NAK™

ISO-9001/14001
ISO/TS-16949
OHSAS-18001

NAK SEALING TECHNOLOGIES CORPORATION

Product Overview

World Class Brand World Class Manufacturing

PAGE 1: HISTORY & DEVELOPMENT OF THE COMPANY

1976 Established Mao Shun Co. Capital: US$40,000.

1979 The production lines moved to Nankang Industrial Zone, Nantou City.

1981 Began exporting to U.S.A.

1982 Began exporting to Europe.

1986 Full computerization implemented.

1988 Installed multiple CNC machinery for tool fabrication.
Established R&D and Quality Control Departments.

1989 Acquired MCS Certificate.

1990 Chairman Mr. Joseph Shek was awarded the 13th Annual National Young Entrepreneur Prize.

1992 Established ISO 9000 Quality Assurance Implementation Committee, pushing for standardisation and improvements on quality management.

1994 Acquired ISO 9002 Certificate.

1995 Received the 4th Annual National Award for Small and Medium Size Enterprises from the Ministry of Economic Affairs.

1997 Established R&D in the UK named Race Tec NAK, specializing in the research and development of high performance seals for F1 racing cars.
Invested diversely in the UK, Iran and Australia.

2000 Acquired QS 9000 and "Revolving Shaft Sealing Structure" Certificate.
Installed a fully automated inventory system.
Started the establishment of Kunshan Maoshun Sealing Products Industrial Co. Ltd. in China.

2001 Acquired "Construction of Mud-Resisted, Complex and Rotational Seal" Certificate.

2002 Became the first Oil Seals manufacturer in Taiwan to be listed on the stock market.
Established NAK Japan in Tokyo, mainly responsible for marketing and sales of sealing products in Japan.
Changed corporate name to NAK SEALING TECHNOLOGIES CORPORATION.

2004 Acquired "NAK Sealing Power of Sealing Device" Certificate.

2006 Acquired ISO/TS16949 Certificate.
Established subsidiaries in Thailand.

2007 Established subsidiaries in Brazil and Russia.

2008 Acquired ISO 14001 and OHSAS 18001 Certificate.

2009 Fully implemented six sigma.

2011 Implemented SAP ERP.

2012 Established subsidiaries in India.

2013 NAK China (Kunshan) new factory/building launched.

2014 Established subsidiaries in Australia.

Quality Assurance

All NAK products meet with ISO9001/TS16949 requirements. All designs and manufacturing processes of NAK products are being done and completed with state-of-the-art equipment. New products of NAK are developed using most advanced lab equipment combined with the latest technologies and methods fully conforming to international standards such as ASTM, DIN, BS, JIS and SAE.

We constantly install new, fully automated equipment and advanced lab instruments to perform even more precise quality tests, provide crucial statistical data to be the basics for quality improvements, and accumulate technical facts and knowledge to reach our goal of improving both proficiency and quality.

Environmental Statement

To improve our abilities to fulfill corporate social responsibility (CSR) of protecting the environment, we established an Environmental Management Policy. In March 2008, we acquired ISO-14001 and OHSAS-18001 certificate. NAK uses the environmental management system to ensure that everything the company does is done with the environment in mind. NAK, as a sealing products leading company, will create sustainable operation environment, manufacture high quality products, and provide best service to conform to customer satisfaction.

Our Environmental Policy

1. We will stress compliance with environmental laws and regulations, and conduct educational programs to raise employees' awareness of environmental preservation.
2. As a leading company specializing in industrial products, we will launch green development to preserve the earth.
3. We will conserve energy resources and reduce environmental pollution.
4. We will reach the goal and target of zero pollution, zero accident, and zero disaster.
5. We will review regularly and keep improving the environmental management system.

Dedicated Team of R&D

NAK has a strong and dedicated team of R&D. Not only do we design, develop and carry out material research on our own but we also take the initiative to follow up with customer requirements. Our R&D team has a direct link with our customers to be able to obtain first-hand information of the specifications, requirements and demands of our customers thus improving the successive rates of new product development and customer satisfaction to a higher level. We also take the investment of advanced testing equipment one of our top priorities. We have also built our own in-house dynamic testing lab and material research lab to bring our developing capabilities to an even higher level.

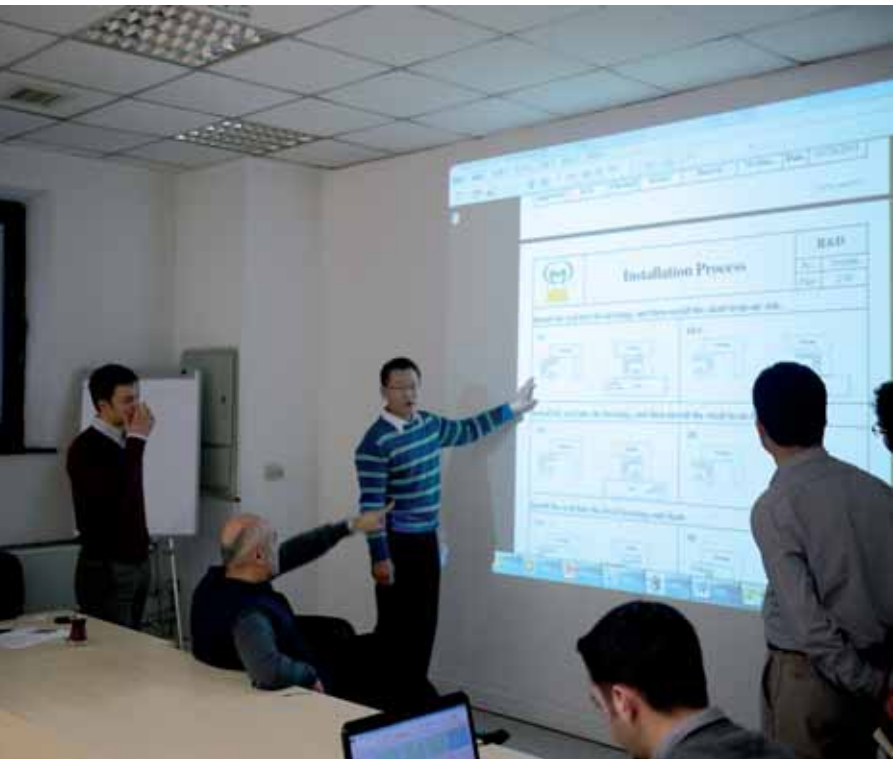
NAK high performance seals have obtained approvals from several race car manufacturers and are now being used widely in the car racing industry. Having a wide product range, patents from multiple countries in the world, and a strong R&D team that has achieved outstanding results in the field of research and development is one of the key factors to our rapid growth every year. With the advanced technology and complete range of product lines, NAK has the absolute advantage in growth.

We have achieved decreases in overhead costs and come out with the finest designs by the full implementation of the FEA software (Finite Element Analysis) that completes theoretical analyses for materials, pressure, temperature rise, oil film, etc. Prototype and tooling designs are synchronized with the NAK developed design software named SCAD (Seal CAD) to decrease failure rates during trial runs.

NAK also designs and develops PU products together with local university labs and government material research centers. We implement fully computerized BOM management system, and design various types of tooling such as boot, bellow, shock absorber seals, Teflon seals, larger size seals, etc. As to material research, NAK has complete equipment and a research lab. The research and development of rubber compounds, characteristic testing, rubber material analysis, and quality inspections are all done systematically here in NAK. NAK also implements the ASTM rubber testing methods including tests of processibility of unvulcanized rubber, hardness of plastic and rubber, material tensile strength and adhesive strength, heat aging / oil immersion / fuel immersion / low temperature capability / compression set, rebound property / microscopy of compound dispersion, FT-IR analysis, X-ray and etc.

Technical Support

We offer on-site technical consultation services. We make the product to the expected function through mutual discussions with the customer, and by continuous improvement we make the product better.



Manufacturing Equipments

Innovated development needs good equipment to back it up, NAK has just the right thing. NAK not only have the professional productivity for rubber compounding, but also designing capability for molds, technical manufacturing capability, constant co-operations with our equipment contractors for the improvement and equipment technical maintenance, so to bring fully automation to our product lines.

NAK is also equipped with machineries to produce over sized seals and fully automated inventory to meet the demands of our customers. Continuous innovation of NAK's technique and expansion of our productivity and constant replacement and implementation of better equipment are one of NAK's main goal at any given moment. The rapid growth of technology and advanced equipment is used by NAK to satisfy our customers throughout the world. A wide range of fully automated machineries such as the automated inventory, automated trimming machines, and automated spring loading machines are also used by NAK to effectively bring down the manufacturing cost.

Constant improvement to present manufacturing processes to bring faster clamping apparatus with higher efficiency by developing machineries such as check boarded machines, automated spring loading machines, torque testing machines, automated packaging machines, automated inventory and etc.

NAK has implemented full automation and computerization to our manufacturing process to replace the traditional manufacturing process thus enabling NAK to place our seals in the range of high quality and high value added seals including seals for F1 racing car, ships, military industry, medical industry, aerospace industry and other high tech industries.

Product Index

Standard Rotary Seals

Type A

- Additional inner case to reinforce structural rigidity.
- Suitable for large diameters.
- The temperature range is depending on the material.

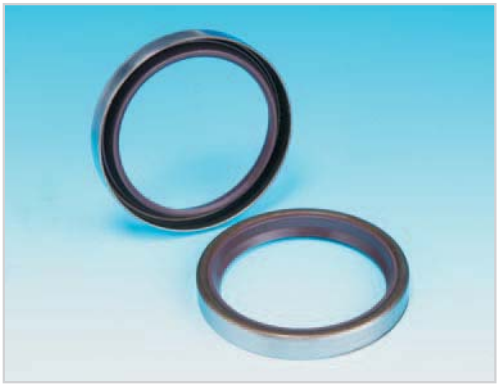
O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SA


TA


VA


KA



Type B

- Outer metal case provides a firm and accurate seat in the housing.
- Suitable for steel housing with good surface condition.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SB


TB


VB


KB

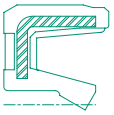
Type C

- Rubber covered OD to increase the OD sealing capability.
- Suitable for soft alloy, plastic, steel or cast iron housing materials.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SC


TC


VC


KC

Type D

- Special design of two spring-loaded lips in opposite directions.
- Designed for applications in which sealing two fluids is required.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
20 -790 mm	-55°C -225°C	≤ 0.3bar	≤ 10m/s


DA


DB


DC


DM

SYMBOL:	=Rotary	=Reciprocating	=Oscillating	=Helix	=Static

Standard Rotary Seals

Type F

- Special design of an additional inner rubber lining for better protection of the inner case.
- Rubber covered OD for improving the sealing on OD.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SF


TF


VF


KF

Type G

- Special design of a corrugated OD.
- Particularly suitable for applications where the housing material is subject to large thermal expansion, i.e. aluminum housing.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SG


TG


VG


KG

Type L

- Special design of metal OD with leading edge to assist in the alignment during installation and replacement
- Refined metal case adds additional structural rigidity
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SL


TL


VL


KL

Type M

- Refined metal OD with a lead-in chamfer.
- Designed with an additional inner rubber lining particularly fit for protecting the case from erosive fluid.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SM


TM


VM


KM

SYMBOL:	 =Rotary	 =Reciprocating	 =Oscillating	 =Helix	 =Static

Standard Rotary Seals

Type Z

- Similar to Type M but the inner rubber lining covers the leading edge of the metal OD for improved sealing capability.
- The temperature range is depending on the material.

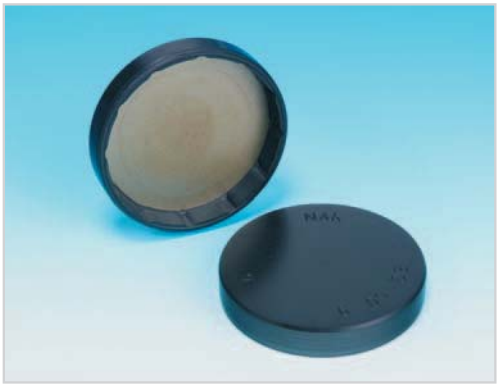
O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SZ


TZ


VZ

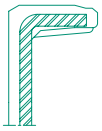

KZ

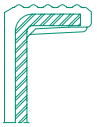


Type EC/EG Gear Box End Cap Seal

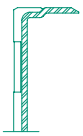
- Designed for static applications to act as a plug or barrier.
- Common applications include sealing in the gearbox as an end cap.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3bar	-


EC


EG

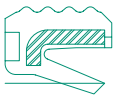

EC2


EBC

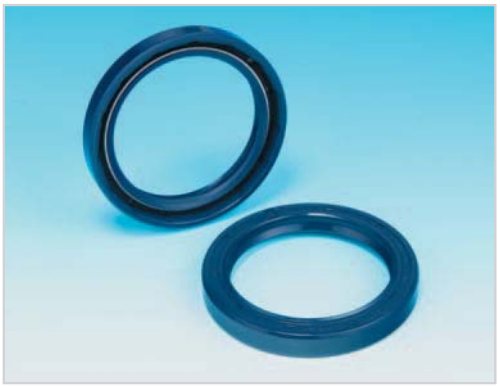
Type G1

- Special design of a corrugated rubber OD with a lip profile suitable for applications with limited radial space.
- High-deflection sealing lip to have a low torque.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10-200 mm	-40°C -200°C	-	≤ 10m/s


VG1

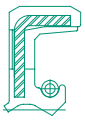

KG1

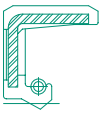


Type N11 Pressure Resistant Seal

- Special design of the short flex section provides better pressure resistance.
- Special material and structural designs for different levels of high-pressure applications.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-40°C -200°C	≤ 10bar	≤ 5 m/s


TCN11


SCN11


SFN11


SMN11

SYMBOL:	 =Rotary	 =Reciprocating	 =Oscillating	 =Helix	 =Static

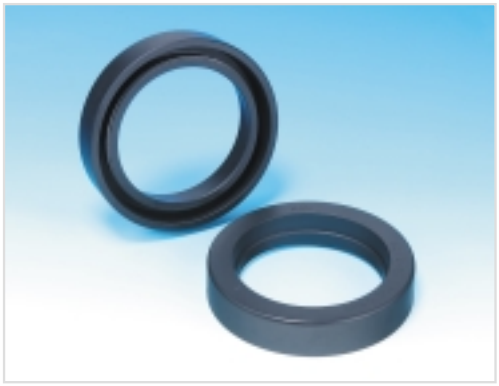
Standard Rotary Seals

Type 2/6/9

- Special design of multiple dust lips to provide better protection against heavy contamination.
- Type 2-Used when a secondary dust lip is needed.
- Type 6-Used for added dust or fine contaminate protection.
- Type 9-Special design combining the functions of radial shaft seal and axial face seal to provide sealing for shaft as well as sealing against a perpendicular counter surface.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-55°C -225°C	≤ 0.3 bar	≤ 8 m/s

TB2 TC2 TC6 TC9



Type Q

- Rubber OD with split design.
- For use where radial space is limited and can be supplied with a split for ease of installation.
- Extra spring within SQS and SQS1 reinforces fastening.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-40°C -200°C	-	≤ 8 m/s

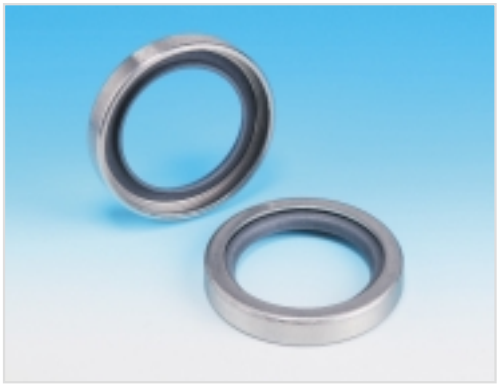
SQ SQ1 SQS SQS1

Type ECA Oil Gauge Seal

- Used for oil gauge seal.

O.D. Range	Temperature Range	Pressure Range	Velocity
16-40 mm	-40°C -100°C	-	-

ECA1 ECA3 ECA4 ECA5



Type PA Teflon Seal

- PTFE (Teflon) sealing lip offers excellent chemical resistance and temperature capability, and low friction.
- Suitable for high-speed applications, and when the reductions of under lip running temperature are required.

O.D. Range	Temperature Range	Pressure Range	Velocity
15 -300 mm	-50°C -250°C	≤ 3bar	≤ 30 m/s

PA1 PA2 PA8L2 PA11R2

SYMBOL: =Rotary =Reciprocating =Oscillating =Helix =Static

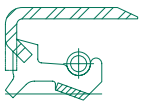
Standard Rotary Seals

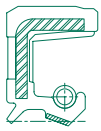
Type PL Teflon Seal

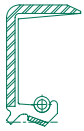
- Designed with a PTFE (Teflon) bonded sealing lip.
- PTFE (Teflon) sealing lip offers excellent chemical resistance and temperature capability, and low friction.
- Suitable for high-speed applications, and when the reductions of under lip running temperature are required.

O.D. Range	Temperature Range	Pressure Range	Velocity
15 -250 mm	-40°C -200°C	≤ 0.3bar	≤ 30 m/s


TA-PL


TB-PL


TC-PL

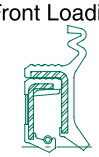

TM-PL

Type WA Washing Machine Seal

- Special design for the washing machine to seal water and washing powder.

O.D. Range	Temperature Range	Pressure Range	Velocity
15 -200 mm	-30°C -100°C	-	≤ 5 m/s

Front Loading


SGWA1

Front Loading


TGWA

Top Loading


DCWA1

Top Loading


TCWA2

Type VA

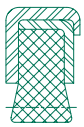
- Special design to seal inner grease and prevent the ingress of the dust or dirt.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-40°C -150°C	-	≤ 5 m/s


VA1


VA2


VA4

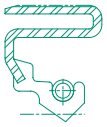

VA6

SYMBOL:	 =Rotary	 =Reciprocating	 =Oscillating	 =Helix	 =Static

Type H

- Special design of reversed metal OD direction, suitable for special installation.
- Allows installation from both sides.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
20 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SH


VH

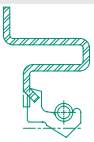

SH1

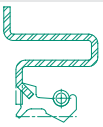

VH1

Type J

- Special design of flanged OD allows easy installation and replacement.
- Refined metal case adds additional structural rigidity and restricts the installation depth into the housing.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
20 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


SBJ


TBJ


VBJ


KBJ

Type X

- Special design of a reversed secondary lip for dust exclusion.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
15 -790 mm	-55°C -225°C	≤ 0.3bar(w/spring)	≤ 10m/s


TXA


TXB

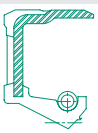

TXC


TXM

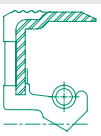
Type BC/BG

- Special design of half-covered rubber OD with both the benefits of Type B, Type C, or Type G
- This design provides the benefits of a metal-to-metal press fit and the rubber OD sealing capability to counter rough or worn housings
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
20 -500 mm	-55°C -225°C	≤ 0.3bar	≤ 10m/s


SBC


TBC


SBG


TBG

SYMBOL:	 =Rotary	 =Reciprocating	 =Oscillating	 =Helix	 =Static

Automotive Seals

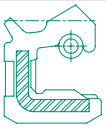
Type O

- O.D. sealing lip with the same design characteristics as standard radial lip seal.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
15 -790 mm	-40°C -200°C	≤ 0.3bar	≤ 10 m/s


OTA


OTB


OTC


OTM

Type RO

- Special design of flexible lip with higher deflection.
- Flexible lip design to have good following ability in high run-out application.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
20 -790 mm	-40°C -200°C	-	≤ 5 m/s


SBRO


SLRO


TCRO


TC2RO

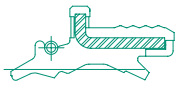
Type 4 Shock Absorber Seal

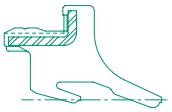
- Special design for motorcycle and bicycle shock absorbers.
- Secondary lip with circle-shape lip design could reduce friction and prevent lip distortion to facilitate the reciprocating movements.

O.D. Range	Temperature Range	Pressure Range	Velocity
15 -100 mm	-30°C -100°C	≤ 6.5 bar(w/spring)	≤ 1.5 m/s


TC4


DC4


TG4JB


KXGJB

Type 4S/AS Shock Absorber Seal

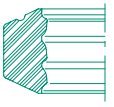
- Special design for automotive shock absorbers.
- Secondary lip with circle-shape lip design could reduce friction and prevent lip distortion to facilitate the reciprocating movements.

O.D. Range	Temperature Range	Pressure Range	Velocity
15 -100 mm	-30°C -100°C	≤ 6.5 bar	≤ 1.5 m/s

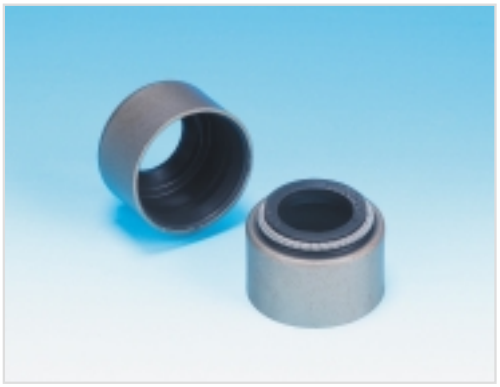

DC4S


TC4S


TC4S7


AS1

SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static



Type VSS Valve Stem Seal

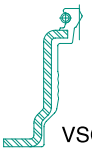
- Maintains an appropriate and stable oil leak volume over long periods of operation to ensure the proper functioning of the valve stem.

O.D. Range	Temperature Range	Pressure Range	Velocity
7 -30 mm	-25°C -200°C	-	≤ 8 m/s


VSB2


VSG1

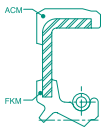

VSG4


VSG12

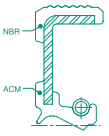
Type -BI Engine Seal

- Special design of two different rubber material for OD and sealing lip.
- With a focus on the sealing lip to provide better material to lower the seal cost.

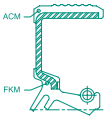
O.D. Range	Temperature Range	Pressure Range	Velocity
15 -250 mm	-25°C -200°C	≤ 0.3 bar	≤ 10 m/s



TC-BI



TG-BI



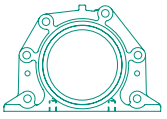
TG2-BI

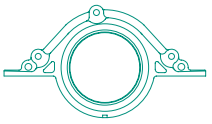

TGK1-BI

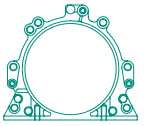
Type CSS Crankshaft Seal

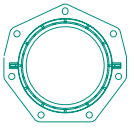
- The seal is applied in the automotive field. It is used for sealing crankshaft at the internal combustion engine.
- The seal is featured with rapidly installation and position.
- Eliminating potential leak paths.

O.D. Range	Temperature Range	Pressure Range	Velocity
Depend on the customer engine size	-25°C -200°C(FKM)	< 0.3 bar	≤ 35 m/s


CSS1


CSS2


CSS3


CSS4

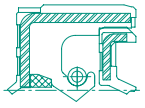
Type CNB Power Steering Seal

- Special design for sealing in the power steering system of the vehicle.
- Excellent sealing capability for highly pressurized PSF (Power-Steering Fluid) and driving in low friction.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -100 mm	-30°C -150°C	≤ 100 bar	≤ 0.075 m/s


CNB


CNB1


CNB5


GNB17

SYMBOL:


=Rotary


=Reciprocating


=Oscillating


=Helix


=Static

Automotive Seals

Type 4P Power Steering Seal

- Special design for sealing in the power steering system of the vehicle.
- Excellent sealing capability for highly pressurized PSF (Power-Steering Fluid).

O.D. Range	Temperature Range	Pressure Range	Velocity
15 -100 mm	-30°C -150°C	≤ 25 bar	≤ 0.28 m/s


SC4P


SG4P


TG4P


SGAP

Type C.V.Joint Boot

- Technical components for protecting the transmission system from external contaminants to ensure proper lubrication that is essential to the delicate mechanism of both the wheel and the gearbox C.V. Joints.

O.D. Range	Temperature Range	Pressure Range	Velocity
20 -200 mm	-40°C -100°C	-	-


BOOT1


BOOT2


BOOT3


BOOT4

Type Bellow

- Installed on the steering system to protect the parts of the steering rack against external contaminants to maintain proper lubrication of the gears that are key components of the steering rack.

O.D. Range	Temperature Range	Pressure Range	Velocity
20 -200 mm	-40°C -100°C	-	-


BELLOW 1


BELLOW 2


BELLOW 3


BELLOW 4

Type VGA Air Compressor Seal

- Design for air compressor application.

O.D. Range	Temperature Range	Pressure Range	Velocity
20-50 mm	-30°C -100°C	≤ 5 bar	≤ 30 m/s


VGA2


VGA4


VGA12

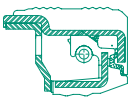

VGA15

SYMBOL:	 =Rotary	 =Reciprocating	 =Oscillating	 =Helix	 =Static

Type ST Hub Seal

- Composite seal with special design
- Labyrinth dust lip design reduces heat generation and prevents mud penetration.
- Special design of hydrodynamic aid increases pumping rate and reduces temperature raise and rubber wear.

O.D. Range	Temperature Range	Pressure Range	Velocity
70 -300 mm	-30°C -200°C	≤ 0.15 bar	≤ 20 m/s



ST5

ST7

ST16

ST34

SYMBOL: =Rotary =Reciprocating =Oscillating =Helix =Static

Agriculture & Construction Seals

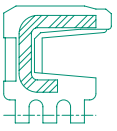
Type U

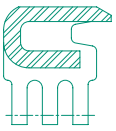
- Special triple flat lip design suitable for use in heavy dirt applications.
- Commonly used in agricultural equipment.
- The temperature range is depending on the material.

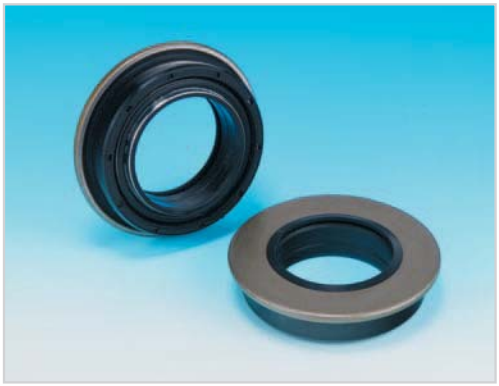
O.D. Range	Temperature Range	Pressure Range	Velocity
25 -300 mm	-40°C -200°C	-	≤ 3.5 m/s


UA


UB


UC


UM



Type AP Agricultural Seal

- Special design for heavy dirt exclusion.
- With a press fit on the shaft and also in the housing it is easy to install and replace without damage to the shaft or the housing.
- Variations as well as custom designs are available for different equipment and applications.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
30-300 mm	-40°C -200°C	≤ 0.3bar	≤ 3.5 m/s


AP5


AP6


AP12


AP13

Type CRS

- Special design with PU or felt composed which can increase the dust-proof capability.

O.D. Range	Temperature Range	Pressure Range	Velocity
30-250 mm	-40°C -150°C	≤ 0.3bar	≤ 10 m/s


CRS2


CRS10


CRS11

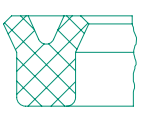

CRS13

SYMBOL: =Rotary =Reciprocating =Oscillating =Helix =Static

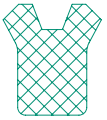
Type for Both Rod & Piston Seal

■ Seal designed with symmetric lips can be used for piston and rod application.

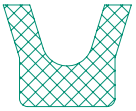
O.D. Range	Temperature Range	Pressure Range	Velocity
12 -245 mm	-40°C -100°C	≤ 300 bar	≤ 1 m/s



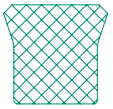
UNP



UNP1



CNP

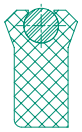


UP1

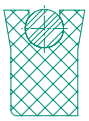
Type for Both Rod & Piston Seal

■ A loaded U-packing with a fitted O-ring, and the O-ring provides extreme loads for effective sealing at low or zero pressure.

O.D. Range	Temperature Range	Pressure Range	Velocity
12 -245 mm	-40°C -100°C	≤ 350 bar	≤ 0.5 m/s



HB



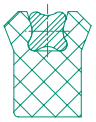
HD

HS

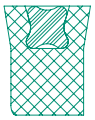
Type for Both Rod & Piston Seal

■ A loaded U-packing with a fitted X-ring, and the X-ring under the U-packing provides effective sealing at low or zero pressure.

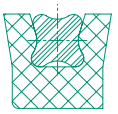
O.D. Range	Temperature Range	Pressure Range	Velocity
12 -245 mm	-40°C -100°C	≤ 350 bar	≤ 0.5 m/s



HBX

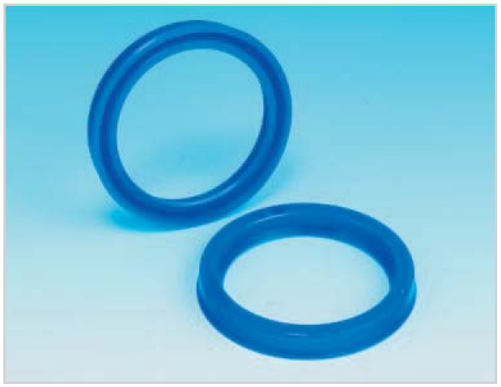


HDX



HSX

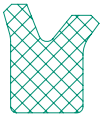
SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static



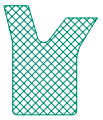
Type Rod Seal

- Seal designed with asymmetric lips. Used for hydraulic rod application.

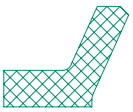
O.D. Range	Temperature Range	Pressure Range	Velocity
12-245 mm	-40°C -100°C	≤ 400 bar	≤ 0.5 m/s



UIP



CIP

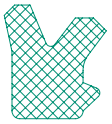


LIP

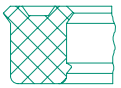
Type Rod Seal

- Used for hydraulic rod application.
- Additional sealing lip prevents the ingress of dirt from air side.
- Lubricant oil will between two lips that results in reduction of wear.

O.D. Range	Temperature Range	Pressure Range	Velocity
8 -250 mm	-40°C -100°C	≤ 400 bar	≤ 0.5 m/s



UIP2

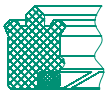


UNP2

Type Rod Buffer Seal

- To buffer the impact pressure generated on the rod side of a hydraulic cylinder.
- To inhibit transmission of oil temperature to rod packing.
- Special shaped slit at the sliding lip that can leak back pressure eliminates the pressure between the rod packing and buffer ring.

O.D. Range	I.D. Range	Temp. Range	Pressure Range	Velocity Range
50 -240 mm	35.5 -210 mm	-40°C -100°C	≤ 500 bar	≤ 1.0 m/s



UIB2

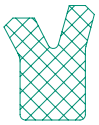
UIB3

SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static

Type Piston Seal

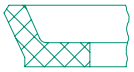
■ Seal designed with asymmetric lips. Used for hydraulic piston application.

O.D. Range	Temperature Range	Pressure Range	Velocity
12-245 mm	-40°C -100°C	≤ 400 bar	≤ 0.5 m/s



UOP

COP



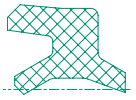
LOP

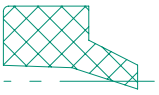
SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static

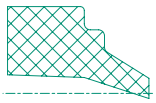
Type Wiper Seal

- Popular dust seals. Used for heavy duty application.

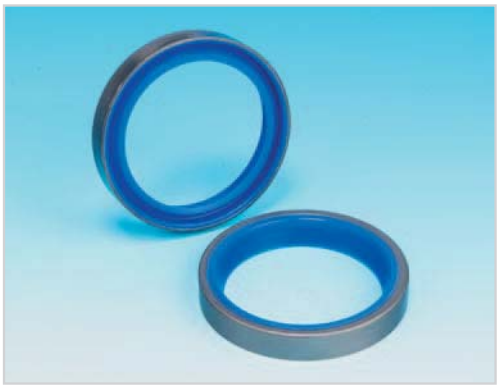
O.D. Range	Temperature Range	Pressure Range	Velocity
12-245 mm	-40°C -100°C	-	≤ 1 m/s


WP1


WP2


WP8

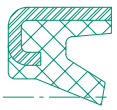

WP10

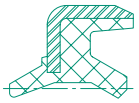


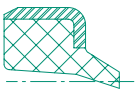
Type Wiper Seal

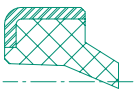
- Popular dust seals with metal case clad. Used for heavy duty application.

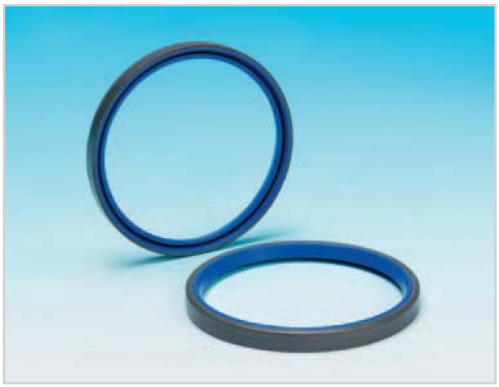
O.D. Range	Temperature Range	Pressure Range	Velocity
35 - 265 mm	-40°C -100°C	-	≤ 1 m/s


WP3


WP4


WP5

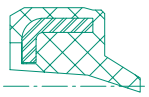

WP6

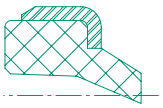


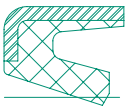
Type Wiper Seal

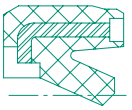
- Popular dust seals with metal case. Used for heavy duty application.

O.D. Range	Temperature Range	Pressure Range	Velocity
35 - 265 mm	-40°C -100°C	-	≤ 1 m/s


WP7


WP9

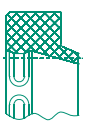

WP11


WP16

Type Wiper Seal

- Bearing segments on the heel of the wiper prevents twisting in the groove.
- And no pressure build-up between seal and wiper.

O.D. Range	Temperature Range	Pressure Range	Velocity
12-245 mm	-40°C -100°C	-	≤ 1 m/s


WP21


WP22


WP27

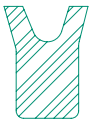
SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static

Type for Both Rod & Piston Seal

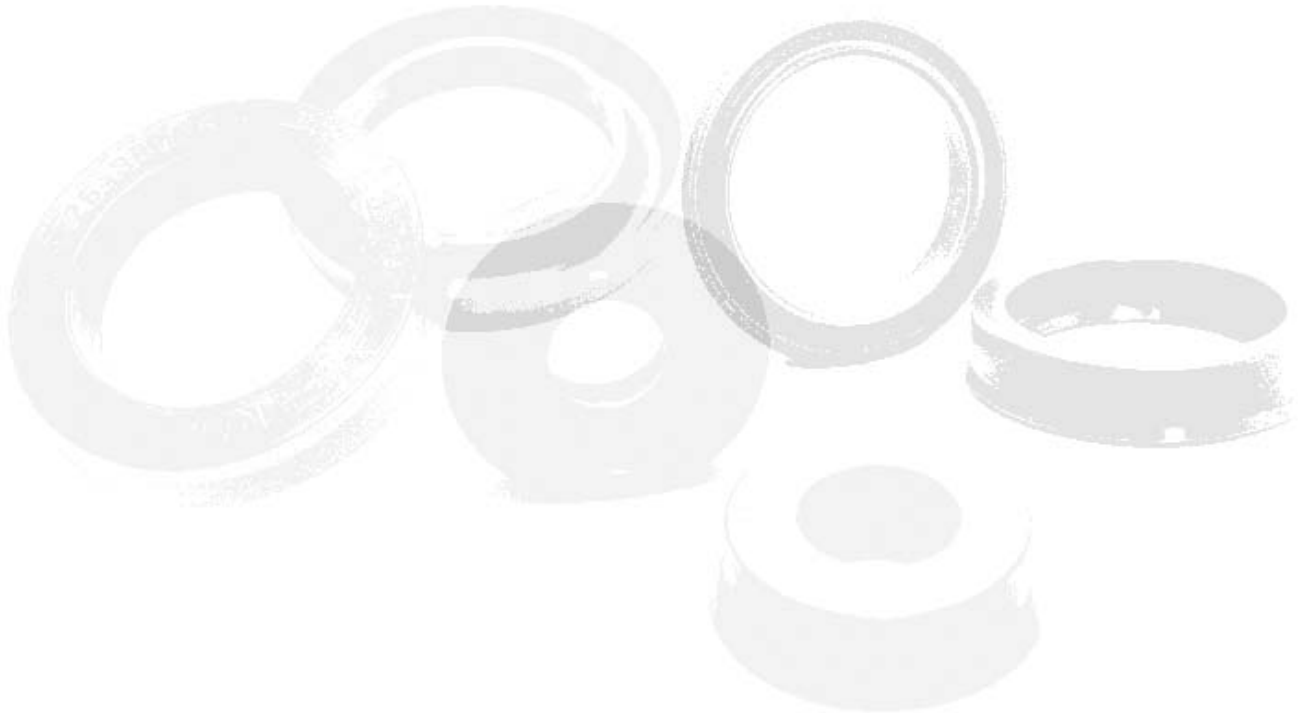
- Seal designed with symmetric lips can be used for piston and rod application.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
8 -790 mm	-55°C -225°C	≤ 10 bar	≤ 0.5 m/s

UNR



CNR



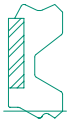
SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static

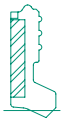
Type PV Gas Spring Seal

- Special design for the gas spring application.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -100 mm	-30°C -100°C	≤ 160 bar	≤ 0.05 m/s


PVG1


PVG2


PVG3

Type UIR

- Seal designed with asymmetric lips. Usually used for pneumatic rod application.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
8 -790 mm	-55°C -225°C	≤ 10 bar	≤ 0.5 m/s


UIR

Type CIR

- Seal designed with asymmetric lips. Used for pneumatic rod application.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
8 -300 mm	-55°C -225°C	≤ 10 bar	≤ 0.5 m/s


CIR

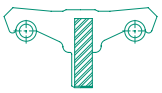
SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static

Type Piston Seal

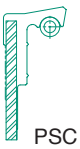
- Seal designed with a case body, spring and rubber lip.
- The seal is fixed on the rod as a piston to save the cost.

O.D. Range	Temperature Range	Pressure Range	Velocity
20 -790 mm	-30°C -100°C	≤ 60 bar	≤ 0.5 m/s

PDC



PDH

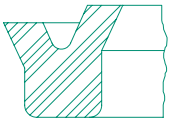


PSC

Type COR

- Seal designed with asymmetric lips. Used for pneumatic rod application.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
8 -790 mm	-55°C -225°C	≤ 10 bar	≤ 0.5 m/s

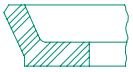


COR

Type LOR

- Flange packings are single-acting non-symmetrical lip-type piston seals designed to retrofit the older well known leather packings.

O.D. Range	Temperature Range	Pressure Range	Velocity
8 -790 mm	-55°C -225°C	≤ 40 bar	≤ 0.5 m/s



LOR

Type UOR

- Seal designed with the asymmetric lips. Usually used for piston application.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
8 -790 mm	-55°C -225°C	≤10 bar	≤ 0.5 m/s

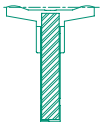
UOR

SYMBOL:	 =Rotary	 =Reciprocating	 =Oscillating	 =Helix	 =Static

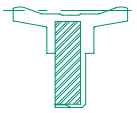
Type Piston Seal

- Seal designed with a case body and rubber lips for double-acting application.
- The seal is fixed on the rod as a piston to save the cost.

O.D. Range	Temperature Range	Pressure Range	Velocity
20 -790 mm	-30°C -100°C	≤10 bar	≤ 1 m/s



PDV

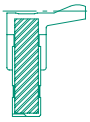


PDV1

Type Piston Seal

- Seal designed with a case body and rubber lip for single-acting application.
- The seal is fixed on the rod as a piston to save the cost.

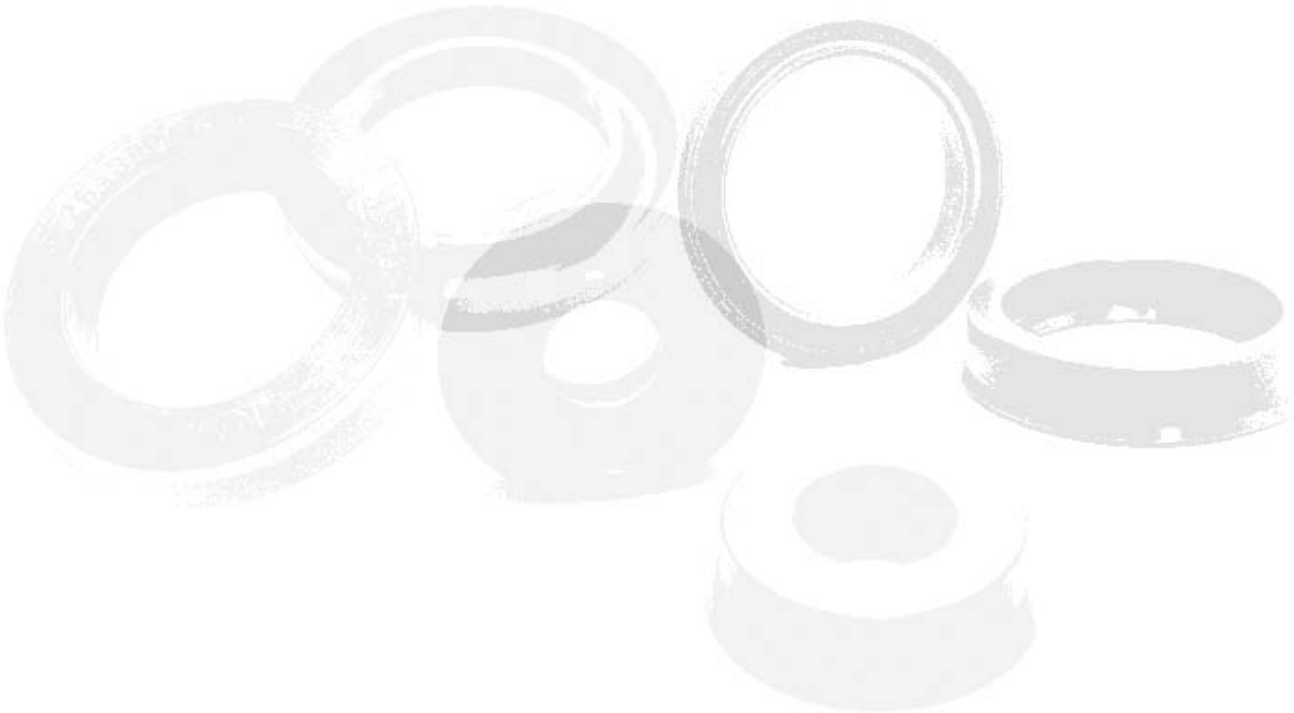
O.D. Range	Temperature Range	Pressure Range	Velocity
20 -790 mm	-30°C -100°C	≤10 bar	≤ 1 m/s



PSV

PSV1

PSV2



SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static

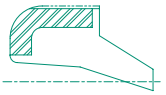
Type Wiper Seal

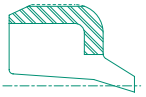
- Popular dust seals with the steel case clad added.
- Used for heavy-duty applications.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-30°C -200°C	-	≤ 1 m/s


WPB


WPK

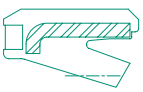

WPM

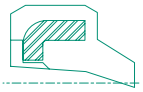

WPV

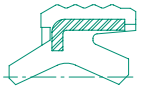
Type Wiper Seal

- Popular dust seals with the steel case clad added.
- Used for heavy-duty applications.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-30°C -200°C	-	≤ 1 m/s


WPC

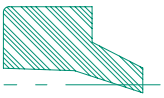

WPR

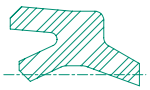

WP13

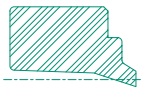
Type Wiper Seal

- Popular dust seals.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-30°C -200°C	-	≤ 1 m/s


WP12


WP14

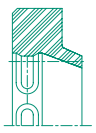

WP15

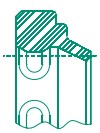

WP17

Type Wiper Seal

- Bearing segments on the heel of the wiper prevents twisting in the groove.
- And no pressure build-up between seal and wiper.

O.D. Range	Temperature Range	Pressure Range	Velocity
10 -790 mm	-30°C -200°C	-	≤ 1 m/s


WP19


WP20

SYMBOL: =Rotary =Reciprocating =Oscillating =Helix =Static

Type HRO

- Seal designed symmetric. Used for hydraulic rod application.
- PTFE is used for sliding material. This packing has low frictional resistance, eliminating stick slip and assuring high wear resistance.
- Installation space is saved because of standard O-ring.

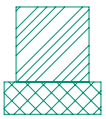
O.D. Range	I.D. Range	Temp. Range	Pressure Range	Velocity Range
18 -300 mm	12 -280 mm	-40°C -100°C	≤ 350 bar	≤ 1.5 m/s

HRO

Type HRS

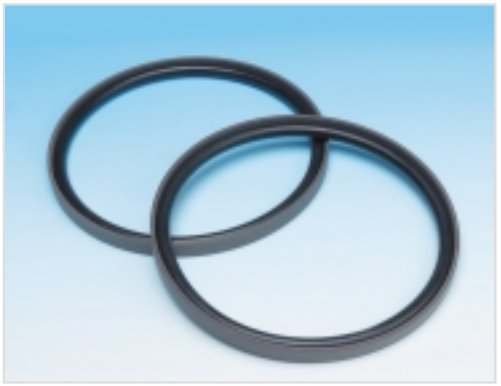
- Seal designed symmetric. Used for hydraulic rod application.
- PTFE is used for sliding material. This packing has low frictional resistance, eliminating stick slip and assuring high wear resistance.

O.D. Range	I.D. Range	Temp. Range	Pressure Range	Velocity Range
27 -153.4 mm	18 -140 mm	-40°C -100°C	≤ 350 bar	≤ 1.5 m/s



HRS

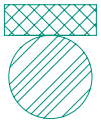
SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static



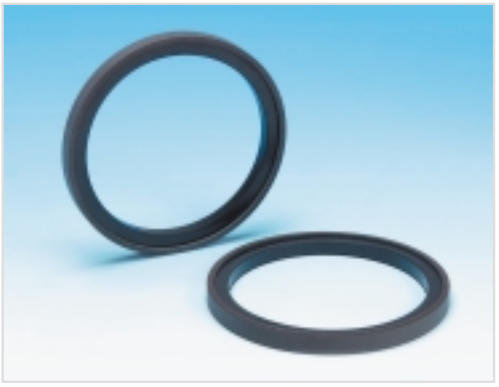
Type HPO

- Seal designed symmetric. Used for hydraulic piston application.
- PTFE is used for sliding material. This packing has low frictional resistance, eliminating stick slip and assuring high wear resistance.
- Installation space is saved because of standard O-ring.

O.D. Range	I.D. Range	Temp. Range	Pressure Range	Velocity Range
20 -300 mm	14 -280 mm	-40°C -100°C	≤ 350 bar	≤ 1.5 m/s



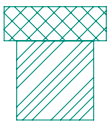
HPO



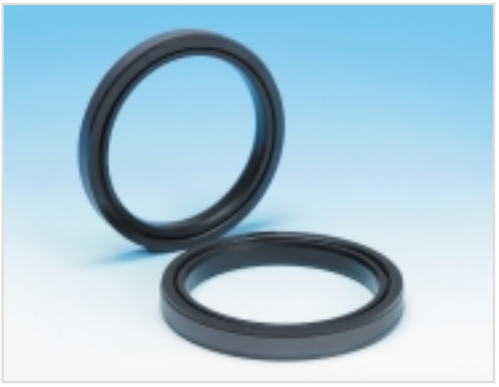
Type HPS

- Seal designed symmetric. Used for hydraulic piston application.
- PTFE is used for sliding material. This packing has low frictional resistance, eliminating stick slip and assuring high wear resistance.

O.D. Range	Temperature Range	Pressure Range	Velocity Range
30 -300 mm	-40°C -100°C	≤ 350 bar	≤ 1.5 m/s



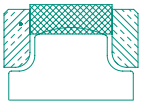
HPS



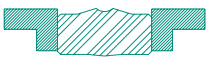
Type HOD

- PTFE is used for sliding material. This packing has low frictional resistance, eliminating stick slip and assuring high wear resistance.
- Installation space is saved because of bi-directional sealing ability by single packing.

O.D. Range	Temperature Range	Pressure Range	Velocity Range
50 -300 mm	NK815-35°C-100°C HKC02-40°C-150°C	≤ 500 bar	≤ 1.5 m/s



HOD



HOD1

HOD2

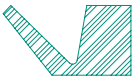
SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static

V-Seals

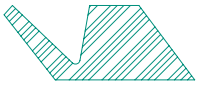
Type V-SEAL

- V-Seals are mounted on the shaft, rotates with the shaft, and seal against a perpendicular counter surface.
- They protect bearings and radial seals in dirty and demanding applications.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
5.5 -790 mm	-40°C -200°C	-	≤ 10 m/s



VA



VS

VL

SYMBOL:

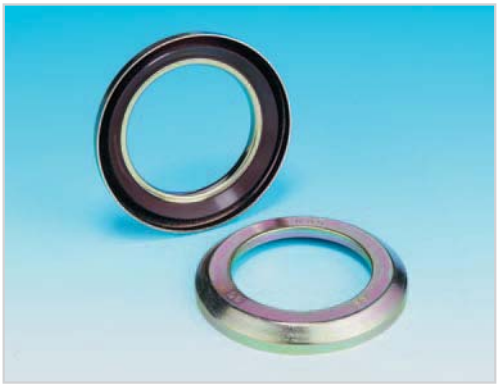
=Rotary

=Reciprocating

=Oscillating

=Helix

=Static

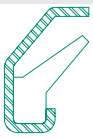


Type RE Axial Face Seal

- Axial Face Seals are mounted on the shaft, rotates with the shaft, and seal against a perpendicular counter face
- Metal case added on a rubber V-ring to increase rigidity and enhance protection against dust.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
24-250 mm	-40°C -200°C	-	≤ 10 m/s

RE



RE1

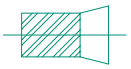
SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static

Bonded Seals

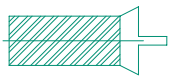
Type WS/KDS Bonded Seal

- The bonded seal is a static seal used as a sealing ring fitted under the bolt head and nut.
- We offer standard as well as the self-centering type with complete thread sizes.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
150 mm	-40°C -200°C	-	-

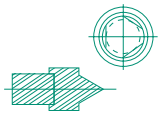


WS



WS1

KDS1



KDS3

SYMBOL:

=Rotary

=Reciprocating

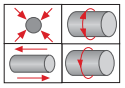
=Oscillating

=Helix

=Static

Type Ring

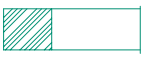
- O-ring, X-ring, Square ring, D-ring, H-ring, V-ring, Backup Ring Custom shapes and sizes.
- Complete AS568, JIS B2401 P/G/S O-rings
- Made of high-performance rubber compounds with excellent capabilities.
- The temperature range is depending on the material.



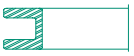
O.D. Range	Temperature Range	Pressure Range	Velocity
0.74 -800 mm	-55°C -225°C	-	-

O-RING

X-RING



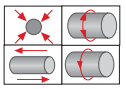
□-RING



H-RING

Type O-Ring Kit

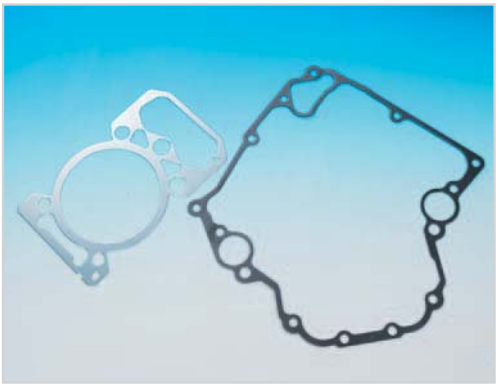
- AS568, JIS, Metric as well as Inch kits available.
- Standard 70 Shore A hardness as well as customer specified durometer O-rings available.
- The temperature range is depending on the material.



O.D. Range	Temperature Range	Pressure Range	Velocity
6.46 -57.46 mm	-55°C -225°C	-	-

SYMBOL:	 =Rotary	 =Reciprocating	 =Oscillating	 =Helix	 =Static

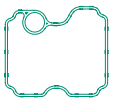
Rubber Molded Parts & Cap



Type Rubber Parts

- Made of high-performance rubber compounds with excellent capabilities.
- Molded specifically to the customer requirements or applicational criteria.
- The temperature range is depending on the material.

O.D. Range	Temperature Range	Pressure Range	Velocity
-	-55°C -225°C	-	-



R9

R15

GASKET-R3

GASKET-R7

SYMBOL:	 =Rotary	 =Reciprocating	 =Oscillating	 =Helix	 =Static

Type Sleeve 4

- Used for repair the worn shaft in different applications on various industries.
- Stainless material with thin-wall design, and high quality surface roughness.
- Sleeve 4 contains the sleeve and assembly tool, simply and fast assembly installation.

I.D. Range	Temperature Range	Pressure Range	Velocity
12.00mm -203.20 mm	-	-	-

Sleeve 4

Disclaimer

1. NAK products are not intended to be used, installed or applied in or on any areospace related instruments and/or equipment. Any such use, installation, or application is prohibited and shall void all waranties.
2. NAK disclaims any and all express or implied warranties if the products:
   2.1 are modified or tampered with;
   2.2 are misused, abused or misapplied;
   2.3 are used in a critical environment or specific equipment without NAK's prior written consent;
   2.4 are not used in accordance with the printed user instruction materials; or
   2.5 are damaged due to natural deterioration, decomposition or transformation of chemical structure.
3. The products may be applied in critical environment or specific equipment only upon official confirmation of the sample by NAK's technical personnel and the passing of tests conducted by buyer.

SYMBOL:  =Rotary  =Reciprocating  =Oscillating  =Helix  =Static

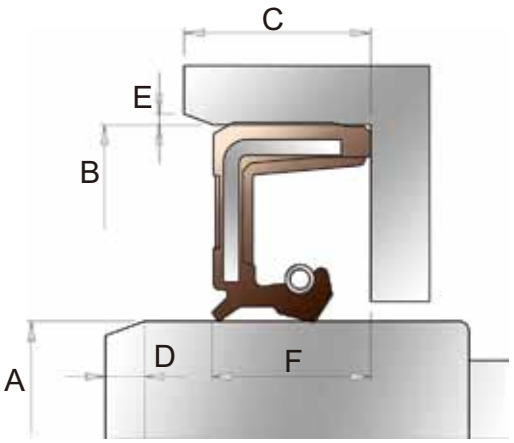
Design Sheet

NO.336 INDUSTRIAL ROAD., NANKANG
INDUSTRIAL ZONE, NANTOU CITY,54012
TAIWAN, R.O.C.
TEL:886-49-2255011, FAX:886-49-2250035,
E-Mail:service@mail.nak.com.tw

NO._____

Customer & Division	**Customer P/N**	**Contact**	**Material**	☐ NAK Standard (ASTM) ☐ Customer Standard
Telephone	**Address**	**Date Required**	**Q.C.**	☐ NAK Standard (AQL 4.0,C=0) ☐ Customer Standard
Annual Usage	**Peak Month Usage**	◯ **OEM** ◯ **Aftermarket**	**Design by**	☐ NAK Standard ☐ ODM ☐ Customer Sample ☐ Customer Drawing
Application (Agricultural, Industrial...)		**Equipment** (Pump, Gearbox….)		

Shaft	Material	Finish	Hardness		
Bore	Material	Finish	Hardness		
Temperature	Min.	Normal	Max.	◯ °C ◯ °F	
Pressure	Min.	Normal	Max.	◯ Bar ◯ Psi	
Media	Internal	Type	Brand and Grade	◯ Dry ◯ Flooded ◯ Mist	
	External	Type			



A. Shaft Diameter: _____
B. Bore Diameter: _____
C. Max Seal OD Width: _____
D. Shaft Chamfer & Angle: _____
E. Bore Chamfer & Angle: _____
F. Max Seal ID Width: _____

Special Requirements (Material, Test, Production Specification…)

Motion	**Rotate**		
	Min. RPM	Normal RPM	Max. RPM
	Run-Out	Shaft-To-Bore Misalignment	Axial-Movement
	Direction From Air Side		
	☐ C.W.	☐ C.C.W.	☐ Bi-Direction
	Shaft Motion Direction		
	☐ Horizontal	☐ Vertical	
	Rotation Frequency		
	☐ Continue	☐ Intermittent	
	Reciprocate		
	Stroke Length	Cycles/Minute	
	Oscillate		
	Arc Degree	Cycles/Minute	
Bearing	☐ Ball or Roller bearing	☐ Bushing	

For NAK fill in only

1.Design Sheet Information ☐ *Yes* ☐ *No* *2.Installation Process* ☐ *Yes* ☐ *No* *3.Assembly Drawing* ☐ *Yes* ☐ *No*

*Check:*_____ *Drawn:*_____ *Date:*_____

Packing Design Sheet

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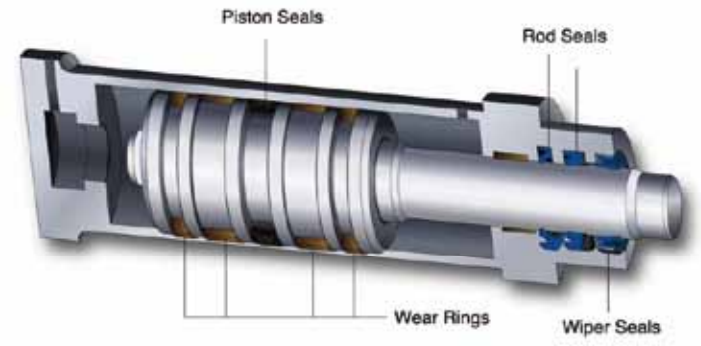
INDUSTRIAL ZONE, NANTOU CITY,54012
TAIWAN, R.O.C.
TEL:886-49-2255011, FAX:886-49-2250035,
E-Mail:service@mail.nak.com.tw

Customer & Division	Customer P/N	Date
Address		
City / State / Zip	Contact ○ Mr ○ Ms./Mis	
Telephone	Fax	E-mail



Application	Equipment

Material	☐ NAK Standard (ASTM) ☐ Customer Standard
Q.C.	☐ NAK Standard (AQL 4.0, C=0) ☐ Customer Standard
Design By	☐ NAK Standard ☐ ODM ☐ Customer Sample ☐ Customer Drawing

Temperature			
Min.	Normal	Max.	○ °C ○ °F
Pressure			
Min.	Normal	Max.	○ Bar ○ Psi ○ Mpa

Media		
Type	Brand & Grade	Viscosity

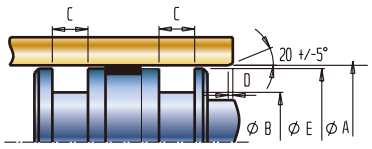
Speed		
Cycles / Min.	Stroke Length	Average Speed

Annual Usage	☐ OEM ☐ Aftermarket
Peak Month Usage	

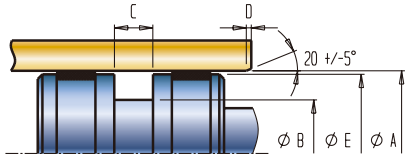
Special Operating Conditions :

Position & Size

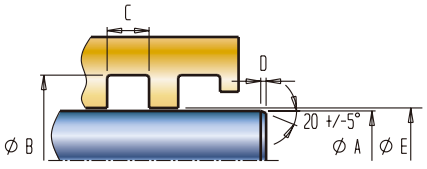
☐ **Piston 1 :**



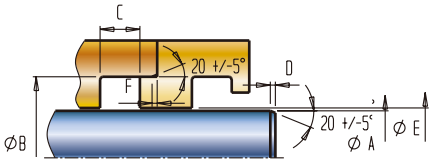
☐ **Piston 2 :**



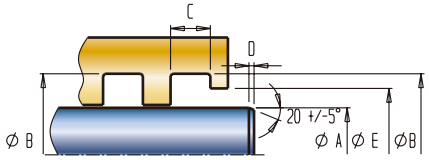
☐ **Rod 1 :**



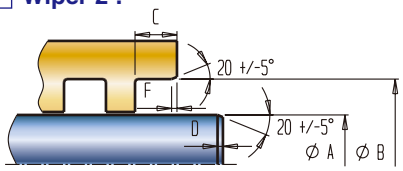
☐ **Rod 2 :**



☐ **Wiper 1 :**



☐ **Wiper 2 :**



A. Dynamic Sealing Face :

B. Static Sealing Face :

c. Static Groove Face :

D. Min. Chamfer :

E. Static Sealing Face :

F. Min. Chamfer :

1.Material Types and General Properties

<Table 1>Material types and general properties

Item / Type	Temp. Range(°C) High Temp.	Temp. Range(°C) Low Temp.	Property	
TPV	125	-60	Good heat, chemical, slip, low temperature and weather resistance. Poor compression set and abrasion resistance.	
SBR	100	-40	Mixing with NR and other synthetic rubber. Poor mechanical property and low curing speed, low elasticity, and high heat build-up.	
CR	100	-40	Good resistance to moderate acid, alkali, salt solutions, commercial oils and fuels. Poor property in chromic and nitric acids, aromatics and chlorinated hydrocarbons.	
EPDM	150	-55	Stable in polar fluids(alcohol, ketone and glycol), and hydrochloric acid. Due to the low specific gravity, it can compound with large amount filler.	
FVMQ	225	-60	Excellent high and low temperature, petroleum oils hydrocarbon fuels and compression set. Application to o-ring, rubber seal, medical devices and food environment.	
CSM	135	-25	Good ozone, weather, heat, chemicals, electrical, and low flammability. Mainly application to outer diameter of oil seal sealing.	
AEM	150	-25	Composed of a terpolymer of ethylene, methyl acrylate, and an acid-containing monomer as a cure site. It exhibits properties similar to those of Polyacrylate, except low temperature and mechanical properties. Good oil, ozone and weather resistance.	
HNBR			HNBR is made from NBR by hydrogenation. It has high temperature resistance, abrasion resistance and good physical properties.	
	125	-40	Sulfur Cure	Better heat resistance and oil resistance than NBR (if containing heavy metal salt, rubber color will be affected).
	150	-40	Peroxide Cure	Peroxide cure suits widely temperature range, better antioxidant and rubber color will be not affected.
TPEE	140	-60	Good heat, oil, slip, electrical and low temperature resistance. Poor compression set resistance and cost expensive.	
NBR			Good resistance to alcohol, amines, petroleum oils, and gasoline over a wide range of temperature. Also good resistance to caustic salts and fair acid. Poor in strong oxidants, chlorinated hydrocarbons, ketones, and esters.	
	100	-55	Low ACN	Increase low temperature resistance and elastic property. Used in where low temperature property is more important than oil resistance property.
	100	-40	Mid ACN	The property is between low and high ACN content. Used in low aromatic content or in where a little swell is acceptable.
	100	-25	High ACN	Increase oil resistance, heat resistance, tensile strength, hardness, abrasion resistance, and gas impermeability. It is usually used in oil well, fuel battery cap, and fuel hose.

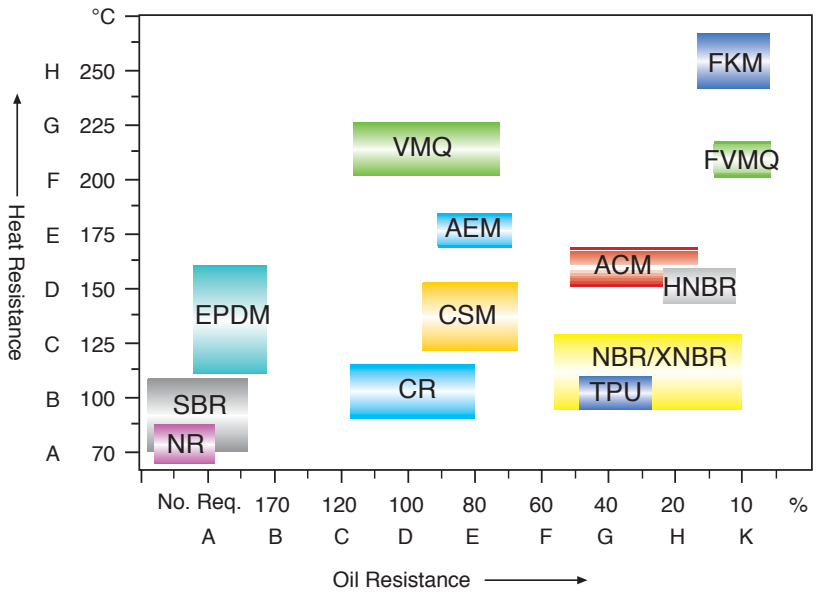
Note: The temperature range of each material shown on the above table is for reference only.
The actual temperature is dependent upon the contents of each individual compound.

1.Material Types and General Properties

<Table 1>Material types and general properties

Item / Type	Temp. Range(°C) High Temp.	Temp. Range(°C) Low Temp.	Property	
ACM	150	-10	It is used in diaphragm, hose for automotive application. Good resistance to heat, ozone and oil. Generally attacked by water, alcohol, glycol and aromatic hydrocarbons. The molecular structure contains ethyl acrylate(EA),butyl acrylate (BA), and methoxy ethyl acrylate(MEA). High BA content get better low temperature resistance, and high MEA content get more oil resistance.	
NR	70	-40	Excellent compression set, high tensile strength, resilience, abrasion, tear resistance, good friction characteristics, excellent bonding capabilities to metal substrate, and good vibration dampening characteristics.	
VMQ	225	-55	The most widely temperature ranges for application. Good weather and ozone resistance, but poor mechanical property and chemical resistance.	
PTFE	250	-150	Due to the low friction coefficient, it is used in oil seal lip. However, it is poor elastic property.	
TPU	100	-40	Polyurethane is one of the groups of elastic thermoplastic materials. PU has been used in seal technology for many years because of their physical characteristics. It is an organic material of high molecular weight whose chemical composition is characterized by a large number of urethane groups. In addition, it is characterized by extremely good mechanical properties such as high tensile strength, abrasive resistance, tear strength, and extrusion strength. However, it is not resistant to polar solvents, chlorinated hydrocarbons, aromatics, brake fluids, acids, and alkalis.	
FKM			Excellent chemical resistance except ester and ketone.	
	200	-25	Dipolymer	Copolymer of vinylidiene fluoride and hexafluoro propylene, and fluorine content is 66%.
		-20	Tripolymer	Copolymer of vinylidiene fluoride, hexafluoro propylene and tetrafluro ethylene. Fluorine content is 68%. Tripolymer has better fluid resistance than dipolymer.
XNBR	100	-40	Modification of traditional NBR with the insertion of carboxyl groups. It has better tensile strength, modulus, abrasion than NBR.	

2. Material Application Temperature Range



<Figure 1> Material application temperature range

3. Typical Properties of Selected Elastomer

<Table 2> The Typical Properties of Selected Elastomer

Rubber Material	NBR	CR	EPDM	ACM	VMQ	FVMQ	FKM
Tear Strength	○	⊙–○	⊙	△–⊙	△–⊙	△	⊙–○
Abrasion Resistance	◎	◎	○	⊙	△–⊙	△	○
Compression Set	○–◎	○–◎	○–◎	○	⊙–◎	○	○–◎
Resilience 23°C	○	○–◎	○	⊙	△–◎	⊙	⊙
Fire resistance	△	○–◎	△	△	⊙–◎	◎	◎
Weather resistance	△	◎	◎	◎	◎	◎	◎
Water Resistance	◎	○	◎	△	○–◎	◎	◎
Steam Resistance	⊙–○	⊙	○–◎	×	⊙–○	⊙–○	○
Ozone Resistance	△–⊙	◎	◎	◎	◎	◎	◎
Oxygen resistance	○	◎	◎	○	◎	◎	◎
Acid Resistance (Dilute)	○	◎	◎	△–⊙	○	◎	◎
Acid Resistance (Concentrate)	○	◎	◎	△–⊙	⊙	○	◎
Base Resistance (Dilute)	○	◎	◎	△–⊙	◎	◎	◎
Base Resistance (Concentrate)	○	◎	◎	△–⊙	◎	○	×
Synthetic Lubricant	○–◎	△	×	△	×	◎	◎
Low Polar Lubricant	◎	◎	×	◎	○	◎	◎
High Polar Lubricant	◎	○	×	◎	⊙	◎	◎
Animal and Vegetable Oil	○	○	○–◎	○	◎	◎	◎
Gas impermeability	○–◎	○	⊙	○	△	△	◎
Electricity resistance	△–⊙	◎	◎	⊙	○–◎	◎	○
Metal Adhesion	○–◎	○–◎	⊙–○	○	○	⊙	⊙

◎ : Excellent ○ : Good ⊙ : Fair △ : Poor × : Very Poor

4. The Stability of Elastomer in Chemicals, Oils, and Fluids

<Table 3>Chemical Resistance Guide of Elastomer

	Fluid	HNBR	NBR	EPDM	CR	CSM	VMQ	FKM	ACM
	Steam (150°C)	○	×	◎	×	×	×	△	×
Organic Acid	Acetic Acid	○	○	◎	◎	◎	◎	○	×
Inorganic Acid	hydrochloric acid (25%)	○	○	◎	◎	◎	◎	○	×
	Phosphoric Acid (20%)	◎	○	◎	○	◎	○	◎	—
	Nitric Acid (25%)	○	×	○	◎	◎	○	△	×
Base	Sodium Hydroxide (30%)	◎	○	◎	×	◎	○	○	—
	Ammonia (28%)	◎	◎	◎	◎	◎	◎	○	×
Salt Solution	NaCl (30%)	◎	◎	◎	◎	◎	◎	◎	—
	Na_2CO_3 (10%)	◎	◎	◎	◎	◎	◎	○	—
Oxidizing Agent	Hydrogen Peroxide (3%)	○	△	○	△	◎	◎	◎	—
	Sodium Chloride (5%)	○	×	○	×	○	○	◎	×
Parafinc Fluid	Isooctane	◎	◎	×	○	○	×	◎	◎
Aromatic Fluid	Benzene	△	△	×	×	×	△	◎	×
Chlorinated Fluid	Trichloroethylene	△	△	×	×	×	×	◎	—
Alcohol	Methanol	◎	◎	◎	◎	◎	◎	△	×
	Ethanol	◎	◎	◎	◎	◎	◎	◎	×
Ether	Ethyl Ether	△	△	△	×	×	×	×	×
Ester	Ethyl Ester	×	×	○	△	△	×	△	—
Ketone	Methyl Ethyl Ketone	×	×	◎	×	×	×	×	×
Aldehyde	Furfural	○	△	◎	×	×	×	×	×
Amine	Trihydroxyethylamine	◎	△	◎	◎	◎	×	×	×
	Carbon Disulfide	△	△	×	×	×	—	◎	—

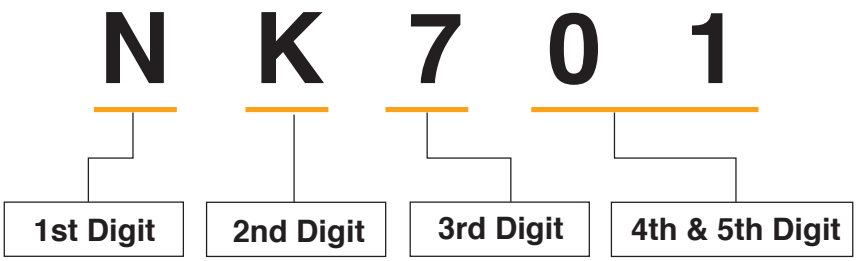
◎ : Excellent ○ : Good △ : Fair × : Poor

4. The Stability of Elastomer in Chemicals, Oils, and Fluids

<Table 4> Oil and Fluid Resistance of Elastomer

Oil,Chemical \ Rubber		HNBR	NBR	EPDM	SBR	PTFE	VMQ	FKM	ACM
Engine oil	SAE #30	◎	◎	×	×	◎	◎	◎	◎
	SAE 10W-#30	◎	◎	×	×	◎	○	◎	◎
Gear oil	Vehicles used	◎	◎	×	×	◎	△	○	◎
	Industrial synthetic base	◎	◎	△	△	◎	△	○	△
Auto transmission Fluid		◎	◎	×	×	◎	×	○	◎
Brake Fluid	DOT 3 (Glycol)	×	△	○	○	◎	○	×	×
	DOT 4 (Glycol)	×	△	○	○	◎	○	×	×
	DOT 5 (silicone base)	◎	◎	×	○	◎	×	○	○
Turbine oil		○	○	×	×	◎	△	◎	◎
Mechanical oil(No.2 lubrication oil)		○	○	×	×	◎	×	◎	○
Hydraulic oil(mineral oil)		◎	◎	×	×	◎	△	◎	◎
Antiburn oil	Phosphate	×	×	×	×	◎	◎	△	×
	Water + Glycol	○	○	×	×	◎	△	△	×
Cutting oil		◎	◎	×	×	◎	◎	◎	△
Grease	Mineral	◎	◎	×	×	◎	◎	◎	◎
	Silicone	◎	◎	×	○	◎	×	◎	◎
	Fluoro	◎	◎	×	×	◎	◎	×	◎
Coolant	R12 + Paraffin	◎	○	×	×	◎	×	×	×
	R134a + Glycol	○	△	◎	×	◎	×	×	×
Gasoline		○	△	×	×	◎	×	◎	×
Naphtha		○	△	×	×	◎	×	◎	×
Heavy oil		◎	○	×	×	◎	×	◎	△
Antifreeze fluid (ethylene glycol)		○	○	◎	◎	◎	△	×	×
Warm water		◎	○	◎	◎	◎	○	○	×
Salt water		◎	○	◎	◎	◎	×	○	×
Steam		○	×	○	△	◎	×	×	×
Hydrochloric acid 10%		○	○	◎	○	◎	○	○	○
Sulfuric acid 30%		△	△	○	△	◎	×	△	△
Nitric acid 10%		△	×	○	×	◎	×	△	×
Sodium hydroxide 40%		◎	○	◎	◎	◎	×	×	×
Benzene		×	×	×	×	◎	×	×	×
Alcohol		○	○	◎	◎	◎	○	○	×
Methyl ethyl ketone (MEK)		×	×	×	×	◎	△	×	×

◎ : Excellent ○ : Fair △ : Poor × : Failure



1st Digit ---------- Material

2nd Digit ---------- Color

3rd Digit ---------- Hardness

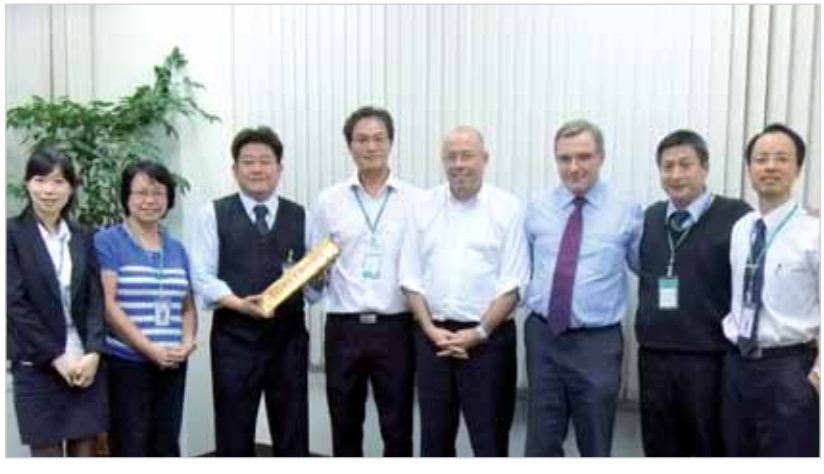
4th & 5th Digit ------ Property (Sequential Number)

<Table 5> Material code of NAK

1st Digit		2nd Digit		3rd Digit	
Material		Color		Hardness	
Symbol	Meaning	Symbol	Meaning	Symbol	Meaning
A	TPV	A	Tangerine	A	95
B	SBR	B	Blue	9	90
C	CR	E	Yellow	B	85
E	EPDM	G	Green	8	80
F	FVMQ	I	Beige	C	75
G	CSM	K	Black	7	70
H	HNBR	N	Brown	D	65
J	TPEE	P	Purple	6	60
M	AEM	R	Red	E	55
N	NBR	T	Gray	5	50
P	ACM	S	Skin	F	45
R	NR	W	White	4	40
S	VMQ	Z	Transparent	0	coating
T	PTFE				
U	TPU				
V	FKM				
X	XNBR				

NAK Family

We consider our suppliers, employees and customers to be family members. With care towards each other, we are closely connected together.



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WEBSITE: http://www.nak.com.tw

NAK SUBSIDIARIES LOCATION MAP

PO201503-08