

RV[®]



Precision Reduction Gear RV[™] High-speed Gearhead

GH

GH Series

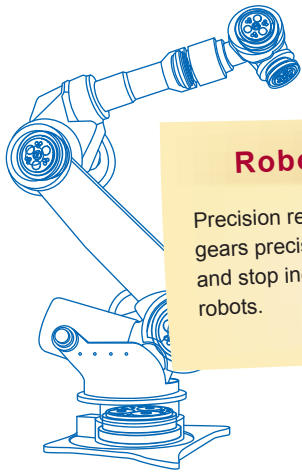


Nabtesco



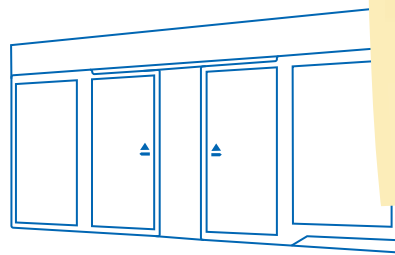
Contributing to society with our 'Moving it. Stopping it.' technologies

Nabtesco manufactures products which are used in everyday life. Our high-accuracy components are essential for moving objects; they may be rarely visible, but are the foundation of everyday objects that you see moving and wonder how. Nabtesco's technologies are found throughout objects that move and stop people's lives.



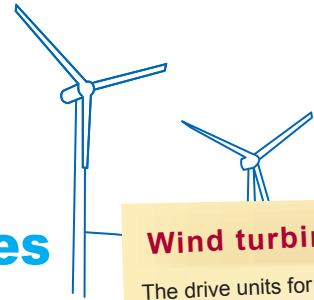
Robots

Precision reduction gears precisely move and stop industrial robots.



Doors

Nabtesco technology opens and closes automatic doors in buildings and platform doors at train stations.

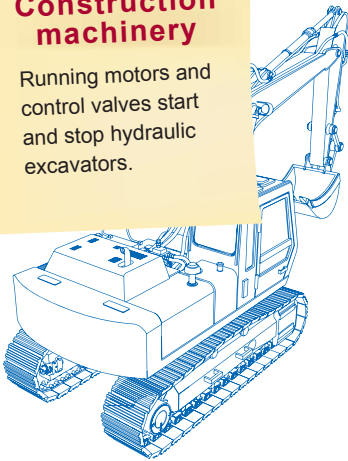


Wind turbines

The drive units for wind turbine generators control the orientation of the wind turbine and the angle of the blades.

Construction machinery

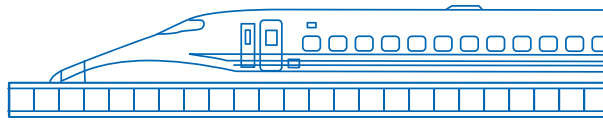
Running motors and control valves start and stop hydraulic excavators.



Nabtesco technologies are at work in many areas of our daily lives.

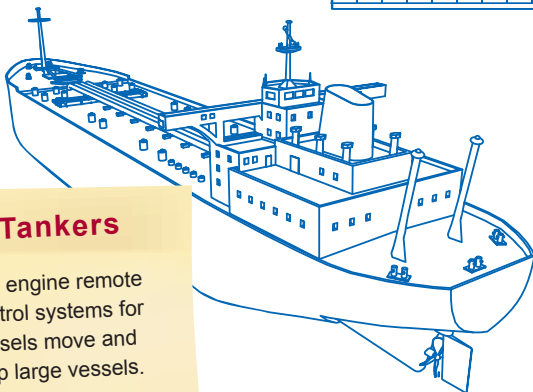
Bullet trains

Brakes and doors ensure safety and comfort for the world-famous Shinkansen bullet trains.



Tankers

The engine remote control systems for vessels move and stop large vessels.



Airplanes

The flight control systems are crucial for the flight safety of aircraft.



CONTENTS

Who is Nabtesco?

The key words for Nabtesco are 'motion control'. We use our strengths in the fields of component and systems technologies to develop highly creative products. Through the Nabtesco Group as a whole, we can also utilize our advantage of expertise to maximum effect in order to further enhance these strengths.

In the air, on land and at sea, we have established a large share in various fields of both international and domestic markets. Nabtesco will continue to evolve by utilizing its strengths in many fields and by exploring the possibilities of the future.



Nabtesco

April 2002 Initiation of hydraulic equipment business alliance
October 2003 Business merger

The business alliance between Teijin Seiki and NABCO on hydraulic equipment projects was the beginning of a mutual confirmation by the companies of the other's product configuration, core technologies, corporate strategies and corporate culture. This led to a common recognition that a business merger would be an extremely effective means of increasing corporate value and achieving long-term development. Based on this mutual judgment, in 2003 an equity transfer was conducted to establish Nabtesco as a pure holding company, with both firms as wholly owned subsidiaries. After a year of preparation, both companies were absorbed and amalgamated by means of a short form merger, and Nabtesco was transitioned to an operating holding company.

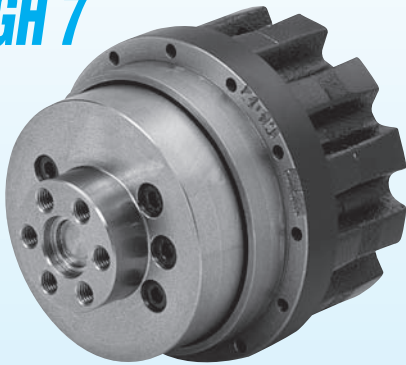
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What is the GH Series?

GH High Speed Gearheads taking your servomotor performance to the limit

The GH Series provides significant advantages in terms of ease-of-use. It is based on a highly successful product, the Precision Reduction Gear RV, used in various applications around the world.

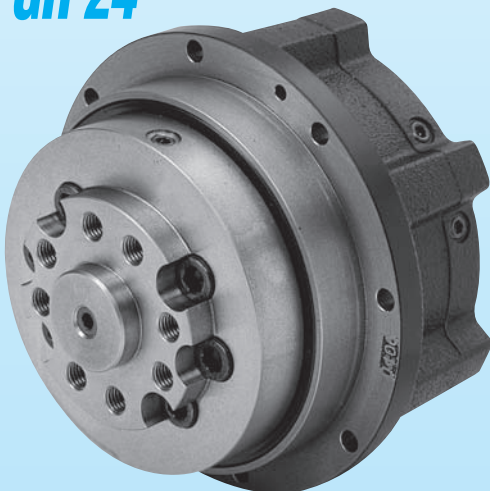
GH 7



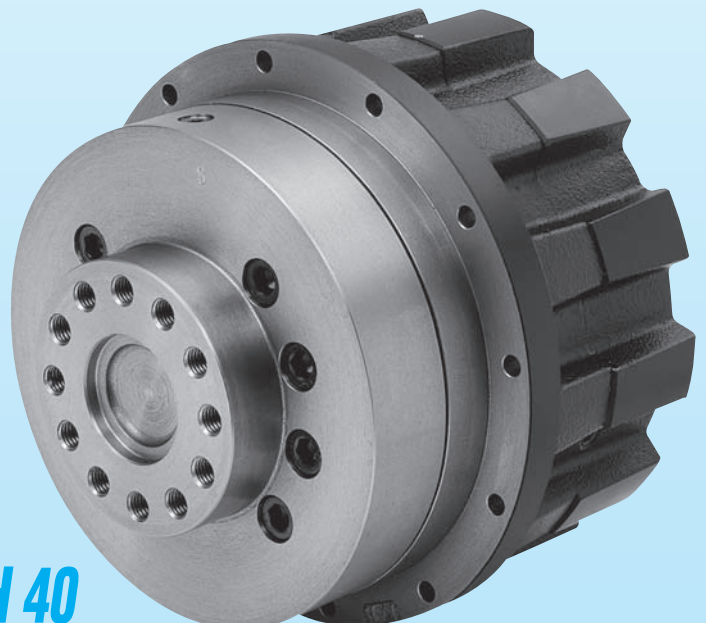
GH 17



GH 24



GH 40



Features and configurations

High reliability
High rigidity
High precision
High speed

The double-end support design and unique pin gear mechanism provide the following advantages:

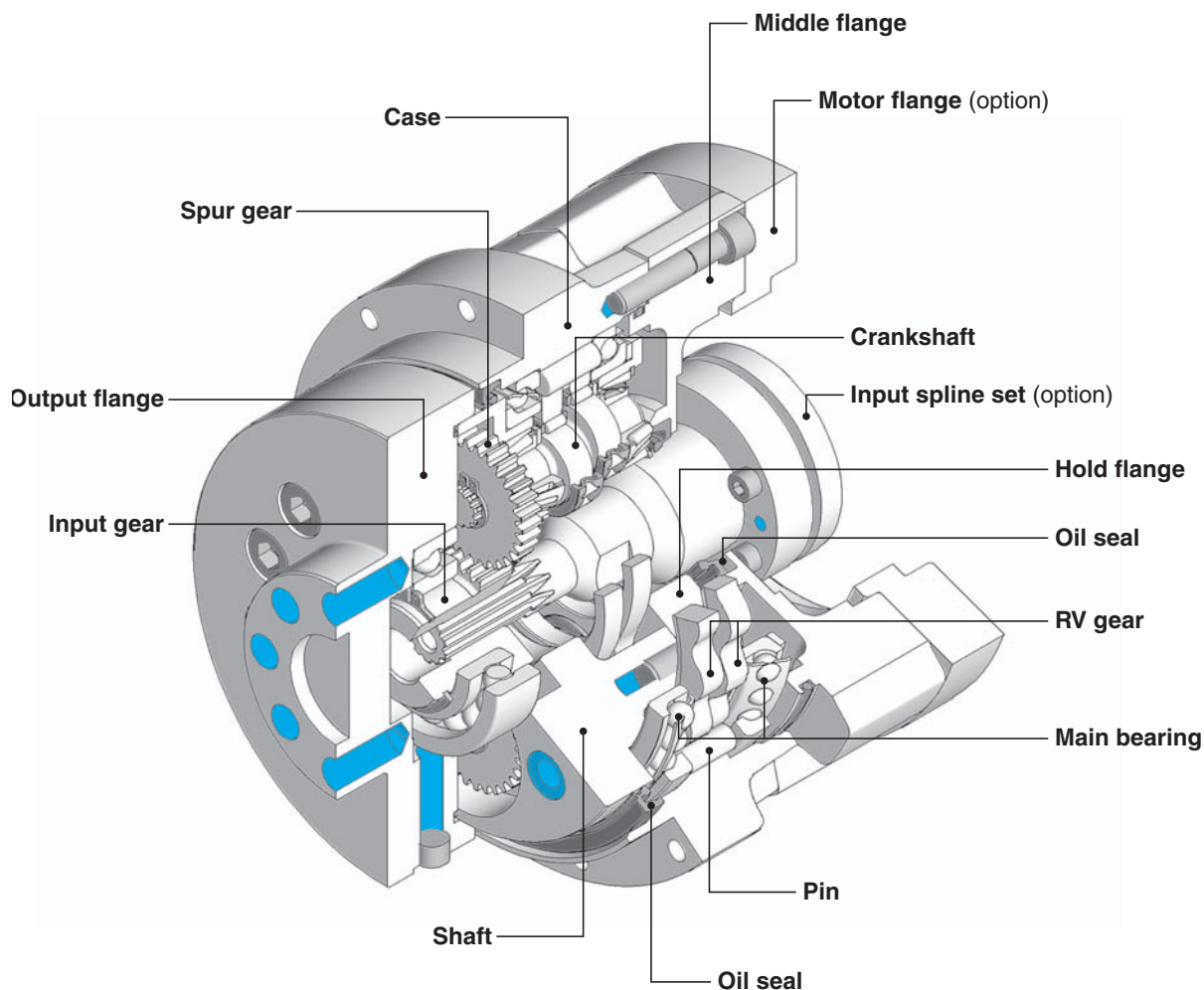
- (1) Capable of 7 times the rated torque
- (2) High rigidity as well as small backlash [6 arc.min]
- (3) Capable of high output speed with low reduction ratio (1/11 to 1/31)
- (4) High torque density

Heavy load support

A set of internal main bearings (large angular ball bearings) enables complete support of heavy external loads.

Maximum ease of use

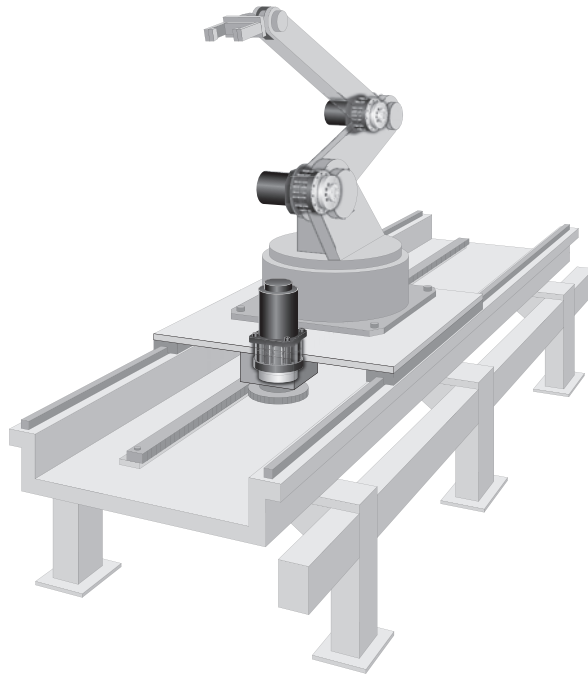
- (1) Pre greased
- (2) Easy motor mounting thanks to the special input spline and motor flange.



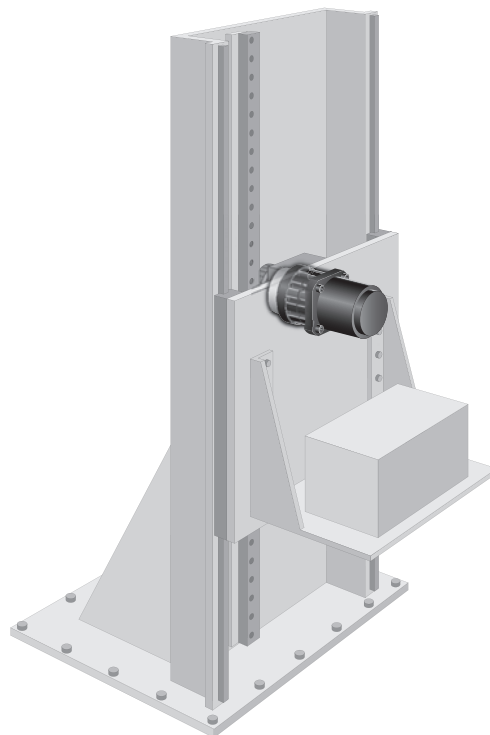
■ **Rotation direction** The rotation direction of the output shaft is same as that of the input spline.

Main GH Series applications

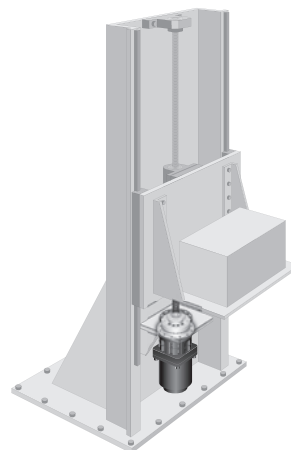
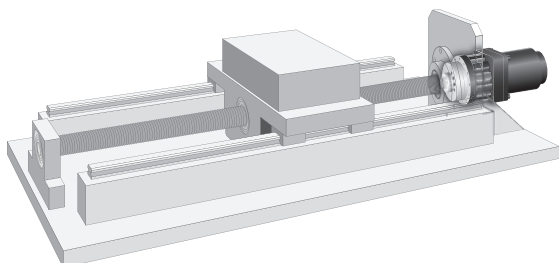
■ Robot travel axis



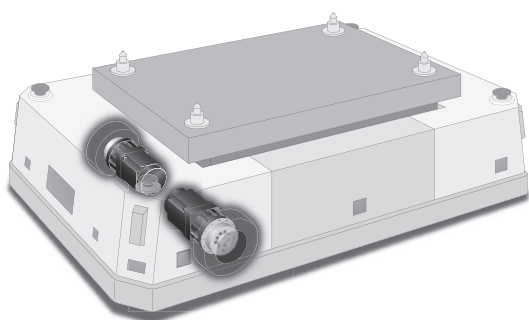
■ Loader travel axis



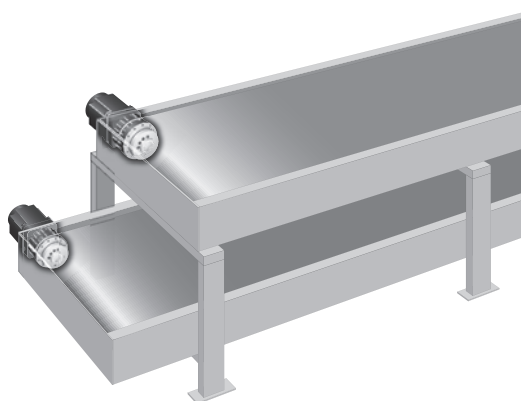
■ Ball screw drive axis



■ AGV drive/handle axis



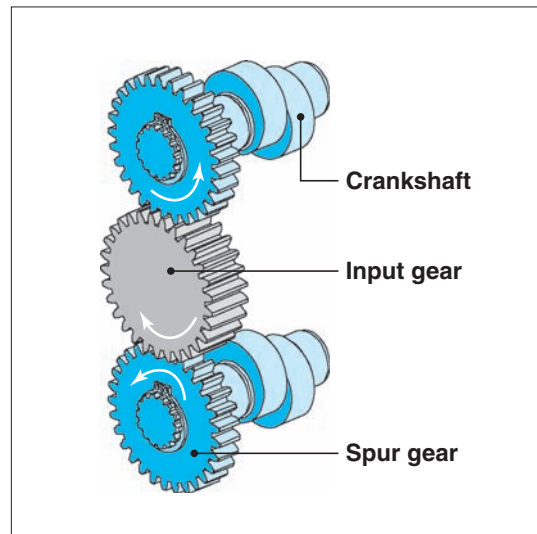
■ Transfer conveyor



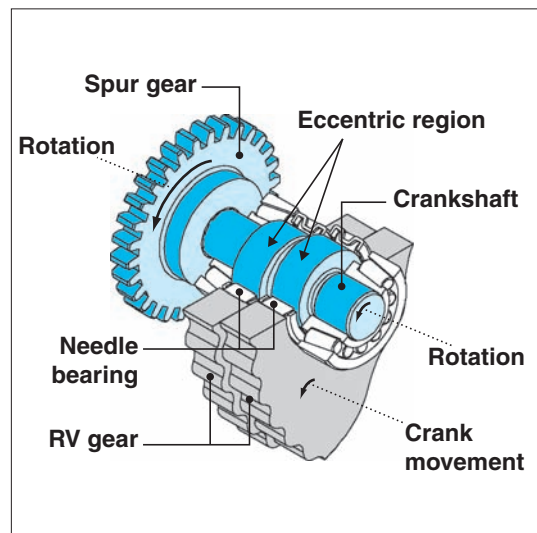
Principle of operation

1. Rotation of the servomotor is transmitted through the input gear to the spur gears, and the speed is reduced accordingly with the gear ratio between the input gear and the spur gears. This is the first reduction section <Fig. 1>.
2. Since they are directly connected, the crankshafts have the same rotational speed as the spur gears <Fig. 1>.
3. Two RV gears are mounted around the needle bearings on the eccentric region of the crankshaft. (In order to balance the equal amount of force, two RV gears are mounted) <Fig. 2>.
4. When the crankshafts rotate, the RV gears mounted on the eccentric sections also revolve eccentrically around the input axis (crank movement) <Fig. 2>.
5. Pins are arrayed in a constant pitch in the grooves inside the case. The number of pins is just one larger than the number of RV teeth <Fig. 3>.
6. As the crankshafts revolve one complete rotation, the RV gears revolve eccentrically one pitch of a pin (crank movement). As a result of this, the RV gears rotate one tooth in the direction opposite to the rotation of the crankshafts <Fig. 3>.
7. The rotation is then transmitted to the shaft (output shaft) via the crankshaft. At this time, the shaft rotation speed can be reduced in proportion to the number of pins against the crankshaft. This is the second reduction section <Fig. 3>.
8. The total reduction ratio is the product of the first reduction ratio multiplied by the second reduction ratio.

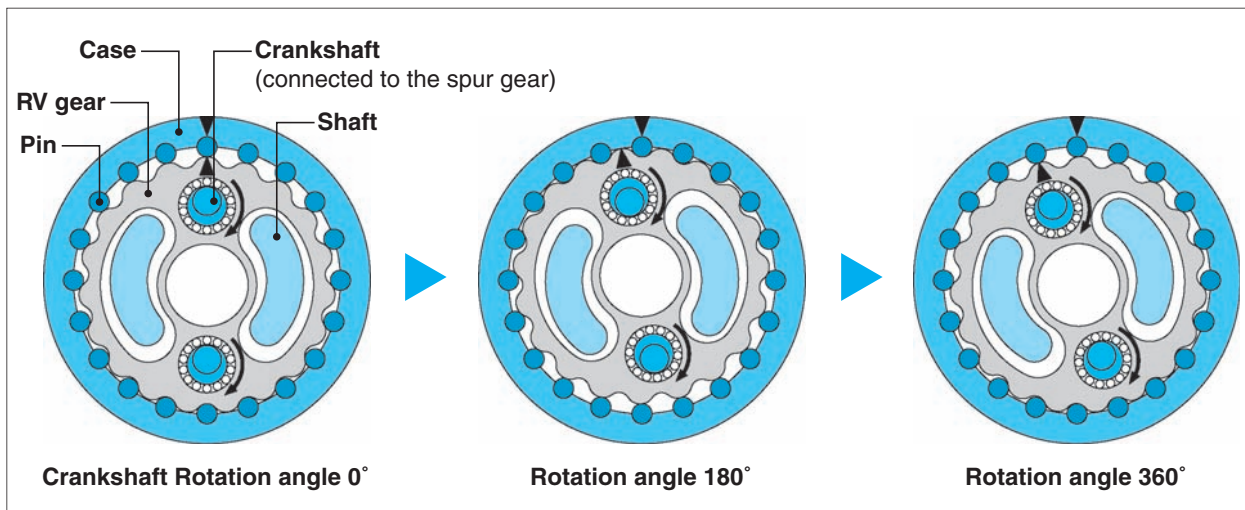
■ Fig. 1 First reduction section



■ Fig. 2 Crankshaft section



■ Fig. 3 Second reduction section



GH Series model code

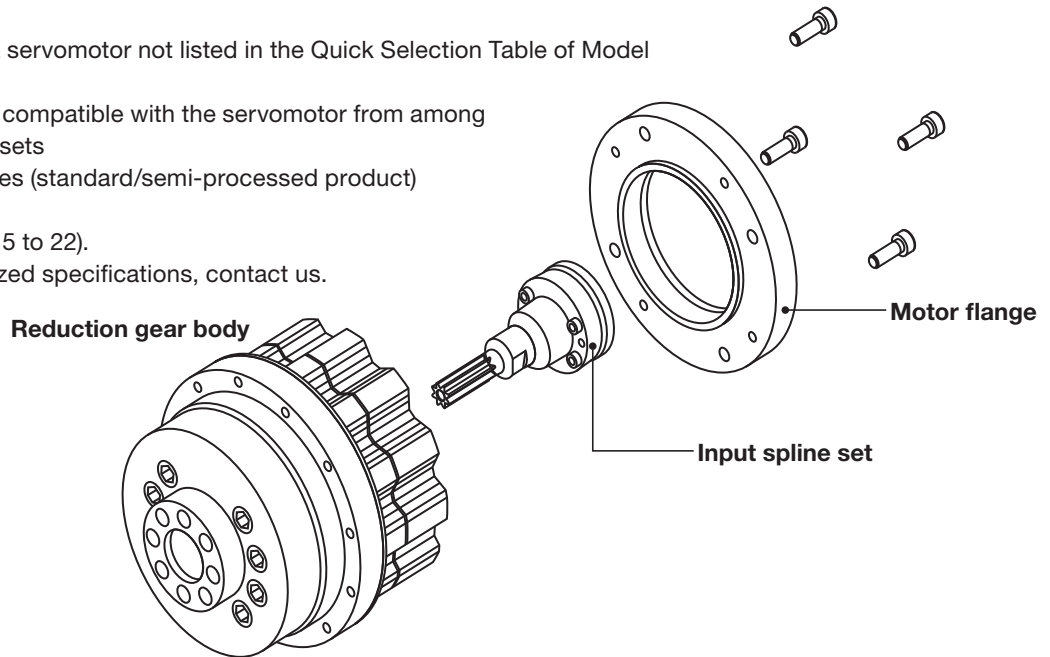
Model code

When ordering or making an inquiry, use the following model code.

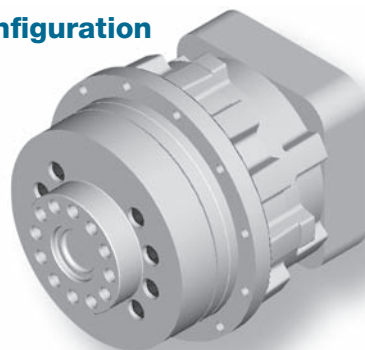
GH	7	21	A	B	P
Model code	Model code	Ratio code	Input spline code		Motor flange code
GH	7	11	Standard	A to ZZ	Standard
	17	21	Blank	Y1	Blank
	24	31	None	Y2	None
	40				Z
	100				Z
					Flange
					P
					Shaft
					S

Selection of model code

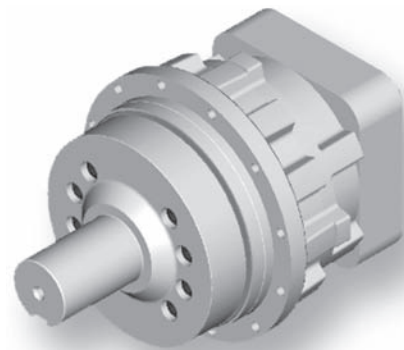
1. Only 21 and 31 can be used as the ratio code of the GH100.
2. Only the flange type output shaft is available for the GH100.
3. Select the model code according to the attached Quick Selection Table of Model Code.
4. When you use a servomotor not listed in the Quick Selection Table of Model Code, select the parts compatible with the servomotor from among the input spline sets and motor flanges (standard/semi-processed product) that we provide (refer to pages 15 to 22).
5. For the customized specifications, contact us.



Output shaft configuration



Output flange type



Output shaft type

GH Series model code

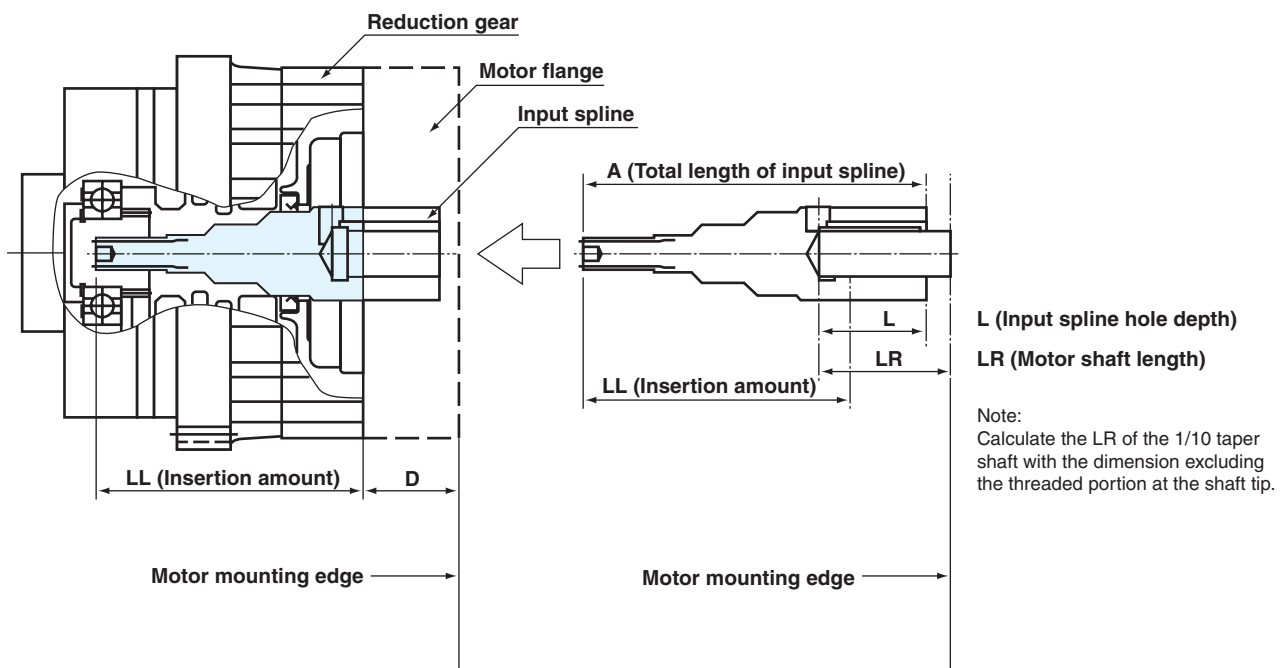
Model code selection (Precautions)

1. Select the model code that is compatible with the servomotor being used according to the Quick Selection Table of Model Code.
2. If a compatible servomotor is not listed in the Quick Selection Table of Model Code, select a part that is compatible with the servomotor according to the external dimension drawings for the input spline set and motor flange shown in pages 15 to 20.

● Check the thickness of the motor flange according to the following equation:

Thickness of motor flange $D = (A + LR - L) - LL$

Model Code	LL Input Spline Insertion Amount (mm)
GH7	100 ^{+4.6} _{-0.7}
GH17	122 ^{+6.3} _{-1.0}
GH24	106 ^{+3.7} _{-0.4}
GH40	158 ^{+3.0} _{-1.1}
GH100	202 ^{+2.5} _{-1.0}



Combination of reduction gear and servomotor

1. The combinations that satisfy the following equation are recommended.
 $(\text{Rated torque of motor} \times 0.5) < \{ \text{Rated torque of reduction gear} / (\text{Speed ratio} \times 0.8) \} < (\text{Rated torque of motor} \times 1.5)$
2. Select the combinations that satisfy the following equation.
 $(\text{Maximum torque of motor}) < \{ \text{Momentary maximum torque of reduction gear} / (\text{Speed ratio} \times 0.8) \}$
3. Limitation must be imposed to the motor torque when the condition indicated in 1 and 2 above cannot be satisfied.
4. For more precise motor selection, the effective torque, load inertia moment, brake torque, regenerative ability, and so forth, must also be considered.

Specifications

Rating table (*1)

Model Code	Ratio Code	R Ratio	To Rated Torque (*5)	No Rated Output Speed	K Rated service life	Ts1 Allowable start/ stop torque	Ts2 Momentary maximum allowable torque	Nso Allowable output speed during continuous operation (* 2)	Ns1 Allowable output speed during intermittent operation (* 2)	Backlash	Lost motion (Representative value)	Torsional rigidity representative value	η Startup efficiency (Typical value)	I Mo1 Inertia Moment I ($I=GD^2/4$) Input Shaft Equivalent (*3)	Mass
			Nm	rpm	Hr	Nm	Nm	rpm	rpm						
GH7	11	461/41	69	50	6,000	206	480	150	270	6	6	20 (2)	80	4.25×10 ⁻⁵	8
	21	21												2.42×10 ⁻⁵	
	31	153/5												1.88×10 ⁻⁵	
GH17	11	11	167	50	6,000	500	1166	150	270	6	6	45 (4.6)	75	1.90×10 ⁻⁴	15.5
	21	21												1.00×10 ⁻⁴	
	31	31												7.71×10 ⁻⁵	
GH24	11	11	235	50	6,000	706	1646	150	250	6	6	65 (6.6)	75	1.48×10 ⁻⁴	15.5
	21	21												6.56×10 ⁻⁵	
	31	31												4.72×10 ⁻⁵	
GH40	11	419/39	392	50	6,000	1176	2744	150	250	6	6	108 (11)	80	8.26×10 ⁻⁴	35.5
	21	21												4.10×10 ⁻⁴	
	31	723/23												3.06×10 ⁻⁴	
GH100	21	20.375	980	50	6,000	2942	6865	65	135	10	10	382 (39)	80	1.49×10 ⁻³	90
	31	31.4												1.14×10 ⁻³	

*1. The rating table shows the specification values of each reduction gear.

*2. The allowable output speed may be limited by heat depending on the operation rate.

If you use this product with the operation rate per cycle exceeding 50% or allowable output speed during continuous operation, contact us.

*3. For the inertia moment value, both the reduction gear and the input gear are taken into consideration. This, however, does not include the inertia moment of the input spline.

*4. The allowable moment will differ depending on the thrust load. Check the allowable moment diagram (p. 33).

*5. The rated torque is the value that produces the rated service life based on operation at the rated output speed; it does not indicate the maximum load. Refer to the "Glossary" (p.23) and the "Product selection flowchart" (p.24).

*6. The specifications above are based on Nabtesco evaluation methods; this product should only be used after confirming that it is appropriate for the operating conditions of your system.

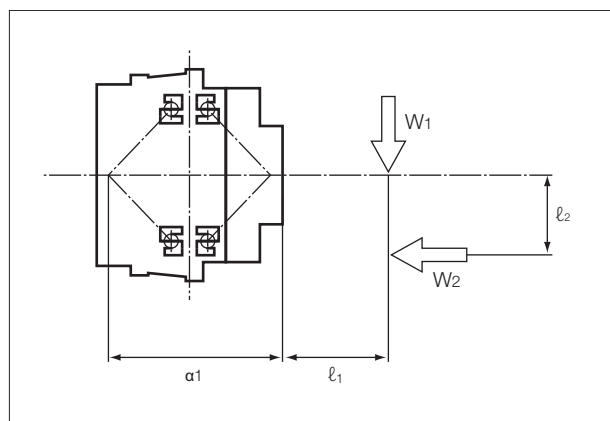
Note:

- The mechanical brake of the motor generates the momentary excessive torque in the reduction gear. Make sure that the value does not exceed the momentary maximum allowable torque.
- The specifications above are based on Nabtesco evaluation methods; this product should only be used after confirming that it is appropriate for the operating conditions of your system.

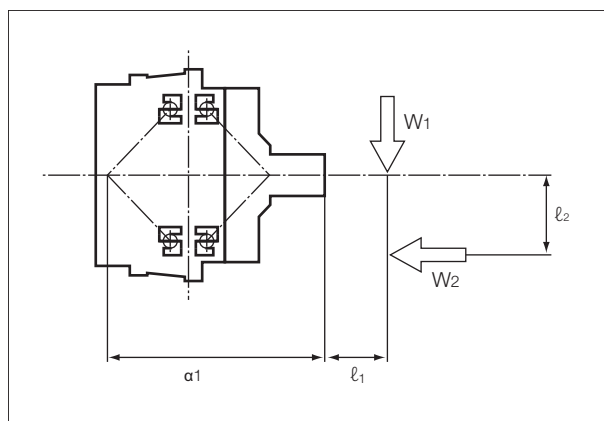
Capacity of main bearing

Model Code	Mo1 Allowable Moment (*4)	Mo2 Momentary maximum allowable moment	W Maximum Thrust Load	Wr Allowable radial load	Dimension $\alpha 1$	
	Nm (Kgf·m)	Nm	N (Kgf)	N	Flange type	Shaft type
					mm	mm
GH7	460	—	1,372	4,244	133.3	155.3
GH17	804	—	1,960	5,869	156.9	200.1
GH24	843	—	2,940	5,635	152.1	211.1
GH40	1,823	—	2,940	10,083	198.1	277.1
GH100	4,900	9,800	5,586	19,726	262.0	—

■ Flange type external load diagram

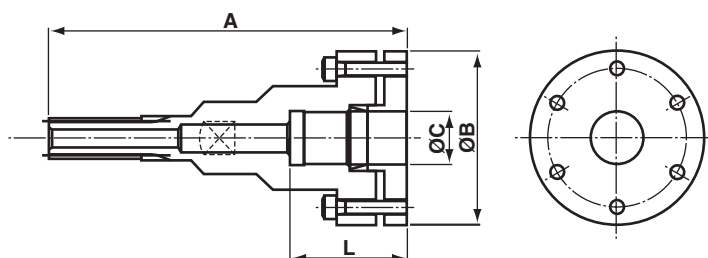


■ Shaft type external load diagram



External dimensions Input spline set

For straight shaft without key



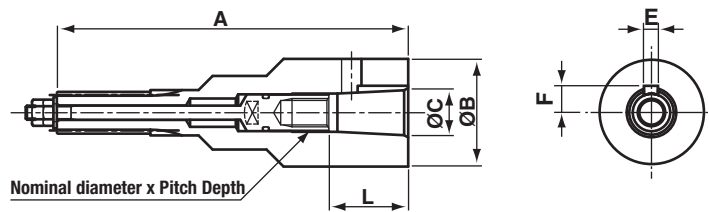
Model	Code	Parts No.	Input Spline Dimension (mm)				
			A	øB	øC		L
GH7	S	10S421-*	124	53	11H7	+0.018 +0	24
	A	10S421A*	124	53	14H7	+0.018 +0	29
	B	10S421B*	124	53	16H7	+0.018 +0	29
	D	10S421D*	123	53	22H7	+0.021 +0	48
	M	10S421M*	126	53	19H7	+0.021 0	31
	N	10S421N*	120	53	22H7	+0.021 0	60
	Q	10S421Q*	144	63	24H7	+0.021 0	49
	R	10S421R*	114	53	19H7	+0.021 0	39
	T	10S421T*	124	53	16H7	+0.018 0	34
	U	10S421U*	124	48	14H7	+0.018 0	24
	AF	10S421AF*	117	53	19H7	+0.021 0	33
	AY	10S421AY*	122	53	22H7	+0.021 0	47
	AZ	10S421AZ*	117	53	10H7	+0.015 0	19
	BA	10S421BA*	123	53	22H7	+0.021 0	31
BB	10S421BB*	123	53	22H7	+0.021 0	38	
GH17	S	20S421-*	137	63	14H7	+0.018 0	30
	B	20S421B*	137	63	24H7	+0.021 0	50
	C	20S421C*	124	63	25H7	+0.021 0	40
	E	20S421E*	124	63	22H7	+0.021 0	40
	P	20S421P*	128	63	19H7	+0.021 0	32
	Q	20S421Q*	134	63	19H7	+0.021 0	32
	T	20S421T*	124	63	19H7	+0.021 0	40
	W	20S421W*	176	68	35	+0.035 +0.010	73
	AB	20S421AB*	134	63	24H7	+0.021 0	37
	AC	20S421AC*	132	63	28H7	+0.021 0	53
	AF	20S421AF*	176	68	35	+0.035 +0.010	59
	AL	20S421AL*	124	63	19H7	+0.021 0	37
	AQ	20S421AQ*	132	63	22H7	+0.021 0	30
	AR	20S421AR*	130	63	24H7	+0.021 0	43
AS	20S421AS*	131	63	16H7	+0.018 0	29	
GH24	S	30S421-*	142	63	24H7	+0.021 0	50
	A	30S421A*	129	63	22H7	+0.021 0	40
	D	30S421D*	174	63	28H7	+0.021 0	74
	E	30S421E*	129	63	28H7	+0.021 0	60
	G	30S421G*	129	63	28H7	+0.021 0	50
	H	30S421H*	142	63	28H7	+0.021 0	74
	Q	30S421Q*	174	68	35	+0.035 +0.010	74
	T	30S421T*	137	63	28H7	+0.021 0	53
	U	30S421U*	139	63	24H7	+0.021 0	57
W	30S421W*	129	63	19H7	+0.021 0	50	

The shape of the part shown here is only a representation. For this reason, the actual shape may differ from the drawing shown here. The part numbers attached with * at the end are our revised numbers. These are subject to change without advance notice. The transmission torque of the wedge-type frictional coupling varies depending on the motor shaft diameter. Due to this, the momentary maximum allowable torque or allowable acceleration/deceleration torque may not be ensured.

External dimensions Input spline set

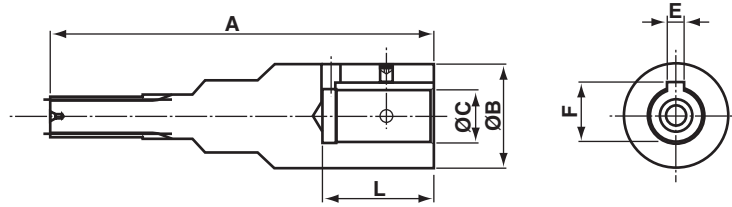
Model	Code	Parts No.	Input Spline Dimension (mm)				
			A	øB	øC	L	
GH24	AA	30S421AA*	159	68	32H7	+0.025 0	33
	AB	30S431AB*	126	63	24H7	+0.021 0	47
	AH	30S421AH*	138	63	22H7	+0.021 0	31
	AL	30S421AL*	174	68	35	+0.035 +0.010	64
	AM	30S421AM*	174	68	35	+0.035 +0.010	59
	AN	30S421AN*	129	63	19H7	+0.021 0	37
	AP	30S421AP*	137	63	28H7	+0.021 0	45
GH40	S	40S421-*	163	68	22H7	+0.021 0	38
	A	40S421A*	176	68	24H7	+0.021 0	48
	B	40S421B*	176	68	28H7	+0.021 0	58
	C	40S421C*	163	68	35H7	+0.025 0	38
	D	40S421D*	177	68	35	+0.035 +0.010	73
	K	40S421K*	175	68	32H7	+0.025 0	32
	M	40S421M*	176	68	24H7	+0.021 0	58
	N	40S421N*	177	68	35	+0.035 +0.010	63
	U	40S421U*	211	70	42H7	+0.025 0	79
	W	40S421W*	171	68	28H7	+0.021 0	51
	AD	40S421AD*	175	68	32H6	+0.016 0	34
	AF	40S421AF*	175	68	32H7	+0.025 0	42
	AL	40S421AL*	175	70	32H7	+0.025 0	57
	AM	40S421AM*	176	68	28H7	+0.021 0	48
AN	40S421AN*	177	68	35	+0.035 +0.010	58	
GH100	A	60S421A*	216	77	42H7	+0.025 0	102
	C	60S421C*	216	75	35	+0.035 +0.010	68
	D	60S421D*	216	77	42H7	+0.025 0	74
	E	60S421E*	216	77	42H7	+0.025 0	68
	F	60S421F*	216	75	35	+0.035 +0.010	53

For 1/10 taper



Model	Code	Parts No.	Input Spline Dimension (mm)						Thread			
			A	øB	øC	L	E	F	Nom. Dia.	Pitch	Depth	
GH7	G	10S422G*	86	28	11	+0.100 0	15	4	7	M6	P1.0	9
	H	10S422H*	112	28	16	+0.100 0	28	5	9.5	M10	P1.25	13
	X	10S422X*	106	28	14	+0.100 0	18	5	8.65	M8	P1.0	13
	AB	10S422AB*	116	28	11	+0.100 0	15	4	7	M6	P1.0	9
	AR	10S422AR*	130	32	22	+0.100 0	36	6	12.9	M12	P1.25	15
GH17	AS	10S422AS*	106	28	14	+0.100 0	18	4	8.25	M8	P1.0	13
	F	20S422F*	104	38	16	+0.100 0	28	5	9.5	M10	P1.25	13
GH24	R	20S422R*	124	38	16	+0.100 0	28	5	9.5	M10	P1.25	13
	F	30S422F*	129	36	16	+0.100 0	28	5	9.5	M10	P1.25	13
GH40	K	30S422K*	145	42	30.8	+0.100 0	46	7	17.75	M20	P1.5	23
	L	30S422L*	105	36	16	+0.100 0	28	5	9.5	M10	P1.25	13
	E	40S422E*	165	45	16	+0.100 0	28	5	9.5	M10	P1.25	13
GH40	H	40S422H*	149	45	30.8	+0.100 0	46	7	17.75	M20	P1.5	23
	X	40S422X*	248	72	55	+0.100 0	82	10	29.85	M36	P3.0	30

For straight shaft with key



Model	Code	Parts No.	Input Spline Dimension (mm)						
			A	ØB	ØC	L	E	F	
GH7	C	10S423C*	124	28	14H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	29	5	16.3
	J	10S423J*	125	28	16H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	35	5	18.3
	W	10S423W*	125	32	19G7	$\begin{smallmatrix} +0.028 \\ +0.007 \end{smallmatrix}$	35	6	21.8
	Y	10S423Y*	112	28	14H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	28	5	16.3
	AC	10S423AC*	120	28	14H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	45	5	16.3
	AD	10S423AD*	133	36	22H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	41	6	24.8
	AH	10S423AH*	112	32	17H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	29	5	19.3
	AK	10S423AK*	134	32	19H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	39	6	21.8
	AM	10S423AM*	134	38	24H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	39	8	27.3
	AN	10S423AN*	133	36	22H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	28	6	24.8
	AP	10S423AP*	125	32	19H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	30	6	21.8
	AQ	10S423AQ*	119	28	14H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	19	5	16.3
	AT	10S423AT*	124	32	17H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	49	5	19.3
	AU	10S423AU*	113	32	16H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	28	5	18.3
	AW	10S423AW*	124	28	11H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	24	4	12.8
AX	10S423AX*	117	28	10H7	$\begin{smallmatrix} +0.015 \\ 0 \end{smallmatrix}$	19	3	11.4	
GH17	G	20S423G*	137	38	22H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	50	6	24.8
	K	20S423K*	137	38	19H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	40	5	21.3
	N	20S423N*	172	50	35	$\begin{smallmatrix} +0.035 \\ +0.010 \end{smallmatrix}$	69	10	38.3
	X	20S423X*	170	45	28H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	43	8	31.3
	Y	20S423Y*	163	50	35	$\begin{smallmatrix} +0.035 \\ +0.010 \end{smallmatrix}$	46	10	38.3
	AD	20S421AD*	130	38	22H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	33	8	25.3
	AA	20S423AA*	130	38	24H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	37	8	27.3
	AE	20S423AE*	123	38	17H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	28	5	19.3
	AK	20S423AK*	123	38	19H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	36	6	21.8
	AP	20S423AP*	137	38	19H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	40	6	21.8
	AT	20S423AT*	136	40	22H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	49	6	24.8
	AU	20S423AU*	135	38	19H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	33	6	21.8
	AX	20S423AX*	136	38	16H7	$\begin{smallmatrix} +0.018 \\ 0 \end{smallmatrix}$	29	5	18.3
AY	20S423AY*	123	38	19H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	39	5	21.3	
GH24	B	30S423B*	159	50	35	$\begin{smallmatrix} +0.035 \\ +0.010 \end{smallmatrix}$	58	10	38.3
	J	30S423J*	159	42	28H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	48	8	31.3
	M	30S423M*	111	36	22H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	38	8	25.3
	X	30S423X*	122	42	24H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	37	8	27.3
	Y	30S423Y*	154	42	28H7	$\begin{smallmatrix} +0.021 \\ +0 \end{smallmatrix}$	37	8	31.3
	AD	30S423AD*	160	50	28H7	$\begin{smallmatrix} +0.021 \\ +0 \end{smallmatrix}$	38	8	31.3
	AE	30S423AE*	159	50	32H7	$\begin{smallmatrix} +0.025 \\ 0 \end{smallmatrix}$	58	10	35.3
	AF	30S423AF*	156	44	28H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	53	8	31.3
AG	30S423AG*	129	42	22H7	$\begin{smallmatrix} +0.021 \\ 0 \end{smallmatrix}$	50	8	25.3	

For the GH100 input spline set, contact us.

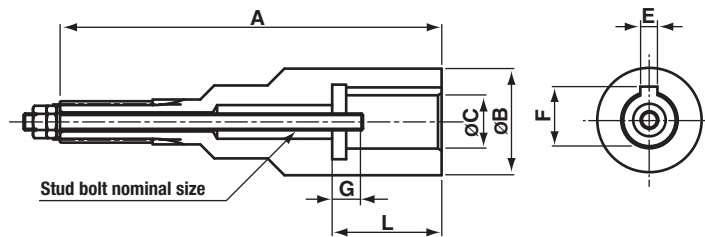
The part numbers attached with * at the end are our revised numbers. These are subject to change without advance notice.

The shape of the part shown here is only a representation. For this reason, the actual shape may differ from the drawing shown here.

External dimensions Input spline set

Model	Code	Parts No.	Input Spline Dimension (mm)						
			A	øB	øC		L	E	F
GH40	F	40S423F*	176	45	28H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	48	8	31.3
	G	40S423G*	194	52	35	$\begin{matrix} +0.035 \\ +0.010 \end{matrix}$	58	10	38.3
	L	40S423L*	225	60	42H7	$\begin{matrix} +0.025 \\ 0 \end{matrix}$	93	12	45.3
	P	40S423P*	169	45	28H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	49	8	31.3
	R	40S423R*	169	45	28H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	49	10	31.3
	T	40S423T*	225	75	55H7	$\begin{matrix} +0.030 \\ 0 \end{matrix}$	56	16	59.3
	Y	40S423Y*	187	50	35H7	$\begin{matrix} +0.025 \\ 0 \end{matrix}$	59	10	38.3
	AA	40S423AA*	173	45	22H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	35	8	25.3
	AB	40S423AB*	172	50	28H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	38	10	31.3
	AC	40S423AC*	176	50	28G7	$\begin{matrix} +0.028 \\ +0.007 \end{matrix}$	58	8	31.3
	AE	40S423AE*	173	50	24H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	55	8	27.3
	AG	40S423AG*	172	50	28H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	38	8	31.3
	AJ	40S423AJ*	194	50	32H7	$\begin{matrix} +0.025 \\ 0 \end{matrix}$	58	10	35.3
AK	40S423AK*	200	60	42H7	$\begin{matrix} +0.025 \\ 0 \end{matrix}$	68	12	45.3	

For straight shaft with key (with stud bolt)



Model	Code	Parts No.	Input Spline Dimension (mm)							Stud Bolt	
			A	øB	øC		L	E	F	Nom. Dia.	G
GH7	E	10S423E*	124	28	16H7	$\begin{matrix} +0.018 \\ 0 \end{matrix}$	34	5	18.3	M5	12
	F	10S423F*	94	28	16H7	$\begin{matrix} +0.018 \\ 0 \end{matrix}$	29	5	18.3	M5	10
	AG	10S423AG*	94	28	16H7	$\begin{matrix} +0.018 \\ 0 \end{matrix}$	29	5	18.3	M5	10
GH17	D	20S423D*	136	38	19H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	39	6	21.8	M6	12
	J	20S423J*	136	38	16H7	$\begin{matrix} +0.018 \\ 0 \end{matrix}$	29	5	18.3	M5	12
	AJ	20S423AJ*	123	38	22H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	39	6	24.8	M5	11
GH24	P	30S423P*	147.5	36	22H7	$\begin{matrix} +0.021 \\ 0 \end{matrix}$	38	6	24.8	M6	12
GH40	J	40S423J*	165.5	50	35H7	$\begin{matrix} +0.025 \\ 0 \end{matrix}$	39	10	38.3	M6	13

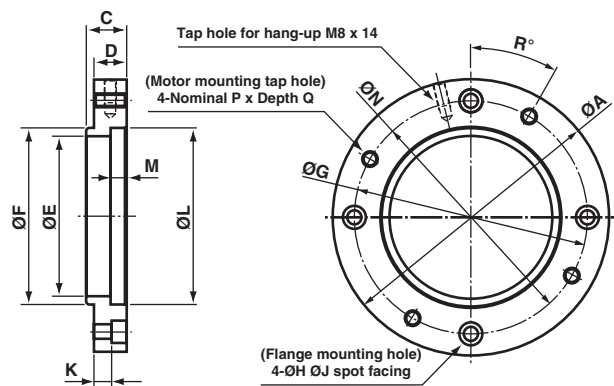
For the GH100 input spline set, contact us.

The part numbers attached with * at the end are our revised numbers. These are subject to change without advance notice.

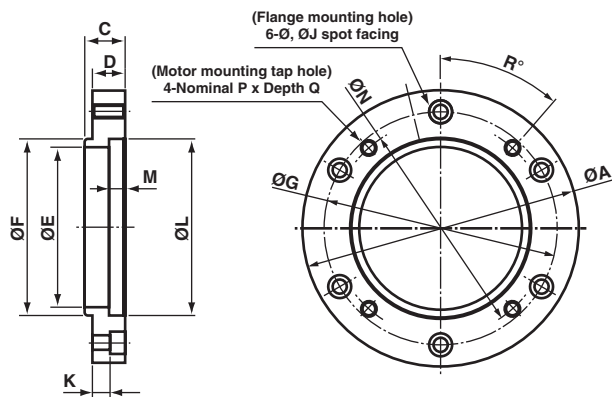
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External dimensions Motor flange

Circle type



Circle type (30S)



Circle type

Model	Code	Parts No.	Motor Flange Dimension (mm)				Reduction Gear Mounting Dimension (mm)					Motor Mounting Dimension (mm)							
			øA	C	D	øE	øF	øG	øH	øJ	K	øL	M	øN	P	Q	R		
GH7	S	10S203-*	135	35	30	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	115	9	14	10	95H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	115	M8	20	45°
	D	10S203D*	135	35	30	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	115	9	14	9	80H7	$\begin{smallmatrix} +0.030 \\ 0 \end{smallmatrix}$	10	100	M6	15	45°
	G	10S203G*	135	35	30	60	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	115	9	14	9	50H7	$\begin{smallmatrix} +0.025 \\ 0 \end{smallmatrix}$	5	070	M4	10	45°
	H	10S203H*	135	35	30	60	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	115	9	14	9	70H7	$\begin{smallmatrix} +0.030 \\ 0 \end{smallmatrix}$	10	090	M6	15	45°
	J	10S203J*	135	35	30	60	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	115	9	14	9	50H7	$\begin{smallmatrix} +0.025 \\ 0 \end{smallmatrix}$	5	070	M5	10	45°
	N	10S203N*	135	55	50	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	115	9	14	9	80H7	$\begin{smallmatrix} +0.030 \\ 0 \end{smallmatrix}$	12	100	M6	15	45°
	Q	10S203Q*	135	35	30	60	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	115	9	14	9	70H7	$\begin{smallmatrix} +0.030 \\ 0 \end{smallmatrix}$	10	090	M5	15	45°
	X	10S203X*	135	55	50	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	115	9	14	10	95H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	115	M8	20	45°
GH17	AE	10S203AE*	135	25	20	70	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	115	9	14	9	80H7	$\begin{smallmatrix} +0.030 \\ 0 \end{smallmatrix}$	10	100	M6	15	60°
	S	20S203-*	170	25	20	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	145	M8	-	30°
	A	20S203A*	190	25	20	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	9	14	10	130H7	$\begin{smallmatrix} +0.040 \\ 0 \end{smallmatrix}$	10	165	M10	-	45°
	B	20S203B*	170	25	20	72	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	80H7	$\begin{smallmatrix} +0.030 \\ 0 \end{smallmatrix}$	10	100	M6	12	45°
	F	20S203F*	170	25	20	80	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	95H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	115	M8	-	30°
	K	20S203K*	190	25	20	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	9	14	10	115H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	165	M8	-	45°
	L	20S203L*	170	65	60	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	145	M8	20	30°
	U	20S203U*	170	40	35	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	145	M8	20	30°
GH24	W	20S203W*	170	25	20	70	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	95H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	115	M6	12	30°
	N	30S203N*	170	65	60	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	8	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	145	M8	15	45°
GH40/ GH100	S	40S203-*	230	30	25	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	200	13.5	20	5	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	7	145	M8	20	0°
	E	40S203E*	230	30	25	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	200	13.5	20	5	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	12	200	M12	-	45°
	G	40S203G*	230	30	25	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	200	13.5	20	7	130H7	$\begin{smallmatrix} +0.040 \\ 0 \end{smallmatrix}$	10	165	M10	-	0°
	H	40S203H*	230	48	43	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	200	13.5	20	5	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	12	200	M12	22	45°
	M	40S203M*	230	62	57	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	200	13.5	20	5	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	12	200	M12	25	45°
	T	40S203T*	230	92	87	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	200	13.5	20	5	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	12	200	M12	22	45°
	W	40S203W*	230	58	53	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	200	13.5	20	5	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	12	200	M12	22	45°

Circle type (30S)

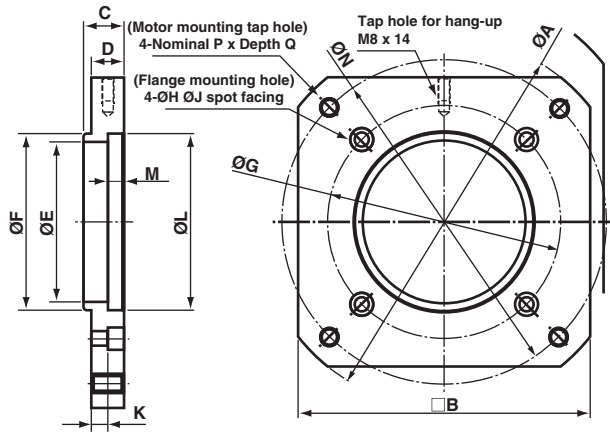
Model	Code	Parts No.	Motor Flange Dimension (mm)				Reduction Gear Mounting Dimension (mm)					Motor Mounting Dimension (mm)							
			øA	C	D	øE	øF	øG	øH	øJ	K	øL	M	øN	P	Q	R		
GH24	L	30S203L*	170	33	28	70	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	8	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	8	145	M8	20	45°
	M	30S203M*	170	33	28	80	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	8	95H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	8	115	M8	17	45°
	Q	30S203Q*	170	33	28	70	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	10	80H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	100	M6	12	45°
	R	30S203R*	170	33	28	70	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	8	95H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	115	M6	12	45°

The shape of the part shown here is only a representation. For this reason, the actual shape may differ from the drawing shown here.

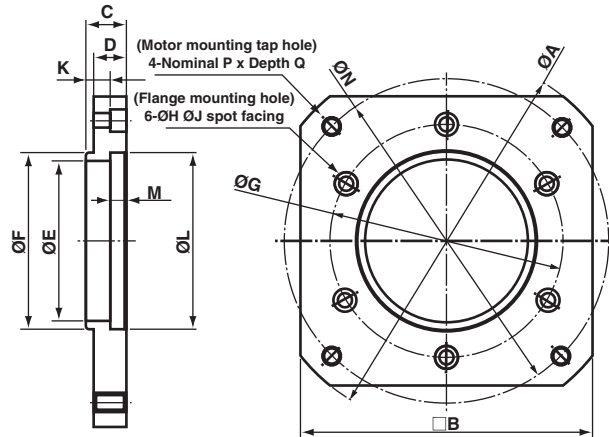
The part numbers attached with * at the end are our revised numbers. These are subject to change without advance notice.

External dimensions Motor flange

Square type



Square type (30S)



Square type

Model	Code	Parts No.	Motor Flange Dimension (mm)					Reduction Gear Mounting Dimension (mm)					Motor Mounting Dimension (mm)						
			øA	øB	C	D	øE	øF	øG	øH	øJ	K	øL	M	øN	P	Q		
GH7	A	10S203A*	165	130	35	30	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	95	9	14	10	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	11	145	M8	20
	C	10S203C*	190	150	35	30	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	95	9	14	9	130H7	$\begin{smallmatrix} +0.040 \\ 0 \end{smallmatrix}$	11	165	M10	-
	E	10S203E*	155	120	35	30	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	95	9	14	9	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	130	M8	20
	F	10S203F*	165	130	55	50	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	95	9	14	10	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	11	145	M8	20
	K	10S203K*	230	180	55	50	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	95	9	14	10	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	12	200	M12	20
	L	10S203L*	230	180	70	65	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	95	9	14	10	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	12	200	M12	20
	M	10S203M*	190	150	55	50	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	95	9	14	10	130H7	$\begin{smallmatrix} +0.040 \\ 0 \end{smallmatrix}$	12	165	M10	20
	P	10S203P*	230	180	35	30	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	95	9	14	10	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	12	200	M12	-
GH17	W	10S203W*	190	150	35	30	72	80h7	$\begin{smallmatrix} 0 \\ -0.030 \end{smallmatrix}$	95	9	14	9	115H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	11	165	M8	-
	C	20S203C*	230	180	25	20	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	200	M12	-
	D	20S203D*	230	180	65	60	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	200	M12	20
	E	20S203E*	270	220	25	20	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	5	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	7	235	M12	-
	G	20S203G*	270	220	65	60	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	10	235	M12	20
GH24	H	20S203H*	270	220	45	40	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	10	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	10	235	M12	20
	B	30S203B*	165	130	46	41	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	145	9	14	8	110H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	145	M8	13
GH40/ GH100	A	40S203A*	250	200	30	25	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	13.5	20	5	180H7	$\begin{smallmatrix} +0.040 \\ 0 \end{smallmatrix}$	7	215	M12	-
	B	40S203B*	270	220	30	25	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	13.5	20	5	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	7	235	M12	-
	C	40S203C*	270	220	48	43	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	13.5	20	5	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	10	235	M12	25
	D	40S203D*	300	250	30	25	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	13.5	20	5	230H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	7	265	M12	-
	F	40S203F*	270	220	30	25	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	13.5	20	5	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	7	250	M8	20
	K	40S203K*	270	220	95	90	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	13.5	20	5	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	10	235	M12	25
	L	40S203L*	250	200	64	59	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	13.5	20	5	180H7	$\begin{smallmatrix} +0.040 \\ 0 \end{smallmatrix}$	12	215	M12	15
	N	40S203N*	330	265	117	112	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	13.5	20	5	250H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	10	300	M16	25
	X	40S203X*	250	200	30	25	100	114.3h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	150	13.5	20	5	180H7	$\begin{smallmatrix} +0.040 \\ 0 \end{smallmatrix}$	7	215	M14	-

Square type (30S)

Model	Code	Parts No.	Motor Flange Dimension (mm)					Reduction Gear Mounting Dimension (mm)					Motor Mounting Dimension (mm)						
			øA	øB	C	D	øE	øF	øG	øH	øJ	K	øL	M	øN	P	Q		
GH24	S	30S203*	230	174	78	73	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	9	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	10	200	M12	13
															138		M14	13	
	C	30S203C*	230	180	46	41	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	9	114.3H7	$\begin{smallmatrix} +0.035 \\ 0 \end{smallmatrix}$	6	200	M12	13
	D	30S203D*	250	200	33	28	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	10	180H7	$\begin{smallmatrix} +0.040 \\ 0 \end{smallmatrix}$	8	215	M12	-
	E	30S203E*	270	220	33	28	100	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	10	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	8	235	M12	-
	F	30S203F*	270	220	65	60	95	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	9	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	10	235	M12	20
	H	30S203H*	270	220	65	60	95	110h7	$\begin{smallmatrix} 0 \\ -0.035 \end{smallmatrix}$	138	9	14	9	200H7	$\begin{smallmatrix} +0.046 \\ 0 \end{smallmatrix}$	10	250	M80	20

The shape of the part shown here is only a representation. For this reason, the actual shape may differ from the drawing shown here.

The part numbers attached with * at the end are our revised numbers. These are subject to change without advance notice.

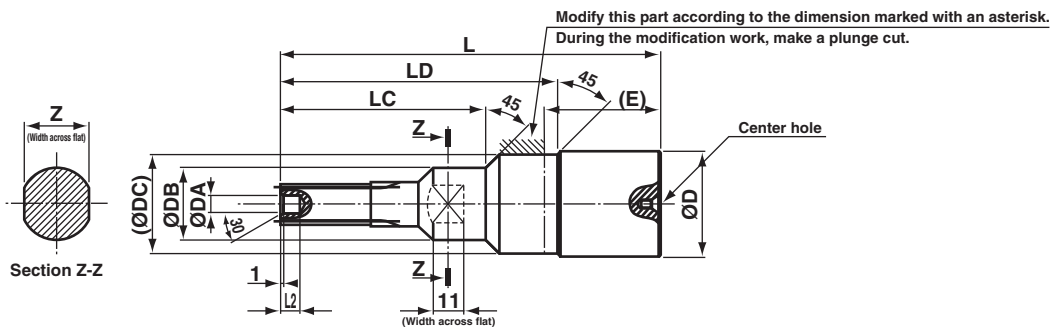
Combination with non-standard product

For the combination with a non-standard product, use a semi-processed product (for the GH100, however, a semi-processed product is not available).

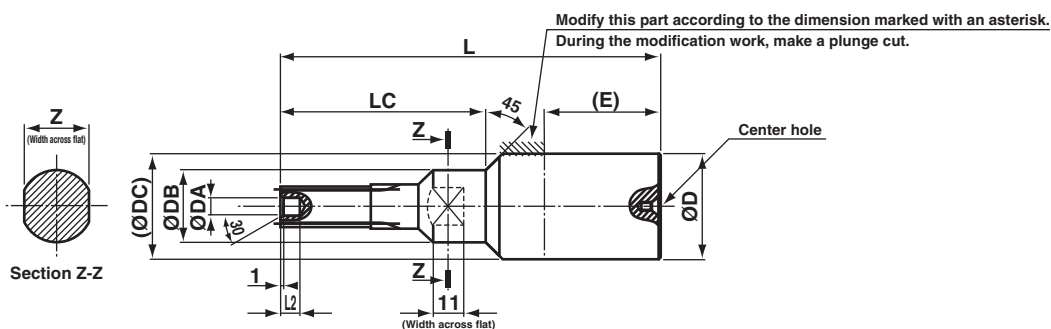
The part numbers attached with * at the end are our revised numbers. These are subject to change without advance notice.

1. Input spline blank

For Y1 taper shaft or straight shaft with key

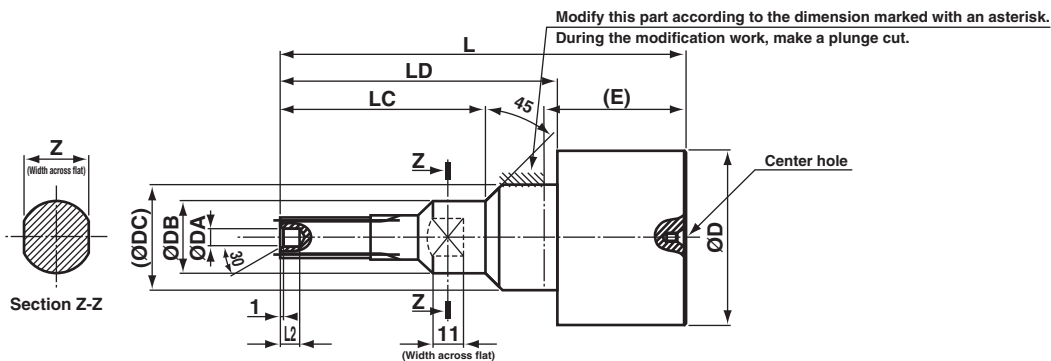


Model	Code	Parts No.	Input Spline Dimension (mm)													
			øD	øDA	øDB	øDC	ø*	(E)	L	L2	LC	LD	Z			
GH7	Y1	10S140-*	32	4.5	24	28.2	$\begin{smallmatrix} +0.1 \\ 0 \end{smallmatrix}$	28h9	$\begin{smallmatrix} 0 \\ -0.052 \end{smallmatrix}$	(52)	137	5	58	94	21	$\begin{smallmatrix} 0 \\ -0.4 \end{smallmatrix}$
GH24	Y1	30S140-*	42	6.6	32	36.2	$\begin{smallmatrix} +0.1 \\ 0 \end{smallmatrix}$	36h9	$\begin{smallmatrix} 0 \\ -0.062 \end{smallmatrix}$	(62)	159	7	65	100	27	$\begin{smallmatrix} 0 \\ -0.4 \end{smallmatrix}$
GH40	Y1	40S140-*	50	11.0	40	45.2	$\begin{smallmatrix} +0.1 \\ 0 \end{smallmatrix}$	45h9	$\begin{smallmatrix} 0 \\ -0.062 \end{smallmatrix}$	(70)	194	8	95.5	128.5	34	$\begin{smallmatrix} 0 \\ -0.4 \end{smallmatrix}$



Model	Code	Parts No.	Input Spline Dimension (mm)													
			øD	øDA	øDB	øDC	ø*	(E)	L	L2	LC	LD	Z			
GH17	Y1	20S140-*	38.2	6.6	26	38.2	$\begin{smallmatrix} +0.1 \\ 0 \end{smallmatrix}$	38h9	$\begin{smallmatrix} 0 \\ -0.062 \end{smallmatrix}$	(41)	137	7	74	-	23	$\begin{smallmatrix} 0 \\ -0.4 \end{smallmatrix}$

For Y2 straight shaft without key

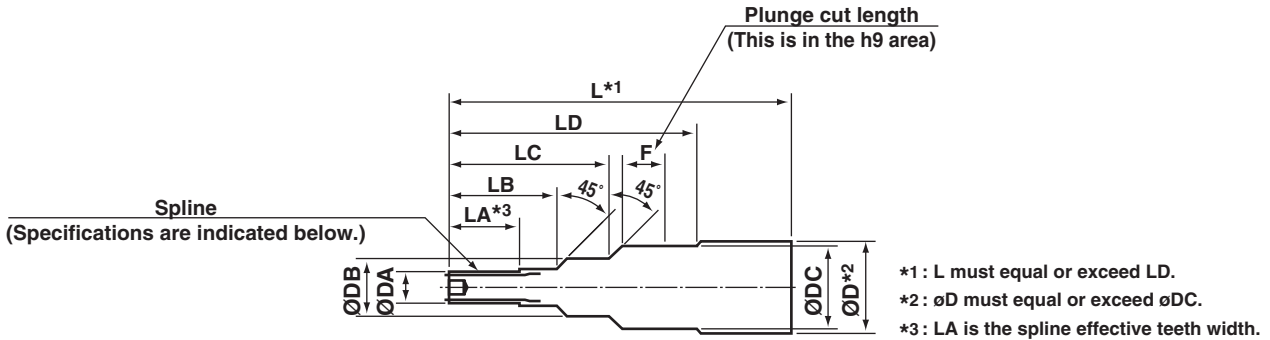


Model	Code	Parts No.	Input Spline Dimension (mm)													
			øD	øDA	øDB	øDC	ø*	(E)	L	L2	LC	LD	Z			
GH7	Y2	10S140A*	53	4.5	24	28.2	$\begin{smallmatrix} +0.1 \\ 0 \end{smallmatrix}$	28h9	$\begin{smallmatrix} 0 \\ -0.052 \end{smallmatrix}$	(48)	133	5	58	90	21	$\begin{smallmatrix} 0 \\ -0.4 \end{smallmatrix}$
GH17	Y2	20S140A*	63	6.6	26	38	$\begin{smallmatrix} +0.2 \\ +0.1 \end{smallmatrix}$	38h9	$\begin{smallmatrix} 0 \\ -0.062 \end{smallmatrix}$	(50)	146	7	74	99	23	$\begin{smallmatrix} 0 \\ -0.4 \end{smallmatrix}$
GH24	Y2	30S140A*	63	6.6	32	36	$\begin{smallmatrix} +0.2 \\ +0.1 \end{smallmatrix}$	36h9	$\begin{smallmatrix} 0 \\ -0.062 \end{smallmatrix}$	(64)	161	7	65	100	27	$\begin{smallmatrix} 0 \\ -0.4 \end{smallmatrix}$
GH40	Y2	40S140A*	70	11	40	45	$\begin{smallmatrix} +0.2 \\ +0.1 \end{smallmatrix}$	45h9	$\begin{smallmatrix} 0 \\ -0.062 \end{smallmatrix}$	(58)	184	8	95.5	131	34	$\begin{smallmatrix} 0 \\ -0.6 \end{smallmatrix}$

Combination with non-standard product

2. Manufacturing of input spline

If a semi-processed input spline product is also not available, manufacture the correct input spline according to the following dimensions.



Model	øDA	øDB	øDC	F (Min)	LA	LB	LC	LD
GH7	14	24	28h9 ⁰ _{-0.052}	25	23	40	58	9
GH17	16	26	38h9 ⁰ _{-0.062}	16	33	50	74	99
GH24	18	32	36h9 ⁰ _{-0.062}	30	20	40	65	100
GH40	26	40	45h9 ⁰ _{-0.062}	28	34	52	95.5	128.5
GH100	30	52	55h9 ⁰ _{-0.074}	30	44	84	155	200

Material: SCM415 HNR
 Surface finishing: Carburizing and quenching
 Surface hardness: HRC58 to 62
 Applicable depth of quench-hardened case: 0.3 to 0.7 mm (HV513)

Spline specifications

GH7

Involute spline (shaft) 12 x 10 x 1.0 (JIS B1603 Appendix)		
Addendum modification coefficient	+0.8	
Tool	Tooth form	Low tooth
	Module	1.00
	Pressure angle	20°
Number of teeth	10	
Pitch circle diameter	10	
Face width	Over-pin diameter	
	Pin diameter	Ø1.80 ^{-0.012} _{-0.078}
	Class	Class b
Remarks	Side fit	

GH17

Involute spline (shaft) 15 x 10 x 1.25 (JIS B1603 Appendix)		
Addendum modification coefficient	+0.8	
Tool	Tooth form	Low tooth
	Module	1.25
	Pressure angle	20°
Number of teeth	10	
Pitch circle diameter	12.5	
Face width	Over-pin diameter	
	Pin diameter	Ø2.25 ^{-0.012} _{-0.078}
	Class	Class b
Remarks	Side fit	

GH24

Involute spline (shaft) 17 x 12 x 1.25 (JIS B1603 Appendix)		
Addendum modification coefficient	+0.6	
Tool	Tooth form	Low tooth
	Module	1.25
	Pressure angle	20°
Number of teeth	12	
Pitch circle diameter	15	
Face width	Over-pin diameter	
	Pin diameter	Ø2.25 ^{-0.013} _{-0.084}
	Class	Class b
Remarks	Side fit	

GH40

Involute spline (shaft) 25 x 18 x 1.25 (JIS B1603 Appendix)		
Addendum modification coefficient	+0.8	
Tool	Tooth form	Low tooth
	Module	1.25
	Pressure angle	20°
Number of teeth	18	
Pitch circle diameter	22.5	
Face width	Over-pin diameter	
	Pin diameter	Ø2.25 ^{-0.013} _{-0.084}
	Class	Class b
Remarks	Side fit	

GH100

Involute spline for automobile (shaft) 30 x 22 x 1.25 (JIS D2001 Appendix)		
Addendum modification coefficient	+0.8	
Tool	Tooth form	Low tooth
	Module	1.25
	Pressure angle	20°
Number of teeth	22	
Pitch circle diameter	27.5	
Face width	Over-pin diameter	
	Pin diameter	Ø2.25 ^{-0.014} _{-0.082}
	Class	Class b
Remarks	Side fit	

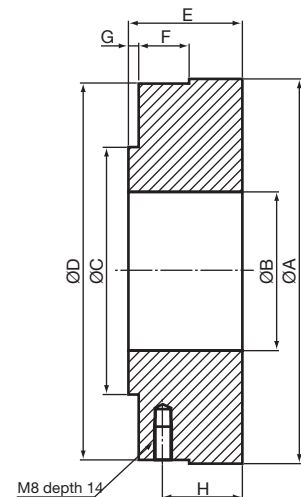
3. Motor flange (blank)

When you use the following semi-processed product, order motor flange code "Y1".

Model	Code	Parts No.	Motor flange size (mm)							
			øA	øB	øC	øD	E	F	G	H
GH7	Y1	10S240-*	140	70	80h7 ⁰ _{-0.030}	135	60	27	5	45
GH17	Y1	20S240-*	170	70	110h7 ⁰ _{-0.035}	166	50	22	5	35
GH40	Y1	40S240-*	230	100	114.3h7 ⁰ _{-0.035}	266	50	22	5	32.5

* In the designing process, determine the hole size for the motor flange mounting bolt in reference to the external dimension drawing of reduction gear.

When determining the motor flange length (thickness), take the input spline dimension and the input spline insertion amount in the reduction gear into consideration (refer to page 8).





Technical Information

Considering the use of the GH Series

This product features high precision and high rigidity, however, it is necessary to strictly comply with various restrictions and make considerations to maximize the product's features. Please read this technical document thoroughly and select and adopt an appropriate model based on the actual operating environment, method, and conditions at your facility.

Export

- When this product is exported from Japan, it may be subject to the export regulations provided in the "Foreign Exchange Order and Export Trade Control Order". Be sure to take sufficient precautions and perform the required export procedures in advance if the final operating party is related to the military or the product is to be used in the manufacture of weapons, etc.

Application

- If failure or malfunction of the product may directly endanger human life or if it is used in units which may injure the human body (atomic facilities, space equipment, medical equipment, transportation equipment, safety units, etc.), examination of individual situations is required. Contact our agent or nearest business office in such a case.

Safety measures

- Although this product has been manufactured under strict quality control, a mistake in operation or misuse can result in breakdown or damage, or an accident resulting in injury or death. Be sure to take all appropriate safety measures, such as the installation of independent safeguards.

Product specifications indicated in this catalog

- The specifications indicated in this catalog are based on Nabtesco evaluation methods. This product should only be used after confirming that it is appropriate for the operating conditions of your system.

Operating environment

Use the reduction gear under the following environment:

- Location where the ambient temperature is within the range from -10°C to 40°C.
- Location where the humidity is less than 85% and no condensation occurs.
- Location where the altitude is less than 1000 m.
- Well-ventilated location

Do not install the reduction gear at the following locations.

- Locations where a lot of dust is collected.
- Outdoor areas that are directly affected by wind and rain
- Locations near to areas that contains combustible, explosive, or corrosive gases and flammable materials.
- Locations that are heated due to heat transfer and radiation from peripherals and direct sun.
- Locations where the performance of the motor can be affected by magnetic fields or vibration.

Note 1: If the required operating environment cannot be established/met, contact us in advance.

2: When using the reduction gear under special conditions (clean room, equipment for food, concentrated alkali, high-pressure steam, etc.), contact our agent or nearest business office in advance.

Maintenance

- The standard replacement time for lubricant is 20,000 hours. However, when operation involves a reduction gear surface temperature above 40°C, the state of degradation of the lubricant should be checked in advance of that and the grease replaced earlier as necessary.

Reduction gear temperature

- When the reduction gear is used under high load and at a high duty ratio, it may overheat and the surface temperature may exceed the allowable temperature. Be aware of conditions so that the surface temperature of the reduction gear does not exceed 60°C while it is in operation. There is a possibility of damage (to the product) if the surface temperature exceeds 60°C.

Reduction gear output rotation angle

- When the range of the rotation angle is small (18 degrees or less), the service life of the reduction gear may be reduced due to poor lubrication or the internal parts being subject to a concentrated load.

Note: Contact us in case the rotation angle is 18 degrees or less.

Manuals

- Safety information and detail product instructions are indicated in the operation manual. The operation manual can be downloaded from the following website.

<http://precision.nabtesco.com/>

Glossary

Rated service life

The lifetime resulting from the operation with the rated torque and the rated output speed is referred to as the "rated service life".

Allowable acceleration/deceleration torque

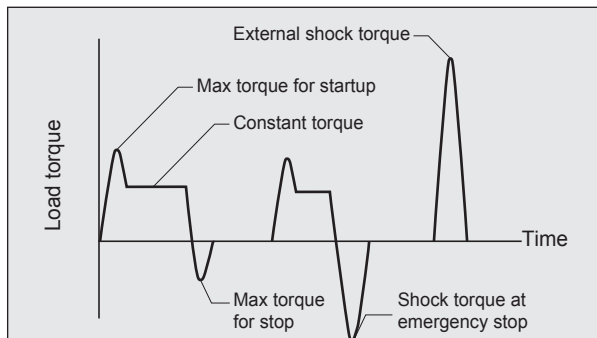
When the machine starts or stops, the load torque to be applied to the reduction gear is larger than the constant-speed load torque due to the effect of the inertia torque of the rotating part. In such a situation, the allowable torque during acceleration/deceleration is referred to as "allowable acceleration/deceleration torque".

Note: Be careful that the load torque, which is applied at startup and stop, does not exceed the allowable acceleration/deceleration torque.

Momentary maximum allowable torque

A large torque may be applied to the reduction gear due to execution of emergency stop or by an external shock. In such a situation, the allowable value of the momentary applied torque is referred to as "momentary maximum allowable torque".

Note: Be careful that the momentary excessive torque does not exceed the momentary maximum allowable torque.



Allowable output speed

The allowable value for the reduction gear's output speed during operation without a load is referred to as the "allowable output speed".

Notes: Depending on the conditions of use (duty ratio, load, ambient temperature), the reduction gear temperature may exceed 60°C even when the speed is under the allowable output speed. In such a case, either take cooling measures or use the reduction gear at a speed that keeps the surface temperature at 60°C or lower.

Duty ratio

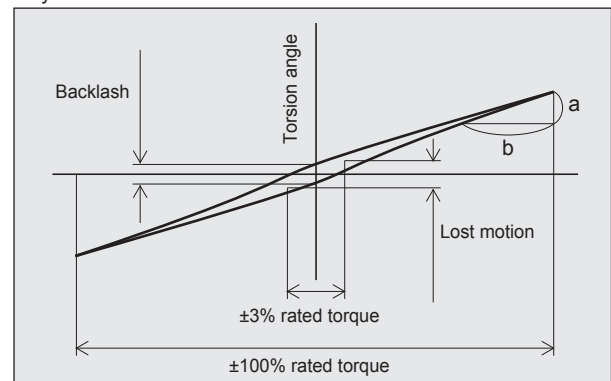
The duty ratio is defined as the ratio of the sum total time of acceleration, constant speed, and deceleration to the cycle time of the reduction gear.

Torsional rigidity, lost motion, backlash

When a torque is applied to the output shaft while the input shaft is fixed, torsion is generated according to the torque value. The torsion can be shown in the hysteresis curves. The value of b/a is referred to as "torsional rigidity".

The torsion angle at the mid point of the hysteresis curve width within $\pm 3\%$ of the rated torque is referred to as "lost motion". The torsion angle when the torque indicated by the hysteresis curve is equal to zero is referred to as "backlash".

<Hysteresis curve>



Startup efficiency

The efficiency of the moment when the reduction gear starts up is referred to as "startup efficiency".

No-load running torque (input shaft)

The torque for the input shaft that is required to run the reduction gear without load is referred to as "no-load running torque".

Allowable moment and maximum thrust load

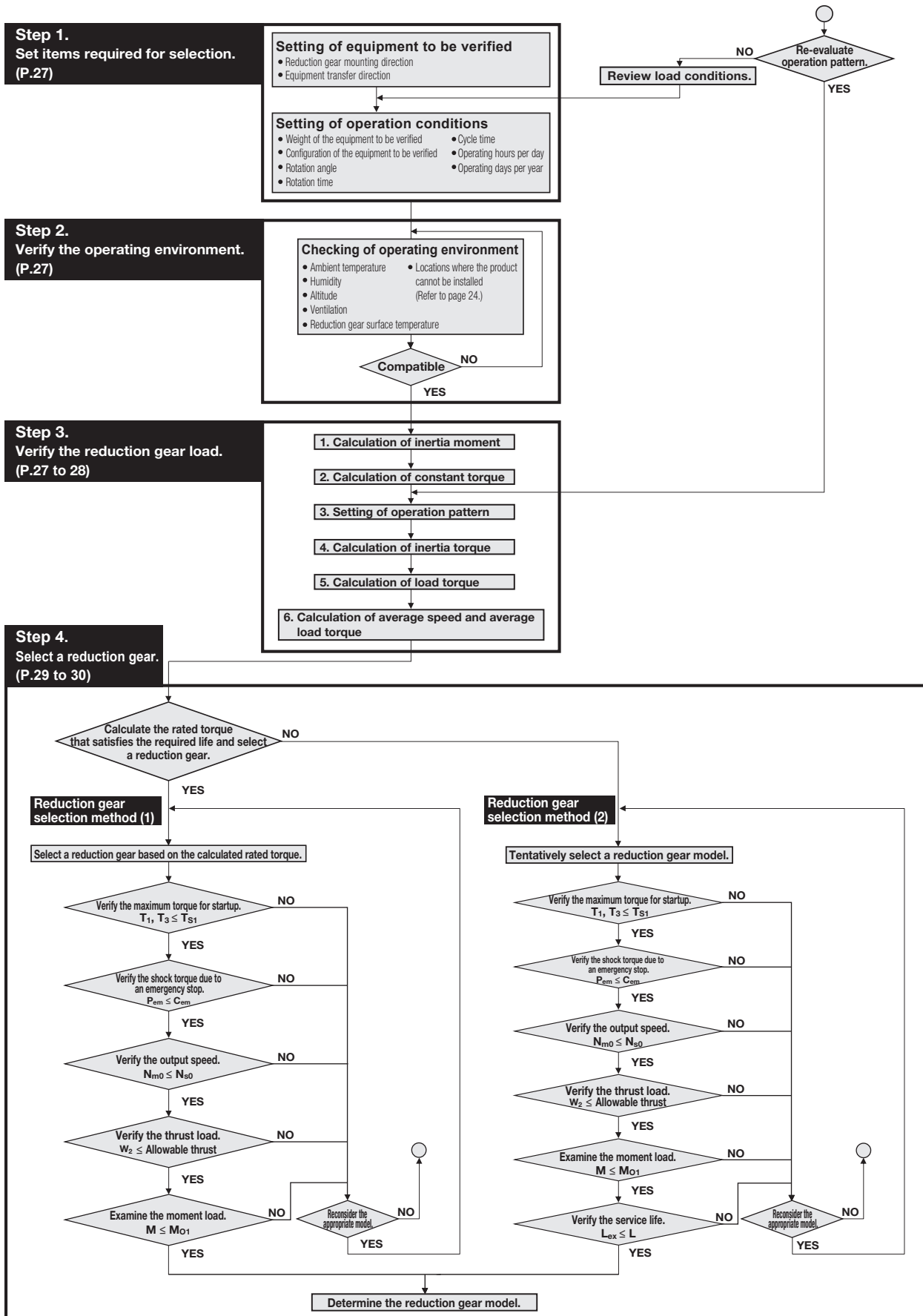
The external load moment may be applied to the reduction gear during normal operation. The allowable values of the external moment and the external axial load at this time are each referred to as "allowable moment" and "maximum thrust load".

Momentary maximum allowable moment

A large moment may be applied to the reduction gear due to an emergency stop or external shock. The allowable value of the momentary applied moment at this time is referred to as "momentary maximum allowable moment."

Note: Be careful so that the momentary excessive moment does not exceed the momentary maximum allowable moment.

Product selection flowchart



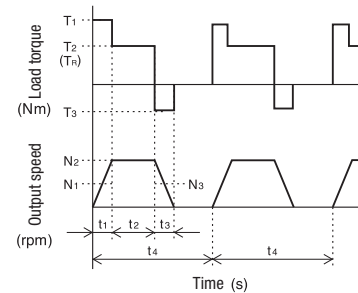
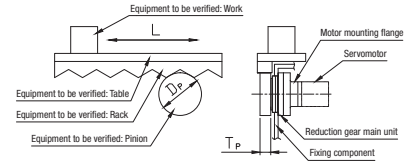
A limitation is imposed on the motor torque value according to the momentary maximum allowable torque of the selected reduction gear. (Refer to page 33.)

Model code selection examples

Using the product for rack & pinion

Step 1. Set the items required for selection.

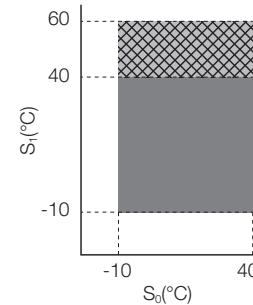
Setting item	Setting
Transfer direction of the equipment	Horizontal transfer
Weight of the equipment to be verified	
W_A ————— Table and rack weight (kg)	150
W_B ————— Work weight (kg)	500
W_P ————— Pinion weight (kg)	2
Shape of the equipment to be verified	
D_P ————— Pinion P.C.D. (mm)	80
T_P ————— Pinion width (mm)	50
Operation conditions	
L ————— Transfer distance (m)	3.23
$[t_1+t_2+t_3]$ ————— Transfer time (S)	10
$[t_2]$ ————— Constant-speed operation time (S)	9.4
$[t_4]$ ————— Cycle time (seconds)	15
Q_1 ————— Equipment operation hours per day (hours/day)	24
Q_2 ————— Equipment operation days per year (days/year)	365



*1. When the range of the rotation angle is small (10 degrees or less), the rating life of the reduction gear may be reduced due to poor lubrication or the internal parts being subject to a concentrated load.

Step 2. Verify the operating environment.

Checkpoint	Standard value
S_0 ————— Ambient temperature (°C)	-10 to +40
S_1 ————— Reduction gear surface temperature (°C)	60 or less



Note: Refer to "Operating environment" on p. 15 for values other than those listed above.

Step 3-1. Examine the reduction gear load

Setting item	Calculation formula	Selection examples
(1) Calculate the inertia moment based the calculation formula on page 32.		
I_R Load inertia moment (kgm ²)	$I_{R1} = W_A + W_B \times \left(\frac{D_P}{2 \times 1,000} \right)^2$ $I_{R2} = \frac{1}{2} + W_P \times \left(\frac{D_P}{2 \times 1,000} \right)^2$ $I_{R1} = \text{Work, table, rack inertia moment}$ $I_{R2} = \text{Pinion inertia moment}$ $I_R = I_{R1} + I_{R2}$	$I_{R1} = 150 + 500 \times \left(\frac{80}{2 \times 1,000} \right)^2$ $= 1.04[\text{kgm}^2]$ $I_{R2} = \frac{1}{2} + 2.0 \times \left(\frac{80}{2 \times 1,000} \right)^2$ $= 0.0016[\text{kgm}^2]$ $I_R = 1.04 + 0.0016$ $= 1.0416[\text{kgm}^2]$
(2) Examine the constant torque.		
T_R Constant torque (Nm)	$T_R = (W_A + W_B) \times 9.8 \times \frac{D_P}{2 \times 1,000} \times \mu$ $\mu = \text{Friction factor}$ <p>Note: For the horizontal transfer, a guide friction factor of 0.05 is used. For the vertical transfer, perform the calculation by omitting the friction factor.</p>	$T_R = (180 + (150 + 500) \times 4) \times 9.8 \times \frac{80}{2 \times 1,000} \times 0.05$ $= 12.74[\text{Nm}]$

Step 3-2: Proceed to p. 28.

Model code selection examples

Step 3-2. Set items required for selection.

Setting item	Calculation formula	Selection examples (With horizontal rotational transfer)
(3) Calculate the transfer speed and each output speed.		
V ——— Transfer speed (m/min)	$L = \frac{t_2 + (t_1 + t_2 + t_3)}{60} \times V \times \frac{1}{2}$ $V = L \times \frac{60}{t_2 + (t_1 + t_2 + t_3)} \times 2$	$3.23 = \frac{9.4 + (0.3 + 9.4 + 0.3)}{60} \times V \times \frac{1}{2}$ $V = 3.23 \times \frac{60}{9.4 + (0.3 + 9.4 + 0.3)} \times 2$ $V = 20[\text{m/min}]$
N ₂ ——— Constant speed (rpm)	$N_1 = \frac{V}{\pi \times \frac{D_P}{1,000}}$	$N_1 = \frac{20}{\pi \times \frac{80}{1,000}} = 79.6[\text{rpm}]$
N ₁ ——— Average speed for startup (rpm)	$N_1 = \frac{N_2}{2}$	$N_1 = \frac{79.6}{2} = 39.8 \text{ (rpm)}$
N ₃ ——— Average speed for stop (rpm)	$N_3 = \frac{N_2}{2}$	$N_3 = \frac{79.6}{2} = 39.8 \text{ (rpm)}$
(4) Calculate the inertia torque for acceleration/deceleration.		
T _A ——— Inertia torque for acceleration (Nm)	$T_A = \left\{ \frac{I_R \times (N_2 - 0)}{t_1} \right\} \times \frac{2\pi}{60}$	$T_A = \left\{ \frac{1.04 \times (79.6 - 0)}{0.3} \right\} \times \frac{2\pi}{60}$ $= 28.9(\text{Nm})$
T _D ——— Inertia torque for deceleration (Nm)	$T_D = \left\{ \frac{I_R \times (0 - N_2)}{t_3} \right\} \times \frac{2\pi}{60}$	$T_D = \left\{ \frac{1.04 \times (0 - 79.6)}{0.3} \right\} \times \frac{2\pi}{60}$ $= -28.9(\text{Nm})$
(5) Calculate the load torque for acceleration/deceleration.		
T ₁ ——— Maximum torque for startup (Nm)	$T_1 = T_A + T_R $ <p>T_R: Constant torque</p>	$T_1 = 28.9 + 12.74 $ $= 41.64 \text{ (Nm)}$
T ₂ ——— Constant maximum torque (Nm)	$T_2 = T_R $	$T_2 = 12.74 \text{ (Nm)}$
T ₃ ——— Maximum torque for stop (Nm)	$T_3 = T_D + T_R $ <p>T_R: Constant torque</p>	$T_3 = -28.9 + 12.74 $ $= 16.16 \text{ (Nm)}$
(6)-1 Calculate the average speed.		
N _m ——— Average speed (rpm)	$N_m = \frac{t_1 \times N_1 + t_2 \times N_2 + t_3 \times N_3}{t_1 + t_2 + t_3}$	$N_m = \frac{0.3 \times 39.8 + 9.4 \times 79.6 + 0.3 \times 39.8}{0.3 + 9.4 + 0.3}$ $= 12 \text{ (rpm)}$
(6)-2 Calculate the average load torque.		
T _m ——— Average load torque (Nm)	$T_m = \sqrt[10]{\frac{t_1 \times N_1 \times I_1^{10} + t_2 \times N_2 \times I_2^{10} + t_3 \times N_3 \times I_3^{10}}{t_1 \times N_1 + t_2 \times N_2 + t_3 \times N_3}}$	$T_m = \sqrt[10]{\frac{0.3 \times 39.8 \times 41.64^{10} + 9.4 \times 79.6 \times 12.74^{10} + 0.3 \times 39.8 \times 16.16^{10}}{0.3 \times 39.8 + 9.4 \times 79.6 + 0.3 \times 39.8}}$ $= 15.6 \text{ (Nm)}$

Go to page 29 if the reduction gear model is verified based on the required life.

Go to page 31 if the service life is verified based on the reduction gear model.

Step 4. Select a reduction gear.

Reduction gear selection method (1) Calculate the required torque based on the load conditions and required life and select a reduction gear.

Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)
(1) Calculate the rated torque for the reduction gear that satisfies the required life.		
L_{ex} — Required life (year)	Based on the operation conditions	10 years
Q_{1cy} — Number of cycles per day (times)	$Q_{1cy} = \frac{Q_1 \times 60 \times 60}{t_4}$	$Q_{1cy} = \frac{24 \times 60 \times 60}{15}$ = 5,760 (times)
Q_3 — Operating hours of reduction gear per day (h)	$Q_3 = \frac{Q_{1cy} \times (t_1 + t_2 + t_3)}{60 \times 60}$	$Q_3 = \frac{5,760 \times (0.3 + 9.4 + 0.3)}{60 \times 60}$ = 16 (h)
Q_4 — Operating hours of reduction gear per year (h)	$Q_4 = Q_3 \times Q_2$	$Q_4 = 16 \times 365$ = 5,840 (h)
L_{hour} — Reduction gear service life (h)	$L_{hour} = Q_4 \times L_{ex}$	$L_{hour} = 5,840 \times 10$ = 58,400 (h)
T_0' — Reduction gear rated torque that satisfies the required life (Nm)	$T_0' = T_m \times \left(\frac{10}{3}\right) \sqrt{\frac{L_{hour} \times \frac{N_m}{N_0}}{K}}$ K : Reduction gear rated life (h) N_0 : Reduction gear rated output speed (rpm)	$T_0' = 15.6 \times \left(\frac{10}{3}\right) \sqrt{\frac{58,400 \times \frac{77.2}{50}}{6,000}}$ = 35.2 (Nm)
(2) Tentatively select a reduction gear model based on the calculated rated torque.		
Tentative selection of the reduction gear	Select a reduction gear for which the rated torque of the reduction gear $[T_0]^{*1}$ is equal to or greater than the rated torque of the reduction gear that satisfies the required life $[T_0']$. *1 $[T_0]$: Refer to the rating table on page 9.	GH7 that meets the following condition is tentatively selected: $[T_0] 69 \text{ (Nm)} \geq [T_0'] 35.2 \text{ (Nm)}$
(3) Verify the maximum torque for startup and stop.		
Verification of maximum torque for startup and stop	Check the following conditions: The allowable acceleration/deceleration torque $[T_{s1}]^{*1}$ is equal to or greater than the maximum starting torque $[T_1]^{*2}$ and maximum stopping torque $[T_3]^{*2}$. If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model. *1 $[T_{s1}]$: Refer to the rating table on page 9. *2 $[T_1]$ and $[T_3]$: Refer to page 28.	$[T_{s1}] 206 \text{ (Nm)} \geq [T_1] 41.64 \text{ (Nm)}$ $[T_3] 16.16 \text{ (Nm)}$ According to the above conditions, the tentatively selected model should be no problem.
(4) Verify the output speed.		
N_{m0} — Average speed per cycle (rpm)	$N_{m0} = \frac{t_1 \times N_1 + t_2 \times N_2 + t_3 \times N_3}{t_4}$	$N_{m0} = \frac{0.3 \times 39.8 + 9.4 \times 79.6 + 0.3 \times 39.8}{15}$ = 51.47 (rpm)
Verification of output speed	Check the following condition: The allowable output speed (100% during continuous operation) $[N_{s0}]^{*1}$ is equal to or greater than the average speed per cycle $[N_{m0}]$. If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model. Contact us regarding use of the model at a speed outside the allowable output speed (40% during intermittent operation) $[N_{s01}]^{*1}$. Note: The value of $[N_{s0}]$ is the speed at which the case temperature is balanced at 60°C for 30 minutes. *1 $[N_{s0}]$ and $[N_{s01}]$: Refer to the rating table on page 9.	$[N_{s0}] 150 \text{ (rpm)} \geq [N_{m0}] 51.47 \text{ (rpm)}$ According to the above condition, the tentatively selected model should be no problem.
(5) Calculate the reaction torque.		
F_n — Reaction torque (N)	In the rack and pinion structure, a radial load is generated as a reaction force to the torque generated by the pinion gear installed on the output stage of the reduction gear. When the pressure angle of the pinion is 20°. $F_n = \frac{T_1}{\left(\frac{D_p}{2 \times 1,000}\right) \times \cos 20^\circ}$ This reaction torque is exerted on the reduction gear as radial load.	$F_n = \frac{41.64}{\left(\frac{80}{2 \times 1,000}\right) \times \cos 20^\circ}$ = 1,108 [N]

Product Selection

Model code selection examples

Reduction gear selection method (1) Calculate the required torque based on the load conditions and required life and select a reduction gear.

Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)								
(6) Verify the shock torque at the time of an emergency stop.										
P_{em} — Expected number of emergency stop times (times)	Based on the operation conditions.	For example, an emergency stop occurs once a month. $[P_{em}] = 1 \times 12 \times \text{required life (year)} [L_{ex}]$ $= 12 \times 10 = 120$ (times)								
T_{em} — Shock torque due to an emergency stop (Nm)		For example, $[T_{em}] = 100$ (Nm)								
N_{em} — Speed at the time of an emergency stop (rpm)		For example, $[N_{em}] = 80$ (rpm)								
t_{em} — Deceleration time at the time of an emergency stop (s)		For example, $[t_{em}] = 0.05$ (s)								
Z_4 — Number of pins for reduction gear		<table border="1"> <thead> <tr> <th>Model</th> <th>Number of pins (Z_4)</th> </tr> </thead> <tbody> <tr> <td>GH7</td> <td rowspan="5">20</td> </tr> <tr> <td>GH17</td> </tr> <tr> <td>GH24</td> </tr> <tr> <td>GH40</td> </tr> <tr> <td>GH100</td> </tr> </tbody> </table>	Model	Number of pins (Z_4)	GH7	20	GH17	GH24	GH40	GH100
Model	Number of pins (Z_4)									
GH7	20									
GH17										
GH24										
GH40										
GH100										
C_{em} — Allowable number of shock torque application times	$C_{em} = \frac{775 \times \left(\frac{T_{S2}}{T_{em}}\right)^{\frac{10}{3}}}{Z_4 \times \frac{N_{em}}{60} \times t_{em}}$ <p>Note $[T_{S2}]$: Momentary maximum allowable torque, refer to the rating table on page 9.</p>	$C_{em} = \frac{775 \times \left(\frac{480}{100}\right)^{\frac{10}{3}}}{20 \times \frac{80}{60} \times 0.05} = 108,434 \text{ (times)}$								
Verification of shock torque due to an emergency stop	<p>Check the following condition: The allowable shock torque application count $[C_{em}]$ is equal to or greater than the expected emergency stop count $[P_{em}]$</p> <p>If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.</p>	$[C_{em}] 108,434 \geq [P_{em}] 120$ According to the above condition, the tentatively selected model should be no problem.								
(7) Verify the thrust load and moment load.										
W_1 — Radial load (N)		$F_n = W_1 = 1,108$ (N)								
l — Distance to the point of radial load application (mm)		25 (mm) Note: At the intermediate position of the pinion width								
W_2 — Thrust load (N)		In this example, $W_2 = 0$ (N)								
l_2 — Distance to the point of thrust load application (mm)		0 (mm) (As the workpiece center is located on the rotation axis)								
M — Moment load (Nm)		GH7 As dimension $a = 133.3$ (mm): $M = \frac{1,108 \times (25 + 133.3) + 0 \times 0}{1,000} = 175.4 \text{ (Nm)}$								
Verify the thrust load and moment load	<p>Check that the thrust load and moment load are within the range in the allowable moment diagram on page 34. When radial load W_1 is applied within dimension b, use the reduction gear within the allowable radial load. W_r: Allowable radial load, see the rating table on page 9.</p> <p>If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.</p>	<p>For this example, Thrust load $[W_2] = 0$ (N) Moment load $[M] = 175.4$ (Nm) As the above values are within the range in the allowable moment diagram, the tentatively selected model should be no problem.</p>								
<p>Select the reduction gear model that satisfies all the conditions of the above verification items. The actual reduction ratio is determined based on the motor speed, input torque, and inertia moment. Check with the motor manufacturer.</p>		Based on the above verification result, GH7 is selected.								

Reduction gear selection method (2): Tentatively select a reduction gear model and evaluate the service life.

Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)								
(1) Tentatively select a desired reduction gear model.										
Tentative selection of a reduction gear	Tentatively select a desired reduction gear model.	For example, tentatively select GH7.								
(2) Verify the maximum torque for startup and stop.										
Verification of maximum torque for startup and stop	<p>Check the following conditions: The allowable acceleration/deceleration torque $[T_{s1}]^1$ is equal to or greater than the maximum starting torque $[T_1]^2$ and maximum stopping torque $[T_3]^2$</p> <p>If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.</p> <p>*1 $[T_{s1}]$: Refer to the rating table on page 9. *2 $[T_1]$ and $[T_3]$: Refer to page 28.</p>	<p>$[T_{s1}] 206 \text{ (Nm)} \geq [T_1] 41.64 \text{ (Nm)}$ $[T_3] 16.16 \text{ (Nm)}$</p> <p>According to the above conditions, the tentatively selected model should be no problem.</p>								
(3) Verify the output speed.										
N_{m0} — Average speed per cycle (rpm)	$N_{m0} = \frac{t_1 \times N_1 + t_2 \times N_2 + t_3 \times N_3}{t_4}$	$N_{m0} = \frac{0.3 \times 39.8 + 9.4 \times 79.6 + 0.3 \times 39.8}{15}$ $= 51.47 \text{ (rpm)}$								
Verification of output speed	<p>Check the following condition: The allowable output speed (during continuous operation) $[N_{s0}]^1$ is equal to or greater than the average speed per cycle $[N_{m0}]$</p> <p>If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model. Contact us regarding use of the model at a speed outside the allowable output speed (during intermittent operation) $[N_{s01}]^1$.</p> <p>Note: The value of $[N_{s0}]$ is the speed at which the case temperature is balanced at 60°C for 30 minutes.</p> <p>*1 $[N_{s0}]$ and $[N_{s1}]$: Refer to the rating table on page 9.</p>	<p>$[N_{s0}] 150 \text{ (rpm)} \geq [N_{m0}] 51.47 \text{ (rpm)}$</p> <p>According to the above condition, the tentatively selected model should be no problem.</p>								
(4) Verify the shock torque at the time of an emergency stop.										
P_{em} — Expected number of emergency stop times (times)	Based on the operation conditions.	For example, an emergency stop occurs once a month. $[P_{em}] = 1 \times 12 \times \text{required life (year)} [L_{ex}]$ $= 12 \times 10 = 120 \text{ (times)}$								
T_{em} — Shock torque due to an emergency stop (Nm)		For example, $[T_{em}] = 100 \text{ (Nm)}$								
N_{em} — Speed at the time of an emergency stop (rpm)		For example, $[N_{em}] = 80 \text{ (rpm)}$								
t_{em} — Deceleration time at the time of an emergency stop (s)		For example, $[t_{em}] = 0.05 \text{ (s)}$								
		Set the operation conditions that meet the following requirement: Shock torque due to an emergency stop $[T_{em}]$ is equal to or less than the momentary maximum allowable torque $[T_{s2}]$								
Z_4 — Number of pins for reduction gear	<table border="1"> <thead> <tr> <th>Model</th> <th>Number of pins (Z4)</th> </tr> </thead> <tbody> <tr> <td>GH7</td> <td rowspan="5">20</td> </tr> <tr> <td>GH17</td> </tr> <tr> <td>GH24</td> </tr> <tr> <td>GH40</td> </tr> <tr> <td>GH100</td> </tr> </tbody> </table>	Model	Number of pins (Z4)	GH7	20	GH17	GH24	GH40	GH100	Number of pins for GH7: 20
Model	Number of pins (Z4)									
GH7	20									
GH17										
GH24										
GH40										
GH100										
C_{em} — Allowable number of shock torque application times	$C_{em} = \frac{775 \times \left(\frac{[T_{s2}]}{[T_{em}]} \right)^{\frac{10}{3}}}{Z_4 \times \frac{N_{em}}{60} \times t_{em}}$ <p>Note $[T_{s2}]$: Momentary maximum allowable torque, refer to the rating table on page 9.</p>	$C_{em} = \frac{775 \times \left(\frac{480}{100} \right)^{\frac{10}{3}}}{20 \times \frac{80}{60} \times 0.05} = 108,434 \text{ (times)}$								
Verification of shock torque due to an emergency stop	<p>Check the following condition: The allowable shock torque application count $[C_{em}]$ is equal to or greater than the expected emergency stop count $[P_{em}]$</p> <p>If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.</p>	<p>$[C_{em}] 108,434 \geq [P_{em}] 120$</p> <p>According to the above condition, the tentatively selected model should be no problem.</p>								

Model code selection examples

Reduction gear selection method (2): Tentatively select a reduction gear model and evaluate the service life.

Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)
(5) Verify the thrust load and moment load.		
W_1 — Radial load (N) ℓ — Distance to the point of radial load application (mm)	$M = \frac{W_1 \times (\ell + a) + W_2 \times \ell_2}{1,000}$ <p>a: See the capacity of the main bearing on page 9. Note: For the external load diagram of the shaft type, see page 9.</p>	$F_r = W_1 = 1,108(\text{N})$ 25(mm) Note: At the intermediate position of the pinion width
W_2 — Thrust load (N) ℓ_2 — Distance to the point of thrust load application (mm)		$W_2 = 0(\text{N})$ 0 (mm) (As the workpiece center is located on the rotation axis)
M — Moment load (Nm)		GH7 As dimension $a = 133.3$ (mm): $M = \frac{1,108 \times (25 + 133.3) + 0 \times 0}{1,000}$ $= 175.4 (\text{Nm})$
Verify the thrust load and moment load		Check that the thrust load and moment load are within the range in the allowable moment diagram on page 34. When radial load W_1 is applied within dimension b , use the reduction gear within the allowable radial load. W_r : Allowable radial load, see the rating table on page 9. If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.
(6) Verify the reduction gear service life.		
L_h — Life (h)	$L_h = 6,000 \times \frac{N_0}{N_m} \times \left(\frac{T_0}{T_m} \right)^{\frac{10}{3}}$	$L_h = 6,000 \times \frac{50}{77.2} \times \left(\frac{69}{15.6} \right)^{\frac{10}{3}}$ $= 551,974(\text{h})$
Q_{1cy} — Number of cycles per day (times)	$Q_{1cy} = \frac{Q_1 \times 60 \times 60}{t_4}$	$Q_{1cy} = \frac{24 \times 60 \times 60}{15} = 5,760 (\text{Times})$
Q_3 — Operating hours per day (h)	$Q_3 = \frac{Q_{1cy} \times (t_1 + t_2 + t_3)}{60 \times 60}$	$Q_3 = \frac{5,760 \times (0.3 + 9.4 + 0.3)}{60 \times 60} = 16 (\text{h})$
Q_4 — Operating hours per year (h)	$Q_4 = Q_3 \times Q_2$	$Q_4 = 16 \times 365 = 5,840 (\text{h})$
L_{year} — Reduction gear service life (year)	$L_{year} = \frac{L_h}{Q_4}$	$L_{year} = \frac{551,974}{5,840} = 94.5 (\text{year})$
L_{ex} — Required life (year)	Based on the operation conditions	10 years
Verification of the service life	Check the following condition: $[L_{ex}]$ is equal to or less than $[L_{year}]$ If the tentatively selected reduction gear is outside of the specifications, change the reduction gear model.	$[L_{ex}] 10 (\text{year}) \leq [L_{year}] 94.5 (\text{year})$ According to the above condition, the tentatively selected model should be no problem.
Select the reduction gear model that satisfies all the conditions of the above verification items. The actual reduction ratio is determined based on the motor speed, input torque, and inertia moment. Check with the motor manufacturer.	Based on the above verification result, GH7 is selected.	

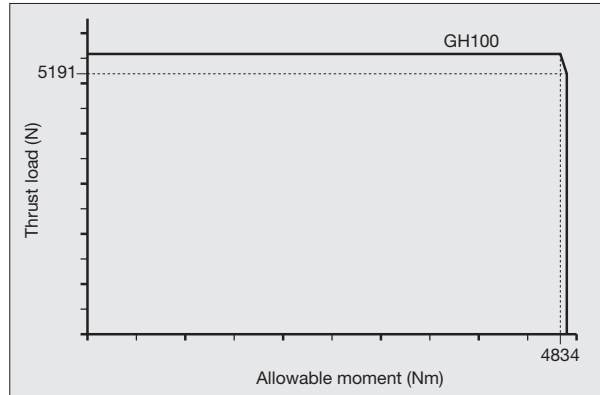
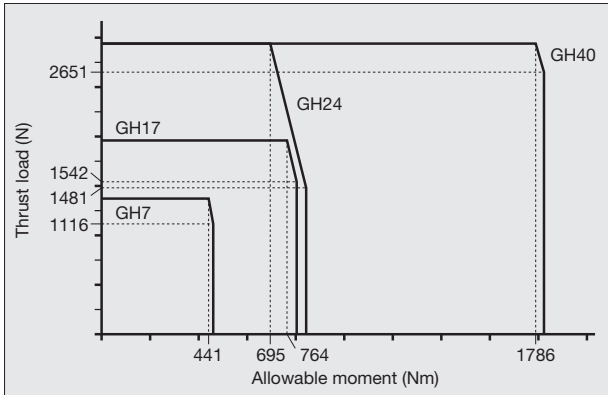
Limitation on the motor torque

A limitation is imposed on the motor torque value so that the shock torque applied to the reduction gear does not exceed the momentary maximum allowable torque.

Setting/verification item	Calculation formula	Selection examples (With horizontal rotational transfer)
T_{M1} Motor momentary maximum torque (Nm)	Determine based on the motor specifications.	For example, $T_{M1} = 90$ (Nm)
T_{M1OUT} Maximum torque generated at the output shaft for the reduction gear (Nm) (When an external shock is applied at the time of an emergency stop or motor stop)	$T_{M1out} = T_{M1} \times R \times \frac{100}{\eta}$ R : Speed ratio η : Startup efficiency (%) ,refer to the rating table on page 9.	For example, calculate the maximum torque generated at the output shaft for the reduction gear based on the specifications when GH7-31 was selected. $T_{M1out} = 10 \times 31 \times \frac{100}{80}$ $= 387.5 \text{ (Nm)}$
T_{M2OUT} Maximum torque generated at the output shaft for the reduction gear (Nm) (When a shock is applied to the output shaft due to hitting by an obstacle)	$T_{M2out} = T_{M1} \times R \times \frac{\eta}{100}$	$T_{M2out} = 10 \times 31 \times \frac{80}{100}$ $= 248 \text{ (Nm)}$
Limitation on motor torque value	Check the following condition: The momentary maximum allowable torque $[T_{S2}]^*$ is equal to or greater than the maximum torque generated at the output shaft for the reduction gear $[T_{M1OUT}]$ and $[T_{M2OUT}]$ If the above condition is not satisfied, a limitation is imposed on the maximum torque value of the motor. *1 $[T_{S2}]$: Refer to the rating table on page 9.	$[T_{S2}] 480 \text{ (Nm)} \geq [T_{M1OUT}] 387.5 \text{ (Nm)}$ and $[T_{M2OUT}] 248 \text{ (Nm)}$ According to the above condition, the torque limit is set for the motor.

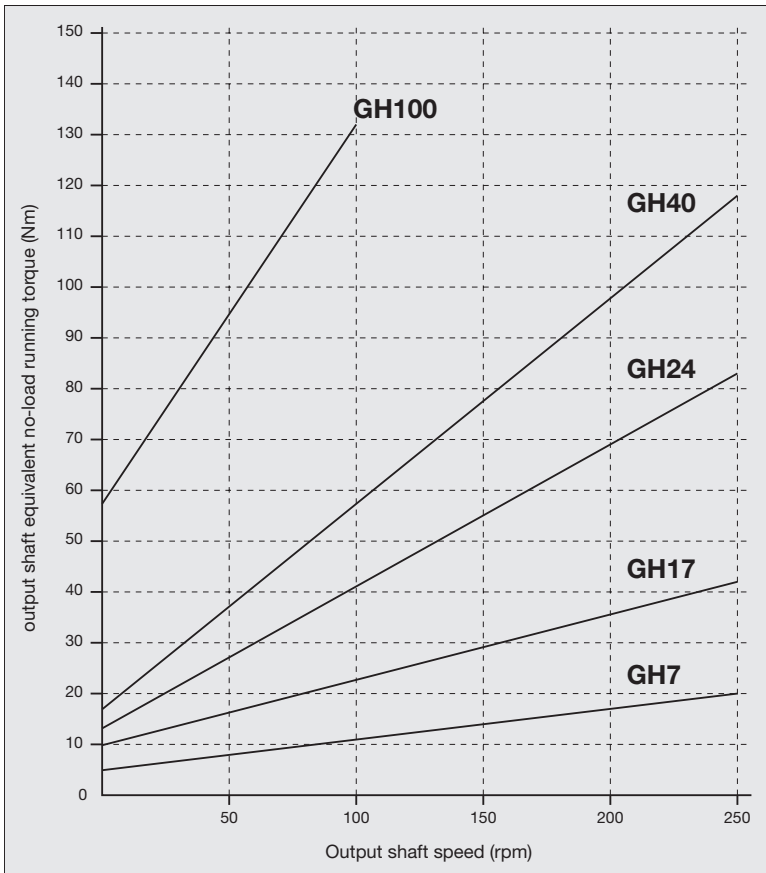
Allowable moment diagram

■ Allowable moment diagram



Technical Data

No-load running torque



The no-load running torque that is converted to the input shaft side value should be calculated using the following equation:

$$\text{No-load running torque on the input shaft side (Nm)} = \frac{\text{No-load running torque on the output shaft side (Nm)}}{\text{Speed ratio}}$$

(Measurement conditions)
Case temperature: 20°C
Lubricant: Grease (Molywhite RE00)

Design Points

Engineering notes

Installation of the reduction gear and mounting it to the output shaft

When installing the reduction gear and mounting it to the output shaft, use hexagon socket head cap screws and tighten to the torque, as specified below, in order to satisfy the momentary maximum allowable torque, which is noted in the rating table.

The use of the serrated lock washers are recommended to prevent the hexagon socket head cap screws from loosening and to protect the seat surface from flaws.

• Hexagon socket head cap screw

<Bolt tightening torque and tightening force>

Hexagon socket head cap screw nominal size x pitch (mm)	Tightening torque (Nm)	Tightening force F (N)	Bolt specification
M5 × 0.8	9.01 ± 0.49	9,310	Hexagon socket head cap screw JIS B 1176: 2006 Strength class JIS B 1051: 2000 12.9 Thread JIS B 0209: 2001 6g
M6 × 1.0	15.6 ± 0.78	13,180	
M8 × 1.25	37.2 ± 1.86	23,960	
M10 × 1.5	73.5 ± 3.43	38,080	
M12 × 1.75	129 ± 6.37	55,100	
M16 × 2.0	319 ± 15.9	103,410	
M18 × 2.5	441 ± 22.0	126,720	
M20 × 2.5	493 ± 24.6	132,170	

Note: 1. The tightening torque values listed are for steel or cast iron material.

2. If softer material, such as aluminum or stainless, is used, limit the tightening torque. Also take the transmission torque and load moment into due consideration.

<Calculation of allowable transmission torque of bolts>

$T = F \times \mu \times \frac{D}{2 \times 1,000} \times n$	T	Allowable transmission torque by tightening bolt (Nm)
	F	Bolt tightening force (N)
	D	Bolt mounting P.C.D. (mm)
	μ	Friction factor μ=0.15: When lubricant remains on the mating face. μ=0.20: When lubricant is removed from the mating face.
	n	Number of bolts (pcs.)

• Serrated lock washer for hexagon socket head cap screw

Name: Belleville spring washer (made by Heiwa Hatsujyo Industry Co., Ltd.)

Corporation symbol: CDW-H

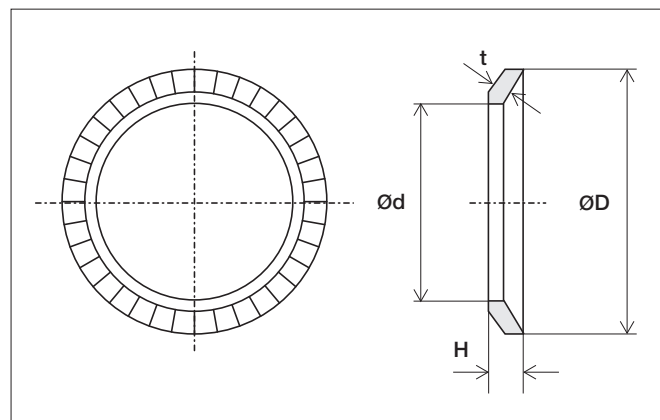
CDW-L (Only for M5)

Material: S50C to S70C

Hardness: HRC40 to 48

(Unit: mm)

Nominal size	ID and OD of Belleville spring washer		t	H
	Ød	ØD		
5	5.25	8.5	0.6	0.85
6	6.4	10	1.0	1.25
8	8.4	13	1.2	1.55
10	10.6	16	1.5	1.9
12	12.6	18	1.8	2.2
16	16.9	24	2.3	2.8
18	18.9	27	2.6	3.15
20	20.9	30	2.8	3.55



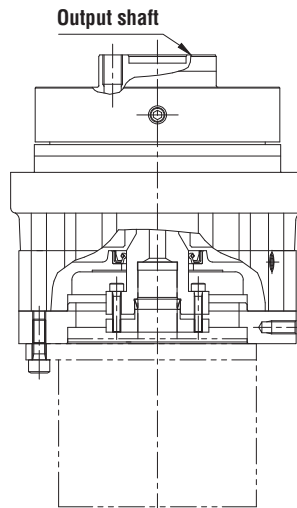
Note: When using any equivalent washer, select it with special care given to its outside diameter D.

Design Points

Reduction gear installation components

Installation direction of the reduction gear

- If you use the reduction gear installed vertically with the shaft facing upward (as shown in the figures below), contact our customer representative in advance.



Vertical shaft installation (with output shaft facing upward)

Note: When the reduction gear is operated under conditions and environments in which its surface temperature is 40°C or less, even the installation direction shown above is not a problem.

Lubrication

- The standard lubrication method for the GH reduction gears is greasing.
Before the reduction gear is shipped, it is filled with our recommended grease. (For the brand of the pre-filled grease, refer to the following table.)
When operating a reduction gear filled with the appropriate amount of grease, the standard replacement time due to deterioration of the grease is 20,000 hours.
When using the gear with deteriorated grease or under an inappropriate ambient temperature condition (40°C or more), check the deterioration condition of the grease and determine the appropriate replacement cycle.
- Specified grease name

Brand	Molywhite RE00
Manufacture	Nabtesco Corporation
Ambient temperature	-10 to 40°C

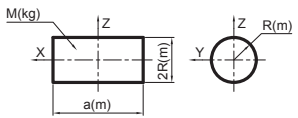
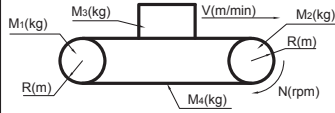
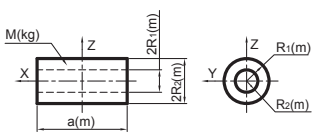
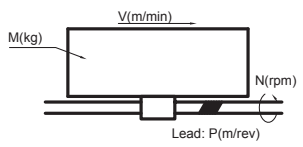
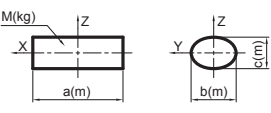
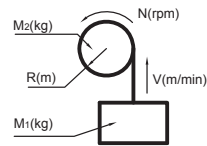
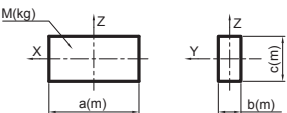
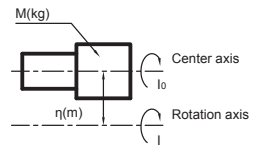
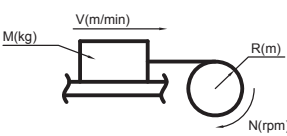
Note: The VIGOGREASE RE0 is also available. If you wish to use it, contact us.

- It is recommended that the running-in operation is performed.
Abnormal noise or torque variation may occur during operation due to the characteristics of the lubricant. There is no problem with the quality when the symptom disappears after the running-in operation is performed.

Requirements for equipment design

- If the lubricant leaks from the reduction gear or if the motor fails, the reduction gear must be removed. Design the equipment while taking this into consideration.

Inertia moment calculation formula

Shape	I(kgm ²)	Shape	I(kgm ²)
<p>1. Cylinder solid</p> 	$I_x = \frac{1}{2} MR^2$ $I_y = \frac{1}{4} M \left(R^2 + \frac{a^2}{3} \right)$ $I_z = I_y$	<p>6. Horizontal movement by conveyor</p> 	$I = \left(\frac{M_1 + M_2}{2} + M_3 + M_4 \right) \times R^2$
<p>2. Cylinder hollow</p> 	$I_x = \frac{1}{2} M (R_1^2 + R_2^2)$ $I_y = \frac{1}{4} M \left\{ (R_1^2 + R_2^2) + \frac{a^2}{3} \right\}$ $I_z = I_y$	<p>7. Horizontal movement by lead screw</p> 	$I = \frac{M}{4} \left(\frac{V}{\pi \times N} \right)^2 = \frac{M}{4} \left(\frac{P}{\pi} \right)^2$
<p>3. Oval cross section</p> 	$I_x = \frac{1}{16} M (b^2 + c^2)$ $I_y = \frac{1}{4} M \left(\frac{c^2}{4} + \frac{a^2}{3} \right)$ $I_z = \frac{1}{4} M \left(\frac{b^2}{4} + \frac{a^2}{3} \right)$	<p>8. Up/down movement by hoist</p> 	$I = M_1 R^2 + \frac{1}{2} M_2 R^2$
<p>4. Rectangle</p> 	$I_x = \frac{1}{12} M (b^2 + c^2)$ $I_y = \frac{1}{12} M (a^2 + c^2)$ $I_z = \frac{1}{12} M (a^2 + b^2)$	<p>9. Parallel axis theorem</p> 	$I = I_0 + M\eta^2$ <p>I_0 : Moment of inertia of any object about an axis through its center of mass</p> <p>I : Moment of inertia about any axis parallel to the axis through its center of mass</p> <p>η : Perpendicular distance between the above two axes</p>
<p>5. General application</p> 	$I = \frac{M}{4} \left(\frac{V}{\pi \times N} \right)^2 = MR^2$		

Troubleshooting checksheet

Check the following items in the case of trouble like abnormal noise, vibration, or malfunctions.

When it is not possible to resolve an abnormality even after verifying the corresponding checkpoint, obtain a "Reduction Gear Investigation Request Sheet" from our Website, fill in the necessary information, and contact our Service Center.

[URL]: <http://precision.nabtesco.com/documents/request.html>

The trouble started immediately after installation of the reduction gear

Checked	Checkpoint
	Make sure the equipment's drive section (the motor side or the reduction gear output surface side) is not interfering with another component.
	Make sure the equipment is not under a greater than expected load (torque, moment load, thrust load).
	Make sure the required number of bolts are tightened uniformly with the specified tightening torque.
	Make sure the reduction gear, motor, or your company's components are not installed at a slant.
	Make sure the specified amount of Nabtesco-specified lubricant has been added.
	Make sure there are no problems with the motor's parameter settings.
	Make sure there are no components resonating in unity.
	Make sure the input spline is appropriately installed on the motor.
	Make sure there is no damage to the surface of the input spline teeth.
	Make sure the input spline specifications (precision, number of teeth, module, shift coefficient, dimensions of each part) are correct.
	Make sure the flange and other components are designed and manufactured with the correct tolerances.

The trouble started during operation

Checked	Checkpoint
	Make sure the equipment has not been in operation longer than the calculated service life.
	Make sure the surface temperature of the reduction gear is not higher than normal during operation.
	Make sure the operation conditions have not been changed.
	Make sure there are no loose or missing bolts.
	Make sure the equipment is not under a greater than expected load (torque, moment load, thrust load).
	Make sure the equipment's drive section is not interfering with another component.
	Make sure an oil leak is not causing a drop in the amount of lubricant.
	Make sure there are no external contaminants in the gear, such as moisture or metal powder.
	Make sure no lubricant other than that specified is being used.

▶ Area In North and South America / In Europe and Africa / In Asia and others
 ▶ FAX USA: 1-248-553-3070 / Germany: 49-211-364677 / Osaka Sales Office: 81-6-6341-7182

Order Information Sheet (Please complete the form below) and send it with your order. Date: _____

Company Name: _____

Dept. Name: _____

Name: _____

E-mail: _____

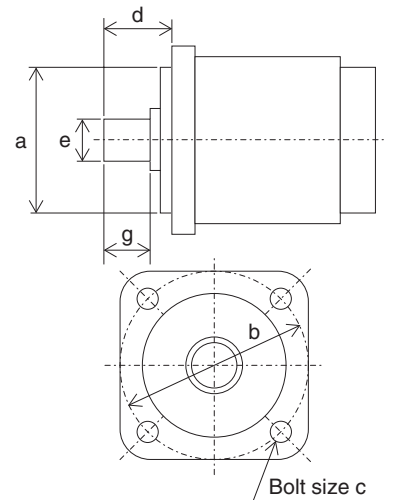
TEL. - -

FAX. - -

◆ **System configuration and selected motor**

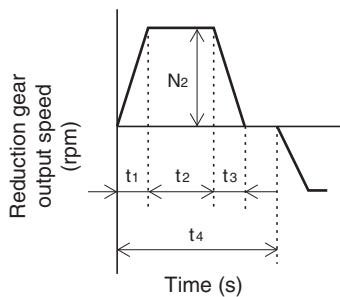
We would appreciate if you could provide your system configuration drawing that helps us to understand the speed, constant torque, and load inertia moment of the output shaft for the reduction gear.

System configuration



Motor model		a	Motor mounting pilot diameter (mm)	
P	Motor rated output (KW)	b	Motor mounting bolt P.C.D (mm)	
T_{M0}	Motor rated torque (Nm)	c	Motor mounting bolt size (mm)	
T_{M1}	Motor momentary maximum torque (Nm)	d	Motor shaft length (mm)	
N_{M0}	Motor rated speed (rpm)	e	Motor shaft diameter (mm)	
		g	Motor shaft effective length (mm)	

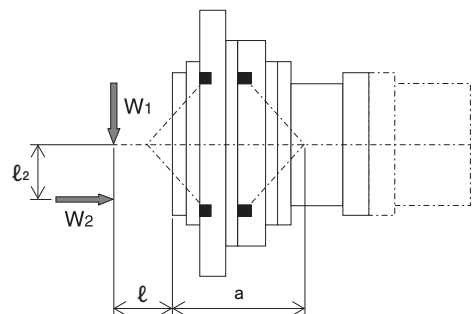
◆ **Operation pattern (output shaft for the reduction gear)**



t₁	Acceleration time (s)	
t₂	Constant speed operation time (s)	
t₃	Deceleration time (s)	
t₄	One operation cycle time (s)	
Q_{1CY}	Number of operation cycles per day (times)	
Q₂	Number of operating days per year (days)	
N₂	Constant speed (rpm)	
T₁	Max. torque for startup (Nm)	
T₂	Constant torque (Nm)	
T₃	Max. torque for stop (Nm)	

Please inform us of whether a key is attached or not, and when it is attached, also inform us of its dimensions.

◆ **External load (output shaft for the reduction gear)**



W₁	Radial load (N)	
l	Distance to the point of radial load application (mm)	
W₂	Axial load (N)	
l₂	Distance to the point of axial load application (mm)	

MEMO

A large grid of dashed lines for writing a memo. The grid consists of 20 columns and 30 rows of small squares, providing a structured space for text entry.

Warranty

1. In the case where Nabtesco confirms that a defect of the Product was caused due to Nabtesco's design or manufacture within the Warranty Period of the Product, Nabtesco shall repair or replace such defective Product at its cost. The Warranty Period shall be from the delivery of the Product by Nabtesco or its distributor to you ("Customer") until the end of one (1) year thereafter, or the end of two thousand (2,000) hours from the initial operation of Customer's equipment incorporating the Product at end user's production line, whichever comes earlier.
 2. Unless otherwise expressly agreed between the parties in writing, the warranty obligations for the Product shall be limited to the repair or replacement set forth herein. OTHER THAN AS PROVIDED HEREIN, THERE ARE NO WARRANTIES ON THE PRODUCT, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.
 3. The warranty obligation under the Section 1 above shall not apply if:
 - a) the defect was caused due to the use of the Product deviated from the Specifications or the working conditions provided by Nabtesco;
 - b) the defect was caused due to exposure to foreign substances or contamination (dirt, sand etc.)
 - c) lubricant or spare part other than the ones recommended by Nabtesco was used in the Product;
 - d) the Product was used in an unusual environment (such as high temperature, high humidity, a lot of dust, corrosive/volatile/inflammable gas, pressurized/depressurized air, under water/liquid or others except for those expressly stated in the Specifications);
 - e) the Product was disassembled, re-assembled, repaired or modified by anyone other than Nabtesco;
 - f) the defect was caused due to the equipment into which the Product was installed;
 - g) the defect was caused due to an accident such as fire, earthquake, lightning, flood or others; or
 - h) the defect was due to any cause other than the design or manufacturing of the Product.
 4. The warranty period for the repaired/replaced Product/part under the Section 1 above shall be the rest of the initial Warranty Period of the defective Product subjected to such repair/replace.
-

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