

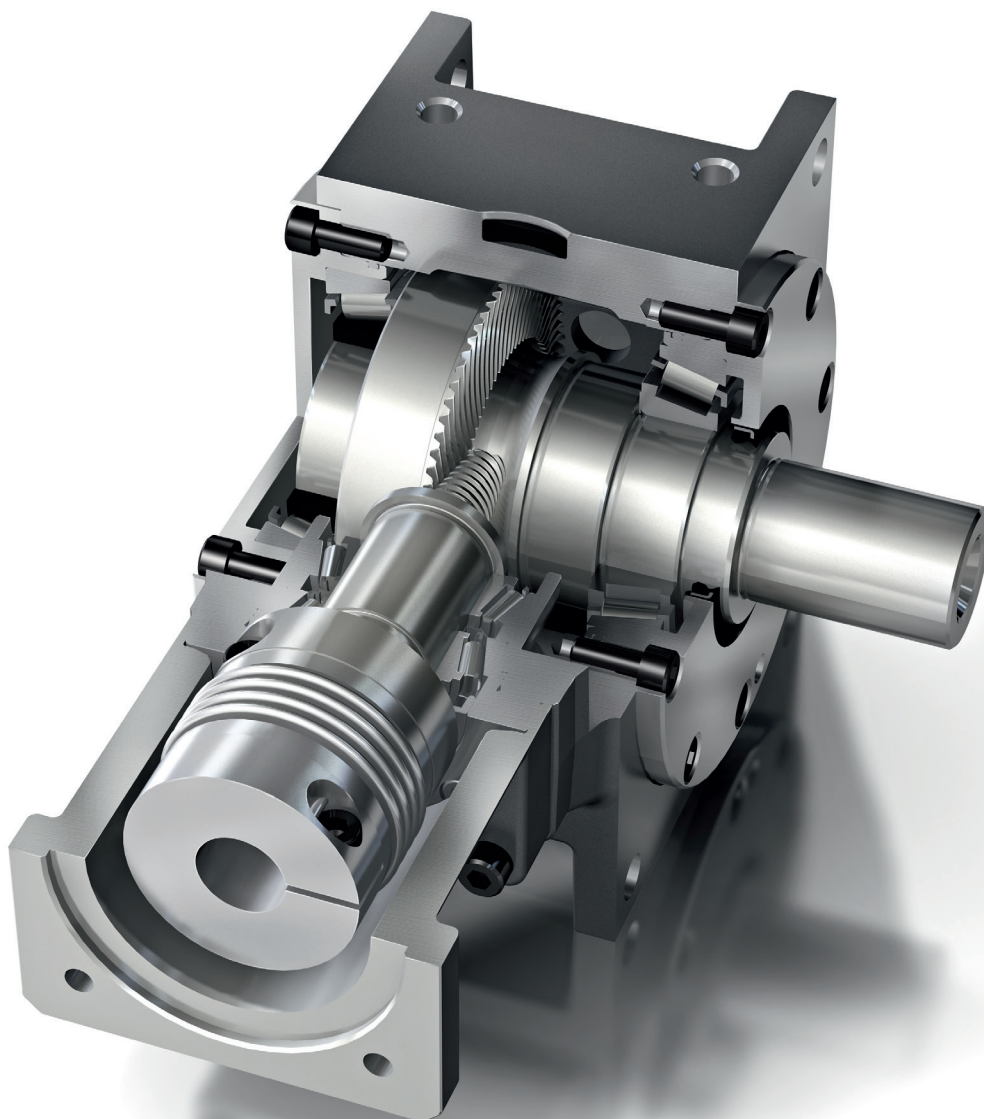


MS-Graessner GmbH & Co. KG

THE GEAR COMPANY

DYNA *GEAR*

The highly dynamic servo right angle gearbox

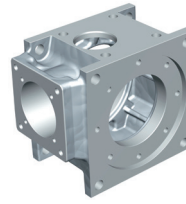


Internal highlights

The design of the DynaGear range has been influenced by extremely varied applications within many industry sectors.

The DynaGear range has been developed with a highly dynamic servo drive solution in mind and therefore benefits from many advantages.

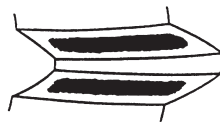
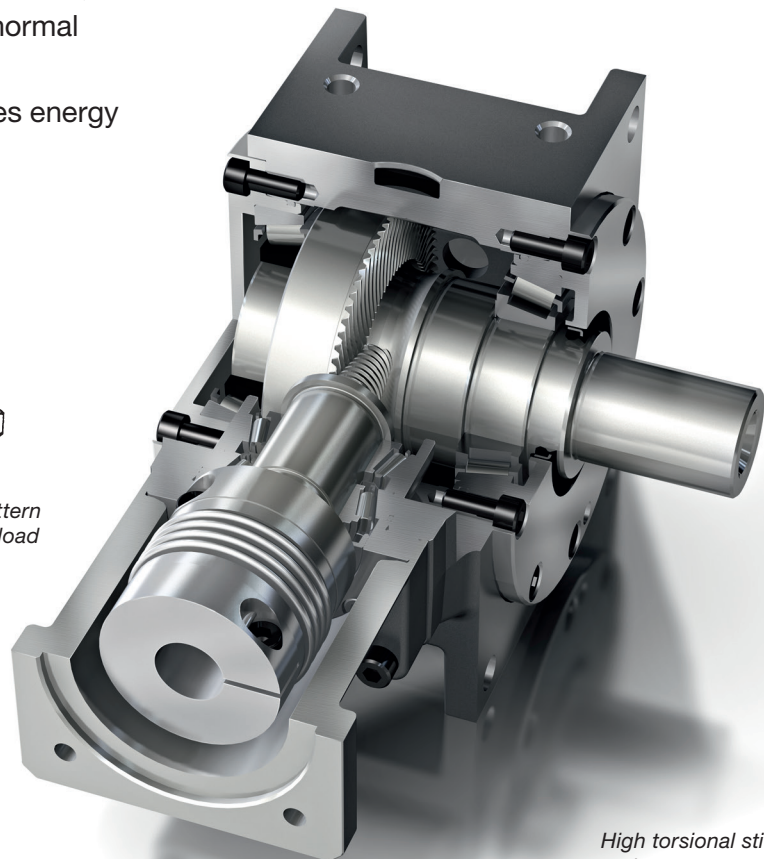
- Right angle gearbox, single-stage, ratios from 3:1 to 15:1; higher ratios on request, two-stage up to 150:1
- The compact and rigid design ensures highest performance whilst being space and weight efficient.
- Lubricated for life, the gearboxes are virtually maintenance-free (when used under normal conditions). A case of fit and forget.
- The high efficiency rating of 96% saves energy costs (92 % at DG-HR).



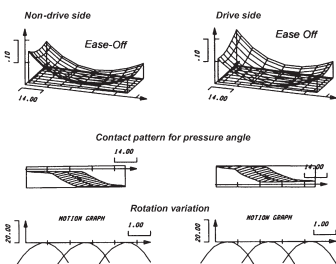
Weight efficient one-piece Aluminium housing ensures highest stability



High-quality taper roller bearings absorb axial and radial loads guaranteeing a long service life



Optimized contact pattern assembly for uniform load distribution



Optimized Gleason hypoid-gearing for high torque ratings and low backlash

Small moments of inertia at the input

High torsional stiffness at the output

Fretting- and backlash-free torque transfer using a friction-locked fit between shaft and hub

System optimization via variable torsional coupling stiffness

External highlights

DYNA GEAR

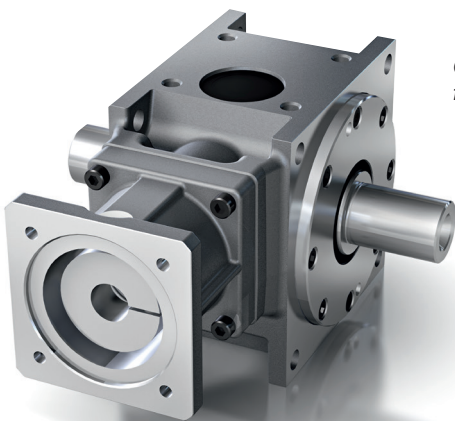
The DynaGear realises the theme “Motor – Coupling – Gearbox – Mounting” in a unique way.

- The DynaGear fits all current servo motors by way of flanges and couplings to suit.
- Torsional vibration can be adjusted via the coupling stiffness.
- The gearbox dimensions are identical for all ratios.

Compact and weight efficient aluminium housing

Easy mounting without additional parts

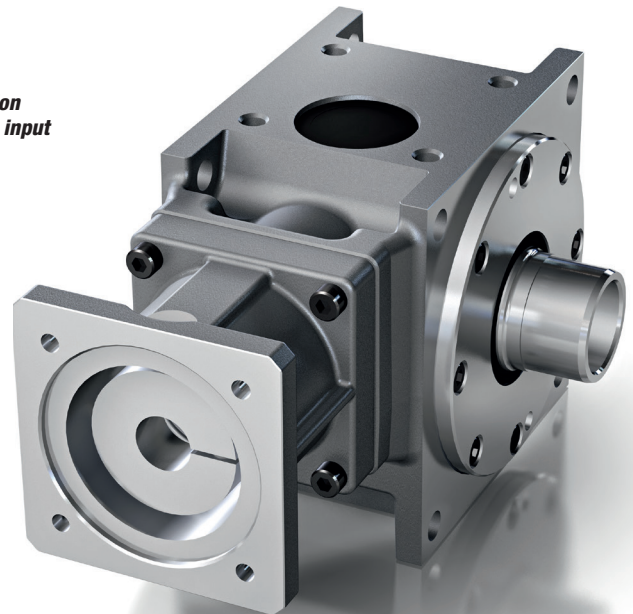
Solid shaft version with continuous shaft, coupling and input flange



Couplings and adaptor flanges to suit all motors

Subsequent motor type changes are possible ensuring highest flexibility

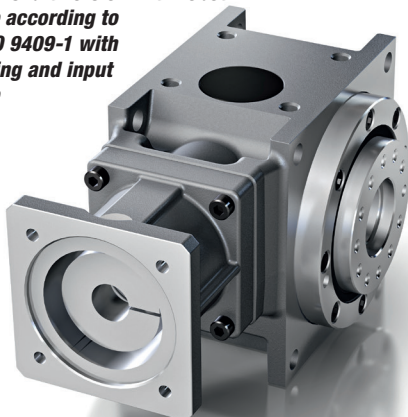
Hollow shaft version with coupling and input flange



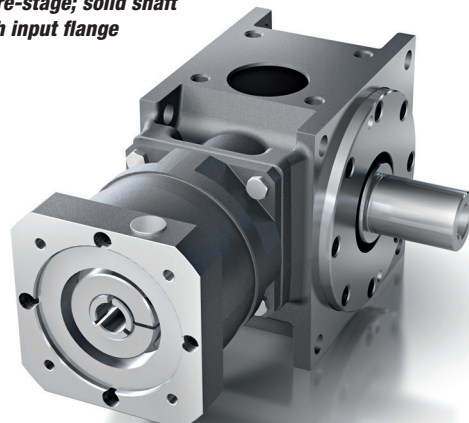
Optimal centering at the mounting sides

Largest possible integrated hollow shaft

Hollow shaft version with robot flange according to EN ISO 9409-1 with coupling and input flange



DynaGear HighRatio (HR) with planetary pre-stage; solid shaft version with input flange



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Performance table/Technical data

DYNA GEAR

DynaGear

Size		D37	D55	D75	D90	D115	D130	D140	D160	D190
Ratio	i	3/4/5/6/8/10								
Output torque										
Nominal torque	T_{2N} [Nm]	22	35	70	140	260	430	720	1100	1440
Maximum acceleration ④	T_{2B} [Nm]	33	53	105	210	390	645	1080	1650	2160
Emergency stop torque ③	T_{2Not} [Nm]	44	70	140	280	520	860	1440	2200	2880
Maximum input speed	n_{1max} [min ⁻¹]	8000	8000	8000	7000	6000	5000	5000	4500	4500
Nominal input speed i = 3/4/5	n_{1N} [min ⁻¹]	2300	2100	1800	1500	1150	1000	700	600	550
Nominal input speed i = 6/8/10	n_{1N} [min ⁻¹]	3700	3200	2700	2200	1800	1500	1200	1100	1000
Standard backlash ①	j_t [arcmin]	< 6	< 5	< 5	< 4	< 4	< 4	< 4	< 4	< 4
Reduced backlash ①	j_t [arcmin]	< 4	< 3	< 3	< 2	< 2	< 2	< 2	< 2	< 2
Backlash stiffness at the output ⑤	C_{t21} [Nm/arcmin]	1,3	2.1	4.2	10.5	23.4	39.6	61.8	90.0	126.0
Radial force ②	F_{2Rmax} [N]	2200	3300	4900	7200	10000	12600	15000	18000	22500
Axial force ②	F_{2Amax} [N]	1100	1650	2450	3600	5000	6300	7500	9000	11250
Efficiency rating at full load	η [%]	> 96	> 96	> 96	> 96	> 96	> 96	> 96	> 96	> 96
Noise level ($n_1=3000$ min ⁻¹)	L_{pA} [dB(A)]	< 65	< 66	< 66	< 68	< 68	< 70	< 70	< 72	< 72
Weight approx.	m [kg]	1,9	3.5	5.5	9.5	15.5	23.5	32.5	46.5	60

Size		D37	D55	D75	D90	D115	D130	D140	D160	D190
Ratio	i	12/15								
Output torque										
Nominal torque	T_{2N} [Nm]	15	25	50	95	180	300	510	815	1020
Maximum acceleration ④	T_{2B} [Nm]	22	38	75	143	270	450	765	1223	1530
Emergency stop torque ③	T_{2Not} [Nm]	30	50	100	190	360	600	1020	1630	2040
Maximum input speed	n_{1max} [min ⁻¹]	8000	8000	8000	7000	6000	5000	5000	4500	4500
Nominal input speed	n_{1N} [min ⁻¹]	4500	3900	3300	2800	2300	2000	1600	1350	1300
Standard backlash ①	j_t [arcmin]	< 6	< 5	< 5	< 4	< 4	< 4	< 4	< 4	< 4
Reduced backlash ①	j_t [arcmin]	< 4	< 3	< 3	< 2	< 2	< 2	< 2	< 2	< 2
Backlash stiffness at the output ⑤	C_{t21} [Nm/arcmin]	1,3	2.1	4.2	10.5	23.4	39.6	61.8	90.0	126.0
Radial force ②	F_{2Rmax} [N]	2200	3300	4900	7200	10000	12600	15000	18000	22500
Axial force ②	F_{2Amax} [N]	1100	1650	2450	3600	5000	6300	7500	9000	11250
Efficiency rating at full load	η [%]	> 93	> 93	> 93	> 93	> 93	> 93	> 93	> 93	> 93
Noise level ($n_1=3000$ min ⁻¹)	L_{pA} [dB(A)]	< 65	< 66	< 66	< 68	< 68	< 70	< 70	< 72	< 72
Weight approx	m [kg]	1,9	3.5	5.5	9.5	15.5	23.5	32.5	46.5	60

Size		D55HR	D75HR	D90HR	D115HR	D130HR	D140HR	D160HR	D190HR	
Ratio	i ⑥	16/18/24/30/32/40/50/60/80/100								
Output torque										
Nominal torque	T_{2N} [Nm]		35	70	140	260	430	720	1100	1440
Maximum acceleration ④	T_{2B} [Nm]		53	105	210	390	645	1080	1650	2160
Emergency stop torque ③	T_{2Not} [Nm]		70	140	280	520	860	1440	2200	2880
Maximum input speed	n_{1max} [min ⁻¹]		6000	6000	6000	6000	5000	5000	4500	4500
Nominal input speed	n_{1N} [min ⁻¹]		3500	3000	3000	2500	2500	2500	2500	2500
Standard backlash ①	j_t [arcmin]		< 7	< 7	< 6	< 6	< 6	< 6	< 6	< 6
Reduced backlash ①	j_t [arcmin]		< 5	< 5	< 3	< 3	< 3	< 3	< 3	< 3
Backlash stiffness at the output ⑤	C_{t21} [Nm/arcmin]		2.1	4.1	10.2	22.8	37.8	60.1	86.5	119.2
Radial force ②	F_{2Rmax} [N]		3300	4900	7200	10000	12600	15000	18000	22500
Axial force ②	F_{2Amax} [N]		1650	2450	3600	5000	6300	7500	9000	11250
Efficiency rating at full load	η [%]		> 92	> 92	> 92	> 92	> 92	> 92	> 92	> 92
Noise level ($n_1=3000$ min ⁻¹)	L_{pA} [dB(A)]		< 66	< 66	< 68	< 68	< 70	< 70	< 72	< 72
Weight approx	m [kg]		4.0	6.5	12.5	19.5	27	36	49	61.5

Service life (SL) [h]: > 30.000 based operation mode S5
 Lubrication: see "Technical service and maintenance" page 10
 Mounting positions: Any
 Operation temperature: -10 °C to 90 °C
 Paint: Primary coated RAL 9005 – black
 Ex-protection: Ex II 2 D/G c T4
 type of protection: IP 64

① At the output, at 2 % load and max. 10 Nm

② Resulting force centre of output shaft at output speed 400 min⁻¹

③ Max 1000 times during the service life of the gearbox

④ At max 1000 cycles per hour, please consider reducing factor in other cases (see page 9)

⑤ At nominal torque (DynaGear without coupling)

⑥ Ratios 120:1 and 150:1 on request

Symbols and units, see page 5

Performance table/Technical data

DYNA GEAR

Mass moment of inertia I_1 related to input [kgcm²] for shaft arrangement WA 1

DynaGear[®]

Ratio i	Size								
	D37	D55	D75	D90	D115	D130	D140	D160	D190
3:1	0.178	0.39	0.98	2.42	7.12	14.03	26.96	52.32	91.47
4:1	0.140	0.30	0.73	1.77	5.09	9.17	17.44	32.78	62.43
5:1	0.123	0.23	0.58	1.41	4.00	7.12	13.53	24.76	44.29
6:1	0.113	0.22	0.52	1.41	3.65	6.76	12.25	22.49	39.55
8:1	0.104	0.17	0.43	1.12	2.85	5.09	8.95	15.67	27.07
10:1	0.099	0.15	0.38	1.00	2.46	4.27	7.38	12.47	21.43
12:1	0.097	0.14	0.36	0.88	2.25	3.81	6.47	10.67	18.14
15:1	0.095	0.13	0.34	0.81	2.07	3.45	5.76	9.23	15.53

[⊙] Values without coupling

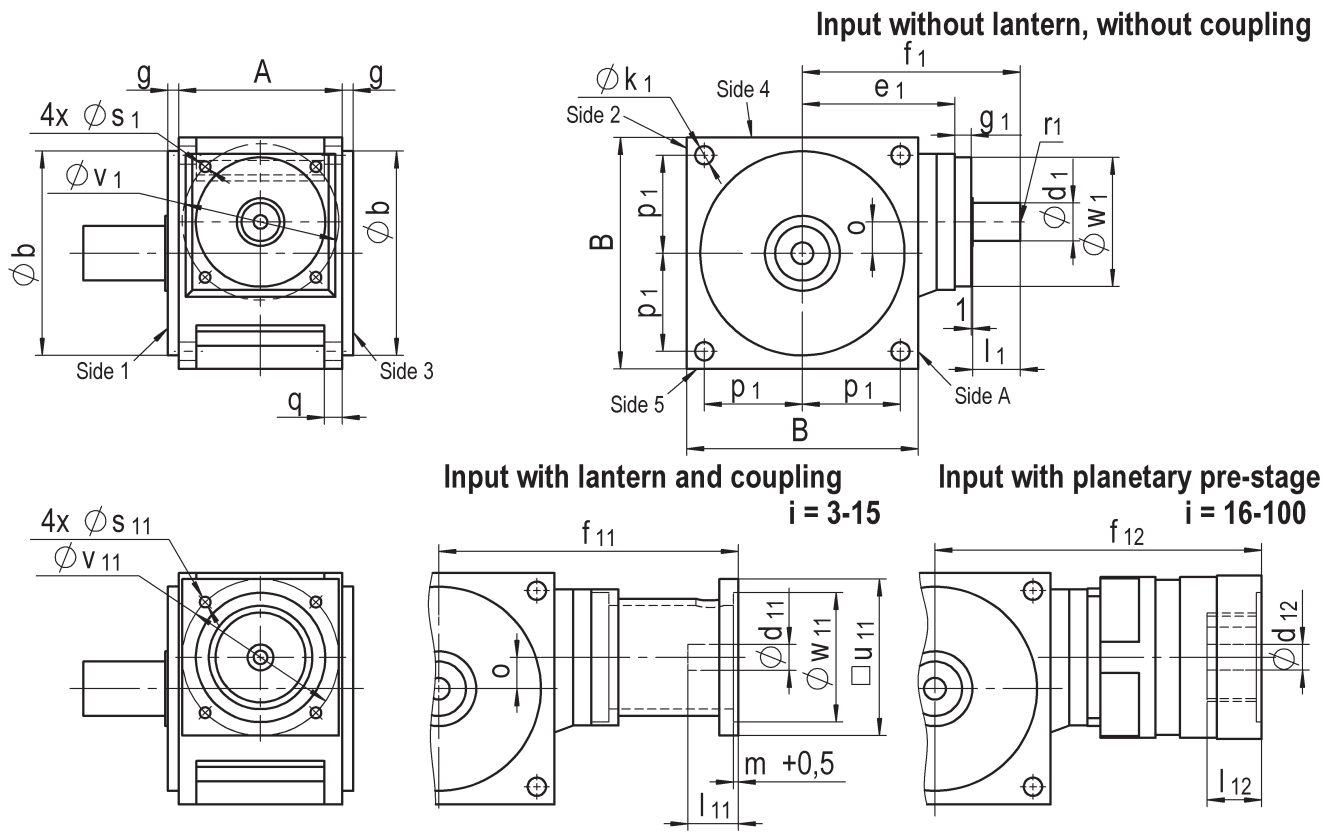
DynaGear HR

Ratio i	Size							
	D55HR	D75HR	D90HR	D115HR	D130HR	D140HR	D160HR	D190HR
16:1	0.40	1.19	1.25	5.12	5.37	8.74	9.70	11.55
18:1	0.46	1.38	1.41	6.64	6.73	12.57	12.85	13.33
24:1	0.39	1.15	1.18	4.90	4.99	7.99	8.27	8.75
30:1	0.37	1.06	1.09	4.15	4.24	6.58	6.86	7.34
32:1	0.38	1.15	1.16	4.84	4.88	7.79	7.89	8.07
40:1	0.36	1.06	1.07	4.09	4.13	6.38	6.48	6.66
50:1	0.36	1.05	1.06	4.07	4.09	6.31	6.36	6.45
60:1	0.35	0.94	0.97	3.20	3.29	4.14	4.42	4.90
80:1	0.34	0.94	0.95	3.14	3.18	3.94	4.04	4.22
100:1	0.34	0.93	0.94	3.12	3.14	3.87	3.92	4.01

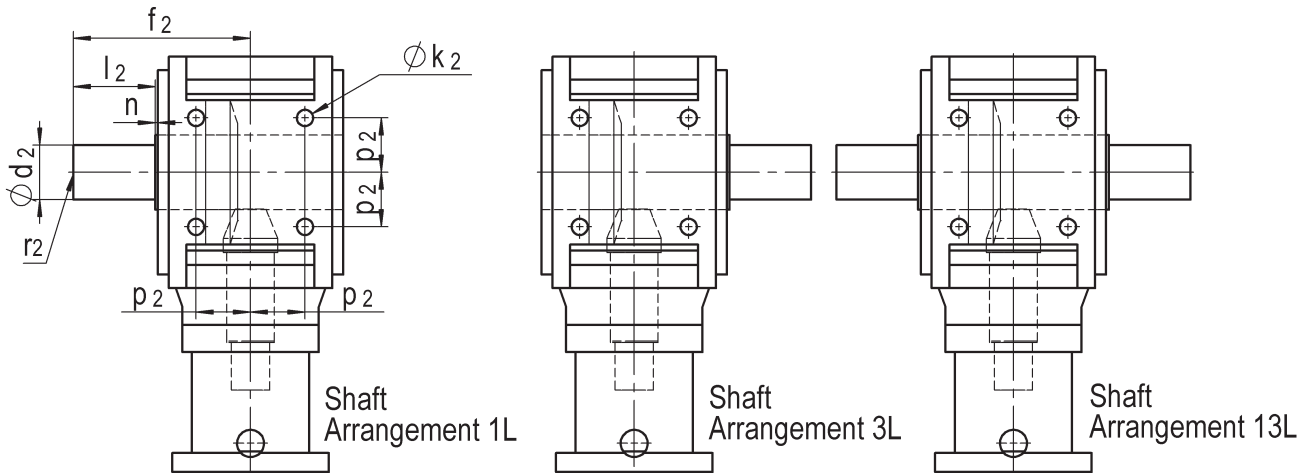
Symbols and units

Maximum motor acceleration torque	T_{1BMot}	Nm
Nominal output torque	T_{2N}	Nm
Maximum output acceleration	T_{2B}	Nm
EMERGENCY STOP output torque	T_{2Not}	Nm
Maximum input speed	n_{1max}	min ⁻¹
Nominal input speed	n_{1N}	min ⁻¹
Output backlash	j_t	arcmin
Torsional output stiffness	C_{t21}	Nm/arcmin
Radial input force	F_{1Rmax}	N
Radial output force	F_{2Rmax}	N
Axial input force	F_{1Amax}	N
Axial output force	F_{2Amax}	N
Efficiency at full load	η	%
Running noise	L_{pA}	dB(A)
Weight	m	kg
Mass moment of inertia	I_1	kgcm ²
Service life	L_h	h
Run time	RT	min
Duty cycle	DC	%
Ambient temperature	t_a	°C
Thermal performance limit	P_{therm}	kW
Performance	P	kW

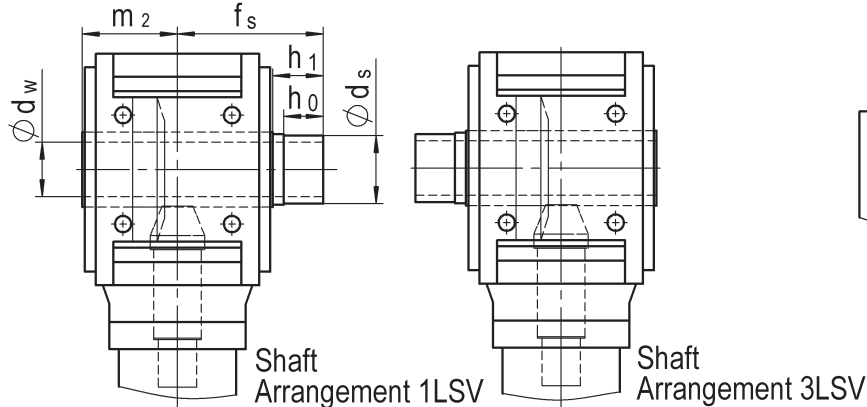
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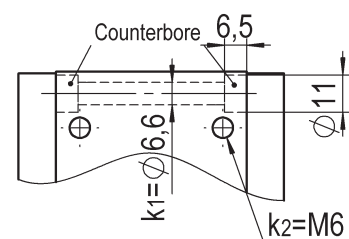
Output with solid shaft



Output with hollow shaft



Fasting bores size D37



Size	A	B	Ø b _{g6}	g	o	p ₁	p ₂	Ø k ₁	k ₂	q
D37	56	75	74	11	7.5	31	21	6.6	M6	-
D55	60	90	89	13.5	9	39	22	6.6	M6	8
D75	80	115	105	8.5	14	49	27	9	M8	10
D90	100	140	125	8	18	59	33	11	M10	11
D115	120	170	150	8	23	72	40	13.5	M12	13
D130	138	192	173	10	27	82	48	13.5	M12	14
D140	146	215	195	10	32	91	52	17.5	M16	15
D160	166	240	225	10	38	103	60	17.5	M16	16
D190	196	260	245	10	42	112	70	17.5	M16	17

Input without lantern and without coupling

Size	Ø d _{1 k6}	l ₁	r ₁ ⊗	Ø w _{1 g6}	g ₁	Ø v ₁	s ₁	f ₁	e ₁
D37	10	14	M3	46	3.5	46	M5	91.5	73
D55	14	15	M5	46	4	67	M6	101	81
D75	18	25	M6	73	11	90	M6	123	86
D90	22	30	M8	85	12	103	M8	139	96
D115	28	35	M10	95	12	115	M8	160	112
D130	32	36	M12	109	14	130	M10	177	126
D140	32	38	M12	119	16	145	M10	197	142
D160	36	42	M12	126	16	153	M10	217	158
D190	40	45	M16	137	16	165	M12	236	174

Input with lantern and coupling

Size	Ø d ₁₁ x l ₁₁			□ u x f ₁ ⊕		
D37	9x23	11x26		55x127.5	70x127.5	
D55	9x23	11x26	14x30	55x130	75x140	
D75	11x26	14x30	19x40	75x168	90x168	90x180
D90	14x30	19x40	24x50	90x191	115x191	115x201
D115	19x40	24x50	32x60	115x220	140x220	140x235
D130	24x50	32x60	38x80	140x245	190x245	190x260
D140	24x50	32x60	38x80	140x260	190x260	190x280
D160	32x60	38x80	48x80	140x298	190x308	260x308
D190	32x60	38x80	48x80	190x335	260x345	

} Pitch circle diameter, centering diameter, thread and centering depth according to the relevant motor data sheet

Input with planetary pre-stage for motor shaft and input flange

Size	Ø d ₁₂ x l ₁₂ x f ₁₂
D55HR	9x25x158.1 / 11x25x158.1 / 14x30x168.1
D75HR	14x30x198.1 / 16x30x198.1 / 19x40x198.6 / 24x50x206.6
D90HR	14x30x214.1 / 16x30x214.1 / 19x40x214.1 / 24x50x222.6
D115HR	19x40x246.5 / 24x50x255.5 / 32x60x255.5
D130HR	19x40x263.5 / 24x50x272.5 / 32x60x272.5
D140HR	24x50x297.8 / 32x60x302.8 / 38x80x322.8
D160HR	24x50x317.8 / 32x60x322.8 / 38x80x342.8
D190HR	24x50x336.8 / 32x60x341.8 / 38x80x361.8

} Square □ u, the pitch circle diameter Ø v with threads s and the centering diameter Ø w with length m are motor dependent.
Please contact us!

Output with solid shaft

Size	Ø d _{2 k6}	l ₂	f ₂	n	r ₂ ⊗
D37	16	25	65	1	M5
D55	20	35	80	1.5	M6
D75	24	40	90	1.5	M8
D90	32	50	110	2	M12
D115	40	60	130	2	M16
D130	48	75	156	2	M16
D140	55	90	175	2	M20
D160	60	100	195	2	M20
D190	70	110	220	2	M20

Output with hollow shaft^③

Size	Ø d _w ^{H7}	Ø d _s T7	h ₀	h ₁	f _s	m ²
D37	16	20	20	25	66	40
D55	20	24	20	25	71.5	45
D75	25	30	22	27	79.5	50
D90	30	36	26	31	93	60
D115	40	50	29	34	107	70
D130	48	55	32	37	121	81
D140	55	68	32	38	127	85
D160	60	75	34	41	139	95
D190	70	80	34	41	159	110

① Standard square for relevant motor type

② According to D DIN 332

③ Extended shaft for the shrink disk (e.g. Stüwe – Type HSD 22)

Delivery with shrink disk on request

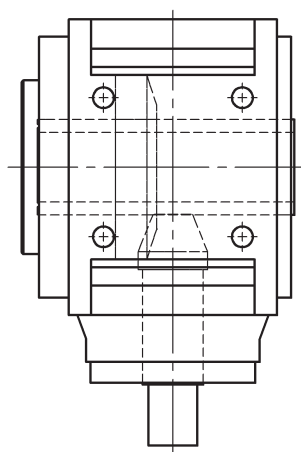
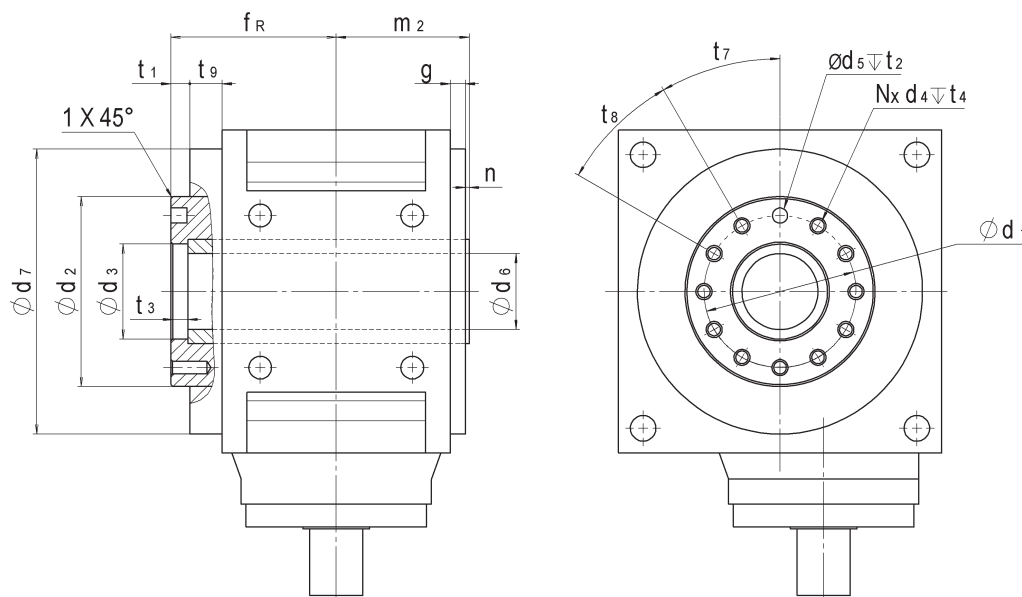
Dimensions and Configurations

DYNA GEAR

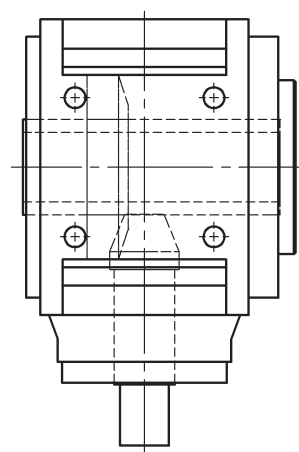
Output with robot flange according to EN ISO 9409-1 and hollow shaft

Size	Position	Pitch circle $\emptyset d_1$		$\emptyset d_2$ h8	$\emptyset d_3$ H7	d_4	$\emptyset d_5$ H7	$\emptyset d_6$	$\emptyset d_7$	f_R	m_2
		Series 1	Series 2								
D55	3	40	—	50	25	M6	6	18	89	57	45
D75	4	—	50	63	31.5	M6	6	24	105	62.5	50
D90	5	63	—	80	40	M6	6	28	125	73	60
D115	6	—	80	100	50	M8	8	40	150	87	70
D130	6	—	80	100	50	M8	8	40	173	96.5	81
D140	7	100	—	125	63	M8	8	52	195	100.5	85
D160	7	100	—	125	63	M8	8	52	225	115	95
D190	8	—	125	160	80	M10	10	65	245	132.5	110

Size	g	n	t ₁	t ₂	t ₃	t ₄	t ₇	t ₈	t ₉	N
D55	13.5	1.5	7	6.5	7	Thread depth > 1.5x d ₄	45°	45°	20	7
D75	8.5	1.5	7	6.5	7		45°	45°	15.5	7
D90	8	2	7	6.5	7		45°	45°	16	7
D115	8	2	10	8.5	8.5		30°	30°	17	11
D130	10	2	10	8.5	8.5		30°	30°	17.5	11
D140	10	2	10	8.5	8.5		30°	30°	17.5	11
D160	10	2	12	8.5	8.5		30°	30°	20	11
D190	10	2	12	10.5	8.5		30°	30°	22.5	11



Shaft Arrangement 1RFH



Shaft Arrangement 3RFH

Selection

For entire DynaGear range

DYNA GEAR

Operation mode S5 duty cycle (DC) < 60 % and run time (RT) < 20 min

Maximum existing motor acceleration torque $T_{1B\text{Mot}}$ [Nm]



Calculate the maximum existing acceleration torque at the gearbox output

$$T_{2B\text{max exist.}} = T_{1B\text{Mot}} \times i \text{ [Nm]}$$



Compare the maximum existing acceleration torque at the gearbox output with the permissible acceleration torque at the gearbox output

$$T_{2B\text{max exist.}} \leq T_{2B\text{perm.}} \times k$$



Existing average speed $n_{1\text{exist.}} \leq$ nominal speed n_{1N}
Valid for an average torque of 30 % of the permissible output torque T_{2N}



Compare the motor dimensional details such as flange size, shaft diameter and shaft length with the gearbox dimensions $\square u, d_1, l_1$ [mm]



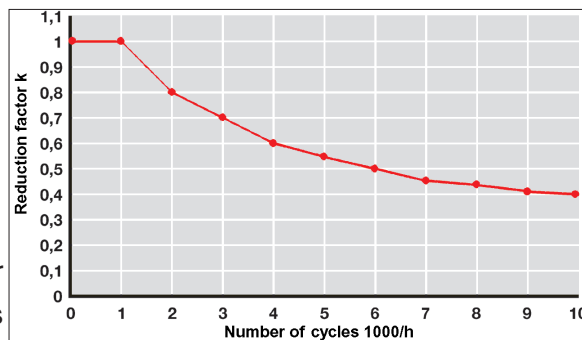
Compare the radial and axial shaft load with the maximum permissible values

$$F_{2R\text{exist.}} \leq F_{2R\text{max}} \text{ [N]} \quad F_{2A\text{exist.}} \leq F_{2A\text{max}} \text{ [N]}$$

These are guide values, dependent on additional loads. Upon request we calculate these values individually.

For continuous operation S1, please contact us.

Reduction factor for high number of cycles



Example:
Positioning drive

Given: Servo motor $T_{1B\text{max}} = 16 \text{ Nm}$
Ratio $i = 8:1$
No of cycles 2000/h

Selection: $T_{2B \text{ max. exist.}} = 16 \text{ Nm} \times 8 = 128 \text{ Nm}$
Gearbox D90 8:1 1L
 $T_{2B \text{ max exist.}} \leq T_{2B \text{ zul}} \times k$
 $128 \text{ Nm} \leq 210 \text{ Nm} \times 0.8 = 168 \text{ Nm}$

Connection dimensions
Motor: Flange $\square 105 \text{ mm}$, shaft $d_1 = \varnothing 19 \text{ mm}$, $l_1 = 40 \text{ mm}$
Gearbox: Flange $\square 115 \text{ mm}$, shaft $d_1 = \varnothing 19 \text{ mm}$, $l_1 = 40 \text{ mm}$

Selected: D90 8:1 1L

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DynaGear and DynaGear Economy Gearboxes

DYNAGEAR gearboxes are supplied ready lubricated for life with a high-quality synthetic oil to CLP DIN 51 517, ISO VG-Class 150 (DIN 51 519). They are therefore maintenance free.

We recommend that for continuous operation close to the thermal performance limit, regular leak controls are undertaken on the shaft seals. After approx 15.000 operating hours, it is advisable to change the oil. Please request instructions which also include advice on lubricants and quantity. Service kits of wear and tear parts with full instructions are available from our service department.

DynaGear High Ratio Gearboxes

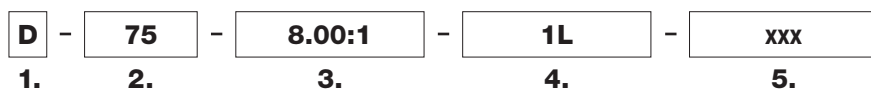
DYNAGEAR High Ratio Gearboxes have two separate lubrication chambers.

The hypoid stage is lubricated with a high-quality synthetic oil (synthetic hydrocarbon plus additives) to CLP DIN 51517, ISO VG-Class 150 (DIN 51 519).

The planetary stage is filled with a special grease, consistency 00 to DIN 51818.

If used under normal conditions, the gearboxes are considered lubricated for life and are therefore maintenance-free.

We recommend that for continuous operation close to the thermal performance limit, regular leak controls are undertaken on the shaft seals. After approx 15,000 operating hours, it is advisable to change the both the oil and the grease. The gearboxes require disassembly in order to change the lubricants. We will be happy to carry out this work for you at our factory. Should you still wish to change the lubricants yourself, please request instructions which also include advice on lubricants and quantity. Service kits of wear and tear parts with full instructions are available from our service department.



1. **Gearbox range** D = DynaGear Page 4 +5
D..HR = DynaGear High Ratio Page 4 +5

2. **Size**

3. **Ratio**

4. **Configuration** See page 6 +8

5. **Additional data**

- Input speeds
Maximum application speed
- Options – if required
- Customised design – if required

Please include the relevant motor data sheet.

Please note that

All information contained in this catalogue is provided without guarantee and is not binding. In particular, dimensions and values only provide guidance. Any exact, specific requirements must be agreed with us.

Specifications and features listed in the catalogue are subject to a written contract.



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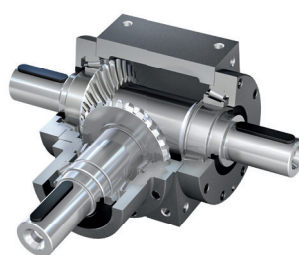
BEVEL GEAR



Spiral, Hypoid and Zerol Bevel Gears

- Standard range of products and custom-made versions
- Module ms from 0.5 to 12
- Diameters up to 410 mm
- Shaft angles from 10° to 170°
- More than 60 years of experience
- In-house gearing calculations
- We manufacture to your drawing or advise you of possible alternatives
- Milled or ground gear tooth cutting

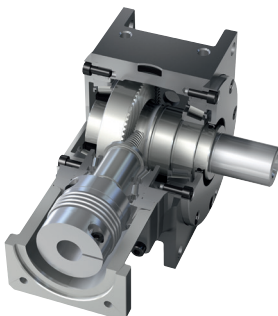
POWER GEAR



The high performance bevel gearbox

- High torque, small size
- For highest input speeds
- Ratios from $i = 1:1$ to $5:1$
- Torques up to 7000 Nm
- Output via solid and hollow shaft
- Motor mounting either directly or via coupling and lantern
- Variable ratios and uniform dimensions

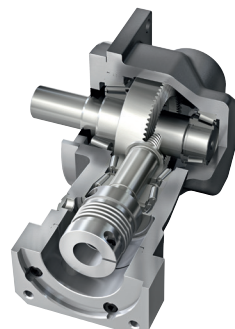
DYNA GEAR



The highly dynamic servo right angle gearbox

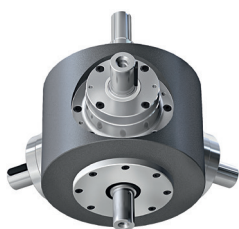
- Hypoid gearing
- High input speeds at medium to high torques
- Ratios single-stage $i = 3:1$ to $30:1$
- Ratios, two-stage, up to $150:1$
- Torques up to 1440 Nm
- Flexible motor mounting via coupling and lantern
- Low backlash < 2 arcmin
- Variable ratios and uniform dimensions

DYNA GEAR ^{Economy} The cost-effective servo right angle gearbox



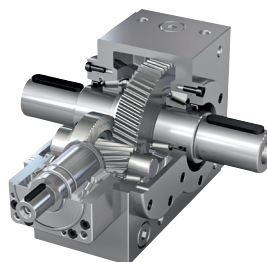
- Hypoid gearing
- High input speeds at medium torques
- Ratios single-stage $i = 5:1, 8:1, 10:1$ and $15:1$
- Torques up to 260 Nm
- Flexible motor mounting via coupling and flange
- Backlash < 6 arcmin
- Variable ratios and uniform dimensions

DESIGN GEAR The customised gearbox



- Single-stage gearbox available as gear-change or reversing gearbox
- Forced oil circulation lubrication system gearbox for high speeds and torques
- Labyrinth sealed gearbox with an efficiency of $> 99\%$
- Special gearbox with additional functional elements
- Endless possibilities on request

KS TWIN GEAR The bevel helical gearbox



- Two-stage bevel helical gearbox with ratios of up to $75:1$
- Torques up to 7500 Nm
- Torsional backlash < 6 arcmin
- Compact design
- Motor mounting either directly or via coupling and lantern
- High torsional stiffness
- High input speeds at high torques
- Variable ratios and uniform dimensions