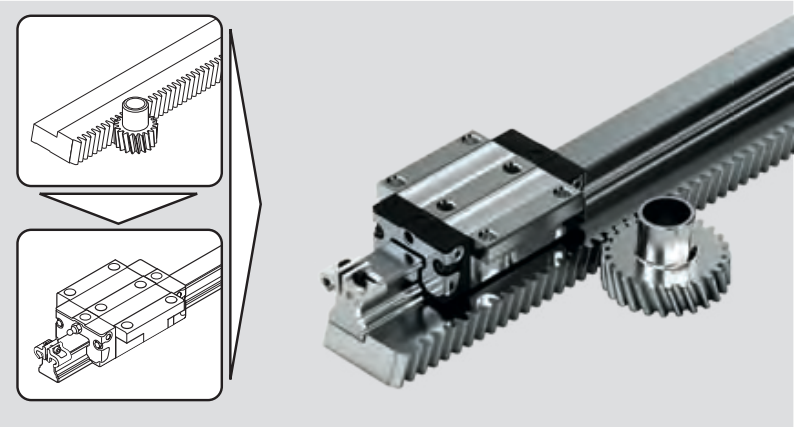
Accessories, Rack and Pinion Drive

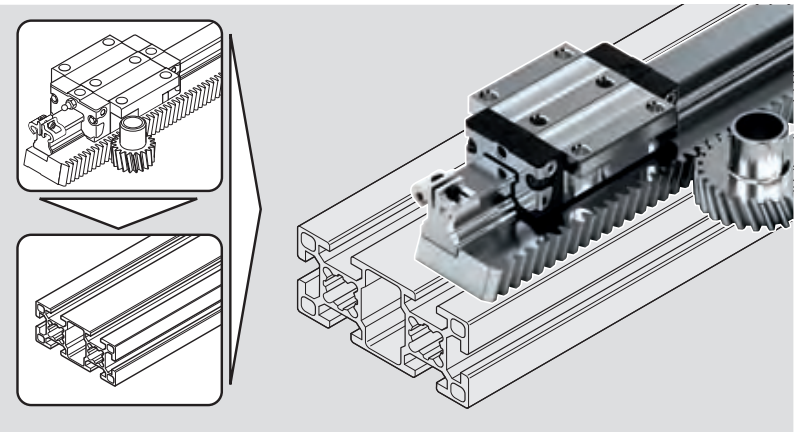
Product Description, Accessories, Rack and Pinion Drive

Gear racks with helical teeth for all ball guide rails SNS, for mounting from above, in sizes 25, 30 and 35.

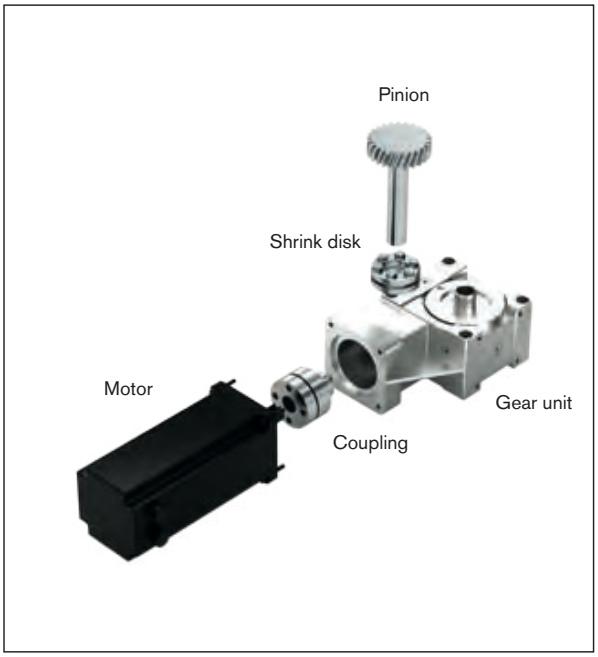
Combination of gear rack with pinion drive and Ball Rail Systems (see application examples).

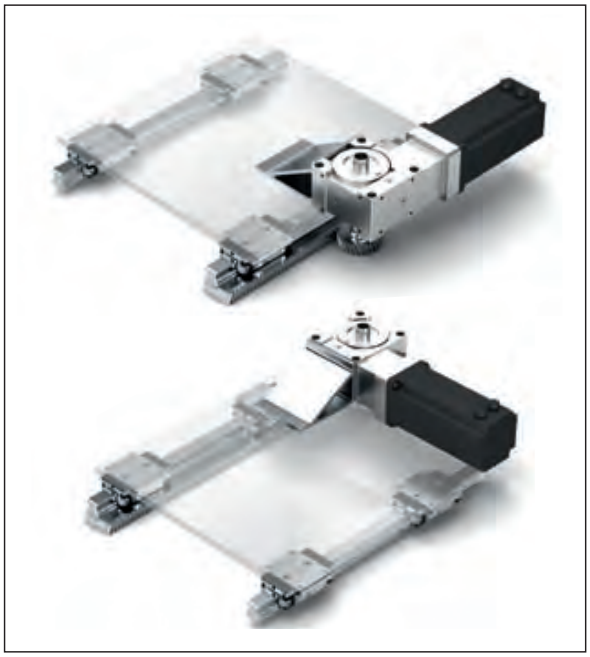


The ball rail system and gear rack can be mounted on profile framing system elements.



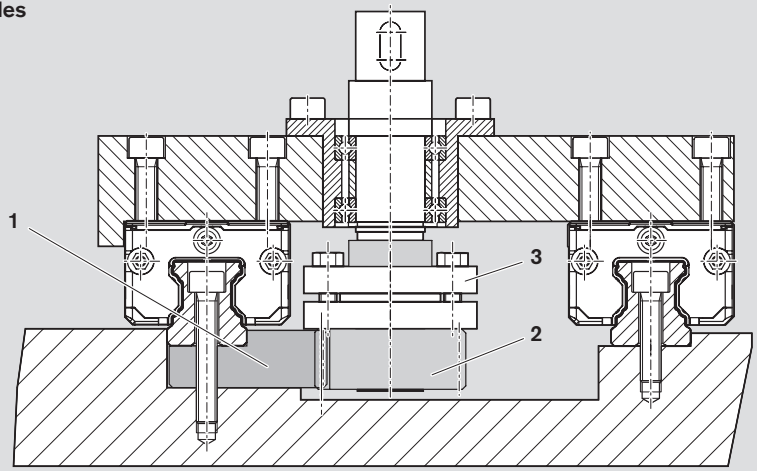
Only gear racks and ball rail systems of the same size can be combined.

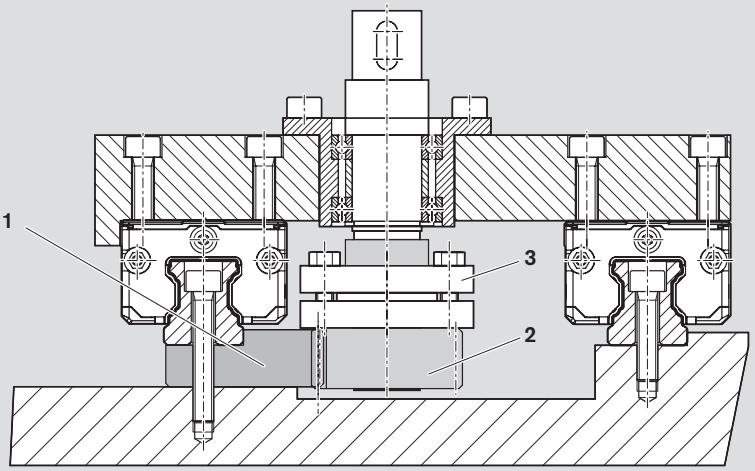


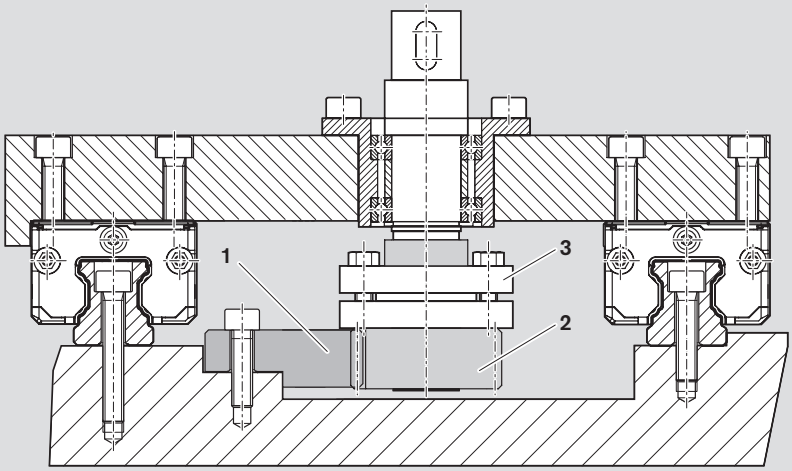


Application examples

1 Gear rack
2 Pinion
3 Shrink disk







Accessories, Rack and Pinion Drive

Combination Options

Normal module	Gear rack			Pinion		Shrink disk	
m_n (-)	Size	Length (mm)	Part number	Version	Part number	Part number	
1.5	25	1200	R2050 213 02	z = 20 d_B = 24	R2051 253 01	R3454 011 35 d_1 = 24	
		600	R2050 214 02	z = 25 d_B = 24	R2051 254 01		
		300	R2050 215 02	z = 25 d_S = 25	R2051 274 01	R3454 010 89 d_1 = 30	
3	30	1200	R2050 713 02	z = 20 d_B = 36	R2051 353 01	R3454 010 90 d_1 = 36	
		640	R2050 714 02	z = 25 d_B = 36	R2051 354 01		
		320	R2050 715 02	z = 25 d_S = 28	R2051 374 01		
	35	1200	R2050 313 02				
		640	R2050 314 02				
		320	R2050 315 02				

d_B = collar diameter (mm) d_1 = shrink disk (mm)
d_S = pinion shaft diameter (mm) z = number of teeth (–)
d_W = shaft diameter (mm)

	Gear unit			Coupling	Motor
	Center distance a_0 (mm)	Gear ratio i (-)	Part number	Part number	Part number
			Customer attachments e.g. shafts, bearings, side drive timing belts, gear unit, motor		
	$a_0 = 50$	i = 4.75	R3454 040 14	R3454 001 08 $d_w = 19$	R3471 095 03 MSK 061
		i = 6.75	R3454 040 04		
		i = 9.25	R3454 040 05		
		i = 14.5	R3454 040 06		
		i = 19.5	R3454 040 07		
		i = 39.0	R3454 040 08		
			Customer attachments e.g. shafts, bearings, side drive timing belts, gear unit, motor		
	$a_0 = 63$	i = 4.75	R3454 040 16	R3454 001 07 $d_w = 19$	R3471 095 03 MSK 061
		i = 6.75	R3454 040 17		
		i = 9.25	R3454 040 18		
		i = 14.5	R3454 040 19		
		i = 19.5	R3454 040 20		
		i = 39.0	R3454 040 21		
	$a_0 = 63$	i = 4.75	R3454 040 15	R3454 001 09 $d_w = 24$	R3471 093 03 MSK 076
		i = 6.75	R3454 040 09		
		i = 9.25	R3454 040 10		
		i = 14.5	R3454 040 11		
		i = 19.5	R3454 040 12		
		i = 39.0	R3454 040 13		

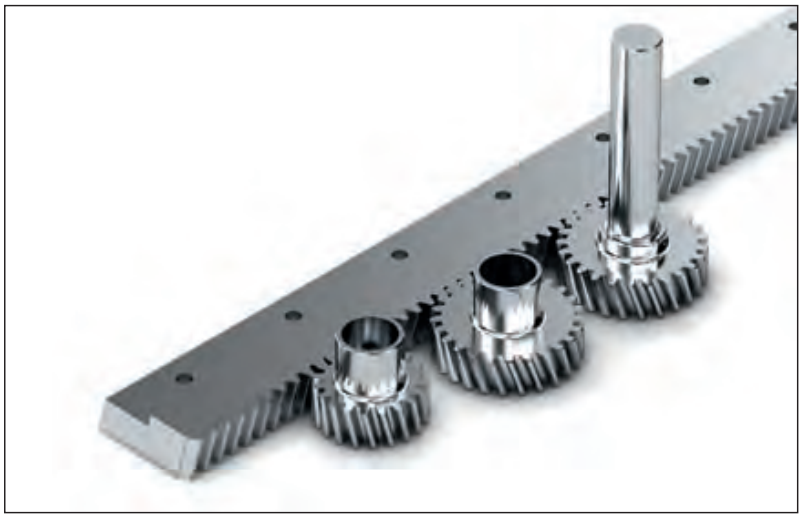
Accessories, Rack and Pinion Drive

Gear Rack with Helical Teeth

Gear Rack with Helical Teeth
- Induction hardened (HRC 54±2)
- Ground teeth, mating surface and flat surfaces
- Toothing quality grade 6h25

Pinion with helical teeth, with bore and collar
- Hardened teeth (HRC 58±2)
- Ground teeth, bore and collar
- Toothing quality grade 6h24

Pinion with helical teeth, with shaft
- Case hardened (HRC 58±2) on all sides
- Ground teeth and shaft
- Toothing quality grade 6h24



Gear rack with helical teeth

Size	Part number	Dimensions (mm)													Weight
		L	m_t	H_1	H_2	T	T_1	p_t	B_1	(B_2)	B_3	B_4	B_5	S_5	(kg)
25	R2050 213 02	1200	1.59	12	16.5	60	30	5	11.5	22.40	21.60	23.10	45.5	7	5.86
25	R2050 214 02	600	1.59	12	16.5	60	30	5	11.5	22.40	21.60	23.10	45.5	7	2.93
25	R2050 215 02	300	1.59	12	16.5	60	30	5	11.5	22.40	21.60	23.10	45.5	7	1.47
30	R2050 713 02	1200	3.18	14	19.0	80	40	10	14.0	27.50	22.47	25.47	53.0	9	7.53
30	R2050 714 02	640	3.18	14	19.0	80	40	10	14.0	27.50	22.47	25.47	53.0	9	4.02
30	R2050 715 02	320	3.18	14	19.0	80	40	10	14.0	27.50	22.47	25.47	53.0	9	2.00
35	R2050 313 02	1200	3.18	16	22.0	80	40	10	17.0	33.15	30.85	33.85	67.0	9	11.25
35	R2050 314 02	640	3.18	16	22.0	80	40	10	17.0	33.15	30.85	33.85	67.0	9	6.00
35	R2050 315 02	320	3.18	16	22.0	80	40	10	17.0	33.15	30.85	33.85	67.0	9	3.00

Pinion with helical teeth, with bore and collar
Module $m_t = 1.59$ mm for gear rack size 25, $m_n = 1.5$

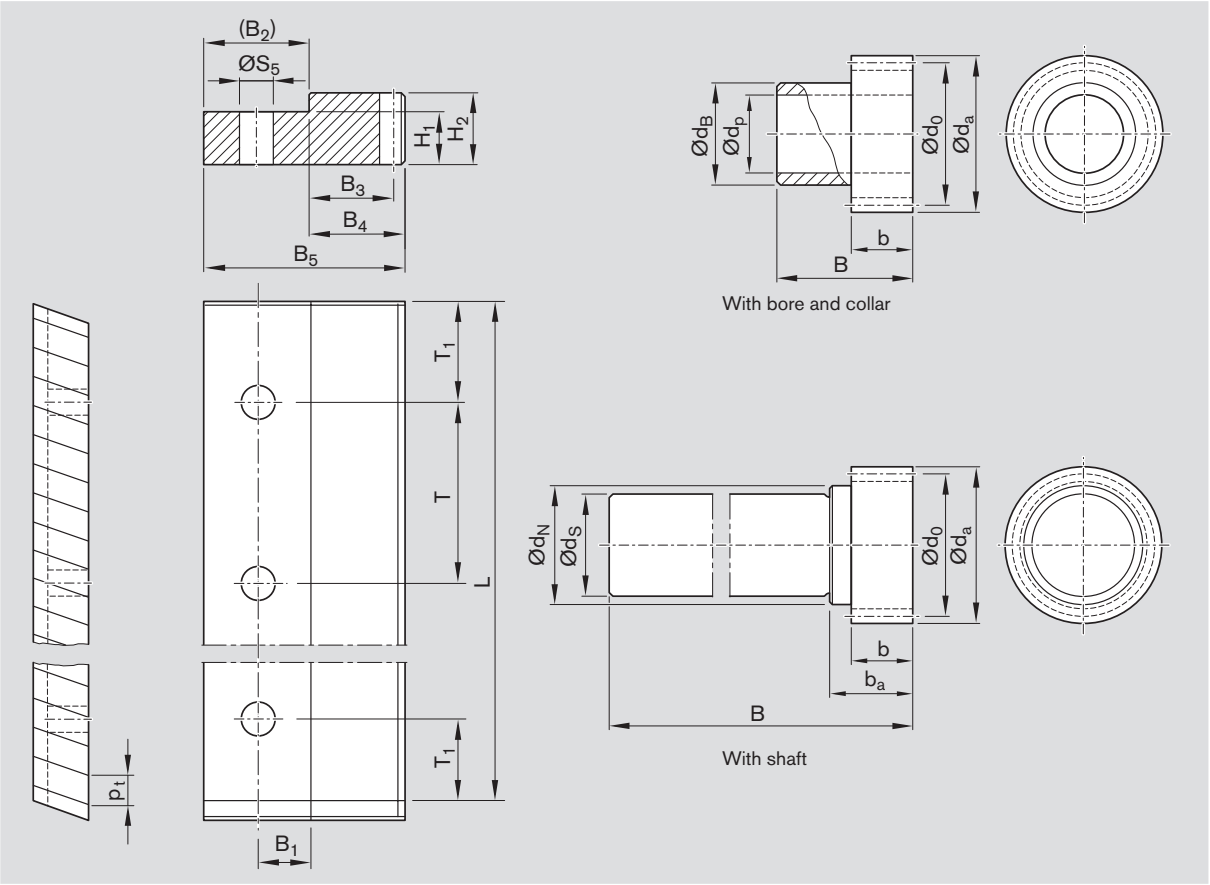
Number of teeth	Part number	Dimensions (mm)							J_p	Weight
		p_t	d_a	d_0	b	B	d_p H6	d_B h8	(10^{-5} kgm^2)	(kg)
20	R2051 253 01	5	34.8	31.831	17.5	43	19	24	1.605	0.103
25	R2051 254 01	5	42.8	39.789	17.5	43	19	24	3.601	0.164

Module $m_t = 3.18$ mm for gear rack size 30 - 35, $m_n = 3$

Number of teeth	Part number	Dimensions (mm)							J_p	Weight
		p_t	d_a	d_0	b	B	d_p H6	d_B h8	(10^{-5} kgm^2)	(kg)
20	R2051 353 01	10	69.7	63.662	23	55	30	36	2.982	0.539
25	R2051 354 01	10	85.6	79.578	23	55	30	36	7.179	0.860

Customer drive shaft for pinion version with bore and collar combined with shrink disks.

⚠ **For safe torque transmission, the clearance between the customer shaft and the bore must not be more than 0.017 mm. The shaft must be manufactured with a tolerance of j6.**



Pinion with helical teeth with shaft for worm gear unit

Module $m_t = 1.59$ mm for gear rack size 25, $m_n = 1.5$

Number of teeth	Part number	Dimensions (mm)								J_p	Weight
		p_t	d_a	d_0	b	b_a	d_S j6	B	d_N	(10^{-5} kgm^2)	(kg)
25	R2051 274 01	5	42.8	39.789	17.5	25	25	130	32	7.147	0.622

Module $m_t = 3.18$ mm for gear rack size 30 - 35, $m_n = 3$

Number of teeth	Part number	Dimensions (mm)								J_p	Weight
		p_t	d_a	d_0	b	b_a	d_S j6	B	d_N	(10^{-5} kgm^2)	(kg)
25	R2051 374 01	10	85.6	79.587	23	33	28	160	38	7.871	1.598

Number of teeth	Maximum transmittable torques M_{max} (Nm)		
	Module 1.59 mm Gear rack size 25 $P_t = 5$	Module 3.18 mm Gear rack size 30 $P_t = 10$	Module 3.18 mm Gear rack size 35 $P_t = 10$
20	56	270	320
25	70	330	380

m_t = transverse module
m_n = normal module
p_t = pitch
d_0 = nominal diameter of pinion
J_p = mass moment of inertia of gear wheel

Accessories, Rack and Pinion Drive

High-Performance Servo Gear Units with Adjustable Backlash

These high performance worm gears have been specially developed for use with the latest AC and DC servo motors.

Typical features of these high-performance gear units are:
- Adjustable low-backlash gearing (backlash < 2')
- Up to 70% higher load capacities
- Casing of light metal for optimal heat dissipation
- Robust tapered-roller bearings of the hollow drive output shaft permitting greater additional forces

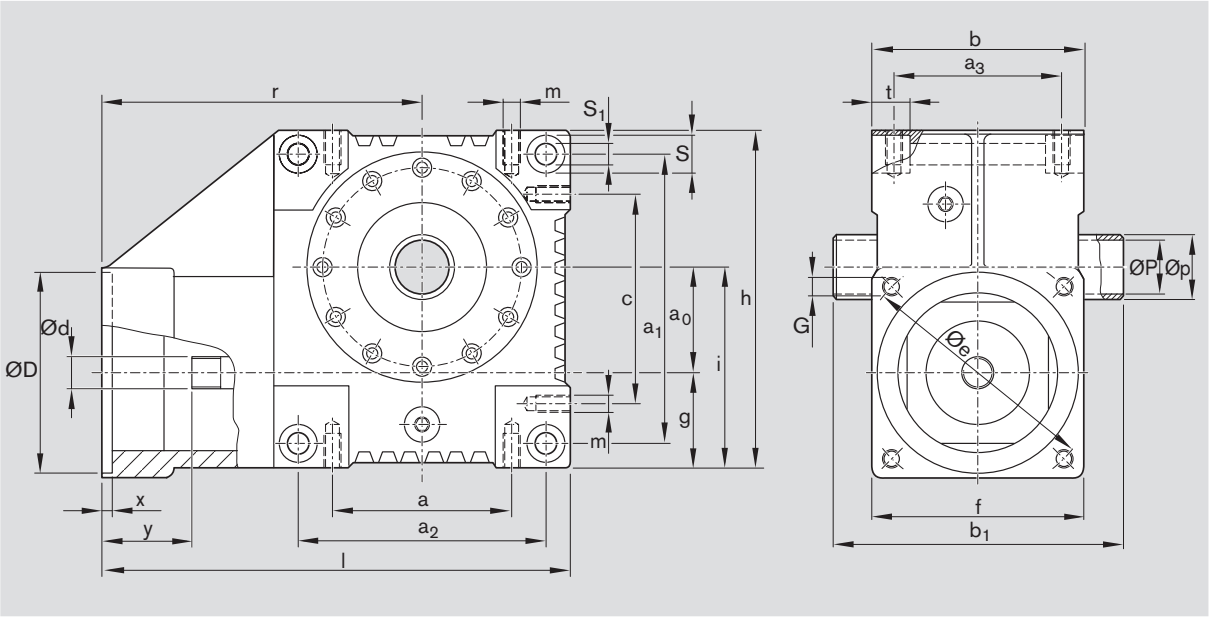
The tooth shape has been optimized to allow easy adjustment of the gear backlash by simply changing the center distance using eccentric flanges. The use of ground, right-hand worms, a worm gear made from special worm-gear bronze, and dip-feed lubrication (special synthetic oil) ensures a high degree of efficiency, smooth running in both directions of rotation, and a long service life. The casing is machined on all sides. Its many fixing bores and tapped holes permit mounting in any position.

The demand for an absolutely force-locking and virtually torsion free connection between the gear unit and the output shaft, especially in intermittent operation, is met by a new gear version designed for shrink disk fastening of the output shaft.

A special coupling ensures backlash-free power transmission from the drive motor to the servo gear. On the gear side, internal gearing meshes with the crowned splines of the drive shaft. On the motor side the smooth drive shaft is rigidly clamped by annular spring elements.

Gear ratio i	Center distance a_0 = 50 mm for servo motor MSK 061		Center distance a_0 = 63 mm for servo motor MSK 061		for servo motor MSK 076	
	Part number	J_{ge} (10^{-4} kgm^2)	Part number	J_{ge} (10^{-4} kgm^2)	Part number	J_{ge} (10^{-4} kgm^2)
4.75	R3454 040 14	0.4830	R3454 040 16	1.8560	R3454 040 15	1.8560
6.75	R3454 040 04	0.4140	R3454 040 17	1.3720	R3454 040 09	1.3720
9.25	R3454 040 05	0.3490	R3454 040 18	0.9825	R3454 040 10	0.9825
14.50	R3454 040 06	0.2800	R3454 040 19	0.9590	R3454 040 11	0.9590
19.50	R3454 040 07	0.1960	R3454 040 20	0.6940	R3454 040 12	0.6940
39.00	R3454 040 08	0.2310	R3454 040 21	1.0100	R3454 040 13	1.0100

J_{ge} = mass moment of inertia of gear



Center distance a_0 (mm)	Motor	Dimensions (mm) a	a_1	a_2	a_3	b	b_1	c	d h8	D G7	e	f	g	G
50 ±0.12	MSK 061	85	138	118	80	100	137	100	14.7	95	130	115	45	M8
63 ±0.2	MSK 061	110	175	145	105	130	168	125	24.7	95	130	115	52	M8
63 ±0.2	MSK 076	110	175	145	105	130	168	125	24.7	110	165	140	52	M10

Center distance a_0 (mm)	Motor	Dimensions (mm) h	i	l	m	p H6	P h8	r	S	S_1	t	x	y	Weight (kg)
50 ±0.12	MSK 061	160	95	238	M8x16	30	25	168	18	10	16	5	58	8.0
63 ±0.2	MSK 061	195	115	265	M10x15	36	28	180	18	11	25	5	48	12.0
63 ±0.2	MSK 076	195	115	270	M10x15	36	28	185	18	11	25	5	53	12.5

Accessories, Rack and Pinion Drive

High-Performance Servo Gear Units with Adjustable Backlash

Selection and load tables for high-performance servo gear units

The values in the table are based upon wear or maximum flank load at 12,000 h full load and on servo operation. With continuous full-load operation it may be necessary to consider temperature limits! (If in doubt, please consult us.)
Gearing efficiency ☞ 229

Drive power and transmitted torque

			For drive speed n_1													
			500 (min^{-1})		750 (min^{-1})		1000 (min^{-1})		1500 (min^{-1})		3000 (min^{-1})		4000 (min^{-1})		5000 (min^{-1})	
a_0	i	M_p	P_a	M_{te}	P_a	M_{te}	P_a	M_{te}	P_a	M_{te}	P_a	M_{te}	P_a	M_{te}	P_a	M_{te}
(mm)	(-)	(Nm)	(kW)	(Nm)	(kW)	(Nm)	(kW)	(Nm)	(kW)	(Nm)	(kW)	(Nm)	(kW)	(Nm)	(kW)	(Nm)
50	4.75	550	0.81	65	1.20	65	1.70	70	2.52	70	5.00	70	6.20	65	7.30	61
	6.75	400	0.50	56	0.77	59	1.10	63	1.75	69	3.50	69	4.40	65	5.20	61
	9.25	275	0.32	48	0.50	51	0.70	54	1.10	58	2.55	70	3.55	70	4.10	65
	14.50	350	0.26	57	0.40	60	0.50	65	0.89	70	1.82	75	2.50	75	3.15	75
	19.50	250	0.16	45	0.25	48	0.34	50	0.55	55	1.20	65	1.65	65	2.10	65
	39.00	200	0.12	53	0.17	56	0.24	60	0.37	65	0.77	75	1.00	75	1.25	75
63	4.75	1000	2.10	170	3.30	180	4.40	180	6.11	170	10.30	145	13.20	135	–	–
	6.75	750	1.50	170	2.35	180	3.10	180	4.25	170	7.20	145	9.30	135	–	–
	9.25	500	0.74	115	1.18	125	1.63	130	2.52	135	4.93	135	6.35	126	–	–
	14.50	600	0.74	165	1.19	180	1.54	180	2.45	180	4.18	170	5.25	160	–	–
	19.50	500	0.39	115	0.61	125	0.85	130	1.28	135	2.98	165	3.83	155	–	–
	39.00	450	0.30	140	0.44	150	0.61	160	0.97	175	1.88	190	2.55	190	–	–

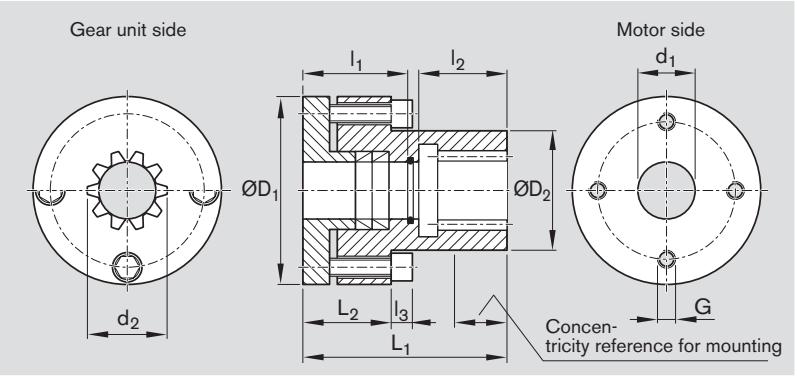
a_0 = center distance
i = gear ratio
M_p = maximum permissible drive torque
P_a = drive power
M_{te} = transmitted torque

Special couplings for motor/gear units

Rigid model, nitrided, pre-assembled for motor shafts without key

Bore on gear unit side, low-clearance internal spline similar to DIN 5480 for push-fitting

Bore on motor side with annular spring elements as clamping connection

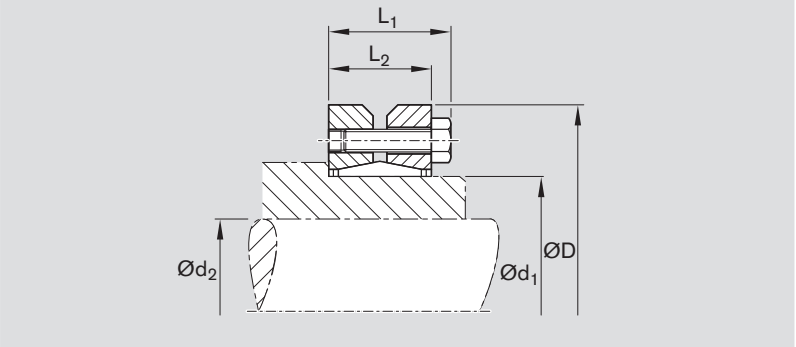


Part number	Dimensions (mm)										J_c	M_A	Weight
	d_1	d_2	D_1	D_2	l_1	l_2	l_3	L_1	L_2	G	(10^{-4} kgm^2)	(Nm)	(kg)
R3454 001 08	19	15x1.25x10	48	29	24.0	16	5	40.0	18.0	4 x M5	0.799	7	0.40
R3454 001 07	19	15x1.25x10	48	29	23.0	17	5	55.0	18.0	4 x M5	0.853	7	0.45
R3454 001 09	24	25x1.25x18	50	29	41.5	24	6	66.5	59.5	4 x M6	2.628	10	0.75

J_c = mass moment of inertia, coupling
M_A = tightening torque

Shrink disk clamping kits for output shafts

Supplied as complete kits



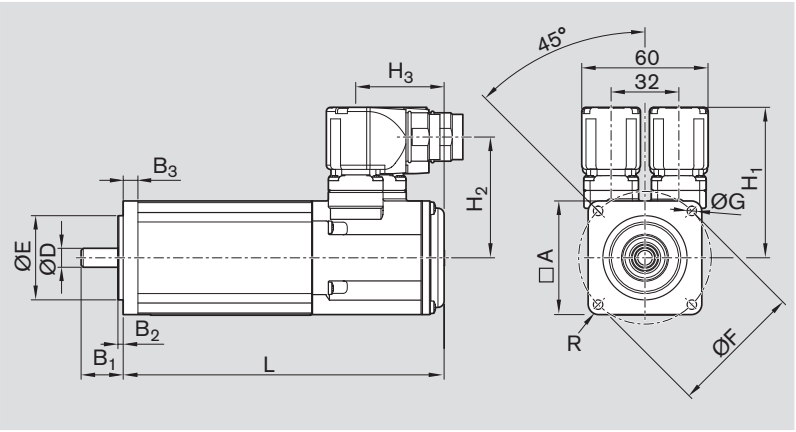
Part number	Dimensions (mm)						J_{sr}	M_A	Weight
	d_1	d_2	D	L_1	L_2	G	(10^{-4} kgm²)	(Nm)	(kg)
R3454 011 35	24	19	50	25.7	21.1	6xM5	1.756	5	0.20
R3454 010 89	30	25	60	26.8	23.3	7xM5	1.756	5	0.30
R3454 010 90	36	30	72	29.3	24.9	5xM6	4.029	12	0.40

J_{sr} = mass moment of inertia of shrink disk
M_A = tightening torque

AC Servo Motors MSK

Note

- All MSK motors have an absolute multiturn encoder.
- The motors can be supplied complete with controller and control unit. For more detailed information on motors and control systems, please refer to the catalogs “ECODRIVE Cs” and “IndraDrive for Linear Motion Systems.”



	Dimensions (mm)												
	A	B_1	B_2	B_3	ØD k6	ØE j6	ØF	ØG	H_1	H_2	H_3	L with brake	R
MSK 061C	116	40	3	9.5	19	95	130	9	98	84.0	37.0	264.0	R18
MSK 076C	140	50	4	14.0	24	110	165	11	110	95.4	57.5	292.5	R12

Motor data

Description		Unit	MSK061C-0600-NN-M1-UG1-NNNN	MSK076C-0450-NN-M1-UG1-NNNN
Part number			R3471 095 03	R3471 093 03
Maximum rotary speed	n_{max}	(min^{-1})	6000	5000
Maximum perm. drive torque	M_{max}	(Nm)	32	43.5
Motor mass moment of inertia	J_m	(10^{-6}kgm²)	750	4300
Mass of motor	m_m	(kg)	8.3	13.8
Holding brake				
Brake holding torque	M_{br}	(Nm)	10.0	11.0
Brake mass moment of inertia	J_{br}	(10^{-6}kgm²)	59	360
Mass of brake	m_{br}	(kg)	0.5	1.1

Accessories, Rack and Pinion Drive

Technical Data and Calculations

Preload-dependent frictional drag F_{R1}

Ball Runner Block .N. (..., normal, ...)
on guide rail with cover strip

Size	Frictional forces for preload class (N)			
	C0 (up to approx. 10 µm)	C1 (2% C)	C2 (8% C)	C3 (13% C)
25	13.5	18.5	22.5	26.5
30	15.8	21.8	26.8	32.8
35	20.8	28.8	34.8	42.8

Ball Runner Block .L. (..., long, ...)
on guide rail with cover strip

Size	Frictional forces for preload class (N)			
	C0 (up to approx. 10 µm)	C1 (2% C)	C2 (8% C)	C3 (13% C)
25	13.5	20.5	25.5	30.5
30	15.8	23.8	29.8	36.8
35	20.8	29.8	37.8	48.8

Load-dependent friction force F_{R2}

$$F_{R2} = F_{comb} \cdot 0.003$$

Mass of the components m_{co}

$$m_{co} = m_m + m_{br} + m_c + m_{ge} + m_{sr} + m_p + m_{ca}$$

Thrust for traveling axis F_L

$$F_L = (m_{co} + m_{ex}) \cdot a + n \cdot F_{R\,1} + F_{R\,2}$$

Thrust for lifting axis F_L
(vertical mounting)

$$F_L = \pm (m_{co} + m_{ex}) \cdot g + (m_{co} + m_{ex}) \cdot a + n \cdot F_{R\,1} + F_{R\,2}$$

Required drive torque $M_{a\,req}$

$$M_{a\,req} = \frac{F_L \cdot d_0}{2000}$$

Maximum permissible drive torque M_p

$$M_p = \frac{M_{max}}{k_f \cdot S \cdot f_L}$$

Operating factor k_f

Drive	Operating factor k_f of the machine to be driven		
	uniform	moderate shocks	heavy shocks
Uniform	1.00	1.25	1.75
Moderate shocks	1.25	1.50	2.00
Heavy shocks	1.50	1.75	2.25

Safety factor S

$$S = 1.1 - 1.4$$

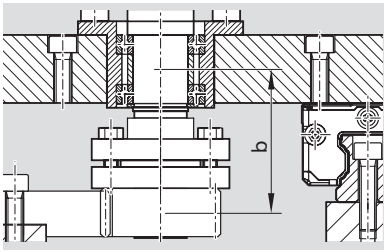
Condition

$$M_{a\,req} \leq M_p$$

a	=	acceleration	(m/s²)
d_0	=	nominal diameter of pinion	(mm)
F_{comb}	=	combined equivalent dynamic load on bearing ☞ 14	(N)
F_L	=	thrust	(N)
f_L	=	life expectancy factor	(-)
F_{R1}	=	preload-dependent frictional drag	(N)
F_{R2}	=	load-dependent friction force	(N)
g	=	gravitational acceleration 9.81	(m/s²)
i	=	gear ratio	(-)
J_{br}	=	mass moment of inertia of brake	(kgm²)
J_c	=	mass moment of inertia, coupling	(kgm²)
J_{co}	=	mass moment of inertia, components	(kgm²)
J_m	=	mass moment of inertia of motor	(kgm²)
k_f	=	operating factor	(-)
m_{co}	=	mass of components	(kg)
m_m	=	mass of motor	(kg)
m_{br}	=	mass of brake	(kg)
m_c	=	mass of coupling	(kg)
m_{ge}	=	mass of gear	(kg)
m_{sr}	=	mass of shrink disk	(kg)
m_p	=	mass of gear wheel	(kg)
m_{ca}	=	mass of carriage	(kg)
m_{ex}	=	moved external load	(kg)
$M_{a\,req}$	=	required drive torque	(Nm)
M_{max}	=	max. permissible motor torque	(Nm)
M_p	=	max. perm. drive torque	(Nm)
n	=	number of runner blocks	(-)
n_{mech}	=	maximum permissible rotary speed of mechanical system	(min⁻¹)
S	=	safety factor	(-)
v_{mech}	=	maximum permissible linear speed of mechanical system	(m/s)

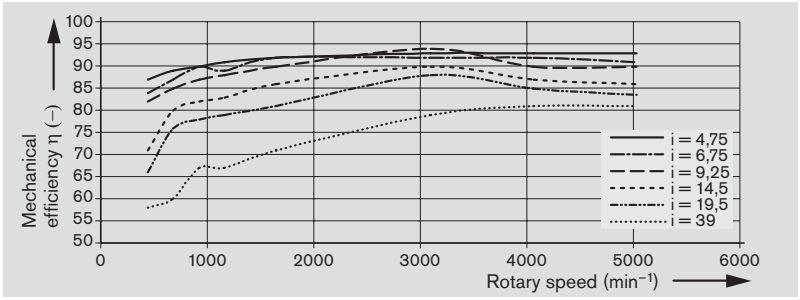
Life expectancy factor f_L

Axial distance between rotary bearing centerline and pinion tooth width centerline

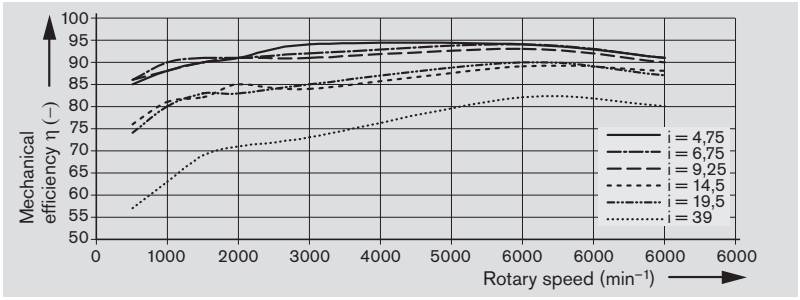


Axial bearing distance b Peripheral speed		Life expectancy factor f_L 1 x tooth width Lubrication		2 x tooth width Lubrication	
(m/s)	(m/min)	continuous	daily	continuous	daily
0.5	30	0.85	0.95	1.05	1.15
1.0	60	0.95	1.10	1.15	1.30
1.5	90	1.00	1.20	1.20	1.45
2.0	120	1.05	1.30	1.25	1.60
3.0	180	1.10	1.50	1.40	1.90
5.0	300	1.25	1.90	1.55	2.30

Gearing efficiency of servo worm gear units
with driving worm and under full load
Center distance $a_0 = 50$ mm



Center distance $a_0 = 63$ mm



Maximum permissible linear speed v_{mech} of mechanical system

$$v_{mech} = n_{mech} \cdot \frac{\pi \cdot d_0}{60 \cdot 1000 \cdot i}$$

Translatory mass moment of inertia of external load J_t referred to the drive journal

$$J_t = m_{ex} \cdot \left(\frac{d_0}{2}\right)^2 \cdot 10^{-6}$$

Mass moment of inertia of gear wheel J_p (calculation for customer-supplied pinion)

$$J_p = \sum V_{Zyl.\,i} \cdot r^2_{i} \cdot \frac{7.8}{2 \cdot 10^{12}}$$

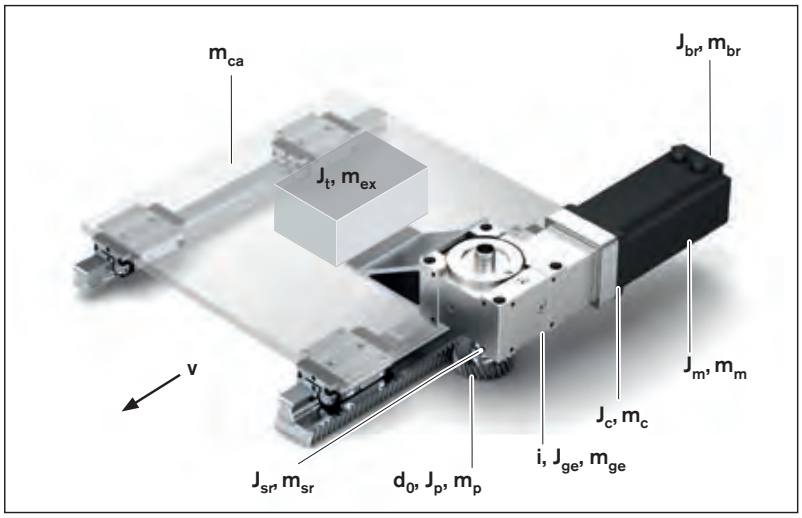
Mass moment of inertia of components J_{co}

$$J_{co} = m_{co} \cdot \left(\frac{d_0}{2}\right)^2 \cdot 10^{-6}$$

J_{ex}	=	mass moment of inertia of mechanical system	(kgm^2)
J_{ge}	=	mass moment of inertia of gear	(kgm^2)
J_p	=	mass moment of inertia of gear wheel	(kgm^2)
J_{sr}	=	mass moment of inertia of shrink disk	(kgm^2)
J_t	=	translatory mass moment of inertia of external load referred to the drive journal	(kgm^2)
$r_{Zyl.\,i}$	=	radius single cylinder, gear wheel from 1 ... n	(mm)
$V_{Zyl.\,i}$	=	volume single cylinder, gear wheel from 1 ... n	(mm^3)
V	=	mass moment of inertia ratio	(-)

Accessories, Rack and Pinion Drive

Technical Data and Calculations



Mass moment of inertia of mechanical system J_{ex}

$$J_{ex} = J_c + J_{ge} + \frac{1}{i^2} \cdot (J_{sr} + J_p + J_t + J_{co})$$

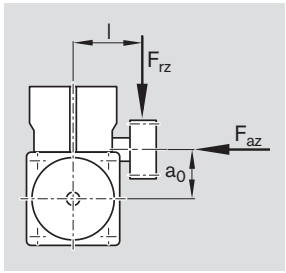
Mass moment of inertia ratio V

$$V = \frac{J_{ex} + J_{br}}{J_m} \Rightarrow 1 \leq V \leq 6$$

Application area	V
Handling	≤ 6.0
Processing	≤ 1.5

Maximum permissible additional loads on gear output

The data given are reference values. The forces arising from the choice of tooth system must also be considered.
It is assumed that the point of action of the force is the center of the shaft journal. In cases where axial forces occur in addition to high radial forces, please ask for advice.



Center distance	Dimensions center casing/ center teeth	Max. additional load	
		radial	axial
a_0 (mm)	l (mm)	F_{rz} (N)	F_{az} (N)
50	90	3600	1800
	140	2300	1800
63	110	5000	2500
	160	3500	2500

F_{rz} = radial force on gear wheel
F_{az} = axial force on gear wheel

Lubrication and Mounting

Lubrication of the gear rack drive

The teeth of the gear rack must be lubricated with grease approx. every 8 hours. For units used in difficult operating conditions the lubrication intervals must be shortened.
Gear racks and pinions must be cleaned to remove dirt and residues of old grease.

Lubricants for gear racks

Recommended lubricants for felt gear rack lubrication:
Klüber Microlube GB 0
Klüber Structovis AHD
Other lubricants:
Rexroth Dynalub 520

Recommended lubricants for brush/ manual lubrication:
Klüber Microlube GB 0
Other lubricants:
Rexroth Dynalub 510

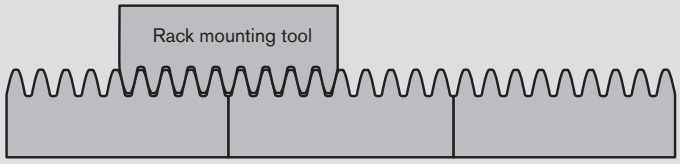
Part number	Designation acc. to		Consistency class per DIN 51818	Temperature range (°C)	Packaging unit
	Rexroth	DIN 51825			
R3416 037 00	Dynalub 510	KP2K	2	–20 to +80	1 x 400 g
R3416 043 00	Dynalub 520	GP00K	00	–20 to +80	1 x 400 g

Lubricants for runner blocks

Runner blocks are pre-lubricated with Dynalub 510 grease.
Dynalub 510 is also recommended for re-lubrication.

Mounting the gear rack

Composite gear racks are mounted with the help of a rack mounting tool.



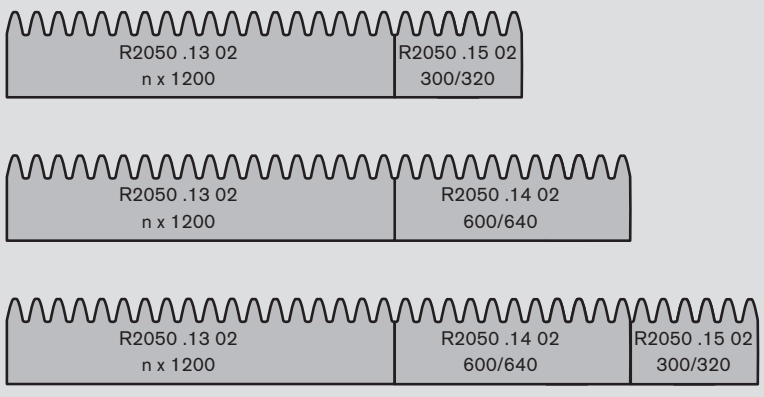
Rack mounting tools

Size	Part number	Dimensions (mm)	
		L	m_t
25	R2052 213 01	200	1.59
30	R2052 713 01	200	3.18
35	R2052 713 01	200	3.18

Tooth flank clearance:

To be adjusted according to the required level of precision. For normal applications, do not set a value smaller than 0.04 mm over the entire travel path.

Fixed length increments



⚠ **Recalculate all screw connections to check their strength!**

⚠ **For vertical applications, provide safety devices to prevent equipment from crashing down!**