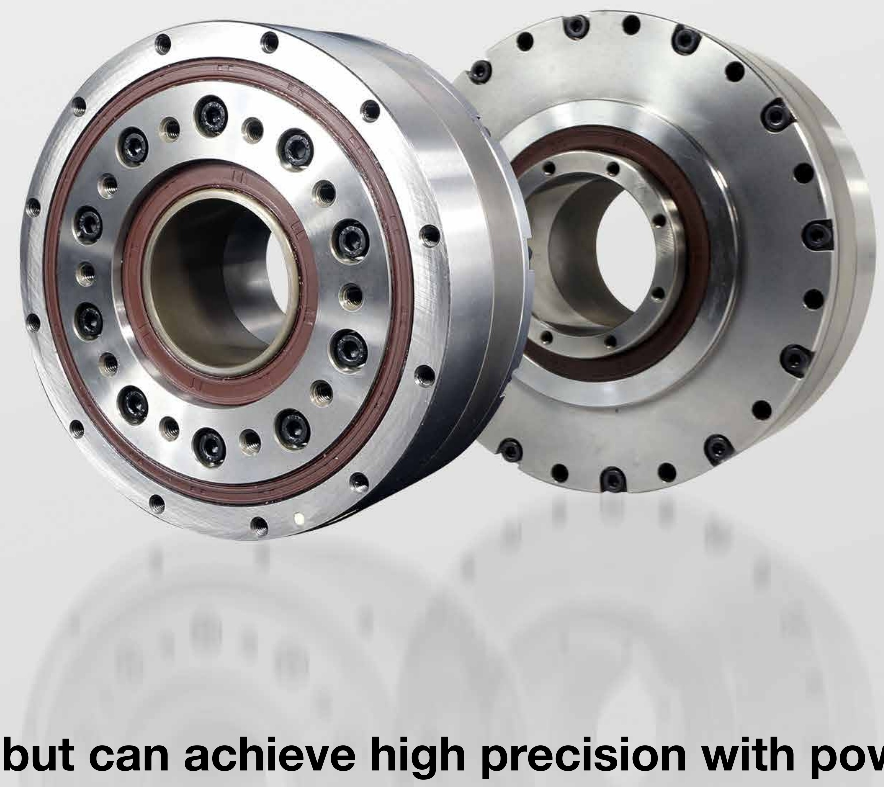
HIGH STIFFNESS REDUCER

[Large Hollow Bore Type]

Large Hollow Shaft with High Torque



Compact but can achieve high precision with powerful drive

Suitable for FA applications, as well as robots with repetitive stops/starts.

HIGH STIFFNESS REDUCER

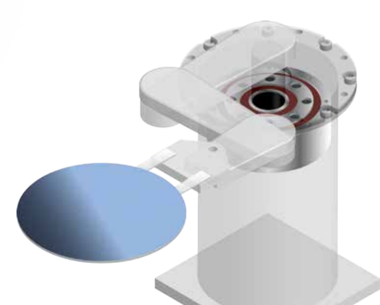
[Large Hollow Bore Type]

Faster, stronger, and better than ever.

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.
Compact but can achieve high precision with powerful drive.

Vertically articulated robot

SCARA robot



Wafer Handling robot

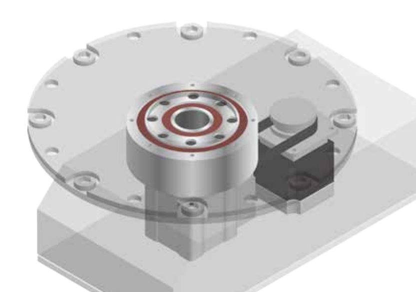
Large Hollow Shaft with High Stiffness and High Torque

Product specifications which would support various applications.

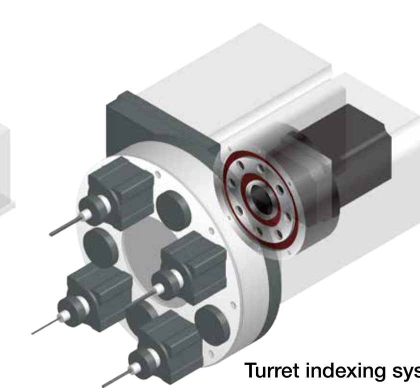
5 Frame Sizes
OD: 71mm /81mm /95mm /110mm /142mm

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

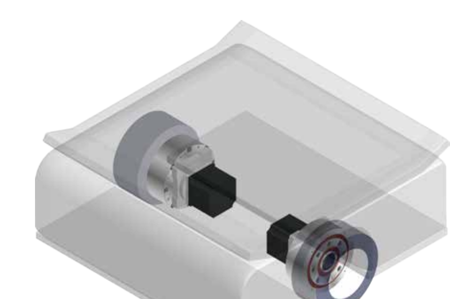
Ideal for Robots, FA products, and other applications which require highprecision frequent driving and stopping.



Positioner



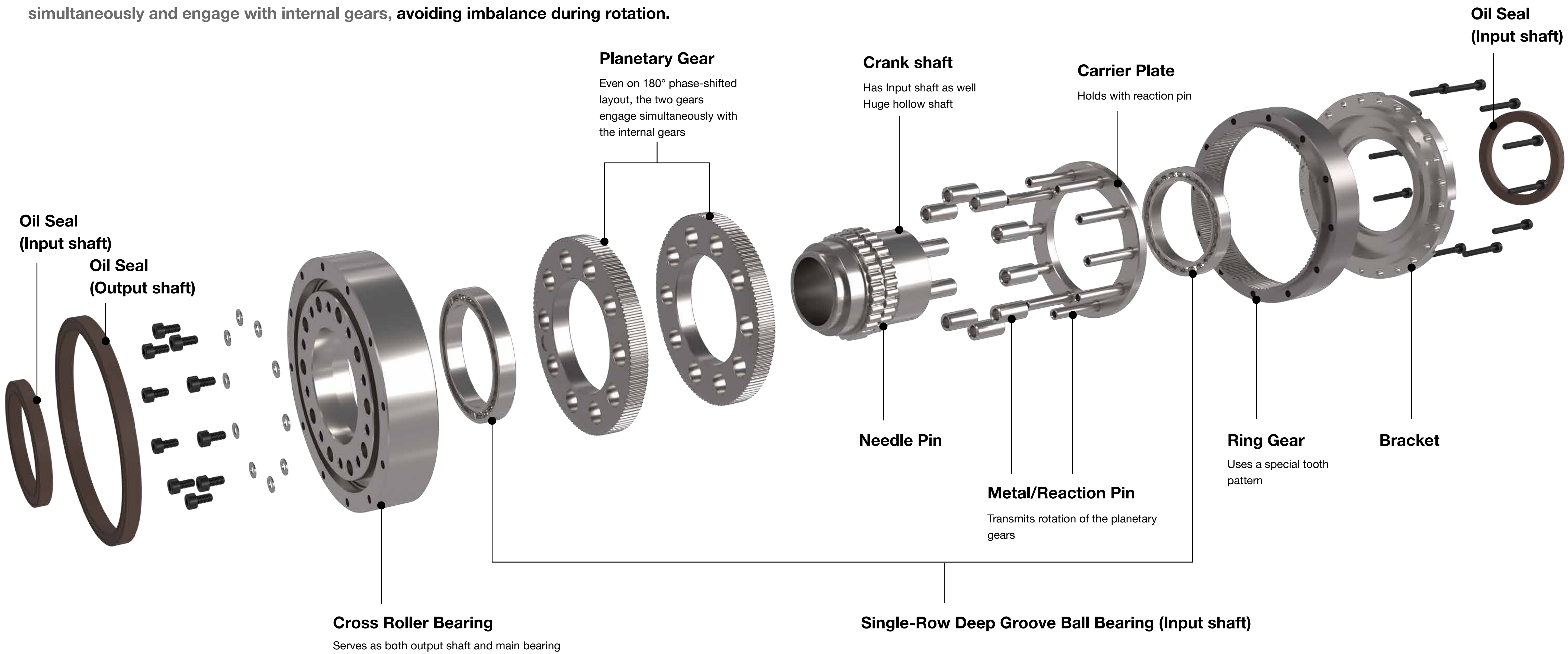
Turret indexing system



AGV drive

Every element is designed with care.

- In accordance with the crankshaft (input shaft) rotation, **the two planetary gears revolve while autorotating,** transmitting their movement through the reaction pin and metal to the output crossed roller bearing.
- Even with on a single stage gearing , **the two planetary gears (180° offset)** can phase simultaneously and engage with internal gears, **avoiding imbalance during rotation.**

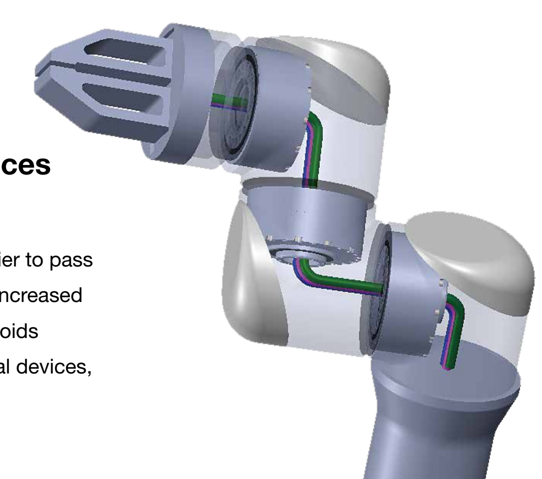


Designed for maximum performance.

The use of a differential reducer mechanism (eccentric oscillation type) achieves high torsional rigidity and high allowable torque. As well, the cross roller bearing integrated with the output shaft keeps the unit compact while ensuring higher moment stiffness. Even if the reduction Ratio changes, the Meshing does not change so the allowable torque is constant.
High torque can be obtained even at low reduction ratios.

The large hollow bore enhances freedom of design.

The large hollow shaft not only makes it easier to pass wiring, piping, shafts, etc. but also enables increased wiring, encompassing even thick wires. It avoids interference with the robot body or peripheral devices, reducing bending and tensile loads.

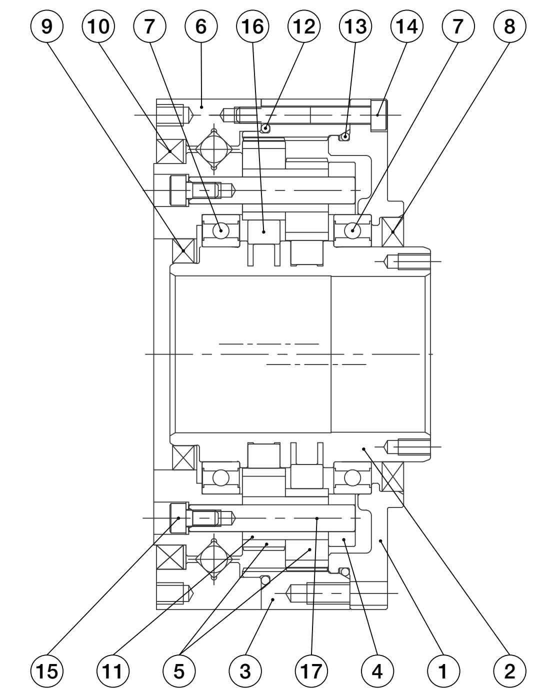


Model and Specs

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

*1. Each Frame Size represents their corresponding Rated Torque

Structure



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.

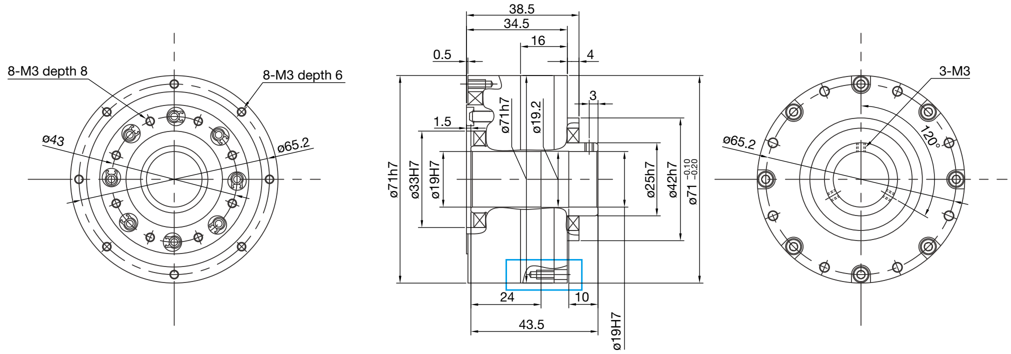
Performance Table

Frame Size	Reduction Ratio	Rated Torque (Input 2000r/min)		Start/Stop Allowable Peak Torque		Allowable Average Load Torque			Allowable Instantaneous Maximum Torque		Allowable Max. Input RPM	Allowable Average Input RPM	Spring Constant	Hysteresis Loss	Angular Transmission Error	Weight
		N · m	kgf · m	N · m	kgf · m	N · m	kgf · m		N · m	kgf · m	r/min	r/min	N · m/arc min	arc min	arc min	kg
010	1/19	10	1.0	30	3.1	19	1.9		61	6.2	6000	3500	2.5	2.0	2.0	0.77
	1/29	10	1.0	30	3.1	19	1.9		61	6.2	6000	3500	2.5	2.0	2.0	0.77
	1/59	10	1.0	30	3.1	19	1.9		61	6.2	6000	3500	2.5	2.0	1.5	0.77
030	1/19	29	3.0	56	5.7	35	3.6		113	11.5	6000	3500	6.0	2.0	1.5	1.14
	1/29	29	3.0	56	5.7	35	3.6		113	11.5	6000	3500	6.0	2.0	1.5	1.14
	1/59	29	3.0	56	5.7	35	3.6		113	11.5	6000	3500	6.0	2.0	1.5	1.14
040	1/19	44	4.5	96	9.8	61	6.2		165	16.8	6000	3500	9.0	2.0	1.5	1.8
	1/29	44	4.5	96	9.8	61	6.2		165	16.8	6000	3500	9.0	2.0	1.2	1.8
	1/59	44	4.5	96	9.8	61	6.2		165	16.8	6000	3500	9.5	2.0	1.0	1.8
080	1/19	82	8.4	178	18.2	113	11.5		332	33.9	6000	3500	18.0	2.0	1.5	2.6
	1/29	82	8.4	178	18.2	113	11.5		332	33.9	6000	3500	19.5	2.0	1.2	2.6
	1/59	82	8.4	178	18.2	113	11.5		332	33.9	6000	3500	21.0	2.0	1.0	2.6
150	1/19	153	15.6	395	40.3	217	22.1		738	75.3	6000	3500	33.0	2.0	1.5	5.2
	1/29	153	15.6	395	40.3	217	22.1		738	75.3	6000	3500	36.5	2.0	1.2	5.2
	1/59	153	15.6	395	40.3	217	22.1		738	75.3	6000	3500	40.0	2.0	1.0	5.2

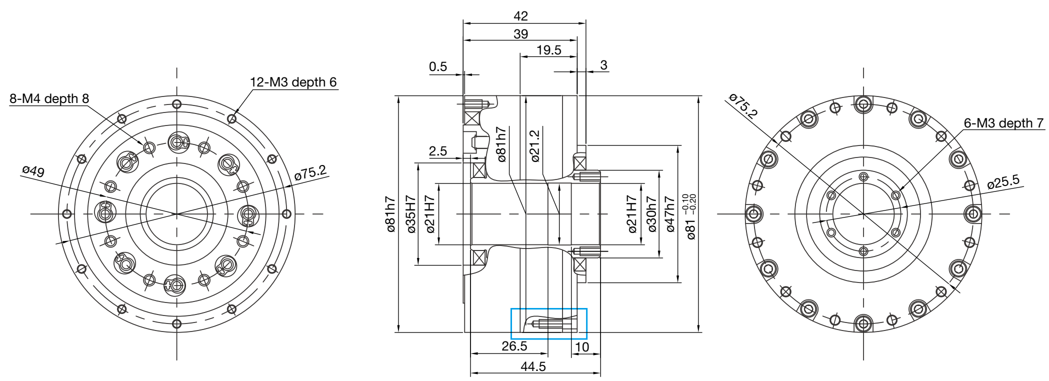
(All performance values in this catalog are at 20°C ambient temperature.)

Drawings

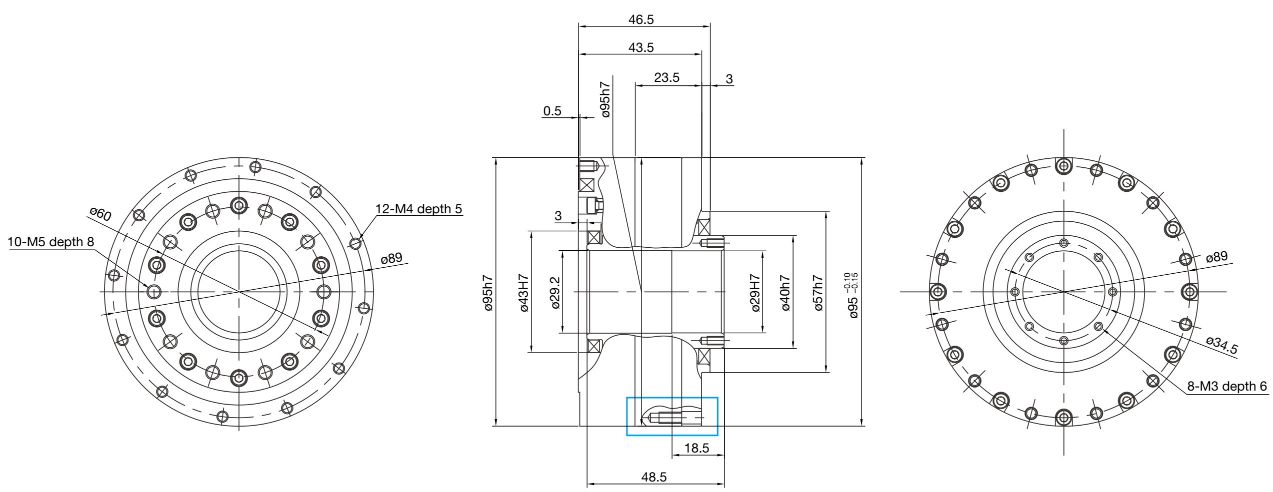
DGH010



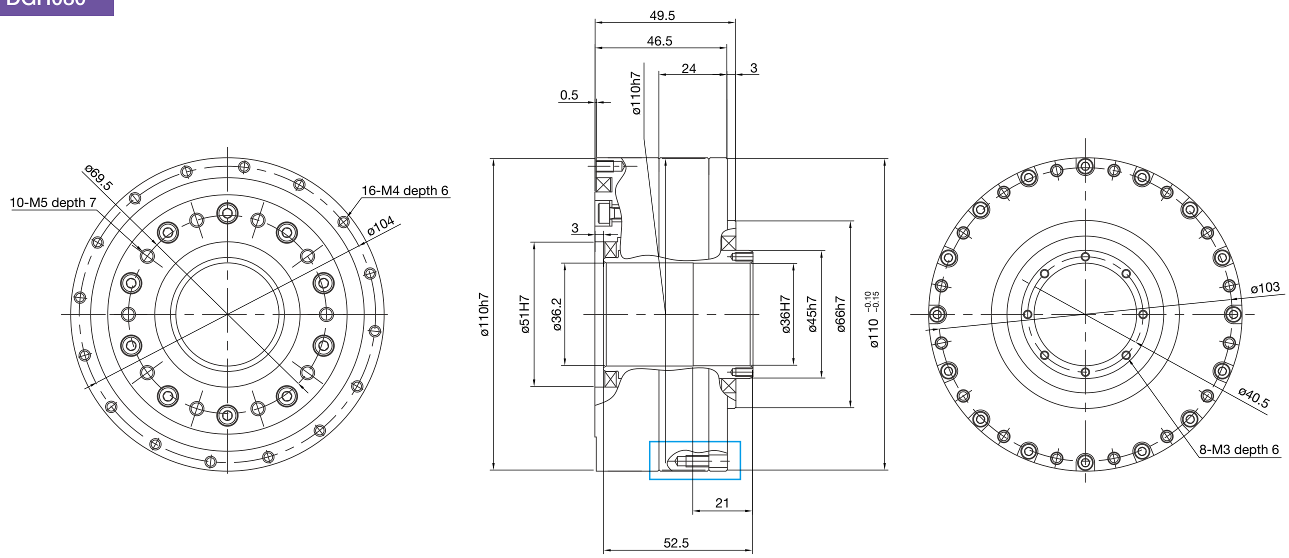
DGH030



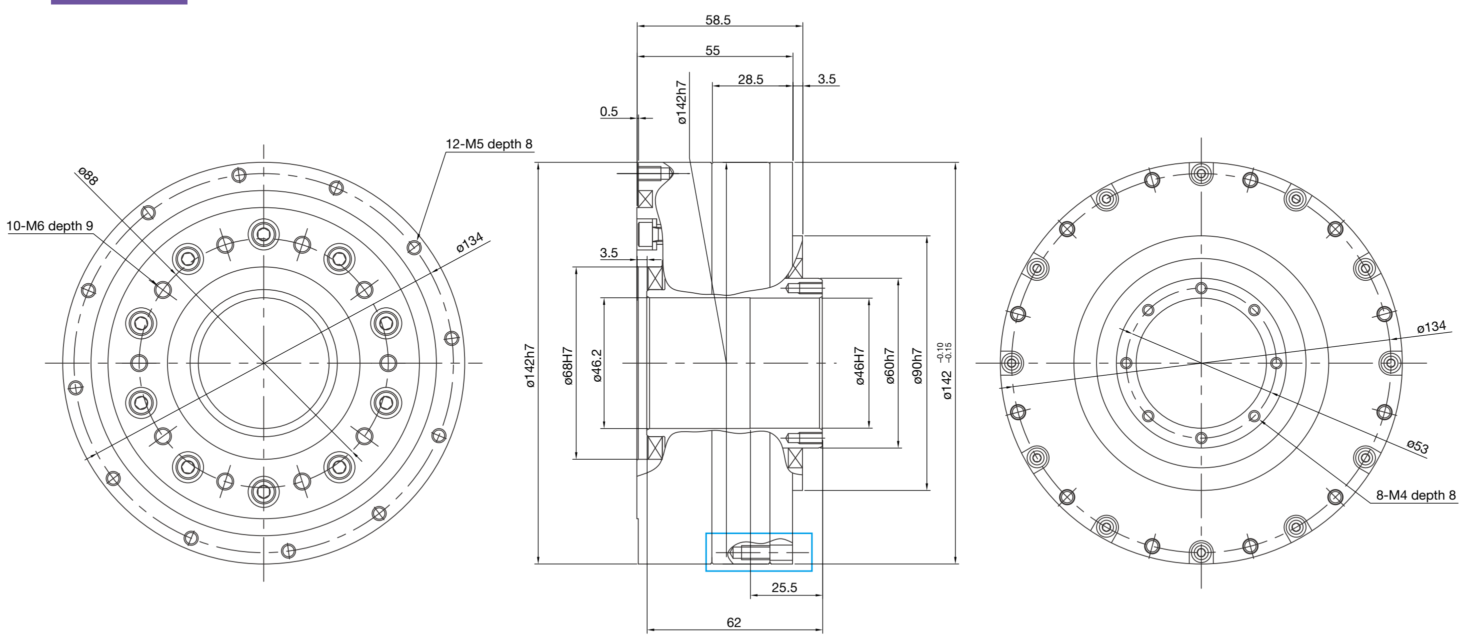
DGH040



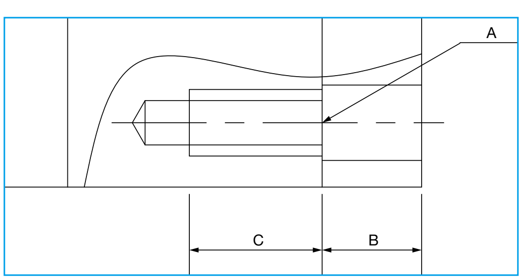
DGH080



DGH150

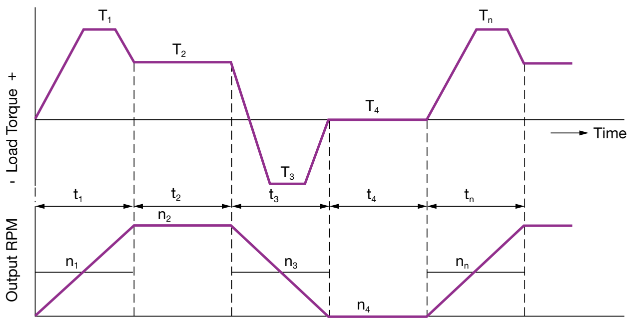


part details



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

■ Operation Pattern



*n_1, n_2, and n_n are average values.

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

Selection Process and Examples / Selection Process Example

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

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

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

$\approx$ 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

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

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

2-2. Deciding on reduction ratio

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

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

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

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

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)

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

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})

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

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})

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

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)
$\frac{Fa_{av}}{Fr_{av} + 2(Fr_{av}(Sr + A) + Fa_{av} \cdot Sa) / dp}$	≤ 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

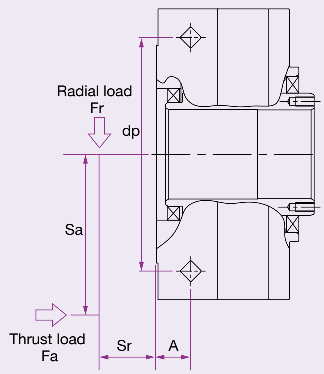
$$L_{10} = \left(\frac{10^6}{60 \times N_{av}}\right) \times \left(\frac{C}{fw \cdot Pc}\right)^{10/3}$$

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

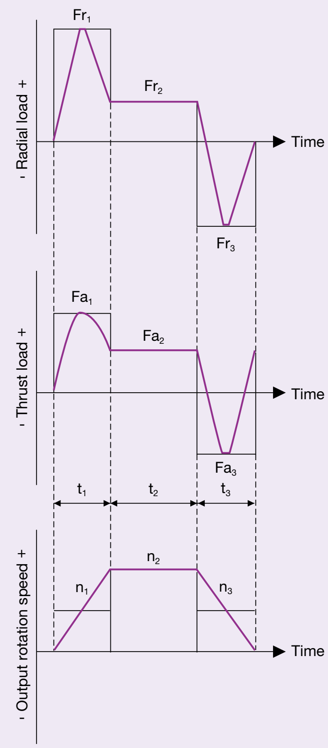
Load Coefficient

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



5-2. Graph



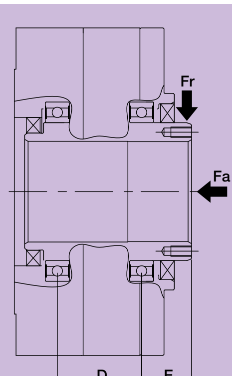
Frame Size	Roller Pitch Diameter (dp)	Roller Position from Output Shaft End (A)	Basic Dynamic Rated Load (C)	Basic Static Rated Load (C_o)	Allowable Moment (Mc)
	(m)	(m)	(N)	(N)	(N · m)
DGH010	0.0556	0.0095	7100	10830	74
DGH030	0.064	0.01	12100	18310	126
DGH040	0.0763	0.0112	17500	25900	220
DGH080	0.0889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

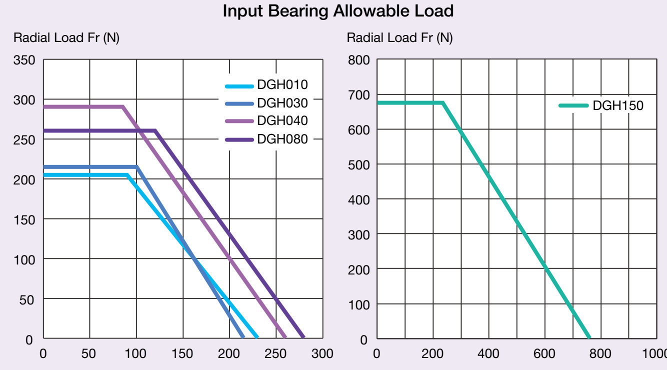
Confirmation of load on input shaft

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



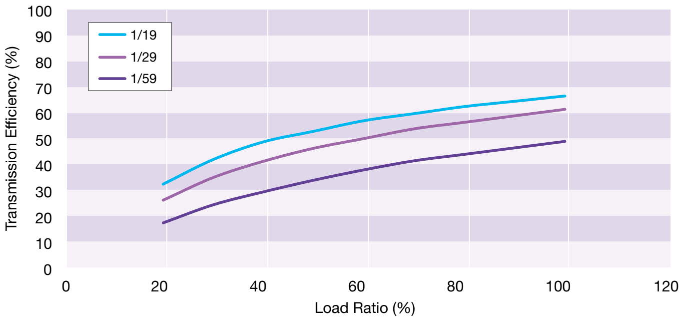
Efficiency Characteristics

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.

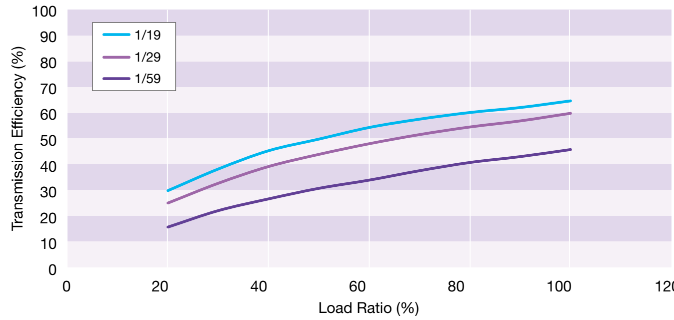
DGH010

Input RPM 2000r/min



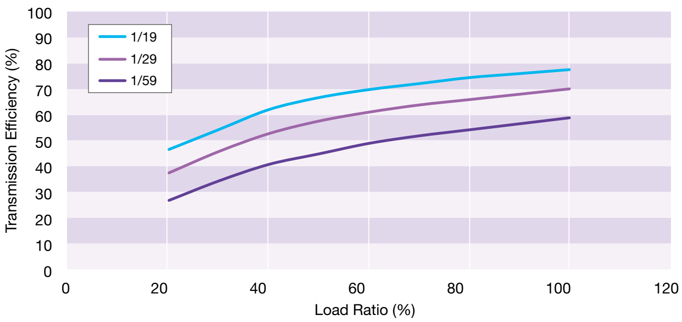
DGH010

Input RPM 3500r/min



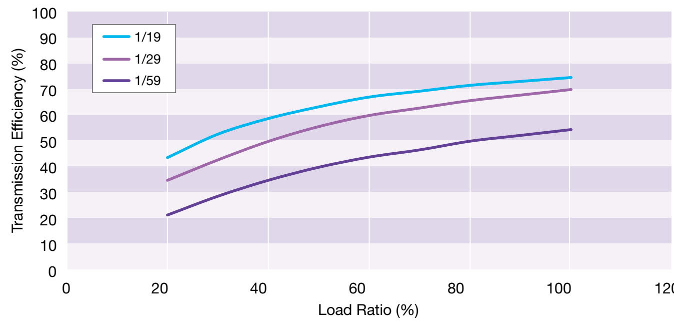
DGH030

Input RPM 2000r/min



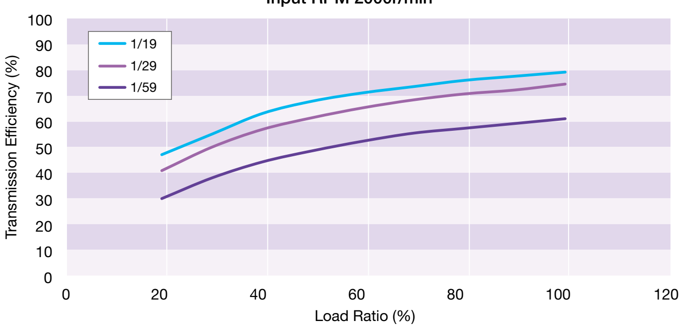
DGH030

Input RPM 3500r/min



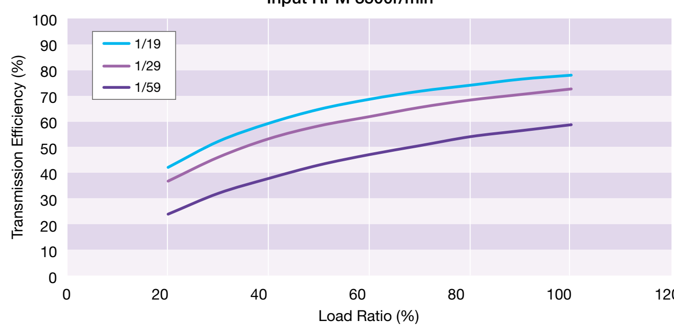
DGH040

Input RPM 2000r/min



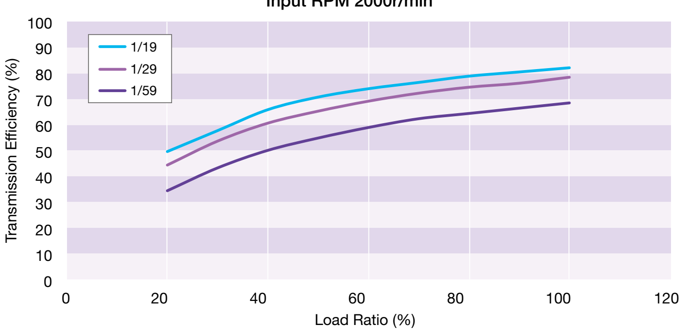
DGH040

Input RPM 3500r/min



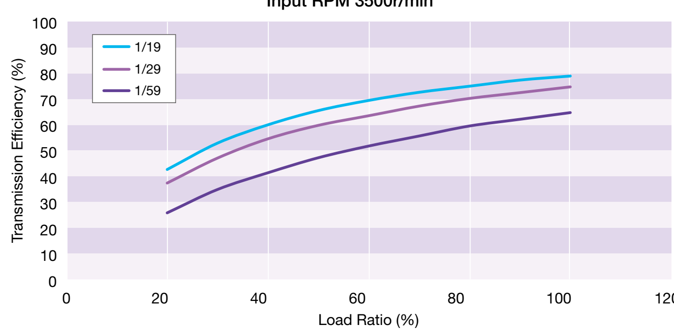
DGH080

Input RPM 2000r/min



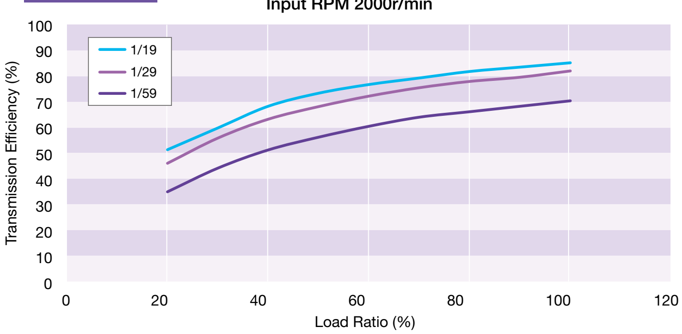
DGH080

Input RPM 3500r/min



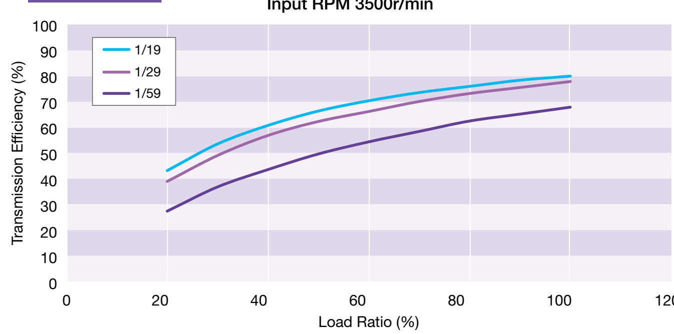
DGH150

Input RPM 2000r/min



DGH150

Input RPM 3500r/min



Starting Torque

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

(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.

(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

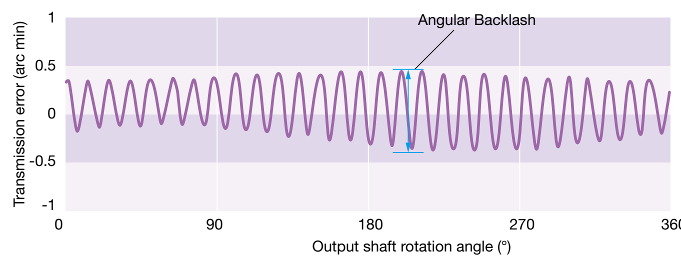
*The values in the table above vary according to usage conditions and are for use as reference only.

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)

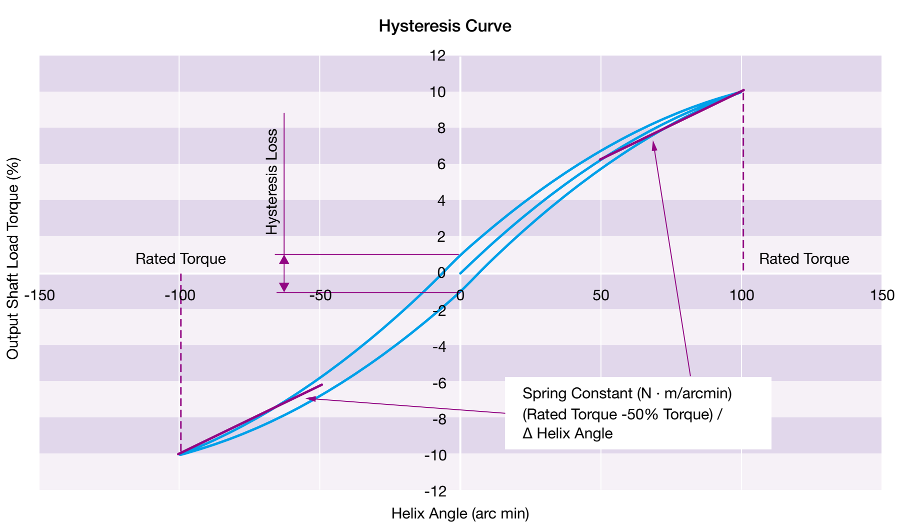
Reduction Ratio \ Frame Size	DGH010	DGH030	DGH040	DGH080	DGH150
1/19	2.0	2.0	2.0	2.0	2.0
1/29	2.0	2.0	2.0	2.0	2.0
1/59	2.0	2.0	2.0	2.0	2.0

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	2.5	6.0	9.0	18.0	33.0
1/29	2.5	6.0	9.0	19.5	36.5
1/59	2.5	6.0	9.5	21.0	40.0



(All performance values in this catalog are at 20°C ambient temperature.)

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 based on tightening torque shown in the table below.
If the foundation is unstable or if mounting surface is not flat enough, vibration may occur during operation which might reduce the life of the product.
The mounting surface flatness should be 0.1 mm or less.

(Reference value)

Bolt Size	Tightening Torque (N · m)	Tightening Torque (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.

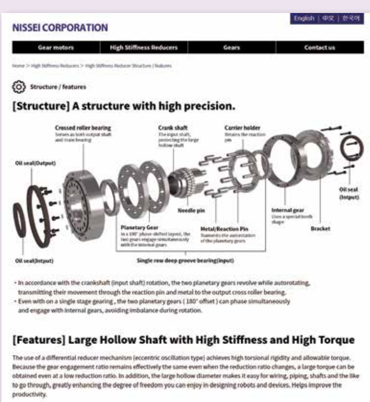
Safety Precautions

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.

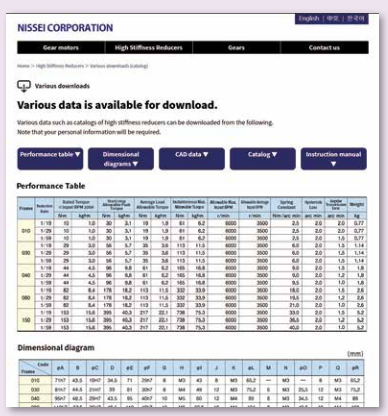
High Stiffness Reducer Instruction Manual(Homepage)
https://english.nissei-gtr.co.jp/pdf/data/gtr/manual/rc/rc-e.pdf

More detailed product information, CAD data, etc. are available.
Please download the files via The High Stiffness Reduces special page.

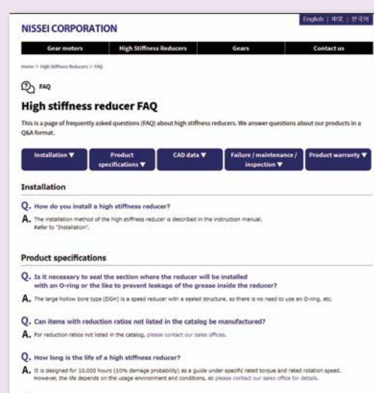
https://english.nissei-gtr.co.jp/rc/



Structure and features explained in video



CAD data and instruction manuals aavailable for download



Common Q&A page available.

* 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.

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