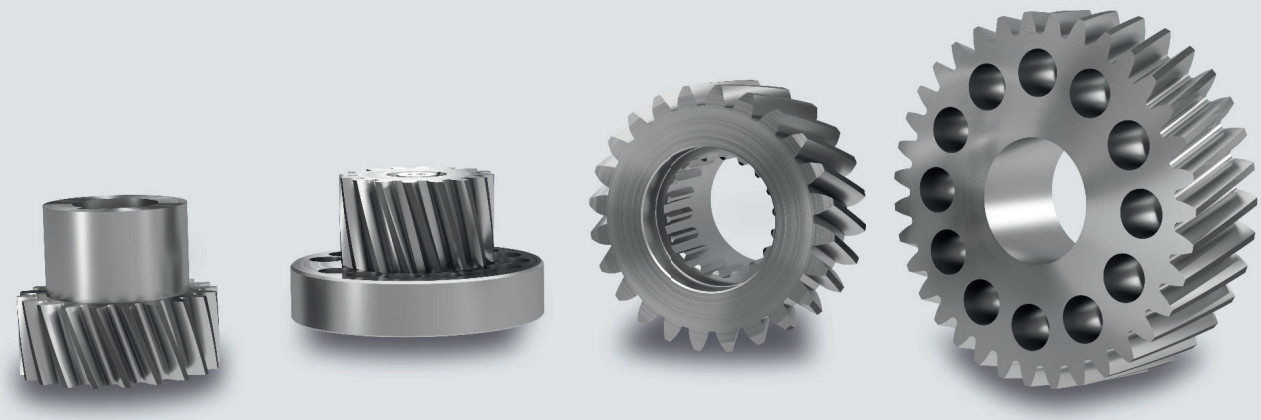
Series	Module	Tolerance of Teeth	Page
78 .. 5.. Hardened & Ground Pinions With ISO 9409-1-A Flange	2, 3, 4, 5	5 e 24	C-24 – C-27
78 .. ... TR and TRS Flanged Pinions	2, 3, 4, 5, 6, 8, 10	5 e 24	C-28 – C-36
79 .. ... Hardened & Ground Pinions and spline profile according DIN 5480	1.5, 2, 3, 4	5 e 24	C-38
24 .. ... Hardened & Ground Bored & Keyed Pinions	1.5, 2, 3, 4, 5, 6, 8, 10	7 e 25	C-39 – C-41
24 .. ... Hardened & Ground Pinions with plain bore for rework	2, 3, 4, 5, 6, 8	6 e 25	C-42



Helical-Tooth, 19° 31' 42" left-hand, A-31.5 to A-63 flange

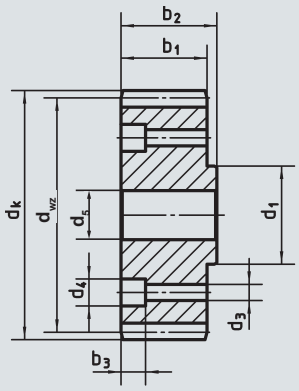


Fig. 1

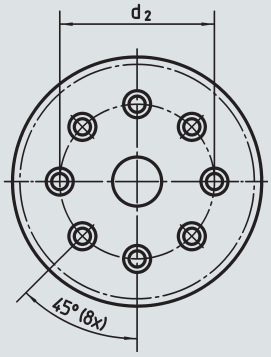
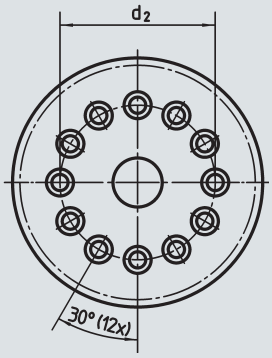


Fig. 2

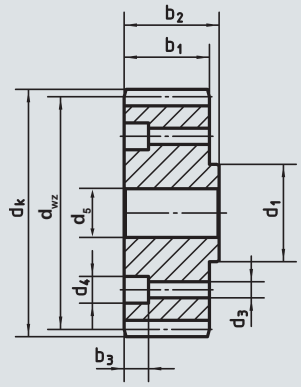


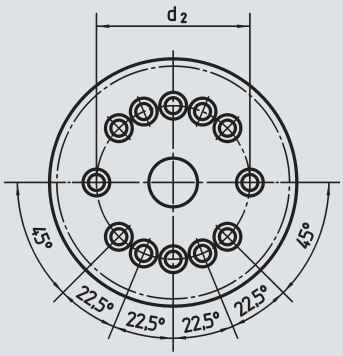
16MnCr5, 1.7131
Case-Hardened
Quality 5 e 24

With Screws 12.9 DIN 912

Order Code	Fig.	Module	N° of Teeth z	x (1)	d_0	d_{wz}	d_k	d_{1h6}	d_2	d_3	d_4	d_5^{H6}	b_1	b_2	b_3	L=PI*d L	kg	ISO Interface
78 20 526	1	2	26	0.4065	55.17	56.80	60.60	20.0	31.5	5.5	10	15	26	29.0	12	173.33	0.4	9409-1-A-31.5
78 20 527	1	2	27	0	57.30	57.30	61.29	20.0	31.5	5.5	10	15	30	33.5	11	180.00	0.5	9409-1-A-31.5
78 20 529	1	2	29	0.4150	61.54	63.20	67.00	20.0	31.5	5.5	10	15	26	29.0	12	193.33	0.5	9409-1-A-31.5
78 20 535	1	2	35	0.3819	74.27	75.80	79.60	20.0	31.5	5.5	10	15	26	29.0	12	233.33	0.8	9409-1-A-31.5
78 25 529	1	2	29	0.4150	61.54	63.20	67.00	25.0	40.0	6.6	11	20	26	30.0	14	193.33	0.5	9409-1-A-40
78 21 533	1	2	33	0.3928	70.03	71.60	75.30	31.5	50.0	6.6	11	20	26	30.0	14	220.00	0.7	9409-1-A-50
78 20 536	1	2	36	0	76.40	76.40	80.39	31.5	50.0	6.6	11	20	30	34.0	8	240.00	1.2	9409-1-A-50
78 21 537	1	2	37	0.4209	78.52	80.20	84.00	31.5	50.0	6.6	11	20	26	30.0	14	246.67	0.9	9409-1-A-50
78 31 531	1	3	31	0.3540	98.68	100.80	106.60	31.5	50.0	6.6	11	20	31	35.5	9	310.00	1.8	9409-1-A-50

(1) Profile Modification Factor





16MnCr5, 1.7131
Case-Hardened
Quality 5 e 24

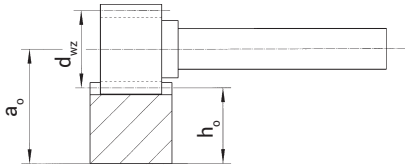
With Screws 12.9 DIN 912

Order Code	Module	N° of Teeth z	x (1)	d_0	d_{wz}	d_k	d_{1h6}	d_2	d_3	d_4	d_5^{H6}	b_1	b_2	b_3	L=PI*d L	kg	ISO Interface
78 22 540	2	40	0.3792	84.88	86.40	90.20	40.0	63.0	6.6	11	31.5	26	30	14	266.69	1.0	9409-1-A-63
78 22 545	2	45	0.3267		96.80	100.60	40.0	63.0	6.6	11	31.5	26	30	14	300.00	1.4	9409-1-A-63
78 30 530	3	30	0	95.49	95.49	101.49	40.0	63.0	6.6	11	20.0	35	39	10	300.00	2.2	9409-1-A-63

(1) Profile Modification Factor

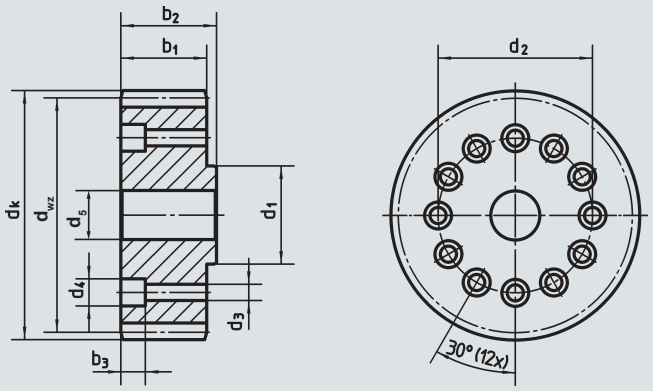
The maximum torque is limited by the threaded connection

Calculation of center distance 'a' between pinion and rack.



$$a_o = \frac{d_{wz}}{2} + h_o$$

Helical-Tooth, 19° 31' 42" left-hand, A-80 to A-125 flange



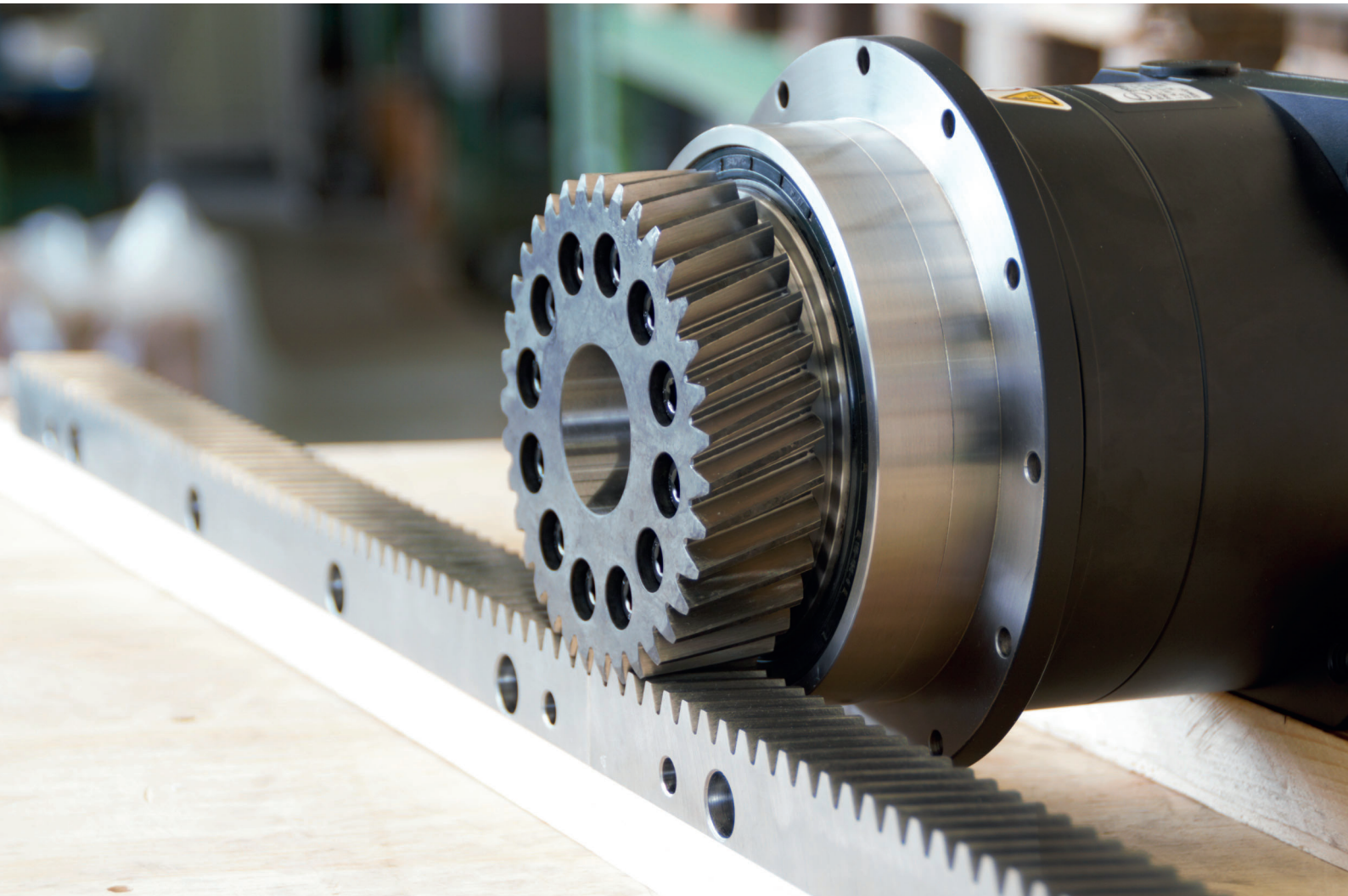
16MnCr5, 1.7131
Case-Hardened
Quality 5 e 24

With Screws 12.9 DIN 912

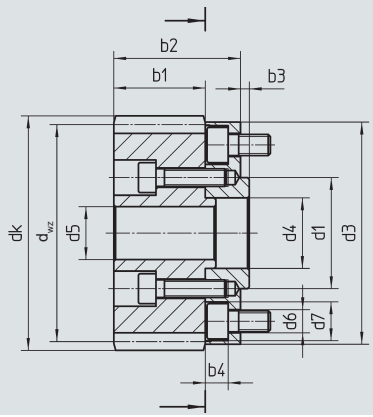
Order Code	Module	N° of Teeth z	x (1)	d_0	d_{wz}	d_k	d_{1h6}	d_2	d_3	d_4	d_5^{H6}	b_1	b_2	b_3	L=PI*d L	kg	ISO Interface
78 33 535	3	35	0.3652		113.60	119.40	50	80	9	15	40	31	35.0	11	350.00	1.8	9409-1-A-80
78 33 540	3	40	0.3792		129.60	135.40	50	80	9	15	40	31	35.0	11	400.00	2.5	9409-1-A-80
78 40 530	4	30	0		127.32	135.32	50	80	9	15	40	45	49.0	11	400.00	3.5	9409-1-A-80
78 50 521	5	21	0		111.40	121.40	50	80	9	–	40	59	64.5	–	350.00	3.5	9409-1-A-80
78 50 536	5	36	0		190.99	200.98	80	125	11	18	60	55	61.0	13	600.00	8.0	9409-1-A-125

(1) Profile Modification Factor

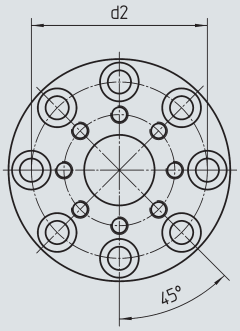
The max. torque is limited by the threaded connection.



Helical-Tooth, 19° 31' 42" left-hand, A-50 to A-63 flange



Set consists of pinion and flange



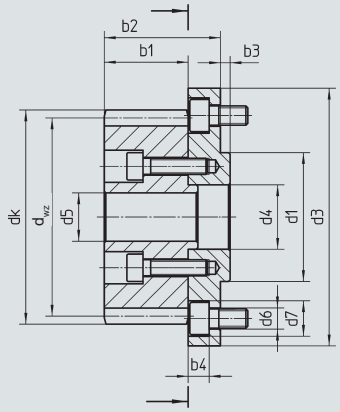
Interface A50

16MnCr5, 1.7131
Case-Hardened
Quality 5 e 24

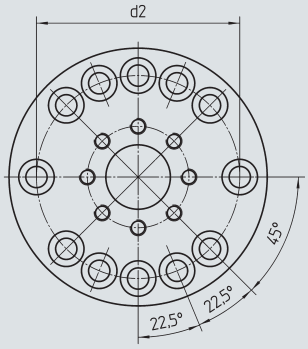
With Screws 12.9 DIN 912

Order Code Pinion	Order Code Flange	Module	N° of Teeth z	x (1)	d_0	d_{wz}	dk	d_{1h6}	d2	d3	d4	d5	d6	d7	b1	b2	b3	b4	L=Pl*d L	kg	ISO Interface
78 20 526	**2 65 78 001**	2	26	0.4065	55.17	56.80	60.60	31.5	50	63	20	15	6.6	11	26	36	2.5	6.5	173.33	0.6	9409-1-A-31.5/50
78 20 527	**2 65 78 001**	2	27	0	57.30	57.30	61.29	31.5	50	63	20	15	6.6	11	30	40	2.5	6.5	180.00	0.7	9409-1-A-31.5/50
78 20 529	**2 65 78 001**	2	29	0.4150	61.54	63.20	67.00	31.5	50	63	20	15	6.6	11	26	36	2.5	6.5	193.33	0.7	9409-1-A-31.5/50
78 20 535	**2 65 78 001**	2	35	0.3819	74.27	75.80	79.60	31.5	50	63	20	15	6.6	11	26	36	2.5	6.5	233.33	1.0	9409-1-A-31.5/50

(1) Profile Modification Factor



Set consists of pinion and flange



Interface A63

16MnCr5, 1.7131
Case-Hardened
Quality 5 e 24

With Screws 12.9 DIN 912

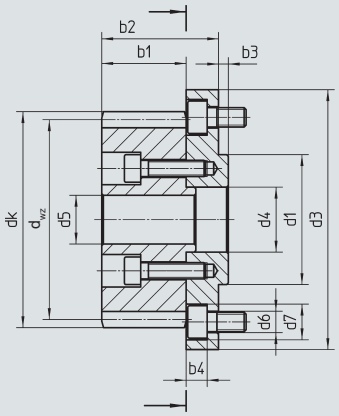
Order Code Pinion	Order Code Flange	Module	N° of Teeth z	x (1)	d.	d_{wz}	dk	d_{1h6}	d2	d3	d4	d5	d6	d7	b1	b2	b3	b4	L=Pl*d L	kg	ISO Interface
78 20 526	**2 65 78 002**	2	26	0.4065	55.17	56.80	60.60	40	63	80	20	15	6.6	11	26	36	3	6.5	173.33	0.7	9409-1-A-31.5/63
78 20 527	**2 65 78 002**	2	27	0	57.30	57.30	61.29	40	63	80	20	15	6.6	11	30	40	3	6.5	180.00	0.8	9409-1-A-31.5/63
78 20 529	**2 65 78 002**	2	29	0.4150	61.54	63.20	67.0	40	63	80	20	15	6.6	11	26	36	3	6.5	193.33	0.8	9409-1-A-31.5/63
78 20 535	**2 65 78 002**	2	35	0.3819	74.27	75.80	79.60	40	63	80	20	15	6.6	11	26	36	3	6.5	233.33	1.1	9409-1-A-31.5/63

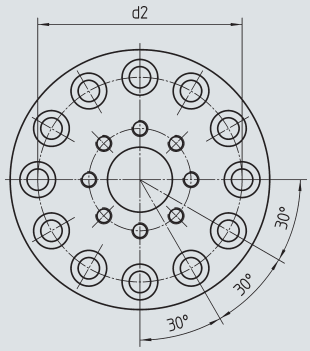
(1) Profile Modification Factor

The maximum torque is limited by the threaded connection

Helical-Tooth, 19° 31' 42" left-hand, A-80 to A-125 flange

Set consists pinion and flange





Interface A80

16MnCr5, 1.7131
Case-Hardened
Quality 5 e 24

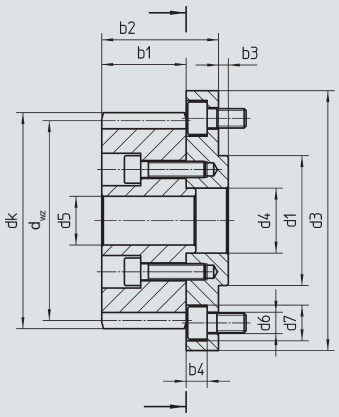
With Screws 12.9 DIN 912

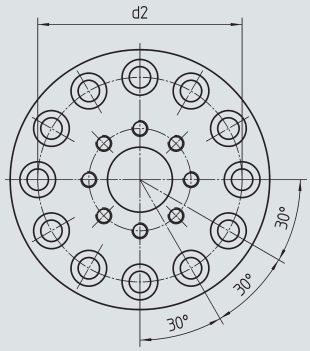
Order Code Pinion	Order Code Flange	Module	N° of Teeth z	x(1)	d_0	d_{wz}	dk	d_{1h6}	d2	d3	d4	d5	d6	d7	b1	b2	b3	b4	L=Pl*d L	kg	ISO Interface
78 20 526	**2 65 78 001** (2)	2	26	0.4065	55.17	56.80	60.60	50	80	100	31.5	15	9	15	26	49	4	9	173.33	1.2	9409-1-A-31.5/50/80
	2 65 78 003 (2)																				
78 20 527	**2 65 78 001** (2)	2	27	0	57.30	57.30	61.29	50	80	100	31.5	15	9	15	30	53	4	9	180.00	1.3	9409-1-A-31.5/50/80
	2 65 78 003 (2)																				
78 20 529	**2 65 78 001** (2)	2	29	0.4150	61.54	63.20	67.00	50	80	100	31.5	15	9	15	26	49	4	9	193.33	1.3	9409-1-A-31.5/50/80
	2 65 78 003 (2)																				
78 20 535	**2 65 78 001** (2)	2	35	0.3819	74.27	75.80	79.60	50	80	100	31.5	15	9	15	26	49	4	9	233.33	1.6	9409-1-A-31.5/50/80
	2 65 78 003 (2)																				
78 21 533	**2 65 78 003**	2	33	0.3928	70.03	71.60	75.30	50	80	100	31.5	20	9	15	26	39	4	9	220.00	1.3	9409-1-A-50/80
78 20 536	**2 65 78 003**	2	36	0	76.40	76.40	80.40	50	80	100	31.5	20	9	15	30	43	4	9	240.00	1.4	9409-1-A-50/80
78 21 537	**2 65 78 003**	2	37	0.4209	78.52	80.20	84.00	50	80	100	31.5	20	9	15	26	39	4	9	246.67	1.5	9409-1-A-50/80
78 31 531	**2 65 78 003**	3	31	0.3540	98.68	100.80	106.60	50	80	100	31.5	20	9	15	31	44	4	9	310.00	2.4	9409-1-A-50/80

(1) Profile Modification Factor

(2) Uses two flanges

Set consists of pinion and flange





Interface A125

16MnCr5, 1.7131
Case-Hardened
Quality 5 e 24

With Screws 12.9 DIN 912

Order Code Pinion	Order Code Flange	Module	N° of Teeth z	x(1)	d_0	d_{wz}	dk	d_{1h6}	d2	d3	d4	d5	d6	d7	b1	b2	b3	b4	L=Pl*d L	kg	ISO Interface
78 31 531	**2 65 78 003** (2)	3	31	0.3540	98.68	100.80	106.60	80	125	148	50	20	11	18	31	63	6	14	310.00	3.4	9409-1-A-50/80/125
	2 65 78 004 (2)																				
78 33 535	**2 65 78 004**	3	35	0.3652	111.41	113.60	119.40	80	125	148	50	40	11	18	31	50	6	14	350.00	3.8	9409-1-A80/125
78 33 540	**2 65 78 004**	3	40	0.3792	127.32	129.60	135.40	80	125	148	50	40	11	18	31	50	6	14	400.00	4.5	9409-1-A80/125
78 40 530	**2 65 78 004**	4	30	0	127.32	127.32	135.32	80	125	148	50	40	11	18	45	64	6	14	400.00	5.5	9409-1-A80/125
78 50 521	**2 65 78 004**	5	21	0	111.40	111.40	121.40	80	125	148	50	40	11	18	59	78	6	14	350.00	5.5	9409-1-A80/125

(1) Profile Modification Factor (2) Uses two flanges

The maximum torque is limited by the threaded connection

TR and TRS Pinions

Our high-precision TR and TRS Pinions (TR = Torque Reduction, TRS = Torque Reduction Supporter) for highly dynamic applications have been specially developed for use on planetary reducers. They comply with the ISO 9409-1-A interface. Used together with ATLANTA racks they open up new possibilities. The compact dimensions of TR and TRS Pinions offer impressive performance: they transmit high circumferential forces and generate low drive torques. This allows you to use smaller and more cost-effective reducers and motors without sacrificing performance.

The TR and TRS Pinions are manufactured in quality 5, which maximizes their load capacity. This makes it possible to realise extremely backlash-free and smooth-running rack drives that offer the highest precision and reliability. Our TR and TRS Pinions enable the implementation of highly rigid and highly dynamic drives due to their unique combination of high stiffness, low mass moment of inertia and minimal backlash.

German Patent
Nr. 10 2008 024 070.2

The teeth of the TR and TRS Pinions are designed in such a way that it is possible to switch between spur and helical geared drives without having to adjust the centre distance. The bolted flange design also allows for easy replacement of the pinion without having to carry out major disassembly work.

The Advantages of TR/TRS Pinions With An Example Calculation:

The following example recalculates 2 pinions for a horizontal traveling operation axis and the suitable planetary gearboxes will be chosen.

Given Values:

Mass to be moved:	m	= 10000 kg
Speed:	v	= 0.7 m/s
Acceleration time:	t_b	= 0.67 s
Coefficient of friction:	μ	= 0.05
Motor rpm:	n_{Mot}	= 1500 min^{-1}

Acceleration due to gravity:	g	= 9.81 m/s^2
Load factor:	K_A	= 1.25
Safety coefficient:	S	= 1.3
Operating time factor :	b_B	= 1.2

Acceleration:

$$a = \frac{v}{t_b} = \frac{0.7}{0.67} = 1.05 m/s^2$$

Tangential force at the pinion:

$$F_u = m \cdot g \cdot \mu + m \cdot a = 10000 \cdot 9.81 \cdot 0.05 + 10000 \cdot 1.05 = 15400\ N$$

TR-Pinion

Module:	m = 5
Number of teeth:	z = 12
Pitch diameter ø of pinion:	d = 63.66 mm

$$T_{2\,req} = \frac{F_u \cdot d}{2000} = \frac{15400 \cdot 63.66}{2000} = \mathbf{490\ Nm}$$

$$n_{pinion} = 60000 \cdot \frac{v}{\pi \cdot d} = 60000 \cdot \frac{0.7}{\pi \cdot} = \mathbf{210\ min^{-1}}$$

$$T_{2\,per} = \frac{T_{2\,Tab.}}{K_A \cdot S \cdot b_B} = \frac{1050}{1.25 \cdot 1.3 \cdot 1.2} = \mathbf{538\ Nm}$$

$$i_{max\text{-}gearbox} = \frac{n_{Motor}}{n_{pinion}} = \frac{1500}{210} = \mathbf{7.14}$$

Conventional Pinion

Module:	m = 5
Number of teeth:	z = 36
Pitch diameter ø of pinion:	d = 190.99 mm

$$T_{2\,req} = \frac{F_u \cdot d}{2000} = \frac{15400 \cdot 190.99}{2000} = \mathbf{1471\ Nm}$$

$$n_{pinion} = 60000 \cdot \frac{v}{\pi \cdot d} = 60000 \cdot \frac{0.7}{\pi \cdot 190.99} = \mathbf{69.9\ min^{-1}}$$

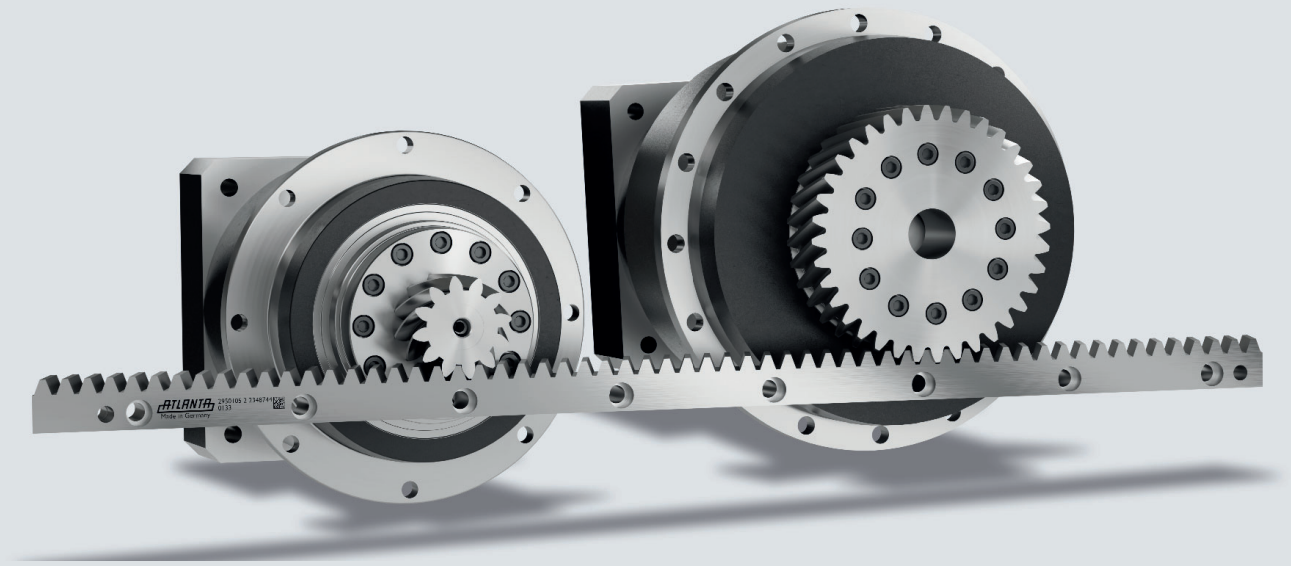
$$T_{2\,per} = \frac{T_{2\,Tab.}}{K_A \cdot S \cdot b_B} = \frac{3300}{1.25 \cdot 1.3 \cdot 1.2} = \mathbf{1692\ Nm}$$

$$i_{max\text{-}gearbox} = \frac{n_{Motor}}{n_{Ritzel\,/\,pinion}} = \frac{1500}{67.1} = \mathbf{22.3}$$

Comparison Results

Pinion Used	TR-Pinion m = 5 z = 12	Conventional Pinion m = 5 z = 36
Pitch Diameter ø of Pinion	d = 63.66 mm	d = 190.99 mm
Required Torque	490 Nm	1471 Nm
Planetary Gearbox Size	Ø 200 mm	Ø 250 mm
Gearbox Ratio	i = 7:1 (1-stage)	i = 20:1 (2-stage)

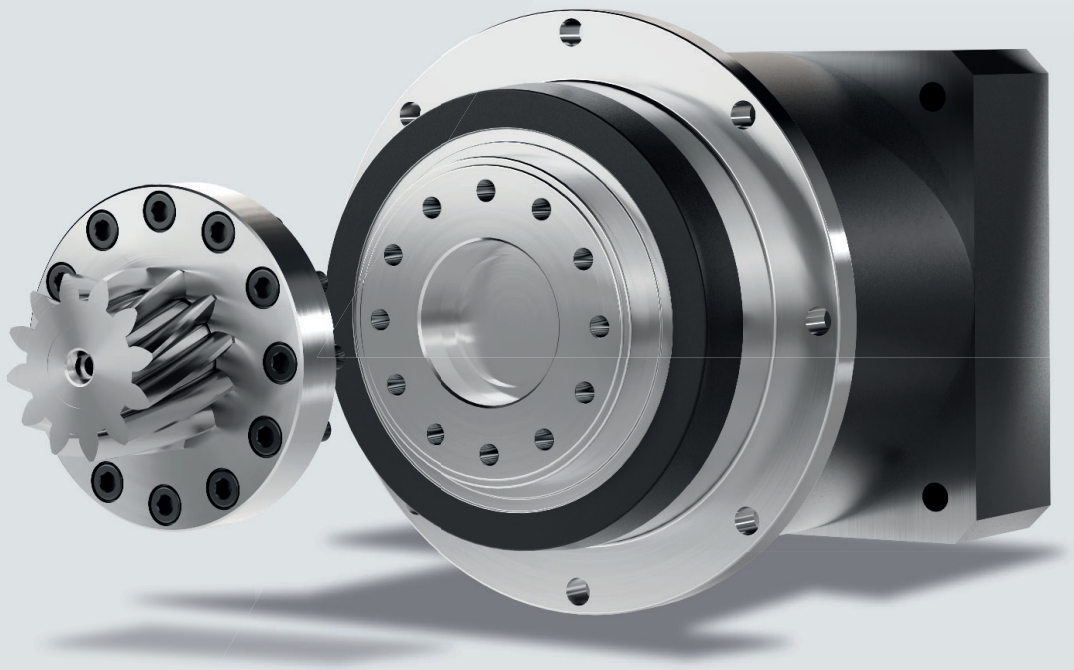
By using a TR-pinion with a smaller pitch diameter, the required torque in this example was reduced by ~66%, allowing a smaller gearbox size to be used and reducing the reduction ratio so only a single stage gearbox is needed.



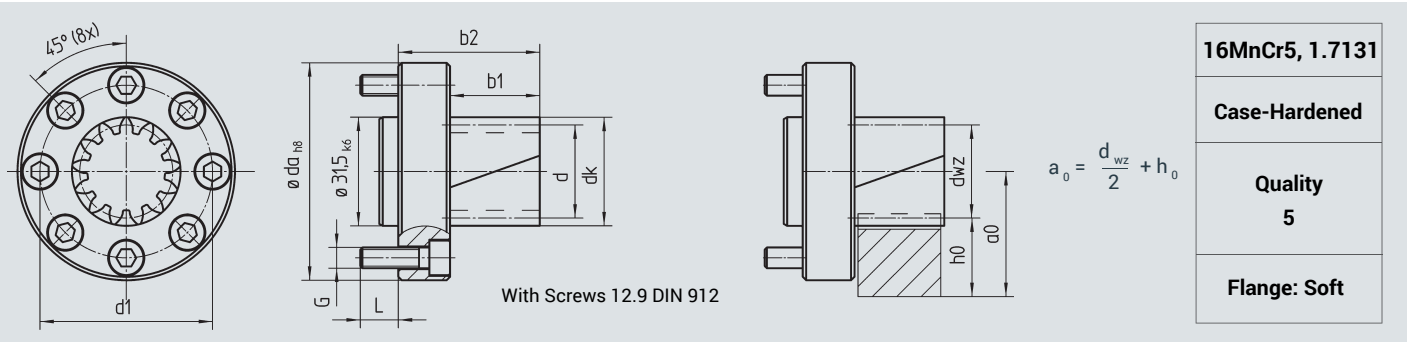
Size Comparison When Using A TR Pinion And A Conventional Pinion

ATLANTA TR and TRS Pinions Offer A Variety Of Advantages:

- **More Compact Design:** The smaller pitch diameter saves you valuable installation space in your machine. The compact design allows you to use the available space more efficiently and opens up additional freedom in the design of your system.
- **Reduced Torque:** With a smaller pinion, you reduce the required torque for your rack and pinion drive. At the same time, smaller drives and motors can be used, resulting in cost savings.
- **Precise Positioning:** The smaller pinion reduces backlash and increases the accuracy of your machine. As a result, you achieve more precise positioning and improved quality of your manufactured products.
- **Higher Accelerations:** Thanks to the lower inertia of the smaller gear, higher acceleration and shorter machining times can be realized in your machine.
- **Increased Linear Stiffness:** The use of a TR and TRS Pinions helps increase linear stiffness and improves the precision and repeatability of the entire rack drive. The use of the TRS pinion and a counter-bearing to the gear enables additional stiffness and associated dynamics and accuracy of your application.

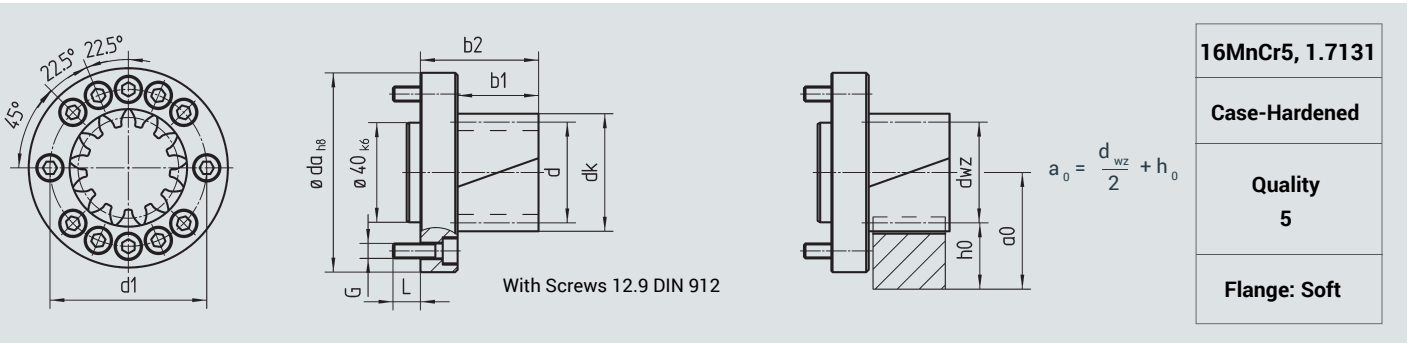


Helical-Tooth Pinion, 19° 31' 42" left-hand, A-50 flange



Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	a0	ISO Interface	d1	G	da_{h8}	L	kg
Module 2														
78 21 912	12	0.5	25.46	27.46	31.50	26.0	41	35.73	9409-1-A-50	50	M6	63	11	0.5
78 21 916	16	0	33.95	33.95	37.95	26.0	41	38.98	9409-1-A-50	50	M6	63	11	0.6

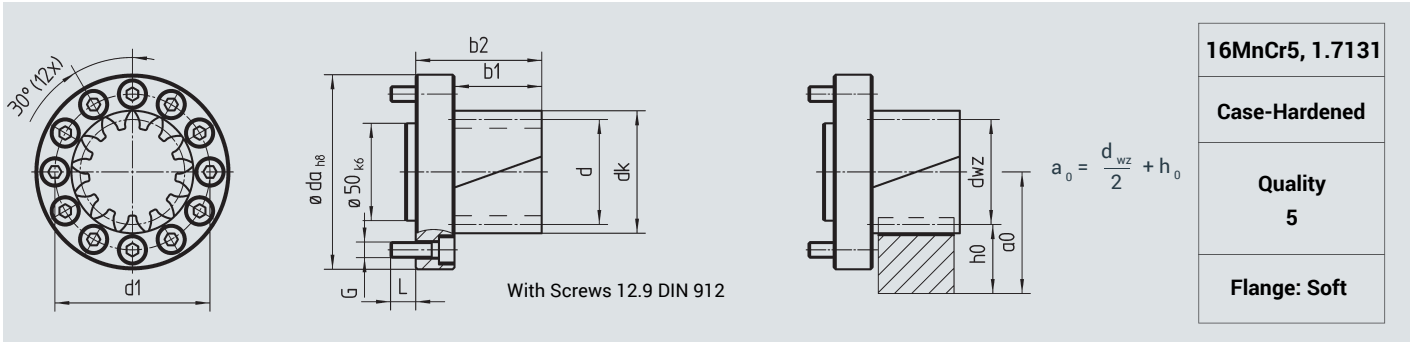
Helical-Tooth Pinion, 19° 31' 42" left-hand, A-63 flange



Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	a0	ISO Interface	d1	G	da_{h8}	L	kg
Module 2														
78 22 912	12	0.5	25.46	27.46	31.5	26.0	41	35.73	9409-1-A-63	63	M6	80	11	0.8
78 22 919	19	0	40.32	40.32	44.3	26.0	41	42.16	9409-1-A-63	63	M6	80	11	0.9
78 22 923	23	0	48.81	48.81	52.8	26.0	41	46.40	9409-1-A-63	63	M6	80	11	1.0
Module 3														
78 32 912	12	0.5	38.20	41.20	47.2	32.5	47.5	46.60	9409-1-A-63	63	M6	80	11	1.0
78 32 914	14	0.3	44.56	46.36	52.4	32.5	47.5	49.18	9409-1-A-63	63	M6	80	11	1.0

Note: The rack and pinion drive must be installed with backlash present, not pressed into engagement with no backlash! Please refer to the ATLANTA operating manual MPZ 001e.

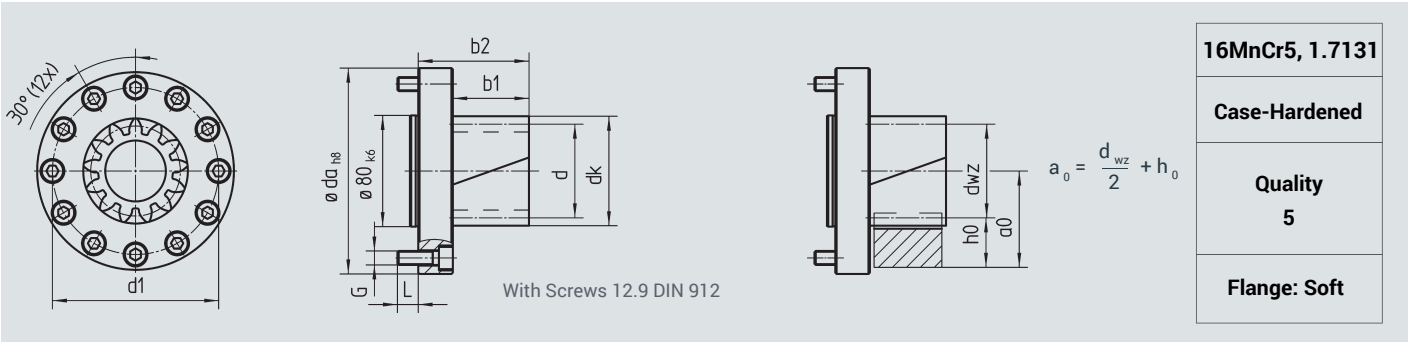
Helical-Tooth Pinion, 19° 31' 42" left-hand, A-80 flange



Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	a0	ISO Interface	d1	G	da_{h8}	L	kg
Module 2														
78 23 912	12	0.5	25.46	27.46	31.5	26.0	46	35.73	9409-1-A-80	80	M8	100	13	1.4
78 23 923	23	0	48.81	48.81	52.8	26.0	46	46.40	9409-1-A-80	80	M8	100	8	1.6
Module 3														
78 33 916	16	0	50.93	50.93	56.9	32.5	52.5	51.46	9409-1-A-80	80	M8	100	8	1.8
78 33 917	17	0	54.11	54.11	60.1	32.5	52.5	53.06	9409-1-A-80	80	M8	100	8	1.9
78 33 919	19	0	60.48	60.48	66.5	32.5	52.5	56.24	9409-1-A-80	80	M8	100	8	2.0
Module 4														
78 43 912	12	0.5	50.93	54.93	62.9	45.0	65	62.46	9409-1-A-80	80	M8	100	8	2.1

Note: The rack and pinion drive must be installed with backlash present, not pressed into engagement with no backlash! Please refer to the ATLANTA operating manual MPZ 001e.

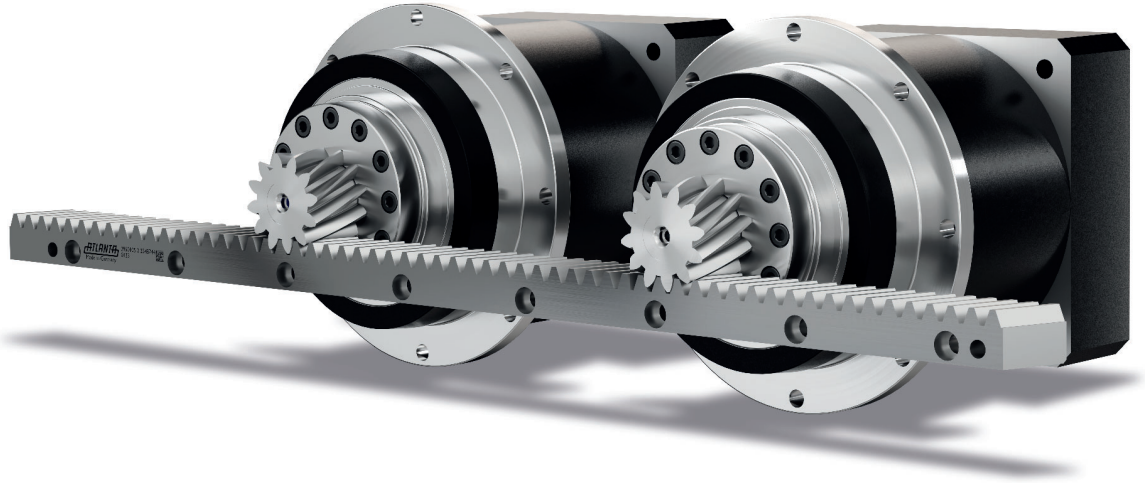
Helical-Tooth Pinion, 19° 31' 42" left-hand, A-125 flange



16MnCr5, 1.7131
Case-Hardened
Quality 5
Flange: Soft

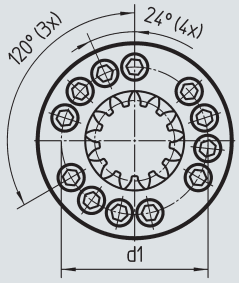
Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	a0	ISO Interface	d1	G	da_{h8}	L	kg
Module 3														
78 34 919	19	0	60.48	60.48	66.50	32.5	57.5	56.24	9409-1-A-125	125	M10	148	15	4.2
78 34 926	26	0	82.76	82.76	88.80	32.5	57.5	67.38	9409-1-A-125	125	M10	148	15	4.9
78 34 932	32	0	101.86	101.86	107.90	32.5	57.5	76.93	9409-1-A-125	125	M10	148	15	5.6
Module 4														
78 44 912	12	0.5	50.93	54.93	62.90	45.0	70.0	62.46	9409-1-A-125	125	M10	148	15	4.4
78 44 917	17	0	72.15	72.15	80.15	45.0	70.0	71.07	9409-1-A-125	125	M10	148	15	5.0
78 44 919	19	0.11	80.64	81.52	89.50	45.0	70.0	75.76	9409-1-A-125	125	M10	148	15	5.4
78 44 920	20	0	84.88	84.88	92.90	45.0	70.0	77.44	9409-1-A-125	125	M10	148	15	5.5
Module 5														
78 54 912	12	0.5	63.66	68.66	78.70	55	80	68.33	9409-1-A-125	125	M10	148	15	5.1
78 54 916	16	0	84.88	84.88	94.90	55	80	76.44	9409-1-A-125	125	M10	148	15	6.0
78 54 918	18	0	95.49	95.49	105.50	55	80	81.75	9409-1-A-125	125	M10	148	15	6.6
Module 6														
78 64 915	15	0	95.49	95.49	107.50	65	90	90.75	9409-1-A-125	125	M10	148	15	6.8

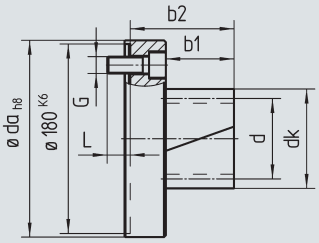
Note: The rack and pinion drive must be installed with backlash present, not pressed into engagement with no backlash! Please refer to the ATLANTA operating manual MPZ 001e.



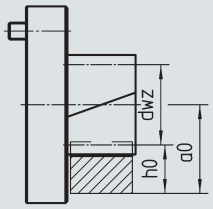
Multiple Pinion Contact For Electrical Preloading

Helical-Tooth Pinion, 19° 31' 42" left-hand, A-140 flange





With Screws 12.9 DIN 912

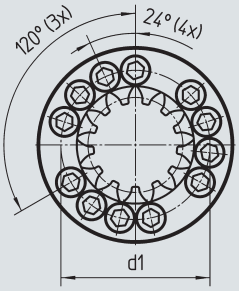


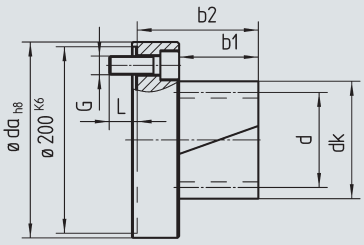
$a_0 = \frac{d_{wz}}{2} + h_0$

16MnCr5, 1.7131
Case-Hardened
Quality 5
Flange: Soft

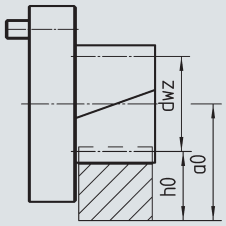
Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	a0	ISO Interface	d1	G	da_{h8}	L	kg
Module 4														
78 46 919	19	0.11	80.64	81.52	89.50	45	79	75.76		140	M16	187	22	9.1
Module 5														
78 56 918	18	0	95.49	95.49	105.50	55	89	81.75		140	M16	187	22	10.3
78 56 919	19	0	100.80	100.80	110.80	55	89	84.40	–	140	M16	187	22	10.6
Module 6														
78 66 916	16	0	101.86	101.86	113.90	65	99	93.93	–	140	M16	187	22	11.3

Helical-Tooth Pinion, 19° 31' 42" left-hand, A-160 flange





With Screws 12.9 DIN 912



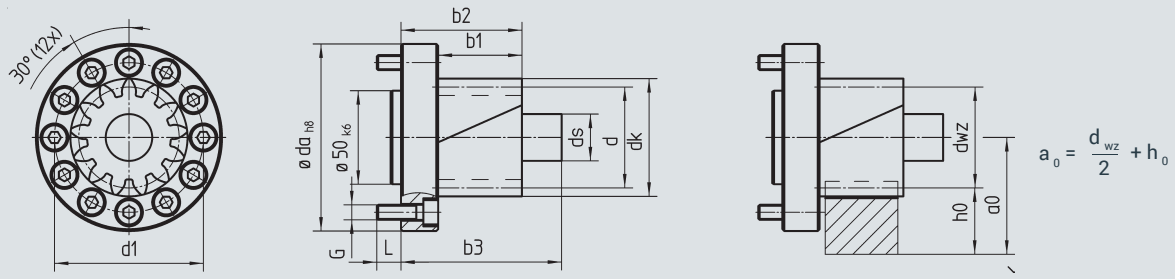
$a_0 = \frac{d_{wz}}{2} + h_0$

16MnCr5, 1.7131
Case-Hardened
Quality 5
Flange: Soft

Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	a0	ISO Interface	d1	G	da_{h8}	L	kg
Module 5														
78 57 919	19	0	100.80	100.80	110.8	55	100	84.40	–	160	M20	210	30	15.6
Module 6														
78 67 916	16	0	101.86	101.86	113.9	65	110	93.93	–	160	M20	210	30	15.9
Module 8														
78 87 912	12	0.5	101.86	109.86	125.9	85	130	125.93	–	160	M20	210	30	17.8

Note: The rack and pinion drive must be installed with backlash present, not pressed into engagement with no backlash! Please refer to the ATLANTA operating manual MPZ 001e.

Helical-Tooth Pinion, 19° 31' 42" left-hand, A-80 flange

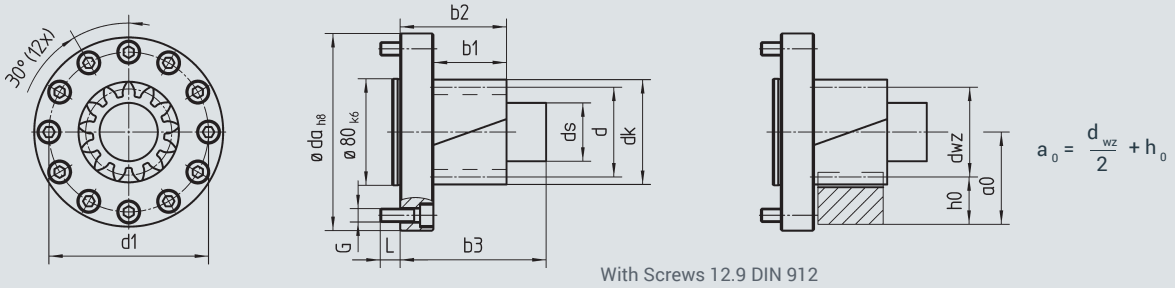


With Screws 12.9 DIN 912

16MnCr5, 1.7131
Case-Hardened
Quality 5
Flange: Soft

Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	b_3	d_s	a0	ISO Interface	d1	G	$d_{a\,h8}$	L	kg
Module 2																
2 78 00 701	23	0	48.81	48.81	52.8	26.0	46	64	25.024	46.40	9409-1-A-80	80	M8	100	13	1.6
Module 3																
2 78 00 703	17	0	54.11	54.11	60.1	32.5	52.5	70.5	25.024	53.06	9409-1-A-80	80	M8	100	13	1.9

Helical-Tooth Pinion, 19° 31' 42" left-hand, A-125 flange



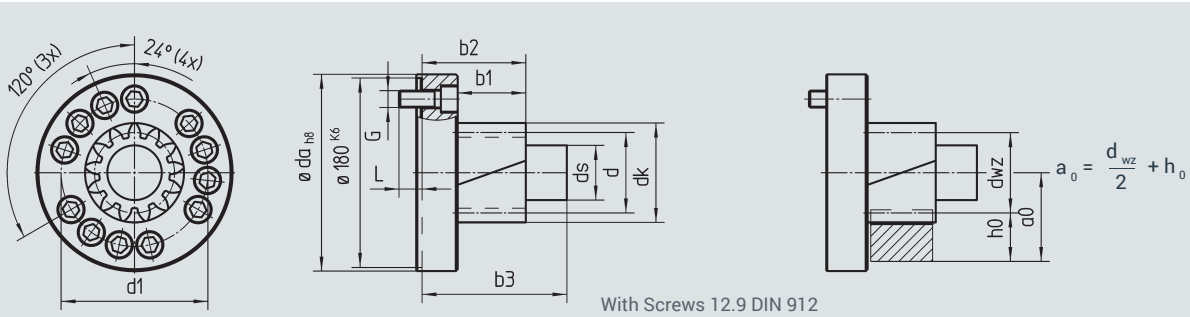
With Screws 12.9 DIN 912

16MnCr5, 1.7131
Case-Hardened
Quality 5
Flange: Soft

Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	b_3	d_s	a0	ISO Interface	d1	G	$d_{a\,h8}$	L	kg
Module 3																
2 78 00 801	26	0	82.76	82.76	88.80	42	67	96	48.024	67.38	9409-1-A-125	125	M10	148	15	4.9
2 78 00 802	32	0	101.86	101.86	107.90	42	67	96	48.024	76.93	9409-1-A-125	125	M10	148	15	5.6
Module 4																
2 78 00 803	20	0	84.88	84.88	92.90	45	70	96	48.024	77.44	9409-1-A-125	125	M10	148	15	5.5
Module 5																
2 78 00 804	16	0	84.88	84.88	94.90	55	80	106	48.024	76.44 (1)	9409-1-A-125	125	M10	148	15	6.0

Note: The rack and pinion drive must be installed with backlash present, not pressed into engagement with no backlash! Please refer to the ATLANTA operating manual MPZ 001e.

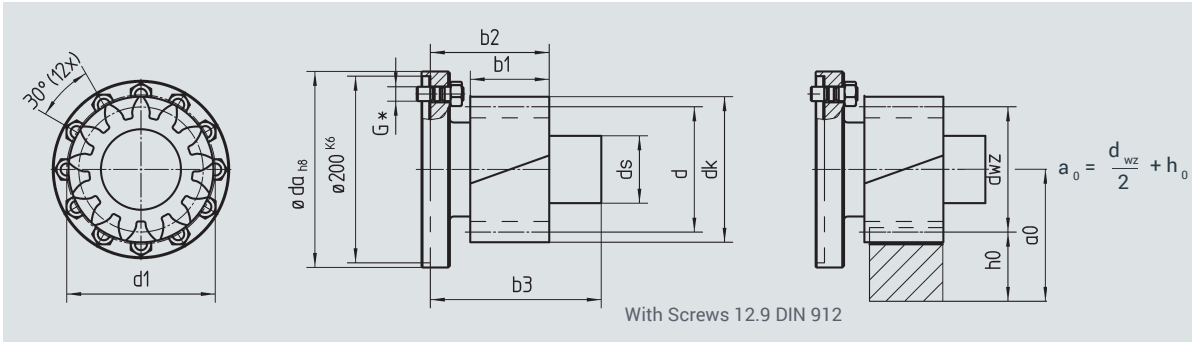
Helical-Tooth Pinion, 19° 31' 42" left-hand, A-140 flange



16MnCr5, 1.7131
Case-Hardened
Quality 5
Flange: Soft

Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	b_3	d_s	a0	ISO Interface	d1	G	$d_{a\,h8}$	L	kg
Module 5																
2 78 00 901	20	0	106.10	106.10	116.1	55	89	131	50.026	87.05	–	140	M16	187	22	10.3
Module 6																
2 78 00 902	16	0	101.86	101.86	113.86	65	99	141	50.026	93.93	–	140	M16	187	22	11.3

Helical-Tooth Pinion, 19° 31' 42" left-hand, A-170 flange

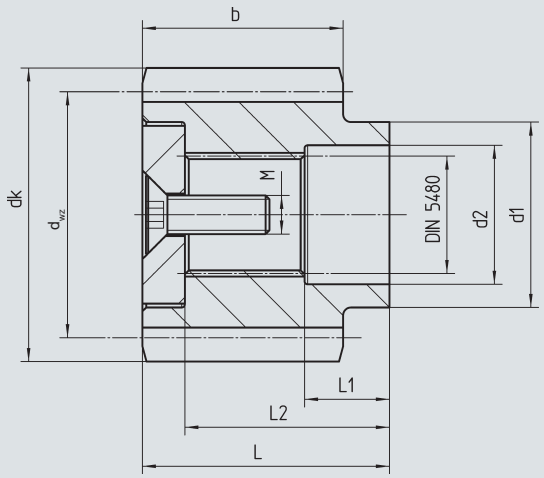


16MnCr5, 1.7131
Case-Hardened
Quality 5
Flange: Soft

Order Code	No. of Teeth z	Profile Modification Factor x	d	d_{wz}	dk	b1	b2	b_3	d_s	a0	ISO Interface	d1	G	$d_{a\,h8}$	L	kg
Module 8																
2 78 00 101	19	0	161.28	161.28	177.28	100	157	205	55.026	151.64	–	170	M20	210	25	26.7
Module 10																
2 78 00 102	15	0.25	159.16	164.16	184.16	100	157	205	55.026	171.08	–	170	M20	210	25	27.5

Note: The rack and pinion drive must be installed with backlash present, not pressed into engagement with no backlash! Please refer to the ATLANTA operating manual MPZ 001e.

Helical-Tooth Pinion, 19° 31' 42" left-hand, splined bore



16MnCr5, 1.7131

Carborized & Hardened

Quality 5 e 24

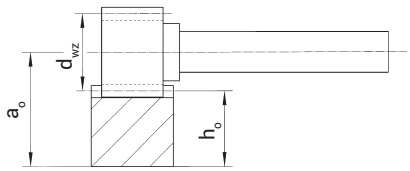
With washer and screw DIN 7991

Screw Size	Strength Class	Tightening Torque (Nm)
M5	10.9	7
M8	8.8	20
M12	8.8	68
M16	8.8	168
M20	8.8	340

Order Code	N° of Teeth	Module	Profile Modification Factor x	Fu Tab.	d	d_{wz}	dk	d1	L	d2	L1	L2	b	M	Spline, Soft DIN 5480 *	kg
79 11 538	38	1.5	–	6.8	60.48	60.48	63.48	30	33	24	12	27.5	20	M8x25	N22x1.25x30x16x7H	0.1
79 20 515	15	2	0.5922	4.5	31.83	34.20	38.0	24	32	18	11	26.5	26	M5x16	N16x0.8x30x18x7H	0.2
79 20 516	16	2	0.6117	4.5	33.95	36.40	40.1	24	32	18	11	26.5	26	M5x16	N16x0.8x30x18x7H	0.2
79 20 518	18	2	0.5000	4.5	38.20	40.20	44.0	24	32	18	11	26.5	26	M5x16	N16x0.8x30x18x7H	0.3
79 21 518	18	2	0.5000	6.8	38.20	40.20	44.0	30	33	24	12	27.5	26	M8x25	N22x1.25x30x16x7H	0.3
79 21 520	20	2	0.4900	6.8	42.44	44.40	48.2	30	33	24	12	27.5	26	M8x25	N22x1.25x30x16x7H	0.3
79 21 522	22	2	0.4786	6.8	46.69	48.60	52.5	30	33	24	12	27.5	26	M8x25	N22x1.25x30x16x7H	0.4
79 21 525	25	2	–	6.8	53.05	53.05	57.05	30	33	24	12	27.5	26	M8x25	N22x1.25x30x16x7H	0.4
79 22 523	23	2	0.4981	19.0	48.81	50.80	54.6	40	34	35	13	27.0	26	M12x35	N32x1.25x30x24x7H	0.4
79 22 525	25	2	0.4871	20.0	53.05	55.00	59.0	40	34	35	13	27.0	26	M12x35	N32x1.25x30x24x7H	0.4
79 22 527	27	2	0.3760	20.0	57.30	58.80	62.6	40	34	35	13	27.0	26	M12x35	N32x1.25x30x24x7H	0.5
79 33 520	20	3	0.4563	28.5	63.66	66.40	72.2	50	51	41	20	41.0	31	M16x45	N40x2x30x18x7H	0.7
79 33 522	22	3	0.4620	29.5	70.03	72.80	78.6	50	51	41	20	41.0	31	M16x45	N40x2x30x18x7H	0.8
79 33 524	24	3	0.4676	29.5	76.39	79.20	85.0	50	51	41	20	41.0	31	M16x45	N40x2x30x18x7H	1.0
79 44 520	20	4	0.4000	54.0	84.88	88.08	96.1	75	54	56	20	44.0	41	M20x50	N55x2x30x26x7H	1.5
79 45 525	25	4	0.3400	57.5	106.10	108.82	116.8	90	65	72	24	55.0	41	M20x50	N70x2x30x34x7H	3.0

* Put MoS2-powder or suitable grease in spline area to reduce micro corrosion

Calculation of center distance 'a' between pinion and rack



$$a_o = \frac{d_{wz}}{2} + h_o$$

All dimensions are in mm

Helical-Tooth Pinion, 19° 31' 42" left-hand, with bore ØH6 and keyway acc. to DIN 6885

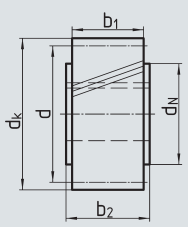


Fig. 1

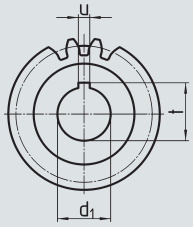


Fig. 1 + 3 Keyway middle of tooth gap

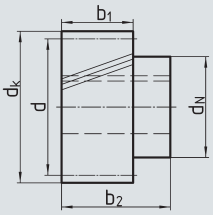


Fig. 3

16MnCr5, 1.7131
Case-Hardened
Quality 6 e 25

Order Code	Fig.	N° of Teeth z	d (=d_{wz})	d*PI	d_k	d_1^{H6}	d_N	b_1	b_2	u	t	kg	Couplings on Page C-76
Module 1.5													
24 11 520 [1]	1	20	31.83	100.00	34.83	11	25	20	22	4	12.8	0.13	
24 14 520 [1]	1	20	31.83	100.00	34.83	14	25	20	22	5	16.3	0.13	
24 16 520 [1]	1	20	31.83	100.00	34.83	16	25	20	22	5	18.3	0.13	
24 16 321 [1]	3	21	33.42	105.00	36.42	16	30	20	46	5	18.3	0.15	80 83 030
Module 2													
24 26 518	1	18	38.197	120.00	42.2	16	25	28	30	5	18.3	0.2	
24 29 520	1	20	42.44	133.33	46.4	19*	30	28	30	6	21.8	0.3	
24 29 320	3	20	42.44	133.33	46.4	19*	30	28	56	6	21.8	0.3	80 83 030
24 22 520	1	20	42.44	133.33	46.4	20	30	28	30	6	22.8	0.3	
24 20 320	3	20	42.44	133.33	46.4	22*	36	28	56	6	24.8	0.3	80 84 036
24 23 520	1	20	42.44	133.33	46.4	22	30	28	30	6	24.8	0.3	
24 26 521	1	21	44.56	140.00	48.6	16	25	28	30	5	18.3	0.3	
24 20 321	3	21	44.56	140.00	48.6	22	36	28	56	6	24.8	0.2	80 84 036
24 29 522	1	22	46.69	146.67	50.7	19*	30	28	30	6	21.8	0.2	
24 29 322	3	22	46.69	146.67	50.7	19*	30	28	56	6	21.8	0.4	80 83 030
24 20 522	1	22	46.69	146.67	50.7	22*	30	28	30	6	24.8	0.3	
24 20 322	3	22	46.69	146.67	50.7	22*	36	28	56	6	24.8	0.4	80 84 036
24 29 525	1	25	53.05	166.67	57.1	19*	30	28	30	6	21.8	0.4	
24 29 325	3	25	53.05	166.67	57.1	19*	30	28	56	6	21.8	0.5	80 83 030
24 22 525	1	25	53.05	166.67	57.1	20	30	28	30	6	22.8	0.4	
24 20 525	1	25	53.05	166.67	57.1	22*	30	28	30	6	24.8	0.3	
24 20 325	3	25	53.05	166.67	57.1	22*	36	28	56	6	24.8	0.5	80 84 036
24 23 525	1	25	53.05	166.67	57.1	25	36	28	30	8	28.3	0.4	
24 29 528	1	28	59.42	186.67	63.4	19*	30	28	30	6	21.8	0.4	
24 29 328	3	28	59.42	186.67	63.4	19*	30	28	56	6	21.8	0.6	80 83 030
24 20 528	1	28	59.42	186.67	63.4	22*	30	28	30	6	24.8	0.4	
24 20 328	3	28	59.42	186.67	63.4	22*	36	28	56	6	24.8	0.7	80 84 036
24 25 528	1	28	59.42	186.67	63.4	35	48	28	30	10	38.3	0.4	
24 26 530	1	30	63.66	200.00	67.7	16	25	28	30	5	18.3	0.7	
24 22 530	1	30	63.66	200.00	67.7	20	30	28	30	6	22.8	0.6	
24 20 330	3	30	63.66	200.00	67.7	22	36	28	56	6	24.8	0.6	80 84 036
24 23 530	1	30	63.66	200.00	67.7	25	36	28	30	8	28.3	0.8	
24 24 530	1	30	63.66	200.00	67.7	30	45	28	30	8	33.3	0.6	
24 22 330	3	30	63.66	200.00	67.7	30	50	28	60	8	33.3	0.8	80 85 050
24 23 330	3	30	63.66	200.00	67.7	32	55	28	65	10	35.3	0.8	80 80 055
24 22 532	1	32	67.91	213.33	71.9	20	30	28	30	6	22.8	0.8	
24 20 532	1	32	67.91	213.33	71.9	22*	30	28	30	6	24.8	0.7	
24 20 332	3	32	67.91	213.33	71.9	22*	36	28	56	6	27.8	0.9	80 84 036
24 23 532	1	32	67.91	213.33	71.9	25	36	28	30	8	28.3	0.7	
24 25 532	1	32	67.91	213.33	71.9	35	48	28	30	10	38.3	0.6	
24 25 536	1	36	76.39	240.00	80.4	35	48	28	30	10	38.3	0.8	
24 23 339	3	39	82.76	260.00	86.8	32	55	28	65	10	35.3	1.3	80 80 055
24 25 540	1	40	84.88	266.67	88.9	35	48	28	30	10	38.3	1.1	

* Bore tolerance G6

[1] Tooth quality 6 f 24

Helical-Tooth Pinion, 19° 31' 42" left-hand, with bore ØH6 and keyway acc. to DIN 6885

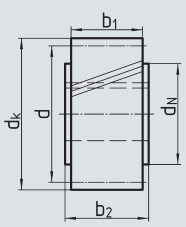


Fig. 1

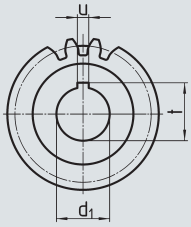


Fig. 1 + 3 Keyway middle of tooth gap

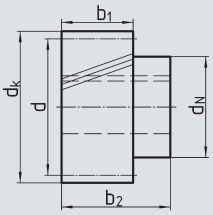


Fig. 3

16MnCr5, 1.7131
Case-Hardened
Quality 6 e 25

Order Code	Fig.	N° of Teeth z	d (=d_{wz})	d*PI	d_k	d_1^{H6}	d_N	b_1	b_2	u	t	kg	Couplings on Page C-76
Module 3													
24 30 320	3	20	63.66	200.00	69.7	22	36	28	56	6	24.8	0.6	80 84 036
24 31 320	3	20	63.66	200.00	69.7	25	44	28	60	8	28.3	0.7	80 80 044
24 34 520	1	20	63.66	200.00	69.7	30	45	28	30	8	33.3	0.8	
24 32 320	3	20	63.66	200.00	69.7	30	50	28	60	8	33.3	0.8	80 85 050
24 33 320	3	20	63.66	200.00	69.7	32	55	28	65	10	35.3	0.8	80 80 055
24 35 520	1	20	63.66	200.00	69.7	35	48	28	30	10	38.3	0.7	
24 33 522	1	22	70.03	220.00	76.0	25	36	28	30	8	28.3	0.8	
24 34 522	1	22	70.03	220.00	76.0	30	45	28	30	8	33.3	0.7	
24 33 322	3	22	70.03	220.00	76.0	32*	55	28	65	10	35.3	1.0	80 80 055
24 35 522	1	22	70.03	220.00	76.0	35	48	28	30	10	38.3	0.7	
24 35 322	3	22	70.03	220.00	76.0	40*	62	28	65	12	43.3	1.0	80 86 062
24 30 325	3	25	79.58	250.00	85.6	22	36	28	56	6	24.8	1.0	80 84 036
24 33 525	1	25	79.58	250.00	85.6	25	36	28	30	8	28.3	1.0	
24 31 325	3	25	79.58	250.00	85.6	25	44	28	60	8	28.3	1.1	80 80 044
24 34 525	1	25	79.58	250.00	85.6	30	45	28	30	8	33.3	1.0	
24 32 325	3	25	79.58	250.00	85.6	30	50	28	60	8	33.3	1.2	80 85 050
24 33 325	3	25	79.58	250.00	85.6	32	55	28	65	10	35.3	1.2	80 80 055
24 35 525	1	25	79.58	250.00	85.6	35	48	28	30	10	38.3	0.9	
24 34 325	3	25	79.58	250.00	85.6	35	55	28	65	10	38.3	1.1	80 80 055
24 36 525	1	25	79.58	250.00	85.6	40	70	28	50	12	43.3	1.1	
24 35 325	3	25	79.58	250.00	85.6	40*	62	28	65	12	43.3	1.1	80 86 062
24 33 328	3	28	89.13	280.00	95.1	32*	55	28	65	10	35.3	1.1	80 80 055
24 35 328	3	28	89.13	280.00	95.1	40*	62	28	65	12	43.3	1.1	80 86 062
24 33 332	3	32	101.86	320.00	107.85	32*	55	28	65	10	35.3	2.1	80 80 055
24 35 332	3	32	101.86	320.00	107.85	40*	62	28	65	12	43.3	2.1	80 86 062

* Bore tolerance G6

Helical-Tooth Pinion, 19° 31' 42" left-hand, with bore ØH6 and keyway acc. to DIN 6885

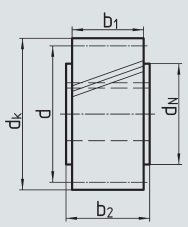


Fig. 1

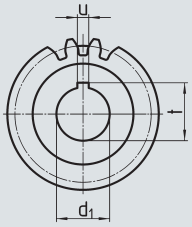


Fig. 1 + 3 Keyway middle of tooth gap

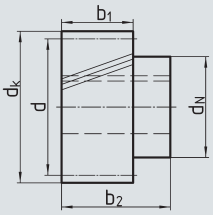
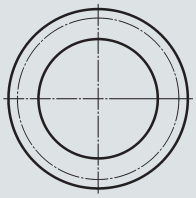


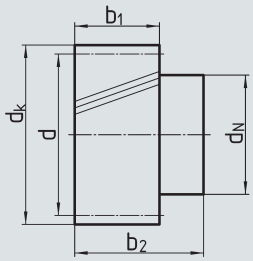
Fig. 3

16MnCr5, 1.7131
Case-Hardened
Quality 6 e 25

Order Code	Fig.	N° of Teeth z	d (=d_{wz})	d*PI	d_k	d_1^{H6}	d_N	b_1	b_2	u	t	kg	Couplings on Page C-76
Module 4													
24 45 515	1	15	63.66	200.00	71.7	35	52	40	50	10	38.3	1.4	
24 43 318	3	18	76.39	240.00	84.4	32	55	40	75	10	35.3	1.5	80 80 055
24 45 520	1	20	84.88	266.67	92.9	35	52	40	50	10	38.3	1.9	
24 47 520	1	20	84.88	266.67	92.9	45	65	40	50	14	48.8	1.6	
24 43 321	3	21	89.13	280.00	97.1	32	55	40	75	10	35.3	2.0	80 80 055
24 44 321	3	21	89.13	280.00	97.1	35	55	40	75	10	38.3	1.9	80 80 055
24 45 321	3	21	89.13	280.00	97.1	40	62	40	75	12	43.3	1.9	80 86 062
24 46 321	3	21	89.13	280.00	97.1	45	68	40	75	14	48.8	1.7	80 80 068
24 45 522	1	22	93.37	293.33	101.4	35	52	40	50	10	38.3	2.3	
24 47 522	1	22	93.37	293.33	101.4	45	65	40	50	14	48.8	2.0	
24 43 324	3	24	101.86	320.00	109.9	32	55	40	75	10	35.3	2.6	80 80 055
24 44 324	3	24	101.86	320.00	109.9	35	55	40	75	10	38.3	2.5	80 80 055
24 45 324	3	24	101.86	320.00	109.9	40	62	40	75	12	43.3	2.5	80 86 062
24 46 324	3	24	101.86	320.00	109.9	45	68	40	75	14	48.8	2.3	80 80 068
24 47 324	3	24	101.86	320.00	109.9	55	80	40	80	16	59.3	2.4	80 87 080
24 45 525	1	25	106.10	333.33	114.1	35	52	40	50	10	38.3	3.1	
24 47 525	1	25	106.10	333.33	114.1	45	65	40	50	14	48.8	2.8	
24 47 325	3	25	106.10	333.33	114.1	55	80	40	80	16	59.3	2.9	80 87 080
Module 5													
24 56 318	3	18	95.49	300.00	105.5	45	68	50	85	14	48.8	2.7	80 80 068
24 56 324	3	24	127.32	400.00	137.3	45	68	50	85	14	48.8	4.9	80 80 068
24 57 324	3	24	127.32	400.00	137.3	55	80	50	90	16	59.3	4.9	80 87 080
24 58 324	3	24	127.32	400.00	137.3	75	110	50	110	20	79.9	5.6	80 80 110
Module 6													
24 67 320	3	20	127.32	400.00	139.3	55	80	60	100	16	59.3	5.7	80 87 080
24 68 320	3	20	127.32	400.00	139.3	75	110	60	120	20	79.9	6.3	80 80 110
24 67 325	3	25	159.16	500.00	171.2	55	80	60	100	16	59.3	9.0	80 87 080
24 68 325	3	25	159.16	500.00	171.2	75	110	60	120	20	79.9	9.6	80 80 110
Module 8													
24 88 318	3	18	152.79	480.00	168.8	75	110	80	140	20	79.9	10.8	80 80 110
24 89 320	3	20	169.80	533.44	185.8	85	125	80	145	22	90.4	13.6	80 80 125
Module 10													
24 09 720	3	20	212.21	666.68	232.2	85	125	100	165	22	90.4	26.2	80 80 125

Helical-Tooth Pinion, 19° 31' 42" left-hand, with plain bore





16MnCr5, 1.7131
Carburized, Induction-Hardened
Quality 6 e 25

Order Code	Module	N° of Teeth z	d (=d_{wz})	d*PI	d_k	d_N	b_1	b_2	kg	Couplings on Page C-76
24 99 121	1.5	21	33.42	105.00	36.4	30	20	46	0.3	80 83 030
24 99 218	2	18	38.20	120.00	42.2	30	28	56	0.3	80 83 030
24 99 220	2	20	42.44	133.33	46.4	30	28	56	0.4	80 83 030
24 99 222	2	22	46.69	146.67	50.7	36	28	56	0.5	80 84 036
24 99 225	2	25	53.05	166.67	57.1	44	28	60	0.8	80 80 044
24 99 228	2	28	59.42	186.67	63.4	50	28	60	1.0	80 85 050
24 99 230	2	30	63.66	200.00	67.7	50	28	60	1.1	80 85 050
24 99 232	2	32	67.91	213.33	71.9	55	28	65	1.4	80 80 055
24 99 318	3	18	57.30	180.00	63.3	44	28	60	0.8	80 80 044
24 99 320	3	20	63.66	200.00	69.7	50	28	60	1.0	80 85 050
24 99 322	3	22	70.03	220.00	76.0	55	28	65	1.4	80 80 055
24 99 325	3	25	79.58	250.00	85.6	62	28	65	1.8	80 86 062
24 99 328	3	28	89.13	280.00	95.1	68	28	65	2.3	80 80 068
24 99 418	4	18	76.39	240.00	84.4	62	40	77	2.0	80 86 062
24 99 420	4	20	84.88	266.67	92.9	62	40	77	2.4	80 86 062
24 99 421	4	21	89.13	280.00	97.1	68	40	77	2.8	80 80 068
24 99 422	4	22	93.37	293.33	101.4	68	40	77	2.9	80 80 068
24 99 424	4	24	101.86	320.00	109.9	80	40	80	3.9	80 87 080
24 99 425	4	25	106.10	333.33	114.1	80	40	80	4.0	80 87 080
24 99 522	5	22	116.71	366.67	126.7	80	50	90	5.5	80 87 080
24 99 524	5	24	127.32	400.00	137.3	110	50	110	9.6	80 80 110
24 99 525	5	25	132.63	416.67	142.6	110	50	110	9.1	80 80 110
24 99 620	6	20	127.32	400.00	139.3	110	60	120	9.7	80 80 110
24 99 820 [1]	8	20	169.77	533.33	185.8	125	80	145	19.4	80 80 125

[1] With bore Ø 40^{H7}

The pinion could be fixed at d_k or d_N to be reworked.

Maximum bore diameter of the pinion on request.