* The specifications in this catalog are subject to change without notice. Kindly inquire in advance before you design.
* Be sure to conduct full inspections and make sure on export procedures while exporting this product, as if its end user is involved with the military, its application connected to weapons manufacture, or in cases of certain export destinations, or it may fall under the Export restrictions stipulated by the Foreign Exchange and Foreign Trade Act of Japan.

NISSEI CORPORATION
https://www.nissei-gtr.global/en/

To order the products in this catalog, contact us as below

2022.11.0.0-3

High Stiffness Reducers DGH / DGF type

High Stiffness & High Torque/Flat, Lightweight Type

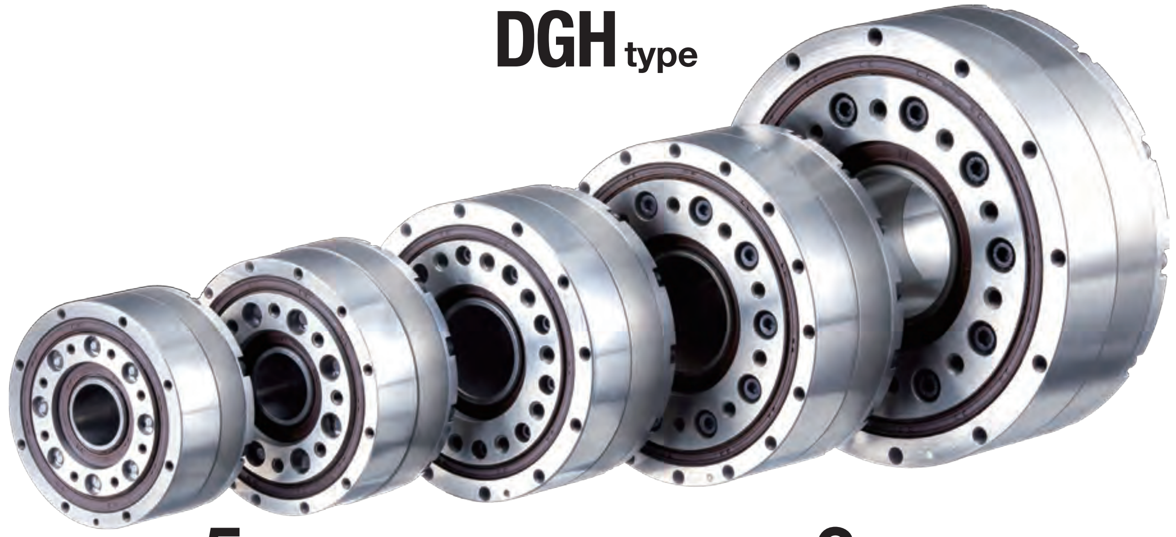
Compact but can achieve high precision with powerful drive

The Best choice for Robots and FA equipment. (other products in need of high-accuracy)

NISSEI CORPORATION

Large Hollow Shaft with High Stiffness and High Torque

DGH type



5 Frame Sizes
OD: 71mm / 81mm / 95mm / 110mm / 142mm

3 stage Reduction
1/19, 1/29, 1/59

Powerful drive, High resistance against loads and impacts.
Large hollow bore shaft is able to contain a thick cable.

High Stiffness Reducers DGH / DGF type

High Stiffness & High Torque/Flat, Lightweight Type

Flat and lightweight with input bearing inside

DGF type

3 Frame Sizes
OD: 71.5mm / 81.5mm / 91.5mm

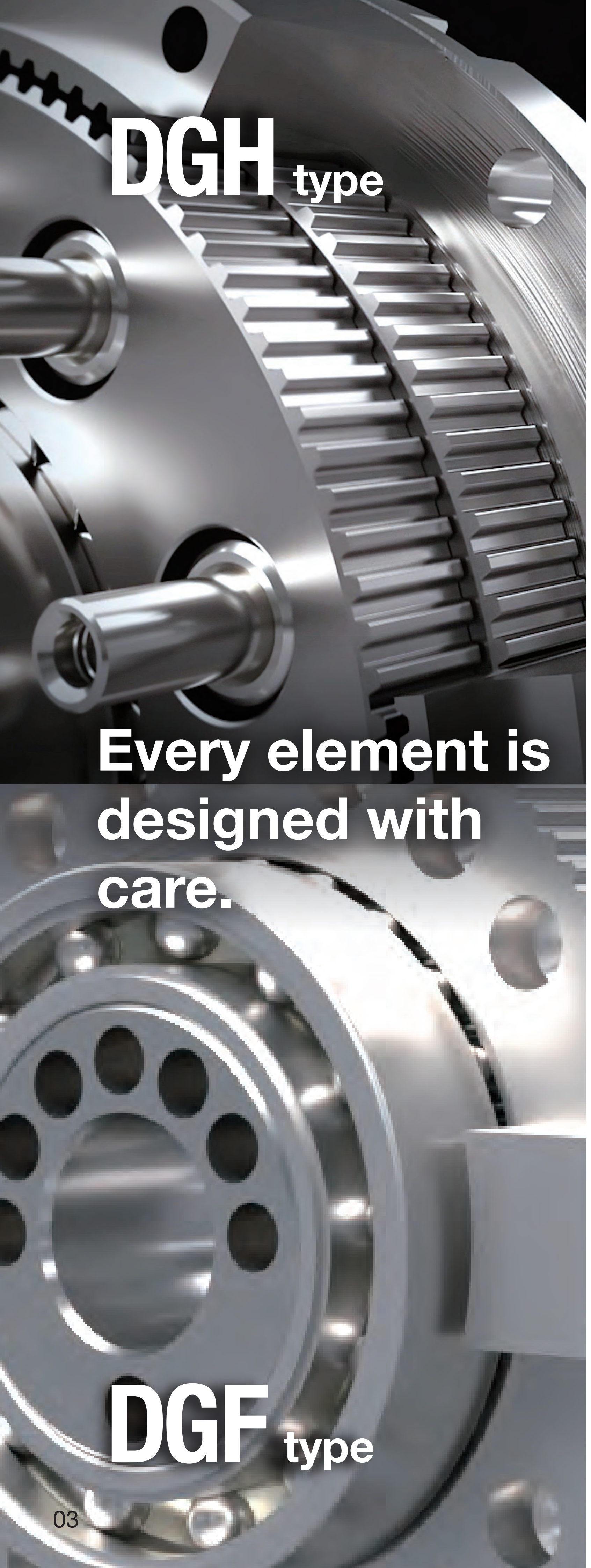
2 stage Reduction
1/50, 1/100

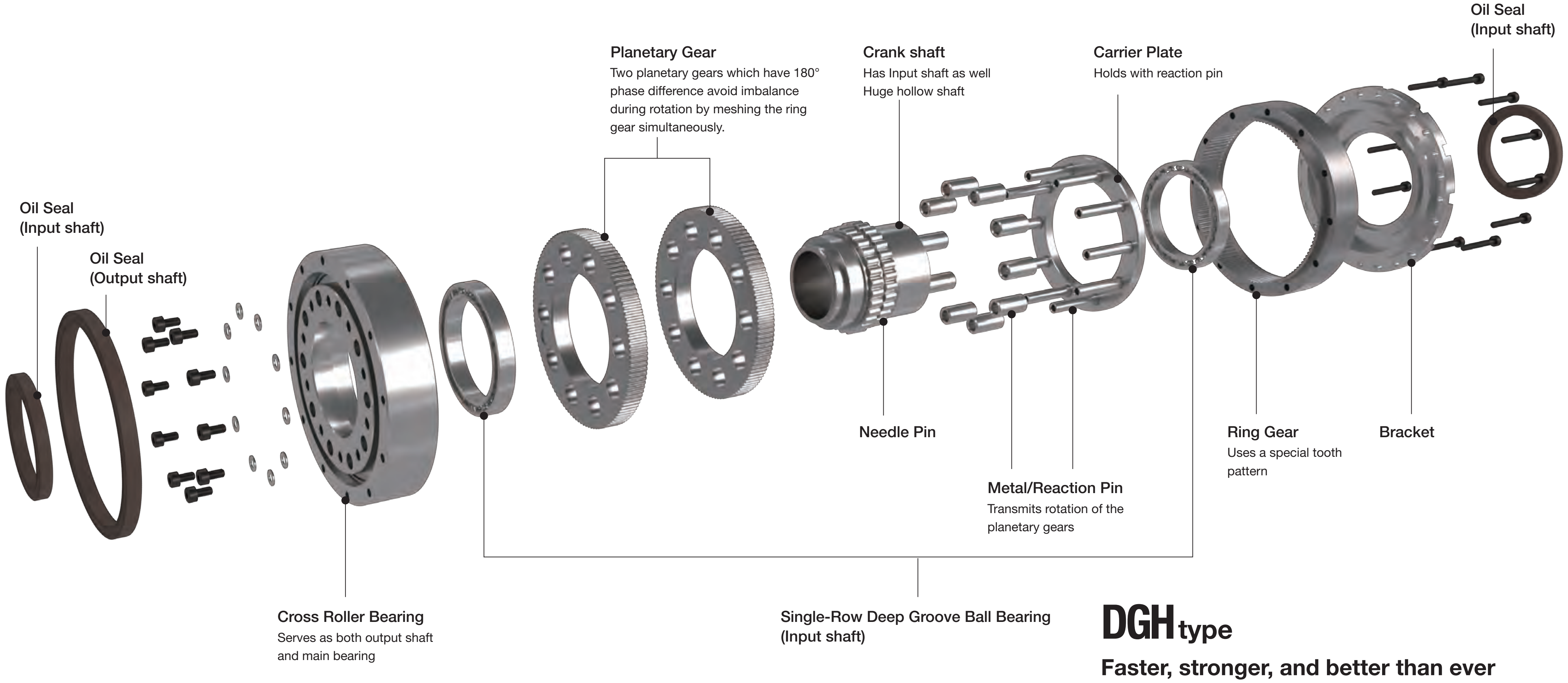
The planetary gear is inside the cross roller bearing, enabling thinness and lightweight.
It will give you greater freedom on equipment design.

In multiple ways, High accuracy drive.

The High Stiffness Reducer has functionality which can meet the needs for increased productivity as well provides efficiency from every angle.
For Fast and Powerful industrial robots or FA products.
Large hollow shaft enables great freedom in product design and composition.

We will provide greater performance than ever in various applications with High Stiffness Reducer.

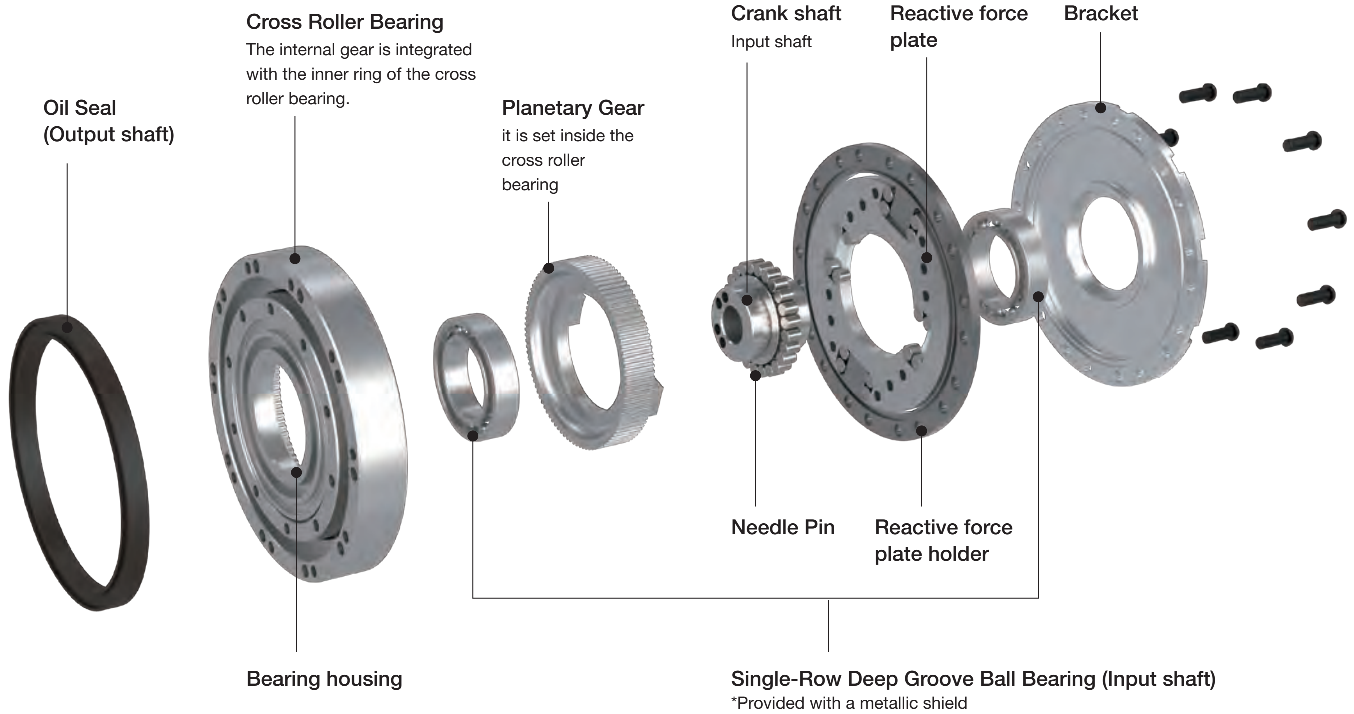




DGH type

Faster, stronger, and better than ever

- Adapting the cross roller bearing enables the compact design yet high moment stiffness. The allowable torque is constant because the gear meshing rate remains almost unchanged at any reduction ratio.
  High torque can be obtained even at a low reduction ratio.
- A large hollow bore shaft ensures smooth passing of a cable, shaft, etc. and helps improve the degree of freedom in designing robots or equipment.



DGF type

Making devices more compact

- Our reducer can contain input bearing inside even it is already very light and thin. Thus, users can feel how compact and light firmly when designing equipment

*Fill the reducer with our dedicated grease (sold separately).
The input shaft is not provided with an oil seal.

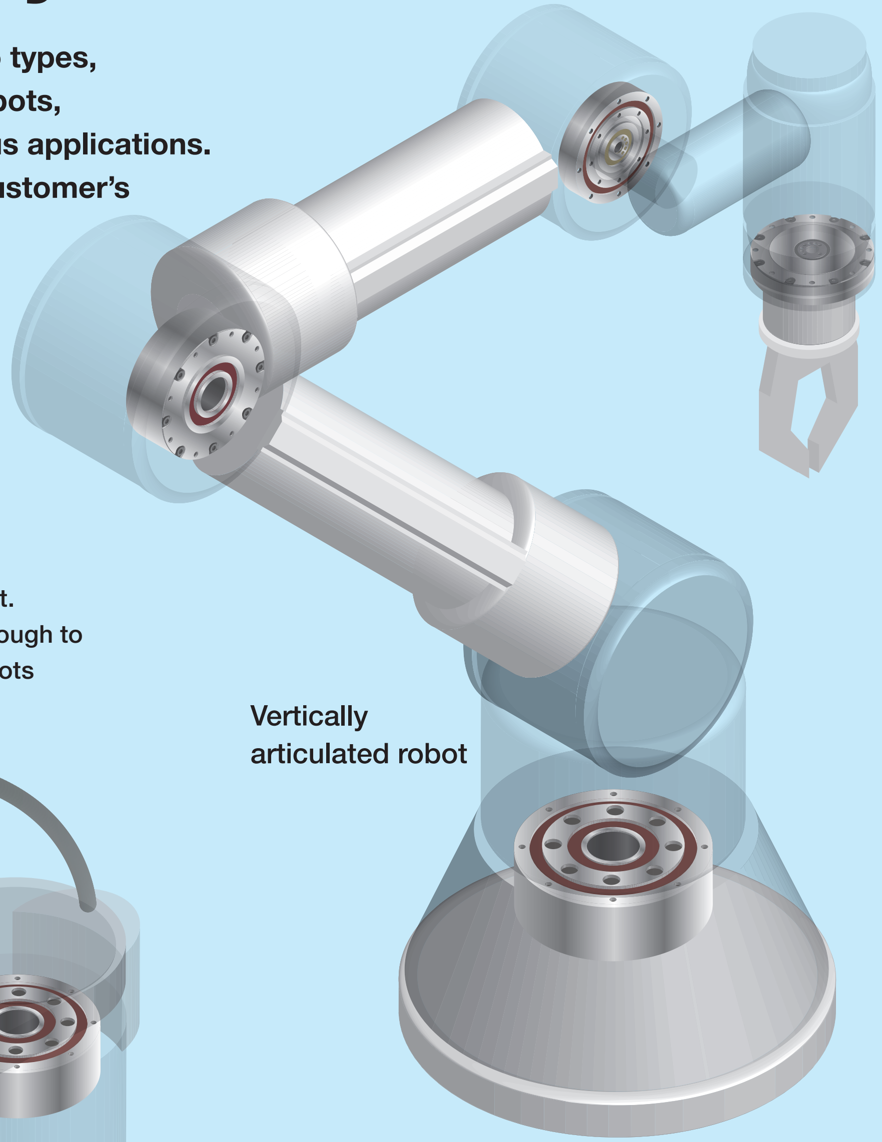
Best fit for wide variety of use

Choose optimum size from two types, DGH type and DGF type, for robots, FA equipment, and other various applications. Outstanding scalability meet customer's needs with high performance.

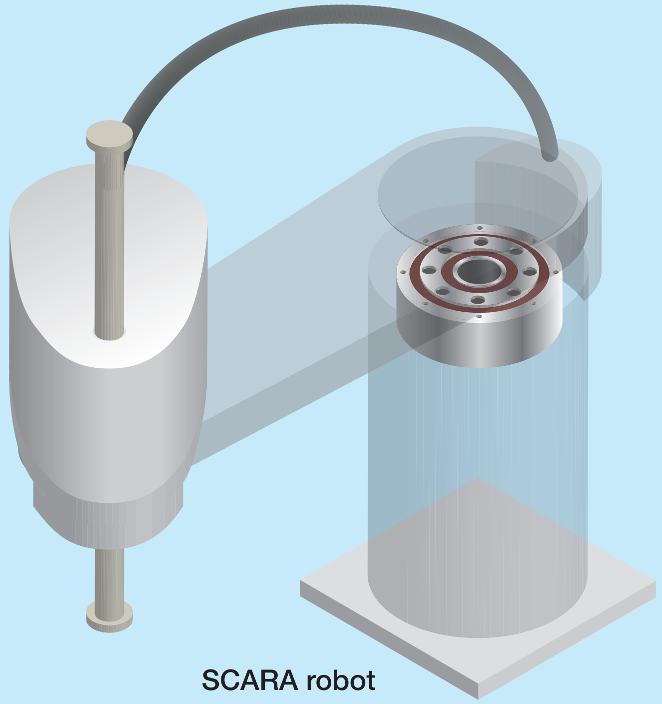
Application **01**

Industrial robots

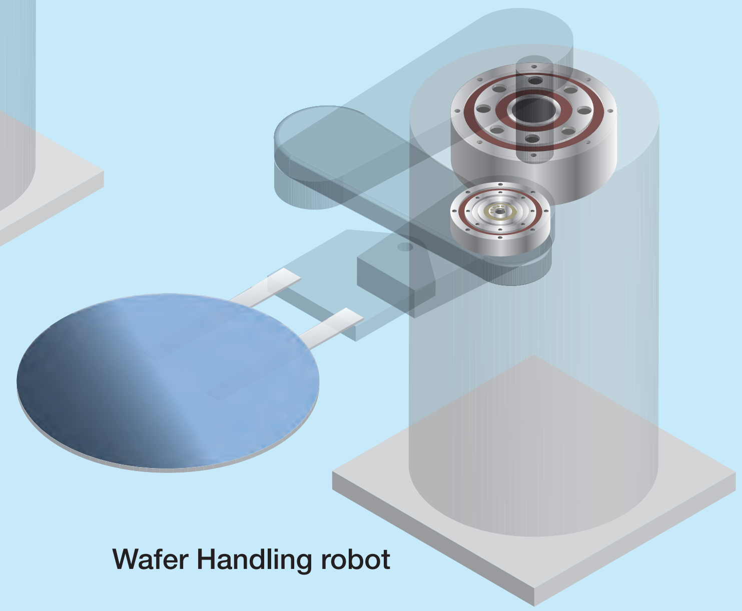
Our reducer is lightweight and compact. However they are stiff and accurate enough to be used for robot joints. That gives robots faster move and grater durability.



Vertically articulated robot



SCARA robot

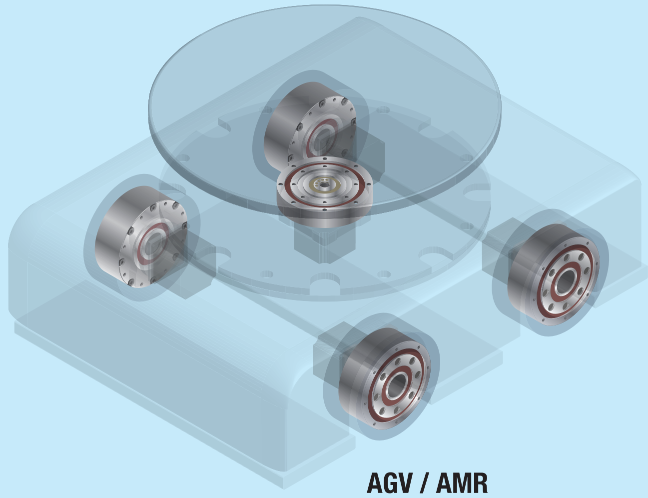


Wafer Handling robot

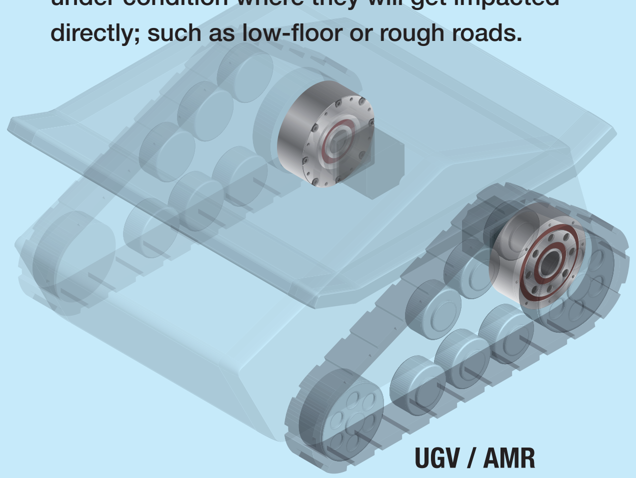
Application **02**

AGV / AMR

Our reducer can make your autonomous mobiles downsized easily, even more, it can serve as in-wheel reducers on wheel axles under condition where they will get impacted directly; such as low-floor or rough roads.



AGV / AMR



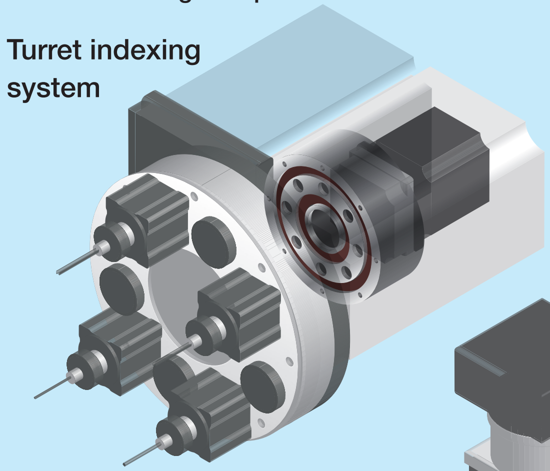
UGV / AMR (Crawler system)

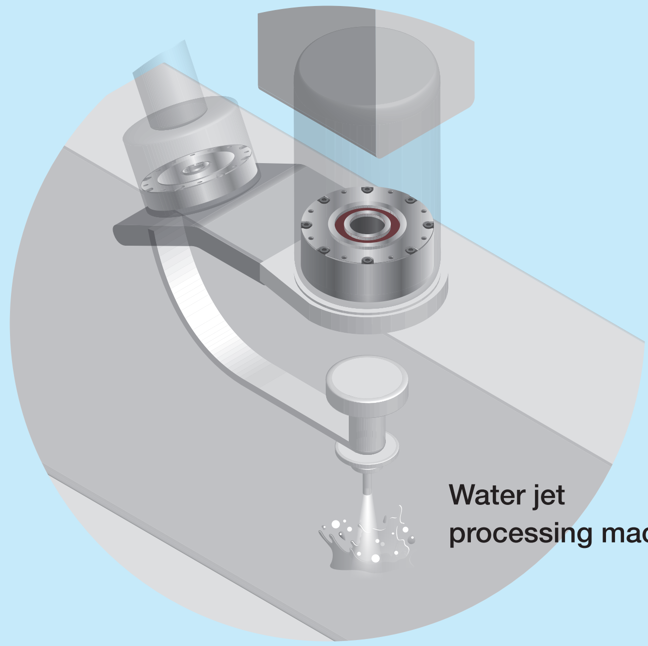
Application **03**

FA devices/Machine tools

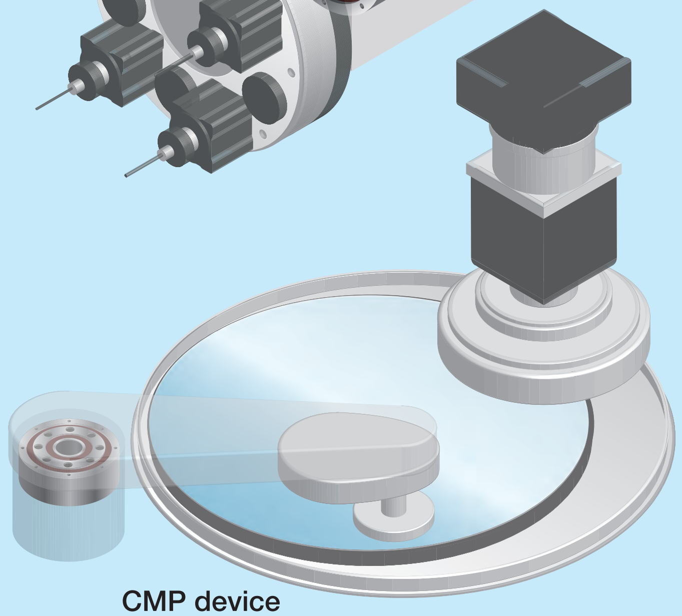
Our reducer can contribute to FA/working machine which are required to be downsized by reducing number of components with its high stiffness and high torque.

Turret indexing system

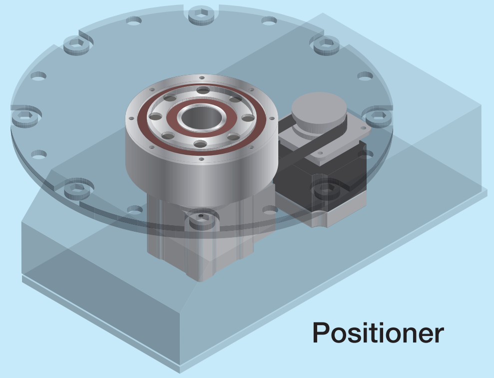




Water jet processing machine



CMP device



Positioner

DGH type High stiffness and high torque type

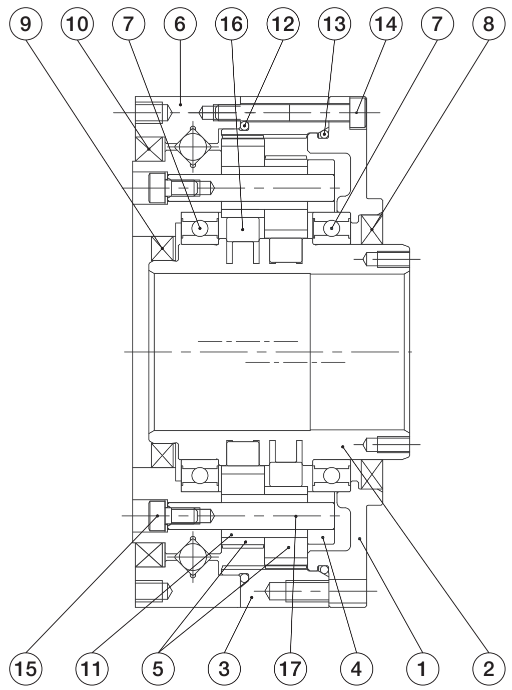
DGH010 DGH030 DGH040 DGH080 DGH150

Model and Specs

Model Name	Type	Frame Size *1		Reduction Ratio
DG	H	040	–	029
DG Series	H: Hollow bore	10 N · m →"010" 29 N · m →"030" 44 N · m →"040" 82 N · m →"080" 153 N · m →"150"		1/19 →"019" 1/29 →"029" 1/59 →"059"

*1. The rated torque value of each size is indicated as the frame size.

Structure



■ Rotational Direction Relationship

The rotational direction of the output shaft is opposite to that of the input shaft.

No.	Part Name	No.	Part Name
1	Bracket	10	Oil Seal (Output shaft)
2	Crank shaft	11	Metal
3	Ring Gear	12	O-ring
4	Carrier Plate	13	O-ring
5	Planetary Gear	14	Hex Socket Head Cap Bolt
6	Cross Roller Bearing	15	Hex Socket Head Cap Bolt *2
7	Single-Row Deep Groove Ball Bearing (Input shaft)	16	Needle Pin
8	Oil Seal (Input shaft)	17	Reaction Pin
9	Oil Seal (Input shaft)		

*2 Frame sizes 010 and 030 use a retaining ring.

Performance Table

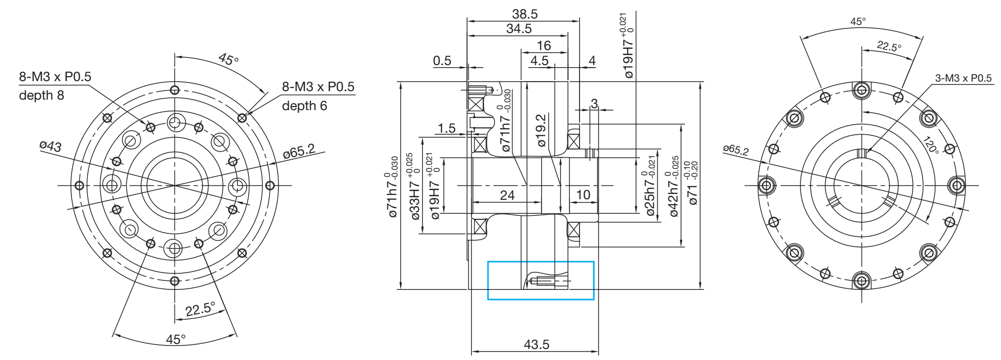
Frame Size	Reduction Ratio	Rated Torque (Input 2000r/min) *1	Start/Stop Allowable Peak Torque *2	Allowable Average Load Torque *3	Allowable Instantaneous Maximum Torque *4	Allowable Max. Input RPM	Allowable Average Input RPM	Spring Constant *5	Hysteresis Loss	Angular Transmission Error	Moment of inertia (input shaft equivalent)	Weight
		N · m	N · m	N · m	N · m	r/min	r/min	N · m/ arc min	arc min	arc min	$X10^{-4}kg \cdot m^2$	kg
010	1/19	10	30	19	61	6000	3500	3.1	2.0	2.0	0.104	0.77
	1/29	10	30	19	61	6000	3500	3.1	2.0	2.0	0.101	0.77
	1/59	10	30	19	61	6000	3500	3.1	2.0	1.5	0.100	0.77
030	1/19	29	56	35	113	6000	3500	7.5	2.0	1.5	0.224	1.14
	1/29	29	56	35	113	6000	3500	7.5	2.0	1.5	0.218	1.14
	1/59	29	56	35	113	6000	3500	7.5	2.0	1.5	0.214	1.14
040	1/19	44	96	61	165	6000	3500	11.2	2.0	1.5	0.685	1.8
	1/29	44	96	61	165	6000	3500	11.2	2.0	1.2	0.674	1.8
	1/59	44	96	61	165	6000	3500	11.8	2.0	1.0	0.667	1.8
080	1/19	82	178	113	332	6000	3500	22.5	2.0	1.5	1.220	2.6
	1/29	82	178	113	332	6000	3500	24.3	2.0	1.2	1.197	2.6
	1/59	82	178	113	332	6000	3500	26.2	2.0	1.0	1.182	2.6
150	1/19	153	395	217	738	6000	3500	41.2	2.0	1.5	4.42	5.2
	1/29	153	395	217	738	6000	3500	45.6	2.0	1.2	4.34	5.2
	1/59	153	395	217	738	6000	3500	50	2.0	1.0	4.30	5.2

*1 Average load torque at which the basic rated life L_{10} becomes 10,000 hours when the average input speed is 2,000 r/min.
*2 Allowable value of the acceleration/deceleration torque to be applied to the output shaft by the moment of inertia on start or stop.
*3 Allowable average load torque during operation when the load fluctuates.
*4 Allowable value of the maximum torque instantaneously applied due to an impact, etc. Torque the shaft can withstand about 10,000 times (does not cause plastic deformation).
*5 The values are for reference. The lower limit value is about 80% of the displayed value.

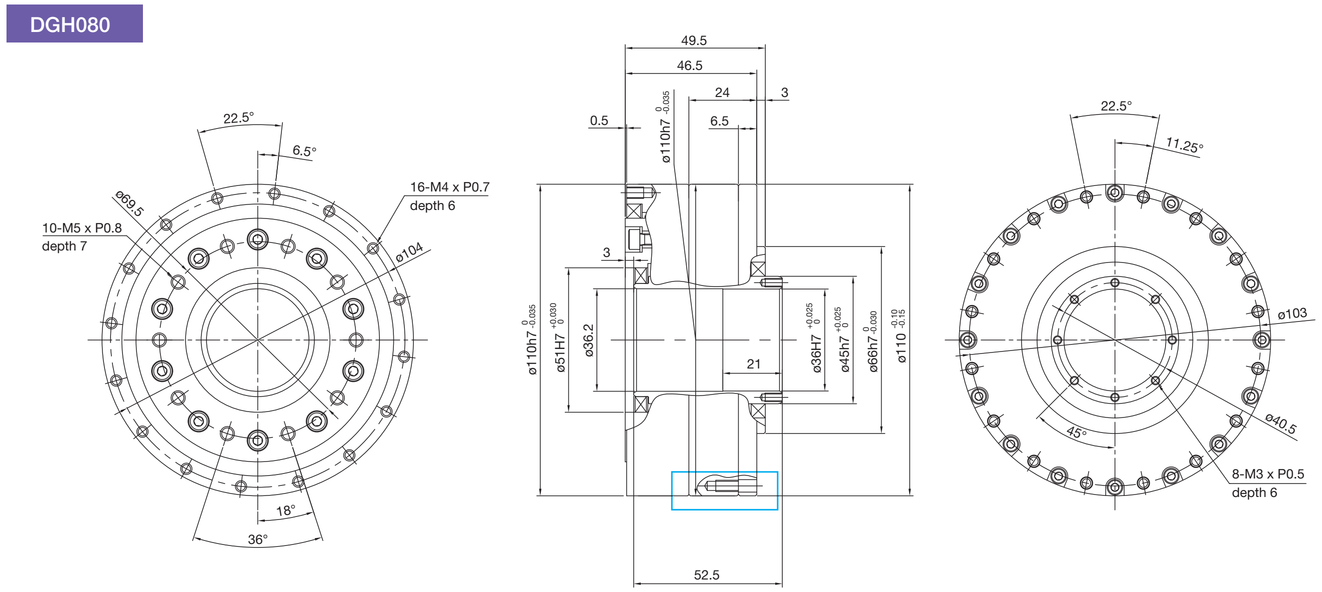
(All performance-related values contained in this catalog are obtained under the designated test conditions by NISSEI CORPORATION.)

Drawings

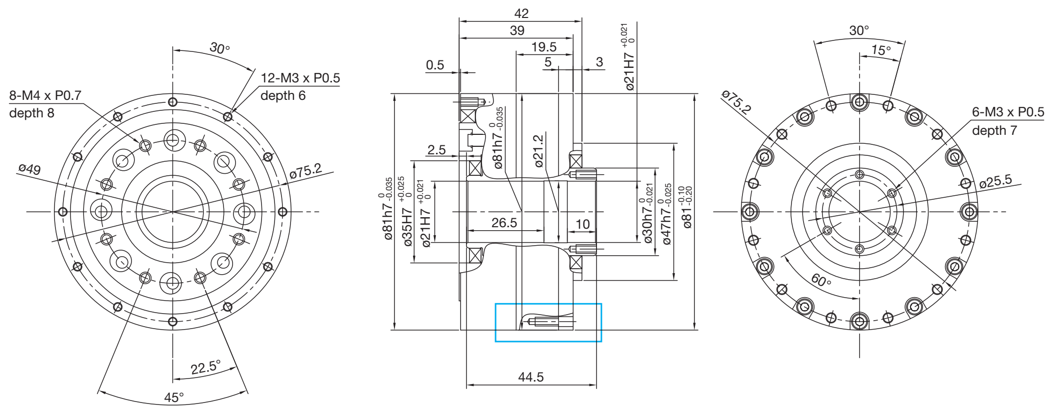
DGH010



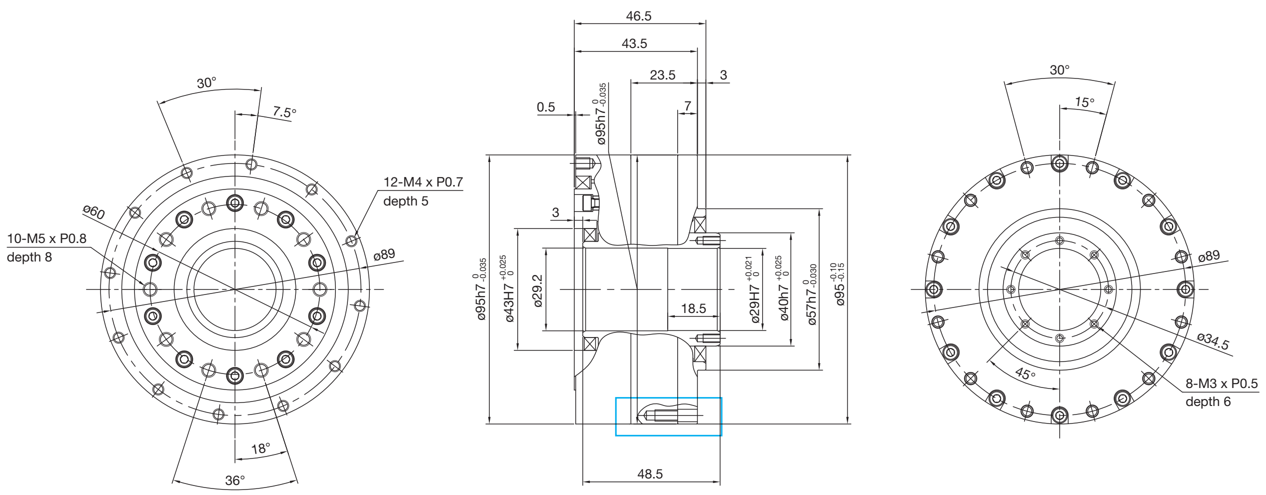
DGH080



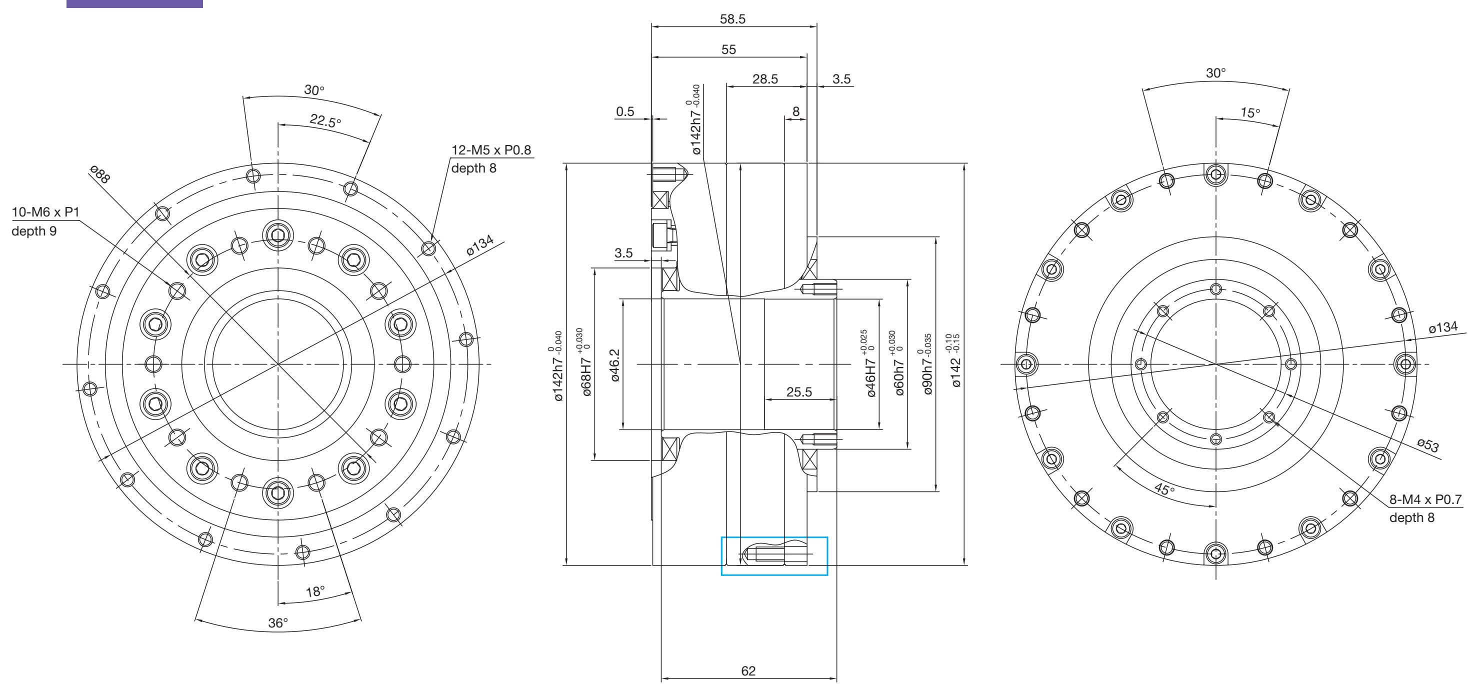
DGH030



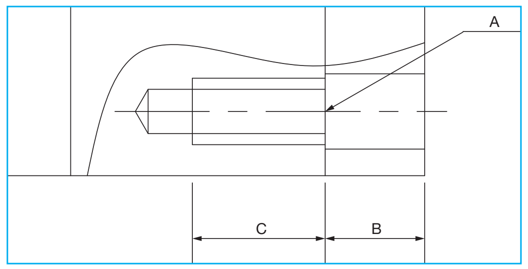
DGH040



DGH150



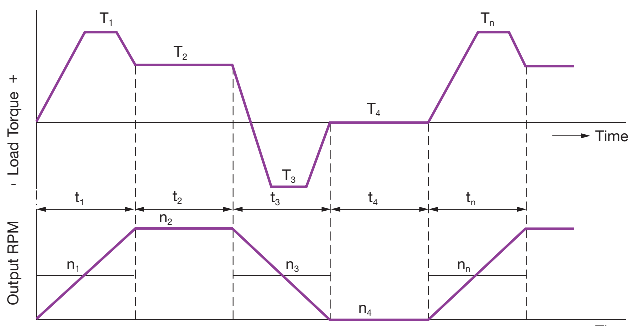
part details



Frame Size	A	B	C
DGH010	8-M3	4.5	6
DGH030	12-M3	5	8
DGH040	12-M4	7	8
DGH080	16-M4	6.5	8
DGH150	12-M5	8	10

Selection Procedure and Examples

■ Operation Pattern



*n1, n3, and nn are average values.

<Operation Conditions :Eg>

Operation Pattern	Load Torque (T_n)		Time (t_n)		Output RPM (n_n)	
	(N · m)		(s)		(r/min)	
At the Start	T_1	150	t_1	0.3	n_1	21
During normal operation	T_2	100	t_2	3	n_2	42
While stopping (reducing speed)	T_3	70	t_3	0.4	n_3	21
When at rest	T_4	0	t_4	0.2	n_4	0

Maximum Output RPM no_{max} = 42(r/min)
Maximum Input RPM ni_{max} = 2500(r/min)
Impact Torque T_s = 250(N · m)
Life time L_{10} = 4000(h)

Selection Process and Examples / Selection Process Example

1. Calculation of average load torque on output shaft side in terms of usage

$$T_{av} = \sqrt[3]{\frac{n_1 \cdot t_1 \cdot (T_1)^3 + n_2 \cdot t_2 \cdot (T_2)^3 + \cdots n_n \cdot t_n \cdot (T_n)^3}{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots n_n \cdot t_n}}$$

$$T_{av} = \sqrt[3]{\frac{21\text{r/min} \cdot 0.3\text{s} \cdot (150\text{N} \cdot \text{m})^3 + 42\text{r/min} \cdot 3\text{s} \cdot (100\text{N} \cdot \text{m})^3 + 21\text{r/min} \cdot 0.4\text{s} \cdot (70\text{N} \cdot \text{m})^3}{21\text{r/min} \cdot 0.3\text{s} + 42\text{r/min} \cdot 3\text{s} + 21\text{r/min} \cdot 0.4\text{s}}}$$

$\approx$ 102N · m

T_{av}= 102N · m ≤ 113N · m (DGH080 allowable average load torque); from this, temporarily select DGH080

2-1. Calculation of average output RPM

$$no_{av} = \frac{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots n_n \cdot t_n}{t_1 + t_2 + \cdots t_n}$$

$$no_{av} = \frac{21\text{r/min} \cdot 0.3\text{s} + 42\text{r/min} \cdot 3\text{s} + 21\text{r/min} \cdot 0.4\text{s} + 0\text{r/min} \cdot 0.2\text{s}}{0.3\text{s} + 3\text{s} + 0.4\text{s} + 0.2\text{s}} \approx 36\text{r/min}$$

2-2. Deciding on reduction ratio

$$\frac{ni_{max}}{no_{max}} \geq R$$

$$\frac{2500\text{r/min}}{42\text{r/min}} = 59.52 \geq 59 = R$$

2-3. Calculation of average input RPM

$ni_{av} = no_{av} \cdot R$

Make sure the average input RPM is within the allowable average input RPM.
ni_{av} = 36r/min · 59 = 2124r/min ≤ 3500r/min (allowable average input RPM of DGH)

2-4. Calculation of maximum input RPM

$ni_{max} = no_{max} \cdot R$

Confirm that the maximum input RPM is within the permissible level.
ni_{max} = 42r/min · 59 = 2478r/min ≤ 6000r/min (allowable maximum input RPM of DGH)

3. Confirmation of whether the usage conditions meet the Performance Table values

T_1 = 150N · m ≤ 178N · m (DGH080 start/stop allowable peak torque)
T_3 = 70N · m ≤ 178N · m (DGH080 start/stop allowable peak torque)
T_S = 250N · m ≤ 332N · m (DGH080 allowable instantaneous maximum torque)

4. Calculation of reducer Life time

$$L_{10} = 10000 \cdot \left(\frac{T_r}{T_{av}}\right)^3 \cdot \left(\frac{n_r}{ni_{av}}\right)$$

*However, L_{10} is equal to or smaller than 10,000.

Confirm that the reducer life time is greater than the required duration.
T_r = 82N · m (DGH080 rated torque)
n_r = 2000r/min (DGH080 rated RPM)

$$L_{10} = 10000 \cdot \left(\frac{82}{102}\right)^3 \cdot \left(\frac{2000}{2124}\right) \approx 4892\ (\text{h}) \geq 4000\ (\text{h})$$

Therefore, select DGH080-059 and confirm the main bearing life and input shaft load.

Confirmation of main bearing life

A. Calculation of max load moment

$$M_{max} = Fr_{max}(Sr + A) + Fa_{max} \cdot Sa$$

Confirmation of max load moment

Maximum load moment (M_{max}) ≤ Allowable moment (Mc)

B. Calculation of average load

Average radial load (Fr_{av})

$$Fr_{av} = \sqrt[10/3]{\frac{n_1 t_1 (|Fr_1|)^{10/3} + n_2 t_2 (|Fr_2|)^{10/3} \cdots n_n t_n (|Fr_n|)^{10/3}}{n_1 t_1 + n_2 t_2 \cdots n_n t_n}}$$

Let the maximum radial load within the t_1 space be Fr_1 and the maximum radial load within the t_3 space be Fr_3.

Average Thrust Load (Fa_{av})

$$Fa_{av} = \sqrt[10/3]{\frac{n_1 t_1 (|Fa_1|)^{10/3} + n_2 t_2 (|Fa_2|)^{10/3} \cdots n_n t_n (|Fa_n|)^{10/3}}{n_1 t_1 + n_2 t_2 \cdots n_n t_n}}$$

Let the thrust load within the t_1 space be Fa_1 and the maximum thrust load within the t_3 space be Fa_3.

Average Output RPM (N_{av})

$$N_{av} = \frac{n_1 t_1 + n_2 t_2 + \cdots + n_n t_n}{t_1 + t_2 + \cdots t_n}$$

Calculation of load coefficient

To find the Load factor	Radial Load Coefficient (X)	Thrust Load Coefficient (Y)
$\frac{Fa_{av}}{Fr_{av} + 2(Fr_{av}(Sr + A) + Fa_{av} \cdot Sa) / dp} \leq 1.5$	1	0.45
$\frac{Fa_{av}}{Fr_{av} + 2(Fr_{av}(Sr + A) + Fa_{av} \cdot Sa) / dp} > 1.5$	0.67	0.67

C. Calculation of life time

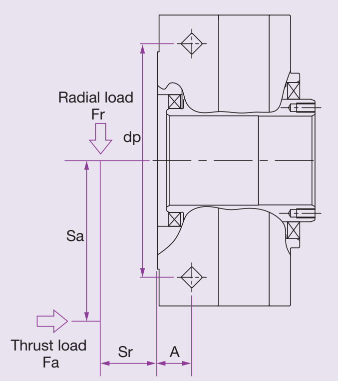
$$L_{10} = \left(\frac{10^6}{60 \times N_{av}}\right) \times \left(\frac{C}{fw \cdot Pc}\right)^{10/3}$$

$$Pc = X \cdot \left(Fr_{av} + \frac{2(Fr_{av}(Sr + A) + Fa_{av} \cdot Sa)}{dp}\right) + Y \cdot Fa_{av}$$

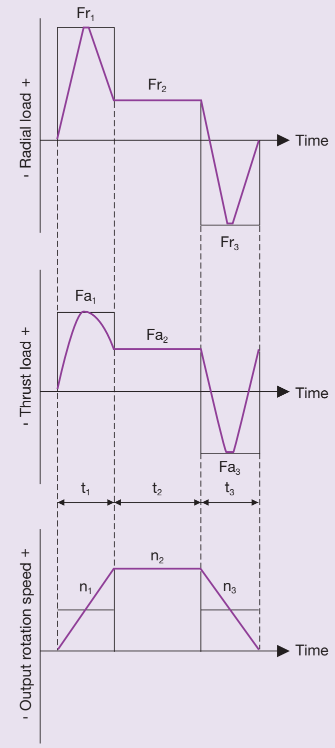
Load Coefficient

Load Status	fw
For smooth movement with no impacts	1 to 1.2
For normal movement	1.2 to 1.5
For high vibration and impacts	1.5 to 3

Fig. A



B. Graph



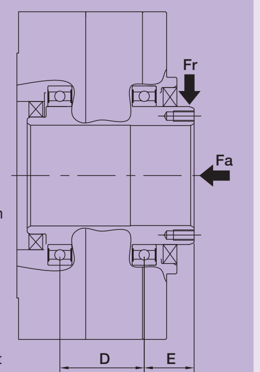
Frame Size	Roller Pitch Diameter (dp)	Roller Position from Output Shaft End (A)	Basic Dynamic Rated Load (C)	Basic Static Rated Load (C_o)	Allowable Moment (Mc)
	(m)	(m)	(N)	(N)	(N · m)
DGH010	0.0556	0.0095	7100	10830	74
DGH030	0.064	0.01	12100	18310	126
DGH040	0.0763	0.0112	17500	25900	220
DGH080	0.0889	0.012	19100	30600	290
DGH150	0.1113	0.013	40800	62500	582

Symbol	Unit	Content
L_{10}	h	Life time
N_{av}	r/min	Average Output RPM
Pc	N	Dynamic Equivalent Radial Load
Fr_{av}	N	Average Radial Load
Fa_{av}	N	Average Thrust Load
Sr,Sa	m	See Fig. A

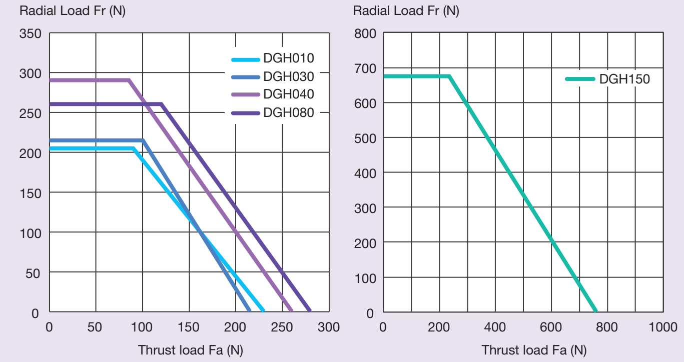
Confirmation of load on input shaft

Frame Size	D	E	Maximum Radial Load
	(m)	(m)	(N)
DGH010	0.02	0.0145	205
DGH030	0.023	0.013	215
DGH040	0.0245	0.0145	290
DGH080	0.02695	0.0153	260
DGH150	0.0325	0.0175	675

The graph shows the relation between the maximum allowable radial load and maximum allowable thrust load for each frame size.
Use within the range shown on the graph at right side.
The graph values are at average input RPM 2000r/min and basic rated life for L_{10} = 10,000hours.
For use exceeding the maximum radial load, consult your nearest sales office.



Input Bearing Allowable Load

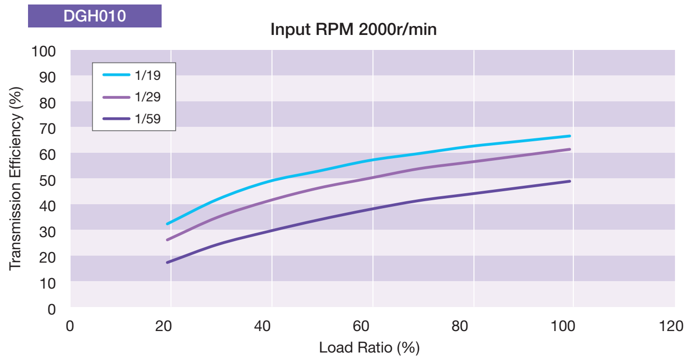


Efficiency Characteristics

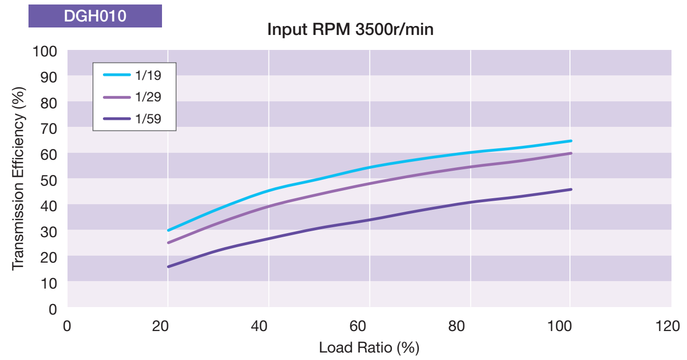
Measurement conditions: Input RPM 2000 r/min, values are measured after two-hours of warm operation

*The values in this graph vary according to usage conditions and can be used for Reference purpose only.

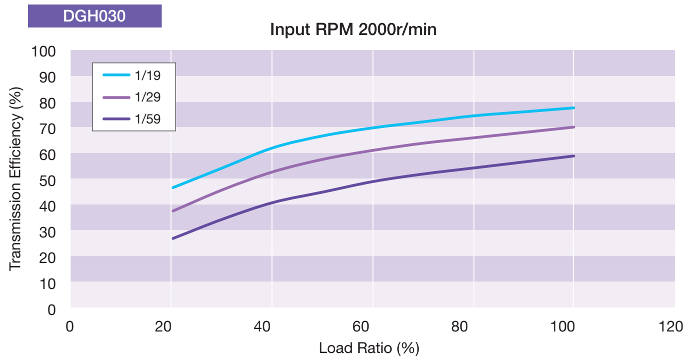
DGH010



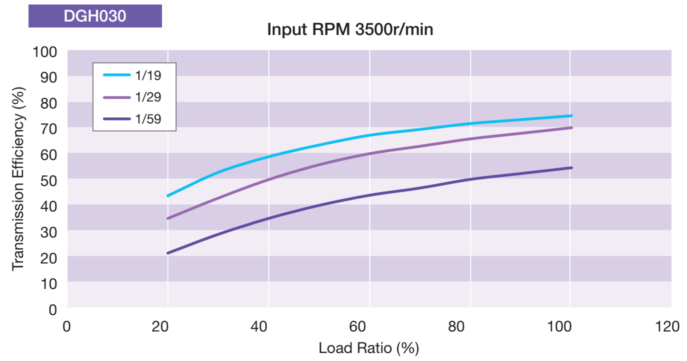
DGH010



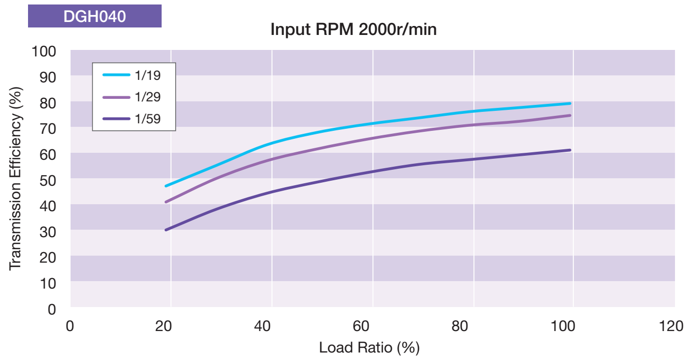
DGH030



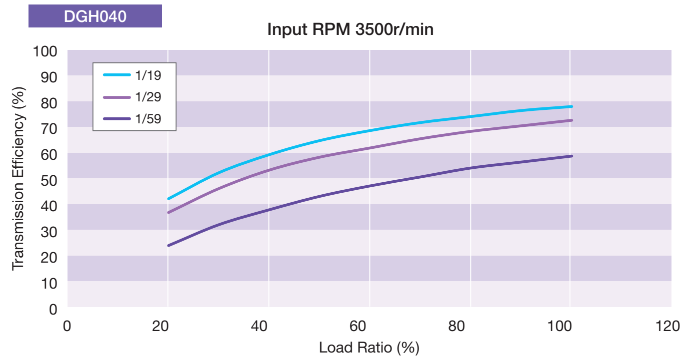
DGH030



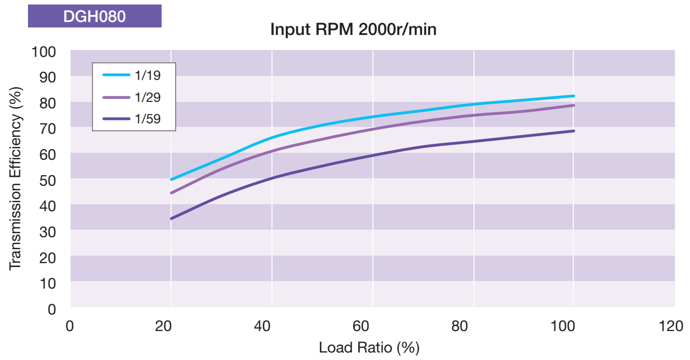
DGH040



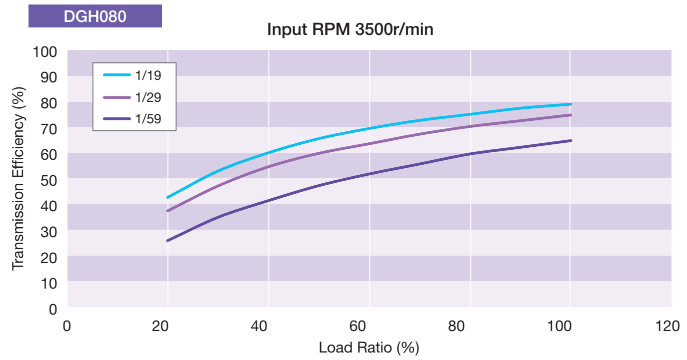
DGH040



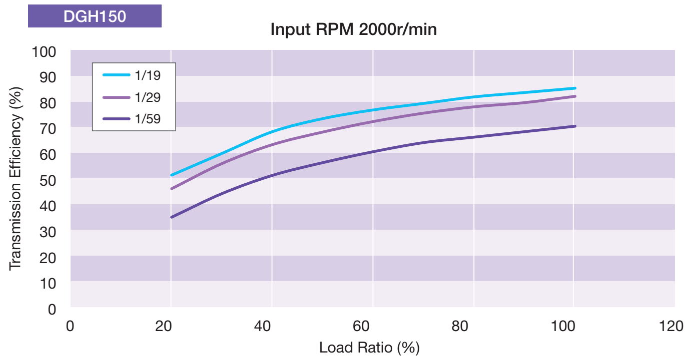
DGH080



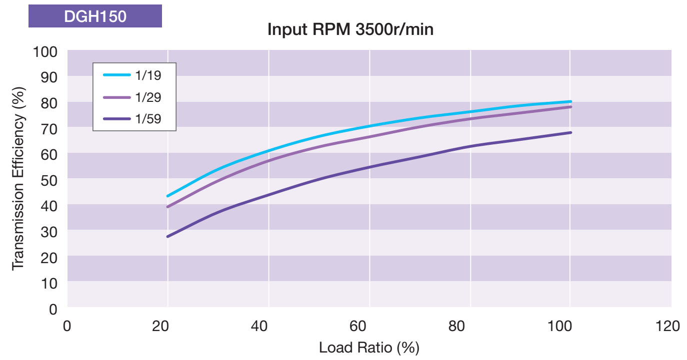
DGH080



DGH150



DGH150



Starting Torque

The torque required to start up (rotate) the reducer from the input shaft with no load.

Measurement conditions: Value after two hours of running-in at an input speed of 2,000 r/min (Unit: cN · m)

Reduction Ratio \ Frame Size	DGH010	DGH030	DGH040	DGH080	DGH150
1/19	16.3	35.0	43.0	64.0	112.0
1/29	14.2	30.0	43.0	64.0	112.0
1/59	12.4	26.0	36.0	56.0	85.0

*The values in the table above vary according to usage conditions and are for use as reference only.

Accelerating Torque

The torque required to start up (rotate) the reducer from the output shaft with no load.

Measurement conditions: Value after two hours of running-in at an input speed of 2,000 r/min (Unit: N · m)

Reduction Ratio \ Frame Size	DGH010	DGH030	DGH040	DGH080	DGH150
1/19	8.2	20	23	35	57
1/29	7.3	17	23	35	57
1/59	9.8	19	22	34	51

*The values in the table above vary according to usage conditions and are for use as reference only.

Running Torque with No Load

The torque required on the input side to rotate the reducer with no load.

Measurement conditions: Input RPM 2000 r/min, values are measured after two-hours of warm operation (Unit: cN · m)

Reduction Ratio \ Frame Size	DGH010	DGH030	DGH040	DGH080	DGH150
1/19	21.5	36.3	53.4	87.8	137.5
1/29	20.2	31.3	45.9	75.6	120.3
1/59	18.0	28.6	42.6	70.2	110.0

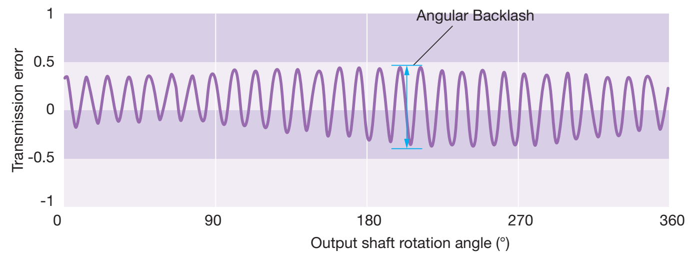
*The values in the table above vary according to usage conditions and are for use as reference only.

Angular Transmission Error

With an arbitrary rotation angle input, the difference between the theoretical rotating output rotation angle and the actual rotating output rotation angle.

(Unit: arc min)

Reduction Ratio \ Frame Size	DGH010	DGH030	DGH040	DGH080	DGH150
1/19	2.0	1.5	1.5	1.5	1.5
1/29	2.0	1.5	1.2	1.2	1.2
1/59	1.5	1.5	1.0	1.0	1.0



Hysteresis Loss

When fixing the input shaft and, after increasing from zero to rated torque on the output shaft, returning the torque to zero, the output shaft torsion angle will retain a minimal amount rather than returning entirely to zero. This is called hysteresis loss.

(Unit: arc min)

Reduction Ratio \ Frame Size	DGH010	DGH030	DGH040	DGH080	DGH150
1/19	2.0	2.0	2.0	2.0	2.0
1/29	2.0	2.0	2.0	2.0	2.0
1/59	2.0	2.0	2.0	2.0	2.0

Spring Constant

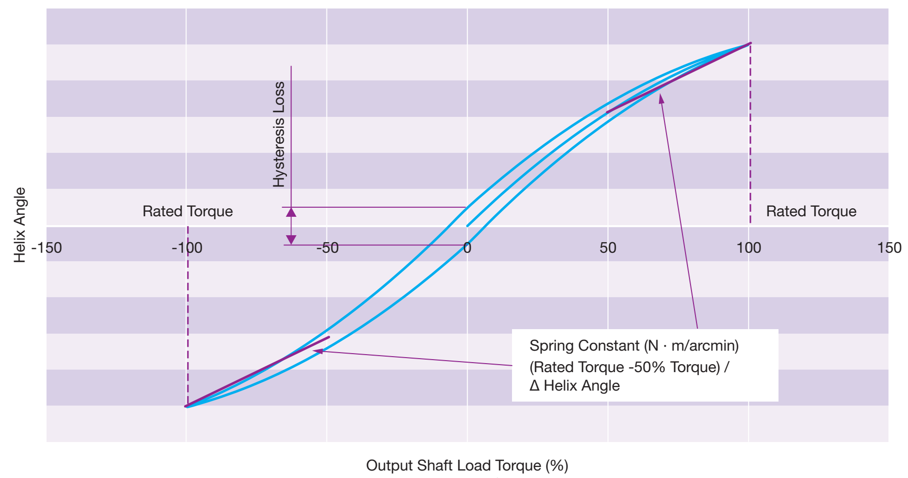
This is the resistance to torsion (torsional rigidity) against rotational force.

(Unit: N · m / arc min)

Reduction Ratio \ Frame Size	DGH010	DGH030	DGH040	DGH080	DGH150
1/19	3.1	7.5	11.2	22.5	41.2
1/29	3.1	7.5	11.2	24.3	45.6
1/59	3.1	7.5	11.8	26.2	50.0

*The values are for reference. The lower limit value is about 80% of the displayed value.

Hysteresis Curve



(All performance-related values contained in this catalog are obtained under the designated test conditions by NISSEI CORPORATION.)

DGF type

Flat, lightweight type

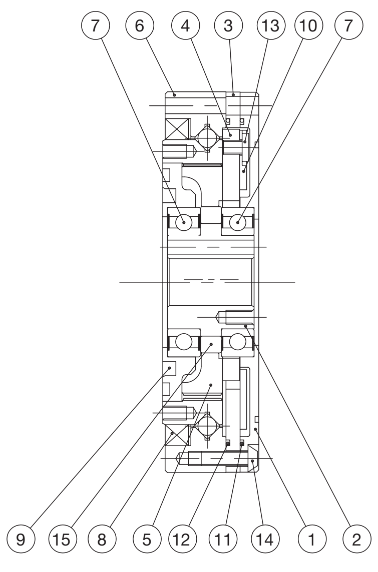
DGF005 DGF020 DGF030

Model and Specs

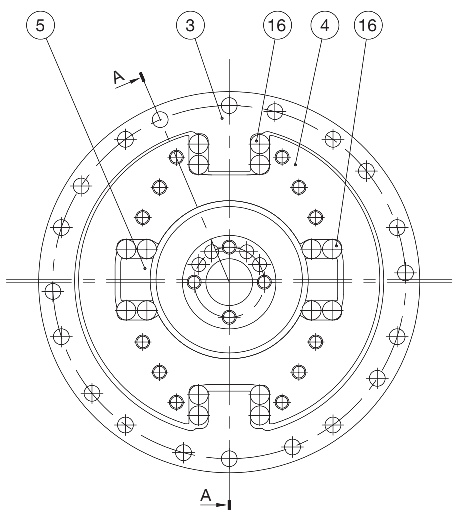
Model Name	Type	Frame Size *1		Reduction Ratio
DG	F	020	–	050
DG Series	F: Flat	5.4N · m →"005" 16N · m →"020" 28N · m →"030"		1/50 →"050" 1/100 →"100"

*1. The rated torque value of each size is indicated as the frame size.

Structure



Cross section A-A



■ Rotational Direction Relationship

The rotational direction of the output shaft is the same as that of the input shaft.

No.	Part Name
1	Bracket
2	Crank shaft
3	Reactive force plate holder
4	Reactive force plate
5	Planetary Gear
6	Cross Roller Bearing
7	Single-Row Deep Groove Ball Bearing (Input shaft)
8	Oil Seal
9	Housing
10	Reinforcing plate
11	O-ring
12	O-ring
13	Hex head cap low-head screw
14	Hex head cap button screw
15	Needle Pin
16	Needle Pin

*Please use our dedicated grease sold separately. The input shaft is not provided with an oil seal.

Performance Table

Frame Size	Reduction Ratio	Rated Torque (Input 2000r/min) *1	Start/Stop Allowable Peak Torque *2	Allowable Average Load Torque *3	Allowable Instantaneous Maximum Torque *4	Allowable Max. Input RPM	Allowable Average Input RPM	Spring Constant *5	Hysteresis Loss	Angular Transmission Error	Moment of inertia (input shaft equivalent)	Weight
		N · m	N · m	N · m	N · m	r/min	r/min	N · m/ arc min	arc min	arc min	X10⁻⁴kg · m²	kg
005	1/50	5.4	19	7.7	35	6000	3500	1.1	2.5	1.5	0.012	0.44
	1/100	5.4	19	7.7	35	6000	3500	1.3	2.0	1.5	0.012	0.44
020	1/50	16	37	27	71	6000	3500	2.6	2.0	1.5	0.024	0.59
	1/100	16	37	27	71	6000	3500	2.7	1.0	1.5	0.024	0.59
030	1/50	28	57	34	95	6000	3500	4.3	2.0	1.0	0.117	0.85
	1/100	28	57	34	95	6000	3500	4.7	1.0	1.0	0.116	0.85

*1 Average load torque at which the basic rated life L_{10} becomes 10,000 hours when the average input speed is 2,000 r/min.

*2 Allowable value of the acceleration/deceleration torque to be applied to the output shaft by the moment of inertia on start or stop.

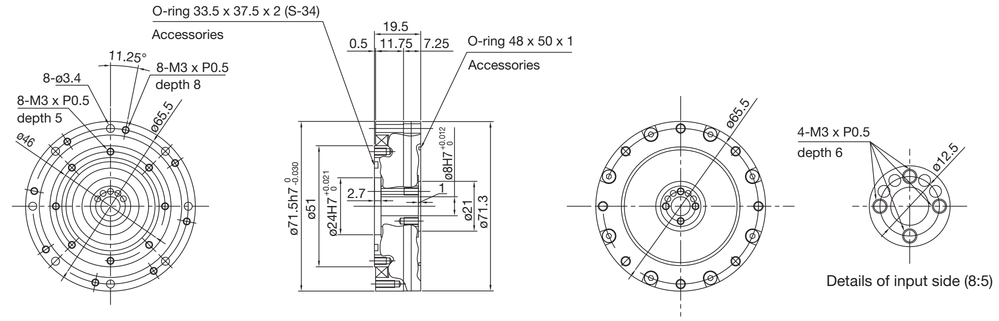
*3 Allowable average load torque during operation when the load fluctuates.

*4 Allowable value of the maximum torque instantaneously applied due to an impact, etc. Torque the shaft can withstand about 10,000 times (does not cause plastic deformation).

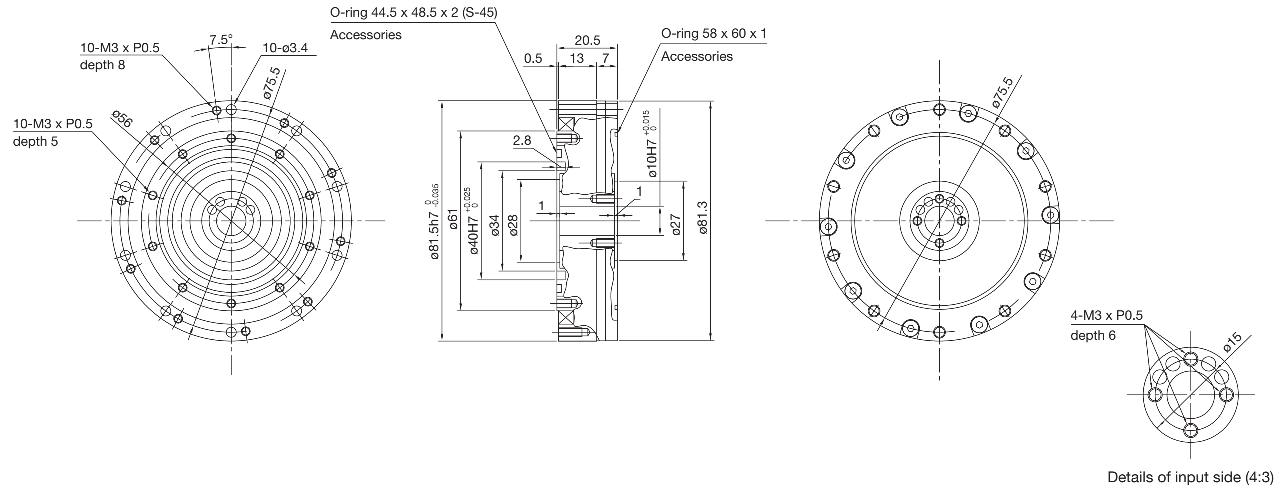
*5 The values are for reference. The lower limit value is about 80% of the displayed value.

Drawings

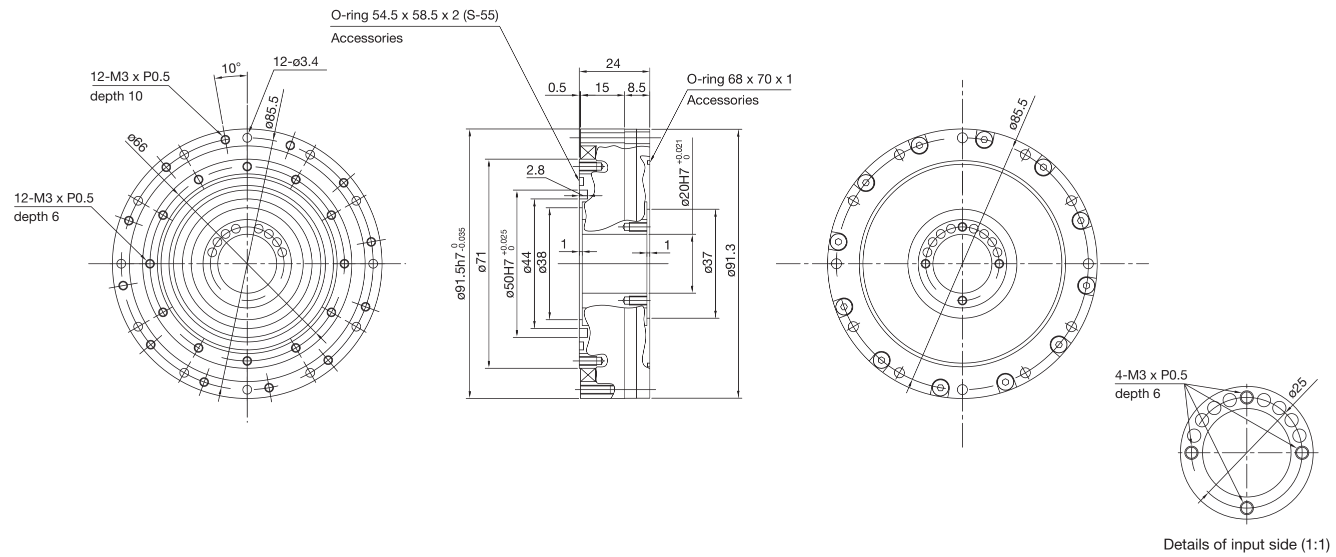
DGF005



DGF020

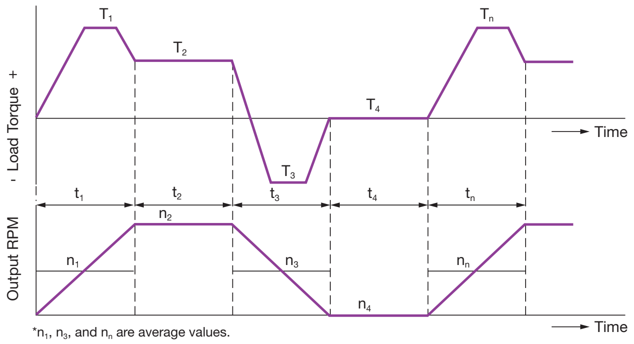


DGF030



Selection Procedure and Examples

■ Operation Pattern



<Operation Conditions :Eg>

Operation Pattern	Load Torque (T_n) (N · m)		Time (t_n) (s)		Output RPM (n_n) (r/min)	
At the Start	T_1	30	t_1	0.5	n_1	15
During normal operation	T_2	15	t_2	5	n_2	23
While stopping (reducing speed)	T_3	25	t_3	0.8	n_3	15
When at rest	T_4	0	t_4	0.7	n_4	0

Maximum Output RPM no_{max} = 23(r/min)
Maximum Input RPM ni_{max} = 2500(r/min)
Impact Torque T_s = 60(N · m)
Life time L_{10} = 4000(h)

Selection Process and Examples	Selection Process Example
1. Calculation of average load torque on output shaft side in terms of usage $T_{av} = \sqrt[3]{\dfrac{n_1 \cdot t_1 \cdot (T_1)^3 + n_2 \cdot t_2 \cdot (T_2)^3 + \cdots n_n \cdot t_n \cdot (T_n)^3}{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots n_n \cdot t_n}}$	$T_{av} = \sqrt[3]{\dfrac{15r/min \cdot 0.5s \cdot (30N \cdot m)^3 + 23r/min \cdot 5s \cdot (15N \cdot m)^3 + 15r/min \cdot 0.8s \cdot 25N \cdot m)^3}{15r/min \cdot 0.5s + 23r/min \cdot 5s + 15r/min \cdot 0.8s}}$ $\approx$ 18N · m T_{av}= 18N · m ≤ 27N · m (DGF020 allowable average load torque); from this, temporarily select DGF020
2-1. Calculation of average output RPM $no_{av} = \dfrac{n_1 \cdot t_1 + n_2 \cdot t_2 + \cdots n_n \cdot t_n}{t_1 + t_2 + \cdots t_n}$	$no_{av} = \dfrac{15r/min \cdot 0.5s + 23r/min \cdot 5s + 15r/min \cdot 0.8s + 0r/min \cdot 0.7s}{0.5s + 5s + 0.8s + 0.7s} \approx 19r/min$
2-2. Deciding on reduction ratio $\dfrac{ni_{max}}{no_{max}} \geq R$	$\dfrac{2500r/min}{23r/min} = 108.7 \geq 100 = R$
2-3. Calculation of average input RPM $ni_{av} = no_{av} \cdot R$	Make sure the average input RPM is within the allowable average input RPM. ni_{av} = 19r/min · 100 = 1900r/min ≤ 3500r/min (allowable average input RPM of DGF)
2-4. Calculation of maximum input RPM $ni_{max} = no_{max} \cdot R$	Confirm that the maximum input RPM is within the permissible level. ni_{max} = 23r/min · 100 = 2300r/min ≤ 6000r/min (allowable maximum input RPM of DGF)
3. Confirmation of whether the usage conditions meet the Performance Table values	T_1 = 30N · m ≤ 37N · m (DGF020 start/stop allowable peak torque) T_3 = 25N · m ≤ 37N · m (DGF020 start/stop allowable peak torque) T_S = 60N · m ≤ 71N · m (DGF020 allowable instantaneous maximum torque)
4. Calculation of reducer Life time $L_{10} = 10000 \cdot \left(\dfrac{T_r}{T_{av}}\right)^3 \cdot \left(\dfrac{n_r}{ni_{av}}\right)$ *However, L_{10} is equal to or smaller than 10,000.	Confirm that the reducer life time is greater than the required duration. T_r = 16N · m (DGF020 rated torque) n_r = 2000r/min (DGF020 rated RPM) $L_{10} = 10000 \cdot \left(\dfrac{16}{18}\right)^3 \cdot \left(\dfrac{2000}{1900}\right) \approx 7393$ (h) ≥ 4000 (h) Therefore, select DGF020-100 and confirm the main bearing life and input shaft load.

Confirmation of main bearing life

A. Calculation of max load moment

$$M_{max} = Fr_{max}(Sr + A) + Fa_{max} \cdot Sa$$

Confirmation of max load moment

Maximum load moment (M_{max}) ≤ Allowable moment (Mc)

B. Calculation of average load

Average radial load (Fr_{av})

$$Fr_{av} = \sqrt[10/3]{\frac{n_1t_1(|Fr_1|)^{10/3} + n_2t_2(|Fr_2|)^{10/3} \cdots n_nt_n(|Fr_n|)^{10/3}}{n_1t_1 + n_2t_2 \cdots n_nt_n}}$$

Let the maximum radial load within the t_1 space be Fr_1 and the maximum radial load within the t_3 space be Fr_3.

Average Thrust Load (Fa_{av})

$$Fa_{av} = \sqrt[10/3]{\frac{n_1t_1(|Fa_1|)^{10/3} + n_2t_2(|Fa_2|)^{10/3} \cdots n_nt_n(|Fa_n|)^{10/3}}{n_1t_1 + n_2t_2 \cdots n_nt_n}}$$

Let the thrust load within the t_1 space be Fa_1 and the maximum thrust load within the t_3 space be Fa_3.

Average Output RPM (N_{av})

$$N_{av} = \frac{n_1t_1 + n_2t_2 + \cdots + n_nt_n}{t_1 + t_2 + \cdots t_n}$$

Calculation of load coefficient

To find the Load factor	Radial Load Coefficient (X)	Thrust Load Coefficient (Y)
$\dfrac{Fa_{av}}{Fr_{av} + 2(Fr_{av}(Sr + A) + Fa_{av} \cdot Sa) / dp} \leq 1.5$	1	0.45
$\dfrac{Fa_{av}}{Fr_{av} + 2(Fr_{av}(Sr + A) + Fa_{av} \cdot Sa) / dp} > 1.5$	0.67	0.67

C. Calculation of life time

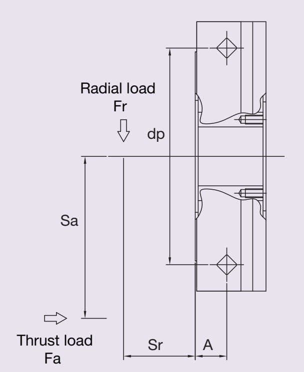
$$L_{10} = \left(\frac{10^6}{60 \times N_{av}}\right) \times \left(\frac{C}{fw \cdot Pc}\right)^{10/3}$$

$$Pc = X \cdot \left(Fr_{av} + \frac{2(Fr_{av}(Sr + A) + Fa_{av} \cdot Sa)}{dp}\right) + Y \cdot Fa_{av}$$

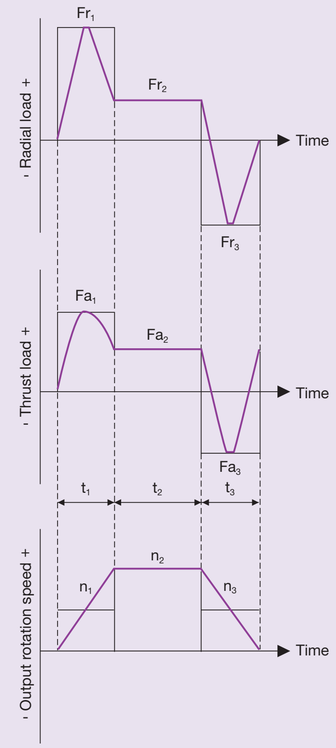
Load Coefficient

Load Status	fw
For smooth movement with no impacts	1 to 1.2
For normal movement	1.2 to 1.5
For high vibration and impacts	1.5 to 3

Fig. A



B. Graph



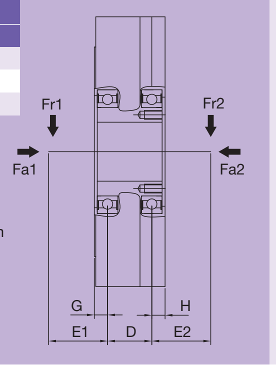
Frame Size	Roller Pitch Diameter (dp) (m)	Roller Position from Output Shaft End (A) (m)	Basic Dynamic Rated Load (C) (N)	Basic Static Rated Load (C_o) (N)	Allowable Moment (Mc) (N · m)
DGF005	0.05195	0.0089	6440	9370	91
DGF020	0.0616	0.0095	11160	16540	124
DGF030	0.0736	0.0107	17330	26350	195

Symbol	Unit	Content
L_{10}	h	Life time
N_{av}	r/min	Average Output RPM
Pc	N	Dynamic Equivalent Radial Load
Fr_{av}	N	Average Radial Load
Fa_{av}	N	Average Thrust Load
Sr,Sa	m	See Fig. A

Confirmation of load on input shaft

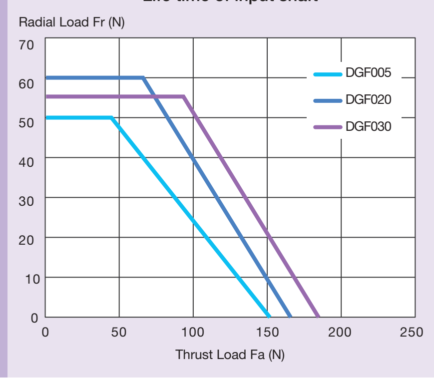
Frame Size	D (m)	E1 (m)	E2 (m)	G (m)	H (m)	Allowable thrust load Fa1,Fa2 (N)	Allowable radial load Fr1,Fr2*1 (N)
DGF005	0.0107	0.025	0.025	0.0053	0.0035	150	50
DGF020	0.0115	0.025	0.025	0.0045	0.0045	165	60
DGF030	0.015	0.025	0.025	0.0045	0.0045	184	55

*1 Assuming a case where a load is applied to Fr1 or Fr2



The graph shows the relation between the maximum allowable radial load and maximum allowable thrust load for each frame size.
Use within the range shown on the graph at right side.
The graph values are at average input RPM 2000r/min and basic rated life for L_{10} = 10,000hours.
For use exceeding the maximum radial load, consult your nearest sales office.

Life time of input shaft

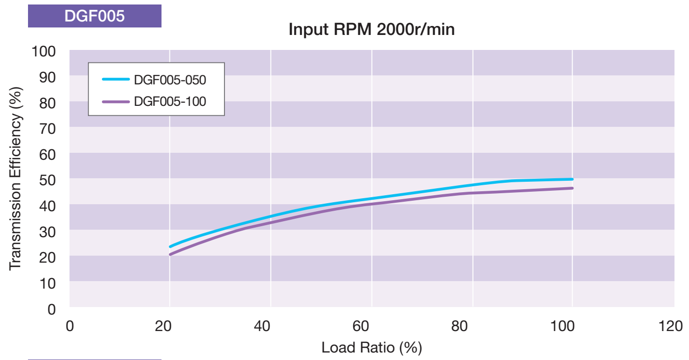


Efficiency Characteristics

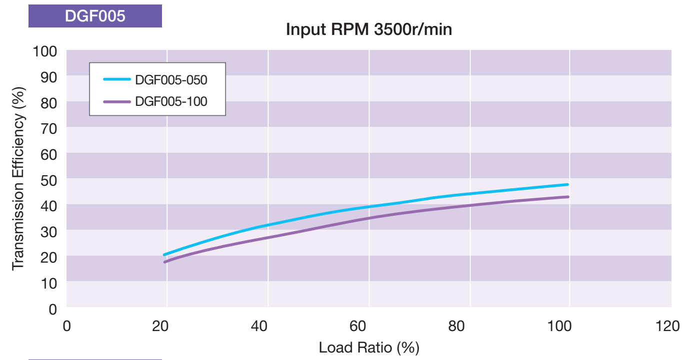
Measurement conditions: Input RPM 2000 r/min, values are measured after two-hours of warm operation

*The values in this graph vary according to usage conditions and can be used for Reference purpose only.

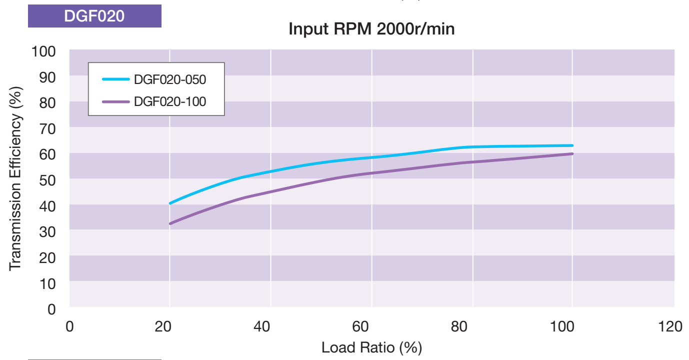
DGF005



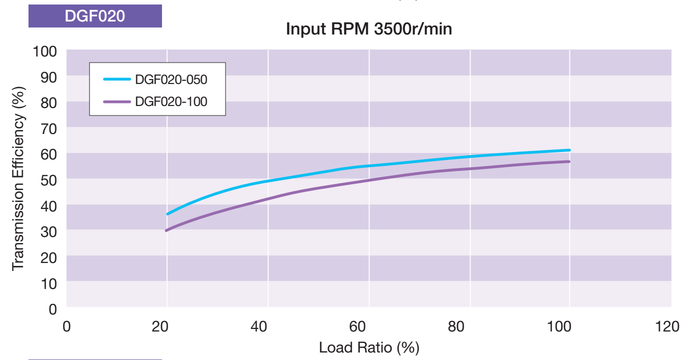
DGF005



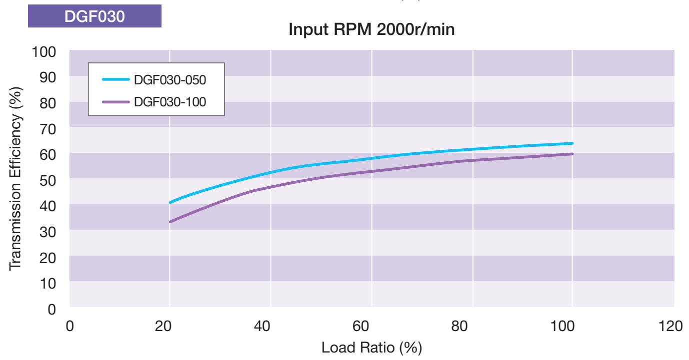
DGF020



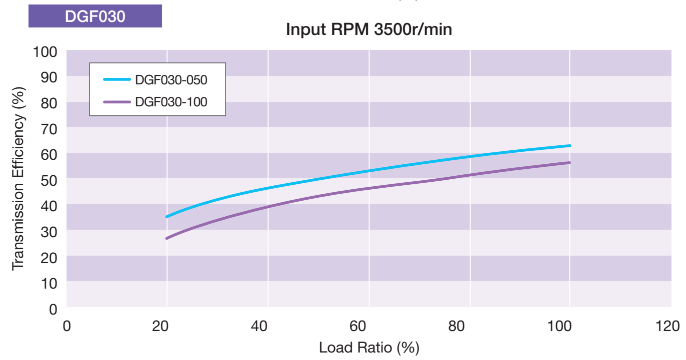
DGF020



DGF030



DGF030



Starting Torque

The torque required to start up (rotate) the reducer from the input shaft with no load.

Measurement conditions: Value after two hours of running-in at an input speed of 2,000 r/min (Unit: cN · m)

Reduction Ratio \ Frame Size	DGF005	DGF020	DGF030
1/50	5.5	7.8	10.2
1/100	3.4	4.5	6.0

*The values in the table above vary according to usage conditions and are for use as reference only.

Accelerating Torque

The torque required to start up (rotate) the reducer from the output shaft with no load.

Measurement conditions: Value after two hours of running-in at an input speed of 2,000 r/min (Unit: N · m)

Reduction Ratio \ Frame Size	DGF005	DGF020	DGF030
1/50	3.5	4.9	6.0
1/100	4.3	5.4	7.1

*The values in the table above vary according to usage conditions and are for use as reference only.

Running Torque with No Load

The torque required on the input side to rotate the reducer with no load.

Measurement conditions: Input RPM 2000 r/min, values are measured after two-hours of warm operation (Unit: cN · m)

Reduction Ratio \ Frame Size	DGF005	DGF020	DGF030
1/50	6.6	10.3	18.0
1/100	5.1	8.4	15.4

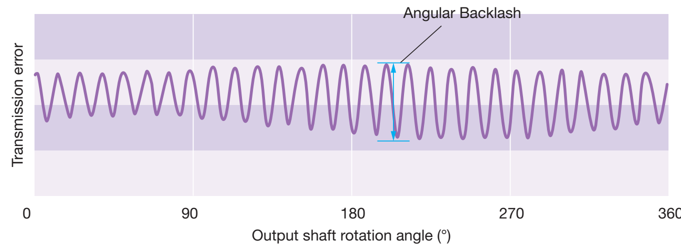
*The values in the table above vary according to usage conditions and are for use as reference only.

Angular Transmission Error

With an arbitrary rotation angle input, the difference between the theoretical rotating output rotation angle and the actual rotating output rotation angle.

(Unit: arc min)

Reduction Ratio \ Frame Size	DGF005	DGF020	DGF030
1/50	1.5	1.5	1.0
1/100	1.5	1.5	1.0



Hysteresis Loss

When fixing the input shaft and, after increasing from zero to rated torque on the output shaft, returning the torque to zero, the output shaft torsion angle will retain a minimal amount rather than returning entirely to zero. This is called hysteresis loss.

(Unit: arc min)

Reduction Ratio \ Frame Size	DGF005	DGF020	DGF030
1/50	2.5	2.0	2.0
1/100	2.0	1.0	1.0

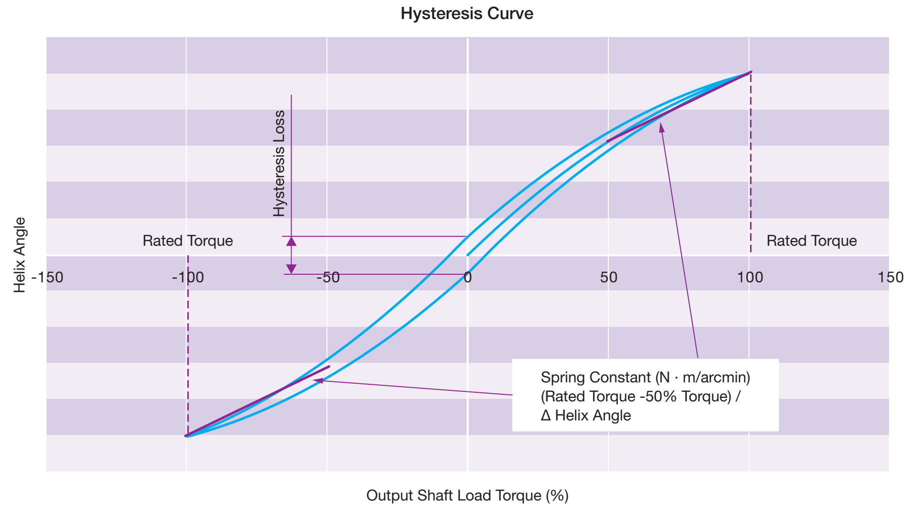
Spring Constant

This is the resistance to torsion (torsional rigidity) against rotational force.

(Unit: N · m / arc min)

Reduction Ratio \ Frame Size	DGF005	DGF020	DGF030
1/50	1.1	2.6	4.3
1/100	1.3	2.7	4.7

*The values are for reference The lower limit value is about 80% of the displayed value.



(All performance-related values contained in this catalog are obtained under the designated test conditions by NISSEI CORPORATION.)

DGF type Precautions for Use

Lubricant / Seal material

Grease is sealed in the reducer when it is shipped from our factory.
However, the oil seal is not attached to the input shaft.
If necessary, attach a seal to the device to prevent grease leakage.

[Important] Fill 70 to 80 % of the spatial volume of the device with our dedicated grease (sold separately).
*Grease density : 0.9 g/cm³

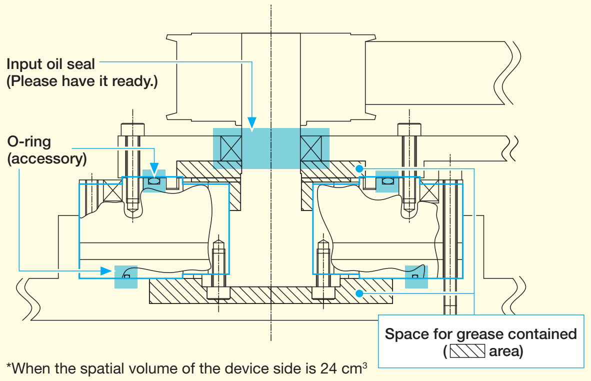
Product name	Manufacturer	Base oil
R2 Grease TA-00 V19	Chukyo Kasei Kogyo Co., Ltd.	Mineral oil Synthetic oil

Representative property		
Appearance		Yellow
Worked penetration	25°C	380
Dropping point	°C	202
Copper plate corrosion	100°C x 24h	Passed
Low-temperature torque (-30°C)	Startup torque, mN · m	32
	Rotation torque, mN · m	27
Four-ball test	1200rpm, 392N, 1h Average wear mark diameter (mm)	0.35
Oxidative stability test	99°C x 100h, kPa	10
Thickener		Lithium soap

The values shown above are representative values. Actual values may be slightly different depending on manufacturing lots.

Handling precautions	- Avoid direct sunlight, and store the reducer in a well-ventilated place. - Please check the "Safety Data Sheet (SDS)" before starting to use.

Example of grease sealing space



*When the spatial volume of the device side is 24 cm³
Sealed amount of grease = <Spatial volume> 24 cm³ x <Grease density> 0.9 g/cm³ x <Filling ratio> 75% = 16.2 g

Precautions for the grease

1. Using grease in over or under designated amount or different grease may result in performance deterioration or early damage.
2. Take care to prevent dust, moisture from entering the grease. Failure to follow this precaution may result in breakdown of the reducer.

■ When installing this product, use the attached O-rings (two types).

Precautions for the O-rings

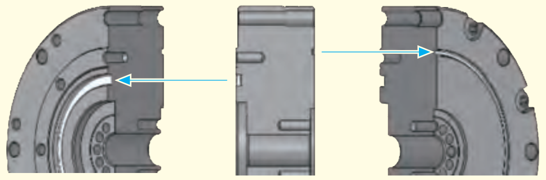
1. Before using O-rings, make sure that they are free from damage.
2. When mounting the O-rings, take care not to allow the adherence or entry of foreign substances and dust.
3. Please attach O-rings so that they do not get twisted.
4. Please attach O-rings so that they do not get pinched.
5. The O-ring contact surface of your device shall have a surface roughness of Ra 1.6 or less (Rz 3.2 or less).
   Failure to follow this precaution may shorten the service life of the reducer due to grease leakage.

For the O-ring mounting positions, see the right figure.

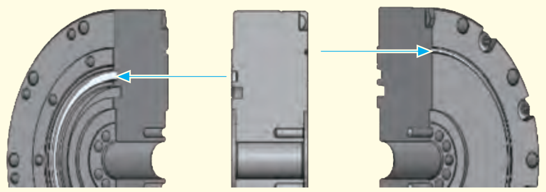
Type Codes	O-ring type	
	O-ring [1]	O-ring [2]
DGF005-•••	33.5 x 37.5 x 2 (S-34)	48 x 50 x 1
DGF020-•••	44.5 x 48.5 x 2 (S-45)	58 x 60 x 1
DGF030-•••	54.5 x 58.5 x 2 (S-55)	68 x 70 x 1

O-ring [1] mounting surface   O-ring [2] mounting surface

●DGF005



●DGF020 / DGF030



DGH / DGF type Precautions for Use

Installation

Ambient Temperature	0°C to 40°C
Ambient Humidity	85% RH or less (no condensation)
Altitude	1000m or less
Installation Environment	A well-ventilated location with no exposure to corrosive gases, explosive gases, steam, chemicals, etc. A location not directly exposed to rain. A location not directly exposed to sunlight. A well-ventilated location with no dust.
Setup Location	Indoors

Securely fasten bolts to a flat machined surface with no vibration.
Tighten the bolts to designated torque shown in the right table.
If the foundation is not proper or the mounting surfaces are not flat enough, vibrations may occur during operation, and the service life of the reducer may be shortened.
Adjust the flatness of the mounting surfaces to 0.1 mm or less.

(Reference value)

Bolt Size	Tightening Torque	
	(N · m)	(kgf · m)
M3	2.4	0.24
M4	5.4	0.55
M5	10.8	1.10
M6	18.4	1.87

*With bolt strength classification of 12.9.

Safety Precautions

It is advised to read catalog and Instruction Manual before use in order to operate the product correctly.
Please download the instruction manual from the following.

High Stiffness Reducer Instruction Manual(Homepage)
https://img-ja.nissei-gtr.co.jp/files/user/pdf/data/gtr/manual/rc/rc_e.pdf

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