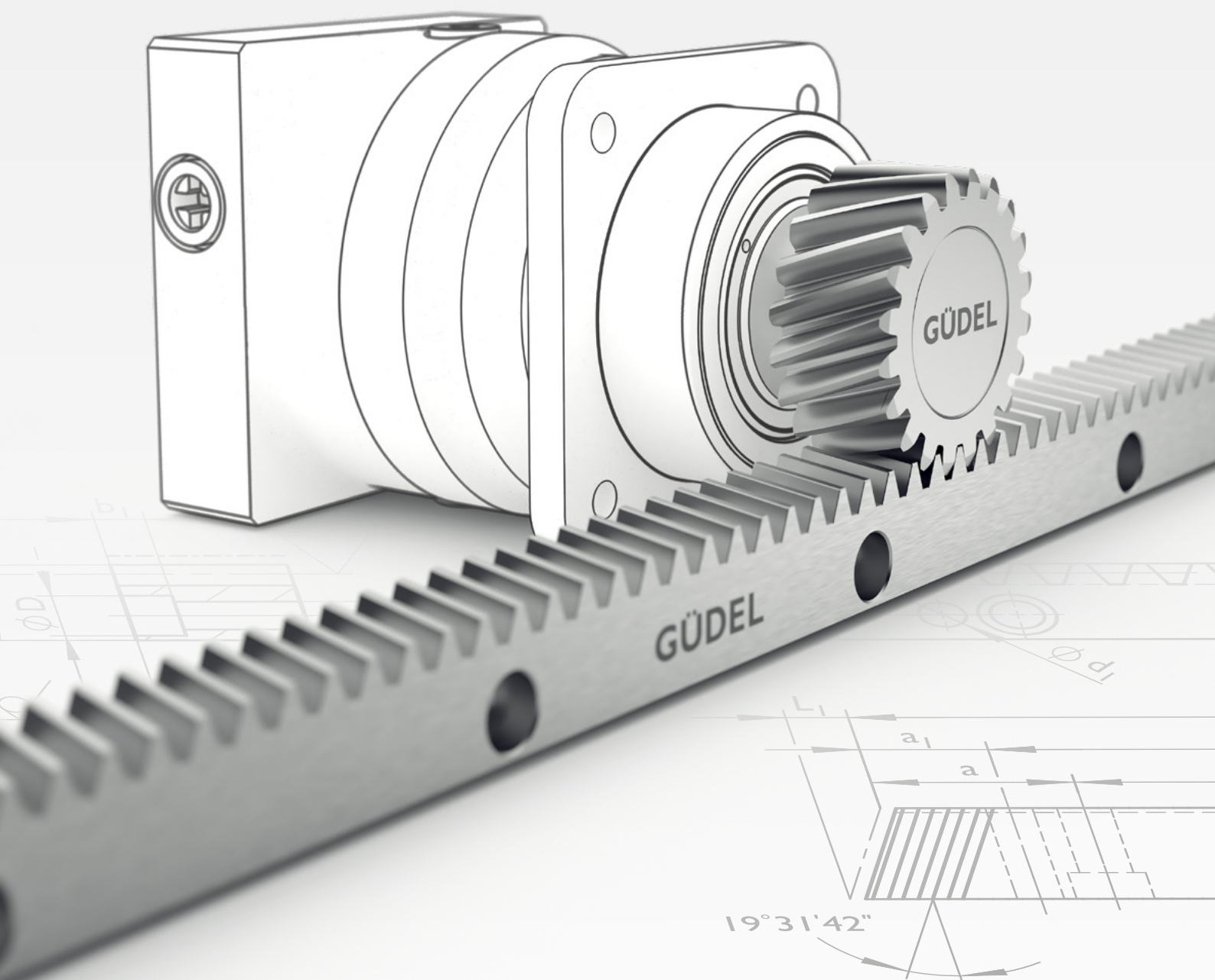
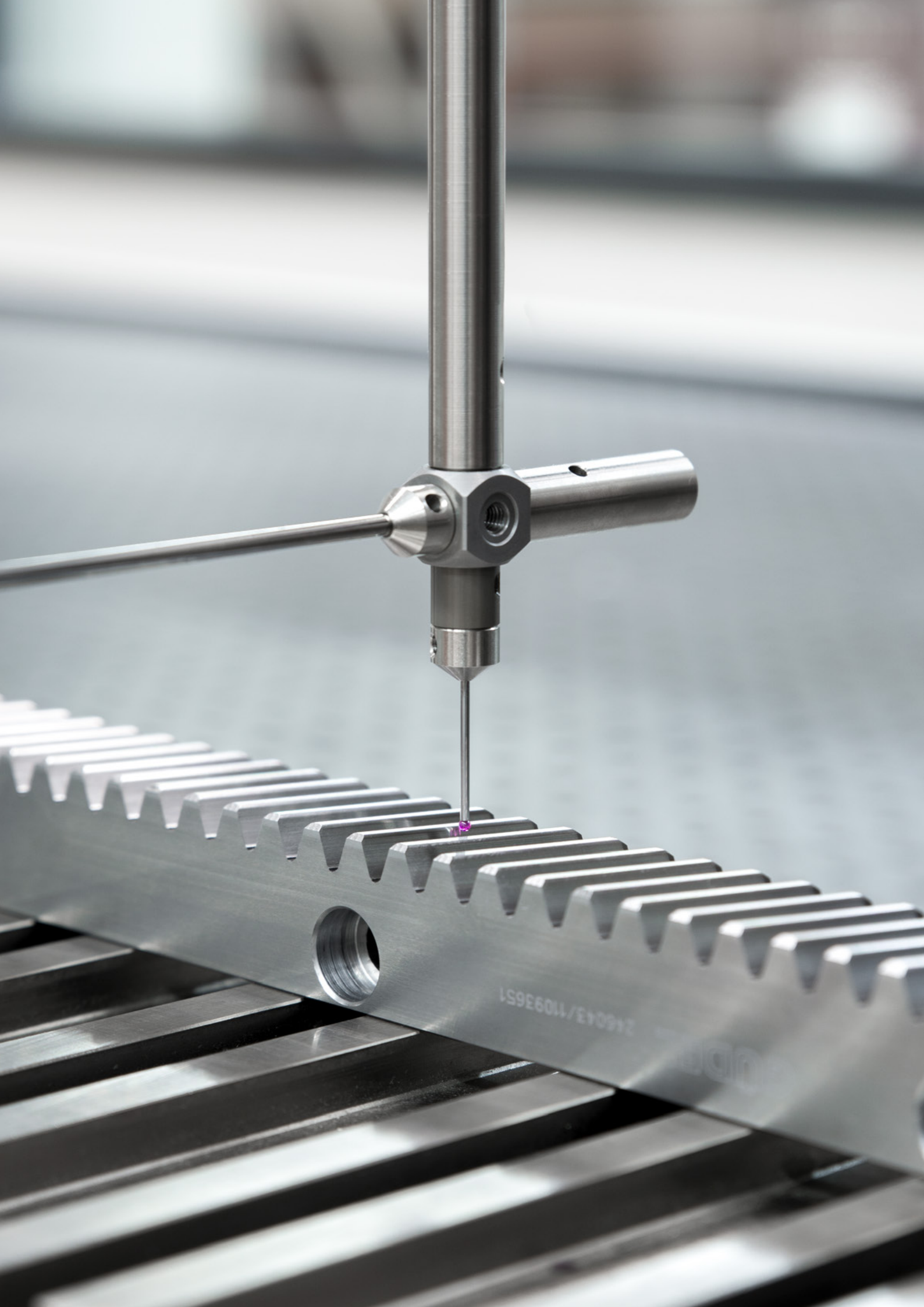


Racks & Pinions



Racks & Pinions

GÜDEL



1S9E6011/E10912
246043/1093651

UBA

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Racks & Pinions

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Technical information

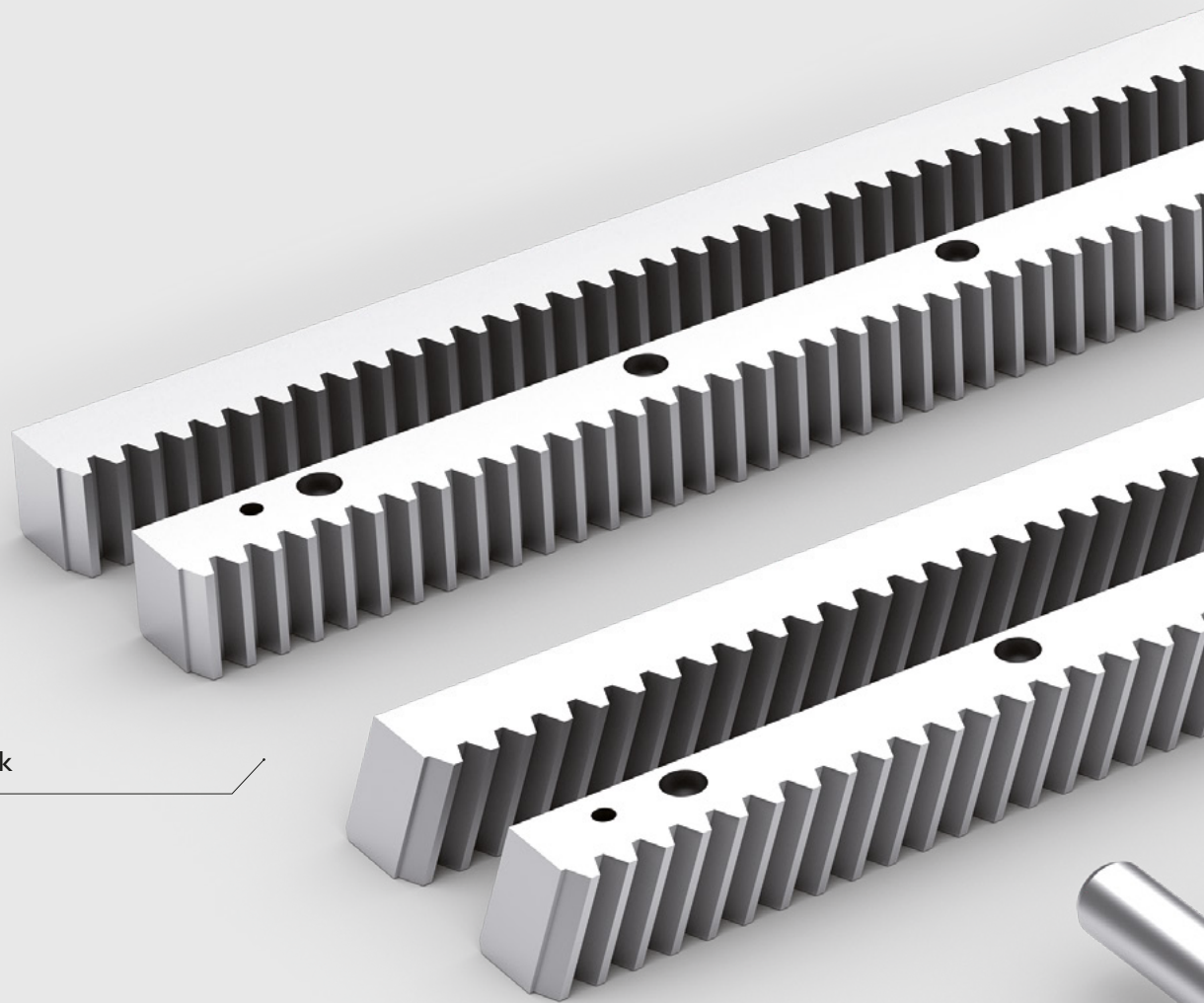
Flowcharts	Calculation of rack and pinion	60
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Güdel worldwide

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Tooth to tooth – Rack and pinion precision

We offer our racks and pinions in different qualities and finishes. In addition to our standard portfolio shown here, we are also able to produce your application-specific designs. In this way, we provide you with the right product for every application and industry.



Rack



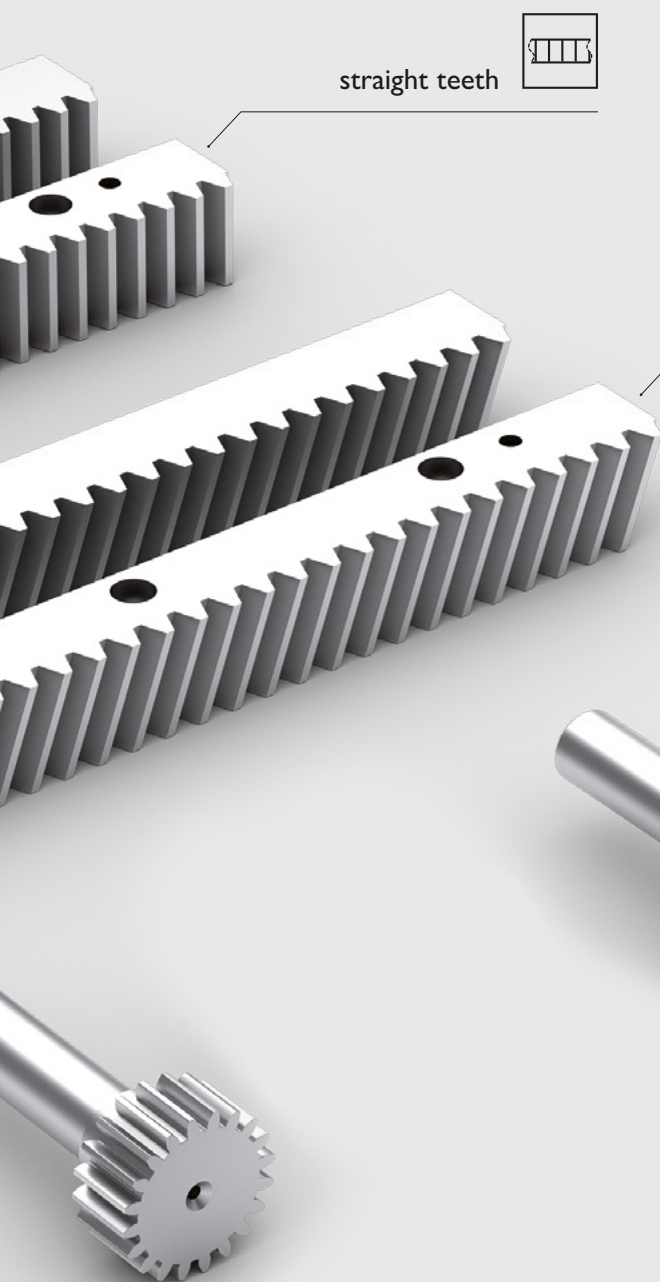
Pinion



We offer you nine sizes from module 1.5 to 10, with the option of straight or helical teeth.

Module		
m_n	p_n	P_t
1.5	4.72	5
2	6.28	6.66
2.5	7.85	8.33
3	9.42	10
4	12.57	13.33
5	15.71	16.66
6	18.85	20
8	25.13	26.66
10	31.42	33.33

m_n : Normal module, P_n : Normal pitch
 P_t : Transverse pitch (for helical teeth)



straight teeth



helical teeth



Demand-oriented performance – Quality according to your requirements

With our standard portfolio we offer four quality grades from Q5 to Q9. Our Q5 and Q6 quality racks are hardened and ground, while quality Q7 is milled out of alloyed tempered steel. Racks of quality grade Q9 are milled and hardened.

Our standard racks and pinions are manufactured from steel. To suit your needs for medical and food applications, racks are also available in stainless steel or polyamide.



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



Materials



Steel



Stainless



Polyamide

Processes



hardened



milled



ground



ground crowned



Your ideal drive train – Highly precise & economical

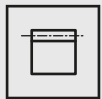
The ideal configuration of your drive train consists of:
Güdel high performance angle gearboxes or high precision
planetary gearboxes, racks and pinions.

The Güdel range of products complement each other perfectly and are ideally suited for a high-performance drive train. They meet the highest demands of precision and economy. With our compact concepts, highly dynamic drive trains can be built that are universally applicable in terms of installation position.

Our ideal drive train is optimized for applications that require speed, precision, high feed force and dynamics even with long strokes. Fields of application include laser cutting systems, tool and wood processing machines as well as applications in robotics and conveyor technology.



Pinion



Rack



Quality



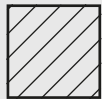
Q7



Q9



Helical



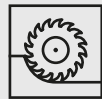
Steel



Hardened



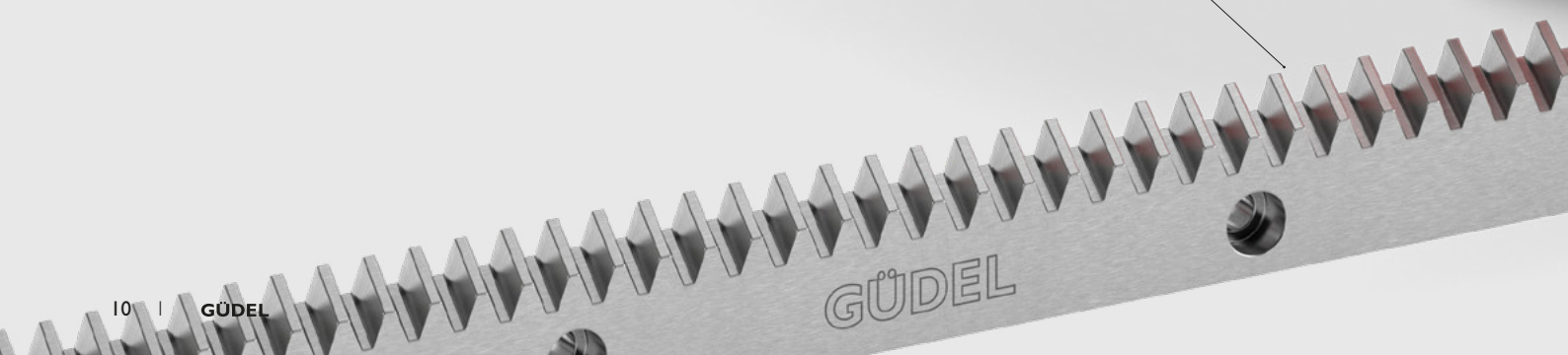
Ground

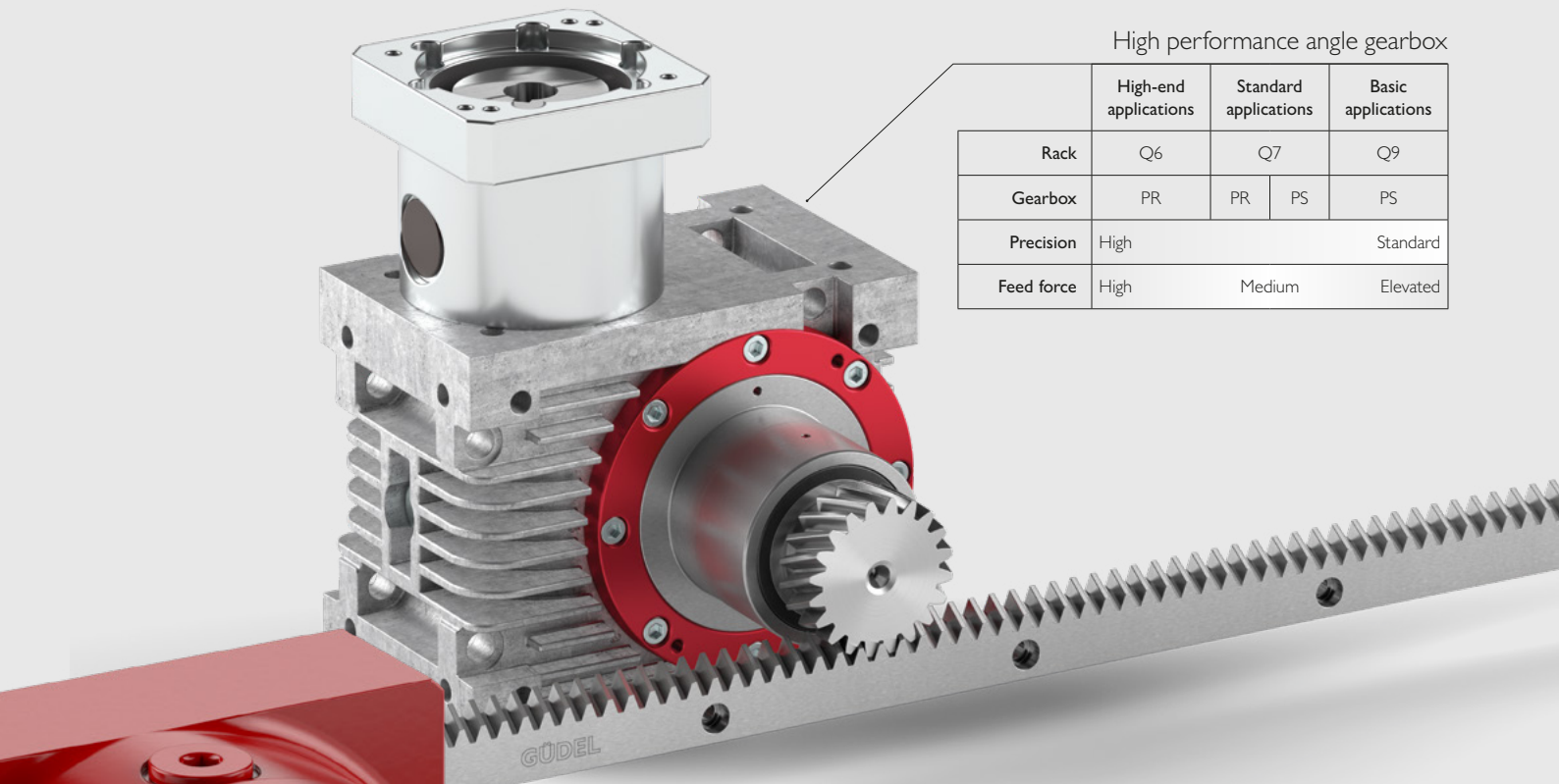


Milled



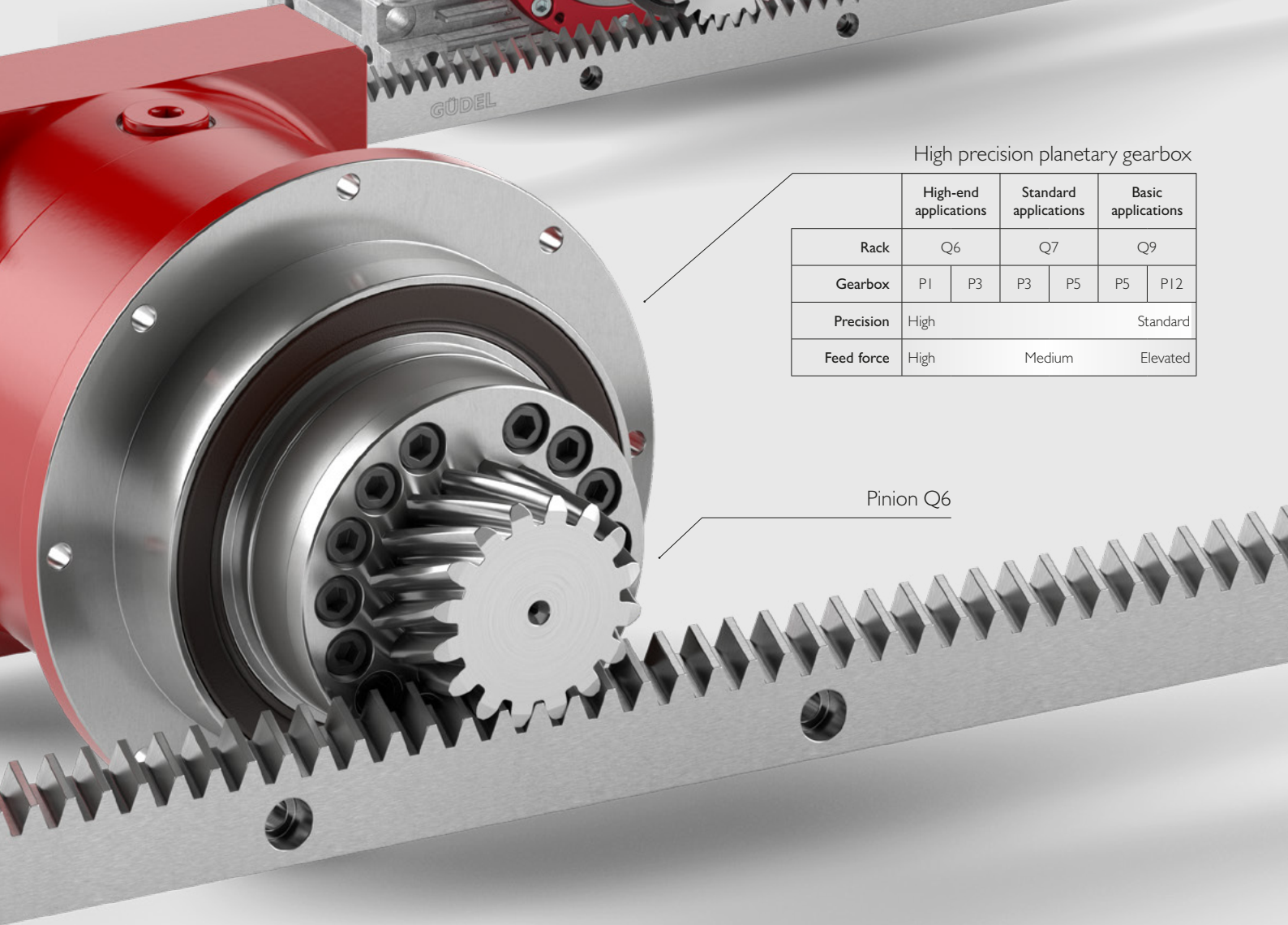
Rack Q6





High performance angle gearbox

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

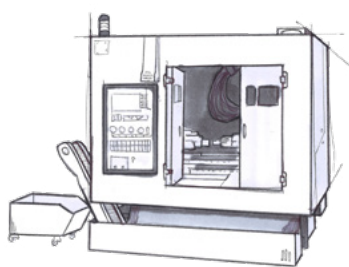


High precision planetary gearbox

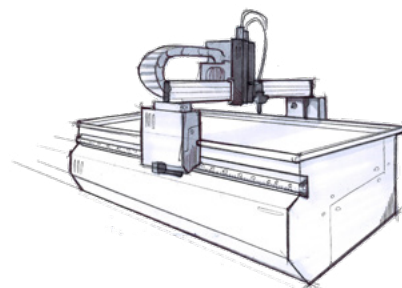
	High-end applications		Standard applications		Basic applications	
Rack	Q6		Q7		Q9	
Gearbox	PI	P3	P3	P5	P5	P12
Precision	High				Standard	
Feed force	High		Medium		Elevated	

Pinion Q6

Your ideal drive train – Quick selection



High-end applications

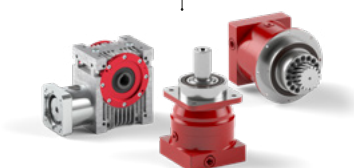


Standard applications



Quality
Processes
Material
Toothing

Rack	<table border="1"> <tr> <td>Q5</td> <td>Q6</td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td colspan="2"></td> </tr> <tr> <td></td> <td></td> </tr> </table>	Q5	Q6							<table border="1"> <tr> <td>Q7</td> </tr> <tr> <td></td> </tr> <tr> <td></td> </tr> <tr> <td></td> </tr> </table>	Q7			
	Q5	Q6												
Q7														



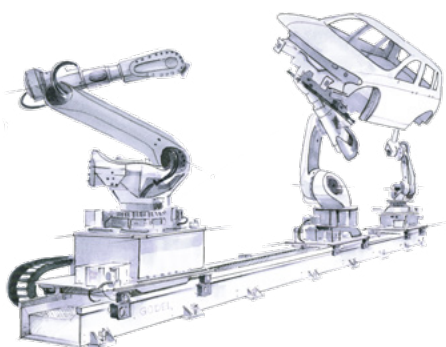
High performance angle gearbox High precision planetary gearbox



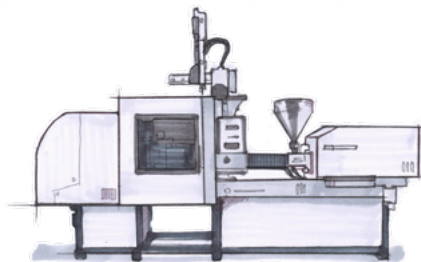
High performance angle gearbox High precision planetary gearbox

Type
Precision grade
Examples of use

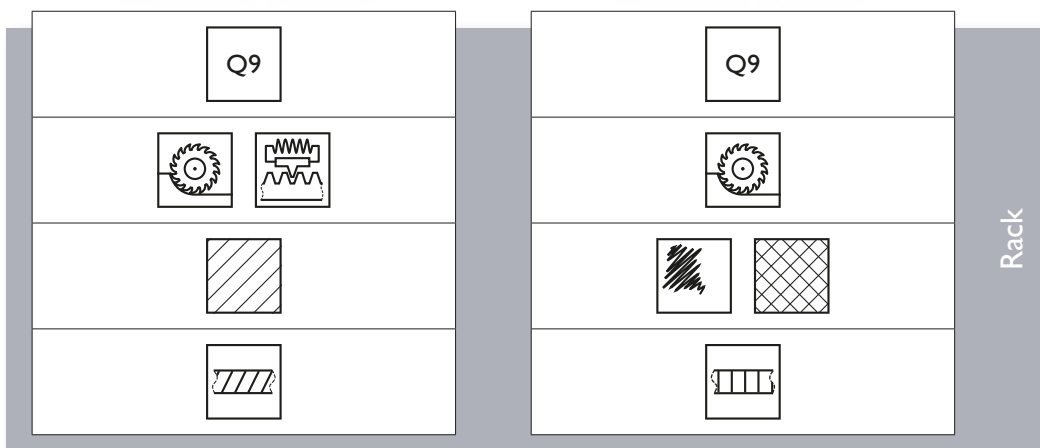
Gearbox	<table border="1"> <tr> <td>HPG</td> <td>NRHP, NRH, SR, PR</td> </tr> <tr> <td>PR</td> <td>PI, P3</td> </tr> </table>	HPG	NRHP, NRH, SR, PR	PR	PI, P3	<table border="1"> <tr> <td>HPG</td> <td>NRH, NR</td> </tr> <tr> <td>PS</td> <td>P3, P5</td> </tr> </table>	HPG	NRH, NR	PS	P3, P5
	HPG	NRHP, NRH, SR, PR								
	PR	PI, P3								
HPG	NRH, NR									
PS	P3, P5									
<p>Optimized drive train for the highest demands on linear drive systems. Modern machine tools of all kinds, for a wide variety of materials, with highly dynamic movements. High quality process machines and automation systems.</p>	<p>The combination of this linear drive train is particularly suitable for applications with medium dynamics and precision requirements. These include for example simple laser cutting machines, plasma cutting machines, Waterjet cutting machines or tube bending machines.</p>									



Basic applications



Solutions for medical and food applications



Quality
Processes
Material
Toothings



High performance angle gearbox

High precision planetary gearbox



High performance angle gearbox

HPG	NRH, NR, SR, PR	HPG	Gearbox
PS	P5, PI2	PS	
Drive train for a high feed force requirement with standard precision for applications such as gantries and linear axes for industrial, welding, and material handling robots.		Applications with special hygienic requirements. Automation in the fields of pharmaceuticals and medical technology, chemicals or food industry.	

Type
Precision grade
Examples of use

Find the right size, power level & design

	Quality	Material	Teeth	Processes
Rack	Q5			
	Q6			
	Q6			
	Q6			
	Q7			
	Q9			
	Q5			
	Q6			
	Q9			
	Q9			
	Q9			
Pinion	Q6			
	Q6			

Holes	Module	Series	Page	
Yes	1.5–10	246...	22	Rack
Yes	1.5–10	246...	23	
Yes*	1.5–6	246I...	24	
No	1.5–10	244...	25	
Yes	1.5–5	155...	26	
Yes	1.5–6	158...	27	
Yes	1.5–10	240...	30	
No	1.5–10	244...	31	
No	1.5–10	124...	32	
No	2–4	127...	36	
No	2–4	130...	37	

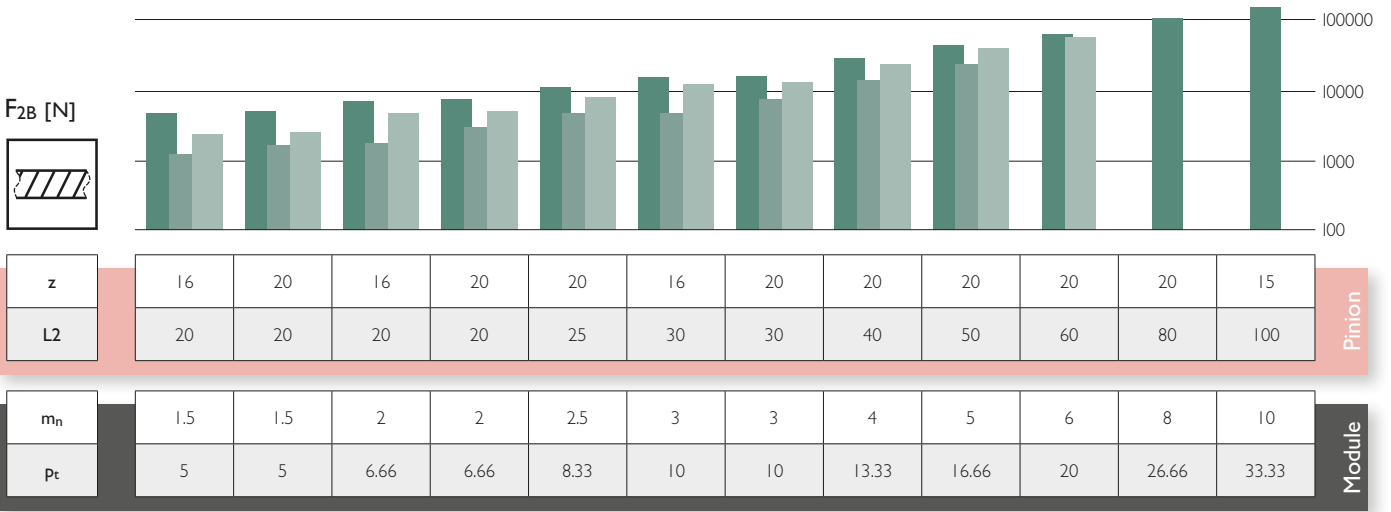
–	1.5–10	21I...	28	Pinion
–	1.5–10	20I...	33	

* Double amount of fixing holes for maximum feed force

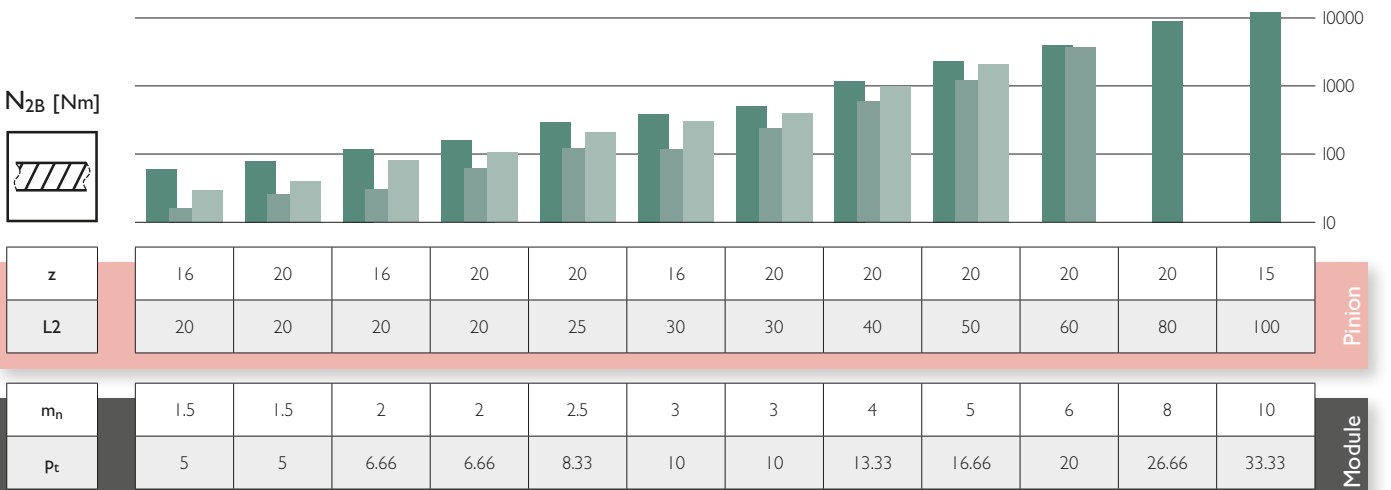
Powerful force – Make your preselection

The following diagrams provide a quick overview of the feed force and torque in combination with the pinions available for the corresponding module.

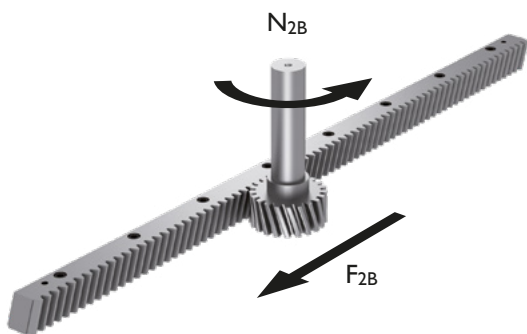
Helical teeth, modular pitch



z: Number of teeth, L₂: Face width [mm], m_n: Normal module, p_t: Transverse pitch [mm]



z: Number of teeth, L₂: Face width [mm], m_n: Normal module, p_t: Transverse pitch [mm]



- Q5 □ Q6
- Q7
- Q9

Straight teeth, modular pitch



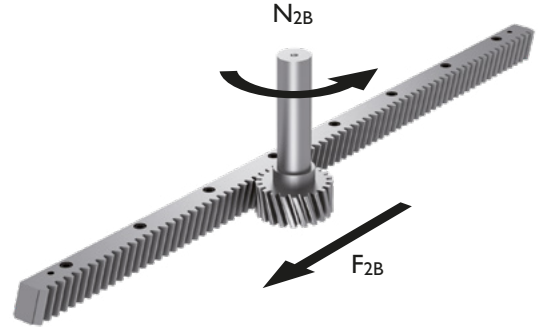
z: Number of teeth, L2: Face width [mm], m_n : Normal module, p_n : Normal pitch [mm]
Racks made of stainless steel are not shown in this diagram.






z: Number of teeth, L2: Face width [mm], m_n : Normal module, p_n : Normal pitch [mm]
Racks made of stainless steel are not shown in this diagram.









Powerful force – Selection and load tables

Identify the most suitable product based on the required feed force.
According to the desired tothing - helical or straight - the following
tables show the correct size in module pitch.



Helical teeth, modular pitch

Pinion	
	
Q6	
 	
z	L_2
16	20.0
20	20.0
16	20.0
20	20.0
20	25.0
16	30.0
20	30.0
20	40.0
20	50.0
20	60.0
20	80.0
15	100.0


Rack					
					
Q5 Q6		Q7		Q9	
 				 	
F_{2B} [N]	N_{2B} [Nm]	F_{2B} [N]	N_{2B} [Nm]	F_{2B} [N]	N_{2B} [Nm]
4724	60	1221	16	2352	30
5004	80	1654	26	2510	40
7075	120	1760	30	4752	81
7490	159	2963	63	5036	107
11199	297	4703	125	8095	215
15272	389	4714	120	12273	313
16163	515	7565	241	12980	413
28585	1213	14084	598	24045	1021
44505	2361	23785	1262	40048	2125
63300	4030	-	-	59005	3756
109734	9315	-	-	-	-
157996	12573	-	-	-	-

m_n	P_t
1.5	5
1.5	5
2	6.66
2	6.66
2.5	8.33
3	10
3	10
4	13.33
5	16.66
6	20
8	26.66
10	33.33


m_n : Normal module, P_t : Transverse pitch [mm], z : Number of teeth, L_2 : Face width [mm]

Straight teeth, modular pitch




Pinion




Q6



Rack

Q5 Q6 Q9 Q9



m_n	P_n
1.5	4.72
1.5	4.72
2	6.28
2	6.28
2.5	7.85
3	9.42
3	9.42
4	12.57
5	15.71
6	18.85
8	25.13
10	31.42

z	L_2
16	20.0
20	20.0
16	20.0
20	20.0
20	25.0
16	30.0
20	30.0
20	40.0
20	50.0
20	60.0
20	80.0
16	100.0

F_{2B} [N]	N_{2B} [Nm]	F_{2B} [N]	N_{2B} [Nm]	F_{2B} [N]	N_{2B} [Nm]
2888	35	1370	16.44	-	-
3638	55	1497	22.455	-	-
4810	77	2583	41.328	531	8.5
5958	119	2907	58.14	651	13
9004	225	4836	120.9	990	25
12597	302	7328	175.872	1156	28
13697	411	7450	223.5	1439	43
24068	963	14639	585.56	2577	103
37317	1866	27905	1395.25	-	-
52880	3173	41797	2507.82	-	-
91220	7298	87244	6980	-	-
137151	10972	116784	9343	-	-

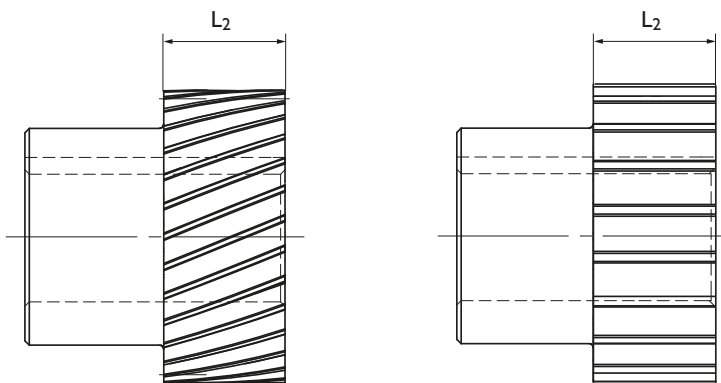
m_n : Normal module, P_n : Normal pitch [mm], z : Number of teeth, L_2 : Face width [mm]

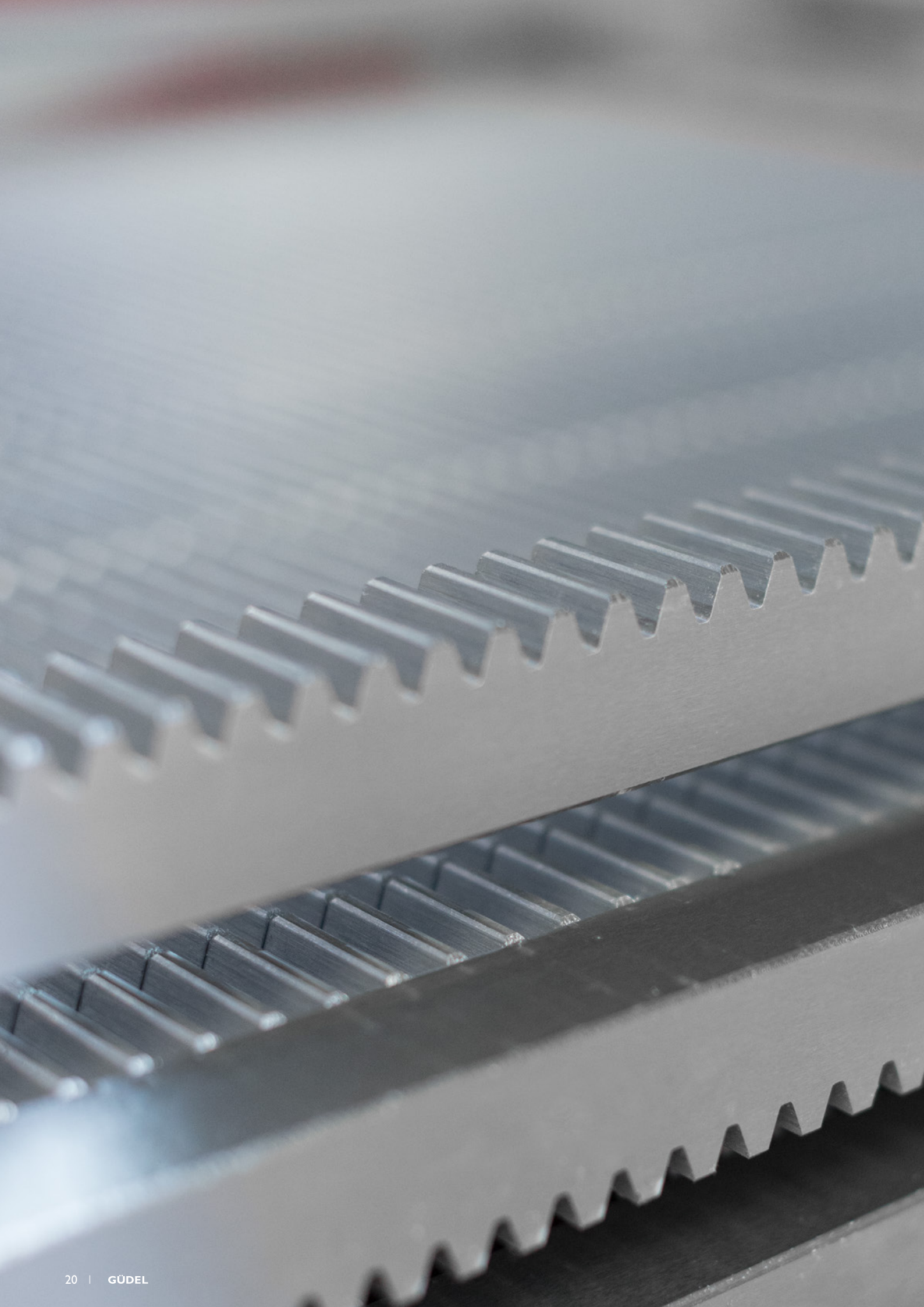
The racks can be supplied milled, milled and hardened or hardened and ground.

The values given are values for shock-free operation, good lubrication and stiff arrangement of the pinion.

An application-specific safety factor f_s 1.0 to 4.0 must be taken into account according to experience.
Recommendation $f_s > 1.5$

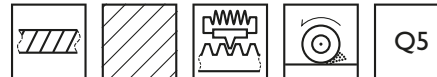
The traction force F_{2B} is related to the number of teeth z of the pinion.





Technical data sheets

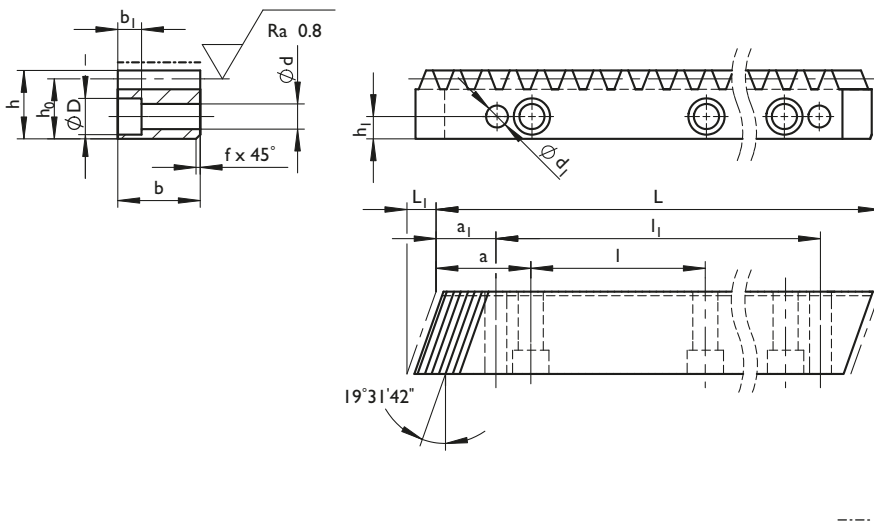
GÜDEL



Helical teeth, modular pitch



Hardened and ground



Material
C45E DIN 1.1191

Profile
all faces ground

Teeth
pressure angle $\alpha = 20^\circ$
helical teeth system right
helix angle $\beta = 19^\circ 31' 42''$
hardened (54⁺⁶/₈ HRC)
and ground

Quality
5h22 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

F_{p250} [mm]
cumulative pitch deviation
based on length 250mm

--- hardened



Geometrical data

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}	F_{p250}	M	Part No.
1.5	5.00	500.00	6.7	100	19	19	17.5	2	62.5	125	8	7	11	7	31.7	436.6	5.7	0.021	0.016	1.3	246012-Q5
1.5	5.00	1000.00	6.7	200	19	19	17.5	2	62.5	125	8	7	11	7	31.7	936.6	5.7	0.030	0.016	2.6	246013-Q5
2	6.66	500.00	8.5	75	24	24	22.0	2	62.5	125	8	7	11	7	31.7	436.6	5.7	0.018	0.014	2.1	246022-Q5
2	6.66	1000.00	8.5	150	24	24	22.0	2	62.5	125	8	7	11	7	31.7	936.6	5.7	0.025	0.014	4.1	246023-Q5
2.5	8.33	500.00	8.5	60	24	24	21.5	2	62.5	125	9	7	11	7	31.7	436.6	5.7	0.019	0.016	2.0	246032-Q5
2.5	8.33	1000.00	8.5	120	24	24	21.5	2	62.5	125	9	7	11	7	31.7	936.6	5.7	0.024	0.016	4.1	246033-Q5
3	10.00	500.00	10.3	50	29	29	26.0	2	62.5	125	9	10	15	9	35.0	430.0	7.7	0.020	0.017	3.0	246042-Q5
3	10.00	1000.00	10.3	100	29	29	26.0	2	62.5	125	9	10	15	9	35.0	930.0	7.7	0.026	0.017	5.9	246043-Q5
4	13.33	506.67	13.8	38	39	39	35.0	2	62.5	125	12	10	15	9	33.3	433.0	7.7	0.021	0.019	5.4	246052-Q5
4	13.33	1000.00	13.8	75	39	39	35.0	2	62.5	125	12	10	15	9	33.3	933.4	7.7	0.026	0.019	10.7	246053-Q5
5	16.66	500.00	17.4	30	49	49	34.0	3	62.5	125	12	14	20	13	37.5	425.0	11.7	0.020	0.018	6.5	246062-Q5
5	16.66	1000.00	17.4	60	49	49	34.0	3	62.5	125	12	14	20	13	37.5	925.0	11.7	0.024	0.018	13.1	246063-Q5
6	20.00	500.00	20.9	25	59	49	43.0	3	62.5	125	16	18	26	17	37.5	425.0	15.7	0.022	0.020	10.0	246072-Q5
6	20.00	1000.00	20.9	50	59	49	43.0	3	62.5	125	16	18	26	17	37.5	925.0	15.7	0.026	0.020	19.9	246073-Q5
8	26.67	480.00	28.0	18	79	79	71.0	3	60.0	120	25	22	33	21	120.0	240.0	19.7	0.021	0.020	22.0	246082-Q5
8	26.67	960.00	28.0	36	79	79	71.0	3	60.0	120	25	22	33	21	120.0	720.0	19.7	0.024	0.020	44.0	246083-Q5
10	33.33	500.00	35.1	15	99	99	89.0	3	62.5	125	32	33	48	32	125.0	250.0	19.7	0.020	0.019	34.0	246092-Q5
10	33.33	1000.00	35.1	30	99	99	89.0	3	62.5	125	32	33	48	32	125.0	750.0	19.7	0.023	0.019	68.0	246093-Q5

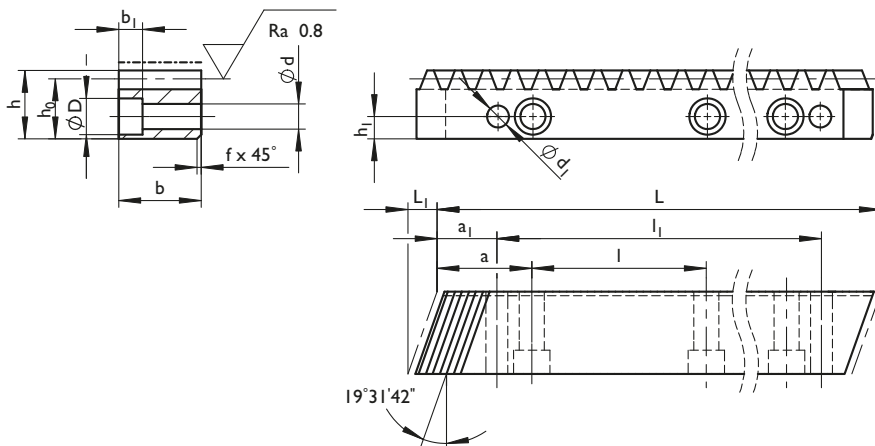
m_n : Normal module, P_t : Transverse pitch [mm], z: Number of teeth, d_1 : Predrilled, M: Weight [kg]



Helical teeth, modular pitch



Hardened and ground



--- hardened

Material
C45E DIN 1.1191

Profile
all faces ground

Teeth
pressure angle $\alpha = 20^\circ$
helical teeth system right
helix angle $\beta = 19^\circ 31' 42''$
hardened (54⁺₆ 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 data

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.
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	0.029	1.3	246012
1.5	5.00	1000.00	6.7	200	19	19	17.50	2	62.5	125.00	8	7	11	7	31.7	936.6	5.7	0.043	2.6	246013
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	0.025	2.1	246022
2	6.66	1000.00	8.5	150	24	24	22.00	2	62.5	125.00	8	7	11	7	31.7	936.6	5.7	0.036	4.1	246023
2	6.66	2000.00	8.5	300	24	24	22.00	2	62.5	125.00	8	7	11	7	31.7	1936.6	5.7	0.058	8.2	246024
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	0.027	2.0	246032
2.5	8.33	1000.00	8.5	120	24	24	21.50	2	62.5	125.00	9	7	11	7	31.7	936.6	5.7	0.036	4.1	246033
2.5	8.33	2000.00	8.5	240	24	24	21.50	2	62.5	125.00	9	7	11	7	31.7	1936.6	5.7	0.053	8.2	246034
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	0.028	3.0	246042
3	10.00	1000.00	10.3	100	29	29	26.00	2	62.5	125.00	9	10	15	9	35.0	930.0	7.7	0.037	5.9	246043
3	10.00	2000.00	10.3	200	29	29	26.00	2	62.5	125.00	9	10	15	9	35.0	1930.0	7.7	0.054	11.2	246044
4	13.33	506.67	13.8	38	39	39	35.00	2	62.5	125.00	12	10	15	9	33.3	433.0	7.7	0.030	5.4	246052
4	13.33	1000.00	13.8	75	39	39	35.00	2	62.5	125.00	12	10	15	9	33.3	933.4	7.7	0.036	10.7	246053
4	13.33	2000.00	13.8	150	39	39	35.00	2	62.5	125.00	12	10	15	9	33.3	1933.4	7.7	0.050	20.5	246054
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
4	13.33	1000.00	13.8	75	39	39	35.00	2	62.5	125.00	12	12	18	11	33.3	933.4	9.7	0.036	10.7	246056
4	13.33	2000.00	13.8	150	39	39	35.00	2	62.5	125.00	12	12	18	11	33.3	1933.4	9.7	0.050	20.5	246057
5	16.66	500.00	17.4	30	49	49	34.00	3	62.5	125.00	12	14	20	13	37.5	425.0	11.7	0.028	6.5	246062
5	16.66	1000.00	17.4	60	49	49	34.00	3	62.5	125.00	12	14	20	13	37.5	925.0	11.7	0.034	13.1	246063
5	16.66	2000.00	17.4	120	49	49	34.00	3	62.5	125.00	12	14	20	13	37.5	1925.0	11.7	0.045	24.5	246064
6	20.00	500.00	20.9	25	59	59	43.00	3	62.5	125.00	16	18	26	17	37.5	425.0	15.7	0.031	10.0	246072
6	20.00	1000.00	20.9	50	59	59	43.00	3	62.5	125.00	16	18	26	17	37.5	925.0	15.7	0.036	19.9	246073
6	20.00	2000.00	20.9	100	59	59	43.00	3	62.5	125.00	16	18	26	17	37.5	1925.0	15.7	0.046	36.5	246074
8	26.66	480.00	28.0	18	79	79	71.00	3	60.0	120.00	25	22	33	21	120.0	240.0	19.7	0.029	22.0	246082
8	26.66	960.00	28.0	36	79	79	71.00	3	60.0	120.00	25	22	33	21	120.0	720.0	19.7	0.033	44.0	246083
8	26.66	1920.00	28.0	72	79	79	71.00	3	60.0	120.00	25	22	33	21	120.0	1680.0	19.7	0.040	78.0	246084
10	33.33	500.00	35.1	15	99	99	89.00	3	62.5	125.00	32	33	48	32	125.0	250.0	19.7	0.029	34.0	246092
10	33.33	1000.00	35.1	30	99	99	89.00	3	62.5	125.00	32	33	48	32	125.0	750.0	19.7	0.032	68.0	246093

m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth, d₁: Predrilled, M: Weight [kg]



Module

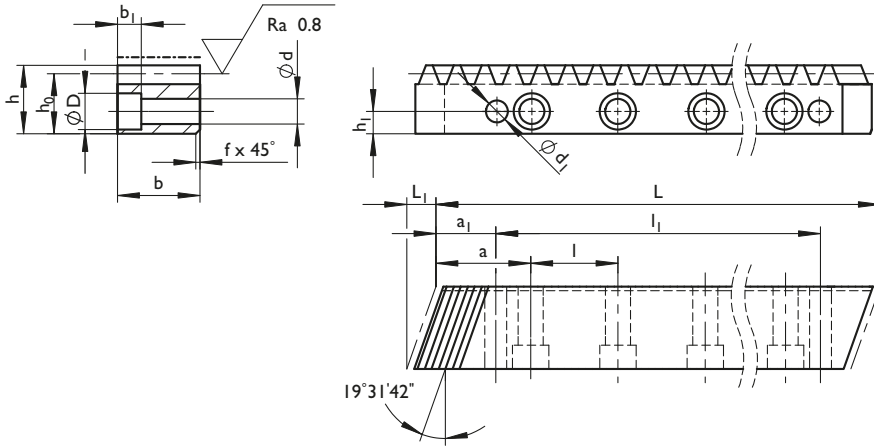
Rack



Helical teeth, modular pitch



Hardened and ground



--- hardened

Material
C45E DIN 1.1191

Profile
all faces ground

Teeth
pressure angle $\alpha = 20^\circ$
helical teeth system right
helix angle $\beta = 19^\circ 31' 42''$
hardened (54⁺⁶/₈ HRC)
and ground

Quality
6h23 DIN 3962/63/67

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

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



Geometrical data

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.
1.5	5.00	500	6.7	100	19	19	17.50	2	62.5	62.5	8	7	11	7	31.7	436.6	5.7	0.029	1.2	246112
1.5	5.00	1000	6.7	200	19	19	17.50	2	62.5	62.5	8	7	11	7	31.7	936.6	5.7	0.043	2.4	246113
2	6.66	500	8.5	75	24	24	22.00	2	62.5	62.5	8	7	11	7	31.7	436.6	5.7	0.025	2.0	246122
2	6.66	1000	8.5	150	24	24	22.00	2	62.5	62.5	8	7	11	7	31.7	936.6	5.7	0.036	3.9	246123
2	6.66	2000	8.5	300	24	24	22.00	2	62.5	62.5	8	7	11	7	31.7	1936.6	5.7	0.058	7.8	246124
2.5	8.33	500	8.5	60	24	24	21.50	2	62.5	62.5	9	7	11	7	31.7	436.6	5.7	0.027	1.9	246132
2.5	8.33	1000	8.5	120	24	24	21.50	2	62.5	62.5	9	7	11	7	31.7	936.6	5.7	0.036	3.8	246133
2.5	8.33	2000	8.5	240	24	24	21.50	2	62.5	62.5	9	7	11	7	31.7	1936.6	5.7	0.053	7.6	246134
3	10.00	500	10.3	50	29	29	26.00	2	62.5	62.5	9	10	15	9	35.0	430.0	7.7	0.028	2.7	246142
3	10.00	1000	10.3	100	29	29	26.00	2	62.5	62.5	9	10	15	9	35.0	930.0	7.7	0.037	5.4	246143
3	10.00	2000	10.3	200	29	29	26.00	2	62.5	62.5	9	10	15	9	35.0	1930.0	7.7	0.054	10.8	246144
4	13.33	506.67	13.8	38	39	39	35.00	2	62.5	62.5	12	12	18	11	33.3	433.0	9.7	0.030	4.9	246152
4	13.33	1000	13.8	75	39	39	35.00	2	62.5	62.5	12	12	18	11	33.3	933.4	9.7	0.036	9.7	246153
4	13.33	2000	13.8	150	39	39	35.00	2	62.5	62.5	12	12	18	11	33.3	1933.4	9.7	0.050	19.5	246154
5	16.66	500	17.4	30	49	49	34.00	3	62.5	62.5	12	14	20	13	37.5	425.0	11.7	0.028	5.8	246162
5	16.66	1000	17.4	60	49	49	34.00	3	62.5	62.5	12	14	20	13	37.5	925.0	11.7	0.034	11.5	246163
5	16.66	2000	17.4	120	49	49	34.00	3	62.5	62.5	12	14	20	13	37.5	1925.0	11.7	0.045	23.0	246164
6	20.00	500	20.9	25	59	59	43.00	3	62.5	62.5	16	18	26	17	37.5	425.0	15.7	0.031	8.5	246172
6	20.00	1000	20.9	50	59	59	43.00	3	62.5	62.5	16	18	26	17	37.5	925.0	15.7	0.036	16.9	246173
6	20.00	2000	20.9	100	59	59	43.00	3	62.5	62.5	16	18	26	17	37.5	1925.0	15.7	0.046	33.9	246174

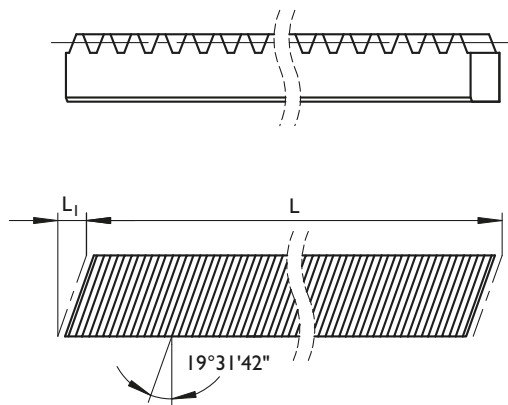
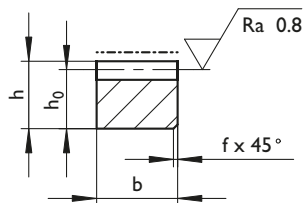
m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth, d₁: Predrilled, M: Weight [kg]



Helical teeth, modular pitch



Hardened and ground



--- hardened

Material
C45E DIN 1.1191

Profile
all faces ground

Teeth
pressure angle $\alpha = 20^\circ$
helical teeth system right
helix angle $\beta = 19^\circ 31' 42''$
hardened (54⁺⁶/₈ 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 data

m _n	P _t	L	L ₁	z	b	h	h ₀	f+0.5	F _{pL}	M	Part No.
1.5	5.00	500.00	6.7	100	19	19	17.50	2	0.029	1.3	244612
1.5	5.00	1000.00	6.7	200	19	19	17.50	2	0.043	2.6	244613
2	6.66	500.00	8.5	75	24	24	22.00	2	0.025	2.1	244622
2	6.66	1000.00	8.5	150	24	24	22.00	2	0.036	4.1	244623
2.5	8.33	500.00	8.5	60	24	24	21.50	2	0.027	2.0	244632
2.5	8.33	1000.00	8.5	120	24	24	21.50	2	0.036	4.1	244633
3	10.00	500.00	10.3	50	29	29	26.00	2	0.028	3.0	244642
3	10.00	1000.00	10.3	100	29	29	26.00	2	0.037	5.9	244643
4	13.33	506.67	13.8	38	39	39	35.00	2	0.030	5.4	244652
4	13.33	1000.00	13.8	75	39	39	35.00	2	0.036	10.7	244653
5	16.66	500.00	17.4	30	49	39	34.00	3	0.028	6.5	244662
5	16.66	1000.00	17.4	60	49	39	34.00	3	0.034	13.1	244663
6	20.00	500.00	20.9	25	59	49	43.00	3	0.031	10.0	244672
6	20.00	1000.00	20.9	50	59	49	43.00	3	0.036	19.9	244673
8	26.66	480.00	28.0	18	79	79	71.00	3	0.029	22.0	244682
8	26.66	960.00	28.0	36	79	79	71.00	3	0.033	44.0	244683
10	33.33	500.0	35.1	15	99	99	89.00	3	0.029	34.5	244692
10	33.33	1000.0	35.1	30	99	99	89.00	3	0.032	69.0	244693

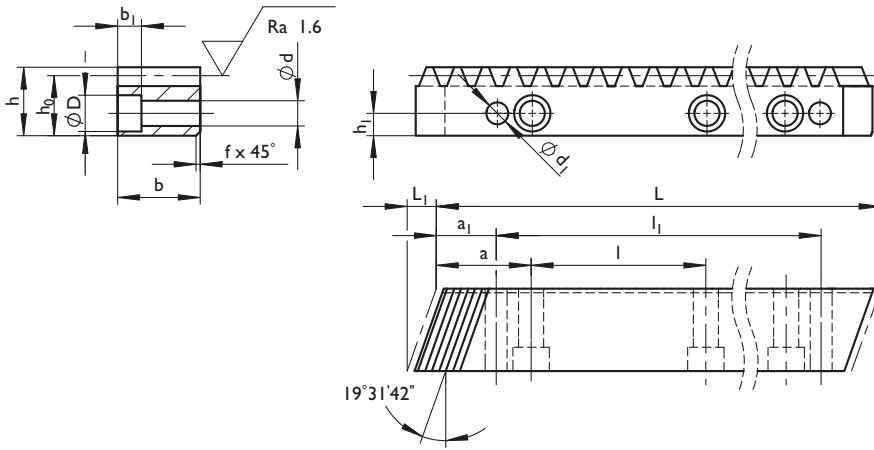
m_n: Normal module, P_t: Transverse pitch [mm], z: Number of teeth, M: Weight [kg]



Helical teeth, modular pitch



Milled



Material
42CrMo4 DIN 1.7225 1

Profile
all faces milled

Teeth
pressure angle $\alpha = 20^\circ$
helical teeth system right
helix angle $\beta = 19^\circ 31' 42''$
milled

Quality
7h25 DIN 3962/63/67

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

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

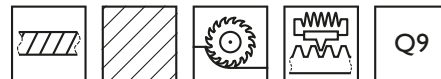


Geometrical data

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.
1.5	5.00	500.00	6.7	100	19	19	17.50	l	62.5	125	8	7	11	7	31.7	436.6	5.7	0.041	1.2	155012
1.5	5.00	1000.00	6.7	200	19	19	17.50	l	62.5	125	8	7	11	7	31.7	936.6	5.7	0.059	2.5	155013
2	6.66	500.00	8.5	75	24	24	22.00	l	62.5	125	8	7	11	7	31.7	436.6	5.7	0.036	2.0	155022
2	6.66	1000.00	8.5	150	24	24	22.00	l	62.5	125	8	7	11	7	31.7	936.6	5.7	0.050	4.0	155023
2	6.66	2000.00	8.5	300	24	24	22.00	l	62.5	125	8	7	11	7	31.7	1936.6	5.7	0.077	8.0	155024
2.5	8.33	500.00	8.5	60	24	24	21.50	l	62.5	125	9	7	11	7	31.7	436.6	5.7	0.038	1.9	155032
2.5	8.33	1000.00	8.5	120	24	24	21.50	l	62.5	125	9	7	11	7	31.7	936.6	5.7	0.050	3.9	155033
2.5	8.33	2000.00	8.5	240	24	24	21.50	l	62.5	125	9	7	11	7	31.7	1936.6	5.7	0.075	7.7	155034
3	10.00	500.00	10.3	50	29	29	26.00	l	62.5	125	9	10	15	9	35.0	430.0	7.7	0.040	2.8	155042
3	10.00	1000.00	10.3	100	29	29	26.00	l	62.5	125	9	10	15	9	35.0	930.0	7.7	0.051	5.6	155043
3	10.00	2000.00	10.3	200	29	29	26.00	l	62.5	125	9	10	15	9	35.0	1930.0	7.7	0.073	11.2	155044
4	13.33	506.67	13.8	38	39	39	35.00	l	62.5	125	12	12	18	11	33.3	433.0	9.7	0.042	5.1	155052
4	13.33	1000.00	13.8	75	39	39	35.00	l	62.5	125	12	12	18	11	33.3	933.4	9.7	0.051	10.1	155053
4	13.33	2000.00	13.8	150	39	39	35.00	l	62.5	125	12	12	18	11	33.3	1933.4	9.7	0.070	20.2	155054
5	16.66	500.00	17.4	30	49	39	34.00	l	62.5	125	12	14	20	13	37.5	425.0	11.7	0.040	6.0	155062
5	16.66	1000.00	17.4	60	49	39	34.00	l	62.5	125	12	14	20	13	37.5	925.0	11.7	0.048	12.0	155063
5	16.66	2000.00	17.4	120	49	39	34.00	l	62.5	125	12	14	20	13	37.5	1925.0	11.7	0.062	24.1	155064

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

Rack

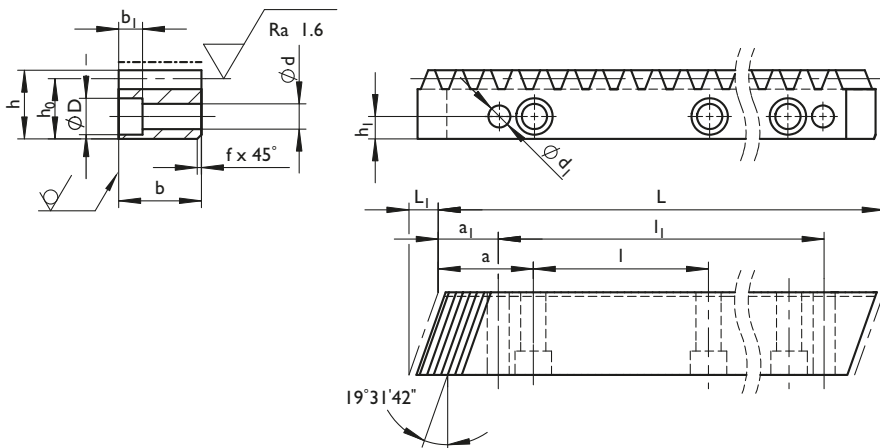


Module

Helical teeth, modular pitch



Milled and hardened



--- hardened

Material
C45E DIN 1.1191

Profile
all faces milled

Teeth
pressure angle $\alpha = 20^\circ$
helical teeth system right
helix angle $\beta = 19^\circ 31' 42''$
hardened (54 ± 0.8 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 data

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.
1.5	5.00	500.00	6.7	100	19	19	17.50	2	62.5	125	8	7	11	7	31.7	436.6	5.7	0.082	1.2	158012
1.5	5.00	1000.00	6.7	200	19	19	17.50	2	62.5	125	8	7	11	7	31.7	936.6	5.7	0.118	2.5	158013
2	6.66	500.00	8.5	75	24	24	22.00	2	62.5	125	8	7	11	7	31.7	436.6	5.7	0.073	2.0	158022
2	6.66	1000.00	8.5	150	24	24	22.00	2	62.5	125	8	7	11	7	31.7	936.6	5.7	0.100	4.0	158023
2	6.66	2000.00	8.5	300	24	24	22.00	2	62.5	125	8	7	11	7	31.7	1936.6	5.7	0.155	8.0	158024
2.5	8.33	500.00	8.5	60	24	24	21.50	2	62.5	125	9	7	11	7	31.7	436.6	5.7	0.076	1.9	158032
2.5	8.33	1000.00	8.5	120	24	24	21.50	2	62.5	125	9	7	11	7	31.7	936.6	5.7	0.101	3.9	158033
2.5	8.33	2000.00	8.5	240	24	24	21.50	2	62.5	125	9	7	11	7	31.7	1936.6	5.7	0.150	7.7	158034
3	10.00	500.00	10.3	50	29	29	26.00	2	62.5	125	9	10	15	9	35.0	430.0	7.7	0.080	2.8	158042
3	10.00	1000.00	10.3	100	29	29	26.00	2	62.5	125	9	10	15	9	35.0	930.0	7.7	0.103	5.6	158043
3	10.00	2000.00	10.3	200	29	29	26.00	2	62.5	125	9	10	15	9	35.0	1930.0	7.7	0.147	11.2	158044
4	13.33	506.67	13.8	38	39	39	35.00	2	62.5	125	12	12	18	11	33.3	433.0	9.7	0.083	5.1	158052
4	13.33	1000.00	13.8	75	39	39	35.00	2	62.5	125	12	12	18	11	33.3	933.4	9.7	0.101	10.1	158053
4	13.33	2000.00	13.8	150	39	39	35.00	2	62.5	125	12	12	18	11	33.3	1933.4	9.7	0.136	20.2	158054
5	16.66	500.00	17.4	30	49	49	34.00	3	62.5	125	12	14	20	13	37.5	425.0	11.7	0.080	6.0	158062
5	16.66	1000.00	17.4	60	49	49	34.00	3	62.5	125	12	14	20	13	37.5	925.0	11.7	0.094	12.0	158063
5	16.66	2000.00	17.4	120	49	49	34.00	3	62.5	125	12	14	20	13	37.5	1925.0	11.7	0.122	24.1	158064
6	20.00	500.00	20.9	25	59	59	43.00	3	62.5	125	16	18	26	17	37.5	425.0	15.7	0.087	8.9	158072
6	20.00	1000.00	20.9	50	59	59	43.00	3	62.5	125	16	18	26	17	37.5	925.0	15.7	0.101	18.0	158073
6	20.00	2000.00	20.9	100	59	59	43.00	3	62.5	125	16	18	26	17	37.5	1925.0	15.7	0.128	36.2	158074

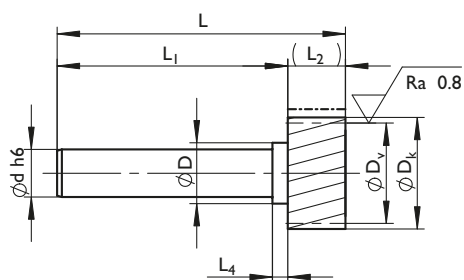
m_n : Normal module, p_t : Transverse pitch [mm], z: Number of teeth, d_1 : Predrilled, M: Weight [kg]



Helical teeth, modular pitch



Hardened and ground



--- hardened

Material
16MnCr5 DIN 1.7131

Teeth
pressure angle $\alpha = 20^\circ$
helical teeth system left
helix angle $\beta = 19^\circ 31'42''$
hardened (58^{+4} HRC)
ground, crowned

Quality
6f24 DIN 3962/63/67



Geometrical data

m_n	P_t	z	d	D_k	D_0	D_v	D	L	L_1	L_2	L_4	J	M	Part No.
1.5	5.00	16	12	29.36	25.465	26.365	16.0	90.0	70.0	20	4.5	8	0.14	211116
1.5	5.00	20	20	34.83	31.831	31.831	26.0	110.0	90.0	20	4.5	26	0.34	211120
2	6.66	16	20	39.15	33.953	35.153	26.0	110.0	90.0	20	8.0	36	0.39	211216
2	6.66	20	25	46.44	42.441	42.441	32.0	140.0	120.0	20	8.0	90	0.70	211220
2.5	8.33	20	25	58.05	53.052	53.052	32.0	145.0	120.0	25	8.0	192	0.91	211320
3	10.00	16	25	58.73	50.930	52.730	32.0	150.0	120.0	30	8.0	218	0.99	211416
3	10.00	20	40	69.66	63.662	63.662	50.0	190.0	160.0	30	12.5	726	2.38	211420
4	13.33	20	40	92.88	84.883	84.883	50.0	200.0	160.0	40	18.0	1954	3.43	211520
5	16.66	20	60	116.10	106.103	106.103	85.0	310.0	260.0	50	35.0	8484	9.96	211620
4	13.33	20	60	92.88	84.883	84.883	74.0	310	270.0	40	14.5	4459	7.89	211521
6	20.00	20	90	139.32	127.324	127.324	105.0	350.0	290.0	60	20.0	27500	20.7	211720
8	26.66	20	90	185.77	169.766	169.766	105.0	350.0	270.0	80	35.0	65990	28.2	211820
10	33.33	15	90	185.16	159.155	165.155	105.0	410.0	310.0	100	40.0	66477	31.63	211915

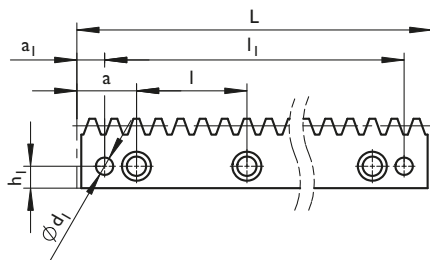
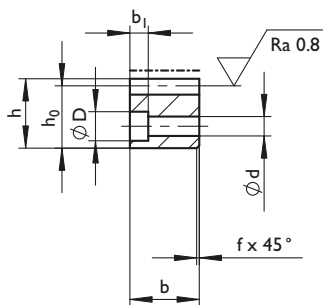
m_n : Normal module, P_t : Transverse pitch [mm], z : Number of teeth, D_0 : Pitch circle diameter for calculation, D_v : Pitch circle diameter for design, J : Inertia [10^{-6} kg m²], M : Weight [kg]



Straight teeth, modular pitch



Hardened and ground



--- hardened

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

Profile
all faces ground

Teeth
pressure angle $\alpha = 20^\circ$
hardened (54^{+4} HRC)
and ground

Quality
6h23 DIN 3962/63/67

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

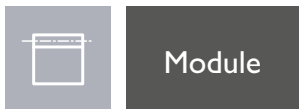
F_{pL} [mm]
cumulative pitch deviation
based on length L



Geometrical data

m_n	p_n	L	z	b	h	h0	f+0.5	a	l	h ₁	d	D	b ₁	a ₁	l ₁	d ₁	F _{pL}	M	Part No.
1.5	4.72	499.51	106	19	19	17.50	2	62.44	124.88	8	7	11	7	29.0	441.5	5.7	0.029	1.3	240012
1.5	4.72	999.03	212	19	19	17.50	2	62.44	124.88	8	7	11	7	29.0	941.0	5.7	0.043	2.6	240013
2	6.28	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
2	6.28	1005.31	160	24	24	22.00	2	62.83	125.66	8	7	11	7	31.3	942.7	5.7	0.036	4.2	240023
2	6.28	2010.62	320	24	24	22.00	2	62.83	125.66	8	7	11	7	31.3	1948.0	5.7	0.058	8.0	240024
2.5	7.85	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
2.5	7.85	1005.31	128	24	24	21.50	2	62.83	125.66	9	7	11	7	31.3	942.7	5.7	0.036	4.1	240033
2.5	7.85	2010.62	256	24	24	21.50	2	62.83	125.66	9	7	11	7	31.3	1948.0	5.7	0.053	8.0	240034
3	9.42	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
3	9.42	1017.88	108	29	29	26.00	2	63.62	127.23	9	10	15	9	34.4	949.1	7.7	0.037	6.0	240043
3	9.42	2035.75	216	29	29	26.00	2	63.62	127.23	9	10	15	9	34.4	1967.0	7.7	0.055	11.5	240044
4	12.57	502.65	40	39	39	35.00	2	62.83	125.66	12	10	15	9	37.5	427.7	7.7	0.030	5.4	240052
4	12.57	1005.31	80	39	39	35.00	2	62.83	125.66	12	10	15	9	37.5	930.3	7.7	0.037	10.8	240053
4	12.57	2010.62	160	39	39	35.00	2	62.83	125.66	12	10	15	9	37.5	1935.6	7.7	0.050	21.0	240054
5	15.71	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
5	15.71	1005.31	64	49	39	34.00	3	62.83	125.66	12	14	20	13	30.2	944.9	11.7	0.034	13.1	240063
5	15.71	2010.62	128	49	39	34.00	3	62.83	125.66	12	14	20	13	30.2	1950.2	11.7	0.045	24.7	240064
6	18.85	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
6	18.85	1017.88	54	59	49	43.00	3	63.62	127.23	16	18	26	17	31.4	955.0	15.7	0.036	20.3	240073
6	18.85	2035.75	108	59	49	43.00	3	63.62	127.23	16	18	26	17	31.4	1973.0	15.7	0.047	37.5	240074
8	25.13	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
8	25.13	1005.31	40	79	79	71.00	3	62.83	125.66	25	22	33	21	26.7	952.0	19.7	0.033	44.3	240083
8	25.13	2010.62	80	79	79	71.00	3	62.83	125.66	25	22	33	21	26.7	1957.3	19.7	0.041	82.5	240084
10	31.42	502.65	16	99	99	89.00	3	62.83	125.66	32	33	48	32	125.2	252.3	19.7	0.029	34.8	240092
10	31.42	1005.31	32	99	99	89.00	3	62.83	125.66	32	33	48	32	125.2	755.0	19.7	0.032	69.5	240093

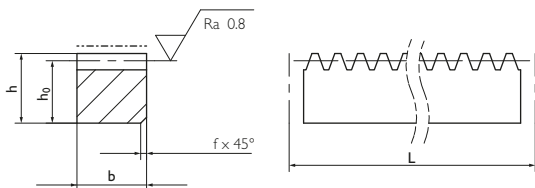
m_n : Normal module, P_n : Normal pitch [mm], z: Number of teeth, d_1 : Predrilled, M: Weight [kg]



Straight teeth, modular pitch



Hardened and ground



--- hardened

Material
C45E DIN 1.1191

Profile
all faces ground

Teeth
pressure angle $\alpha = 20^\circ$
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

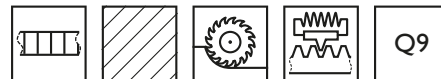
F_{pL} [mm]
cumulative pitch deviation
based on length L



Geometrical data

m _n	p _n	L	z	b	h	h ₀	f+0.5	F _p	M	Part No.
1.5	4.72	499.51	106	19	19	17.50	2	0.029	1.3	244512
1.5	4.72	999.03	212	19	19	17.50	2	0.043	2.6	244513
2	6.28	502.65	80	24	24	22.00	2	0.025	2.1	244522
2	6.28	1005.31	160	24	24	22.00	2	0.036	4.2	244523
2.5	7.85	502.65	64	24	24	21.50	2	0.027	2.0	244532
2.5	7.85	1005.31	128	24	24	21.50	2	0.036	4.1	244533
3	9.42	508.94	54	29	29	26.00	2	0.029	3.0	244542
3	9.42	1017.88	108	29	29	26.00	2	0.037	6.0	244543
4	12.57	502.65	40	39	39	35.00	2	0.030	5.4	244552
4	12.57	1005.31	80	39	39	35.00	2	0.037	10.8	244553
5	15.71	502.65	32	49	39	34.00	3	0.028	6.6	244562
5	15.71	1005.31	64	49	39	34.00	3	0.034	13.1	244563
6	18.85	508.94	27	59	49	43.00	3	0.031	10.1	244572
6	18.85	1017.88	54	59	49	43.00	3	0.036	20.3	244573
8	25.13	502.65	20	79	79	71.00	3	0.029	22.1	244582
8	25.13	1005.31	40	79	79	71.00	3	0.033	44.3	244583
10	31.42	502.65	16	99	99	89.00	3	0.029	34.8	244592
10	31.42	1005.31	32	99	99	89.00	3	0.032	69.5	244593

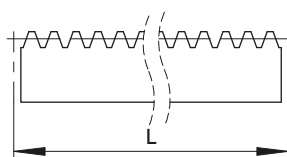
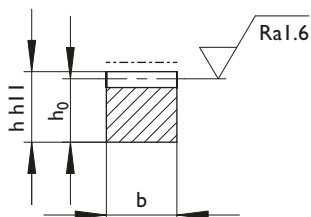
m_n: Normal module, P_n: Normal pitch [mm], z: Number of teeth, M: Weight [kg]



Straight teeth, modular pitch



Milled and hardened



--- hardened

Material
C45E DIN 1.1191

Profile
cold formed h11

Teeth
pressure angle $\alpha = 20^\circ$
hardened (54^{+6} HRC)

Quality
9h27 DIN 3962/63/67

F_p [mm]
cumulative pitch deviation
based on length L



Geometrical data

m _n	p _n	L	z	b	h	h ₀	F _p	p _f	M	Part No.
1.5	4.72	999.03	212	17	17	15.50	0.118	-0.05/-0.49	2.07	124513
1.5	4.72	1998.05	424	17	17	15.50	0.191	-0.05/-0.49	4.14	124514
2	6.28	999.03	159	20	20	18.00	0.100	-0.05/-0.66	2.80	124523
2	6.28	1998.05	318	20	20	18.00	0.155	-0.05/-0.66	5.70	124524
2.5	7.85	997.46	127	25	25	22.50	0.100	-0.05/-0.82	4.40	124533
2.5	7.85	2002.77	255	25	25	22.50	0.150	-0.05/-0.82	8.80	124534
3	9.42	999.03	106	30	30	27.00	0.103	-0.05/-0.99	6.40	124543
3	9.42	1998.05	212	30	30	27.00	0.147	-0.05/-0.99	12.70	124544
4	12.57	1005.31	80	40	40	36.00	0.101	-0.05/-1.32	11.30	124553
4	12.57	1998.05	159	40	40	36.00	0.136	-0.05/-1.32	22.60	124554
5	15.71	1005.31	64	50	50	45.00	0.094	-0.05/-1.65	17.60	124563
5	15.71	2010.62	128	50	50	45.00	0.122	-0.05/-1.65	35.30	124564
6	18.85	999.03	53	60	60	54.00	0.101	-0.05/-1.98	25.20	124573
6	18.85	1998.05	106	60	60	54.00	0.128	-0.05/-1.98	50.50	124574
8	25.13	1005.31	40	80	80	72.00	0.094	-0.05/-2.64	45.20	124583
8	25.13	2010.62	80	80	80	72.00	0.115	-0.05/-2.64	90.30	124584
10	31.42	1005.31	32	100	100	90.00	0.090	-0.05/-3.30	70.60	124593
10	31.42	2010.62	64	100	100	90.00	0.106	-0.05/-3.30	141.10	124594

m_n: Normal module, P_n: Normal pitch [mm], z: Number of teeth, F_p: Teilungs-Gesamtabweichung [mm], p_f: Tolerance of pitch-accurate cutting [mm], M: Weight [kg]



Module

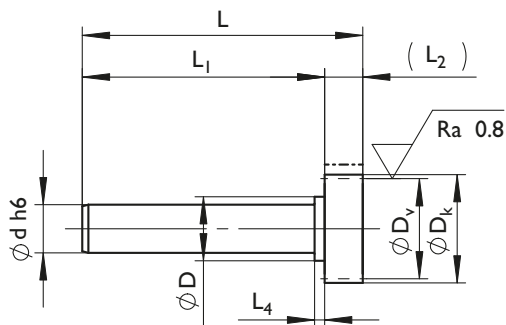
Pinion



Straight teeth, modular pitch



Hardened and ground



--- hardened

Material
16MnCr5 DIN 1.7131

Teeth
pressure angle $\alpha = 20^\circ$
straight teeth
hardened (58^{+1} HRC)
ground, crowned

Quality
6f24 DIN 3962/63/67



Geometrical data

m_n	p_n	z	d	D_k	D_0	D_v	D	L	L1	L2	L4	J	M	Part No.
1.5	4.72	16	12	27.90	24.000	24.900	16	90	70	20	4.5	7	0.14	201116
1.5	4.72	20	20	33.00	30.000	30.000	26	110	90	20	4.5	24	0.34	201120
2	6.28	16	20	37.20	32.000	33.200	26	110	90	20	8.0	31	0.37	201216
2	6.28	20	25	44.00	40.000	40.000	32	140	120	20	8.0	79	0.68	201220
2.5	7.85	20	25	55.00	50.000	50.000	32	145	120	25	8.0	160	0.86	201320
3	9.42	16	25	55.80	48.000	49.800	32	150	120	30	8.0	181	0.93	201416
3	9.42	20	40	66.00	60.000	60.000	50	190	160	30	12.5	647	2.30	201420
4	12.57	20	40	88.00	80.000	80.000	50	200	160	40	18.0	1619	3.24	201520
5	15.71	20	60	110.00	100.000	100.000	85	310	260	50	35.0	7461	9.57	201620
6	18.85	20	60	132.00	120.000	120.000	85	320	260	60	35.0	13159	11.80	201720
8	25.13	20	60	176.00	160.000	160.000	85	340	260	80	35.0	43780	19.06	201820
10	25.13	20	90	176.00	160.000	160.000	105	385	305	80	35.0	56971	28.31	201821
10	31.42	16	90	186.00	160.000	166.000	105	410	310	100	40.0	67473	31.78	201916

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, J: Inertia [10^{-6} kg m²], M: Weight [kg]



Solutions for medical and food applications

GÜDEL



Straight teeth, modular pitch



Polyamide, milled

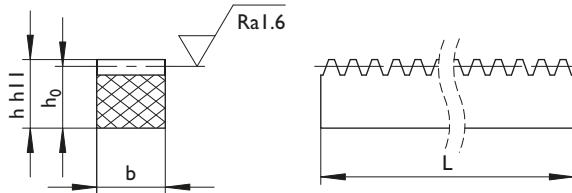
Material
Polyamid PA 6

Profile
milled

Teeth
pressure angle $\alpha = 20^\circ$
milled

Quality
9h27 DIN 3962/63/67

F_p [mm]
cumulative pitch deviation
0.15 / 1000mm



Geometrical data

m_n	p_n	L_0^{+10}	b	h	h_0	M	Part No.
2	6.28	1000	20	20	18.00	0.29	127123
2	6.28	2000	20	20	18.00	0.58	127124
2.5	7.85	1000	25	25	22.50	0.62	127133
2.5	7.85	2000	25	25	22.50	1.24	127134
3	9.42	1000	30	30	27.00	0.92	127143
3	9.42	2000	30	30	27.00	1.84	127144
4	12.57	1000	40	40	36.00	1.60	127153
4	12.57	2000	40	40	36.00	3.20	127154

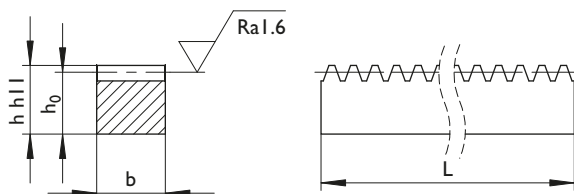
m_n : Normal module, p_n : Normal pitch [mm]; M : Weight [kg]



Straight teeth, modular pitch



Stainless steel, milled



Material
X10CrNiS189 DIN 1.4305

Profile
cold formed h11

Teeth
pressure angle $\alpha = 20^\circ$
milled

Quality
9h27 DIN 3962/63/67

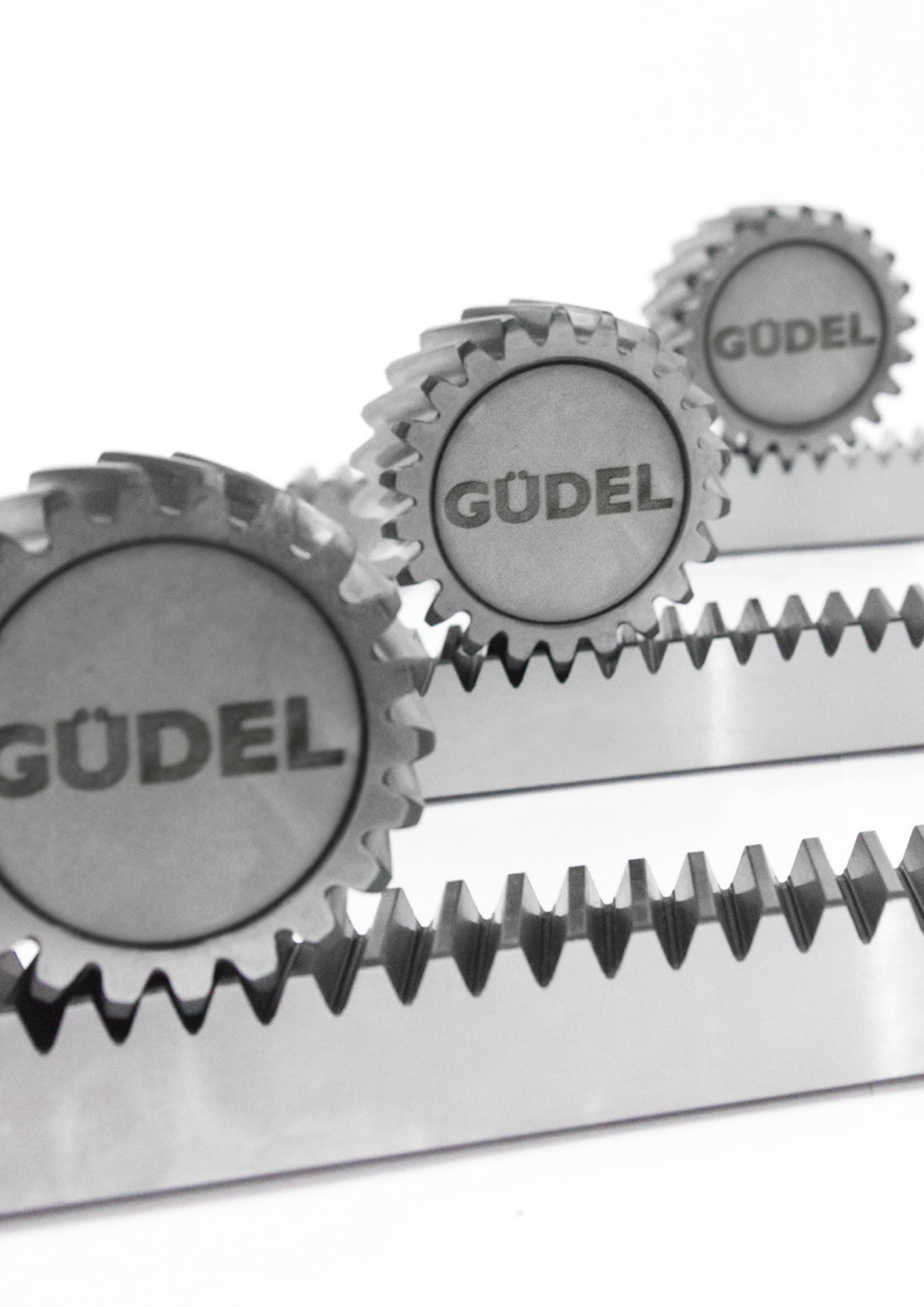
F_p [mm]
cumulative pitch deviation
0.15 / 1000mm



Geometrical data

m_n	P_n	L_0^{+10}	b	h	h_0	M	Part No.
2	6.28	500	16	16	14.00	0.90	130526
2	6.28	1000	16	16	14.00	1.80	130527
2.5	7.85	500	20	20	17.50	1.40	130536
2.5	7.85	1000	20	20	17.50	2.80	130537
3	9.42	500	24	24	21.00	2.00	130546
3	9.42	1000	24	24	21.00	4.00	130547
4	12.57	500	30	30	26.00	3.00	130556
4	12.57	1000	30	30	26.00	6.00	130557

m_n : Normal module, P_n : Normal pitch [mm]; M : Weight [kg]

A black and white photograph of three interlocking gears. The gears are arranged in a diagonal line from the bottom left towards the top right. Each gear has the word "GÜDEL" printed in a bold, sans-serif font in the center of its face. The gears are meshed together, and the lighting creates highlights on their teeth and shadows in the gaps between them. The background is a plain, light color.

GÜDEL

GÜDEL

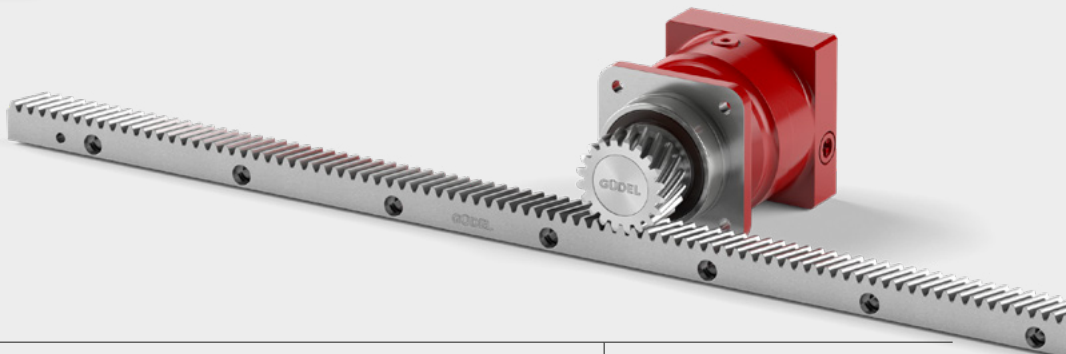
GÜDEL

Your ideal drive train

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Rack & pinion programm

Find your solution in our high precision planetary gearboxes catalog.

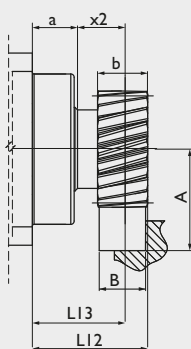
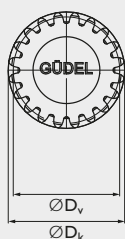


Pinion

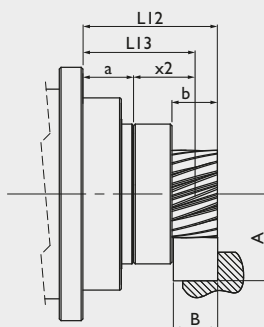
Helical teeth, modular pitch



Hardened and ground



NRH, NR, SR



NRHP

Material
16MnCr5 DIN 1.7131

Teeth
pressure angle $\alpha = 20^\circ$
helical teeth system left
helix angle $\beta = 19^\circ 31' 42''$
hardened (58⁺⁴ HRC)
ground, crowned

Quality
6f24 DIN 3962/63/67

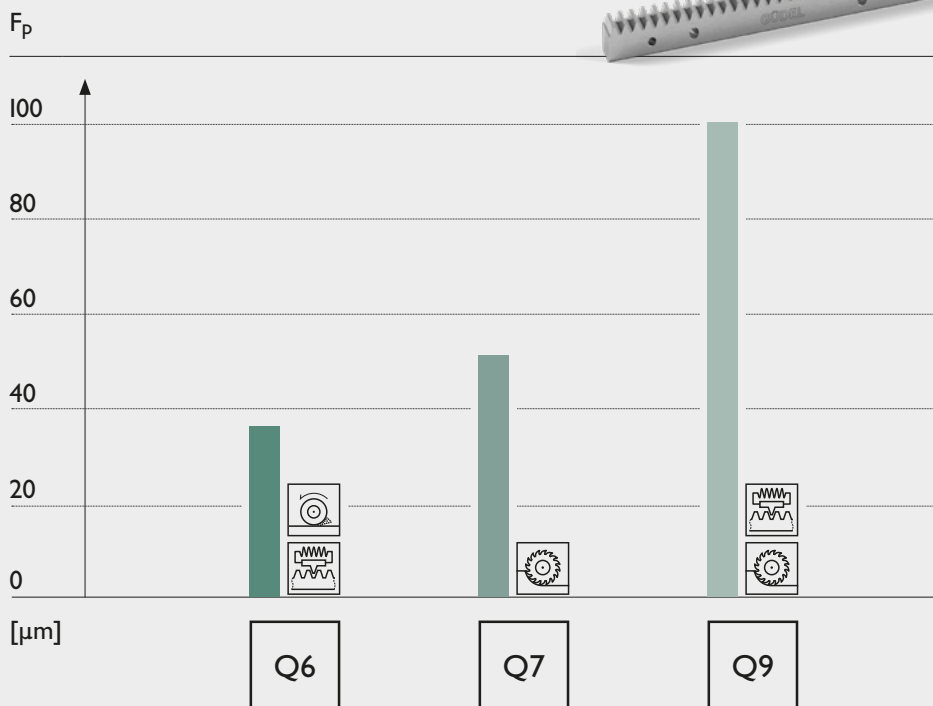
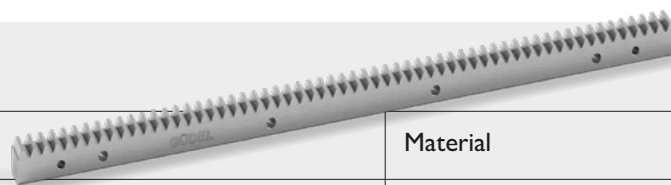


Geometrical data

	Size	m_n	P_t	z	A	b	D_k	D_0	D_v	L12	L13	x2	a	M
NRH/NR/SR	080	2	6.66	20	43.221	25	46.44	42.441	42.441	52.5	40.0	20.0	20	0.3
	100	2	6.66	25	48.526	25	57.05	53.052	53.052	63.3	51.0	24.0	27	0.4
		3	10.00	20	57.831	30	69.66	63.662	63.662	69.0	54.0	27.0	27	0.7
	140	3	10.00	22	61.014	30	76.03	70.028	70.028	69.5	54.5	27.5	27	0.8
4		13.33	20	77.441	40	92.88	84.883	84.883	79.0	59.0	32.0	27	1.6	
NRHP	080	2	6.66	16	39.577	26	39.15	33.953	35.153	75.0	62.0	32.0	30	0.6
	100	2	6.66	16	39.577	26	39.15	33.953	35.153	77.0	64.0	35.0	29	1.0
		2	6.66	21	44.282	26	48.56	44.563	44.563	77.0	64.0	35.0	29	1.0
		2.5	8.33	16	43.471	26	48.94	42.441	43.941	77.0	64.0	35.0	29	1.0
	3	10.00	14	49.182	32	52.36	44.563	46.363	83.0	67.0	38.0	29	1.2	
140	2.5	8.33	21	49.352	26	60.70	55.704	55.704	89.0	76.0	38.0	38	1.9	
	3	10.00	18	54.648	32	63.30	57.296	57.296	95.0	79.0	41.0	38	2.0	
NR	180	4	13.33	20	77.441	40	92.88	84.883	84.883	83.5	63.5	31.5	32	1.5
		5	16.66	20	87.052	50	116.10	106.103	106.103	89.5	64.5	32.5	32	3.0
	240	5	16.66	24	97.662	50	137.32	127.324	127.324	112.5	87.5	47.5	40	5.4
		6	20.00	20	106.662	60	139.32	127.324	127.324	111.0	81.0	41.0	40	5.6
SR	180	4	13.33	20	77.441	40	92.88	84.883	84.883	89.5	69.5	31.5	38	1.5
		5	16.66	20	87.052	50	116.10	106.103	106.103	95.5	70.5	32.5	38	3.0
	240	5	16.66	24	97.662	50	137.32	127.324	127.324	120.5	95.5	47.5	48	5.4
		6	20.00	20	106.662	60	139.32	127.324	127.324	119.0	89.0	41.0	48	5.6

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]

Rack



Material



Steel

Processes



Hardened



Milled



Ground



Helical

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

Geometrical data

Size	m_n	P_t	L	z	b	h
080 100	2	6.66	500.00	75	24	24
			1000.00	150		
			2000.00	300		
100 140	2.5	8.33	500.00	60	24	24
			1000.00	120		
			2000.00	240		
100 140	3	10.00	500.00	50	29	29
			1000.00	100		
			2000.00	200		
140 180	4	13.33	506.67	38	39	39
			1000.00	75		
			2000.00	150		
180 240	5	16.66	500.00	30	49	39
			1000.00	60		
			2000.00	120		
240	6	20.00	500.00	25	59	49
			1000.00	50		
			2000.00	100		

Q6
Part No.
246022
246023
246024
246032
246033
246034
246042
246043
246044
246055
246056
246057
246062
246063
246064
246072
246073
246074

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Q6+*
Part No.
246122
246123
246124
246132
246133
246134
246142
246143
246144
246152
246153
246154
246162
246163
246164
246172
246173
246174

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Q7
Part No.
155022
155023
155024
155032
155033
155034
155042
155043
155044
155052
155053
155054
155062
155063
155064
-
-
-

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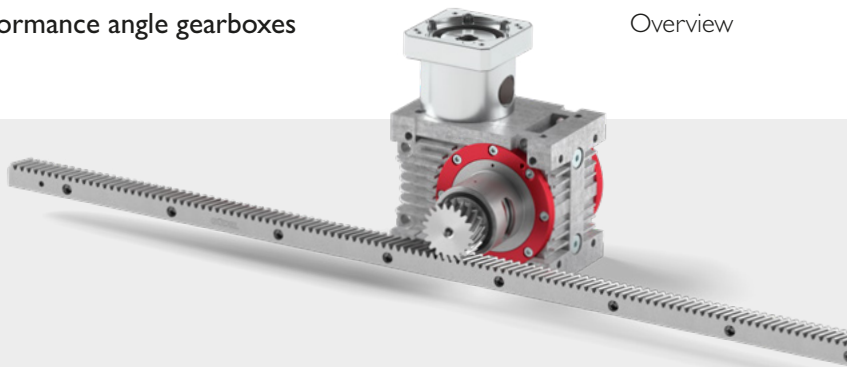
Q9
Part No.
158022
158023
158024
158032
158033
158034
158042
158043
158044
158052
158053
158054
158062
158063
158064
158072
158073
158074

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m_n : Normal module, P_t : Transverse pitch [mm], z: Number of teeth
 * Double amount of fixing holes for maximum feed force

Rack & pinion programm

Find your solution in our high performance angle gearboxes catalog.

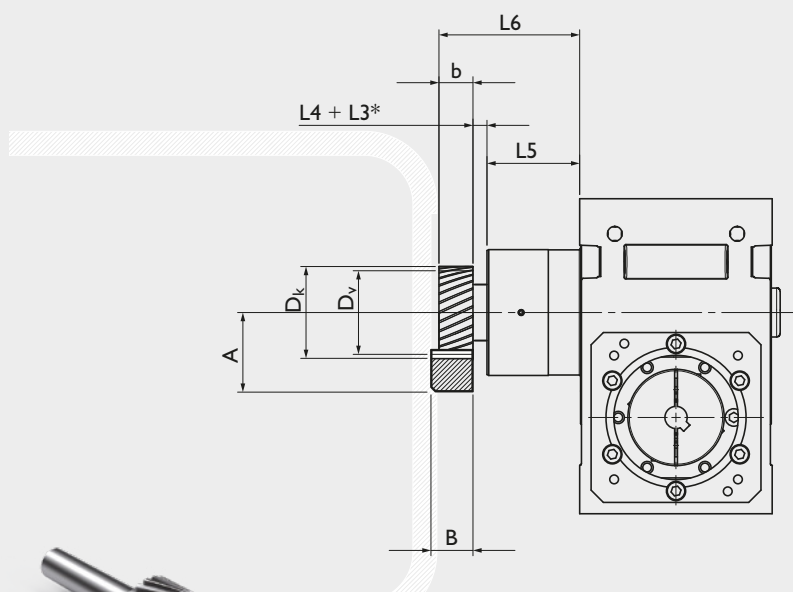


Pinion

Helical teeth, modular pitch



Hardened and ground



Material
16MnCr5 DIN 1.7131
shaft/bore soft

Teeth
pressure angle $\alpha = 20^\circ$
helical teeth system left
helix angle $\beta = 19^\circ 31'42''$
hardened (58^{+4}_0 HRC)
ground, crowned

Quality
6f24 DIN 3962/63/67

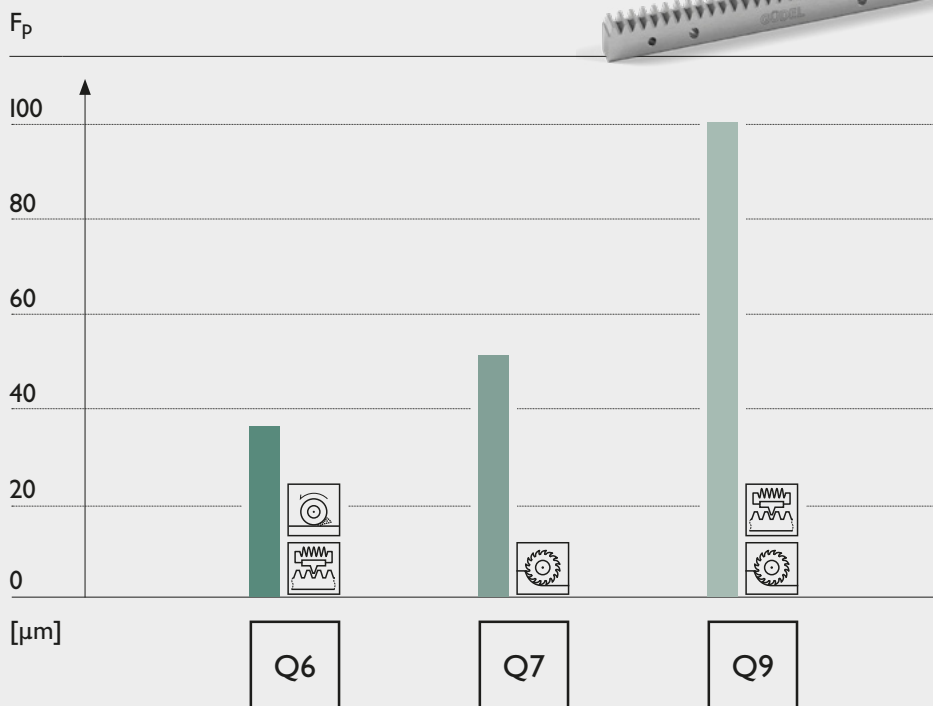
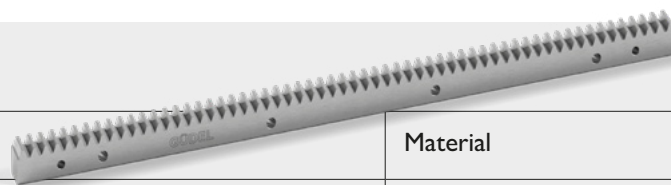
Geometrical data

Size	m_n	P_t	z	A	b	D_k	D_0	D_v	L4	L5	L6	M	Part No.
030	1.5	5.00	16	30.68	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	20	39.15	33.953	35.153	8	43	71	0.39	211216
										53	81		
060	2	6.66	20	43.22	20	46.44	42.441	42.441	8	53	81	0.7	211220
										58	86		
										83	111		
										53	86		
	2.5	8.33	20	48.025	25	58.05	53.052	53.052	8	58	91	0.91	211320
										83	116		
										53	91		
	3	10.00	16	52.365	30	58.73	50.930	52.730	8	58	96	0.99	211416
										83	121		
										53	91		
090	3	10.00	20	57.83	30	69.66	63.662	63.662	12.5	63	105.5	2.38	211420
										104.5	147		
	4	13.33	20	77.44	40	92.88	84.883	84.883	18	63	121	3.43	211520
										104.5	162.5		
120	4	13.33	20	77.44	40	92.88	84.883	84.883	14.5	123	177.5	7.89	211521

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

Rack



Material



Steel

Processes



Hardened



Milled



Ground



Helical

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

Geometrical data

Size	m_n	P_t	L	z	b	h
030 045	1.5	5.00	500.00	100	19	19
			1000.00	200		
045 060	2	6.66	500.00	75	24	24
			1000.00	150		
			2000.00	300		
060	2.5	8.33	500.00	60	24	24
			1000.00	120		
			2000.00	240		
060 090	3	10.00	500.00	50	29	29
			1000.00	100		
			2000.00	200		
090 120	4	13.33	506.67	38	39	39
			1000.00	75		
			2000.00	150		
120	5	16.66	500.00	30	49	39
			1000.00	60		
			2000.00	120		

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

Q6		Q7		Q9	
Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
246012	155012	158012			
246013	155013	158013			
246022	155022	158022			
246023	155023	158023			
246024	155024	158024			
246032	155032	158032			
246033	155033	158033			
246034	155034	158034			
246042	155042	158042			
246043	155043	158043			
246044	155044	158044			
246055	155055	158052			
246056	155056	158053			
246057	155057	158054			
246062	155062	158062			
246063	155063	158063			
246064	155064	158064			

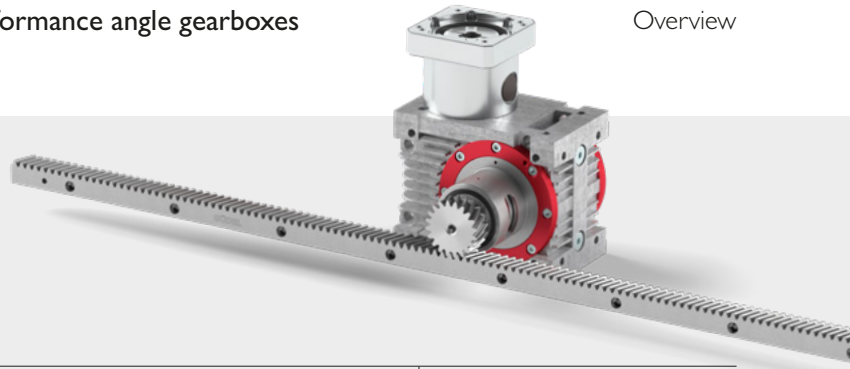
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Rack & pinion programm

Find your solution in our high performance angle gearboxes catalog.

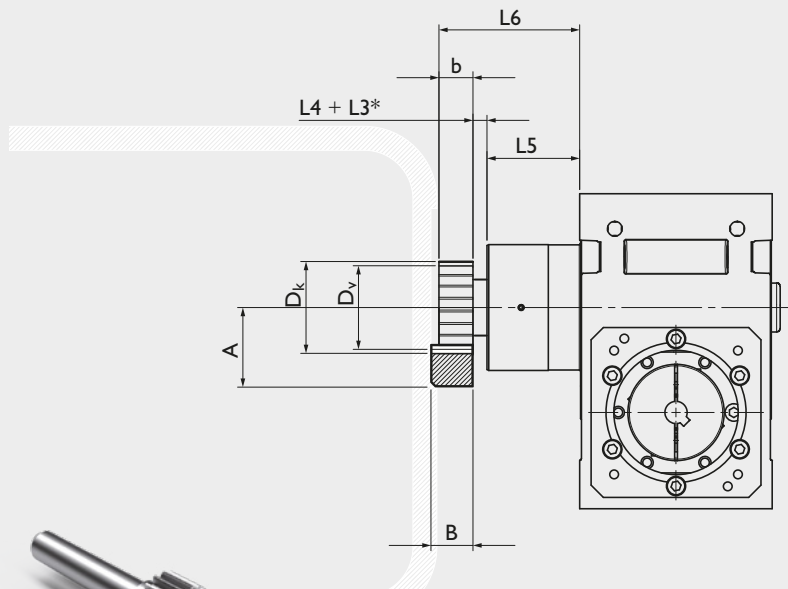


Pinion

Straight teeth, modular pitch



Hardened and ground



Material
16MnCr5 DIN 1.7131
shaft / bore soft

Teeth
pressure angle $\alpha = 20^\circ$
straight teeth
hardened ($58^{+0.4}$ HRC)
ground, crowned

Quality
6f24 DIN 3962/63/67

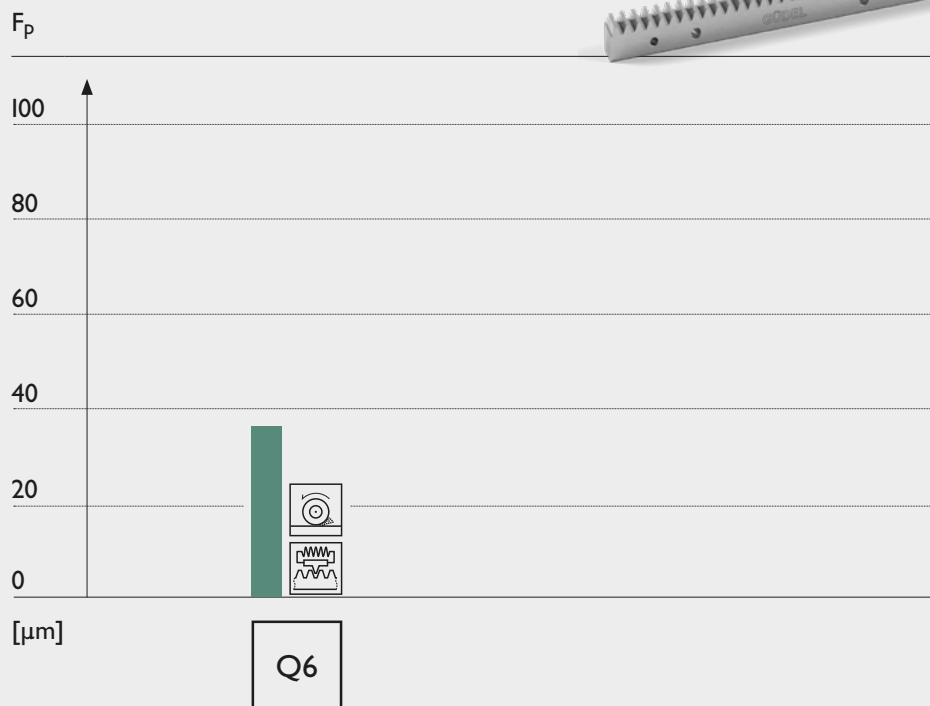
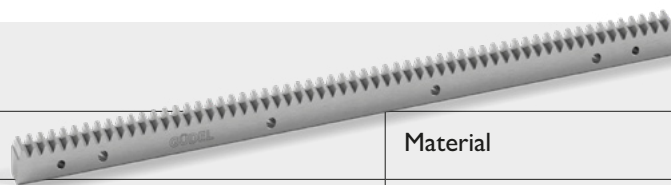
Geometrical data

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	27.9	24.000	24.900	4.5	38	82.5	0.14	201116	
										43	67.5			
045	1.5	4.72	20	32.5	20	33.0	30.000	30.000	4.5	43	67.5	0.34	201120	
										53	77.5			
	2	6.28	16	38.6		37.2	32.000	33.200	8	43	71	0.37	201216	
										53	81			
060	2	6.28	20	42.0	20	44.0	40.000	40.000	8	53	81	0.68	201220	
										58	86			
										83	111			
	2.5	7.85		46.0	25	55.0	50.000	50.000	8	53	86	0.86	201320	
										58	91			
										83	116			
	3	9.42	16	50.9	30	55.8	48.000	49.800		53	91	0.93	201416	
										58	96			
										83	121			
090	3	9.42	20	56.0	30	66.0	60.000	60.000	12.5	63	105.5	2.30	201420	
										104.5	147			
	4	12.57		75.0	40	88.0	80.000	80.000	18	63	121	3.24	201520	
										104.5	162.5			
120	5	15.71	20	84.0	50	110.0	100.000	100.000	35	123	208	9.57	201620	
											218			11.80
											238			19.06
	6	18.85		103.0	60	132.0	120.000	120.000	35				201720	
	8	25.13		151.0	80	176.0	160.000	160.000	35				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




Material



Steel


Processes



Hardened



Milled



Straight

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

Geometrical data

Size	m_n	P_n	L	z	b	h
030 045	1.5	4.72	499.51	106	19	19
			999.03	212		
045 060	2	6.28	502.65	80	24	24
			1005.31	160		
			2010.62	320		
060	2.5	7.85	502.65	64	24	24
			1005.31	128		
			2010.62	256		
060 090	3	9.42	508.94	54	29	29
			1017.88	108		
			2035.75	216		
90	4	12.57	502.65	40	39	39
			1005.31	80		
			2010.62	160		
120	5	15.71	502.65	32	49	39
			1005.31	64		
			2010.62	128		

Q6

Part No.
240012
240013
240022
240023
240024
240032
240033
240034
240042
240043
240044
240052
240053
240054
240062
240063
240064

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



Accessories

GÜDEL

The optimal lubrication for smooth processes

Güdel racks and pinions are of high precision and quality. Our modular system enables us to meet a wide variety of needs. Due to Güdel's vertically integrated product range, we know how our components work together smoothly. We offer the appropriate lubrication pinions, fastening axles and lubricators to match your systems. An optimal lubrication film on the rack and pinion is achieved by a carefully measured quantity of grease, distributed by the lubrication system and lubrication elements. The lubrication pinion additionally cleans the teeth so that dirt particles and contaminants are removed with the lubrication process.

Lubrication system



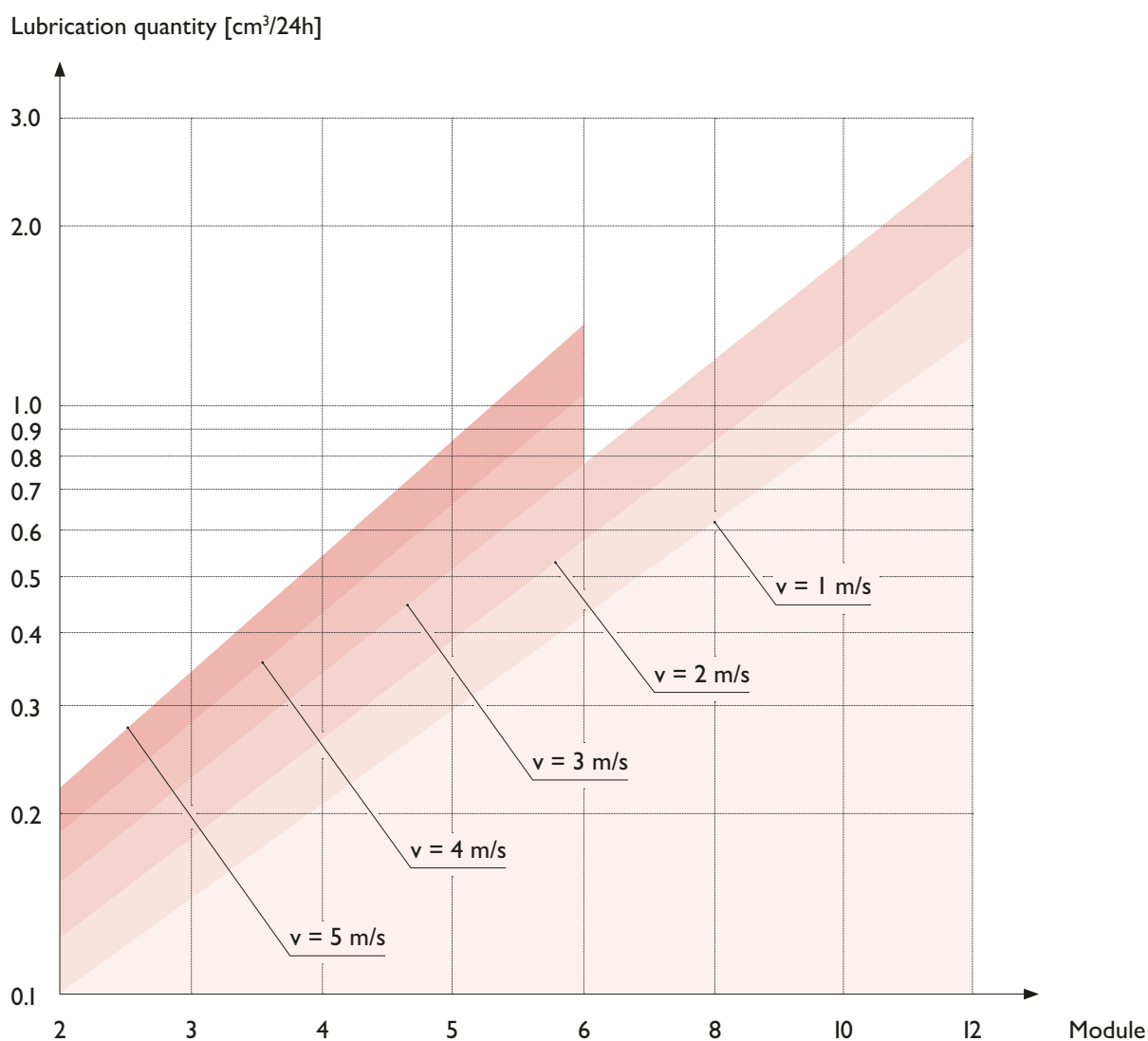
Consult our service manual for detailed instructions.

Lubricating pinion

To ensure that the rack-and-pinion drives have a long service life, they must be lubricated regularly.

The polyurethane foam lubrication pinion takes on the task and is available in the versions SL and SR - lubrication of the rack or lubrication of the pinion. The properties of the polyurethane foam allow the lubricant to be stored and gradually released, thus achieving an optimum lubricating film.

Lubrication quantity



Lubricator

Dimensions (B x H x T)	[mm]	Max. 112 x 196 x 94
Weight	[g]	1120
Lubricant volume	[cm ³]	400
Lubricant type		Grease up to NLGI 3
Method of operation		Piston pump
Operating pressure	[bar]	Max. 70
Metering volume / stroke	[cm ³]	0,15 (output / pulse signal)
Outlet		Rotating, right-angled hose connections 6 mm to 100 bar
Operating voltage	[VDC]	24
Current input	[mA]	I _{max} during operation 350 (regular < 200)
Fuse	[mA]	350 (characteristic: medium slow-blow or slow-blow)
Protection class		IP 65
Operating temperature	[°C]	-20 bis +70
Control		Integrated, microelectronic
Pressure monitoring		Integrated, electronic (system pressure measurement)
Fill level monitoring		Integrated; reed contact
Control connection		Connector; M12x1, 4-pole
Activation of progressive distributor		Suitable

Lubricator versions

Designation	404-DLS	402-Battery	402-24VDC
Outlets	4	2	2
Pump body	2	1	1
Lubricant	Güdel HI	Güdel HI	Güdel HI
Part No.	0193906	10194590	0204578

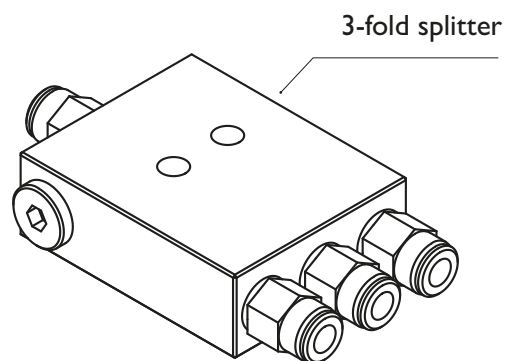
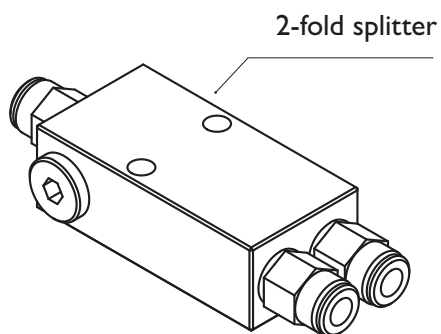
Replacement cartridge

Designation	Cartridge Güdel HI
Lubricant volume	400 cm ³
Lubricant type	Güdel HI
Temperature range	10°C bis 40°C
Part No.	0206399

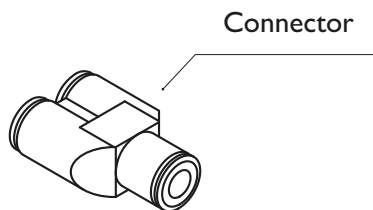
Hoses, hose connectors and splitters

Designation	Splitter 2-fold	Splitter 3-fold	Connector	Hose Ø6/3mm	Screw connection straight	Screw connection angled
Thread / connection	Pluggable	Pluggable	Pluggable	–	M6x1/pluggable	M6x1/pluggable
Model / no. of outlets	2	3	2 zu 1	PA 12	–	90°
Hose diameter	Ø6/3	Ø6/3	Ø6/3	Ø6/3	Ø6/3	Ø6/3
Part No.	0193908	0204580	0193909	0193912	0193910	0193911

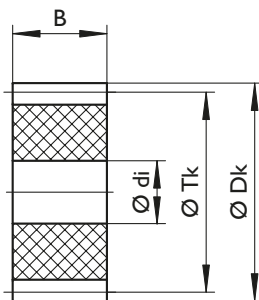
The splitters divide the lubrication to equal quantities.



The connector combines two hoses into one lubrication point.



Lubricating pinion - Helical teeth, modular pitch

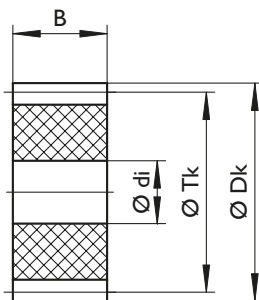


Geometrical data

Module	Number of teeth	Type	Use	B	dk	di	Tk	Part No.
1.5	24	SL	Rack	20	41.2	12	38.20	10348529
		SR	Pinion					10348521
2	17	SL	Rack	20	40.1	12	36.08	10142168
		SR	Pinion					–
2.5	17	SL	Rack	24	50.1	12	45.09	10392654
		SR	Pinion					–
3	17	SL	Rack	30	60.1	12	54.11	0193925
		SR	Pinion					–
4	17	SL	Rack	40	80.1	12	72.15	0193926
		SR	Pinion					0212416
5	17	SL	Rack	50	100.2	20	90.19	10348590
		SR	Pinion					10348528
6	17	SL	Rack	60	120.2	20	108.23	0215808
		SR	Pinion					–
8	13	SL	Rack	80	126.3	20	110.35	10392655
		SR	Pinion					–
10	13	SL	Rack	100	157.9	20	137.94	10392656
		SR	Pinion					–

SL: Lubricating pinion left, SR: Lubricating pinion right

Lubricating pinion - Straight teeth, modular pitch

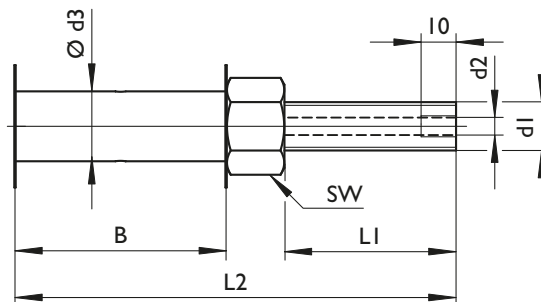


Geometrical data

Module	Number of teeth	Type	Use	B	dk	di	Tk	Part No.
1.5	24	SG	Rack & Pinion	15	39	12	36	10392626
2	17	SG	Rack & Pinion	20	38	12	34	10392629
2.5	17	SG	Rack & Pinion	24	47.5	12	42.5	10392640
3	17	SG	Rack & Pinion	30	57	12	51	10336637
4	17	SG	Rack & Pinion	40	76	12	68	10392641
5	17	SG	Rack & Pinion	50	95	20	85	10392642
6	17	SG	Rack & Pinion	60	114	20	102	0193169
8	13	SG	Rack & Pinion	80	120	20	104	10392643
10	13	SG	Rack & Pinion	100	150	20	130	10392644

SG: Lubricating pinion straight

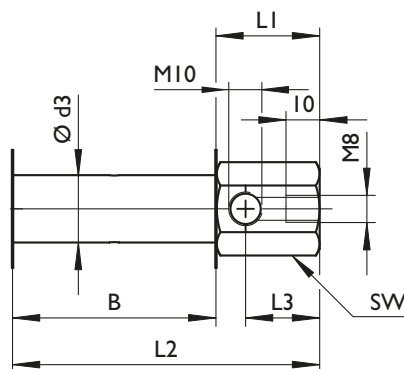
Fastening axle straight



Geometrical data

Type	d3	B	L1	L2	d1	d2	SW	Part No.
A	12	15	34.2	60.4	M10	M6	17	10392664
A	12	20	32	63.2	M10	M6	17	10348522
A	12	24	30	65.2	M10	M6	17	103992665
A	12	30	30	71.2	M10	M6	17	10392666
A	12	40	30	81.2	M10	M6	17	10392667
A	20	50	49.1	116.4	M16	G1/8	24	10348523
A	20	60	49.1	126.4	M16	G1/8	24	0193168
A	20	80	49.1	146.4	M16	G1/8	24	10392668
A	20	100	49.1	166.4	M16	G1/8	24	10392669

Fastening axle right-angle



Geometrical data

Type	d3	B	L1	L2	L3	SW	Part No.
B	12	15	30	46.4	22	17	10392671
B	12	20	30	51.4	22	17	10142167
B	12	24	30	55.4	22	17	10392672
B	12	30	30	61.4	22	17	0193923
B	12	40	30	71.4	22	17	0193924
B	20	50	30	81.4	22	24	10348526
B	20	60	30	91.4	22	24	0215813
B	20	80	30	111.4	22	24	10392673
B	20	100	30	131.4	22	24	10392674

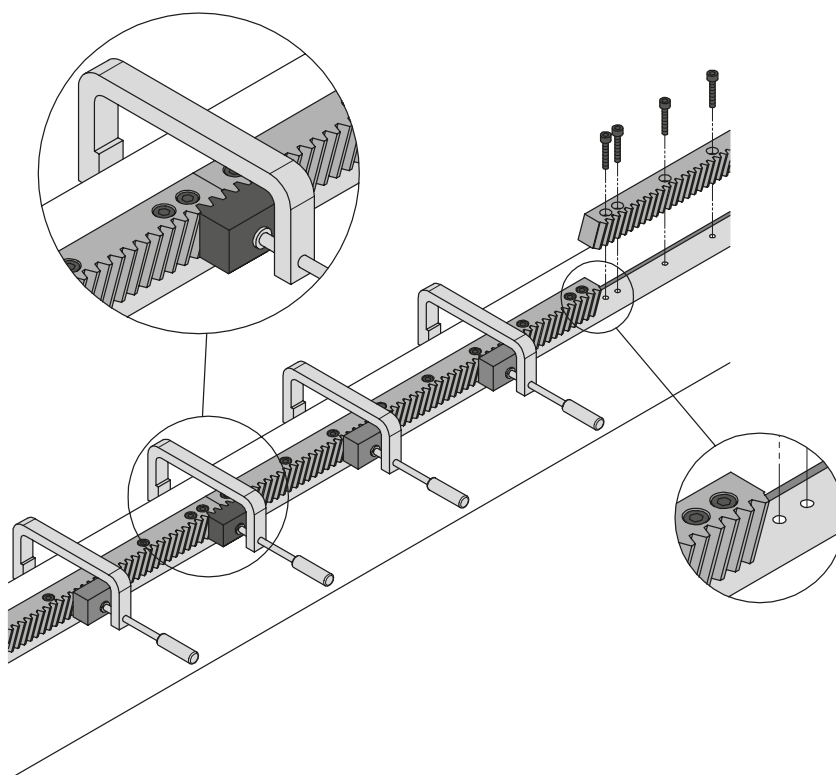
Smooth transition – Accurate assembling of your racks

To make it possible to link our standard racks to form any desired length, the teeth are cut so that there is a half-tooth gap at each end of the rack.

In order to achieve the smoothest and quietest possible transition, we recommend using a mounting aid with teeth in the opposite direction.

Suitable mounting aids are shown on the following page.

Assembling



Consult our service manual for detailed instructions.

Mounting aids for helical toothed racks

Part No.	m_n	P_t
902280	1.5	5.00
902281	2	6.66
902282	2.5	8.33
902283	3	10.00
902284	4	13.33
902285	5	16.66
902286	6	20.00
902287	8	26.66
902288	10	33.33

m_n : Normal module, P_t : Transverse pitch [mm]

Mounting aids for straight toothed racks

Part No.	m_n	P_n
902411	1.5	4.72
902412	2	6.28
902413	2.5	7.85
902414	3	9.42
902415	4	12.57
902416	5	15.71
902417	6	18.85
902418	8	25.13
902419	10	31.42

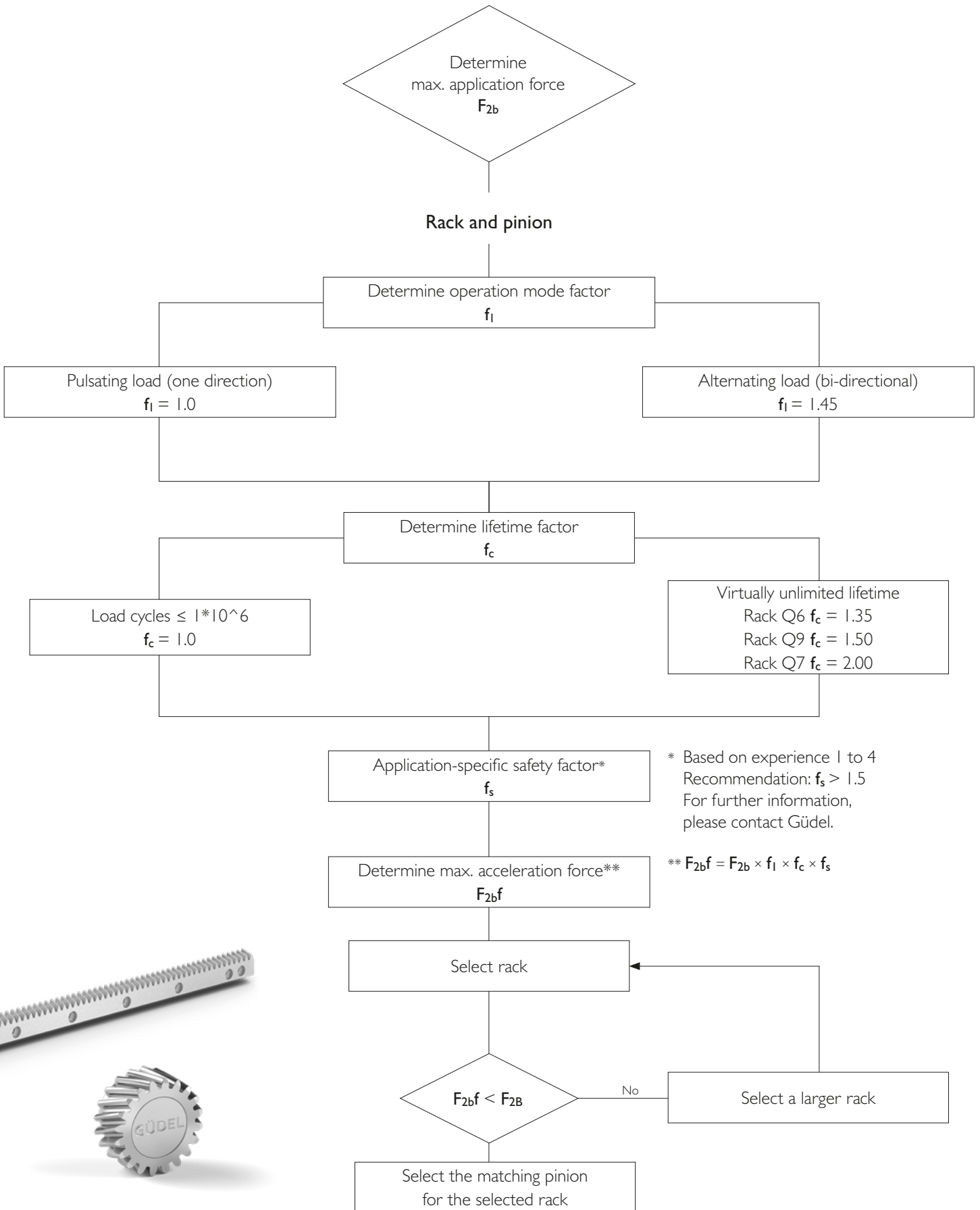
m_n : Normal module, P_n : Normal pitch [mm]



Technical information

GÜDEL

Calculation of rack and pinion



Your ideal drive train combined with our high precision planetary and high performance angle gearboxes

Güdel offers high precision planetary and high performance angle gearboxes suitable to the calculated rack and pinion requirements of your application. The flowchart for calculating your ideal drive train can be found in the relevant gearbox catalogue.

The image displays three pages from a technical manual. The left page features a photograph of a rack and pinion gearbox and the heading "Find your ideal drive train". The middle page contains a flowchart titled "Calculate your ideal drive train" which starts with "Determine max. application force F_a " and branches into "Gearbox" and "Rack and pinion". The "Gearbox" path includes "Dental selection", "Bearing calculation", and "Determine max. forces F_{max} and F_{min} ". A decision diamond "Calculation $\frac{M_{ax}}{M_{max}}$ [$\frac{F_{max}}{F_{max}}$, $\frac{F_{min}}{F_{min}}$]" leads to "Result < 2.0" (Contact Check) or "Result > 2.0" (Bearing check required). The right page shows a flowchart for "Rack and pinion" gearboxes, starting with "Determine operation mode ϵ " and "Determine max. force F_a ". It includes a decision diamond for "Pulling load (one direction) $\epsilon \leq 1.0$ " and another for "Load cycles $\leq 1^{*}10^6$ $\epsilon \leq 1.0$ ".



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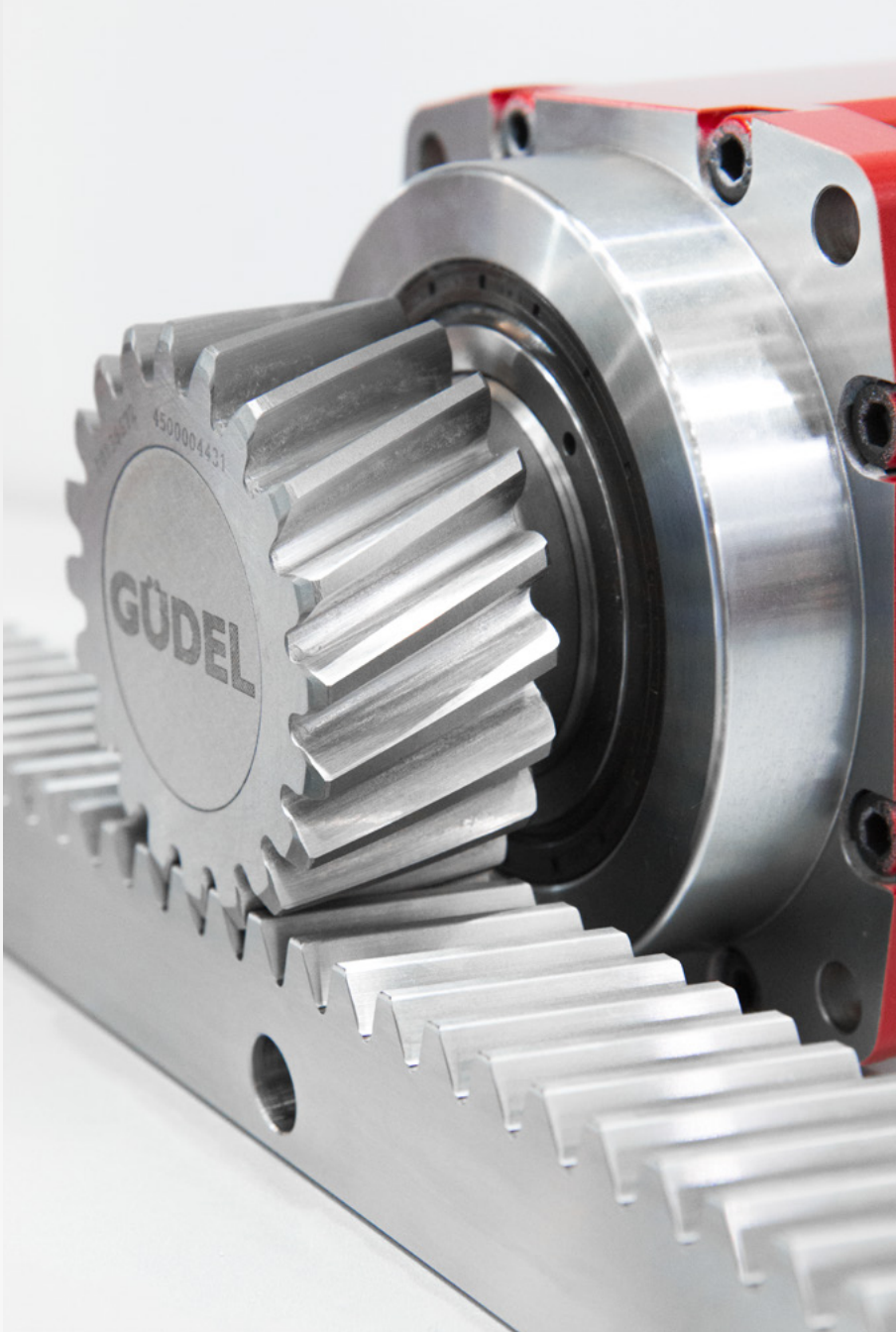
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