

Automotive Products



MOTION & CONTROL
NSK



There is the path that we have trodden.
And the path that lies ahead.

The NSK Way

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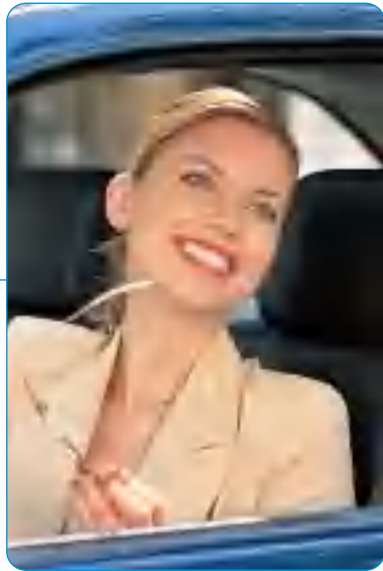
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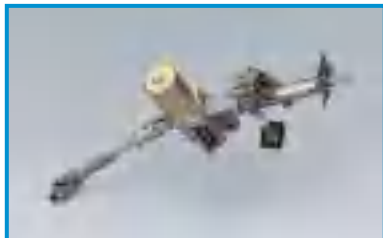
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Technology that values sensitivity for a new bond between the human and the machine.

Steering that precisely conveys the will of the driver to the vehicle, and accurately provides feedback to the driver of road conditions. Steering is an important human-and-machine interface that connects drivers to their cars. Besides a high level of maneuverability, comfort, and safety, the latest steering systems promote excellent fuel efficiency and environmental awareness.

Electric Power Steering (EPS)



EPS is the newest trend in power steering with enhanced fuel efficiency.

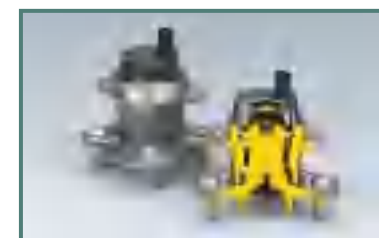
Compact and lightweight, EPS contributes to a scaled-down chassis and improves fuel efficiency. Conventional hydraulic fluids are eliminated, making EPS an environmentally friendly technology. EPS motor control generates the right amount of power at just the right moment, thus enabling finely tuned handling for an exceptionally driver-friendly human-and-machine interface.



When the going gets tough, the tough get going.

Hub Unit Bearings provide reliable support for wheels exposed to a wide range of driving conditions, from extended highway driving to harsh, off-road paths. NSK is also examining ways to harmonize its products with future intelligent transport systems (ITS) and by-wire technologies.

Hub Unit Bearings



Hub unit bearings are highly durable and impervious to mud and water.

Repetitive and thorough testing under various severe conditions has resulted in the development of bearings that are remarkably durable and offer high sealing performance. To meet increasingly diverse requirements such as lighter weight and higher fuel efficiency, as well as module production systems, we are furthering our research and development by updating to the latest technology. NSK hub unit bearings embody the comfort demanded in the 21st century.



The comfort of watching a child sleeping peacefully.

A transmission converts power from the engine into the required speed and driving force, which is then conveyed to the drive wheels. NSK is the first company in the world to put the POWERTOROS Unit, a half-toroidal CVT, into practical use after research and development spanning 21 years. The POWERTOROS Unit is a continuously variable transmission (CVT) that is the result of NSK's advanced technology in tribology (friction, wear, and lubrication).

Half Toroidal CVT POWERTOROS Unit



Technology makes a car run silently and smoothly.

By changing the angle of the power rollers between two disks, the half-toroidal CVT POWERTOROS Unit executes smooth, continuous gear ratio changes. With its unique features of silent and smooth running performance minus the traditional shift shock, as well as high efficiency and excellent fuel efficiency, the CVT is the 21st century's transmission to which NSK, the world leader in automotive bearings, applied its company-wide technology for the cars of tomorrow.

Because I want to drive through the beautiful scenery forever. . .

The Earth's beautiful natural environment is an irreplaceable gem for the present and for all future generations. In recent years, environmental issues have become a significant global concern. To combat global warming, the automobile industry has been called upon to help protect the environment by means such as vehicle weight reduction, resource-saving technologies, and the reduction of CO₂ emissions.



Our regard for the environment is instilled in all of our products from bearings to EPS.

Various NSK products, including bearings and other parts built into a car, are environmentally friendly products that contribute to conserving energy and preservation of natural resources by means of their function, their performance, and by their friction control and reduced energy-loss characteristics. Through our tribology technology, we at NSK contribute to reducing environmental stress, and are actively promoting preservation of the Earth today as well as in the future.

The NSK Automotive Way

Our proactive approach: NSK shall continue to contemplate the future of cars through newly developed products incorporating true value.

1. Contribute to Global Motorization
= Brand in Brands=
2. Contribute to the well being of humankind with policies and actions that protect the environment.
3. Create, refine and promote new values.
Instill these values into our future generations.
4. Supply NSK Products that :
Meet global standards for excellence
Are of the highest quality
Have an optimal price-performance ratio
Are manufactured in the appropriate volume, and delivered to the appropriate locations, at the appropriate time.
All these and more in order to give unparalleled customer satisfaction globally.
5. NSK accepts all its obligations to be a responsible corporate citizen.

In order to realize the NSK Automotive Way on a higher level, we shall maintain a corporate attitude to which we shall hold true:
Keep that which should not be changed, and aggressively challenge that which should be.



Our Fundamental Technology & Global Network

The basic technology of NSK that creates the future of automotive parts.

Motion and control is constantly evolving at NSK to further provide timely responses to the needs of our customers on a worldwide scale by continuously reinforcing our tribology technology and mechatronics technology, which we have accumulated from our many years of experience with rolling bearing technology.



Materials

In order to produce even more excellent products, NSK conducts research into a wide range of basic materials technologies. Products made with NSK's own materials enjoy long service life and provide customers with maintenance-free products. They have also contributed to the downsizing of machines for many industries.



Lubrication

NSK is continuing its basic research into tribology as a key technology that takes full advantage, and maintains the performance, of machines. Applied to lubricants or lubrication methodologies, this research technology contributes to protecting the environment, including the preservation of natural resources and conserving energy.



Numerical Simulation

NSK has independently developed an analysis tool called BRAIN, which stands for Bearing Analysis In NSK. This software digitizes tribology technology, enabling simulations of movement and performance related to friction. Combining this data with the finite elements method (FEM), NSK has achieved advanced computer-aided engineering (CAE).



Mechatronics

Based on advanced sensing, motor and control technology, NSK is developing a basic motion and control technology for further high-precision products. This in turn is contributing to the development of sensor bearings as well as highly advanced mechatronics products.

Global Network

We provide just-in-time delivery to vehicle makers worldwide.

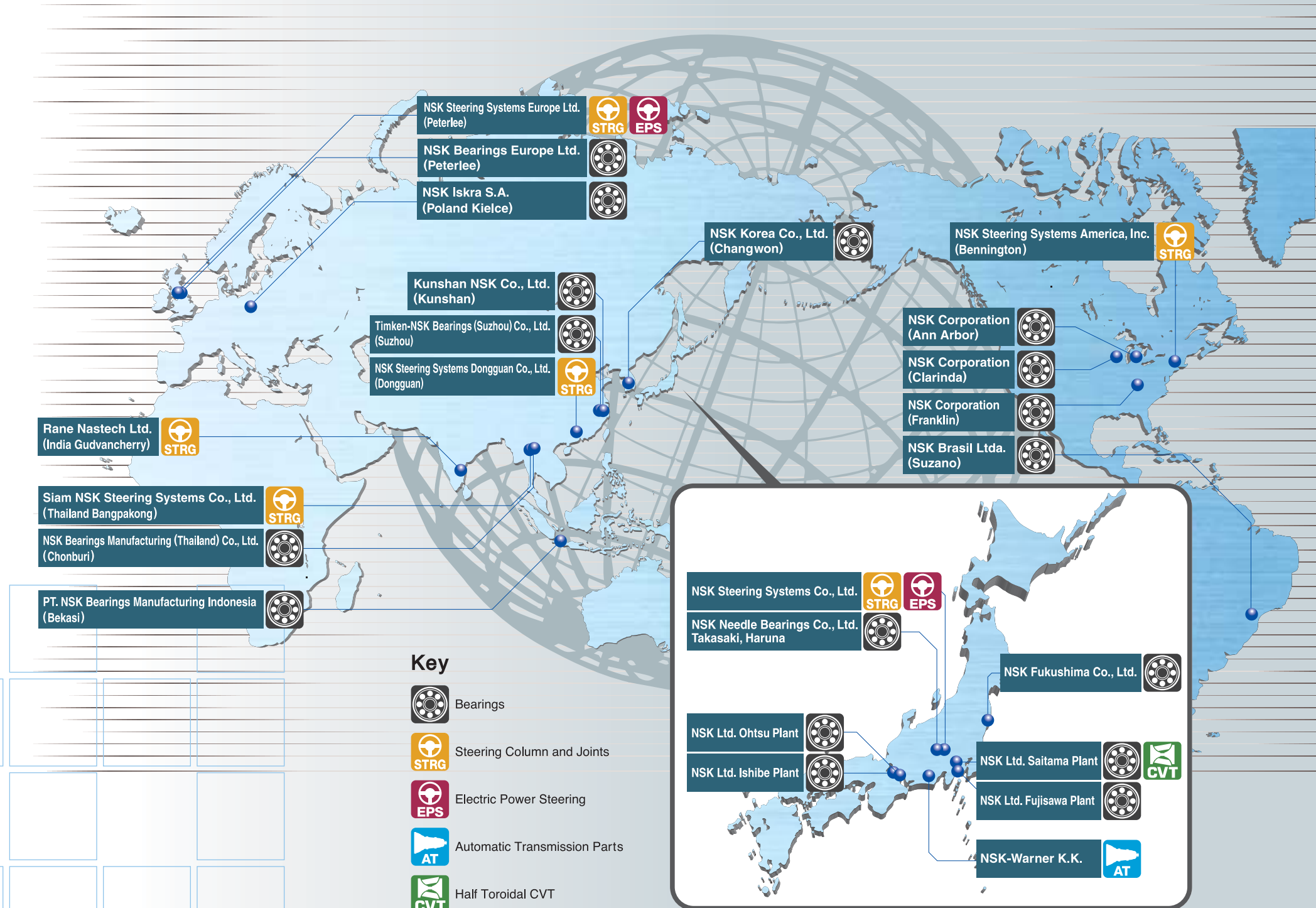
Automakers have extended their manufacturing across national borders.

Extensive alliances and mergers are forming between manufacturers from various countries.

The big issue of efficiency and cost savings for these large-scale manufacturers is to standardize their platforms.

In order to fulfill the requirements of borderless production and cost savings, NSK has set up a network that combines production in the best supply base and production in areas with a large demand.

NSK is supplying its products as required to meet market needs with just-in-time delivery on a global scale.



(as of April 2004)

Product Line-up

From Bearings to EPS.
NSK manufactures various products that contribute to the three greatest elements of automobiles: running, turning, and stopping.

Since the start of Japanese production of ball bearings in 1916, NSK has been playing the role of supplying optimal bearings for growing industries in each era. For the automobile industry as well, NSK has foreseen the potential and expanded its business field to automotive parts. As a global brand in automotive parts, NSK has supplied high-performance and high-quality products unrivaled by competitors worldwide. These include various types of bearings as well as automatic transmission parts, steering column, joints, and EPS, which is associated with 21st century steer-by-wire technology.

Chassis 17 Steering Systems 23 Hub Unit Bearings



Power train 29 Engine Parts 31 Electrical Accessories



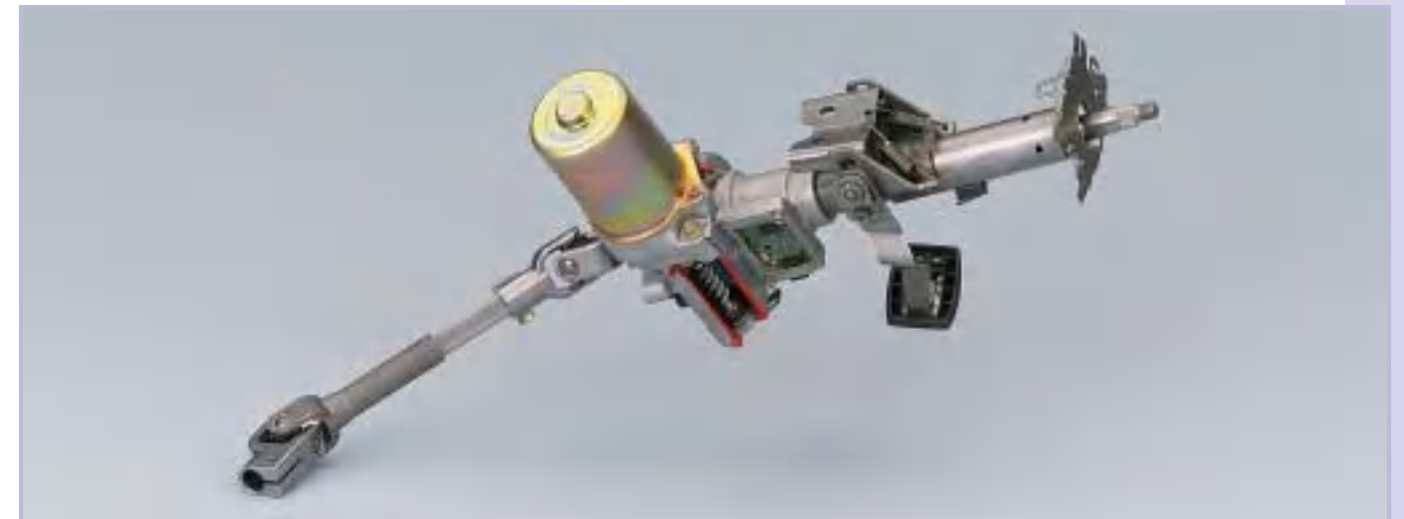
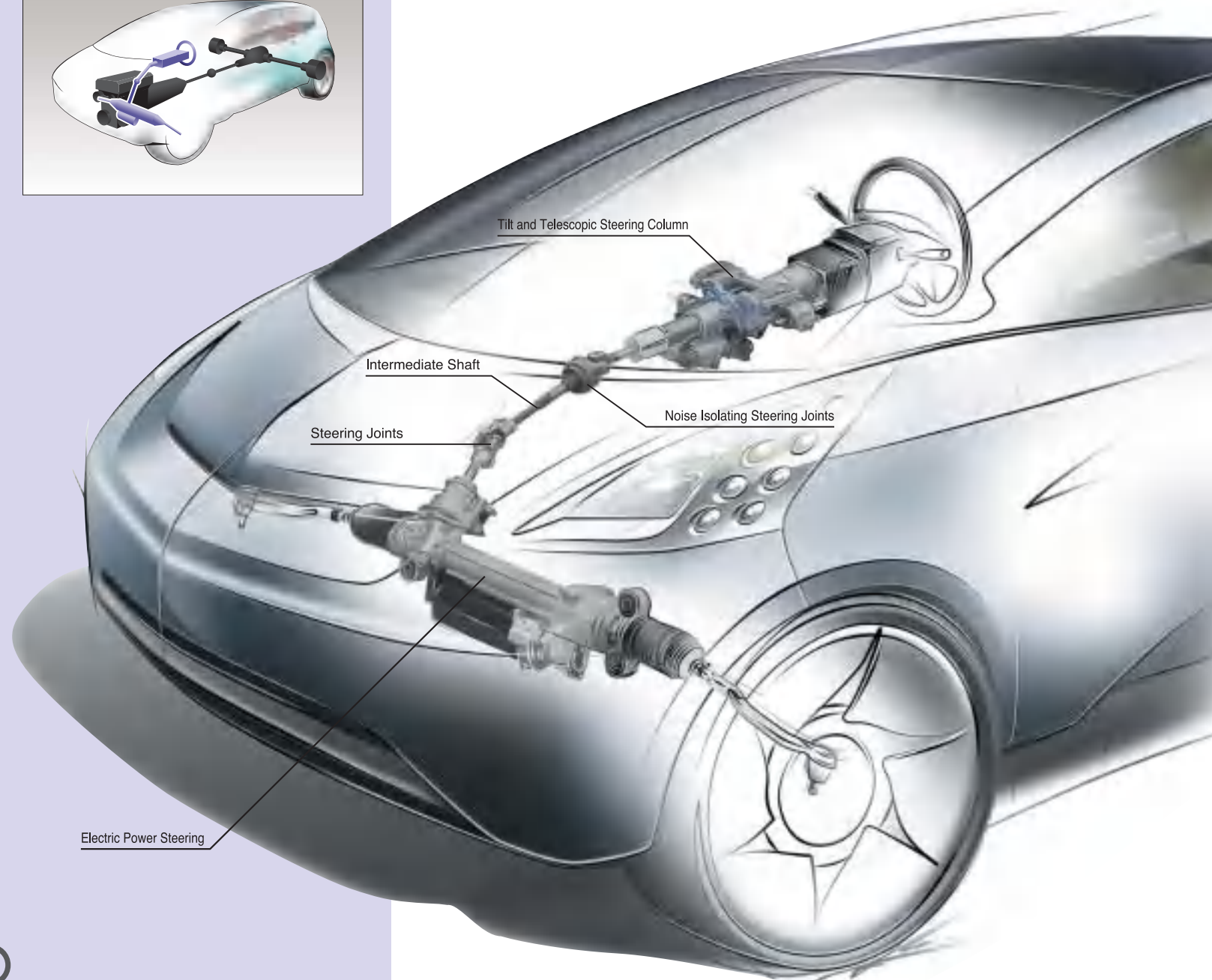
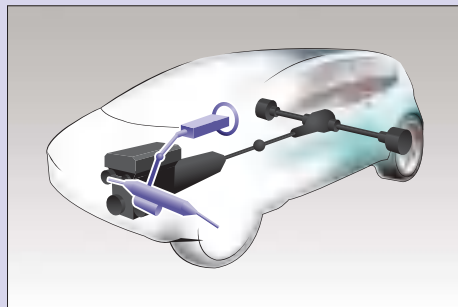
Drive train 33 Transmissions 41 Differential Gear & Propeller Shaft



Steering Systems

The lightweight and compact EPS creates various merits for the future, in addition to improvements in fuel efficiency due to its lightweight. The steering system, which accurately conveys road conditions to the driver, is indispensable for safe and comfortable driving. By applying its unique precision control based on vehicle running tests, NSK can ensure flexible management for the different input loads of various types of vehicles. NSK's ideal EPS will be one where you can truly sense the car. Moreover, NSK's original plastic technology used in various types of steering columns contributes to improved safety due to its excellent impact-absorbing characteristics.

Serving the driver's need for precise and responsive steering...



Column Type Electric Power Steering
Column type EPS with lower pivot tilt mechanism for small cars.



Column Type Electric Power Steering
Column type EPS for minivehicles.



Pinion Type Electric Power Steering
Pinion type EPS for small cars.

Steering Systems



Column Type Electric Power Steering

Column type EPS with mid-tilt mechanism for small cars.



Electrical Tilt and Telescopic Steering Column

Electrical adjustment mechanism for position memory steering column.



Dual Pinion Type Electric Power Steering

Pinion type EPS that transmits power assist to the rack gear by a pinion gear located separately in consideration of limited space availability.



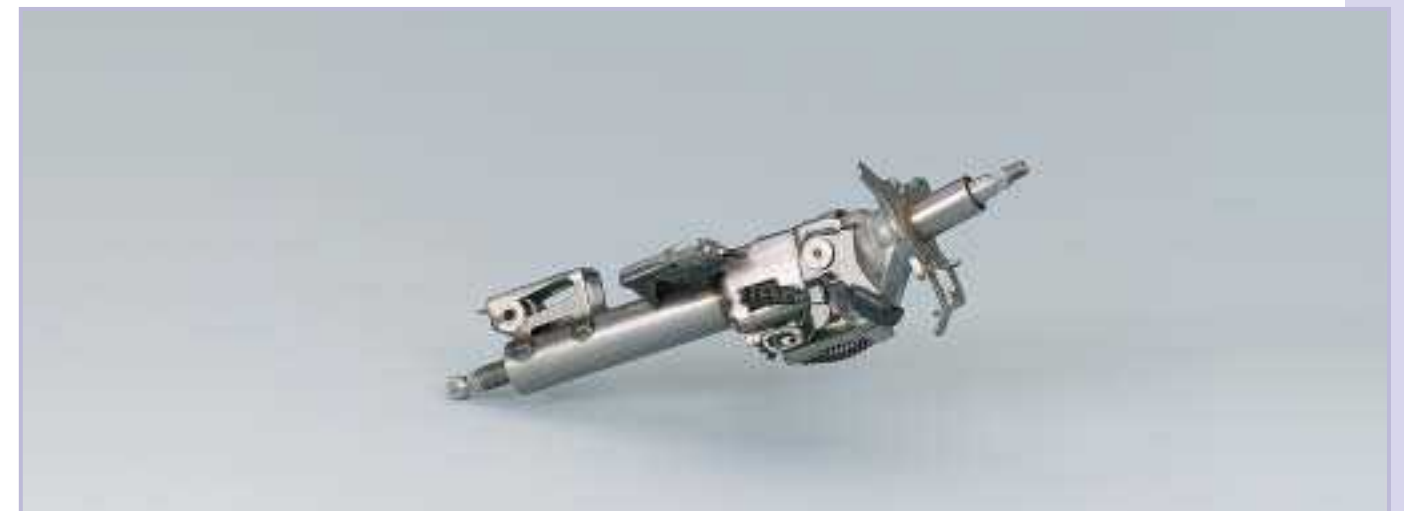
Upper Pivot Tilt and Telescopic Steering Column

Tilt and telescopic steering column with a pivot center in the upper part of the column. Steering wheel position can be adjusted back and forth, and up and down. The automatic tilt-away steering column feature raises the steering wheel for ease when exiting the vehicle.



Offset Ball Screw Type Electric Power Steering

Offset ball screw type EPS that transmits robust power assist to the rack gear by a highly efficient reduction gear and ball screw.



Upper Pivot Tilt Steering Column

Tilt steering column with a pivot center in the upper part of the column. Steering wheel position can be adjusted up and down. The automatic tilt-away steering column feature raises the steering wheel for ease when exiting the vehicle.

Steering Systems



Lower Pivot Tilt and Telescopic Steering Column

Tilt and telescopic steering column with a pivot center in the lower part of the column. Steering wheel position can be adjusted up and down. Lightweight achieved by using magnesium materials. The unitized design of the steering wheel and lock is an added deterrent to vehicle theft.



Lower Pivot Tilt Steering Column

Tilt steering column with a pivot center in the lower part of the column. Steering wheel position can be adjusted up and down.



Tilt and Telescopic Steering Column for Trucks

Steering column with added rigidity for trucks.



(From left to right: resin coated spline type, triangular section type, expandable serration type)

Slidable Intermediate Shafts

Slidable intermediate shafts for absorbing displacement of body frame.



(From left to right: resin injection mold type, bending type, press fit type, bellows type)

Collapsible Intermediate Shafts

Intermediate shafts for displacement and load absorption at the time of a collision.



Noise Isolating Steering Joints

Noise isolating steering joints that excel in characteristics of vibration absorption and soundproofing.

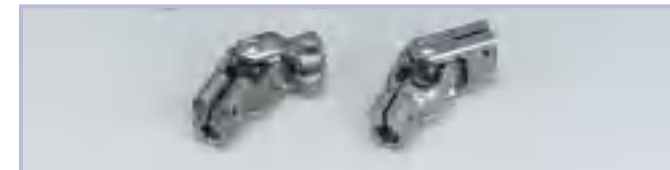


Double Cardan Constant Velocity Joint

Compact joint that maintain constant velocity.



(From left to right: single flange type, free phase type, slap-up type)



(From left to right: double flange type, forged type)

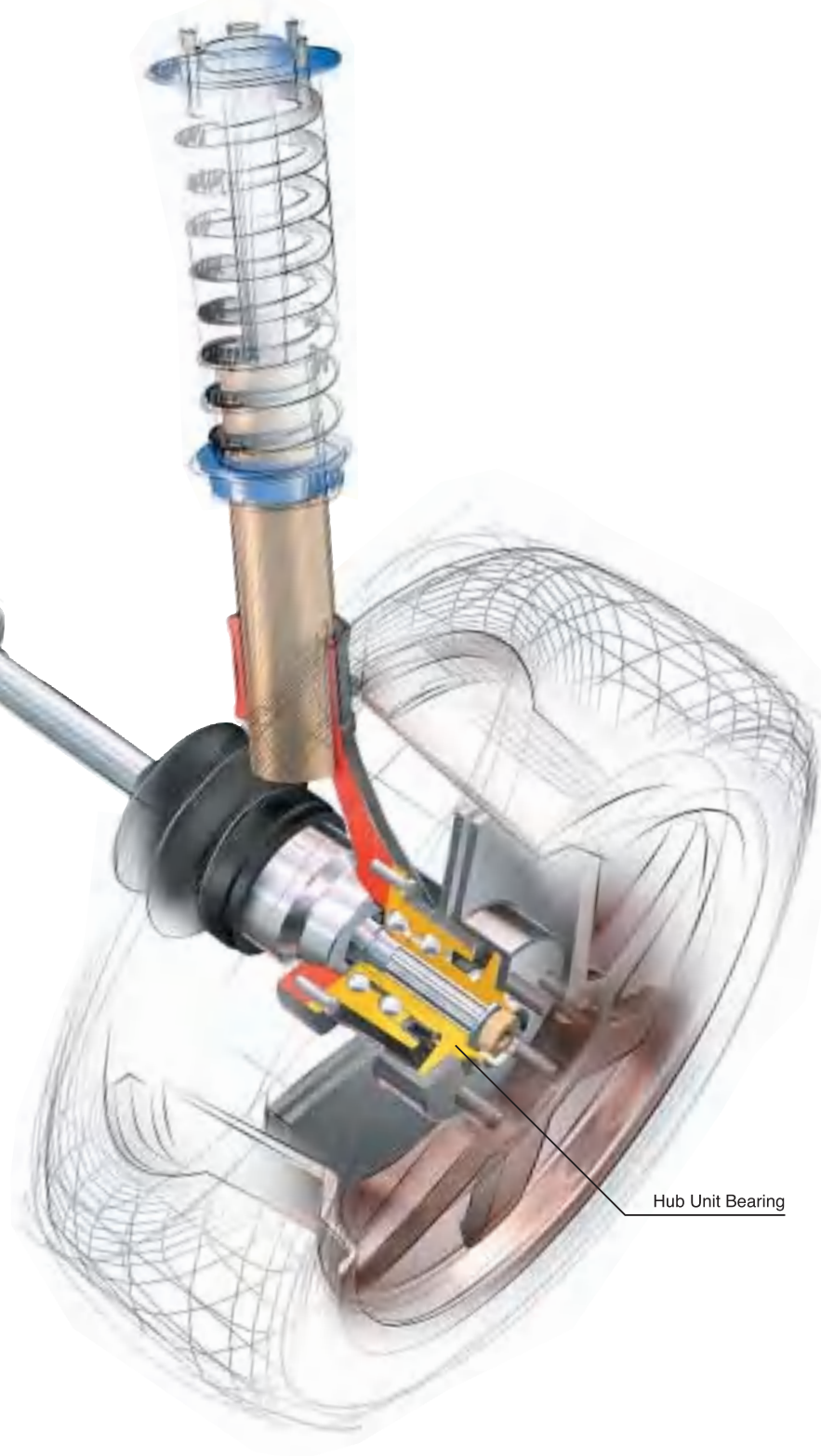
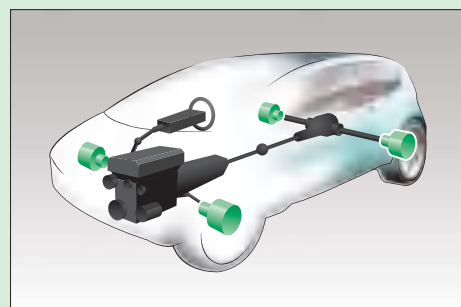
Steering Joints

Various joints that can be selected according to the usage.

Hub Unit Bearings

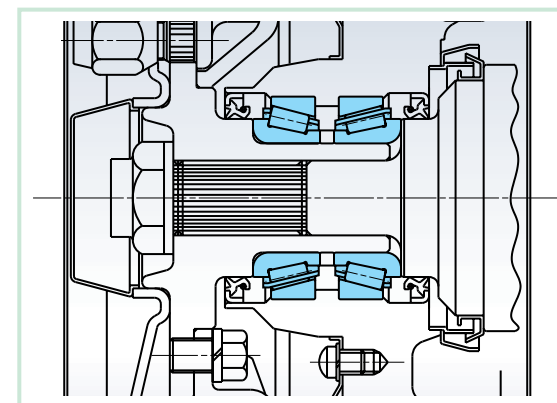
Hub unit bearings have to meet increasingly strict requirements that demand lighter weight, greater promotion of fuel efficiency, and enhanced module production systems. Along with the widespread adoption of antilock braking systems (ABS) to ensure stable maneuverability during braking, there is a growing need for our hub unit bearings with a built-in sensor. NSK guarantees high quality of all of our products by repeated, rigorous bench testing and other checks that take full advantage of our cutting-edge technology, which only the top-bearing maker can offer. NSK offers compact and lightweight hub unit bearings with built-in ABS sensors.

Compact, light-weight, durable and integrated...



Hub Unit Bearings

Conventional Type

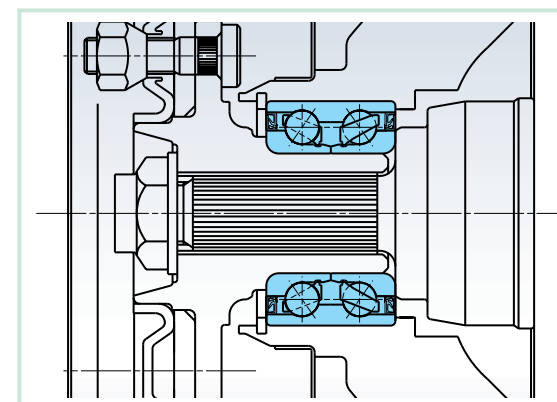


[Features]

● Long distance between effective load centers (for non-driven wheels);

1. Difficult to set preload.
2. Complicated mounting process.
3. Grease packing required.

HUB I

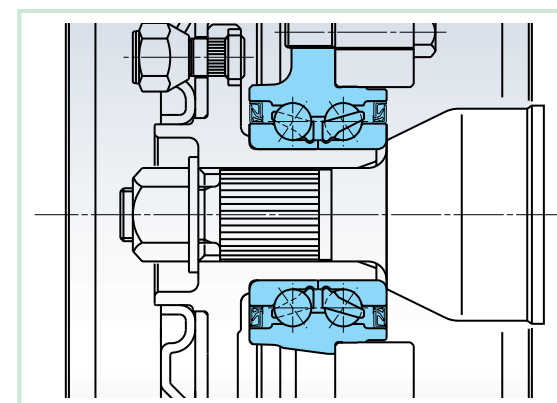


[Features]

● Compared to conventional type;

1. Easy and reliable preload setting.
2. Easy mounting process.
3. No spacer required.
4. No grease packing required.
5. Compact.
6. Integral high performance seal.

HUB II

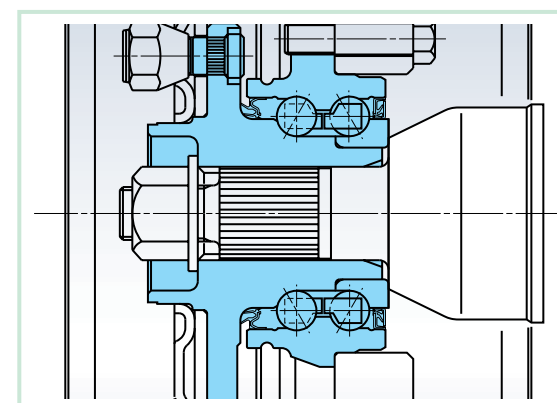


[Features]

● Compared to HUB I;

1. Easier and more reliable preload setting.
2. Easy mounting process.
3. No need to press fit into knuckle.
4. Integral Sensor rotor is optional. (for outer ring rotation type)

HUB III



[Features]

● Compared to HUB II;

1. Preset optimum preload. (for non-driven wheels)
2. Easy mounting process.
3. High rigidity.
4. Easy incorporation of ABS sensor.

Hub Unit Bearings

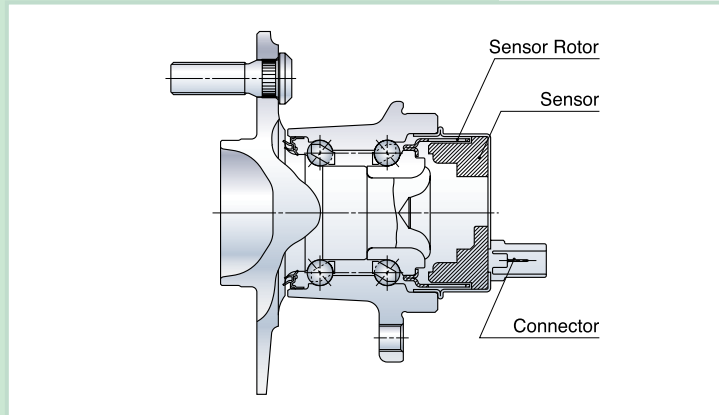


Hub unit bearings with annular passive sensor

An annular passive sensor is located in the radial space between the swaged shaft end and sensor cover.

[Features]

- 1.Compact size attained by utilizing the space inside the bearing.
- 2.Improvement of reliability by sealing the sensor part.
- 3.Integral high-output sensor.
- 4.Small fluctuation output by elastic deformation of bearing.

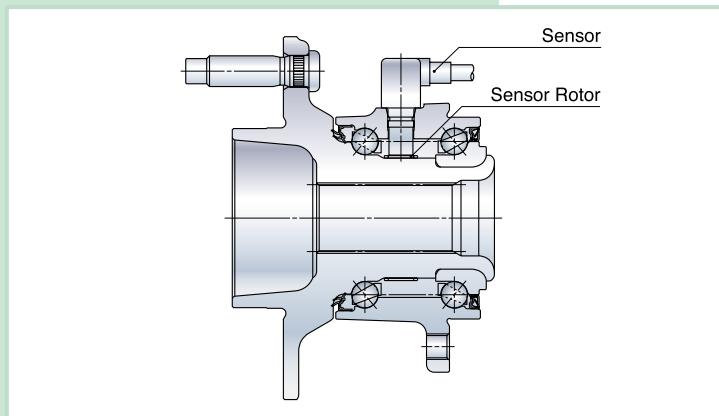


Hub unit bearings with integral sensor located between the rows

The ABS sensor is located between the rows with a very small air gap.

[Features]

- 1.Compact size achieved by utilizing the space inside the bearing.
- 2.Improved reliability by sealing the sensor part.
- 3.Integral sensor for driven wheels.
- 4.Stabilized sensing under high moment load.

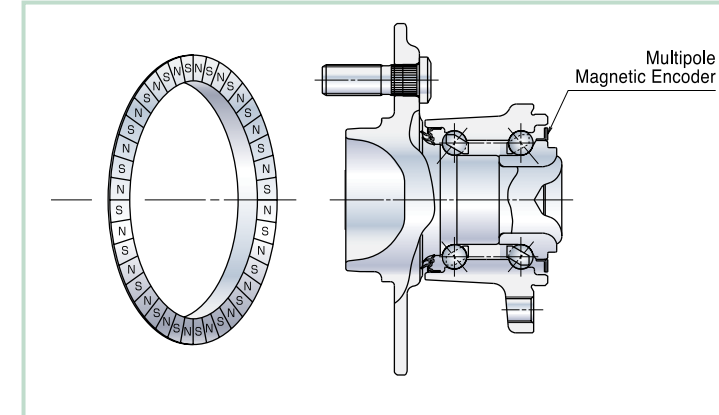


Hub unit bearings with multipole magnetic encoder

A multipole magnetic encoder for active sensor is used for ABS attached to the HUB unit bearing.

[Features]

- 1.Integrated sensor rotor (encoder).
- 2.For active sensor.
- 3.Utilizing high performance encoder.
- 4.Stabilized sensing at low speed rotation.
- 5.Packed Seal with encoder is available.

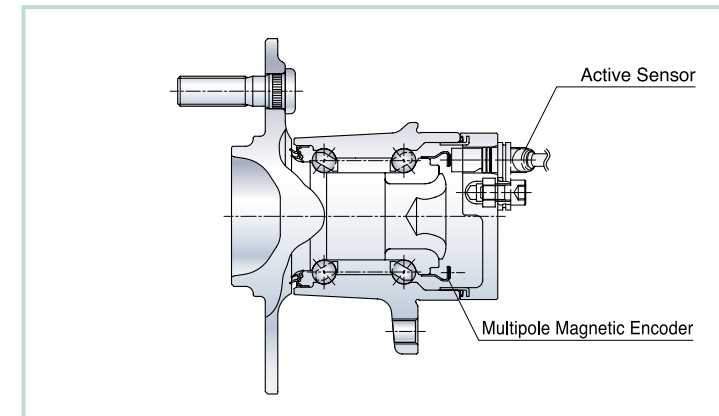


Hub unit bearings with end-cap type active sensor

Integration of ABS Active Sensor and Bearing.

[Features]

- 1.Integrated sensor rotor (encoder).
- 2.Compact size and lightweight achieved by utilizing active sensor.
- 3.Senses, stability at low speed rotation.



Hub Unit Bearings



Double-Row Angular Contact Ball Bearings (HUB I)
Double-row angular contact ball bearing with integral high performance seal. Easier preload setting.



Double-Row Tapered Roller Bearings (HUB I)
Double-row tapered roller bearing with integral high performance seal. Suitable for heavy-duty vehicles.



Double-Row Angular Contact Ball Bearings with Outer Mounting Flange (HUB II for Outer Ring Rotation Type)
Outer ring rotating hub unit bearing with outer flange for mounting the wheel.



Double-Row Angular Contact Ball Bearings with Outer Mounting Flange (HUB II for Inner Ring Rotation Type)
Inner ring rotating hub unit bearing with outer flange for mounting onto the knuckle.



Double-Row Tapered Roller Bearings with Outer Mounting Flange (HUB II for Inner Ring Rotation Type)
Inner ring rotating tapered roller hub unit bearing with integral flange for mounting onto knuckle. Suitable for heavy-duty vehicles.



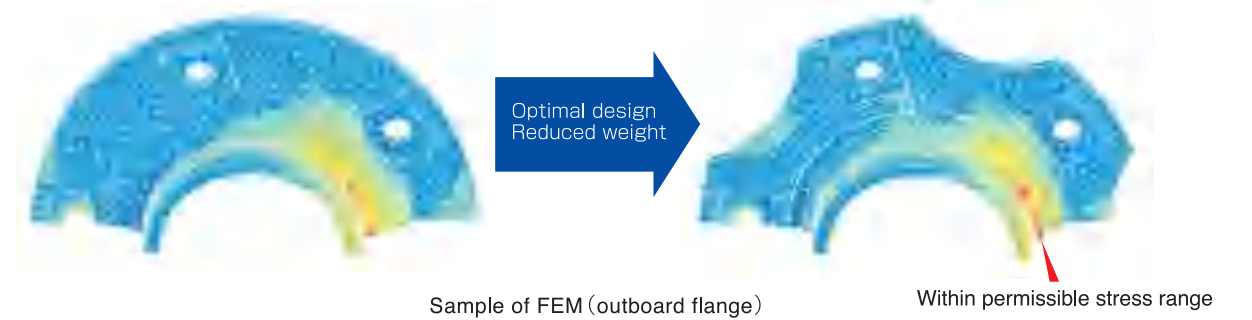
Double-Row Angular Contact Ball Bearings with Inner and Outer Mounting Flange (HUB III for Driven Wheels)
Double-row angular contact ball bearing with integral inner and outer mounting flange. Easier mounting because of preset preload.



Double-Row Angular Contact Ball Bearings with Inner and Outer Mounting Flange (HUB III for Non-Driven Wheels)
Double-row angular contact ball bearing with integral inner and outer mounting flange. Easy incorporation of ABS sensor.

Outboard hub flange

Achieved optimal design of outboard hub flange using FEM to maintain stress concentrations within the permissible range, and for further weight reduction.



Double-Row Angular Contact Ball Bearings with Inner and Outer Mounting Flange (HUB III for Minivehicles)
Hub unit bearing achieves lightweight by incorporating a unique design specifically for minivehicles.

Engine Parts

An engine utilizes a large number of bearings and engine-related parts. The requirements for comfort and convenience in the vehicle have diversified in the car market in recent years, resulting in roomier car interiors with reduced engine sizes. NSK offers compact and durable engine parts that lead the trend toward smaller engines.

Roller Followers for Engine Tappets

Low friction has been achieved by changing a part of the rocker arm tappet that makes contact with the cam for rolling.



Water Pump Bearings

High reliability has been achieved by special grease and high performance seals. NSK offers a wide line of bearings to meet all requirements.



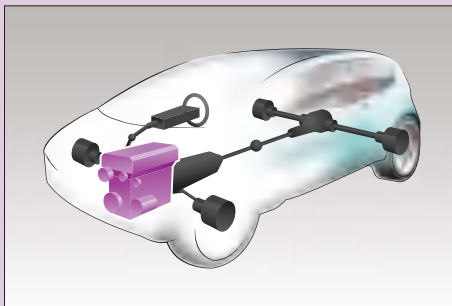
Pressed Rocker Arm Assemblies

Reduced weight and costs have been achieved with press technology including thickening of the necessary parts for strength.



Drawn-Cup Needle Roller Bearings for Camshaft Journals

Super thin cross section and low friction have been achieved.



Pressed Rocker Arm Assemblies

Roller Followers for Engine Tappets

Auto-Tensioner for Timing Belt

Ball Bearing for Turbocharger

Water Pump Bearing

Bearings for Tensioner & Idler

State-of-the-art technology contribute ever-evolving engines...



BWFH Type Water Pump Bearings

High capacity and high moment rigidity have been achieved by increasing the limited number of balls in the front row.



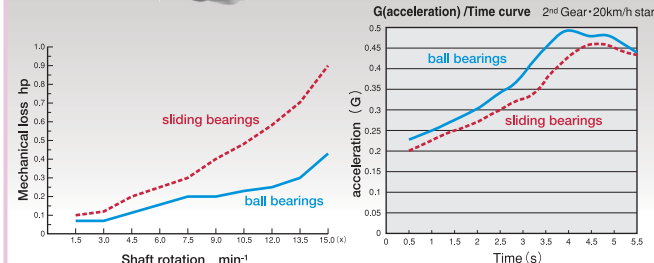
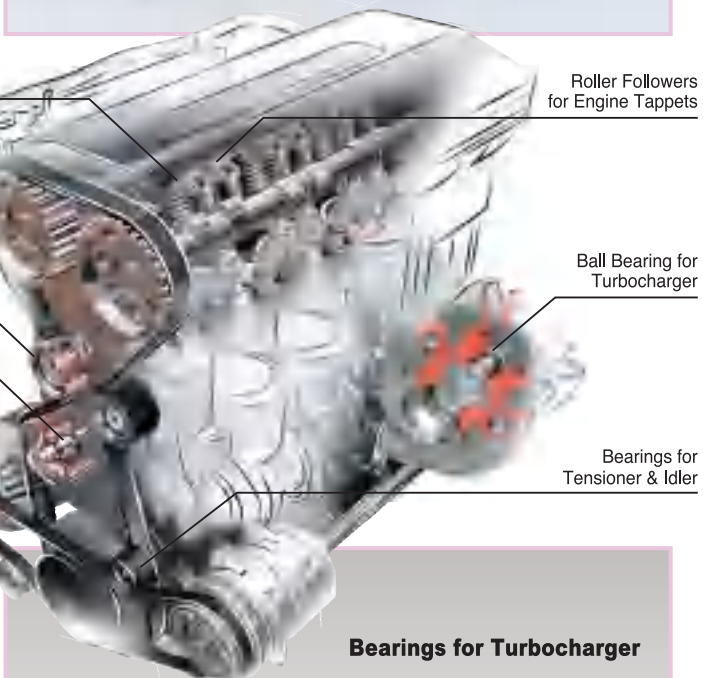
Ball Bearings for Turbocharger

The cartridge bearing has little mechanical loss while requiring no preload setting.



Bearings for Tensioner & Idler

High reliability has been achieved by special grease and high performance seal. NSK offers a wide line of bearings to meet the needs of every type of belt and layout.



Plastic Pulley for Accessory & Timing Belt

High precision & lightweight plastic pulley bearing with creep prevention mechanism.



Auto-Tensioner for Timing Belt

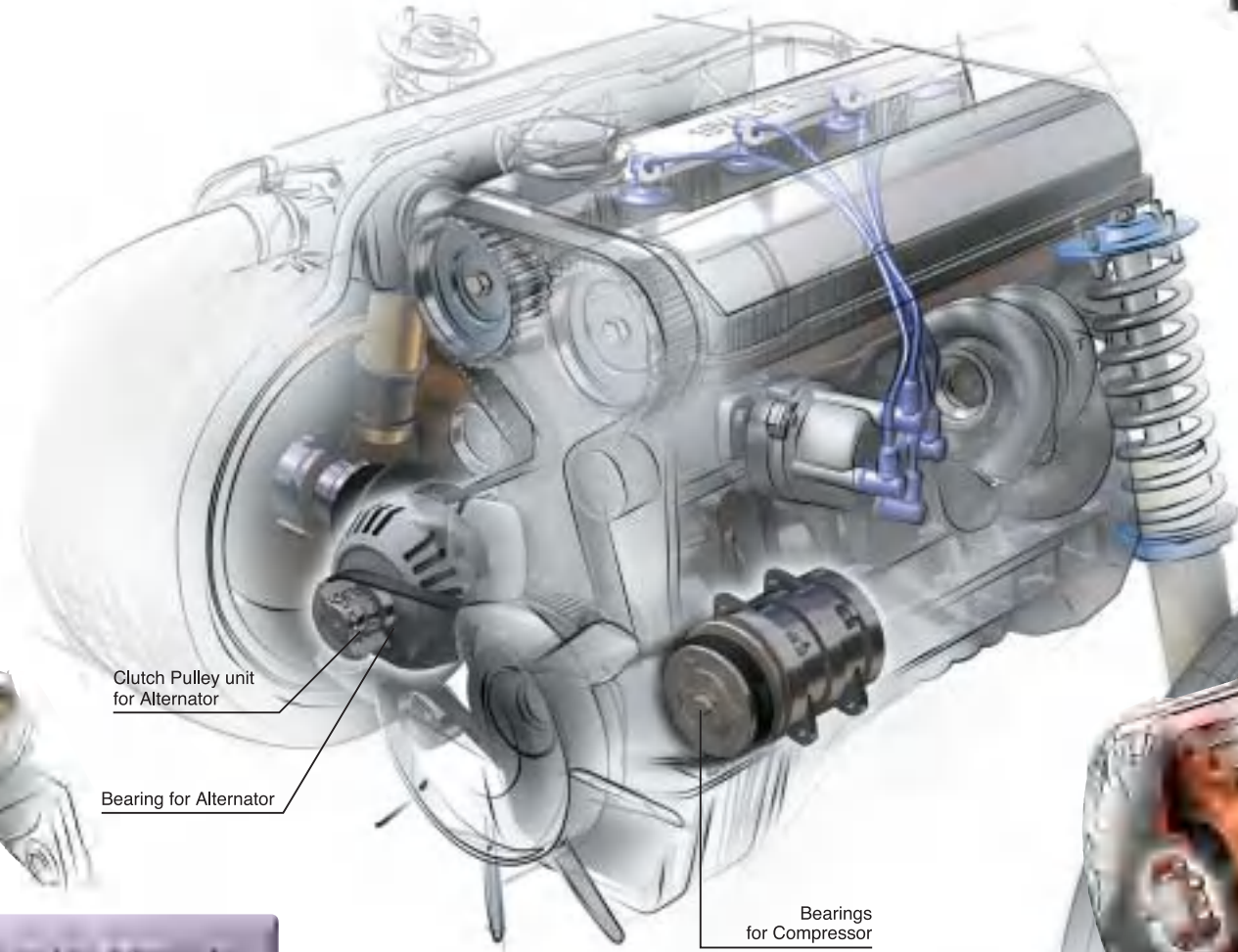
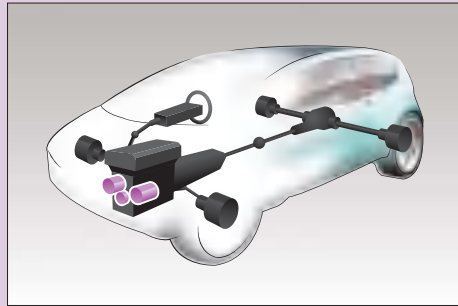
Optimum timing belt tension has been achieved with a multi-disc damper adjusted to various engine specifications.

Electrical Accessories

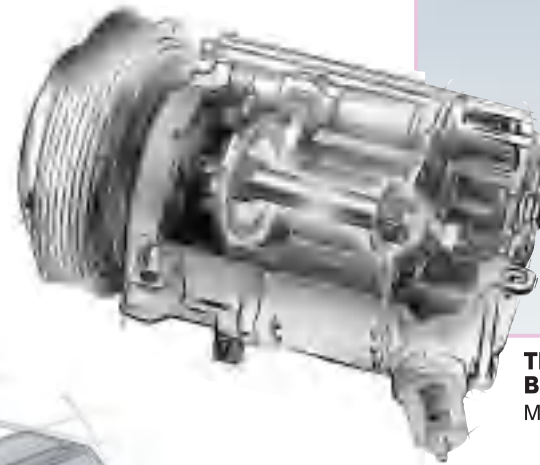
Vehicles include a vast array of electrical accessories such as engine starters, air-conditioning systems for a comfortable riding environment, windshield wipers for safety, and oil-pressurized motors to assist power steering. These days, we cannot even imagine a vehicle on the road without these components. Unlike household appliances, these parts are exposed to extreme temperatures and vibrations. Therefore, they are equipped with far more durable and reliable bearings.

NSK's advanced bearing technology has revitalized the automobile industry with such items as a clutch pulley unit for alternators, which is an automotive power source.

For additional comfort...



Bearings for Compressor



Thin Cross-Section Double Row Angular Contact Ball Bearings for Magnetic Clutch

Magnetic clutch bearings with high sealing performance, high moment rigidity, and long life.



Thrust Needle Roller Bearings with Integrated Races for Compressor

High durability under the alternative coolant (non-Freon type) and high rotating speed.



Drawn-Cup Needle Roller Bearings for Compressor

High durability under the alternative coolant (non-Freon type) and high rotating speed.

Bearings for Motor



Needle Roller Bearings for ABS Motor

Reduced weight and costs have been achieved with pressed outer ring.



Bearings for Cooling Fan Motor

Long life for high temperature and brush wear particle conditions have been achieved with special grease.

Bearings for Alternator



Clutch Pulley Unit for Alternator

The pulley unit with a one-way clutch decreases belt noise and extends belt life by absorbing the speed fluctuation transmitted through the crank pulley.



Bearings for Alternator

Highly reliable alternator bearings that offer high performance under high-temperatures conditions, high speed, with sealing features. Includes creep prevention function between the bearing and housing.



Bearings for Electric Power Steering Motor

EPS motor bearing for low torque, low vibration, and high reliability.



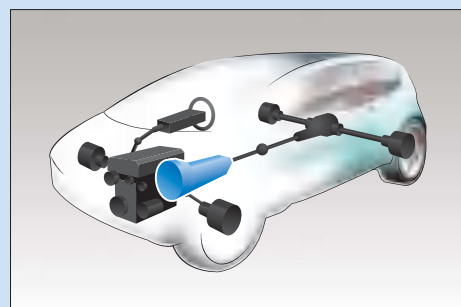
Bearings for Throttle Motor, Bearings for EGR Motor

Low torque for low temperatures, and long life under high temperatures have been achieved with newly developed exclusive grease.

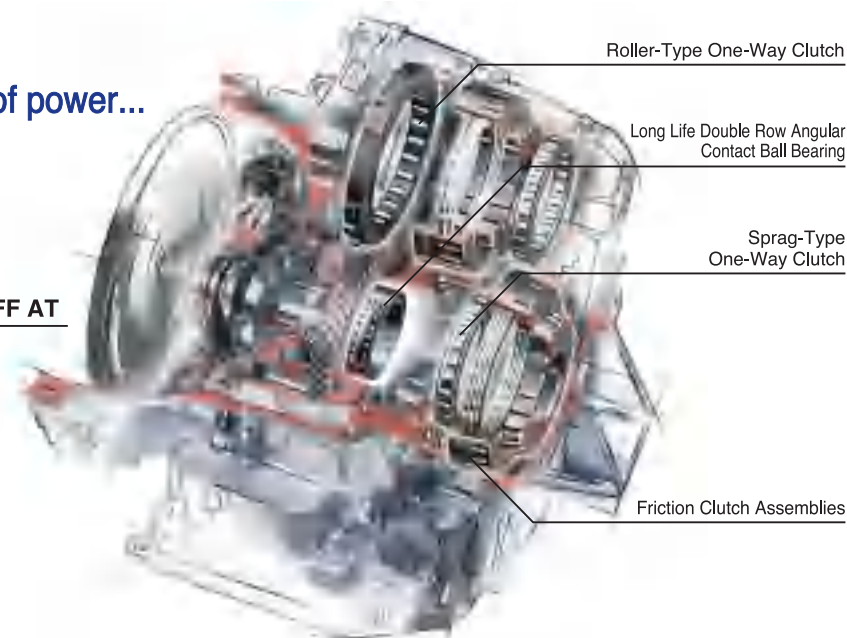
Automatic Transmission

Automatic transmissions ensure smooth gear changes with minimal shift shock while operating under various kinds of driving conditions. A complex and extremely intricate form of technology known as friction control is ideal for efficiently conveying power from the engine and for smooth gear shifting. Friction-related parts and one-way clutches, which have been developed based on our advanced tribology technology, are the most important products in determining the performance of automatic transmissions. They contribute to a smooth and powerful driving experience.

For smooth driving with minimal loss of power...



for FF AT



Roller-Type One-Way Clutch

Long Life Double Row Angular Contact Ball Bearing

Sprag-Type One-Way Clutch

Friction Clutch Assemblies

Thrust Needle Roller Bearing

Hydraulic Lock-up Clutch

Flex Band

Cage & Roller Assemblies for Planetary Gears

Friction Plates/Separator Plates

Friction Clutch Assembly

for FR AT

Thrust Needle Roller Bearings



Friction Plates / Separator Plates

Unique friction materials produce an excellent and smooth shift quality.



Sprag-Type One-Way Clutches

Lightweight, compact, and reliable shifting can be achieved.



Flex Bands / Maji Bands

The compact design for high torque capacity is established.



Friction Clutch Assemblies

An optimal design to maximize functionality of the clutch.



Hydraulic Lock-up Clutches

A traction control system is achieved with high anti-shudder performance.



Roller-Type One-Way Clutches

The action of roller and spring reduce drag torque remarkably.

Automatic Transmission



Thrust Needle Roller Bearings for Power Train
Selection of the raceway washer and retainer type can be according to operating conditions, such as load, rotation speed, and lubrication.



Thrust Needle Roller Bearings for Torque Converter
A bearing and a raceway washer with anti-rotation function have been unified for easy assembly and high capacity.



Long Life Double Row Angular Contact Ball Bearings
Reduced weight and costs have been achieved by using PA46 plastic cage with superior oil and heat resistance. Initial internal clearance is used to provide optimum preload.



Long Life Double Row Tapered Roller Bearings
Original materials and heat treatment have been developed for longer life. Initial internal clearance is used to provide optimum preload.



Cage & Roller Assemblies and Shaft for Planetary Gears
For coping with increasingly high-speed rotations and low-friction torque while maintaining durability.



Drawn-Cup Needle Roller Bearings for Power Train
From sliding bearings to rolling bearings, low friction torque has been achieved by the technology of thin cross section drawn-cup bearings.



Long Life Tapered Roller Bearings with Outer Mounting Flange
The number of parts is reduced by unitization of the housing and outer ring, which also allows for easier assembly.



Long Life Double Row Bearings with Outer Ring Splines
The outer ring has a mounting flange and splines, which attach to the one-way clutch. This affords greater compactness of FF-type automatic transmissions.



Drawn-Cup Needle Roller Bearings for Shift Linkage
Smoother shifting is achieved by replacing sliding bearing with rolling bearing.



Linear Bearings for Solenoid Valve
Special arrangement of balls achieves a reduction of rotational torque and sliding friction torque.



Cylindrical Roller Bearings with PA46 Plastic Cage
Reduced weight and costs have been achieved by using PA46 plastic cage with superior oil and heat resistance.

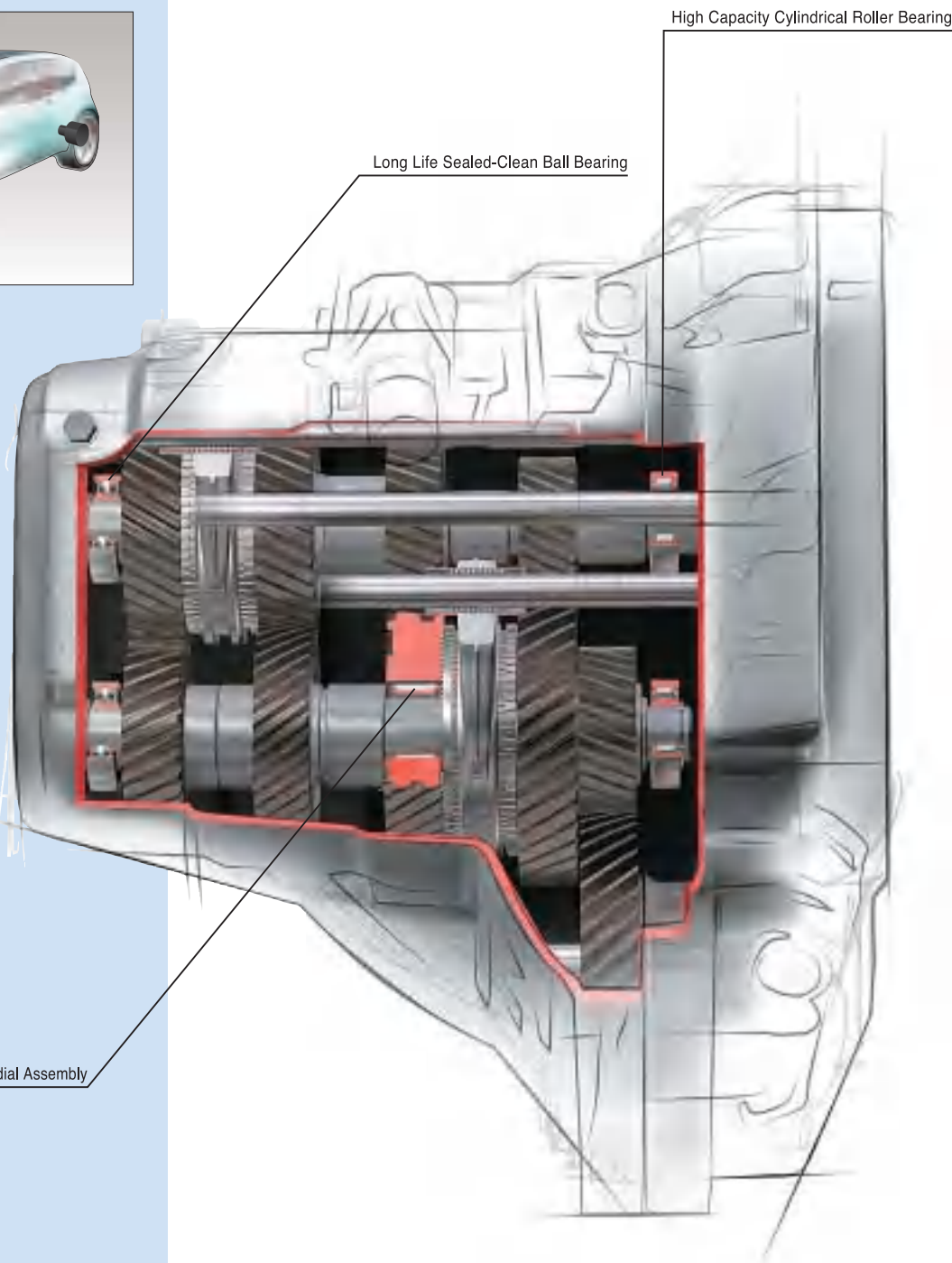
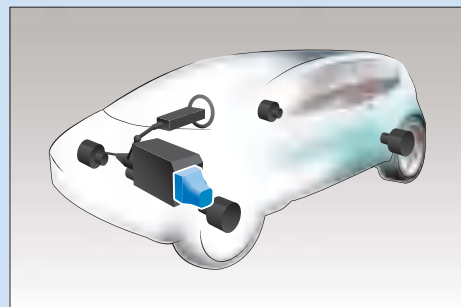


Thin-Walled Tapered Roller Bearings
Maximum capacity in a limited space (thin section) has been achieved by high-level design technology, which promotes greater compactness of FF-type automatic transmissions.

Manual Transmission

Manual transmissions must adequately meet driver expectations of control by conveying a smooth, precise, and crisp feeling. Transmissions must also be compact, lightweight, and be able to deliver excellent fuel efficiency for the increased number of gears that are appearing in newer vehicles. The bearings and synchronized parts created by NSK play a key role in supporting the future of manual transmissions with their unsurpassed reliability and capability developed with tribology technology.

Reflecting the driver's feel for "driving"...



Long Life Sealed-Clean Ball Bearing

High Capacity Cylindrical Roller Bearing

Split Needle Roller & Plastic Cage Radial Assembly



Long Life Sealed-Clean Ball Bearings

Long life has been achieved by specially designed seals for transmissions. The seals prevent ingress of contaminants in the oil. Size reductions from standard open type bearings can be achieved.



High Thrust Capacity Cylindrical Roller Bearings

High capacity cylindrical roller bearings for radial load, as well as axial load from gear meshing.



Quick-Assembly Tapered (QAT) Roller Bearings

Superior roller stability after assembling the cup and the cone achieves quick and high precision preload setting. The set preload is maintained at higher levels for longer periods.



Drawn-Cup Linear Ball Bearings

Smooth rotation and sliding have been achieved in a compact size.



Needle Roller & Plastic Cage Radial Assemblies

Reduced weight and costs have been achieved by using plastic cage with superior oil and heat resistance.



Split Needle Roller & Plastic Cage Radial Assemblies

Best for preventing fretting generated at the time of non-relative rotation between gear and shaft.



Light weight and Low Costs TKZ Type Clutch Release Bearings

Self-centering clutch release bearing with reduced weight and costs has been achieved by reducing the number of parts combined with press technology.



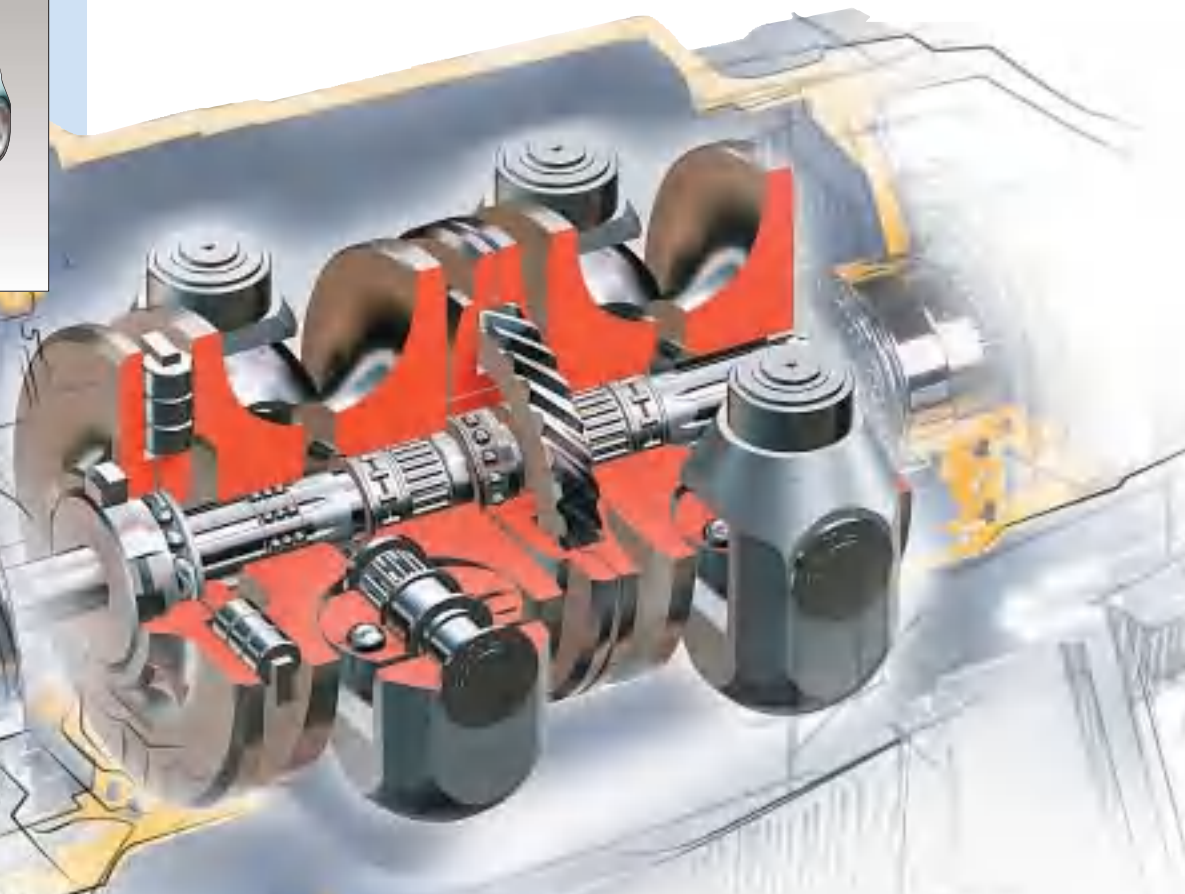
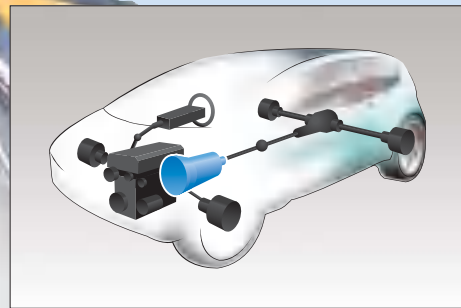
Synchronizer Steel Cones

Reduced costs have been achieved by using original material that allows for press forming and through hardening. Superior friction characteristics from precision taper surface processing technology contribute to smoother shifting.

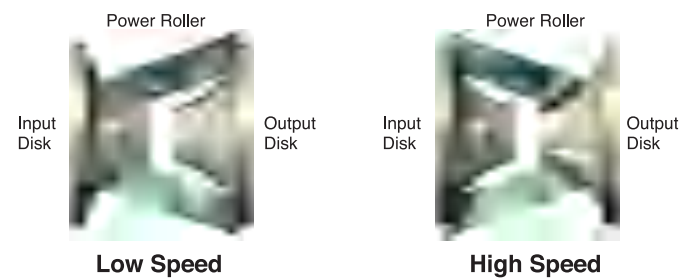
Half Toroidal CVT POWERTOROS Unit

The half-toroidal CVT is an innovative transmission that executes smooth, continuous gear ratio changes by changing the angle of the power rollers between the input disk and output disk. Toroidal CVT development began in 1877. One hundred years later, NSK undertook its development in 1978, spending as much as 21 years to develop a practical application. Featuring smooth, silent, and continuous gear ratio changes, as well contributing to conserving energy and further reduction of CO₂ emissions, the highly efficient half-toroidal CVT POWERTOROS Unit is the desired transmission that is a result of NSK's advanced technology in tribology.

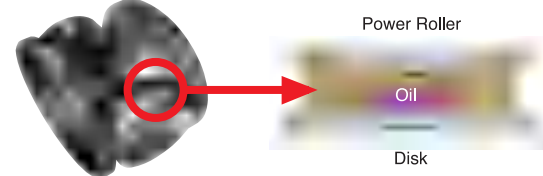
The Continuously Variable Transmission...
quiet and energy efficient...



Operation of the Half Toroidal CVT POWERTOROS Unit

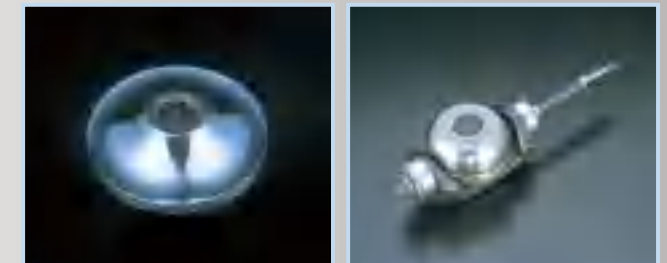


Power is transmitted by this lubricating oil film, which is only 1/1,000mm thick.



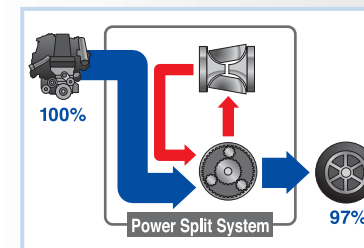
■ Tribology in Half Toroidal CVT

Power can be transmitted much more smoothly if the gear teeth that transmit power are made as small as possible. Although a half-toroidal CVT has no real gear teeth, power is transmitted by a mechanism called traction drive. In the half-toroidal CVT, which achieves a quiet and smooth transmission of great power, is a layer of oil that is pressurized under an extreme load to approximately 1/1000 mm thick at the point of contact between the disk and power roller. This special oil has a characteristic of forming into a glass-like substance under high pressure. Power is transmitted from the disk to the oil, and then to the power roller. In other words, since it is in rolling contact under high surface pressure, the durability of the contact surface becomes an issue. In order to solve this issue, NSK gathered all of its tribology technology to develop CVT steel, which is highly purified steel for CVTs where non-metal inclusions have been removed to the most possible extent. This material achieves constant rigidity by increasing the amount of austenite composition in the steel, which helps make foreign substances entering the gear virtually harmless. We succeeded in developing a material that is highly reliable with long life while operating under the most severe conditions of massive loads, high temperatures, and high speeds.

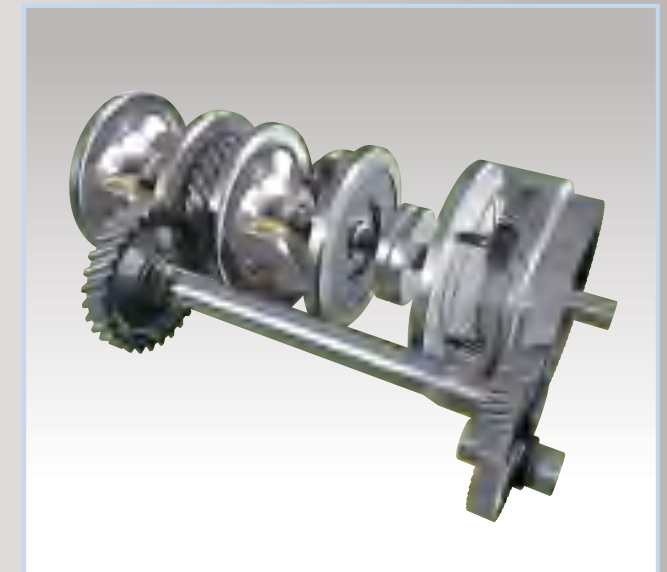


■ Power Split System

The next generation of the half-toroidal CVT is even more efficient thanks to NSK's power-split system. This system utilizes planetary gears combined with the half-toroidal CVT and a planetary gear device. This power circulatory speed-changing mechanism had been conceived in theory before, but had not actually been developed since the best non-level speed changer had not yet been developed. By changing two modes, a wide range of speeds and a very highly efficient form of power conveyance was achieved in our power-split system, which is the truly ideal speed changer.

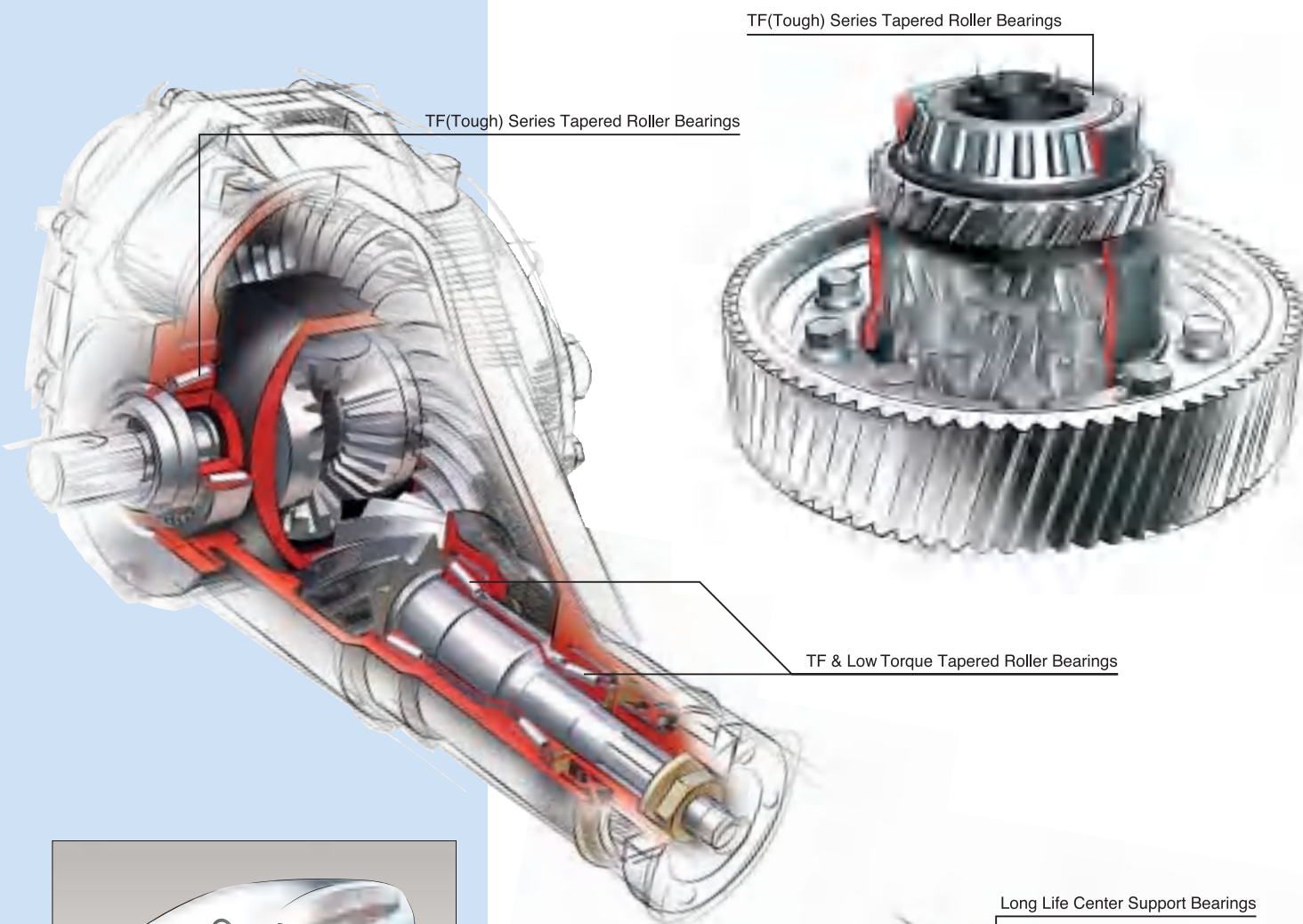


Incorporating a planetary gear allows most of the engine power to be transmitted directly to the wheel, bypassing the half-toroidal CVT.



Differential Gear & Propeller Shaft

In FR vehicles, the engine power is transmitted to the rear differential gear via the propeller shaft. The fact that the center bearing used to support the propeller shaft is located on the vehicle's exterior gives rise to a demand for optimum mud and turbid water resistance in addition to maintaining fast rotational speeds. Due to the large speed-reduction gear ratio of the rear differential gear that conveys engine power to the rear wheels, a large gear-interlocking load affects the bearings that provide support for the pinion gear and the ring gear. In particular, bearings that support the pinion gear require low torque and high durability since these bearings rotate at the same speed as the propeller shaft.



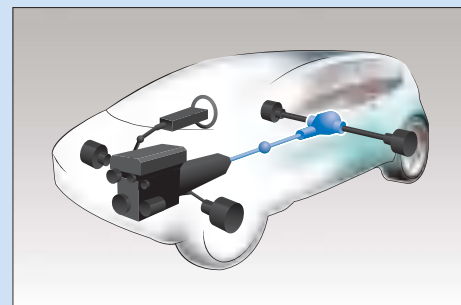
TF(Tough) Series Tapered Roller Bearings

TF(Tough) Series Tapered Roller Bearings

TF & Low Torque Tapered Roller Bearings

Long Life Center Support Bearings

Needle Roller Bearings for Universal Joints



For smooth rotation under conditions of high-temperature and heavy load....



TF(Tough) Series Tapered Roller Bearings

Long life in contaminated oil including metal wear powder has been achieved by original materials and heat treatment. Size reductions from standard open type bearings are available.



Low Torque Tapered Roller Bearings

Low friction torque has been achieved by logical friction analysis and improved parts surface processing technology.



Long Life Cylindrical Roller Bearings for Pinion Shaft Pilot Support

For a pinion shaft pilot in a straddle mount type differential of heavy trucks. The full roller design allows for heavy radial loads.



Long Life Needle Roller Bearings for Universal Joints

Low friction torque and improvement of seizure resistance between the spider and bearings have been achieved by using specially designed bearing cups.



Long Life Center Support Bearings

Center support bearings for propeller shaft with high sealing performance against mud, turbid water, and particles.



Long Life Coupling Support Bearings for 4WD Vehicles.

Thin walled and large diameter bearings for 4WD coupling. These bearings with large bore and minimized outer diameter have superior heat resistance, high load capacity, and sealing performance against mud and turbid water.

Motorcycles & All-Terrain Vehicles

NSK's products are also used in a wide variety of vehicles ranging from motorcycles to all-terrain vehicles. The mechanical parts of motorcycles are exposed to rough running and high-rotation conditions, while all-terrain vehicles are utilized in a vast range of activities and environmental conditions. Bearings for these vehicles must be durable against water and dirt. To meet these requirements, NSK offers highly durable, well-sealed bearings. NSK has put a great deal of effort in to developing unitized products to enhance usability.



Deep Groove Ball Bearings for Wheel

The open type bearing and grease filled type bearings having high durability for wheels.



Deep Groove Ball Bearings for Crankshaft

Bearing with an anti-creep pin on the outer ring. Bearing with a strengthened cage to resist vibration and shock.



Needle Roller Bearings for Balance Shaft

High durability under hard operating conditions is shown by special coating on the surface of the cage.



Deep Groove Ball Bearings and Needle Roller Bearings for Transmission

Long life open type ball bearings in contaminated lubricant oil. Ball bearings with pressure resistant seals to cut the flow of oil.



Angular Contact Ball Bearing and Tapered Roller Bearing for Steering

Angular contact ball bearing for low friction applications and tapered roller bearings for high rigidity applications of high capacity motorcycles.



Needle Roller Bearings for Swing Arm

High strength design of the outer ring achieves high durability under heavy loads.



Ball Screw for Hydro-static CVT

High efficiency ball screw can help reduce motor size.



Wheel Hub Bearings for All-Terrain Vehicles

Unitized bearings for wheels with high performance seals for mud and turbid water.

The Latest NSK Technology & Next Generation Products

Far beyond its advances in compactness and fuel efficiency, automobile technology continues to evolve to meet the needs of the times, such as 42-volt batteries, by-wire technology, ITS, hybrid electric vehicles (HEV), and fuel cell electric vehicles (FCEV).

In order to respond adequately to the immediate and pressing technological needs of our customers, NSK has established a support system that unites the four economic zones of Japan, the Americas, Europe, and Asia. Moreover, in 2002, NSK established the new Fujisawa R&D Center to serve as a core location for developing technology that will play a pivotal role in the 21st century. With cutting-edge tribology technology as our foundation, NSK will continue to develop its products, including bearings, drive train-related products, and EPS to meet the needs of the changing times.

Next Generation Steering Columns

The column guarantees stable operation and control for superior driving in any desired position while providing energy absorption properties.

Next Generation Electric Power Steering

Achieving high output levels with the adoption of a brushless motor.

Snap Fit Hub Shaft (HUB 3.5)

Significantly reduced weight and improved mounting operations achieved by eliminating the nut and adding a snap ring that secures the hub unit bearing and drive shaft with a single operation. Maintenance also can be carried out at automobile repair shops easily.

Sensor Bearings

A compact design has been achieved by unifying sensors for rotation, positioning, temperature, and vibration. Applicable to a wide variety of motors and actuators.

Electric Linear Actuator

An electric linear actuator that harmoniously incorporates a highly effective ball screw with control technology. A critical product for the advancement of drive-by-wire technology.

Clutch Pulley Unit

A pulley unit brings together a one-way clutch, bearings, and a pulley, for diverse applications due to its reduced weight and size.

Sophisticated Clutch Unit

A sophisticated clutch unit that offers smooth, powerful acceleration and shifting for a more exciting driving experience.

Needle Roller Bearings for Planetary Gears

Cage and rollers optimized for planetary gears featuring low torque, high durability, and lightweight properties. A pinion shaft is used to support the needle roller bearings.

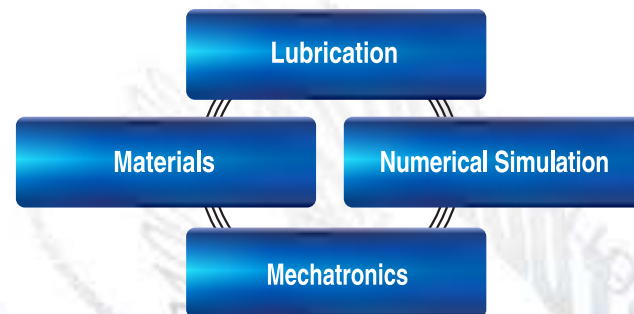
Drawn-Cup Needle Roller Bearings with Floating Seal for Automatic Transmisson

Incorporates a floating seal between the outer mounting flange and the retainer, featuring dramatically extended bearing life.

Research & Development



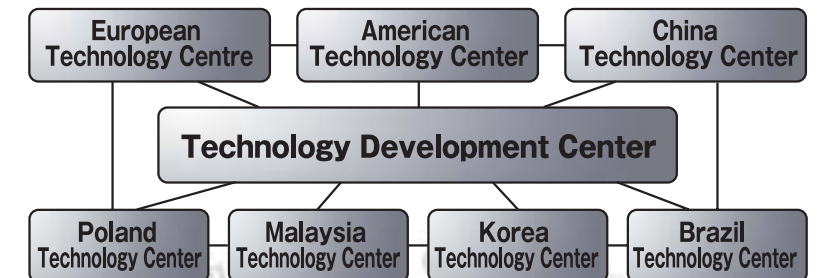
The pursuit of mechatronics technology, which supports materials technology, lubrication technology, numerical simulation, and control, ultimately controls friction, and supports various technologies in order to smoothly convey power.



NSK's research and development department is the think tank of NSK. At the core of R&D is our technology development center, where the latest in technology is combined with creativity for the development of future products. While promoting further strengthening of basic technology, the numerous products and state-of-the-art technology that is created here attracts attention from around the world.



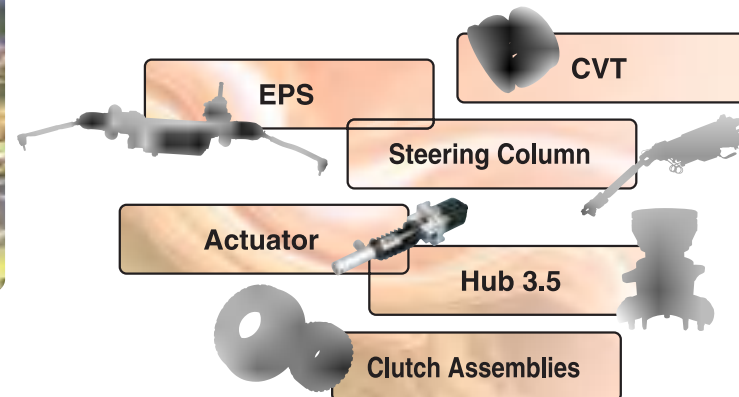
Maintaining close contact with centers within Japan and abroad with NSK's technology development center at the core, technology is shared openly for the development of market-oriented products and the strengthening of technological developments.



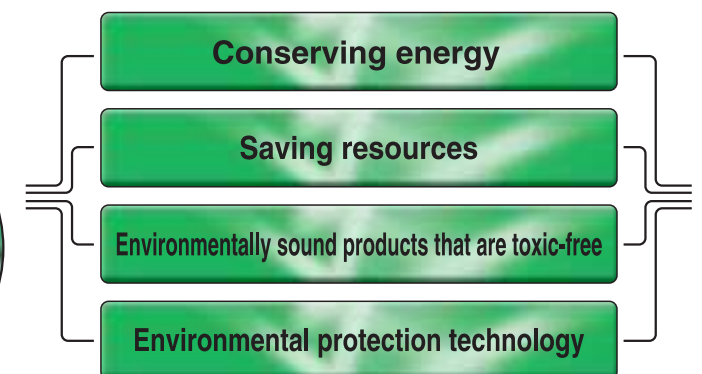
Technology Development Center
(Fujisawa-shi, Kanagawa)



Starting with EPS, which was first put into practical application by NSK, electric linear actuators and such are the sum of NSK ball screw technology, which is a part of the pursuit for new technology for superior motorization of the future.



In addition to improving efficiency, capability, preservation of the global environment, driving comfort and safety, NSK is also actively developing an environmental management system that includes the entire group with the goal of implementing more effective environmental measures.



Offices & Plants

Europe and Africa

<p>NSK EUROPE LTD. Belmont Place, Belmont Road, Maidenhead, Berkshire SL6 6TB U.K. TEL:+44-1628-509800 FAX:+44-1628-509808 Business:Headquarters for all European operations</p>
<p>NSK BEARINGS EUROPE LTD. 3 Brindley Road, South West Industrial Estate, Peterlee, Co. Durham, SR8 2JD U.K. TEL:+44-191-586-6111 FAX:+44-191-586-3482 Business:Manufacture and sales of bearings and precision machinery & parts</p> <p>PLANTS:PETERLEE 3 Brindley Road, South West Industrial Estate, Peterlee, Co. Durham, SR8 2JD U.K. TEL:+44-191-586-6111 FAX:+44-191-586-3482</p> <p>PETERLEE (Forge) Davy Drive, North West Industrial Estate, Peterlee, Co. Durham, SR8 2PW U.K. TEL:+44-191-518-0777 FAX:+44-191-518-0303</p> <p>NEWARK Northern Road, Newark, Nottinghamshire, NG24 2JF U.K. TEL:+44-1636-605123 FAX:+44-1636-642083</p>
<p>NSK UK LTD. Northern Road, Newark, Nottinghamshire, NG24 2JF U.K. TEL:+44-1636-605123 FAX:+44-1636-602750 Business:Sales of bearings, automotive components, and precision machinery & parts</p>
<p>NSK STEERING SYSTEMS EUROPE LTD. Silverstone Drive, Rowley's Green, Coventry, CV6 6PA U.K. TEL:+44-24-76-588588 FAX:+44-24-76-588599 Business:Manufacture and sales of automotive components</p> <p>BRANCH OFFICE:Stuttgart</p> <p>PLANT:PETERLEE (EPS) 6/7 Doxford Drive, South West Industrial Estate, Peterlee, Co. Durham, SR8 2RL U.K. TEL:+44-191-518-6400 FAX:+44-191-518-6421</p>
<p>NSK EUROPEAN TECHNOLOGY CENTRE Northern Road, Newark, Nottinghamshire, NG24 2JF U.K. TEL:+44-1636-605123 FAX:+44-1636-643241 Business:Research, development and engineering of bearings</p>
<p>NSK DEUTSCHLAND GMBH Harkortstrasse 15,40880 Ratingen, Germany TEL:+49-2102-4810 FAX:+49-2102-4812290 Business:Sales of bearings and precision machinery & parts</p> <p>BRANCH OFFICES:Stuttgart, Leipzig</p>
<p>NEUWEG FERTIGUNG GMBH Ehinger Strasse 5, D89597 Munderkingen, Germany TEL:+49-7393-540 FAX:+49-7393-3732 Business:Manufacture of bearings</p>
<p>NSK FRANCE S.A.S Quartier de l'Europe, 2Rue Georges Guynemer, 78283 Guyancourt Cedex, France TEL:+33-1-30-57-39-39 FAX:+33-1-30-57-00-01 Business:Sales of bearings and precision machinery & parts</p>
<p>NSK ITALIA S.P.A. Via Garibaldi, 215 20024, Garbagnate Milanese (MI), Italy TEL:+39-2-99-5-19-1 FAX:+39-2-990-28-373,+39-2-990-25-778 Business:Sales of bearings and precision machinery & parts</p>
<p>INDUSTRIA CUSCINETTI SPA Via Giotto 4, 10080, S.Benigno C. se, Torino, Italy TEL:+39-119824811 FAX:+39-119880284 Business:Manufacture and sales of bearings</p>
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<p>NSK EUROPEAN DISTRIBUTION CENTRE B.V. De Kroonstraat 38, 5048 AP Tilburg, Nederland TEL:+31-13-4647647 FAX:+31-13-4647648 Business:Serves as central warehouse and distribution center for continental Europe</p>
<p>NSK ISKRA S.A. UL. Jagiellonska 109, 25-734 Kielce, Poland TEL:+48-41-366-5001 FAX:+48-41-366-5008 Business:Manufacture and sales of bearings</p>
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<p>NSK (CHINA) INVESTMENT CO., LTD. Floor 10, Building No.A, Shanghai Far East International Plaza, 319 Xian Xia Road, Shanghai, 200051, China TEL:+86-21-6235-0198 FAX:+86-21-6235-1033 Business:Headquarters for all operations in China</p>
<p>KUNSHAN NSK CO., LTD. 258 South Huang Pu Jiang Road, Kunshan Economic & Technical Development Zone, Jiangsu 215335, China TEL:+86-512-5771-5654 FAX:+86-512-5771-5689 Business:Manufacture and sales of bearings</p> <p>BRANCH OFFICE:Shanghai</p>
<p>NSK STEERING SYSTEMS DONGGUAN CO., LTD. Dongguan, Guangdong Province High-tech Park, Shilong Road, Guanlong Section, Dongguan 523072, China TEL:+86-769-2427230 FAX:+86-769-2427837 Business:Manufacture and sales of automotive components</p>
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<p>GUIZHOU HS NSK BEARINGS CO., LTD. Dongjiao, Anshun, Guizhou, 561000, China TEL:+86-853-3521505 FAX:+86-853-3522722 Business:Manufacture and sales of bearings</p>
<p>TIMKEN-NSK BEARINGS (SUZHOU) CO., LTD. Suzhou, Jiangsu Province Room 3A, Kings Tower-3FL, 12 Shishan Road Suzhou New District, Jiangsu 215011, China TEL:+86-512-68083708 FAX:+86-512-68083738 Business:Manufacture of bearings</p>
<p>NSK HONG KONG LTD. Room 512, Wing On Plaza, Tsim Sha Tsui East, Kowloon, Hong Kong TEL:+852-2739-9933 FAX:+852-2739-9323 Business:Sales of bearings, automotive components, and precision machinery & parts</p>
<p>NSK REPRESENTATIVE OFFICES</p> <p>BEIJING Room 1001, Beijing Fortune Bldg., 5 Dong San Huan Beilu, Chao Yang District, Beijing, 100004, China TEL:+86-10-6590-8161 FAX:+86-10-6590-8166</p> <p>SHANGHAI Floor 10, Building No.A, Shanghai Far East International Plaza, 319 Xian Xia Road, Shanghai, 200051, China TEL:+86-21-6235-0198 FAX:+86-21-6235-1033</p> <p>GUANGZHOU Room 2701-02, Guangzhou International Electronics Tower 403, Huan Shi Rd East, Guangzhou, 510095, China TEL:+86-20-8732-0583 FAX:+86-20-8732-0574</p> <p>ANSHUN Dongjiao, Anshun, Guizhou, 561000, China TEL:+86-853-3522522 FAX:+86-853-3522552 Business:Sales of bearings, automotive components, and precision machinery & parts</p>
<p>NSK LTD. INDIA BRANCH OFFICE 2A, First Street, Cenotaph Road, Chennai, 600 018, India TEL:+91-44-2433-4732, +91-44-2434-3066, 3067 FAX:+91-44-2433-4733 Business:Sales of bearings, automotive components, and precision machinery & parts</p>
<p>RANE NASTECH LTD. 14, Rajagopalan Salai, Vallancherry Guduvancherry, Pin-603 202, India TEL:+91-4114-266002, 265313 FAX:+91-4114-266001 Business:Manufacture and sales of automotive components</p>
<p>PT. NSK BEARINGS MANUFACTURING INDONESIA Blok M-4, Kawasan Berikat, MM2100, Industrial Town, Cikarang Barat, Bekasi 17520, Jawa Barat, Indonesia TEL:+62-21-898-0155 FAX:+62-21-898-0156, 0183 Business:Manufacture and sales of bearings</p>
<p>PT. NSK INDONESIA Summitmas II 6th Floor, Jl. Jend. Sudirman Kav. 61-62, Jakarta 12190, Indonesia TEL:+62-21-252-3458 FAX:+62-21-252-3223 Business:Sales of bearings and machine components</p>
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<p>NSK BEARINGS (MALAYSIA) SDN. BHD. 1001, Level 10, Uptown2, 2 Jalan SS 21/37, Damansara Uptown, 47400 Petaling Java, Selangor Darul Ehsan, Malaysia TEL:+60-3-77223373 FAX:+60-3-77285543, 77287450 Business:Sales of bearings, automotive components, and precision machinery & parts</p> <p>BRANCH OFFICES:Prai, Johor Bahru, Kota Kinabalu</p>
<p>NSK MICRO PRECISION (M) SDN.BHD. No.43 Jalan Taming Dua, Taman Taming Jaya, 43300 Balakong, Selangor Darul Ehsan, Malaysia TEL:+60-3-961-6288 FAX:+60-3-961-6488 Business:Manufacture of bearings</p>
<p>NSK INTERNATIONAL (SINGAPORE) PTE LTD. 2 Toh Guan Road East #02-02 Singapore 608837 TEL:+65-6273-0357 FAX:+65-6275-8937 Business:Sales of Bearings</p> <p>BRANCH OFFICE:Bangkok</p>
<p>NSK SINGAPORE (PTE) LTD. 2 Toh Guan Road East #02-03 Singapore 608837 TEL:+65-6278-1711 FAX:+65-6273-0253 Business:Sales of bearings, automotive components, and precision machinery & parts</p>
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<p>NSK BEARINGS (THAILAND) CO., LTD. 25th Floor, RS Tower, 121/76-77 Rachadaphisek Road, Dindaeng, Bangkok 10320, Thailand TEL:+66-2-6412150~58 FAX:+66-2-6412161 Business:Sales of bearings, automotive components, and precision machinery & parts</p>
<p>NSK BEARINGS MANUFACTURING (THAILAND) CO., LTD. 700/430 Moo 7, Amata Nakorn Industrial Estate, T. Donhualor, A. Muangchonburi, Chonburi 20000, Thailand TEL:+66-38-454-010~016 FAX:+66-38-454-017,020 Business:Manufacture and sales of bearings</p>
<p>SIAM NSK STEERING SYSTEMS CO., LTD 90 Moo 9, Wellgrow Industrial Estate, Km. 36 Bangna-Trad Road, Bangwao, Bangkokong, Chachoengsao 24180, Thailand TEL:+66-38-522-343~350 FAX:+66-38-522-351 Business:Manufacture and sales of automotive components</p>
<p>NSK AUSTRALIA PTY. LTD. 11 Dalmore Drive, Scoresby, Victoria 3179, Australia TEL:+61-3-9764-8302 FAX:+61-3-9764-8304 Business:Sales of bearings, automotive components, and precision machinery & parts</p> <p>BRANCH OFFICES:Melbourne, Sydney, Brisbane, Adelaide, Perth</p>
<p>NSK NEW ZEALAND LTD. 3 Te Apunga Place, Mt. Wellington, Auckland, New Zealand TEL:+64-9-276-4992 FAX:+64-9-276-4082 Business:Sales of bearings, automotive components, and precision machinery & parts</p>

(as of April 2004)

**Aiming for the future,
NSK realizes infinite possibilities.**

NSK Ltd.

<http://www.nsk.com>



NSK



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