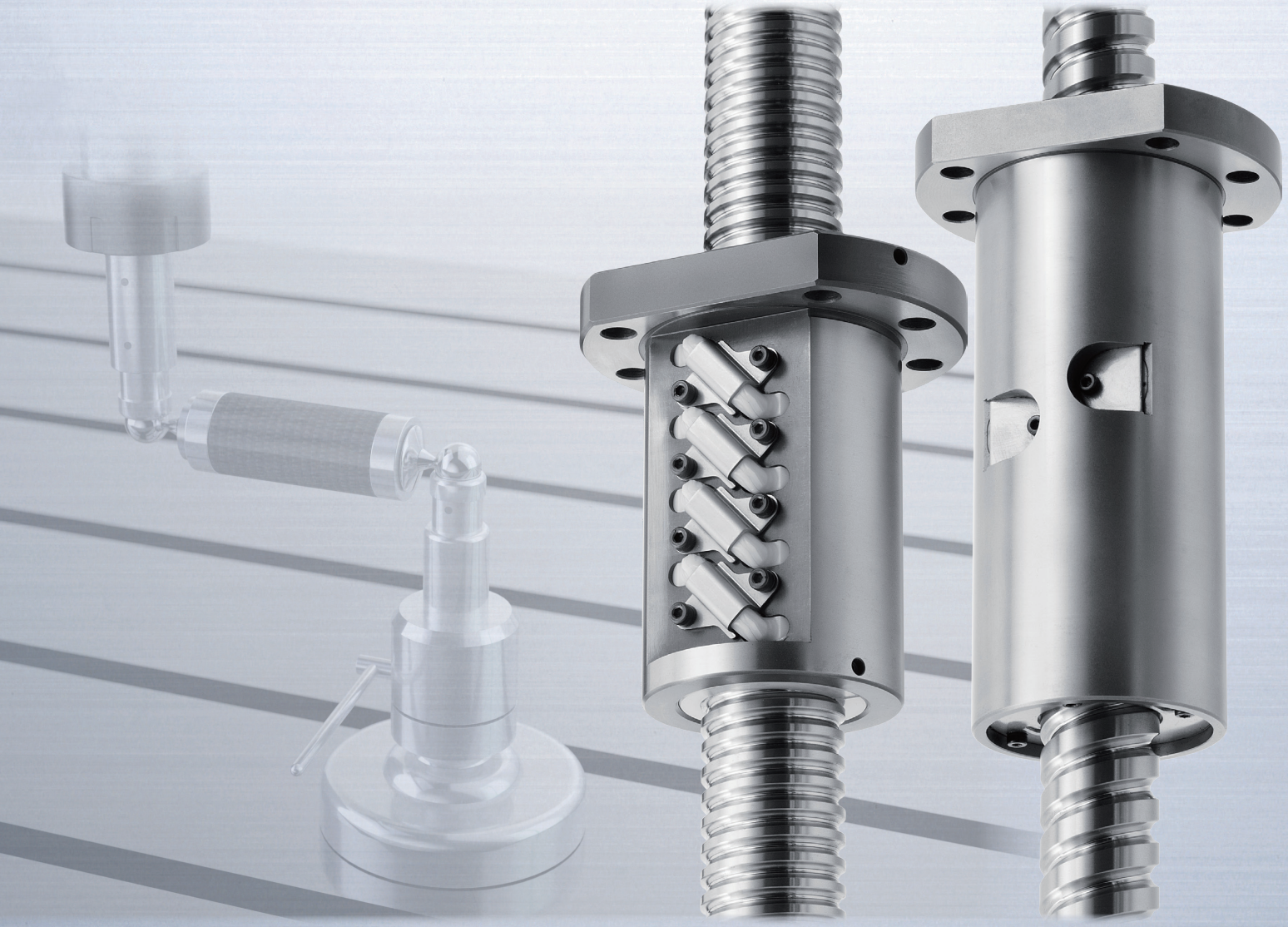
MOTION & CONTROL™
NSK

Ball Screws For High-Accuracy Machine Tools

New!

Patent pending

Reduced motion errors help improve machine tool productivity through higher quality surface finishes.



■Features

1. Stable friction during reversals of ball screw direction

Building on exclusive analysis and manufacturing technologies, NSK has pioneered internal specifications that reduce fluctuations in friction when a ball screw reverses direction.
This helps achieve smoother motion when switching quadrants in circular interpolation machining and similar applications.

2. Reduced motion errors contribute to better surface quality

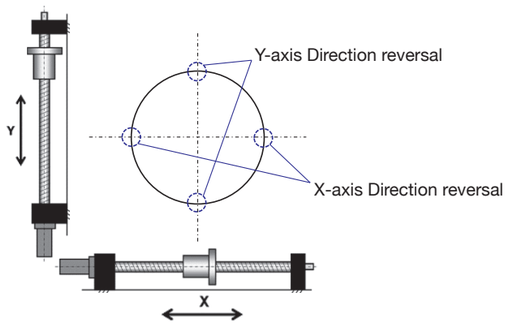
By combining this technology with servo controller compensation, ball screws with quadrant glitch control significantly reduce errors, helping machine tools achieve a high-quality finished surface.

Optimized Internal Specifications Reduce Quadrant Glitches

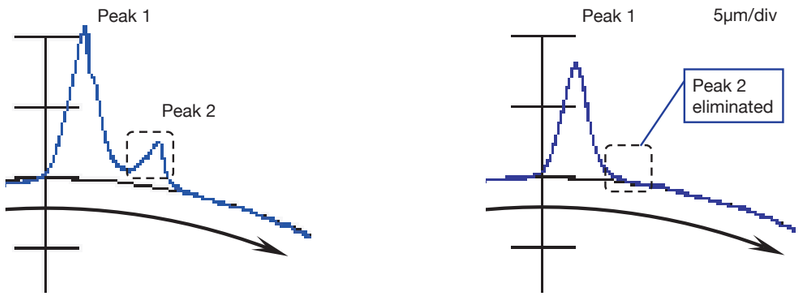
Stable Drive Torque During Reversals Eliminates a Quality Roadblock

In typical ball screws, when the drive system reverses direction, the motor cannot maintain proper tracking for the resulting sudden changes in friction characteristics (driving torque). This causes motion errors called “quadrant glitches” that leave streaks on the surface of the workpiece requiring additional machining. When using ball screws with two points of contact, quadrant glitches appear as two error peaks.

Though this problem was thought to be unavoidable, these ball screws with quadrant glitch control eliminate the “low torque area” characteristic of typical designs. This advancement completely erases the 2nd peak and improves surface finish quality through smooth motion.



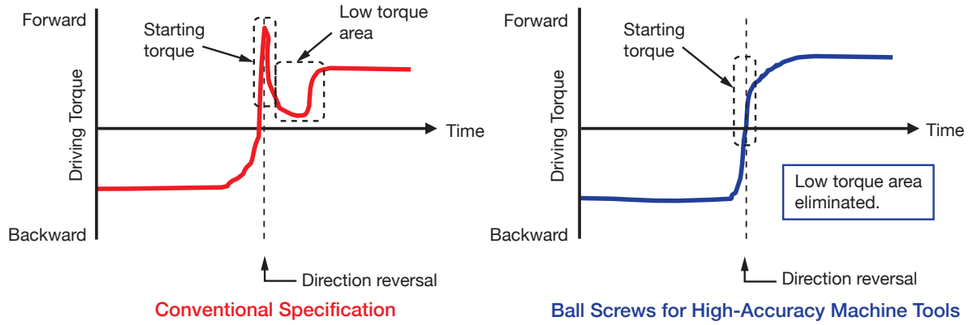
Reversal of circular interpolation direction



Conventional Specification　　Ball Screws for High-Accuracy Machine Tools

Example circularity error when reversing direction of circular interpolation

Test conditions : Ball screw shaft dia. = ϕ36 mm, Lead = 16 mm
Radius of circular interpolation = 10 mm, Peripheral velocity = 300 mm/min

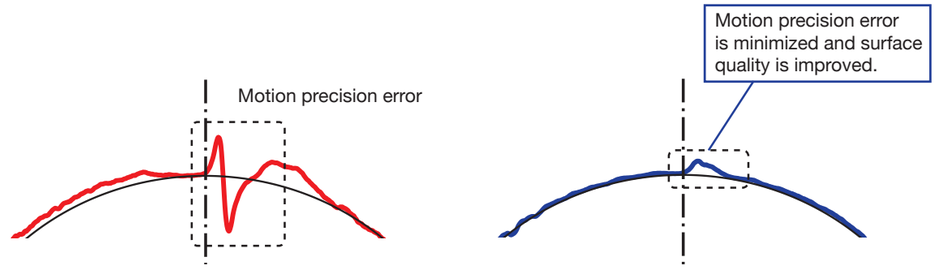


Conventional Specification　　Ball Screws for High-Accuracy Machine Tools

Variation of drive torque during direction reversal (schematic)

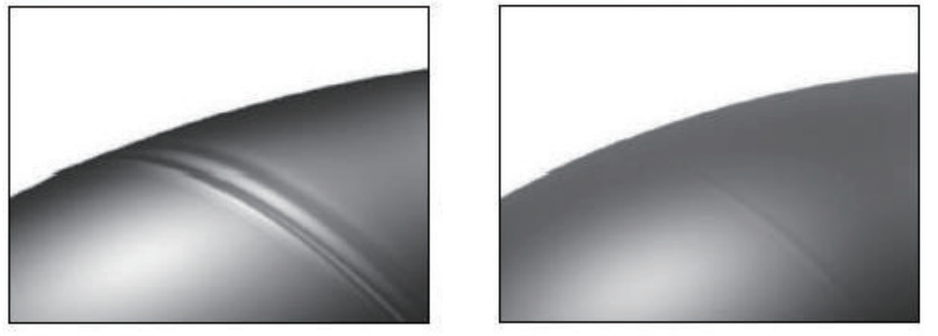
Improving the Effectiveness of Controller Compensation for Motion Errors

Controlling the 2nd peak with the ball screw itself allows the servo controller to better correct for the 1st peak. As there’s no need to correct for the 2nd peak, control parameters can be identified more easily, greatly reducing quadrant glitches overall. With simplified controller compensation, machine tools can achieve a higher quality finished surface.



Conventional Specification　　Ball Screws for High-Accuracy Machine Tools

Motion precision error after servo control correction (schematic)



Conventional Specification　　Ball Screws for High-Accuracy Machine Tools

Enlarged view of machined surface (representation)

Compatible with Existing Mountings

Mountings are fully interchangeable with those of conventional products, allowing ball screws for high-accuracy machine tools to be used without costly equipment changes.

Design Precautions

- The relationship between preload, dynamic preload torque, and nut rigidity for this product is different than that for conventional ball screws.Please contact NSK for details.
- Machined surface quality is affected by various factors. This product is designed to improve surface quality by suppressing the 2nd peak of quadrant glitches that occur when using ball screws with offset preload or double-nut preload.
  This product may not improve the quality of machined surfaces affected by other factors.

Applicable Specifications

Shaft Dia. and Lead	Shown in table below.
Accuracy Grade	C0 to C5
Preload Type	• Offset preload (Z preload) • Double-nut preload (D preload) • Spring double-nut preload (J preload)
Recirculation System	All

Shaft Diameter/Lead (mm)

Dia. \ Lead	5	6	8	10	12	16	20	25	32
25	○	○	○	○	–	–	–	–	–
28	○	○	○	○	–	–	–	–	–
32	○	○	○	○	○	–	–	–	–
36	○	○	○	○	○	○	–	–	–
40	○	○	○	○	○	○	–	–	–
45	○	○	○	○	○	○	○	–	–
50	○	○	○	○	○	○	○	○	–
55	–	○	○	○	○	○	○	○	–
63	–	○	○	○	○	○	○	○	○

○ : Available (Excludes some ball diameters. Please contact NSK for details.)

For more information about NSK products, please contact: **www.nsk.com**

Eco-awareness and reliability in motion™

NSK used environmentally friendly printing methods for this publication.

CAT. No. E3247 2024 Z-10 Printed in Japan ©NSK Ltd. First edition published in OCT. 2024