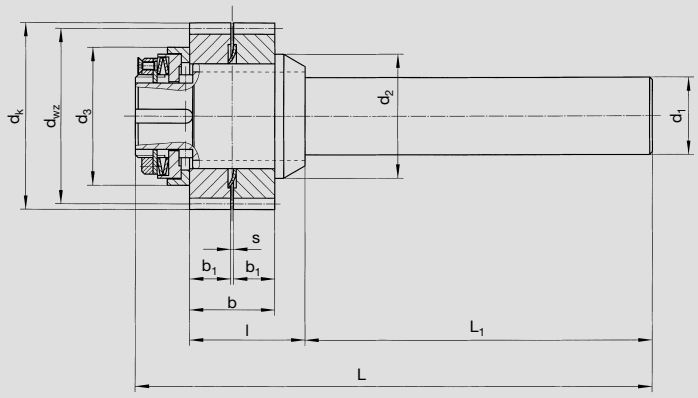
Helical Tooth System, 19°31‘42” left hand, 20° Pressure Angle, Ground Teeth, Tolerance acc. to DIN 3962/63/67



16MnCr5, 1.7131
Case-Hardened
Gearing Grade **7 e 25**

Order Code	Module	Gearbox Size HT	Gearbox Size HP	Shrink-Disk	T_2 (Nm)* without pre-load	$T_{v\,max.}$ (Nm)* with max. pre-load	z No. of teeth	d_{wz}*	d_k	b	b_1	d_{1h6}	d_2	d_3	s	l	L_1	L	kg
74 92 330	**2**		50	80 83 030	135	67	30	63.66	67.7	31	15	25	45	50	1	37.5	114.0	171.5	1.41
74 92 430	**2**	50	63	80 84 036	135	67	30	63.66	67.7	31	15	28	45	50	1	42.0	141.5	203.5	1.75
74 93 320	**3**		50	80 83 030	250	125	20	63.66	69.7	31	15	25	45	50	1	37.5	114.0	171.5	1.45
74 93 420	**3**	50	63	80 84 036	250	125	20	63.66	69.7	31	15	28	45	50	1	42.0	141.5	203.5	1.70
74 93 520	**3**	63	80	80 85 050	250	125	20	63.66	69.7	31	15	36	48	50	1	41.0	170.5	237.5	2.45
74 94 515	**4**	63	80	80 85 050	385	192	15	63.66	71.7	41	20	36	48	50	1	46.0	170.5	237.5	2.50
74 95 615	**5**	80	100	80 86 062	650	325	15	84.58	94.5	52	25	48	57	70	2	57.0	196.5	284.5	5.50
74 96 613	**6**	80	100	80 86 062	975	487	13	82.76	100.7	62	30	48	57	68	2	67.0	196.5	284.5	6.00
74 96 713	**6**	100	125	80 87 080	975	487	13	82.76	100.7	62	30	60	72	68	2	67.0	220.0	308.0	9.00
74 98 712	**8**	100	125	80 87 080	2100	1050	12	109.86	125.8	82	40	60	80	88	2	88.0	220.0	332.0	9.50

* Torques based on using hardened and ground racks.

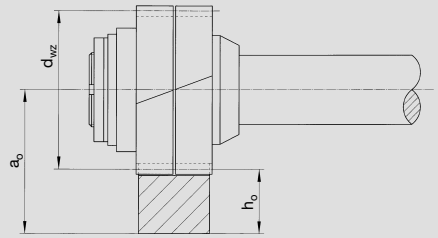
Max. Pre-Load Torque $T_{v\,max.}$

Module	$T_{v\,max.}$	Disk Spring Layers	Tightening of Adjusting Nut
2	67 Nm	single	14 Graduation Marks
3	125 Nm	double	6 Graduation Marks
4	192 Nm	triple	7 Graduation Marks
5	325 Nm	double	3 Graduation Marks
6	487 Nm	double	5 Graduation Marks
8	550 Nm	double	3 Graduation Marks
8	1050 Nm	double	6 Graduation Marks

Note: Stronger pre-load is obtainable by means of multiple spring layers, but then Tv max. has to be smaller. Disk springs can also be ordered separately.

How to adjust the pre-load pinion shaft, see page GG-6.

Calculation of Center Distance “a” between pinion and rack.



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

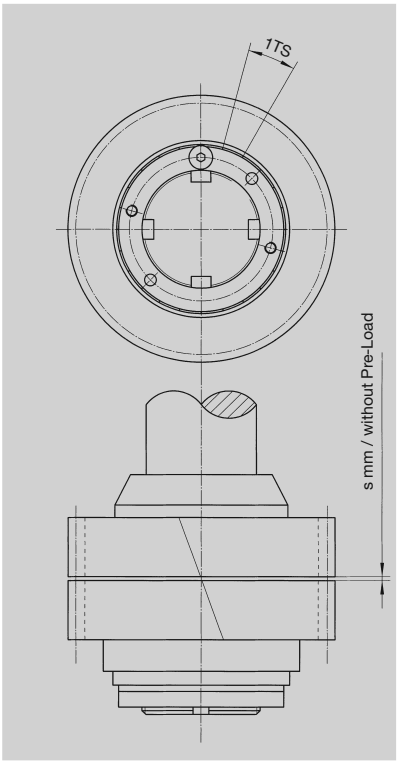
m	a	x	ho
2	53.83	–	22
3	57.83	–	26
4	66.83	–	35
5	76.29	0.5	34
6	87.38	0.5	43
8	125.93	0.5	71

Description of Operation
Pre-load pinion shafts consist of an output shaft, a helical split pinion and a pre-load unit. The split pinion is manufactured as a unit with an axial distance of s = 1 mm (m = 2...4) and s = 2 mm (m = 5...8). By reducing the distance between the pinions (axial displacement of the outer pinion) the backlash is reduced and pre-load initiated when teeth are in mesh with the rack. A defined pre-load torque between rack and split pinion can be produced by means of the pre-load unit.

Adjusting Instructions
The pre-load unit consists of:
- an adjusting nut which is secured against turning by means of a safety washer and a countersunk screw
- a disk spring assembly
- a thrust plate.

The reverse side of the thrust plate is provided with 24 marks at m = 2...4 and 12 at m = 5...8, and the adjusting nut with 4 marks (graduations).

1. Determine the optimal tooth contact with non-preloaded split-pinion shaft. For this purpose mount the pinion shaft with gap „s“ (see above).
2. The backlash between rack and split pinion should be < 0.1 mm.
3. Tighten the adjusting nut (loosen the countersunk screw) until no backlash remains. The two flanks of the split pinion should be in mutual contact. This can be checked by scanning the tooth flanks with a dial indicator.
4. The specified degree of pre-load (T_V) can be produced by turning the adjusting nut by a definite number of graduation marks (TS) (see adjusting diagram).



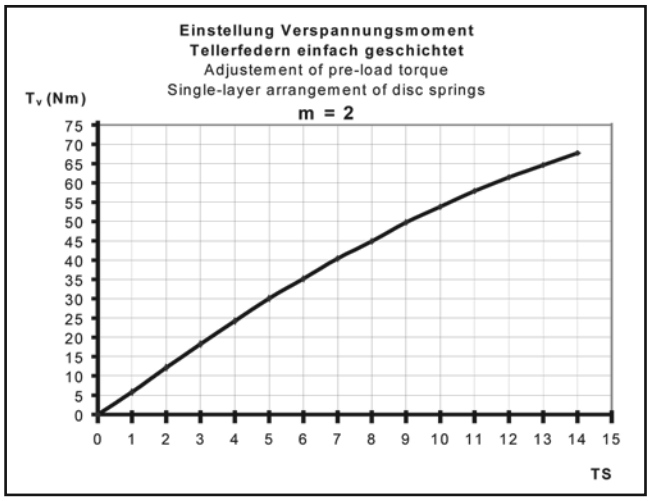
The pre-load torque „T_V“ is the torque which ensures backlash-free positioning of the rack and pinion drive. The transmissible torque outside the positioning points „$T_{2max.}$“ can be determined according to the following formula:

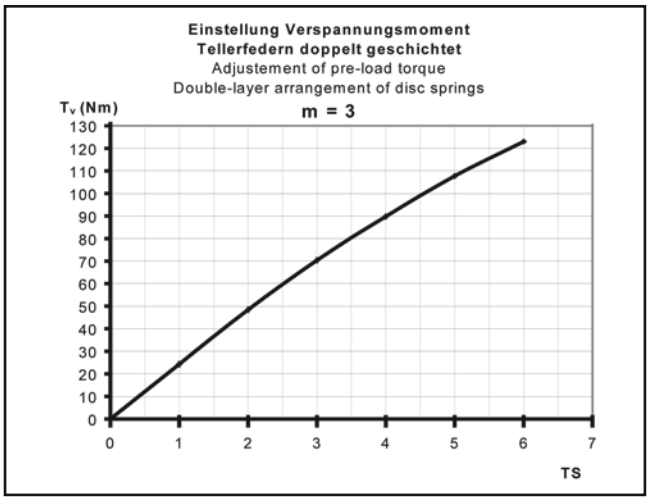
$$\mathbf{T_{2max.} = T_2 - T_v}$$

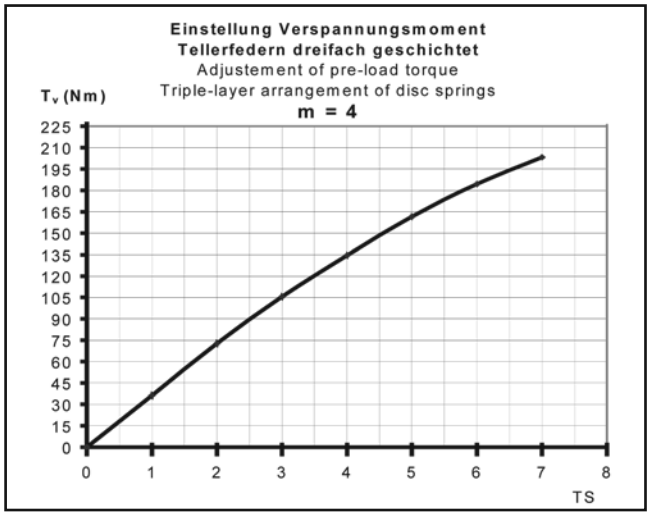
If: $T_{v\,max.} = T_{2\,max.}$ the drive is free from play throughout the travelling distance.

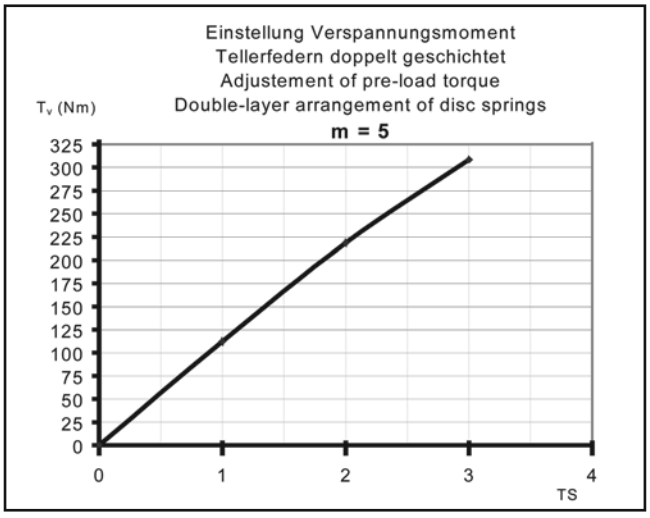
Attention: The pre-load is adjusted in assembled condition; therefore the front side of the pinion shaft must be accessible.
To adjust the pre-load, we recommend our adjusting wrench (page GG-8).

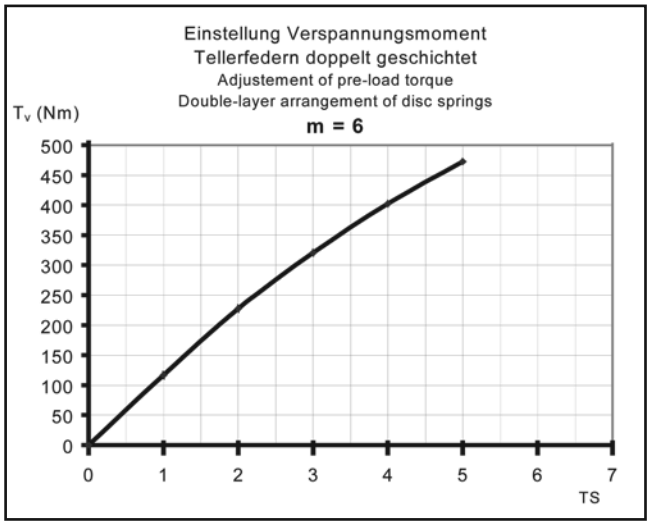
Lubrication Recommendations
Felt gearwheel or sliding brush with grease supply by means of an electronically controlled lubricator. Due to the elasticity of the teeth, the felt gearwheels can be used even with maximum backlash compensation.
Lubricants see Servo-Catalog page ZE-2 to ZE-9.

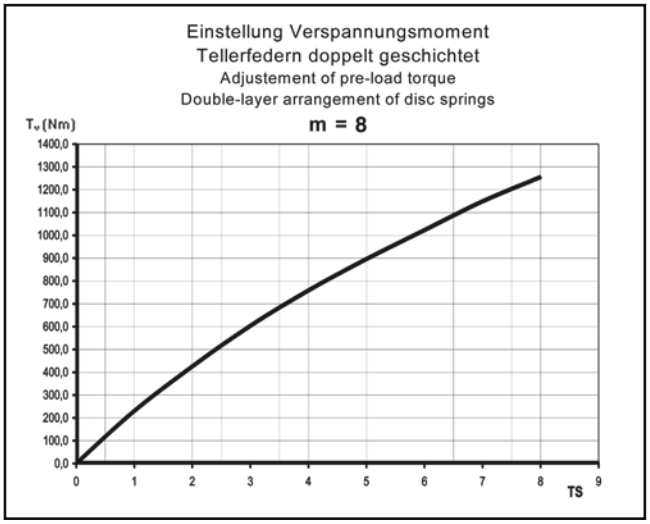

Einstellung Verspannungsmoment
Tellerfedern einfach geschichtet
Adjustement of pre-load torque
Single-layer arrangement of disc springs
Tv (Nm)
m = 2
75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TS

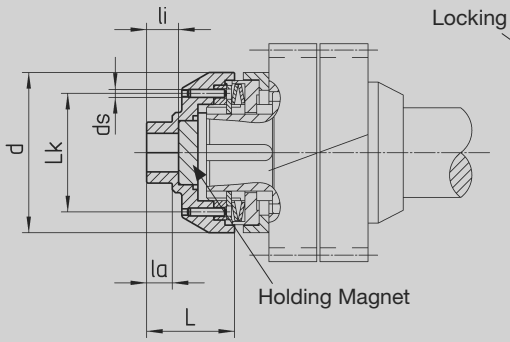

Einstellung Verspannungsmoment
Tellerfedern doppelt geschichtet
Adjustement of pre-load torque
Double-layer arrangement of disc springs
Tv (Nm)
m = 3
130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 1 2 3 4 5 6 7
TS

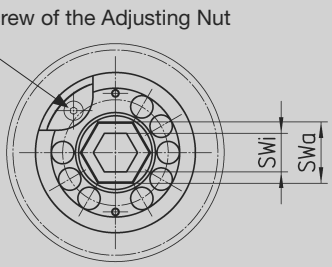

Einstellung Verspannungsmoment
Tellerfedern dreifach geschichtet
Adjustement of pre-load torque
Triple-layer arrangement of disc springs
Tv (Nm)
m = 4
225 210 195 180 165 150 135 120 105 90 75 60 45 30 15 0
0 1 2 3 4 5 6 7 8
TS


Einstellung Verspannungsmoment
Tellerfedern doppelt geschichtet
Adjustement of pre-load torque
Double-layer arrangement of disc springs
Tv (Nm)
m = 5
325 300 275 250 225 200 175 150 125 100 75 50 25 0
0 1 2 3 4
TS


Einstellung Verspannungsmoment
Tellerfedern doppelt geschichtet
Adjustement of pre-load torque
Double-layer arrangement of disc springs
Tv (Nm)
m = 6
500 450 400 350 300 250 200 150 100 50 0
0 1 2 3 4 5 6 7
TS


Einstellung Verspannungsmoment
Tellerfedern doppelt geschichtet
Adjustement of pre-load torque
Double-layer arrangement of disc springs
Tv (Nm)
m = 8
1400,0 1300,0 1200,0 1100,0 1000,0 900,0 800,0 700,0 600,0 500,0 400,0 300,0 200,0 100,0 0,0
0 1 2 3 4 5 6 7 8 9
TS





Steel

Order Code	Pre-Load $T_{2\ max}$ Pinion Shafts	SWa	la	SWi	li	ds	Lk	d	L	kg
74 90 001	**74 92 330** **74 92 430** **74 93 320** **74 93 420** **74 93 520** **74 94 515**	19	8	12	10.0	2.5	37	50	27.5	0.113
74 90 002	**74 95 615** **74 96 613** **74 96 713**	19	8	12	12.5	4.0	50	74	34.0	0.338
74 90 003	**74 98 612** **74 98 712**	22	9	12	13.0	6.0	67	96	40.0	0.625

Attention:

Apply the adjusting wrench by hand.

Be careful to position the adjusting wrench correctly in relation to the locking screw.

Pins must engage the adjusting nut (do not tap).

The holding magnet holds the adjusting wrench in position.

Loosen the locking screw by the adjusting nut.

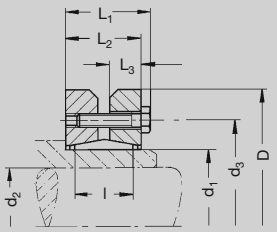
Mind the functional characteristics and adjusting instructions for making the adjustment.

Use the Allen wrench with width over flats SWi or the fork wrench with width over flats SWa for turning the adjusting wrench.

Tighten the locking screw by the adjusting nut.

For Output Drive Shafts of Gear Series HT, HP, E, B, BG and Gearwheels with Ground Teeth

Supplied as
Complete Set



$$J_{red} = \frac{J}{i^2}$$

Order Code	$T_{2\,max}$ (Nm)	d_2	d_1	d_3	D	L_1	L_2	L_3	l	G	Screw Torque (Nm)	J 10^{-4} kg m²	kg
80 83 030	400	25	30	44	60.2	25.0	21.5	9.00	18.0	7 x M5	4	1.756	0.3
	200	19											
	130	16											
80 84 036	540	28	36	52	72.2	27.5	23.5	10.00	22.0	5 x M6	12	4.029	0.4
	270	22											
80 80 044	870	33	44	61	80.2	29.5	25.5	11.00	22.0	7 x M6	12	6.524	0.6
	810	32											
	490	25											
80 85 050	1350	38	50	72	90.2	31.5	27.5	12.00	22.0	9 x M6	12	11.322	0.8
	1180	36											
	870	32											
	730	30											
80 80 055	1480	44	55	75	100.2	34.5	30.5	13.00	23.0	8 x M6	12	18.729	1.1
	810	35											
	630	32											
80 86 062	2300	48	62	89	110.2	34.5	30.5	13.00	22.0	10 x M6	12	27.137	1.3
	1420	40											
80 80 068	1940	50	68	86	115.2	34.5	30.5	13.00	22.0	10 x M6	12	31.648	1.4
	1490	45											
80 87 080	3240	60	80	100	145.3	38.0	32.5	14.00	22.0	7 x M8	30	88.870	1.9
	2580	55											
80 80 110	7710	75	110	145	185.2	57.0	50.0	22.00	39.0	9 x M10	59	351.503	5.9
80 80 125	11080	85	125	160	215.3	61.0	54.6	23.00	42.0	12 x M10	59	664.000	8.3
80 81 024	270	20	24	36	50.2	23.0	19.5	7.60	14.0	5 x M5	5	0.780	0.2
80 83 130	280	25	30	44	60.2	21.5	18.0	7.25	14.0	7 x M6	12	1.756	0.3
80 84 136	430	28	36	52	72.2	25.5	21.5	9.10	17.5	5 x M6	12	4.029	0.4
80 85 150	950	36	50	70	90.2	28.0	24.0	10.25	22.0	9 x M6	12	11.322	0.8

Description
The series 24 cylindrical gears (pages ZA-24 to ZA-27 and ZB-21 to ZB-27) can be fitted on shafts (tolerance h7) either with key or with shrink plate fitting proceed as follows:

Mounting
Slide shrink plate onto cylindrical gear hub (do not tighten the screws before). Push the cylindrical gear on the shaft up to a stop or the desired position. Now make the transverse pressure connection by uniformly tightening the clamping bolts. Tighten the bolts on after the other in several passes to the correct torque specified in the table (do not tighten crosswise). Check the torque with an indicating torque wrench.