

Improvement of productivity

High-Gain Rubber Couplings

eXtraGain
XG2

Solution to High Response



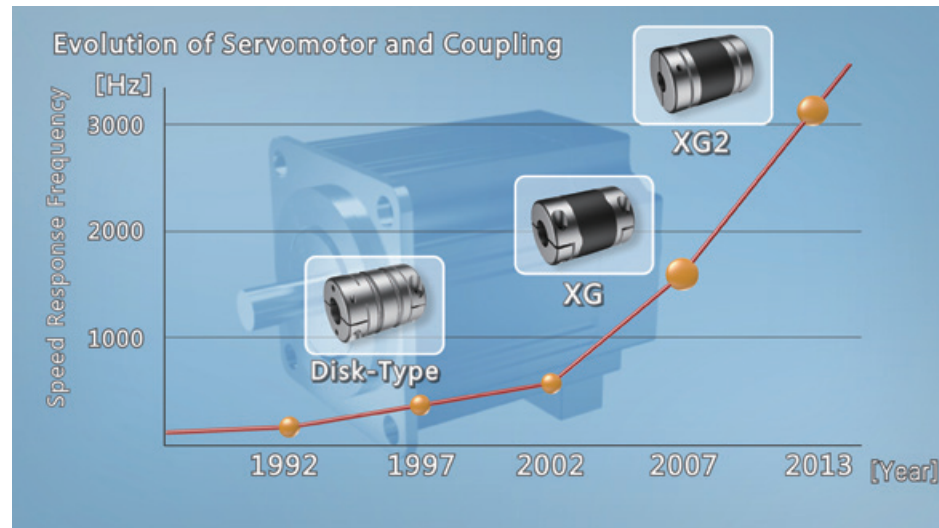
NBK[®]

The Motion Control Components

The story behind the XG Series

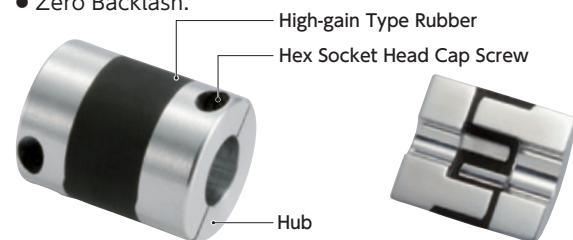
In accordance with the evolution of servomotors, coupling needs have changed as well. Servomotor speed response frequency has improved drastically over the past few years, creating an environment prone to vibration: it is difficult to achieve maximizing servomotor performance with existing high-rigidity couplings (disk-type).

The "High gain Rubber Coupling XG Series", with properties evolving in tandem with servomotor evolution, is the ideal servomotor coupling.



Structure

- Integrated combination of aluminum hub and high gain type rubber.
- Zero Backlash.



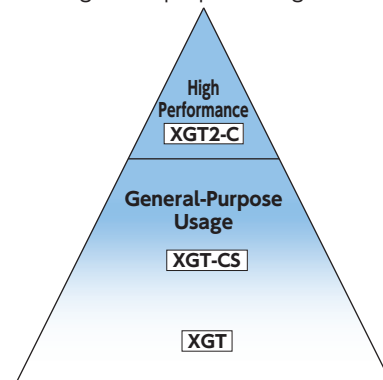
Characteristics

- High gain servomotor reduces stabilization time.
- Suppressing speed unevenness during Stepping Motor Operation.
- They have excellent vibration absorption.
- Actuator drive noise reducible.
- High Torque.

Lineup

Offers a wide variety of usages, from high-performance servomotor applications to general-purpose usage.

Product Code	XGT2-C	XGT-CS	XGT
Shape			
High-gain Type Rubber Material	FKM	HNBR	HNBR
Performance	⊙	○	○
Attachment	Clamp	Clamp	Set Screw
Price	△	○	⊙

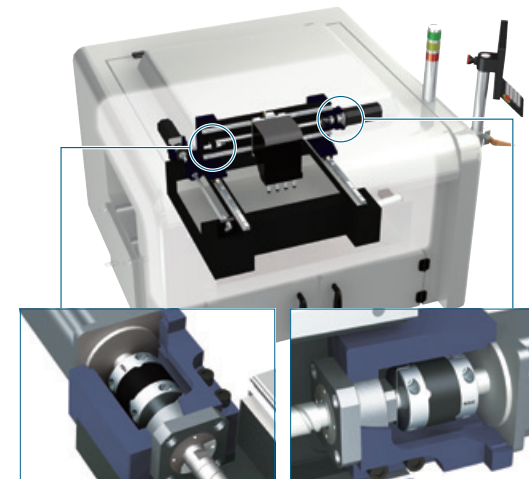


Examples of Use

Surface-mount machine

Device Problem
Production improvement (high throughput)

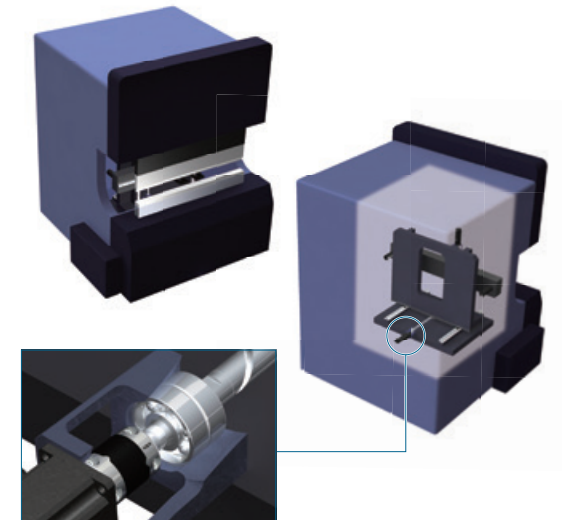
- Selection point: Reduction of the stabilization time by supporting high gain in servomotor



Press brake

Device Problem
Suppression of back gauge vibration

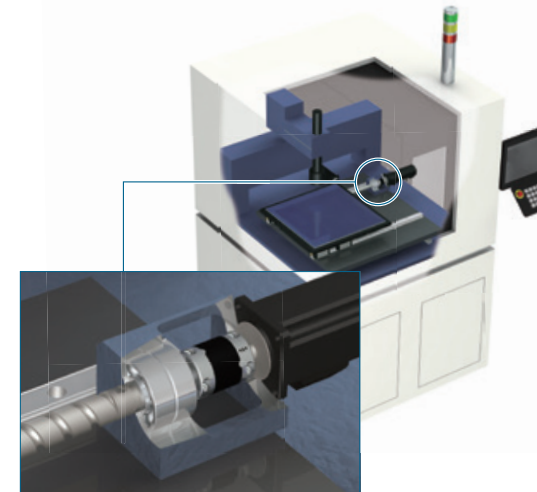
- Selection point: Excellent vibration absorption



Duplex image inspection machine

Device Problem
Production improvement (high throughput)

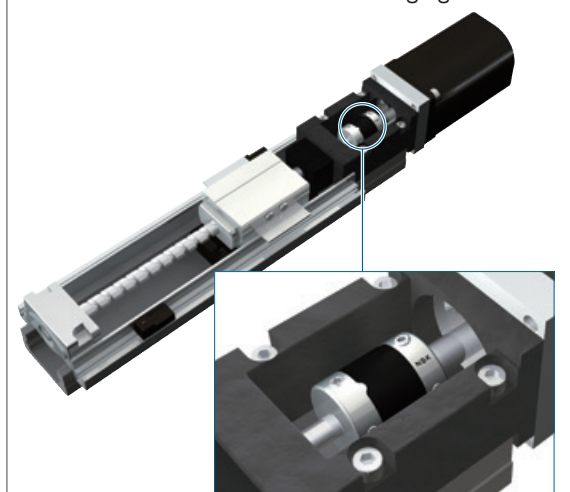
- Selection point: Reduction of the stabilization time by supporting high gain in servomotor



Single shaft actuator

Device Problem
Prevention of hunting when the servomotor is in high gain and space saving

- Selection point: Suppression of vibration when servomotor is in high gain



Solution to High Response

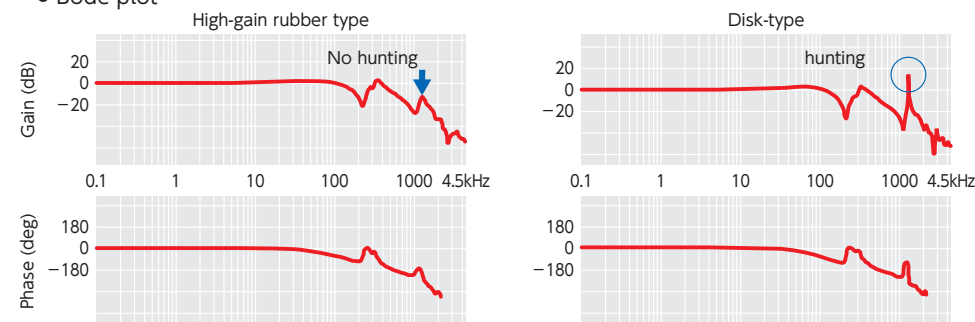
High-Gain Rubber Type Coupling XG2



1. Reduction of Stabilization Time

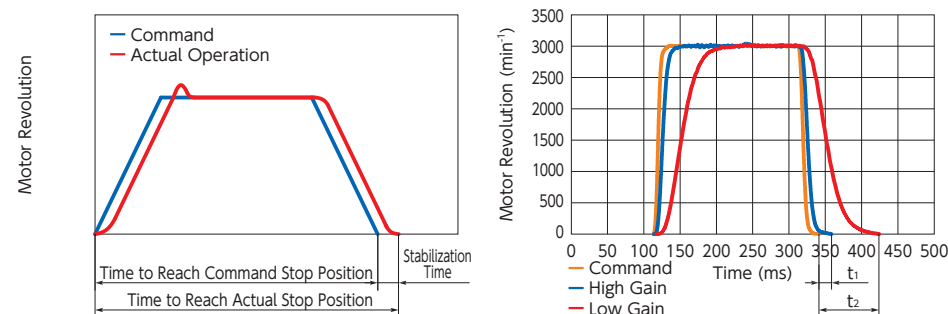
Improvement in servomotor's limit gain can reduce stabilization time.

• Bode plot



Hunting suppression

• Gain and stabilization time



Improvement in limit gain

• Measurement of stabilization time and overshoot

Gain*		XGT2-C	XGT-CS	Disk-type
25	Stabilization time (ms)	12	12	12
	Overshoot (μm)	0.4	0.9	0.6
27	Stabilization time (ms)	8	8	Occurrence of hunting
	Overshoot (μm)	0.6	1	
32	Stabilization time (ms)	3	Occurrence of hunting	Occurrence of hunting
	Overshoot (μm)	1.7		

* Values after adjustment of all gains including position control gain and speed control gain (1 - 32)

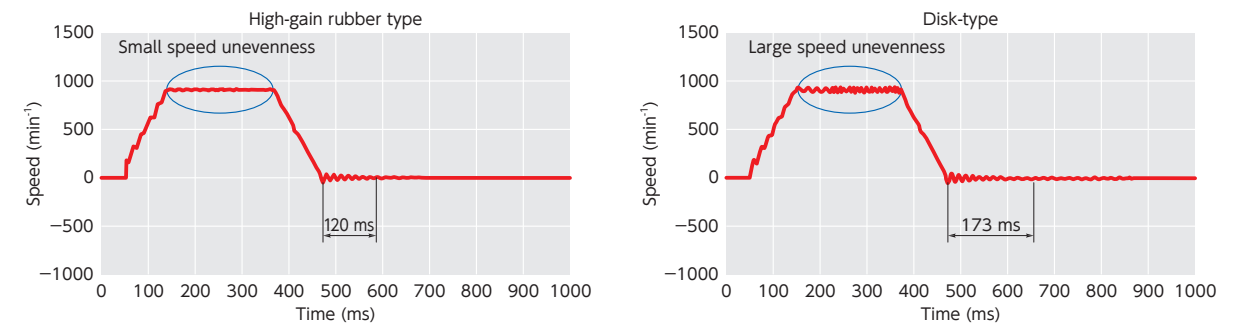
• The values in the table vary depending on the test conditions.

Reduction of Stabilization Time

Improved Productivity (Movie featuring comparison with disc-type is available on NBK website.)

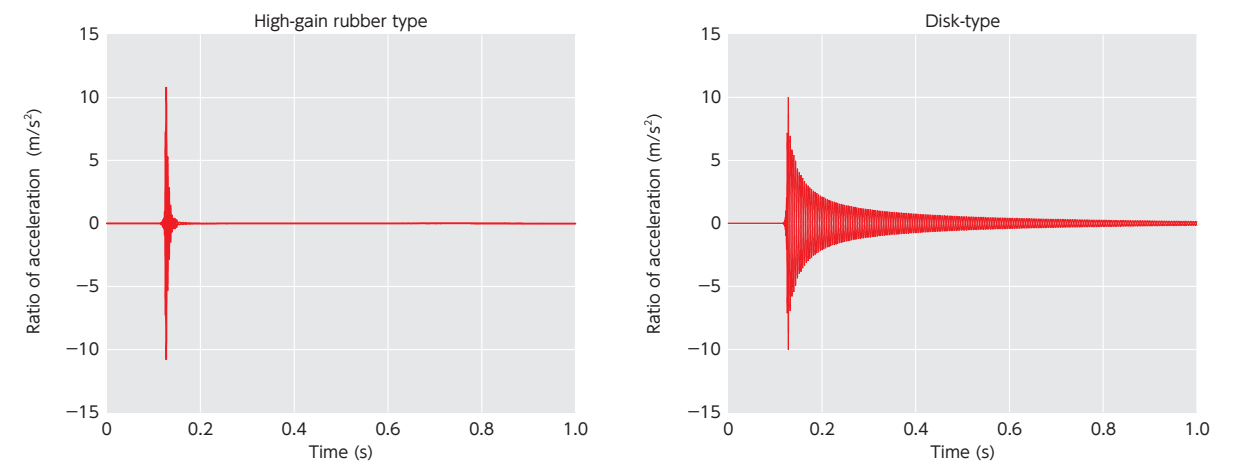
2. Speed Unevenness Suppression

Speed and torque unevenness arising from misalignment will be suppressed.



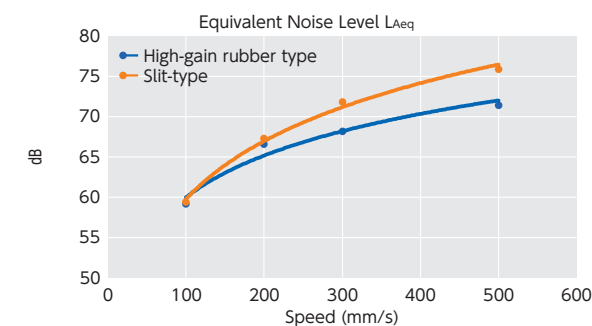
3. Vibration Suppression

High damping ratio will enable quick absorption of vibrations.



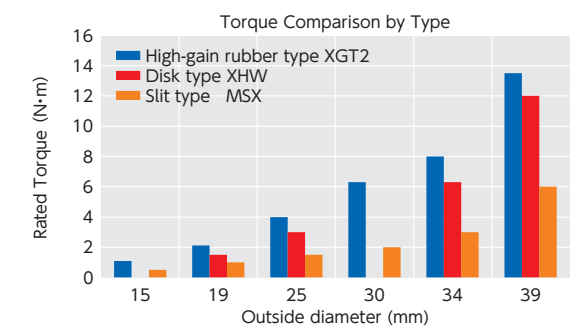
4. Quietness

Actuator drive noise can be reduced.



5. High Torque

High torque use is possible compared with disk-type and slit-type.



Technical Information

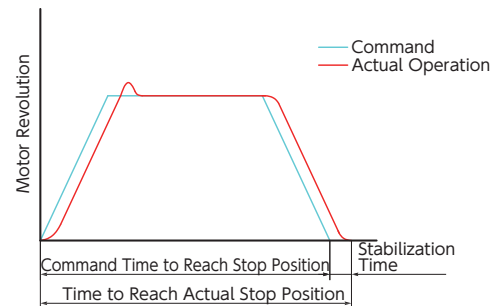
High-gain rubber types can improve productivity

● Productivity and stabilization time

In a production facility, using servomotor's and actuator's, operating these components accurately, as directed by the program, can lead to the improvement of productivity.

Reality, in actual operation, execution of commands may be delayed. For example, when trying to stop the actuator at a predetermined position, the actuator stops somewhat later than the command. We call this delay "stabilization time."

Since the operation does not shift to next process until the actuator completely stops, it is important to shorten the stabilization time to improve productivity.



● Gain and stabilization time of servomotor

Servomotor's gain is an indicator representing to what degree the motor operation can follow the command.

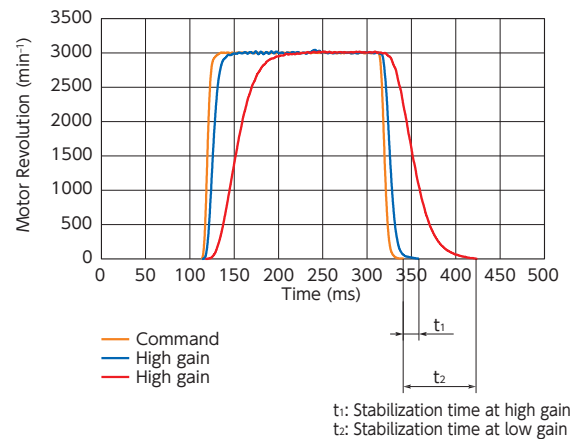
Although raising the gain can reduce the stabilization time, excessive gain increases are likely to cause hunting, thereby disable the control of the servomotor.

Raising the gain while suppressing hunting requires fine adjustment of respective parameters of the servomotor.

However, when a servomotor is combined with a coupling with a metal disk type in the elastic segment, raising the gain tends to cause hunting, making it difficult to resolve the problem by fine adjustments to parameters.

When hunting occurs, it is usually recommended to change to a more rigid coupling to increase the rigidity of the rotating system.

However, in reality, it is difficult to increase the rigidity of the entire rotating system including the ball screw simply by changing the coupling. So, changing to a highly-rigid coupling such as a disk-type may not be effective.



● High-gain rubber type

The high-gain rubber type can be used at higher gain than the disk type, enabling reduction of stabilization time.

In addition, the outstanding damping performance reduces the amount of troublesome parameter adjustments required, making it possible to make optimal actuator adjustments in a shorter time.

● Why does the high-gain rubber type allows higher gain setting than the disk type?

The main reasons can be understood from the bode plot.

Intersection point between 0 dB gain line the phase lag in the board wiring is -180 degrees is called the "gain margin".

As a general guideline, in servo systems, the gain margin should be 10 - 20 dB, and when the servomotor gain is increased, the gain margin decreases, with the risk of hunting occurs at 10 dB or lower.

A comparison at the disk type limit gain shows not only that the high-gain rubber type features a larger gain margin, but also that the gain margin is over 10 dB. This is why the high-gain rubber type allows greater servomotor gain than the disk type.

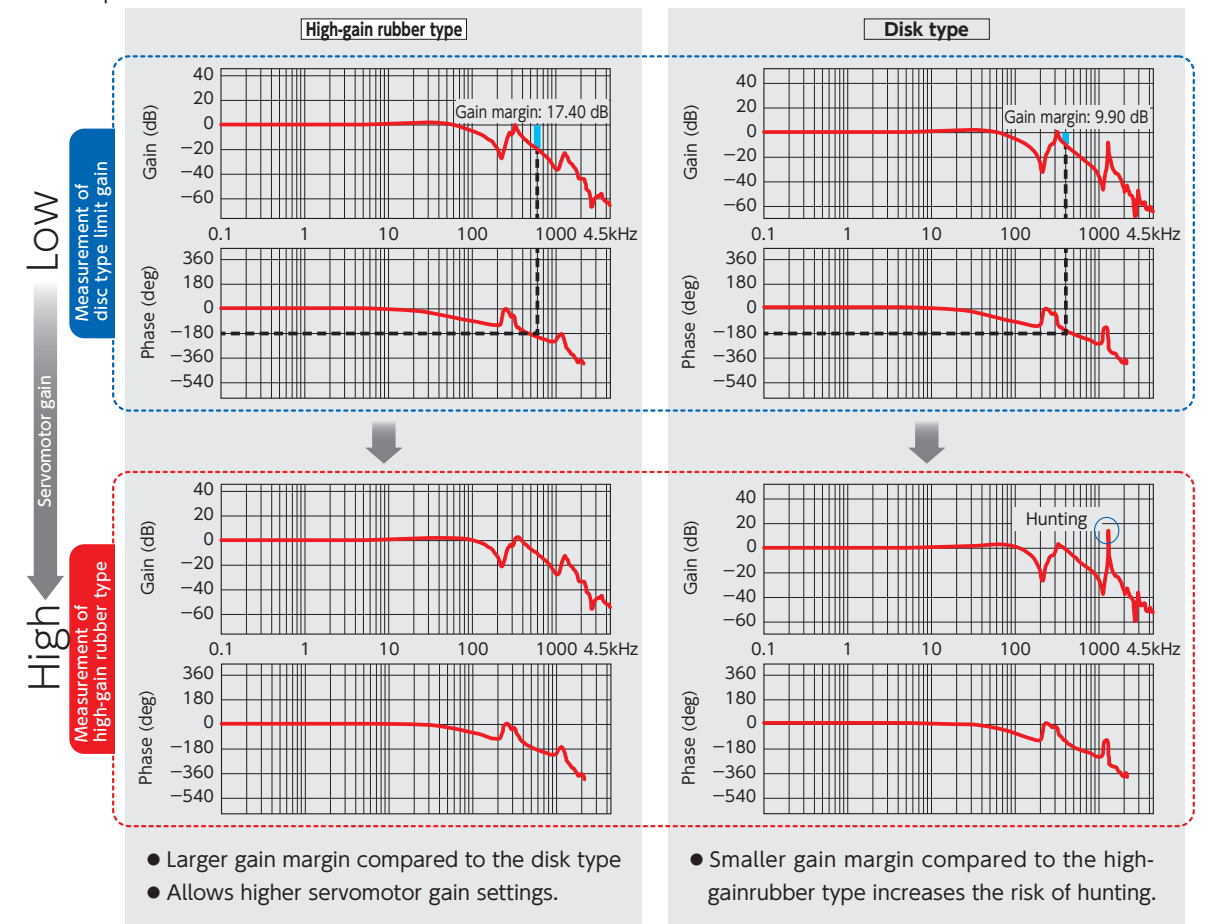
To increase the gain margin are that both coupling damping ratio and dynamic rigidity are high.

Gain margin at the disk type limit gain

High-gain rubber type : 17.40 dB

Disk type : 9.90 dB

● Bode plot





Please visit our web site.

<https://www.nbk1560.com/>

Customer Service

USA and Canada

NBK America LLC

<9:00 to 17:00 on weekdays, Eastern Standard Time>

phone: **+1 (484) 685-7500**

fax: **+1 (484) 685-7600**

Asia and Europe

Nabeya Bi-tech Kaisha

<8:00 to 17:00 on weekdays, Japan time>

phone: **+81-575-23-1162**

fax: **+81-575-23-1129**

Nabeya Bi-tech Kaisha

Head Office / Seki Garden Factory 1, Toko-Taichi, Seki City, Gifu 501-3939, Japan

phone: +81-575-23-1121 fax: +81-575-23-1129

Sales Office Tokyo - Osaka - Chubu

NBK America LLC

421 Feheley Drive, Suite B, King of Prussia, PA 19406-2658 USA

phone: +1 (484) 685-7500 fax: +1 (484) 685-7600

- The dimensions, shapes, and other standards described in this catalog are subject to change without notice due to the improvement.
- Compensation for the damage caused by the defects of products described in this catalog shall be recompense at purchased price.
- Although this catalog is correctly described, we are not responsible for the damages caused by typographical errors and omissions.