T24	191	T28	236				
90	d 7	70	3	16	40	T19	160	T24	191	T28	236				
95	d 6.6	50	2.5	14	30	T19	153	T19	184						
100	d 7	80	3	14	30	T19	153	T24	191	T28	236	T28	297		
100	d 7	80	3	19	40			T24	191	T28	236	T28	297		
100	d 6.5	80	2.5	14	30	T19	153	T24	191	T28	236	T28	297		
100	d 6.5	80	3	19	40			T24	191	T28	236	T28	297		
100	d 6.6	80	4	10	32	T19	155	T24	195	T24	232				
100	d 6.6	80	5	14	37	T19	155	T24	195	T28	236	T28	297		
100	d 6.6	80	5	16	40	T19	162	T24	195	T28	236	T28	297		
115	d 9	95	3	19	40			T24	191	T28	236	T28	297	T38	373
115	d 7	95	3	24	45			T24	201	T28	253	T38	317	T38	373
115	d 10	95	3	19	40			T24	191	T28	236	T28	297	T38	373
130	d 9	95	3	19	40			T24	191	T28	236	T28	297	T38	373
130	d 9	95	3	24	50			T24	201	T28	253	T38	317	T38	373
130	d 9	110	3	24	50			T24	201	T28	253	T38	317	T38	373
130	d 9	110	3.5	24	50			T24	201	T28	253	T38	317	T38	373
130	d 9	110	3.5	19	40			T24	191	T28	236	T28	297	T38	373
130	M8	110	3.5	19	40			T24	191	T28	236				
130	M8	110	3.5	24	50			T24	201	T28	253				
130	M8	110	3.5	28	60					T28	269				
145	d 9	110	6	19	55			T24	206	T28	253	T38	318	T38	374
145	d 9	110	6	19	58					T28	253	T38	318	T38	374
145	d 9	110	6	22	58					T28	253	T38	318	T38	374
145	d 9	110	6	24	58					T28	253	T38	318	T38	374
145	d 9	110	6	28	63					T28	269	T38	318	T42	384
145	d 10	110	3.5	16	40			T24	191	T28	236	T28	298	T38	374
145	d 10	110	3.5	19	40			T24	191	T28	236	T28	298	T38	374
165	d 11	110	4	24	50					T28	253	T38	317	T38	373
165	d 11	130	3	28	60					T28	269	T38	317	T42	383
165	d 11	130	3.5	19	28					T28	236	T28	297		
165	d 11	130	3.5	24	50					T28	253	T38	317	T38	373
165	d 11	130	3.5	32	58					T28	269	T38	317	T42	383
165	d 11	130	4	32	58					T28	269	T38	317	T42	383
190	d 11	155	3.5	32	60							T38	317	T42	383
190	d 11	155	3.5	35	60							T38	317	T42	383
200	d 13.5	114.3	3.2	35	79							T38	335	T42	398
200	d 13.5	114.3	3.2	42	113									T42	448
215	d 14	130	4	32	60							T38	317	T42	383
215	d 14	130	4	38	60							T38	335	T42	383
215	d 13	180	4	28	60							T38	317	T42	383
215	d 13	180	4	38	80							T38	355	T42	398
215	d 14	180	4	28	42							T38	317	T38	373
215	d 14	180	4	28	60							T38	317	T42	383
215	d 14	180	4	32	58							T38	317	T42	383
215	d 14	180	4	32	60							T38	317	T42	383
215	d 14	180	4	32	80							T38	335	T42	398
215	d 14	180	4	38	80							T38	355	T42	398
235	d 13.5	200	4	42	116									T42	448
265	d 13	230	4	38	80									T42	398
265	d 14	230	4	38	80									T42	398
265	d 14	230	4	55	110									T42	448
300	d 18	250	5	42	110									T42	425
300	d 18	250	5	48	82									T42	425
300	d 18	250	5	48	110									T42	448
300	d 19	250	5	48	110									T42	448

Calculate your gearbox



Define the maximum output speed
n_{2max} [rpm]

↓

Define ratio **i**

↓

$n_{1max} < n_{1Max}$ — No → Select smaller ratio **i** (back to $n_{1max} < n_{1Max}$)

↓

Define maximum acceleration torque
T_{2b}

↓

$T_{2b} < T_{2B}$ — No → Select larger gearbox (back to $n_{1max} < n_{1Max}$)

↓

Define the emergency stop torque
T_{2not} [Nm]

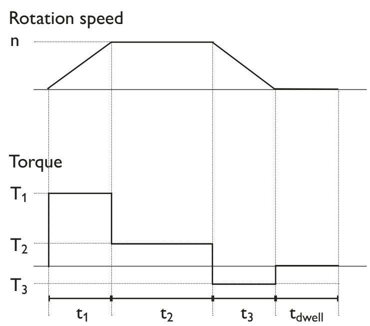
↓

$T_{2not} < T_{2Not}$ — No → Select larger gearbox (back to $n_{1max} < n_{1Max}$)

↓

Define the average nominal output torque
T_{2m} [Nm]

$$T_{2m} = \sqrt[3]{\frac{(|n|/2)\times t_1\times|T_1|^3+|n|\times t_2\times|T_2|^3+(|n|/2)\times t_3\times|T_3|^3}{(|n|/2)\times t_1\times|n|\times t_2+(|n|/2)\times t_3}}$$



↓

Define the average output speed
n_{1m} [rpm]

$$n_{1m} = \frac{(|n|/2)\times t_1+|n|\times t_2\times(|n|/2)\times t_3}{t_1+t_2+t_3}$$

↓

Define the duty cycle
ED

$$ED = (t_1+t_2+t_3)/(t_1+t_2+t_3+t_{dwell})\times 100\%$$

↓

Define the shock factor
f_B

Input	Shock factor f_B
Polynomia	1.0
Standard Servo / Sinus2	1.1
FU / VFD	1.25
AC-Motor	1.4
External output-shock	1.6

↓

Define the starting frequency factor
f_A

Starting frequency	Starting frequency factor f_A
< 60 / h	0.7
< 360 / h	0.8
< 1200 / h	1.0
< 3600 / h	1.3

↓

	Size				
	030	045	060	090	120
n_{1m} < 500 rpm	5.50	3.00	1.70	1.10	1.00
n_{1m} < 1000 rpm	4.00	2.30	1.40	1.05	1.00
n_{1m} < 1500 rpm	3.30	2.00	1.30	1.05	1.00
n_{1m} < 3000 rpm	2.30	1.50	1.15	1.05	1.00
n_{1m} < 4500 rpm	1.70	1.30	1.05	1.00	1.00
n_{1m} < 6000 rpm	1.50	1.20	1.00		

Abrasion factor f_P* for high-accuracy applications, otherwise f_P = 1.

Define the abrasion factor f_P

Define the duty factor f_{ED}

Duty cycle	Duty service factor f_{ED}
< 25%	0.7
< 40%	1.0
< 60%	1.2
< 70%	1.3
< 80%	1.4
< 100%	1.8

Define the **temperature factor** (ambient air) f_U

Ambient temperature	Temperature factor f_U
< 10°C	0.85
< 20°C	1.0
< 30°C	1.2
< 40°C	1.5
< 50°C	1.9

Define the **temperature factor** f_T

	Size				
	030	045	060	090	120
n_{1m} < 500 rpm	0.40	0.40	0.40	0.60	0.80
n_{1m} < 1000 rpm	0.40	0.40	0.45	0.70	0.90
n_{1m} < 1500 rpm	0.40	0.40	0.55	0.80	1.20
n_{1m} < 3000 rpm	0.40	0.40	0.70	0.95[a)]	2.00[a)]
n_{1m} < 4500 rpm	0.40	0.40	0.70	1.00[a)]	2.80[a)]
n_{1m} < 6000 rpm	0.40	0.40	0.75		

a) Maximum duty cycle 80%
b) Maximum duty cycle 60%

Mechanical output torque
$T_{2mech} = T_{2m} \times f_B \times f_A \times f_P$*

$T_{2mech} < T_{2N}$ — No → Select a larger gearbox

Thermic output torque
$T_{2therm} = T_{2m} \times f_{ED} \times f_T \times f_U$

$T_{2therm} < T_{2N}$ — No → Select a larger gearbox

Select a motor

	Motor limitation				
	030	045	060	090	120
Mass [kg]	6	13	25	50	85
Length [mm]	225	300	375	500	625

Check permissible motor weight and motor length on cantilevered position and on horizontal position — No → Select another motor or another gearbox (ask your contact)

Select the appropriate motor interface / coupling type on pages 84 and 85 — No → Select another motor or another gearbox (ask your contact)

Coupling Type		Torque [Nm] Standard applications	Applications in difficult conditions*
T19	5103-19	8.4	5.3
T24	5103-24	30	18.8
T28	5103-28	80	50
T38	5103-38	162	100
T42	5103-42	224	140

* High durability, high temperatures. For Support please contact Güdel.

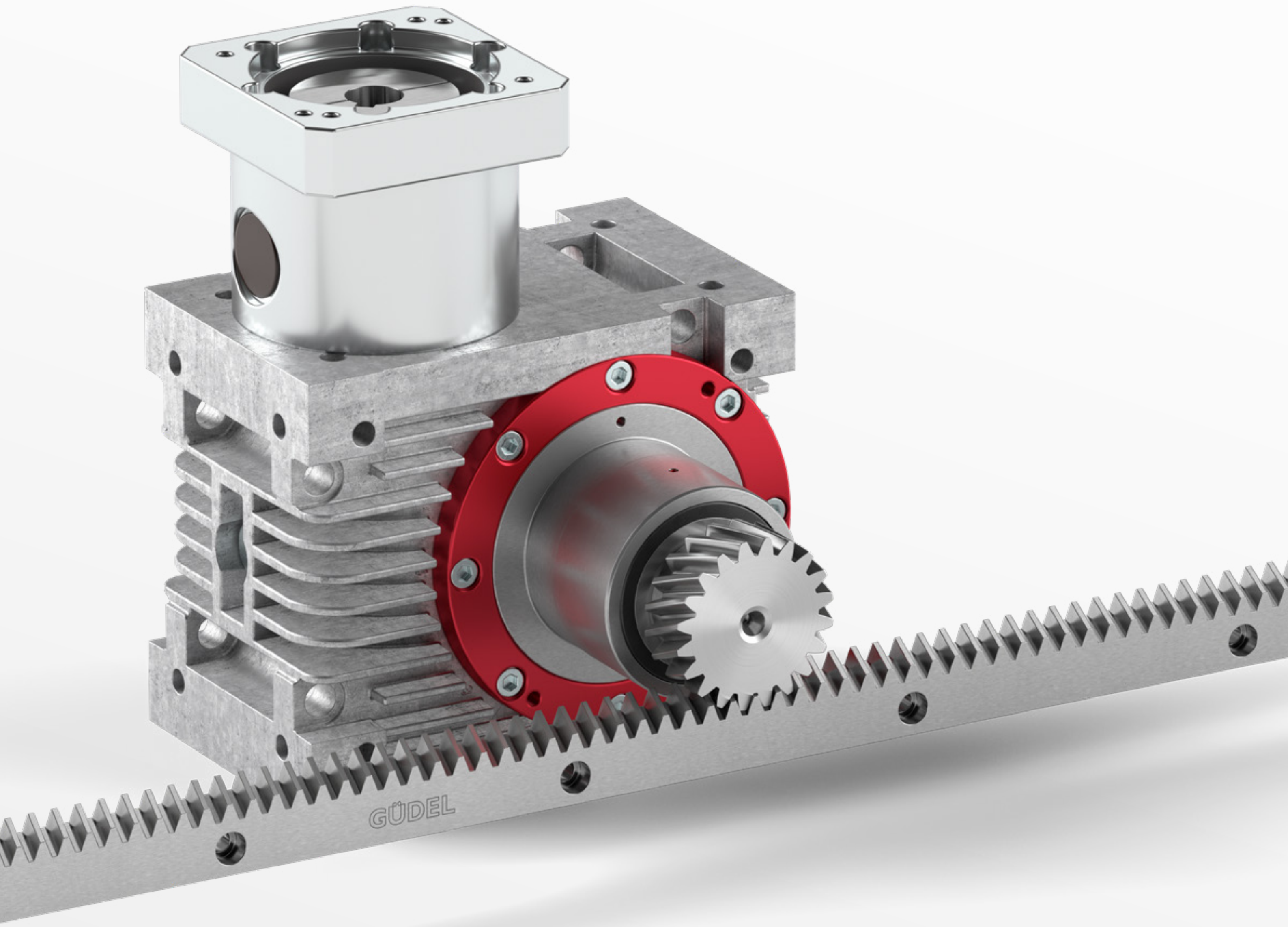
$T_{1maxmot} < T_{Coupling}$ — No → Limit the motor current

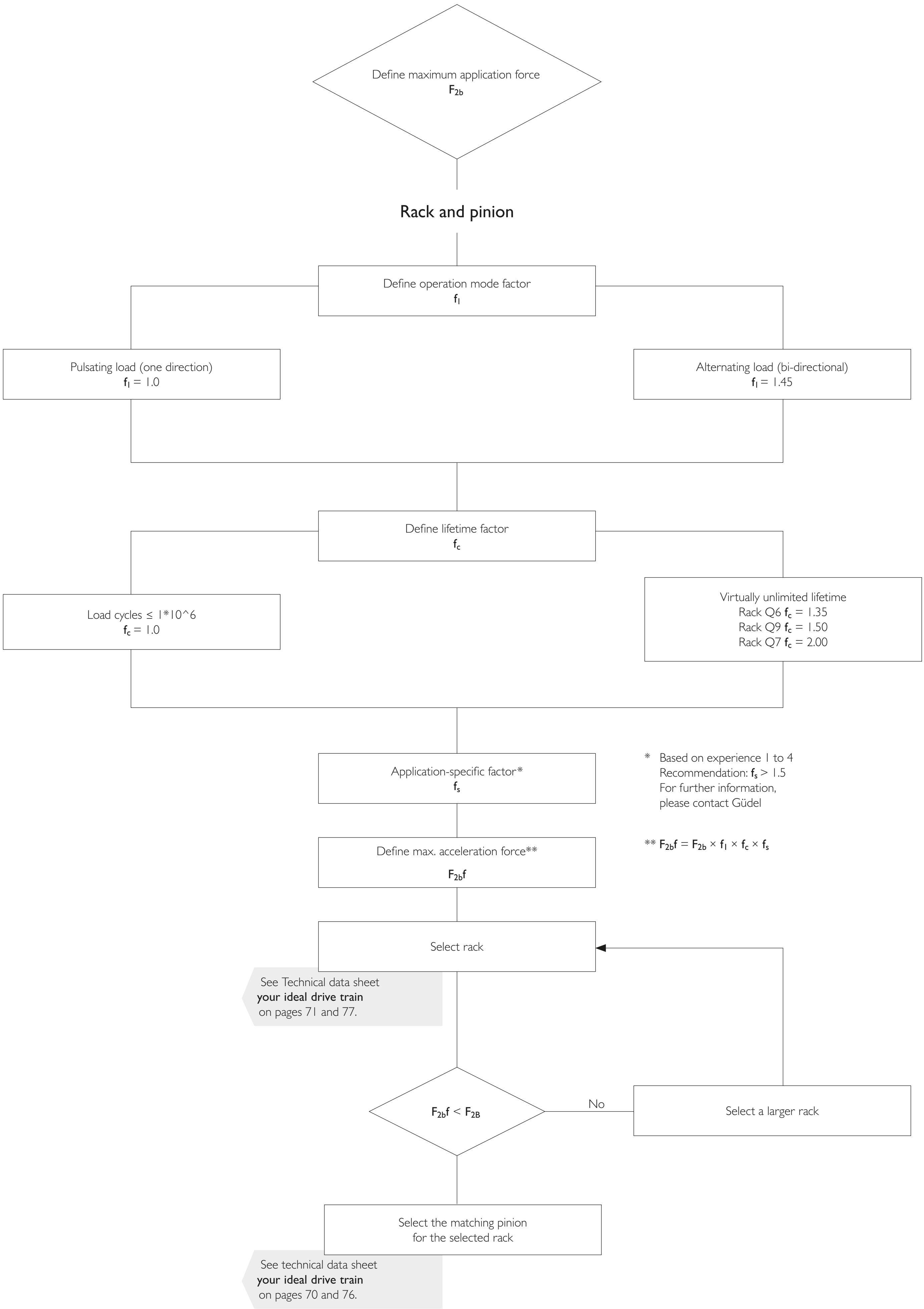
* $T_{2maxmot} < T_{2Not}$ — No → Limit the motor current

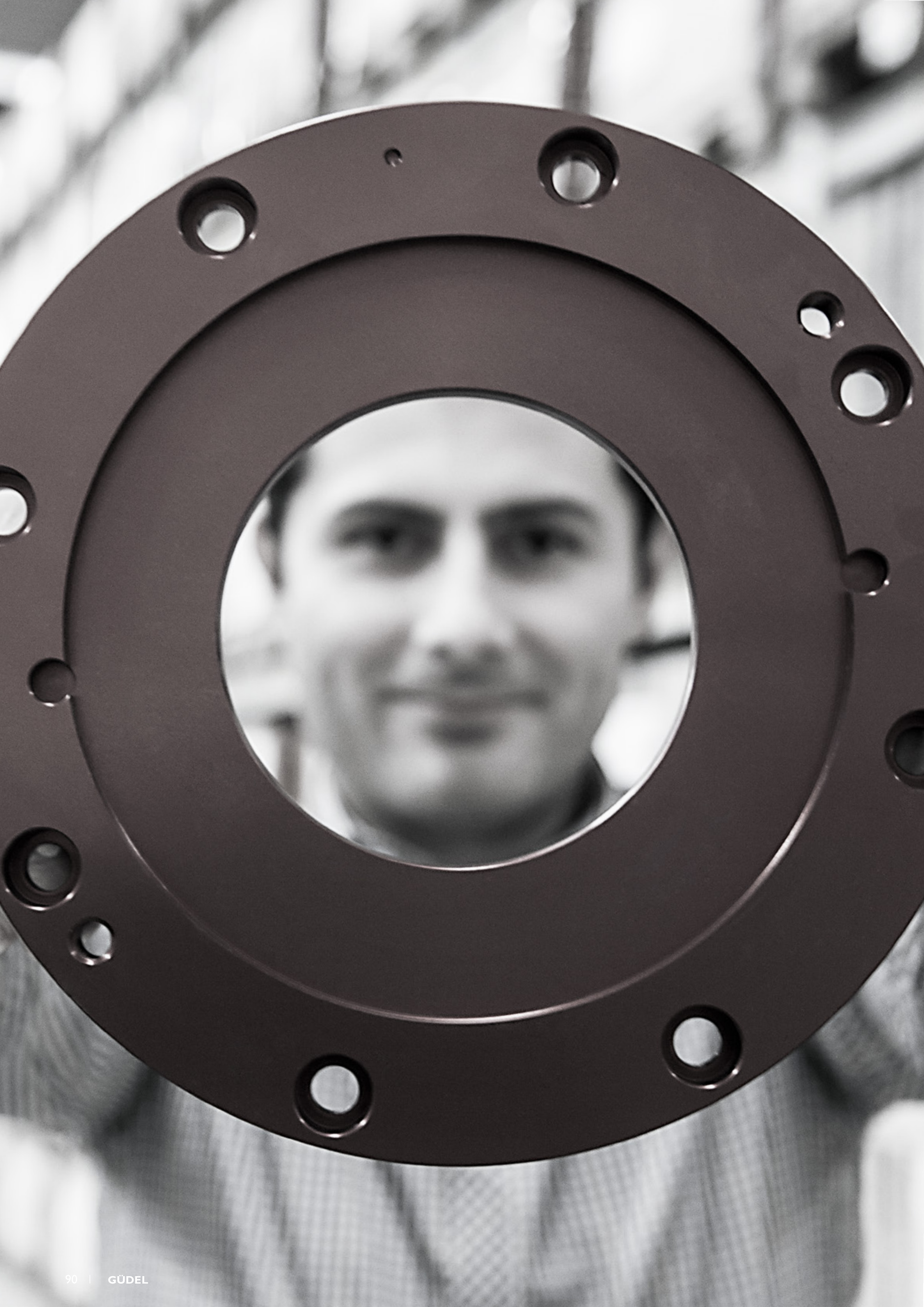
HPG gearbox sizing finished

* When the engine is under full load, the gear must not be damaged.
$T_{2max\,mot} = T_{1max\,mot} \times i \times \eta$

Find your ideal drive train




Define maximum application force
F2b
Rack and pinion
Define operation mode factor
fl
Pulsating load (one direction)
fl = 1.0
Alternating load (bi-directional)
fl = 1.45
Define lifetime factor
fc
Load cycles ≤ 1*10^6
fc = 1.0
Virtually unlimited lifetime
Rack Q6 fc = 1.35
Rack Q9 fc = 1.50
Rack Q7 fc = 2.00
Application-specific factor*
fs
* Based on experience 1 to 4
Recommendation: fs > 1.5
For further information,
please contact Güdel
Define max. acceleration force**
F2bf
** F2bf = F2b × fl × fc × fs
Select rack
See Technical data sheet
your ideal drive train
on pages 71 and 77.
F2bf < F2B
No
Select a larger rack
Select the matching pinion
for the selected rack
See technical data sheet
your ideal drive train
on pages 70 and 76.



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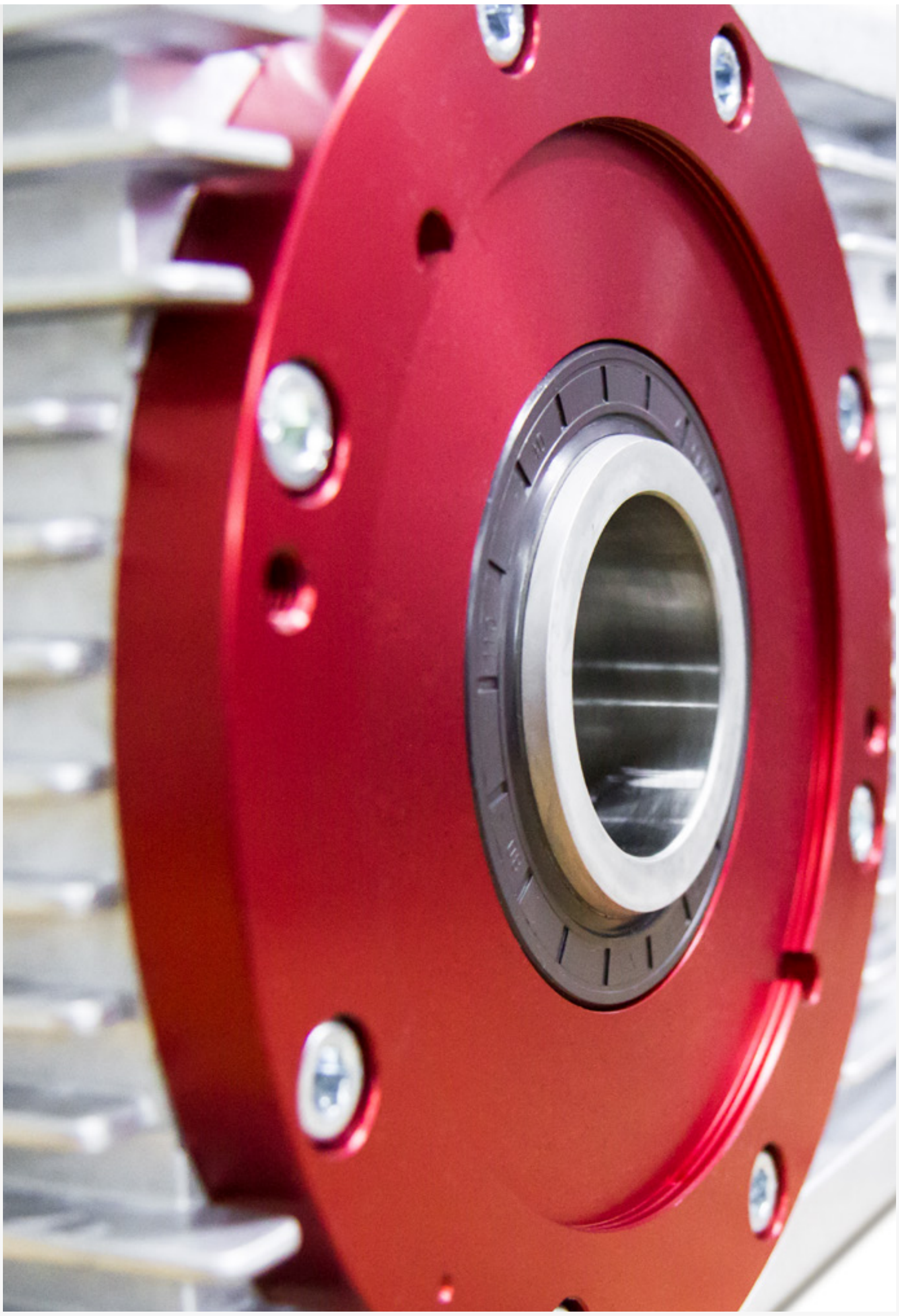

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