

# BEVEL GEARBOX

# Bevel gearboxes YD Series

## Materials and components

### Housing

- Cubic shape
- Material: GGG - 40
- All sides machine finished.
- On request: Stainless steel.

### Covers and hubs

- Material: GGG - 40
- Machining: Internal centring tolerance **h7**, outer centring tolerance **f7**.
- On request: Stainless steel.

### Solid Shafts

- Material: Carbon steel C45E + H + QT (UNI EN 10083-2), hardened and tempered.
- Machining: Cylindrical end, ground in tolerance **j6**, with key according to DIN 6885 part 1.
- On request: Stainless steel.

Shaft end with spline profile according to DIN 5480.

Shaft end machined to drawing.

### Hollow Shafts

- Material: Input hollow shaft - carbon steel C45E + QT (UNI EN 10083-2), hardened and tempered.  
Output hollow shaft - alloy steel 39 NiCrMo 3 (UNI EN 10083-3), hardened and tempered.
- Machining: Cylindrical end, ground in tolerance **H7**, with keyway according to DIN 6885 Part 1.
- On request: Stainless steel.  
Bore with spline profile according to ISO 14.

### Bevel gears

- Material: Alloy steel 20 MnCr 5 (UNI EN 10084), case-hardened and tempered.
- Tothing: GLEASON, with spiroidal tooth.
- Running in with lapping.

### Seals

- Oil seals in NBR, on request in VITON.
- O-rings in NBR.

### Bearings

- Taper roller bearings on solid output shaft and input shafts.
- Ball bearings on hollow input shaft for motor flange.
- On request: Larger bearings for higher radial and / or axial load capacity.

## Bevel gearboxes YD Series

### Bevel gearbox selection

The selection of a bevel gearbox depends on several application factors:

- The kinematic scheme of the application to determine the design form, the kinematic scheme of the gear assembling and the shafts rotation directions.
- Torque and rotation speed required by the load (operating machine)
- Load variability, regarding the operating machine and its inertia.
- Working cycle: Number of starts-up per hour, operating time in hours per day duty cycle.
- Environmental conditions, ambient temperature, presence of aggressive agents.
- Service life requirements in terms of operating hours of the application.
- Type of engine or type of drive on the bevel gearbox input, available or required by the application.

The above mentioned points are all very important to determine the right size and the type of suitable bevel gearbox for customer's application.

To simplify the selection, some factors, which take into consideration the variability of the above mentioned conditions, are introduced. Applying these factors on the performance required by the application, we obtain recalculated reference performances which should be considered as a starting base for the selection by consulting the table of **Nominal performances** given for each bevel gearbox size.

The nominal data required by the application or by the operating machine are:

- Rotation speed,  $n$  [rpm]
- Torque,  $M_m$  [Nm]

These data allow to calculate the required nominal power  $P_n$  [kW]:

$$P_n = \frac{M_m \times n}{9550}$$

It is then necessary to determine the **recalculated reference power**  $P$ , defined by the following formula:

$$P = P_n \times f_c \times f_u \times f_d$$

Where:

- $P_n$  required nominal power
- $f_c$  load factor
- $f_u$  daily operating time factor
- $f_d$  service life factor

The **load factor**  $f_c$  regards the load variability and the number of starts-up per hour; for its quantification and explanation please refer to the description and the table below. The **load factor**  $f_c$ , regarding the load variability is defined as follows:

**$f_{c1}$**  Light overloads: Load variation not exceeding 10% of the required nominal load no mass to be accelerated.

**$f_{c2}$**  Medium overloads : Load variation not exceeding 25% of the required nominal load with mass to be accelerated.

**$f_{c3}$**  heavy overload: Load variation up to 100% of the required nominal load, with large mass to be accelerated.

Number of starts-up per hour	1	5	60	120	240	1000	1800
$f_{c1}$	1	1	1.1	1.2	1.25	1.3	2
$f_{c2}$	1.2	1.2	1.3	1.4	1.45	1.5	1.6
$f_{c3}$	1.5	1.5	1.6	1.7	1.75	1.8	2

## Bevel gearboxes YD Series

### Materials and components

#### Housing

Cubic shape

Material: Grey cast iron EN-GJL-250 (UNI EN 1561)

All sides machine finished.

On request: Stainless steel.

#### Covers and hubs

Material: Grey cast iron EN-GJL-250 (UNI EN 1561)

Machining: Internal centring tolerance **h7**, outer centring tolerance **f7**.

On request: Stainless steel.

#### Solid Shafts

Material: Carbon steel C45E + H + QT (UNI EN 10083-2), hardened and tempered.

Machining: Cylindrical end, ground in tolerance **j6**, with key according to DIN 6885 part 1.

On request: Stainless steel.

Shaft end with spline profile according to DIN 5480.

Shaft end machined to drawing.

#### Hollow Shafts

Material: Input hollow shaft - carbon steel C45E + QT (UNI EN 10083-2), hardened and tempered.

Output hollow shaft - alloy steel 39 NiCrMo 3 (UNI EN 10083-3), hardened and tempered.

Machining: Cylindrical end, ground in tolerance **H7**, with keyway according to DIN 6885 Part 1.

On request: Stainless steel.

Bore with spline profile according to ISO 14.

#### Bevel gears

Material: Alloy steel 20 MnCr 5 (UNI EN 10084), case-hardened and tempered.

Toothing: GLEASON, with spiroidal tooth.

Running in with lapping in paris.

#### Seals

Oil seals in NBR, on request in VITON.

O-rings in NBR.

#### Bearings

Taper roller bearings on solid output shaft and input shafts.

Ball bearings on hollow input shaft for motor flange.

On request: Larger bearings for higher radial and / or axial load capacity.

## Bevel gearboxes YD Series

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- The kinematic scheme of the application to determine the design form, the kinematic scheme of the gear assembling and the shafts rotation directions.
- Torque and rotation speed required by the load (operating machine)
- Load variability, regarding the operating machine and its inertia.
- Working cycle: Number of starts-up per hour, operating time in hours per day duty cycle.
- Environmental conditions, ambient temperature, presence of aggressive agents.
- Service life requirements in terms of operating hours of the application.
- Type of engine or type of drive on the bevel gearbox input, available or required by the application.

The above mentioned points are all very important to determine the right size and the type of suitable bevel gearbox for customer's application.

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**$f_{c1}$**  Light overloads: Load variation not exceeding 10% of the required nominal load no mass to be accelerated.

**$f_{c2}$**  Medium overloads : Load variation not exceeding 25% of the required nominal load with mass to be accelerated.

**$f_{c3}$**  heavy overload: Load variation up to 100% of the required nominal load, with large mass to be accelerated.

Number of starts-up per hour	1	5	60	120	240	1000	1800
$f_{c1}$	1	1	1,1	1,2	1,25	1,3	1,4
$f_{c2}$	1,21	1,21	1,3	1,4	1,45	1,5	1,6
$f_{c3}$	1,51	1,51	1,6	1,7	1,75	1,8	2

## Bevel gearboxes YD Series

The **daily operating factor**  $f_u$  considers the number of operating hours per day referring to operating under load with duty cycle required by the application:

Operating hours / day	1	2	4	8	16	24
$f_u$	0.7	0.8	0.9	1	1.15	1.3

The **service life factor**  $f_d$  considers the life time required by the application compared to the life time calculated with performances shown in the tables (average value 10.000 hours) reference to the gears.

Theoretic service life [hours]	20.000	15.000	10.000	5.000	3.000
$f_d$	1.2	1.1	1	0.9	0.8

With the **calculated input power**  $P$ :

$$P = P_n \times f_c \times f_u \times f_d$$

It is possible to calculate the **torque**  $M_{t2}$  **required on the gearbox output**, considering the rotation speed required by the operating machine or the load:

$$M_{t2} = \frac{P \times 9550}{n_2}$$

Based on **nominal performances** table on page 12-13, using  $M_{t2}$  and  $n_2$ , it is possible to determine the bevel gearbox size for an initial selection. Then evaluating the gearbox ratios and the characteristics of the rotation speeds available or required by the application, it is possible to select easily a ratio and determine the bevel gearbox input speed. The **input power**  $P_1$  [kW] **required on the bevel gearbox**, shown in the table, already takes into account the **total bevel gearbox efficiency**  $\eta$ , with the ratio and the considered input speed:

$$P_1 = \frac{M_{t2} \times n_2}{9550 \times \eta}$$

Usually, the ratio selection implies a modification of the real gearbox output speed regards to the previously calculated one unless it is possible to vary and adjust the bevel gearbox input speed.

## Bevel gearboxes YD Series

### Thermal power limit ( $P_T$ )

After the gearbox size has been determined, it is necessary to verify the thermal operating conditions, which means to verify if the selected gearbox can operate in the required conditions without risk of overheating of the oil lubricant and of the components.

Each gearbox has a **thermal power limit**  $P_T$ , which is determined based on continuous operating duty cycle over max. 3 hours at 20°C environment temperature, value stated in the table at the bottom of this page, which must not be exceeded without a controlled and forced cooling.

In case of risk of exceeding the thermal power limit, the bevel gearbox should be always lubricated exclusively with oil instead of grease.

In order to consider the real environment conditions, if different from 20°C, and the duty cycle if different from the reference one (continuous operating over max. 3 hours) two factors are introduced which modify the thermal power limit, allowing the calculation of the **corrected thermal power limit**  $P_{Tc}$ :

$$P_{Tc} = P_T \times f_r \times f_i$$

Where:

$P_T$  thermal power limit

$f_r$  ambient temperature factor

$f_i$  duty cycle factor referred to continuous operating over 3 hours (period of time considered to determine the thermal power limit)

#### Ambient temperature factor $f_r$ :

T [°C]	0	10	20	30	40	50	60
$f_r$	1.3	1.15	1	0.85	0.7	0.55	0.5

#### Duty cycle factor $f_i$ :

Operating time over 3 hours [%]	100	80	60	40	20	10
$f_i$	1	1.2	1.3	1.5	1.6	1.8

Therefore, the continuous power used over 3 hours in the selected bevel gear box must not exceed the value of the **corrected thermal power**  $P_{Tc}$  referred to the same gearbox, otherwise the oil lubricant should be cooled.

#### Thermal power limit ( $P_T$ ) for continuous operating over 3 hours at 20°C ambient temperature:

SIZE	86	110	134	166	200	250
$P_T$ [kW]	3.4	5.5	8	12.2	17.9	26.5



## Bevel gearboxes YD Series

### Technical features summary

SIZE	YD85	YD110	YD135
Housing side dimensions [mm]	85	110	135
Ratio	1 : 1   1 : 1.5   1 : 2   1 : 3   1 : 4		
Total efficiency ( $\eta$ )	$0.90 \leq \eta \leq 0.93$ (*)		
Input: solid shaft cylindrical with key STANDARD diameter [mm]	Ø 16 j6	Ø 20 j6	Ø 24 j6
Input: solid shaft cylindrical with key LARGER diameter [mm]	Ø 24 j6	Ø 26 j6	Ø 32 j6
Input: IEC motor flange	IEC 71 B5 IEC 80 B5 IEC 80 B14	IEC 80 B5 IEC 80 B14 IEC 90 B5 IEC 90 B14	IEC 90 B5 IEC 100-112 B5 IEC 100-112 B14
Output: solid shaft cylindrical with key	Ø 24 j6	Ø 25 j6	Ø 32 j6
Output: hollow shaft cylindrical with keyway	Ø 16 H7	Ø 20 H7Ø	24 H7
Output: solid shaft with hub cylindrical with key STANDARD diameter [mm]	Ø 16 j6	Ø 20 j6	Ø 24 j6
Output: solid shaft with hub cylindrical with key LARGE diameter [mm]	Ø 24 j6	Ø 25 j6	Ø 32 j6
Gearbox housing, shaft hub and covers material	GGG - 40		
Solid input shaft material	Steel C45E + H +QT (UNI EN 10083-2) hardened and tempered		
Hollow input shaft material	Steel C45E + H +QT (UNI EN 10083-2) hardened and tempered		
Solid output shaft material	Steel C45E + H +QT (UNI EN 10083-2) hardened and tempered		
Hollow output shaft material	Steel 39 NiCrMo 3 (UNI EN 10083-3) hardened and tempered		
Bevel gears	Toothings: Spiral GLEASON Material : Steel 20 MnCr 5 (UNI EN 10084) case-hardened lapped		
Gearbox mass [kg] (gearbox with solid input shaft and solid output shaft on both sides)	3.59		18

\* Value referred to bevel gearbox without additional output.

## Bevel gearboxes YD Series

### Technical features summary

YD165	YD200	YD250	SIZE
165	200	250	Housing side dimensions [mm]
1 : 1   1 : 1.5   1 : 2   1 : 3   1 : 4			Ratio
0.90 ≤ $\eta$ ≤ 0.93 (*)			Total efficiency ( $\eta$ )
Ø 32 j6	Ø 42 j6	Ø 55 j6	Input: solid shaft cylindrical with key STANDARD diameter [mm]
Ø 45 j6	Ø 55 j6	Ø 70 j6	Input: solid shaft cylindrical with key LARGER diameter [mm]
90 B5 100-112 B5 100-112 B14	100-112 B5 132 B5 132 B14	132 B5 160 B5	Input: IEC motor flange
Ø 45 j6	Ø 55 j6	Ø 70 j6	Output: solid shaft cylindrical with key
Ø 32 H7	Ø 42 H7	Ø 55 H7	Output: hollow shaft cylindrical with keyway
Ø 32 j6	Ø 42 j6	Ø 55 j6	Output: solid shaft with hub cylindrical with key STANDARD diameter [mm]
Ø 45 j6	Ø 55 j6	Ø 70 j6	Output: solid shaft with hub cylindrical with key LARGE diameter [mm]
GGG - 40			Gearbox housing, shaft hub and covers material
Steel C45E + H +QT (UNI EN 10083-2) hardened and tempered			Solid input shaft material
Steel C45E + H +QT (UNI EN 10083-2) hardened and tempered			Hollow input shaft material
Steel C45E + H +QT (UNI EN 10083-2) hardened and tempered			Solid output shaft material
Steel 39 NiCrMo 3 (UNI EN 10083-3) hardened and tempered			Hollow output shaft material
Toothings: Spiral GLEASON Material : Steel 20 MnCr 5 (UNI EN 10084) case-hardened lapped			Bevel gears
32	60	145	Gearbox mass [kg] (gearbox with solid input shaft and solid output shaft on both sides)

\* Value referred to bevel gearbox without additional output.

# Bevel Gearboxes YD Series

## Nominal Performances - Torque and Power

SIZE		YD85		YD110		YD135	
n <sub>1</sub> rpm	n <sub>2</sub> rpm	P <sub>1max</sub> [kW]	T <sub>2max</sub> [Nm]	P <sub>1max</sub> [kW]	T <sub>2max</sub> [Nm]	P <sub>1max</sub> [kW]	T <sub>2max</sub> [Nm]
Ratio R 1							
50	50	0.32	60	0.97	180	1.62	300
250	250	0.94	35	3.78	140	7.85	291
500	500	1.62	30	6.21	115	13.0	241
1000	1000	2.7	25	10.3	95	21.1	196
1500	1500	3.24	20	13.0	80	28.1	173
2000	2000	3.89	18	16.2	75	34.3	159
3000	3000	5.18	16	22.7	70	45.6	141
Ratio R 1.5							
50	33	0.23	65	0.49	135	0.81	225
250	167	0.72	40	2.25	125	3.95	220
500	333	1.08	30	4.32	120	7.75	215
1000	667	1.80	25	6.84	95	14.7	204
1500	1000	2.48	23	9.18	85	20.6	191
2000	1333	2.88	20	11.5	80	25.2	175
3000	2000	3.89	18	15.1	70	33.4	155
Ratio R 2							
50	25	0.15	55	0.31	115	0.51	190
250	125	0.54	40	1.42	105	2.44	181
500	250	0.94	35	2.70	100	4.71	175
1000	500	1.62	30	5.13	95	9.02	167
1500	750	2.02	25	7.29	90	13.0	160
2000	1000	2.38	22	9.18	85	16.7	155
3000	1500	3.24	20	12.1	75	23.4	144
Ratio R 3							
50	17	0.06	35	0.14	80	0.23	126
250	83	0.29	32	0.63	70	1.07	119
500	167	0.54	30	1.17	65	2.04	113
1000	333	1.01	28	2.19	61	3.91	109
1500	500	1.40	26	3.16	59	5.66	105
2000	667	1.58	22	4.07	57	7.30	101
3000	1000	2.16	20	5.94	55	10.3	95
Ratio R 4							
50	12.5	0.04	30	0.09	65	0.14	104
250	62.5	0.18	26	0.37	55	0.59	84
500	125	0.34	25	0.67	50	1.11	82
1000	250	0.65	24	1.21	45	2.12	79
1500	375	0.93	23	1.75	43	3.08	76
2000	500	1.19	22	2.26	42	3.98	74
3000	750	1.62	20	3.24	40	5.63	70

Thermal power limit [kW]	3.4	5.5	8
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P<sub>1max</sub>

The torque and power values stated in the Nominal performances table refer to a minimum service life of 10 000 hours at following operating conditions:

- Applied load: uniform and without variations
- Driving unit: electric motor
- Rotation direction: one-way
- 1 (one) start-up per hour

- Operating hours per day 8
- Ambient temperature: 20C
- Thermal power limit value calculated considering a continuous operating time over 3 hours at nominal performances.

# Bevel Gearboxes YD Series

## Nominal Performances - Torque and Power

YD165		YD200		YD250		SIZE	
P <sub>1max</sub> [kW]	T <sub>2max</sub> [Nm]	P <sub>1max</sub> [kW]	T <sub>2max</sub> [Nm]	P <sub>1max</sub> [kW]	T <sub>2max</sub> [Nm]	n <sub>1</sub> rpm	n <sub>2</sub> rpm
Ratio R 1							
3.02	560	5.24	970	10.7	1980	50	50
11.4	420	22.1	820	37.2	1380	250	250
18.4	340	36.2	670	60.5	1120	500	500
30.2	280	59.4	550	98.2	910	1000	1000
40.5	250	77.7	480	131	810	1500	1500
50.0	230	95.0	440	160	740	2000	2000
64.8	200	126	390	214	660	3000	3000
Ratio R 1.5							
1.51	420	2.63	730	5.33	1480	33	50
7.38	410	13.0	720	26.1	1450	167	250
13.3	370	24.8	690	45.3	1260	333	500
21.6	300	43.2	600	73.4	1020	667	1000
29.2	270	57.2	530	98.2	910	1000	1500
36.0	250	70.5	490	119	830	1333	2000
47.5	220	92.8	430	160	740	2000	3000
Ratio R 2							
0.97	360	1.67	620	3.45	1280	25	50
4.72	350	8.23	610	17.0	1260	125	250
9.18	340	16.2	600	33.2	1230	250	500
17.3	320	30.8	570	57.8	1070	500	1000
22.7	280	44.5	550	76.9	950	750	1500
28.1	260	55.1	510	93.9	870	1000	2000
37.3	230	72.9	450	125	770	1500	3000
Ratio R 3							
0.43	240	0.76	420	1.53	850	17	50
2.07	230	3.60	400	7.42	825	83	250
3.96	220	7.02	390	14.6	810	167	500
7.56	210	13.3	370	28.1	780	333	1000
10.8	200	19.4	360	40.5	750	500	1500
14.0	195	25.2	350	52.5	730	667	2000
20.0	185	35.6	330	74.5	690	1000	3000
Ratio R 4							
0.27	200	0.46	340	0.94	700	12.5	50
1.15	170	1.96	290	4.18	620	62.5	250
2.16	160	3.78	280	8.10	600	125	500
4.18	155	7.29	270	15.7	580	250	1000
6.07	150	10.5	260	22.7	560	375	1500
7.83	145	13.5	250	29.1	540	500	2000
11.4	140	19.4	240	42.1	520	750	3000

12.2

17.9

26.5

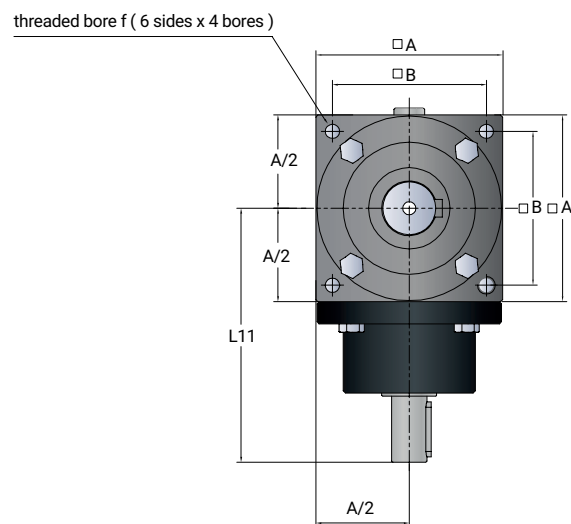
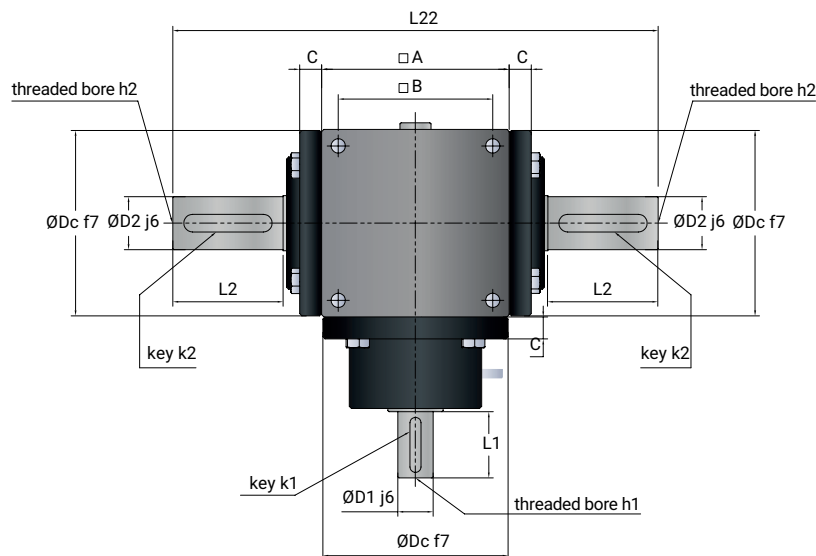
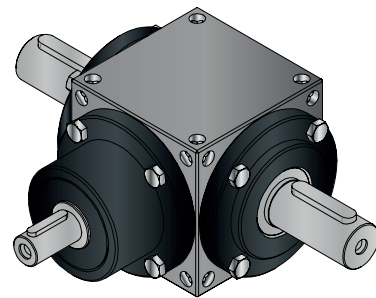
Thermal power limit [kW]

n<sub>1</sub> - input shaft speed  
n<sub>2</sub> - output shaft speed  
P<sub>1max</sub> - max. input power  
T<sub>2max</sub> - max. output torque

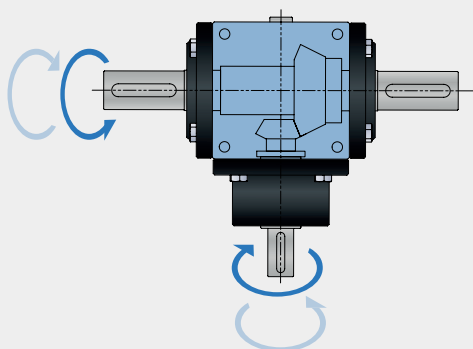
# Bevel Gearbox MMC Type

Input : Solid shaft

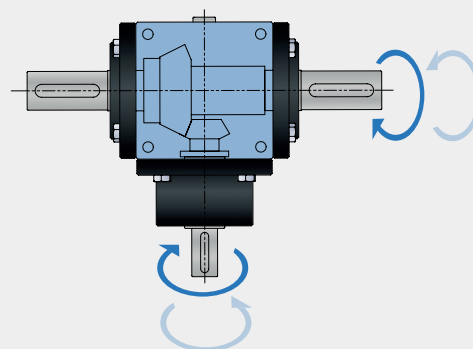
Output : Solid shaft on both sides



**Scheme: 10**



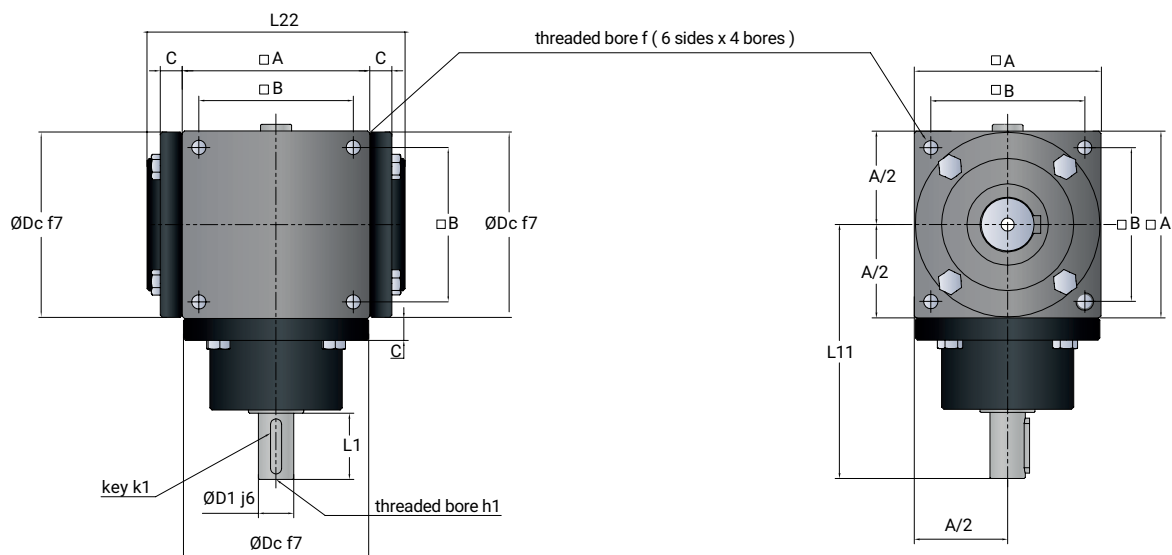
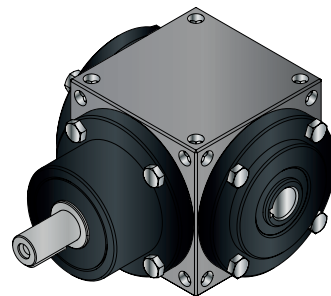
**Scheme: 20**



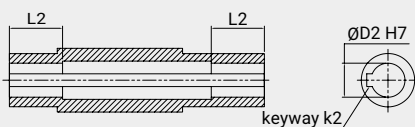
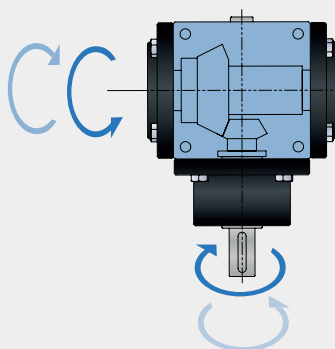
SIZE	YD85	YD 110	YD 135	YD 165	YD 200	YD 250
cube A	85x85x85	110x100x100	135x135x135	165x165x165	200x200x200	250x250x250
Ø D1	16	20	24	32	42	55
Ø D2	24	25	32	45	55	70
Ø Dc	84	100	122	156	185	230
□B	70x70	90x90	115x115	144x144	175x175	215x215
L1	30	40	50	65	85	100
L11	116	150	182	217	267	318
L2	50	55	65	90	110	140
L22	220	254	304	392	470	580
C	10	8	9	11	11	11
f	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 30	M14, depth 35	M16, depth 40
h1	M6, depth 12	M8, depth 20	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 25
h2	M6, depth 12	M8, depth 20	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 25
k1	5x5x25	6x6x35	8x7x45	10x8x60	12x8x80	116x10x90
k2	8x7x40	8x7x45	10x8x55	14x9x80	16x10x100	20x12x120

# Bevel Gearbox MD Type

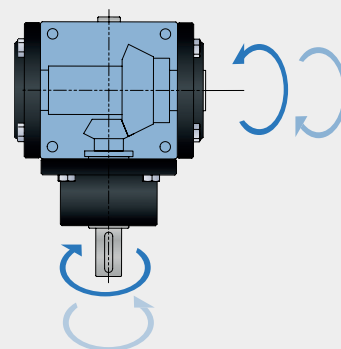
Input : Solid shaft  
Output : Hollow shaft



**Scheme: 10**



**Scheme: 20**

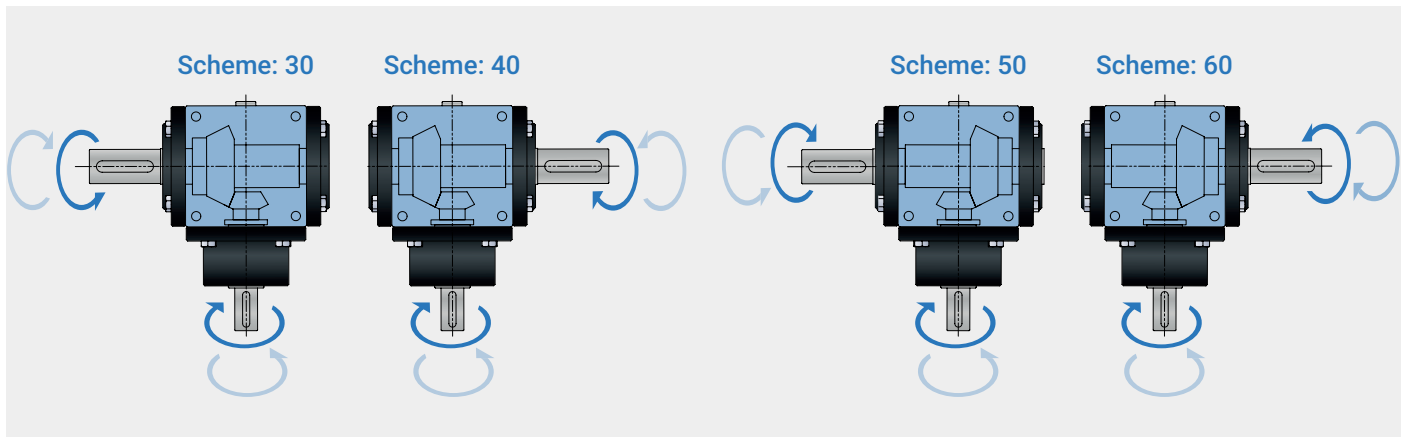
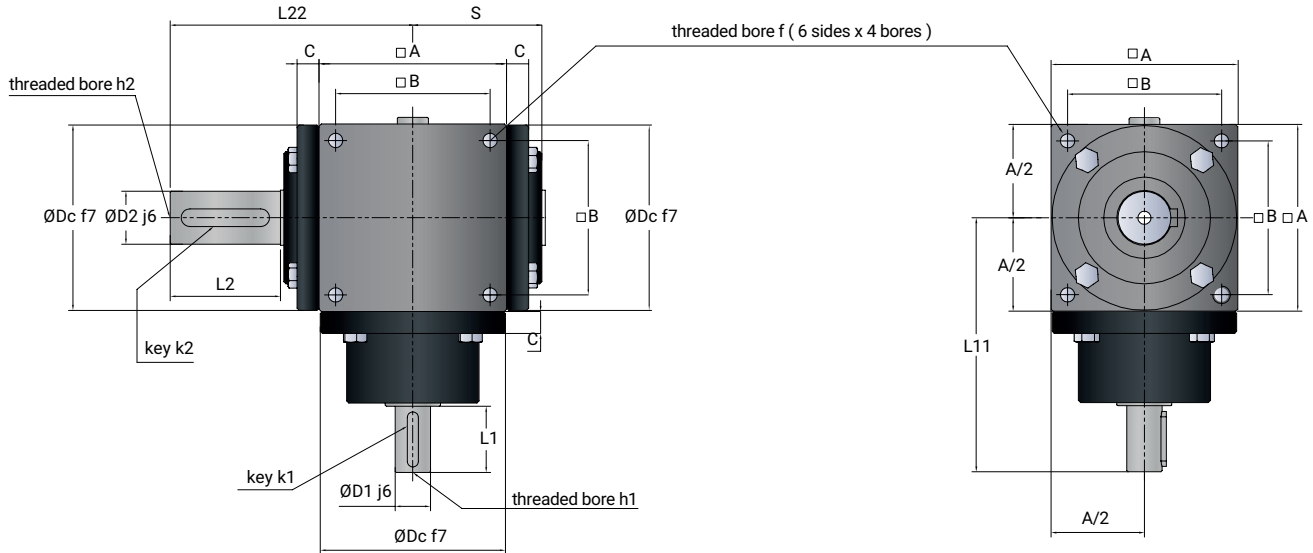
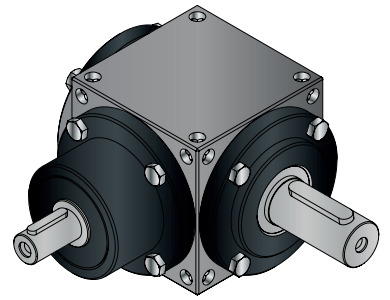


SIZE	YD 85	YD 110	YD 135	YD 165	YD 200	YD 250
cube A	85x85x85	110x110x110	135x135x135	165x165x165	200x200x200	250x250x250
Ø D1	16	20	24	32	42	55
Ø D2	16	20	24	32	42	55
Ø Dc	84	100	122	156	185	230
□B	70x70	90x90	114x114	144x144	175x175	215x215
L1	30	40	50	65	85	100
L11	116	150	182	217	267	318
L2	30	30	35	45	50	55
L22	120	144	174	212	250	300
C	10	8	9	11	11	11
f	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 30	M14, depth 35	M16, depth 40
h1	M6, depth 12	M8, depth 20	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 25
k1	5x5x25	6x6x35	8x7x45	10x8x60	12x8x80	12x8x80
k2	5x5	6x6	8x7	10x8	12x8	16x10

# Bevel Gearbox MM Type

Input : Solid shaft

Output : Solid shaft on one side



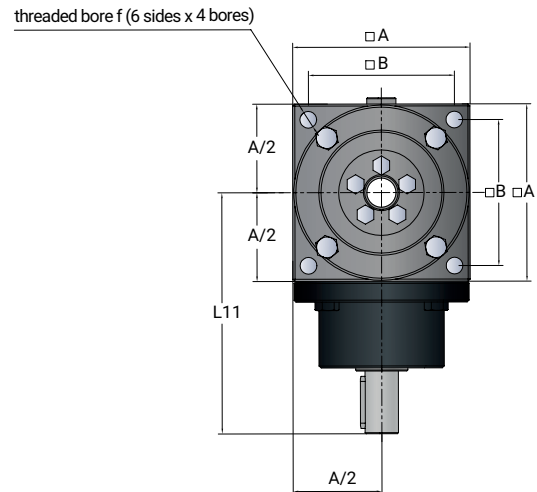
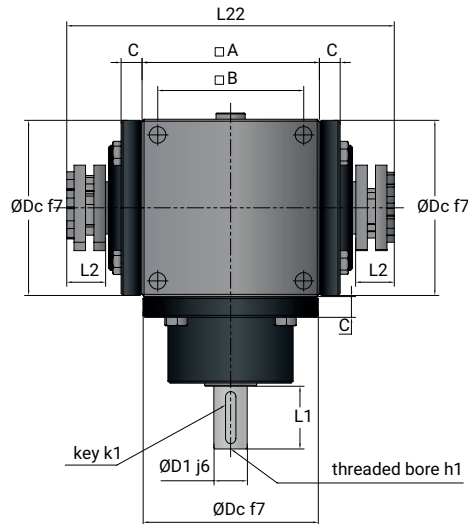
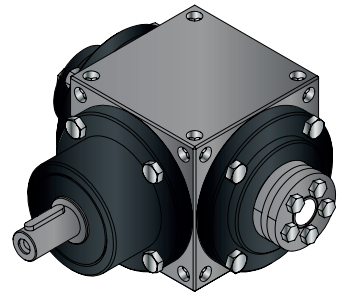
SIZE	YD 85	YD 110	YD 135	YD 165	YD 200	YD 250
cube A	85x85x85	110x110x110	135x135x135	165x165x165	200x200x200	250x250x250
S	58	70	75	104	123	145
Ø D1	16	20	24	32	42	55
Ø D2	24	26	32	45	55	70
Ø Dc	84	100	122	156	185	230
□B	70x70	90x90	114x114	114x114	175x175	215x215
L1	30	40	50	65	85	100
L11	116	150	182	217	267	318
L2	50	55	65	90	110	140
L22	110	127	152	196	235	290
C	10	8	9	11	11	11
f	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 30	M14, depth 35	M16, depth 40
h1	M6, depth 12	M8, depth 20	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 25
h2	M6, depth 12	M8, depth 20	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 25
k1	5x5x25	6x6x35	8x7x45	10x8x60	12x8x80	16x10x90
k2	8x7x40	8x7x45	10x8x55	14x9x80	16x10x100	20x12x120



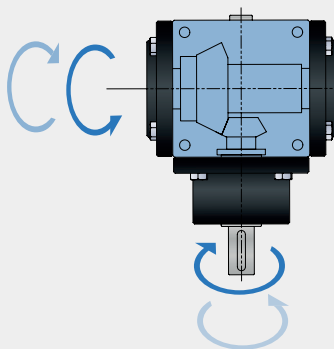
# Bevel Gearbox MH Type

Input : Solid shaft

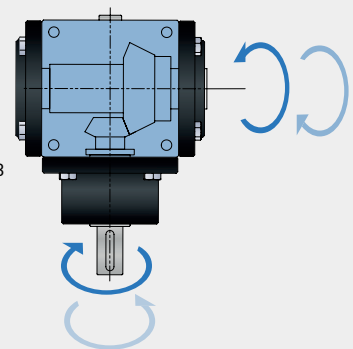
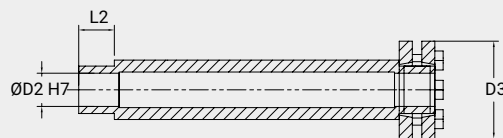
Output : Solid shaft on one side



Scheme: 10



Scheme: 20



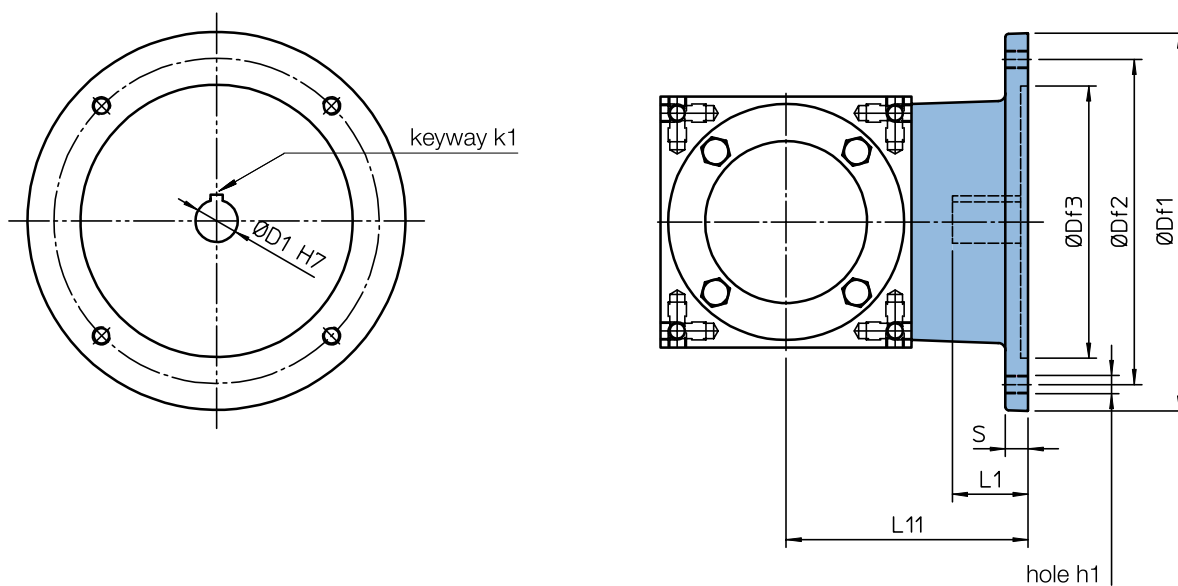
SIZE	YD 85	YD 110	YD 135	YD 165	YD 200	YD 250
cube A	85x85x85	110x110x110	135x135x135	165x165x165	200x200x200	250x250x250
S	58	70	75	104	123	145
Ø D1	16	20	24	32	42	55
Ø D2	24	26	32	45	55	70
Ø Dc	84	100	122	156	185	230
□B	70x70	90x90	114x114	114x114	175x175	215x215
L1	30	40	50	65	85	100
L11	116	150	182	217	267	318
L2	23	23	25	30	32	35
L22	166	190	224	272	314	370
C	10	8	9	11	11	11
f	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 30	M14, depth 35	M16, depth 40
h1	M6, depth 12	M8, depth 20	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 25
h2	M6, depth 12	M8, depth 20	M8, depth 20	M10, depth 25	M10, depth 25	M12, depth 25
k1	5x5x25	6x6x35	8x7x45	10x8x60	12x8x80	16x10x90
ØD3	50	50	60	80	90	115



## Bevel Gearboxes YD Series

### Overall dimensions: YD - MF

Input: IEC motor flange and hollow shaft with keyway



Size	IEC Motor	Ø D1	Ø Df1	Ø Df2	Ø Df3	L1	L11	h1	k1	s
YD 85	71 B5	14	160	130	110	30	90	M8	5 x 5	13
	80 B5	19	200	165	130	40	100	M10	6 x 6	13
	80 B14	19	120	100	80	40	100	O7	6 x 6	13
YD 110	80 B5	19	200	165	130	40	105	M10	6 x 6	13
	80 B14	19	120	100	80	40	105	O7	6 x 6	13
	90 B5	24	200	165	130	50	115	M10	8 x 7	13
	90 B14	24	140	115	95	50	115	O9	8 x 7	13
YD 135	90 B5	24	200	165	130	50	125	M10	8 x 7	13
	100 - 112 B5	28	250	215	180	60	135	M12	8 x 7	13
	100 - 112 B14	28	160	130	110	60	135	O9	8 x 7	13
YD 165	90 B5	24	200	165	130	50	160	M10	8 x 7	15
	100 - 112 B5	28	250	215	180	60	160	M12	8 x 7	15
	100 - 112 B14	28	160	130	110	60	160	O9	8 x 7	15
	100 - 112 B5	28	250	215	180	60	220	M12	8 x 7	23
YD 200	132 B5	38	300	256	230	80	220	M12	10 x 8	23
	132 B14	38	200	165	130	80	220	O11	10 x 8	23
YD 250	132 B5	38	300	265	230	80	250	M12	10 x 8	25
	160 B5	42	350	300	250	110	250	M16	12 x 8	25

## Bevel gearboxes YD Series

### Bevel gearbox efficiency ( $\eta$ )

The efficiency of the bevel gears with GLEASON spiral toothing, lapped in pairs, basically is not influenced by the ratio and / or by the rotation input speed.

Furthermore, it has no remarkable variations by varying the gearbox size.

The value  $\eta = 0.97$ , result of calculated average values, is assumed as a reasonable average value.

On the contrary, the efficiency of bearings and oil seals, mounted on the input and output shafts depends on the rotation speed and the ratio.

Generally, it varies from 0.96 to 0.93 by changing from the minimum rotation speed of the shafts up to the maximum speed, referring to the **Nominal performances**.

The above considerations bring to average values of the bevel gearbox total efficiency in a range within 0.90 ... 0.93

### Angular backlash

The standard angular on the output shaft, with input shaft locked, is lower than or equal to 10 arcmin.

Therefore, 10 arcmin is assumed as maximum value of the standard backlash.

On request bevel gears with the gear set to obtain a lower backlash on the output shafts can be supplied.

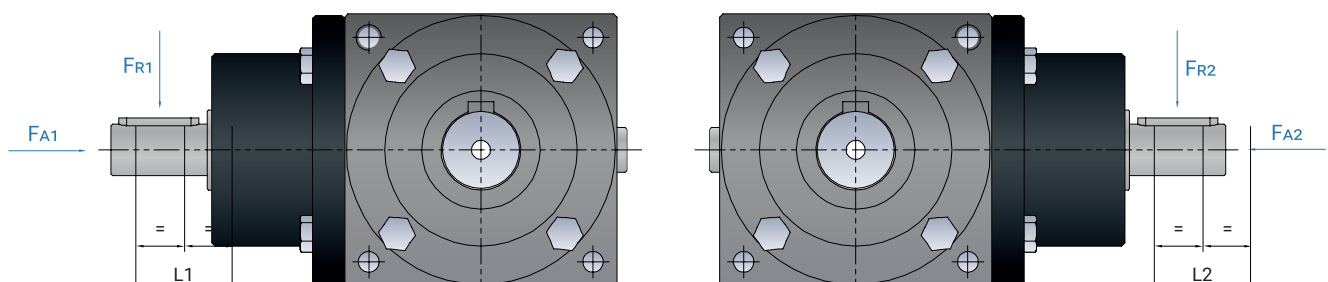
The value of the reduced backlash is lower than (5 ... 6) arcmin.

### Radial and axial forces on the shafts

The following table shows the maximum permissible radial ( $F_{R1}$ ,  $F_{R2}$ ) and axial ( $F_{A1}$ ,  $F_{A2}$ ) forces on the bevel gearbox input and output shafts, with reference to 1500 rpm input speed and the performances shown in the **Nominal performances** table.

Operating conditions different from the indicated reference conditions require a specific verification.

SIZE	INPUT SHAFT		OUTPUT SHAFT	
	$F_{R1}$ [ N ]	$F_{A1}$ [ N ]	$F_{R2}$ [ N ]	$F_{A2}$ [ N ]
YD 86	510	45	600	180
YD 110	600	180	1800	540
YD 134	1200	360	2500	750
YD 166	1800	540	3500	1000
YD 200	2500	750	4500	1350
YD 250	3800	1150	6500	1900



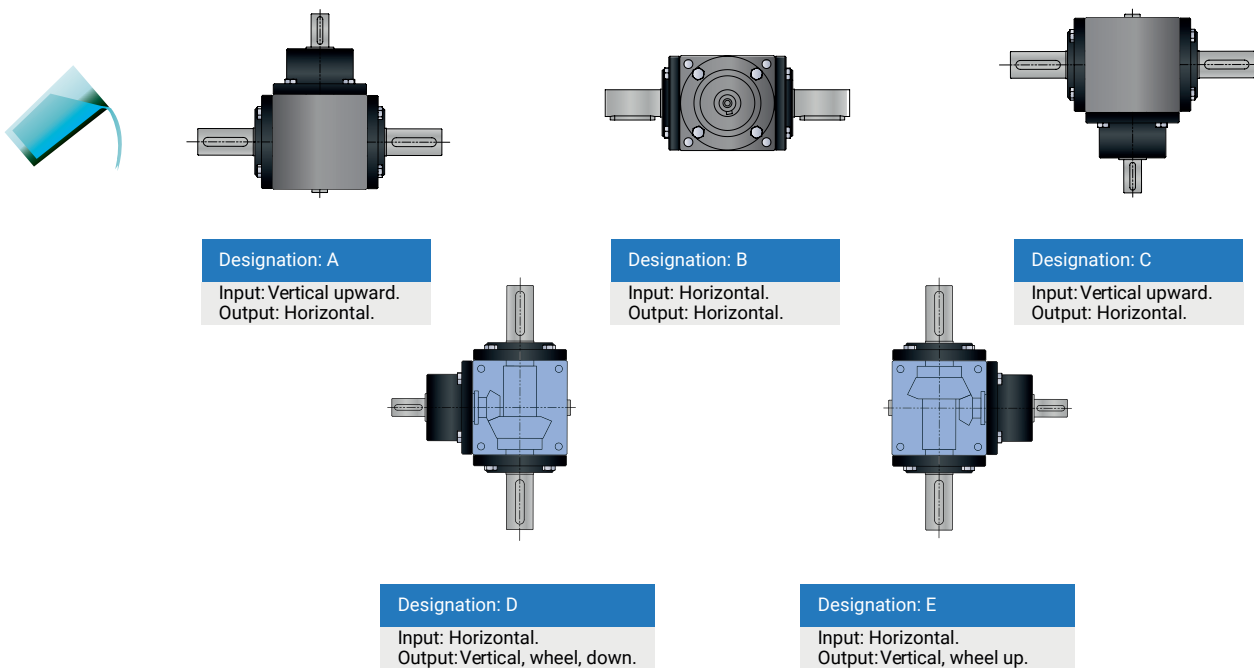
## Bevel gearboxes YD Series

### Mounting and operating position

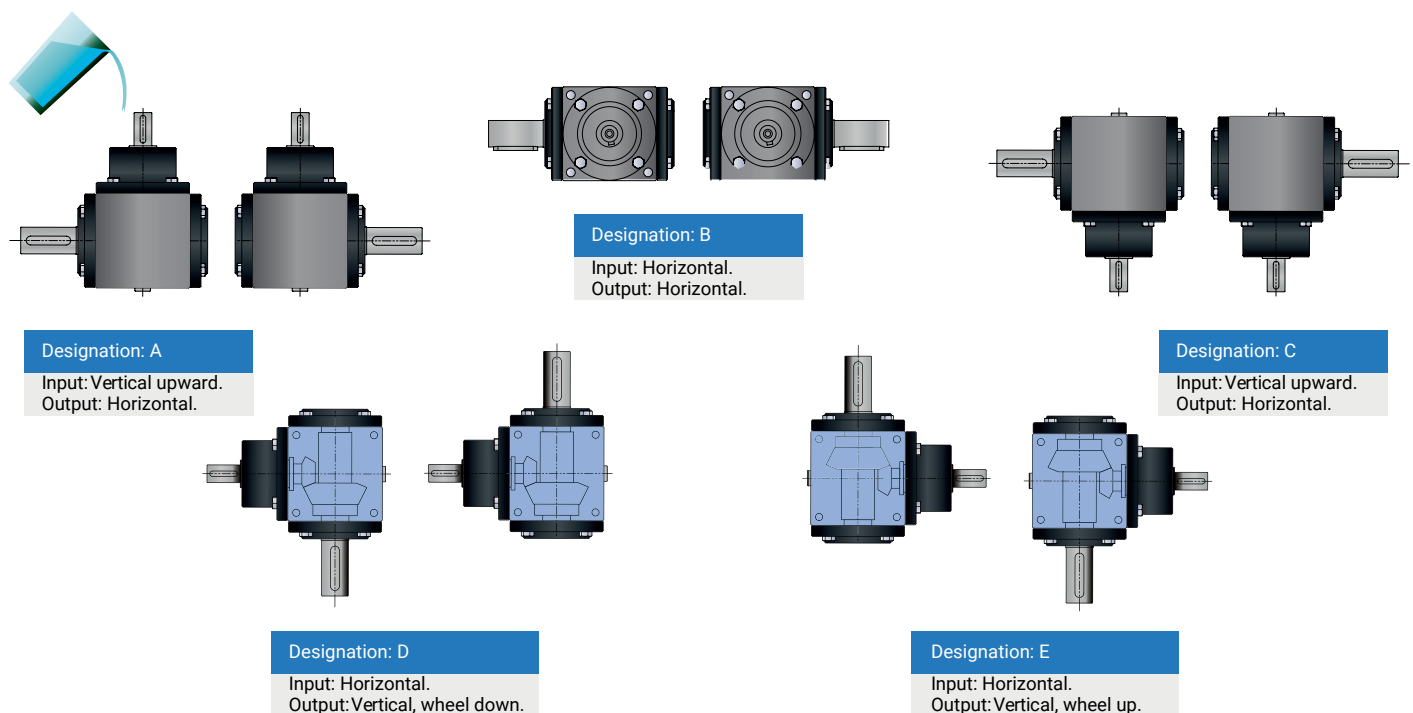
The operating position of the bevel gearbox is important for an optimal lubrication of gears and bearings, as well as for the right definition of the oil plug and air breather position (if present).

Following schemes show the bevel gearbox with input solid shaft but they can also be applied for gearboxes with IEC motor flange (MF). In case of gearboxes with additional output shafts, please refer to the same schemes to define the input and main output position of the gearbox the position of the additional output shaft can be identified consequently.

#### Bevel gearbox with output shaft MMC



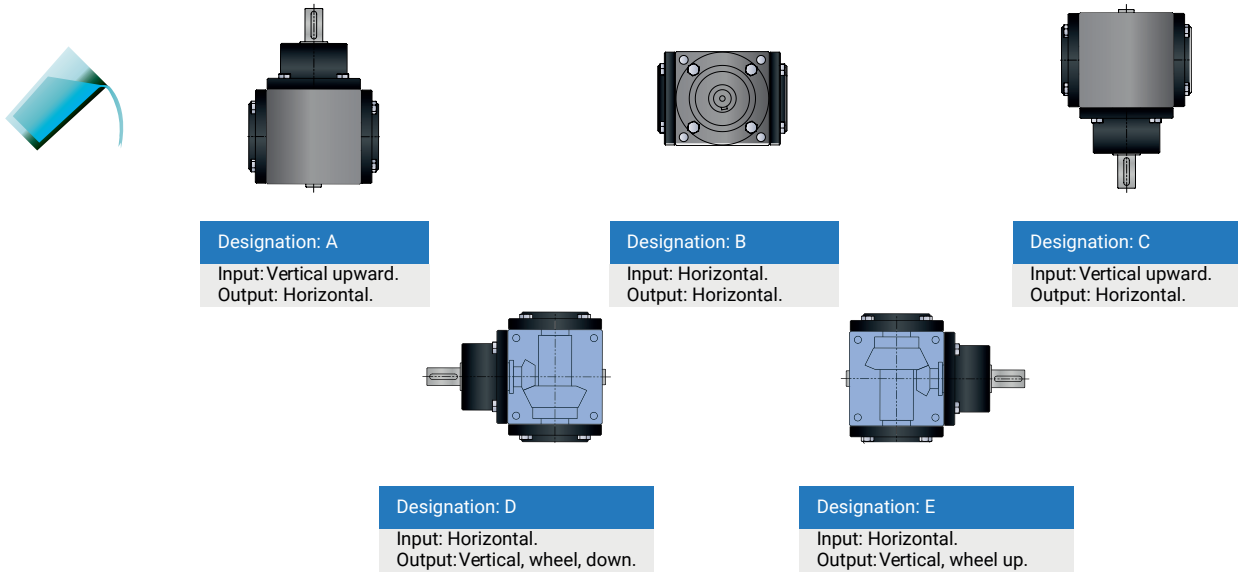
#### Bevel gearbox with output shaft MM



# Bevel gearboxes YD Series

## Mounting and operating position

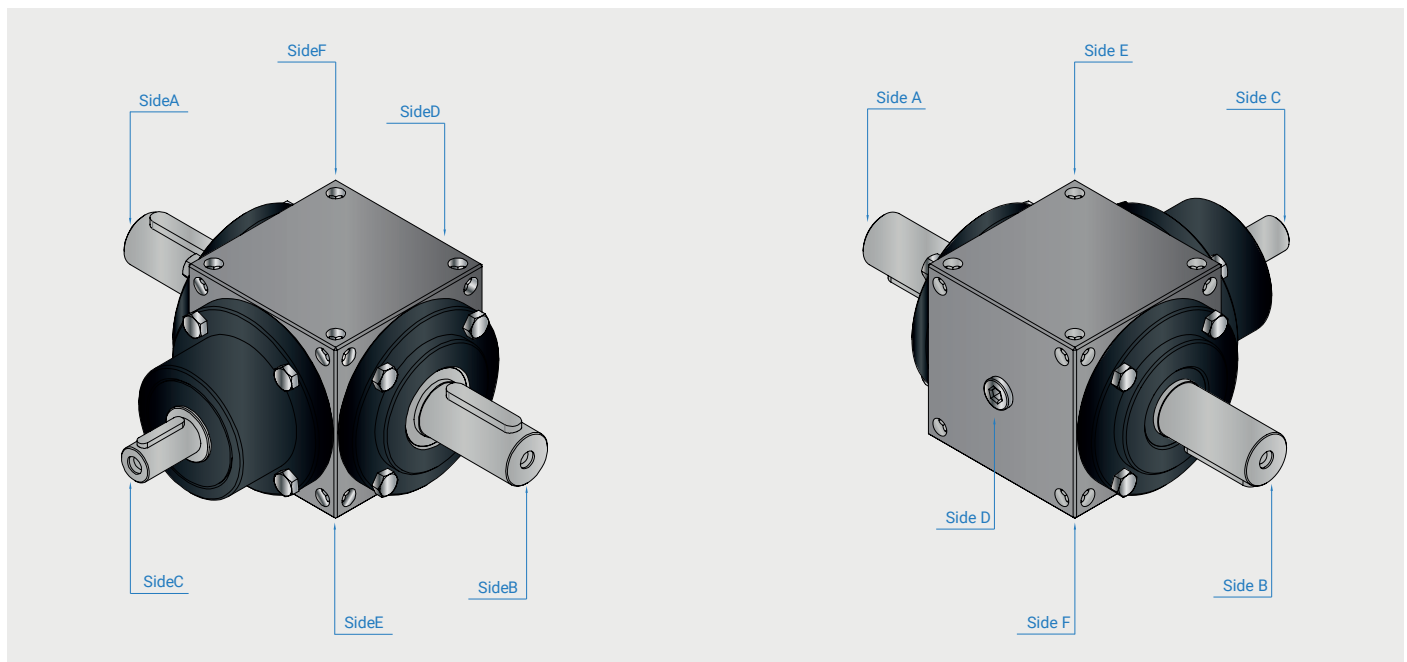
### Bevel gearbox with output shaft MD



### Identification Of Bevel Gearbox Housing Sides

To describe and define a bevel gearbox accurately, to indicate the mounting side of the bevel gear on the external structure or to determine the side of the oil plugs and air breather, it is necessary to identify each side of the gearbox housing.

In the following scheme, each side of the gearbox housing is identified with a letter and a colour. These references are used hereafter to show the direction of shafts rotation and the mounting operating position of the bevel gearbox.



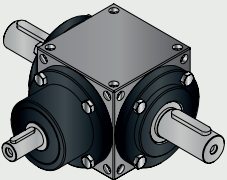
Side C is the side of the main input (solid shaft or IEC motor flange). Side A and side B correspond to the main output axis of the gearbox (solid shaft, cylindrical with key, on one or both sides, or hollow shaft with cylindrical hole and keyway). On side D and / or side E and / or side F it is possible to mount a solid shaft with hub, cylindrical with key, as additional output.

## Bevel gearboxes YD Series

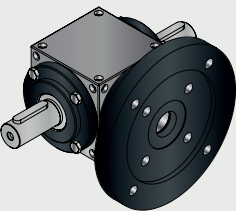
### Moment of inertia of rotating mass

Following tables show the moment of inertia of the bevel gearbox rotating mass, referred to the input axis, expressed in  $\text{kg}\cdot\text{cm}^2$ .

Design : Standard solid input shaft output shaft on both sides.

DESIGN	SIZE	Moment of inertia referred to input axis [ $\text{kg}\cdot\text{cm}^2$ ]				
		Ratio R 1	Ratio R 1.5	Ratio R 2	Ratio R 3	Ratio R 4
 YD ... MMC-MM-MD-MH	YD 85	3.5	2.0	1.5	1.2	1.1
	YD 110	7.6	3.4	2.3	1.5	1.3
	YD 135	21	11	7.5	5.6	4.9
	YD 165	73	37	27	20	17
	YD 200	176	92	67	50	43
	YD 250	595	317	233	177	158

Design : Connection for IEC motor (MF) as input - output shaft on both sides.

DESIGN	SIZE	Moment of inertia referred to input axis [ $\text{kg}\cdot\text{cm}^2$ ]				
		Ratio R 1	Ratio R 1.5	Ratio R 2	Ratio R 3	Ratio R 4
 YD ... MF-MMC-MM-MD-MH	YD 85	5.1	4.8	4.7	4.7	4.6
	YD 110	11.1	6.9	5.8	5.0	4.8
	YD 135	24	14	11	8.9	8.2
	YD 165	73	36	26	19	16
	YD 200	174	90	65	48	41
	YD 250	594	311	226	170	151

## Bevel gearboxes YD Series

### Ordering Code

	85	R1	MMC	Design 10	EH	0	...
YD	1	2	3	4	5	6	7

#### 1 - Bevel gearbox size

85 - 110 - 135 - 165 - 200 - 250

#### 2 - Ratio

R1 - R1.5 - R2 - R3 - R4

#### 3 - Gearbox type

MMC - Input solid shaft, output solid shaft on both sides.

MM - Input solid shaft, output solid shaft on one side.

MD - Input solid shaft, output hollow shaft.

MH - Input solid shaft, output hollow shaft with shrink disk.

#### 4 - Kinematic type

#### 5 - Mounting side

A - B - C - D - E - F

#### 6 - Operating position

A - B - C - D - E

#### 7 - Other specifications

Example: Lubricant type - **grease** (standard) or **oil** (on request)

Example: Corrosion resist

Example:

YD 85 R1 MMC 10 E A

## Bevel gearboxes YD Series

### Product Label

Each Mecmot bevel gearbox is supplied with an identification label, as shown below which allows to identify the gearbox and contains technical information about the product.

The diagram shows a rectangular identification label for Mecmot bevel gearboxes. The label features the Mecmot logo (Mechanic Motion Partner) in the top right corner. Below the logo, there are several input fields with labels and arrows pointing to them from external text labels:

- Product Code**: Points to the **CODE :** field.
- Ratio**: Points to the **R :** field.
- Kinematic Type**: Points to the **KINEMATIC TYPE:** field.
- Mounting**: Points to the **MOUNTING SIDE :** field.
- Delivery Date**: Points to the **DATE :** field.
- Serial Number**: Points to the **SERIAL NO :** field.

**Product Code:** Alphanumeric code which identifies the size and the execution of the bevel gearbox.

**Ratio:** Ratio of the gearbox.

**Kinematic Type:** Kinematic type related to the direction of the shafts rotation.

**Mounting Side:** Mounting and working position of the bevel gearbox.

**Delivery Date:** Date of assembling, expressed in week and year.

**Serial Number:** Identification number of the bevel gearbox which ensures the individuation of the product even after a long time; the serial number must be indicated in case of spare parts orders.

## Bevel gearboxes YD Series

### Lubrication and Maintenance

Mecmot bevel gearboxes YD series are supplied already lubricated.

Standard lubrication with grease, suitable for applications with low input speed and low daily duty cycle.

For applications with high speeds and / or high daily duty cycle oil lubrication is recommended. In such cases, the gearbox housing is equipped with oil plugs and visual oil level indicator, while the air breather is supplied as separate component and must be fitted by the customer on the top upon installation.

Grease - lubricated gearboxes are maintenance - free. With no occasional seals damage nor disassembling of components due to maintenance, an inspection every 4 years, in case of daily operation up to 8 hours is sufficient.

Oil - lubricated gearbox require the first oil change after 500 operating hours and thereafter every 3000 operating hours.

Recommended type of lubricant, based on input speed										
SIZE	<div><div>Grease lubrication</div><div>Oil lubrication</div></div>								Q.ty	
									Grease [kg]	Oil [l]
YD 86									0.2	0.22
YD 110									0.4	0.45
YD 134									0.5	0.55
YD 166									1	1.1
YD 200									2.5	2.8
YD 250									5	5.5
Input speed [ rpm ]										
0200400600800100012001400160018002000										

**NOTE :** The quantity of oil lubricant, expressed in litres, is approximate; please refer to the oil level for a correct filling.

Operating conditions different from the above should be specified for a correct evaluation and choice of lubricant type and quantity.

Mounting positions where input and output shafts are not all on the horizontal plane should be specified to evaluate the correct lubrication of the bearings and the shafts mounted on the vertical top position.

By ordering, please specify lubrication requirements: **Grease** or **oil**.

**Recommended lubricants;**

**Grease :** SHELL Gadus S5 V142W

**Oil :** SHELL Omala S4 GX