



Solutions and Case Studies

for Mechanical Designers

SEMI
CONDUCTOR
MANUFACTURING EQUIPMENT
SOLUTION | **55**
CASES



CONTENTS

This booklet offers
lots of information about our technology to
help you resolve any issues you may have.

Contact us if you still require
additional support.

We are happy to help solve any problems.

Detailed information on our products can be retrieved from the product number on the NBK website.
The QR codes in each section can also be used.

01 **Industry Trends and NBK's Actions** 2

Introducing the issues NBK has been solving, based on information on the current industry trends.

02 **Search Issue Solutions and Case Studies by equipment** 6

Explanations of how to handle special environments such as vacuum,
high temperatures, and chemical adherence, sorted by equipment.

03 **Search Issue Solutions and Case Studies by manufacturing process** ... 22

Introducing issues and solution examples needed for various machinery and parts,
sorted by process.

04 **Search Issue Solutions and Case Studies by environment** 28

Discussing important design points for the severe environments within
semiconductor manufacturing equipment, such as vacuum, gas, and electron beams.

05 **Solving complex problems using engineering capabilities Examples of Special Solutions** ... 38

Introducing examples of special solutions for various complex problems, based
on flexible engineering capabilities.



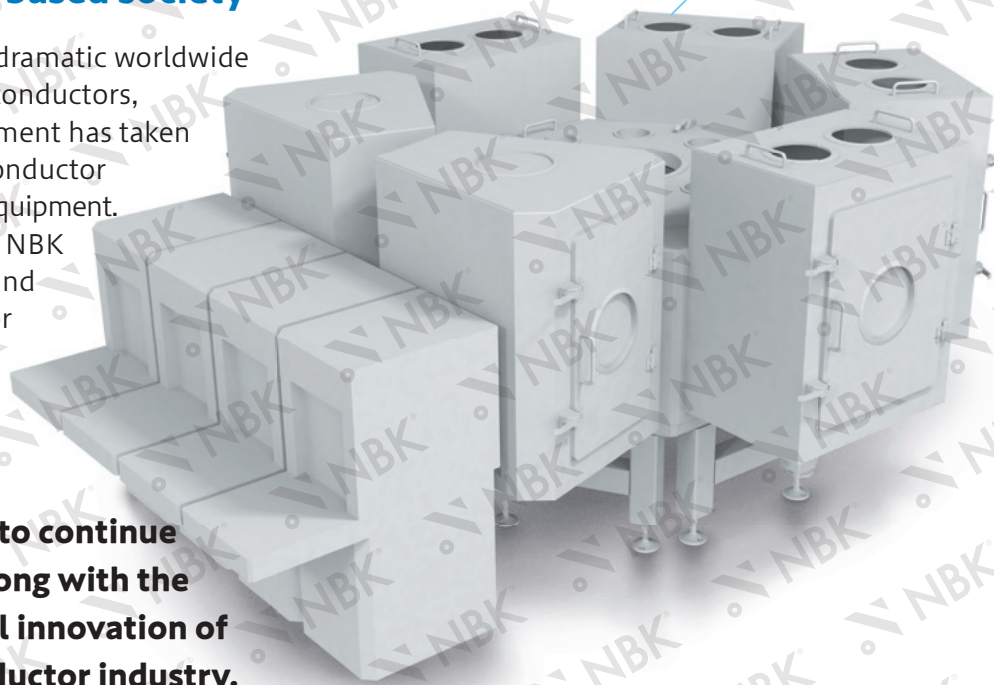
01
Special feature

Industry Trends and NBK's Actions

Semiconductors, the so-called "bread of industry," are essential for the data-based society

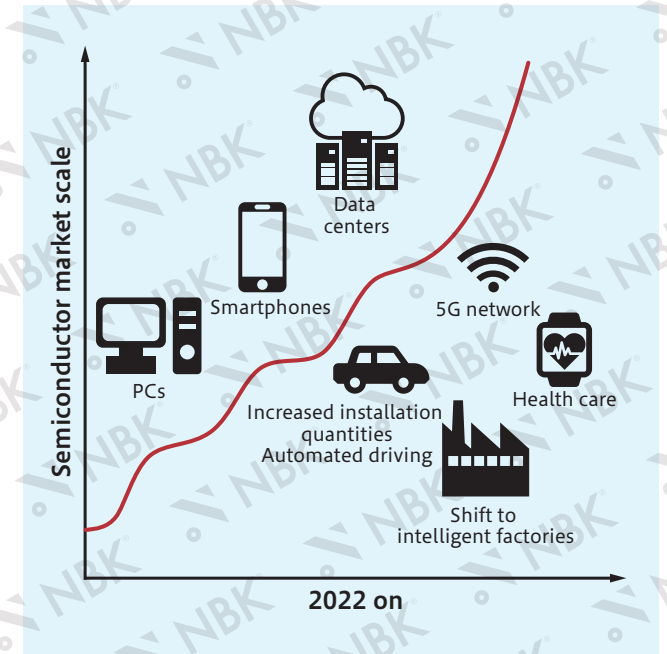
Along with the dramatic worldwide growth of semiconductors, similar development has taken place for semiconductor manufacturing equipment. For many years, NBK has developed and sold products for semiconductor manufacturing equipment.

NBK intends to continue its growth along with the technological innovation of the semiconductor industry.



01 Semiconductor industry facts as of 2022

In recent years, due among other things to the novel coronavirus, the shift to a data-based society has picked up speed, including remote work, online classes and medical consultations, video streaming services and so on. Additionally, the demand for semiconductors is expected to increase even further, due to the 5G network, the increase in data centers, the shift to intelligent factories, the increase in semiconductors installed in automobiles and so on.



02

Toward realizing a carbon-neutral society

Semiconductors' evolution is a source of expectations toward realizing a carbon-neutral society. In order to realize this carbon-neutral society, energy-saving in every field, via devices using semiconductors, is an essential step. Higher semiconductor performance and greater mass production are urgent issues.

Therefore, semiconductor manufacturing equipment
**is surely also called on for
higher precision, higher quality, and greater throughput.**

Semiconductor manufacturing issues resolved by NBK

As semiconductor manufacturing equipment tends toward increased precision, quality, and throughput, special requests for the screws used in the equipment are increasing as well. NBK offers a wide lineup including characteristics such as corrosion resistance, heat resistance, non-magnetism and so on, responding to various requests. In addition, NBK handles everything from requests from semiconductor manufacturing equipment manufacturers through product development and standardization.

High Quality
High Precision
High Throughput

Request example 01

Screws with seizing prevention which will not contaminate a vacuum chamber are required

Customer Comments

In the clean environment inside vacuum chambers, the friction coefficient of male and female screws goes up, increasing the likelihood of screw seizing and galling, which causes problems. Surface coated screws, the conventional seizing/galling countermeasure, cannot be used because of the risk of contamination due to coating peeling. Screws with seizing prevention which will not contaminate vacuum environments are required.

Here Development of Special Surface Hardened Screws

Galling and seizing are prevented by curing the screw surface. Unlike plating or coating, there is nothing adhering to the surface, eliminating concerns about contamination due to stripping when tightening.

Surface Hardened Screws (SUS316L)

NSNL-PN



Surface Hardened Screws (With Ventilation Hole)

SVSL-PN



Request example 02

Screws with higher corrosion resistance than Hastelloy

Customer Comments

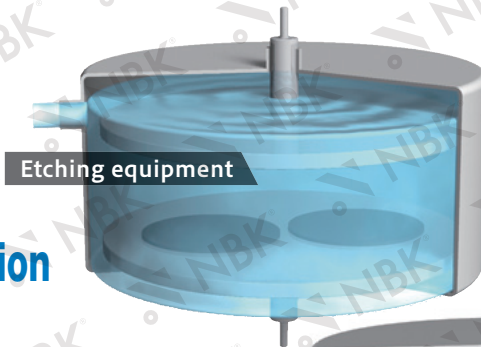
Etching equipment and coating equipment sometimes use more corrosive plasma gas than in the past, so that even the Hastelloy screws now in use corrode and cause problems.

Here Production of MAT21 screws

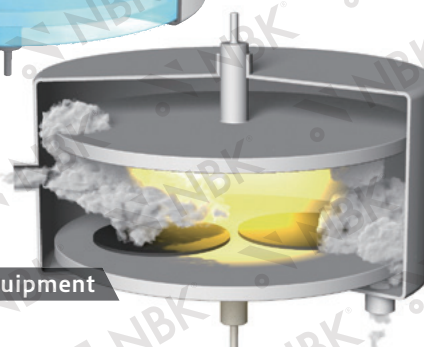
MAT21*1 demonstrates excellent corrosion resistance in both oxidizing and reducing environments. In a wide range of corrosive environments, it demonstrates better corrosion resistance than Hastelloy*2C-22 and C-276.

*1: MAT and MAT21 are registered trademarks of Hitachi Metals, Ltd. *2: Hastelloy is a registered trademark of Haynes International, Inc.

Etching equipment



Coating equipment



Hex Socket Head Cap Screws (MAT21)

SNSMT



Request example 03

Screws with higher strength than resin which will not corrode due to cleaning agents

Customer Comments

Environments inside wafer cleaning equipment, exposed to cleaning agents, require chemical resistance and thus generally use plastic parts. However, tightening force is required in some locations, calling for the use of stronger metal screws rather than plastic screws. That said, standard metals will corrode or melt when exposed to cleaning agents. Screws made of materials with high chemical resistance and high strength are required.

Wafer cleaning equipment



Here Development of tantalum and silicon carbide screws

Tantalum is a material characterized by excellent chemical resistance; with excellent corrosion resistance to strong acids such as sulfuric acid, it is also resistant to aqua regia. Silicon carbide has excellent resistance to chemicals, including ammonia water, hydrogen peroxide water, hydrofluoric acid, and 50% sulfuric acid.

Surface Hardened Screws (Tantalum)

SNSTA



Slotted Pan Head Screws (Silicon Carbide)

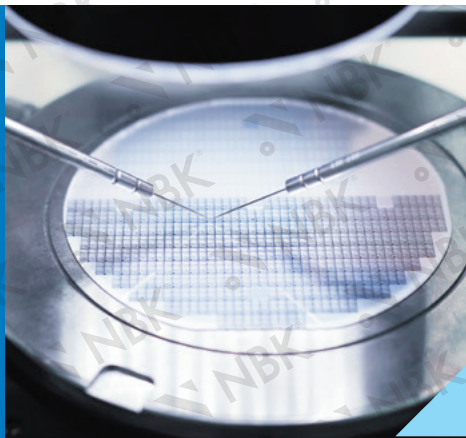
SICX-SX



02

Search Issue Solutions and Case Studies by equipment

Explanations of how to handle special environments such as vacuum, high temperatures, and chemical adherence, sorted by equipment and processes.



1

Equipment interior overall

01 Tools that can be used even in narrow working spaces are required

Learn More → P.8



02 Tools that can be used even in locations where magnetization must be avoided are required

Learn More → P.9



03 Devices must be firmly connected

Learn More → P.9



04 Screws that will not affect communication are required

Learn More → P.10



05 Improved coupling insulation properties are required

Learn More → P.10



06 Screws that can be used in limited spaces are required

Learn More → P.11



07 High-speed control of raising / lowering shafts, suppressing hunting, is required

Learn More → P.11

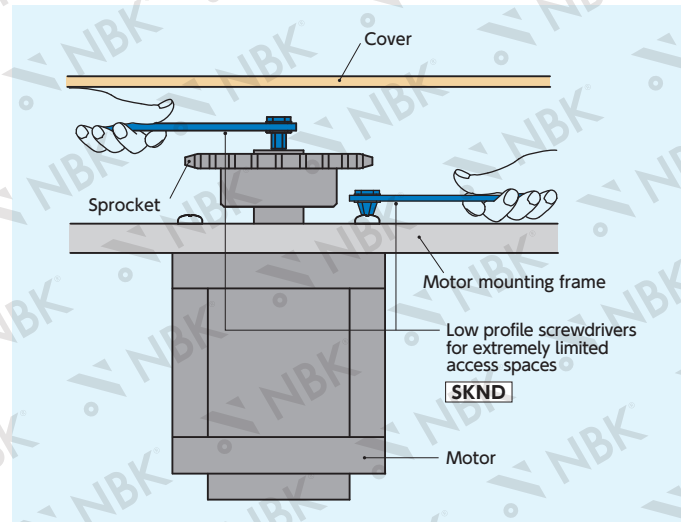


Q:01

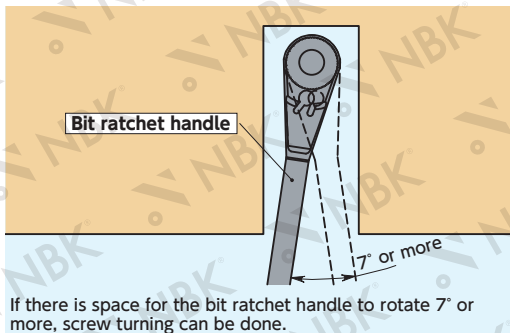
Tools that can be used even in **narrow working spaces** are required

A: Tools optimized for working in narrow spaces are available

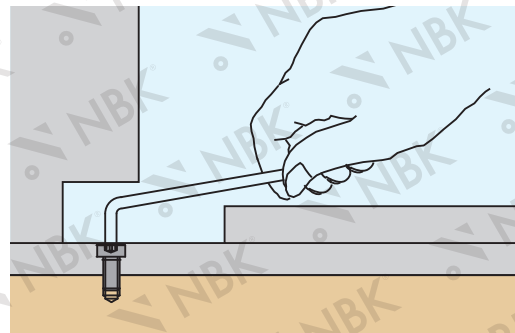
Tools with reduced height dimensions are available. Required working space is decreased, so device/equipment structure can also be made more compact.



► For Extremely Limited Access Spaces
Low Profile Screwdriver
SKND



► For Extremely Limited Access Spaces
Bit Ratchet Handle Set
SKNBR-6.35-8SET



► For Extremely Limited Access Spaces
Hexalobular Wrench
SKX-N



Q:02

Tools that can be used even in locations where **magnetization must be avoided** are required

A: Non-magnetic tools are available

Suitable for assembly and maintenance of equipment and devices in environments with strong magnetic fields. They can also be used on devices for which magnetization must be avoided.



► Non-magnetic
Titanium Hexagon Key
SKHTG



► Non-magnetic
CFRTPT Adjustable Wrench
SKMWCP-200

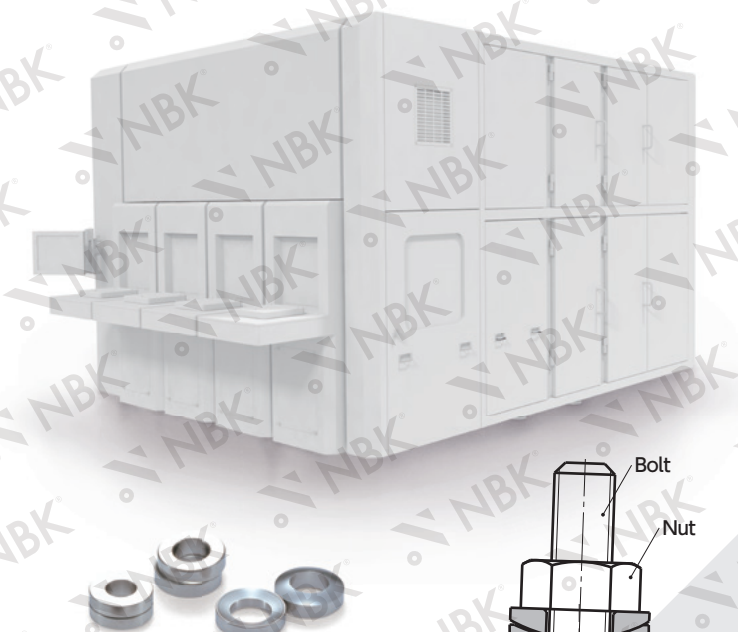


Q:03

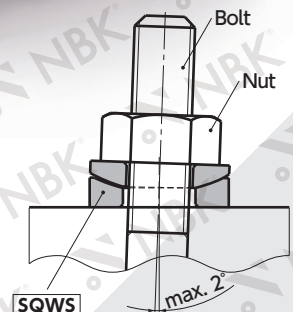
Devices must be **firmly connected**

A: Washers which can correct an alignment mismatch between the bolt and seating surface, occurring frequently when connecting equipment, are available

When connecting two pieces of equipment, the use of spherical washers absorbs any bolt tilting, enabling reliable fastening.



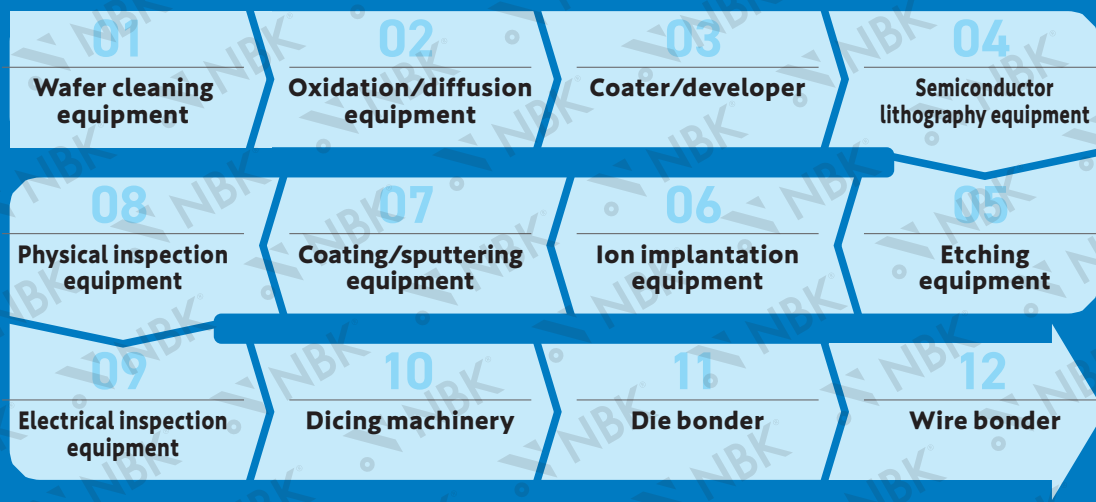
► Spherical Washers
SQWS



03

Search Issue Solutions and Case Studies by manufacturing process

Because equipment interior environments vary widely by process in semiconductor manufacturing, the performance required of machinery and parts also differs by equipment and process. Here we present case studies of issue solutions by process and equipment.



01. Wafer cleaning machinery

Cleaning process

▶ Component corrosion prevention is required

Screws with superior chemical resistance can be selected to withstand environments within equipment where chemicals are applied.

Characteristics required for special screws: **Chemical resistance**



▶ Tantalum

Special Material Screws
SNSTA



▶ PEEK

Plastic Screws
SPE



▶ Silicon Carbide

Special Material Screws
SICX-SX



▶ Ceramic

Special Material Screws
SCX



▶ VESPEL

Plastic Screws
SPDC



02. Oxidation/diffusion equipment

Heat treatment/oxidation/diffusion process

▶ Resistance to high temperatures and chemicals is required

For environments where various gases are used at high temperatures, screws with excellent heat resistance and chemical resistance are effective.

Characteristics required for special screws: **Heat resistance**

Chemical resistance

▶ Tantalum

Special Material Screws
SNSTA



▶ MAT21

Special Material Screws
SNSMT

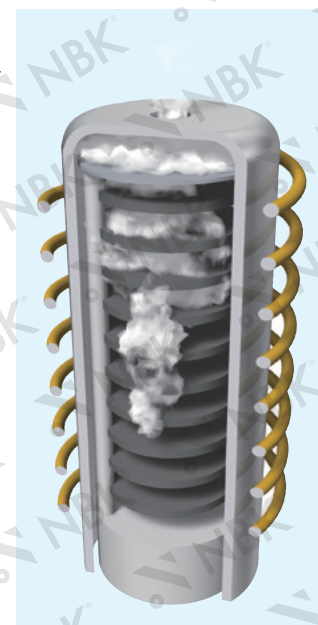


▶ Inconel 600 equivalent

Special Material Screws
SNSI



* Inconel is a registered trademark of Special Metals Corporation.



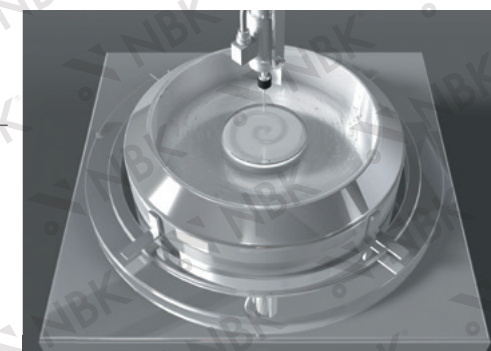
03. Coater/developer

Film formation process

▶ Improved production capacity is required

High-rigidity couplings are effective for the high-speed rotation required for photoresist film formation on the wafer.

Characteristics required for couplings: **High rigidity**



▶ High Rigidity

Disk Coupling
XHW-C



▶ Vibration-Absorption Capable Disk Type

Flexible Couplings
XGHW-C



▶ Component corrosion prevention is required

Screws with superior chemical resistance can be selected to withstand environments within equipment where chemicals are applied.

Characteristics required for special screws: **Chemical resistance**

▶ Inconel 600 equivalent

Special Material Screws
SNSI



▶ VESPEL

Plastic Screws
SPDC



* Inconel is a registered trademark of Special Metals Corporation.