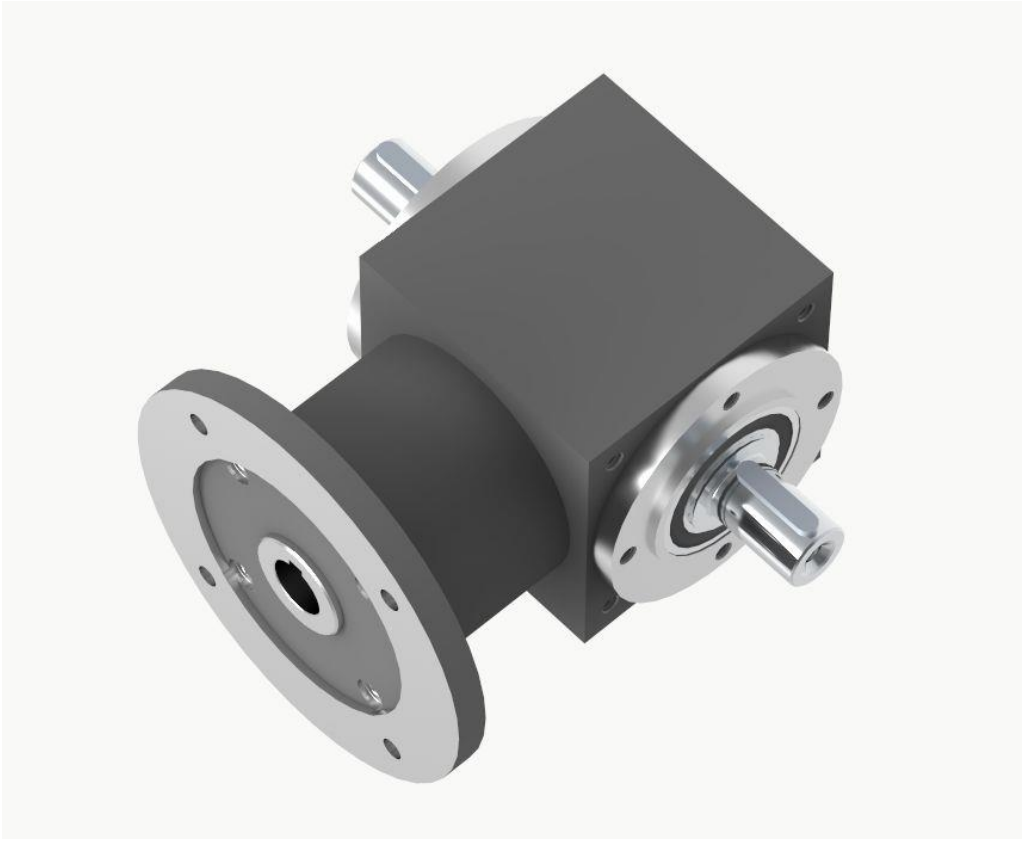
Gesellschaft für innovative Automationstechnik mbH

Bevel gears



Preface

To realise automation solutions in a technically and economically efficient way, it is essential to trust in the competence and experience of specialists.
We consequently follow the idea of systems to offer a comprehensive range of standardised automation solutions with which line and gantry robots, palletisers and manipulators can be realised in an economically efficient way.

Take advantage of our experience and our specialist's know-how! Benefit from our innovative technologies for economical, user-oriented solutions. Wherever custom-tailored and individual automation solutions are required – we are your competent partner!

Although this catalogue was compiled with the greatest care and checked for errors, we cannot take any liability for incomplete or incorrect data.
Due to the permanent technical progress all data given in this catalogue are subject to change without notice.
Printing or copying the catalogue or excerpts of it, no matter how or by what means, is only allowed with written permission by GiA mbH.

Table of content

Bevel gears

Our spiral bevel gears feature robust housings made of cast iron, they are hardened and lapped in pairs with well-dimensioned rolling bearings. Spiral bevel gears have the great advantage of favourable meshing characteristics (i. e. high contact ratio). They are extremely robust, have an optimal running quietness and a high degree of transmission accuracy. Curved bevel gears are more reseistant against distortion than those with straight or helical teeth. Their relative insensitivity to elastic distortion of wheels, shafts and bearings is another benefit of these gearboxes. That is why the bevel gears are able to transmit even extreme shock loads. Ten different standard models of the bevel gears are available. The can be used in all operating positions and be provided with mounting holes on all siedes.

Design with low backlash

All bevel gears are available with low backlash. When the drive shaft is locked, the circumferential backlash on the slow-running shaft is measured on a 100 mm lever arm with a measuring force of 20 to 50 N and then is quoted as a torsion angle.

Standard gear sets are available with the following values:

S1: i = 1:1 to 2:1 <6 arc minutes

S2: i = 3:1 to 6:1 <10 arc minutes

Torsion angles <6 arc minutes are available (contact us).

Non-corrosive gears

Non-corrosive gears are suitable for all applications where the drive is in contact with aggressive substances. As a standard the housings are nickel-plated and tinned afterwards. The shafts are made of stainless steel. The sealings are adapted to the respective application.

For special applications the bevel gears are also available in stainless steel design.

NOTOX gears

Especially for applications of the food or pharmaceutical industry our bevel gears are available with NOTOX lubricants. We use fully synthetic oils and greases that comply with USDA H-1.

Bevel gears

Gear ratios

The standard gear ratios are 1 – 1.5 – 2 – 3 – 4 - 5 and 6 : 1. All gear ratios are mathematically exact. The gears are suitable for gearing down and gearing up. Special gear ratios are available on demand.

Efficiency

The efficiency of the bevel gears is **94 to 98 %** (depending on speed, operating position, sealing and kind of lubricant). The efficiency refers to the rated power of the gears. In certain operating positions the bevel gears are fully covered with lubricant. Especially larger gears with high circumferential speeds are subject to considerable churn losses (contact us). Please note that the starting efficiency is always lower than the operating efficiency. The resulting increased breakaway torque has to be considered for the dimensioning of the drive power.

Sealing

As a standard all gears feature sealing rings to prevent oil leakage. Splash-proof gears with radial shaft lip type seals (type AS) at input and output are available on demand as well as special sealings for particular ambient conditions.

Outside coating

The coating consists of a red-brown acrylic primer. Finishings are available at an extra charge.

Bevel gears

Lubrication

The lubrication depends on the circumferencial speed of the bevel gears.

Low speed – lubrication A:

The gears are delivered fully closed and need neither be bleeded during storage nor during operation. The lubricant is synthetic oil with a viscosity according to ISO VG 460.

High speed – lubrication B:

Depending on the speed the bevel gears are filled with synthetic oil of a viscosity according to ISO VG 220 to VG 32. The gears are equipped with an air vent according to the operating position (lubrication B1). If the housing temperature of the gear exceeds 50 °C, the bleed filter provided has to be fitted to avoid overpressure in the gear and with that a leakage. In case of intermittent operation or other application conditions where gear temperatures of over 50 °C are not to be expected a bleed hole is not necessary (lubrication B0).

Very high speed – lubrication C:

Injection lubrication – dimensioning according to the application. Please contact us and give us the details of the application.

Speed	Gear size – flange dimension						
n2 [1/min]	065	090	120	140	160	200	260
300							
400	Lubrication A						
500							
700							
1000							
1500	Lubrication B						
1800							
2400							
3000							
3600							
4500						Lubrication C	
6000							

Instructions

Gears with permanent lubrication

We only take liability for the promised characteristics of our bevel gears if the following instructions are complied with.

Delivery state

All bevel gears leave the factory only after strict tests and properly packed. Check the delivery immediately after receipt for potential transport damage to make potential complaints to the shipping company immediately.

Lubrication

Bevel gears with permanent lubrication are supplied oil filled, ready for operation. Relubrication is only required if large amounts of lubricant have leaked. If initial filling is not required the inner parts of the gears will be preserved. The preservation lasts under normal transport conditions and for about six month until commissioning.

Installation

Gears with a free shaft should either be mounted onto a stable foundation or as flange gears directly to the machine. With regard to operating safety and quiet running the shafts have to be aligned very carefully. Use elastic couplings to compensate small mounting inaccuracies. The coupling should be mounted warmed up or using the centring and a screw. Connecting components must not be mounted using a hammer or similar tools to avoid damage of the teeth flanks, the roller bearings and retaining rings! Shaft mounted gears can be mounted directly to the machine shaft. They are monted axially using an end plate and a screw. When using flange gears make sure the mounting face and the shaft axis of the machine are exactly angular. Otherwise the bearings of the gear will be additionally loaded and might possibly be destroyed prematurely. The reaction torque equaling the torque can be conpensated using a torque support. In order to avoid additional bending stress the torque support has to be mouted to the machine side of the gear. Never mount the gear directly to the foundation if the machine shaft bearing is near the gear!

Commissioning

The bevel gears are closed for transport, i. e. equipped with a closing screw. If a gear vent is provided the closing screw has to be replaced by the air vent provided.

Warranty

During the warranty period the bevel gears must only be opened with our written permission. Otherwise all waranty claims will expire.

Dimensioning of the gear

The gear type, the model and the gear ratio usually result from the kind of application, the machine to be driven and the space. When a gear is dimensioned, all influences the drive will be exposed to during operation should be considered. The following topics are vital for operating safety and a long working life of the gears.

1. Use of the gear

- Kind, power and speed of the drive
- Gear ratio required
- Kind, power, torque, output torque and output speed of the machine
- Setting of the sense of rotation of input and output shaft
- Ambient conditions
- Other requirements

2. Load conditions of the gear

- Operation mode of the drive
- Operation mode of the machine
- Average operating hours per day
- Average duty cycle per hour in %
- Start-ups per hour
- Ambient temperature
- Kind of lubricant
- Additional loads at input and output shaft

Terms, formulas and factors

n1	[1/min]	Speed of the fast running shaft
n2	[1/min]	Speed of the slow running shaft (n1 : i)
iN		Rated gear ratio
iI		Actual gear ratio
J	[kgm²]	Mass inertia
P1	[kW]	Effective driving power (P1 = T2 x·n2 : 9550 x η) nicht definiert
P1m	[kW]	Driving power corrected by factors, mechanical
P1t	[kW]	Driving power corrected by factors, thermal
P1N	[kW]	Permissible rated driving power of the gear, mechanical
P1Nt	[Nm]	Permissible rated driving power of the gear, thermal

Dimensioning of the gear

T2	[Nm]	Effective output torque (T2 = 9550 x P1 : n2 x η)
T2m	[Nm]	Output torque, corrected by factors, mechanical
T2t	[Nm]	Output torque, corrected by factors, thermal
T2N	[Nm]	Permissible rated output torque of the gear, mechanical
T2Nt	[Nm]	Permissible rated output torque of the gear, thermal
T2max	[Nm]	Maximum permissible output torque of the gear
f1		Operational factor
f2		Start-up factor
f3		Lubrication factor (only for mineral oil lubrication)
f4		Ambient temperature
f5		Duty cycle per hour

Determination of the size

The permissible power input ratings P1N and the rated output torques T2N given in the tables are valid for shock-free operation, 10 operating hours per day and 10 start-ups per hour, with an input power of 2.5 times the nominal power being permitted during start-up.

The thermal power ratings P1Nt and rated output torques T2Nt apply to an ambient temperature of 20 °C and a duty cycle of 100 %. The maximum output torque T2max may be reached frequently for short loading peaks, but must not be exceeded.

The input power or output torque required has to be calculated on the basis of the operating factors for the dimensioning of the gears.

Mechanical:	Thermal:
P1m = P1 x f1 x f2 x f3	P1t = P1 x f3 x f4 x f5
T2m = T2 x f1 x f2 x f3	T2t = T2 x f3 x f4 x f5

The formulas take machanical and thermal influences into account. The following conditions are valid for the dimensioning of the gears:

P1m < P1N	P1t < P1Nt	T2m < T2N	T2t < T2Nt

The values given in the performance tables are valid for lubrication by synthetic oils, based on a lubricant temperature of 95 °C.

If an excession of the maximum oil temperature can be safely prevented by special measures (e. g. oil cooler) the thermal power limit needs not to be determined. The permissible torques may be exceeded in special cases, e. g. very short running times or static loading only (contact us). Exploitation of the maximum output torque T2max may make a press fit on the output shaft necessary, as the normal feather key connection is not always adequate.

Dimensioning of the gear

Load factor f1

Driving motor	Load category	Operating hours/day			
		< 0,5	3	10	24
Elektric motor	G	0.8	0.9	1.0	1.25
Hydraulic motor	M	0.9	1.0	1.25	1.5
Turbine	S	1.0	1.25	1.5	1.75
IC engine	G	0.9	1.0	1.25	1.5
	M	1.0	1.25	1.5	1.75
4 - 6 cylinders	S	1.25	1.5	1.75	2.0
IC engine	G	1.0	1.25	1.5	1.75
	M	1.25	1.5	1.75	2.0
1 - 2 cylinders	S	1.5	1.75	2.0	2.25

Load parameters

Category G: small load/no shocks

Mass acceleration factor <0.25

Filling machines, elevators, light screw conveyors, light conveyor belts, blowers, small agitators, control machines, assembly lines, auxiliary drives for machine tools, centrifuges, packaging machinery

Category M: medium loads/light shocks

Mass acceleration factor <3.00

Reel winders, agitators, plate conveyors, calenders, lifts, mixers, balancing machines, heavy-duty conveyor belts, sheet metal bending machines, road-building machinery, planing machines, shears, extruders, main drives for machine tools, kneading machines, weaving looms, light table rollers

Category S: heavy loads/heavy shocks

Mass acceleration factor <10.00

Excavators, heavy-duty mixers, presses, muller mixers, rolling mills, heavy-duty table rollers, cold reduction mills, stone crushers, eccentric presses, cutter heads, folding machines, rubber belt conveyors (batch loads), bark peeling drums, running gears, punching presses, piston pumps, rotary furnaces, mills, plate filters.

Dimensioning of the gear

Start-up factor f2

A prerequisite for application of the start-up factor is that the start-up torque (or braking torque) of the driving machine does not exceed 2.5 times the rated torque of the gear.

T1A < 2.5 x T1N = 9550 x P1N / n1

Start-ups per hour	**up to 10**	**10 - 60**	**60 - 500**	**500 - 1500**
f2	1.0	1.1	1.2	1.3

Lubrication factor f3

Efficiency, working life and the permissible oil temperature depend on the quality of the oil used. Consider the lubrication factor when using mineral oils.

Ölart	**Syntheseöl**	**Mineralöl**
f3	1.0	1.1

Temperature factor f4

Ambient temperature [°C]	**10**	**20**	**30**	**40**	**50**
f4	0.9	1.0	1.15	1.4	1.7

Duty cycle per hour f5

ED [%]	**100**	**80**	**60**	**40**	**20**
f5	1.0	0.95	0.86	0.75	0.56

Selection of the gears – Bevel gear V

iN/il	n1	n2	[KW]	Size						
	[1/min]	[1/min]	[Nm]	065	090	120	140	160	200	260
1:1-6:1			**P1Nt**	**1.60**	**3.80**	**6.20**	**10.00**	**15.00**	**26.00**	**42.00**
1/1	3000	3000	P1N	3.31	8.93	21.82	39.68			
			T2N	10.00	27.00	66.00	120.00			
	1500	1500	P1N	1.82	5.29	13.56	26.78	42.99	74.40	157.07
			T2N	11.00	32.00	82.00	162.00	260.00	450.00	950.00
	750	750	P1N	1.07	3.06	8.51	16.20	25.63	45.88	96.72
			T2N	13.00	37.00	103.00	196.00	310.00	555.00	1170.00
	500	500	P1N	0.83	2.20	6.34	11.46	18.19	34.17	72.75
			T2N	15.00	40.00	115.00	208.00	330.00	620.00	1320.00
	250	250	P1N	0.47	1.21	3.39	5.92	9.64	19.58	42.44
			T2N	17.00	44.00	123.00	215.00	350.00	710.00	1540.00
	50	50	P1N	0.10	0.28	0.72	1.21	2.09	4.13	9.64
			T2N	18.00	50.00	130.00	220.00	380.00	750.00	1750.00
			T2max	**25.00**	**105.00**	**220.00**	**430.00**	**660.00**	**1090.00**	**2310.00**
1,5/1	3000	2000	P1N	2.20	5.51	13.45	24.91	40.78	72.75	189.58
			T2N	10.00	25.00	61.00	113.00	185.00	330.00	860.00
	1500	1000	P1N	1.21	3.20	8.60	17.08	27.78	48.17	104.71
			T2N	11.00	29.00	78.00	155.00	252.00	437.00	950.00
	750	500	P1N	0.72	1.93	5.18	10.47	16.26	30.31	64.48
			T2N	13.00	35.00	94.00	190.00	295.00	550.00	1170.00
	500	333	P1N	0.55	1.36	3.85	7.34	11.56	22.57	47.72
			T2N	15.00	37.00	105.00	200.00	315.00	615.00	1300.00
	250	167	P1N	0.31	0.74	1.99	3.76	6.07	12.70	27.43
			T2N	17.00	40.00	108.00	204.00	330.00	690.00	1490.00
	50	33	P1N	0.07	0.16	0.41	0.76	1.29	2.73	6.18
			T2N	18.00	45.00	113.00	210.00	355.00	750.00	1700.00
			T2max	**25.00**	**80.00**	**169.00**	**358.00**	**650.00**	**980.00**	**2100.00**
2/1	3000	1500	P1N	1.65	3.80	9.26	16.53	28.11	51.25	133.92
			T2N	10.00	23.00	56.00	100.00	170.00	310.00	810.00
	1500	750	P1N	0.91	2.23	6.03	11.41	20.25	35.13	78.53
			T2N	11.00	27.00	73.00	138.00	245.00	425.00	950.00
	750	375	P1N	0.54	1.32	3.55	6.86	11.57	22.32	48.36
			T2N	13.00	32.00	86.00	166.00	280.00	540.00	1170.00
	500	250	P1N	0.41	0.94	2.54	4.96	8.27	16.81	35.27
			T2N	15.00	34.00	92.00	180.00	300.00	610.00	1280.00
	250	125	P1N	0.23	0.50	1.35	2.62	4.41	9.37	20.12
			T2N	17.00	36.00	98.0	190.00	320.00	680.00	1460.00
	50	25	P1N	0.05	0.10	0.29	0.55	0.98	2.07	4.55
			T2N	18.00	37.00	107.00	200.00	355.00	750.00	1650.00
			T2max	**25.00**	**80.00**	**169.00**	**320.00**	**650.00**	**980.00**	**2100.00**
3/1	3000	1000	P1N		2.54	6.39	12.12	20.94	46.29	85.97
			T2N		23.00	58.00	110.00	190.00	420.00	780.00
	1500	500	P1N		1.49	4.08	8.05	12.68	28.38	49.60
			T2N		27.00	74.00	146.00	230.00	515.00	900.00
	750	250	P1N		0.88	2.40	4.60	6.89	15.98	28.93
			T2N		32.00	87.00	167.00	250.00	580.00	1050.00
	500	167	P1N		0.63	1.66	3.20	4.79	11.04	20.43
			T2N		34.00	90.00	174.00	260.00	600.00	1110.00
	250	83	P1N		0.33	0.87	1.62	2.56	5.76	11.16
			T2N		36.00	95.00	177.00	280.00	630.00	1220.00
	50	17	P1N		0.07	0.21	0.34	0.57	1.29	2.55
			T2N		37.00	110.00	180.00	305.00	690.00	1360.00
			T2max		**70.00**	**155.00**	**280.00**	**457.00**	**910.00**	**1940.00**

Dimensioning of the gears – Bevel gear V

iN/il	n1	n2	[kW]	Size						
	[1/min]	[1/min]	[Nm]	065	090	120	140	160	200	260
1:1-6:1			**P1Nt**		**3.80**	**6.20**	**10.00**	**15.00**	**26.00**	**42.00**
4/1	3000	750	P1N		1.90	4.96	8.51	14.88	28.93	57.87
			T2N		23.00	60.00	103.00	180.00	350.00	700.00
	1500	375	P1N		1.12	3.06	4.96	9.09	18.81	37.20
			T2N		27.00	74.00	120.00	220.00	455.00	900.00
	750	187.5	P1N		0.66	1.69	3.06	5.17	10.54	22.73
			T2N		32.00	82.00	148.00	250.0	510.00	1100.00
	500	125	P1N		0.47	1.16	2.12	3.58	7.23	16.26
			T2N		34.00	84.00	154.00	260.00	525.00	1180.00
	250	62.5	P1N		0.25	0.60	1.12	1.86	3.79	8.61
			T2N		36.00	87.00	162.00	270.00	550.00	1250.00
	50	12.5	P1N		0.05	0.12	0.23	0.39	0.80	1.82
			T2N		37.00	90.00	170.00	280.00	580.00	1320.00
			T2max		**70.00**	**155.00**	**280.00**	**422.00**	**860.00**	**1940.00**
5/1	3000	600	P1N		1.52	3.97	6.61	11.90	19.84	46.29
			T2N		23.00	60.00	100.00	180.00	300.00	700.00
	1500	300	P1N		0.89	2.38	3.80	7.11	12.57	29.10
			T2N		27.00	72.00	115.00	215.00	380.00	880.00
	750	150	P1N		0.53	1.42	2.15	3.97	7.27	18.19
			T2N		32.00	86.00	130.00	240.00	440.00	1100.00
	500	100	P1N		0.37	0.98	1.50	2.76	5.18	13.23
			T2N		34.00	89.00	136.00	250.00	470.00	1200.00
	250	50	P1N		0.20	0.51	0.79	1.49	2.78	7.11
			T2N		36.00	92.00	143.00	270.00	505.0	1290.00
	50	10	P1N		0.40	0.10	0.17	0.32	0.58	1.47
			T2N		37.00	95.00	150.00	290.00	525.00	1330.00
			T2max		**60.00**	**140.00**	**250.00**	**420.00**	**860.00**	**1910.00**
6/1	3000	500	P1N		1.25	2.95	5.18	7.09	11.45	27.27
			T2N		23.00	54.00	95.00	130.00	210.00	500.00
	1500	250	P1N		0.74	1.75	2.95	3.95	6.54	16.36
			T2N		27.00	64.00	108.00	145.00	240.00	600.00
	750	125	P1N		0.41	0.94	1.61	2.43	3.98	10.91
			T2N		30.00	69.00	118.00	178.00	292.00	800.00
	500	83	P1N		0.27	0.63	1.09	1.72	2.79	8.06
			T2N		30.00	70.00	120.00	190.00	308.00	890.00
	250	42	P1N		0.14	0.33	0.56	0.92	1.44	4.35
			T2N		31.00	71.00	122.00	200.00	315.00	950.00
	50	8	P1N		0.03	0.06	0.11	0.18	0.28	0.87
			T2N		31.00	72.00	125.00	210.00	320.00	1000.00
			T2max		**50.00**	**120.00**	**200.00**	**350.00**	**625.00**	**1730.00**

The bevel gears are also suitable for gearing up. In this case the output torque T2N given in the table will be the permissible torque T1N of the gearing-down version. The output torque at the faster running shaft is calculated by:

T2N = T1N/gear ratio

Selection of the gears - AdServo gears VC

Maximum permissible output torques of the gears, maximum permissible input speed.

iN/il		n1	n2		Size					
		[1/min]	[1/min]	[Nm]	065	090	120	140	160	200
1/1	Permanent operation S1	4000	4000	T2N	3.6	8				
		3000	3000	T2N	4.8	11	18			
		2400	2400	T2N	6	14	23	37	56	
		1500	1500	T2N	8	17	37	60	90	157
	Intermittent operation S5 (duty cycle <60 %)			T2N	8	25	50	120	180	350
	Acceleration torque			T2B	15	40	70	180	350	700
	Emergency stop torque			T2NOT	23	50	150	260	480	980
	Max. input speed			n1max	4400	3200	2400	2100	1800	1500
1,5/1	Permanent operation S1	4000	2667	T2N	5.4	12	21	34		
		3000	2000	T2N	7.2	17	28	45	68	
		2400	1600	T2N	9	21	35	56	85	147
		1500	100	T2N	10	25	56	90	136	236
	Intermittent operation S5 (duty cycle <60 %)			T2N	10	25	61	113	185	330
	Acceleration torque			T2B	17	37	105	200	330	690
	Emergency stop torque			T2NOT	25	50	140	280	500	850
	Max. input speed			n1max	6000	4800	3600	3000	2500	2250
2/1	Permanent operation S1	4000	2000	T2N	7.2	17	28	45		
		3000	1500	T2N	9.6	23	37	60	90	157
		2400	1200	T2N	10	24	46	75	113	196
		1500	750	T2N	10	27	73	120	181	314
	Intermittent operation S5 (duty cycle <60 %)			T2N	10	25	65	110	185	320
	Acceleration torque			T2B	17	36	98	190	320	600
	Emergency stop torque			T2NOT	25	60	140	280	550	800
	Max. input speed			n1max	6000	6000	4800	4200	3200	3000
3/1	Permanent operation S1	4000	1333	T2N		21	42	68	102	177
		3000	1000	T2N		23	56	90	136	235
		2400	800	T2N		24	63	113	170	294
		1500	500	T2N		27	74	130	230	472
	Intermittent operation S5 (duty cycle <60 %)			T2N		23	58	110	190	420
	Acceleration torque			T2B		36	95	177	280	630
	Emergency stop torque			T2NOT		60	140	260	400	850
	Max. input speed			n1max		6000	6000	5000	4500	4000
4/1	Permanent operation S1	4000	1000	T2N		21	52	85	136	235
		3000	750	T2N		23	60	103	180	314
		2400	600	T2N		25	67	111	200	393
		1500	375	T2N		27	74	120	220	155
	Intermittent operation S5 (duty cycle <60 %)			T2N		23	60	105	180	350
	Acceleration torque			T2B		36	87	162	270	550
	Emergency stop torque			T2NOT		60	140	260	400	800
	Max. input speed			n1max		6000	6000	6000	5000	4500

Dimensioning of the gears - AdServo gears VC

iN/il		n1 [1/min]	n2 [1/min]	[Nm]	Size 065	090	120	140	160	200
5/1	Permanent operation S1	4000	800	T2N		21	52	90	160	275
		3000	600	T2N		23	60	100	180	300
		2400	480	T2N		25	65	105	198	340
		1500	300	T2N		27	72	115	215	380
	Intermittent operation S5 (duty cycle <60 %)			T2N		23	60	100	180	300
	Acceleration torque			T2B		36	92	143	270	505
	Emergency stop torque			T2NOT		50	120	220	380	800
	Max. input speed			n1max		6000	6000	6000	6000	5000
6/1	Permanent operation S1	4000	667	T2N		21	45	85	115	190
		3000	500	T2N		23	54	95	130	210
		2400	400	T2N		25	59	102	137	225
		1500	250	T2N		27	64	108	145	240
	Intermittent operation S5 (duty cycle <60 %)			T2N		23	54	95	130	210
	Acceleration torque			T2B		31	71	122	200	315
	Emergency stop torque			T2NOT		45	110	200	350	625
	Max. input speed			n1max		6000	6000	6000	6000	6000

Maximum permissible torques during acceleration (TB1) and emergency stop (T1NOT) at the motor shaft, depending on kind of coupling and shaft diameter.

KN = clamping collar – smooth motor shaft

KNN = clamping collar – keyed motor shaft

SN = clamping ring hub – smooth motor shaft

Gear size	Coupling	[Nm]	Diameter of motor shaft [mm] 9	11	14	16	19	24	28	32	38	42
065	KN	TB1	3.8	4	4.4	4.6						
		T1NOT	7	7	8	9						
	KNN/SN	TB1	12	12	12	12						
		T1NOT	23	23	23	23						
090	KN	TB1		17	17	17	17					
		T1NOT		34	34	34	34					
	KNN/SN	TB1		17	17	17	17					
		T1NOT		34	34	34	34					
120	KN	TB1			26	27.5	28	31	33			
		T1NOT			45	48	50	55	58			
	KNN/SN	TB1			60	60	60	60	60			
		T1NOT			100	100	100	100	100			
140	KN	TB1					61	65	69	73	78	
		T1NOT					106	114	120	128	136	
	KNN/SN	TB1					160	160	160	160	160	
		T1NOT					240	240	240	240	240	
160	KN	TB1					61	65	69	73	78	
		T1NOT					106	114	120	128	136	
	KNN/SN	TB1					160	160	160	160	160	
		T1NOT					240	240	240	240	240	
200	KN	TB1						74	78	81	87	90
		T1NOT						130	136	142	152	158
	KNN/SN	TB1						325	325	325	325	325
		T1NOT						500	500	500	500	500

Mass moment of inertia

Mass moments of inertia reduced to the driving shaft.

V = Bevel gear

VL = Bevel gear without motor shaft bore

VC = Bevel gear without coupling hub

Gear size	Type	Model	Gear ratio						
			1:1	1.5:1	2:1	3:1	4:1	5:1	6:1
065	V	B0, C0	0.4231	0.3111	0.2330				
		D0	0.4330	0.3155	0.2355				
	VL	B0, C0	0.6519	0.5534	0.4824				
		D0	0.6618	0.5578	0.4849				
	VC	B0, C0	0.4685	0.3187	0.2594				
		D0	0.4784	0.3231	0.2619				
090	V	B0, C0	3.3543	2.1833	1.3652	1.0465	0.4607	0.3933	0.3502
		D0	3.3827	2.1959	1.3723	1.0496	0.4625	0.3945	0.3510
		E0	3.2507	2.1372	1.3393	1.0350	0.4542	0.3892	0.3473
		E0/HSD	3.9213	2.4353	1.5069	1.1095	0.4961	0.4160	0.3660
	VL	B0, C0	3.6662	2.5154	1.6904	1.3662	1.2350	1.1677	1.1242
		D0	3.6946	2.5280	1.6975	1.3693	1.2368	1.1689	1.1250
		E0	3.5626	2.4693	1.6645	1.3547	1.2285	1.1636	1.1213
		E0/HSD	4.2332	2.7674	1.8321	1.4292	1.2704	1.1904	1.1400
	VC	B0, C0	3.6690	2.7897	1.6949	1.3409	1.2057	1.1401	1.0968
		D0	3.6974	2.8023	1.7020	1.3441	1.2075	1.1412	1.0976
		E0	3.5654	2.7437	1.6690	1.3294	1.1992	1.1359	1.0939
		E0/HSD	4.2360	3.0417	1.8367	1.4039	1.2412	1.1627	1.1125
120	V	B0. C0	15.3022	7.4441	4.9747	3.0123	1.6729	1.0593	0.8982
		D0	15.5996	7.5762	5.0490	3.0453	1.6915	1.0712	0.9065
		E0	15.1939	7.3959	4.9476	3.0003	1.6661	1.0550	0.8952
		E0/HSD	16.9812	8.1903	5.3944	3.1988	1.7778	1.1265	0.9449
	VL	B0, C0	17.2592	9.4088	6.6007	5.3661	4.7915	4.4765	4.3205
		D0	17.5566	9.5409	6.6750	5.3991	4.8101	4.4884	4.3288
		E0	17.1509	9.3606	6.5736	5.3541	4.7847	4.4722	4.3175
		E0/HSD	18.9382	10.1550	7.0204	5.5526	4.8964	4.5437	4.3672
	VC	B0, C0	16.9681	8.8473	6.7790	5.1172	4.5420	4.2271	4.0428
		D0	17.2655	8.9795	6.8534	5.1502	4.5606	4.2390	4.0511
		E0	16.8599	8.7992	6.7520	5.1051	4.5352	4.2227	4.0398
		E0/HSD	18.6472	9.5935	7.1988	5.3037	4.6469	4.2942	4.0894

[kgcm²]

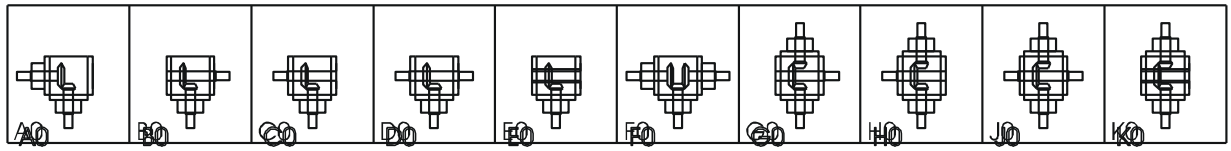
Mass moments of inertia

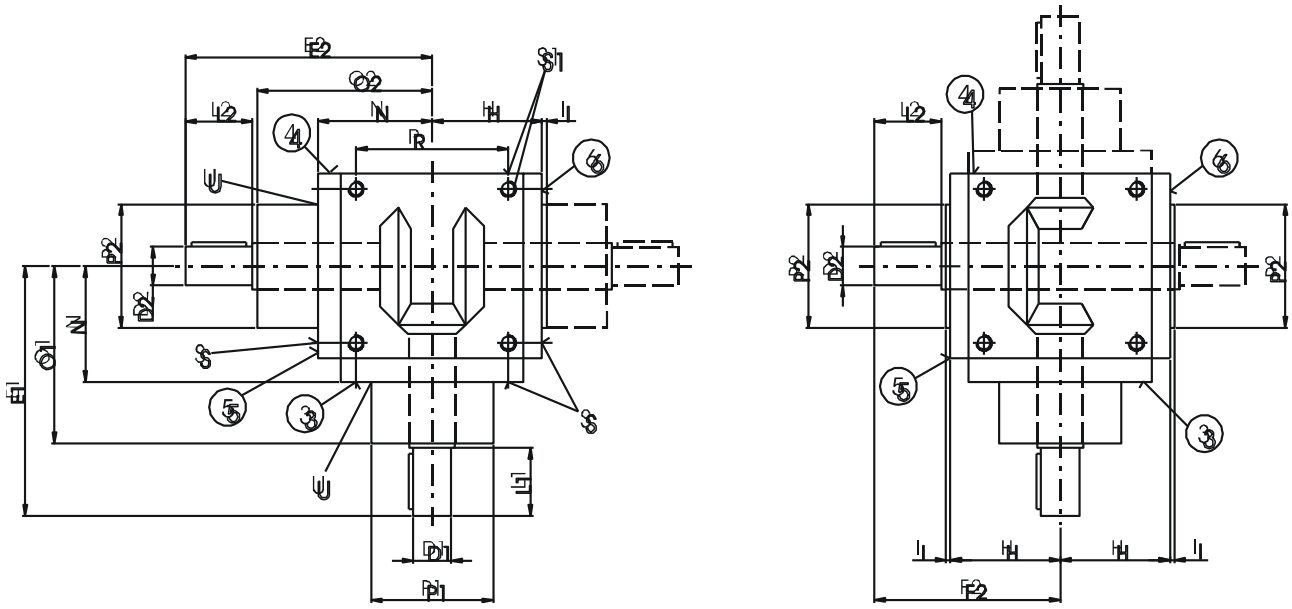
Gear size	Type	Model	Gear ratio						
			1:1	1.5:1	2:1	3:1	4:1	5:1	6:1
140	V	B0, C0	36.0994	18.7513	12.2785	7.9547	2.6978	2.2113	1.8426
		D0	37.0815	19.1878	12.5241	8.0639	2.7592	2.2506	1.8698
		E0	32.6630	17.2240	11.4194	7.5729	2.4830	2.0739	1.7471
		E0/HSD	39.0643	20.0691	13.0198	8.2842	2.8831	2.3299	1.9249
	VL	B0, C0	44.8769	27.2723	20.6828	16.5303	14.8203	14.3495	13.9815
		D0	45.8590	27.7088	20.9284	16.6395	14.8817	14.3888	14.0087
		E0	41.4405	25.7450	19.8237	16.1485	14.6055	14.2121	13.8860
		E0/HSD	47.8418	28.5901	21.4241	16.8598	15.0056	14.4681	14.0638
	VC	B0, C0	40.2704	22.7864	16.3856	11.4392	9.7639	9.2932	8.9251
		D0	41.2525	23.2229	16.6311	11.5483	9.8253	9.3325	8.9524
		E0	36.8340	21.2591	15.5265	11.0574	9.5491	9.1557	8.8296
		E0/HSD	43.2353	24.1041	17.1268	11.7686	9.9492	9.4118	9.0075
160	V	B0, C0	31.5527	32.0243	20.1006	12.0803	8.4198	3.6887	2.9407
		D0	32.5820	32.4818	20.3579	12.1947	8.4841	3.7299	2.9693
		E0	34.3851	33.1416	20.6658	12.3315	8.5611	3.7791	3.0048
		E0/HSD	40.6750	35.9371	22.2382	13.0304	8.9542	4.0307	3.1795
	VL	B0, C0	43.0841	43.3063	31.4651	24.6600	22.5327	21.5417	20.7916
		D0	44.1134	43.7638	31.7224	24.7744	22.5970	21.5829	20.8202
		E0	45.9165	44.4236	32.0303	24.9112	22.6740	21.6321	20.8557
		E0/HSD	52.2064	47.2191	33.6027	25.6101	23.0671	21.8837	21.0304
	VC	B0, C0	37.0516	37.5232	25.4769	17.3858	15.0698	14.1140	13.1644
		D0	38.0809	37.9807	25.7343	17.5001	15.1341	14.1552	13.1930
		E0	39.8840	38.6404	26.0421	17.6369	15.2111	14.2044	13.2285
		E0/HSD	46.1739	41.4360	27.6146	18.3358	15.6042	14.4560	13.4032
200	V	B0, C0	174.7000	103.5829	71.6215	34.1931	22.7181	12.8770	10.0616
		D0	177.8173	104.9684	72.4008	34.5395	22.9130	13.0016	10.1482
		E0	201.3904	109.0276	76.4341	35.2209	23.3588	13.8070	10.7075
		E0/HSD	222.4124	118.3707	81.6896	37.5567	24.6726	14.6479	11.2914
	VL	B0, C0	214.2418	149.2207	114.7144	81.9650	70.9700	67.7153	64.9180
		D0	217.3591	150.6062	115.4937	82.3114	71.1649	67.8400	65.0046
		E0	240.9322	154.6654	119.5270	82.9928	71.6107	68.6453	65.5638
		E0/HSD	261.9542	164.0085	124.7825	85.3286	72.9245	69.4862	66.1478
	VC	B0, C0	185.5150	119.4939	86.1875	55.8382	43.3232	40.0860	36.8887
		D0	188.6323	120.8794	86.9669	56.1845	43.5180	40.2107	36.9753
		E0	212.2054	124.9385	91.0001	56.8660	43.9638	41.0160	37.5345
		E0/HSD	233.2274	134.2816	96.2556	59.2018	45.2777	41.8569	38.1185
260	V	B0, C0	827.4400	168.2622	281.3350	117.2211	66.6638	50.0136	40.7039
		D0	841.8500	383.5556	284.9375	52.2667	67.5644	50.5900	41.1042
		E0	828.6900	413.2622	287.8975	120.1100	68.2888	51.0536	41.4261
		E0/HSD	892.3400	441.5511	303.8100	127.1800	72.2656	53.5988	43.1936

[kgcm²]

Bevel gear V

Model





Typ	i = 1:1 – 2:1					i = 3:1					i = 4:1					i = 5:1 - 6:1				
	D1	L1	E1	O1	P1	D1	L1	E1	O1	P1	D1	L1	E1	O1	P1	D1	L1	E1	O1	P1
065	12	26	100	72	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
090	18	35	122	85	60	12	35	122	85	60	12	35	132	95	60	12	35	132	95	60
120	25	45	162	115	80	20	45	162	115	80	20	45	172	125	80	15	35	162	125	70
140	32	50	180	128	90	28	50	180	128	90	24	50	195	143	85	24	50	195	143	85
160	35	60	212	150	110	28	60	212	150	100	24	60	232	170	100	24	60	232	170	100
200	42	80	273	190	120	35	68	261	190	120	35	68	261	190	120	28	68	261	190	110
260	60	110	380	265	160	45	90	360	265	160	45	90	360	265	160	45	90	360	265	160

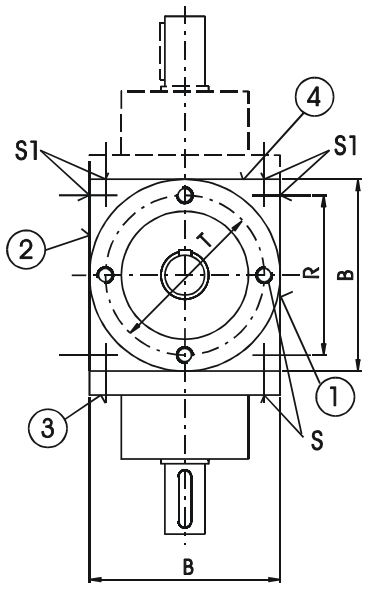
[mm]

Mounting holes:

All 6 sides of the gears are machined and can be used as mounting faces. The sides 3+5+6 are fitted with mounting holes "S" as a standard feature. The sides 1, 2 or 4 can be optionally fitted with mounting holes "s1".

Bevel gear V

In case of hollow shafts please refer to the dimensions overleaf.



Type														
	B	**D2**	**E2**	**F2**	**H**	**I**	**L2**	**N**	**O2**	**P2**	**R**	**S, S1**	**T**	**U**
065	65	12	100	72	42	2	26	42	72	44	45	M 6	54	0,5
090	90	18	122	95	55	2	35	55	85	60	70	M 8	75	1,0
120	120	25	162	122	72	3	45	75	115	80	100	M 10	100	1,0
140	140	32	180	137	82	3	50	85	128	90	110	M 10	115	1,5
160	160	35	212	160	95	3	60	95	150	110	120	M 12	135	2,0
200	200	42	273	203	117	3	80	120	190	120	160	M 12	175	3,0
260	260	60	380	268	150	4	110	150	265	160	220	M 16	230	5,0

[mm]

Fittings:

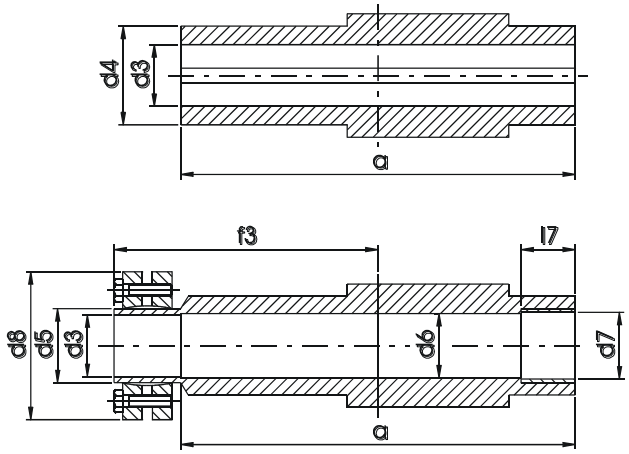
Shaft ends:	ISO j6	Shaft centring:	DIN 332 Sheet 2
Hollow bore:	ISO H7	Feather keys and grooves:	DIN 6885 Sheet 1
Groove of the hollow shaft:	ISO JS9	Thread depths:	2x∅ or flange thickness resp.
Centring (P1, P2):	ISO f7		

Bevel gear V

Hollow shafts

Typ E0	with groove acc. to DIN 6885/1
Typ E0/HG	without groove – hardened
Typ E0/KN	with internal splines
Typ E0/PG	spline profile
Typ E0/HS5	without shrink disc
Typ E0/HSD5	with shrink disc

(5 = side 5 [standard]; alternative 6 = side 6)



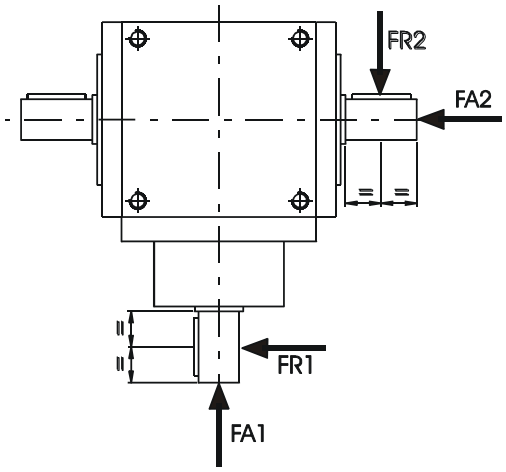
Type										Internal splines	Spline profile
	a	f3	Ød3	Ød4	Ød5	Ød6	Ød7	Ød8	l7	DIN 5463	DIN 32712
090	124	87	18	30	24	19	20	50	18	A 6x16x20	B P4C 17H7
120	160	107	25	40	30	26	27	60	22	A 6x21x25	B P4C 21H7
140	180	122	32	50	44	33	34	80	25	A 6x26x32	B P4C 30H7
160	206	135	35	55	44	36	37	80	25	A 8x32x38	B P4C 35H7
200	250	162	42	70	55	43	44	100	35	A 8x42x48	B P4C 43H7
260	320	200	60	80	75	61	62	138	40	A 8x56x65	B P4C 53H7

[mm]

Permissible radial/axial forces

The permissible radial forces FR given in the table relate to the centre of the journals of the shaft, depending on speed and torque.

Axial forces FA of up to 50 % of the permissible radial forces can be applied without any further calculation. If the axial forces exceed this value considerably or if there are combined forces of FR an FA please contact us.



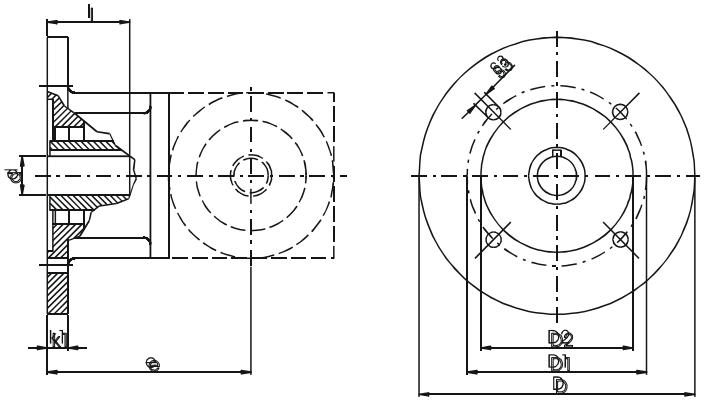
			FR1 [N]						FR2 [N]					
Gear size		**T**	**n1 [1/min]**						**n1 [1/min]**					
		[Nm]	**3000**	**1000**	**500**	**250**	**100**	**50**	**3000**	**1000**	**500**	**250**	**100**	**50**
065	<	12	180	250	300	350	450	550	300	400	500	650	750	900
	>	12	150	210	250	290	380	460	250	330	420	540	630	750
090	<	30	300	400	470	580	700	800	500	660	800	950	1250	1500
	>	30	250	330	390	490	590	670	420	550	670	790	1040	1250
120	<	80	470	620	720	900	1150	1400	750	1000	1250	1500	1900	2200
	>	80	390	520	600	750	960	1170	630	830	1040	1250	1580	1830
140	<	140	700	870	1150	1370	1700	2000	1300	1700	2000	2500	3000	3800
	>	140	590	730	960	1140	1420	1670	1083	1420	1670	2080	2500	3170
160	<	220	1200	1600	1900	2200	2850	3300	2000	2800	3300	4000	5000	6500
	>	220	1000	1340	1590	1840	2380	2750	1670	2340	2750	3340	4170	5420
200	<	500	2200	1700	3200	3900	5000	6200	3200	4300	5000	6500	8000	10000
	>	500	1840	1420	2670	3250	4170	5170	2670	3580	4170	5420	6670	8330
260	<	950	7000	8600	11200	15000	17500	20000	8500	13000	16000	18000	22000	28000
	>	950	5830	7170	9330	12500	14580	16670	7080	10830	13300	15000	18330	23330

Bevel gear for motor mounting VL

Design with hollow drive shaft

Fittings:

Hollow bore:	ISO F7
Groove of the hollow shaft:	ISO JS9
Flange centring (D2):	ISO H7



All types of bevel gears are available ready for motor mounting or in combination with three-phase motors. The type with mounted motor features a flange bearing neck on side 3 of the gear (see picture) instead of a bearing neck. Please refer to the following table for the dimensions. All other dimensions can be found next to the respective gear type.

Type	Flange						Shaft	Motor size
	e	k1	ØD	ØD1	ØD2	ØS3	Ødxl	
065	90	10	105	85	70	7	9x20	063
			120	100	80	7	11x23	071
			140	115	95	9	14x30	
090	110	12	120	100	80	7	11x23	063
			140	115	95	9	14x30	071
			160	130	110	9	19x40	080
120	135	15	140	115	95	9	19x40	080
			160	130	110	9	24x50	090S
			200	165	130	11	28x60	090L
			250	215	180	14	32x60	100L
140	170	15	160	130	110	9	24x50	090S
			200	165	130	11	28x60	090L
			250	215	180	14	32x60	100L
							38x60	132S
							38x80[1)]	132M
160	190	18	200	165	130	11	24x50	090S
			250	215	180	14	28x60	090L
			300	265	230	14	32x60	100L
							38x60	132S
							38x80[1)]	132M
200	230	20	200	165	130	11	28x60	100L
			250	215	180	14	32x60	132S
			300	265	230	14	38x80	132M
			350	300	250	18	42x80	160
							42x110[1)]	180
260	280	28	300	265	230	14	38x80	132S
			350	300	250	18	42x110	132M
			400	350	300	18	48x110	160
			450	400	350	18	55x110	180
								200

1) Shaft length only available for gear ratios of 1:1 to 2:1.

[mm]

Bevel gear for motor mounting VC

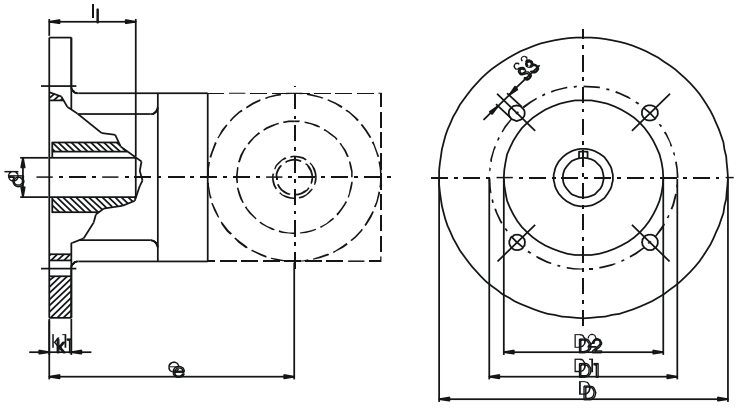
Design with coupling

Fittings:

Hollow bore: ISO F7

Grove of the hollow shaft: ISO JS9

Flange centring (D2): ISO H7



All types of bevel gears are available ready for motor mounting or in combination with three-phase motors. The type with mounted motor features a flange bearing neck on side 3 of the gear (see picture) instead of a bearing neck. Please refer to the following table for the dimensions. All other dimensions can be found next to the respective gear type.

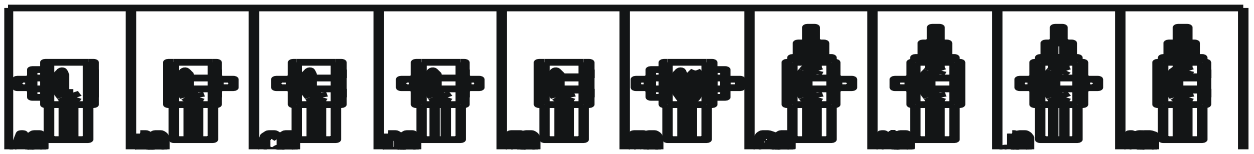
Type	Flange					Motor size	Shaft	Flange
	k1	ØD	ØD1	ØD2	ØS3		Ødxl	e
065	10	90	75	60	6	063	9x20	101
		105	85	70	7	071	11x23	101
		120	100	80	7		14x30	119.5
		140	115	95	9			
090	12	120	100	80	7	063	11x23	140
		140	115	95	9	071	14x30	
		160	130	110	9	080	19x40	
120	15	140	115	95	M8	071	14x30	170
		160	130	110	9	080	19x40	
		200	165	130	11	090S	24x50	
		250	215	180	14	090L		
140	15	160	130	110	M8	080	19x40	196
		200	165	130	11	090S	24x50	
		250	215	180	14	090L	28x60	
						100L	32x60	
160	18	200	165	130	M10	090S	24x50	215
		250	215	180	14	090L	28x60	
		300	265	230	14	100L	32x60	
						112M		
200	20	200	165	130	M10	100L	24x50	262
		250	215	180	M12	112M	28x60	262
		300	265	230	14	132S	32x60	262
		350	300	250	18	132M	38x80	274
							42x80	299

[mm]

AdServo for motor mounting VC

All types of bevel gears are available. AdServo gears features a flange bearing neck on side 3 of the gear (see picture) instead of a bearing neck. Please refer to the following table for the dimensions. All other dimensions can be found next to the table of dimensions for bevel gears.

Model



Easy motor mounting

Attachment to the motor is by means of a backlash-free, axial plug-on coupling. Two congruent coupling halves are held together by an involute plastic toothed ring with positive precompression. Extreme torque peaks and abrupt loads (e. g. emergency stop) result however in a slight elastic deformation which provides a cushioning effect. This prolongs the working life since it attenuates harmful vibrations and shifts the resonant range to non-critical speed levels.

Metal bellows couplings with clamping collar KN for smooth shafts are optionally available for special applications requiring absolute torsional rigidity.

Types of couplings

KN = clamping collar – smooth motor shaft

KNN = clamping collar – keyed motor shaft

SN = clamping ring hub – smooth motor shaft

Circumferential backlash

Standard design: S2 = <10 arc minutes

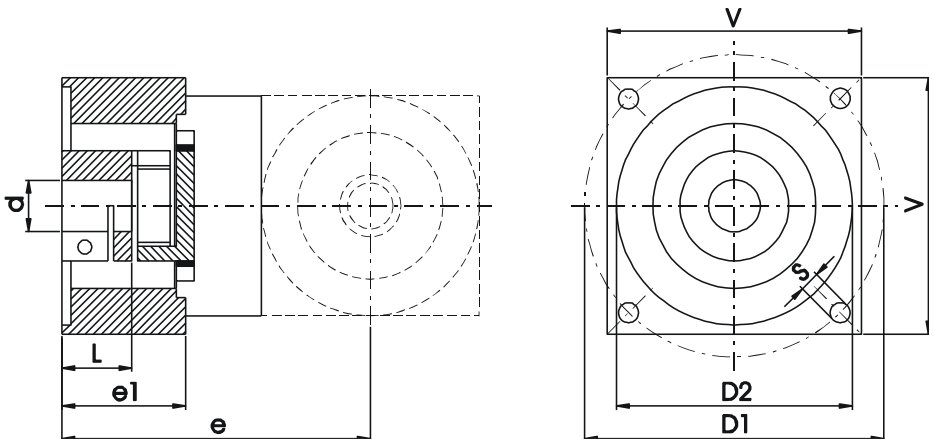
Precision design: S1 = <6 arc minutes

Special design: S0 = on demand

Mass moments of inertia

High dynamics due to low mass moments of inertia. Extraordinary suitability for highly dymamic intermittent operation (values see table “Mass moments of inertia”).

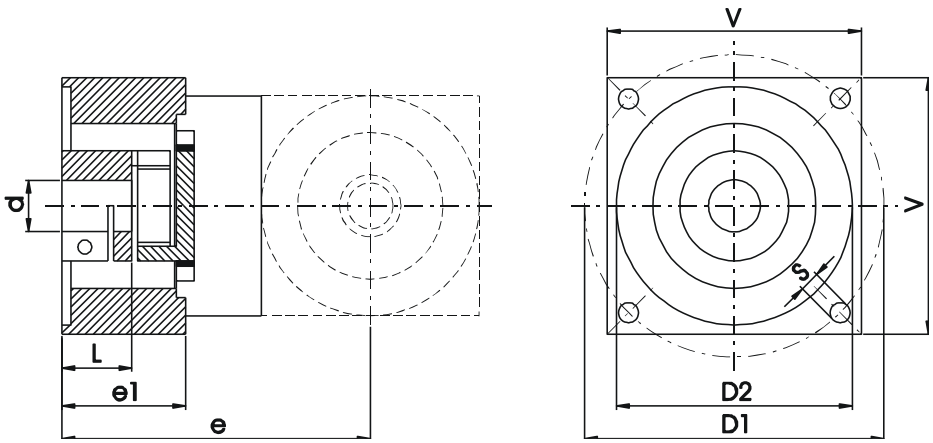
AdServo for motor mounting VC



Flange	Motor dimensions					Size - 065			Size - 090			Size - 120		
no.	ØD1	ØD2	Øs	Ød	L	V	e	e1	V	e	e1	V	e	e1
001	63	40	M4	9	20	65	101	26.5						
002	63	40	M5	9	20	65	101	26.5						
101	75	60	M5	11	23	65	101	26.5						
102	75	60	M5	11	23	70	101	26.5						
103	75	60	M6	14	30	70	119.5	45	90	140	45	120	170	54
201	90	60	M5	14	30	75	119.5	45	90	140	45	120	170	54
301	95	50	M6	14	30	80	119.5	45	90	140	45	120	170	54
401	100	80	M6	14	30	90	119.5	45	90	140	45	120	170	54
402	100	80	M6	14	30	110	119.5	45	110	140	45			
501	115	95	M8	14	30	100	119.5	45	100	140	45	120	170	54
801	165	110	M10	14	30	140	119.5	45	140	140	45	140	170	54
403	100	80	M6	19	40				95	140	45	120	170	54
502	115	95	M8	19	40				100	140	45	120	170	54
503	115	95	M8	19	40				105	140	45			
504	115	95	M8	19	40				110	140	45			
601	130	95	M8	19	40				115	140	45	120	170	54
611	130	110	M8	19	40				115	140	45	120	170	54
612	130	110	M8	19	40				120	140	45			
613	130	110	M8	19	40				130	140	45	130	170	54
701	145	110	M8	19	40				120	140	45	120	170	54
614	130	110	M8	24	50							120	170	54
615	130	110	M8	24	50							130	170	54
802	165	110	M10	24	50							140	170	54
811	165	130	M10	24	50							140	170	54

[mm]

AdServo for motor monting VC



Flange	Motor dimensions					Size - 140			Size - 160			Size - 200		
no.	ØD1	ØD2	Øs	Ød	L	V	e	e1	V	e	e1	V	e	e1
403	100	80	M6	19	40	140	196	61	160	215	62			
502	115	95	M8	19	40	140	196	61	160	215	62			
601	130	95	M8	19	40	140	196	61	160	215	62			
611	130	110	M8	19	40	140	196	61	160	215	62			
701	145	110	M8	19	40	140	196	61	160	215	62			
614	130	110	M8	24	50	140	196	61	160	215	62	200	262	76
802	165	110	M10	24	50	140	196	61	160	215	62	200	262	76
811	165	130	M10	24	50	140	196	61	160	215	62	200	262	76
901	215	130	M12	28	42	190	196	61	190	215	62	200	262	76
911	215	180	M14	28	60	190	196	61	190	215	62	200	262	76
616	130	110	M10	32	60	140	196	61	160	215	62	200	262	76
812	165	130	M10	32	60	140	196	61	160	215	62	200	262	76
912	215	180	M12	32	60	190	196	61	190	215	62			
913	215	180	M12	32	60	200	196	61	200	215	62	200	262	76
902	215	130	M12	32	60	190	196	61	190	215	62	200	262	76
914	215	180	M12	32	64	190	196	61	190	215	62	200	266	80
915	215	180	M12	38	80							200	274	88
916	215	180	M12	42	82							200	299	113

[mm]

Order code

V 200	-	4:1	-	D0	-	2	.	4	-	250	/	0000

V 200 - Size of bevel gear
4:1 - gear ratio
D0 - Model
2 - Mounting side
4 - Operating position
250 - Speed n2
0000 - Design

Mounting side

The data sheets of the gear types show the standard mounting holes. The mounting side determines the positions of additional mounting holes:

0 Standard mounting hols only
1...6 Gear side with mounting holes
9 Mounting holes on all sides

Operating position

Please indicate the operating position in order to:

- Determine the optimal amount of lubricant
- The position of the oil fittings
- Take measures to lubricate the upper bearings

1...6 Gear bottom
9 Operating position varying or all-side (completely closed gear without ventilation)

Speed n2

The output speed determines viscosity and amount of the lubricant necessary. If the speed varies please indicate the maximum speed or the details of the application.

Design

The four-digit key code for the design of the gear contains all special demands. When ordering for the first time, please send us the details in written form, e. g.:

- Splash-proof
- Reinforced bearing
- Low backlash
- Special shaft end
- etc.

Product range

Drives and linear systems

- Linear axis
- Linear positioning tables with/without drive
- High precision positioning tables
- Ball screws and roller screws
- Trapezoidal screws
- Screw jacks
- Electromechanical cylinders
- Bevel gears
- Planetary gears

Drives and accessory

- Three-phase asynchronous motors
- Worm gear motors
- Spur gear motors
- Servo drives
- Stepper drives
- DC motors
- Frequency converters
- Controllers
- Switches, proximity sensors

Linear guides

- Linear ball or roller guides
- Precision shafts
- Linear ball bearings
- Glide bushings

Links

- Couplings
- Universal shafts
- Power trains
- Clamps

Roller bearings

Customised solutions

GIA – Gesellschaft für innovative Automationstechnik mbH
Scarletallee 11, 50735 Köln, Germany
Tel.: +49 221 / 7174 - 380 Fax: +49 221 / 7174 - 375
E-mail: gia-mbh@web.de
Internet: www.giambh.com