

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.

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.



German Patent
Nr. 10 2008 024 070.2



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: $m = 10000 \text{ kg}$
 Speed: $v = 0.7 \text{ m/s}$
 Acceleration time: $t_b = 0.67 \text{ s}$
 Coefficient of friction: $\mu = 0.05$
 Motor rpm: $n_{\text{Mot}} = 1500 \text{ min}^{-1}$

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

Acceleration:

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

Tangential force at the pinion:

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

TR-Pinion

Module: $m = 5$
 Number of teeth: $z = 12$
 Pitch diameter \varnothing of pinion: $d = 63.66 \text{ mm}$

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

$$n_{\text{pinion}} = 60000 \cdot \frac{v}{\pi \cdot d} = 60000 \cdot \frac{0.7}{\pi \cdot 63.66} = 210 \text{ min}^{-1}$$

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

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

Conventional Pinion

Module: $m = 5$
 Number of teeth: $z = 36$
 Pitch diameter \varnothing of pinion: $d = 190.99 \text{ mm}$

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

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

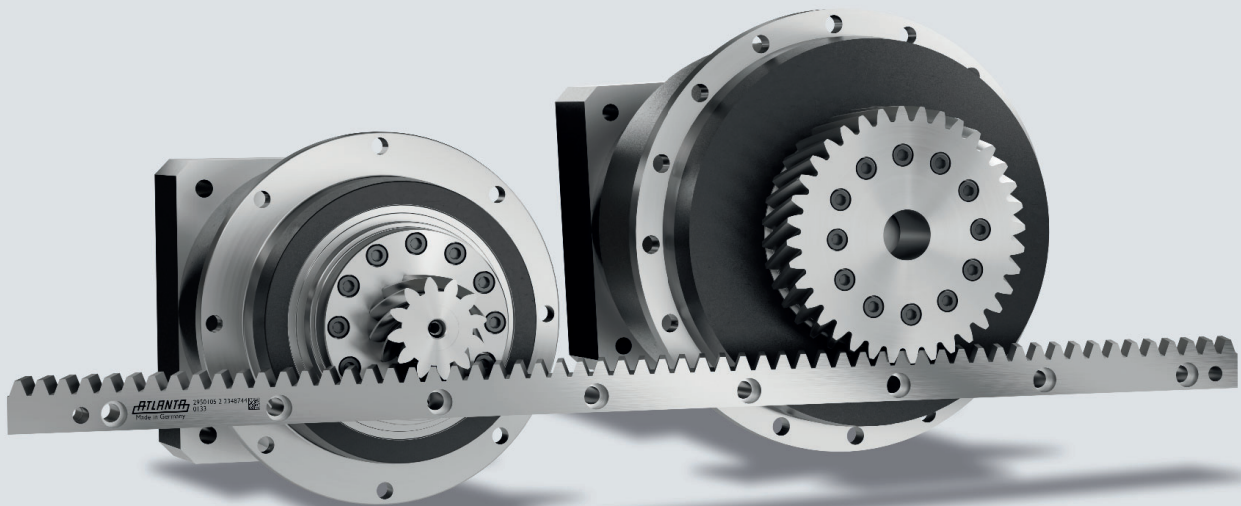
$$T_{2\text{per}} = \frac{T_{2\text{Tab}}}{K_A \cdot S \cdot b_B} = \frac{3300}{1.25 \cdot 1.3 \cdot 1.2} = 1692 \text{ Nm}$$

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

Comparison Results

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

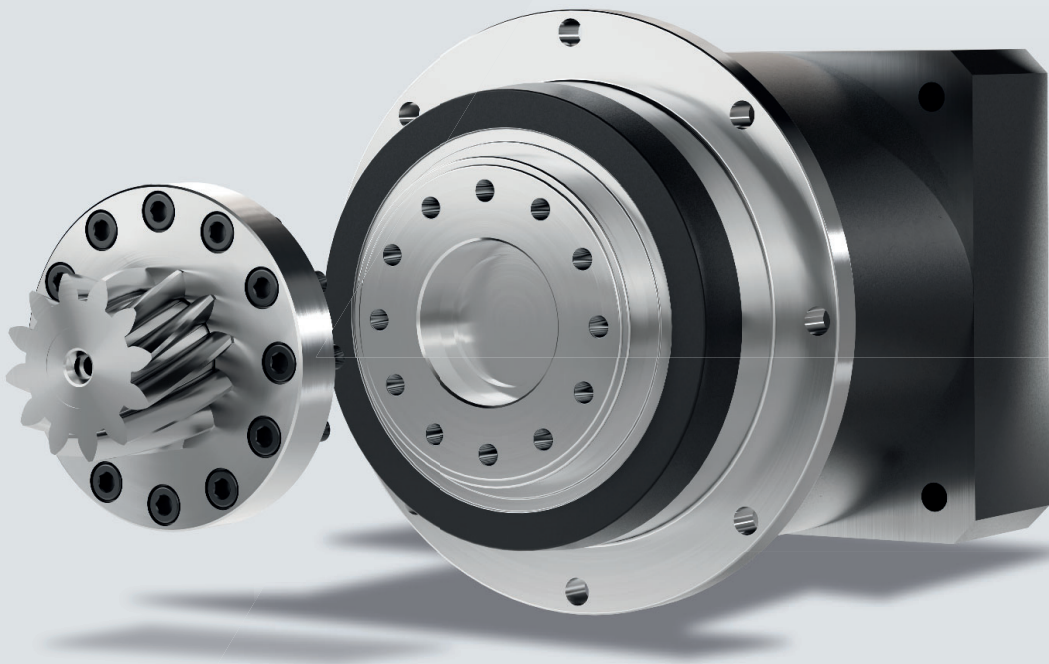
By using a TR-pinion with a smaller pitch diameter, the required torque in this example was reduced by ~66%, allowing a smaller gearbox size to be used and reducing the reduction ratio so only a single stage gearbox is needed.



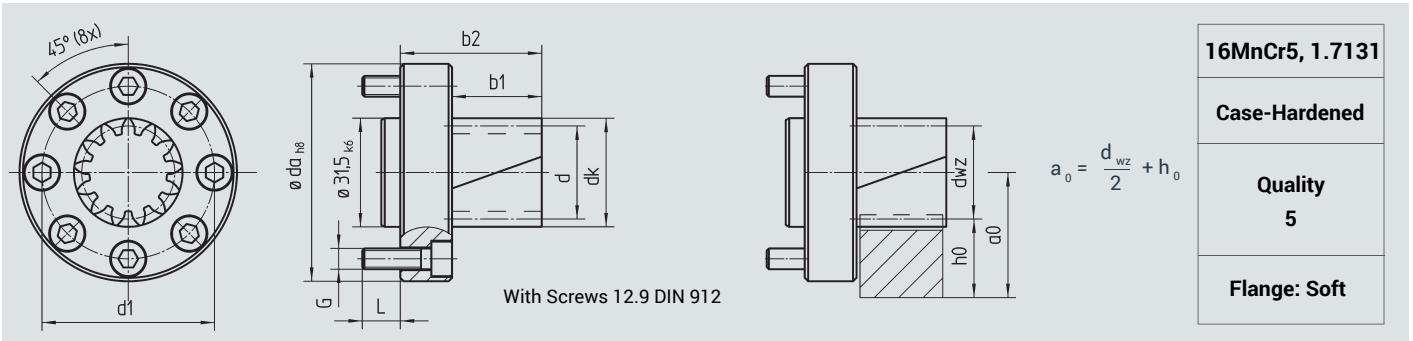
Size Comparison When Using A TR Pinion And A Conventional Pinion

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.

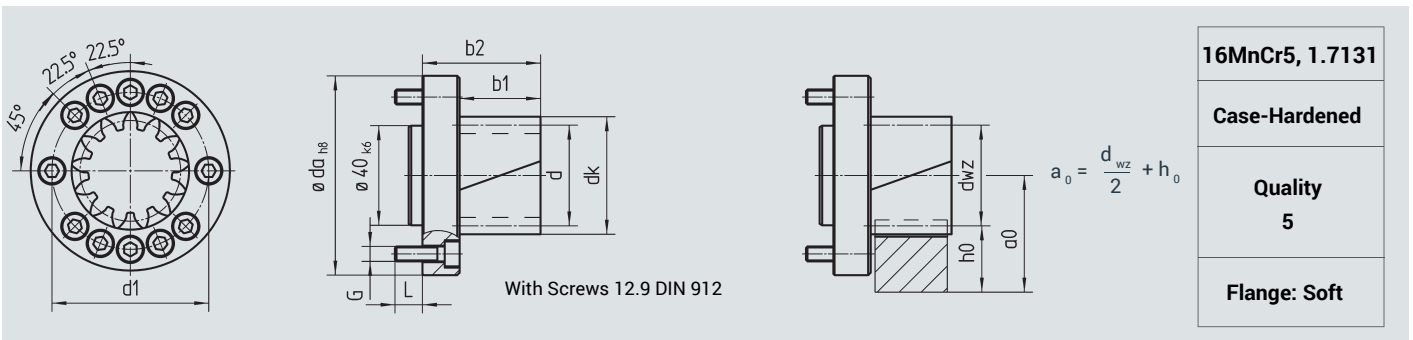


Helical-Tooth Pinion, 19° 31' 42" left-hand, A-50 flange



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

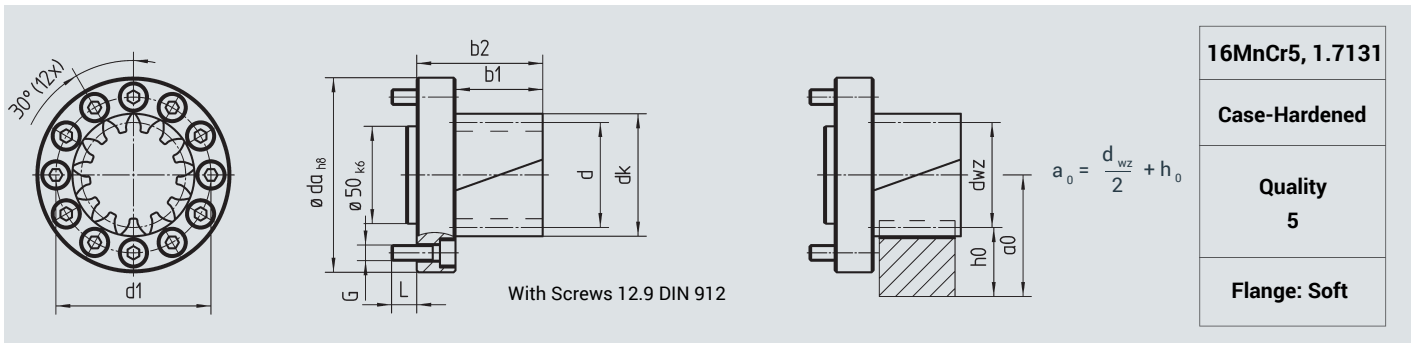
Helical-Tooth Pinion, 19° 31' 42" left-hand, A-63 flange



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.

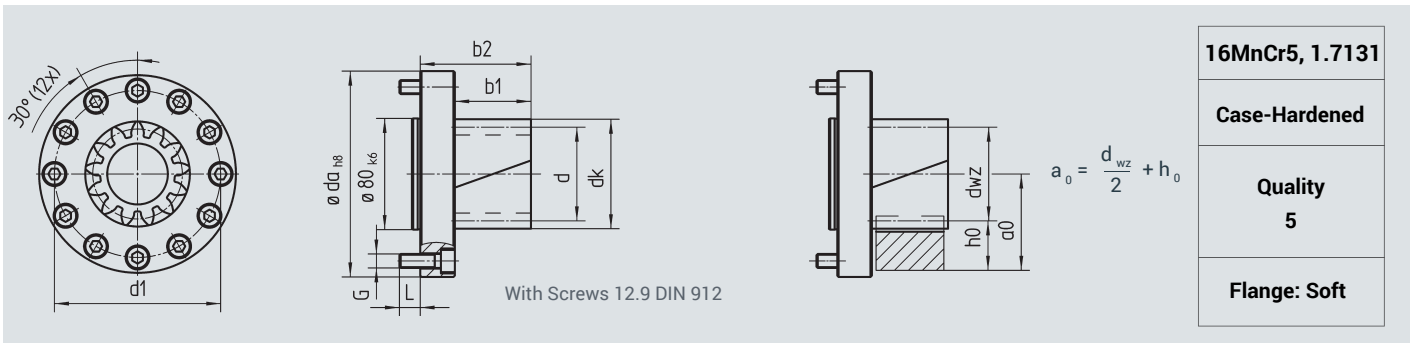
Helical-Tooth Pinion, 19° 31' 42" left-hand, A-80 flange



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

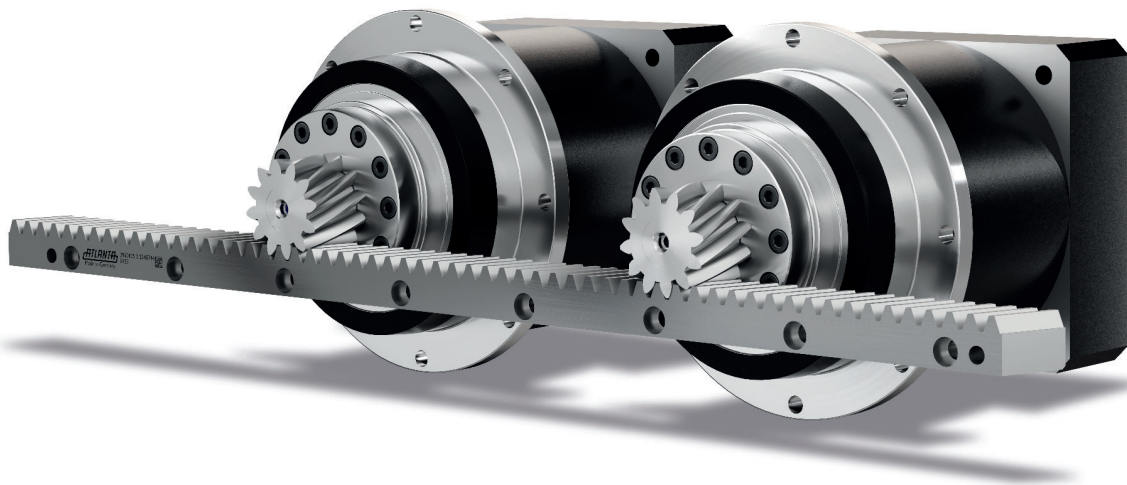
Note: The rack and pinion drive must be installed with backlash present, not pressed into engagement with no backlash! Please refer to the ATLANTA operating manual MPZ 001e.

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



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

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

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

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

With Screws 12.9 DIN 912

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

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

With Screws 12.9 DIN 912

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	b ₁	b ₂	b ₃	d _s	a ₀	ISO Interface	d ₁	G	d _{aH8}	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	b ₁	b ₂	b ₃	d _s	a ₀	ISO Interface	d ₁	G	d _{aH8}	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.