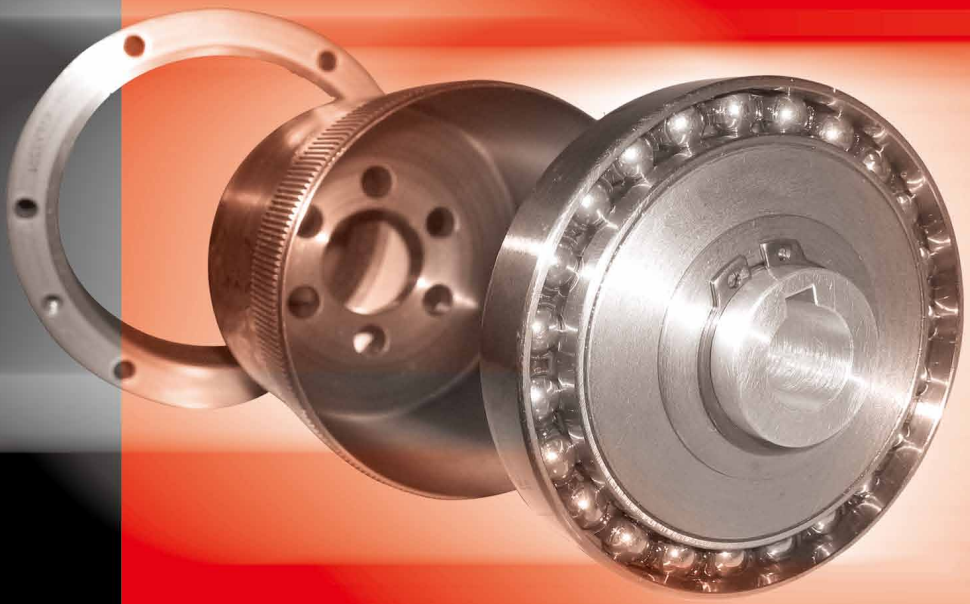
漢眞科技
HanZhen Harmonic Gear



HARMONIC GEAR PRODUCTS

English Version

Content

General Introduction of Harmonic Gear Product Technique

Harmonic Gear Technical Theory

In the current mechanical gear driving system, according to its structure's difference, can be divided into cylinder gear drive structure, planet drive structure, double bevel gear and harmonic gear structure etc.

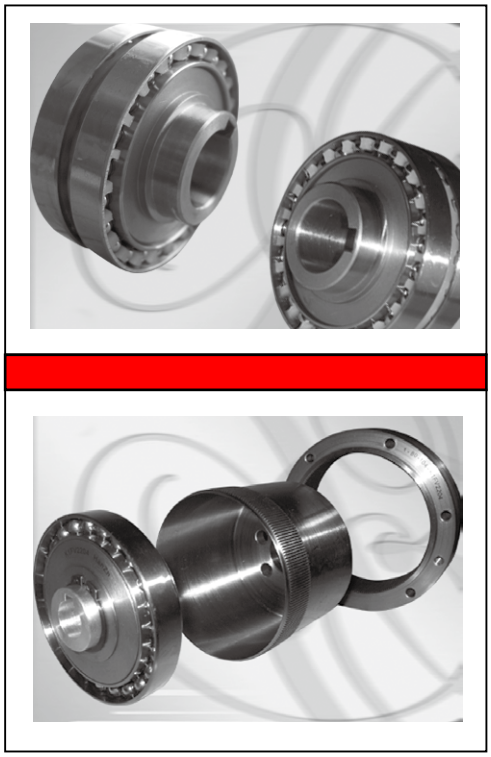
The working process of harmonic gear is as follows: Harmonic gear consists of circular spline, flex spline and wave generator, three basic components:

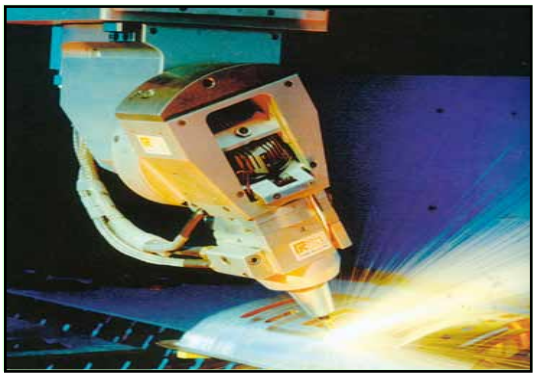
The three components' sequence from exterior to inner is:

Circular spline: Rigid and undeformed internal gear.

Flex spline: Shell component, has flexible external gear. Along with cam (wave generator)'s running, shell bearing's outer annulus will do elliptic deformation movement .

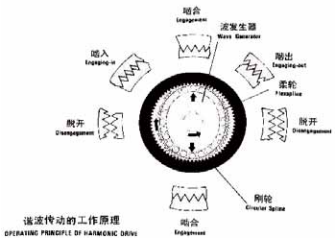
Wave generator: Generally is elliptic cam. When it's circumvolving, it will cause periodically wave extrusion to the around shell bearing (flex spline).





Drive Principle

We take the most familiar drive gear's application for example, to introduce harmonic gear principle. When wave generator is driving, cam runs inside the flex spline, and make flex spline occurring deformation (controllable flexible deformation), now flex spline's teeth will engaging-in or engaging-out between circular spline's teeth during the course of deformation, and it's in complete engaging-in at wave generator's major axis, and teeth at minor axis in complete disengagement.



Wave generator usually is elliptic cam, put the cam in flexibel bearing, and then put them into flex spline. Now, flex spline will change from original circle to ellipse, flex spline at two ends of elliptic major axis and the matched circular spline teeth are at the complete engaging-in state, namely flex spline's external gear and circular spline's annular gear engaging-in along tooth depth. This is engagement area, usually about 30% teeth are at engagement state; flex spline at two ends of elliptic minor axis and circular spline are at the state of complete disengagement, short for disengagement; flex spline teeth between wave generator major axis and minor axis, along the different section of flex spline perimeter, some exit the circular spline teeth gradually, and at the semidisengagement state, we call it engaging-out.

When wave generator running inside flex spline, flex spline occurring continuous flexible deformation, now wave generator's continuous running will make flex spline teeth's four states of engaging in, engagement, engaging out, and disengagement change each teeth original engaging state continuously. This process is called alternate tooth, just for this alternate tooth movement, the gear reduce input high speed running into low speed output running.

For double-wave generator's harmonic gear, when wave generator run 1/8 circle clockwise, flex spline teeth and circular spline teeth will change to engagement state from the original engaging-in state, and the original disengagement state will change to engaging-in state. The same principle,engaging-out become disengagement, engagement become engaging-out, this way flex spline runs (angular displacement) 1/4 tooth relative to circular spline; same way, when wave generator runs 1/8 circle again, repeats the above course, now flex spline displace a pitch. The rest may be deduced by analogy,wave generator runs a circle relative to circular spline, and flex spline's displacement relative to circular spline is two pitches.

Flex spline teeth and circular spline teeth's engagement course at pitch circle is just like two simple rolling circle (without sliding), the both at any moment, their running arc at pitch circle must be equal. Because flex spline's pitch on pitch circle is two less than circular spline, during the course of engagement, flex spline must run two pitches angular displacement relative to circular spline, this angular displacement is just reducer output shaft's running, accordingly realize the purpose of deceleration.

Wave generator's continuous running compels flex spline's point change position continuously, now at any point of flex spline's pitch, follow the course of wave generator angular displacement, form a harmonic wave which up and down, left and right is symmetrical, so call it "harmonic".

The above three components' different combination in harmonic transmission product, can form decelerating drive, increasing drive or differential mechanism etc multi input drive mechanism.

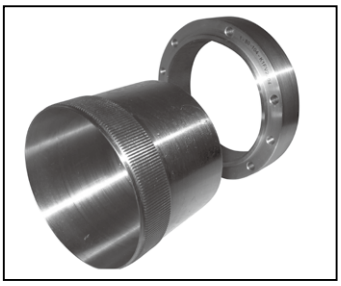
▲ When wave generator is driving, flex spline is driven, and circular spline is fixed, system realizes high speed ratio's decelerating output.

▲ When circular spline is driving, flex spline and wave generator is driven, and system can realize increasing movement of running.

▲ When generator and circular spline is driving, and flex spline is driven, system can form differential mechanism (that is algebra composing of generator and circular spline's rotation speed).

Advantage of Harmonic Gear Technique

Compare with other mechanical drive device, harmonic gear device has the following advantage:



☐Simple Structure, Small Volume and Light Weight.

The main components of harmonic gear are only three: wave generator, flex spline and circular spline.

Compare with the common mechanical reducer with corresponding drive ratio, its parts number reduce 50%, volume and weight all reduce about 1/3 or more.

☐Large Range of Drive Ratio

Single wave harmonic gear ratio can reach 50-300, optimizing can reach 75-250;

Multiple wave harmonic gear ratio can realize 300-150,000.

☐More Teeth of Engagement at the Same Time

Harmonic gear's engaging teeth at the same time can reach 30%, or even more. But in common gear drive, engaging teeth at the same time only can be 2-7%, for spur gear mechanism engaging teeth at the same time is only 1-2 pair. Just because the special character of engaging teeth are more at the same time, the number of engaging teeth will directly influence mechanical decelerating device's precision and load capability. Therefore, compare with common mechanical decelerating device, harmonic gear's precision is higher, load capability of tooth is larger, and then realize large speed ratio with small volume.

☐Larger Load Capability

It's well known that harmonic gear drive engaging teeth at the same time are more, capacity of load are more, and at the circumstance that material and speed are the same, load capability will exceed other drive greatly. Power range pass by it can from several watts to tens of Kw.

☐Better Moving Precision

Because multiple teeth engagement, in common cases, harmonic gear's moving precision can improve four times, compare with common gear.

☐Smooth Moving, Without Impact, Smaller Noise

Engaging-in and engaging-out of gear teeth are gradually come into and exit among circular spline teeth along with deformation of flex spline, during the course, teeth surface contact, slip speed is small,and without suddenly change.

☐Clearance of Tooth Side Can be Adjusted

During engagement of harmonic gear, clearance between flex spline and circular spline mainly depends on the biggest dimension of wave generator shape and tooth dimension of two gears, so, can make drive's gear backlash very small, in some cases, it even can be zero gear backlash.

☐Better Drive Efficiency.

Compare with other drive with the same speed ratio, harmonic gear has less moving components, and engaging tooth's speed is quite low, so efficiency is very high, at different speed ratio (such as 60~250 range), efficiency is about 65%-96%.

☐Well Coaxiality

Harmonic gear drive's input axis and output axis has exact coaxial.

☐Can Realize Passing Movement and Motivity to Air-tight Space

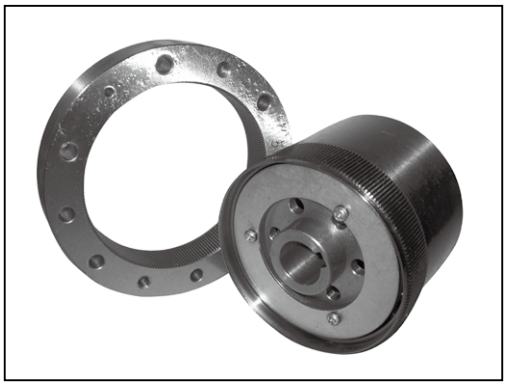
Adopt airtight flex spline harmonic gear device, is able to work in high vacuum, corrosive and other deleterious medium space, the special excellence of harmonic gear is unaccessible for other drive mechanism.

☐Can Realize High Increasing Speed Movement

Because harmonic gear drive's efficiency is high and character of mechanism, together with the excellence of small volume and light weight, it's the ideal speed increasing device. For hand motor and wind power motor etc equipment which need high increasing speed, it has wide application aera.

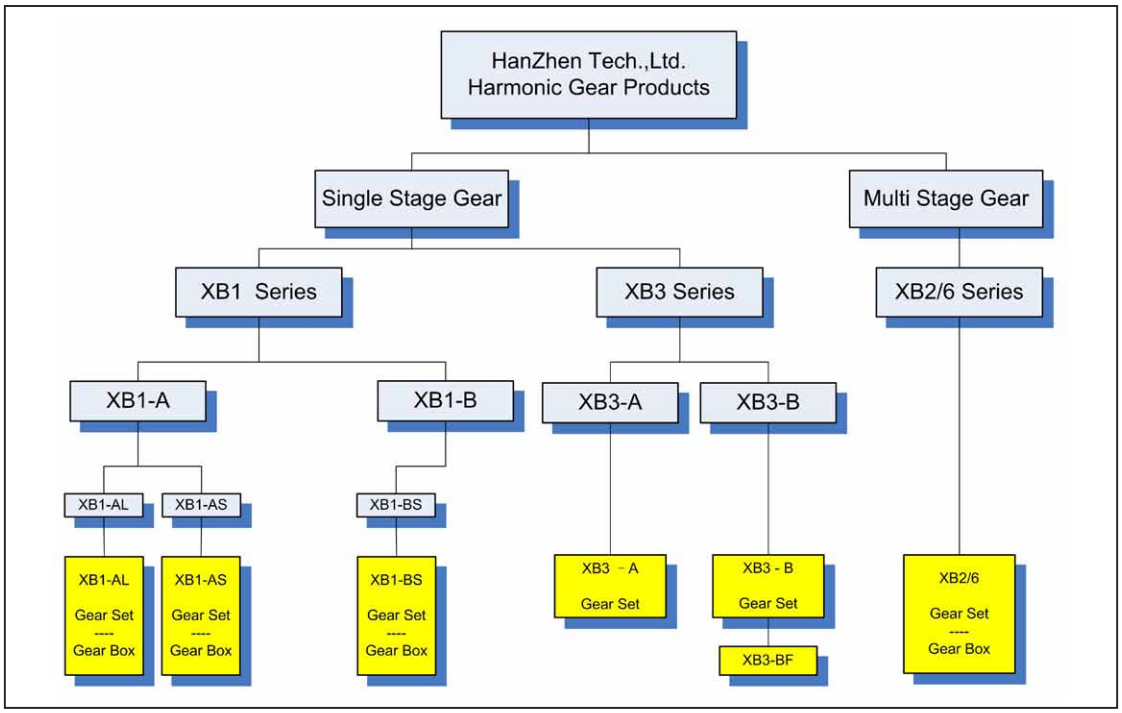
☐Can Realize Compensating Gear Easily

Because the three basic components of harmonic gear, any two can be driving and another one driven, can form a differential drive mechanism, accordingly realize fast and slow speed working condition easily. This point has very practical value on many machine tools' advance mechanism, through proper design, can change machine tools advance part's structure performance greatly.



Highlight of HanZhen Harmonic Gear Products

All of HanZhen company's harmonic gears fall under two principal categories, both derivatives of XB1 and XB2, which differ from one another in terms of their respective drive structures. Drives under the single wave series mechanism employs single wave decelerating drive structure, while multi wave series utilizes multi wave decelerating drive structure.For the structure specifications, please refer to the product series diagram.



As the most popular model on the market, the single wave serial products , which includes a total of two types, viz, XB1, XB3. This serial products are capable of providing a range of 50~300 speed ratio, which is better refined to meet the requests of most customers.

Multi wave serial products utilize tubby flex spline drive structure, which belongs to the products family of multi wave harmonic gear with XB2 and XB6 models altogether. The principal feature of the serial products lies in the wide range of output speed ratio from 300 to 150,000 so as to accommodate customers' special needs.

Comparing with other companies' products, our company products have following features:

□ Improved Speed Ratios

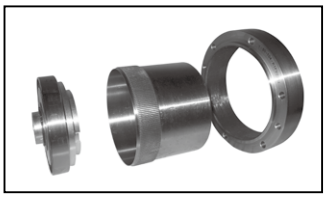
The speed ratio of our products has been raised to cover the broad range from 50 to 150,000. As is widely known, the harmonic gear could not reach the speed ratio between 300 and 2000 in the past. And thus, the customers with particular demands in this regard cannot but choose as a substitute drives with different ratio speed so that customers' resources are wasted and costs are raised. With a view to meet the technical deficiency in this speed ratio range, our company has developed XB6 model harmonic gear with its distinct technology entitled to patent protection, which can easily accomplish the drives at various speed ratio grades between 300 and 2000.

□ More Sophisticated Wave Generator Production Technology

As one of the three major parts of the harmonic gear, the wave generator directly bears on the operation of the other two parts (viz., the Circular spline, and the Flex spline). Due to its composition mainly by cam and shell bearing, of which two parts the cam outweighs the latter in terms of their functionalities, the workmanship of processing precision of the cam exerts a direct effect on the operation and life-span of a harmonic gear. Renowned as a professional manufacturer of harmonic gear equipment, the manufacturing technique of the cam modeled according to varied grades, which is exclusively held by HanZhen Company, has effectively improved the processing precision of a wave generator so that the circular spline and the flex spline in the harmonic gear are meshed in a more symmetrical fashion to bring about an improved working state and prolonged life-span.

□Higher Reliability

Thanks to their advanced technology and stable operation, the whole host of various models of harmonic gear products marketed by our company has passed rigid reliability tests. It is ensured that the machine can run an average of over 10000 hours in one stretch without failure, provided that the prescribed load of the equipment not be exceeded.



How to Choose a Harmonic gear

In order to determine whether a harmonic gear reducer fits in well with customers' actual working conditions, one has to take into account the following considerations: by and large, the exterior sizes, the output torque sustainable by the product, the transmission efficiency, operation precision, the no-load start torque, etc. Amongst them, the output torque sustainable by the product is of the greatest importance.

In the ensuing sections are passages specifically devoted to the listings of the rated output torque for the various harmonic gears of our company under respective models.

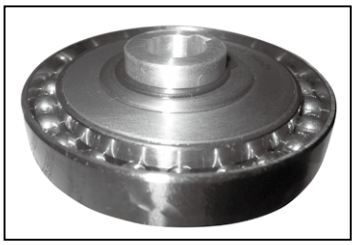
When customers consult the tables of specifications for our company's drive gears, the rated input power, the rated output torque, and other parameters of the like kind, found by customers themselves in the tables of this manual, can only be understood to be no other way than the input power bearable by the harmonic gear singly and the output torque attainable by the system in a protracted run. Ideally, while choosing among different models of devices, customers are recommended to pick no other than those harmonic gear, whose input power and output torque satisfy the needs of their working conditions.

In routine operations, however, customers are not to directly apply the input power or the output torque specified in the tables of this manual. For the three causes below:

1. The transmission mechanisms conducting force from the prime mover to the drive gear or from the drive gear to the work load, such as belt, chain, gears, etc., shall exert an effect on the input and output of the speed reducer;

2. At the moment when the device starts or brakes, the acceleration or deceleration movement exacts higher demands on the load capacity of the drive gear;

3. in the working conditions of some customers, there might encounter operations such as, frequent accelerations/dec-elerations or even impacts. In these cases, the load borne by the device may shoot up drastically, so that the harmonic gear is affected in its run. It is, therefore, necessary to take into consideration these factors in choosing a harmonic gear.



In this manual are put forward two criteria to which customers may refer in choosing a harmonic gear:

Criterion A, The Output Torque

Rated output torque(Tn)

The harmonic gear caters to the following grades of output torque:

Rated output torque(referring to the parameter tables); the torque can be borne by the system in a steady and protracted run;

Recurrent overload torque(Tg)

In case the system encounters acceleration/deceleration or frequent impacts during its run, the torque can be sustained by the drive gear. To ensure the safe working of the component sets of the harmonic gear, the Tg should be kept below 1.7 times Tn.

The peak overload torque(Tm)

This grade is the maximal force of moment that can be with-stood by the harmonic gear.Tm=2.7Tn. In no case is this torque allowed to be exceeded in the run of the system, or the harmonic gear may otherwise be damaged.

Criterion B, Parameter Adjustment

While choosing a harmonic gear, the customer shall meet the following conditions:

$$Tg = k * Tx \leq 1.7Tn$$

Tg: the real-load torque

k: parameter of operating mode. Please refer to the table below.

Tx:The torque needed for the steady run of working load

Tn:Please refer to the performance table for the rated torque for the harmonic gear.

The operating mode parameters in varied working states can be found in the table below:

The working conditions for the device	Load features		
	Steady input	Medium impact	Strong impact or inertia impact
Less than 3 hours/day	0.9	1.0	1.4
hours/day	1.0	1.2	1.6
more than 20 hours/day	1.2	1.4	1.85

Single Stage Harmonic Gear

The harmonic gear, which runs on the working principle of single wave, resorts to two modes of output, one the direct-connection output by the flex spline.

In this section is briefed first on the XB1-AL-C Model, which adopts the output mode of direct-connection by the flex spline.

XB1-AL-C

(Ordering Code)

COMPONENT GEAR SET

Exterior Specifications of XB1-AL-C

For the exterior specifications of XB1 Model harmonic gears, please refer to the diagram/table

Standard Wave Generator

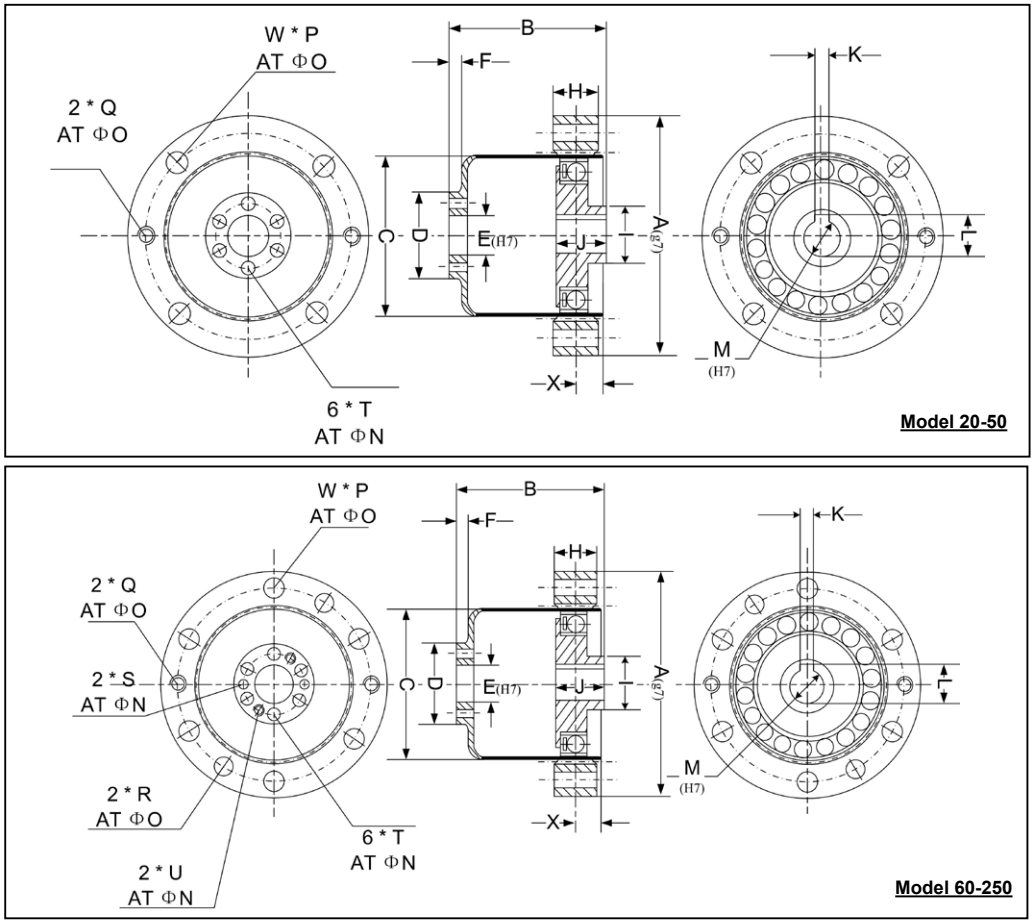


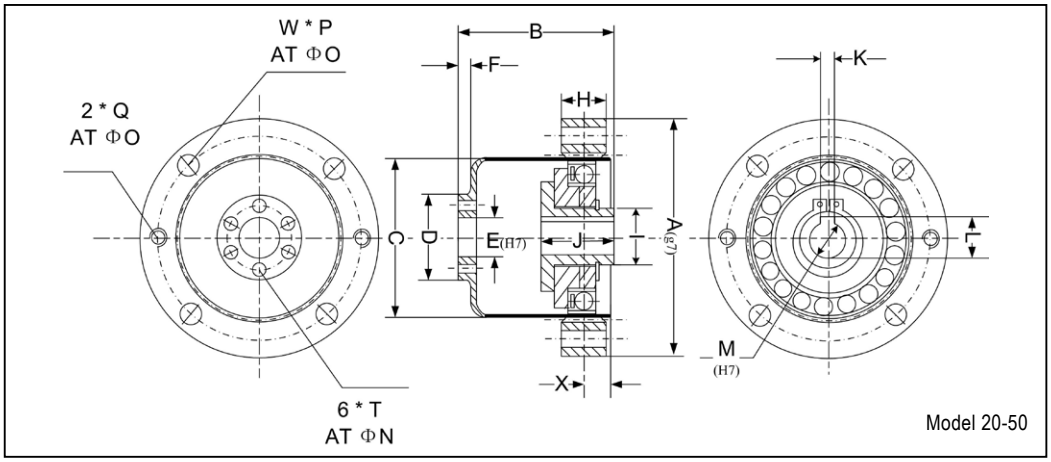
Diagram 1-01

Model	A	B	C	D	E	F	H	I	J	K	L
	(g7)				(H7)						
20	30	21	20.4	12.3	5	2.2	4.5	10	7	2	7
25	40	27	25.5	16.5	6	2.8	9	11	8.8	2	7
32	50	35.75	32.6	17.5	7	3	10	15	13	3	11.4
40	60	42	40.7	24	11	2.8	11	20	15	4	13.8
50	70	52.5	51	32	16	3.6	12	24	17	5	16.3
60	85	59.5	61	40	25	5	14	28	19	6	20.8
80	115	73	82	52	30	4	18	28	21	6	20.8
100	135	97.5	102	65	32	10	24	36	25	8	27.3
120	170	113	123	80	40	10	28	36	29.5	8	27.3
160	220	162	163	104	56	15	38	56	42	12	43.3
200	270	195	204	130	70	12	46	70	52	14	53.8
250	330	239	245	160	80	16	55	85	62	14	53.8

Model	M	N	O	P	Q	R*	S*	T	U	W	X
	(H7)										
20	6	8.5	25.5	2.2				2.2		6	4.5
25	6	11	34	3.5	M3			3.3	M2.5	4	4
32	10	12	43	3.5	M3			3.3	M2.5	4	4.75
40	12	18	51	4.5	M4			3.3	M3	4	6
50	14	24	62	4.5	M4			4.4	M3	4	7.5
60	18	32.5	75	5.5	M5	5	4	5.5	M5	6	9
80	18	41	100	6.5	M6	6	5	6.5	M6	6	11
100	24	48	120	9	M8	8	8	9	M8	6	14
120	24	60	150	11	M10	10	10	13	M10	6	16
160	40	80	195	13	M12	12	10	13	M10	6	21
200	50	100	240	18	M16	16	12	17	M12	6	25
250	50	120	295	21	M16	20	20	22	M16	6	34

Dimension Unit: mm ***: Fixing pin holes, will be made by customer themselves.**

Wave Generator with Double hub sliders



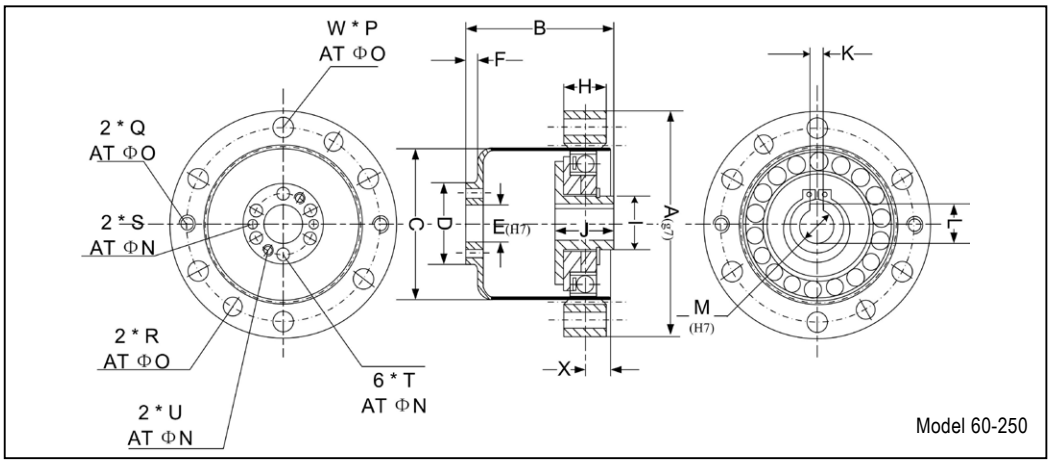


Diagram 1-02

Model	A	B	C	D	E	F	H	I	J	K	L
	(g7)				(H7)						
20	30	21	20.4	12.3	5	2.2	4.5	10	12	2	7
25	40	27	25.5	16.5	6	2.8	9	12	14.6	2	7
32	50	32.5	32.6	17.5	7	3	10	15	16	3	11.4
40	60	39.6	40.7	24	11	2.8	11	18	19	4	13.8
50	70	49.5	51	32	16	3.6	12	22	22	5	16.3
60	85	55.5	61	40	25	5	14	25	24	5	17.3
80	115	71.6	82	52	30	4	18	25	30	5	17.3
100	135	98	102	65	32	10	24	32	37	5	22.3
120	170	113.5	123	80	40	10	28	32	40	5	22.3
160	220	157.5	163	104	56	15	38	42	48	8	33.3
200	270	189	204	130	70	12	46	55	60	8	33.3
250	330	235	245	160	80	16	55	65	73	2	43.3

Model	M	N	O	P	Q	R*	S*	T	U	W	X
	(H7)										
20	6	8.5	25.5	2.2				2.2		6	4.5
25	6	11	34	3.5	M3			3.3	M2.5	4	4
32	10	12	43	3.5	M3			3.3	M2.5	4	4.75
40	12	18	51	4.5	M4			3.3	M3	4	6
50	14	24	62	4.5	M4			4.4	M3	4	7.5
60	15	32.5	75	5.5	M5	5	4	5.5	M5	6	9
80	15	41	100	6.5	M6	6	5	6.5	M6	6	11
100	20	48	120	9	M8	8	8	9	M8	6	14
120	20	60	150	11	M10	10	10	13	M10	6	16
160	30	80	195	13	M12	12	10	13	M10	6	21
200	30	100	240	18	M16	16	12	17	M12	6	25
250	40	120	295	21	M16	20	20	22	M16	6	34

Dimension Unit: mm ***: Connecting pin holes, will be made by customer themselves.**

For Model XB1-AL-C, of mini-type, (including: 25，32/35，40，50), because of its slight workload, our company provides, besides the output scheme adopting the six-boring flexspline, as demonstrated above, the output scheme using the flexspline bolt, which, on account of its simplicity and effectiveness, is of great help to customers in retrenching costs.

Standard Wave Generator

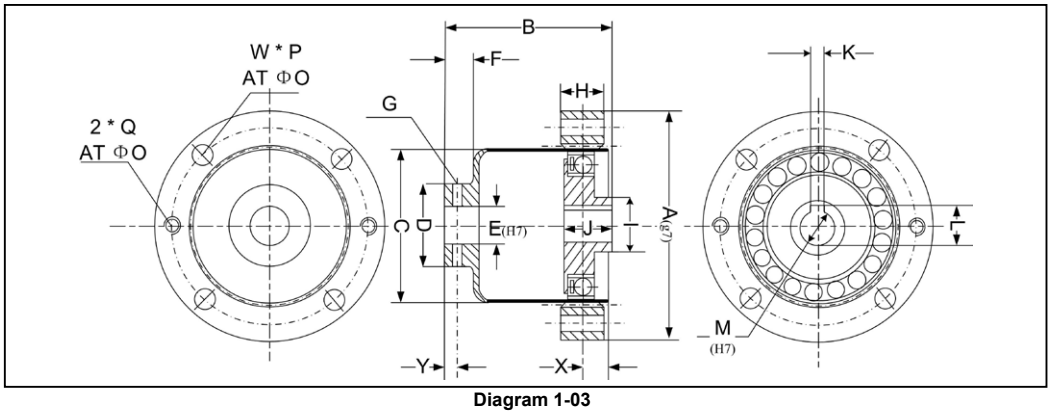


Diagram 1-03

Model	A	B	C	D	E	F	G*	H	I	J	K	L	M	O	P	Q	W	X	Y
	(g7)				(H7)								(H7)						
25	40	31	25.5	14	10	6	3	9	11	8.8	2	7	6	34	3.5	M3	4	4	3
32	50	38.75	32.6	17	13	6	3	10	15	13	3	11.4	10	43	3.5	M3	4	4.75	3
40	60	47	40.7	24	18	7	4	11	20	15	4	13.8	12	51	4.5	M4	4	6	3.5
50	70	56.5	51	27	21	8	5	12	24	17	5	16.3	14	62	4.5	M4	4	7.5	4

Dimension Unit: mm ***：Connecting pin holes, will be made by customer themselves.**

Wave Generator with Double hub sliders

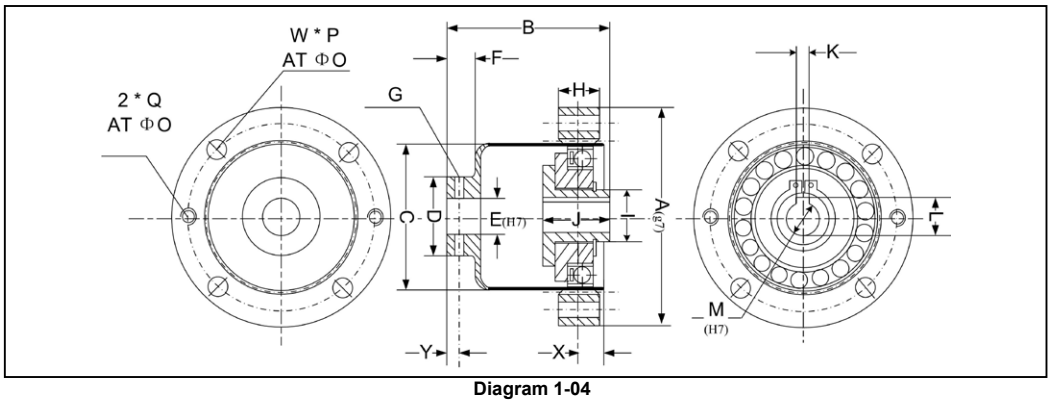
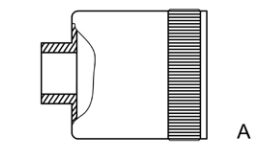


Diagram 1-04

Model	A	B	C	D	E	F	G*	H	I	J	K	L	M	O	P	Q	W	X	Y
	(g7)				(H7)								(H7)						
25	40	31	25.5	14	10	6	3	9	12	14.6	2	7	6	34	3.5	M3	4	4	3
32	50	35.7	32.6	17	13	6	3	10	15	16	3	9.4	8	43	3.5	M3	4	4.75	3
40	60	43.5	40.7	24	18	7	4	11	18	19	3	11.4	10	51	4.5	M4	4	6	3.5
50	70	53.5	51	27	21	8	5	12	22	22	4	13.8	12	62	4.5	M4	4	7.5	4

Dimension Unit: mm ***：Connecting pin holes, will be made by customer themselves.**



1.Flex spline
2.Output shaft
3.Pin

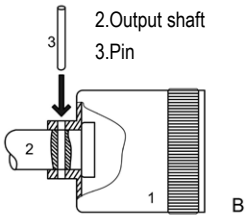


Diagram 1-05

A

The pinholes on model 25~50 are not drilled when they are rolled off the production lines, but left to be done by customers according to their own needs.

B

After fitting together the output shaft and the flex splines, puncture on the two parts now assembled a pinhole on a drill press that passes through both the flex splines and the shaft.
Where customers need a normal pin with high precision, please refine the pinhole behind it with a reamer to a degree that suits your requests.
Customers may opt for a springing pin, thus doing away with the step of refinement with a reamer.

XB1-AL-C Harmonic Gear Technical Performance Parameter Sheet

For the performance specifications of XB1 Model harmonic gear, please refer to the table below:

Parameter Unit

Rated Output Torque (R.O.T.): N.m

Output Rotation Speed(O.R.S.): rpm

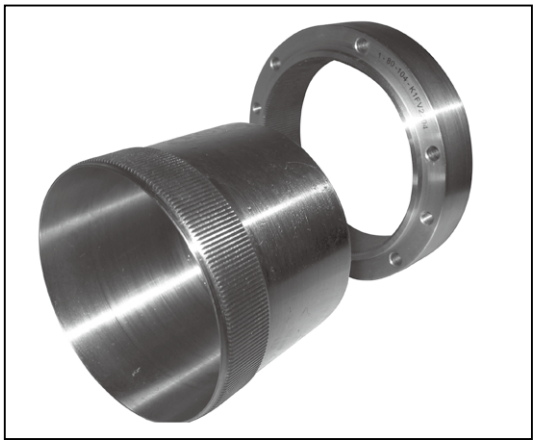
Rated Input Power(R.I.P): kW

Model	Speed Ratio	Input Rotation Speed(3000/rpm)			Input Rotation Speed(1500/rpm)			Input Rotation Speed(1000/rpm)		
		R.O.T.	O.R.S.	R.I.P.	R.O.T.	O.R.S.	R.I.P.	R.O.T.	O.R.S.	R.I.P.
20	40	0.9	75	0.006	1	37.5	0.004	1	25	0.003
	50	1.1	60	0.006	1.1	30	0.004	1.1	20	0.003
	63	1.1	47.6	0.007	1.1	23.8	0.005	1.1	16	0.004
25	30	1	100	0.012	1.2	50	0.007	1.2	33	0.005
	41	1	73	0.012	1.2	36	0.007	1.2	24	0.005
	50	1.5	60	0.015	2	30	0.010	2	20	0.006
	63	2	48	0.015	2.5	24	0.010	2.5	16	0.006
	80	2	38	0.015	2.5	19	0.010	2.5	12.5	0.010
32/35	40	2.5	75	0.028	3	37	0.014	3	25	0.009
	52	3	58	0.028	3	29	0.014	3	19	0.009
	64	4.5	47	0.034	5.5	23	0.020	5.5	16	0.014
	80	5	38	0.030	6.5	19	0.020	6.5	13	0.013
	100	5	30	0.030	6.5	15	0.020	6.5	10	0.013
	110	5	28	0.030	6.5	14	0.020	6.5	9	0.013
40	40	8	75	0.081	8	37	0.040	8	25	0.027
	50	8	60	0.081	8	30	0.040	8	20	0.027
	65	10	46	0.074	10	23	0.037	10	15	0.025
	80	12	38	0.073	12	19	0.036	12	13	0.024
	100	15	30	0.073	17	15	0.040	17	10	0.027
50	41	15	73	0.158	15	36	0.079	15	24	0.053
	50	15	60	0.151	15	30	0.076	15	20	0.050
	58	20	52	0.167	20	26	0.083	20	17	0.056
	60	20	50	0.164	20	25	0.082	20	17	0.055
	61	20	49	0.158	20	25	0.079	20	16	0.053
	70	25	42	0.155	25	21	0.077	25	14	0.052
	80	25	38	0.151	25	19	0.076	25	13	0.050
	83	25	36	0.146	25	18	0.073	25	12	0.049
	84	25	36	0.146	25	18	0.073	25	12	0.049
	95	25	32	0.153	25	16	0.084	25	11	0.056
	100	30	30	0.145	33	15	0.080	33	10	0.053
	118	30	25	0.123	33	13	0.068	33	8	0.045
	120	30	25	0.121	33	13	0.066	33	8	0.044
	125	30	24	0.116	33	12	0.073	33	8	0.056
60	42	25	71	0.252	25	35	0.126	25	24	0.084
	50	25	60	0.237	25	30	0.118	25	20	0.079
	58	30	52	0.250	30	26	0.125	30	17	0.083
	59	30	51	0.246	30	25	0.123	30	17	0.082
	60	30	50	0.234	30	25	0.117	30	16	0.078
	73	40	41	0.265	40	21	0.132	40	14	0.088
	75	40	40	0.258	40	20	0.129	40	13	0.086
	80	40	38	0.248	40	19	0.124	40	13	0.083
	100	50	30	0.242	55	15	0.133	55	10	0.089
	105	50	29	0.230	55	14	0.127	55	10	0.084
	118	50	25	0.205	62	13	0.127	72	8	0.098
	120	50	25	0.201	62	13	0.125	72	8	0.097
	126	50	24	0.192	62	12	0.119	72	8	0.092
	148	50	20	0.163	62	10	0.101	72	7	0.078
	150	50	20	0.161	62	10	0.100	72	7	0.077
	160	50	19	0.151	62	9	0.094	72	6	0.073
80	50	60	60	0.539	60	30	0.269	60	20	0.180
	52	60	58	0.518	60	29	0.259	60	19	0.173
	60	60	50	0.530	72	25	0.265	72	16	0.177
	66	60	45	0.497	72	22	0.249	72	15	0.166
	78	100	38	0.575	100	19	0.288	100	13	0.192
	80	100	38	0.561	100	19	0.281	100	13	0.187
	98	120	31	0.550	130	15	0.298	130	10	0.198
	100	120	30	0.539	130	15	0.292	130	10	0.194
	120	120	25	0.539	130	12	0.292	130	8	0.194
	135	120	22	0.399	150	11	0.249	150	7	0.166
	160	120	19	0.337	150	9	0.210	150	6	0.140
	200	120	15	0.269	150	8	0.168	150	5	0.122
100	50	120	60	1.122	150	30	0.701	150	20	0.468
	58	145	52	1.122	180	26	0.696	180	17	0.464
	61	145	49	1.084	180	24	0.673	180	16	0.449
	70	145	43	1.001	180	21	0.621	180	14	0.414
	78	200	38	1.151	200	19	0.575	200	13	0.383
	80	200	38	1.122	200	19	0.561	200	13	0.374
	83	200	36	1.081	200	18	0.541	200	12	0.360
	84	200	36	1.081	200	18	0.541	200	12	0.360
	95	200	32	1.134	200	16	0.626	200	11	0.417
	100	240	30	1.077	265	15	0.595	265	10	0.396
	118	240	25	0.913	265	13	0.571	265	8	0.380
	125	240	24	0.862	300	12	0.539	300	8	0.359
	145	240	20	0.673	300	10	0.421	300	7	0.280
	160	240	19	0.673	300	9	0.421	300	6	0.280
	168	240	18	0.641	300	9	0.401	300	6	0.267
	200	240	15	0.539	300	8	0.337	300	5	0.224
	255	240	12	0.422	300	6	0.264	300	4	0.176

Model	Speed Ratio	Input Rotation Speed(3000/rpm)			Input Rotation Speed(1500/rpm)			Input Rotation Speed(1000/rpm)		
		R.O.T.	O.R.S.	R.I.P.	R.O.T.	O.R.S.	R.I.P.	R.O.T.	O.R.S.	R.I.P.
120	50	230	60	2.244	230	30	1.122	230	20	0.748
	60	270	50	2.289	270	25	1.044	270	16	0.694
	75	320	40	1.915	320	20	0.957	320	13	0.738
	80	360	38	2.020	360	19	1.010	360	13	0.673
	85	360	35	2.020	360	17	1.010	360	11	0.673
	100	450	30	2.020	495	15	1.111	505	10	0.756
	120	450	25	1.683	550	13	1.029	600	9	0.748
	150	450	20	1.346	550	10	0.823	600	7	0.598
	200	450	15	1.010	550	8	0.617	600	5	0.449
	243	450	12	0.835	550	6	0.510	600	4	0.371
160	50	N/A			500	30	2.200	580	20	1.701
	60				600	25	2.172	690	16	1.665
	66				600	22	2.172	690	15	1.665
	80				800	19	2.244	920	13	1.720
	100				900	15	2.020	1050	10	1.571
	107				900	14	1.888	1050	9	1.468
	115				900	13	1.888	1050	8	1.468
	135				1000	11	1.662	1150	7	1.274
	160				1000	9	1.403	1150	6	1.075
	200				1000	8	1.122	1150	5	0.860
	235				1000	6	1.122	1150	4	0.860
	270				1000	6	0.831	1150	4	0.637
200	50	N/A			1000	30	4.675	1150	20	3.584
	62				1200	24	4.143	1400	16	3.222
	72				1200	20	4.143	1400	14	3.222
	80				1600	19	4.488	1850	13	3.460
	100				1800	15	4.039	2000	10	2.992
	125				2000	12	3.590	2300	8	2.753
	135				2000	11	3.325	2300	7	2.549
	168				2000	9	2.672	2300	6	2.048
	200				2000	8	2.244	2300	5	1.720
	255				2000	6	1.760	2300	4	1.350
	290				2000	5	1.760	2300	3	1.350
250	50	N/A			1750	30	7.552	2000	20	5.754
	60				1750	25	7.552	2000	16	5.754
	75				2100	20	8.125	2400	13	6.190
	80				2800	19	7.845	3200	12	5.984
	100				3150	15	7.441	3600	10	5.669
	120				3500	13	6.545	4000	8	4.987
	150				3500	10	5.236	4000	7	3.989
	160				3500	9	4.909	4000	6	3.740
	170				3500	9	4.909	4000	6	3.740
	200				3500	8	3.927	4000	5	2.992
	245				3500	6	3.246	4000	4	2.473
	310				3500	5	2.550	4000	3	1.943

Driving Arrangement

Model XB1 harmonic gear is composed of the flex spline, the circular spline, and the wave generator. When putting them into use, customers can clasp anyone of these components, leaving the other two to work as the input and output ends, and thereby attaining the different speed ratios specified in this section.



Below are the transmission parameters of the harmonic gear:

$$R = Zr / 2$$

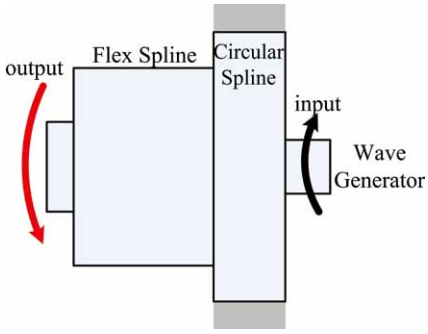
(Zr : Teeth number on flex spline)

The parameters determine the speed ratios that can be achieved by the harmonic gear.

i : speed ratio

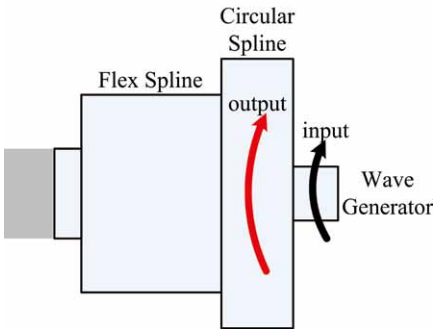
1. Each speed ratio listed in the harmonic speed ratio table in the preceding section is calculated when the drive gear is put into routine run in the commonest working conditions (i.e., the circular spline clasping, the wave generator input, and the flex spline output).

$$i = -R$$



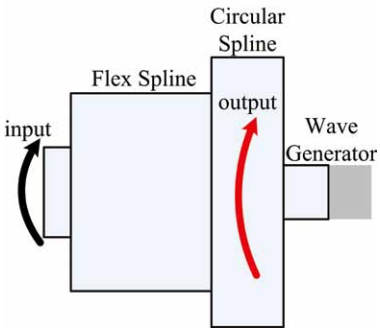
2. The flex spline clasping, the wave generator input, the circular spline output

$$i = R+1$$



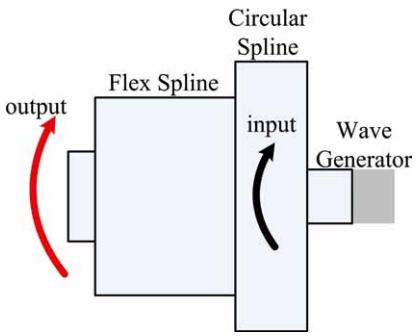
3.The wave generator clasping, the flex spline input, the circular spline outpute

$$i = \frac{R+1}{R}$$



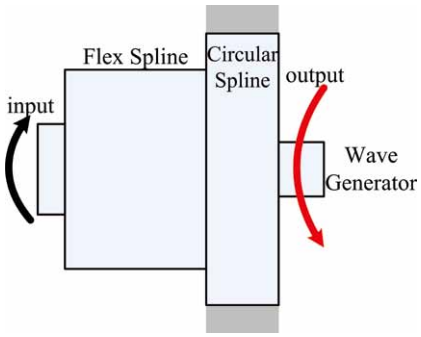
4.The wave generator clasping, the circular spline input, the flex spline output

$$i = \frac{R}{R+1}$$



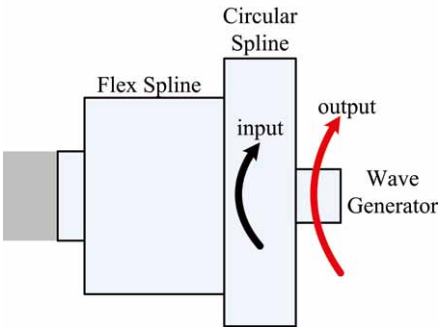
5.The circular spline clasping, the flexslpine input, the wave generator output

$$i = \frac{-1}{R}$$



6.The flexslpine clasping, The circular spline input, the wave generator output.

$$i = \frac{1}{R+1}$$

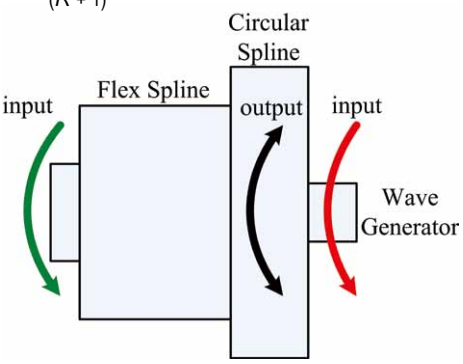


Where the three components of the harmonic gear are all left unclasped, pick any two of them to work at the input ends, and have the third component run at the output end to constitute the harmonic differential system. With respect to various working conditions, the rotation speeds of harmonic differential system can be worked out according to the formulae below:

Nw : the rotation speeds of the wave generator(rpm)
Nf : the rotation speeds of the flex spline (rpm)
Nc : the rotation speeds of the circular spline(rpm)

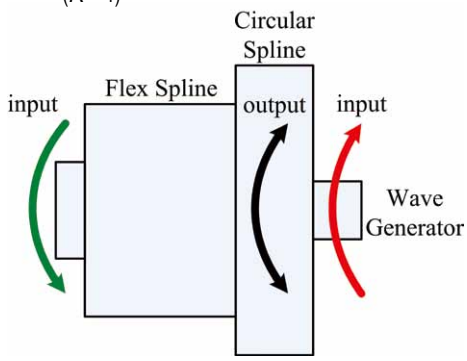
1. The flex spline and the wave generator run as the input ends are spun in the same direction, the circular spline output end.

$$Nc = \frac{Nw+R * Nf}{(R+1)}$$



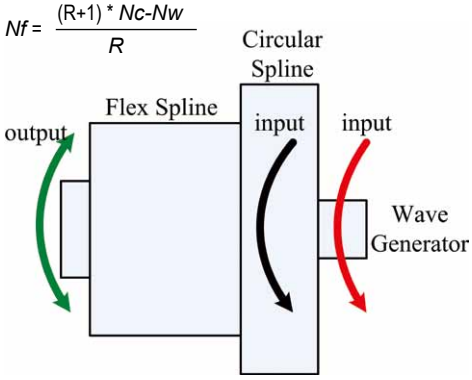
2. The flex spline and the wave generator run as the input ends are spun in the opposite directions, the circular spline output end

$$Nc = \frac{Nw-R * Nf}{(R+1)}$$



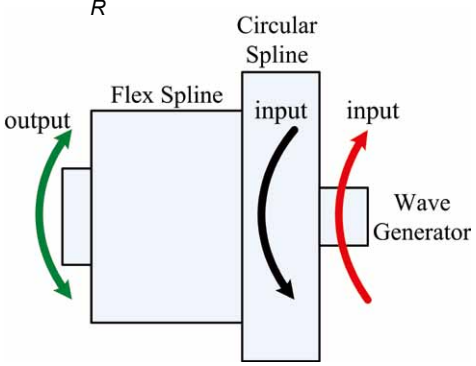
3. The circular spline and the wave generator run as the input ends are spun in the same direction, the flex spline output end

$$Nf = \frac{(R+1) * Nc-Nw}{R}$$



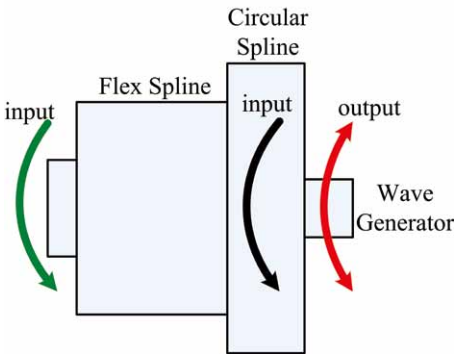
4. The circular spline and the wave generator run as the input ends are spun in the opposite directions, the flex spline output end

$$Nf = \frac{(R+1) * Nc+Nw}{R}$$



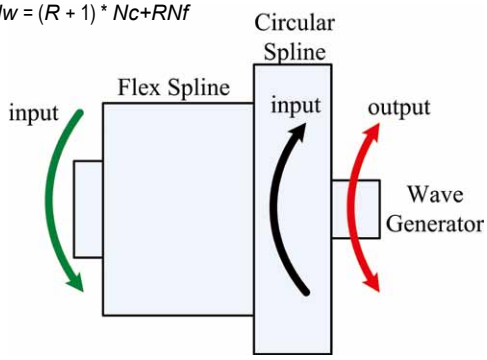
5. The flex spline and the circular spline run as the input ends are spun in the same direction, the wave generator output end

$$Nw = (R+1) * Nc-RNf$$



6. The flex spline and the circular spline run as the input ends are spun in the opposite directions, the wave generator output end

$$Nw = (R+1) * Nc+RNf$$



Torsional Rigidity Coefficient XB1-AL-C

Ka: Torsional rigidity coefficient, including the range from pure backlash to elastic twist of the output shaft to about 20% of rated torque.

Kb: Torsional rigidity coefficient, covering the range thereafter to the rated torque, for elastic twist of the shaft.

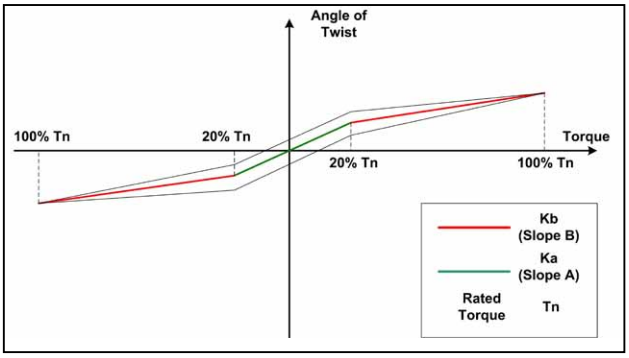


Diagram 1-06

Model (Ka)	20	25	32	40	50	60	80	100	120	160	200	250
Torsional Rigidity (N.m/arc min)	0.034	0.072	0.24	0.6	1.2	2.24	5.32	9.6	18	43.63	89.01	151.36

Model (Kb)	20	25	32	40	50	60	80	100	120	160	200	250
Torsional Rigidity (N.m/arc min)	0.2	0.36	0.99	2.4	4.79	8.9	21.28	38.38	72.1	177.9	354.7	701

Moment of Inertia of the Input Shaft Assembly XB1-AL-C

Model	20	25	32	40	50	60
Moment of Inertia ($kg.m^2$)	$0.38*10^{-6}$	$0.6*10^{-6}$	$2.41*10^{-6}$	$0.63*10^{-5}$	$2.04*10^{-5}$	$0.49*10^{-4}$
Model	80	100	120	160	200	250
Moment of Inertia ($kg.m^2$)	$1.40*10^{-4}$	$0.41*10^{-3}$	$1.15*10^{-3}$	$0.48*10^{-2}$	$1.68*10^{-2}$	$3.35*10^{-2}$

Notes: The data specified in the table above conform to the standard-structured camponent sets of our company's harmonic gear. In case customers require the wave generator tailored to their individual needs, the data shall be altered accordingly.

The Efficiency of the XB1-AL-C

The Drive Efficiency of the Model XB1-AL-C Harmonic Gear is affected by the following causes:

1. Model Type
2. Input rotary speed
3. Drive speed ratio
4. Lubricant
5. Setting temperature
6. Amount of the load driven

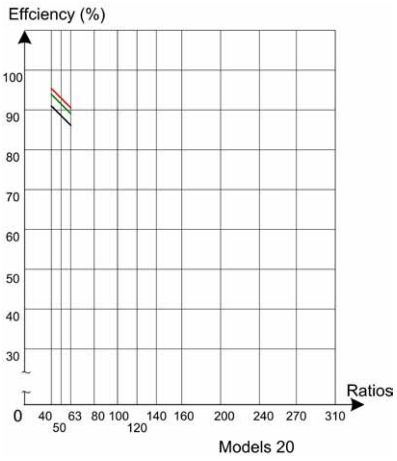
This section treats of the drive efficiency effected by the Model XB1-AL-C Harmonic Gear under varied conditions.

In the charts, as shown below, are drawn the drive efficiency curves observed of the various model types when put to work at varied speed ratios and input rotary speeds (3000rpm, 1500rpm, 1000rpm).

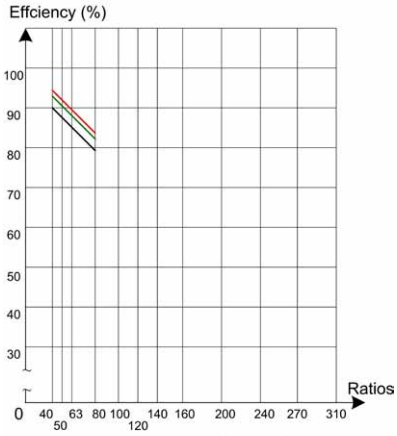
Among which, models 20,25,32,40,50,60 make use of lubrication grease as the lubricant, whereas models 80,100,120,160,200,250 utilize lubrication oil as the lubricant.

Input rotation speed:

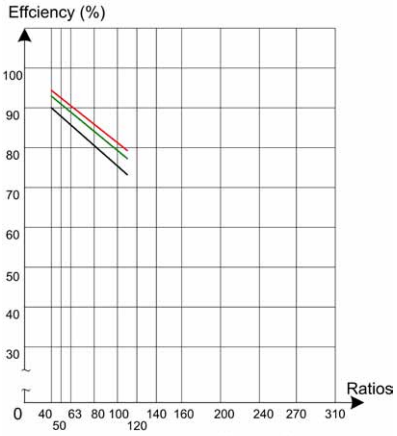
- 3000 rpm
- 1500 rpm
- 1000 rpm



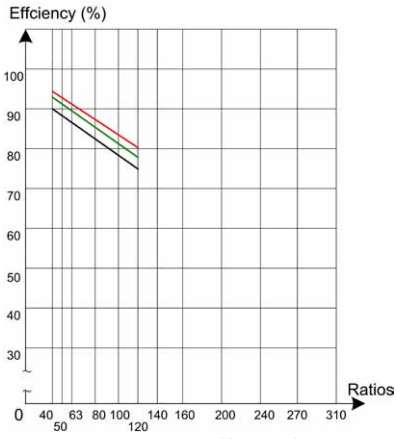
Models 20



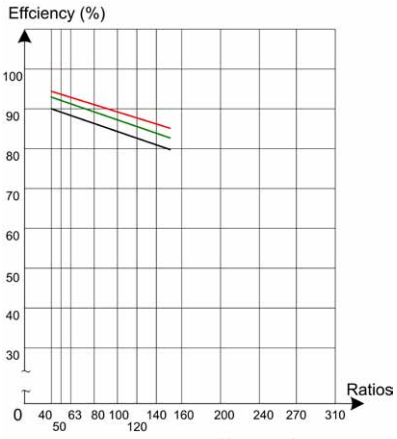
Models 25



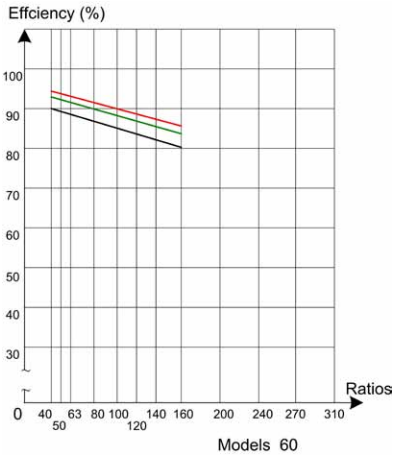
Models 32



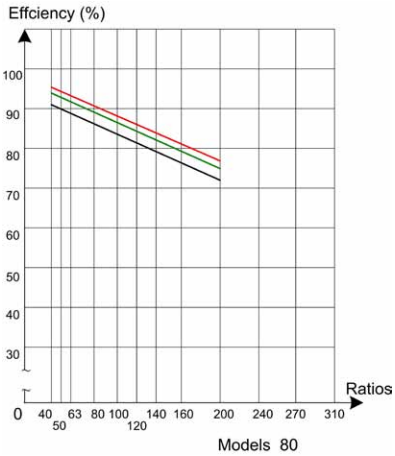
Models 40



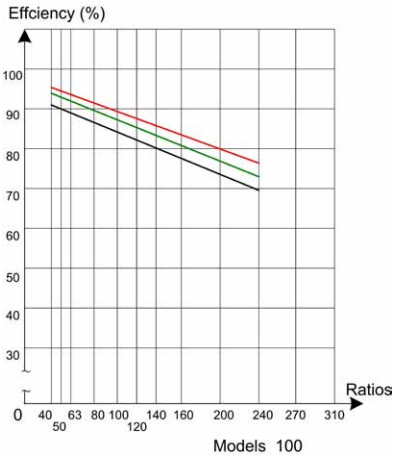
Models 50



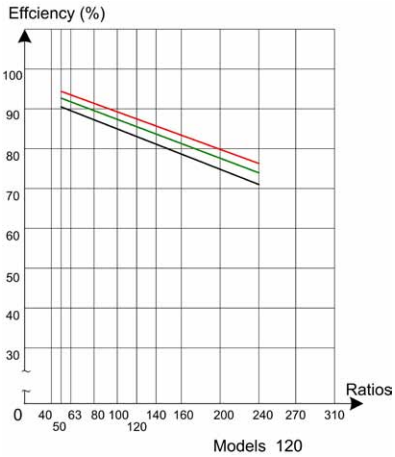
Models 60



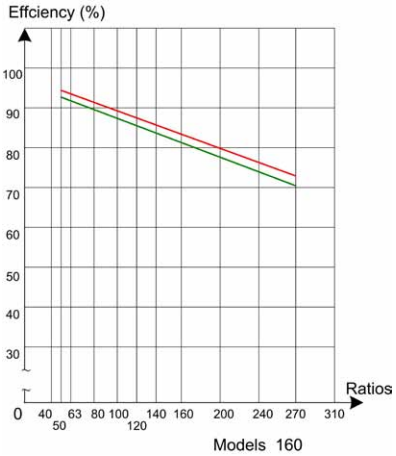
Models 80



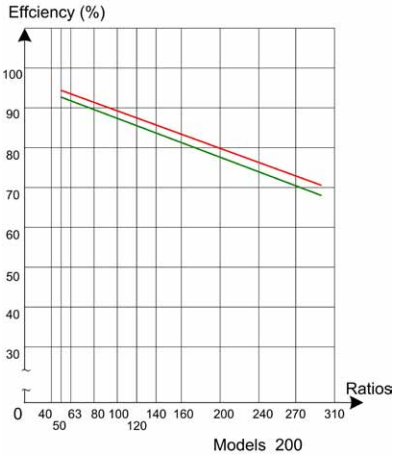
Models 100



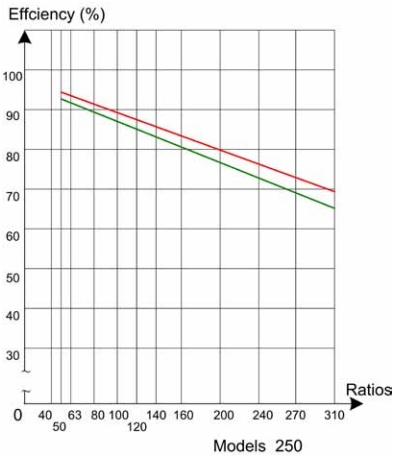
Models 120



Models 160



Models 200



Models 250

The drive efficiency curves, as shown in the chart above, observed of the several models are effected under such conditions as the setting temperature is kept at 50℃, and the 100% rated load is imposed. When changes are made to the setting temperature and the load driven, adjustments need to be effected to the gear drive efficiency according to the temperature-efficiency relationship chart and load-efficiency relationship chart, as respectively shown below.

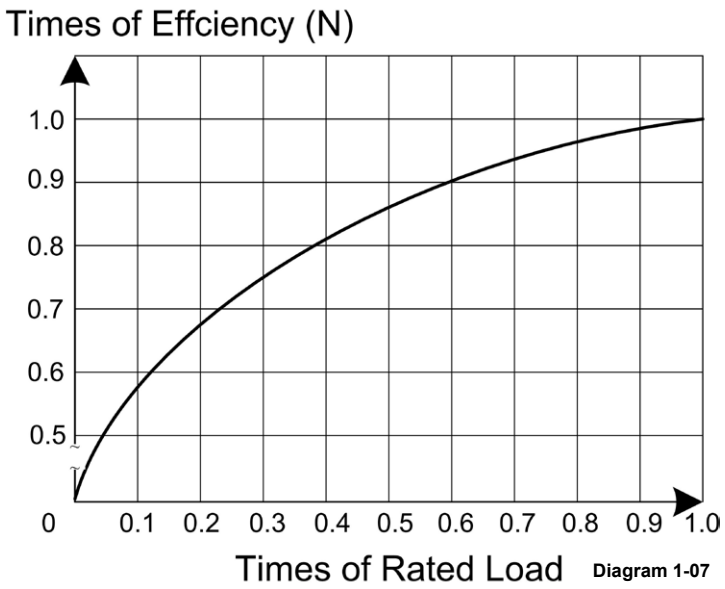


Diagram 1-07

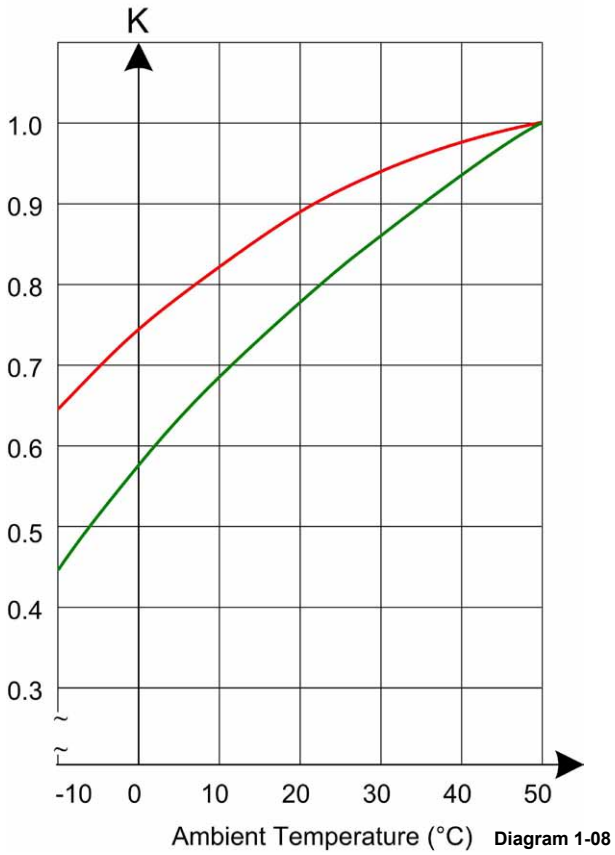


Diagram 1-08

How to apply the relationship charts:

For example: when input rotary speed reaches 1500rpm, XB1-AL-C Model 100, 100 speed ratio, by consulting the XB1-AL-C 100 efficiency chart, we can find out the basic efficiency η0 of the model under discussion to be 87%.

At this time, supposing the setting temperature is maintained at 20℃, and besides, the gear is not put to work to capacity, the load being regulated at 0.9 times of the rated load.

1. By referring to the temperate-efficiency chart, when the setting temperature comes at 20℃, K, standing for the adjusted parameter, is 0.85(Lubrication: Oil);

2. By referring to the load-efficiency chart, when 0.9 times of rated load is kept, N, representing the adjusted parameter, is 0.98.

Thus, the actual drive efficiencyηattained by the gear in question is:

η =η0 * N * K

= 87% * 0.85 * 0.98 = 72.4%

That is, the actual drive efficiency rate, achieved by Gear XB1-AL-C 100-100, under this specified working condition, is 72.4%.

No-load startup torque XB1-AL-C

No-load startup torque means the minimum torque required when the high-speed end is activated from rest to work, under the condition that no load is set on the output end (the low-speed end) of the Harmonic gear set.

No-load startup torque has a close bearing on the drive efficiency of the component set (for the efficiency factor, please refer to page 15); the chart below is figured out under the conditions as follows:

Setting Temperature: 50℃

Lubrication: 20，25，32，40，50，60: lubrication grease

80，100，120，160，200，250: lubrication oil

In addition: represented in this chart is none other than the no-load startup performance wrought by the Harmonic gear set. As no regard is had to the effects exerted on the drive efficiency by the input/output axial bearings adopted in real customers' systems, seal rings and a slew of unknown factors, so the figures in question do not represent those of the Harmonic Gear of finished product.

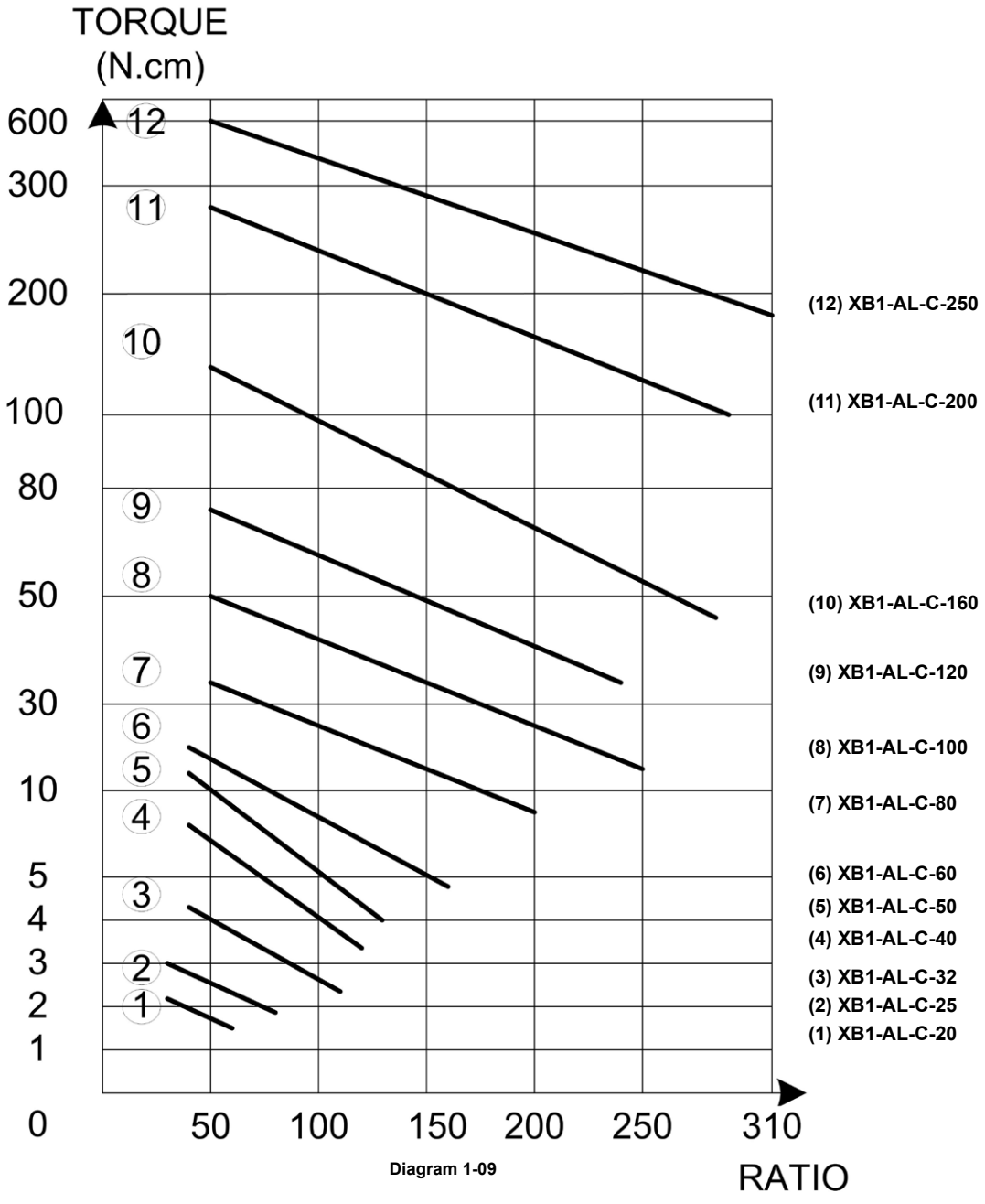


Diagram 1-09

No-load startup torque under the condition of acceleration(Back driving) XB1-AL-C

Model XB1-AL-C Harmonic Gear can be applied as an acceleration device. Its no-load startup torque means the minimum torque required when the low-speed end is activated from rest to work, under the condition that no load is set on the output end (the high-speed end) of the Harmonic gear set.

Represented in this chart is none other than the no-load startup performance wrought by the Harmonic gear set. As no regard is had to the effects exerted on the drive efficiency by the input/output axial bearings adopted in real customers' systems, seal rings and a slew of unknown factors, so the figures in question do not represent those of the Harmonic Gear of finished product.

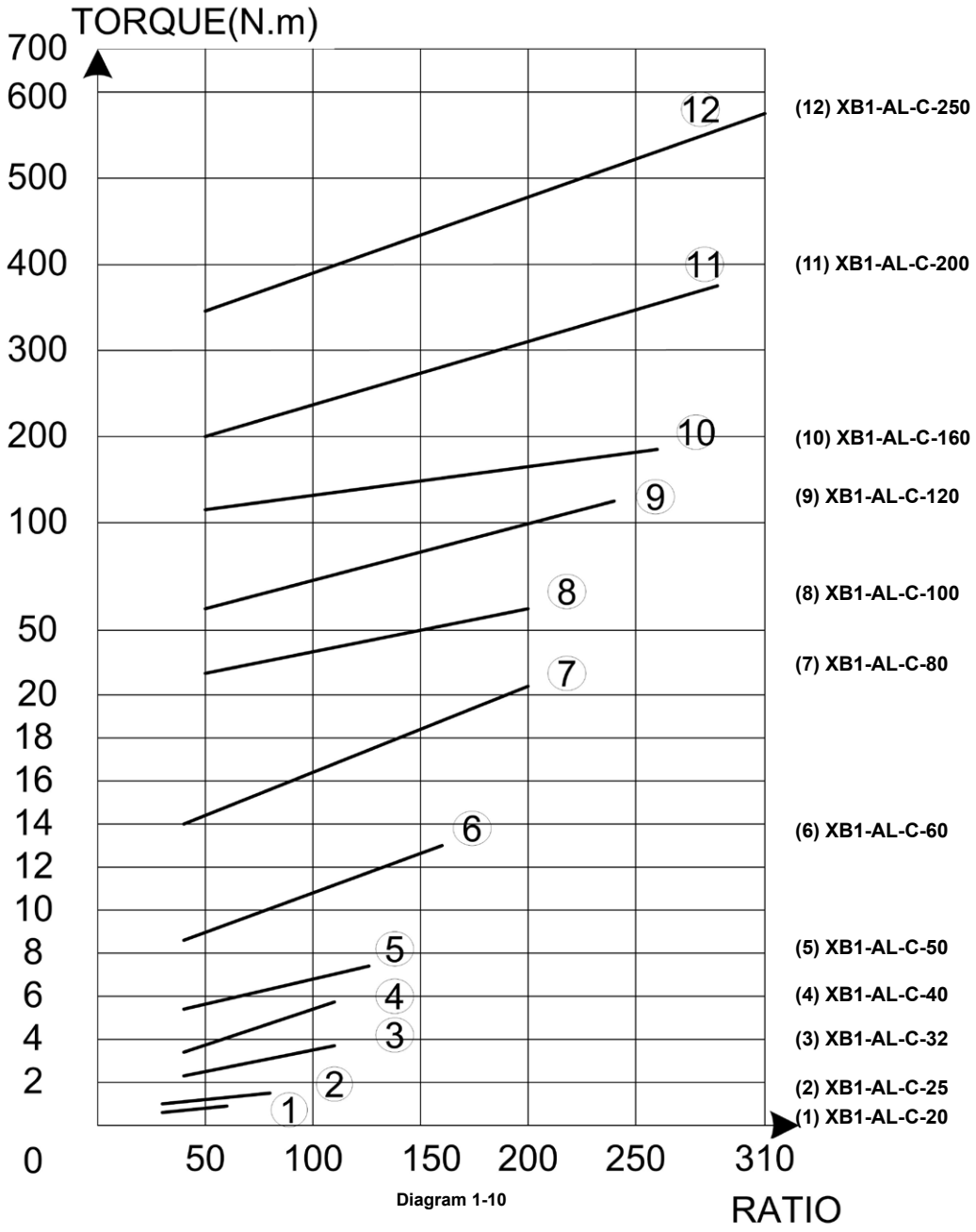


Diagram 1-10

Assembly Tolerance And Position XB1-AL-C

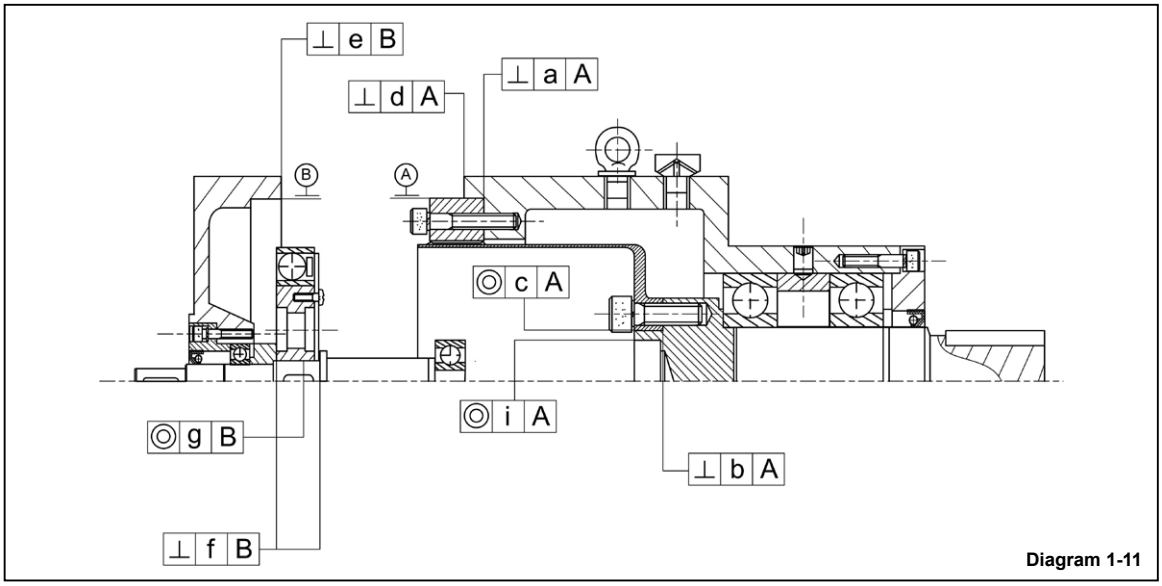


Diagram 1-11

MODEL	A	B	C	D	E	F	G	I
20	0.01	0.012	0.01	0.012	0.012	0.012	0.01	0.01
25	0.01	0.015	0.012	0.015	0.015	0.015	0.012	0.012
32	0.015	0.02	0.015	0.015	0.015	0.015	0.012	0.012
40	0.015	0.02	0.02	0.025	0.025	0.015	0.015	0.015
50	0.02	0.025	0.02	0.025	0.025	0.02	0.02	0.015
60	0.02	0.025	0.025	0.025	0.025	0.02	0.02	0.015
80	0.025	0.03	0.025	0.03	0.03	0.025	0.025	0.02
100	0.025	0.03	0.03	0.03	0.03	0.025	0.025	0.02
120	0.03	0.035	0.03	0.035	0.035	0.03	0.025	0.02
160	0.03	0.035	0.035	0.035	0.035	0.03	0.03	0.025
200	0.035	0.04	0.035	0.04	0.04	0.035	0.03	0.025
250	0.04	0.045	0.04	0.04	0.04	0.035	0.03	0.025

Unit: mm

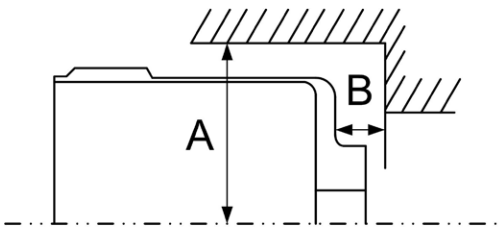


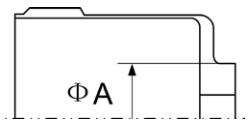
Diagram 1-12

When the Gear Set of Model XB1-AL-C is installed, ample room must be reserved both in the axial and radial directions between the adjoining parts and the flexspline, so as to ensure the normal deformation by the flexspline.
For the specific values, please refer to the corresponding chart.

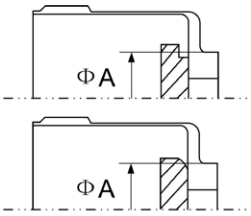
Model	50	60	80	100	120	160	200	250
A	27	33	42	52	65	84	105	130
B	2	2	3	3	4	4	6	8

Unit: mm

Model XB1-AL-C Harmonic Gear adopts the cup-shaped flexspline. When fitting the flexspline onto the output shaft, please take notices as follows:
The outer diameter of the presser, which is set into the flexspline, must needs be kept smaller than A—that of the outer ring encompassing the surface of the tip on which the flexspline receives attachment;



if, however, the outer diameter of the presser is of necessity to outstrip A, the two schemes, as shown beside, may be employed, so as to ensure the deformation capacity of the flexspline bottom.



The jointure schemes resembling those as shown beside should be avoided, or else cracks may be effected on the flexspline bottom.

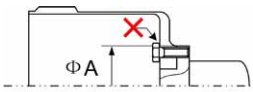


Diagram 1-13

Single Stage Harmonic Gear

Our company's products, besides a multitude of component sets belonging to their several series, furnish customers with a whole-series of the harmonic gearing devices designed for all the machine models, as well.

The harmonic gearing is such a device as its performance is ascertained or its various model numbers classified according to the character of the gear component parts. (For particular performance and numbers, please refer to the Component Parts Manual).

XB1-AL-GS

(Ordering Code)

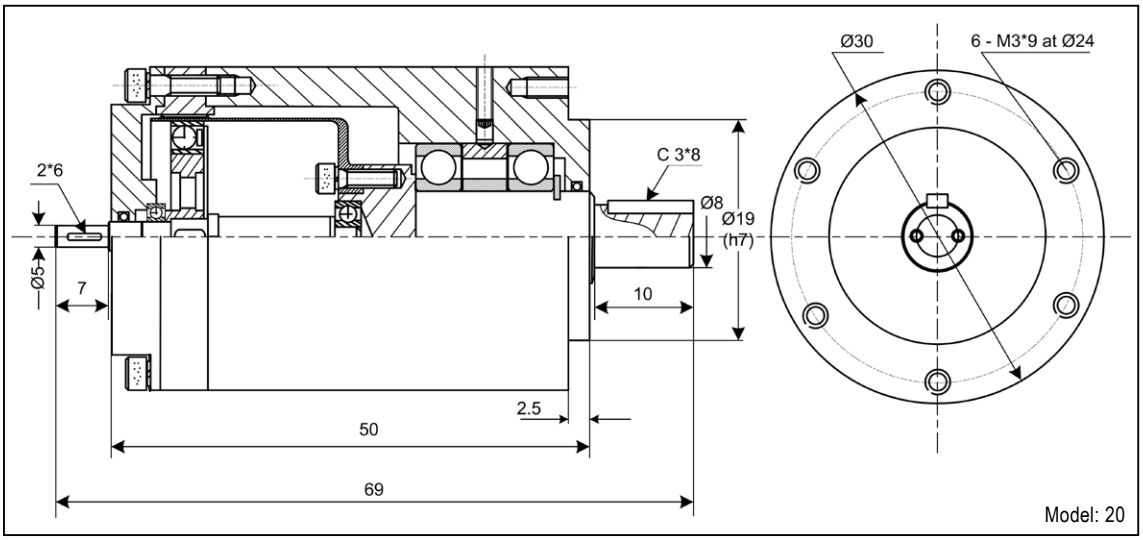
XB1-AL-GF

(Ordering Code)

XB1-AL-GS

The structure in which is framed the gear box of XB1-AL-GS Harmonic Gear of this kind utilizes such a style that are exposed the Input/ Output shafts, which moreover have themselves linked after the manner of key-type connection.

Please refer to Diagram (1)



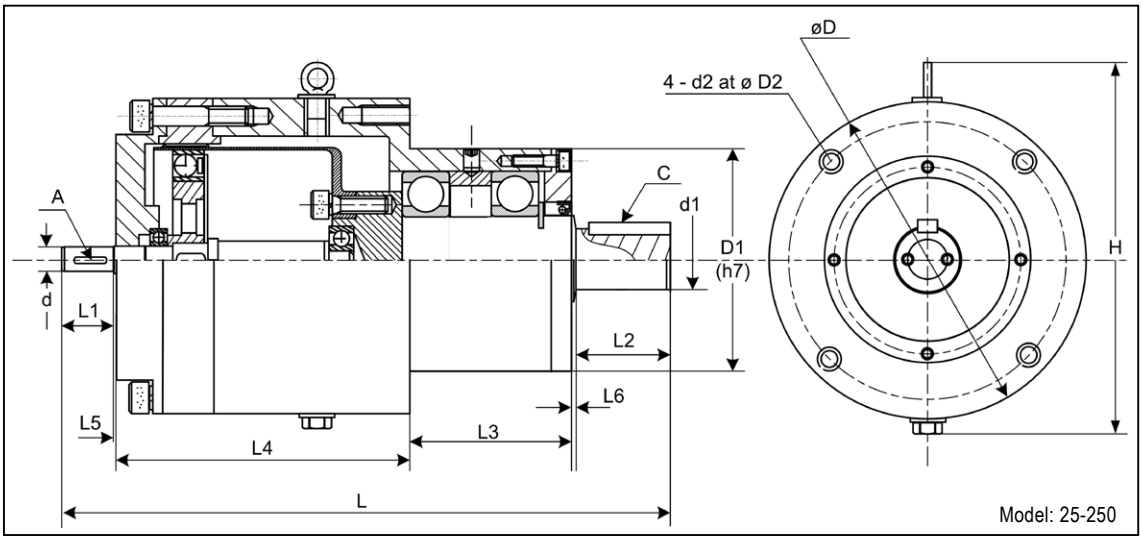


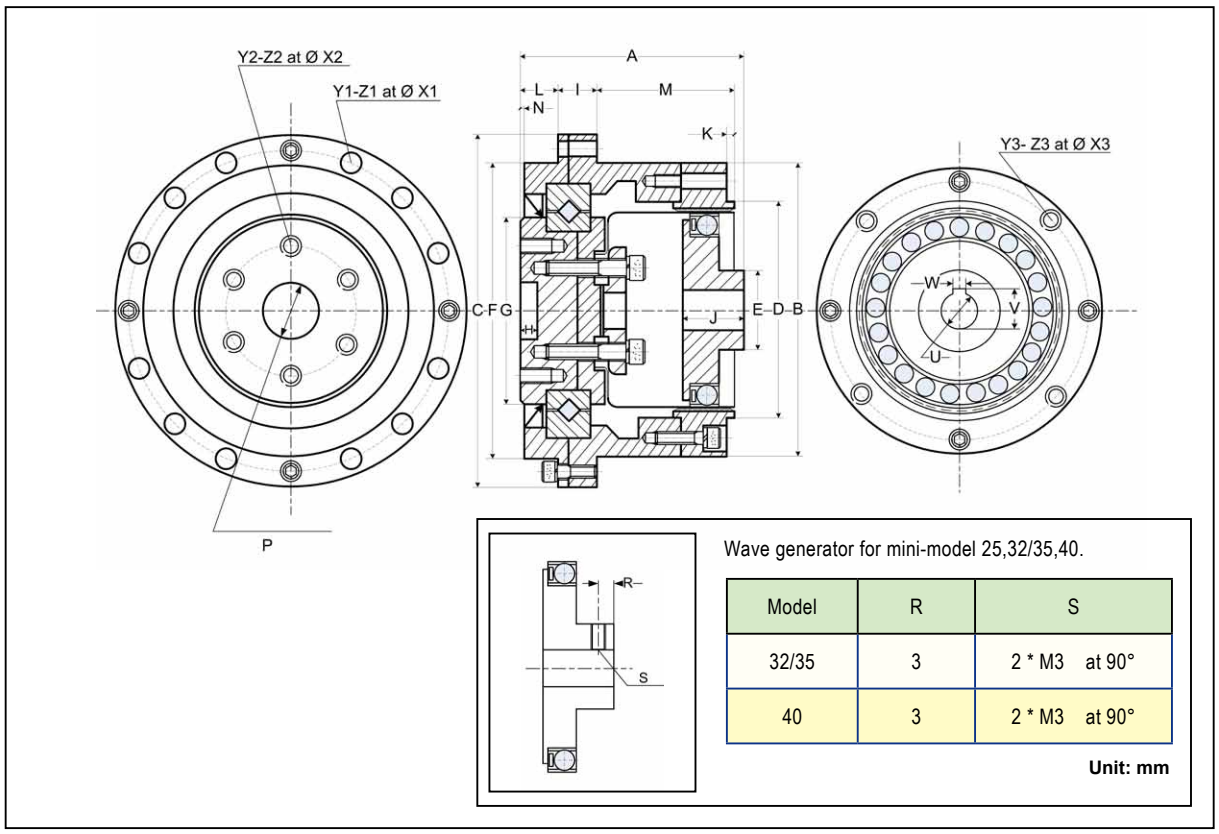
Diagram 2-01

Model	d	d1	d2	D	D1 (h7)	D2	L	L1	L2	L3	L4	L5	L6	H	A	C	Material of Housing	Weight (kg)
20	As the Drawing																Aluminum	0.17
25	5	8	M3	40	28	34	86	8	12	22	41	2	1		2 * 6	C3 * 10	Aluminum	0.3
32	6	12	M3	50	40	45	115	12	16	33	51.5	1	1.3		2 * 8	C4 * 14	Aluminum	0.5
40	8	15	M4	60	45	52	140	16	22	38	62	1	1.1		3 * 12	C5 * 18	Aluminum	1
50	10	18	M4	70	54	62	169.5	18	30	43	75	1.5	2		3 * 15	C6 * 25	Aluminum	1.5
60	14	22	M6	85	60	72	193.5	18	35	47	90	1.5	2		6 * 14	C6 * 32	Aluminum	3
80	14	30	M8	115	85	100	243	20	44	63	112	2.6	1.4		5 * 16	C8 * 40	Steel	10
100	16	35	M10	135	100	120	292	24	53	67	142.5	3.6	2	157	5 * 20	C10 * 50	Steel	16
120	18	45	M10	170	120	150	350	28	68	82	167	2.5	2	223.7	6 * 24	C14 * 62	Steel	31
160	24	60	M14	220	140	195	443	38	88	91	220	2	3	276	8 * 32	C18 * 80	Steel	52
200	30	80	M16	270	180	240	536	48	108	115	262	1	2	326.5	8 * 40	C22 * 100	Steel	98
250	35	95	M20	330	215	295	668	60	128	156	318	2	4	386.5	10 * 50	C25 * 120	Steel	160

Unit: mm

XB1-AL-GF

For the specifications given for the exterior and installation of the final finished XB1-AL-GF Model Gearbox, please consult the drawing/table, as shown below:



Wave generator for mini-model 25,32/35,40.

Model	R	S
32/35	3	2 * M3 at 90°
40	3	2 * M3 at 90°

Unit: mm

Diagram 2-02

Model	A	B	C	D	E	F	G	H	I	J	K	L	M	N
		(h7)		(h7)										
32/35	44.5	52	65	37	15	52	28	3	8.5	10	2	10	22.5	0.5
40	53	63.5	79	45	20	66	38	4	9.5	11	2.5	13	27	0.5
50	58.4	78	93	56	24	78	50	5	9	17	3	10	35	0.5
60	70	91	113	67	28	91	55	5	15	19	3	15.5	34.5	0.5
80	85	117	142	90	28	117	80	5	15	21	3	13.5	55	0.5
100	98	140	172	108	36	140	100	6	19	25	3	15	62	1
120	121	176	208	135	36	176	125	8	26	29.5	4	23	71.5	1
160	160	225	267	177	56	225	155	8	30	42	5	25	101.5	1
200	202	280	336	218	70	280	170	10	37	52	6	25.5	133	1.5
250	246.5	340	420	264	85	340	235	14	46	60	7	30	162	2

Model	P	U	V	W	X1	Y1	Z1	X2	Y2	Z2	X3	Y3	Z3	weight
	(H7)	(H7)												(kg)
32/35	10	6			58.5	8	3.5	18	6	M3*6	45	4	ø3.5*M3*6	0.8
40	10	10			72.5	8	3.5	23	6	M4*8	54	4	ø3.5*M3*6	1.2
50	15	12	13.8	4	85.5	8	4.5	36	6	M4*8	65	4	ø4.5*M4*8	1.6
60	20	14	16.3	5	102	12	5.5	40	6	M5*10	79	4	ø5.5*M5*10	2.3
80	25	14	16.3	5	129.5	12	6.5	60	6	M6*12	100	4	ø6.5*M6*12	5.8
100	30	14	16.3	5	156	12	6.5	70	6	M8*14	124	4	ø9*M8*16	15
120	40	19	21.8	6	192	12	9	90	6	M12*20	155	4	ø11*M10*20	23
160	50	24	27.3	8	247	12	11	116	6	M12*24	200	4	ø13*M12*24	55
200	60	30	33.3	8	308	12	13	108	6	M16*25	242	4	ø13*M12*24	98
250	80	50	53.8	14	380	12	18	150	6	M20*30	297	4	ø18*M16*32	180

Unit: mm

Install and apply XB1-AL-GF:

1.Where such XB1-AL-GF gear box as adopts other than the closed-structure is applied, customers may, in line with their own needs, take out designs or workings on the linking part, wherewith to join the speed reducer to the electromotor.

Gear box-electromotor-fixtures, and their correlations are indicated in the cases below:

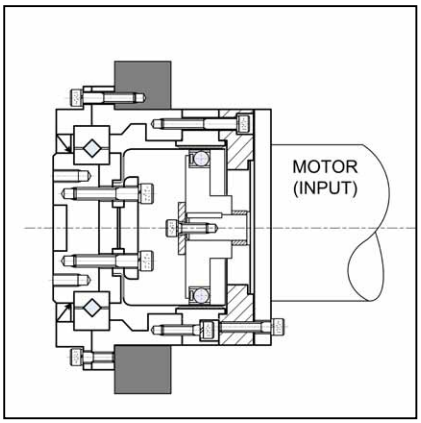


Diagram 2-03

2.When the output shaft of the electromotor is joined to the wave generator, in order to prevent the wave generator from moving loosely on the electromotor shaft, please have on hand the following drawings when working to fix it in place.

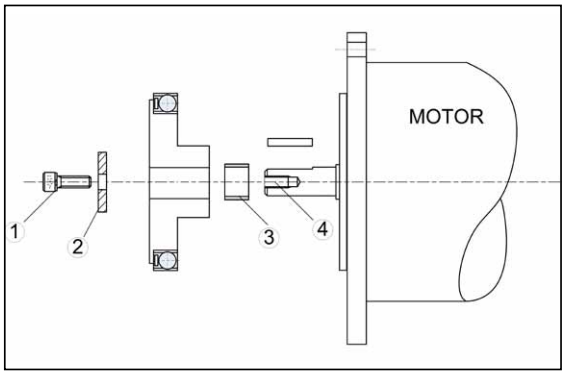


Diagram 2-04

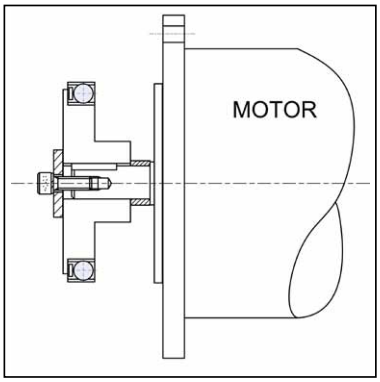


Diagram 2-05

XB1-AL-GF Model Gearbox, the type of full-closed structure, as demonstrated below, is available. For exterior and installation specifications, please look to the drawings/tables below:

Gearbox with input shaft

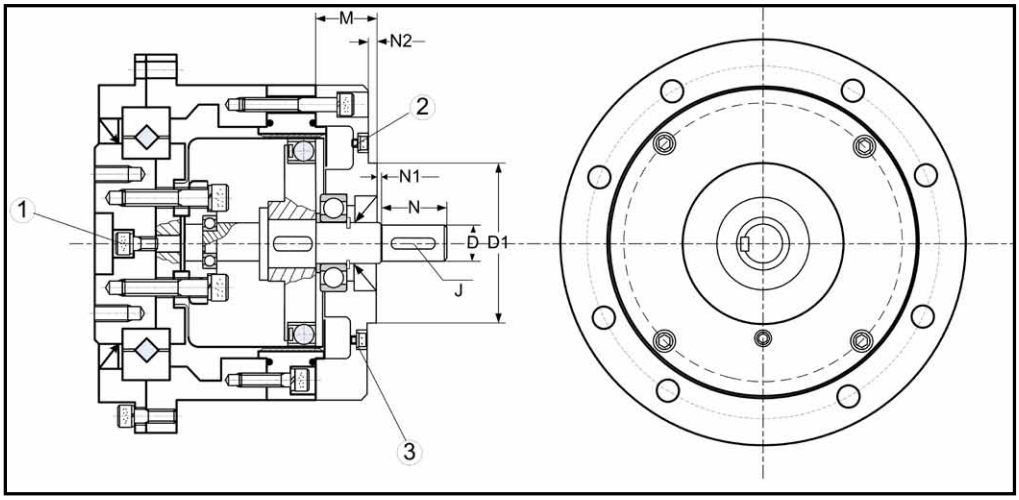


Diagram 2-06

GearBox Model	D	D1	J	M	N1	N2	N
32/35	6	24	2 * 8	11.5	1	2	12
40	8	25	3 * 12	13.5	1	2	16
50	10	30	3 * 15	16	1.5	3	18
60	14	40	5 * 14	23	1.5	3	18
80	14	65	5 * 16	24	2	4	20
100	16	80	5 * 20	25	3	4	24
120	18	80	6 * 24	31	3	9	28
160	24	108	8 * 32	37	3	5	38
200	30	120	8*40	39	3	5	48
250	35	145	10*50	50.5	3	4	60

Unit: mm

Notice: The figures 1-3, as marked in the drawing, are employed to indicate the holes where the lubricating oil may be applied or removed, in case the speed reducer feel the need in this regard. Of these figures, holes 2 and 3 are for application, and 1 for removal.

3.Where such XB1-AL-GF Gearbox as employs the closed-structure is set to work, on account of the gearbox that is shut up, lubricant oil can be used as the way to keep it oiled. When viewed against the lubricant grease, the oil is preferable for its ease in dissipating the heat, thereby fitter for a long stretch of work or the speed reducer as is kept spinning at high input speed.

Should the closed-structure XB1-AL-GF be adopted, for the volume of lubricant oil to be administered to the varied models as set to work under different conditions, please consult the table below:

Model	80	100	120	160	200	250
Status						
Horizontal	90	160	280	650	1400	3900
Vertical Output up	90	180	310	800	1800	4500
Vertica Output down	180	350	630	1600	3000	8000

Unit: ml

Single Stage Harmonic Gear

The harmonic gear, which runs on the working principle of single wave, resorts to two modes of output, one the direct-connection output by the flex spline.

In this section is briefed first on the XB1-AS-C Model, which adopts the output mode of direct-connection by the flex spline.

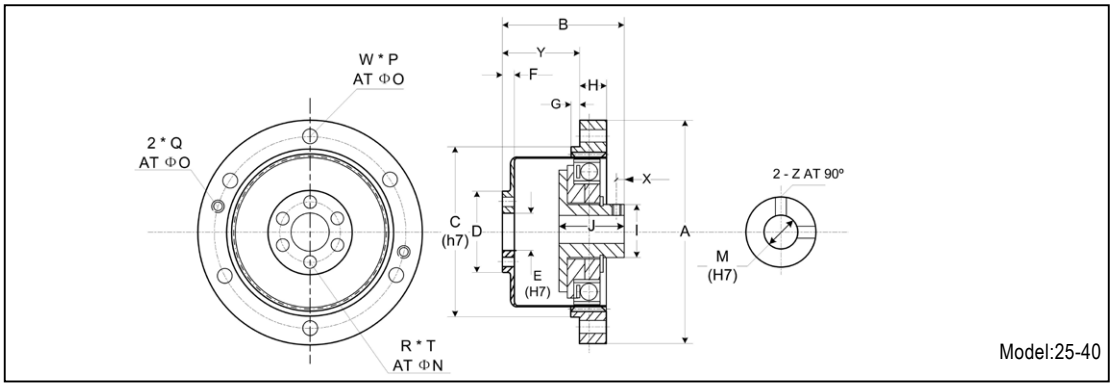
XB1-AS-C

(Ordering Code)

COMPONENT GEAR SET

Exterior Specifications of XB1-AS-C

For the exterior specifications of XB1-AS-C Model harmonic gears, please refer to the diagram/table



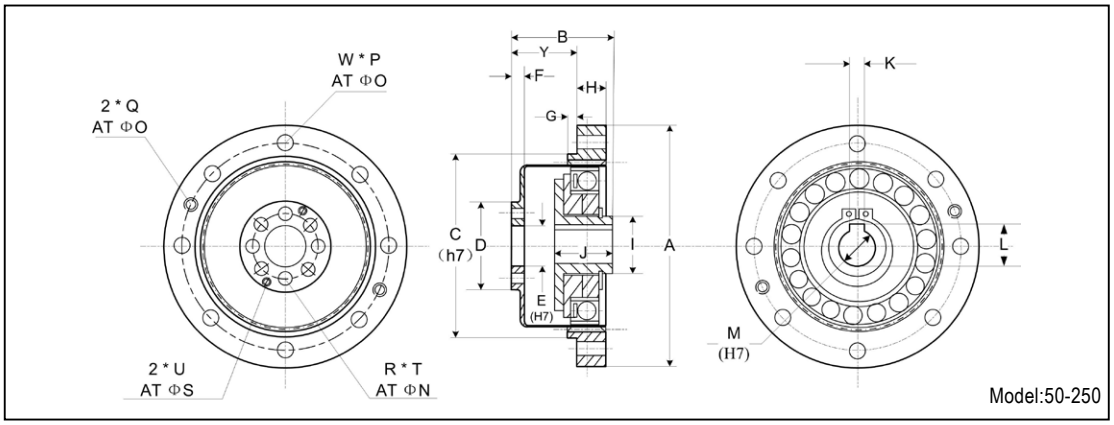


Diagram 3-01

Model	A	B	C	D	E	F	G	H	I	J	K	L	M
	(g7)		(h7)		(H7)						(js9)		(H7)
25	40	25.8	31	17.8	6	2	2	5	11	16			5
32	50	28.5	38	23	11	2.4	2	6	14	17.5			6
40	60	32.5	48	27.2	10	3	2.5	6.5	18	19.5			8
50	70	33.5	54	32	16	3	3	7.5	22	21.5	3	10.4	9
60	85	37	68	40	20	3	3	10	26	21.6	4	12.8	11
80	110	44	90	52	26	3.2	3	14	26	25.5	5	16.3	14
100	135	55	110	64	32	5	4	17	32	29.7	5	16.3	14
120	170	66	135	80	40	5	4	22	32	34.8	6	21.8	19
160	215	83	177	104	52	6.5	5	29	48	44.6	8	27.3	24

Model	N	O	P	Q	R	S	T	U	W	X	Y	Z	Weight
													(kg)
25	12	35	3	M2.5	6		3		6	3	14.5	M3	0.05
32	17	44	3.5	M3	6		3.5		6	3	17.5	M3	0.09
40	19	54	3.5	M3	6		3.5		6	3	20	M3	0.15
50	24	62	3.5	M3	8	27	5.5	M3	12		21.5		0.28
60	30	75	4.5	M4	8	34	6.5	M4	12		24		0.42
80	40	100	5.5	M5	8	45	9	M5	12		28		0.89
100	50	120	6.5	M6	8	56	11	M6	12		34		1.7
120	60	150	9	M8	8	68	15.5	M8	12		43		3.2
160	80	195	11	M10	8	90	18	M8	12		52.5		6.8

Unit: mm

XB1-AS-C Harmonic Gear Technical Performance Parameter Sheet

For the performance specifications of XB1-AS-C Model harmonic gear, please refer to the table below:

Parameter Unit

Rated Output Torque (R.O.T.): N.m

Output Rotation Speed(O.R.S.): rpm

Rated Input Power(R.I.P): kW

Model	Speed Ratio	Input Rotation Speed(3000/rpm)			Input Rotation Speed(1500/rpm)			Input Rotation Speed(1000/rpm)		
		R.O.T.	O.R.S.	R.I.P.	R.O.T.	O.R.S.	R.I.P.	R.O.T.	O.R.S.	R.I.P.
25	30	1	100	0.012	1.2	50	0.007	1.2	33	0.005
	41	1	73	0.012	1.2	36	0.007	1.2	24	0.005
	50	1.5	60	0.015	2	30	0.010	2	20	0.006
	63	2	48	0.015	2.5	24	0.010	2.5	16	0.006
	80	2	38	0.015	2.5	19	0.010	2.5	12.5	0.010
32/35	40	2.5	75	0.028	3	37	0.014	3	25	0.009
	52	3	58	0.028	3	29	0.014	3	19	0.009
	64	4.5	47	0.034	5.5	23	0.020	5.5	16	0.014
	80	5	38	0.030	6.5	19	0.020	6.5	13	0.013
	100	5	30	0.030	6.5	15	0.020	6.5	10	0.013
	110	5	28	0.030	6.5	14	0.020	6.5	9	0.013
40	40	8	75	0.081	8	37	0.040	8	25	0.027
	50	8	60	0.081	8	30	0.040	8	20	0.027
	65	10	46	0.074	10	23	0.037	10	15	0.025
	80	12	38	0.073	12	19	0.036	12	13	0.024
	100	15	30	0.073	17	15	0.040	17	10	0.027
50	50	15	60	0.151	15	30	0.076	15	20	0.050
	60	20	50	0.164	20	25	0.082	20	17	0.055
	70	25	42	0.155	25	21	0.077	25	14	0.052
	80	25	38	0.151	25	19	0.076	25	13	0.050
	84	25	36	0.146	25	18	0.073	25	12	0.049
	100	30	30	0.145	33	15	0.080	33	10	0.053
	118	30	25	0.123	33	13	0.068	33	8	0.045
	120	30	25	0.121	33	13	0.066	33	8	0.044
	125	30	24	0.116	33	12	0.073	33	8	0.056
60	42	25	71	0.252	25	35	0.126	25	24	0.084
	50	25	60	0.237	25	30	0.118	25	20	0.079
	58	30	52	0.250	30	26	0.125	30	17	0.083
	60	30	50	0.234	30	25	0.117	30	16	0.078
	75	40	40	0.258	40	20	0.129	40	13	0.086
	80	40	38	0.248	40	19	0.124	40	13	0.083
	100	50	30	0.242	55	15	0.133	55	10	0.089
	118	50	25	0.205	62	13	0.127	72	8	0.098
	120	50	25	0.201	62	13	0.125	72	8	0.097
	150	50	20	0.161	62	10	0.100	72	7	0.077
	160	50	19	0.151	62	9	0.094	72	6	0.073
80	50	60	60	0.539	60	30	0.269	60	20	0.180
	60	60	50	0.530	72	25	0.265	72	16	0.177
	78	100	38	0.575	100	19	0.288	100	13	0.192
	80	100	38	0.561	100	19	0.281	100	13	0.187
	100	120	30	0.539	130	15	0.292	130	10	0.194
	120	120	25	0.539	130	12	0.292	130	8	0.194
	135	120	22	0.399	150	11	0.249	150	7	0.166
	160	120	19	0.337	150	9	0.210	150	6	0.140
	200	120	15	0.269	150	8	0.168	150	5	0.122
100	50	120	60	1.122	150	30	0.701	150	20	0.468
	60	145	50	1.084	180	25	0.673	180	16	0.449
	70	145	43	1.001	180	21	0.621	180	14	0.414
	80	200	38	1.122	200	19	0.561	200	13	0.374
	84	200	36	1.081	200	18	0.541	200	12	0.360
	100	240	30	1.077	265	15	0.595	265	10	0.396
	118	240	25	0.913	265	13	0.571	265	8	0.380
	125	240	24	0.862	300	12	0.539	300	8	0.359
	145	240	20	0.673	300	10	0.421	300	7	0.280
	160	240	19	0.673	300	9	0.421	300	6	0.280
	168	240	18	0.641	300	9	0.401	300	6	0.267
	200	240	15	0.539	300	8	0.337	300	5	0.224
	255	240	12	0.422	300	6	0.264	300	4	0.176
120	50	230	60	2.244	230	30	1.122	230	20	0.748
	60	270	50	2.289	270	25	1.044	270	16	0.694
	75	320	40	1.915	320	20	0.957	320	13	0.738
	80	360	38	2.020	360	19	1.010	360	13	0.673
	85	360	35	2.020	360	17	1.010	360	11	0.673
	100	450	30	2.020	495	15	1.111	505	10	0.756
	120	450	25	1.683	550	13	1.029	600	9	0.748
	150	450	20	1.346	550	10	0.823	600	7	0.598
	200	450	15	1.010	550	8	0.617	600	5	0.449
	243	450	12	0.835	550	6	0.510	600	4	0.371
160	50	N/A			500	30	2.200	580	20	1.701
	60				600	25	2.172	690	16	1.665
	80				800	19	2.244	920	13	1.720
	100				900	15	2.020	1050	10	1.571
	135				1000	11	1.662	1150	7	1.274
	160				1000	9	1.403	1150	6	1.075
	200				1000	8	1.122	1150	5	0.860
	235				1000	6	1.122	1150	4	0.860
	270				1000	6	0.831	1150	4	0.637

Torsional Rigidity Coefficient XB1-AS-C

Ka: Torsional rigidity coefficient, including the range from pure backlash to elastic twist of the output shaft to about 20% of rated torque.

Kb: Torsional rigidity coefficient, covering the range thereafter to the rated torque, for elastic twist of the shaft.

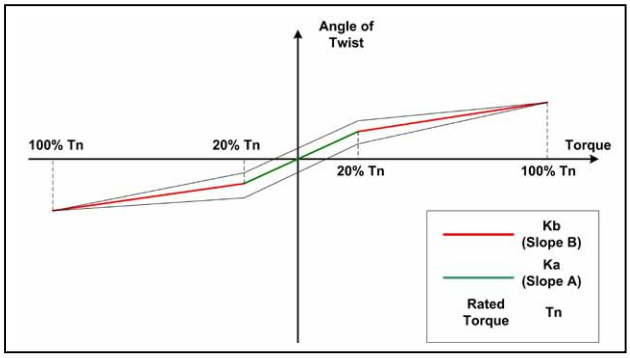


Diagram 3-02

Model (Ka)	25	32	40	50	60	80	100	120	160
Torsional Rigidity (N.m/arc min)	0.076	0.25	0.65	1.25	2.32	5.35	9.8	19	44.2

Model (Kb)	25	32	40	50	60	80	100	120	160
Torsional Rigidity (N.m/arc min)	0.45	1.15	2.6	5.3	9.5	21.9	38.6	72.1	185

Moment of Inertia of the Input Shaft Assembly XB1-AS-C

Model	25	32	40	50	60
Moment of Inertia ($kg.m^2$)	$0.6*10^{-6}$	$2.41*10^{-6}$	$0.63*10^{-5}$	$2.04*10^{-5}$	$0.49*10^{-4}$
Model	80	100	120	160	
Moment of Inertia ($kg.m^2$)	$1.40*10^{-4}$	$0.41*10^{-3}$	$1.15*10^{-3}$	$0.48*10^{-2}$	

Notes: The data specified in the table above conform to the standard-structured componet sets of our company's harmonic gear. In case customers require the wave generator tailored to their individual needs, the data shall be altered accordingly.

The Efficiency of the XB1-AS-C

The Drive Efficiency of the Model XB1 Harmonic Gear is affected by the following causes:

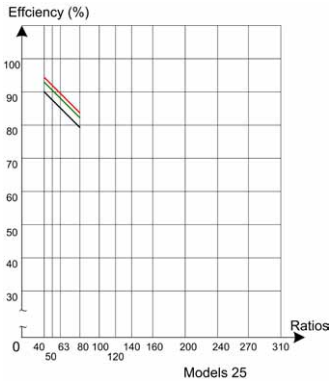
1. Model Type
2. Input rotary speed
3. Drive speed ratio
4. Lubricant
5. Setting temperature
6. Amount of the load driven

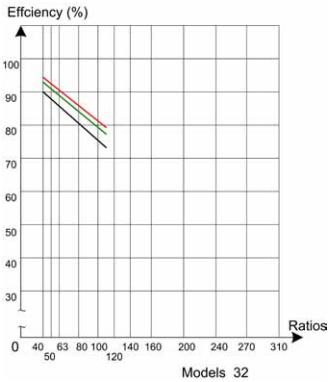
This section treats of the drive efficiency effected by the Model XB1-AS-C Harmonic Gear under varied conditions.

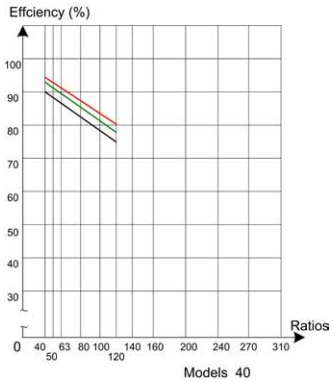
In the charts, as shown below, are drawn the drive efficiency curves observed of the various model types when put to work at varied speed ratios and input rotary speeds (3000rpm, 1500rpm, 1000rpm).
Among which, models 25,32,40,50,60 make use of lubrication grease as the lubricant, whereas models 80,100,120,160,200 utilize lubrication oil as the lubricant.

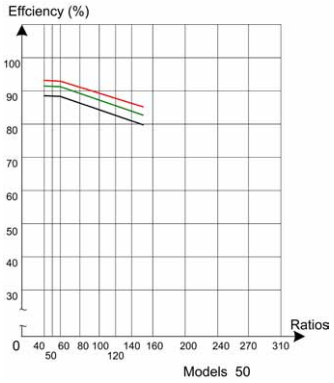
Input rotation speed:

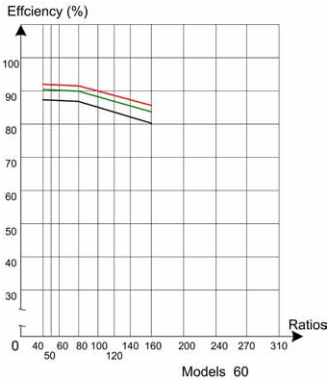
- 3000 rpm
- 1500 rpm
- 1000 rpm

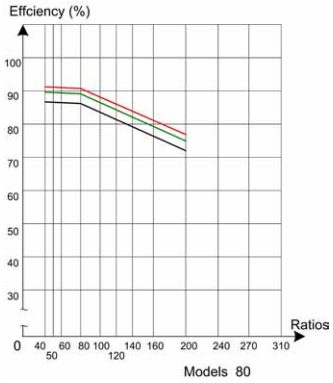


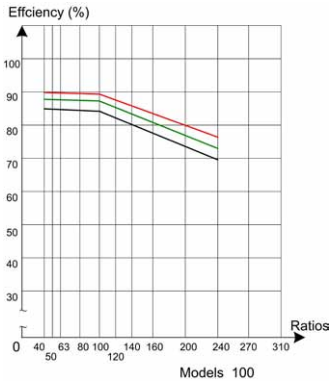


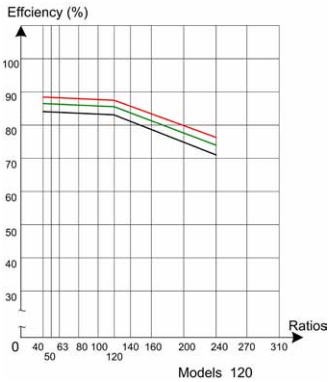


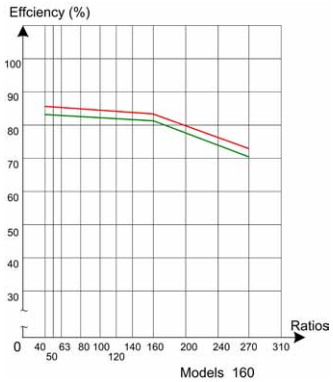












The drive efficiency curves, as shown in the chart above, observed of the several models are effected under such conditions as the setting temperature is kept at 50℃, and the 100% rated load is imposed. When changes are made to the setting temperature and the load driven, adjustments need to be effected to the gear drive efficiency according to the temperature-efficiency relationship chart and load-efficiency relationship chart, as respectively shown below.

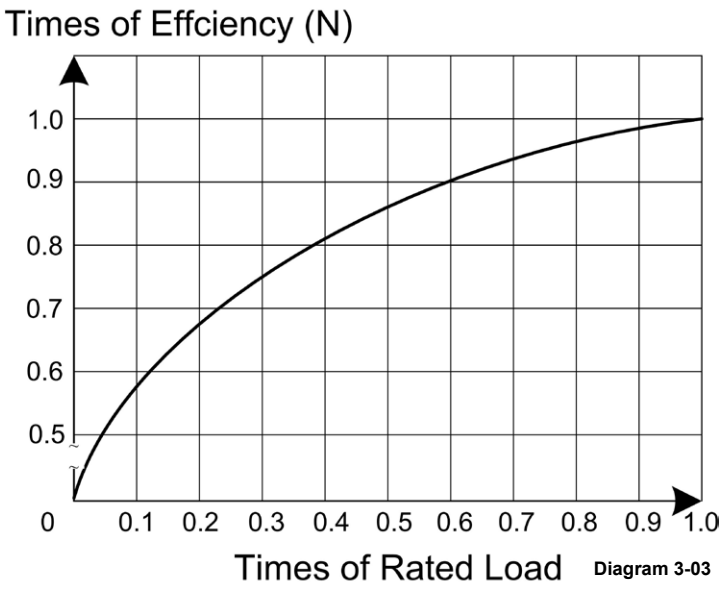


Diagram 3-03

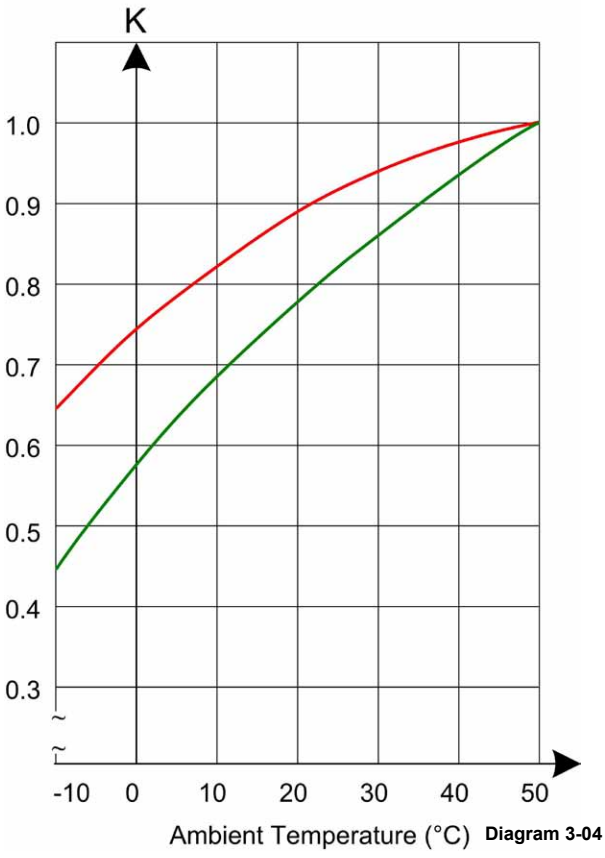
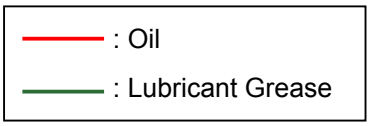


Diagram 3-04



How to apply the relationship charts:

For example: when input rotary speed reaches 1500rpm, XB1 Model 100, 100 speed ratio, by consulting the XB1 100 efficiency chart, we can find out the basic efficiency η0 of the model under discussion to be 87%.

At this time, supposing the setting temperature is maintained at 20℃, and besides, the gear is not put to work to capacity, the load being regulated at 0.9 times of the rated load.

1. By referring to the temperate-efficiency chart, when the setting temperature comes at 20℃, K, standing for the adjusted parameter, is 0.85(Lubrication: Oil);

2. By referring to the load-efficiency chart, when 0.9 times of rated load is kept, N, representing the adjusted parameter, is 0.98.

Thus, the actual drive efficiencyηattained by the gear in question is:

η =η0 * N * K

= 87% * 0.85 * 0.98 = 72.4%

That is, the actual drive efficiency rate, achieved by Gear XB1—100-100, under this specified working condition, is 72.4%.

No-load startup torque XB1-AS-C

No-load startup torque means the minimum torque required when the high-speed end is activated from rest to work, under the condition that no load is set on the output end (the low-speed end) of the Harmonic gear set.

No-load startup torque has a close bearing on the drive efficiency of the component set (for the efficiency factor, please refer to page 15); the chart below is figured out under the conditions as follows:

Setting Temperature: 50℃

Lubrication: 25，32，40，50，60: lubrication grease

80，100，120，160: lubrication oil

In addition: represented in this chart is none other than the no-load startup performance wrought by the Harmonic gear set. As no regard is had to the effects exerted on the drive efficiency by the input/output axial bearings adopted in real customers' systems, seal rings and a slew of unknown factors, so the figures in question do not represent those of the Harmonic Gear of finished product.

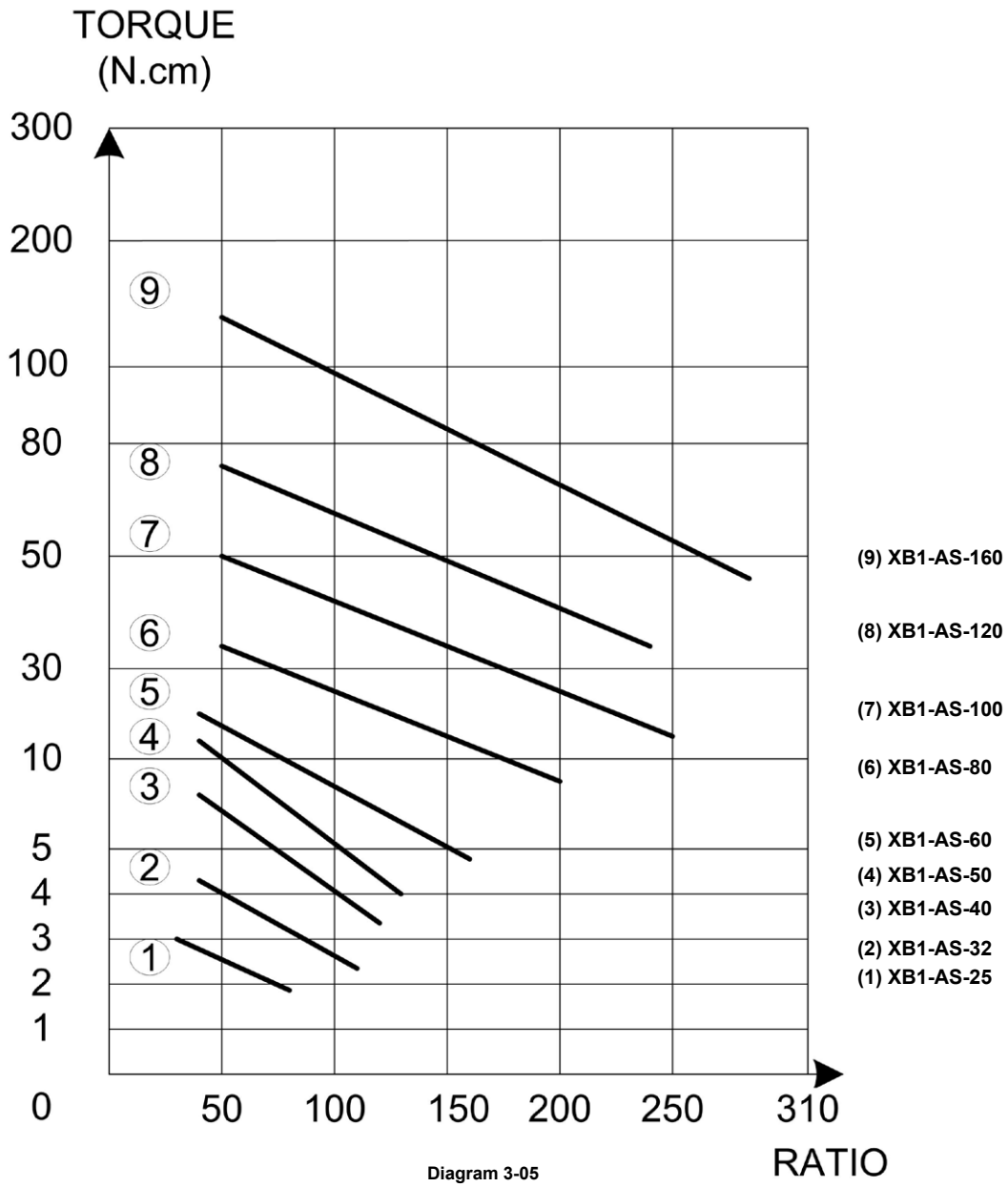


Diagram 3-05

No-load startup torque under the condition of acceleration(Back driving) XB1-AS-C

Model XB1-AS-C Harmonic Gear can be applied as an acceleration device. Its no-load startup torque means the minimum torque required when the low-speed end is activated from rest to work, under the condition that no load is set on the output end (the high-speed end) of the Harmonic gear set.

Represented in this chart is none other than the no-load startup performance wrought by the Harmonic gear set. As no regard is had to the effects exerted on the drive efficiency by the input/output axial bearings adopted in real customers' systems, seal rings and a slew of unknown factors, so the figures in question do not represent those of the Harmonic Gear of finished product.

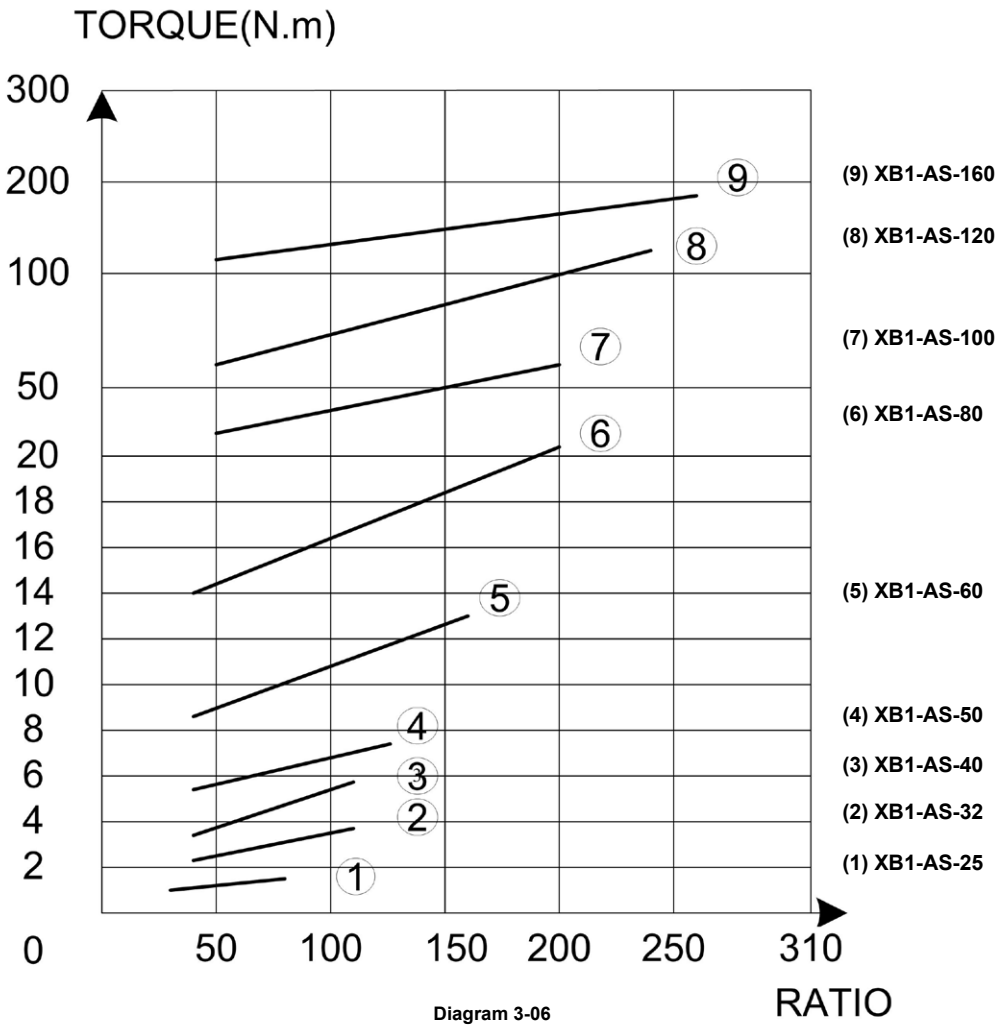


Diagram 3-06

Assembly Tolerance And Position XB1-AS-C

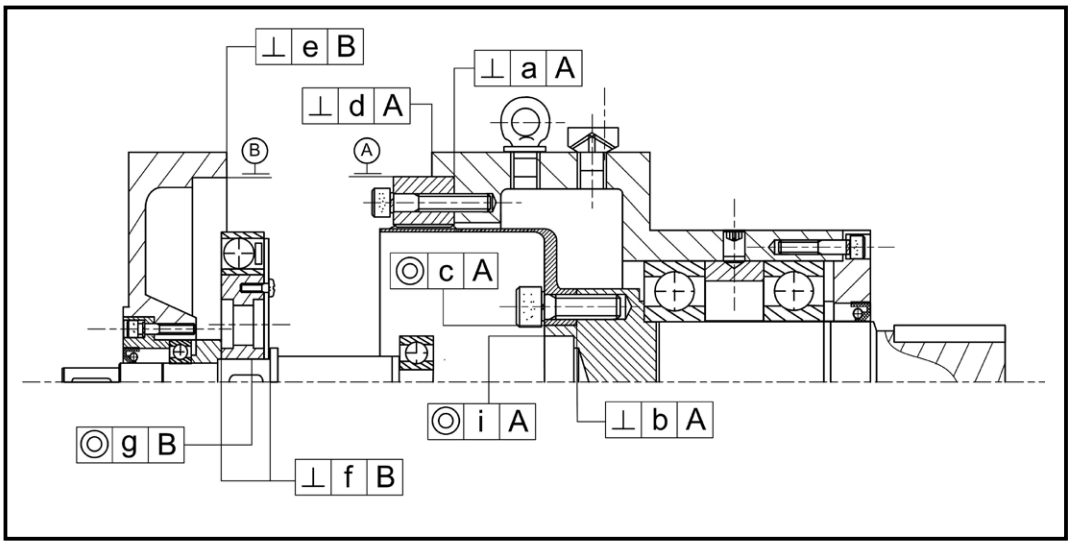


Diagram 3-07

Model	a	b	c	d	e	f	g	i
25	0.01	0.015	0.012	0.015	0.015	0.015	0.012	0.012
32	0.015	0.02	0.015	0.015	0.015	0.015	0.012	0.012
40	0.015	0.02	0.02	0.025	0.025	0.015	0.015	0.015
50	0.02	0.025	0.02	0.025	0.025	0.02	0.02	0.015
60	0.02	0.025	0.025	0.025	0.025	0.02	0.02	0.015
80	0.025	0.03	0.025	0.03	0.03	0.025	0.025	0.02
100	0.025	0.03	0.03	0.03	0.03	0.025	0.025	0.02
120	0.03	0.035	0.03	0.035	0.035	0.03	0.025	0.02
160	0.03	0.035	0.035	0.035	0.035	0.03	0.03	0.025

Unit: mm

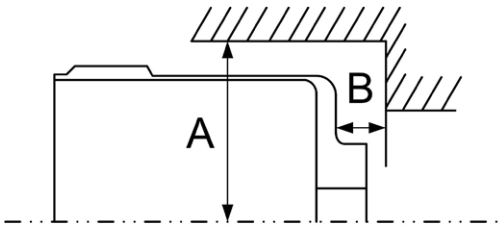


Diagram 3-08

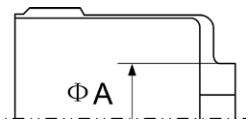
When the Gear Set of Model XB1-AS-C is installed, ample room must be reserved both in the axial and radial directions between the adjoining parts and the flexspline, so as to ensure the normal deformation by the flexspline.

For the specific values, please refer to the corresponding chart.

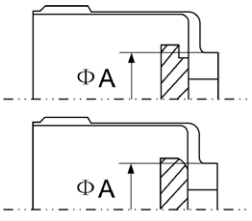
Model	50	60	80	100	120	160
A	27	33	42	52	65	84
B	2	2	3	3	4	4

Model XB1-AS-C Harmonic Gear adopts the cup-shaped flexspline. When fitting the flexspline onto the output shaft, please take notices as follows:

The outer diameter of the presser, which is set into the flexspline, must needs be kept smaller than A—that of the outer ring encompassing the surface of the tip on which the flexspline receives attachment;



if, however, the outer diameter of the presser is of necessity to outstrip A, the two schemes, as shown beside, may be employed, so as to ensure the deformation capacity of the flexspline bottom.



The jointure schemes resembling those as shown beside should be avoided, or else cracks may be effected on the flexspline bottom.

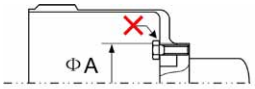


Diagram 3-09

Single Stage Harmonic Gear

Our company's products, besides a multitude of component sets belonging to their several series, furnish customers with a whole-series of the harmonic gearing devices designed for all the machine models, as well.

The harmonic gearing is such a device as its performance is ascertained or its various model numbers classified according to the character of the gear component parts. (For particular performance and numbers, please refer to the Component Parts Manual).

XB1-AS-GF

(Ordering Code)

XB1-AS-GF

For the specifications given for the exterior and installation of the final finished XB1-AS-GF Model Gearbox, please consult the drawing/table, as shown below:

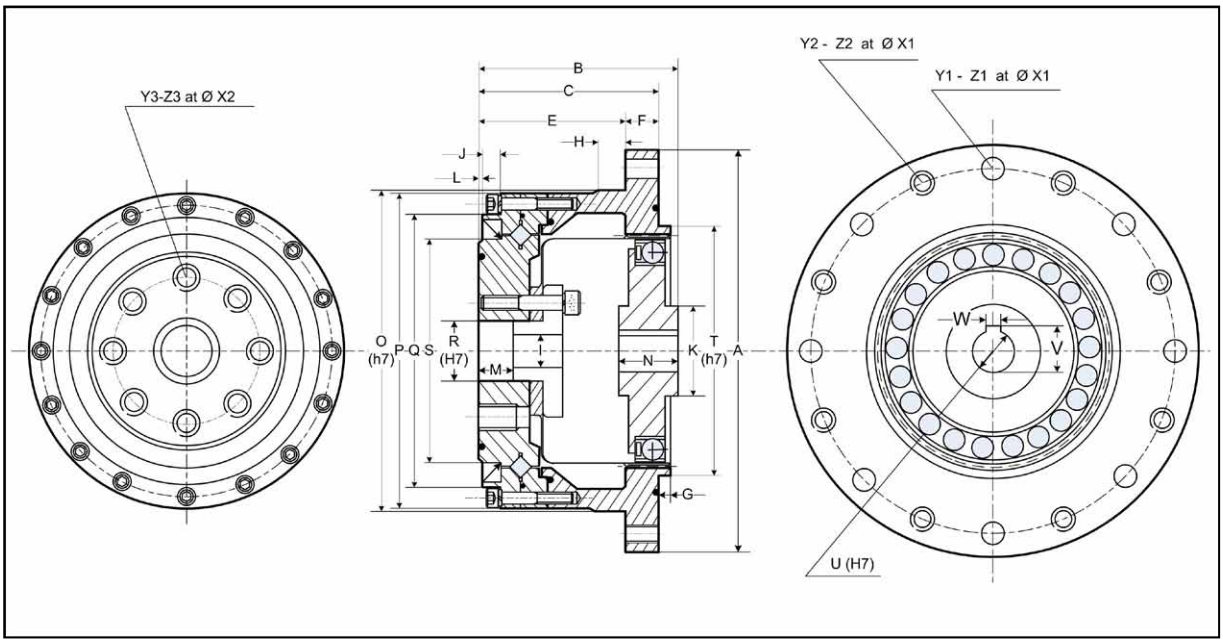


Diagram 4-01

Model	A	B	C	E	F	G	H	I	J	K	L	M	N	O	P	Q
														(h7)		
50	93	45.5	38	28	10	3	5	10	4	21	0.5	9	20	72	70	58
60	107	52	46	36	10	3	5	15	4.5	26	0.5	12	20	86	85	73
80	138	62	57	45	12	3	5	20	5.5	26	1.5	15	22	113	112	96
100	160	72.5	66.5	50.5	16	4	5	24	7.5	32	1.5	5	27.5	127	126	109
120	190	90	97	77	20	5	6	32	8	32	1	8	32	158	157	137
160	260	115	108.5	84.5	24	5	6	44	8.5	48	2	8	41	212	210	186

Model	R	S	T	U	V	W	X1	Y1	Z1	X2	Y2	Z2	Y3	Z3	Mass(kg)
	(H7)		(h7)	(H7)		(JS9)									
50	14	45	56	12	13.8	4	82	6	5.5	32	6	M5	8	M6 * 9	1
60	20	58	68	14	16.3	5	96	8	5.5	42	8	M5	8	M8 * 12	1.5
80	26	78	90	14	16.3	5	125	12	6.6	55	12	M6	8	M10 * 15	3.2
100	32	90	110	14	16.3	5	144	8	9	68	8	M8	8	M10 * 15	5
120	46	112	135	19	21.8	6	174	12	9	84	12	M8	8	M14 * 21	9
160	52	155	177	24	27.3	8	236	8	14	110	8	M12	8	M16 * 24	21

Unit: mm

Install and apply XB1-AS-GF:

1.Where such XB1-AS-GF gearbox as adopts other than the closed-structure is applied, customers may, in line with their own needs, take out designs or workings on the linking part, wherewith to join the gearbox to the electromotor.

Gearbox-electromotor-fixtures, and their correlations are indicated in the diagram 4-02.

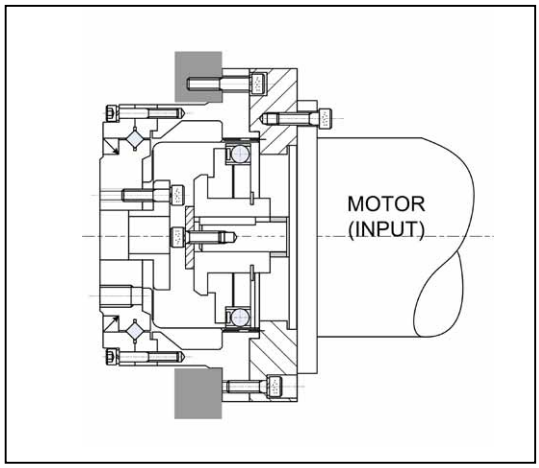


Diagram 4-02

2.When the output shaft of the electromotor is joined to the wave generator, in order to prevent the wave generator from moving loosely on the electromotor shaft, please have on hand the following drawings when working to fix it in place.

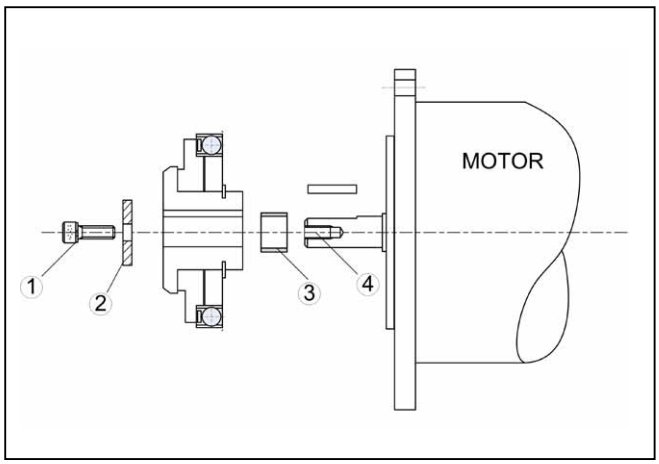


Diagram 4-03

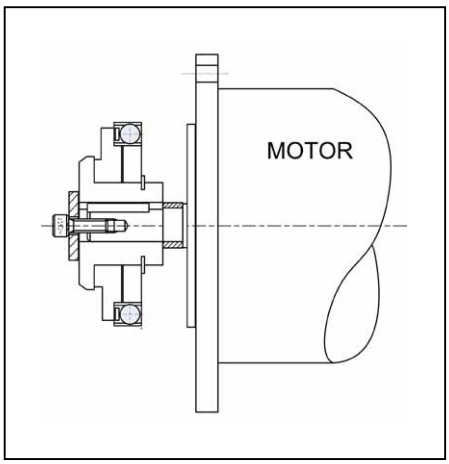


Diagram 4-04

The components, as marked 1-4 in the drawing, need to be supplied by users.

Single Stage Harmonic Gear

The harmonic gear, which runs on the working principle of single wave, resorts to two modes of output, one the direct-connection output by the flex spline.

In this section is briefed first on the XB1-BS-C Model, which adopts the output mode of direct-connection by the flex spline.

XB1-BS-C

(Ordering Code)

COMPONENT GEAR SET

Exterior Specifications of XB1-BS-C

For the exterior specifications of XB1 Model harmonic gears, please refer to the diagram/table

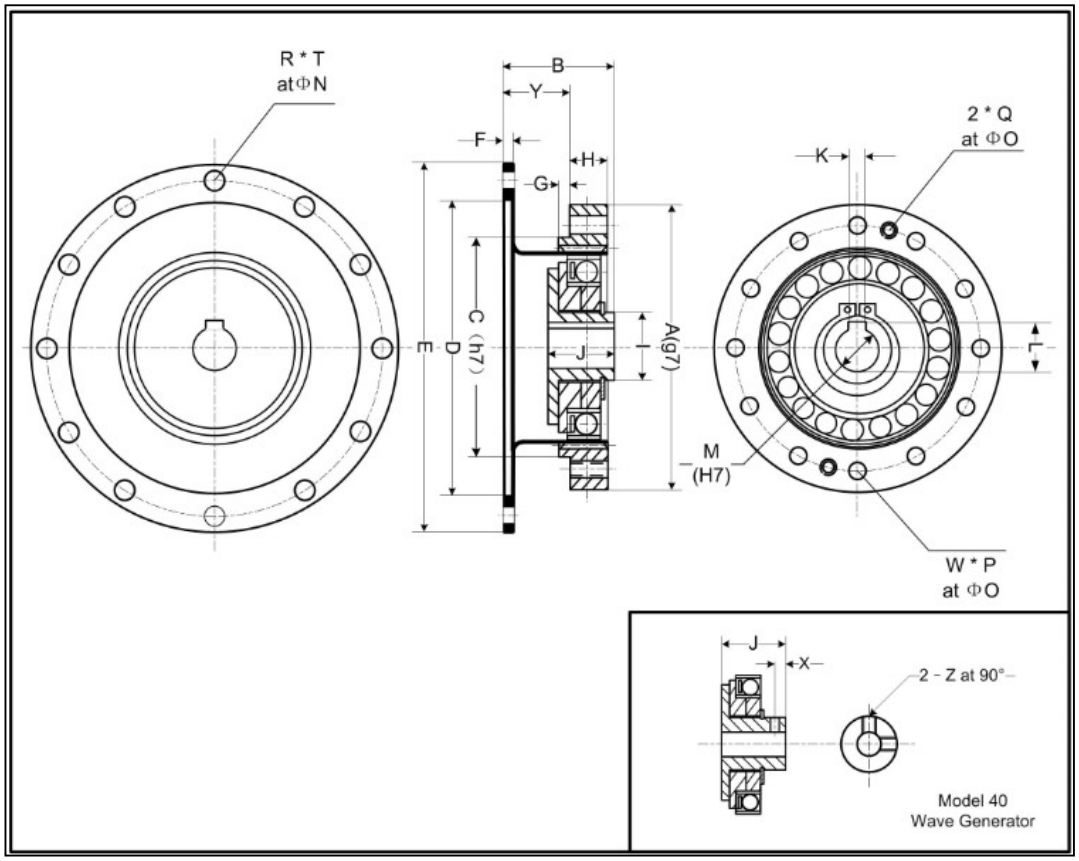


Diagram 5-01

Model	A	B	C	D	E	F	G	H	I	J	K	L
	(g7)		(h7)	(H7)	(h7)						JS9	
40	60	32.5	48	60	72	3	2.5	6.5	18	19.5		
50	70	33.5	54	70	82	3	3	7.5	22	21.5	3	10.4
60	85	37	68	88	104	3.3	3	10	26	21.6	4	12.8
80	110	44	90	114	134	3.6	3	14	26	25.5	5	16.3
100	135	53	110	140	164	4	4	17	32	29.7	5	16.3

Model	M	N	O	P	Q	R	T	W	X	Y	Z
	(H7)										
40	8	66	54	3.5	M3	12	2.5	12	3	20	M3
50	9	76	62	3.5	M3	12	3.5	16		21.5	
60	11	96	75	4.5	M4	12	4.5	16		24	
80	14	124	100	5.5	M5	12	5.5	16		28	
100	14	152	120	6.5	M6	12	6.5	16		34	

Unit: mm

Torsional Rigidity Coefficient XB1-BS-C

Ka: Torsional rigidity coefficient, including the range from pure backlash to elastic twist of the output shaft to about 20% of rated torque.

Kb: Torsional rigidity coefficient, covering the range thereafter to the rated torque, for elastic twist of the shaft.

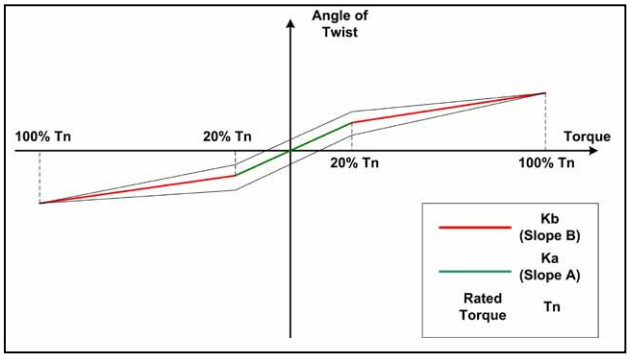


Diagram 5-02

Model (Ka)	50	60	80	100
Torsional Rigidity (N.m/arc min)	1.25	2.32	5.35	9.8
Model (Kb)	50	60	80	100
Torsional Rigidity (N.m/arc min)	5.3	9.5	21.9	38.6

Moment of Inertia of the Input Shaft Assembly XB1

Model	50	60	80	100
Moment of Inertia ($kg.m^2$)	$2.04*10^{-5}$	$0.49*10^{-4}$	$1.40*10^{-4}$	$0.41*10^{-3}$

Notes: The data specified in the table above conform to the standard-structured camponent sets of our company's harmonic gear. In case customers require the wave generator tailored to their individual needs, the data shall be altered accordingly.

The Efficiency of the XB1-BS-C

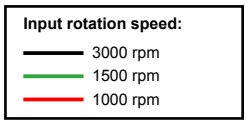
The Drive Efficiency of the Model XB1-BS-C Harmonic Gear is affected by the following causes:

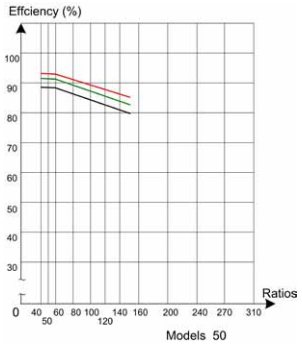
1. Model Type
2. Input rotary speed
3. Drive speed ratio
4. Lubricant
5. Setting temperature
6. Amount of the load driven

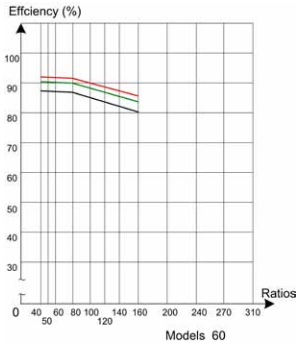
This section treats of the drive efficiency effected by the Model XB1-BS-C Harmonic Gear under varied conditions.

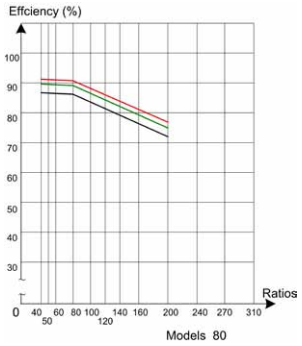
In the charts, as shown below, are drawn the drive efficiency curves observed of the various model types when put to work at varied speed ratios and input rotary speeds (3000rpm, 1500rpm, 1000rpm).

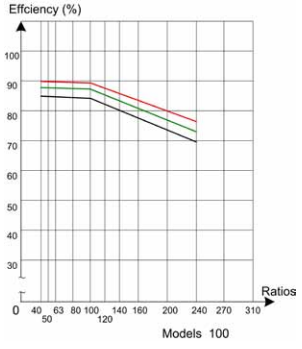
Among which, models 50,60 make use of lubrication grease as the lubricant, whereas models 80,100,120,160 utilize lubrication oil as the lubricant.











The drive efficiency curves, as shown in the chart above, observed of the several models are effected under such conditions as the setting temperature is kept at 50℃, and the 100% rated load is imposed. When changes are made to the setting temperature and the load driven, adjustments need to be effected to the gear drive efficiency according to the temperature-efficiency relationship chart and load-efficiency relationship chart, as respectively shown below.

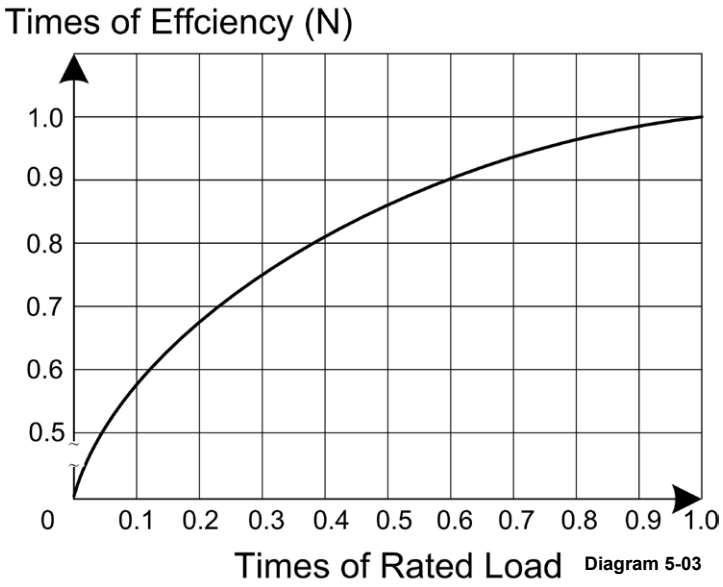


Diagram 5-03

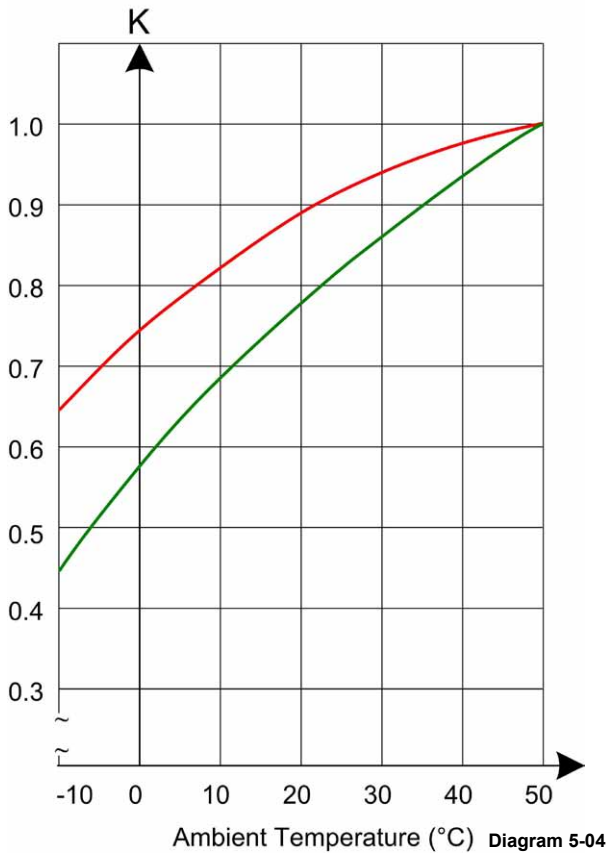


Diagram 5-04

: Oil

: Lubricant Grease

How to apply the relationship charts:

For example: when input rotary speed reaches 1500rpm, XB1-BS-C Model 100, 100 speed ratio, by consulting the XB1-BS-C 100 efficiency chart, we can find out the basic efficiency η0 of the model under discussion to be 87%.

At this time, supposing the setting temperature is maintained at 20℃, and besides, the gear is not put to work to capacity, the load being regulated at 0.9 times of the rated load.

1. By referring to the temperate-efficiency chart, when the setting temperature comes at 20℃, K, standing for the adjusted parameter, is 0.85(Lubrication: Oil);

2. By referring to the load-efficiency chart, when 0.9 times of rated load is kept, N, representing the adjusted parameter, is 0.98.

Thus, the actual drive efficiencyηattained by the gear in question is:

η =η0 * N * K

= 87% * 0.85 * 0.98 = 72.4%

That is, the actual drive efficiency rate, achieved by Gear XB1-BS-C 100-100, under this specified working condition, is 72.4%.

XB1-BS-C Harmonic Gear Technical Performance Parameter Sheet

For the performance specifications of XB1-BS-C Model harmonic gear, please refer to the table below:

Parameter Unit

Rated Output Torque (R.O.T.): N.m

Output Rotation Speed(O.R.S.): rpm

Rated Input Power(R.I.P): kW

Model	Speed Ratio	Input Rotation Speed(3000/rpm)			Input Rotation Speed(1500/rpm)			Input Rotation Speed(1000/rpm)		
		R.O.T.	O.R.S.	R.I.P.	R.O.T.	O.R.S.	R.I.P.	R.O.T.	O.R.S.	R.I.P.
50	50	15	60	0.151	15	30	0.076	15	20	0.050
	60	20	50	0.164	20	25	0.082	20	17	0.055
	70	25	42	0.155	25	21	0.077	25	14	0.052
	80	25	38	0.151	25	19	0.076	25	13	0.050
	84	25	36	0.146	25	18	0.073	25	12	0.049
	100	30	30	0.145	33	15	0.080	33	10	0.053
	118	30	25	0.123	33	13	0.068	33	8	0.045
	120	30	25	0.121	33	13	0.066	33	8	0.044
	125	30	24	0.116	33	12	0.073	33	8	0.056
60	42	25	71	0.252	25	35	0.126	25	24	0.084
	50	25	60	0.237	25	30	0.118	25	20	0.079
	58	30	52	0.250	30	26	0.125	30	17	0.083
	60	30	50	0.234	30	25	0.117	30	16	0.078
	75	40	40	0.258	40	20	0.129	40	13	0.086
	80	40	38	0.248	40	19	0.124	40	13	0.083
	100	50	30	0.242	55	15	0.133	55	10	0.089
	118	50	25	0.205	62	13	0.127	72	8	0.098
	120	50	25	0.201	62	13	0.125	72	8	0.097
	150	50	20	0.161	62	10	0.100	72	7	0.077
	160	50	19	0.151	62	9	0.094	72	6	0.073
80	50	60	60	0.539	60	30	0.269	60	20	0.180
	60	60	50	0.530	72	25	0.265	72	16	0.177
	78	100	38	0.575	100	19	0.288	100	13	0.192
	80	100	38	0.561	100	19	0.281	100	13	0.187
	100	120	30	0.539	130	15	0.292	130	10	0.194
	120	120	25	0.539	130	12	0.292	130	8	0.194
	135	120	22	0.399	150	11	0.249	150	7	0.166
	160	120	19	0.337	150	9	0.210	150	6	0.140
	200	120	15	0.269	150	8	0.168	150	5	0.122
100	50	120	60	1.122	150	30	0.701	150	20	0.468
	60	145	50	1.084	180	25	0.673	180	16	0.449
	70	145	43	1.001	180	21	0.621	180	14	0.414
	80	200	38	1.122	200	19	0.561	200	13	0.374
	84	200	36	1.081	200	18	0.541	200	12	0.360
	100	240	30	1.077	265	15	0.595	265	10	0.396
	118	240	25	0.913	265	13	0.571	265	8	0.380
	125	240	24	0.862	300	12	0.539	300	8	0.359
	145	240	20	0.673	300	10	0.421	300	7	0.280
	160	240	19	0.673	300	9	0.421	300	6	0.280
	168	240	18	0.641	300	9	0.401	300	6	0.267
	200	240	15	0.539	300	8	0.337	300	5	0.224
	255	240	12	0.422	300	6	0.264	300	4	0.176

No-load startup torque XB1-BS-C

No-load startup torque means the minimum torque required when the high-speed end is activated from rest to work, under the condition that no load is set on the output end (the low-speed end) of the Harmonic gear set.

No-load startup torque has a close bearing on the drive efficiency of the component set (for the efficiency factor, please refer to page 15); the chart below is figured out under the conditions as follows:

Setting Temperature: 50℃

Lubrication: 50，60: lubrication grease

80，100: lubrication oil

In addition: represented in this chart is none other than the no-load startup performance wrought by the Harmonic gear set. As no regard is had to the effects exerted on the drive efficiency by the input/output axial bearings adopted in real customers' systems, seal rings and a slew of unknown factors, so the figures in question do not represent those of the Harmonic Gear of finished product.

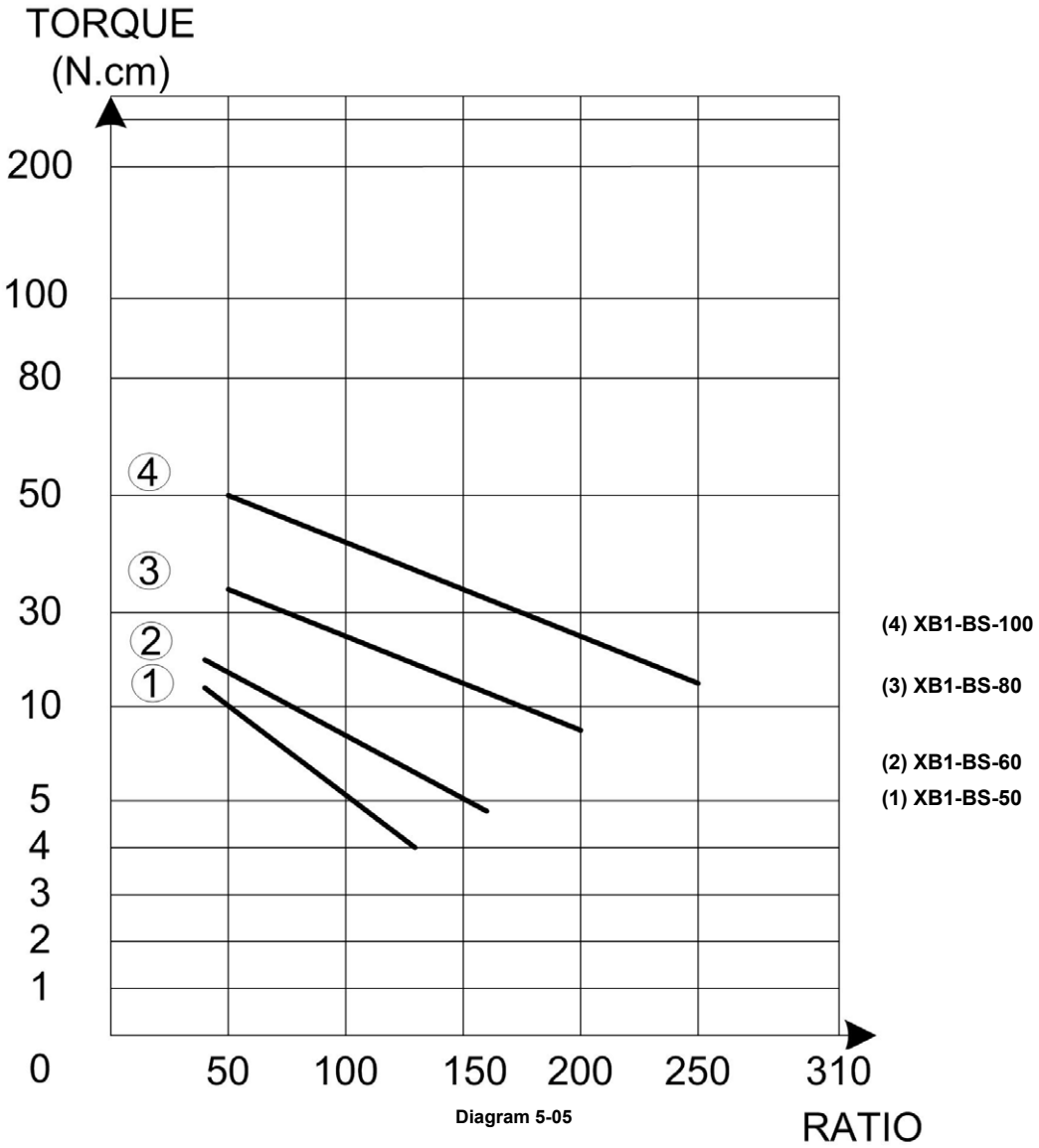


Diagram 5-05

No-load startup torque under the condition of acceleration(Back driving) XB1-BS-C

Model XB1-BS-C Harmonic Gear can be applied as an acceleration device. Its no-load startup torque means the minimum torque required when the low-speed end is activated from rest to work, under the condition that no load is set on the output end (the high-speed end) of the Harmonic gear set. Represented in this chart is none other than the no-load startup performance wrought by the Harmonic gear set. As no regard is had to the effects exerted on the drive efficiency by the input/output axial bearings adopted in real customers' systems, seal rings and a slew of unknown factors, so the figures in question do not represent those of the Harmonic Gear of finished product.

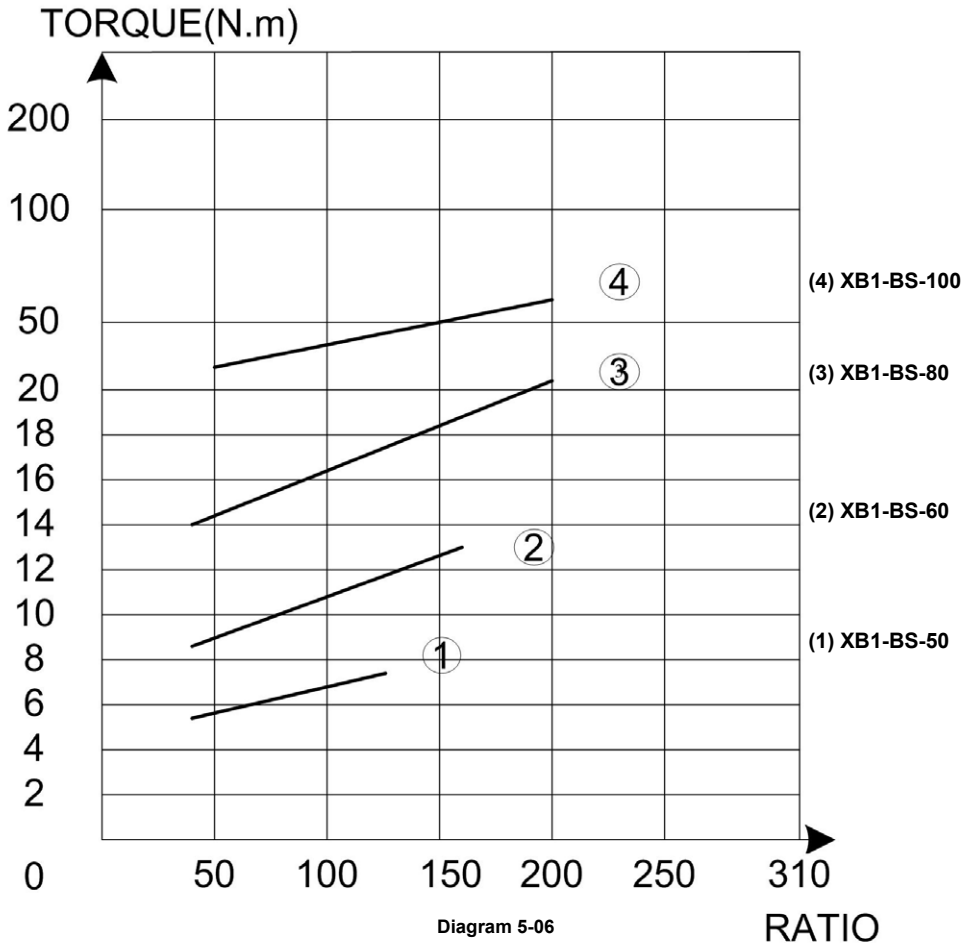


Diagram 5-06

Assembly Tolerance And Position XB1-BS-C

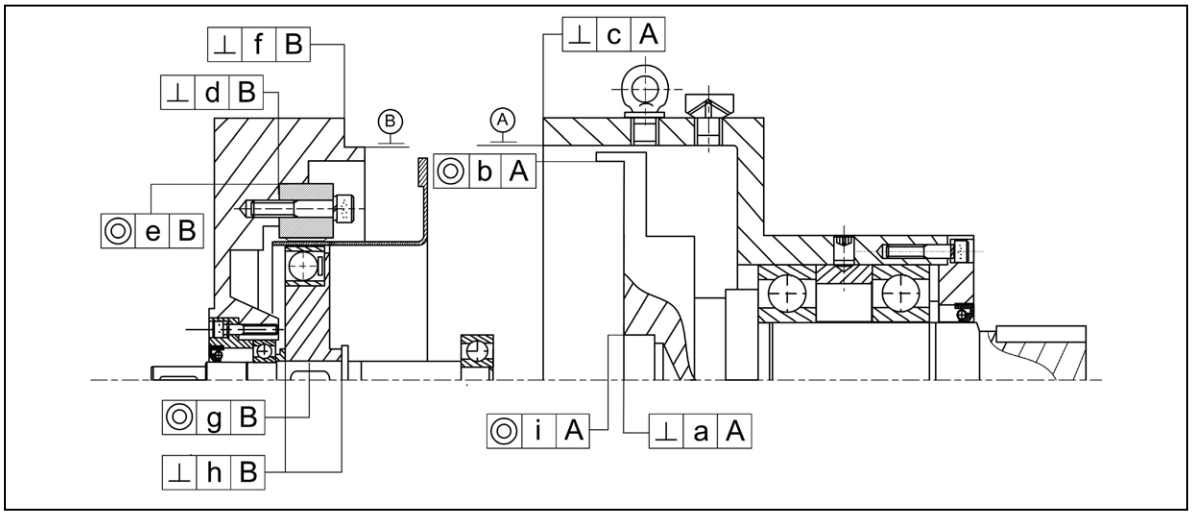


Diagram 5-07

Model	A	B	C	D	E	F	G	I
50	0.02	0.025	0.02	0.025	0.025	0.02	0.02	0.015
60	0.02	0.025	0.025	0.025	0.025	0.02	0.02	0.015
80	0.025	0.03	0.025	0.03	0.03	0.025	0.025	0.02
100	0.025	0.03	0.03	0.03	0.03	0.025	0.025	0.02

Unit: mm

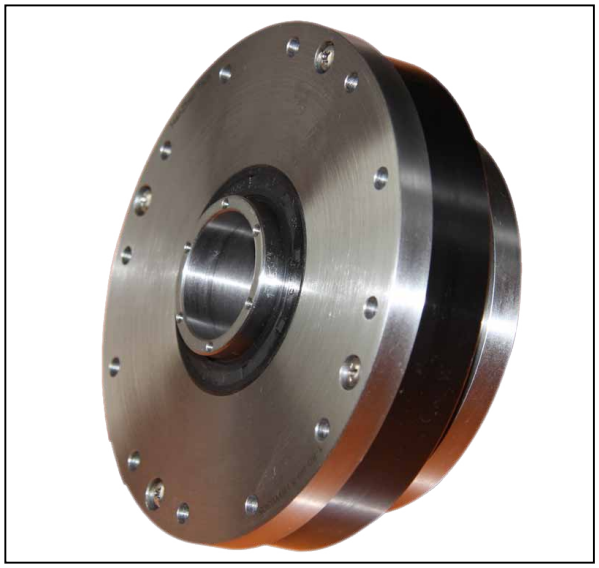
Single Stage Harmonic Gear

Our company's products, besides a multitude of component sets belonging to their several series, furnish customers with a whole-series of the harmonic gearing devices designed for all the machine models, as well.

The harmonic gearing is such a device as its performance is ascertained or its various model numbers classified according to the character of the gear component parts. (For particular performance and numbers, please refer to the Component Parts Manual).

XB1-BS-GF

(Ordering Code)



XB1-BS-GF

For the specifications given for the exterior and installation of the final finished XB1-BS-GF Model Gearbox, please consult the drawing/table, as shown below:

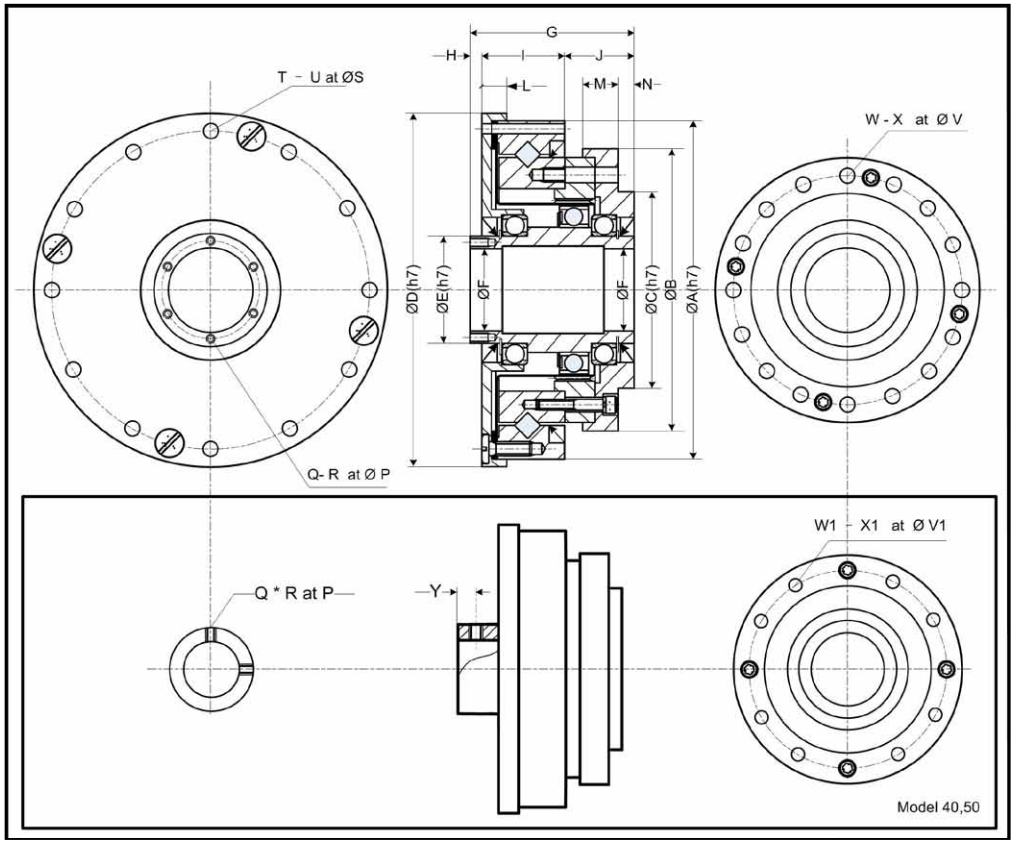


Diagram 5-08

Model	A	B	C	D	E	F	G	H	I	J	L	M
	(h7)		(h7)	(h7)	(h7)	(H7)						
40	80	64	45	84	25	19	56.5	6.5	24	20.5	11	8.5
50	90	75	50	95	30	21	51.5	5	25	21.5	10.5	9
60	110	90	60	115	38	29	55.5	6	27.5	22	10.5	8.5
80	142	115	85	147	45	36	65.5	7	32	26.5	12	9.5
100	170	140	100	175	59	46	79	8	38	33	14	13

Model	N	P	Q	R	S	T	U	V	W	X	Y
40	8.5	90°	2	M3	74	12	35	54	16	M3-6 ø3.5* 11	2.5
50	7	25.5	6	M3- 6	84	12	3.5	62	8	M3-6 ø3.5* 13.5	
60	6	33.5	6	M3-6	102	12	4.5	77	16	M4-7 ø4.5* 15.5	
80	5	40.5	6	M3- 6	132	12	5.5	100	16	M5-9 ø5.5* 20.5	
100	7	52	6	M4- 8	158	12	6.5	122	16	M6-10 ø6.5* 25	

Unit: mm

XB1-BS-GF install and apply:

Speed reducer-electromotor-fixtures, and their correlations are indicated in the 2 cases below:

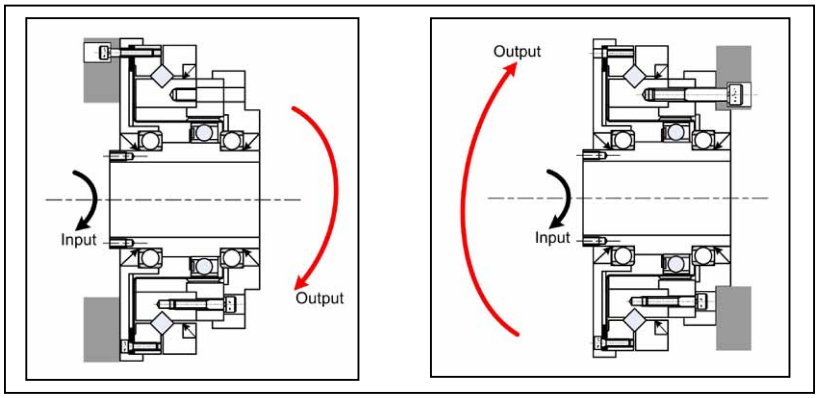


Diagram 5-09

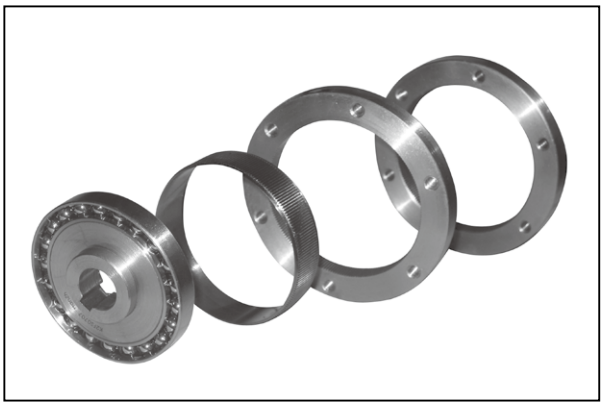
Single Stage Harmonic Gear

The XB3 harmonic gear, which runs on the working principle of single wave, resorts to two modes of output, one the connection output by the dynamic spline.

XB3 Model, which adopts the engagement output by the dynamic spline, may, according to the varied structures of its wave generator, be broken down into 2 sub-models, viz., Model XB3-A and Model XB3-B.

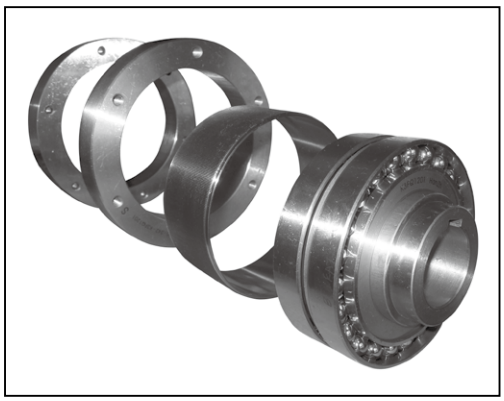
XB3-A

(Ordering Code)



XB3-B

(Ordering Code)



COMPONENT GEAR SET

Specifications Sheet of XB3-A

For the exterior specifications of XB3-A Model of the harmonic gear, please refer to the diagram/table below:

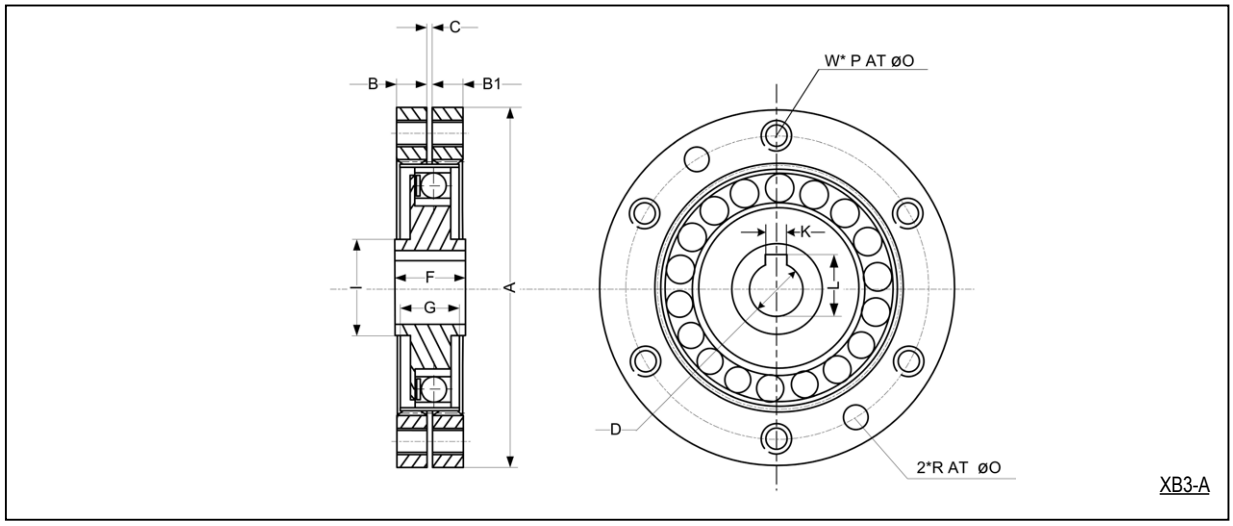


Diagram 6-01

Modle	Speed Ratio	A（g7）	B	B1	C	D(H7)	F	G	I	O	P	*R	K	L	W	Rated Output Torque (N.m)
25	40，50，63	40	5	4	1	6	12	8	11	34	M3	3	2	7	4	
32	40，50，64，80	50	5	5	1	10	13	9	15	43	M3	3	3	11.4	4	
40	40，50，65，80，100	60	5.5	4.5	1	12	14	10	20	51	M4	4	4	13.8	4	
50	50，60，70，80，83，100，120，125	70	6	5	1	14	16	10	24	62	M4	4	5	16.3	4	
60	50，60，85，100，120，150	85	8	7	1	18	18	14	28	75	M5	5	6	20.8	6	
63	62，80，126，160	85	8	7	1	18	18	14	28	75	M4	4	6	20.8	6	
80	50，60，80，100，120，135，160，200	115	9	8	1	18	20	16	28	100	M6	6	6	20.8	6	75% of XB1 Rated Output Torque
100	50，61，70，83，100，125，145，168，200	135	10	9	1	24	22	18	36	120	M8	8	8	27.3	6	
120	50，60，66，80，100，120，150，175，200，243	170	15	14	1	24	30	29	36	150	M10	10	8	27.3	6	
160	50，60，66，80，100，115，135，160，200，235，270	220	19	17	1	40	37	36	56	195	M12	12	12	43.3	6	
200	50，62，72，80，100，125，145，170，200，255，290	270	21	19	1	50	46	40	70	240	M16	16	14	53.3	6	
250	60，75，80，100，120，150，160，170，200，245，310	330	27	25	1	50	53	52	85	295	M20	20	18	53.3	6	

Dimension Unit: mm ***：Fixing pin holes, will be made by customer themselves.**

XB3-A Harmonic Gear Components Exterior Size

Specifications Sheet of XB3-B

For the exterior specifications of XB3-B Model of the harmonic gear, please refer to the diagram/table below:

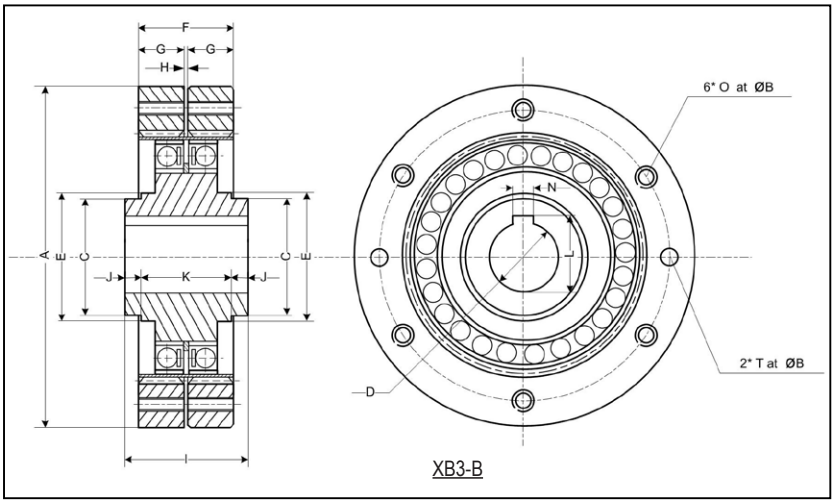


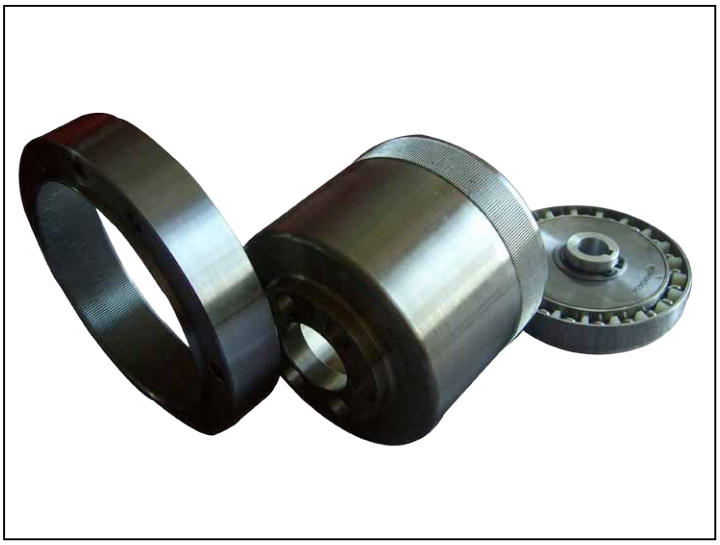
Diagram 6-02

Model	Speed Ratio	A	B	C	D	E	F	G	H	I	J	K	N	L	O	*T	Rated Output Torque (N.m)
		g7		JS6	H7												
25	40,50,63	40	34	10	6	11	15	7	1	24	4	18	2	7	M3	3	2
32	40,50,64,80	50	43	15	10	16	18	8.5	1	28	4.5	20	3	11.4	M3	3	5
40	40,50,65,80,100	60	51	17	12	19	20	9.5	1	32	5	22	4	13.8	M4	4	15
50	50,60,70,80,83,100, 120,125	70	62	20	12	23	25	12	1	38	8.25	21.5	4	13.8	M4	4	30
60	50,60,85,100,120,150	85	75	30	20	32	29	14	1	40	7.5	25	6	22.8	M5	5	50
63	62,80,126,160	87	77	30	20	35	29	14	1	40	7	26	6	22.8	M5	5	50
80	50,60,80,100,120,135, 160,200	115	100	40	30	46	37	18	1	50	10	30	8	33.3	M6	6	120
100	50,61,70,83,100,125,145,1 68,200	135	120	50	35	56	43	21	1	68	12	44	10	38.3	M8	8	240
120	50,60,75,80,85,100, 120,150,175,200,243	170	150	60	40	68	53	26	1	78	12	54	12	43.3	M10	10	450
160	50,60,66,80,100,115,135,1 60,200,235,270	220	195	70	50	80	71	35	1	87	14	59	14	53.8	M12	12	1000
200	50,62,72,80,100,125, 145,170,200,255,290	270	240	90	65	100	83	41	1	106	16	74	18	69.4	M16	16	2000
250	60,75,80,100,120,150, 160,170,200,245,310	330	295	110	80	120	101	50	1	130	19	92	22	85.4	M20	20	3500

Dimension Unit: mm

***: Fixing pin holes, will be made by customer themselves.**

XB3-B Harmonic Gear Components Exterior Size



XB3-BF (Phase Adjuster For Printing Machine)

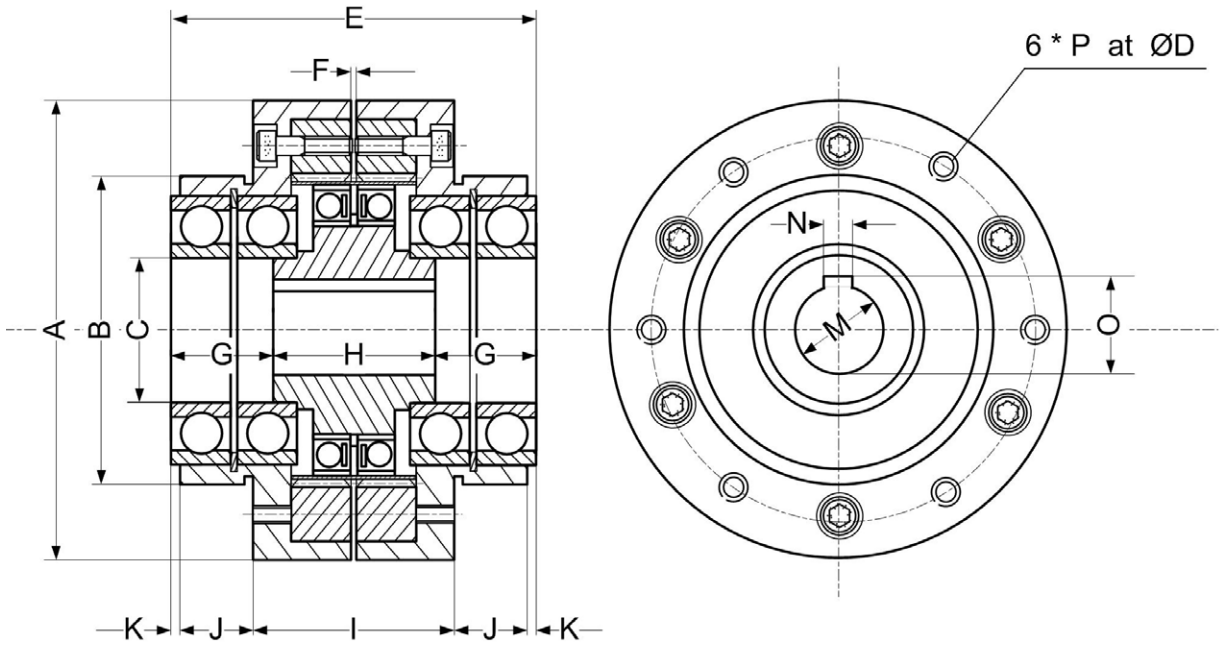


Diagram 6-03

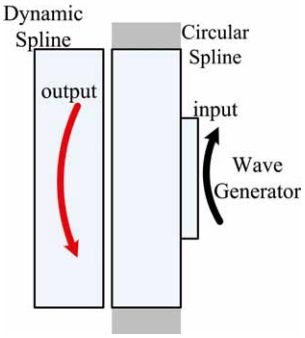
Model	A(g6)	B(h7)	C	D	E	F	G	H
50	85	52	20	70	73	1	17.5	38
60	95	65	30	80	81	1	20.5	40
80	125	85	40	105	95	1	22.5	50
100	145	100	50	125	113	1	22.5	68
120	185	125	60	155	132	1	27	78
160	235	140	70	195	147	1	30	87
200	290	180	90	240	178	1	36	106
250	360	210	110	290	212	1	41	130

Model	I	J	K	M(H7)	N	O	P
50	44	12.5	2	12	4	13.8	M4
60	45	16	2	20	6	22.8	M5
80	55	18	2	30	8	33.3	M6
100	65	20	4	35	10	38.3	M8
120	80	22	4	40	12	43.3	M10
160	117	12	3	50	14	53.8	M12
200	129	21.5	3	65	18	69.4	M12
250	155	25.5	3	80	22	85.4	M14

Unit: mm

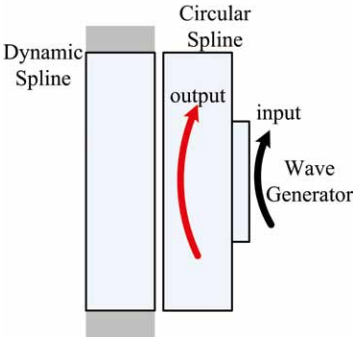
Driving Arrangment

The component sets of XB3 harmonic wave comprise of 4 constituents, i.e., the static spline, the flex spline, the wave generator, and the dynamic spline. The speed ratios specified herein before in this manual are worked out in the following transmission order, viz., the wave generator installed at the input end, static spline clasping, and the dynamic spline installed at the output end. Where the transmission order is altered among these 4 components, customers can accomplish different speed ratios. In the diagrams below are illustrated the varied transmission speed ratios of XB3 Model of harmonic gears in the different working orders.



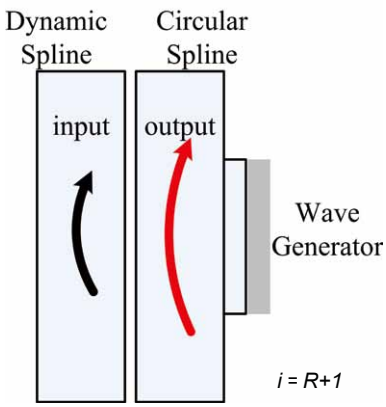
$i = -R$

The static spline clasping, the wave generator input, and the dynamic spline utput

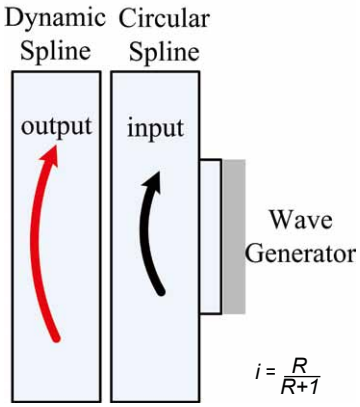


$i = R+1$

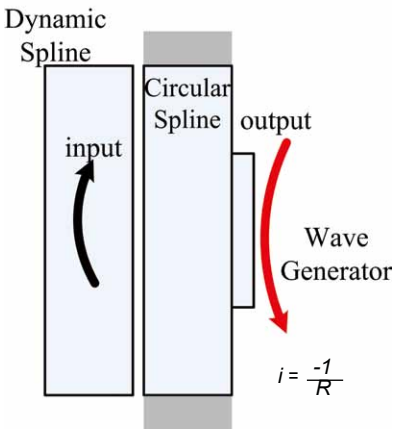
The dynamic spline clasping, the wave generator input, and static spline output



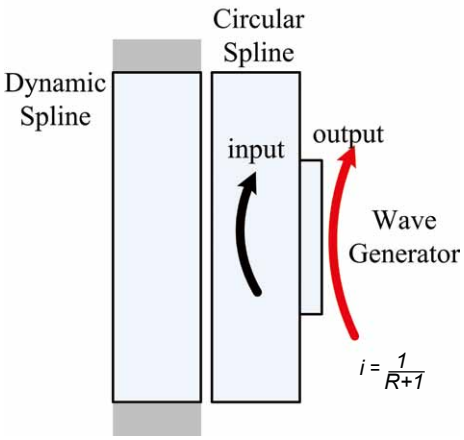
The wave generator clasping, the dynamic spline input, static spline output



The wave generator clasping, static spline input, the dynamic spline output



The static spline clasping, the dynamic spline input, the wave generator output



The dynamic spline clasping, the static spline input, the wave generator output

Torsional Rigidity Coefficient for XB3

Ka: Torsional rigidity coefficient, including the range from pure backlash to elastic twist of the output shaft to about 20% of rated torque.

Kb: Torsional rigidity coefficient, covering the range thereafter to the rated torque, for elastic twist of the shaft.

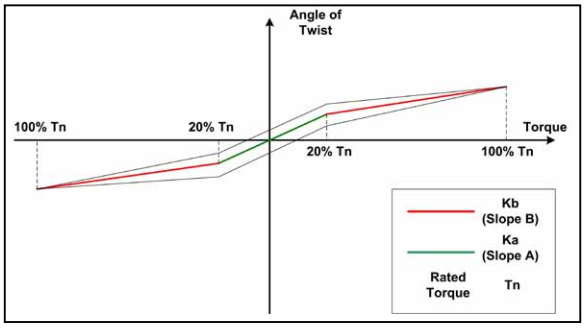


Diagram 6-04

XB3-A

Model (Ka)	25	32	40	50	60	80	100	120	160	200	250
Torsional Rigidity (N.m/arc min)	0.11	0.36	0.91	1.82	3.36	7.98	14.5	27	65.5	133.6	227.2

Model (Kb)	25	32	40	50	60	80	100	120	160	200	250
Torsional Rigidity (N.m/arc min)	0.71	2.2	4.78	10.3	17.7	45.3	73.4	145	342	677	1332

XB3-B

Model (Ka)	25	32	40	50	60	80	100	120	160	200	250
Torsional Rigidity (N.m/arc min)	0.11	0.36	0.95	1.86	3.55	8.05	14.7	27.7	65.4	134.8	227.9

Model (Kb)	25	32	40	50	60	80	100	120	160	200	250
Torsional Rigidity (N.m/arc min)	0.69	2	4.7	9.8	17.8	44	72.9	144	338	673.9	1332

Moment of Inertia of the Input Shaft Assembly for XB3-A

Model	25	32	40	50	60	80	100	120	160	200	250
Moment of Inertia ($kg.m^2$)	$0.6*10^{-6}$	$2.41*10^{-6}$	$0.63*10^{-5}$	$2.04*10^{-5}$	$0.49*10^{-4}$	$1.40*10^{-4}$	$0.41*10^{-3}$	$1.15*10^{-3}$	$0.48*10^{-2}$	$1.68*10^{-2}$	$3.35*10^{-2}$

Moment of Inertia of the Input Shaft Assembly for XB3-B

Model	25	32	40	50	60	80	100	120	160	200	250
Moment of Inertia ($kg.m^2$)	$2.85*10^{-6}$	$6.11*10^{-6}$	$1.58*10^{-5}$	$3.6*10^{-5}$	$8.6*10^{-5}$	$2.92*10^{-4}$	$9.26*10^{-4}$	$3.05*10^{-3}$	$9.05*10^{-3}$	$2.67*10^{-2}$	$7.62*10^{-2}$

Notes: The data specified in the table above conform to the standard-structured camponent sets of our company's harmonic gear. In case customers require the wave generator tailored to their individual needs, the data shall be altered accordingly.

The Efficiency of the XB3

The Drive Efficiency of the Model XB3 Harmonic Gear is affected by the following causes:

1. Model Type
2. Input rotary speed
3. Drive speed ratio
4. Lubricant
5. Setting temperature
6. Amount of the load driven

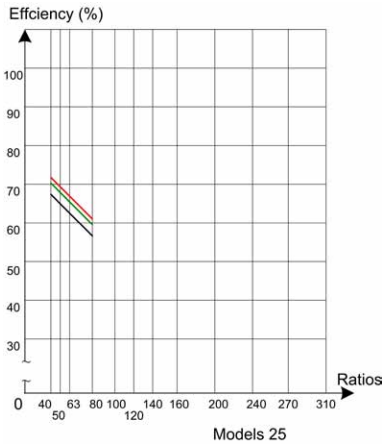
This section treats of the drive efficiency effected by the Model XB3 Harmonic Gear under varied conditions.

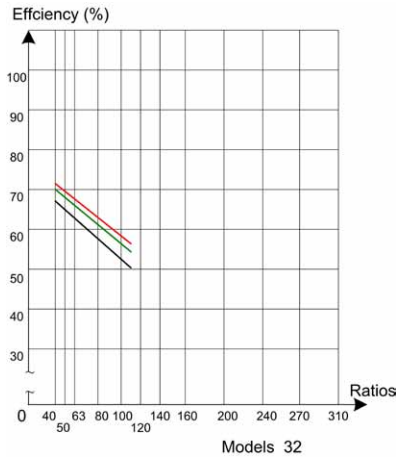
In the charts, as shown below, are drawn the drive efficiency curves observed of the various model types when put to work at varied speed ratios and input rotary speeds (3000rpm, 1500rpm, 1000rpm).

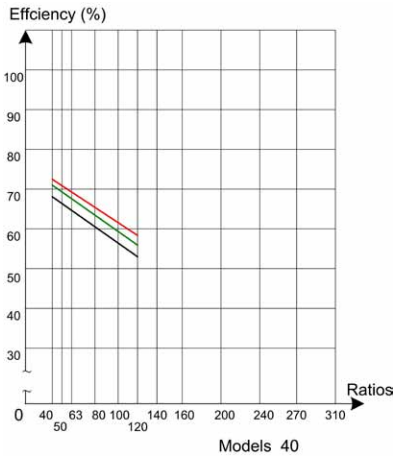
Among which, models 25,32,40,50,60 make use of lubrication grease as the lubricant, whereas models 80,100,120,160,200,250 utilize lubrication oil as the lubricant.

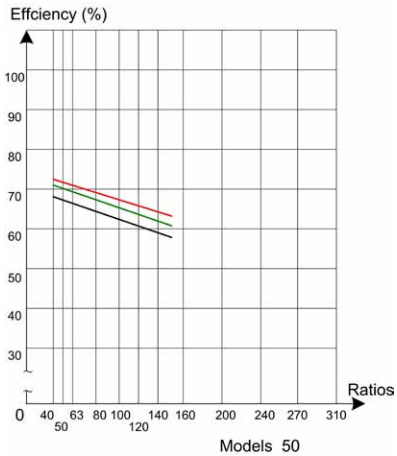
Input rotation speed:

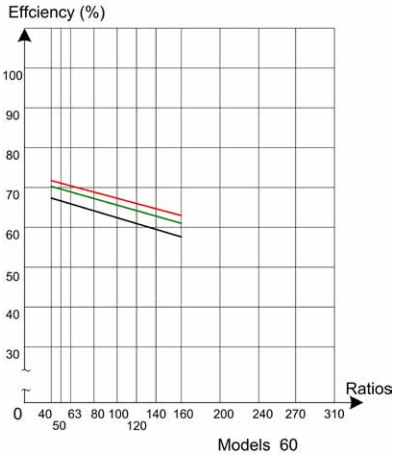
- 3000 rpm
- 1500 rpm
- 1000 rpm



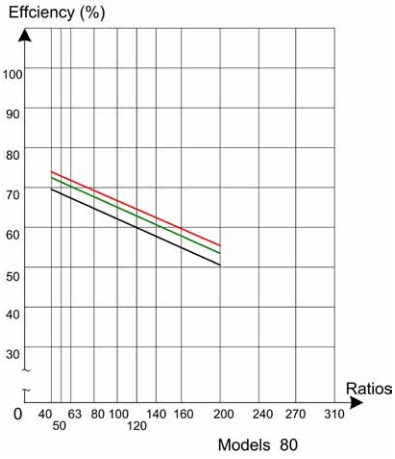




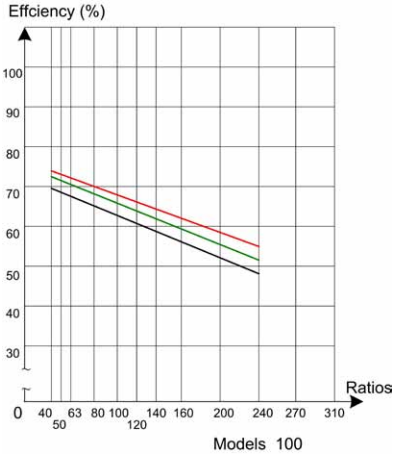




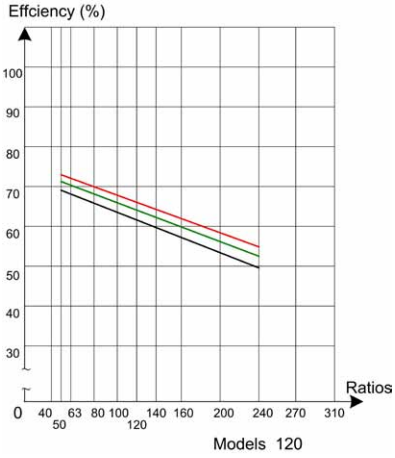
Models 60



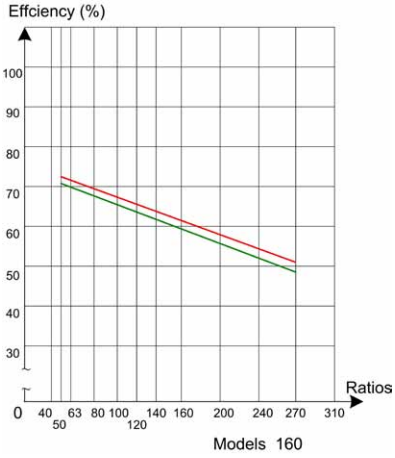
Models 80



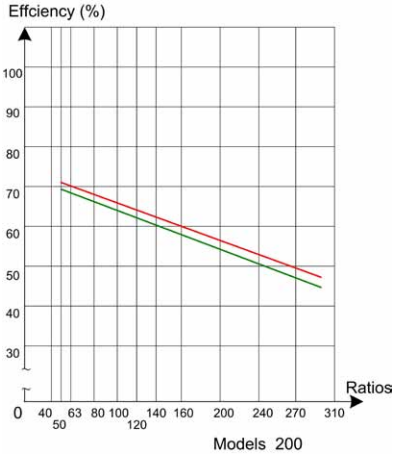
Models 100



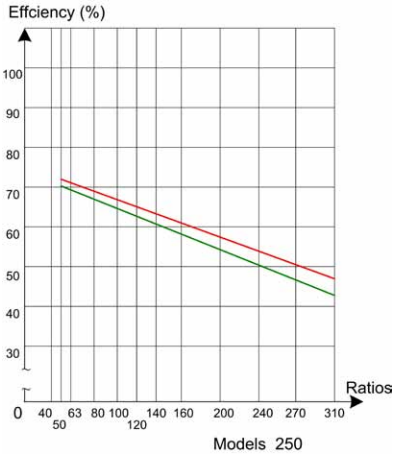
Models 120



Models 160



Models 200



Models 250

The drive efficiency curves, as shown in the chart above, observed of the several models are effected under such conditions as the setting temperature is kept at 50℃, and the 100% rated load is imposed. When changes are made to the setting temperature and the load driven, adjustments need to be effected to the gear drive efficiency according to the temperature-efficiency relationship chart and load-efficiency relationship chart, as respectively shown below.

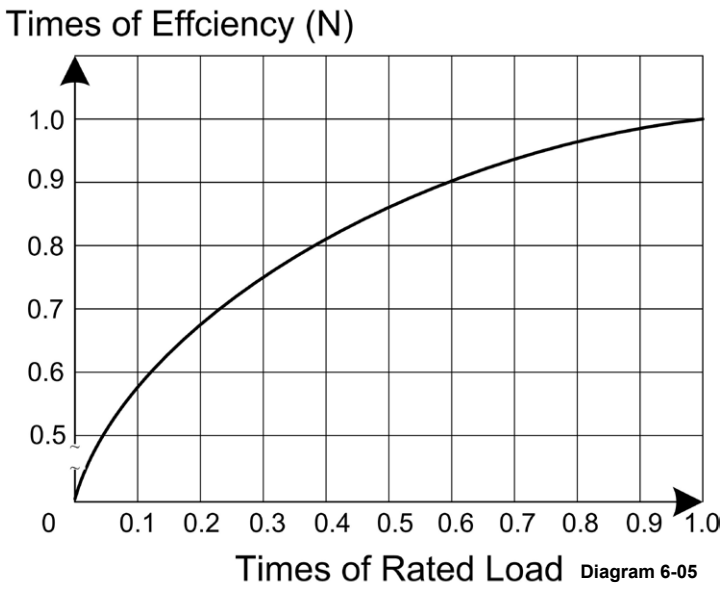


Diagram 6-05

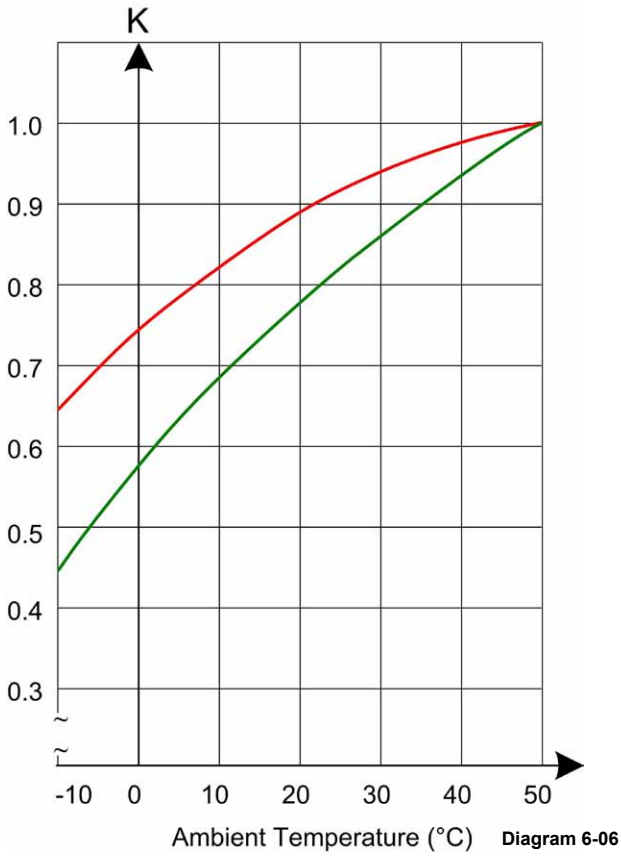


Diagram 6-06

: Oil

: Lubricant Grease

How to apply the relationship charts:

For example: when input rotary speed reaches 1500rpm, XB3 Model 100, 100 speed ratio, by consulting the XB3 100 efficiency chart, we can find out the basic efficiency η0 of the model under discussion to be 87%.

At this time, supposing the setting temperature is maintained at 20℃, and besides, the gear is not put to work to capacity, the load being regulated at 0.9 times of the rated load.

1. By referring to the temperate-efficiency chart, when the setting temperature comes at 20℃, K, standing for the adjusted parameter, is 0.85(Lubrication: Oil);

2. By referring to the load-efficiency chart, when 0.9 times of rated load is kept, N, representing the adjusted parameter, is 0.98.

Thus, the actual drive efficiencyηattained by the gear in question is:

η =η0 * N * K

= 87% * 0.85 * 0.98 = 72.4%

That is, the actual drive efficiency rate, achieved by Gear XB3-100-100, under this specified working condition, is 72.4%.

No-load startup torque XB3

No-load startup torque means the minimum torque required when the high-speed end is activated from rest to work, under the condition that no load is set on the output end (the low-speed end) of the Harmonic gear set.

No-load startup torque has a close bearing on the drive efficiency of the component set (for the efficiency factor, please refer to page 25); the chart below is figured out under the conditions as follows:

Setting Temperature: 50℃

Lubrication: 25，32，40，50，60: lubrication grease

80，100，120，160，200，250: lubrication oil

In addition: represented in this chart is none other than the no-load startup performance wrought by the Harmonic gear set. As no regard is had to the effects exerted on the drive efficiency by the input/output axial bearings adopted in real customers' systems, seal rings and a slew of unknown factors, so the figures in question do not represent those of the Harmonic Gear of finished product.

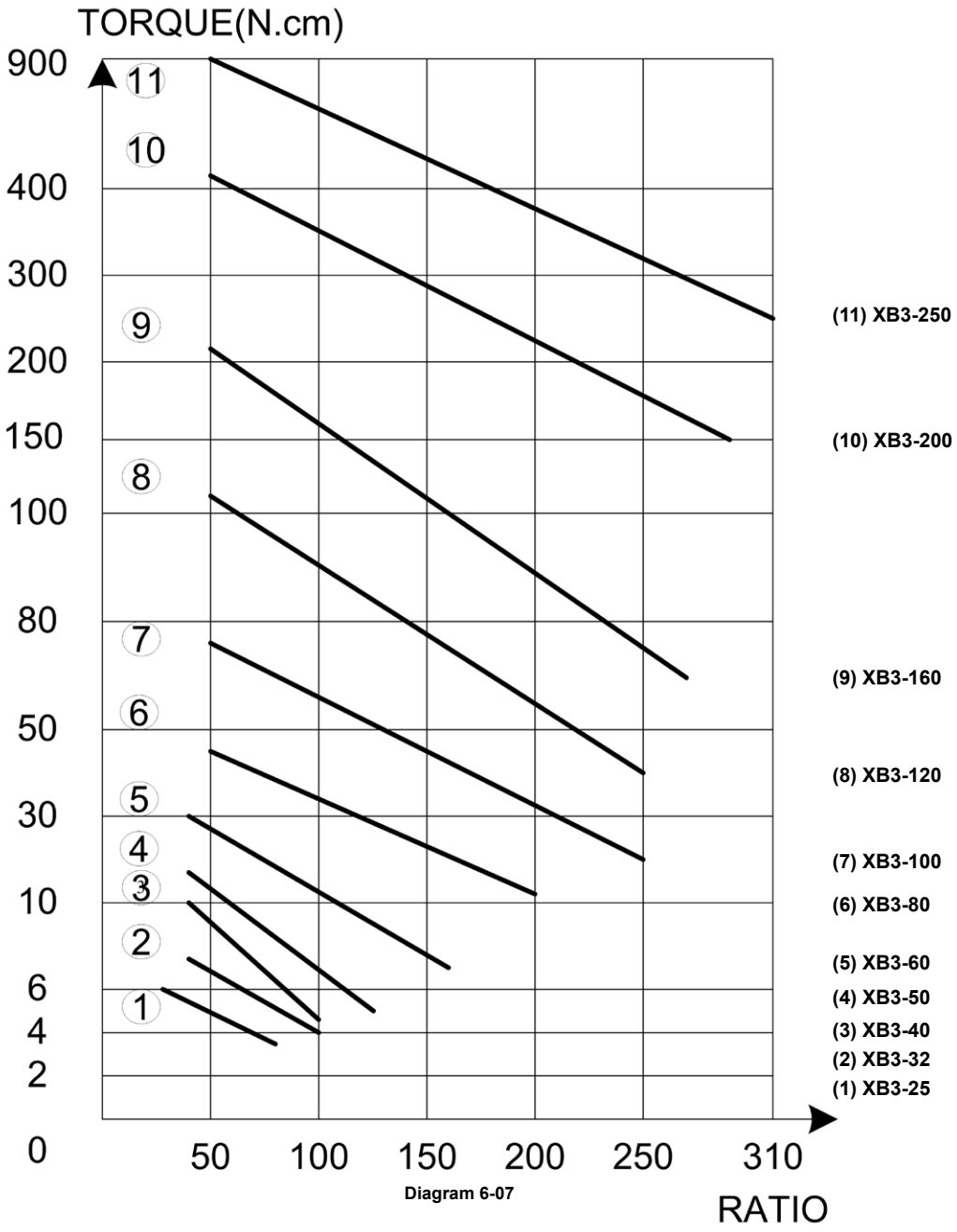


Diagram 6-07

No-load startup torque under the condition of acceleration(Back driving) XB3

Model XB3 Harmonic Gear can be applied as an acceleration device. Its no-load startup torque means the minimum torque required when the low-speed end is activated from rest to work, under the condition that no load is set on the output end (the high-speed end) of the Harmonic gear set.

Represented in this chart is none other than the no-load startup performance wrought by the Harmonic gear set. As no regard is had to the effects exerted on the drive efficiency by the input/output axial bearings adopted in real customers' systems, seal rings and a slew of unknown factors, so the figures in question do not represent those of the Harmonic Gear of finished product.

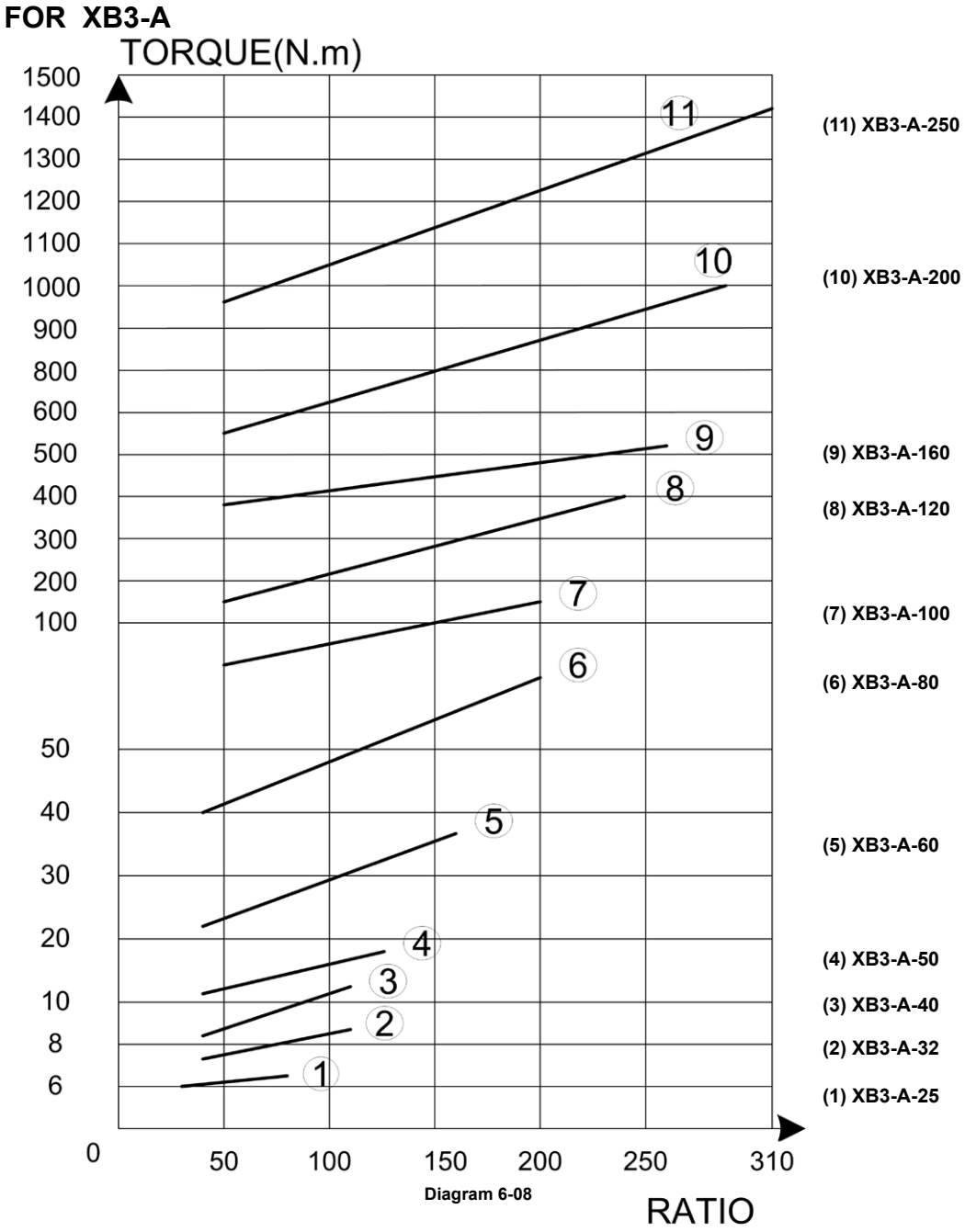


Diagram 6-08

FOR XB3-B

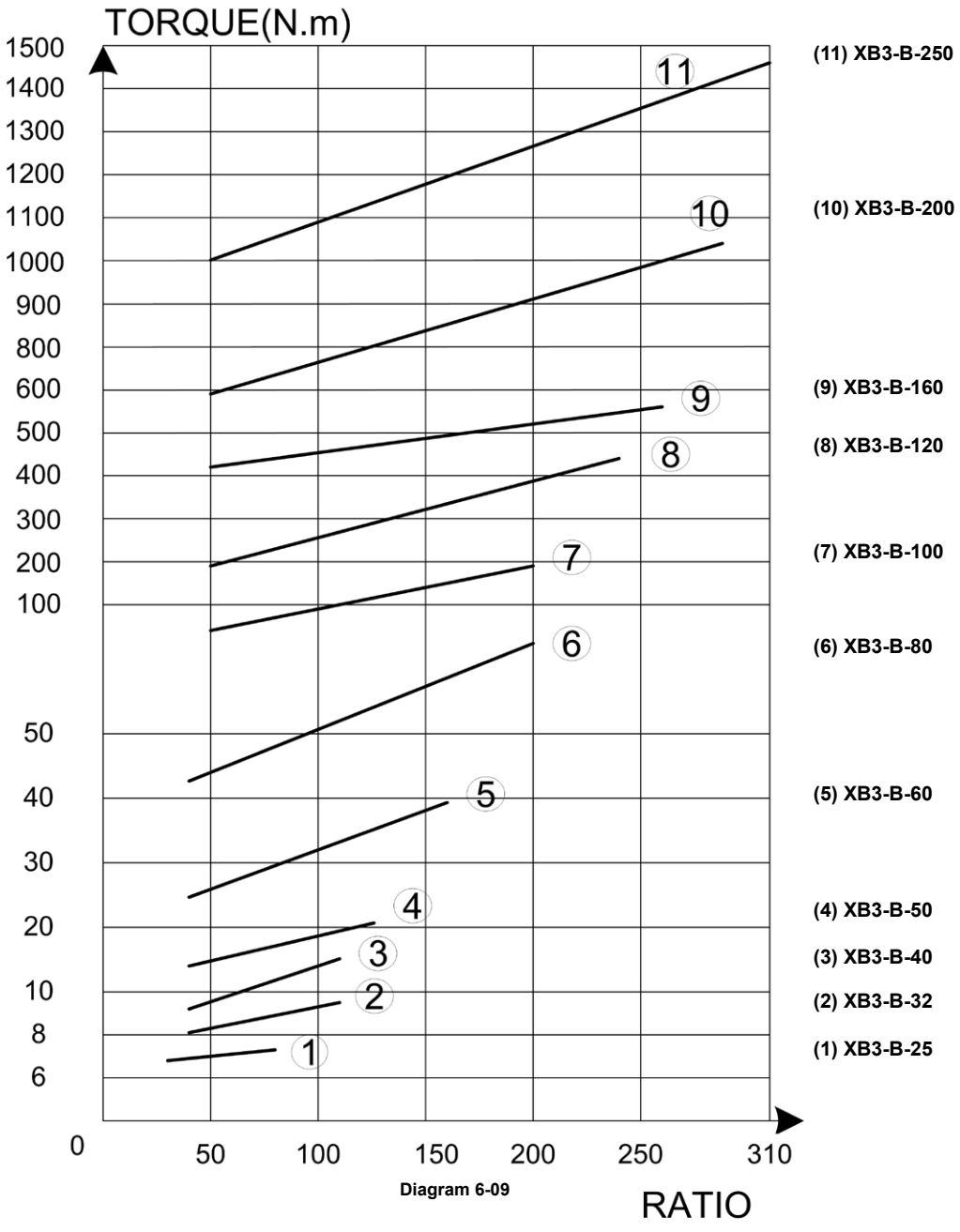
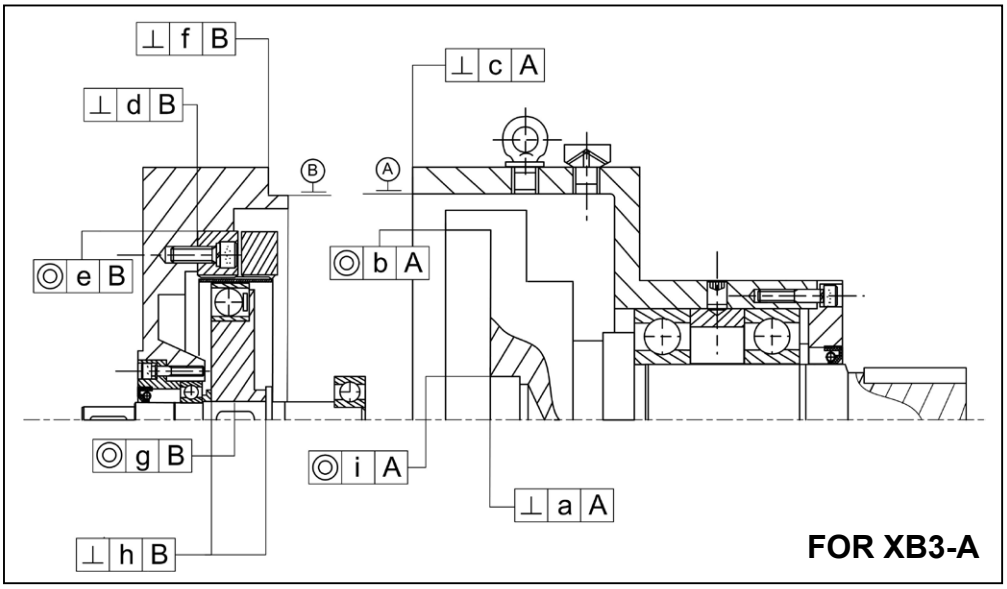


Diagram 6-09

Assembly Tolerance And Position XB3



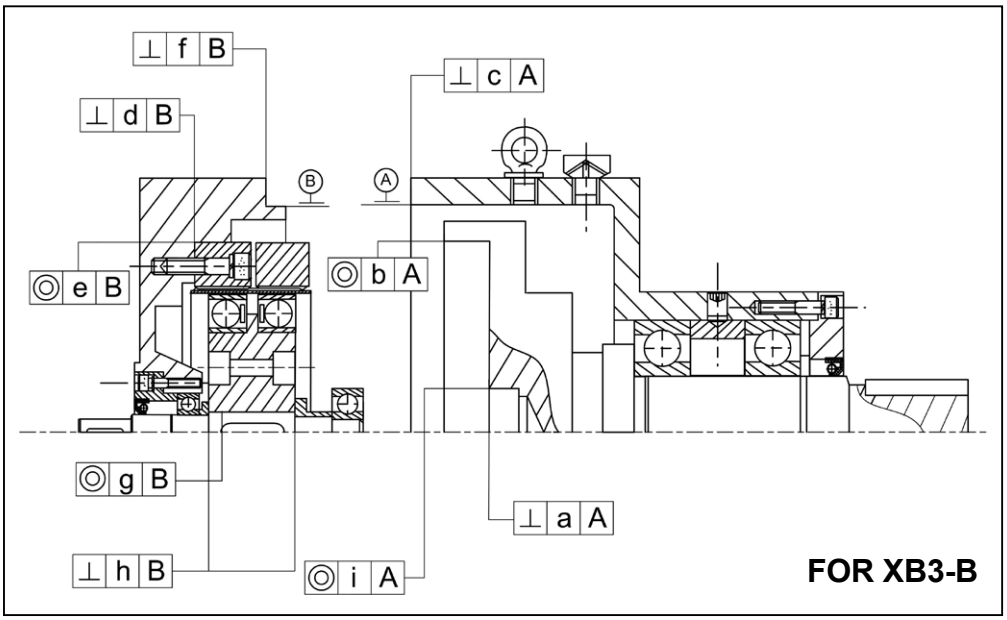


Diagram 6-10

Model	A	B	C	D	E	F	G	H	I
25	0.01	0.015	0.015	0.015	0.012	0.015	0.012	0.01	0.012
32	0.015	0.02	0.015	0.015	0.015	0.015	0.012	0.012	0.012
40	0.015	0.02	0.025	0.015	0.02	0.025	0.015	0.012	0.015
50	0.02	0.025	0.025	0.02	0.02	0.025	0.02	0.012	0.015
60	0.02	0.025	0.025	0.02	0.025	0.025	0.02	0.015	0.015
80	0.025	0.03	0.03	0.025	0.025	0.03	0.025	0.015	0.02
100	0.025	0.03	0.03	0.025	0.03	0.03	0.025	0.015	0.02
120	0.03	0.035	0.035	0.03	0.03	0.035	0.025	0.015	0.02
160	0.03	0.035	0.035	0.03	0.035	0.035	0.03	0.015	0.025
200	0.035	0.04	0.04	0.035	0.035	0.04	0.03	0.02	0.025
250	0.04	0.045	0.04	0.035	0.04	0.04	0.03	0.02	0.025

Unit: mm

Multi Stage Harmonic Gear

The XB2/6 harmonic gear, which runs on the working principle of multi wave, connection output by the dynamic spline.

XB2/6-C

(Ordering Code)

COMPONENT GEAR SET

Exterior Specifications of XB2/6-C

For the exterior specifications of XB2 and XB6 harmonic gears, please refer to the diagram/table below:

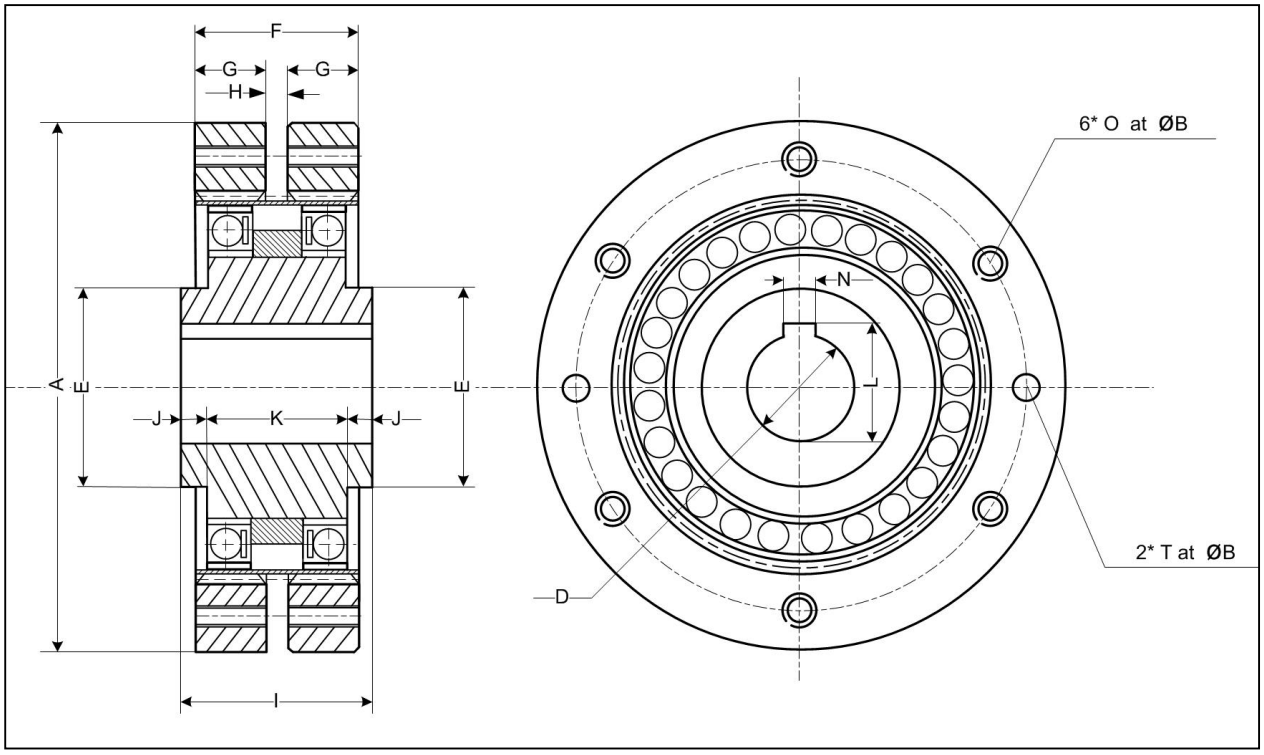


Diagram 7-01

Model	A	B	D	E	F	G	H	I	J	K	N	L	O	T*
	g7		H7											
25	40	34	6	11	17	7	3	18	2	14	2	7	M3	3
32	50	43	10	16	20	8.5	3	21.5	2.5	16.5	3	11.4	M3	3
40	60	51	12	19	22	9.5	3	23.5	2.5	18.5	4	13.8	M4	4
50	70	62	12	23	28	12	4	30	3	24	4	13.8	M4	4
60	85	75	20	32	32	14	4	35	4	27	6	22.8	M5	5
80	115	100	30	46	40	18	4	44	4	35	8	33.3	M6	6
100	135	120	35	56	47	21	5	51	5	41	10	38.3	M8	8
120	170	150	40	68	57	26	5	59	5	49	12	43.3	M10	10
160	220	195	50	80	75	35	5	78	7	64	14	53.8	M12	12
200	270	240	65	100	88	41	6	91	7	77	18	69.4	M16	16
250	330	295	80	120	106	50	6	108	9	90	22	85.4	M20	20

Dimension Unit: mm

***: Fixing pin holes, will be made by customer themselves.**

Performance Specifications of XB2/6-C

For the performance specifications of XB2 and XB6 harmonic gear, please refer to the table

Model	Reliable Speed Ratio Range	Rated Output Torque(N.m)
25	200 ~ 8260	2
32	200 ~ 12880	5
40	200 ~ 20100	15
50	200 ~ 30000	30
60	200 ~ 45000	50
80	200 ~ 80000	120
100	300 ~ 130000	240
120	300 ~ 110000	450
160	300 ~ 140000	1000
200	300 ~ 130000	2000
250	300 ~ 110000	3500

The Efficiency of Multi-wave transmission device (XB2, XB6) series

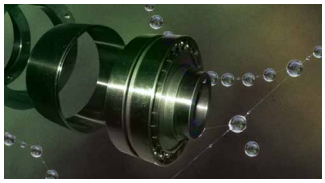
Below is the formula for the transmission efficiency of multi-wave transmission device

$$\eta = a \cdot i^{b}$$

of them: η: transmission efficiency

i: speed ratio

a. b stand for the constants corresponding to the respective models. The specific values are specified in the efficiency curves for the different models.



As the speed ratios attainable by the multi-wave device span over a broad range (300~150,000), so it is impossible to note one by one all the transmission efficiencies for each speed ratio grade in the curves of this manual. Where customers cannot find the efficiency curves for the desired speed ratio grade in the manual, they can be worked out on their own by the formula.

Under this formula, it can be reckoned that, where the multi-wave device is run at a high speed ratio, a low transmission efficiency rate shall be the result. It is therefore recommended that when choosing device models, customers should avoid going merely by the efficiency rate.

By the formula below, customers can work out the relations among the torque of the output shaft, the input rotation speeds of the electric motor, transmission efficiency, transmission speed ratio, and the input power.

$$N = \frac{n \cdot M}{9555 \cdot i \cdot \eta}$$

n: The input rotation speeds of the electric motor (rpm)

M: Torque of output shaft(N.m)

η : Transmission efficiency

i: speed ratio

N: Input power(kW)

For example: supposing customers' working conditions demand following requirements for the harmonic gear:

The torque of output shaft needed to work the load(M): 200Nm

Input rotation speeds(n):2000

Speed ratio(i): 5000

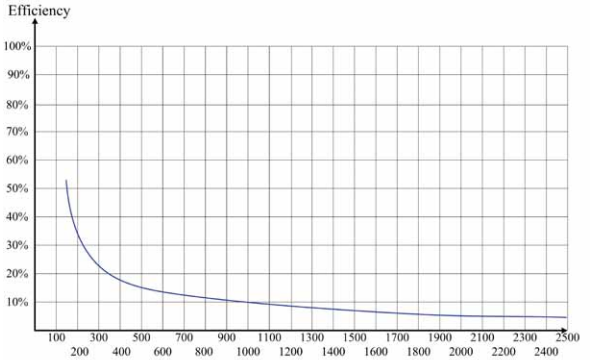
Transmission Efficiency: where customers' need for the speed ratio amounts to 5000, the efficiency rate, which cannot be found in the diagrams and tables, is worked out to be 5% by the efficiency rate calculation formula for the multi-wave harmonic gear. Below is the calculation of all the values by the formula:

$$N = \frac{2000\ rpm \cdot 200\ Nm}{9555 \cdot 5000 \cdot 5\%}$$

N = 0.167 kW

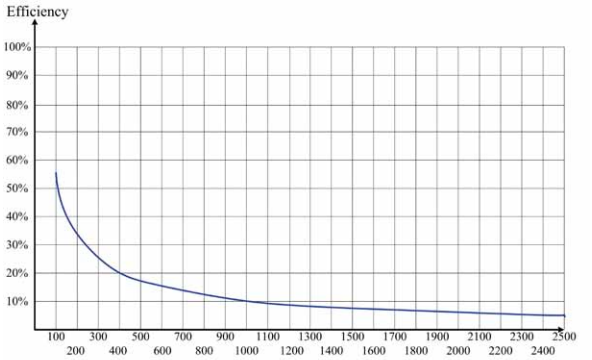
It can be calculated by the formula that the output power required to run the electric motor comes to 0.167kW.

Note:The output power of the electric motor worked out with this formula is the minimal power needed to work the load. In routine operation, customers are advised to allow for the room of power for the safe run of electric motors in accordance with their own working conditions.



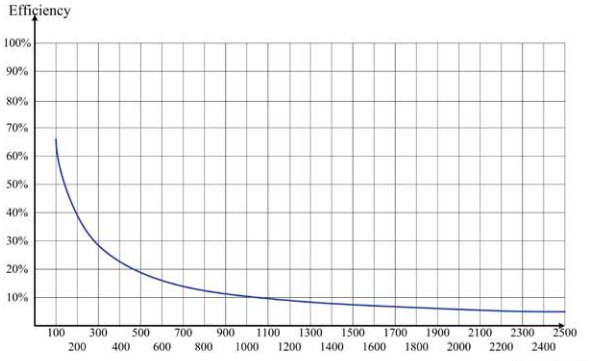
Model 25

a:18.026,b:-0.7744



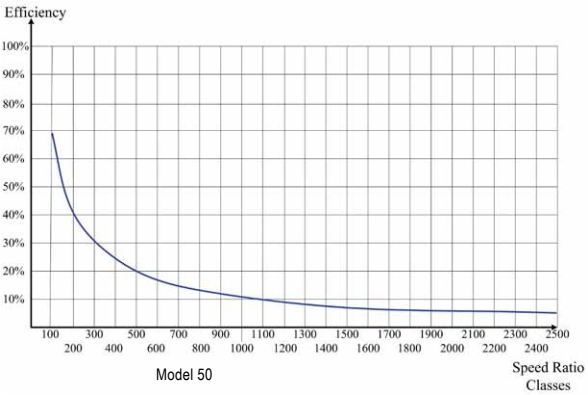
Model 32

a:15.83,b:-0.724



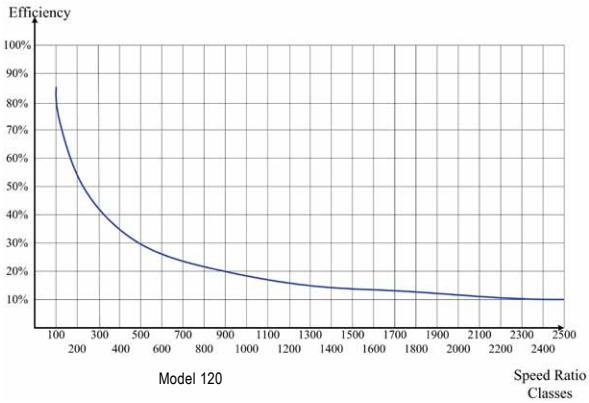
Model 40

a:25.355,b:-0.7886



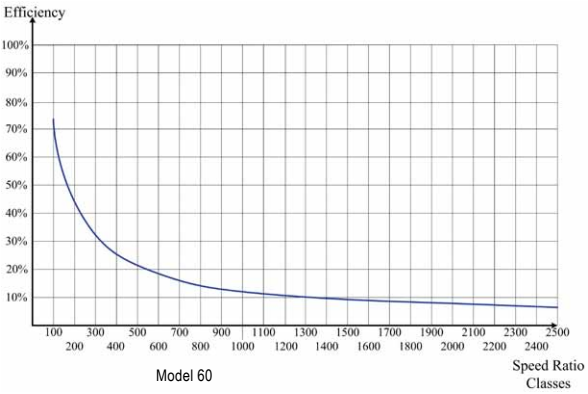
Model 50

a:29.72,b:-0.814



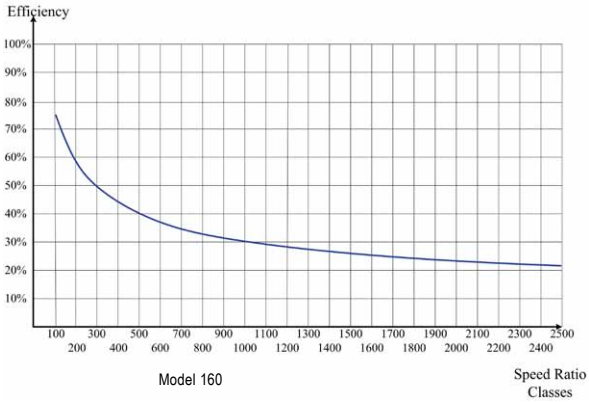
Model 120

a:17.428,b:-0.6547



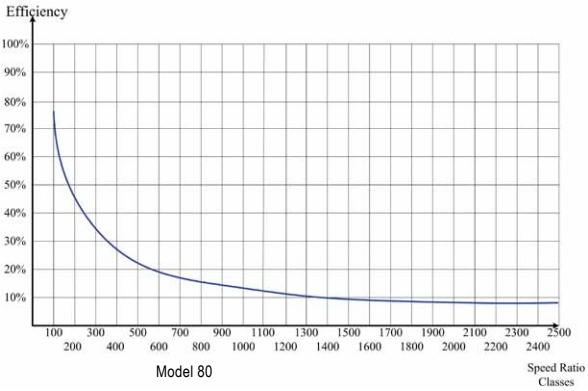
Model 60

a:26.99,b:-0.7868



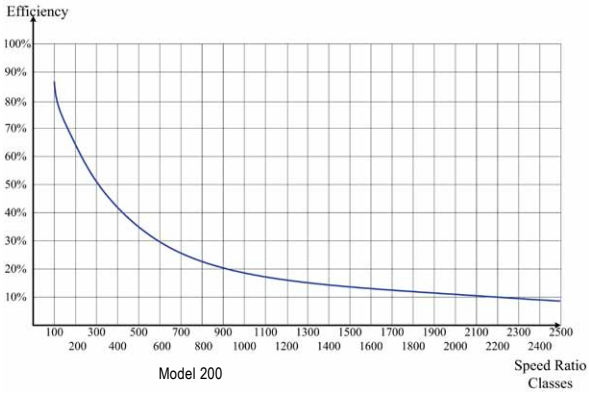
Model 160

a:4.64,b:-0.3959



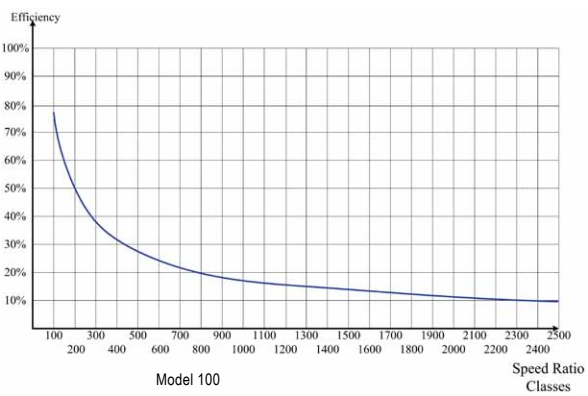
Model 80

a:26.916,b:-0.7664



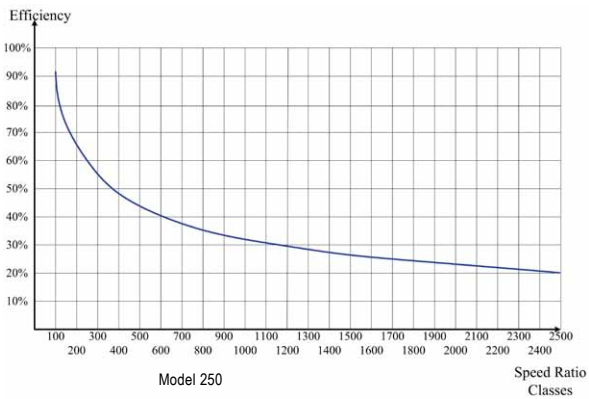
Model 200

a:8.0,b:-0.4815



Model 100

a:16.37,b:-0.6615



Model 250

a:8.0,b:-0.469

The Drive Efficiency of Model XB2/6 Harmonic Gear Drive Device

The Drive Efficiency of the Model XB2/6 Harmonic Gear is affected by the following causes:

1. Model Type
2. Input rotary speed
3. Drive speed ratio
4. Lubricant
5. Setting temperature
6. Amount of the load driven

Among which, models 25,32,40,50,60 make use of lubrication grease as the lubricant, whereas models 80,100,120,160,200,250 utilize lubrication oil as the lubricant.

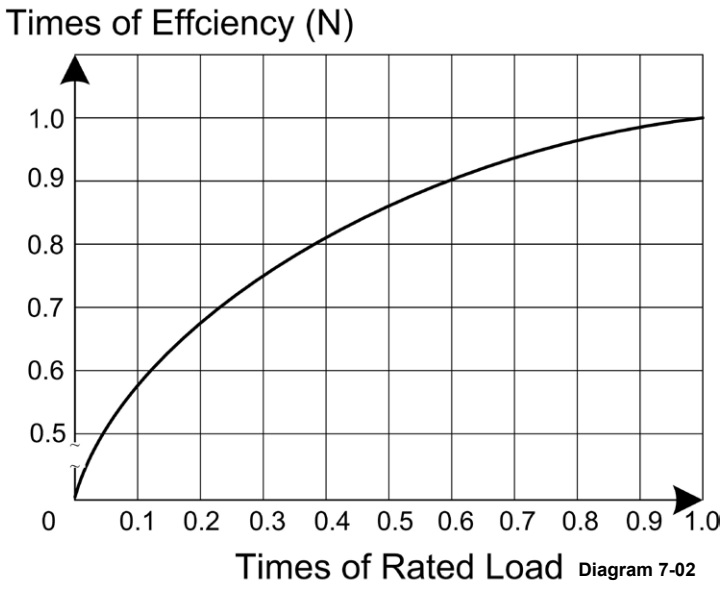


Diagram 7-02

The drive efficiency curves, as shown in the chart above, observed of the several models are effected under such conditions as the setting temperature is kept at 50℃, and the 100% rated load is imposed. When changes are made to the setting temperature and the load driven, adjustments need to be effected to the gear drive efficiency according to the temperature-efficiency relationship chart and load-efficiency relationship chart, as respectively shown beside.

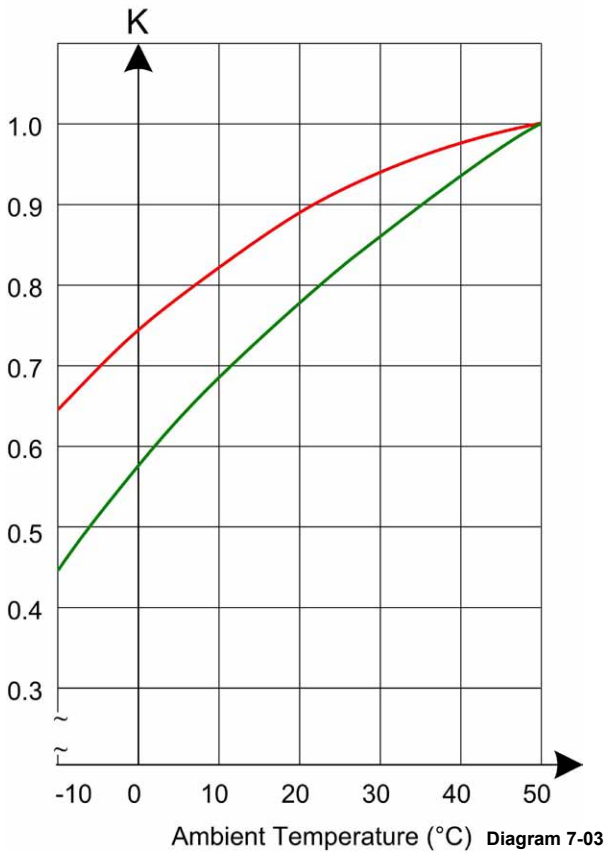


Diagram 7-03

How to apply the relationship charts:

For example: when XB2/6 Model 100, 1000 speed ratio, by consulting the XB2/6 100 efficiency chart, we can find out the basic efficiency η0 of the model under discussion to be 15%.

At this time, supposing the setting temperature is maintained at 20℃, and besides, the gear is not put to work to capacity, the load being regulated at 0.9 times of the rated load.

1. By referring to the temperate-efficiency chart, when the setting temperature comes at 20℃, K, standing for the adjusted parameter, is 0.85(Lubrication: Oil);

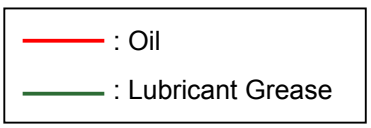
2. By referring to the load-efficiency chart, when 0.9 times of rated load is kept, N, representing the adjusted parameter, is 0.98.

Thus, the actual drive efficiencyηattained by the gear in question is:

η =η0 * N * K

= 15% * 0.85 * 0.98 = 12.4%

That is, the actual drive efficiency rate, achieved by Gear XB2/6-100-1000, under this specified working condition, is 12.4%.



No-load startup torque XB2/6-C

No-load startup torque means the minimum torque required when the high-speed end is activated from rest to work, under the condition that no load is set on the output end (the low-speed end) of the Harmonic gear set.

No-load startup torque has a close bearing on the drive efficiency of the component set (for the efficiency factor, please refer to page 35); the chart below is figured out under the conditions as follows:

Setting Temperature: 50℃

Lubrication: 25，32，40，50，60: lubrication grease

80，100，120，160，200，250: lubrication oil

In addition: represented in this chart is none other than the no-load startup performance wrought by the Harmonic gear set. As no regard is had to the effects exerted on the drive efficiency by the input/output axial bearings adopted in real customers' systems, seal rings and a slew of unknown factors, so the figures in question do not represent those of the Harmonic Gear of finished product.

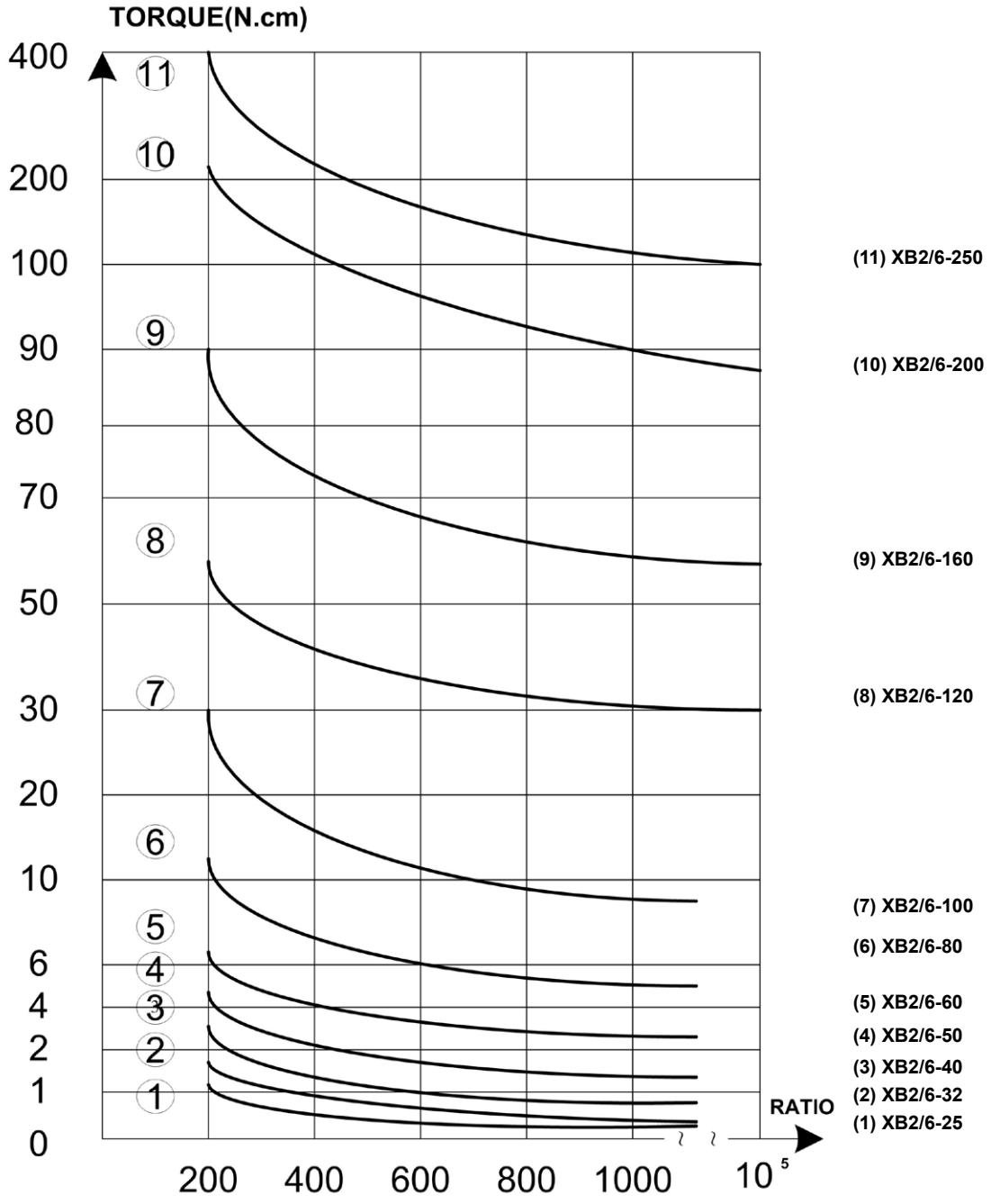


Diagram 7-04

No-load startup torque under the condition of acceleration(Back driving) XB2/6-C

As Model XB2/6 Harmonic Gear, which, working by a complicated drive principle, delivers a relatively low drive efficiency, shows the phenomenon of self-locking when back driving is desired, so it cannot be applied as a gear acceleration device.

Torsional Rigidity Coefficient for XB2/6-C

Ka: Torsional rigidity coefficient, including the range from pure backlash to elastic twist of the output shaft to about 20% of rated torque.

Kb: Torsional rigidity coefficient, covering the range thereafter to the rated torque, for elastic twist of the shaft.

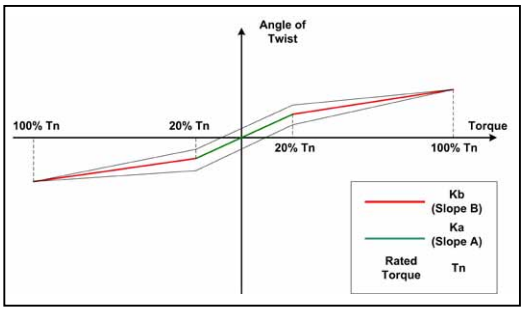


Diagram 7-05

Model (Ka)	25	32	40	50	60	80	100	120	160	200	250
Torsional Rigidity (N.m/arc min)	0.11	0.36	0.91	1.82	3.36	7.98	14.5	27	65.5	133.6	227.2

Model (Kb)	25	32	40	50	60	80	100	120	160	200	250
Torsional Rigidity (N.m/arc min)	0.69	2	4.7	9.8	17.8	44	72.9	144	338	673.9	1332

Moment of Inertia of the Input Shaft Assembly for XB2/6-C

Model	25	32	40	50	60	80	100	120	160	200	250
Moment of Inertia ($kg.m^2$)	$2.85*10^{-6}$	$6.11*10^{-6}$	$1.58*10^{-5}$	$3.6*10^{-5}$	$8.6*10^{-5}$	$2.92*10^{-4}$	$9.26*10^{-4}$	$3.05*10^{-3}$	$9.05*10^{-3}$	$2.67*10^{-2}$	$7.62*10^{-2}$

Notes: The data specified in the table above conform to the standard-structured component sets of our company's harmonic gear. In case customers require the wave generator tailored to their individual needs, the data shall be altered accordingly.

Assembly Tolerance And Position

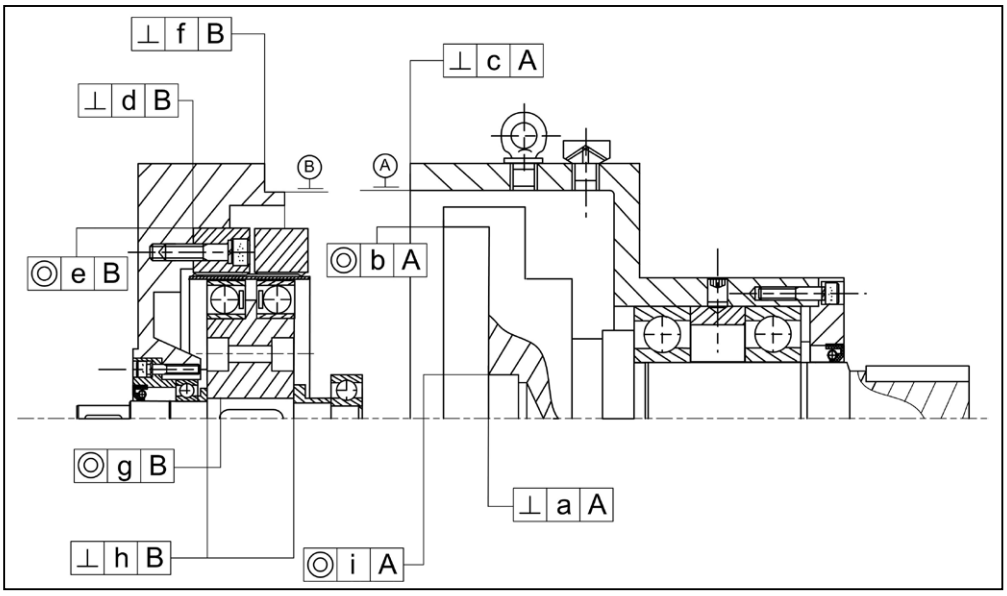


Diagram 7-06

MODEL	A	B	C	D	E	F	G	H	I
25	0.01	0.015	0.015	0.015	0.012	0.015	0.012	0.01	0.012
32	0.015	0.02	0.015	0.015	0.015	0.015	0.012	0.012	0.012
40	0.015	0.02	0.025	0.015	0.02	0.025	0.015	0.012	0.015
50	0.02	0.025	0.025	0.02	0.02	0.025	0.02	0.012	0.015
60	0.02	0.025	0.025	0.02	0.025	0.025	0.02	0.015	0.015
80	0.025	0.03	0.03	0.025	0.025	0.03	0.025	0.015	0.02
100	0.025	0.03	0.03	0.025	0.03	0.03	0.025	0.015	0.02
120	0.03	0.035	0.035	0.03	0.03	0.035	0.025	0.015	0.02
160	0.03	0.035	0.035	0.03	0.035	0.035	0.03	0.015	0.025
200	0.035	0.04	0.04	0.035	0.035	0.04	0.03	0.02	0.025
250	0.04	0.045	0.04	0.035	0.04	0.04	0.03	0.02	0.025

Unit: mm

Multi Stage Harmonic Gear

Our company's products, besides a multitude of component sets belonging to their several series, furnish customers with a whole-series of the harmonic gearing devices designed for all the machine models, as well.

The harmonic gearing is such a device as its performance is ascertained or its various model numbers classified according to the character of the gear component parts. (For particular performance and numbers, please refer to the Component Parts Manual).

XB2/6-GS

(Ordering Code)

XB2/6-GS

The structure in which is framed the gear box of XB2/6-GS Harmonic Gear of this kind utilizes such a style that are exposed the Input/Output shafts, which moreover have themselves linked after the manner of key-type connection.

Please refer to Diagram (1)

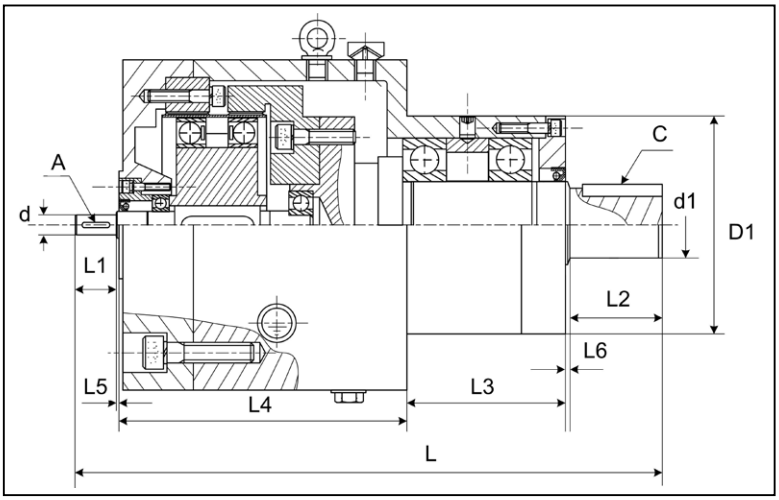


Diagram 8-01

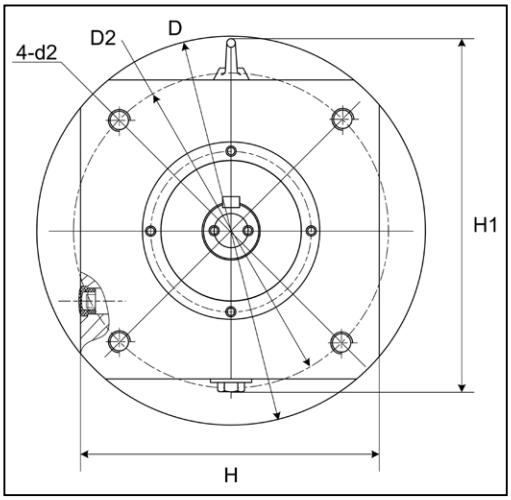
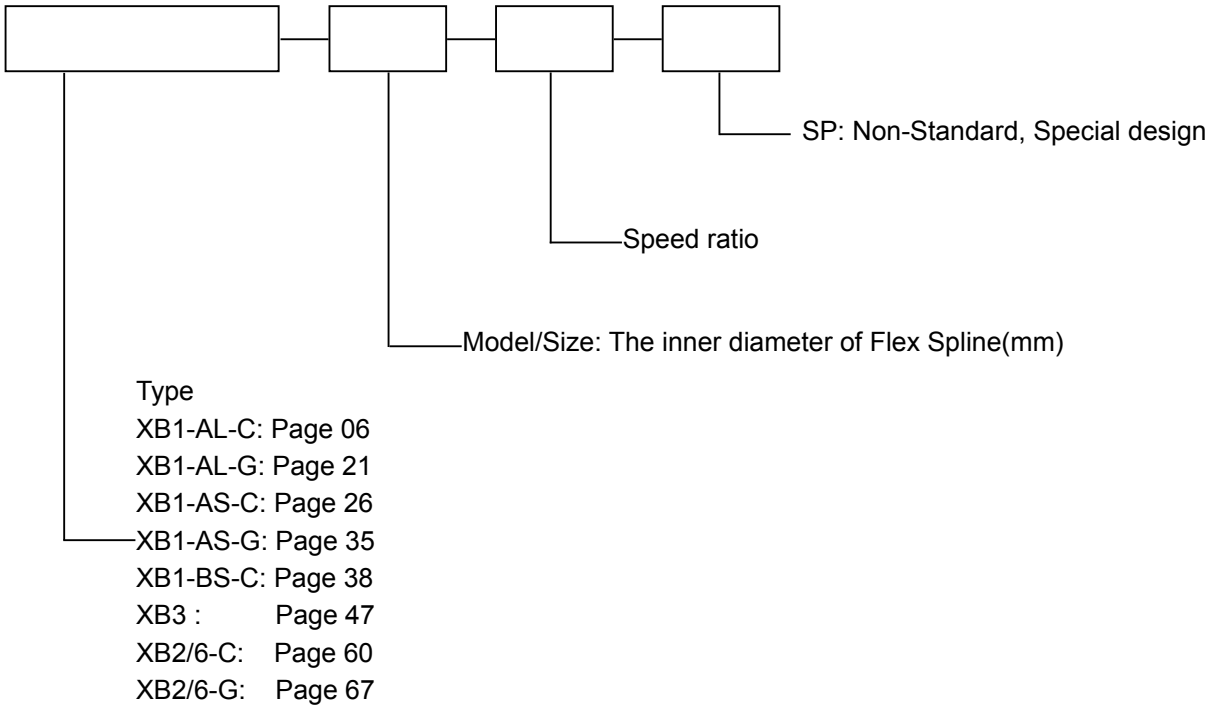


Diagram 8-02

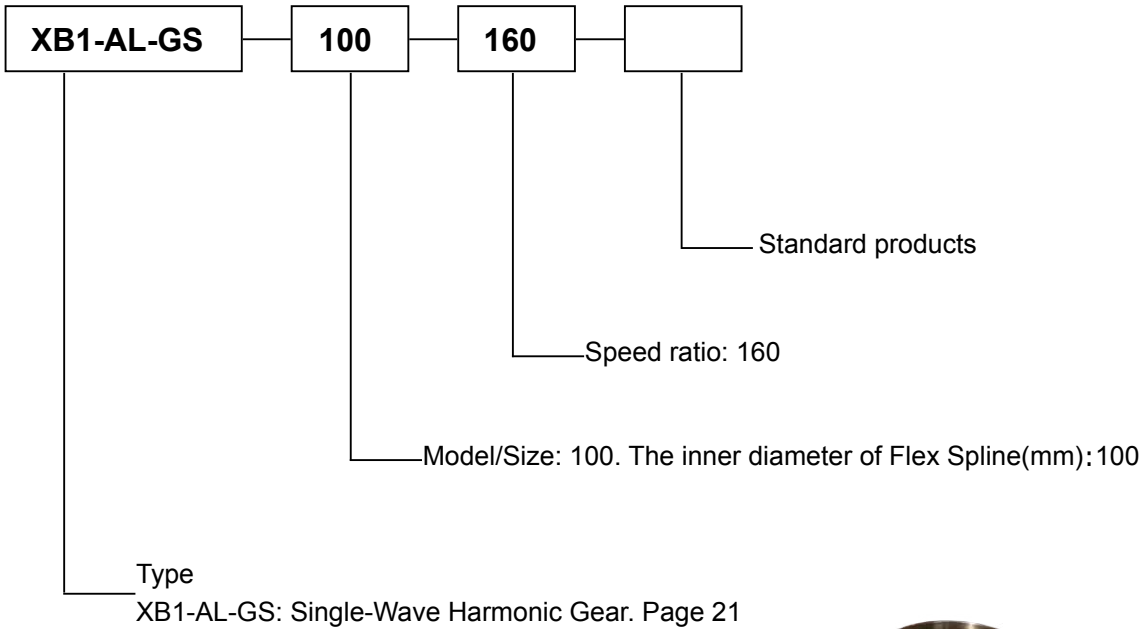
Model	d	d1	d2	D	D1	D2	L	L1	s	L3	L4	L5	L6	H	H1	A	C	Weight of Gear-box (kg)
25	4	8	M4	55	30	43	86	8	12	22	41	2	1	45		2 X 6	3 X 10	0.5
32	6	12	M5	68	45	55	115	12	16	33	52	1	1	55		2 X 8	4 X 14	0.8
40	8	15	M5	80	50	66	140	16	22	38	62	1	1	65		3 X 12	5 X 18	1.5
50	10	18	M6	92	60	76	170	18	30	43	75	2	2	75		3 X 15	6 X 25	2
60	14	22	M6	115	68	100	194	18	35	47	90	2	2	92		5 X 14	6 X 32	4~5.5
80	14	30	M10	155	85	130	243	20	44	62	113	2	2	124		5 X 16	8 X 40	12
100	16	35	M12	180	100	155	293	24	53	67	143	3	3	145	167	5 X 20	10 X 50	19
120	18	45	M14	230	120	195	350	28	68	82	167	3	2	185	240	6 X 24	14 X 62	35
160	24	60	M20	280	140	245	443	38	88	91	220	3	3	235	293	8 X 32	18 X 80	60
200	30	80	M24	335	180	300	538	48	108	115	262	3	2	285	340	8 X 40	22 X 100	115
250	35	95	M27	405	215	360	669	60	128	156	318	3	4	350	423	10 X50	25 X 120	180

Unit: mm

Products Ordering Code



Example:



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