



Contributing to a Society where Humans and Robots Coexist through Advanced Technological Capabilities and Innovative Solutions

Introducing Our Products for the Robotics Industry

Att. No.385E • 07-2026



The need for automation and labor-saving solutions, along with the development of new technologies, is driving up demand for robots.

Current challenges facing Japan and other countries

- A worsening labor shortage caused by declining birthrates and an aging population
- The need to improve productivity amid intensifying global competition
- Long working hours, death caused by overwork, and mental health issues are becoming increasingly significant



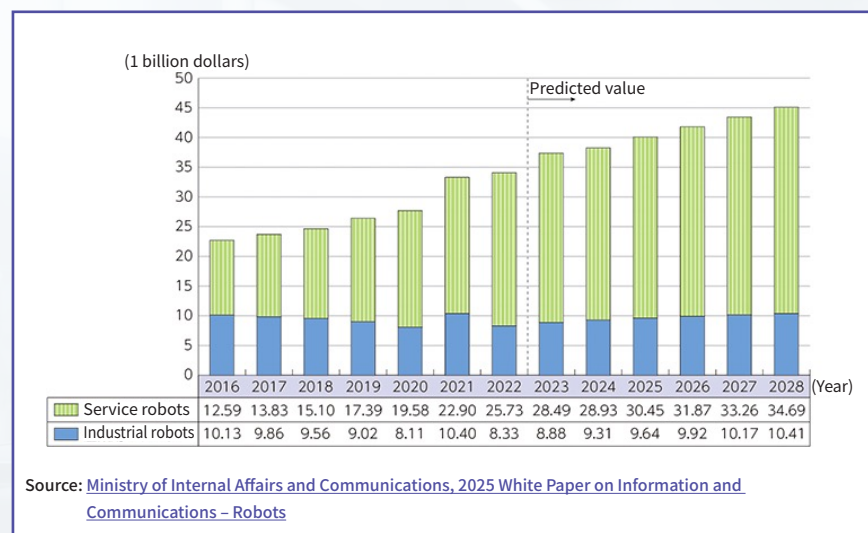
Roles expected of robots going forward

- Expanding beyond manufacturing into the three major process sectors (food, pharmaceuticals, and cosmetics) and the service sector
- Improving operational efficiency through automation while reducing costs and enhancing quality
- Contributing to better working environments through the application of AI (Artificial Intelligence) and IoT (Internet of Things) technologies

► The NOK Group offers a range of products tailored to customer needs.

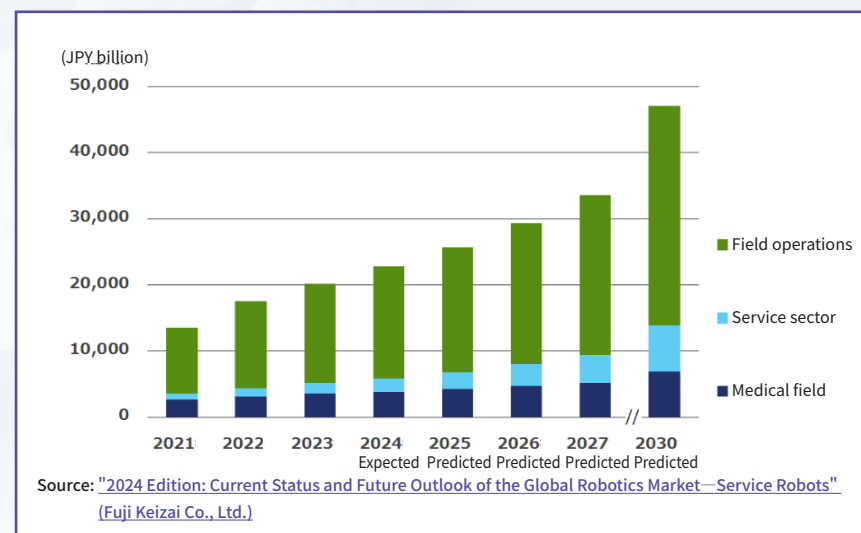
Forecasts for the Robotics Market

Trends and Forecasts for the Global Robot Market



The robotics industry is expected to nearly double in size by 2028, primarily due to growth in the service sector.

Global Market for Service Robots



The field operations sector (drones, unmanned helicopters, and transport robots) is anticipated to increase significantly in the global market.

Advancement of AI and Communication Infrastructure is Broadening the Scope of Robot Applications

Industrial robots



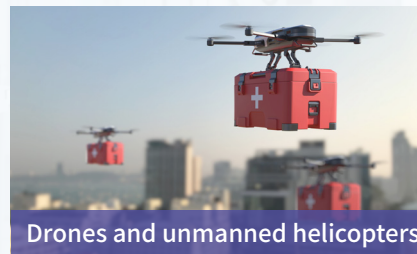
Factory automation robots



Collaborative robots



Medical robots



Drones and unmanned helicopters



Communication robots

Service robots



Agricultural robots



Transport robots (AGV/AMR)



Assist suits



Disaster-response robots



Humanoid robots



Infrastructure management robots

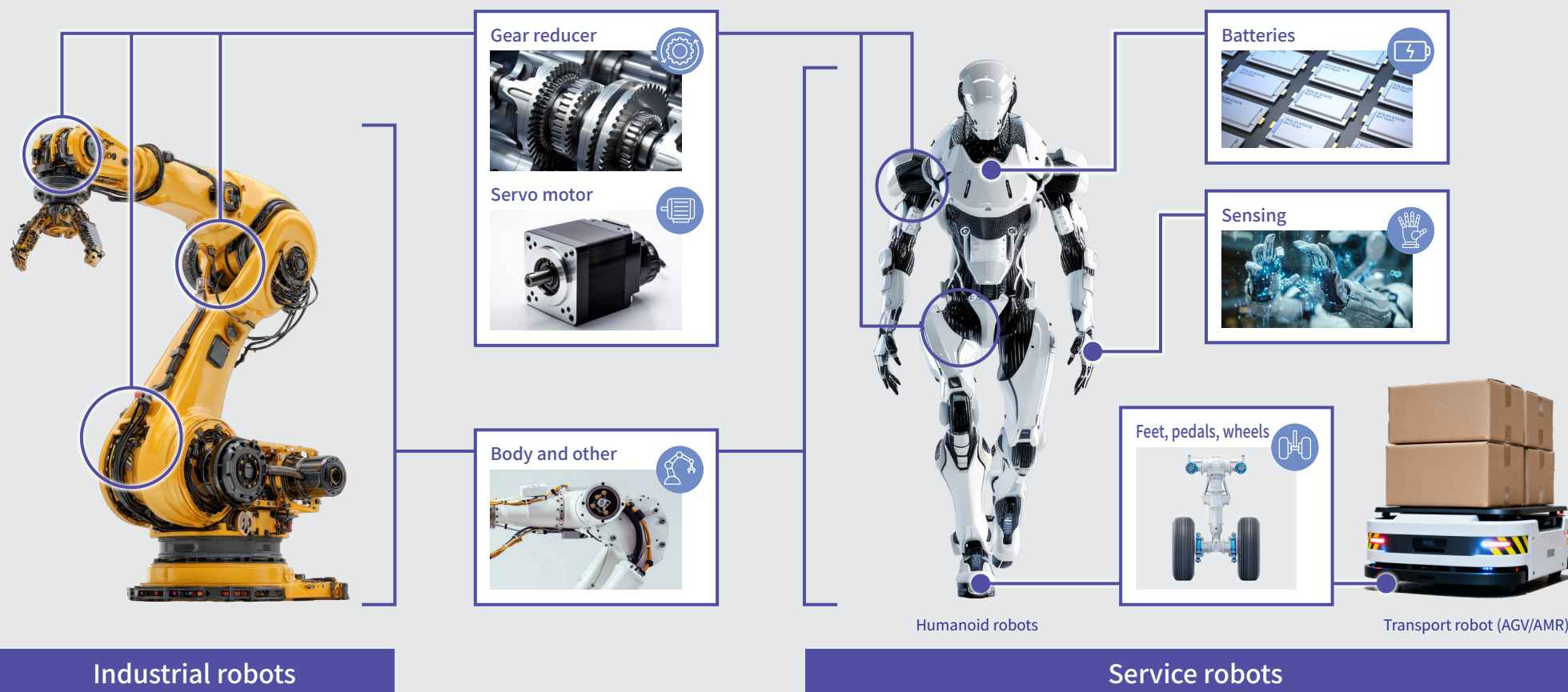
Future Trends in Robotics Capabilities



(1) Durability	A durable design capable of withstanding prolonged operation in harsh environments is required.
(2) Reduction in size and weight	Battery life must also be increased to facilitate mobility and operation
(3) Measures against heat	Measures against heat are necessary because excessive heat can deteriorate parts (such as batteries) and result in equipment failure
(4) Low noise	There is a need to improve workplace comfort and comply with noise regulations
(5) Improved work efficiency	Work procedures that are easy for collaborative robots to perform are required
(6) High precision	Collaboration with AI and machine learning is required to obtain human-like precision in tasks and delicate processes

NOK Group products

can be used in a wide range of unit designs for various types of robots



We help to enhance the overall performance of robots with a product lineup that is crucial to robotics functionality.

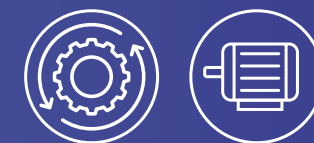
NOK Group Lineup of Robot-Related Products

Robotics Features Trends	NOK Group Products		Applicable Units					
	Click the product name marked with ► to go to the product information page.		Gear reducer	Servo motor	Body and other components	Batteries	Sensing	Feet, pedals, wheels
(1) Durability	► Contamination-resistant oil seal	...P8	☐	☐				
	► Low-friction oil seal	...P9	☐	☐				
	► Robot lubricants	...P10	☐		☐			
	► Extremely high load grease	...P11	☐					
	► Dust cover boots	...Web Web			☐			☐
	► Low-friction fabric-covered tooth belt	...P12			☐			
	► Flame retardant insulating rubber	...P13				☐		
	Open-cell polyurethane foam sheet					☐		
(2) Reduction in size and weight	► Flexible printed circuits (FPC)	...Web Web		☐	☐			
(3) Measures against heat	► Thermally conductive material QLEASE™ series	...P14-18		☐		☐		
	► Pressure control valve series	...P19-24			☐	☐		
	► Heat-resistant FPC	...P25			☐			
(4) Low noise	► High damping rubber HDR™	...P26			☐			☐
	► Polyurethane elastomer products IRON RUBBER™	...P27			☐			☐
(5) Improved work efficiency	► Silicone-film-coated O-ring	...P28		☐	☐			
	► Rubber-coated metal gaskets SOFT METAL™	...P29		☐	☐			
	Adhesive urethane gasket				☐	☐		
(6) High precision	► Biosignal rubber electrode Sotto™ series	...P30-32					☐	
	► Stretchable FPC	...P33					☐	
	► High-frequency FPC	...P34					☐	

Durability

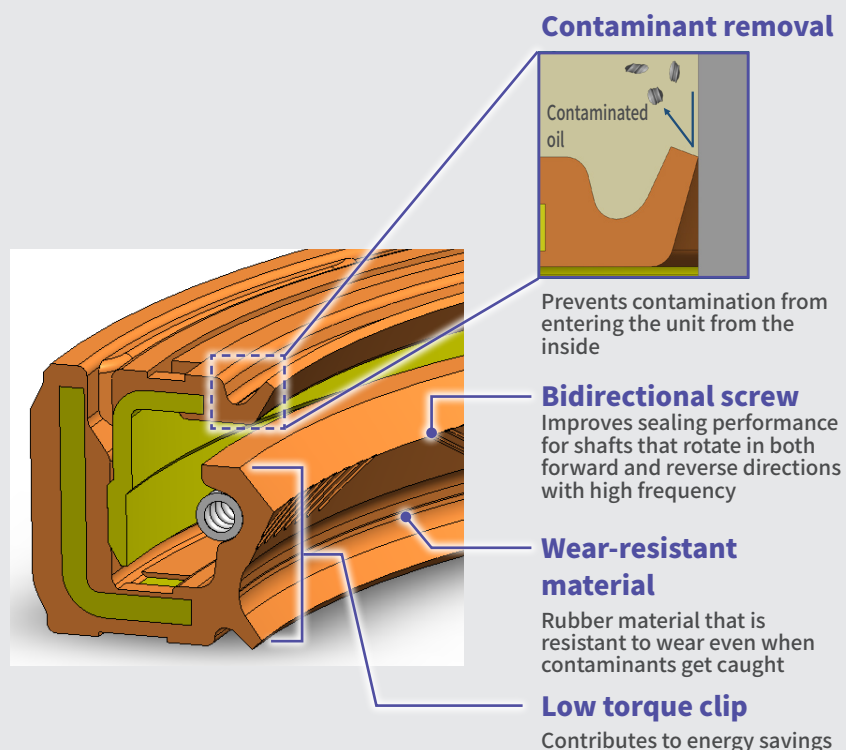
Contamination-resistant oil seal

► Provides resistance to contamination in oil and grease



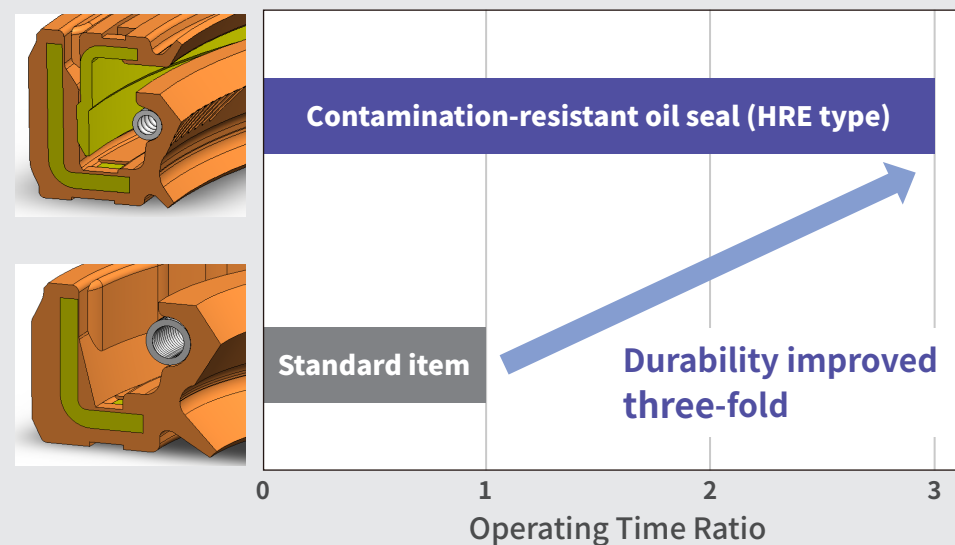
Gear reducer Servo motor

Role of each part



Comparison of durability with standard product

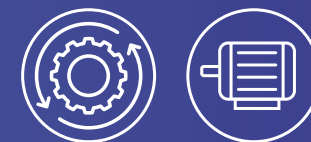
It features a bidirectional screw, wear-resistant materials, and a low-torque lip, making it nearly three times more durable than the standard product.



Durability

Low-friction oil seal

- ▶ Reduces friction and frictional heat, leading to better fuel economy and lower energy use



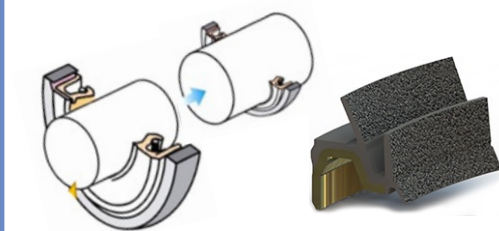
Gear reducer Servo motor

Low-friction oil seals contributes to the global environment through low-friction technology



Four friction-reduction technologies

Shape design technology

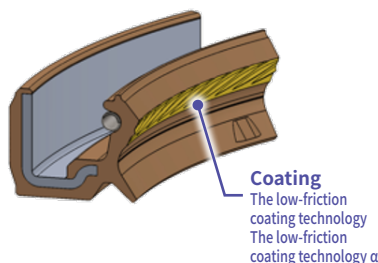


Small cross section

Texturing the lip

Reduces friction, lowering the load on the lip

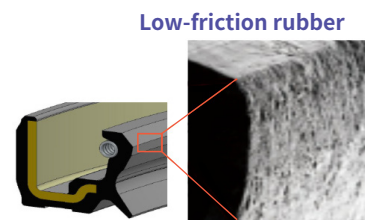
Surface function design technology



Coating
The low-friction coating technology
The low-friction coating technology α

Applies a low-friction coating to the sliding surface of the lip, reducing the coefficient of friction

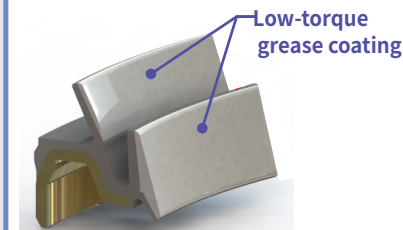
Material design technology



Low-friction rubber

Optimizes the unevenness of the sliding surface to reduce the coefficient of friction under fluid lubrication

Grease design technology



Low-torque grease coating

Reduces the coefficient of friction by improving fluidity during operation

Durability

Robot Lubricants

Klübersynth GE 44-51

▶ Enhances durability with superior wear resistance, reducing maintenance frequency



Gear reducer



Body and other

Excellent wear resistance for harsh operating environments such as robot joint gear reducer

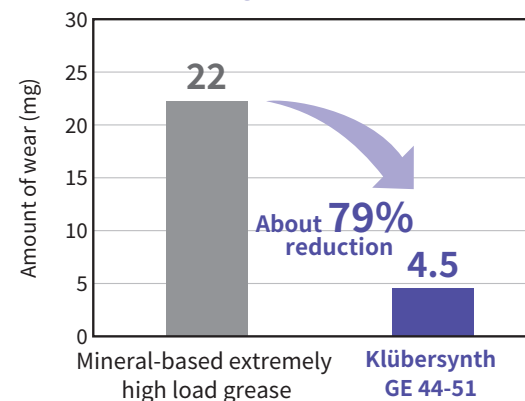
Main Features



- Excellent wear resistance increases the lubricant's service life and lowers the need for frequent maintenance
- The extremely low bearing torque, even at low temperatures, helps to reduce power consumption
- A stable oil film can form across a broad temperature range because of its favorable temperature and viscosity characteristics, which minimize temperature-induced viscosity changes

Excellent wear resistance for harsh operating environments such as robot joint gear reducer

FE8 Bearing wear test (DIN 51819)



Wear tests conducted under the following conditions show that Klübersynth GE 44-51, a robot lubricant, can reduce wear to about one-fifth of that of mineral-based extremely high load grease

[Test conditions]

Bearings: Tapered roller bearings
Engine speed: 75 rpm
Load: 50 kN
Temperature: 80 °C
Test time: 500 h

Durability

Extremely high load grease

NOXLUB™ TB 0315, TB 0325

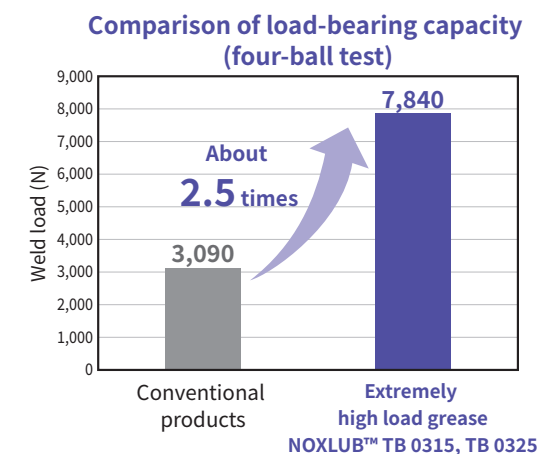
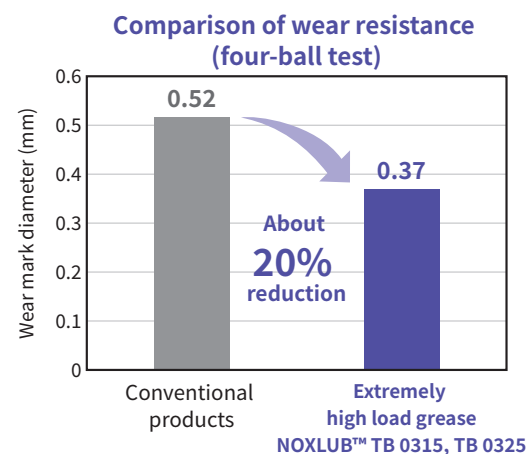
Gear reducer

- ▶ **Extends the service life of equipment by maximizing the wear resistance and load-bearing ability of grease**

Increasing the speed, precision, and compactness of gear reducers to lessen the load on gears and bearings

Main Features

- Prevents gear wear and seizure with outstanding wear resistance and load-bearing capacity
- Combines high-speed capability, heat resistance, water resistance, and low-temperature performance, making it suitable for use in any environment
- Even in difficult situations, it does not soften, making it easier to maintain and monitor processes
- Available in two consistency grades, extremely high load grease NOXLUB™ TB 0315 Grade 1 and extremely high load grease NOXLUB™ TB 0325 Grade 2, allowing the selection of appropriate grease consistency for their application

Wear resistance and load-bearing capacity test data

Durability

Low-friction fabric-covered tooth belt



Body and other

- ▶ **Perfect for high-load, high-speed applications; lowers torque to reduce power consumption and save energy.**

Main Features

High load capacity

- Contributes to greater productivity through enhanced speed and load performance
- Reduced sliding friction reduces the load created when engaging with the pulley teeth

Improved tooth durability

- Significantly reduces heat-induced friction with pulley teeth
- Significantly reduces tooth jumping, reduced stop-position accuracy, wear debris, and other issues caused by sliding against the pulley, improving durability

Low noise and low vibration

- Smooth engagement with the pulley, accomplished by reduced friction, produces low noise and vibration. Contributes to improving the working environment in the factory

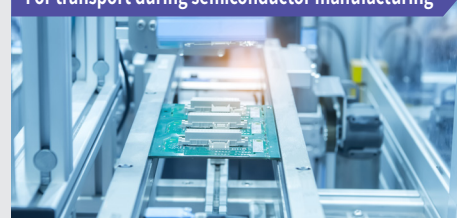
Energy saving

- Compared to conventional nylon fabric specifications, the coefficient of friction was reduced by 44%, and a 70% reduction was achieved compared to low-friction material specifications
- Lower torque also reduces power consumption

Main Applications

Arm of a multi-axis robot

Reduced friction causes lower torque, which reduces the power consumption of robots

For transport during semiconductor manufacturing

Its low vibration makes it excellent for transporting precision equipment, and the enhanced movement speed contributes to higher output.

For driving station platform gates (doors)

Belt drives can be used even in high-load applications, including opening and closing platform doors, due to reduced sliding friction.

Thermal insulation and flame retardancy test

Flame retardant Insulating rubber

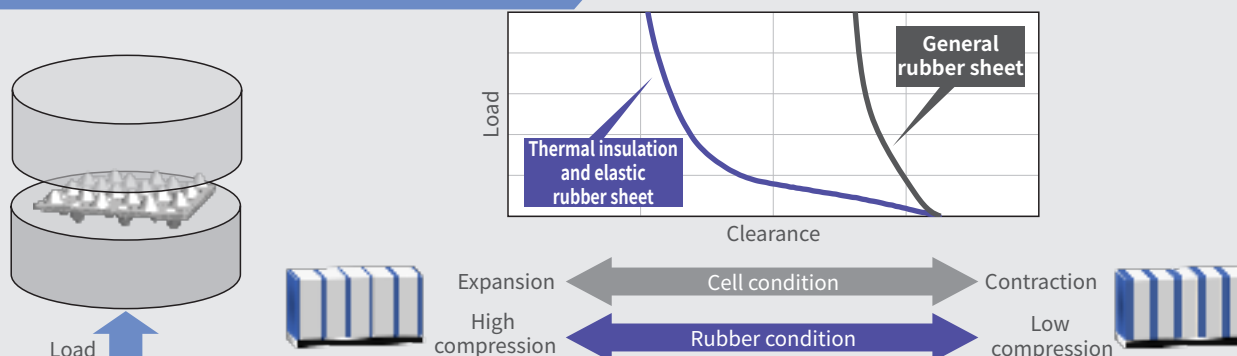


Batteries

► Suppresses degradation of battery performance and improves battery safety through thermal insulation and flame retardancy

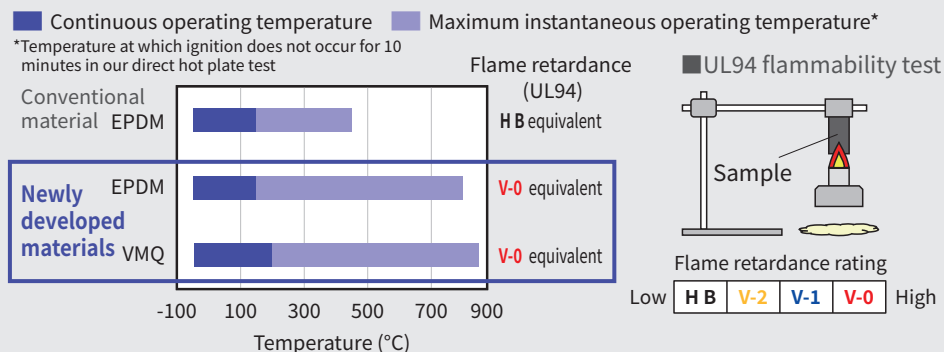
Ensure a constant reaction force and support the cell with an appropriate load.

Reaction force characteristic measurement test



Comply with UL94 V-0 flame-retardant standards.

Hot plate direct placement test



(*)The values shown in the graph are for reference only and are not guaranteed

(*)UL94 flammability test results were obtained in-house.

Measures Against Heat

Thermally conductive material **QLEASE™ series**

▶ Thermal management component that efficiently transmits heat with original concept



Servo motor



Batteries

QLEASE™ series

QLEASE™
 キュリース

New concept heat conduction member that differs from conventional heat dissipation sheets by improving heat transfer and adhesion
 Utilizing NOK's technology accumulated over the years, the heat is efficiently transmitted by eliminating the insulation layer of air between the heat source and heat dissipation member as much as possible.

	QLEASE™ series			
	Rubber type	Clay type	Cross type	Resin type
Schematic				
Hardness	Medium hardness *Durometer A60	Soft (low)	Soft & hard (low)	Hard (high) *Rockwell R110
Thermal conductivity	+	+++	++	++++
Degree of adhesion (integral molding)	++(+++)	+++	+++	+(++)
Handle ability	+++	++	+++	+++
Heat resistance	+	++	++	+++

Measures Against Heat

Clay-like thermally conductive material **QLEASE™ clay type**

► Fits freely in complex and uneven spaces to achieve a high heat dissipation effect



Servo motor

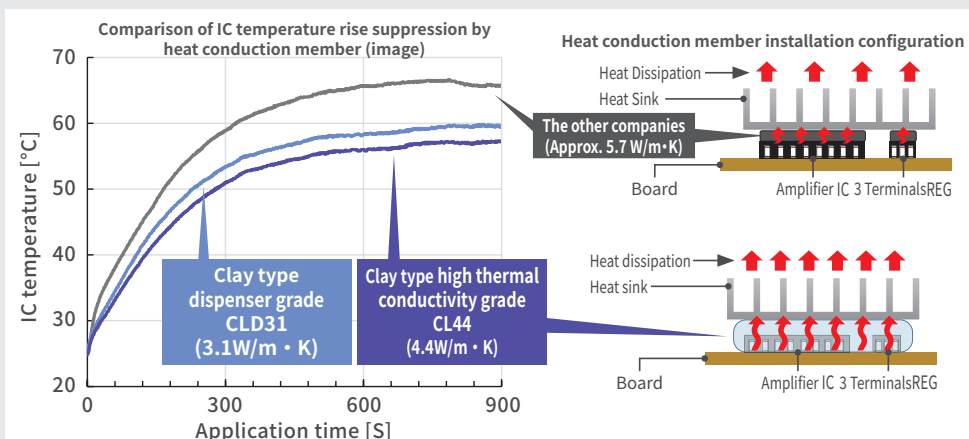


Batteries

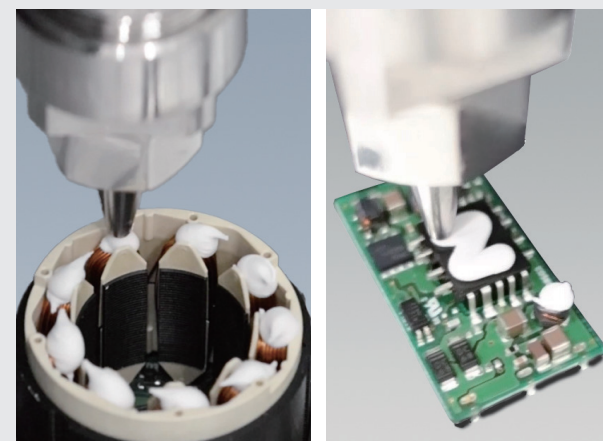
Soft clay type, available in three grades according to application

QLEASE™
 キュリース

High heat conduction grade for parts requiring higher heat dissipation



Dispenser grade contributing to automation



Item	Product grade	
	Dispenser grade CLD31	High thermal conductivity grade CL44
Hardness (unworked penetration)	220	120
Thermal conductivity W/m·K	3.1	4.4
Dielectric breakdown strength (AC) kV/mm	4.5	8.4
Low-molecule siloxane (D3 to D10) ppm	56	44

*QLEASE™ clay series complies with REACH regulations and complies with the RoHS Directive. *All values are measured values and are not guaranteed values.

Measures Against Heat

Thermally conductive rubber **QLEASE™** rubber type

► High heat dissipation effect achieved with rubber shaped along heating element



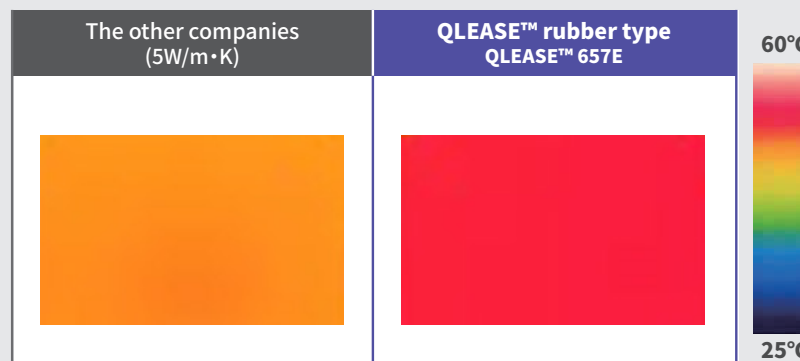
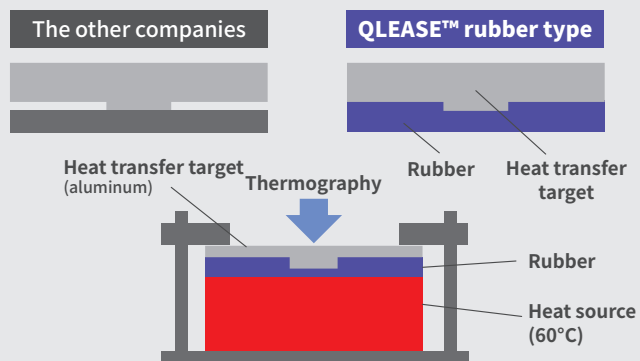
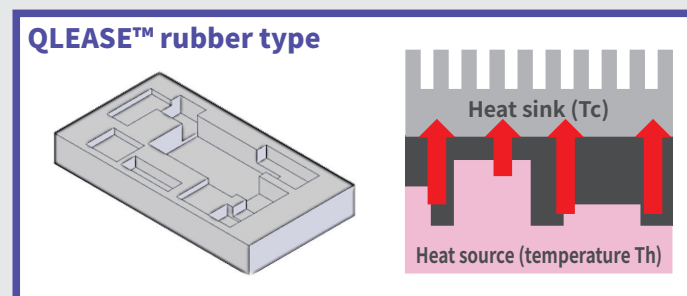
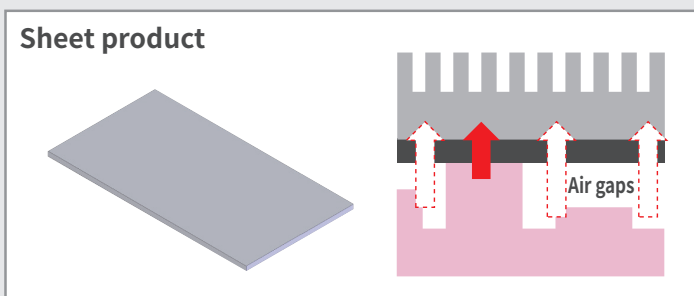
Servo motor



Batteries

High heat dissipation effect achieved by eliminating air gaps with rubber shaped along the heating element

QLEASE™
キューリース



Temperature distribution 90 seconds after setting

Measures Against Heat

Hybrid thermally conductive materials QLEASE™ cross type

► Handlability and heat dissipation at the same time, excellent workability and automation are possible



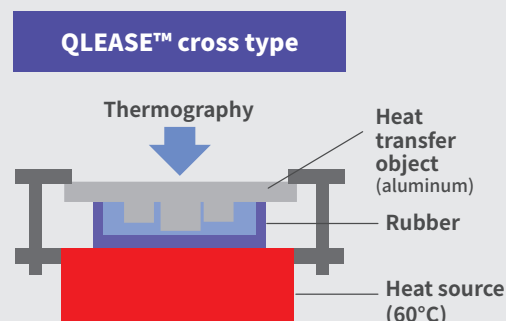
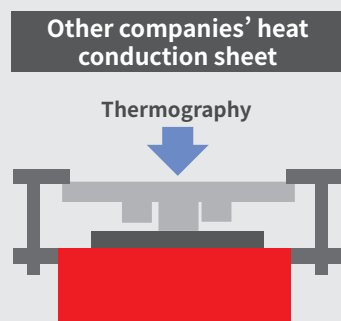
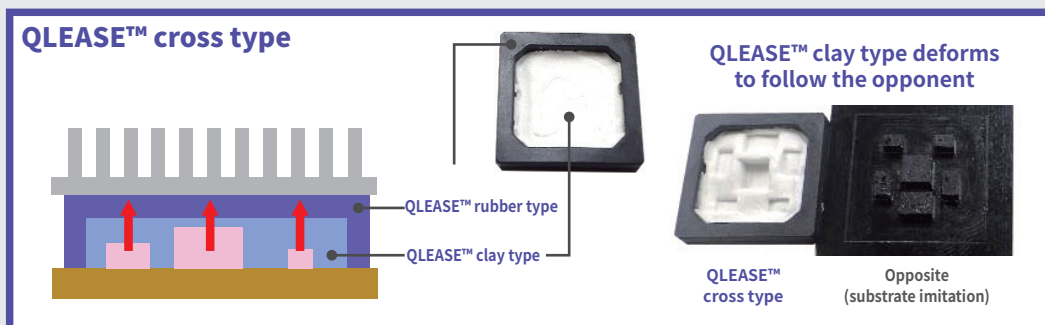
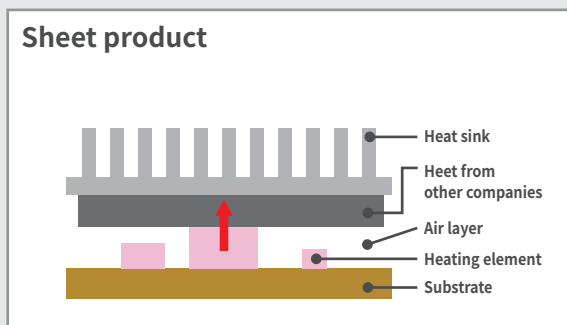
Servo motor



Batteries

The heating element is gently wrapped in clay and surrounded by heat-conducting rubber.

QLEASE™
キュリース



	Heat conduction sheet from other companies (5W/m·K)	QLEASE™ cross type Clay Type: 3.1 W/m·K Rubber Type : 1.2 W/m·K	
Initial			
After 75 seconds			
After 150 seconds			
			25°C

Measures Against Heat

Thermally conductive insulating resin **QLEASE™ resin type**

► High heat dissipation and high heat resistance contribute to weight reduction by replacing metal parts



Servo motor



Batteries

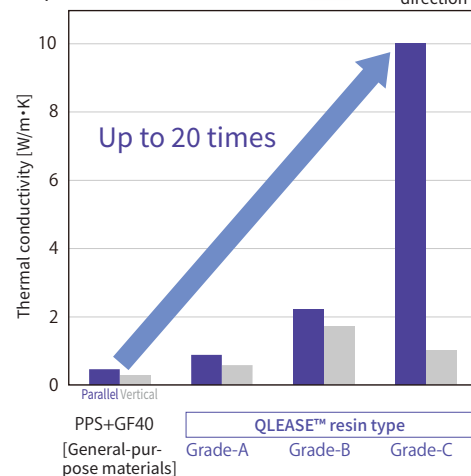
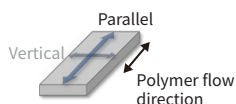
Can be molded with high precision, has high heat resistance, and can be used continuously at up to 220°C.

QLEASE™
キユリース

Thermal conductivity

【Measurement conditions】

- Method: ISO 22007-02 compliant
- Temperature: 23°C

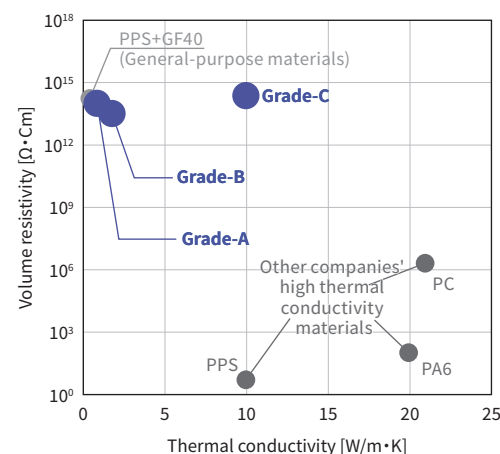


Volume low efficiency

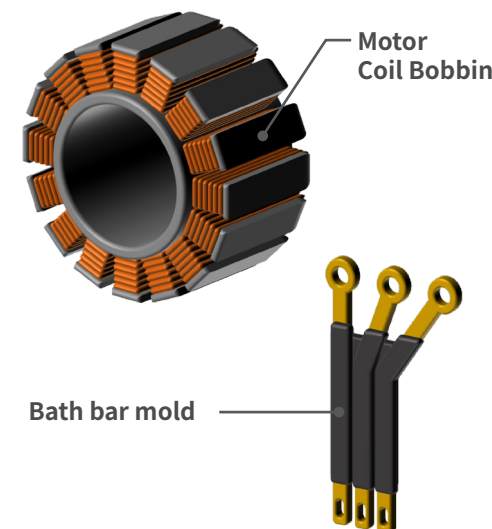
【Measurement conditions】

- Method: ASTM D257

*QLEASE™ resin type Grade-A, Grade-B, Grade-Only



Example applications



Measures Against Heat

Pressure control valve series

- A lineup of 5 types that can be selected according to valve opening pressure, flow rate, and application

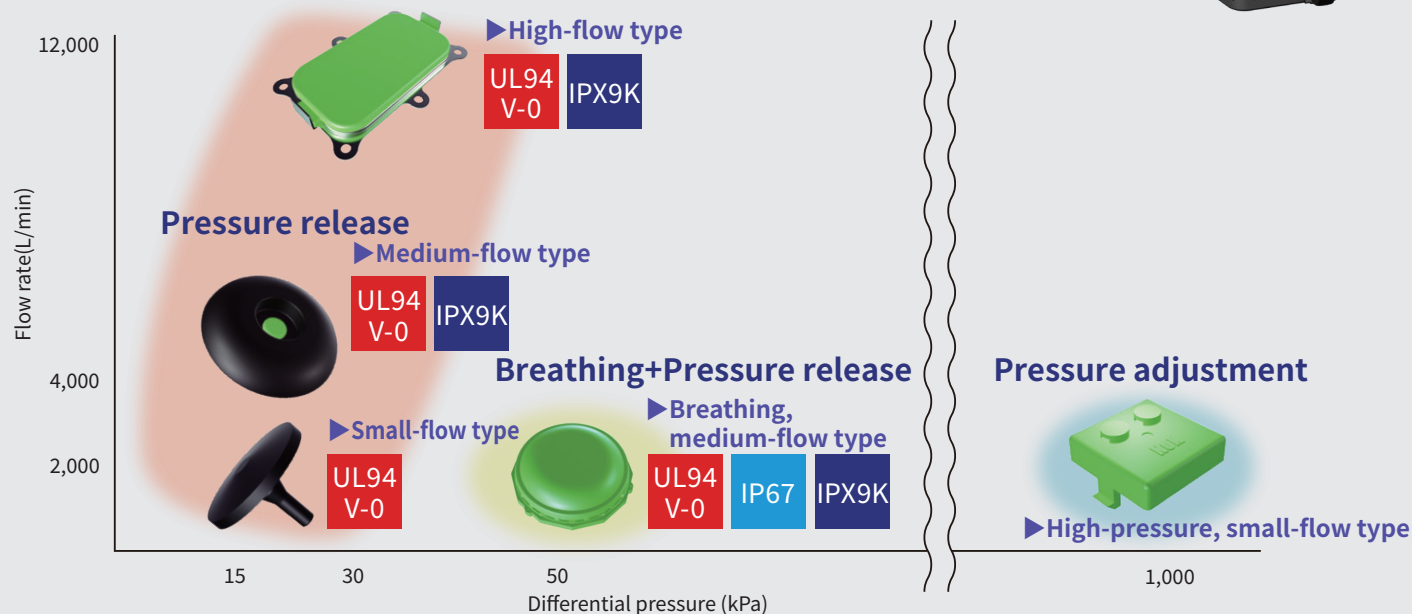


Body and other



Batteries

By attaching to the EV battery case, when a large amount of gas is generated due to thermal runaway in the battery, an appropriate amount of gas is released to the outside



Measures Against Heat

Pressure control valve **small-flow type**

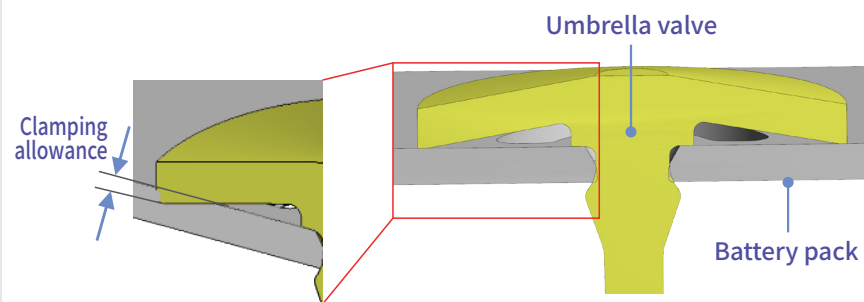


Body and other Batteries

► Simple structure with only rubber valve opening

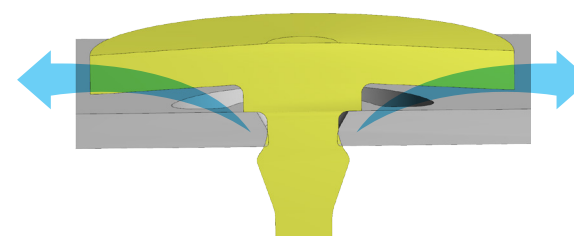
Release increased internal pressure only by opening the umbrella valve

Structure



When the valve is open

Rubber umbrella valve opens to release internal pressure



Specifications and main features

- Flame retardant standard UL94 V-0 equivalent (EPDM material)
- Compatible with a flow rate of 150 L/min
- Specifications can be set according to valve opening pressure by controlling rubber hardness and tightness

Measures Against Heat

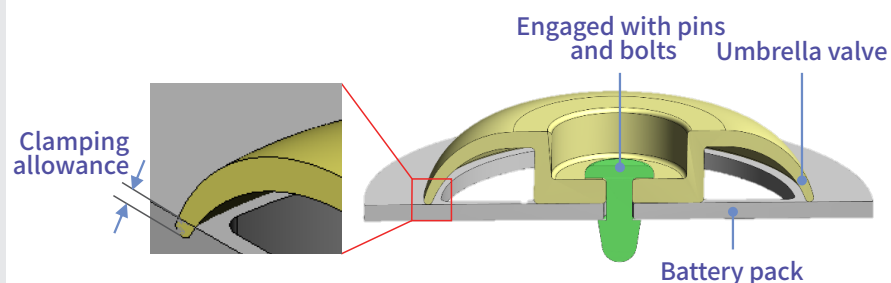
Pressure control valve **middle-flow type**

Body and other Batteries

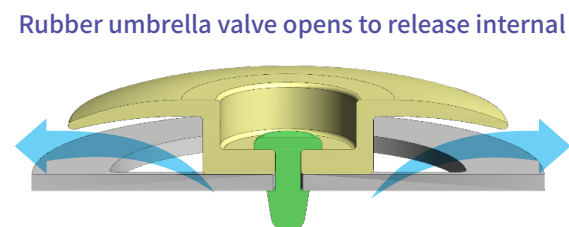
► Middle flow pressure release with simple structure

Simple structure of umbrella valve and pin releases increased internal pressure

Structure



When the valve is open

**Specifications and
main features**

- Waterproof and dustproof standard IPX9K compatible (can be set as desired)
- Flame retardant standard UL94 V-0 equivalent (EPDM material)
- Specifications can be set according to valve opening pressure by controlling rubber hardness and tightness
- Easy installation

Measures Against Heat

Pressure control valve **high-flow type**

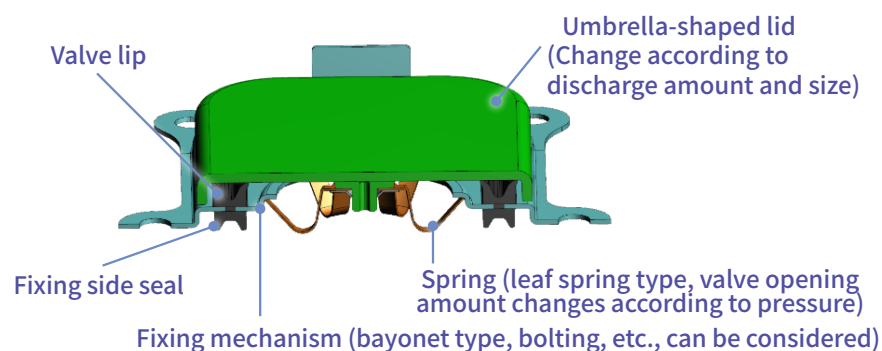
► Low pressure open/large flow



Body and other Batteries

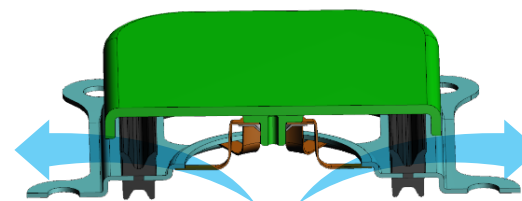
Achieves a high flow rate of 12,000 L/min at a differential pressure of 30 kPa

Structure



When the valve is open

Internal plate integrated valve
Large flow pressure release achieved by spring repulsion.

**Specifications and
main features**

- Compatible with IPX9K waterproof and dustproof standards
- Equivalent to UL94 V-0 flame retardant standards
- Shuts off oxygen inflow, prevents fire spread
- Specifications can be set according to valve opening pressure by controlling lid diameter and spring repulsion force
- Can be installed with one touch (by selecting bayonet fixing mechanism)

Measures Against Heat

Pressure control valve **breathing, medium-flow type Diavent™**

- ▶ The integration of the breathable membrane and exhaust valve helps to keep the battery case lightweight and small



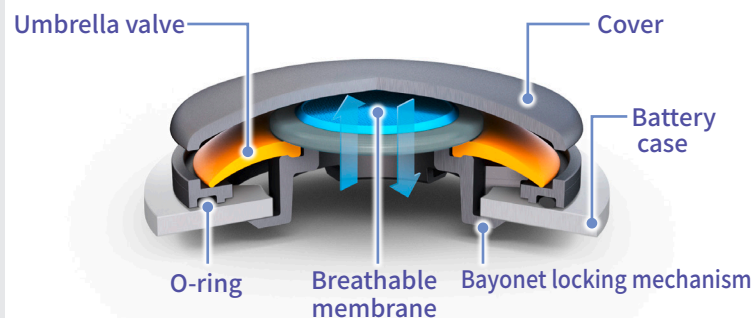
Body and other



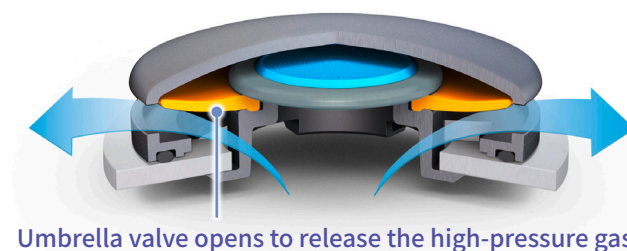
Batteries

Regulates pressure during normal operation and releases high-pressure gas in an emergency

Structure (normal operation)



Emergency valve opening (battery fire)



Specifications and main features

- Compatible with IP67 and IPX9K waterproof and dustproof standards
- Equivalent to UL94 V-0 flame retardant standards
- High-flow models with high gas discharge rates for emergencies are also available (compatible with large battery packs)
- Can be installed with one touch

Measures Against Heat

Pressure control valve **high-pressure, small-flow type**

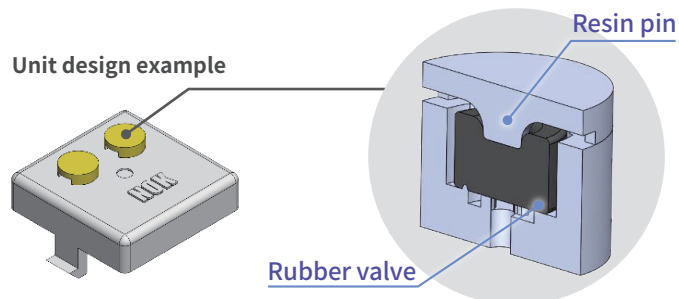
Body and other Batteries

► Compact and space-saving while meeting high valve opening pressure requirements

Internal plate integrated valve releases large flow pressure by spring repulsion

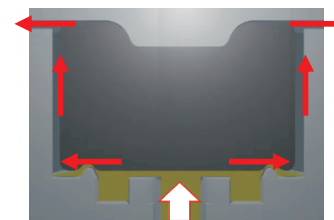
Structure

Unit design example



When the valve is open

Valve opening pressure is controlled by controlling seal surface pressure with valve structure.

**Specifications and
main features**

- Can be used repeatedly without valve replacement
- Supports high pressure
- Space saving design with $\phi 6 \sim$ valve diameter
- Can seal gas, electrolyte, etc.
- Can be used in low temperature environments (when cold resistant rubber is used for valve part)

Measures Against Heat

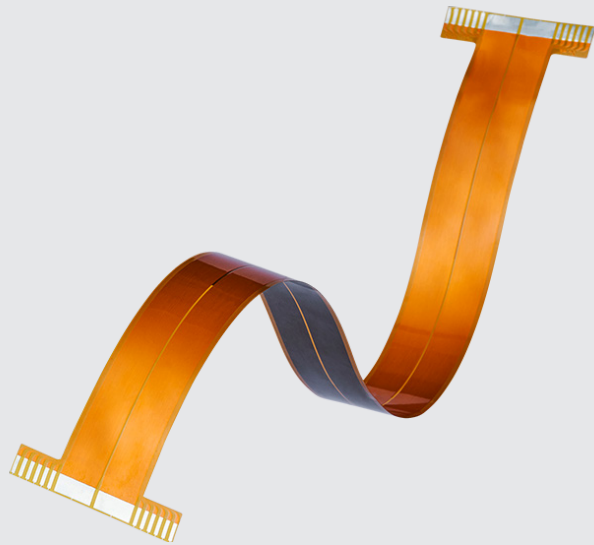
Heat-resistant FPC



Body and other

► Heat-proof capability up to 150°C with proprietary adhesive technology

Three grades are available depending on the operating temperature



Merits

- Three grades are available depending on the operating temperature
- All three grades passed the 3,000-hour heat resistance test, meeting the company's internal standard (cover film peel strength of 0.343 N/mm or higher)
- The high-temperature-resistant model can be used at temperature up to 150 °C.
*If temperatures above 150 °C are required, contact NOK or Mectech

Comparison of specifications for three grades based on operating temperature

	Heat-resistant FPC		
	General specifications	Heat-resistant specifications	High heat-resistant specifications
Operating temperature range	-40 to 105 °C	-40 to 125 °C	-40 to 150 °C

Low noise High damping rubber **HDR™**

► High-performance vibration-isolating rubber balances high damping performance with strength and durability

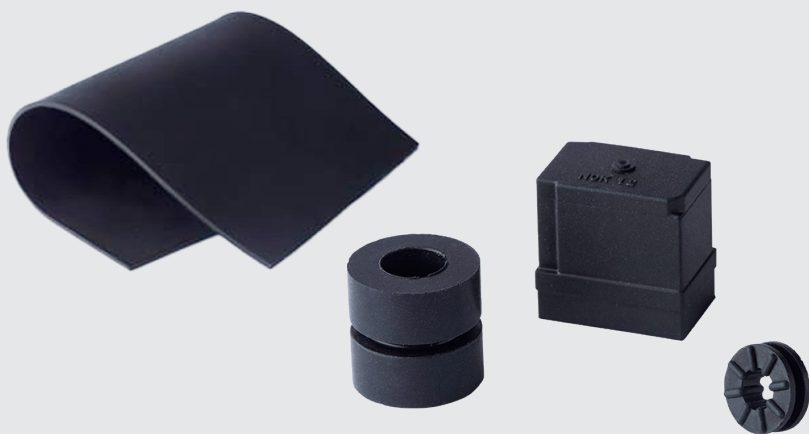


Body and other

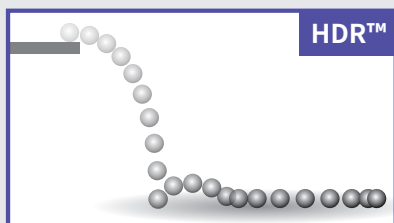
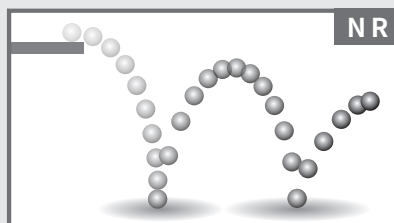


Feet, pedals, wheels

NOK's innovative high-performance rubber material lowers vibrations throughout a wide frequency range



Comparison of characteristics (experimental image)

**HDR™****NR**

[Click here to watch a video of an experiment](#) in which a rubber ball made of HDR™ and a rubber ball made of a standard vibration-damping rubber material (NR: natural rubber) were dropped

Merits

- This vibration-damping rubber material has significantly improved damping performance and is more durable than traditional options, making it ideal for use as mounts and stoppers
- Additionally, the range includes grades for electronic circuit boards intended to prevent outgassing

Achieves both high damping performance and durability

Poor ← × · △ · ○ · ◎ → Excellent

Material name	Degree of damping	Mechanical strength	Heat resistance	Ozone resistance	Cold resistance	Oil resistance ^{*1}
HDR™	Maximum	○	○	◎	△	×
NR	Low	◎	△	△	◎	×
NBR	Medium	○	○	△	○	○

^{*1} Flame-resistant hydraulic fluids such as phosphate esters and water-glycol are not considered oil-resistant. Contact NOK for further details.

Low noise

Polyurethane elastomer products **IRON RUBBER™**

► Combines the elasticity of rubber with the toughness of resin using proprietary materials absorbing shocks and vibrations



Body and other

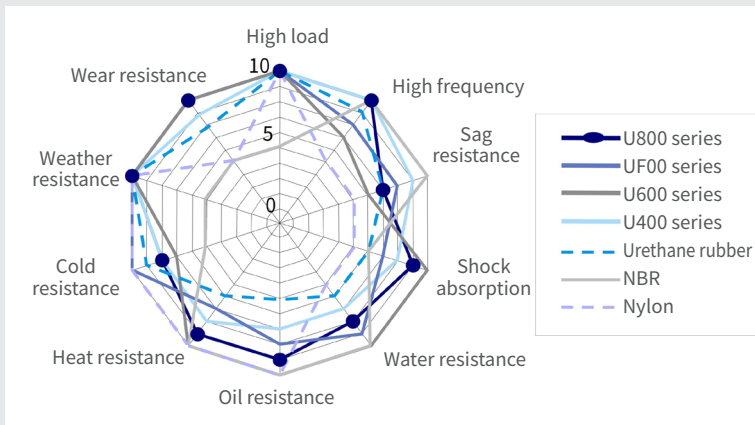


Feet, pedals, wheels

It provides better heat resistance, oil resistance, shock absorption, and load-bearing capacity than other materials



You can select materials based on your specific application



Merits

- It has excellent elasticity and effectively absorbs shocks, protecting equipment from vibrations and impacts
- It has high wear and weather resistance, and it resists degradation even in tough conditions.
- It has sound-dampening properties and is effective as a soundproofing material
- We have a wide range of materials that have undergone multiple improvements and modifications, and since they are easy to mold and process, we can offer shapes and sizes tailored to various applications

Comparison of characteristics

	Mechanical strength	Wear resistance	Compression permanent strain	Water resistance	Weather resistance	Oil resistance	Guideline for allowable temperature
IRON RUBBER™ (UR)	◎	◎	○	○/△	○	◎	-40 to 110 *C
Natural rubber (NR)	◎	◎	△	○	△	x	-50 to 100 °C
Butyl rubber (IIR)	○	○	△	○	◎	x	-50 to 120 °C
Styrene-butadiene rubber (SBR)	○	○	△	◎	△	x	-50 to 100 °C
Ethylene propylene rubber (EPDM)	○	○	○	◎	◎	x	-50 to 150 °C
Nitrile rubber (NBR)	○	○	○	○	△	◎	-25 to 100 °C
Hydrogenated nitrile rubber (H-NBR)	○	◎	○	○	○	◎	-25 to 130 °C
Acrylic rubber (ACM)	△	△	◎	x	◎	◎	-20 to 150 °C
Fluoro-rubber (FKM)	○	○	◎	○	◎	◎	-20 to 150 °C

Improved work efficiency

Silicone-film-coated O-ring

- Improves workability and efficiency during assembly, while maintaining a clean work environment and consistent quality



Servo motor Body and other

[Click here for catalog specifications and dimensions](#)

Coated with an ultra-thin film just a few micrometers (μm) thick that maintains its low-friction properties even after heat aging and immersion

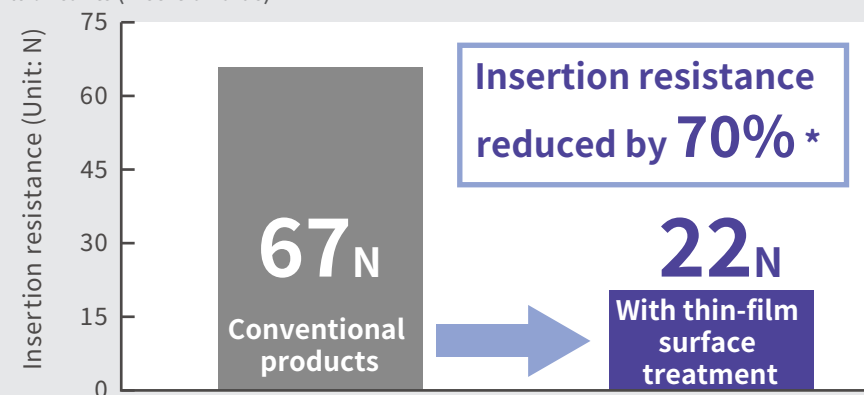
Le- μ 's
Low emission μ seal

Four effects ► Merits of application

- | | |
|--|--|
| <p>1 Non-adhesiveness
Prevents adhesion between O-rings</p> | <p>► The parts feeder is now operating smoothly, resulting in improved productivity
Click here to watch the demo video</p> |
| <p>2 Low friction
Ease of insertion and assembly</p> | <p>► Enables low-force O-ring installation while significantly reducing twisting and galling</p> |
| <p>3 No lubricant required
Keeps worksites clean</p> | <p>► Because no lubricants (insertion aids) are used, foreign matter is less likely to adhere, resulting in a cleaner working environment</p> |
| <p>4 Antistatic
Less prone to static electricity</p> | <p>► Prevents dust and other particles from being attracted by static electricity, minimizing defects caused by foreign particle adhesion</p> |

Insertion resistance measurement test

- Without surface treatment, the insertion resistance is 67 N; with surface treatment, it is decreased by around 70% to 22 N
- Silicone-film-coated O-ring can be assembled under low load without the need for lubricants (insertion aids)



*Values are experimental results from our testing and are not guaranteed.

Improved work efficiency

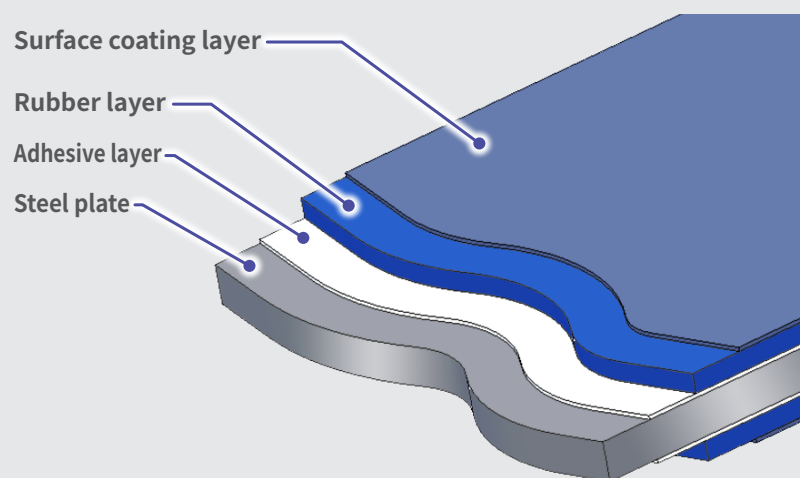
Rubber-coated metal gaskets **SOFT METAL™**

► Achieves both excellent sealing performance and reduced assembly time



Servo motor Body and other

Enhances sealing performance by leveraging the properties of rubber and metal



Merits

- Fixed sealing gasket, usable in high-temperature and high-pressure environments
- Compared to other gaskets, it has less shape deformation
Ideal for automated assembly, which helps to minimize total production costs
- Since groove processing on the housing is unnecessary, it helps to reduce processing man-hours

Material type

These SOFT METAL™ are available in both solid and foam types, and our product lineup includes materials that can meet a variety of needs, such as resistance to LLC, oil, water, heat, and refrigeration oil

	Solid type	Foam type
Structure		
Merits	Resistant to rubber extrusion at high surface pressure	The foamed rubber enables sealing at low surface pressure

High precision Biosignal rubber electrode **Sotto™ series**

► Rubber electrodes considerably reduce the time and effort required for EEG and ECG measurements



All Sotto™ series products are flexible, gentle on the skin, and can be used in dry environments.
Even faster response can also be expected.



Types of electrodes	General biopotential electrode		Sotto™ series	
	Metal electrode	Gel electrode	Brain	Fabric+
Characteristics				
Material	Metal	Gel	Rubber	Rubber + Fabric
Measurement conditions	Wet	Wet	Dry	Dry
Wearing comfort	×	△	○	○
Handle ability	△	×	○	○
Contact stability	△	○	○	○
Repetitive use	○	×	○	○

High precision

Brainwave rubber electrode **Sotto™ brain**

Sensing

► Soft, comfortable, and requires no conductive paste, and reusable

Soft, dry rubber electrodes that are perfect for measuring EEG and come in a range of styles to suit various uses



Merits

- **Conductive silicone rubber** → The soft rubber minimizes pain and discomfort when wearing
- **No conductive paste required** → can be used dry, so there is no irritation and no need to wash or shampoo after measurement
- **Highly durable** → Can be cleaned with ethanol and other solvents, making it reusable and highly resistant to sebum

Lineup

Brush type

~ Maintains stable contact with the scalp ~



- Easily connects to standard snap buttons
- Can also be used for ECG measurement in pets

Button type

~ For measuring brain waves on the forehead ~



- Easily connects to standard snap buttons

Earpiece type

~ For measurements taken from the outer ear ~



- For measuring brain waves from the outer ear, such as through earphones

Representative Characteristics

Material		Silicone rubber (Snap button: Brass / Ni-plated)
Physical properties (reference)	Hardness (Durometer A)	60
	Tensile strength (MPa)	3.6
	Stretch (%)	358
	Product resistance value (Ω)	$< 10^2$
Bio compatibility	Intradermal test	None or negligible
	Dermal sensitization test	Believed not to be sensitizing
	Cytotoxicity	Moderate *Derived from silver particles
	Primary skin irritation test	Non-irritating
Chemical resistance	Water	○
	Saltwater (simulated sweat)	○
	Oleic acid (simulating sebum)	○
	Moisturizer	○
	Conductive paste for EEG measurement	○
	Ethanol	○

High precision Rubberized cloth electrode **Sotto™ fabric⁺**

► Only 0.5 mm thick! Dry, reusable, and sewable electrodes



Sensing

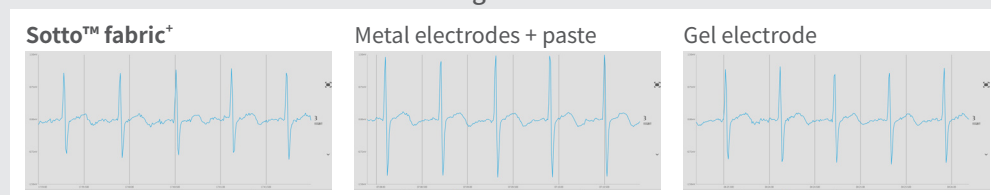
A flexible, fabric-like rubber electrode with a two-layer structure made up of conductive rubber and conductive fibers



Merits

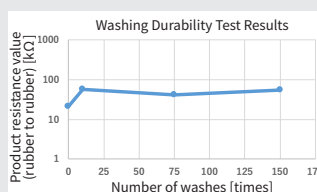
- High-responsiveness dry electrodes → Enables low-noise detection of ECG and EMG signals without using conductive paste
- Excellent washing durability → It is hygienic, reusable, and can be disinfected with alcohol wipes
- Sewable and easy to handle
→ Can be sewn onto innerwear or supporters, attached by adhesive, or connected to wiring by crimping snap buttons

Output Waveform Comparison Capable of obtaining biosignals comparable to those obtained with metal electrodes or gel electrodes in wet conditions



Wash durability

There is no significant change in any of the resistance values, even after being washed 10, 75, and 150 times in a laundry net



Representative Characteristics

Material		Urethane rubber (Fabric: PET + Ni plating)
Physical properties (reference)	Tensile strength (MPa)	6.3
	Stretch (%)	26.0
	Tear strength (N/mm)	11.4
	Product resistance value (Ω)	<10K
Bio compatibility	Cytotoxicity test	None or negligible
	Intradermal test	Believed not to be sensitizing
	Dermal sensitization test	Moderate *Derived from silver particles
	Primary skin irritation test	Non-irritating
Chemical resistance	Water	○
	Saltwater (simulated sweat)	○
	Oleic acid (simulating sebum)	○
	Hand cream	○
	Ethanol	○
	Laundry detergent / Fabric softener / Bleach	○

High precision

Ultra-flexible bioelectrode sheet

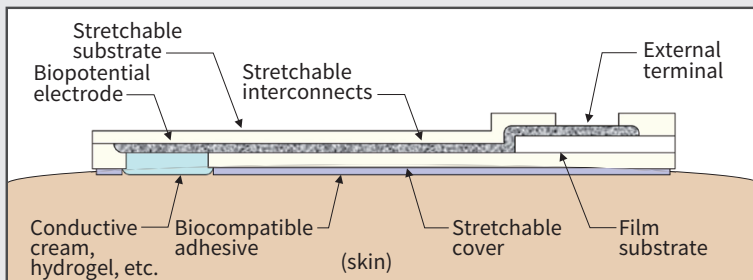
Stretchable FPC



► **Excellent flexibility allows the electrode to conform to the body, enabling stress-free biosignal detection**

Offers stretchable flexibility to fit the body while ensuring reliable electrical conductivity

The stretchable section, external terminal section, and bioelectrode section are formed as a single unit



Supports connector connection

The combined assembly of the external terminal block and the film substrate makes it easy to connect to external devices

Can acquire biometric information when applied directly to the body

Can acquire biosignals such as EMG and EEG, and has been patch-tested for skin compatibility

Excellent breathability and moisture permeability

Made from highly breathable and moisture-permeable material, it prevents stuffiness when applied to the body and reduces discomfort during wear



Product image when stretched and retracted

Can be stretched up to 50% in all directions

Stretchable FPC uses stretchable conductors, base materials, and cover materials to create flexible circuit boards that can stretch while retaining electrical performance. Furthermore, while the stretchable FPC's resistance value increases with stretching, it does not break even when stretched to 50%.

Comparison table of various electrodes

Types of electrodes	Conventional products		Our company
	Metal plate electrode	General biopotential electrode sheet	Ultra-flexible biopotential electrode sheet
Characteristics			
Softness	×	△	◎
Thinness	×	△	◎
Multi-channel	×	◎	◎
Ease of installation	×	△	◎
Biological fixation	×	△	○

High precision

High-frequency FPC

► Optimized for high-speed transmission, supporting 5G and 6G connection



Sensing

Supports high-speed IoT communication and helps save space in high-speed transmission lines

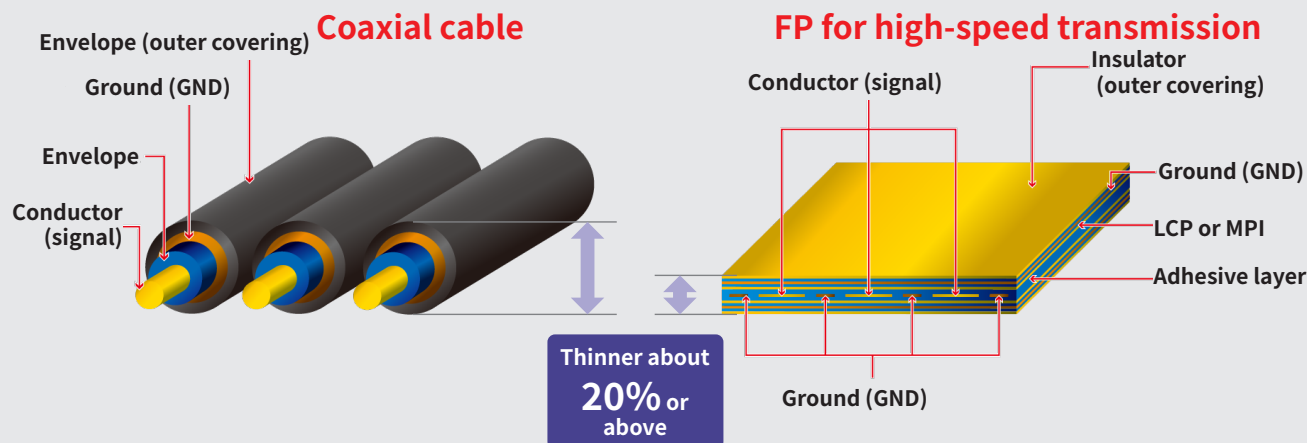
Merits

- Reduces thickness by at least 50% compared to coaxial cable, while retaining the same data transfer speeds
- Transmission loss reduced by 65% compared to conventional products
*Conventional product: Microstrip line structure at @10GHz
- Contributes to increased battery capacity, improved operability, and reduced risk of incorrect wiring

Material type

There are three types of base and cover materials: polytetrafluoroethylene (PTFE), liquid crystal polymer (LCP), and modified polyimide (MPI).

These materials outperform typical polyimides in terms of relative permittivity and dissipation factor, as well as decreased water absorption, allowing for stable, high-speed signal transmission.



[Measurement Conditions] Relative permittivity, dissipation factor: ASTM D2520 (@10 GHz) Water absorption: 24-hour immersion in water (IPC TM-650 2.6.2.1)

	PTFE Polytetrafluoroethylene	LCP Liquid crystal polymer	MPI Modified polyimide	General PI Polyimide
Relative permittivity: DK	2.01	3.3	3.0	3.1
Dissipation factor: DF	0.0003	0.002	0.003	0.008
Water absorption rate	< 0.002	< 0.04	0.4	1.1

Manufacturing that Leverages the Unique Strengths of Each Group Company

We make not only sealing items but also products for vibration and noise damping, as well as drive and conveyor systems, using a wide range of rubber and resin materials developed over many years of research.

In addition, the NOK Group provides a comprehensive range of products, including electronic circuit boards that contribute to equipment miniaturization and a large selection of lubricants that assist the operation of machinery.

Oil seals

[▶ To the product page](#)



Provides both sealing and lubrication for motion surfaces such as machine rotary shafts

O-rings

[▶ To the product page](#)



Annular rubber seal utilizes compression-generated repulsive force for secure sealing

Hydraulic packings

[▶ To the product page](#)



Offers both sealing and lubrication for reciprocating surfaces using a variety of materials, from rubber to resin

Vibration and sound isolators

[▶ To the product page](#)



Resolves vibration and noise issues with proprietary technology

Drive and transport belts

[▶ To the product page](#)



Features proprietary materials with superior mechanical strength and wear resistance for various conveying applications

Flexible printed circuits

[▶ To the product page](#)



Thin, lightweight, and highly durable and flexible electronic circuit board

Lubricants

[▶ To the product page](#)



Delivers outstanding performance even under harsh conditions, such as extremely high or low temperatures, high speeds, heavy loads, and environments exposed to chemicals or water

Support

NOK Supports Your Development

Highly Reliable



NOK products boast high reliability through extensive research into materials and mechanical design, and have been used in various machinery for many years.

Technology Development



NOK's self-contained development system covers the entire process from product design to product inspection. We actively promote the integration of research and development with production technology, resulting in the creation of unique, cutting-edge technologies and products.

Material Technology



By engaging in material formulation techniques and chemical analysis technologies necessary for the development of rubbers and adhesives used in sealing products, material technology has become one of NOK's core technologies.

Global Operations



We have established production bases around the world, including Japan, China, and across Asia. We have built a stable supply system to meet our customers' needs.

For consultations and inquiries, feel free to contact us using ► [**this form.**](#)

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