Assembly instructions

DATORKER® strain wave gear

DT-01-3-EN-2304-MA

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Contents

Foreword

DATORKER® strain wave gears are characterised by high precision, a high degree of efficiency, high torsional stiffness and a low starting torque. They are widely used in robotics, in automation, in semiconductor technology, in machine tools and in many other industrial sectors.

1 Description of the DATORKER® strain wave gear

1.1 Features

- Compact and lightweight – easy handling for the customer
- High accuracy – provides stable repeatability and positioning accuracies
- Improved lubrication properties
- High torque – widely used in automation and measurement technology
- Large coaster gear reduction range – different selection options for the same models

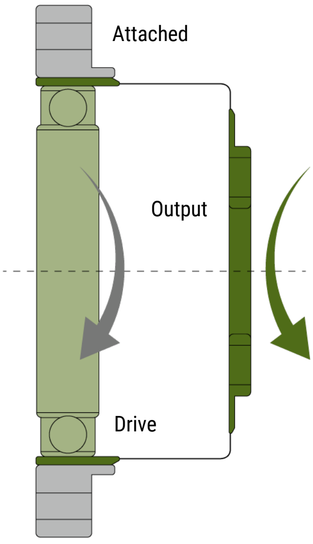
1.2 Structure

1. Flexible sprocket
Slim and elastic metal ring with external teeth. Continuous elastic deformation during operation. Typically used as the output side.

2. Rigid sprocket
Rigid metal ring with internal teeth. The internal teeth have two teeth more than the external teeth of the flexible sprocket. This is typically screwed on tightly.

3. Shaft generator
Elliptical bearing for generating the wave movement. Typically used as the drive side.

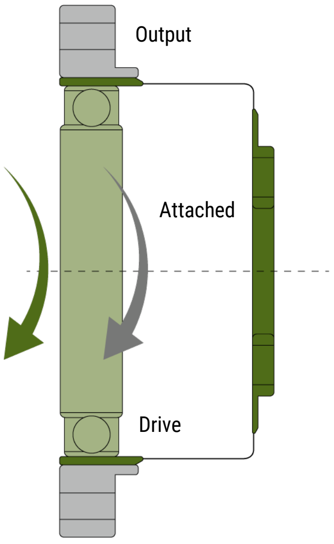
Reduction ratio and direction of rotation



Input and output with opposite direction of rotation

Effective reduction ratio = $\frac{-1}{R}$

(R = reduction ratio from data sheet)



Drive and output with same direction of rotation

Effective reduction ratio = $\frac{1}{R+1}$

1.3 Order code

Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Order code	**D**	**S**	**H**	**25**	**80**	**P**	**H**	**M**

1	**D**	DATORKER® strain wave gear
2	**S**	Type: S: Standard
3	**H**	Structure of the flexible sprocket: C: Mug form H: Hollow form
4	**25**	Size: 14, 17, 20, 25, 32
5	**80**	Reduction: 50, 80, 100, 120
6	**P**	Structure: C: Component from gearbox without bearing P: Combination of gearbox and bearing A: Combination of gearbox, bearing and seal
7	**H**	Input type: O: Hub with feather key groove H: Hollow shaft J: Journal
8	**M**	M: Reinforced crossed roller bearing

1.4 Type / Function

DSC type

Combination (PO)

- Combination type (P) with gear and bearing
- Connection by oldham coupling
- Withstands axial and radial load
- Reduced play

Component (CO)

- Component type (C) with gear without bearing
- Connection by oldham coupling
- Self-assembly of parts required: flex spline and circular spline are not screwed together
- Reduced play

DSH type

Combination (PO)

- Combination type (P) with gear and bearing
- Connection by oldham coupling
- Withstands axial and radial load
- Reduced play

Combination (PH)

- Combination type (P) with gear and bearing
- Input hollow shaft design
- Withstands axial and radial load
- Zero play

Combination (AH)

- Sealed type (A) with gear, bearing and seal
- Input hollow shaft design
- Withstands axial and radial load
- Zero play
- Completely sealed design
- User friendly design

Combination (AJ)

- Sealed type (A) with gear, bearing and seal
- Input solid shaft design
- Withstands axial and radial load
- Completely sealed design
- User friendly design

DSC-M type

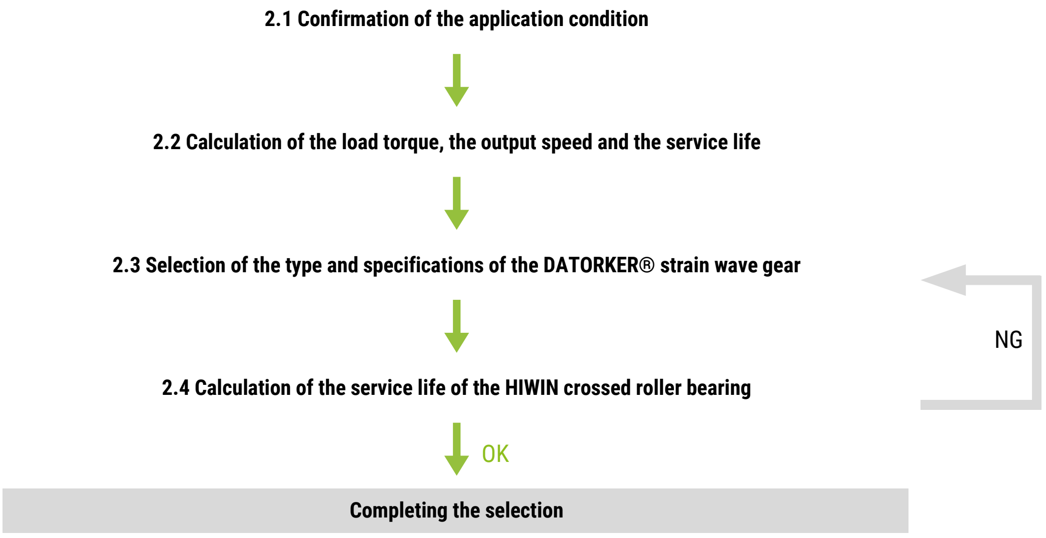
Combination (PO)

- Combination type (P) with gear and bearing
- Connection by oldham coupling
- Withstands increased axial and radial load
- Reduced play

Combination (AJ)

- Sealed type (A) with gear, bearing and seal
- Input solid shaft design
- Withstands increased axial and radial load
- Completely sealed design
- User friendly design

2 Selection procedure



2.1 Confirmation of the application condition

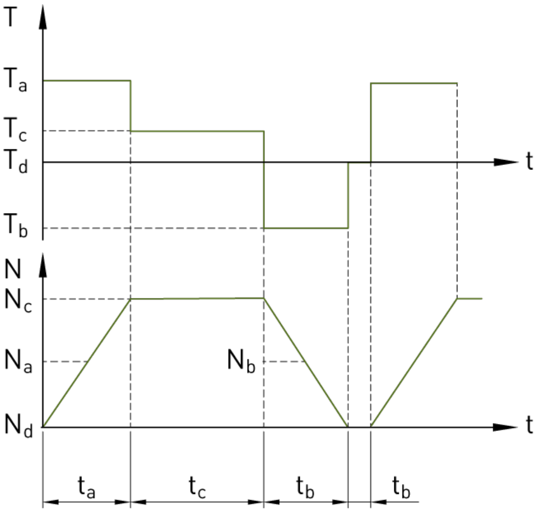
2.2 Calculation of the load torque, the output speed and the service life

2.3 Selection of the type and specifications of the DATORKER® strain wave gear

2.4 Calculation of the service life of the HIWIN crossed roller bearing

Completing the selection

2.1 Confirmation of application condition



Model \ Element	Load torque (T)	Time (t)	Output speed (N)	Maximum output speed	Maximum input speed
Start time (acceleration)	T_a	t_a	N_a	N_{max}	n_{max}
Operating time (constant)	T_c	t_c	N_c		
Stop time (deceleration)	T_b	t_b	N_b		
Switch-off time	T_d	t_d	N_d		
Impact effect	T_e	t_e	N_e		

2.2 Calculation of the load torque, the speed and the service life

2.2.1 Calculation of the load torque

$T_{av} \leqq$ Permissible maximum value of the average load torque

↓

2.2.2 Confirmation

T_a, $T_b \leqq$ Permissible permissible peak torque during start/stop

↓

2.2.3 Confirmation

$T_e \leqq$ Permissible maximum instantaneous torque

↓

2.2.4 Calculation

$n_{av} \leqq$ Permissible average input speed

$n_{max} \leqq$ Permissible maximum input speed

↓

2.2.5 Calculation

$L_h \geqq$ Nominal life of gearbox 7.000 hours

2.2.1 Maximum permissible value of the average load torque

When the input speed or load torque changes, please calculate the average load torque and confirm whether it is in accordance with the values in the nominal power table of each specification. Please note that a value exceeding the catalogue value may cause premature ageing of the lubricant and abnormal gear wheel wear due to heat.

Calculation of the average load torque:

$$T_{av} = \sqrt[3]{\frac{N_1 t_1 |T_1|^3 + N_2 t_2 |T_2|^3 + \cdots + N_n t_n |T_n|^3}{N_1 t_1 + N_2 t_2 + \cdots + N_n t_n}}$$

2.2.2 Permissible peak torque during start/stop

During starting and stopping, a load greater than the average torque is applied to the gearbox due to the moment of inertia of the load.

2.2.3 Permissible maximum instantaneous torque

The permissible maximum instantaneous torque is the maximum permissible load torque in the event of an impact.

2.2.4 Permissible average input speed and permissible maximum input speed

When setting the operating conditions of the gearbox, do not exceed the values specified in the nominal power table.

Calculation of the average output speed:

$$N_{av} = \frac{N_1 t_1 + N_2 t_2 + \cdots + N_n t_n}{t_1 + t_2 + \cdots + t_n}$$

Calculation of the average input speed

$$n_{av} = N_{av} * R$$

Calculation of the maximum input speed

$$n_{max} = N_{max} * R$$

R = Reduction ratio

2.2.5 Nominal service life of the gearbox

The service life of the gearbox depends on the flexible bearing of the shaft generator. The nominal service life of the shaft generator is 7.000 hours. The calculation formula is as follows:

Calculation of the service life

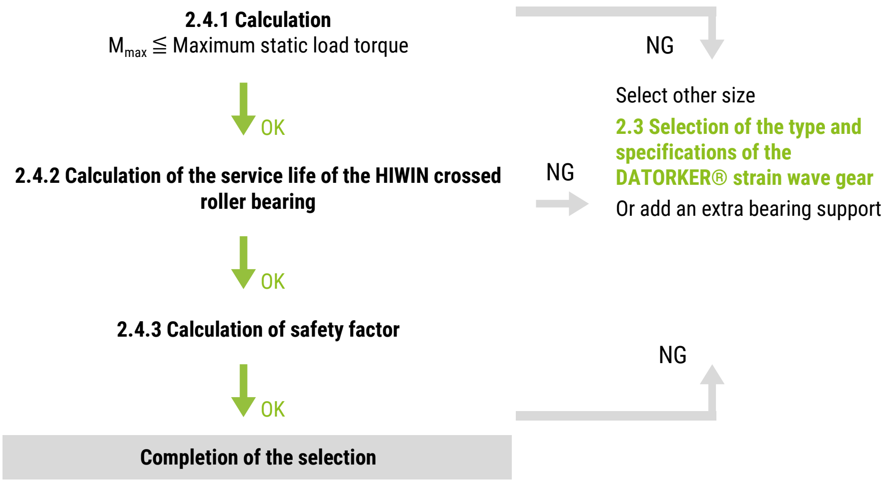
$$L_H = 7.000 * \left(\frac{T_r}{T_{av}}\right) * \left(\frac{n_r}{n_{av}}\right)$$

T_r = Nominal torque
n_r = Nominal speed

2.3 Selection of DATORKER® strain wave gear type and specification

Select the DATORKER® strain wave gear design according to the operating requirements and check the nominal power table of each unit according to the calculation results from the previous step to confirm whether the selected model specifications match the application. If the gearbox contains a crossed roller bearing, please proceed to the next step and calculate the service life of the crossed roller bearing.

2.4 Calculation of the service life of the crossed roller bearing

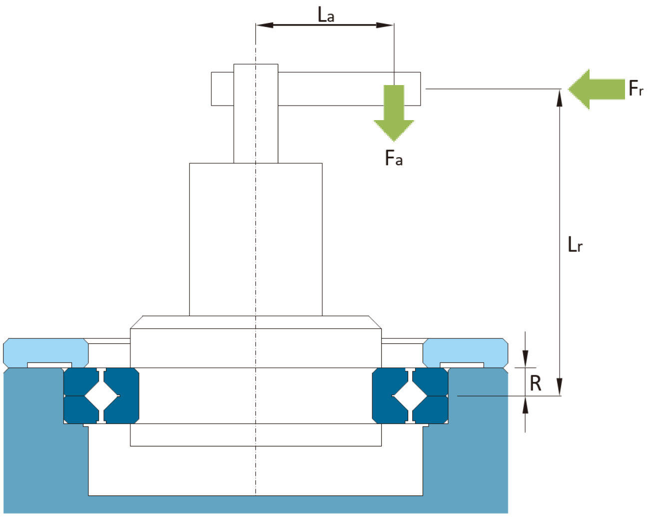


2.4.1 Maximum static load torque

The crossed roller bearing can withstand the maximum radial and maximum axial load.

Calculation of the static load torque $M_{max} = Fr_{max} \times Lr + Fa_{max} \times L_a$

Fr = radial load
Fa = axial load



2.4.2 Calculation of the service life of crossed roller bearings

Calculation of the basic service life

$$L = \left(\frac{C_{dyn}}{F_w * P_{dyn}}\right)^{\frac{10}{3}}$$

P_{dyn} = dynamic equivalent load
C_{dyn} = dynamic load
F_w = load factor

Load condition	Load factor (F_w)
No shocks / vibrations	1 – 1,2
Normal	1,2 – 1,5
With jolting and vibration	1,5 - 3

Calculation of the dynamic equivalent load

$$P_{dyn} = X(F_r + \frac{2M}{Dpw} + Y * F_A)$$

where $\frac{F_a}{F_r+\frac{2M}{Dpw}} \leq 1{,}5 \text{ with } X = 1, Y = 0{,}45$ where $\frac{F_a}{F_r+\frac{2M}{Dpw}} \geq 1{,}5 \text{ at } X = 0{,}67, Y = 0.67°$

M = torque
Dpw = hole circle diameter

For an application with short oscillations, please carry out the calculation according to the following formula

Calculation of the lifetime of the vibration

$$L_{oc} = \frac{180°}{\theta} * L$$

θ = angle of the oscillation

2.4.3 Calculation of safety factor

The safety factor is determined by the static load and the static equivalent load as follows:

Calculation of safety factor

$$f_s = \frac{C_0}{P_0}$$

P_0 = static equivalent load

C_0 = static load rating

Operating condition	Safety factor (f_s)
Standard operation	≧ 1,5
Bearing with vibrating load	≧ 2
High speed and high accuracy	≧ 3

Calculation of the statically equivalent load

$$P_0 = F_r + \frac{2M}{Dpw} + 0{,}44\ F_a$$

*The table above shows the lower limit of the static safety factor. If the situation is dynamic, a safety factor of 7 or more is recommended.

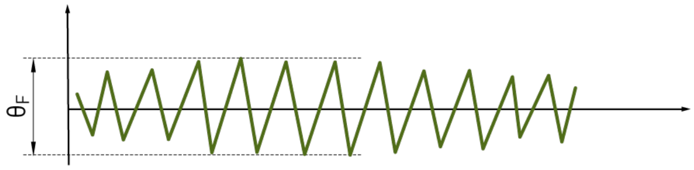
3 Definition

3.1 Accuracy of angular transmission

When a rotation angle (θ_1) is input, the difference in value (θ_{error}) between the theoretical output rotation angle (θ_2) and the actual output rotation angle (θ_3) is the accuracy of the angle transmission.

$$\theta = \frac{\theta_1}{\text{Reduction ratio}}$$

$$\theta_{\text{Error}} = \theta_3 - \theta_2$$



3.2 Starting torque

The starting torque is the maximum torque value required during idling when the input (high speed) applies torque and the output (low speed) starts working.

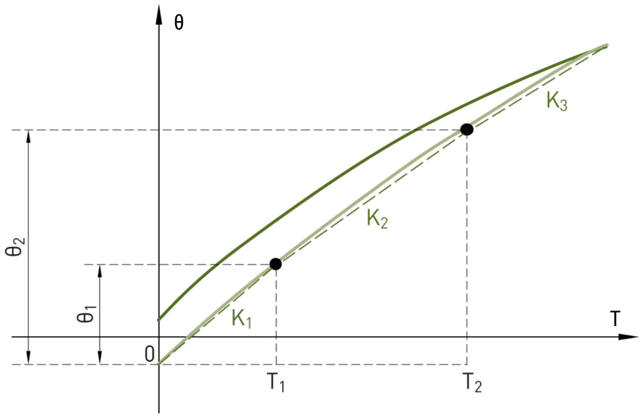
3.3 Reverse starting torque

The reverse starting torque is the maximum torque value required during idling when the output (low speed) applies torque and the input (high speed) starts working.

3.4 Torsional rigidity

The torsional stiffness is defined as a fixed input (shaft generator) and applies a torque to the output (flexible sprocket) of the gearbox of the industrial robot. The ratio generated by the torque and the torsion angle.
The slope of the “torque torsion angle diagram” is expressed as a spring constant. The “torque torsion angle diagram” is divided into three parts and the spring constant of each section represents K_1, K_2 and K_3.

- K_1 refers to the spring constant from “0” to “T_1"
- K_2 refers to the spring constant from “T_1” to “T_2”
- K_3 refers to the spring constant with a torque above "T_2"

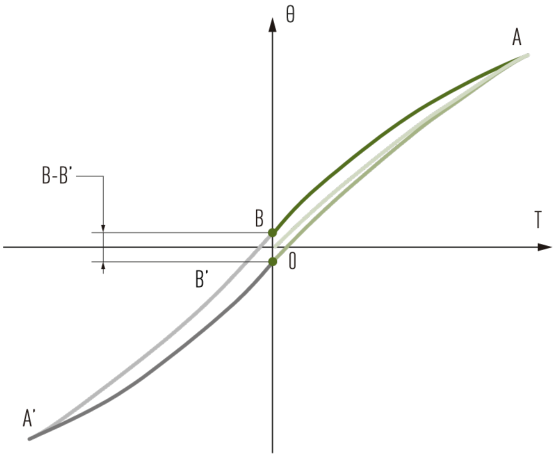


θ Torsion angle (rad)

T torque (Nm)

3.5 Hysteresis loss

After the torque is applied at the nominal value and reset to “0”, the torsion angle is not completely “0” and has some displacement (B-B’), which is called hysteresis loss. The hysteresis loss is mainly caused by internal friction. When the torque is extremely small, it is almost non-existent.



θ	Torsion angle (rad)
T	torque (Nm)
B-B'	Hysteresis loss

3.6 Maximum backlash

In a mechanical system, maximum backlash describes the maximum displacement or rotation in a given direction while a part is held stationary. The backlash of the HIWIN DATORKER® strain wave gear is damped to "0". The source of maximum backlash is caused by the gap between the coupling and the shaft generator. This applies to all types equipped with an oldham coupling.

4 Product series

4.1 DSC-PO type

4.1.1 Technical data

Table 4.1: Valuation table

Model	Reduction	Nominal torque at 2.000 rpm	Peak torque at start/stop	Maximum average torque	Collision torque	Maximum input speed	Maximum average speed
		Nm	Nm	Nm	Nm	rpm	rpm
14	50	5,4	18,0	6,9	35,0	8.500	3.500
	80	7,8	23,0	11,0	47,0		
	100	7,8	28,0	11,0	54,0		
17	50	16,0	34,0	26,0	70,0	7.300	3.500
	80	22,0	43,0	27,0	87,0		
	100	24,0	54,0	39,0	108,0		
	120	24,0	54,0	39,0	86,0		
20	50	25,0	56,0	34,0	98,0	6.500	3.500
	80	34,0	74,0	47,0	127,0		
	100	40,0	82,0	49,0	147,0		
	120	40,0	87,0	49,0	147,0		
25	50	39,0	98,0	55,0	186,0	5.600	3.500
	80	63,0	137,0	87,0	255,0		
	100	67,0	157,0	108,0	284,0		
	120	67,0	167,0	108,0	304,0		
32	50	76,0	216,0	108,0	382,0	4.800	3.500
	80	118,0	304,0	167,0	568,0		
	100	137,0	333,0	216,0	647,0		
	120	137,0	353,0	216,0	686,0		

Table 4.2: Crossed roller bearing specifications

Model	Centre circle diameter of the rollers	Offset	Basic load ratings		Permitted torque	Moment rigidity
	Dpw	R	Dynamic load C_{dyn}	Static load C_0		
	m	m	kN	kN	Nm	$\times 10^4$ Nm/rad
14	0,0350	0,0095	4,7	6,1	41	4,38
17	0,0425	0,0095	5,3	7,6	64	7,75
20	0,0500	0,0095	5,8	9,0	91	12,80
25	0,0620	0,0115	9,6	15,1	156	24,20
32	0,0800	0,0130	15,0	25,0	313	53,90

Table 4.3: Accuracy of angular transmission

Reduction ratio	Model	14	17	20	25	32
50 - 120	×10^{-4} rad	4,4	4,4	2,9	2,9	2,9

Table 4.4: Hysteresis loss

Reduction ratio	Model	14	17	20	25	32
50	×10^{-4} rad	5,8	5,8	5,8	5,8	5,8
80 - 120	×10^{-4} rad	2,9	2,9	2,9	2,9	2,9

Table 4.5: Maximum backlash of oldham coupling

Reduction ratio	Model	14	17	20	25	32
50	×10^{-5} rad	17,5	9,7	8,2	8,2	6,8
80	×10^{-5} rad	11,2	6,3	5,3	5,3	4,4
100	×10^{-5} rad	8,7	4,8	4,4	4,4	3,4
120	×10^{-5} rad	–	3,9	3,9	3,9	2,9

Table 4.6: Starting torque (unit cNm)

Reduction ratio Model	14	17	20	25	32
50	4,1	6,1	7,8	15,0	31
80	2,8	4,0	4,9	9,2	19
100	2,5	3,4	4,3	8,0	18
120	–	3,1	3,8	7,3	15

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.7: Reverse starting torque (unit Nm)

Model Reduction ratio	14	17	20	25	32
50	1,6	3,0	4,7	9,0	18
80	1,6	3,0	4,8	9,1	19
100	1,8	3,3	5,1	9,8	20
120	–	3,5	5,5	11,0	22

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.8: Torsional rigidity

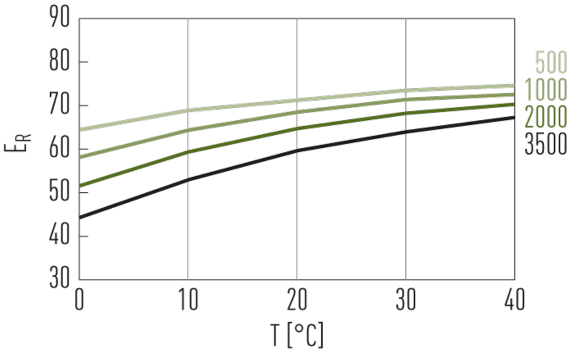
Model Reduction ratio			14	17	20	25	32
T_1		Nm	2,0	3,9	7,0	14,0	29,0
T_2		Nm	6,9	12,0	25,0	48,0	108,0
50	K_1	$\times 10^4$ Nm/rad	0,34	0,81	1,3	2,5	5,4
	K_2	$\times 10^4$ Nm/rad	0,47	1,1	1,8	3,4	7,8
	K_3	$\times 10^4$ Nm/rad	0,57	1,3	2,3	4,4	9,8
	θ_1	$\times 10^{-4}$ rad	5,8	4,9	5,2	5,5	5,5
	θ_2	$\times 10^{-4}$ rad	16,0	12,0	15,4	15,7	15,7
80 - 120	K_1	$\times 10^4$ Nm/rad	0,47	1,0	1,6	3,1	6,7
	K_2	$\times 10^4$ Nm/rad	0,61	1,4	2,5	5,0	11,0
	K_3	$\times 10^4$ Nm/rad	0,71	1,6	2,9	5,7	12,0
	θ_1	$\times 10^{-4}$ rad	4,1	3,9	4,4	4,4	4,4
	θ_2	$\times 10^{-4}$ rad	12,0	9,7	11,3	11,1	11,6

Note: The values are for reference purposes only. The lower limit is 20% below the value in this table.

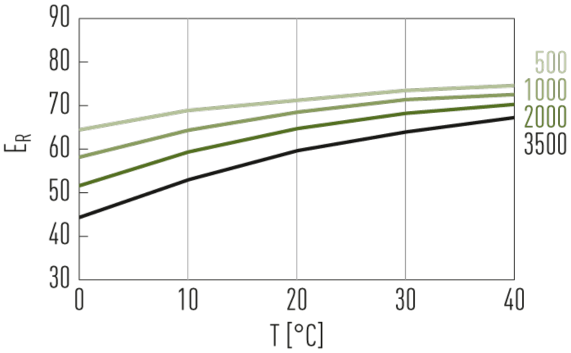
4.1.2 Efficiency E_R

The efficiency of DATORKER® strain wave gears changes depending on the specification, ratio, operating conditions (speed/load) and lubrication (lubricant type/amount).

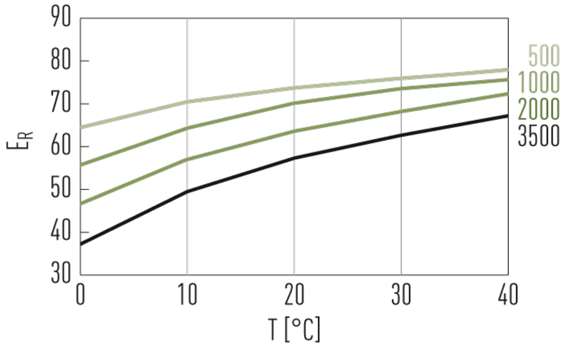
Model: 14, ratio: 50



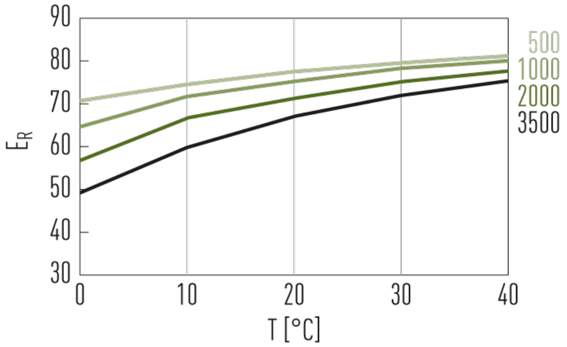
Model: 14, ratio: 80



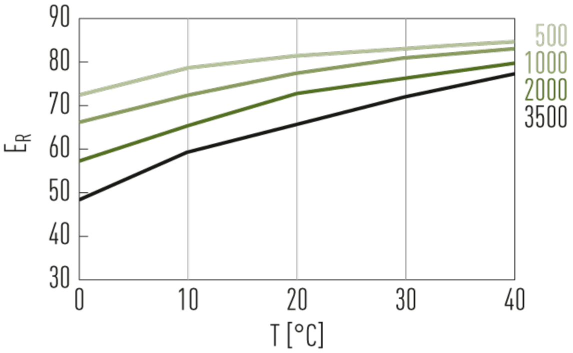
Model: 14, ratio: 100



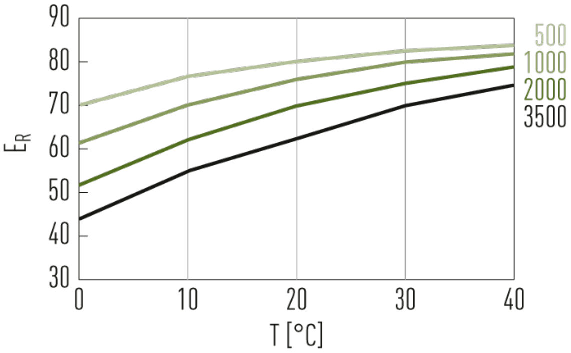
Model: 17-32, ratio: 50



Model: 17-32, ratio: 80, 100



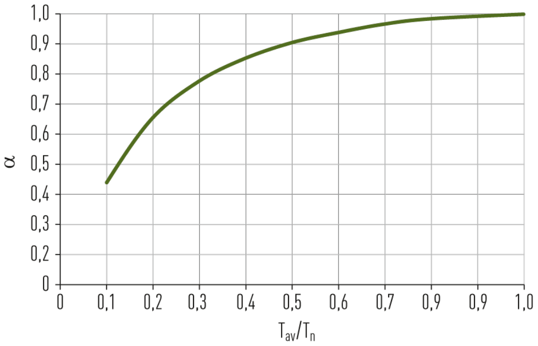
Model: 17-32, ratio: 120



Correction coefficient α

Efficiency = $\alpha\ x_{ER}$

α= coefficient of correction
ER = efficiency at nominal torque



4.1.3 Idling operating torque

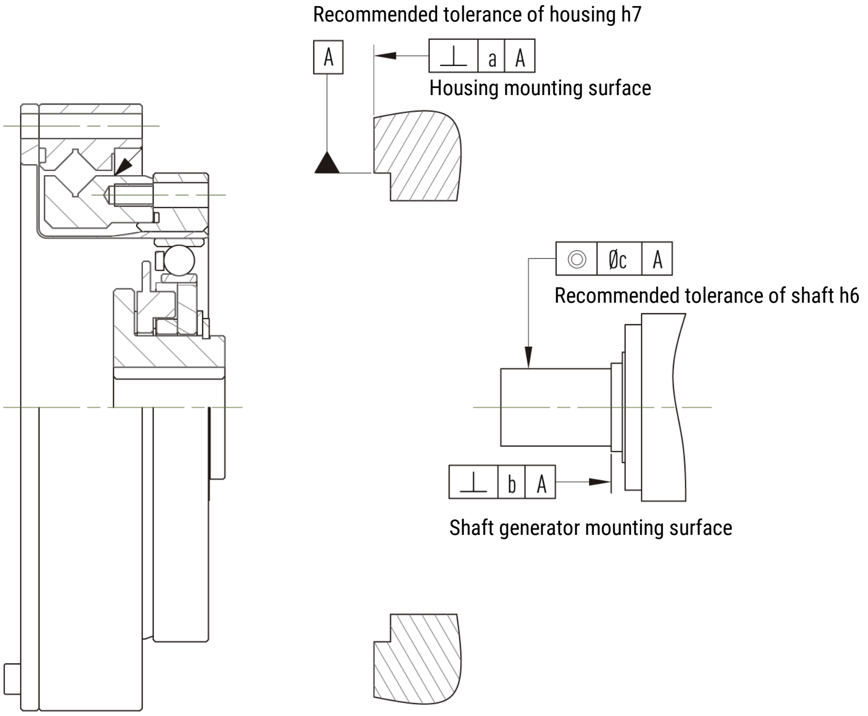
The idling operating torque is the torque required to drive the DATORKER® strain wave gear input (high speed end) after more than 2 hours at an input speed of 2.000 rpm at an average ambient temperature of 25 °C without load.

Unit: cNm

Reduction ratio	Input speed	Model				
		14	17	20	25	32
50	500 rpm	3,2	5,1	7,3	12,8	26,1
	1.000 rpm	3,9	6,1	9,1	17,8	33,1
	2.000 rpm	4,6	7,6	11,8	21,8	44,1
	3.500 rpm	5,9	9,6	12,7	28,8	57,1
80	500 rpm	2,3	3,8	5,5	9,7	20,3
	1.000 rpm	3,0	4,8	7,3	14,7	27,3
	2.000 rpm	3,7	6,3	10,0	18,7	38,3
	3.500 rpm	5,0	8,3	10,9	25,7	51,3
100	500 rpm	2,1	3,5	5,0	9,0	19,0
	1.000 rpm	2,8	4,5	6,8	14,0	26,0
	2.000 rpm	3,5	6,0	9,5	18,0	37,0
	3.500 rpm	4,8	8,0	10,4	25,0	50,0
120	500 rpm	–	3,3	4,7	8,5	18,1
	1.000 rpm	–	4,3	6,5	13,5	25,1
	2.000 rpm	–	5,8	9,2	17,5	36,1
	3.500 rpm	–	7,8	10,1	24,5	17,2

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

4.1.4 Installation accuracy



Unit: mm

Model Labelling	14	17	20	25	32
a	0,011	0,015	0,017	0,024	0,026
b	0,017	0,020	0,020	0,024	0,024
	(0,008)	(0,010)	(0,010)	(0,012)	(0,012)
c	0,030	0,034	0,044	0,047	0,050
	(0,016)	(0,018)	(0,019)	(0,022)	(0,022)

Note: The value in () is the value of the shaft generator (without coupling).

4.1.5 Tightening torque of the installation screw

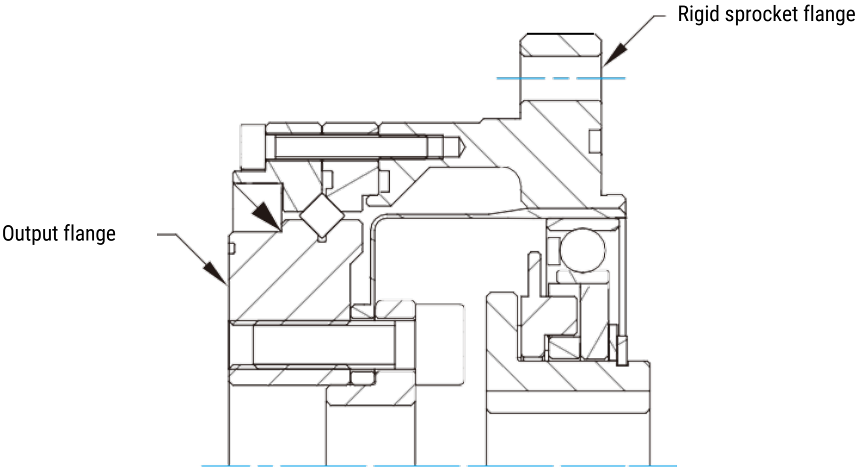


Table 4.9: Screw tightening torque for the output flange

Model Element		14	17	20	25	32
Number of screws			6	8	8	8
Screw size			M5	M6	M8	M10
Installation of PCD screws	mm	23	27	32	42	55
Screw tightening torque	Nm	4,5	9	15,3	37	74

Table 4.10: Screw tightening torque for the rigid sprocket flange

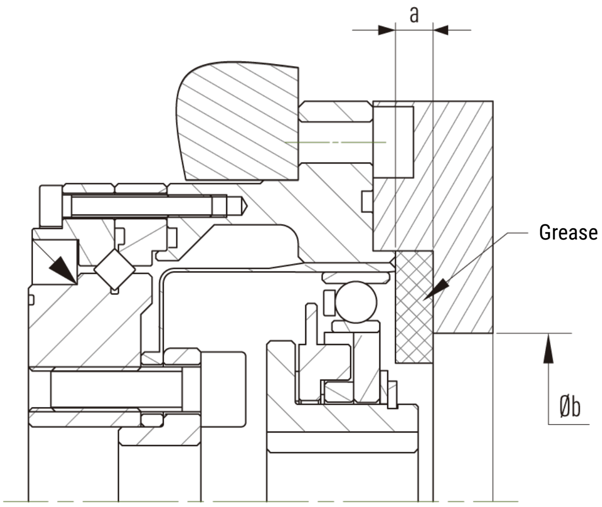
Model Element		14	17	20	25	32
Number of screws		6	6	8	8	8
Screw size		M4	M4	M5	M5	M6
Installation of PCD screws	mm	65	71	82	96	125
Screw tightening torque	Nm	4,5	4,5	9,0	9,0	15,3

Note:

1. Recommended tightening torques for 12,9 DIN EN ISO 4762 mounting bolts DIN912 according to VDI 2230 for µK = µG = 0,125
2. Screw-in depth at least 2 x thread diameter

4.1.6 Lubrication

Keep the distance between the gearbox and the mounting flange as small as possible so that the grease remains inside during operation.



Unit mm

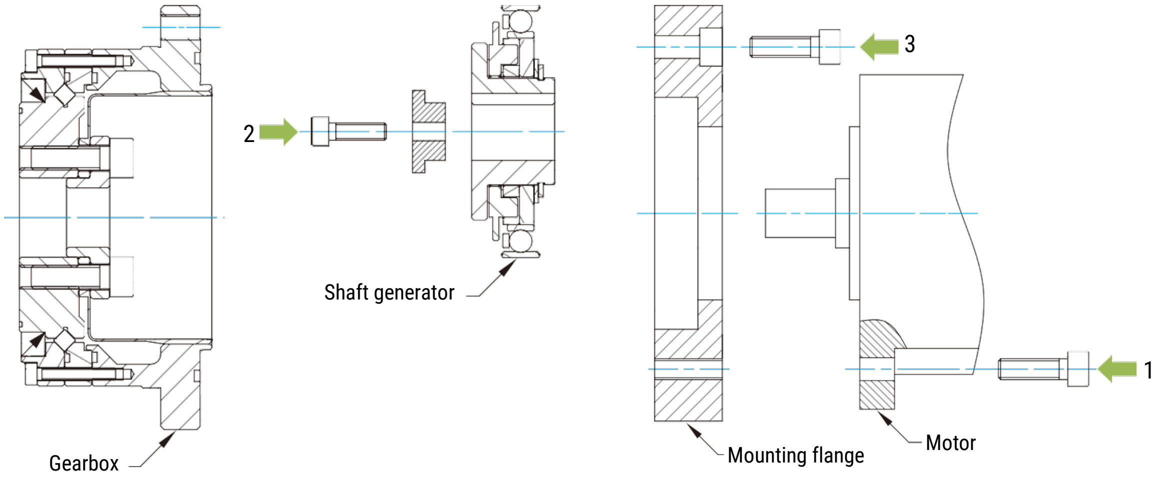
Model Element	14	17	20	25	32
a [1)]	1	1	1,5	1,5	1,5
a [2)]	3	3	4,5	4,5	4,5
Øb	16	26	30,0	37,0	37,0

[1)] Medium wave horizontal or vertical: when the shaft generator is pointing downwards

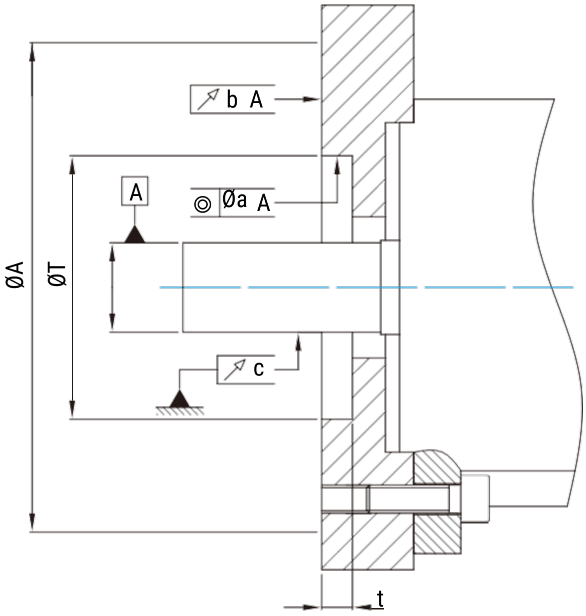
[2)] Medium wave vertical: when the shaft generator is pointing upwards

4.1.7 Installation procedure

1. Install the mounting flange on the motor mounting surface
2. Install the shaft generator on the motor output shaft
3. Install the gearbox



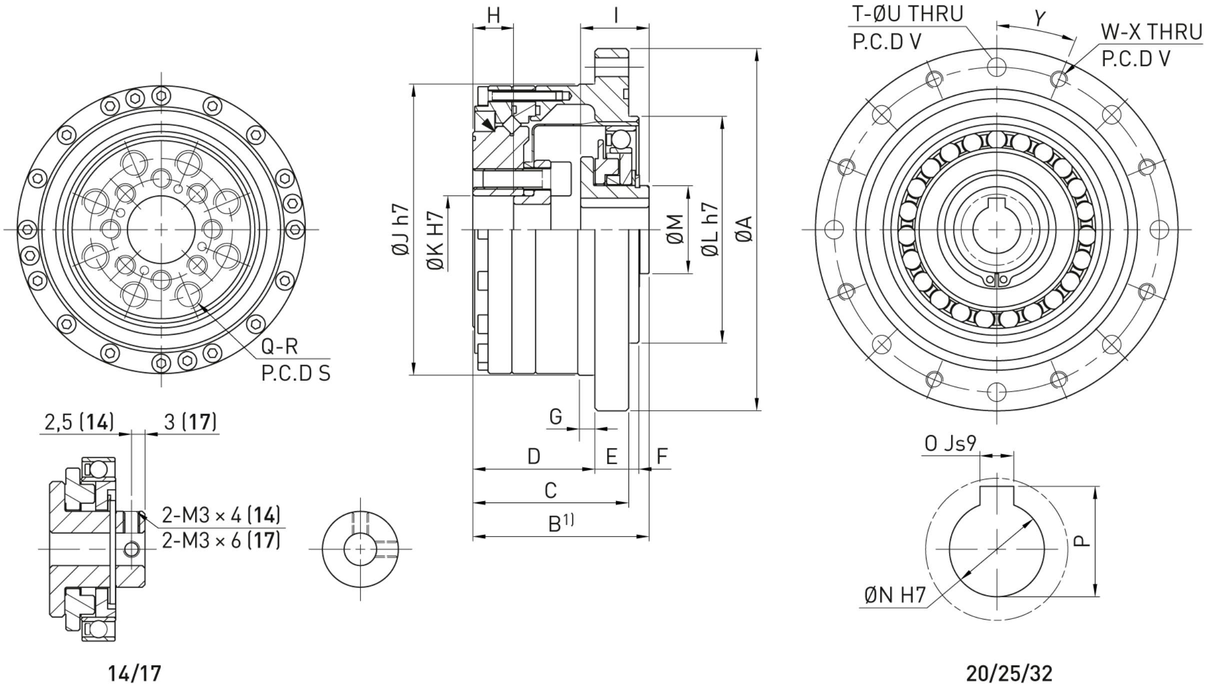
4.1.8 Motor installation



Unit mm

Model Labelling	14	17	20	25	32
a	0,030	0,040	0,040	0,040	0,040
b	0,030	0,040	0,040	0,040	0,040
c	0,015	0,015	0,018	0,018	0,018
ØA	73	79	93	107	138
t	3	3	4,5	4,5	4,5
ØT	38H7	48H7	56H7	67H7	90H7

4.1.9 DSC-PO type, size chart



Model Labelling	14	17	20	25	32
ØA	73	79	93	107	138
B*	$41\,{}^{0}_{-0.9}$	$45\,{}^{0}_{-0.9}$	$45.5\,{}^{0}_{-1}$	$52\,{}^{0}_{-1}$	$62\,{}^{0}_{-1.1}$
C	34	37	38	46	57
D	27	29	28	36	45
E	7	8	10	10	12
F	2	2	3	3	3
G	3,5	4	5	5	5
H	9,4	9,5	9	12	15
I	$17{,}6\,{}^{0}_{-0{,}1}$	$19{,}5\,{}^{0}_{-0{,}1}$	$20{,}1\,{}^{0}_{-0{,}1}$	$20{,}2\,{}^{0}_{-0{,}1}$	$22\,{}^{0}_{-0{,}1}$
ØJ h7	56	63	72	86	113
ØK H7	11	10	14	20	26
ØL h7	38	48	56	67	90
ØM	14	18	21	26	26
ØN H7	6	8	12	14	14
O Js9	–	–	4	5	5
P	–	–	$13{,}8\,{}^{+0{,}1}_{0}$	$16{,}3\,{}^{+0{,}1}_{0}$	$16{,}3\,{}^{+0{,}1}_{0}$
Q	6	6	8	8	8
R	M4 x 8DP	M5 x 10DP	M6 x 9DP	M8 x 12DP	M10 x 15DP
S (P.C.D)	23	27	32	42	55
T	6	6	6	8	12
ØU	4,5	4,5	5,5	5,5	6,6
V (P.C.D)	65	71	82	96	125
W	6	6	6	8	12
X	M4	M4	M5	M5	M6
Y (degrees)	30°	30°	30°	22,5°	15°
Moment of inertia (×10^{-4} kgm^2)	0,033	0,079	0,193	0,413	1,69
Weight (kg)	0,52	0,68	0,98	1,5	3,2

Dimensions without unit in mm

*Dimension B is the mounting position and the permissible tolerance in axial direction.

4.2 DSC-CO type

4.2.1 Technical data

Table 4.11: Valuation table

Model	Reduction	Nominal torque at 2.000 rpm	Peak torque at start/stop	Maximum average torque	Collision torque	Maximum input speed	Maximum average speed
		Nm	Nm	Nm	Nm	rpm	rpm
14	50	5,4	18,0	6,9	35,0	8.500	3.500
	80	7,8	23,0	11,0	47,0		
	100	7,8	28,0	11,0	54,0		
17	50	16,0	34,0	26,0	70,0	7.300	3.500
	80	22,0	43,0	27,0	87,0		
	100	24,0	54,0	39,0	108,0		
	120	24,0	54,0	39,0	86,0		
20	50	25,0	56,0	34,0	98,0	6.500	3.500
	80	34,0	74,0	47,0	127,0		
	100	40,0	82,0	49,0	147,0		
	120	40,0	87,0	49,0	147,0		
25	50	39,0	98,0	55,0	186,0	5.600	3.500
	80	63,0	137,0	87,0	255,0		
	100	67,0	157,0	108,0	284,0		
	120	67,0	167,0	108,0	304,0		
32	50	76,0	216,0	108,0	382,0	4.800	3.500
	80	118,0	304,0	167,0	568,0		
	100	137,0	333,0	216,0	647,0		
	120	137,0	353,0	216,0	686,0		

Table 4.12: Accuracy of angular transmission

Reduction ratio	Model	14	17	20	25	32
50 - 120	$\times 10^{-4}$ rad	4,4	4,4	2,9	2,9	2,9

Table 4.13: Hysteresis loss

Reduction ratio	Model	14	17	20	25	32
50	$\times 10^{-4}$ rad	5,8	5,8	5,8	5,8	5,8
80 – 120	×10-4 rad	2,9	2,9	2,9	2,9	2,9

Table 4.14: Maximum backlash of oldham coupling

Model Reduction ratio		14	17	20	25	32
50	$\times 10^{-5}$ rad	17,5	9,7	8,2	8,2	6,8
80	$\times 10^{-5}$ rad	11,2	6,3	5,3	5,3	4,4
100	$\times 10^{-5}$ rad	8,7	4,8	4,4	4,4	3,4
120	$\times 10^{-5}$ rad		3,9	3,9	3,9	2,9

Table 4.15: Starting torque (unit: cNm)

Model Reduction ratio	14	17	20	25	32
50	3,3	5,1	6,6	12,0	26
80	2,4	3,3	4,1	7,7	16
100	2,1	2,9	3,7	6,9	15
120	–	2,7	3,3	6,3	13

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.16: Reverse starting torque (unit Nm)

Model Reduction ratio	14	17	20	25	32
50	1,4	2,5	4,0	7,5	16
80	1,4	2,5	4,2	7,7	16
100	1,7	2,8	4,5	8,4	18
120	–	3,1	4,9	9,2	19

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.17: Torsional rigidity

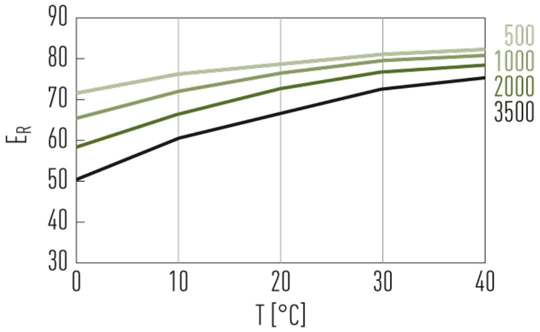
Reduction ratio		Model	14	17	20	25	32
T_1		Nm	2,0	3,9	7,0	14,0	29,0
T2		Nm	6,9	12,0	25,0	48,0	108,0
50	K_1	$\times 10^4$ Nm/rad	0,34	0,81	1,3	2,5	5,4
	K_2	$\times 10^4$ Nm/rad	0,47	1,1	1,8	3,4	7,8
	K_3	$\times 10^4$ Nm/rad	0,57	1,3	2,3	4,4	9,8
	θ_1	$\times 10^{-4}$ rad	5,8	4,9	5,2	5,5	5,5
	θ_2	$\times 10^{-4}$ rad	16,0	12,0	15,4	15,7	15,7
80 - 120	K_1	$\times 10^4$ Nm/rad	0,47	1,0	1,6	3,1	6,7
	K_2	$\times 10^4$ Nm/rad	0,61	1,4	2,5	5,0	11,0
	K_3	$\times 10^4$ Nm/rad	0,71	1,6	2,9	5,7	12,0
	θ_1	$\times 10^{-4}$ rad	4,1	3,9	4,4	4,4	4,4
	θ_2	$\times 10^{-4}$ rad	12,0	9,7	11,3	11,1	11,6

Note: The values are for reference purposes only. The lower limit is 20% below the value in this table.

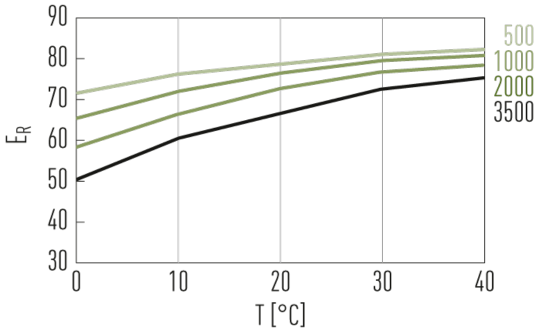
4.2.2 Efficiency E_R

The efficiency of DATORKER® strain wave gears changes depending on the specification, ratio, operating conditions (speed/load) and lubrication (lubricant type/amount).

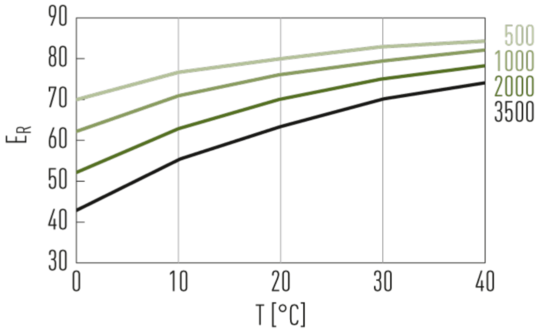
Model: 14, ratio: 50



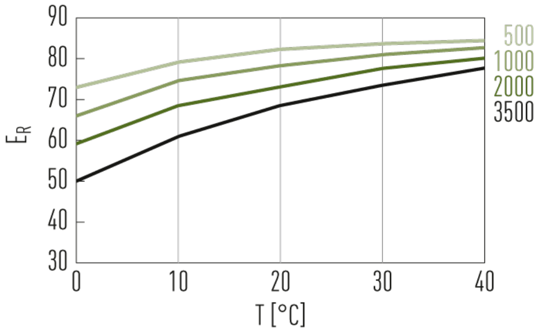
Model: 14, ratio: 80



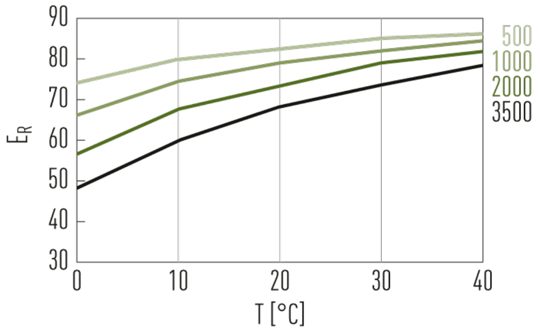
Model: 14, ratio: 100



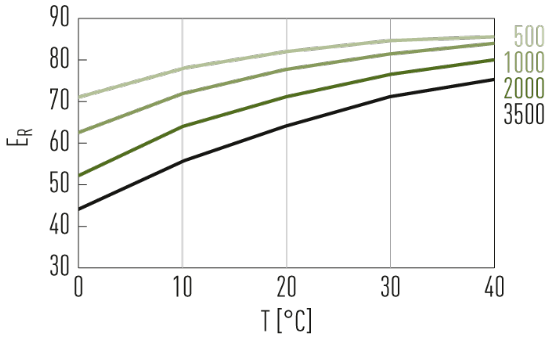
Model: 17-32, ratio: 50



Model: 17-32, ratio: 80, 100



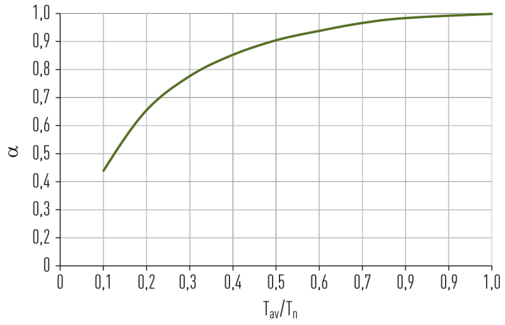
Model: 17-32, ratio: 120



Correction coefficient α

Efficiency = α x_{ER}

α= coefficient of correction
ER = efficiency at nominal torque



4.2.3 Idling operating torque

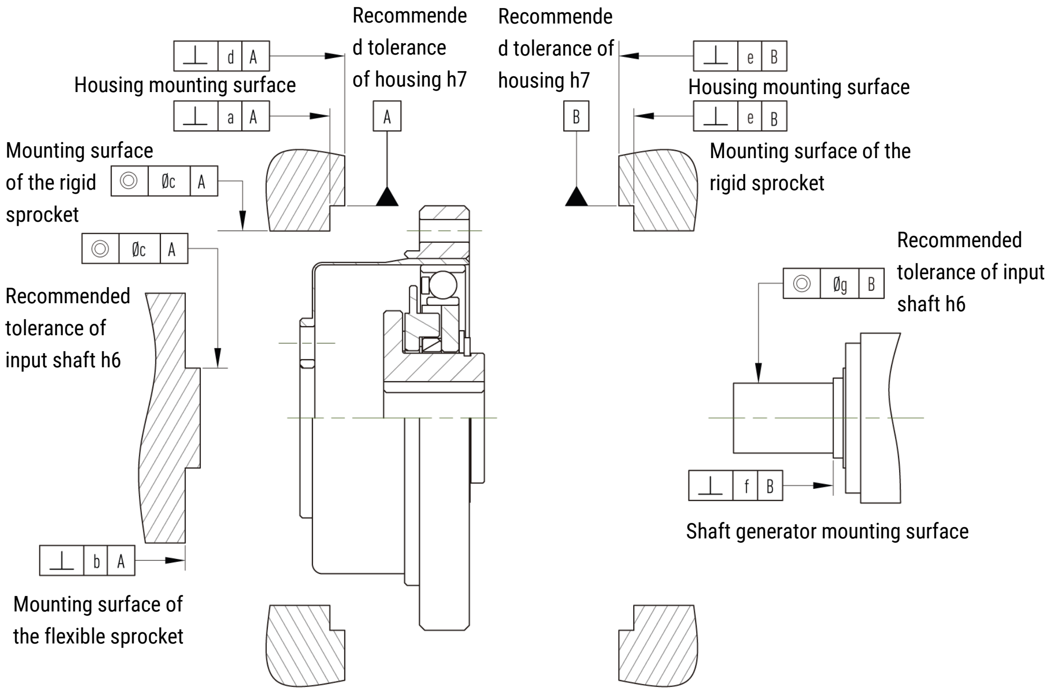
The idling operating torque is the torque required to drive the DATORKER® strain wave gear input (high speed end) after more than 2 hours at an input speed of 2.000 rpm at an average ambient temperature of 25 °C without load.

Unit: cNm

Reduction ratio	Input speed	Model				
		14	17	20	25	32
50	500 rpm	1,8	3,4	5,1	9,7	21,2
	1.000 rpm	2,3	4,4	6,9	12,5	27,2
	2.000 rpm	3,1	5,8	9,4	18,5	37,2
	3.500 rpm	4,2	7,9	13,4	25,5	50,2
80	500 rpm	1,4	2,6	3,9	7,6	16,8
	1.000 rpm	1,9	3,6	5,7	10,4	22,8
	2.000 rpm	2,7	5,0	8,2	16,4	32,8
	3.500 rpm	3,8	7,1	12,2	23,4	45,8
100	500 rpm	1,3	2,5	3,7	7,2	16,0
	1.000 rpm	1,8	3,5	5,5	10,0	22,0
	2.000 rpm	2,6	4,9	8,0	16,0	32,0
	3.500 rpm	3,7	7,0	12,0	23,0	45,0
120	500 rpm	–	2,4	3,5	6,9	15,4
	1.000 rpm	–	3,4	5,2	9,7	21,4
	2.000 rpm	–	4,8	7,8	15,7	31,4
	3.500 rpm	–	6,9	11,8	22,7	44,4

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

4.2.4 Installation accuracy

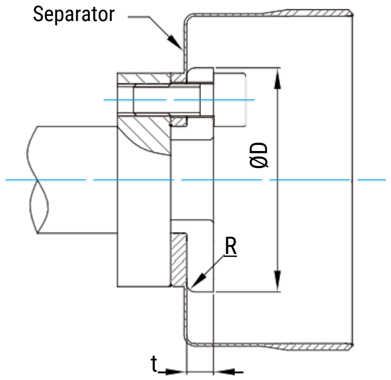


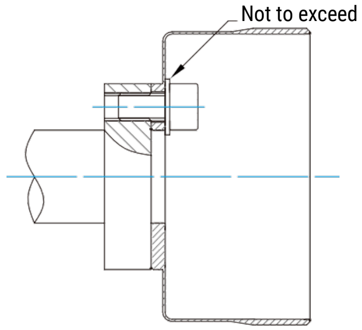
Unit: mm

Model Labelling	14	17	20	25	32
a	0,011	0,012	0,013	0,014	0,016
b	0,008	0,011	0,014	0,018	0,022
Øc	0,015	0,018	0,019	0,022	0,022
d	0,011	0,015	0,017	0,024	0,026
e	0,011	0,015	0,017	0,024	0,026
f	0,017 (0,008)	0,020 (0,010)	0,020 (0,010)	0,024 (0,012)	0,024 (0,012)
Øg	0,030 (0,016)	0,034 (0,018)	0,044 (0,019)	0,047 (0,022)	0,050 (0,022)

Note: The value in () is the value of the shaft generator (without coupling).

4.2.5 Recommended size of the pressing plate





Unit: mm

Model Labelling	14	17	20	25	32
ØD $^{0}_{-0,1}$	24,5	29,0	34,0	42,0	55,0
R $^{+0,1}_{0}$	1,2	1,2	1,4	1,5	2,0
t	2,0	2,5	2,5	5,0	7,0

Note: To prevent the screws on the press plate from sinking or loosening, the following is recommended:

1. Material S45C.
2. The heat treatment hardness grade should be HB200 - 270.

4.2.6 Tightening torque of the installation screw

1. Side of the flexible sprocket

○ If the load torque is below the rated power value in Table 4.11: Valuation table "Peak torque during start/stop", use only screws for installation.

○ If the load torque can reach the rated power value given in Table 4.11: Valuation table "Collision moment", use a combination of screws and pins for installation.

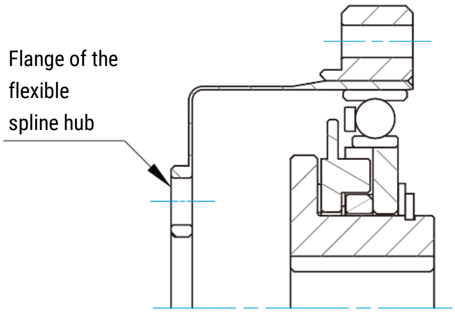


Table 4.18: Flange-side screw tightening torque of the flexible sprocket

Model Element		14	17	20	25	32
Number of screws		6	6	8	8	8
Screw size		M4	M5	M5	M6	M8
Installation of PCD screws	mm	17	19	24	30	40
Screw tightening torque	Nm	4,5	9,0	9,0	15,3	37

Note:

1. Recommended tightening torques for 12,9 DIN EN ISO 4762 mounting bolts DIN912 according to VDI 2230 for µK = µG = 0,125
2. Screw-in depth at least 2 x thread diameter

Table 4.19: Installation of the flexible sprocket with the help of a pin

Model Element		14	17	20	25	32
Number of screws		2	2	2	2	2
Pin diameter	mm	3	3	3	4	5
Pinhole PCD	mm	18,5	21,5	27	34	45
Screw plus transmission torque of the pin	kgfm	7,5	11	17	32	74

Note: Recommended pin type: Cylindrical pin; material: S45C-Q

2. Side of the rigid sprocket flange

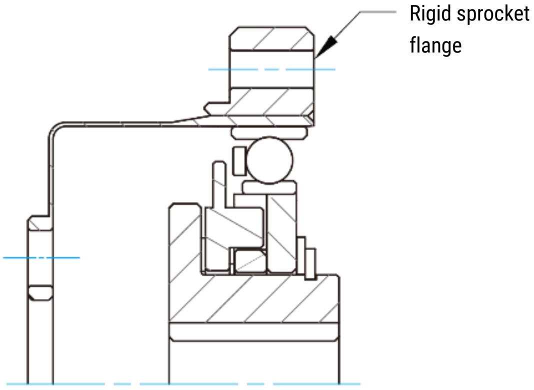


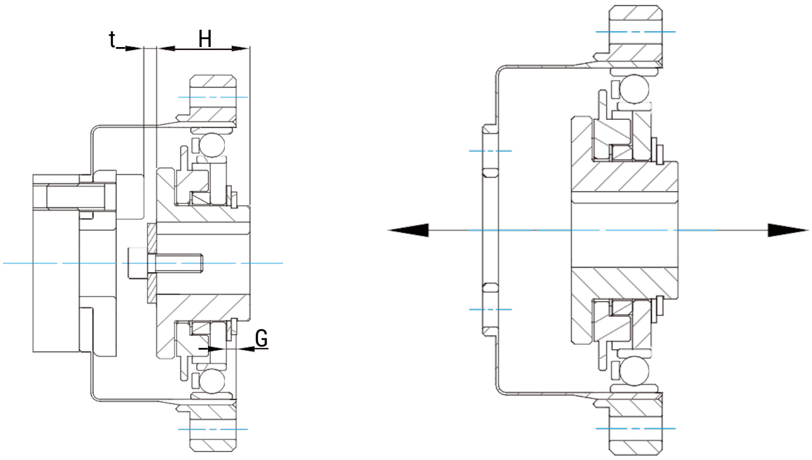
Table 4.20: Installation the rigid sprocket flange with the help of a screw

Model Element		14	17	20	25	32
Number of screws		6	12	12	12	12
Screw size		M3	M3	M3	M4	M5
Installation of PCD screws	mm	44	54	62	75	100
Screw tightening torque	Nm	2,0	2,0	2,0	4,5	9,0

Note:

1. Recommended tightening torques for 12,9 DIN EN ISO 4762 mounting bolts DIN912 according to VDI 2230 for μK = μG = 0,125
2. Screw-in depth at least 2 x thread diameter

4.2.7 Installation of the shaft generator



Unit: mm

Model Labelling	14	17	20	25	32
G	0,4	0,3	0,1	2,1	2,5
$H^{0}_{-0,1}$	17,6	19,5	20,1	20,2	22,0
t	2,5	2,5	2,9	2,8	3,8

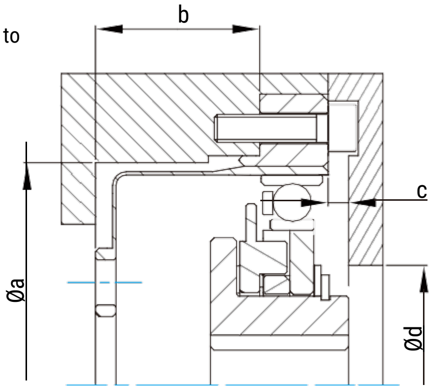
Note:

1. Avoid interference between the shaft generator and the screw of the flexible sprocket.
2. Due to the elastic deformation of the flexible sprocket, the gearbox causes a displacement of the shaft generator during operation. The displacement changes with the operating conditions. In any case, a mechanism must be used to prevent slippage due to displacement of the shaft generator.

4.2.8 Lubrication

1. Recommended dimensions of the inner wall of the housing

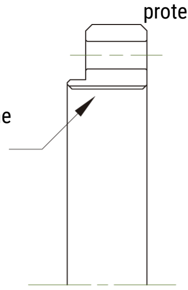
Keeping the following dimensions is recommended to avoid too much lubricant splashing on other parts during operation:



Unit: mm

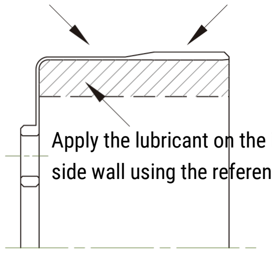
Model Labelling	14	17	20	25	32
Øa	38,0	45,0	53,0	66,0	86,0
b	17,1	19,0	20,5	23,0	26,8
c	1,0	1,0	1,5	1,5	1,5
Ød	16,0	26,0	30,0	37,0	37,0

2. Lubricant application


Apply the lubricant to the entire rim

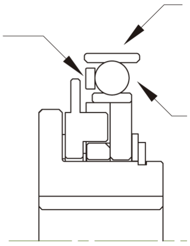
Apply a thin layer of rust protection to the outer ring

Rigid sprocket


Apply the lubricant to the entire rim

Apply the lubricant on the inner side wall using the reference value

Flexible sprocket

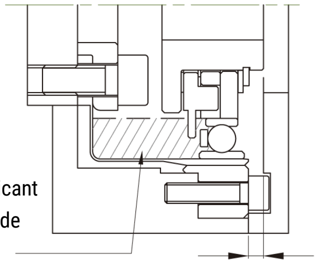

Apply a thin layer of rust protection to the outer ring

Please fill the holder with partition gaps

Apply grease to the bearing when turning

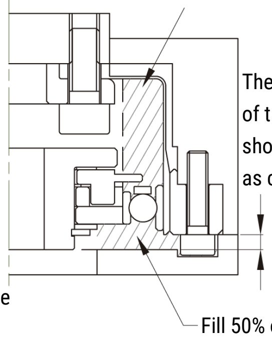
Shaft generator

3. The most important points of different application methods


Apply the lubricant on the inner side wall using the reference value

The inner wall size of the enclosure should be as large as c

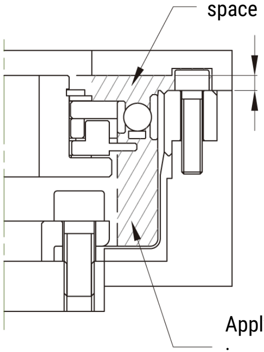
For horizontal use


Apply the lubricant on the inner side wall using the reference value

The inner wall size of the enclosure should be as large as c

Fill 50% of the space

Shaft generator points downwards


Fill 60% of the space

The inner wall size of the enclosure is double as large as c

Apply the lubricant on the inner side wall using the reference value

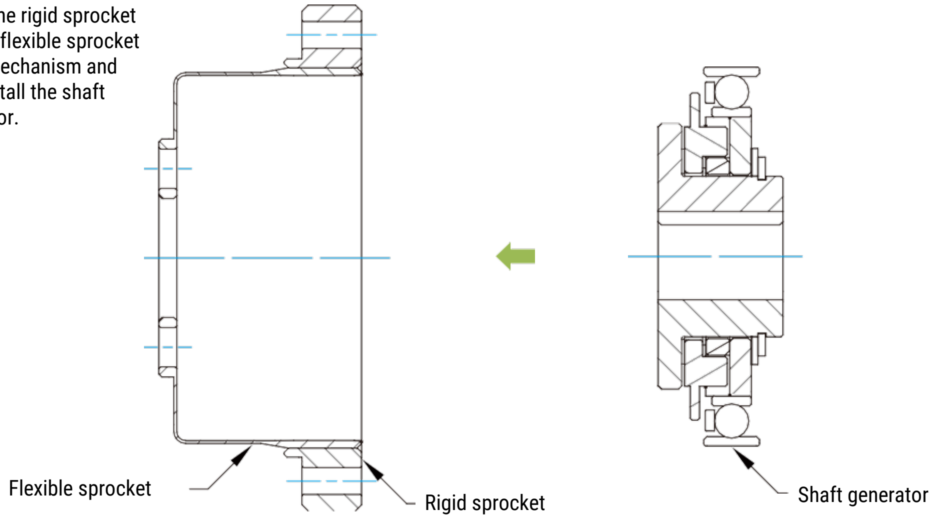
Shaft generator points upwards

Unit: g

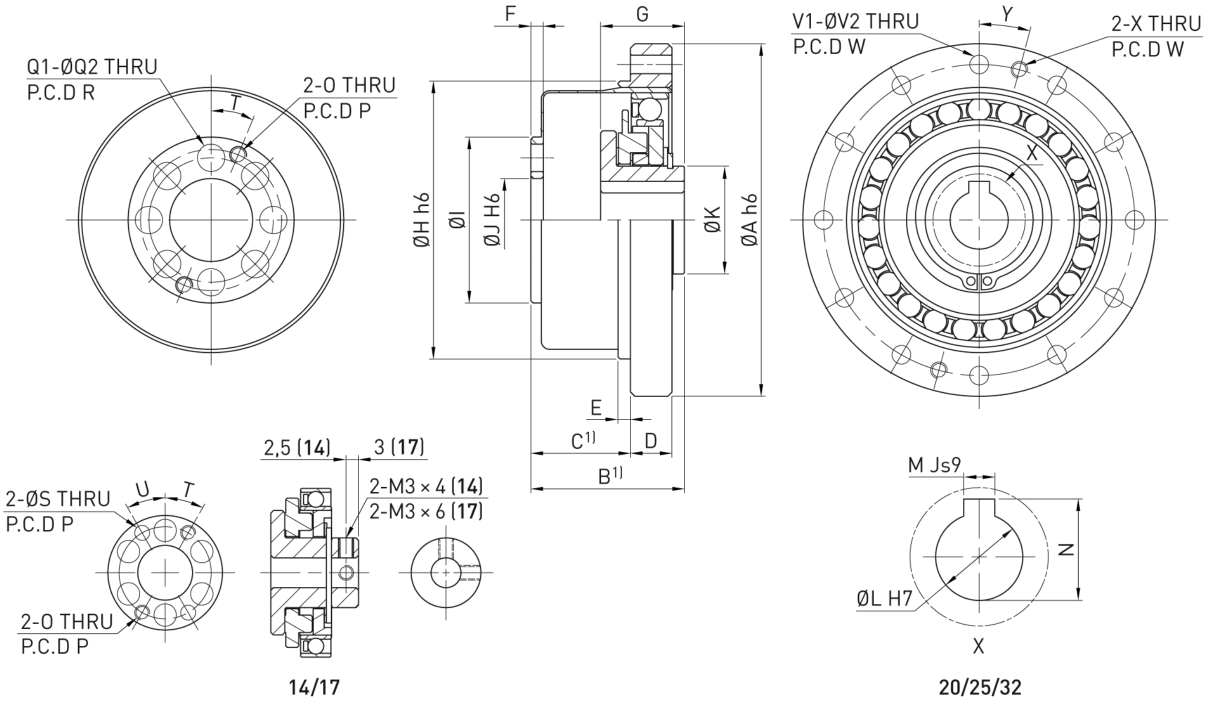
Model Instructions		14	17	20	25	32
Horizontal use		5,5	10	16	30	60
Vertical use	Shaft generator points downwards	7,0	12	18	35	70
	Shaft generator points upwards	8,5	14	21	40	80

4.2.9 Installation procedure

Install the rigid sprocket and the flexible sprocket in the mechanism and then install the shaft generator.



4.2.10 DSC-CO type, size chart



Model Labelling	14	17	20	25	32
ØA h6	50	60	70	85	110
B*	$28{,}5\,^{0}_{-0{,}8}$	$32{,}5\,^{0}_{-0{,}9}$	$33{,}5\,^{0}_{-1{,}0}$	$37\,^{0}_{-1{,}0}$	$44\,^{0}_{-1{,}1}$
C*	$17{,}5\,^{0{,}4}_{0}$	$20\,^{+0{,}5}_{0}$	$21{,}5^{+0{,}6}_{0}$	$24\,^{+0{,}6}_{0}$	$28\,^{+0{,}6}_{0}$
D	6	6,5	7,5	10	14
E	2	2,5	3	3	3
F	2,4	3	3	3	3,2
G	$17{,}6\,^{0}_{-0{,}1}$	$19{,}5\,^{0}_{-0{,}1}$	$20{,}1\,^{0}_{-0{,}1}$	$20{,}2\,^{0}_{-0{,}1}$	$22\,^{0}_{-0{,}1}$
ØH h6	38	48	54	67	90
ØI	23	27,2	32	40	52
J H6	11	10	16	20	26
ØK	14	18	21	26	26
ØL H7	6	8	9	11	14
M Js9	–	–	3	4	5
N	–	–	$10{,}4\,^{+0{,}1}_{0}$	$12{,}8\,^{+0{,}1}_{0}$	$16{,}3\,^{+0{,}1}_{0}$
O	M3	M3	M3	M4	M5
P (P.C.D)	18,5	21,5	27	34	45
Q1	6	6	8	8	8
ØQ2	4,5	5,5	5,5	6,6	9
R (P.C.D)	17	19	24	30	40
S	$3\,^{+0{,}015}_{0}$	$3\,^{+0{,}015}_{0}$	–	–	–
T (degrees)	30°	30°	22,5°	22,5°	22,5°
U (degrees)	30°	30°	–	–	–
V1	6	12	12	12	12
ØV2	3,5	3,5	3,5	4,5	5,5
W (P.C.D)	44	54	62	75	100
X	M3	M3	M3	M4	M5
Y (degrees)	30°	15°	15°	15°	15°
Moment of inertia (10^{-4} kgm^{2})	0,033	0,079	0,193	0,413	1,69
Weight (kg)	0,09	0,15	0,28	0,45	0,89

Dimensions without unit in mm

*Dimension B, C is the mounting position and the permissible tolerance in axial direction.

4.3 DSH-PO type

4.3.1 Technical data

Table 4.21: Valuation table

Model	Reduction	Nominal torque at 2.000 rpm [1]	Peak torque at start/stop [2]	Maximum average torque [3]	Collision torque [4]	Maximum input speed	Maximum average speed
		Nm	Nm	Nm	Nm	rpm	rpm
14	50	5,4	18	6,9	35	8.500	3500
	80	7,8	23	11	47		
	100	7,8	28	11	54		
17	50	16	34	26	70	7.300	3.500
	80	22	43	27	87		
	100	24	54	39	110		
	120	24	54	39	86		
20	50	25	56	34	98	6.500	3.500
	80	34	74	47	127		
	100	40	82	49	147		
	120	40	87	49	147		
25	50	39	98	55	186	5.600	3.500
	80	63	137	87	255		
	100	67	157	108	284		
	120	67	167	108	304		
32	50	76	216	108	382	4.800	3.500
	80	118	304	167	568		
	100	137	333	216	647		
	120	137	353	216	686		

[1] Permissible rated torque
[2] Permissible maximum torque
[3] Permissible average torque
[4] Permissible maximum value of impact

Table 4.22: Crossed roller bearing specifications

Model	Pitch circle diameter of roller	Offset amount	Basic load ratings		Permissible moment load	Moment rigidity
	Dpw	R	Dynamic load C	Static load Co		
	m	m	kN	kN	Nm	$\times 10^4$ Nm/rad
14	0,050	0,0217	5,8	8,6	74	8,5
17	0,060	0,0239	10,4	16,3	124	15,4
20	0,070	0,0255	14,6	22,0	187	25,2
25	0,085	0,0296	21,8	35,8	258	39,2
32	0,111	0,0364	38,2	65,4	580	100

Table 4.23: Accuracy of angular transmission

Model Reduction ratio		14	17	20	25	32
50 - 120	$\times 10^{-4}$ rad	4,4	4,4	2,9	2,9	2,9

Table 4.24: Hysteresis loss

Model Reduction ratio		14	17	20	25	32
50	$\times 10^{-4}$ rad	5,8	5,8	5,8	5,8	5,8
80 – 120	$\times 10^{-4}$ rad	2,9	2,9	2,9	2,9	2,9

Table 4.25: Starting torque (unit: cNm)

Model Reduction ratio	14	17	20	25	32
50	4,1	6,1	7,8	15	31
80	2,8	4	4,9	9,2	19
100	2,5	3,4	4,3	8	18
120	—	3,1	3,8	7,3	15

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.26: Reverse starting torque (unit Nm)

Model Reduction ratio	14	17	20	25	32
50	1,6	3	4,7	9	18
80	1,6	3	4,8	9,1	19
100	1,8	3,3	5,1	9,8	20
120	—	3,5	5,5	11	22

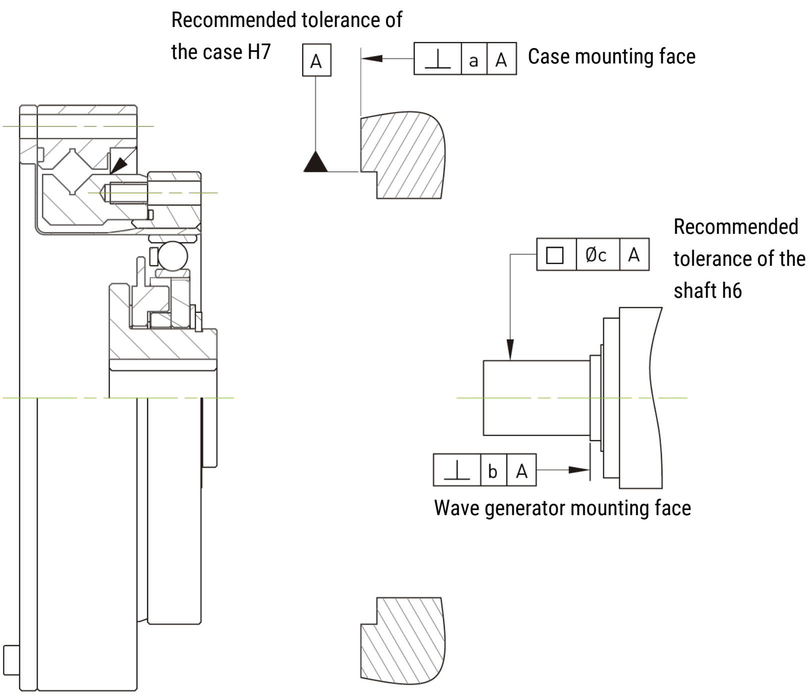
Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.27: Torsional rigidity

Model Reduction ratio			14	17	20	25	32
T_1		Nm	2,0	3,9	7,0	14	29
T_2		Nm	6,9	12	25	48	108
50	K_1	$\times 10^4$ Nm/rad	0,34	0,81	1,3	2,5	5,4
	K_2	$\times 10^4$ Nm/rad	0,47	1,1	1,8	3,4	7,8
	K_3	$\times 10^4$ Nm/rad	0,57	1,3	2,3	4,4	9,8
	θ_1	$\times 10^{-4}$ rad	5,8	4,9	5,2	5,5	5,5
	θ_2	$\times 10^{-4}$ rad	16	12	15,4	15,7	15,7
80 - 120	K_1	$\times 10^4$ Nm/rad	0,47	1	1,6	3,1	6,7
	K_2	$\times 10^4$ Nm/rad	0,61	1,4	2,5	5,0	11
	K_3	$\times 10^4$ Nm/rad	0,71	1,6	2,9	5,7	12
	θ_1	$\times 10^{-4}$ rad	4,1	3,9	4,4	4,4	4,4
	θ_2	$\times 10^{-4}$ rad	12	9,7	11,3	11,1	11,6

Note: The values are for reference purposes only. The lower limit is 20% below the value in this table.

4.3.2 Installation accuracy



Unit: mm

Model Labelling	14	17	20	25	32
a	0,011	0,015	0,017	0,024	0,026
b	0,017	0,020	0,020	0,024	0,024
	(0,008)	(0,010)	(0,010)	(0,012)	(0,012)
c	0,030	0,034	0,044	0,047	0,047
	(0,016)	(0,018)	(0,019)	(0,022)	(0,022)

Note: The value in () is the value of the shaft generator (without oldham coupling).

4.3.3 Tightening torque of the installation screw

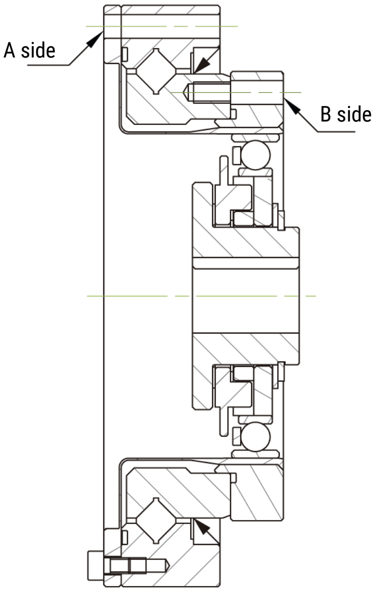


Table 4.28: A side mounting bolt tightening torque

Element	Model	14	17	20	25	32
Number of bolts		8	12	12	12	12
Bolts size		M3	M3	M3	M4	M5
Installation of Bolts PCD	mm	64	74	84	102	132
Bolt tightening torque	Nm	2	2	2	4,5	9

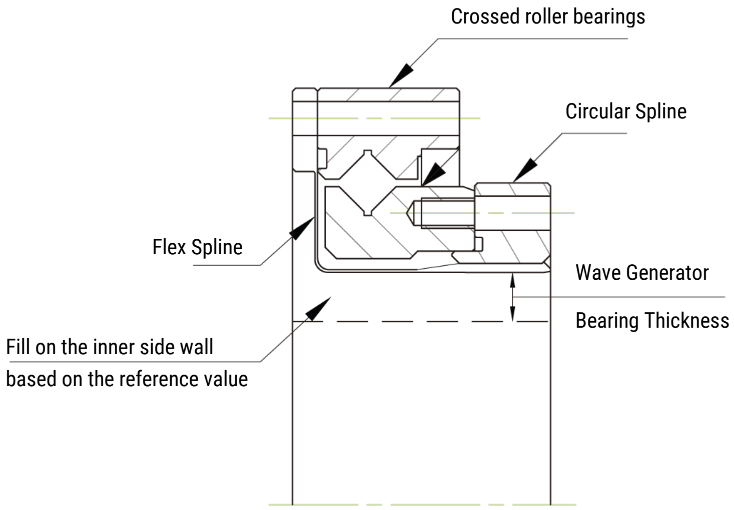
Table 4.29: B side mounting bolt tightening torque

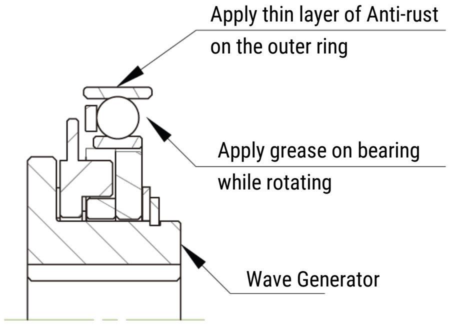
Element	Model	14	17	20	25	32
Number of bolts		8	16	16	16	16
Bolts size		M3	M3	M3	M4	M5
Installation of Bolts PCD	mm	44	54	62	77	100
Bolt tightening torque	Nm	2	2	2	4,5	9

Note:
1. Recommended tightening torques for the 12,9 DIN EN ISO 4762 fastening bolts DIN912 in accordance with VDI 2230 for μK = μG = 0,125
2. Bolt-in depth at least 2 x thread diameter

4.3.4 Lubrication

Other than the tooth space of DSH-PO Type, all other parts are not packed with lubricant. Please follow the below points for applying the lubricant.



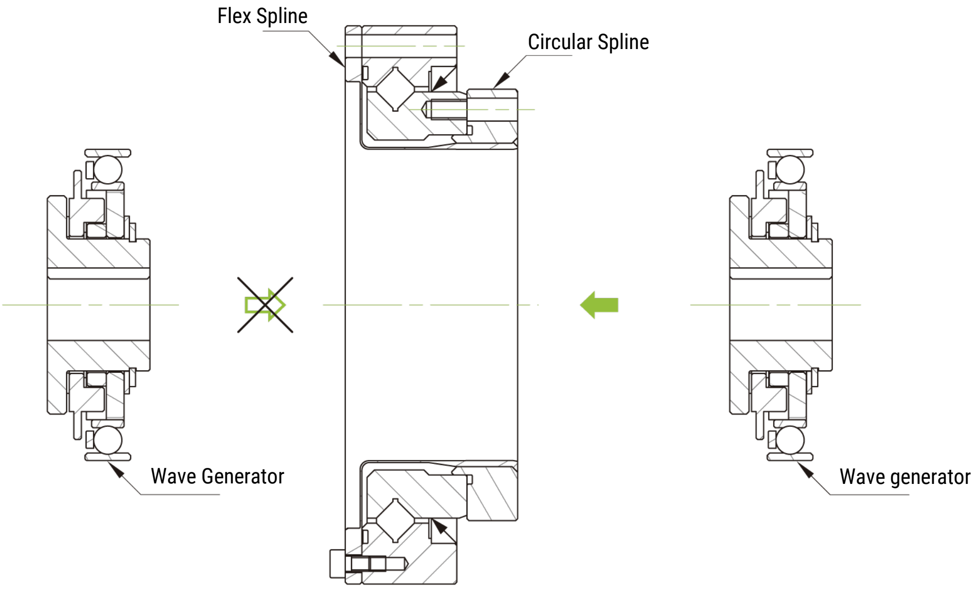


Unit: g

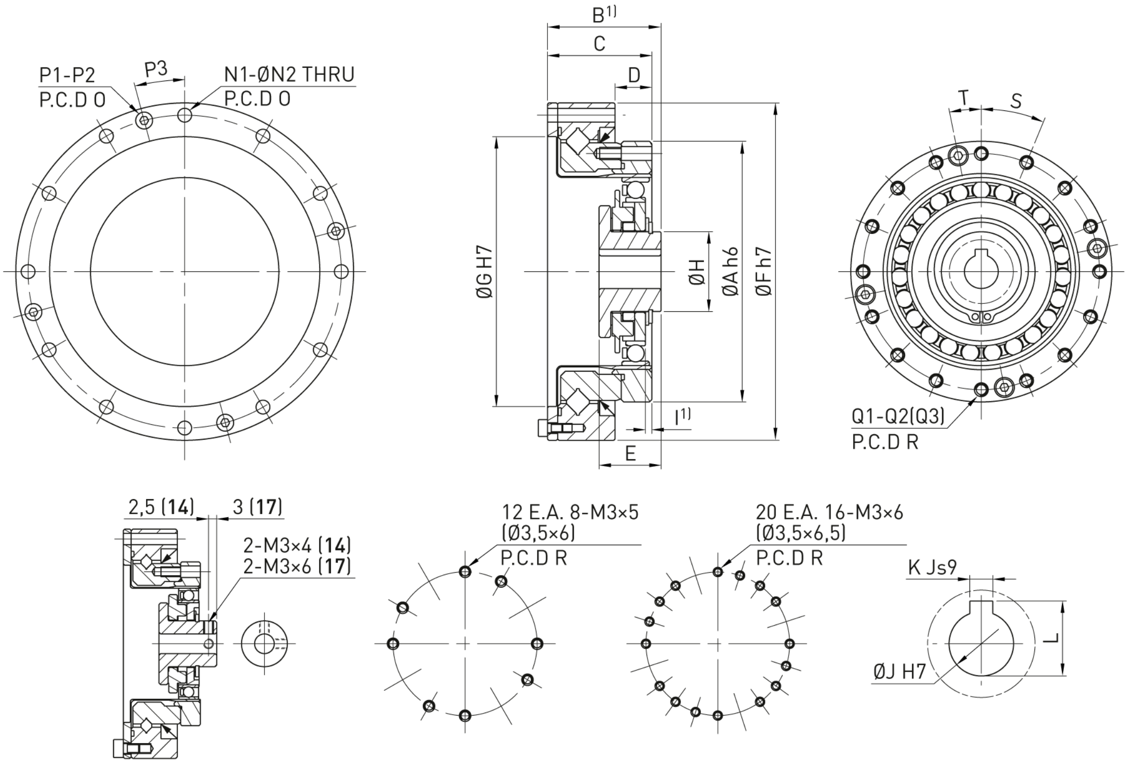
Instructions	Model	14	17	20	25	32
Horizontal use		5,8	11	18	32	64
Vertical use	Shaft generator points downwards	7,5	13	19	37	74
	Shaft generator points upwards	8,9	15	22	42	84

4.3.5 Installation procedure

Install the wave generator only after installing the reducer body into the case. Please note the installation sequence to avoid damage on the tooth face.



4.3.6 DSH-PO type, size chart



14/17 14 17 20/25/32

Unit: mm

Model Labelling	14	17	20	25	32
ØA h6	50	60	70	85	110
B*	$28,5^{0}_{-0,8}$	$32,5^{0}_{-0,9}$	$33,5^{0}_{-1}$	$37^{0}_{-1,1}$	$44^{0}_{-1,1}$
C	23,5	26,5	29	34	42
D	7	7,5	8,5	12	15
E	$17,6^{0}_{-0,1}$	$19,5^{0}_{-0,1}$	$20,1^{0}_{-0,1}$	$20,2^{0}_{-0,1}$	$22^{0}_{-0,1}$
ØF h7	70	80	90	110	142
ØG H7	48	60	70	88	114
ØH	14	18	21	26	26
I*	0,4	0,3	0,1	2,1	2,5
ØJ H7	6	8	9	11	14
K Js9	–	–	3	4	5
L	–	–	$10,4^{+0,1}_{0}$	$12,8^{+0,1}_{0}$	$16,3^{+0,1}_{0}$
N1	8	12	12	12	12
ØN2	3,5	3,5	3,5	4,5	5,5
O (P.C.D)	64	74	84	102	132
P1	2	4	4	4	4
P2	M3	M3	M3	M3	M4
P3 (Degree)	22,5°	15°	15°	15°	15°
Q1	12 E.A. 8	20 E.A. 16	16	16	16
Q2	M3 x 5DP	M3 x 6DP	M3 x 6DP	M4 x 7DP	M5 x 8DP
Q3	Ø3,5 x 6DP	Ø3,5 x 6,5DP	Ø3,5 x 7,5DP	Ø4,5 x 10DP	Ø5,5 x 14DP
ØR	44	54	62	77	100
S (Degree)	30°	18°	22,5°	22,5°	22,5°
T (Degree)	30°	18°	11,25°	11,25°	11,25°
Moment of Inertia ($\times 10^{-4}$ kgm^{2})	0,033	0,079	0,193	0,413	1,69
Weight (kg)	0,41	0,57	0,81	1,31	2,94

*The dimension B, I is the fitting position and permissible tolerance in the axial direction.

4.4 DSH-PH type

4.4.1 Technical data

Table 4.30: Valuation table

Model	Reduction	Nominal torque at 2.000 rpm	Peak torque at start/stop	Maximum average torque	Collision torque	Maximum input speed	Maximum average speed
		Nm	Nm	Nm	Nm	rpm	rpm
14	50	5,4	18,0	6,9	35,0	8.500	3.500
	80	7,8	23,0	11,0	47,0		
	100	7,8	28,0	11,0	54,0		
17	50	16,0	34,0	26,0	70,0	7.300	3.500
	80	22,0	43,0	27,0	87,0		
	100	24,0	54,0	39,0	108,0		
	120	24,0	54,0	39,0	86,0		
20	50	25,0	56,0	34,0	98,0	6.500	3.500
	80	34,0	74,0	47,0	127,0		
	100	40,0	82,0	49,0	147,0		
	120	40,0	87,0	49,0	147,0		
25	50	39,0	98,0	55,0	186,0	5.600	3.500
	80	63,0	137,0	87,0	255,0		
	100	67,0	157,0	108,0	284,0		
	120	67,0	167,0	108,0	304,0		
32	50	76,0	216,0	108,0	382,0	4.800	3,500
	80	118,0	304,0	167,0	568,0		
	100	137,0	333,0	216,0	647,0		
	120	137,0	353,0	216,0	686,0		

Table 4.31: Crossed roller bearing specifications

Model	Centre circle diameter of the rollers	Offset	Basic load ratings		Permitted torque	Moment rigidity
	Dpw	R	Dynamic load C_{dyn}	Static load C_0		
	m	m	kN	kN	Nm	$\times 10^4$ Nm/rad
14	0,050	0,0217	5,8	8,6	74	8,5
17	0,060	0,0239	10,4	16,3	124	15,4
20	0,070	0,0255	14,6	22,0	187	25,2
25	0,085	0,0296	21,8	35,8	258	39,2
32	0,111	0,0364	38,2	65,4	580	100,0

Table 4.32: Accuracy of angular transmission

Model Reduction ratio		14	17	20	25	32
50 - 120	$\times 10^{-4}$ rad	4,4	4,4	2,9	2,9	2,9

Table 4.33: Hysteresis loss

Model Reduction ratio		14	17	20	25	32
50	$\times 10^{-4}$ rad	5,8	5,8	5,8	5,8	5,8
80 - 120	$\times 10^{-4}$ rad	2,9	2,9	2,9	2,9	2,9

Table 4.34: Starting torque (unit cNm)

Model Reduction ratio	14	17	20	25	32
50	4,1	6,1	7,8	15,0	31
80	2,8	4,0	4,9	9,2	19
100	2,5	3,4	4,3	8,0	18
120	–	3,1	3,8	7,3	15

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.35: Reverse starting torque (unit Nm)

Model Reduction ratio	14	17	20	25	32
50	1,6	3,0	4,7	9,0	18
80	1,6	3,0	4,8	9,1	19
100	1,8	3,3	5,1	9,8	20
120	–	3,5	5,5	11,0	22

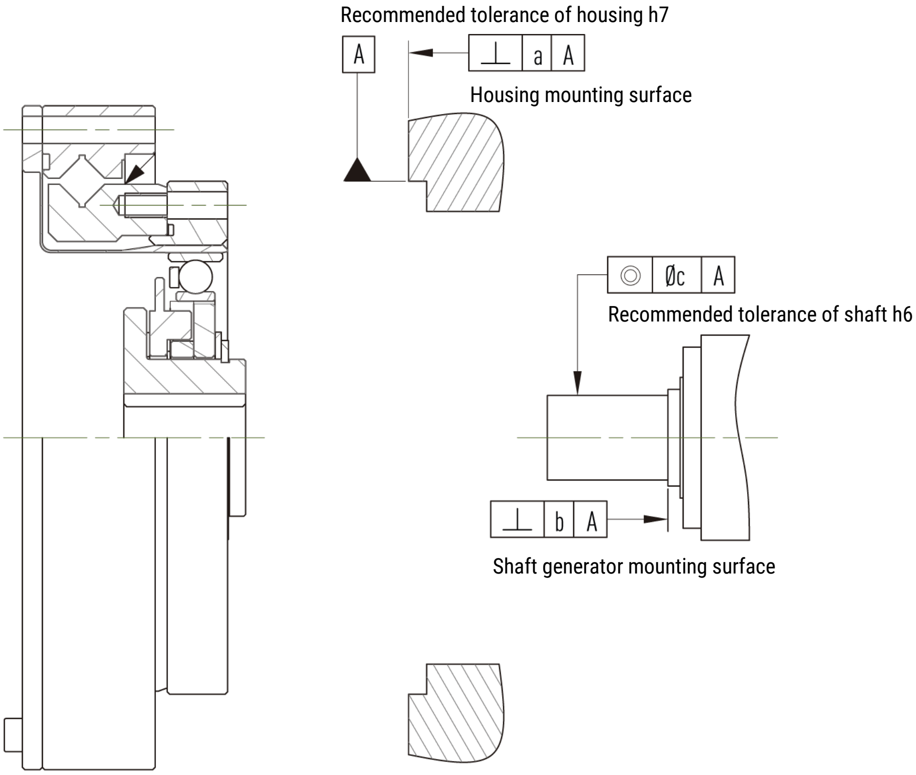
Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.36: Torsional rigidity

Reduction ratio		Model	14	17	20	25	32
T_1		Nm	2,0	3,9	7,0	14,0	29,0
T_2		Nm	6,9	12,0	25,0	48,0	108,0
50	K_1	$\times 10^4$ Nm/rad	0,34	0,81	1,3	2,5	5,4
	K_2	$\times 10^4$ Nm/rad	0,47	1,1	1,8	3,4	7,8
	K_3	$\times 10^4$ Nm/rad	0,57	1,3	2,3	4,4	9,8
	θ_1	$\times 10^{-4}$ rad	5,8	4,9	5,2	5,5	5,5
	θ_2	$\times 10^{-4}$ rad	16,0	12,0	15,4	15,7	15,7
80 - 120	K_1	$\times 10^4$ Nm/rad	0,47	1,0	1,6	3,1	6,7
	K_2	$\times 10^4$ Nm/rad	0,61	1,4	2,5	5,0	11,0
	K_3	$\times 10^4$ Nm/rad	0,71	1,6	2,9	5,7	12,0
	θ_1	$\times 10^{-4}$ rad	4,1	3,9	4,4	4,4	4,4
	θ_2	$\times 10^{-4}$ rad	12,0	9,7	11,3	11,1	11,6

Note: The values are for reference purposes only. The lower limit is 20% below the value in this table.

4.4.2 Installation accuracy



Unit: mm

Labelling / Model	14	17	20	25	32
a	0,011	0,015	0,017	0,024	0,026
b	0,017	0,020	0,020	0,024	0,024
	(0,008)	(0,010)	(0,010)	(0,012)	(0,012)
c	0,030	0,034	0,044	0,047	0,050
	(0,016)	(0,018)	(0,019)	(0,022)	(0,022)

Note: The value in () is the value of the shaft generator (without coupling).

4.4.3 Tightening torque of the installation screw

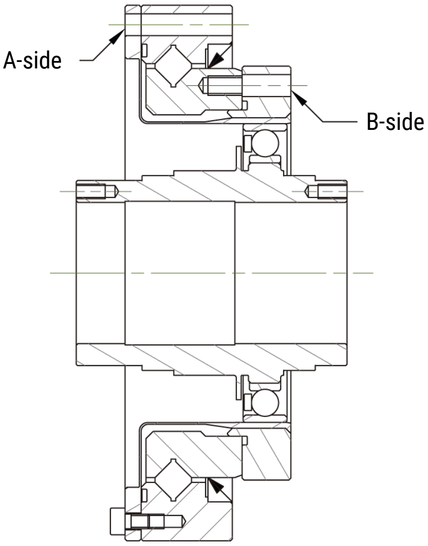


Table 4.37: Mounting screw tightening torque on the A-side

Element / Model		14	17	20	25	32
Number of screws		8	12	12	12	12
Screw size		M3	M3	M3	M4	M5
Installation of PCD screws	mm	64	74	84	102	132
Screw tightening torque	Nm	2	2	2	4,5	9

Table 4.38: Mounting screw tightening torque on the B-side

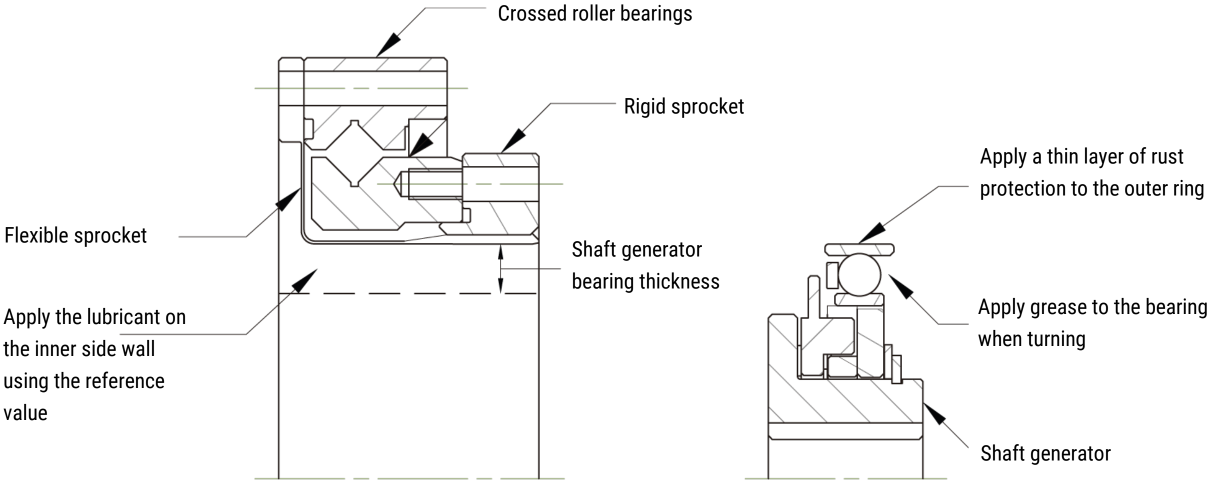
Element / Model		14	17	20	25	32
Number of screws		8	16	16	16	16
Screw size		M3	M3	M3	M4	M5
Installation of PCD screws	mm	44	54	62	77	100
Screw tightening torque	Nm	2	2	2	4,5	9

Note:

1. Recommended tightening torques for 12,9 DIN EN ISO 4762 mounting bolts DIN912 according to VDI 2230 for µK = µG = 0,125
2. Screw-in depth at least 2 x thread diameter

4.4.4 Lubrication

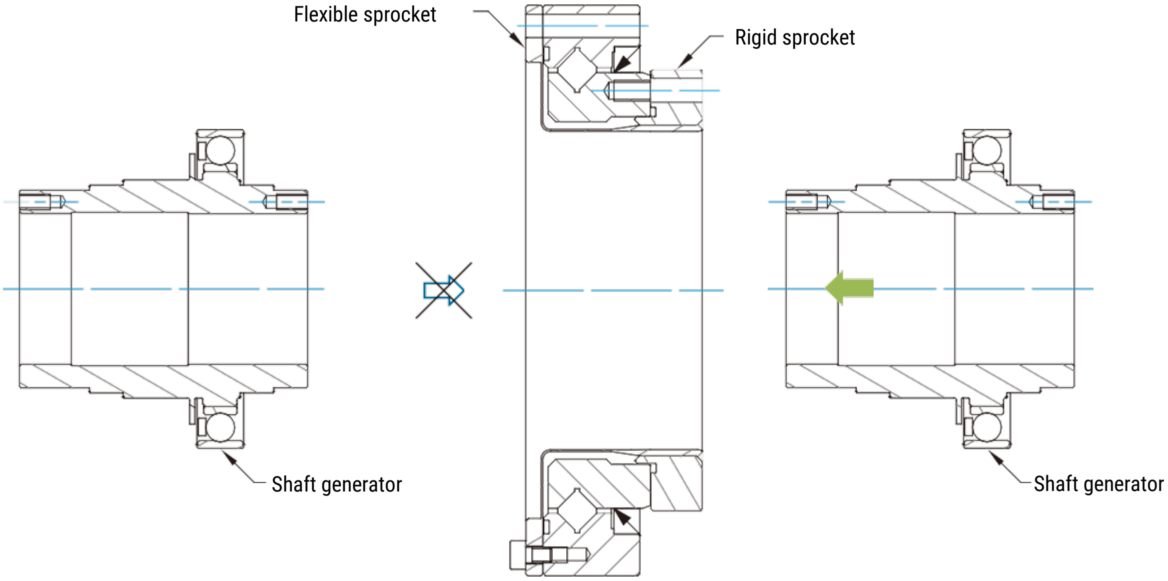
With the exception of the inner tooth area of the DSH-PH type, all other parts are not filled with lubricant. Please observe the following points for applying the lubricant.



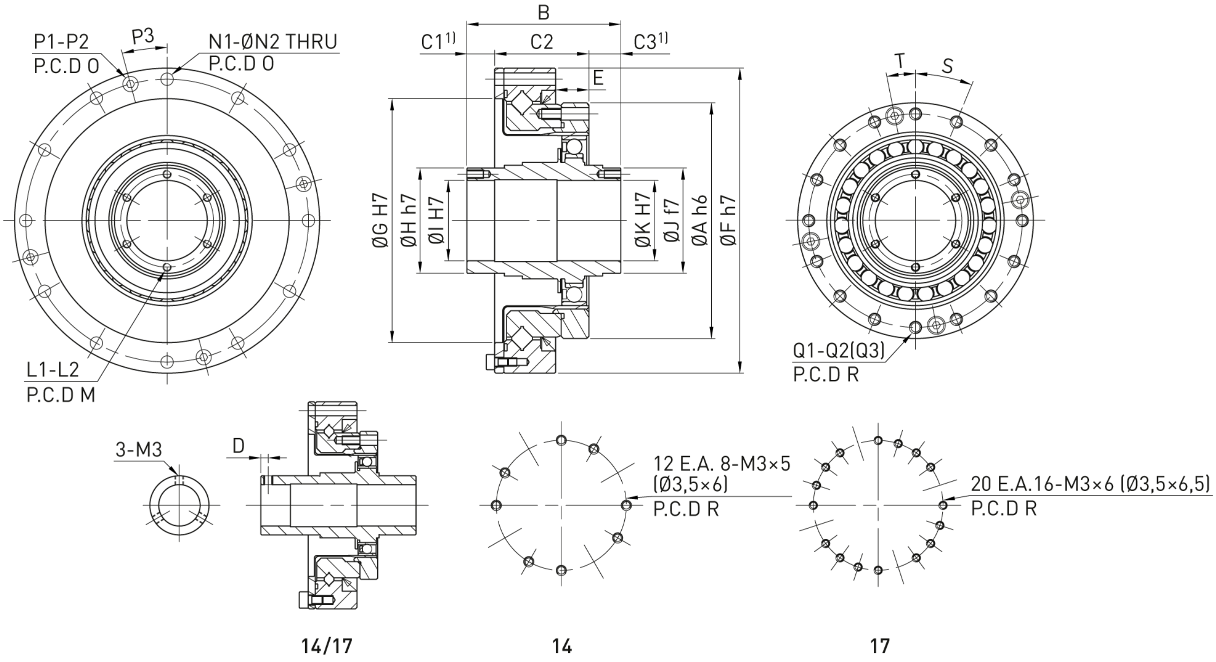
Unit: g

Instructions / Model		14	17	20	25	32
Horizontal use		5,8	11	18	32	64
Vertical use	Shaft generator points downwards	7,5	13	19	37	74
	Shaft generator points upwards	8,9	15	22	42	84

4.4.5 Installation procedure



4.4.6 DSH-PH type, size chart



Model Labelling	14	17	20	25	32
ØA h6	50	60	70	85	110
B	52,5 $^{0}_{-0,1}$	56,5 $^{0}_{-0,1}$	51,5 $^{0}_{-0,1}$	55,5 $^{0}_{-0,1}$	65,5 $^{0}_{-0,1}$
C1*	16 $^{+0,8}_{0}$	16 $^{+0,9}_{0}$	16 $^{+1,0}_{0}$	10 $^{+1,1}_{0}$	12 $^{+1,1}_{0}$
C2	23,5	26,5	29	34	42
C3*	13	14	13	11,5	11,5
D	2,5	2,5	–	–	–
E	7	7,5	8,5	12	15
ØF h7	70	80	90	110	142
ØG H7	48	60	70	88	114
ØH h7	20	25	30	38	45
ØI H7	14	19	21	29	36
ØJ f7	20	25	30	38	45
ØK H7	14	19	21	29	36
L1	3	3	2x6	2x6	2x6
L2	M3	M3	M3 x DP6	M3 x DP6	M3 x DP6
M (P.C.D)	–	–	25,5	33,5	40,5
N1	8	12	12	12	12
ØN2	3,5	3,5	3,5	4,5	5,5
O (P.C.D)	64	74	84	102	132
P1	2	4	4	4	4
P2	M3	M3	M3	M3	M4
P3 (degree)	22,5°	15°	15°	15°	15°

Model Labelling	14	17	20	25	32
Q1	12 E.A. 8	20 E.A. 16	16	16	16
Q2	M3 x 5DP	M3 x 6DP	M3 x 6DP	M4 x 7DP	M5 x 8DP
Q3	Ø3,5 x 6DP	Ø3,5 x 6,5DP	Ø3,5 x 7,5DP	Ø4,5 x 10DP	Ø5,5 x 14DP
ØR	44	54	62	77	100
S (degree)	30°	18°	22,5°	22,5°	22,5°
T (degrees)	30°	18°	11,25°	11,25°	11,25°
Moment of inertia (10^{-4} kgm^2)	0,033	0,079	0,193	0,413	1,69
Weight (kg)	0,45	0,63	0,89	1,44	3,1

Dimensions without unit in mm

*Dimension C1, C3 is the mounting position and the permissible tolerance in axial direction.

4.5 DSH-AH type

4.5.1 Technical data

Table 4.39: Valuation table

Model	Reduction	Nominal torque at 2.000 rpm	Peak torque at start/stop	Maximum average torque	Collision torque	Maximum input speed	Maximum average speed
		Nm	Nm	Nm	Nm	rpm	rpm
14	50	5,4	18,0	6,9	35,0	8.500	3.500
	80	7,8	23,0	11,0	47,0		
	100	7,8	28,0	11,0	54,0		
17	50	16,0	34,0	26,0	70,0	7.300	3.500
	80	22,0	43,0	27,0	87,0		
	100	24,0	54,0	39,0	108,0		
	120	24,0	54,0	39,0	86,0		
20	50	25,0	56,0	34,0	98,0	6.500	3.500
	80	34,0	74,0	47,0	127,0		
	100	40,0	82,0	49,0	147,0		
	120	40,0	87,0	49,0	147,0		
25	50	39,0	98,0	55,0	186,0	5.600	3.500
	80	63,0	137,0	87,0	255,0		
	100	67,0	157,0	108,0	284,0		
	120	67,0	167,0	108,0	304,0		
32	50	76,0	216,0	108,0	382,0	4.800	3.500
	80	118,0	304,0	167,0	568,0		
	100	137,0	333,0	216,0	647,0		
	120	137,0	353,0	216,0	686,0		

Table 4.40: Crossed roller bearing specifications

Model	Centre circle diameter of the rollers	Offset	Basic load ratings		Permitted torque	Moment rigidity
	Dpw	R	Dynamic load C_{dyn}	Static load C_0		
	m	m	kN	kN	Nm	$\times 10^4$ Nm/rad
14	0,050	0,0217	5,8	8,6	74	8,5
17	0,060	0,0239	10,4	16,3	124	15,4
20	0,070	0,0255	14,6	22,0	187	25,2
25	0,085	0,0296	21,8	35,8	258	39,2
32	0,111	0,0364	38,2	65,4	580	100,0

Table 4.41: Accuracy of angular transmission

Reduction ratio	Model	14	17	20	25	32
50 - 120	$\times 10^{-4}$ rad	4,4	4,4	2,9	2,9	2,9

Table 4.42: Hysteresis loss

Reduction ratio	Model	14	17	20	25	32
50	$\times 10^{-4}$ rad	5,8	5,8	5,8	5,8	5,8
80 - 120	$\times 10^{-4}$ rad	2,9	2,9	2,9	2,9	2,9

Table 4.43: Starting torque (unit cNm)

Model Reduction ratio	14	17	20	25	32
50	8,8	27	36	56	85
80	7,5	25	33	50	74
100	6,9	24	32	49	72
120	_	24	31	48	68

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.44: Reverse starting torque (unit Nm)

Model Reduction ratio	14	17	20	25	32
50	5,3	16	22	34	51
80	7,2	24	31	48	70
100	8,2	29	38	59	86
120	_	34	45	69	97

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.45: Torsional rigidity

Model Reduction ratio			14	17	20	25	32
T_1		Nm	2,0	3,9	7,0	14,0	29,0
T_2		Nm	6,9	12,0	25,0	48,0	108,0
50	K_1	×10^4 Nm/rad	0,34	0,81	1,3	2,5	5,4
	K_2	×10^4 Nm/rad	0,47	1,1	1,8	3,4	7,8
	K_3	×10^4 Nm/rad	0,57	1,3	2,3	4,4	9,8
	θ_1	×10^{-4} rad	5,8	4,9	5,2	5,5	5,5
	θ_2	×10^{-4} rad	16,0	12,0	15,4	15,7	15,7
80 - 120	K_1	×10^4 Nm/rad	0,47	1,0	1,6	3,1	6,7
	K_2	×10^4 Nm/rad	0,61	1,4	2,5	5,0	11,0
	K_3	×10^4 Nm/rad	0,71	1,6	2,9	5,7	12,0
	θ_1	×10^{-4} rad	4,1	3,9	4,4	4,4	4,4
	θ_2	×10^{-4} rad	12,0	9,7	11,3	11,1	11,6

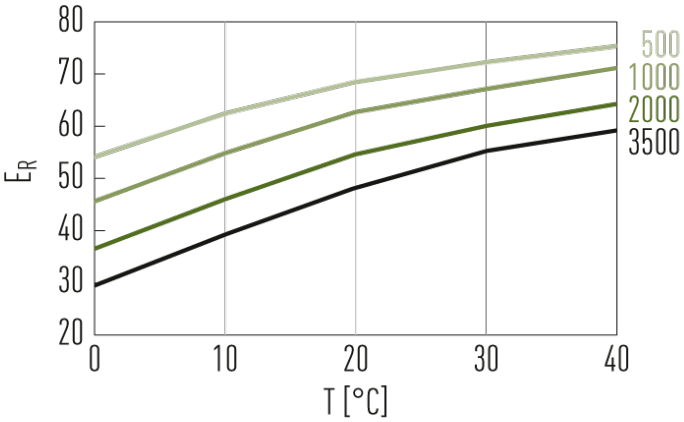
Note: The values are for reference purposes only. The lower limit is 20% below the value in this table.

4.5.2 Efficiency E_R

1. Rated torque E_R

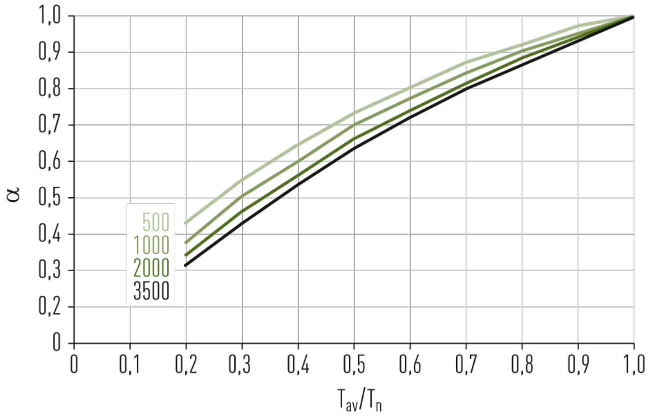
The efficiency of DATORKER® strain wave gears changes depending on the specification, ratio, operating conditions (speed/load) and lubrication (lubricant type/amount).

Model: 14-32, ratio: 50, 80, 100, 120



2. Correction coefficient α

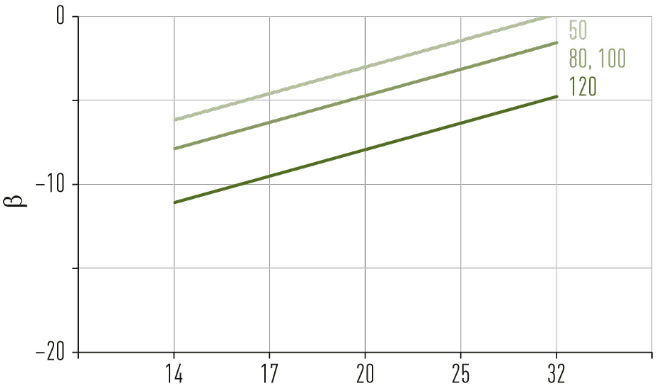
Coefficient for correcting efficiency α according to load torque



3. Correction coefficient β

Coefficient for correcting efficiency β according to specification

Efficiency = α x$_{ER}$



4.5.3 Idling operating torque

The idling operating torque is the torque required to drive the DATORKER® strain wave gear input (high speed end) after more than 2 hours at an input speed of 2.000 rpm at an average ambient temperature of 25 °C without load.

Unit: cNm

Reduction ratio	Input speed	Model				
		14	17	20	25	32
50	500 rpm	6,3	17,8	23,6	37,2	58,0
	1.000 rpm	7,8	21,8	28,6	49,2	76,0
	2.000 rpm	10,1	27,8	37,6	62,2	98,0
	3.500 rpm	14,1	36,8	48,6	89,2	138,0
80	500 rpm	5,4	16,4	21,5	33,8	51,5
	1.000 rpm	6,9	20,4	26,5	45,8	69,5
	2.000 rpm	9,2	26,4	35,5	58,8	91,5
	3.500 rpm	13,2	35,4	46,5	85,8	131,5
100	500 rpm	5,2	16,0	21,0	33,0	50,0
	1.000 rpm	6,7	20,0	26,0	45,0	68,0
	2.000 rpm	9,0	26,0	35,0	58,0	90,0
	3.500 rpm	13,0	35,0	46,0	85,0	130,0
120	500 rpm	–	15,8	20,6	32,4	48,9
	1.000 rpm	–	19,8	25,6	44,4	66,9
	2.000 rpm	–	25,8	34,6	57,4	88,9
	3.500 rpm	–	34,8	45,6	84,4	128,9

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

4.5.4 Tightening torque of the installation screw

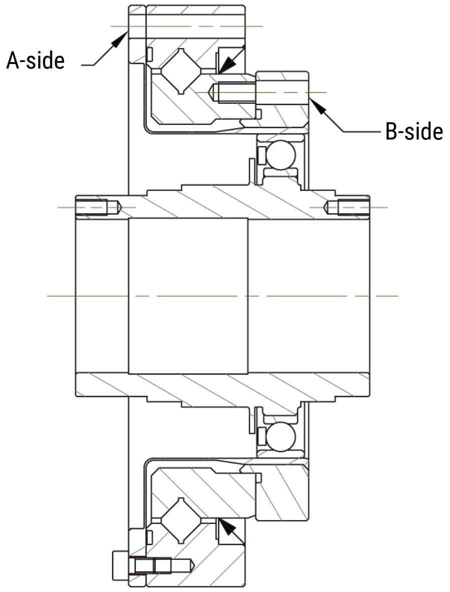


Table 4.46: Mounting screw tightening torque on the A-side

Element	Model	14	17	20	25	32
Number of screws		8	12	12	12	12
Screw size		M3	M3	M3	M4	M5
Installation of PCD screws	mm	64	74	84	102	132
Screw tightening torque	Nm	2	2	2	4,5	9

Table 4.47: Mounting screw tightening torque on the B-side

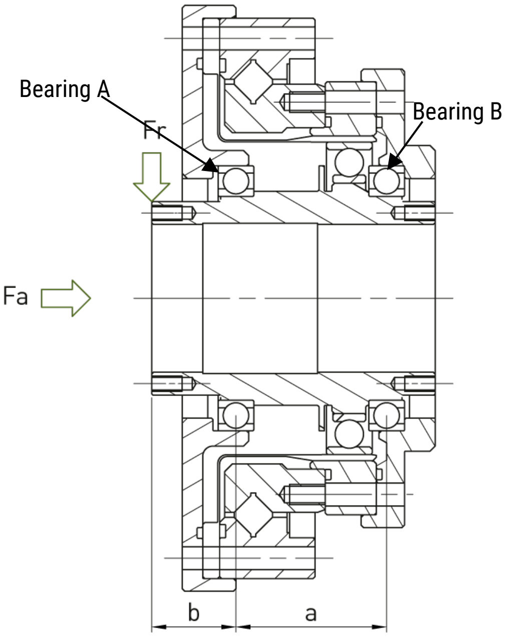
Element	Model	14	17	20	25	32
Number of screws		8	16	16	16	16
Screw size		M3	M3	M3	M4	M5
Installation of PCD screws	mm	44	54	62	77	100
Screw tightening torque	Nm	2	2	2	4,5	9

Note:

1. Recommended tightening torques for 12,9 DIN EN ISO 4762 mounting bolts DIN912 according to VDI 2230 for µK = µG = 0,125
2. Screw-in depth at least 2 x thread diameter

4.5.5 Permissible input load

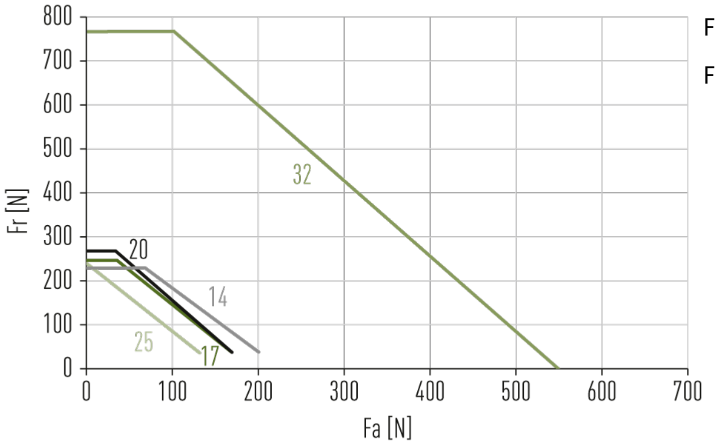
The hollow shaft is supported by two deep groove bearings. To ensure proper performance of the gearbox, please confirm the load on the hollow shaft. As shown below:



Fa: Axial load (N)

Fr: Radial load (N)

The following figure shows the average input speed of 2.000 rpm and the basic nominal service life L10 = 7.000 hours.

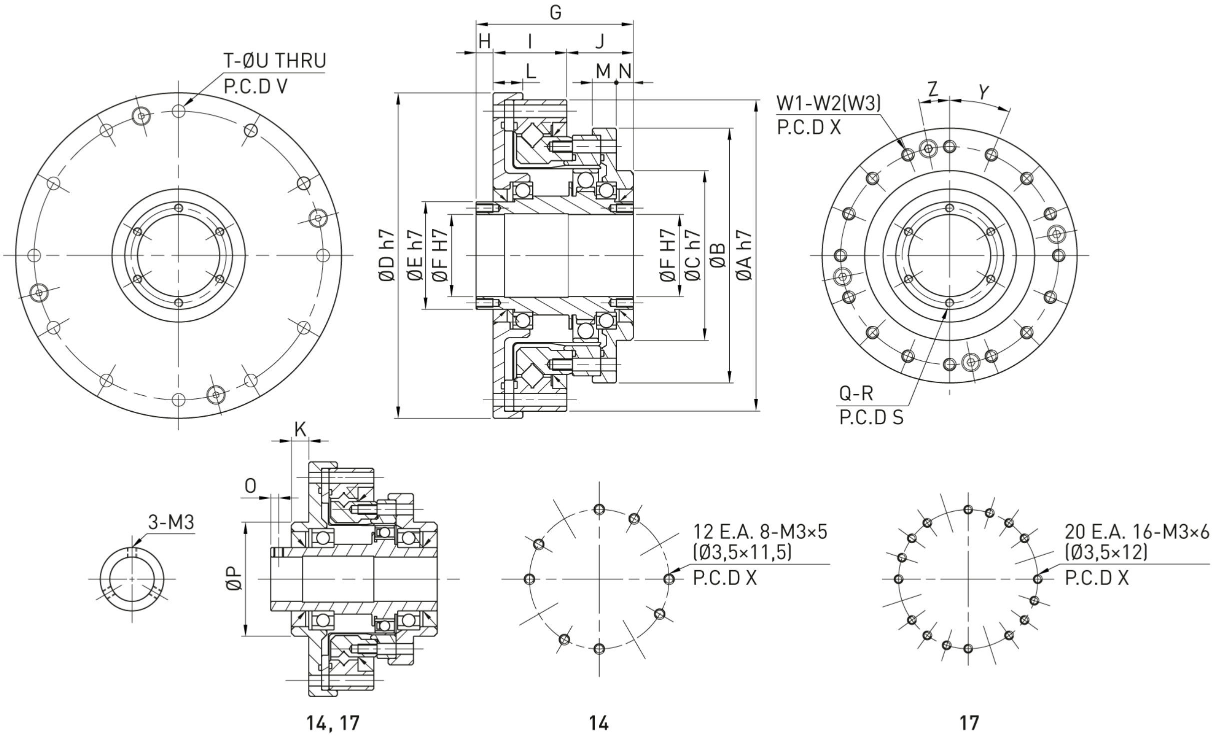


Fr Radial load (N)

Fa Axial load (N)

Element Model	Bearing A		Bearing B		a (mm)	b (mm)	Maximum radial load Fr (N)
	Dynamic load C_{dyn} (kN)	Static load C_0 (kN)	Dynamic load C_{dyn} (kN)	Static load C_0 (kN)			
14	4,0	2,47	4,00	2,47	27,0	16,5	230
17	4,3	2,95	4,30	2,95	29,0	17,5	250
20	4,5	3,45	4,50	3,45	27,0	15,5	275
25	4,9	4,35	4,90	4,35	29,5	16,5	250
32	14,1	10,90	5,35	5,25	33,0	23,0	770

4.5.6 DSH-AH type, size chart



14, 17 14 17

Model Labelling	14	17	20	25	32
ØA h7	70	80	90	110	142
ØB	54	64	75	90	115
ØC h7	36	45	50	60	85
ØD h7	74	84	95	115	147
ØE h7	20	25	30	38	45
ØF H7	14	19	21	29	36
G	52,5	56,5	51,5	55,5	65,5
H	12	12	5	6	7
I	20,5	23	25	26	32
J	20	21,5	21,5	23,5	26,5
K	5,5	5,5	–	–	–
L	9	10	10,5	10,5	12
M	8	8,5	9	8,5	9,5
N	7,5	8,5	7	6	5
O	2,5	2,5	–	–	–
P	36	45	–	–	–
Q	3	3	2 x 6	2 x 6	2 x 6
R	M3	M3	M3 x DP6	M3 x DP6	M3 x DP6
S (P.C.D)	–	–	25,5	33,5	40,5
T	8	12	12	12	12
ØU	3,5	3,5	3,5	4,5	5,5
V (P.C.D)	64	74	84	102	132
W1	12 E.A. 8	20 E.A. 16	16	16	16
W2	M3 x 5DP	M3 x 6DP	M3 x 6DP	M4 x 7DP	M5 x 8DP
W3	Ø3,5 x 11,5DP	Ø3,5 x 12DP	Ø3,5 x 13,5DP	Ø4,5 x 15,5DP	Ø5,5 x 20,5DP
X (P.C.D)	44	54	62	77	100
Y (degrees)	30°	18°	22,5°	22,5°	22,5°
Z (degrees)	30°	18°	11,25°	11,25°	11,25°
Moment of inertia (10^{-4} kgm^2)	0,091	0,193	0,404	1,07	2,85
Weight (kg)	0,71	1,0	1,38	2,1	4,5

Dimensions without unit in mm

4.6 DSH-AJ type

4.6.1 Technical data

Table 4.48: Valuation table

Model	Reduction	Nominal torque at 2.000 rpm [1]	Peak torque at start/stop [2]	Maximum average torque [3]	Collision torque [4]	Maximum input speed	Maximum average speed
		Nm	Nm	Nm	Nm	rpm	rpm
14	50	5,4	18	6,9	35	8.500	3.500
	80	7,8	23	11	47		
	100	7,8	28	11	54		
17	50	16	34	26	70	7.300	3.500
	80	22	43	27	87		
	100	24	54	39	110		
	120	24	54	39	86		
20	50	25	56	34	98	6.500	3.500
	80	34	74	47	127		
	100	40	82	49	147		
	120	40	87	49	147		
25	50	39	98	55	186	5.600	3.500
	80	63	137	87	255		
	100	67	157	108	284		
	120	67	167	108	304		
32	50	76	216	108	382	4.800	3.500
	80	118	304	167	568		
	100	137	333	216	647		
	120	137	353	216	686		

[1] Permissible rated torque

[2] Permissible maximum torque

[3] Permissible average torque

[4] Permissible maximum value of impact

Table 4.49: Crossed roller bearing specifications

Model	Pitch circle diameter of roller	Offset amount	Basic load ratings		Permissible moment load	Moment rigidity
	Dpw	R	Dynamic load C	Static load Co		
	m	m	kN	kN	Nm	$\times 10^4$ Nm/rad
14	0,050	0,0217	5,8	8,6	74	8,5
17	0,060	0,0239	10,4	16,3	124	15,4
20	0,070	0,0255	14,6	22,0	187	25,2
25	0,085	0,0296	21,8	35,8	258	39,2
32	0,111	0,0364	38,2	65,4	580	100

Table 4.50: Accuracy of angular transmission

Model Reduction ratio		14	17	20	25	32
50 - 120	$\times 10^{-4}$ rad	4,4	4,4	2,9	2,9	2,9

Table 4.51: Hysteresis loss

Model Reduction ratio		14	17	20	25	32
50	$\times 10^{-4}$ rad	5,8	5,8	5,8	5,8	5,8
80 – 120	$\times 10^{-4}$ rad	2,9	2,9	2,9	2,9	2,9

Table 4.52: Starting torque (unit: cNm)

Model Reduction ratio	14	17	20	25	32
50	5,7	9,7	14	22	41
80	4,4	7,2	11	15	29
100	3,7	6,5	9,9	14	27
120	—	6,2	9,3	13	24

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.53: Reverse starting torque (unit Nm)

Model Reduction ratio	14	17	20	25	32
50	3,4	5,8	8,4	13	25
80	4,2	6,9	10	15	28
100	4,5	7,8	12	17	33
120	—	8,9	13	19	34

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.54: Torsional rigidity

Reduction ratio		Model	14	17	20	25	32
T_1		Nm	2,0	3,9	7,0	14	29
T_2		Nm	6,9	12	25	48	108
50	K_1	$\times10^4$ Nm/rad	0,34	0,81	1,3	2,5	5,4
	K_2	$\times10^4$ Nm/rad	0,47	1,1	1,8	3,4	7,8
	K_3	$\times10^4$ Nm/rad	0,57	1,3	2,3	4,4	9,8
	θ_1	$\times10^{-4}$ rad	5,8	4,9	5,2	5,5	5,5
	θ_2	$\times10^{-4}$ rad	16	12	15,4	15,7	15,7
80 - 120	K_1	$\times10^4$ Nm/rad	0,47	1	1,6	3,1	6,7
	K_2	$\times10^4$ Nm/rad	0,61	1,4	2,5	5,0	11
	K_3	$\times10^4$ Nm/rad	0,71	1,6	2,9	5,7	12
	θ_1	$\times10^{-4}$ rad	4,1	3,9	4,4	4,4	4,4
	θ_2	$\times10^{-4}$ rad	12	9,7	11,3	11,1	11,6

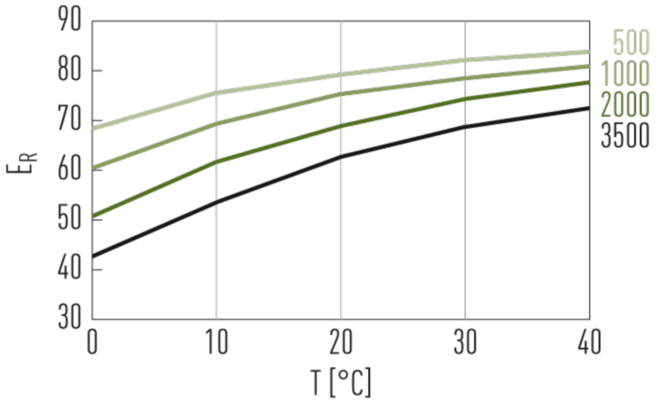
Note: The values are for reference purposes only. The lower limit is 20% below the value in this table.

4.6.2 Efficiency E_R

1. Rated torque E_R

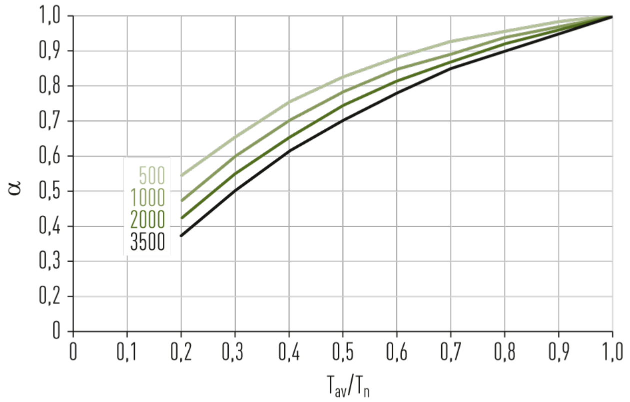
The efficiency of DATORKER® strain wave gears changes depending on the specification, ratio, operating conditions (speed/load) and lubrication (lubricant type/amount).

Model: 14-32, ratio: 50, 80, 100, 120



2. Correction coefficient α

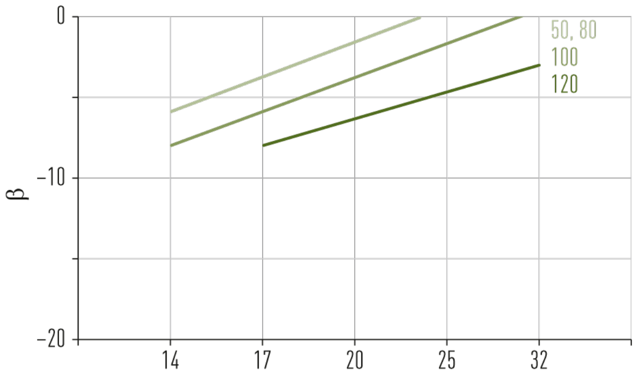
Coefficient for correcting efficiency α according to load torque



3. Correction coefficient β

Coefficient for correcting efficiency β according to specification

Efficiency = α x_{ER}



4.6.3 Idling operating torque

The idling operating torque is the torque required to drive the DATORKER® strain wave gear input (high speed end) after more than 2 hours at an input speed of 2.000 rpm at an average ambient temperature of 25 °C without load.

Unit: cNm

Reduction ratio	Input speed	Model				
		14	17	20	25	32
50	500 rpm	3,9	8	11,6	18,2	31
	1.000 rpm	4,7	9,8	14,6	22,2	38
	2.000 rpm	5,8	12,8	19,6	28,2	53
	3.500 rpm	7	14,8	22,6	35,2	68
80	500 rpm	3	6,6	9,5	14,8	24,5
	1.000 rpm	3,8	8,4	12,5	18,8	31,5
	2.000 rpm	4,9	11,4	17,5	24,8	46,5
	3.500 rpm	6,1	13,4	20,5	31,8	61,5
100	500 rpm	2,8	6,2	9	14	23
	1.000 rpm	3,6	8	12	18	30
	2.000 rpm	4,7	11	17	24	45
	3.500 rpm	5,9	13	20	31	60
120	500 rpm	–	6	8,6	13,4	21,9
	1.000 rpm	–	7,8	11,6	17,4	28,9
	2.000 rpm	–	10,8	16,6	23,4	43,9
	3.500 rpm	–	12,8	19,6	30,4	58,9

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

4.6.4 Tightening torque of the installation screw

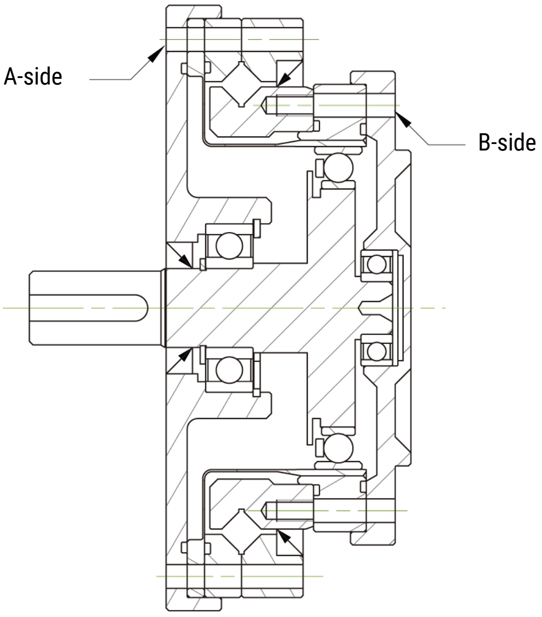


Table 4.55: Mounting screw tightening torque on the A-side

Element	Model	14	17	20	25	32
Number of screws		8	12	12	12	12
Screw size		M3	M3	M3	M4	M5
Installation of PCD screws	mm	64	74	84	102	132
Screw tightening torque	Nm	2	2	2	4,5	9

Table 4.56: Mounting screw tightening torque on the B-side

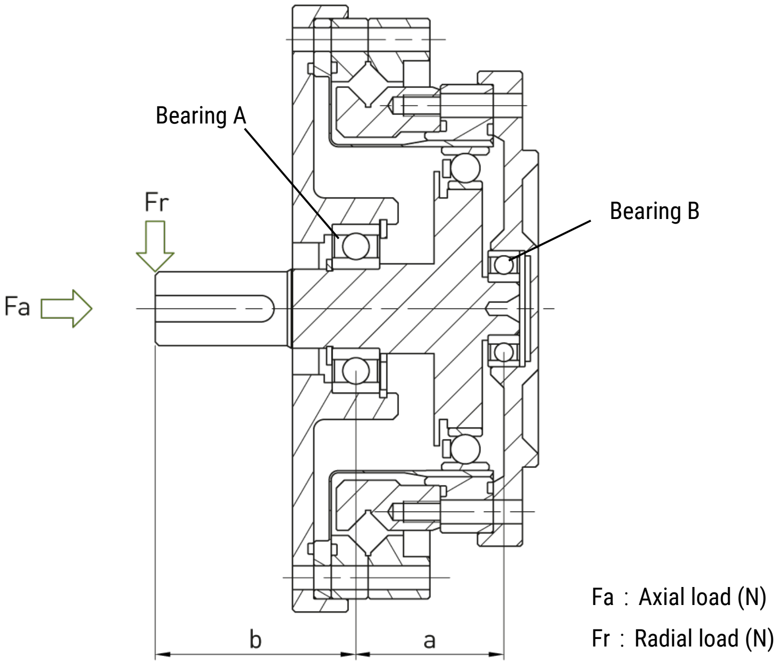
Element	Model	14	17	20	25	32
Number of screws		8	16	16	16	16
Screw size		M3	M3	M3	M4	M5
Installation of PCD screws	mm	44	54	62	77	100
Screw tightening torque	Nm	2	2	2	4,5	9

Note:

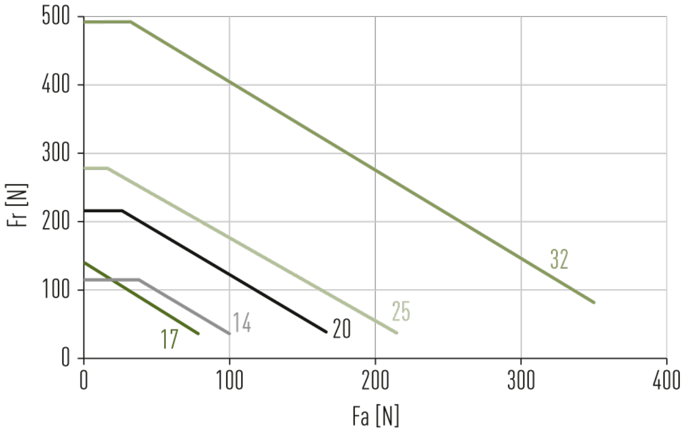
1. Recommended tightening torques for 12,9 DIN EN ISO 4762 mounting bolts DIN912 according to VDI 2230 for µK = µG = 0,125
2. Screw-in depth at least 2 x thread diameter

4.6.5 Permissible input load

The hollow shaft is supported by two deep groove bearings. To ensure proper performance of the gearbox, please confirm the load on the hollow shaft. As shown below:



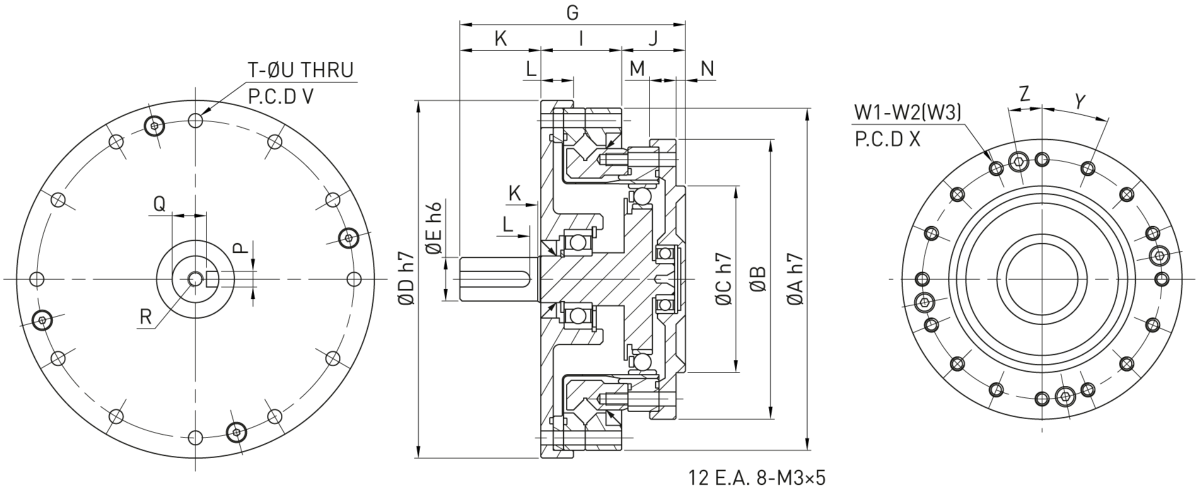
The following figure shows the average input speed of 2.000 rpm and the basic nominal service life L10 = 7.000 hours.

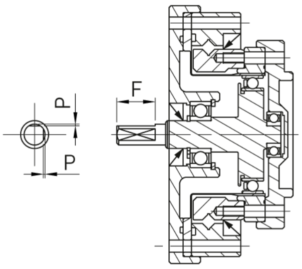


Fr Radial load (N)
Fa Axial load (N)

Element Model	Bearing A		Bearing B		a (mm)	b (mm)	Maximum radial load Fr (N)
	Dynamic load C$_{dyn}$ (kN)	Static load C$_0$ (kN)	Dynamic load C$_{dyn}$ (kN)	Static load C$_0$ (kN)			
14	2,24	0,91	1,08	0,43	20	14	110
17	2,7	1,27	1,61	0,71	23,5	21	135
20	4,35	2,26	2,24	0,91	26,5	23,3	210
25	5,6	2,83	2,7	1,27	28	28	270
32	9,4	5	4,35	2,26	36	27	490

4.6.6 DSH-AJ type, size chart





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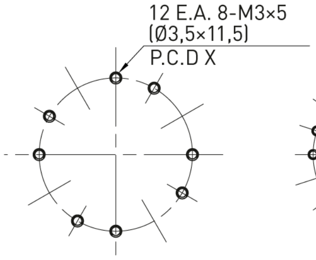

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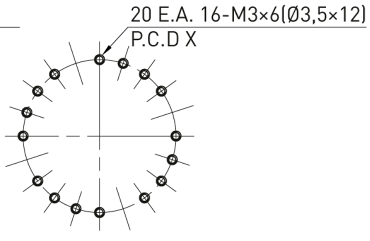

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Unit: mm

Model Labelling	14	17	20	25	32
ØA h7	70	80	90	110	142
ØB	54	64	75	90	115
ØC h7	36	45	50	60	85
ØD h7	74	84	95	115	147
ØE h6	6	8	10	14	14
ØF	11	12	16,5	22,5	22,5
G	50,5	56	63,5	72,5	84,5
H	15	17	21	26	26
I	20,5	23	25	26	32
J	15	16	17,5	20,5	26,5
K	14	16	20	25	25
L	9	10	10,5	10,5	12
M	8	8,5	9	8,5	9,5
N	2,5	3	3	3	5
P	0,5	0,5	$3^{-0,004}_{-0,029}$	$5^{0}_{-0,03}$	$5^{0}_{-0,03}$
Q	–	–	8,2	11	11
R	–	–	M3 x 6DP	M5 x 10DP	M5 x 10DP
T	8	12	12	12	12
ØU	3,5	3,5	3,5	4,5	5,5
V (P.C.D)	64	74	84	102	132
W1	12 E.A. 8	20 E.A. 16	16	16	16
W2	M3 x 5DP	M3 x 6DP	M3 x 6DP	M4 x 7DP	M5 x 8DP
W3	Ø3,5 x 11,5DP	Ø3,5 x 12DP	Ø3,5 x 13,5DP	Ø4,5 x 15,5DP	Ø5,5 x 20,5DP
X (P.C.D)	44	54	62	77	100
Y (Degree)	30°	18°	22,5°	22,5°	22,5°
Z (Degree)	30°	18°	11,25°	11,25°	11,25°
Moment of Inertia (×10^{-4} kgm^{2})	0,025	0,059	0,137	0,32	1,2
Weight (kg)	0,66	0,94	1,38	2,1	4,4

4.7 DSC-PO-M type

4.7.1 Technical data

Table 4.57: Valuation table

Model	Reduction	Nominal torque at 2.000 rpm 1)	Peak torque at start/stop 2)	Maximum average torque 3)	Collision torque 4)	Maximum input speed	Maximum average speed
		Nm	Nm	Nm	Nm	rpm	rpm
14	50	5,4	18	6,9	35	8.500	3.500
	80	7,8	23	11	47		
	100	7,8	28	11	54		
17	50	16	34	26	70	7.300	3.500
	80	22	43	27	87		
	100	24	54	39	110		
	120	24	54	39	86		
20	50	25	56	34	98	6.500	3.500
	80	34	74	47	127		
	100	40	82	49	147		
	120	40	87	49	147		
25	50	39	98	55	186	5.600	3.500
	80	63	137	87	255		
	100	67	157	108	284		
	120	67	167	108	304		
32	50	76	216	108	382	4.800	3.500
	80	118	304	167	568		
	100	137	333	216	647		
	120	137	353	216	686		

1) Permissible rated torque

2) Permissible maximum torque

3) Permissible average torque

4) Permissible maximum value of impact

Table 4.58: Crossed roller bearing specifications

Model	Pitch circle diameter of roller	Offset amount	Basic load ratings		Permissible moment load	Moment rigidity
	Dpw	R	Dynamic load C	Static load Co		
	m	m	kN	kN	Nm	$\times 10^4$ Nm/rad
14	0,0465	0,014	8,25	11,4	73	7,9
17	0,059	0,014	10,7	14,8	114	13,7
20	0,070	0,016	21,0	27,0	172	24,0
25	0,088	0,018	21,8	35,8	254	39,2
32	0,114	0,02	34,5	59	578	120,3

Table 4.59: Accuracy of angular transmission

Reduction ratio	Model	14	17	20	25	32
50 - 120	×10^{-4} rad	4,4	4,4	2,9	2,9	2,9

Table 4.60: Hysteresis loss

Reduction ratio	Model	14	17	20	25	32
50	×10^{-4} rad	5,8	5,8	5,8	5,8	5,8
80 – 120	×10^{-4} rad	2,9	2,9	2,9	2,9	2,9

Table 4.61: Starting torque (unit: cNm)

Model Reduction ratio	14	17	20	25	32
50	4,1	6,1	7,8	15	31
80	2,8	4	4,9	9,2	19
100	2,5	3,4	4,3	8	18
120	—	3,1	3,8	7,3	15

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.62: Reverse starting torque (unit Nm)

Model Reduction ratio	14	17	20	25	32
50	1,6	3	4,7	9	18
80	1,6	3	4,8	9,1	19
100	1,8	3,3	5,1	9,8	20
120	—	3,5	5,5	11	22

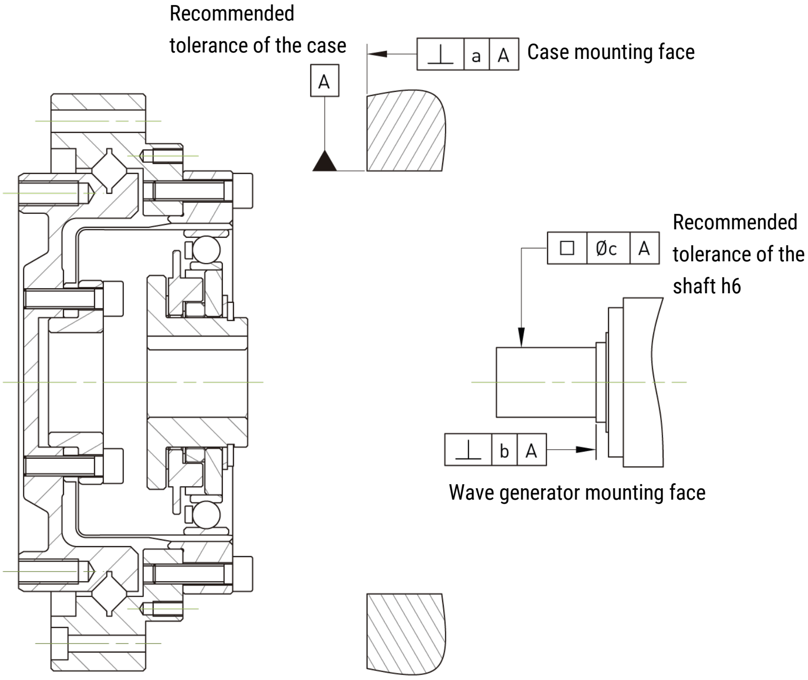
Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.63: Torsional rigidity

Reduction ratio		Model	14	17	20	25	32
T_1		Nm	2,0	3,9	7,0	14	29
T_2		Nm	6,9	12	25	48	108
50	K_1	$\times 10^4$ Nm/rad	0,34	0,81	1,3	2,5	5,4
	K_2	$\times 10^4$ Nm/rad	0,47	1,1	1,8	3,4	7,8
	K_3	$\times 10^4$ Nm/rad	0,57	1,3	2,3	4,4	9,8
	θ_1	$\times 10^{-4}$ rad	5,8	4,9	5,2	5,5	5,5
	θ_2	$\times 10^{-4}$ rad	16	12	15,4	15,7	15,7
80 - 120	K_1	$\times 10^4$ Nm/rad	0,47	1	1,6	3,1	6,7
	K_2	$\times 10^4$ Nm/rad	0,61	1,4	2,5	5,0	11
	K_3	$\times 10^4$ Nm/rad	0,71	1,6	2,9	5,7	12
	θ_1	$\times 10^{-4}$ rad	4,1	3,9	4,4	4,4	4,4
	θ_2	$\times 10^{-4}$ rad	12	9,7	11,3	11,1	11,6

Note: The values are for reference purposes only. The lower limit is 20% below the value in this table.

4.7.2 Installation accuracy



Unit: mm

Model Labelling	14	17	20	25	32
a	0,011	0,015	0,017	0,024	0,026
b	0,017	0,020	0,020	0,024	0,024
	(0,008)	(0,010)	(0,010)	(0,012)	(0,012)
c	0,030	0,034	0,044	0,047	0,050
	(0,016)	(0,018)	(0,019)	(0,022)	(0,022)

Note: The value in () is the value of the shaft generator (without oldham coupling).

4.7.3 Installation bolt tightening torque

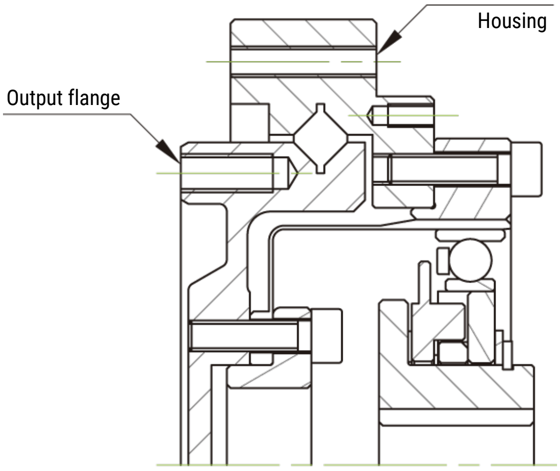


Table 4.64: A side mounting bolt tightening torque

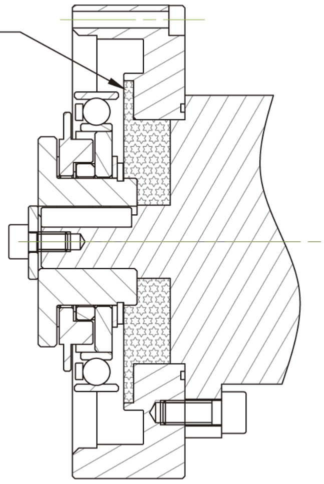
Element	Model	14	17	20	25	32
Number of bolts		12	12	12	12	12
Bolts size		M3	M4	M4	M5	M6
Installation of Bolts PCD	mm	43	52	62	76	96
Bolt tightening torque	Nm	2,3	5,1	5,1	10	17,4

Table 4.65: B side mounting bolt tightening torque

Element	Model	14	17	20	25	32
Number of bolts		8	12	12	12	12
Bolts size		M3	M3	M3	M4	M5
Installation of Bolts PCD	mm	68	80	89	105	135
Bolt tightening torque	Nm	2,3	2,3	2,3	5,1	10

Note:
1. Recommended tightening torques for the 12,9 DIN EN ISO 4762 fastening bolts DIN912 in accordance with VDI 2230 for $\mu K = \mu G = 0{,}125$
2. Bolt-in depth at least 2 x thread diameter

4.7.4 Lubrication



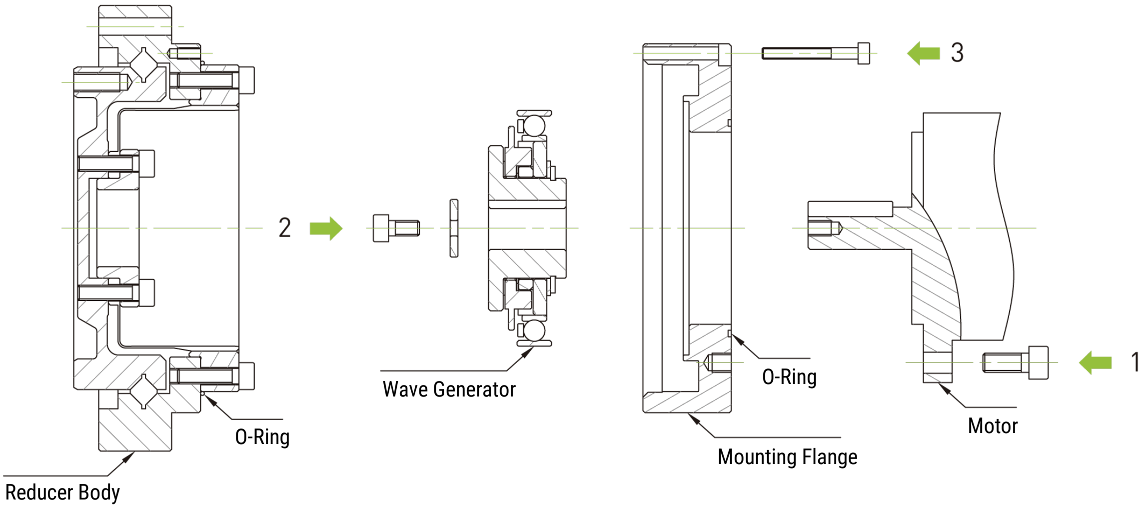
Fill on the inside of the flange based on the reference value

Unit: g

Model	14	17	20	25	32
Standard grease quantity	5,5	10	16	40	60

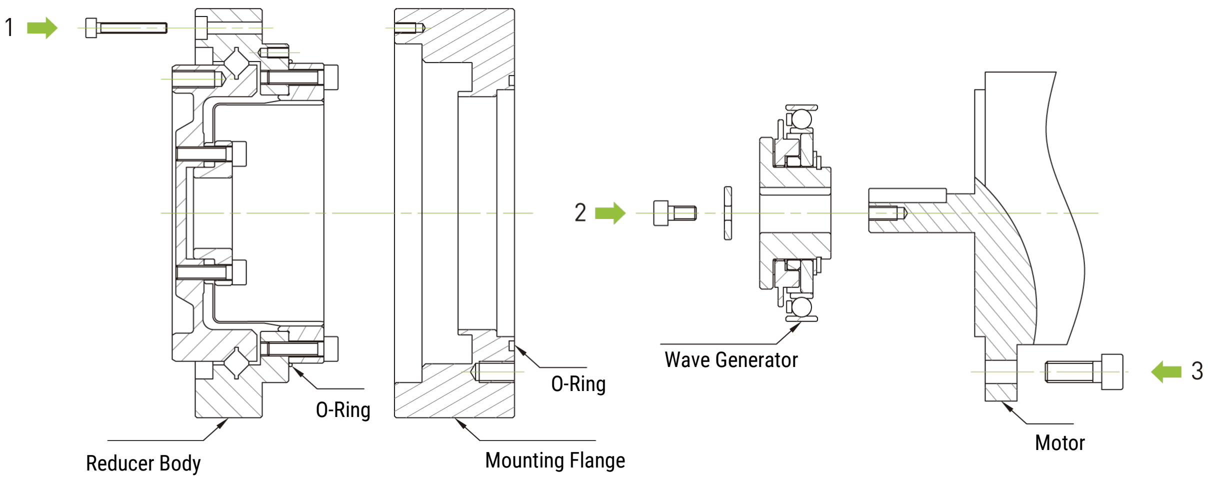
4.7.5 Installation procedure

Mounting flange type A



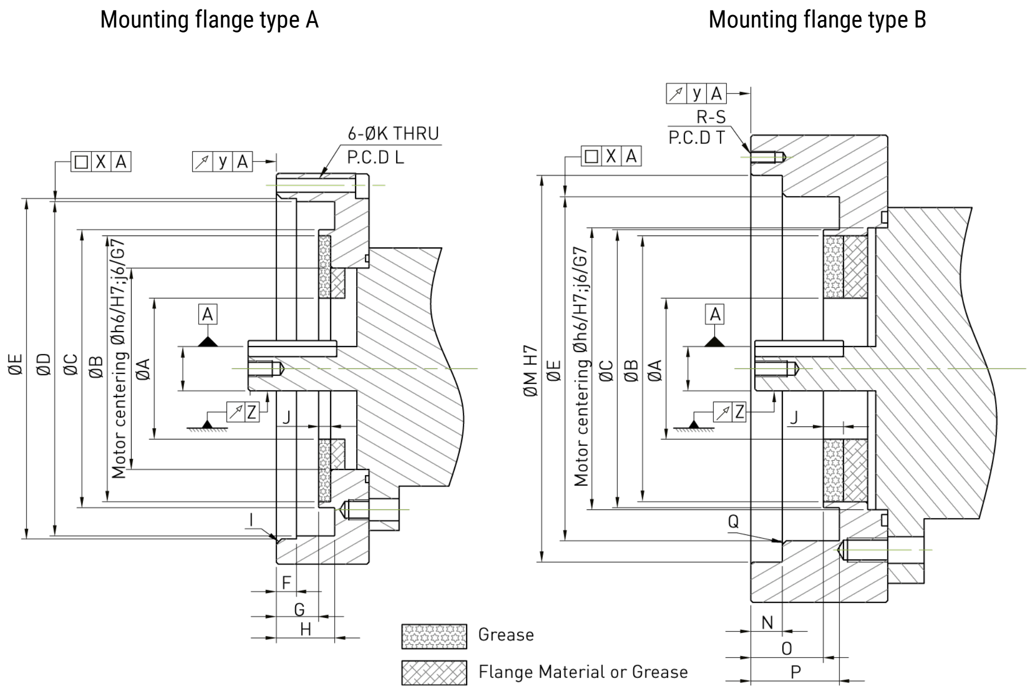
- 1. Install the mounting flange on the motor mounting surface
- 2. Install the wave generator on the motor output shaft
- 3. Install the reducer body

Mounting flange type B



- 1. Install the reducer body on the mounting flange surface
- 2. Install the wave generator on the motor output shaft
- 3. Install the mounting flange on the motor mounting surface

4.7.6 Motor installation

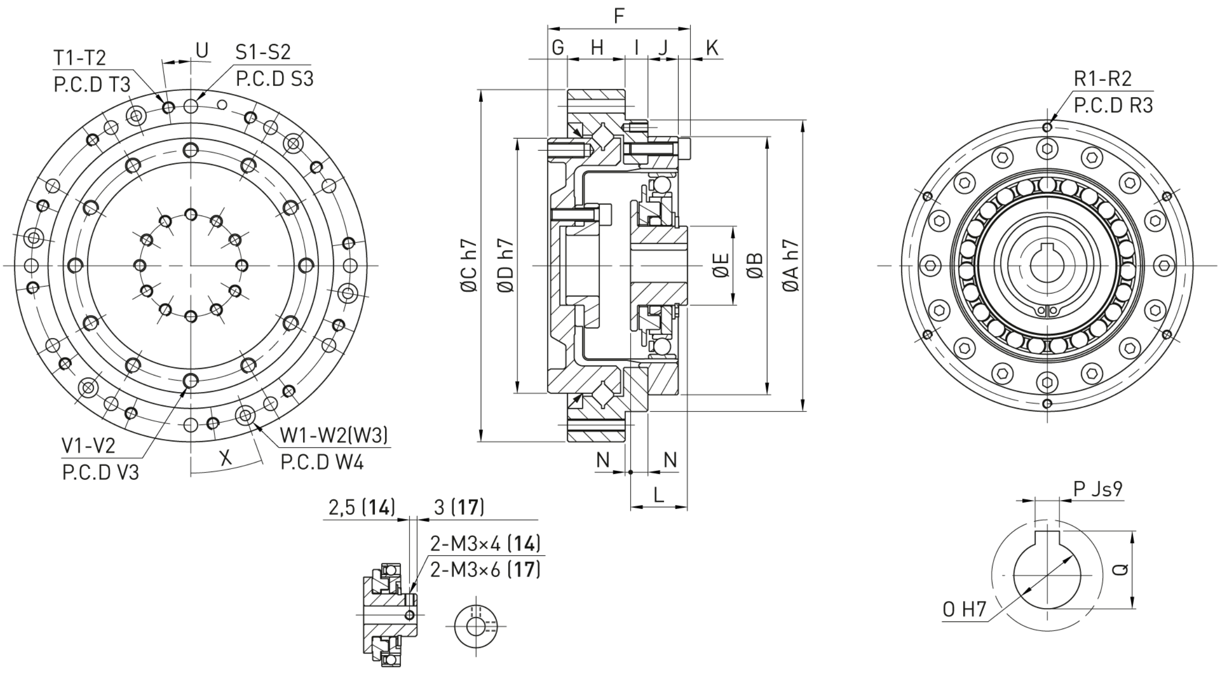

Mounting flange type A

Mounting flange type B

Model Labelling	14	17	20	25	32
ØA	16	26	30	37	37
ØB	36,5	47	53	66	86
ØC	$37,5\,^{0}_{-0,1}$	$48\,^{0}_{-0,1}$	$55\,^{0}_{-0,1}$	$69\,^{0}_{-0,1}$	$90,5\,^{0}_{-0,1}$
ØD	$50\,^{+0,027}_{0}$	$60\,^{+0,034}_{0}$	$70\,^{+0,036}_{0}$	$85\,^{+0,050}_{0}$	$110\,^{+0,055}_{0}$
ØE	$50,4\,^{+0,1}_{0}$	$60,4\,^{+0,1}_{0}$	$70,4\,^{+0,1}_{0}$	$85,4\,^{+0,1}_{0}$	$110,4\,^{+0,1}_{0}$
F	2,5	3	3	5	6,5
G	$6,5\,^{+0,1}_{0}$	$7\,^{+0,1}_{0}$	$8\,^{+0,1}_{0}$	$10,5\,^{+0,1}_{0}$	$14,5\,^{+0,1}_{0}$
H	$9,5\,^{+0,1}_{0}$	$10\,^{+0,1}_{0}$	$11\,^{+0,1}_{0}$	$14,5\,^{+0,1}_{0}$	$19,5\,^{+0,1}_{0}$
I	$1\,^{0}_{-0,1}$	$1,3\,^{0}_{-0,1}$	$1,3\,^{0}_{-0,1}$	$1,3\,^{0}_{-0,1}$	$1,3\,^{0}_{-0,1}$
J	1	1,5	1,5	1,5	2
ØK	2,9	3,4	3,4	3,4	4,5
L(P.C.D)	55	66	76	91	118
ØM	60	72	82	96	125
N	$4,3\,^{+0,1}_{0}$	$6,3\,^{+0,1}_{0}$	$6,9\,^{+0,1}_{0}$	$7,8\,^{+0,1}_{0}$	$9,8\,^{+0,1}_{0}$
O	$10,5\,^{+0,1}_{0}$	$13\,^{+0,1}_{0}$	$14,6\,^{+0,1}_{0}$	$18\,^{+0,1}_{0}$	$24\,^{+0,1}_{0}$
P	$13,5\,^{+0,1}_{0}$	$16\,^{+0,1}_{0}$	$17,6\,^{+0,1}_{0}$	$22\,^{+0,1}_{0}$	$29\,^{+0,1}_{0}$
Q	$0,7\,^{0}_{-0,1}$	$1\,^{0}_{-0,1}$	$1\,^{0}_{-0,1}$	$1\,^{0}_{-0,1}$	$1\,^{0}_{-0,1}$
R	4	6	6	6	6
S	M2,5	M2,5	M2,5	M3	M4
T (P.C.D)	68	78	88	105	135
X	0,030	0,034	0,044	0,047	0,050
Y	0,030	0,040	0,040	0,040	0,040
Z	0,030 (0,016)	0,034 (0,018)	0,044 (0,019)	0,047 (0,022)	0,050 (0,022)

Note: The value in ( ) is the value of the wave generator (without oldham coupling).

4.7.7 DSC-PO-M type, size chart



14/17

20/25/32

Labelling / Model	14	17	20	25	32
ØA h7	60	72	82	96	125
ØB	$50_{-0{,}015}^{+0{,}01}$	$60_{-0{,}02}^{+0{,}01}$	$70_{-0{,}02}^{+0{,}01}$	$85_{-0{,}025}^{+0{,}01}$	$110_{-0{,}025}^{+0{,}01}$
ØC h7	78	88	98	116	148
ØD h7	49	59	69	84	110
ØE	14	18	21	26	26
F	30	34	40	47	59
G	5	5	5,7	6,5	6,5
H	12	13,5	17,2	19	24
I	4	6	6,6	7,5	9,5
J	6	6,5	7,5	10	14
K	3	3	3	4	5
L	$17{,}6_{-0{,}1}^{0}$	$19{,}5_{-0{,}1}^{0}$	$20{,}1_{-0{,}1}^{0}$	$20{,}2_{-0{,}1}^{0}$	$22_{-0{,}1}^{0}$
M (flange type A)	$6{,}6_{0}^{+0{,}4}$	$7_{0}^{+0{,}45}$	$8{,}1_{0}^{+0{,}5}$	$7{,}2_{0}^{+0{,}5}$	$6_{0}^{+0{,}55}$
N (flange type B)	$2{,}6_{0}^{+0{,}4}$	$1_{0}^{+0{,}45}$	$1{,}5_{0}^{+0{,}5}$	$0{,}3_{0}^{+0{,}5}$	$3{,}5_{0}^{+0{,}55}$
ØO H7	6	8	9	11	14
P Js9	–	–	3	4	5
Q	–	–	10,4	12,8	16,3
R1	6	6	6	6	6
R2	M2,5 x 4DP	M3 x 6DP	M3 x 6DP	M3 x 6DP	M4 x 8DP
R3 (P.C.D)	55	66	76	91	118
S1	8	12	12	12	12
ØS2	3,4	3,4	3,4	4,5	5,5
S3 (P.C.D)	68	80	89	105	135

Model Labelling	14	17	20	25	32
T1	8	12	12	12	12
T2	M3 x 7,8DP	M3	M3	M4	M5
T3 (P.C.D)	68	80	89	105	135
U (Degree)	15°	10°	10°	8°	10°
V1	12	12	12	12	12
V2	M3 x 6DP	M4 x 8DP	M4 x 8DP	M5 x 10DP	M6 x 10DP
V3 (P.C.D)	43	52	62	76	96
W1	4	6	6	6	6
W2	Ø5,5 x 3DP	Ø5,5 x 3DP	Ø5,5 x 3DP	Ø6,5 x 3,4DP	Ø8 x 4,4DP
ØW3	2,9	2,9	2,9	3,4	4,5
W4 (P.C.D)	68	78	88	105	135
X (Degree)	30°	20°	20°	20°	20°
Moment of Inertia ($\times 10^{-4}$ kgm^2)	0,033	0,079	0,193	0,413	1,69
Weight (kg)	0,54	0,79	1,30	1,95	3,90

4.8 DSC-AJ-M type

4.8.1 Technical data

Table 4.66: Valuation table

Model	Reduction	Nominal torque at 2.000 rpm [1]	Peak torque at start/stop [2]	Maximum average torque [3]	Collision torque [4]	Maximum input speed	Maximum average speed
		Nm	Nm	Nm	Nm	rpm	rpm
14	50	5,4	18	6,9	35	8.500	3.500
	80	7,8	23	11	47		
	100	7,8	28	11	54		
17	50	16	34	26	70	7.300	3.500
	80	22	43	27	87		
	100	24	54	39	110		
	120	24	54	39	86		
20	50	25	56	34	98	6.500	3.500
	80	34	74	47	127		
	100	40	82	49	147		
	120	40	87	49	147		
25	50	39	98	55	186	5.600	3.500
	80	63	137	87	255		
	100	67	157	108	284		
	120	67	167	108	304		
32	50	76	216	108	382	4.800	3.500
	80	118	304	167	568		
	100	137	333	216	647		
	120	137	353	216	686		

[1] Permissible rated torque

[2] Permissible maximum torque

[3] Permissible average torque

[4] Permissible maximum value of impact

Table 4.67: Crossed roller bearing specifications

Model	Pitch circle diameter of roller	Offset amount	Basic load ratings		Permissible moment load	Moment rigidity
	Dpw	R	Dynamic load C	Static load Co		
	m	m	kN	kN	Nm	$\times 10^4$ Nm/rad
14	0,0465	0,014	8,25	11,4	73	7,9
17	0,059	0,014	10,7	14,8	114	13,7
20	0,070	0,016	21	27	172	24
25	0,088	0,018	21,8	35,8	254	39,2
32	0,114	0,02	34,5	59	578	120,3

Table 4.68: Accuracy of angular transmission

Model Reduction ratio		14	17	20	25	32
50 - 120	$\times 10^{-4}$ rad	4,4	4,4	2,9	2,9	2,9

Table 4.69: Hysteresis loss

Model Reduction ratio		14	17	20	25	32
50	$\times 10^{-4}$ rad	5,8	5,8	5,8	5,8	5,8
80 – 120	$\times 10^{-4}$ rad	2,9	2,9	2,9	2,9	2,9

Table 4.70: Starting torque (unit: cNm)

Model Reduction ratio	14	17	20	25	32
50	5,7	9,7	14	22	41
80	4,4	7,2	11	15	29
100	3,7	6,5	9,9	14	27
120	—	6,2	9,3	13	24

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.71: Reverse starting torque (unit Nm)

Model Reduction ratio	14	17	20	25	32
50	3,4	5,8	8,4	13	25
80	4,2	6,9	10	15	28
100	4,5	7,8	12	17	33
120	—	8,9	13	19	34

Note: The values in this table vary depending on the working conditions and are for reference purposes only. The upper limit is 20% above the value in this table.

Table 4.72: Torsional rigidity

Reduction ratio		Model	14	17	20	25	32
T_1		Nm	2,0	3,9	7,0	14	29
T_2		Nm	6,9	12	25	48	108
50	K_1	$\times 10^4$ Nm/rad	0,34	0,81	1,3	2,5	5,4
	K_2	$\times 10^4$ Nm/rad	0,47	1,1	1,8	3,4	7,8
	K_3	$\times 10^4$ Nm/rad	0,57	1,3	2,3	4,4	9,8
	θ_1	$\times 10^{-4}$ rad	5,8	4,9	5,2	5,5	5,5
	θ_2	$\times 10^{-4}$ rad	16	12	15,4	15,7	15,7
80 - 120	K_1	$\times 10^4$ Nm/rad	0,47	1	1,6	3,1	6,7
	K_2	$\times 10^4$ Nm/rad	0,61	1,4	2,5	5,0	11
	K_3	$\times 10^4$ Nm/rad	0,71	1,6	2,9	5,7	12
	θ_1	$\times 10^{-4}$ rad	4,1	3,9	4,4	4,4	4,4
	θ_2	$\times 10^{-4}$ rad	12	9,7	11,3	11,1	11,6

Note: The values are for reference purposes only. The lower limit is 20% below the value in this table.

4.8.2 Tightening torque of the installation screw

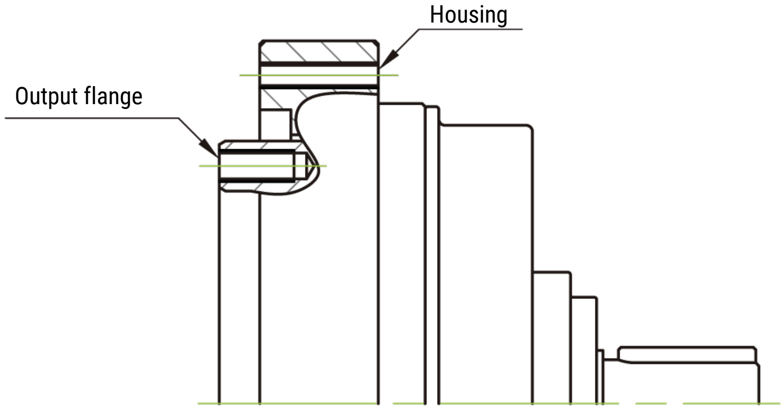


Table 4.73: Mounting screw tightening torque on the A-side

Element	Model	14	17	20	25	32
Number of screws		12	12	12	12	12
Screw size		M3	M4	M4	M5	M6
Installation of PCD screws	mm	43	52	62	76	96
Screw tightening torque	Nm	2,3	5,1	5,1	10	17,4

Table 4.74: Mounting screw tightening torque on the B-side

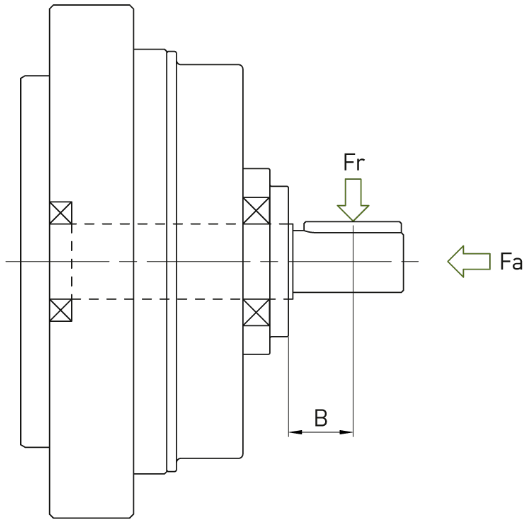
Element	Model	14	17	20	25	32
Number of screws		8	12	12	12	12
Screw size		M3	M3	M3	M4	M5
Installation of PCD screws	mm	68	80	89	105	135
Screw tightening torque	Nm	2,3	2,3	2,3	5,1	10

Note:

1. Recommended tightening torques for 12,9 DIN EN ISO 4762 mounting bolts DIN912 according to VDI 2230 for μK = μG = 0,125
2. Screw-in depth at least 2 x thread diameter

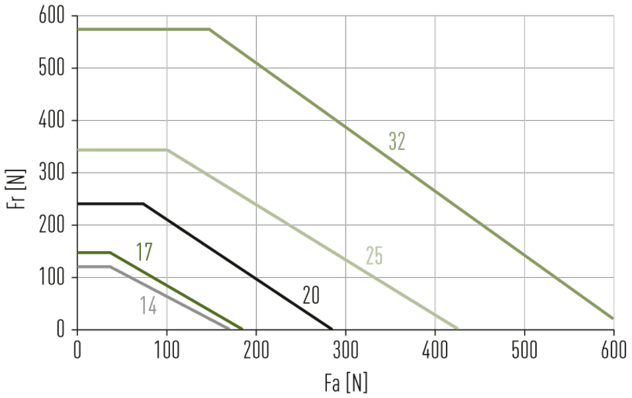
4.8.3 Permissible input load

To ensure proper performance of the reducer, please confirm the load applied to the input section. As shown below:



Fa : Axial load (N)
Fr : Radial load (N)

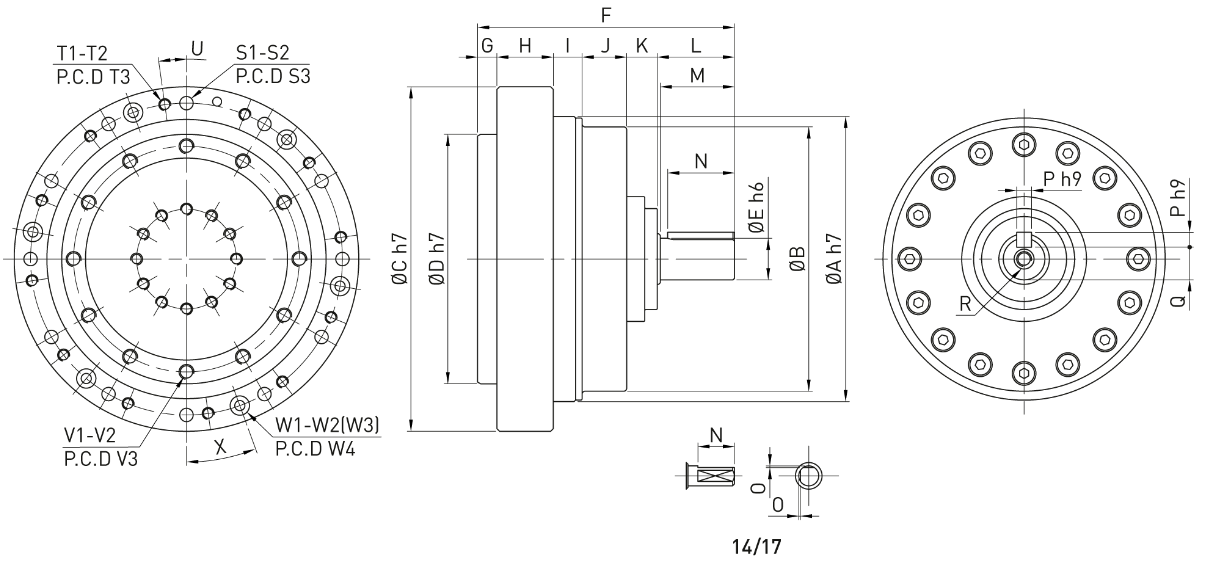
The following figure shows the average input speed of 2.000 rpm and the basic nominal service life L10 = 7.000 hours.



Fr Radial load (N)
Fa Axial load (N)

Element	Model	14	17	20	25	32
Offset (B)	mm	7	8	10	12,5	12,5
Maximum radial load (Fr)	N	118	145	232	342	567

4.8.4 DSH-AJ-M type, size chart



Unit: mm

Model Labelling	14	17	20	25	32
ØA h7	60	72	82	96	125
ØB	53	64	74	89	116
ØC h7	78	88	98	116	148
ØD h7	49	59	69	84	110
ØE h6	6	8	10	14	14
F	55	61,5	73,5	86,5	100,5
G	5	5	5,7	6,5	6,5
H	12	13,5	17,2	19	24
I	5,7	8,2	8,8	9,7	12,7
J	9,8	9,8	11,5	15	20
K	7,5	8	9,3	10,3	11,3
L	15	17	21	26	26
M	14	16	20	25	25
N	11	12	16,5	22,5	22,5
O	0,5	0,5	–	–	–
P h9	–	–	3	5	5
Q	–	–	$8,2\,^{0}_{-0,1}$	$11\,^{0}_{-0,1}$	$11\,^{0}_{-0,1}$
R	–	–	M3 x 6DP	M5 x 10DP	M5 x 10DP
S1	8	12	12	12	12
ØS2	3,4	3,4	3,4	4,5	5,5
S3 (P.C.D)	68	80	89	105	135
T1	8	12	12	12	12
T2	M3 x 7,8DP	M3	M3	M4	M5
T3 (P.C.D)	68	80	89	105	135
U (Degree)	15°	10°	10°	8°	10°

Model Labelling	14	17	20	25	32
V1	12	12	12	12	12
V2	M3 x 6DP	M4 x 8DP	M4 x 8DP	M5 x 10DP	M6 x 10DP
V3 (P.C.D)	43	52	62	76	96
W1	4	6	6	6	6
W2	Ø5,5 x 3DP	Ø5,5 x 3DP	Ø5,5 x 3DP	Ø6,5 x 3,4DP	Ø8 x 4,4DP
ØW3	2,9	2,9	2,9	3,4	4,5
W4 (P.C.D)	68	78	88	105	135
X (Degree)	30°	20°	20°	20°	20°
Moment of Inertia ($\times 10^{-4}$ kgm^2)	0,025	0,059	0,137	0,32	1,20
Weight (kg)	0,64	0,95	1,40	2,50	5,40

5 Installation notes

5.1 Precautions for installing the gearbox

- Check the evenness of the installation level and make sure it is not tilted.
- Check the housing mounting part and make sure that it does not interfere with the gearbox.
- When locking the bolt, tighten it temporarily to half the value of the specified torque in diagonal order before reaching the specified torque. Do not tighten the screws directly to the specified torque.
- The surface of the product is not treated with rust protection. If rust protection is required, please apply it to the surface.

5.2 Precautions for installing the shaft generator

- To avoid excessive force on the shaft generator bearing during installation, rotate the shaft generator and insert it carefully.
- If you choose a shaft generator without the coupling mechanism, please make sure that the concentricity and perpendicularity are within the recommended range (see “Mounting accuracy" of each series).

5.3 Other

- Make sure you use the specified grease in the product. (See chapter 6 Lubricant).
- Avoid overload operation.
- Note that the input speed should be within the specified range.
- Please use thread locker (the use of Loctite242 is recommended) in the threaded hole and avoid leakage of the thread locker.

5.4 Cause of problems

- Caster
- Insufficient lubricant
- Damaged bearing/gearbox components
- Poor connection with other interface components

5.5 If the following problems occur, please stop operation immediately and check the gearbox

- The internal temperature rises above 80 ℃or the ambient temperature above 40 ℃
- Abnormal noises or vibrations

6 Lubricant

HIWIN G11 special lubricating oil for the gearbox

- Terms of use and properties
    1. Load resistance
    2. Wear resistance
    3. Excellent shear stability
    4. Suitable for industrial robots, automation equipment, semiconductor equipment, machine tools, etc.
- Basic properties

Colour	Yellow
Base oil	Mineral oil
Texture improver	Lithium soap
Maintenance temp. (°C)	-20 - 130
Ambient operating temperature (°C)	0 – 40
NLGI class (0,1 mm)	265 – 295
Drip point (°C)	196

- Packaging specifications: 400 g hard tube packed
- Other
    1. The DATORKER® strain wave gear is pre-lubricated with HIWIN G11 grease and can be installed directly. With the exception of the DSC-CO type, due to the high speed and high torque, applying additional grease to each part according to the lubrication instructions in these assembly instructions is recommended.
    2. Do not mix and use it with other types of lubricants.
    3. For use under special conditions with high vibrations, in clean rooms, vacuums, at high or low temperatures, please contact us for a more detailed assessme