KING

ENGINE BEARING SPECIALISTS

Catalog
2017-2018

KING STORY

We are Bearing Specialists

King Engine Bearings was founded in 1960 with one objective: to supply the highest quality bearings available in the marketplace.

By specializing in engine bearings, King has built an extensive product offering that includes a wide range of engine bearings for automobiles, light-duty and heavy-duty trucks, marine, aviation, standby power and many other types of internal combustion engines. Every King bearing utilizes the highest quality materials and the most advanced designs to ensure complete customer satisfaction.

From concept to final product, everything is done under one roof. This allows King to produce bearings more efficiently and with more accuracy in order to keep up with the needs of our customers. During production, all bearings must pass rigorous quality control checkpoints throughout the entire process. This stringent system of multiple quality checks ensures that only the highest quality bearings ever make it into our customers' hands.

King is the first choice in the extremely demanding aviation and racing industries due to our in-depth understanding of the specific needs of those industries. This knowledge and experience is then applied to every aftermarket bearing we make.

To achieve our goal of supplying the highest quality bearings, we had to reinvent the entire manufacturing process from the ground up, making King a pioneer in developing proprietary manufacturing machinery and multi-function, high speed production lines.

KING
ENGINE BEARING SPECIALISTS

GENERAL

King History

1960 - King Engine Bearings founded

1965 - First in-house designed production machinery is developed

1969 - Sales expand to Europe and the Middle East

1980 - Engine bearing production for the U.S. Army begins

1981 - U.S. subsidiary established

1984 - New research facility for material development and product validation is opened

1985 - First generation of automatic multi-function production lines is introduced

1991 - Launch of silicon alloy bearings including Alecular™ high performance products

1993 - Tri-metal bearing production commences

1997 - ISO 9002 certified

1998 - Integration of advanced QA system

2000 - Relocation to larger, new facility / OEM production line opens with Gen II fully automated machinery

2001 - Self-casting strip factory opens, producing from raw materials to finished product under one roof

2002 - U.S. aircraft engine bearing production begins

2006 - King becomes OEM aviation supplier and earns FAA approval

2006 - ISO/TS16949 (automotive) & ISO/AS9100 (aerospace) certified

2011 - XP tri-metal race bearings launch

2012 - Development and implementation of ACP- AutoCheckPoint system/ Gen III fully automated production line technology with superior accuracy and faster set-ups introduced

2013 - New racing line is launched incorporating pMax Black™ metal construction and unique geometric features

2014 - Sales & logistics center opens in Turkey / mass production of silver alloy material begins

2015 - Mass production of Sputter bearings

TECHLAB

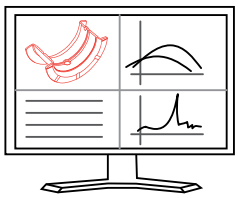
Leading The Way in Technology

As a technological leader and OEM development partner, King is committed to being at the leading edge of bearing technology to meet our customers' needs the world over.

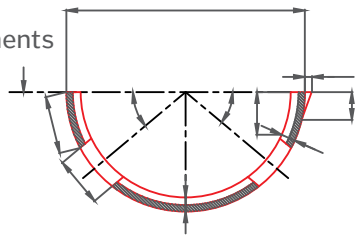
To maintain our position as the leading developer of engine bearings, King established TechLab. This research and development unit is constantly monitoring market changes to transform the future of bearings by formulating new bearing designs and materials. King's TechLab utilizes advanced ENSIM™ software to analyze and simulate variable bearing conditions using a wide range of equipment. This system allows us to create and test all new bearing designs and determine the optimal configuration for that application. King is also able to analyze engines after real-world use to improve bearing designs. We then leverage this information by applying the data to our aftermarket bearing designs.

King's Development Process

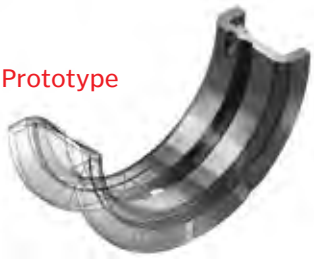
ENSIM™ - engine simulation system
Thermodynamic & hydrodynamic analysis,
Dynamic & press fit calculations



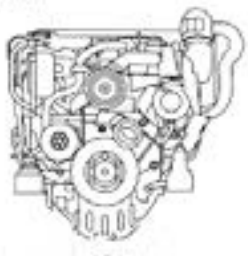
Product design
Metallurgic developments
Bearing geometry



Prototype



Validation
Rig testing
Dynamometer



On track test

KING
NGINE BEARING SPECIALISTS

HIGH TECH PRODUCTION

Production Technology

At King, we take great pride in the unique high-tech production lines and machines that we design in-house to exceed the needs of our customers. As a company that specializes in bearing manufacturing, we are constantly implementing new software and production systems that offer a higher level of precision. Our ongoing investment in new technology results in improved accuracy and a wider range of bearing sizes and features.

King's production technologies enable flexible and fast production changeover, which is required to support our wide range of bearings and sizes. This allows us to respond quickly to market demands and increase our production efficiency, while retaining our price advantage among the leading brands.

King's production process begins with in-house casting of our unique alloys. Production continues by way of automated production lines to the overlay plating process, and then concludes with packaging and product delivery.

King's attention to detail, and our self-imposed quality requirements exceed industry standards for product quality and production efficiency.

QUALITY

King ACP Quality System

King has developed and implemented an advanced, proprietary QA system called AutoCheckPoint. It conducts fully in-process automated monitoring of each phase of bearing production.

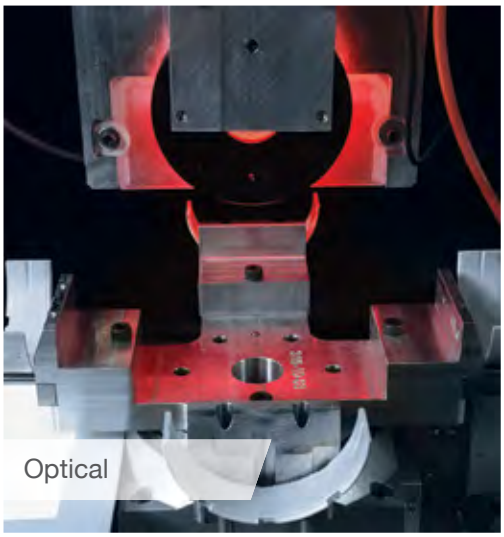
This process ensures that superior quality is built into each bearing from the start. This sophisticated system is integrated into our ERP module, and can uncover potential production problems on-the-spot, enabling any issues to be resolved immediately.

King produces its full line of bearings entirely in-house. This allows for complete control of the entire production process and results in an unequaled level of product quality.

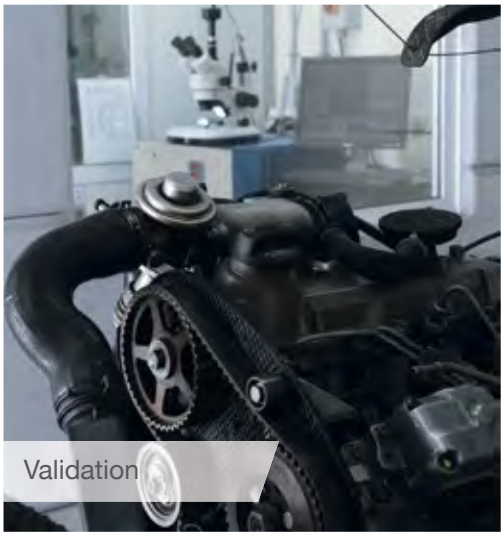
ACP AUTO CHECK POINT
Advanced QA System

King Inspection & Monitoring Tools


Geometrical


Optical


Metallurgical


Validation

KING
ENGINE BEARING SPECIALISTS

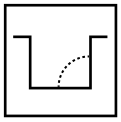
EXTREME PERFORMANCE

King Racing Activities

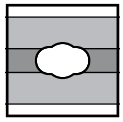
In the world of racing, poor bearing performance or bearing failure can result in losing a race. That's why so many leading race teams worldwide count on the reliability and quality of King bearings every day, in every engine.

Our XP and HP bearings are constantly being tested and proven on the track, under extreme conditions, in the real world. King's ability to meet the continuously changing and challenging demands of the racing industry with unique materials and geometric features is a testament to the quality and reliability of our bearings. King is committed to the ongoing design and development of superior race bearings.

By analyzing the specific needs of race engines, we have developed unique features including:

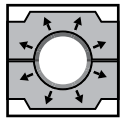


U-Groove™

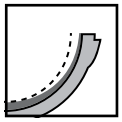


EllipticX™

Bull's Eye Tolerance™



RadiaLock™



EccentriX™

pMaxBlack™

King Aviation - OE Partner

In the world of aviation, quality, reliability and durability are essential. King works closely with OE aviation manufacturers to design new products, and develop engineering solutions to meet their requirements. Our aviation partners rely on the strict quality control that King provides, and benefit from our precision manufacturing and high quality materials.

King is an AS9100 company certified by the International Aerospace Quality Group (IAQG), and by the FAA.

Quality Commitment

King is committed to providing its customers with the best performing and most reliable products. Our dedication to quality is reinforced by proven internal processes and procedures, and comprehensive technological tools used for quality control and inspection.

We proudly certify that the products listed in this catalog are genuine King factory made products, and they meet or exceed the technical specifications declared by the vehicle manufacturers.

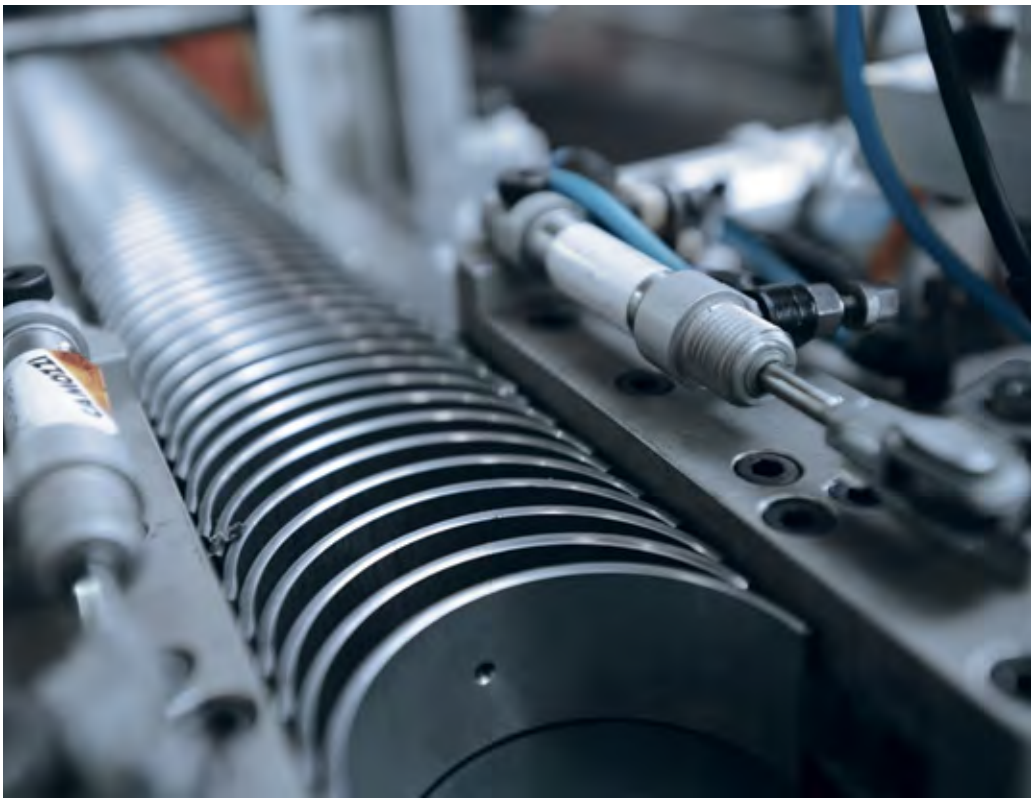
Our quality credentials include ISO/AS9100 (Aviation) and ISO/TS16949 (Automotive).

Gideon Zaslavsky
CEO
King Engine Bearings

ISO TS 16949 OE Quality

ISO AS 9100 Aviation Standard

ACP CHECK POINT Advanced QA System



KING
ENGINE BEARING SPECIALISTS

AFTERMARKET

Bearing Materials

AM	Upper	K-783
	Lower	K-783
SI	Upper	K-788
	Lower	K-788
SM	Upper	K-789
	Lower	K-783/8/9
CA	Upper	K-794
	Lower	K-783
CP	Upper	K-794
	Lower	K-794
XA	Upper	K-795
	Lower	K-788
SX	Upper	K-795
	Lower	K-795
SV	Upper	K-796
	Lower	K-794/5/6
SP	Upper	K-624
	Lower	K-794/5/6
HP	Upper	K-787
	Lower	K-787
XP	Upper	K-798
	Lower	K-798
GP	Upper	K-805
	Lower	K-805/798
AVIATION		K-895

*Bearing overlay color is a non-functional element.
Color variations do not affect bearing performance.

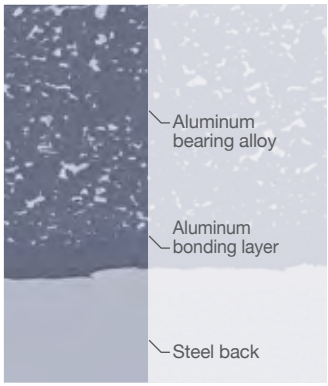
Bimetal

K-783

Traditional aluminum based material, equivalent to SAE-783. Used for low and medium load engines.

Lining	Al20Sn1Cu
Overlay	no overlay

Load Capacity
Anti - Seizure
Wear Resistance
Conformability/Embedability

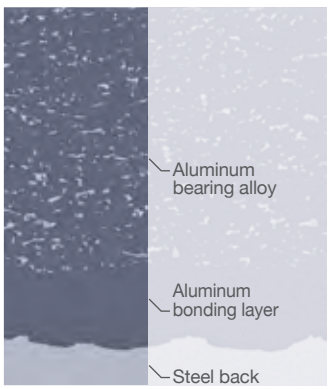


K-788

Aluminum based material, strengthened by 2.5-3% silicon. For medium load engines and/or engines with nodular cast iron crankshafts.

Lining	Al12Sn2.5Si1Cu
Overlay	no overlay

Load Capacity
Anti - Seizure
Wear Resistance
Conformability/Embedability



K-789

Aluminum alloy bearing layer. The strongest aluminum based material, with aluminum bonding layer. The alloy is strengthened by the addition of manganese and chromium (Mn, Cr). Used for high load applications.

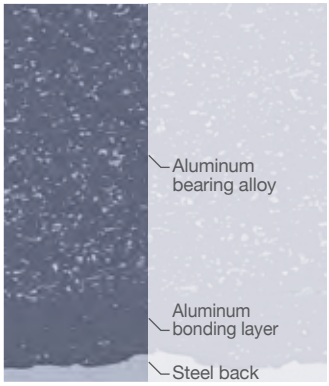
Lining	Al7Sn2Si1.5CuMnCr
Overlay	no overlay

Load Capacity

Anti - Seizure

Wear Resistance

Conformability/Embedability



Trimetal

K-794

Traditional tri-metal copper based material, equivalent to SAE-794. For medium load engines.

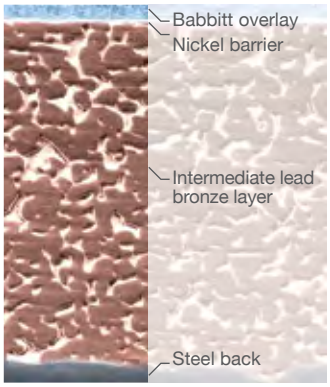
Intermediate	Cu23Pb3.5Sn
Overlay	Pb10Sn3Cu

Load Capacity

Anti - Seizure

Wear Resistance

Conformability/Embedability



K-795

Strengthened copper based material , with higher tin content. For medium and high load engines.

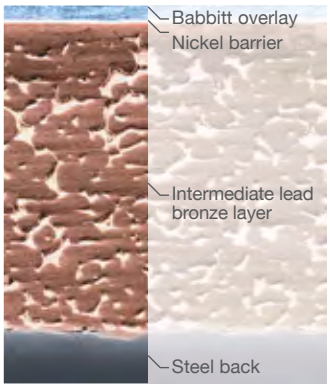
Intermediate	Cu21Pb4.5Sn
Overlay	Pb10Sn3Cu

Load Capacity

Anti - Seizure

Wear Resistance

Conformability/Embedability



AFTERMARKET

Bearing Materials

K-796

A lead free tri-metal silver based overlay material containing solid lubricant additives distributed throughout the silver matrix. For extreme load engines. Can be used as a sputter replacement.

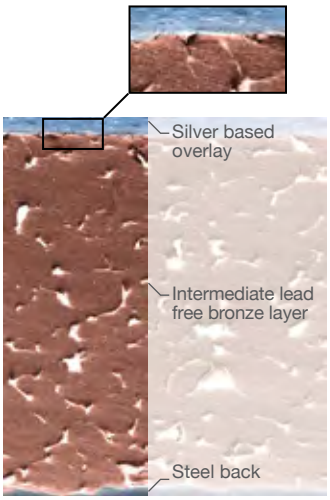
Intermediate	Cu8Sn4Bi
Overlay	Ag base alloy

Load Capacity

Anti - Seizure

Wear Resistance

Conformability/Embedability



K-624

Lead free or leaded material with sputter overlay (plated by Physical Vapor Deposition). For extreme loads.

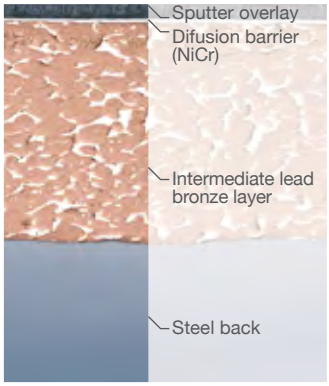
Intermediate	Cu8Sn4Bi
Overlay	Al20Sn1Cu

Load Capacity

Anti - Seizure

Wear Resistance

Conformability/Embedability



RACING

K-787

The HP Series featuring the Alecular™ metal structure used for high loads over short durations. Suitable for race applications such as drag racing, which can benefit from a harder than Babbitt top layer material. Alecular™ also serves other performance applications that use nodular cast iron crankshafts, such as street/strip and some levels of circle track racing.

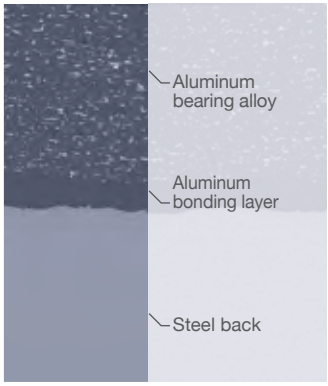
Lining	Al12Sn2.5Si1Cu
Overlay	no overlay

Load Capacity

Anti - Seizure

Wear Resistance

Conformability/Embedability



K-798

pMax Black™ is a unique tri-metal structure for race applications. The overlay is strengthened by a proprietary nano-scaled hardening process that modifies the molecular structure and creates a black fatigue-resistant shield.

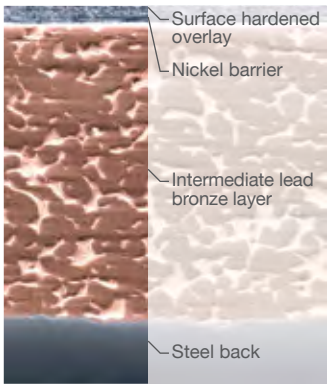
Intermediate	Cu21Pb4.5Sn
Overlay	Pb10Sn5Cu surface hardened

Load Capacity

Anti - Seizure

Wear Resistance

Conformability/Embedability



K-805

A tri-metal lead free silver based overlay material for extreme load racing applications. Contains solid lubricant additives distributed throughout the silver matrix.

Intermediate	Cu8Sn4Bi
Overlay	Ag base alloy

Load Capacity

Anti - Seizure

Wear Resistance

Conformability/Embedability

AVIATION

K-895

Tri-metal material for medium and high load aviation engines.

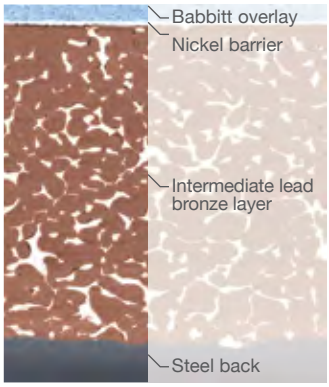
Intermediate	Cu21Pb4.5Sn
Overlay	Pb10Sn3Cu

Load Capacity

Anti - Seizure

Wear Resistance

Conformability/Embedability



KING
ENGINE BEARING SPECIALISTS

SURFACE TREATMENT

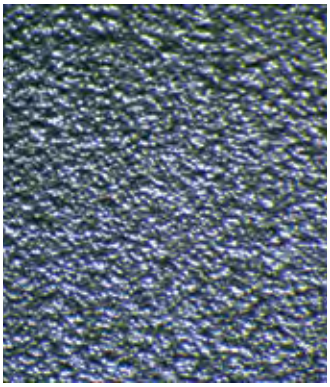
Bearing Materials

Polymer Coating

Polymer based coating containing solid lubricants that enhance the anti-friction properties of various bearing materials.

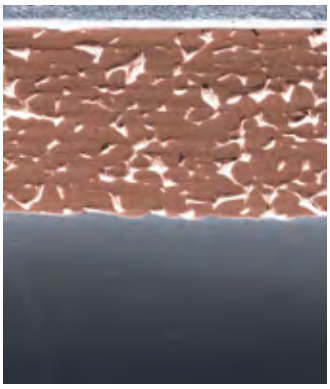
Compressive Stress Surface (CSS) Treatment

Surface hardening treatments that increase fatigue strength and load capacity of various bearing materials.



pMax Black™

King Racing pMax Black™ overlay is strengthened by a proprietary nano-scaled hardening process that modifies the molecular structure and creates a black fatigue-resistant shield. The outcome is a significant 24% increase in hardness and load capacity, reaching 18.1HV.
pMax Black™ is a non-polymer structure.



AFTERMARKET

King Silver Based Bearings

An Ideal Alternative to Sputter Bearings

King prides itself on developing new products and solutions, while remaining environmentally responsible.

The requirements of modern engines continue to challenge. The constant demand for greater performance, lower friction, increased resistance to wear, and less weight drives King to develop more efficient solutions for each engine's requirements.

The increasing number of diesel and turbo-diesel engines available today and planned for tomorrow presents its own specific challenges and needs. The inherent high load of these engine types requires an exceptionally strong bearing with very specific benefits. Most bearing manufacturers can only offer Sputter bearings as the best choice for these engines, but King offers, in addition to Sputter, an advanced, more efficient alternative: a silver based composite bearing with similar performance characteristics and greater economy.

Silver (SV) Material Composition

These new bearings from King incorporate a tri-metal, lead-free silver based overlay material designed specifically for extremely high-load applications. This new bearing overlay contains solid lubricant additives distributed throughout the material matrix for increased longevity and dramatically reduced friction and wear.

Silver vs. Sputter	Silver Features	Sputter Features
Load Capacity		
Anti - Seizure		
Wear Resistance		
Conformability/Embedability		

KING
ENGINE BEARING SPECIALISTS

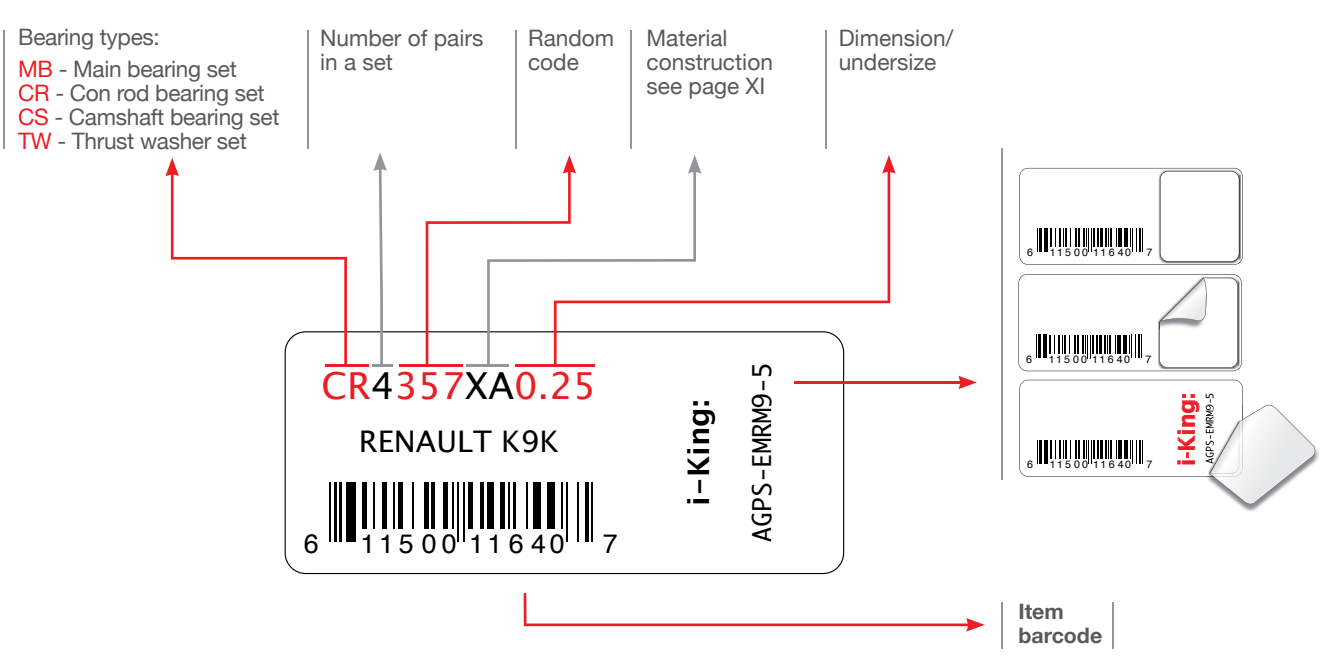
Identifying King Product

Check to Protect
King Product Verification

Protecting our customers from counterfeit bearings is very important to us. This is why we are investing in security measures so our customers will be certain that the products they purchase contain genuine King components.

3 ways to ensure you have genuine King product:

1. Look for the circle in the left corner of the King hologram label. By using a special filter you'll see the letter K inside this circle. Filters are available from King authorized distributors.
2. A pattern of the letter "K" appears when a blank piece of paper is held perpendicular up against the hologram label, while shining a laser beam on the "genuine product" area of the label.



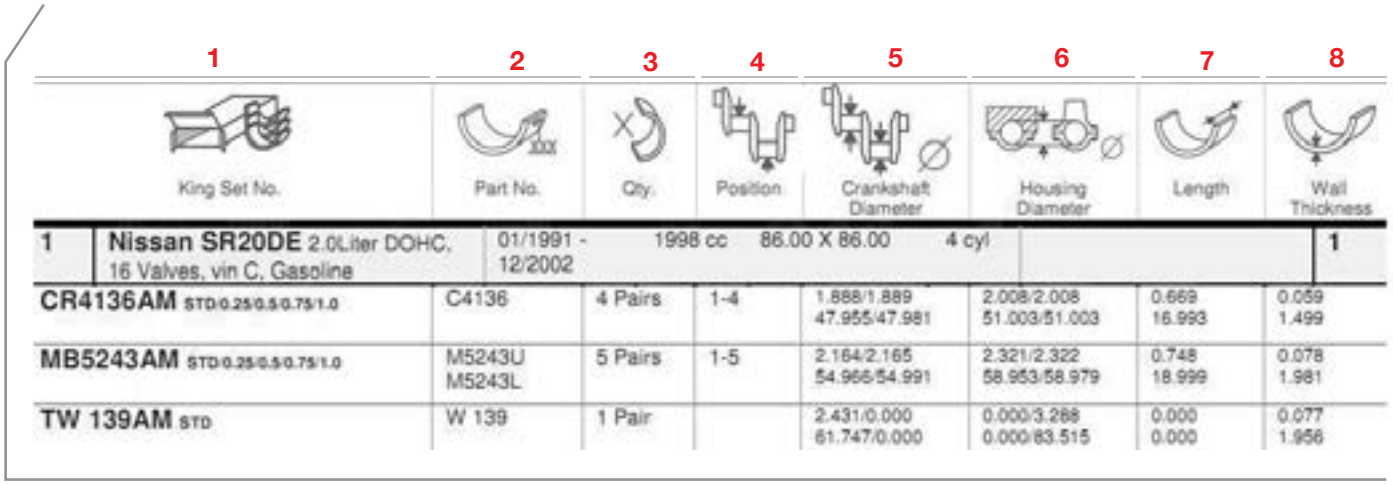
GENERAL

How to Use This Catalog

Manufacturers are arranged in alphabetical order.

Manufacturer's engine index is located at the beginning of each manufacturer section and refers to the relevant engine group panel.

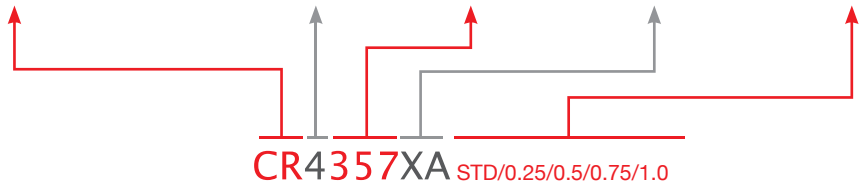
Engines using the same parts are grouped together under the same panel number. Technical details are provided after each engine group.



1	2	3	4	5	6	7	8
King Set No.	Part No.	Qty.	Position	Crankshaft Diameter	Housing Diameter	Length	Wall Thickness
1 **Nissan SR20DE** 2.0Liter DOHC, 16 Valves, vin C, Gasoline	01/1991 - 12/2002	1998 cc	86.00 X 86.00	4 cyl			1
CR4136AM STD/0.25/0.5/0.75/1.0	C4136	4 Pairs	1-4	1.888/1.889 47.955/47.981	2.008/2.008 51.003/51.003	0.669 16.993	0.059 1.499
MB5243AM STD/0.25/0.5/0.75/1.0	M5243U M5243L	5 Pairs	1-5	2.164/2.165 54.966/54.991	2.321/2.322 58.953/58.979	0.748 18.999	0.078 1.981
TW 139AM STD	W 139	1 Pair		2.431/0.000 61.747/0.000	0.000/3.268 0.000/83.515	0.000 0.000	0.077 1.956

1. King set number

Bearing types:	Number of pairs in a set	Random code	Material construction see page XI	Dimension/undersize
MB - Main bearing set CR - Con rod bearing set CS - Camshaft bearing set TW - Thrust washer set				**Additional undersizes available upon request, inquire for MOQ.



2. King part number (shell number)

The first letter indicates the type of bearing:

C = Connecting rod bearing
M = Plain main bearing
F = Flanged bearing
MK = Flanged bearing (clinched)
W = Thrust washer
B = Bushing
S = Bushing/camshaft bearing

The suffix letter indicates positioning of the part:

U = Upper position
L = Lower position

3. Quantity of parts in the set

4. Location of the part on the crankshaft

5. Minimum and maximum diameter of the crankshaft journal

6. Minimum and maximum diameter of the housing

7. Bearing length

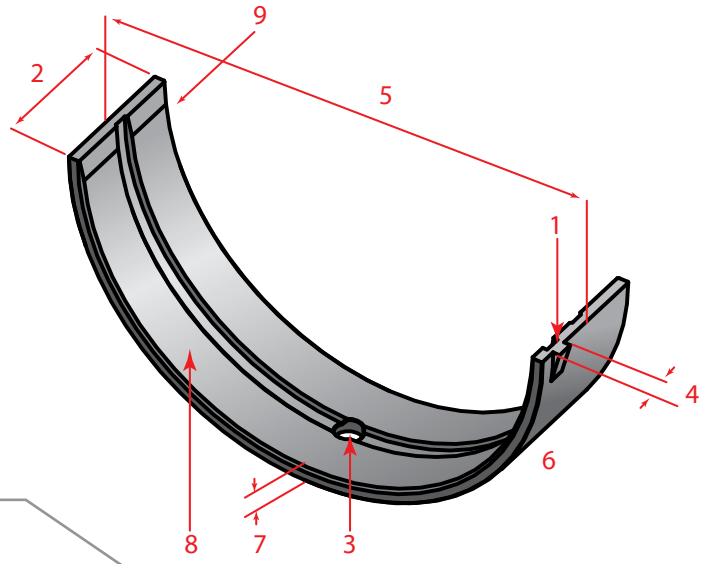
8. Maximum bearing wall thickness, measured at crown

GENERAL

Bearing Terminology

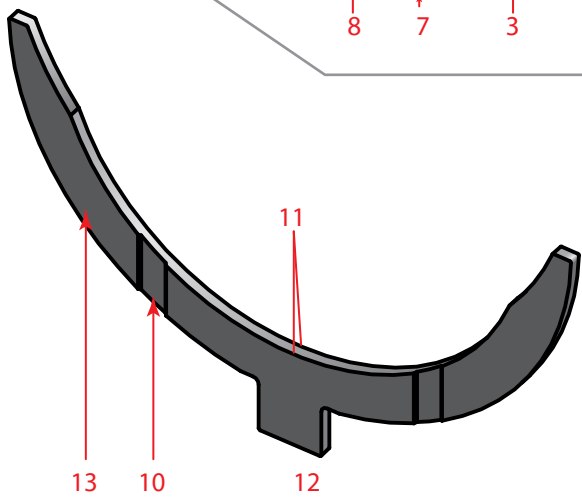
A. Straight Shell Bearing

1. Locating lug
2. Bearing length
3. Oil hole
4. Width of locating lug
5. Free spread
6. Bearing back
7. Bearing wall thickness
8. Bearing surface
9. Crush relief



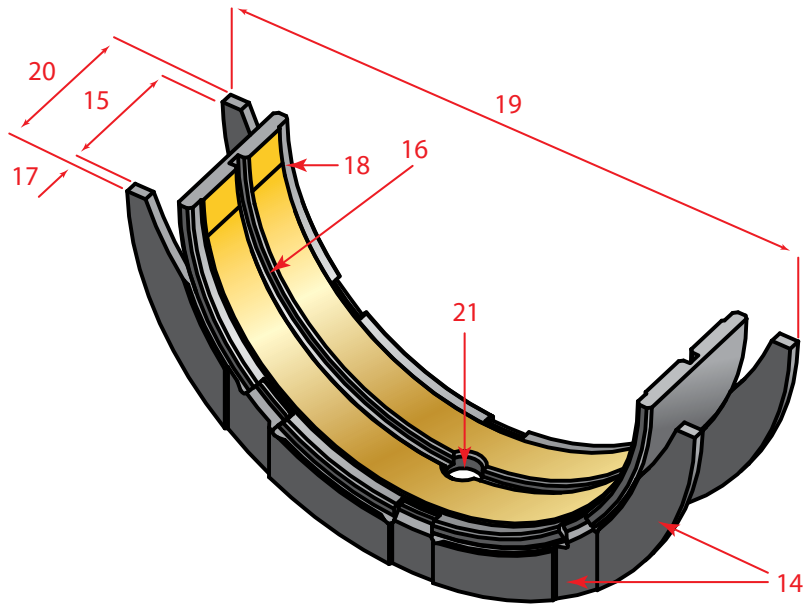
B. Thrust Washer

10. Oil groove
11. Wall thickness
12. Locking lug
13. Thrust surface



C. Flange Bearing

14. Thrust surface relief
15. Distance between flanges
16. Oil groove
17. Flange thickness
18. Crush relief
19. Flange diameter
20. Flange bearing length
21. Oil hole



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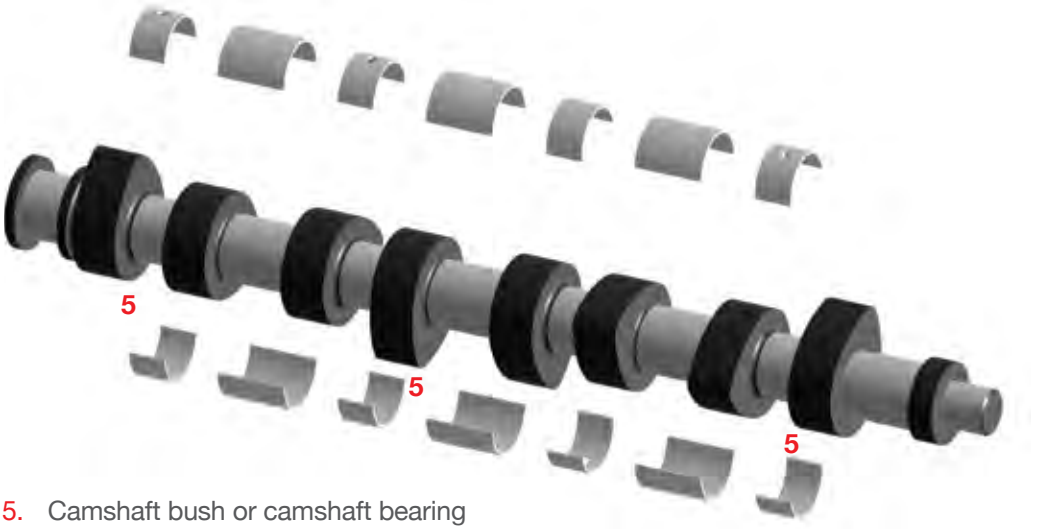
ENGINE BEARING SPECIALISTS

Bearing Positioning

1. Main bearing
2. Connecting rod bearing
3. Flange bearing or main bearing with thrust washer
4. Piston pin bushing



5. Camshaft bush or camshaft bearing

BEARING GEOMERTY

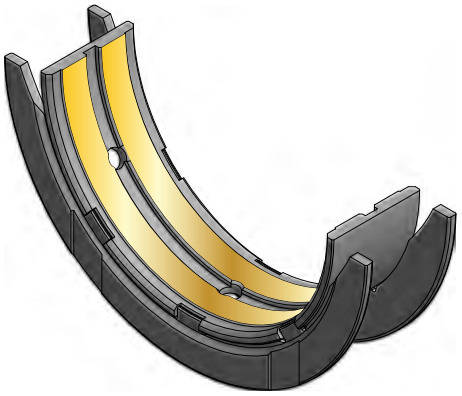
Clinched Thrust Bearings

Recent developments in thrust bearing design and technology have led to greater use of a three-piece configuration, where separate thrust washer bearing surfaces are mechanically attached (clinched) to the main axial bearing shell. Each component of the three-piece bearing can be manufactured separately. Consequently, both thrust washers and the axial bearing itself can include unique features and properties that could not have been achieved with the one-piece formed bearing.

This superior clinched design replaces the one-piece formed thrust bearing previously found in many O.E. and aftermarket applications, while preserving the one-piece ease of assembly for the installer. Traditional one-piece designs are restricted to using the same bearing surface material on the thrusts as on the axial bearing surface.

The three-piece design enables different bearing materials to be used, affording better performance and service life to the critical dual role of thrust bearings. Furthermore, the attached thrust washers have the freedom to flex due to crankshaft deflection, without causing excessive loading, oil starvation and overheating between the two surfaces.

Formed Flange Bearing



Clinched Bearing (three-piece design)

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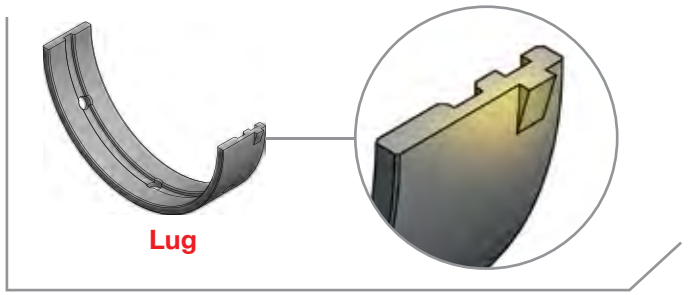
BEARING GEOMERTY

Bearing Lug Innovation

The growing trend among O.E. engine manufacturers is to use robotic equipment for engine block assembly. Guided by computer programming and lasers for high speed assembly, such devices do not require locating recesses or notches in connecting rods or main bearing bores. Consequently, engine bearings are required to be supplied without locating lugs.

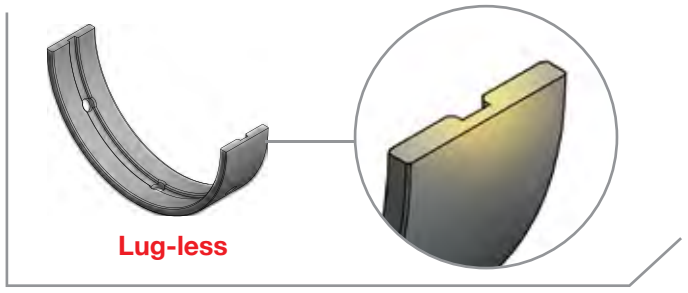
This design leaves the aftermarket bearing installer without the traditional visual marker to aid in the quick, if only approximate, location of the bearing in its housing. Lug-less engine bearings can be installed in housings that have notches, but obviously bearings with lugs cannot be installed in housings without recess notches.

The locating lug does not keep the bearing from spinning in its housing. During engine operation, engine bearings are retained in place due to their crush height – a parameter completely unaffected by the presence or absence of locating lugs. If proper crush is not achieved during assembly, the bearing will spin regardless if there is a lug.



For aftermarket installers, placing lug-less bearings into their correct position requires some additional attention to detail. Shell and housing should be aligned for unimpeded oil hole orientation and for proper centering to avoid bearing to crank fillet ride.

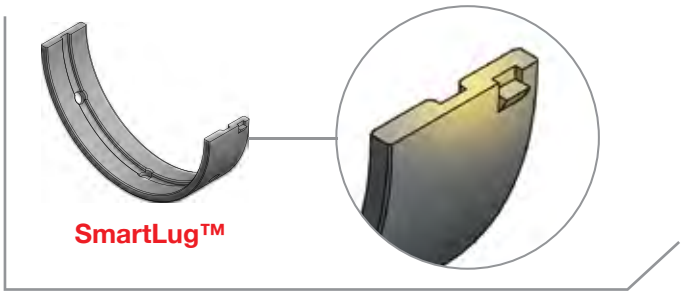
Generally, the proper initial procedure for installing a lug-less bearing is to line up the center of the bearing with the center of the connecting rod or main bore. Slight adjustments can then be performed for final optimal location.



SmartLug™ by King

King developed SmartLug™ for high performance bearings. It prevents lug generated oil leaks and maintains full bearing surface in the parting line area for better load capacity and oil film distribution.

SmartLug™ features a traditional locating lug protruding from the back of the bearing -- without removing any material from the working surface side of the bearing. Traditional locating lug designs reduce available load carrying surface area and can cause oil leak paths, especially when located adjacent to an oil groove.



Engine Bearing Undersizes

King engine bearings are manufactured to precision finished wall thicknesses. They cannot be resized, nor should their inner working surfaces be scuffed or otherwise altered.

The following chart shows the range of sizes typically produced for most applications. Consult this catalog's data block, specific to your engine, to review actual undersize options. Before grinding the crankshaft, always check with your nearest King bearing dealer to ensure availability of the undersizes you may need.

The size of each King bearing shell is stamped into its steel back. It is the installer's responsibility to check each shell and to confirm that it is the size intended for the job.

Special undersizes, not shown here, can be produced in volume quantities upon request. Contact us directly with such requests.

Bearing size, inches	STD	.010	.012	.020	.030	.032	.040	.050	.060
Bearing size, metric	STD	0.25	0.3	0.5	0.75	0.8	1.0	1.25	1.5
Crankshaft undersize, inches	0	-.010		-.020	-.030		-.040	-.050	-.060
Crankshaft undersize, metric	0	-0.25	-0.3	-0.5	-0.75	-0.8	-1.0	-1.25	-1.5
Additional shell thickness (on nominal), inches	0	+.005		+.010	+.015		+.020	+.025	+.030
Additional shell thickness (on nominal), metric	0	+0.125	+0.15	+0.25	+0.375	+0.40	+0.50	+0.625	+0.75

INSTALLATION GUIDELINES

Installation Guidelines

1
Identify Matching Caps
Ensure matching connecting rod and main bearing caps are identified with the correct position number before they are removed from the engine.

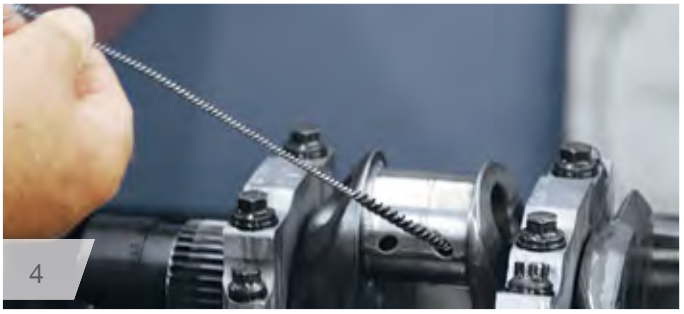
2
Housing Bore Conditions
With rod and main cap fasteners torqued, check housing bores for size, roundness, taper and surface condition using a calibrated inside micrometer. If any specs are found to be out of tolerance, have a qualified machinist correct them.


2

3
Crankshaft Journals
Check crankshaft rod and main journals for size, shape, and surface condition using an outside micrometer. If any specs are found to be out of tolerance, have a qualified machinist correct them. Before doing any crankshaft journal resizing, check with your King Engine Bearings distributor for available bearing undersizes. Also, remember to inspect the crank thrust surfaces for possible reconditioning. King ProFlange (O/S flange lengths) are available for certain applications.


3

4
Cleanliness
Both engine block and crankshaft should be free of any debris. A wire brush should be used to clean all oil passages. Thoroughly wash all engine components with hot soapy water before assembly. Dry all components with compressed air to remove any lodged debris.


4

5
Install Bearings in Bores
Carefully clean and install each bearing half into its appropriate position by referring to the latest King catalog for correct position. Firmly push each bearing into its bore until a slight snap is felt.


5

6
Check Proper Bearing Alignment
Ensure that all bearing oil holes line up with oil supply holes in the block. Also make sure locating lugs are nested into their appropriate slots and each bearing lines up properly in its bore.


6

7
Pre Lube Bearing Surfaces
Apply a sufficient amount of bearing assembly lube to the bearing surfaces and the rear main lip seal

8
Crankshaft Installation
With engine block in the inverted position, carefully lower the crankshaft into the upper main bearings. Take extra care to prevent possible damage to the upper thrust bearing. Assemble and tap each main cap into its appropriate position making sure the caps are firmly seated and facing the correct direction.

9
Main Bearing Cap Torqueing
Clean and lubricate all main fasteners to ensure accurate torque readings. With a pry bar, push the crankshaft towards the front to align the thrust bearing surfaces. Obtain the correct torque specs from the original manufacturer's listing and hand tighten each main fastener. Using a calibrated torque wrench, torque each fastener to the specified load, starting at the center main and working toward each end. The shaft should turn freely after each main cap torqueing. Check for proper oil clearance before final assembly.


9

10
Check Crankshaft End Play
Install a dial indicator on the snout end of the crankshaft. Force the crankshaft to its most forward position and zero the dial. Force the crank in the opposite direction till it bottoms out and read the dial. A feeler gauge can also be used.


10

11
Connecting Rod to Crankshaft Assembly
Lubricate rod cap fasteners, cylinder wall and corresponding connecting rod journal. Cover rod bolts with boots to prevent cylinder wall/ journal damage. Carefully insert connecting rod piston assembly into cylinder bore until the rod makes contact with the corresponding crank pin. Make sure the piston and rod are oriented in the correct direction. Assemble the corresponding connecting rod cap to the rod and hand tighten rod cap fasteners. Using a calibrated torque wrench, torque the rod cap fasteners to manufacturer's specifications. Follow same procedure for all cylinders. The crank should turn freely after each rod has been installed.


11

12
Prime the Engine
To prevent a dry start and possible damage to bearing surfaces, the engine oiling system should be completely filled with good clean engine oil and pressure tested. This can be accomplished using two methods. Pressure spin test the engine with a pre-lubricator or simply turn the oil pump shaft with a drill motor until adequate pressure is reached.

BEARING FAILURE

Engine Bearing Failure Analysis Guide

Fatigue of Aluminum Lining

Appearance:

Cracks, cratered & distressed bearing surface due to loss of aluminum lining material.

Possible causes:

- Wrong selection of engine bearing material
- Engine power increased beyond original design
- Excessive clearance
- Fuel detonation/advanced ignition
- Geometry defects causing localized bearing overloading

Corrective actions:

- Select a bearing material with higher load capacity
- Check: clearances and component geometry
- Retard ignition or use fuel with higher octane number
- Repair/replace distorted parts

Fatigue of Babbitt Overlay

Appearance:

Irregular spider web-like cracks and craters in the overlay. Fatigue may lead to partial flaking of the overlay, followed by fatigue of the copper-lead intermediate layer.

Possible causes:

- Wrong selection of engine bearing material
- Engine power increased beyond original design
- Excessive clearance
- Fuel detonation/advanced ignition
- Geometry defects causing localized bearing overloading

Corrective actions:

- Select a bearing material with higher load capacity
- Check: clearances and component geometry
- Retard ignition or use fuel with higher octane number
- Repair/replace distorted parts

Fatigue of Bronze Intermediate Layer

Appearance:

Babbitt surface missing and intermediate layer cracked and cratered. Fragments are detached from the steel back causing imminent bearing failure.

Possible causes:

- Wrong selection of engine bearing material
- Engine power increased beyond original design
- Excessive clearance
- Fuel detonation/advanced ignition
- Geometry defects causing localized bearing overloading

Corrective actions:

- Select a bearing material with higher load capacity
- Check: clearances and component geometry
- Retard ignition or use fuel with higher octane number
- Repair/replace distorted parts

Surface Wear

Appearance:

- Accelerated wear - shiny surface
- Heavy wear - signs of overheating (blackening), partial melting/removal of overlay (top shell)
- Severe wear - torn surface, heavy overheating, melted/missing overlay and lining material (bottom shell)

Possible causes:

- Insufficient oil supply (starvation)
- Non-uniform/unstable oil film (due to bearing fatigue)
- Geometrical irregularities or poor journal surface finish
- Grinding chatter marks and lobing
- Contaminated oil

Corrective actions:

- Check oil supply system, prevent oil dilution/contamination
- Change bearing material
- Verify proper grinding/polishing procedures
- Improve cleaning procedures, replace oil and filter more frequently

Edge Wear Due to Distorted Connecting Rod

Appearance:

Localized excessive wear of the bearing surface along the bearing edge.
Possibility of fatigue cracks in the affected area.

Possible causes:

- Rod distortion caused by:
  - Overloading
  - Detonation
  - Excessive torque
- Distorted rod produces non-parallel orientation of the bearing and journal surfaces
- Metal-to-metal contact occurs along the bearing edge

Corrective actions:

- Replace the distorted parts
- Prevent engine detonation and pre-ignition (check cooling system, air-fuel ratio, ignition timing, knock sensor, octane number of fuel)
- Choose higher strength connecting rods

Imperfect Journal Geometry

Appearance:

Localized wear in parts of the bearing surface.
Fatigue cracks may occur in these areas.

Possible causes:

- Inconsistent journal diameter. Areas of greater diameter produce metal-to-metal contact with the bearing surface, causing local wear
- Use of worn or improperly dressed grinding wheel when resizing the crankshaft. Journals may result as tapered, hourglass shape or barrel shape

Corrective actions:

- Replace/redress grinding wheel
- Re-grind the crankshaft

Cavitation Erosion

Appearance:

Erosion damaged areas on the overlay due to sharp changes of pressure in the oil film.

Possible causes:

Vapor cavities (bubbles) in the oil – when the load applied to a bearing fluctuates at high frequency (high RPM).

The oil pressure can instantly fall, causing vapor cavities (bubbles) due to fast evaporation (boiling). When the pressure rises, vapor cavities (cavitation bubbles) contract at high velocity. Such collapse results in impact pressure, that can erode the bearing material.

Corrective actions:

- Select stronger (harder) bearing material
- Decrease oil clearance
- Avoid running the engine at extremely high rotation speeds

Spinning of the Bearing in the Housing

Appearance:

Highly polished area on the bearing back caused by bearing spinning in the housing.

Possible causes:

- Insufficient crush height
- Oil starvation/lugging the engine causing seizure
- Housing diameter greater than specified value

Corrective actions:

- Choose bearings with sufficient crush height for the application
- Eliminate the cause of seizure
- Check housing diameter for size and roundness
- Tighten bolts to the specified torque value

Fatigue in the Crush Relief Area

Appearance:

Fatigue cracks in the area of crush relief.

Possible causes:

- Excessive crush height - upon torqueing the housing, the parting line region of the bearings deflects inward. This reduces the gap between the journal and bearing surfaces. Such change of bearing profile at the parting line region produces localized peak oil film pressure, which can cause fatigue of the bearing material.
- Excessive RPM producing rod bore stretch

Corrective actions:

- Prevent excessive crush height
- Check the housing diameter
- Avoid over-torqueing the rods
- Choose more rigid connecting rods

Damage Caused by Foreign Particles

Appearance:

Circumferential scores or scratches on the bearing surface.

Possible causes:

- Particles of grinding abrasive entrapped in crankshaft oil passages and/or other engine block components
- Ambient dirt, sand or dust
- Metal particles (e.g. fragments of fatigued material from failed components)

Corrective actions:

- Find the origin of the abrasive particles and other contaminants
- Replace air filter, oil and oil filter
- Check crankshaft oil passages and all engine components. Thoroughly clean them with hot soapy water prior to assembly.

Disclaimer

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The catalog is not an operating manual for the use and installation of the bearings. Any individual reference made in this catalog for the installation and the application of the bearings is intended solely for the use by technically qualified specialists. Furthermore, the instructions must be examined and verified by specialized technicians as to their applications in each case. KING accepts no responsibility for any improper application decisions.

Any names, serial numbers, description of vehicles and manufacturers have been included solely for the purpose of reference and comparison.

Part numbers, vehicle model and engine details may change from time to time. Although the information contained in the catalog is, to the best of King's knowledge, accurate at the time of its publication, King does not accept responsibility for any inaccuracies and subsequent changes to the information provided in the catalog.