SP-The Classic Precision

SP Low-Backlash Planetary Gear Reducer

S Version
Self-Contained Gear Reducer

M Version
Motor-Mounted Gear Reducer

K Version
Angle Gear Reducer

alpha

3

7

11

WINNER OF
TOP
100
GOLD 2002
alpha getriebebau GmbH

The „Best of TOP100 Germany“ prize is among the highest-profile awards for medium-sized companies. 454 companies took part in the competition.

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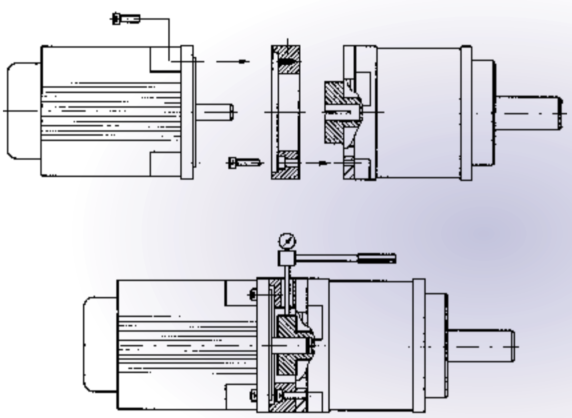
The classic precision

alpha's SP **Low-backlash Planetary gear reducers** are applied in increasing numbers in robots, automation applications, machine tools, packaging machines and printing presses for highly dynamic positioning operations as well as for continuous operations as a state-of-the-art component of servo systems.

The principles of design of the SP gear reducers renders them particularly applicable for drive systems with high standards of precision and reliability:

Excellent quality
- a long service life and extremely constant backlash achieved by optimized, ground gearing and high-duty material
- for highly dynamic cycle operations (S5) and high failsafety in continuous operations (S1) alpha gear reducers should be your first choice
- optimized quality assurance: a result of controlling 100% of the manufactured products

Unsurpassed concepts
- high efficiency and low mass moments of inertia of the planetary gear reducers enable highly dynamic drives with minimized energy loss
- as a consequence alpha gear reducers contribute noticeably to saving our resources and to the protection of our environment
- alpha offers forward-looking drive concepts to our customers



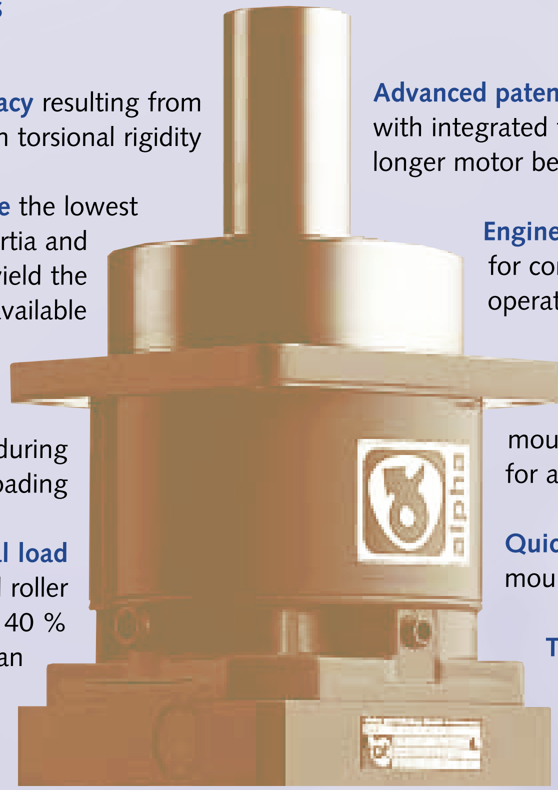
Innovative techniques
- **ingeniously simple, patented** system of **motor mounting** with integrated thermal length compensation
- creative solutions in design and in the production process ensure technical superiority
- forward-looking manufacturing technologies guarantee precision and premium quality standard

Modular planetary gear reducer program
- standardized modules are the basis of all alpha reducer series
- flexible, modular adapter parts enable simple, safe and fast mounting on practically any motor
- since alpha has standardized the geometry of the output parts, we guarantee the compatibility of our entire gear reducer range

Worldwide partnerships
- sales agencies and service worldwide guarantee competent support wherever you are
- the market requests minimized maintenance: alpha's gear reducers are maintenance-free and lubricated for life - a perfect service
- our customers can feel perfectly safe thanks to our excellent reliability, even if extreme demands are to be met

SP M-Version

Product characteristics



Superior positioning accuracy resulting from low backlash and high torsional rigidity

Dynamic response time the lowest moments of inertia and highest torsional rigidity yield the best settling time available

Emergency stop protection case hardened gears ensure resiliency during extreme shock loading

High radial and axial load capacity dual tapered roller bearings guarantee up to 40 % more load capacity than angular contact bearings

Low backlash maintained through life of reducer
high surface hardness, finished ground precision, and oil lubrication maximize gear tooth life

Advanced patented motor mounting
with integrated thermal length compensation, longer motor bearing life is guaranteed

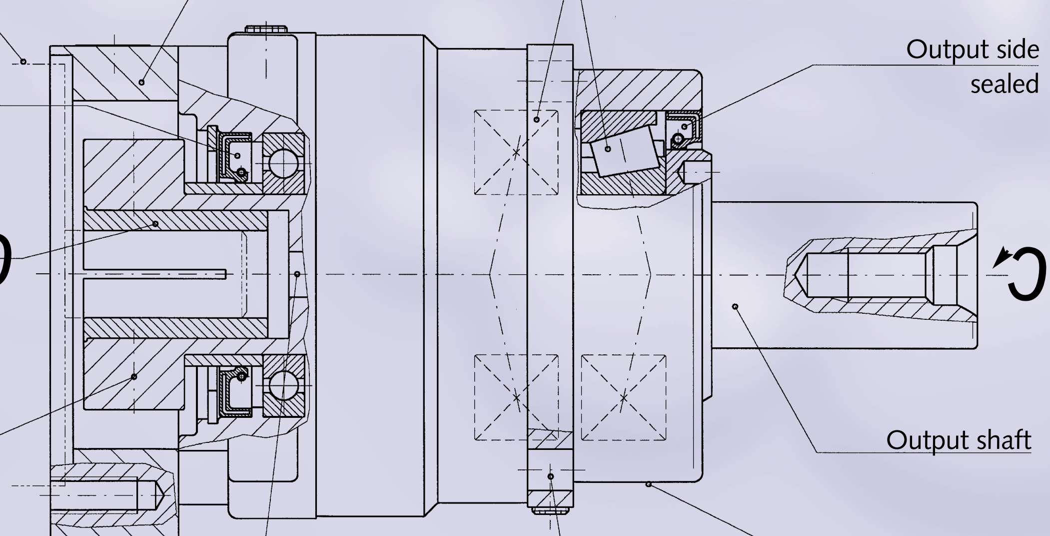
Engineered for any duty cycle ideally suited for continuous and highly dynamic cyclic operations

Flexible motor mounting
field interchangeable motor mounting kits allow stocking one reducer for any customer's motor specification

Quick and easy mounting
mounts in minutes to any servomotor

True running gear train
provides exceptionally quiet operation, high efficiency and smooth torque transmission

Product details



Technical data

Size				SP 060	SP 075	SP 100	SP 140	SP 180	SP 210	SP 240
max. Acceleration Torque 1)	T_{2B}	Nm	i = 4-7 i = 16-70	40	100	250	500	1100	1900	3400
			i = 10/100	32	80	200	400	880	1520	2720
Emergency Stop 2)	T_{2Not}	Nm	i = 4-7 i = 16-70	100	250	625	1250	2750	4750	8500
			i = 10/100	80	200	500	1000	2200	3800	6800
Nominal Output Torque	T_{2N}	Nm	i = 4-7 i = 16-70	25	70	170	360	550	1000	1700
			i = 10/100	15	45	110	215	550	1000	1700
max. Input Speed	n_{1Max}	rpm	1-stage 2-stage	6000	6000	4500	4000	3500	2500	2200
			2-stage					4000	3500	3500
Nominal Input Speed 3)	n_{1N}	rpm	i = 4/5	3300	2900	2500	2100	1500	1200	1000
			i = 7/10	4000	3100	2800	2600	2300	1700	1500
			i = 16	4400	3500	3100	2900	2700	2100	1900
			i = 50	4800	3800	3500	3200	2900	2300	2100
			i = 100	5500	4500	4200	3900	3400	2900	2400
Ratios	i		1-stage	4 / 5 / 7 / 10						
			2-stage	16 / 20 / 28 / 40 / 50 / 70 / 100						
Torsional Backlash Standard	j_t	arcmin	1-stage	≤ 6		≤ 4				
			2-stage	≤ 8		≤ 6				
Torsional Backlash Reduced	j_t	arcmin	1-stage	≤ 4		≤ 2				
			2-stage	≤ 6		≤ 4				
Torsional Rigidity	C_{t21}	Nm/arcmin		3	8	24	45	144	≈225	≈350
max. Axial Load 4)	F_{2AMax}	N		2300	3200	5400	9400	13500	22500	27800
max. Radial Load 4)	F_{2RMax}	N		2600	3800	6000	9000	14000	18000	27000
max. Tilting Mom.	M_{2KMax}	Nm		133	225	464	907	1523	2430	4226
No-load Running Torque 5) (n_1=3000 rpm)	T_{012}	Nm	i = 4	0.5	0.9	2.7	3.9	6.2		
			i = 16	0.3	0.7	1.7	2.4			
			i = 100	0.2	0.4	0.7	1.1			
Service Life 6)	L_h	h		> 20.000						
Efficiency with full load	η	%	1-stage	≥ 97						
			2-stage	≥ 94						
Weight	m	kg	1-stage	1.5	2.8	6.2	11.5	27	53	80
			2-stage	1.8	3.1	7.1	14.5	29	50	70
Lubrication				Synthetic oil viscosity ISO VG220						
Paint				Blue RAL 5002						
Mounting Position				advised with your order						
Permissible Gear Reducer Temp.		°C		- 10°C to + 90°C						
Direction of Rotation				Motor and gear reducer same direction						
Degree of Gearbox Protection				IP 64						
Noise Level (n_1=3000 rpm)	L_{PA}	dB(A)		≤ 68		≤ 70			≤ 72	

1) 1000 cycles per hour.

2) 1000 times during the service life.

3) at 20°C ambient temperature (if you have higher ambient temperature, please reduce the n_{1N} speed). In case of S1 conditions please contact alpha.

4) applied to the shaft centre.

5) at 20°C gear reducer temperature.

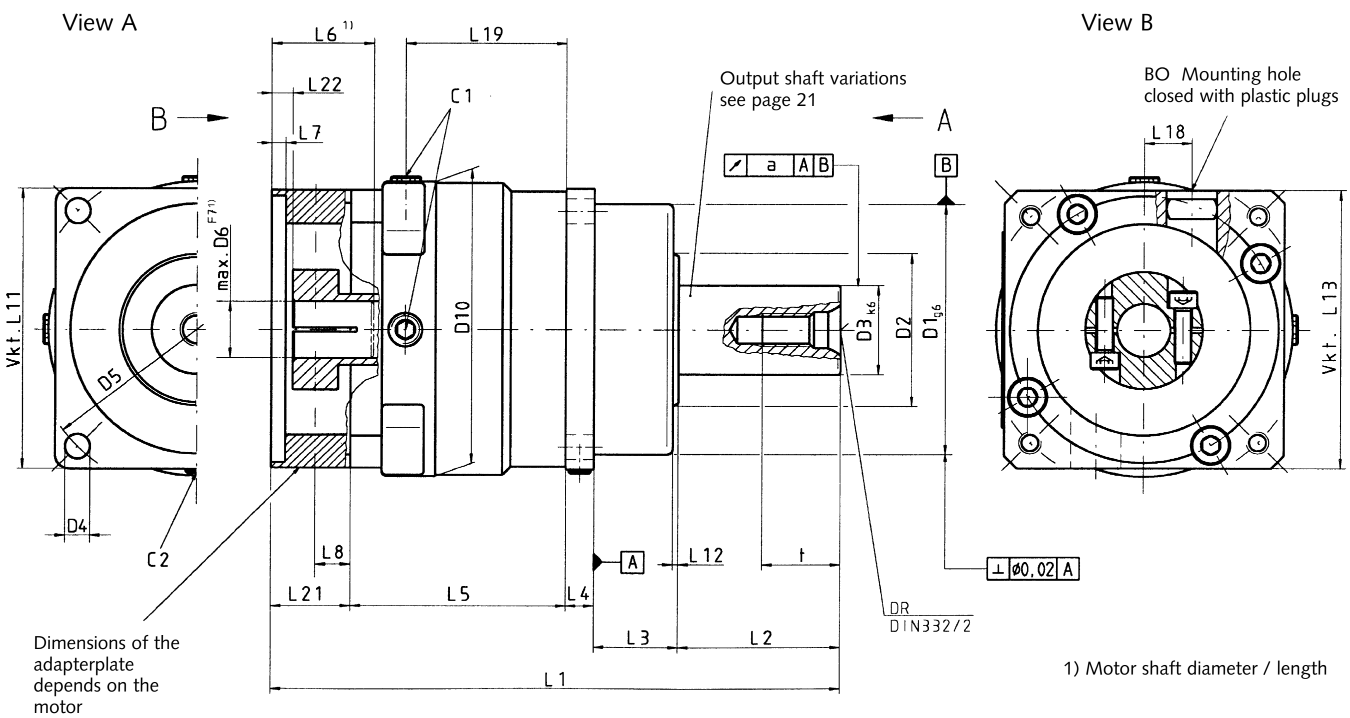
6) service life of output bearings see page 20.

Conversion Table:

1 Nm = 8.85 in. lb.
1 kgcm² = 8.85 x 10^{-4} in. lb.s²
1 N = .225 lb_f
1 kg = 2.205 lb.

Dimensions [mm]

1 mm = 0.03937 in.



Size			SP 060	SP 075	SP 100	SP 140	SP 180	SP 210	SP 240
Gear Stages			1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
a			0.03	0.03	0.035	0.04	0.04	0.04	0.04
BO			8	15	18	20	20	20	30 / 20
C1			1xM8x1	1xM8x1	3xM12x1.5	3xM12x1.5	3xM12x1.5	3xM12x1.5	3xM12x1.5
C2			-	-	1xM8x1	1xM8x1	1xM8x1	1xM8x1	1xM12x1.5
DR			M5	M8	M12	M16	M20	M20	M20
D1	g6		60	70	90	130	160	180	200
D2			30	38	55	70	90	120	130
D3	k6		16	22	32	40	55	75	85
D4			5.5	6.6	9	11	13	17	17
D5			68	85	120	165	215	250	290
D6 3)	F7		14	19	32	38	48 / 38	55 / 48	60 / 48
D10	+1		61.5	82	106	140	193	□212	□242
L1 2) 3)	±2		129 / 149	156 / 182.5	202 / 234.5	256.5 / 296.5	297 / 315.5	350 / 397	436 / 453.5
L2			28	36	58	82	82	105	130
L3			20	20	30	30	30	38	40
L4			6	7	10	12	15	17	20
L5			60 / 80	71 / 97.5	76 / 108.5	102 / 142	132.5 / 158	152.5 / 199.5	200 / 226
L6 3)		min.	15	23	30	32	45 / 32	45	55 / 45
		max.	30	40	50	60	82 / 60	82	110 / 82
L7 3)	+0.5		4	4	5	6	6	6	8 / 6
L8			5.6	8.5	10	12.5	13 / 12.5	13	18 / 13
L11	±1		62	76	101	141	182 4)	212 4)	242 4)
L12			2	2	2	3	3	3	3
L13 3)	±1	min.	60	80	100	140	190 / 140	190	260 / 190
L18			10	12	17	19	29 / 19	29	40 / 29
L19			47.5 / 67.5	57 / 83.5	56 / 88.5	74.5 / 114.5	100.5 / 130.5	114.5 / 167.5	147 / 194
L21 3)			15	22	28	30.5	37.5 / 30.5	37.5	46 / 37.5
L22 3)	+0.9		3.7	6.2	6.7	5.2	9.3 / 5.2	9.2 / 9.3	12.6 / 9.3
t			12.5	19	28	36	42	42	42

2) If you have involute toothing at the output shaft, L1 will change (see page 21).
3) Dimensions depend on the motor.
4) additional draft 1,5°.

1 kgcm² = 8.85 x 10^{-4} in. lb.s²
1 mm = 0.03937 in.
1 Nm = 8.85 in.lb.

Mass moments of inertia J_1 [kgcm²] applies to the input

Gear reducer size		Motor shaft diameter [mm]	Ratio i single-stage 4	5	7	10	Ratio i two-stage 16	20	28	40	50	70	100
SP 060		≤ 11	0.14	0.14	0.13	0.12	0.15	0.15	0.15	0.12	0.12	0.12	0.12
		> 11 ≤ 14	0.17	0.17	0.16	0.15	0.19	0.19	0.19	0.15	0.15	0.15	0.15
SP 075		≤ 11	0.52	0.44	0.38	0.35	0.48	0.47	0.47	0.34	0.34	0.34	0.34
		> 11 ≤ 14	0.57	0.49	0.43	0.40	0.53	0.52	0.52	0.39	0.39	0.39	0.39
		> 14 ≤ 19	0.63	0.55	0.49	0.46	0.59	0.58	0.58	0.45	0.45	0.45	0.45
SP 100		≤ 14	1.9	1.6	1.3	1.2	1.7	1.7	1.7	1.1	1.1	1.1	1.1
		> 14 ≤ 19	2.0	1.7	1.4	1.3	1.8	1.8	1.8	1.2	1.2	1.2	1.2
		> 19 ≤ 24	2.7	2.4	2.1	2.0	2.5	2.5	2.5	1.9	1.9	1.9	1.9
		> 24 ≤ 28	3.5	3.2	2.9	2.8	3.3	3.3	3.3	2.7	2.7	2.7	2.7
		> 28 ≤ 32	4.6	4.3	4.0	3.9	4.4	4.4	4.4	3.8	4.8	3.8	3.8
SP 140		≤ 19	5.0	4.1	3.3	2.8	4.4	4.4	4.4	2.7	2.7	2.7	2.7
		> 19 ≤ 24	5.7	4.8	4.0	3.5	5.1	5.1	5.1	3.4	3.4	3.4	3.4
		> 24 ≤ 32	8.4	7.5	6.7	6.2	7.8	7.8	7.8	6.1	6.1	6.1	6.1
		> 32 ≤ 35	8.2	7.3	6.5	6.0	7.6	7.6	7.6	5.9	5.9	5.9	5.9
		> 35 ≤ 38	10.0	9.1	8.3	7.8	9.4	9.4	9.4	7.7	7.7	7.7	7.7
SP 180	2-stage	≤ 19	-	-	-	-	5.0	4.8	4.6	2.8	2.8	2.7	2.7
		> 19 ≤ 24	-	-	-	-	5.7	5.5	5.3	3.5	3.5	3.4	3.4
		> 24 ≤ 32	-	-	-	-	8.4	8.2	8.0	6.2	6.2	6.1	6.1
		> 32 ≤ 35	-	-	-	-	8.2	8.0	7.8	6.0	6.0	5.9	5.9
		> 35 ≤ 38	-	-	-	-	10.0	9.8	9.6	7.8	7.8	7.7	7.7
SP 180	1-stage	≤ 32	30.6	24.9	20.0	17.4	-	-	-	-	-	-	-
		> 32 ≤ 38	31.7	26.0	21.1	18.5	-	-	-	-	-	-	-
		> 38 ≤ 48	36.2	30.5	25.6	23.0	-	-	-	-	-	-	-
SP 210	2-stage	≤ 32	-	-	-	-	36.3	34.5	32.3	23.1	21.9	20.2	18.9
		> 32 ≤ 38	-	-	-	-	37.4	35.6	33.4	24.3	23.0	21.3	20.0
		> 38 ≤ 48	-	-	-	-	42.0	40.2	37.9	28.8	27.6	25.8	24.6
SP 210	1-stage	≤ 55	75.8	63.5	52.9	47.1	-	-	-	-	-	-	-
SP 240	2-stage	≤ 32	-	-	-	-	47.3	43.1	37.5	32.4	29.5	24.9	21.4
		> 32 ≤ 38	-	-	-	-	48.4	44.2	38.6	33.6	30.6	26.0	22.5
		> 38 ≤ 48	-	-	-	-	53.0	48.8	43.2	38.1	35.1	30.6	27.1
SP 240	1-stage	≤ 60	146.3	119.9	96.4	83.1	-	-	-	-	-	-	-

Quick Selection

Exact gear reducer selection can be found on page 16 to 20

Cycle Operation S5

(for number of cycles ≤ 1000)

Duty cycle < 60%

1. Determination of the max. motor acceleration torque
   T_{1BMot} [Nm]
2. Determination of the actual max. acceleration torque on the reducer output T_{2b} [Nm]
   $T_{2b} = T_{1BMot} \times i$
3. Comparison of the actual max. acceleration torque T_{2b} [Nm] with the max. permissible acceleration torque T_{2B} [Nm] on the reducer output.
   $T_{2b} \leq T_{2B}$
4. Comparison of the motor shaft diameter D_{Mot} [mm] with the dimension D6 [mm]
   $D_{Mot} \leq D6$
5. Comparison of the motor shaft length L_{Mot} [mm] with the dimension L6 [mm]
   $L6_{min} \leq L_{Mot} \leq L6_{max}$

Continuous Operation S1

(use FPM-sealings, indicate this in your order)

Duty cycle ≥ 60%

1. Determination of the motor nominal torque
   T_{1NMot} [Nm]
2. Determination of the actual nominal torque on the reducer output T_{2n} [Nm]
   $T_{2n} = T_{1NMot} \times i$
3. Comparison of the actual nominal torque T_{2n} [Nm] with the permissible nominal torque T_{2N} [Nm] on the reducer output
   $T_{2n} \leq T_{2N}$
4. Determination of the actual input speed
   n_{1n} [rpm]
5. Comparison of the actual input speed n_{1n} [rpm] with the permissible nominal speed n_{1N} [rpm]
   $n_{1n} \leq n_{1N}$
6. Comparison of the motor shaft diameter D_{Mot} [mm] with the dimension D6 [mm]
   $D_{Mot} \leq D6$
7. Comparison of the motor shaft length L_{Mot} [mm] with the dimension of L6 [mm]
   $L6_{min} \leq L_{Mot} \leq L6_{max}$

SP S-Version

Product characteristics

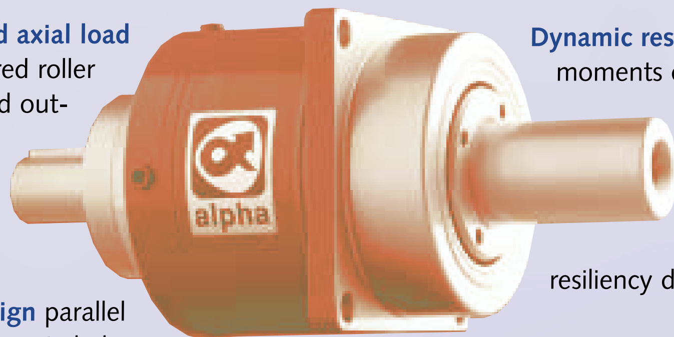
True running gear train provides exceptionally quiet operation, high efficiency and smooth torque transmission

High radial and axial load capacity dual tapered roller bearings on input and output shaft guarantee up to 40% more load capacity than angular contact bearings

Space-saving design parallel mounting of motor via belt or gear coupled shaft allows for the most compact machine envelope

Engineered for any duty cycle ideally suited for continuous and highly dynamic cyclic operations

Very easy to install owing to input fastening thread for coupling flanges



Superior positioning accuracy resulting from low backlash and high torsional rigidity

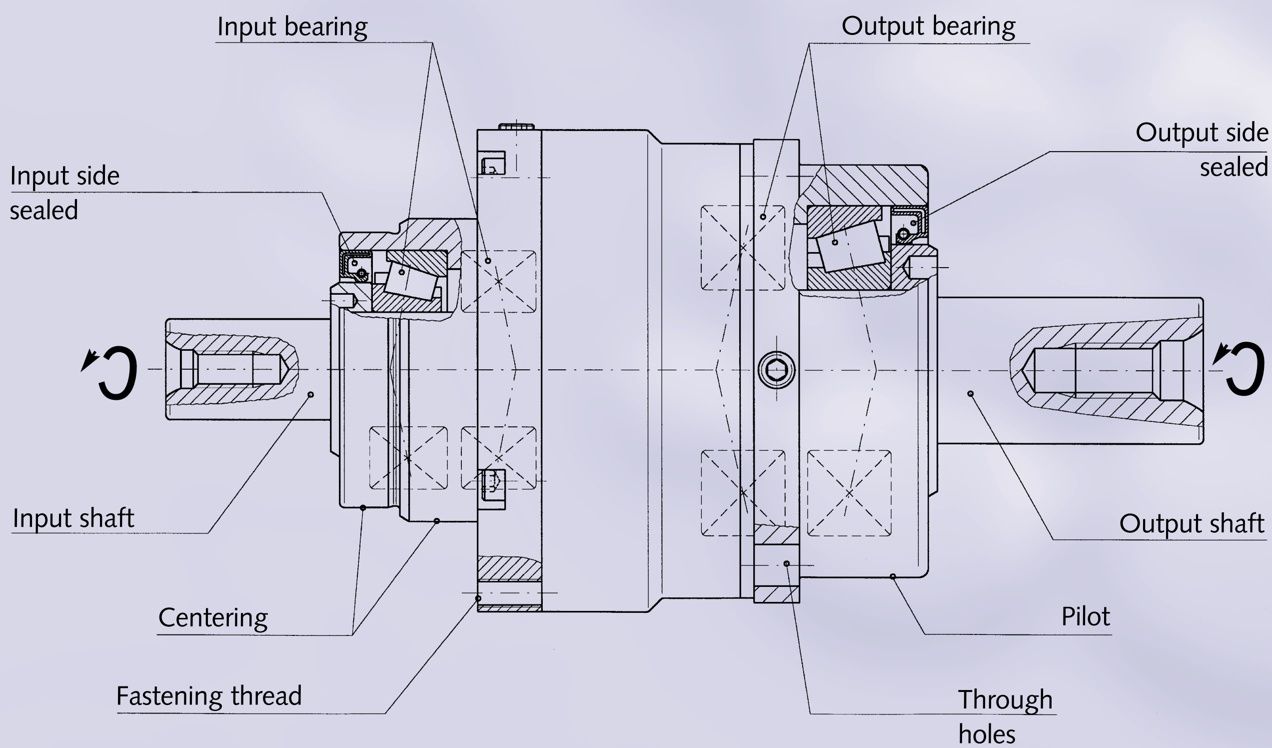
Dynamic response time the lowest moments of inertia and highest torsional rigidity yield the best settling time available

Emergency stop protection case hardened gears ensure resiliency during extreme shock loading

Low backlash maintained through life of reducer high surface hardness. finished ground precision, and oil lubrication maximize gear tooth life

Quick and easy mounting mounts in minutes to any servomotor

Product details



Conversion Table:

1 Nm	= 8.85 in. lb.
1 kgcm²	= 8.85 x 10⁻⁴ in. lb.s²
1 N	= .225 lb$_f$
1 kg	= 2.205 lb.

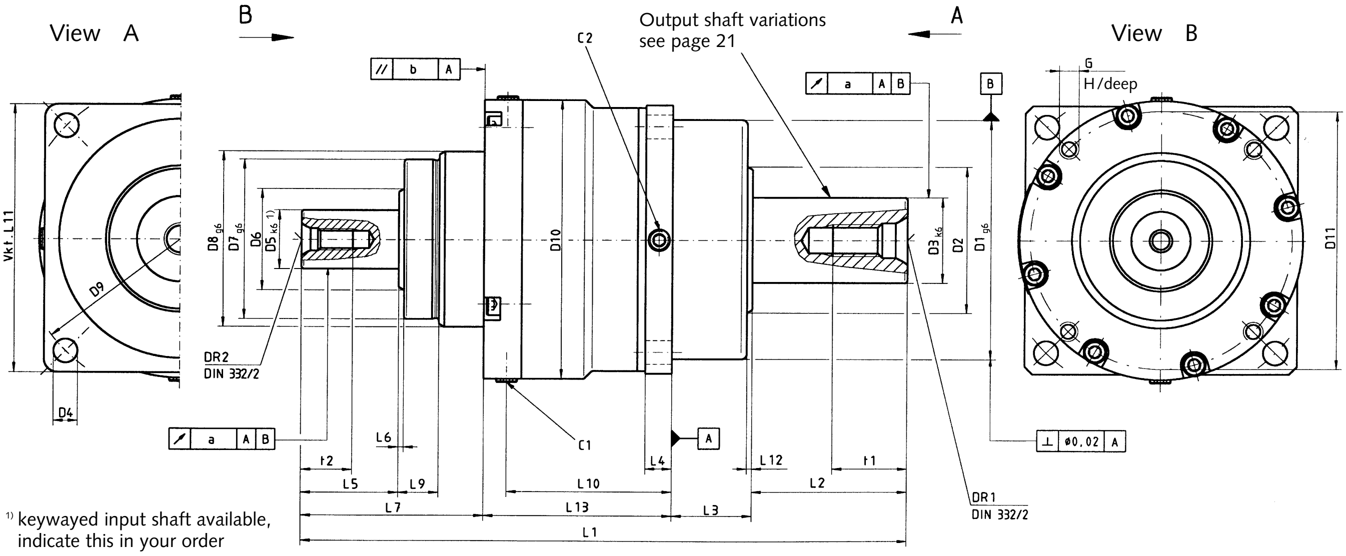
Technical data

Size				SP 060	SP 075	SP 100	SP 140	SP 180
max. Acceleration Torque 1)	T_{2B}	Nm	i = 4-7 i = 16-70	40	100	250	500	1100
			i = 10/100	32	80	200	400	880
Emergency Stop 2)	T_{2Not}	Nm	i = 4-7 i = 16-70	100	250	625	1250	2750
			i = 10/100	80	200	500	1000	2200
Nominal Output Torque	T_{2N}	Nm	i = 4-7 i = 16-70	25	70	170	360	550
			i = 10/100	15	45	110	215	550
max. Input Speed	n_{1Max}	rpm	1-stage 2-stage	6000	6000	4500	4000	3500 4000
Nominal Input Speed 3)	n_{1N}	rpm	i = 4/5	1700	1500	1300	1100	800
			i = 7/10	2000	1600	1400	1300	1200
			i = 16	2200	1800	1600	1500	1400
			i = 50	2400	1900	1800	1600	1500
			i = 100	2800	2300	2100	2000	1700
Ratios	i		1-stage	4 / 5 / 7 / 10				
			2-stage	16 / 20 / 28 / 40 / 50 / 70 / 100				
Torsional Backlash Standard	j_t	arcmin	1-stage	≤ 6		≤ 4		
			2-stage	≤ 8		≤ 6		
Torsional Backlash Reduced	j_t	arcmin	1-stage	≤ 4		≤ 2		
			2-stage	≤ 6		≤ 4		
Torsional Rigidity	C_{t21}	Nm/arcmin		3	8	24	45	144
max. Axial Load 4) (Output)	F_{2AMax}	N		2300	3200	5400	9400	13500
max. Radial Load 4) (Output)	F_{2RMax}	N		2600	3800	6000	9000	14000
max.Tilting Moment Output	M_{2KMax}	Nm		133	225	464	907	1523
max.Tilting Moment Input	M_{1KMax}	Nm		26	66	113	232	454
max. Axial Load (Input)	F_{1AMax}	N		950	1150	1600	2700	4700
max. Radial Load 4) (Input)	F_{1RMax}	N		550	1300	1900	3000	4500
No-load Running Torque 5) (n_1=3000 rpm)	T_{012}	Nm	i = 4	1.5	3.0	6.0	11.5	23.0
			i = 10	0.8	1.2	2.5	4.0	9.0
			i = 100	0.6	0.9	1.8	3.0	7.0
Service Life 6)	L_h	h		>20.000				
Efficiency with full load	η	%	1-stage	≥ 96				
			2-stage	≥ 93				
Weight	m	kg	1-stage	1.5	3.0	5.7	14.0	31.5
			2-stage	1.8	3.7	6.3	17.0	33.5
Lubrication				Synthetic oil viscosity ISO VG220				
Paint				Blue RAL 5002				
Mounting Position				advised with your order				
Permissible Gear Reducer Temp.		°C		- 10°C to + 90°C				
Direction of Rotation				Motor and gear reducer same direction				
Degree of Gearbox Protection				IP 64				
Noise Level (n_1=3000 rpm)	L_{PA}	dB(A)		≤ 68		≤ 70		

1) 1000 cycles per hour.
2) 1000 times during the service life.
3) at 20°C ambient temperature (if you have higher ambient temperature, please reduce the n_{1N} speed). In case of S1 conditions please contact alpha.
4) applied to the shaft/flange centre.
5) at 20°C gear reducer temperature.
6) service life of output bearings see page 20.

Dimensions [mm]

1 mm = 0.03937 in.



[1] keywayed input shaft available, indicate this in your order

Size		SP 060	SP 075	SP 100	SP 140	SP 180
Gear Stages		1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
a		0,03	0,03	0.035	0.04	0.04
b		0.03	0.03	0.03	0.035	0.035
C1		1xM8x1	1xM8x1	3xM8x1	3xM12x1.5	3xM12x1.5
C2		-	-	1xM8x1	1xM8x1	1xM8x1
DR1		M5	M8	M12	M16	M20
DR2		M4	M5	M8	M12	M16 / M12
D1	g6	60	70	90	130	160
D2		30	38	55	70	90
D3	k6	16	22	32	40	55
D4		5.5	6.6	9	11	13
D5	k6	12	16	22	32	40 / 32
D6		25	30	38	55	70 / 55
D7	g6	40	52	60	80	110 / 80
D8	g6	45	58	72	93	134 / 93
D9		68	85	120	165	215
D10		61.5	82	105	140.5	192
D11		55.5	74	97	123	179 / 123
G		M4	M5	M6	M8	M10 / M8
H		11	12	12	12	15 / 12
L1 [2]	± 2	143 / 163	179 / 205.5	226 / 258.5	297 / 337.5	352 / 356
L2		28	36	58	82	82
L3		20	20	30	30	30
L4		6	7	10	12	15
L5		18	28	36	58	82 / 58
L6		1	2	2	2	3 / 2
L7	± 1	36.7	53	68	90	124 / 90
L9		10	12	15	20	23 / 20
L10		52.8 / 72.8	63 / 89.5	63 / 95.5	86 / 126.5	106 / 145
L11	± 1	62	76	101	141	182[4]
L12		2	2	2	3	3
L13	± 1	58.3 / 78.3	70 / 96.5	70 / 102.5	95 / 135.5	116 / 154
t1		12.5	19	28	36	42
t2		10	12.5	19	28	36 / 28

[2] If you have involute toothing at the output shaft, L1 will change (see page 21).

[4] additional draft 1,5°.

1 kgcm² = 8.85 x 10^{-4} in. lb.s²	
1 Nm	= 8.85 in.lb.

Mass moments of inertia J_1 [kgcm²] applies to the input

Gear reducer size	Ratio i single-stage				Ratio i two-stage						
	4	5	7	10	16	20	28	40	50	70	100
SP 060	0.16	0.14	0.12	0.11	0.14	0.14	0.14	0.11	0.11	0.11	0.11
SP 075	0.50	0.43	0.37	0.33	0.46	0.45	0.45	0.33	0.33	0.33	0.33
SP 100	1.6	1.4	1.1	1.0	1.5	1.4	1.4	0.9	0.9	0.9	0.9
SP 140	6.4	5.5	4.6	4.2	5.8	5.8	5.7	4.1	4.1	4.1	4.1
SP 180	28.6	23.3	18.8	16.3	6.6	6.3	6.0	4.2	4.2	4.1	4.1

Quick Selection

Exact gear reducer selection can be found on page 16 to 20

Cycle Operation S5 (for number of cycles ≤ 1000) **Duty cycle < 60%**	1. Determination of the max. motor acceleration torque $\mathbf{T_{1BMot}}$ **[Nm]** 2. Determination of the actual max. acceleration torque on the reducer output T_{2b} [Nm] $\mathbf{T_{2b} = T_{1BMot} \times i}$	3. Comparison of the actual max. acceleration torque T_{2b} [Nm] with the max. permissible acceleration torque T_{2B} [Nm] on the reducer output $\mathbf{T_{2b} \leq T_{2B}}$
Continuous Operation S1 (use FPM-sealings, indicate this in your order) **Duty cycle ≥ 60%**	1. Determination of the motor nominal torque $\mathbf{T_{1NMot}}$ **[Nm]** 2. Determination of the actual nominal torque on the reducer output T_{2n} [Nm] $\mathbf{T_{2n} = T_{1NMot} \times i}$ 3. Comparison of the actual nominal torque T_{2n} [Nm] with the permissible nominal torque T_{2N} [Nm] on the reducer output $\mathbf{T_{2n} \leq T_{2N}}$	4. Determination of the actual input speed $\mathbf{n_{1n}}$ **[rpm]** 5. Comparison of the actual input speed n_{1n} [rpm] with the permissible nominal speed n_{1N} [rpm] $\mathbf{n_{1n} \leq n_{1N}}$

SP K-Version

Product characteristics
SK Bevel Gear Reducer

Space-saving design motor orientation enabled by right-angle spiral bevel gearing allows for a very compact machine envelope

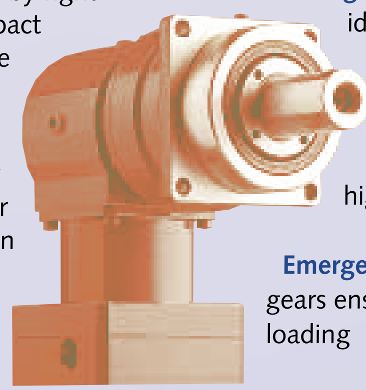
Flexible motor mounting field interchangeable motor mounting kits allow stocking one reducer for any customer`s motor specification

Dynamic response time the lowest moments of inertia and highest torsional rigidity yield the best settling time available

Advanced patented motor mounting with integrated thermal length compensation, longer motor bearing life is guaranteed

High radial and axial load capacity dual tapered roller bearings guarantee up to 40% more load capacity than angular contact bearings

SPK Planetary Bevel Gear Reducer



Engineered for any duty cycle ideally suited for continuous and highly dynamic cycle operations

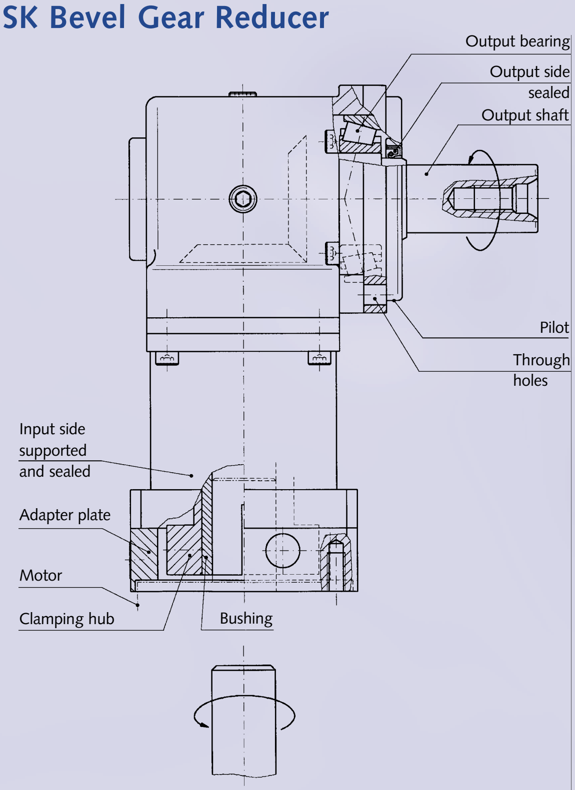
Superior positioning accuracy resulting from low backlash and high torsional rigidity

Emergency stop protection case hardened gears ensure resiliency during extreme shock loading

Quick and easy mounting mounts in minutes to any servomotor

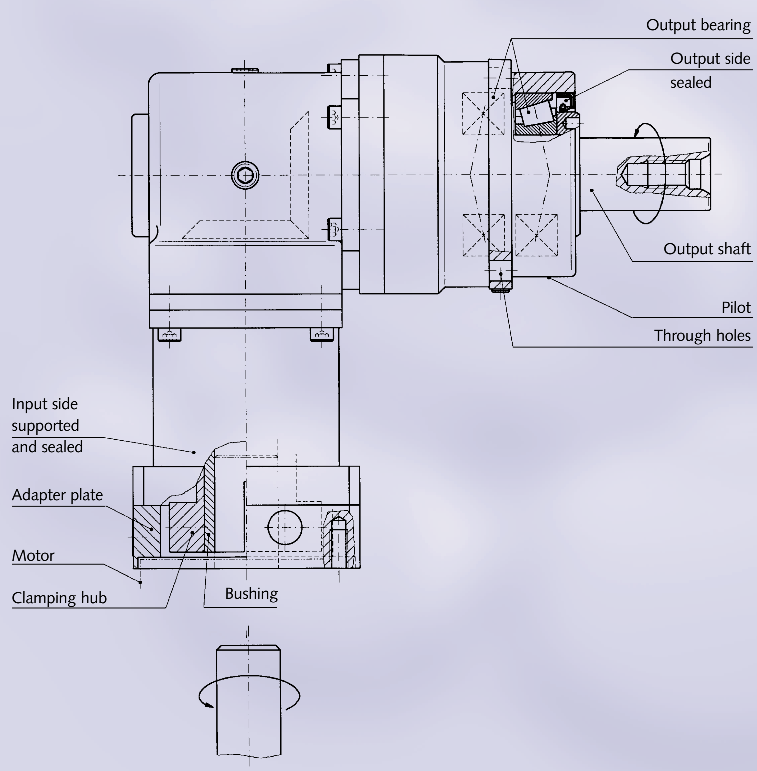
True running gear train provides exceptionally quiet operation, high efficiency and smooth torque transmission

Product details
SK Bevel Gear Reducer



1-stage i = 1 - 3

SPK Planetary Bevel Gear Reducer



2-stage i = 4 - 20
3-stage i = 32 - 200

Technical data

Size				SK 060	SK 075	SK 100	SK 140	SK 180	SPK 060	SPK 075	SPK 100	SPK 140	SPK 180	SPK 210	SPK 240
Gear Stages				1	1	1	1	1	2/3	2/3	2/3	2/3	2/3	3	3
max. Acceleration Torque [1]	T_{2B}	Nm		10	25	62.5	125	275	40	100	250	500	1100	1900	3400
			i = 20/200	-	-	-	-	-	32	80	200	400	880	1520[7]	2720[7]
Emergency Stop [2]	T_{2Not}	Nm		25	62.5	156	312	688	100	250	625	1250	2750	4750	8500
			i = 20/200	-	-	-	-	-	80	200	500	1000	2200	3800[7]	6800[7]
Nominal Output Torque	T_{2N}	Nm		6.5	16	40	80	175	25	70	170	360	550	1000	1700
			i = 20/200	-	-	-	-	-	16.25	45.5	110.5	234	357.5	650[7]	1105[7]
max. Input Speed	n_{1Max}	rpm		6000	6000	4500	4500	4000	6000	6000	4500/6000	4000/4500	3500/4000	3500	3000
Nominal Input Speed [3]	n_{1N}	rpm	SK i = 1	2500	2400	2000	1600	700	-	-	-	-	-	-	-
			SK i = 3	3300	3000	3000	2400	1100	-	-	-	-	-	-	-
			SPK i = 4/5/7	-	-	-	-	-	1700	1600	1300	1300	1000	-	-
			SPK i = 10/14/20						2700	2500	1900	1900	1300		-
			SPK i = 32-200			-			2500	2700	2500	2000	1800	700	600
Ratios	i		SK 1-stage	1 / 2 / 3					-						
			SPK 2-stage	-					4 / 5 / 7 / 10 / 14 / 20					-	-
			SPK 3-stage	-					32 / 40 / 56 / 80 / 100 / 140 / 200						
Torsional Backlash, Standard	j_t	arcmin	SK 1-stage	≤ 5		≤ 4			-		-			-	-
			SPK 2-stage	-		-			≤ 7		≤ 5			-	-
			SPK 3-stage	-		-			≤ 8		≤ 6			≤ 6	≤ 6
Torsional Backlash, Reduced	j_t	arcmin	SK 1-stage	-		-			-		-			-	-
			SPK 2-stage	-		-			≤ 5		≤ 3			-	-
			SPK 3-stage	-		-			≤ 6		≤ 4			≤ 4	≤ 4
Torsional Rigidity	C_{t21}	Nm/arcmin							3	8	24	45	144	≈225	≈350
max. Axial Load [4]	F_{2AMax}	N		500	700	1900	3000	4500	2300	3200	5400	9400	13500	22500	27800
max. Radial Load [4]	F_{2RMax}	N		950	1300	3800	6000	9000	2600	3800	6000	9000	14000	18000	27000
max. Tilting Moment	M_{2KMax}	Nm		30	59	238	456	797	133	225	464	907	1523	2430	4226
No-load Running Torque [5] (n_1=3000 rpm)	T_{012}	Nm	i = 7	-					1.1		5.3				
			i = 10	-					0.7	1.8					
			i = 20	-							3.4				
			i = 100	-					0.6	1.0	1.4	3.5			
Service Life [6]	L_h	h		>20.000											
Efficiency with full load	η	%	1-stage	≥ 96											
			2-stage						≥ 94						
			3-stage						≥ 91						
Weight	m	kg		2.3	4.6	7.3	15	40,5	2.9 / 3.3	5.7 / 5.4	12 / 10.5	23 / 19	44 / 41	79	
Lubrication				Synthetic oil viscosity ISO VG220											
Paint				Blue RAL 5002											
Mounting Position				Please advise with order											
Permissible Gear Reducer Temp.			°C	- 10°C to + 90°C											
Direction of Rotation				Motor and gear reducer same direction											
Degree of Gearbox Protection				IP 64											
Noise Level (n_1=3000 rpm)	L_{PA}	dB(A)		≤70		≤72			≤70		≤72			≤75	

1) 1000 cycles per hour.

2) 1000 times during the service life.

3) If you require higher n_{1N} speed please contact alpha.
At 20°C ambient temperature (if you have higher ambient temperature, please reduce the n_{1N} speed).
In case of S1 conditions please contact alpha.

4) applied to the shaft centre.

5) at 20°C gear reducer temperature.

6) service life of output bearings see page 20.

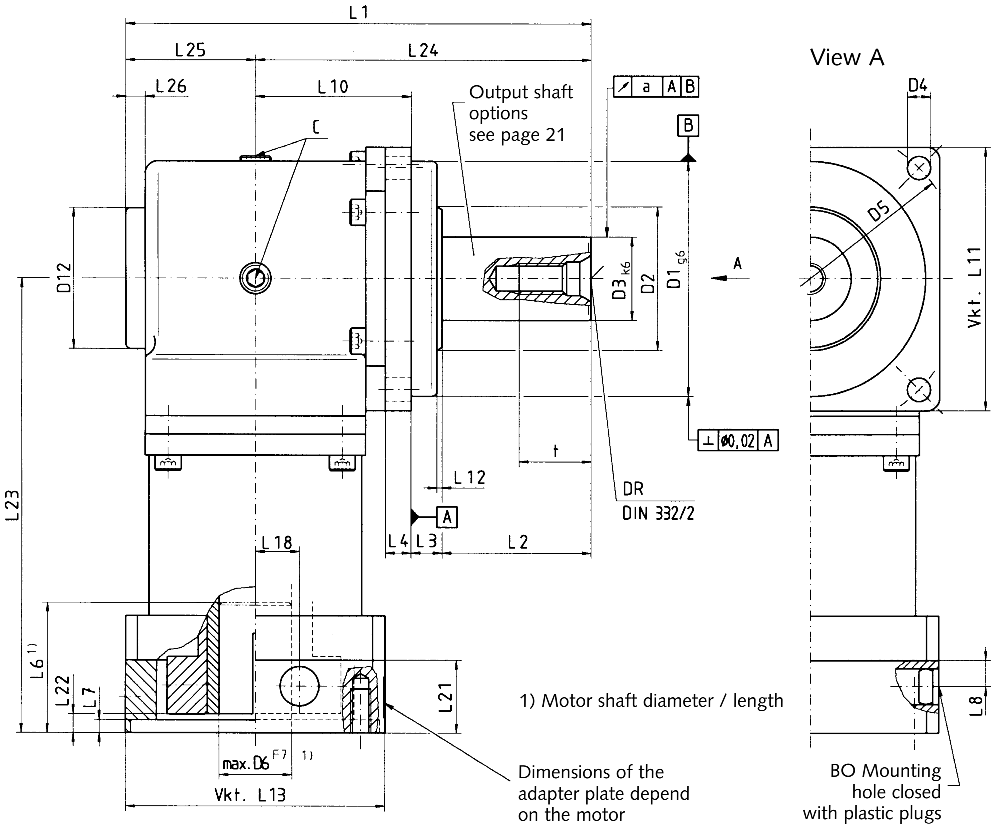
7) only i=200.

Conversion Table:

1 Nm = 8.85 in. lb.
1 kgcm² = 8.85 x 10^{-4} in. lb.s²
1 N = .225 lb_f
1 kg = 2.205 lb_m

Dimensions [in.(mm)]
SK

1 in. = 25.4 mm

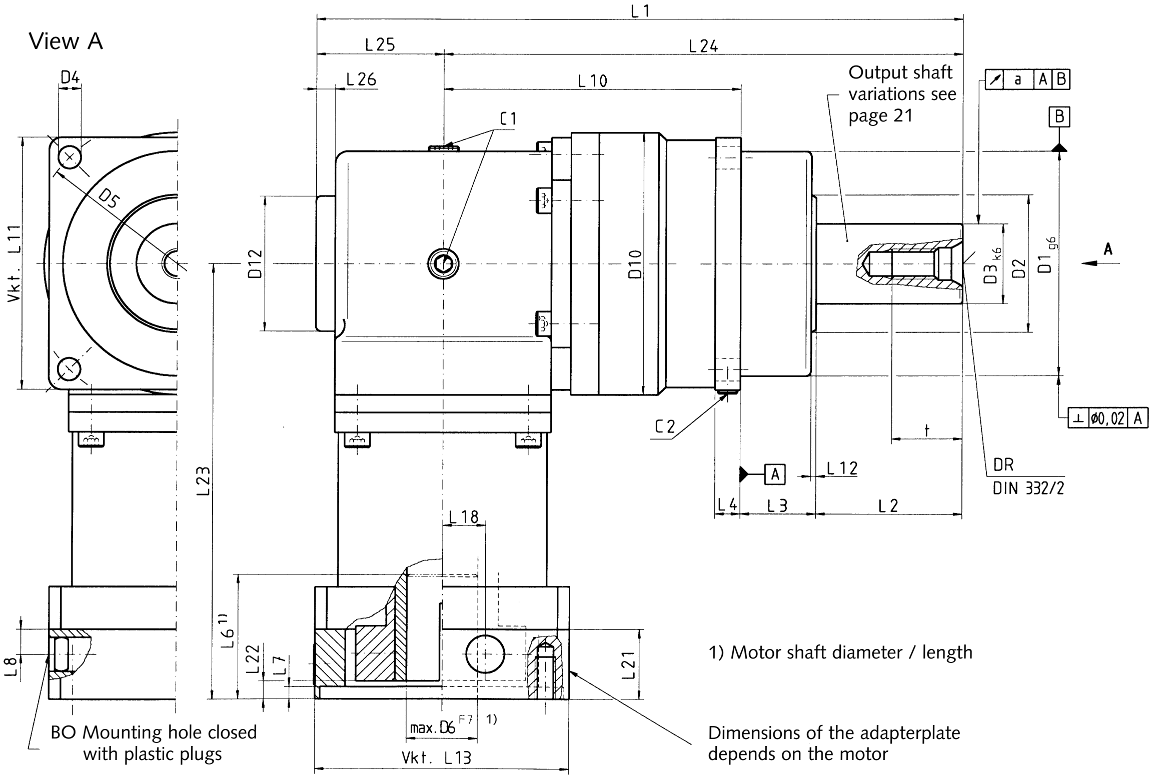


Size		SK 060	SK 075	SK 100	SK 140	SK 180
Gear Stages		1	1	1	1	1
a		0.0012 (0.03)	0.0012 (0.03)	0.0014 (0.035)	0.0016 (0.04)	0.0016 (0.04)
BO		0.3150 (8)	0.5906 (15)	0.7087 (18)	0.7874 (20)	0.7874 (20)
C		3xM8x1	3xM8x1	3xM12x1.5	3xM12x1.5	3xM12x1.5
DR		M4	M5	M8	M12	M16
D1 [2] g6		2.3622 (60)	2.7559 (70)	3.5433 (90)	5.1181 (130)	6.2992 (160)
D2		0.6693 (17)	0.8661 (22)	1.1811 (30)	1.5748 (40)	2.2835 (58)
D3 k6		0.4724 (12)	0.6299 (16)	0.8661 (22)	1.2598 (32)	1.5748 (40)
D4		0.2165 (5.5)	0.2598 (6.6)	0.3543 (9)	0.4331 (11)	0.5118 (13)
D5		2.6772 (68)	3.3465 (85)	4.7244 (120)	6.4961 (165)	8.4646 (215)
D6 [2)4)] F7		0.5512 (14)	0.7480 (19)	1.1024 (28)	1.3780 (35)	1.8898 (48)
D12		1.5748 (40)	1.6535 (42)	2.1260 (54)	2.7559 (70)	3.9370 (100)
L1 [3] ±0.07874 (±2)		4.1339 (105)	5.4527 (138.5)	6.1024 (155)	8.4449 (214.5)	11.2205 (285)
L2		0.7087 (18)	1.1024 (28)	1.4173 (36)	2.2835 (58)	3.2283 (82)
L3		0.4528 (11.5)	0.3543 (9)	0.3937 (10)	0.5512 (14)	0.7087 (18)
L4		0.2362 (6)	0.3543 (9)	0.3937 (10)	0.4724 (12)	0.5906 (15)
L6 [4]	min.	0.5906 (15)	0.9055 (23)	1.1811 (30)	1.2598 (32)	1.7717 (45)
	max.	1.1811 (30)	1.5748 (40)	1.9685 (50)	2.3622 (60)	3.2283 (82)
L7 [4]		0.1575 (4)	0.1575 (4)	0.1969 (5)	0.2362 (6)	0.2362 (6)
L8		0.2205 (5.6)	0.3346 (8.5)	0.3937 (10)	0.4921 (12.5)	0.5118 (13)
L10		1.4961 (38)	2.3031 (58.5)	2.4016 (61)	3.3268 (84.5)	4.0157 (102)
L11 ±0.03937 (±1)		2.4409 (62)	2.9921 (76)	3.9764 (101)	5.5512 (141)	7.1653 (182)
L12		0.0787 (2)	0.0787 (2)	0.0787 (2)	0.0787 (2)	0.1181 (3)
L13 [4] ±0.03937 (±1)	min.	2.3622 (60)	3.1496 (80)	3.9370 (100)	5.5118 (140)	7.4803 (190)
L18		0.3937 (10)	0.4724 (12)	0.6693 (17)	0.7480 (19)	1.1417 (29)
L21 [4]		0.5906 (15)	0.8661 (22)	1.1024 (28)	1.2008 (30.5)	1.4764 (37.5)
L22 [4]		0.1457 (3.7)	0.2441 (6.2)	0.2638 (6.7)	0.2047 (5.2)	0.3661 (9.3)
L23 [4]		4.8622 (123.5)	5.6693 (144)	6.5354 (166)	7.4606 (189.5)	9.9606 (253)
L24		2.6575 (67.5)	3.7598 (95.5)	4.2126 (107)	6.1614 (156.5)	7.9527 (202)
L25		1.4764 (37.5)	1.6929 (43)	1.8898 (48)	2.2835 (58)	3.2677 (83)
L26		0.2953 (7.5)	0.4134 (10.5)	0.1181 (3)	0.2165 (5.5)	0.3150 (8)
t		0.3937 (10)	0.4921 (12.5)	0.7480 (19)	1.1024 (28)	1.4173 (36)

[2] Please reference page 19 for tolerance conversions.
[3] If you have involute toothing at the output shaft, L1 will change (see page 21).
[4] Dimensions depend on the motor.

Dimensions [mm]
SPK

1 mm = 0.03937 in.



Size	SPK 060	SPK 075	SPK 100	SPK 140	SPK 180	SPK 210	SPK 240
Gear Stages	2 / 3	2 / 3	2 / 3	2 / 3	2 / 3	3	3
a	0.03	0.03	0.035	0.04	0.04	0.04	0.04
BO	8	15 / 8	18 / 15	20 / 18	20	20	20
C1	3 x M8 x 1	3 x M8 x 1	3 x M12 x 1.5	3 x M12 x 1.5	3 x M12 x 1.5	3 x M12 x 1.5	3 x M12 x 1.5
C2	-	-	1 x M8 x 1	1 x M8 x 1	1 x M8 x 1	1 x M8 x 1	1 x M8 x 1
DR	M5	M8	M12	M16	M20	M20	M20
D1 g6	60	70	90	130	160	180	200
D2	30	38	55	70	90	120	130
D3 2) k6	16	22	32	40	55	75	85
D4	5.5	6.6	9	11	13	17	17
D5	68	85	120	165	215	250	290
D6 3) F7	14	19 / 14	28 / 19	35 / 28	48 / 35	48	48
D10 ±1	61.5	82	106	140	193	N 212	N 242
D12	40	42 / 40	54 / 42	70 / 54	100 / 70	100	100
L1 2) ±2	172.5 / 192	204.5 / 215.5	254 / 280	320 / 340	399 / 379	498.7	555
L2	28	36	58	82	82	105	130
L3	20	20	30	30	30	38	40
L4	6	7	10	12	15	17	20
L6 3) min.	15	23 / 30	30 / 23	32 / 30	45 / 32	45	45
max.	30	40 / 30	50 / 40	60 / 50	82 / 60	82	82
L7 3) +0.5	4	4	5 / 4	6 / 5	6	6	8
L8	5.6	8.5 / 5.6	10 / 8.5	12.5 / 10	13 / 12.5	13	18
L10	87 / 106.5	105.5 / 122	118 / 149	150 / 180	204 / 209	272.7	302
L11 ±1	62	76	101	141	182 4)	212 4)	242 4)
L12	2	2	2	3	3	3	3
L13 3) ±1 min.	60	80 / 60	100 / 80	140 / 100	190 / 140	190	190
L18	10	12 / 10	17 / 12	19 / 17	29 / 19	29	29
L21 3)	15	22 / 15	28 / 22	30.5 / 28	37.5 / 30.5	37.5	37.5
L22 3) +0.9	3.7	6.2 / 3.7	6.7 / 6.2	5.2 / 6.7	9.3 / 5.2	9.3	9.3
L23 3)	123.5	144 / 123.5	166 / 144	189.5 / 166	253 / 189.5	253	253
L24	135 / 154.5	161.5 / 178	206 / 237	262 / 292	315.5 / 321	415.7	472
L25	37.5	43 / 37.5	48 / 43	58 / 48	83 / 58	83	83
L26	7.5	10.5 / 7.5	3 / 10.5	5.5 / 3	8 / 5.5	8	8
t	12.5	19	28	36	42	42	42

2) If you have involute toothing at the output shaft, L1 will change (see page 21).

3) Dimensions depend on the motor.

4) additional draft 1,5°.

1 mm = 0.03937 in.
1 kgcm² = 8.85 x 10⁻⁴ in. lb.s²
1 Nm = 8.85 in. lb.

Mass moments of inertia J_1 [kgcm²] applies to the input

Gear reducer size	SK 1-stage Ratio i			SPK 2-stage Ratio i						SPK 3-stage Ratio i						
	1	2	3	4	5	7	10	14	20	32	40	56	80	100	140	200
SK 060/SPK 060	0.911	0.663	0.622	0.962	0.947	0.926	0.673	0.667	0.667	0.673	0.673	0.672	0.665	0.665	0.665	0.665
SK 075/SPK 075	3.3	2.33	2.16	3.46	3.39	3.33	2.35	2.33	2.33	0.703	0.701	0.701	0.67	0.67	0.67	0.669
SK 100/SPK 100	11.6	7.98	7.33	12.4	12.1	11.8	8.11	8.05	8.05	2.48	2.47	2.47	2.35	2.35	2.35	2.34
SK 140/SPK 140	25.8	17.8	16.2	27.6	26.6	25.8	18	17.8	17.8	8.5	8.48	8.47	8.07	8.06	8.06	8.06
SK 180/SPK 180	182	91.5	78.8	183	178	173	90.4	89.3	89.3	27.8	27.5	27.2	17.7	17.7	17.6	17.6
SK 210		-				-				95.3	94.8	94.3	92.0	91.7	91.2	90.1
SK 240		-				-				98.0	97.0	95.6	94.3	93.6	92.4	91.5

J_1 isn't dependent on the motor shaft diameter.

Quick Selection

Exact gear reducer selection can be found on page 16 to 20

Cycle Operation S5

(for number of cycles ≤ 1000)

Duty cycle < 60%

1. Determination of the max. motor acceleration torque
   T_{1BMot} [Nm]
2. Determination of the actual max. acceleration torque on the reducer output T_{2b} [Nm]
   $T_{2b} = T_{1BMot} \times i$
3. Comparison of the actual max. acceleration torque T_{2b} [Nm] with the max. permissible acceleration torque T_{2B} [Nm] on the reducer output **$T_{2b} \leq T_{2B}$**
4. Comparison of the motor shaft diameter D_{Mot} [mm] with the dimension D6 [mm]
   $D_{Mot} \leq D6$
5. Comparison of the motor shaft length L_{Mot} [mm] with the dimension L6 [mm]
   $L6_{min} \leq L_{Mot} \leq L6_{max}$

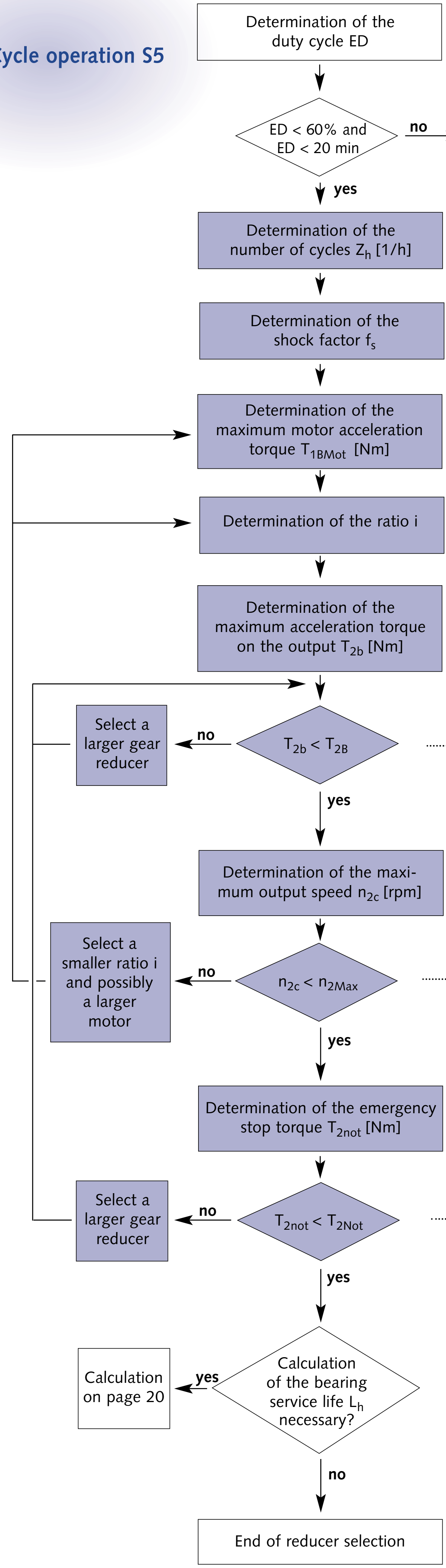
Continuous Operation S1

(use FPM-sealings, indicate this in your order)

Duty cycle ≥ 60%

1. Determination of the motor nominal torque **T_{1NMot} [Nm]**
2. Determination of the actual nominal torque on the reducer output T_{2n} [Nm]
   $T_{2n} = T_{1NMot} \times i$
3. Comparison of the actual nominal torque T_{2n} [Nm] with the permissible nominal torque T_{2N} [Nm] of the reducer output
   $T_{2n} \leq T_{2N}$
4. Determination of the actual input speed
   n_{1n} [rpm]
5. Comparison of the actual input speed n_{1n} [rpm] with the permissible nominal speed n_{1N} [rpm]
   $n_{1n} \leq n_{1N}$
6. Comparison of the motor shaft diameter D_{Mot} [mm] with the dimension D6 [mm]
   $D_{Mot} \leq D6$
7. Comparison of the motor shaft length L_{Mot} [mm] with the dimension of L6 [mm]
   $L6_{min} \leq L_{Mot} \leq L6_{max}$

Cycle operation S5



$$ED = \frac{(t_b + t_c + t_d)}{(t_b + t_c + t_d + t_e)} \cdot 100\ [\%]$$ ED = · 100 [%]

$$ED = t_b + t_c + t_d \quad [min]$$ ED = [min]

$$Z_h = \frac{3600\ [s/h]}{\text{cycle time [s]}}$$ $Z_h = \frac{3600}{}$

Z_h =

f_s =

T_{1BMot} =

i from
- maximum possible input speed
- ratio of the mass moments of inertia
- needed output speed

i =

$T_{2b} = T_{1BMot} \cdot i \cdot f_s \cdot \eta$

T_{2b} =

T_{2b} =

n_{2c} depends on the application

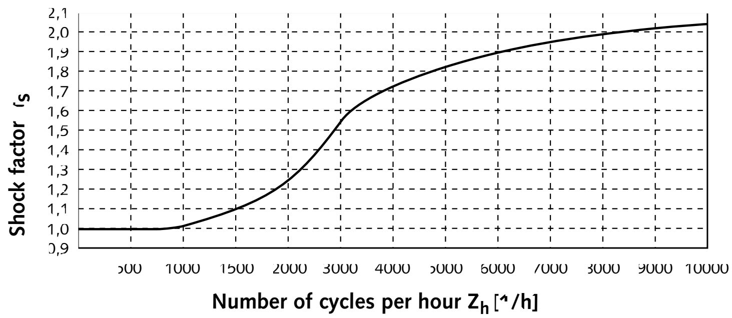
n_{2c} =

$n_{2Max} = \frac{n_{1Max}}{i}$

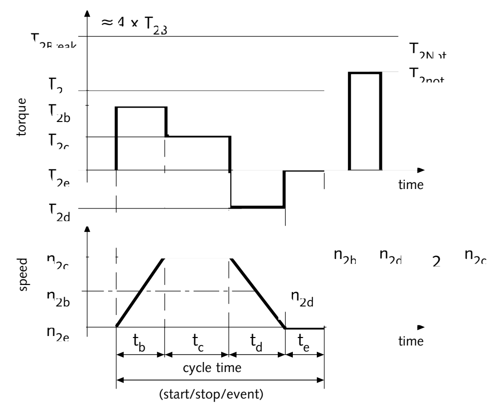
T_{2not} depends on the application

T_{2not} =

Rapid reversals in combination with short acceleration times may cause vibration within the drive assembly. The resulting overloads should be calculated using the shock factor f_s.



All usual loads at the output



Version		η [%]
M	1-stage	≥97
	2-stage	≥94
S	1-stage	≥96
	2-stage	≥93
K	1-stage	≥96
	2-stage	≥94
	3-stage	≥91

1 in.lb = 0.113 Nm

	Version			SP060	SP075	SP100	SP140	SP180	SP210	SP240
T_{2B} [in.lb(Nm)]	M/S		i=4-7/16-70	354 (40)	885 (100)	2213 (250)	4425 (500)	9735 (1100)	16815 (1900)	30090 (3400)
			i=10/100	283 (32)	708 (80)	1770 (200)	3540 (400)	7788 (880)	13452 (1520)	24072 (2720)
	K	SK	i=1-3	89 (10)	221 (25)	553 (62.5)	1106 (125)	2434 (275)	-	-
		SPK	i=4-140	354 (40)	885 (100)	2213 (250)	4425 (500)	9735 (1100)	16814 (1900)	30088 (3400)
			i=20/200	283 (32)	708 (80)	1770 (200)	3540 (400)	7788 (880)	13451 (1520)	24071 (2720)

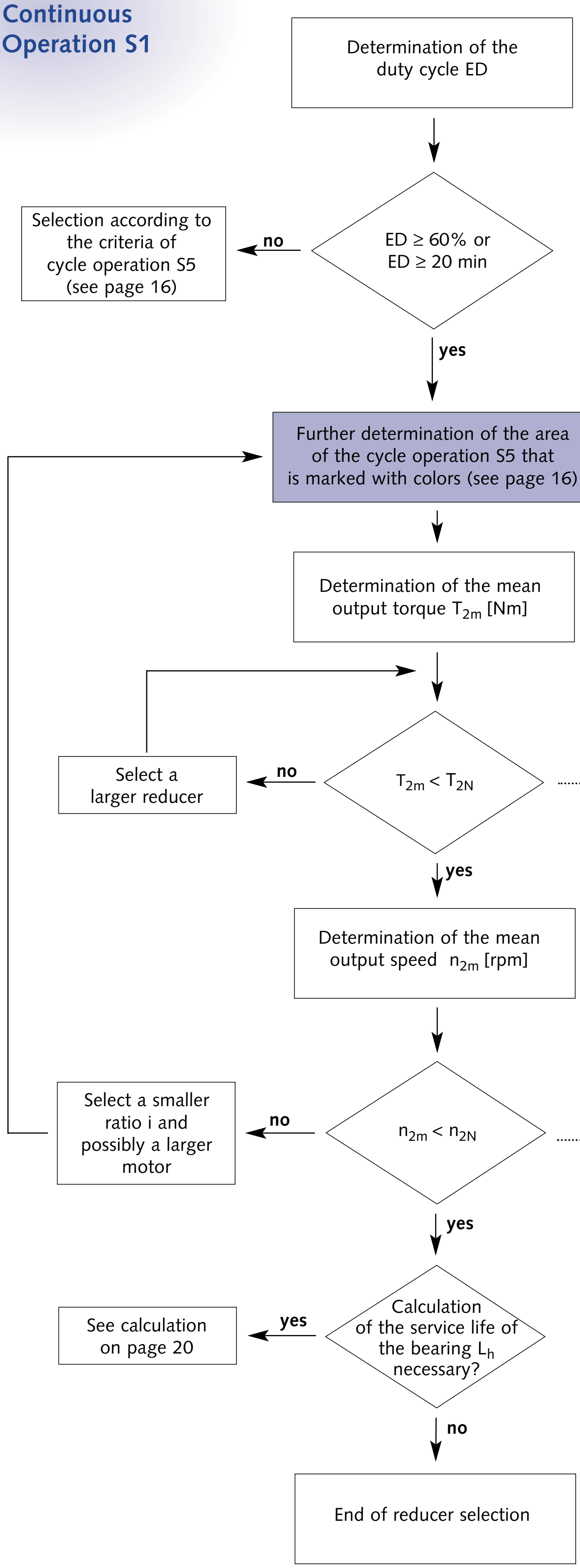
	Version		SP060	SP075	SP100	SP140	SP180	SP210	SP240
n_{1Max} [rpm]	M/S	1-stage	6000	6000	4500	4000	3500	2500	2200
		2-stage					4000	3500	3500
	K	i=1-20	6000	6000	4500	4000	3500	-	-
		i=32-200			6000	4500	4000	700	600

	Version			SP060	SP075	SP100	SP140	SP180	SP210	SP240
T_{2Not} [in.lb(Nm)]	M/S		i=4-7/16-70	885 (100)	2213 (250)	5531 (625)	11063 (1250)	24338 (2750)	42038 (4750)	75225 (8500)
			i=10/100	708 (80)	1770 (200)	4425 (500)	8850 (1000)	19470 (2200)	33630 (3800)	60180 (6800)
	K	SK	i=1-3	221 (25)	553 (62.5)	1381 (156)	2761 (312)	6089 (688)	-	-
		SPK	i=4-140	885 (100)	2213 (250)	5531 (625)	11063 (1250)	24338 (2750)	42035 (4750)	75221 (8500)
			i=20/200	708 (80)	1770 (200)	4425 (500)	8850 (1000)	19470 (2200)	33628 (3800)	60177 (6800)

Save time, let alpha do the sizing for you.
Call (847) 439-0700, and ask for our application engineering department.

Designation and index see page 19

Continuous Operation S1



$$ED = \frac{(t_b + t_c + t_d)}{(t_b + t_c + t_d + t_e)} \cdot 100\ [\%] \qquad ED = \qquad \cdot 100\ [\%]$$

$$ED = t_b + t_c + t_d \quad [min] \qquad ED = \qquad [min]$$

$$T_{2m} = \sqrt[3]{\frac{n_{2b} \cdot t_b \cdot T_{2b}^3 + \ldots + n_{2n} \cdot t_n \cdot T_{2n}^3}{n_{2b} \cdot t_b + \ldots + n_{2n} \cdot t_n}}$$

$$T_{2m} = \sqrt[3]{\frac{\qquad}{\qquad}}$$

$$T_{2m} =$$

$$n_{2m} = \frac{n_{2b} \cdot t_b + \ldots + n_{2n} \cdot t_n}{t_b + \ldots + t_n}$$

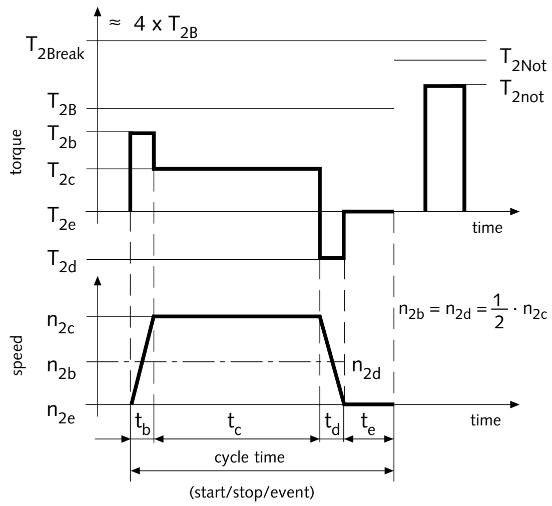
$$n_{2m} = \frac{\qquad}{\qquad}$$

$$n_{2m} =$$

$$n_{2N} = \frac{n_{1N}}{i}$$

On request we carry out calculations at our company for you to select a gear reducer.

All usual loads at the output



If in continuous operations S1 the gear reducer is loaded below or equal the nominal torque T_{2N}, the gearing's fatigue strength will be sufficient. If the input speeds are lower than or equal to the nominal speed n_{1N} and the ambient conditions are normal, the gear reducer temperature will not exceed 90°C.

1 Nm = 8.85 in. lb.

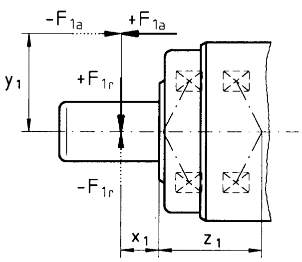
Version			SP060	SP075	SP100	SP140	SP180	SP210	SP240
T_{2N}	M/S	i=4-7/16-70	25	70	170	360	550	1000	1700
		i=10/100	15	45	110	215	550	1000	1700
[Nm]	K SK	i=1-3	6.5	16	40	80	175	-	-
	K SPK	i=4-14, 32-140	25	70	170	360	550	1000	1700
		i=20/200	16.25	45.5	110.5	234	357.5	650	1105

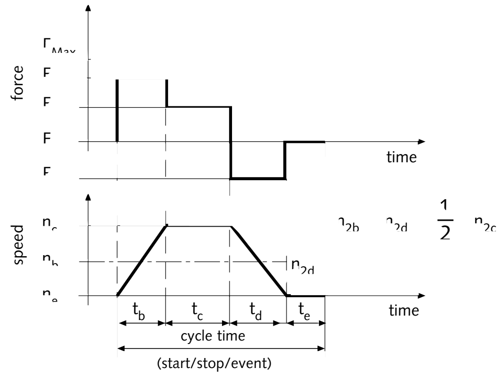
Version			SP060	SP075	SP100	SP140	SP180	SP210	SP240
n_{1N}	M	i=4/5	3300	2900	2500	2100	1500	1200	1000
		i=7/10	4000	3100	2800	2600	2300	1700	1500
		i=16	4400	3500	3100	2900	2700	2100	1900
		i=50	4800	3800	3500	3200	2900	2300	2100
		i=100	5500	4500	4200	3900	3400	2900	2400
	S	i=4/5	1700	1500	1300	1100	800	-	-
		i=7/10	2000	1600	1400	1300	1200	-	-
[rpm]		i=16	2200	1800	1600	1500	1400	-	-
		i=50	2400	1900	1800	1600	1500	-	-
		i=100	2800	2300	2100	2000	1700	-	-
	K SK	i=1	2500	2400	2000	1600	700	-	-
	K SK	i=3	3300	3000	3000	2400	1100	-	-
	K SPK	i=4/5/7	1700	1600	1300	1300	1000	-	-
	K SPK	i=10/14/20	2700	2500	1900	1900	1300	-	-
	K SPK	i=32-200	2500	2700	2500	2000	1800	700	600

Symbol	Unit	Designation
C	Nm/arcmin	Rigidity
ED	%	Duty cycle
F	N	Force
f_s	-	Shock factor
i	-	Ratio
j	arcmin	Backlash
K1	Nm	Bearing calculation factor
L	h	Service Life
M	Nm	Moment
n	rpm	Speed
p	-	Bearing calculation exponent
η	%	Efficiency
t	s	Time
T	Nm	Torque
x	mm	Distance of the radial load to the shaft collar
y	mm	Distance of the axial load to the centre of the gear reducer
z	mm	Bearing calculation factor
Z	1/h	Number of cycles

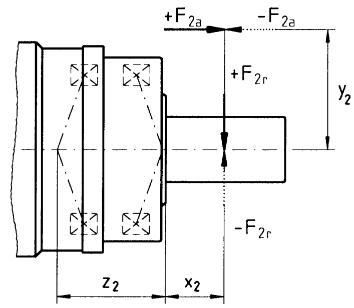
Index	
Capital letters	Permissible values
Small letters	Actual values
1	Input
2	Output
A/a	Axial
B/b	Acceleration
Break	Break
c	Constant
d	Delay
e	Pause
h	Hours
K/k	Tilt
m	Mean
Max/max	Maximum
Mot	Motor
N	Nominal
Not/not	Emergency stop
0	No-load running
R/r	Radial
t	Torsional

Input (S - Version)





Output (M/S/K - Version)



$$F_{1am} = \sqrt[3]{\frac{n_{1b} \cdot t_b \cdot F_{1ab}^3 + \ldots + n_{1n} \cdot t_n \cdot F_{1an}^3}{n_{1b} \cdot t_b + \ldots + n_{1n} \cdot t_n}}$$

$$F_{1rm} = \sqrt[3]{\frac{n_{1b} \cdot t_b \cdot F_{1rb}^3 + \ldots + n_{1n} \cdot t_n \cdot F_{1rn}^3}{n_{1b} \cdot t_b + \ldots + n_{1n} \cdot t_n}}$$

$$F_{2am} = \sqrt[3]{\frac{n_{2b} \cdot t_b \cdot F_{2ab}^3 + \ldots + n_{2n} \cdot t_n \cdot F_{2an}^3}{n_{2b} \cdot t_b + \ldots + n_{2n} \cdot t_n}}$$

$$F_{2rm} = \sqrt[3]{\frac{n_{2b} \cdot t_b \cdot F_{2rb}^3 + \ldots + n_{2n} \cdot t_n \cdot F_{2rn}^3}{n_{2b} \cdot t_b + \ldots + n_{2n} \cdot t_n}}$$

Determine the mean axial and radial force F_{am},F_{rm} [lb_f(N)]

Input: $\frac{F_{1am}}{F_{1rm}} \leq 0.4$; SP60 $\frac{F_{1am}}{F_{1rm}} \leq 1.14$; $x_1 > 0$

Output: $\frac{F_{2am}}{F_{2rm}} \leq 0.4$; SK60, SK75 $\frac{F_{2am}}{F_{2rm}} \leq 1.14$; $x_2 > 0$

no → Consult alpha!

Conversion Table:

1 in.lb = 0.113 Nm
1 lb_f = 4.44 N
1 in. = 25.4 mm

yes

Determine the mean tilting moment M_{km} [in.lb.(Nm)]

$$M_{1km} = \frac{F_{1am} \cdot y_1 + F_{1rm} \cdot (x_1+z_1)}{1000}$$

S-Version	SP060	SP075	SP100	SP140	SP180
z_1[in.(mm)]	1.4961 (38)	1.4567 (37)	1.6240 (41.25)	1.8996 (48.25)	2.3524 (59.75)

$$M_{2km} = \frac{F_{2am} \cdot y_2 + F_{2rm} \cdot (x_2+z_2)}{1000}$$

	Version	SP060	SP075	SP100	SP140	SP180	SP210	SP240
z_2 [in.(mm)]	M/S/K	1.4567 (37)	1.6240 (41.25)	1.8996 (48.25)	2.3524 (59.75)	2.6673 (67.75)	3.2480 (82.5)	3.6024 (91.5)
	SK	0.8858 (22.5)	1.2402 (31.5)	1.7520 (44.5)	1.8504 (47)	1.8701 (47.5)	-	-

Determine the maximum tilting moment M_{kmax} [in.lb.(Nm)]

$$M_{1kmax} = \frac{F_{1amax} \cdot y_1 + F_{1rmax} \cdot (x_1+z_1)}{1000}$$

$$M_{2kmax} = \frac{F_{2amax} \cdot y_2 + F_{2rmax} \cdot (x_2+z_2)}{1000}$$

$M_{kmax} \leq M_{KMax}$
$F_{rmax} \leq F_{RMax}$
$F_{amax} \leq F_{AMax}$

no → Select a larger reducer (Gear reducer selection)

S-Version		SP060	SP075	SP100	SP140	SP180
M_{1KMax}	[in.lb(Nm)]	230 (26)	584 (66)	1000 (113)	2053 (232)	4018 (454)
F_{1RMax}	[lb_f(N)]	124 (550)	293 (1300)	428 (1900)	675 (3000)	1013 (4500)
F_{1AMax}	[lb_f(N)]	214 (950)	259 (1150)	360 (1600)	608 (2700)	1058 (4700)

	Version	SP060	SP075	SP100	SP140	SP180	SP210	SP240
M_{2KMax} [in.lb(Nm)]	M/S/K	1177 (133)	1991 (225)	4106 (464)	8027 (907)	13479 (1523)	21506 (2430)	37400 (4226)
	SK	266 (30)	522 (59)	2106 (238)	4036 (456)	7053 (797)	-	-
F_{2RMax} [lb_f(N)]	M/S/K	585 (2600)	855 (3800)	1350 (6000)	2025 (9000)	3150 (14000)	4050 (18000)	6075 (27000)
	SK	214 (950)	293 (1300)	855 (3800)	1350 (6000)	2025 (9000)	-	-
F_{2AMax} [lb_f(N)]	M/S/K	518 (2300)	720 (3200)	1215 (5400)	2115 (9400)	3038 (13500)	5063 (22500)	6255 (27800)
	SK	113 (500)	158 (700)	428 (1900)	675 (3000)	1013 (4500)	-	-

yes

Determine the mean speed n_m [rpm]

$$n_{1m} = \frac{n_{1b} \cdot t_b + \ldots + n_{1n} \cdot t_n}{t_b + \ldots + t_n}$$

$$n_{2m} = \frac{n_{2b} \cdot t_b + \ldots + n_{2n} \cdot t_n}{t_b + \ldots + t_n}$$

Determine the service life L_h [h]

$$L_{h1} = \frac{16666}{n_{1m}} \cdot \left[\frac{K1_1}{M_{1km}}\right]^{p_1}$$

		SP060	SP075	SP100	SP140	SP180
p_1		3	3.33	3.33	3.33	3.33
$K1_1$	[in.lb(Nm)]	2407 (272)	4929 (557)	8341 (942.5)	16727 (1890)	31860 (3600)

$$L_{h2} = \frac{16666}{n_{2m}} \cdot \left[\frac{K1_2}{M_{2km}}\right]^{p_2}$$

	Version	SP060	SP075	SP100	SP140	SP180	SP210	SP240
p_2	M/S/K	3.33	3.33	3.33	3.33	3.33	3.33	3.33
	SK	3	3	3.33	3.33	3.33	3.33	3.33
$K1_2$ [in.lb(Nm)]	M/S/K	4929 (557)	8341 (942.5)	16727 (1890)	31860 (3600)	54162 (6120)	105138 (11880)	146698 (16576)
	SK	1991 (225)	3567 (403)	15346 (1734)	24444 (2762)	79482 (8981)	-	-

Enough life time L_h?

no → Select a larger reducer (Gear reducer selection)

yes

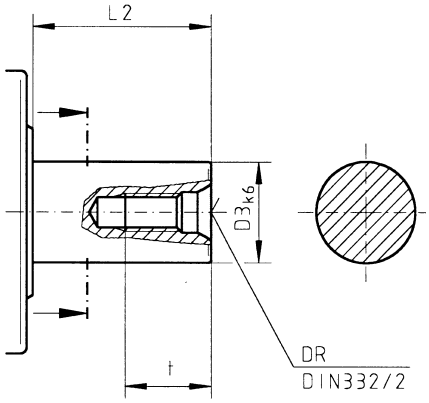
End of the bearing service life calculation L_h

Designations and index see page 19

1 mm = 0.03937 in.

Output Shaft Variations

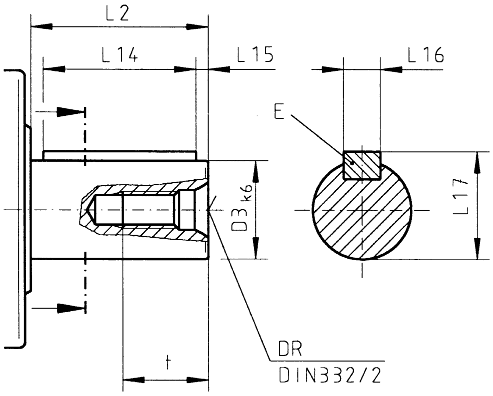
The following output shafts are available for M-, S- and K-version, please indicate this in your order.



Smooth output shaft [mm]

Size	SP(M/S)		SP 060	SP 075	SP 100	SP 140	SP 180	SP 210(M)	SP 240(M)
	SPK		SPK 060	SPK 075	SPK 100	SPK 140	SPK 180	SPK 210	SPK 240
	SK	SK 060	SK 075	SK 100	SK 140	SK 180			
Output shaft-Ø	D3 k6	12	16	22	32	40	55	75	85
Centering bore	DR	M4	M5	M8	M12	M16	M20	M20	M20
Output shaft length	L2 1)	18	28	36	58	82	82	105	130
Depth of thread, centering bore	t	10	12.5	19	28	36	42	42	42

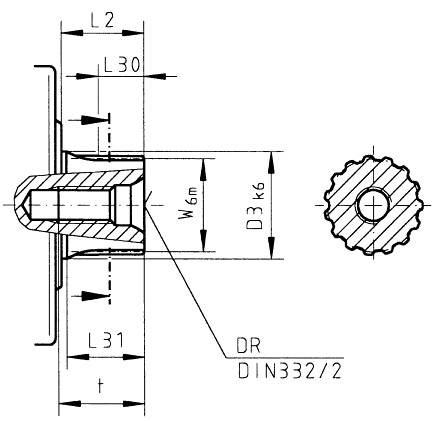
We recommend smooth output shafts for reversing operation and high load at the gear reducer.



Keywayed output shaft [mm]

Size	SP(M/S)		SP 060	SP 075	SP 100	SP 140	SP 180	SP 210(M)	SP 240(M)
	SPK		SPK 060	SPK 075	SPK 100	SPK 140	SPK 180	SPK 210	SPK 240
	SK	SK 060	SK 075	SK 100	SK 140	SK 180			
Output shaft-Ø	D3 k6	12	16	22	32	40	55	75	85
Centering bore	DR	M4	M5	M8	M12	M16	M20	M20	M20
Key	E	Key to DIN 6885 page 1 form A							
Output shaft length	L2	18	28	36	58	82	82	105	130
Key length	L14	14	25	32	50	70	70	90	125
Key location	L15	2	2	2	4	5	6	7	3
Key width	L16 h9	4	5	6	10	12	16	20	22
Output shaft with key	L17	13.5	18	24.5	35	43	59	79.5	90
Depth of thread, centering bore	t	10	12.5	19	28	36	42	42	42

We recommend smooth output shafts for reversing operation and high load at the gear reducer.



Output shaft with involute toothing to DIN 5480 [mm]

Size	SP(M/S)		SP 060	SP 075	SP 100	SP 140	SP 180	SP 210(M)	SP 240(M)
	SPK		SPK 060	SPK 075	SPK 100	SPK 140	SPK 180	SPK 210	SPK 240
	SK	SK 060	SK 075	SK 100	SK 140	SK 180			
Output shaft-Ø	D3 k6	-	16	22	32	40	55	75	85
Centering bore	DR	-	M5	M8	M12	M16	M16	M20	M20
Angle of pressure			30°	30°	30°	30°	30°	30°	30°
Output shaft length	L2 1)	-	26	26	26	40	41.5	52	60
Involute effective length	L30	-	15	15	15	20	21.5	28	36
Involute length	L31	-	21	22.5	23	32	33.5	45	53
Module	m	-	0.8	1.25	1.25	2	2	2	2
Depth of thread, centering bore	t	-	12.5	19	28	36	42	42	42
Shaft DIN 5480	W 6m	-	16	22	32	40	55	70	80
Number of teeth	z	-	18	16	24	18	26	34	38
The fit combination 7H/6m results in the following backlash values:									
min. Backlash	j_{tmin}	-	-0.027	-0.027	-0.033	-0.033	-0.037	-0.037	-0.037
max. Backlash	j_{tmax}	-	0.021	0.021	0.028	0.028	0.031	0.031	0.031

For j_{tmin} the pinion should be warmed to + 80°C.

[1] The total length L1 (page 5, 9, 13 and 14) contains the length L2 of the smooth shaft.
If you use an output shaft with involute toothing, L1 will be shorter correspondingly.
Example: L_1 involute shaft = L_1 smooth shaft – L_2 smooth shaft + L_2 involute shaft

Ordering Code **SP 075 - MF2 - 70 - 021/Motor - V3**

Gear Reducer Type
SP 060/075/100/140/180/210/240

Reducer Design
M = Motor-mounted "M"
S = Self-contained "S"
SP 210 / SP 240 only "M"

Reducer Execution
F = Standard
FPM seals (Viton®)
X = Customized

Number of Stages
1 = 1-stage
2 = 2-stage

Ratio i
1-stage = 4 / 5 / 7 / 10
2-stage = 16 / 20 / 28 / 40 / 50 / 70 / 100

Mounting Position (see below)

Motor Designation (Manufacturer-Type)
isn't necessary for S-Version

Backlash
1 = Standard
0 = Reduced

Clamping hub bore Diameter
M-version: Code numbers - see table below
S-version: 0 = smooth input shaft
1 = keyed input shaft

Type of Output shaft
0 = smooth shaft
1 = Shaft with key DIN 6885 Form A
2 = Involute DIN 5480
4 = Others

Code Number - Diameter of bore for the clamping hub (SP)

1 in. = 25.4 mm

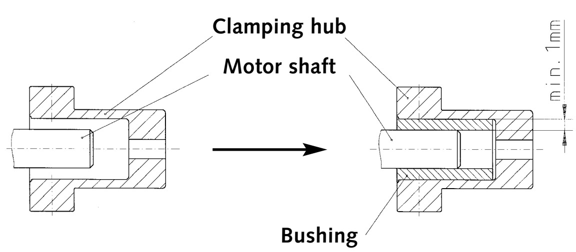
Gear stages	1 2	1 2	1 2	1 2	1	2	1	2	1	2
Motor shaft-Ø [in.(mm)]*	SP 060	SP 075	SP 100	SP 140	SP 180		SP 210		SP 240	
0.4331 (11)	2	1	x	x	x	x	x	x	x	x
0.5512 (14)	3	2	1	x	x	x	x	x	x	x
0.7480 (19)	-	3	2	1	x	1	x	x	x	x
0.9449 (24)	-	-	3	2	x	2	x	x	x	x
1.1024 (28)	-	-	4	x	x	x	x	x	x	x
1.2598 (32)	-	-	5	4	4	4	x	1	x	1
1.3780 (35)	-	-	-	5	x	5	x	x	x	x
1.4961 (38)	-	-	-	6	6	6	x	2	x	2
1.8898 (48)	-	-	-	-	7	-	x	3	x	3
2.1654 (55)	-	-	-	-	-	-	4	-	x	-
2.3622 (60)	-	-	-	-	-	-	-	-	4	-

* If your motor shaft diameter is not listed, add 2mm to diameter and select next higher size.

- = choose next larger gear reducer
x = choose next larger code number

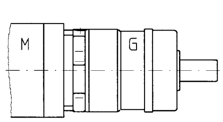
Bushing

If the motor shaft and the clamping hub diameter do not fit together . . .

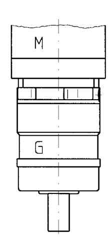


. . . a bushing is used.

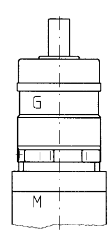
Mounting Position



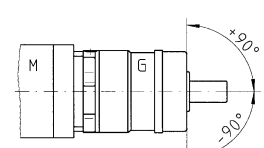
B5-horizontal



V1-vertical
with output shaft
facing downwards



V3-vertical
with output shaft
facing upwards



S-can be pivoted ± 90°
from the horizontal

M = Motor
G = Gear reducer

Ordering Code

SK 075 - MF1 - 3 - 031/Motor - V3/B5
SPK 075 - MF3 - 200 - 021/Motor - V3/B5

Gear reducer Type
SK 060 / 075 / 100 / 140 / 180
SPK 060 / 075 / 100 / 140 / 180 / 210 / 240

Reducer Design
M = Motor-mounted "M"

Reducer Execution
F = Standard
FPM seals (Viton®)
X = Customized

Number of Stages
SK: 1 = 1-stage
SPK: 2 = 2-stage / 3 = 3-stage
SPK 210 / SPK 240 only 3-stage

Ratio i
SK: 1-stage = 1 / 2 / 3
SPK: 2-stage = 4 / 5 / 7 / 10 / 14 / 20
3-stage = 32 / 40 / 56 / 80 / 100 / 140 / 200

Mounting Position (see below)

Motor Designation
(Manufacturer-Type)

Backlash
1 = Standard (SK / SPK)
0 = Reduced (only SPK)

Clamping hub bore Diameter
Code numbers - see table below

Type of Output shaft
0 = smooth shaft
1 = Shaft with key DIN 6885 Form A
2 = Involute DIN 5480
4 = Others

Code Number - Diameter of bore for the clamping hub (SK/SPK)

1 mm = 0.03937 in.

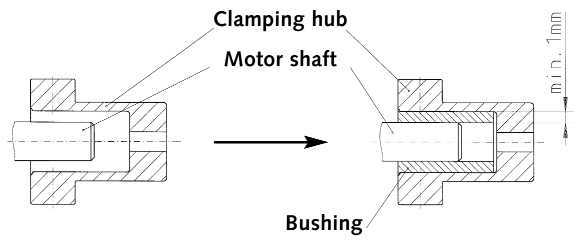
Gear stages	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	3	3
Motor shaft Ø [mm]*	SK 060	SPK 060		SK 075	SPK 075		SK 100	SPK 100		SK 140	SPK 140		SK 180	SPK 180		SPK 210	SPK 240
14	3	3	3	x	x	2	x	x	x	x	x	x	x	x	x	x	x
19	-	-	-	3	3	-	x	x	2	x	x	x	x	x	x	x	x
28	-	-	-	-	-	-	4	4	-	x	x	3	x	x	x	x	x
35	-	-	-	-	-	-	-	-	-	5	5	-	x	x	5	x	x
48	-	-	-	-	-	-	-	-	-	-	-	-	7	7	-	7	7

* If your motor shaft diameter is not listed, add 2 mm to diameter and select next higher size.

- = choose next larger gear reducer
x = choose next larger code number

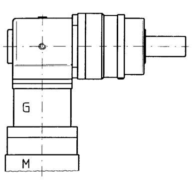
Bushing

If the motor shaft- and the clamping hub diameter do not fit together . . .

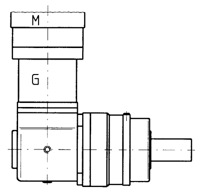


. . . a bushing is used.

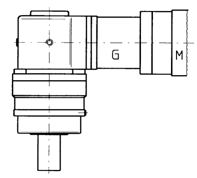
Mounting Position



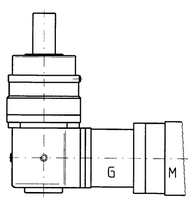
B5/V3-Output shaft horizontal, Motor shaft facing upwards



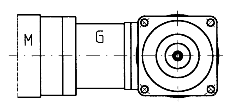
B5/V1-Output shaft horizontal, Motor shaft facing downwards



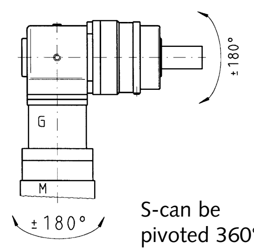
V1/B5-Output shaft vertical facing downwards, Motor shaft horizontal



V3/B5-Output shaft vertical facing upwards, Motor shaft horizontal



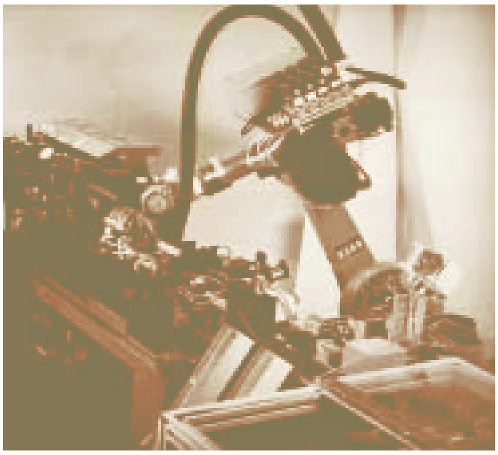
B5/B5-Output shaft and motor shaft horizontal



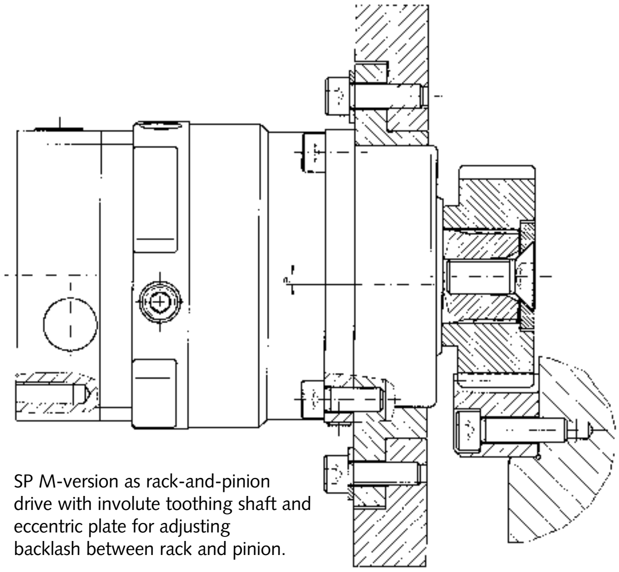
S-can be pivoted 360°

M = Motor
G = Gear reducer

Installation- and Application Examples

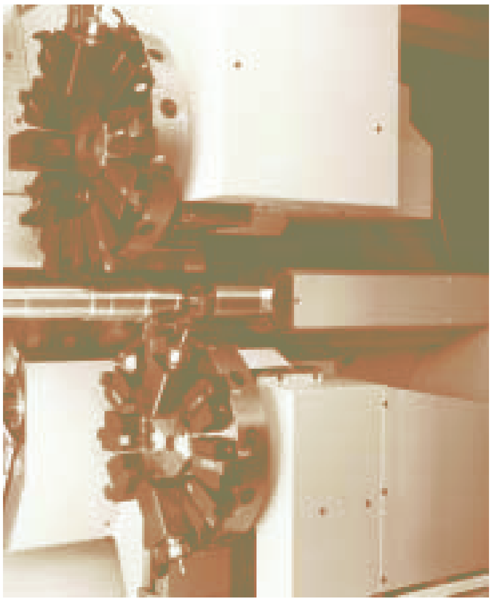


KUKA–Industrial Robot IR 363/6.0



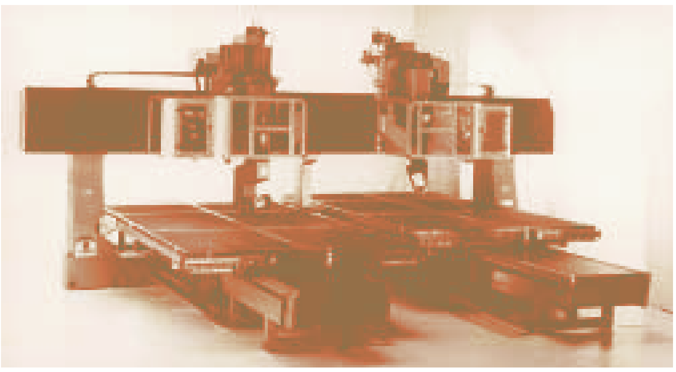
SP M-version as rack-and-pinion drive with involute toothing shaft and eccentric plate for adjusting backlash between rack and pinion.

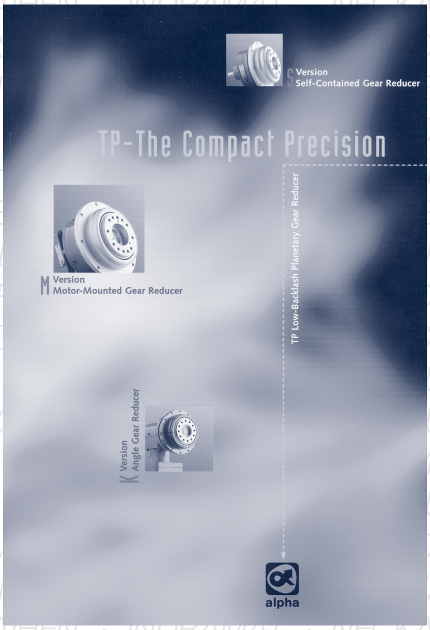
Böhringer–CNC Lathe VDF 25 M/Turret Head

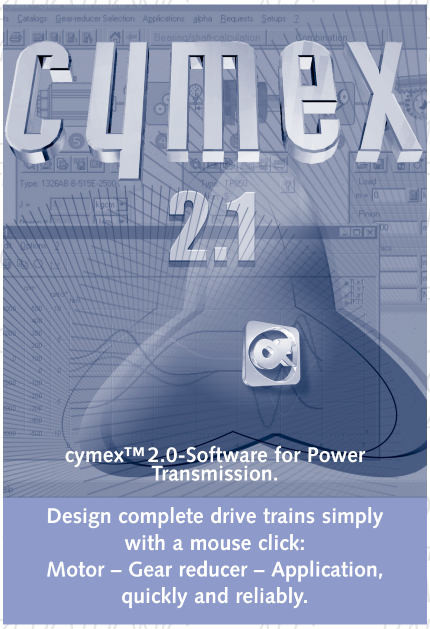


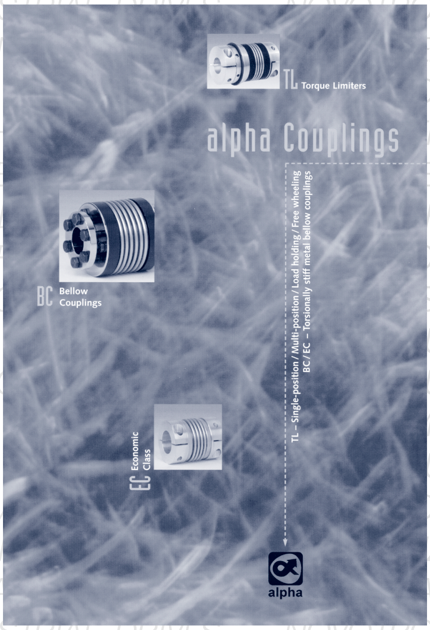
Husky–Servo "C" PET-Robot

CMS-Wood working machine









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