ACL PRODUCT CATALOG

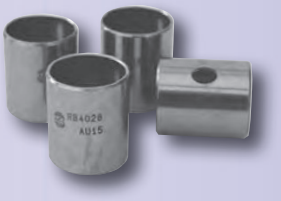
Includes Light Duty Diesel Engines

Rod and Main Bearings

Cam Bearings

Thrust Washers

Piston Pin Bushings



PLEASE NOTE: BEFORE GRINDING CRANKSHAFT WE ADVISE YOU TO CHECK WITH YOUR LOCAL DISTRIBUTOR TO ENSURE THE UNDERSIZE REQUIRED IS AVAILABLE.

Note: All information in this Catalog has been compiled from the most reliable sources available to us, and prepared with the greatest care, in an endevor to have it correct. However, no responsibility can be accepted if any details are found to be incorrect. We welcome any feedback on any errors which you may come across while using this Catalog.

UNDERSTANDING THIS PART LISTING

This catalog is designed in an index format to make the selection of ACL engine bearings an easy task.

ACL SET NUMBERING SYSTEM

EXAMPLE

4 B 1780P - STD

- **4** — DENOTES QUANTITY OF PAIRS PER SET
- **B** — DENOTES SET TYPE
- **1780** — UNDERSIZE OF SET
- **P** — DENOTES MATERIAL/BRAND
- **STD** — UNDERSIZE OF SET

B	CONROD BEARING SET
M	MAIN BEARING SET
C	CAMSHAFT BEARING SET
T	THRUSTWASHER SET
BS	BALANCE SHAFT OR AUXILIARY BEARING SET
RB	SMALL END BUSH
SC	SPECIAL CAMSHAFT BEARING SET

A	ALUGLIDE
D	DURAGLIDE (DIESEL)
P	DURAGLIDE
H	RACE SERIES
HX	RACE SERIES .001" EXTRA CLEARANCE
HD	RACE SERIES ALL ST DOWEL HOLE LOCATION

1. Locate the manufacturer – these names are listed at the top of each page in alphabetical order.
2. Locate the type of engine you have by using the Engine Index at the beginning of each section. Confirm your engine details by comparing the engine description, displacement, cylinder configuration and year information. Once you have found the engine you are looking for, note the corresponding Group number.
3. Turn to the group number for the selection of parts available. The Group number will appear at the top of the relevant group.

The following is a guide to the technical data provided in the catalog:

1. Engine Set No./Sizes Available

This lists the set numbers for the various types of bearing sets and sizes available. Any comments relating to these sets are positioned above the technical data for that set.

2. Type and Location

This gives the type of bearing set, and when relevant the position or location of each bearing shell or bush in the engine. These are numbered from the front (no. 1) to the rear.

3. Standard Shaft Size

Minimum and Maximum dimensional information supplied in metric and imperial format. Note for thrustwashers this refers to the inside diameter of the washer.

4. Housing Bore

Minimum and Maximum dimensional information supplied in metric and imperial format. Note for thrustwashers this refers to the outside diameter of the washer.

5. Max. Bearing Thickness

Maximum wall thickness of the bearing supplied in metric and imperial format.

6. Max. Overall Length

Maximum dimensional information supplied in metric and imperial format. Note for thrustwashers this refers to the thickness of the washer.

7. Material Code

Refer to the following bearing materials section for a description of the various material codes.

8. Bearing Shell No.

Bearing shell numbers applicable to the pairs or bushes.
For half bearings shells, the letters below the shell number indicate the type of half:

UL = indicates a pair of shells with different upper and lower halves.

IH = indicates a pair of shells with identical upper and lower halves.

U = indicates the shell is only used in the upper position.

L = indicates the shell is only used in the lower position.

BEARING FEATURES

Bearing materials

Bearing materials are made from multi-layered materials. Typically these feature:

- A steel backing – to provide supporting strength for the lining and to ensure a good fit in the housing.
- One or more lining layers – to provide the bearing with good fatigue strength as well as good anti-seizure properties.

Lining materials for crankshaft bearings can be divided into 3 types:

1. Babbitt (Whitemetal)

   Lead or Tin based alloys, these are soft, forgiving and provide excellent embedability of contaminants. However load capacity is low, so they are usually reserved for early model engines and low load applications requiring great seizure resistance. They are commonly used for camshaft bearing sets. ACL examples are F1 and F23.

2. Copper-lead (Tri-Metal)

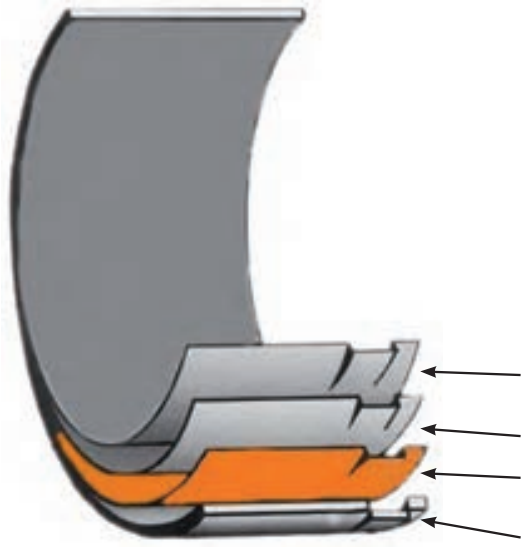
   These are leaded bronze alloys, and are strong and adaptable. They are suitable for a broad range of applications including highly load engines. For crankshaft bearings this lining is combined with a softer electroplated lead based overlay to give the bearing better conformability and anti-seizure properties. ACL F780 (Duraglide), F781 (Race).

3. Aluminum-tin (Bi-Metal)

   Aluminum based alloys are tough and durable. They possess excellent load capacity for intermediate duty and are suitable for modern passenger vehicle engines. ACL F817, F820, F810 (Aluglide).

MATERIAL CODE	
F1 (Whitemetal)	= Cast whitemetal, tin based, steel backed. NOMINAL COMPOSITION: 89% Tin, 7.5% Antimony, 3.5% Copper
F23 (Whitemetal)	= Cast whitemetal, lead based, steel backed. NOMINAL COMPOSITION: 84% Lead, 15% Antimony, 1% Tin
F100	= Sintered copper lead, unplated, steel backed. NOMINAL COMPOSITION: 80% Copper, 10% Tin, 10% Lead
F147	= Rolled aluminum-tin, steel backed. NOMINAL COMPOSITION: 91% Aluminum, 6% Tin, 1.5% Silicon, 1% Copper, 0.5% Nickel
F250	= Sintered copper lead, unplated, steel backed. NOMINAL COMPOSITION: 74% Copper, 23% Lead, 3% Tin
F780 (Tri-Metal)	= Sintered copper lead, lead plated, steel backed. NOMINAL COMPOSITION: 74% Copper, 24% Lead, 2% Tin
F781 (Tri-Metal)	= Sintered copper lead, high strength lead plated, high strength steel backed. NOMINAL COMPOSITION: 74% Copper, 24% Lead, 2% Tin
F810 (Alutin)	= Rolled aluminum-tin-silicon, steel backed. NOMINAL COMPOSITION: 87% Aluminum, 9% Tin, 3% Silicon, 1% Copper
F820 (Alutin)	= Rolled aluminum-tin, steel backed. NOMINAL COMPOSITION: 79% Aluminum, 20% Tin, 1% Copper
F830 (Alutin)	= Rolled aluminum-tin, steel backed. NOMINAL COMPOSITION: 69% Aluminum, 30% Tin, 1% Copper
F817 (Alutin)	= Rolled aluminum-tin, steel backed. NOMINAL COMPOSITION: 80% Aluminum, 17% Tin, 1% Copper, 2% Lead

The tri-metal material F781 has the same composition as F780 but is heat treated to provide properties suited to highest performance applications. F781 is used for conrod bearings in ACL Race Series range.



Benefits of multi layer bearings

The following diagram highlights the benefits of multi-layer bearings. The bearing in this example is a tri-metal bearing:

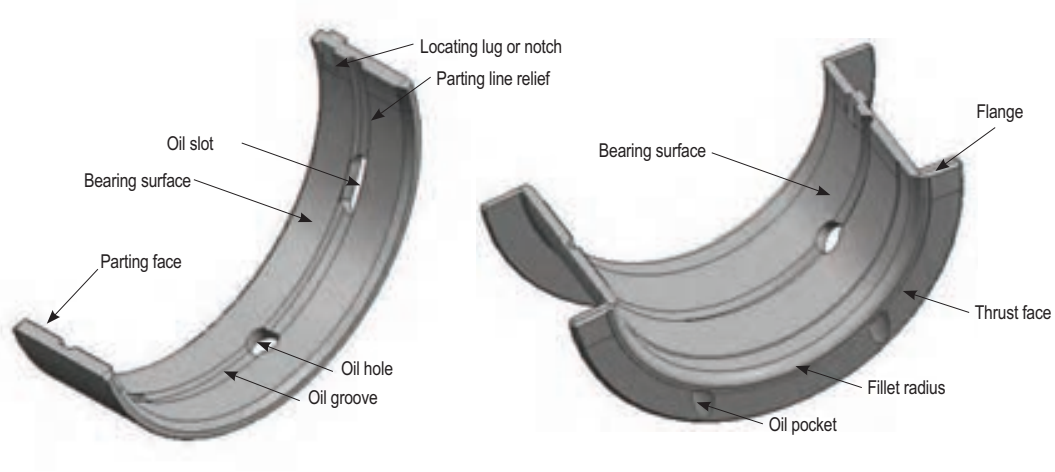
Layer	Alloy (Typical)	Thickness	Contribution
Overlay	Lead-Tin-Copper	0.013mm - 0.018mm	Seizure resistance - Low friction & deformable
Barrier	Nickel	0.001mm	Separation layer
Lining	Copper-Lead-Tin	0.3mm	Fatigue strength - Strong yet deformable
Steel	SAE1010 (High Tensile)	Remaining	High Strength - supports bearing lining

Comparison between Tri-metal and Bi-metal Bearings

Bearing Type Characteristic	Duraglide F780	Aluglide F810
Strength Ability to assume prolonged, high fatigue loads.	Babbitt overlay (<20HV) is supported by a strong copper lead alloy (>50HV) in turn supported by the steel backing. Strength is high as long as the overlay is thin (<.020mm).	Strength is engineered through targeted alloying and modification of the Aluminum structure particularly with the addition of Silicon (from 45 to 55HV). No overlay means that the load is taken directly by the alloy and transmitted through to the steel.
Anti-Seizure Conformability Ability to adapt to assembly and misalignment errors.	Very soft Babbitt overlay readily adapts. Copper lead alloy has moderate conformability and helps to adapt where shape errors are significant.	Alloy composition, casting and heat treatment methods develop exceptional toughness. This enables the alloy to conform without detriment to strength.
Compatibility Ability to accommodate shaft to bearing contact through thin oil films.	Crankshaft journal finish is the dominant factor. Contact with the surface results in adaptation through wear of the Babbitt layer with no damage to the shaft.	Bearing and shaft interact beneficially. Extra fine silicon particles at the bearing surface act as a mild polishing agent that can lessen shaft surface roughness. System adapts to maintain oil film integrity. This is particularly effective when running against cast iron shafts.
Emergency Running Ability to continue operation during temporary oil film breakdown.	The lead in the Babbitt and copper-lead alloy has natural lubricity and can function as a dry lubricant. The low melting point on the alloy also allows it to provide a temporary liquid lubricant.	The tin phase of the alloy provides lubricity and low melting point liquid lubrication but is not as effective as lead.
Anti-Wear Resistance to abrasion by shaft and dirt.	Babbitt alloys are prone to wear (see above), however the alloy composition is carefully controlled to optimise the strengthening effects of copper and minimising the wear potential.	The relatively harder surface of the aluminum alloy has substantially reduced wear. Combined with shaft interaction (see above), which minimises shaft abrasion, wear becomes insignificant.
Embeddability	The soft Babbitt readily absorbs all kinds of dirt particles up to 0.015mm without damage. Larger particles are not accommodated so well by the underlying layers.	As the aluminum alloy is substantially softer than shaft materials, hard particles of all sizes will embed in the bearing rather than score the shaft. The toughness of the alloy ensures the localised deformation does not compromise strength.
Anti-Corrosion	Tin content in the alloys gives the lead partial protection from attack. If the bearing is worn to the copper-lead layer, resistance is minimal.	Aluminum tin base alloys are essentially inert to known contaminants.
Applications	Duraglide bearings provide a high combination of high strength and the ability to withstand harsh and demanding operating conditions. This makes them ideal for performance and race engines and rebuilds.	Aluglide bearings provide a combination of moderate to high strength, good seizure resistance and excellent wear resistance. These bearings are ideally suited to general purpose applications (passenger cars and light commercial vehicles) where reliability and long service intervals are desirable. Aluglide bearings are highly preferred in modern import engines that have been designed for aluminum based bearings as OE standard fitment.

BEARING DESIGN FEATURES

The following will give a better understanding of the terminology and features of a bearing and their intended functions.



Wall Thickness

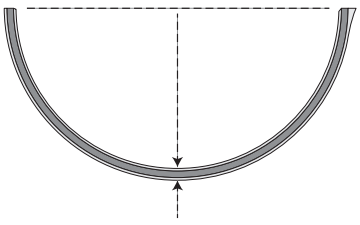
The wall thickness quoted in catalogs and workshop manuals refers to the thickness at the crown of the bearing. This value is also used to calculate the vertical clearance of the bearing assembly.

The correct wall thickness is critical for the correct clearance, which is critical to the performance of the bearing system. It ensures:

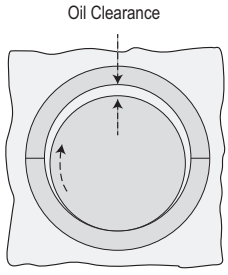
- Good oil supply which ensures high pressure oil film generation for better load support and increased durability.
- Predictable engine oil pressure and flow rates to ensure constant supply throughout the engine and adequate bearing cooling under all operating conditions.

Typical wall size tolerance ranges:

- Regular aftermarket 0.008 – 0.013mm / .0003 - .0005”
- ACL Race Series 0.008mm / 0.0003”



Thickness at crown of bearing



Vertical Oil Clearance

Eccentricity

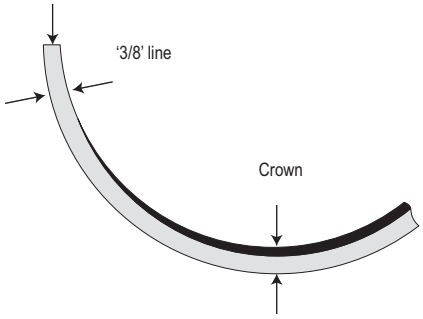
Most bearings are manufactured with an eccentric wall as shown in the following figure. This means the wall thickness gradually becomes thinner from the crown of the bearing to a lesser amount at a specified distance from the parting line, usually 9.5mm and hence is often called the ‘3/8’ line.

This slight eccentricity built into the bearing wall assists in the formation of the hydrodynamic oil film, or the oil film required under the loaded area of the bearing. It also compensates for bore distortions under load by providing a greater horizontal clearance than vertical, allowing the bore to distort without pinching the bearing at the sides. The eccentricity allows for smaller vertical clearances while still permitting adequate oil flow in the clearance space for cooling purposes.

As a result of the eccentric wall it is important that wall size measurements are always taken at the crown of the bearing, readings taken elsewhere will be less depending on the degree of eccentricity. Typical values for eccentricity can be:

- 0.000 – 0.008mm / .000 - .0003” for rigid housings.
- 0.010 – 0.020mm / .0004 - .0008” for most current bearings
- 0.015 – 0.025mm / .0006 - .0010” for high performance (ACL Race Series)

Parting line



Bearing Crush (or Press fit)

Crush is essential for bearing retention and creates a radial pressure which holds the bearing inserts tightly in the housing after assembly.

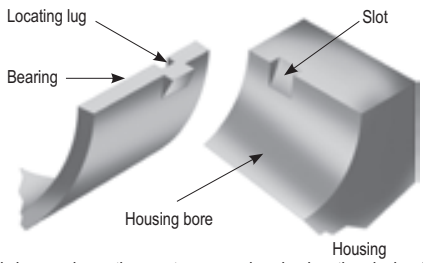
Crush is applied to half bearings by making each half slightly greater in circumferential length than an exact half circle, so in effect the bearing parting line will sit slightly higher than the bearing seat. When two half bearings are paired and assembled into their housings, the tightening of the cap bolts will produce the controlled and uniform radial pressure which has two important functions:

- Provides bearing retention in the housing, preventing turning or creep.
- It ensures intimate contact between the back of the bearing and the bore of the housing, allowing heat dissipation through thermal transfer during operation of the engine.

During manufacture bearings are checked in a special gauging fixture in the factory, these fixtures are specific to the OD of the bearing.

For further explanation of crush and retention of the bearings refer to the following article on notchless bearings.

Locating Devices



This image shows the most common bearing location device. The lug or notch enters a machined notchway in the housing, providing an endwise locating guide. The notch is not intended provide bearing retention and will not prevent rotation of the insert. See the separate article on notchless bearings for a full explanation of this.

Another locating device not commonly used are dowel pins. These will most commonly be located at the center of the housing and require a hole in the crown of the upper half bearing.

Parting Line Relief

A small relief is usually incorporated at the parting line of bearing inserts. The purpose of this is to compensate for any distortion at the parting line resulting from the crush. It also blends the running surface between the two halves and compensates for any mismatch at assembly. A small chamfer is also placed on the inside corner of the parting line, removing ay chance a square corner could act as a scraper during operation.

Bearing Free Spread

Most main and conrod bearings are manufactured with positive free spread. This means the distance across the outside of the parting edges of the bearing is slightly greater than the bore of the housing. This assists holding the bearing half in place in the housing during assembly operations.

Oil Grooves

Main bearings are usually provided with a circumferential groove, for the transfer of oil to the camshaft and conrod bearings. Conrod bearings are usually not grooved, as grooving reduces the effective bearing area and breaks up the surface into smaller areas which act independently. Hence the size and number of grooves is kept to a minimum.

There are three main configurations for grooves:

- Fully grooved (360°), upper and lower both fully grooved – this will supply a continuous flow of oil to the conrod bearing.
- Half grooved (180°), upper fully grooved and lower plain – oil will only flow to the conrod during half of the rotation. Suitable for general application.
- Three quarter grooved (about 270°), upper fully grooved and lower partially grooved, this provides a compromize between the first two types and is suitable for high performance applications. This will maximize the bearing area in the higher loaded areas of the lower bearing but still provide better oil flow than half grooved assemblies. The tapered run-out of the partial groove will also smooth the oil supply cut off, avoiding pressure pulsing and cavitation.

Oil Holes

Many bearings receive their oil supply through holes drilled in the crank-case, so the bearing will have a matching hole so the oil can flow through to the clearance gap between the bearing and shaft. Some bearings will have an oil hole to provide flow to other areas in the engine. If there is an oil groove the oil holes will normally be in line with the groove. It is important to ensure when replacing bearings that the oil holes match correctly.

Thrust Bearings

There are 3 distinct types of thrust bearings design:

1. Single Piece
   - Thrust bearing is formed from the same piece of material as the shell bearing forming a rigid thrust bearing.
2. Three-Piece
   - The thrust bearing is made up of a shell bearing and two thrustwashers which are then attached to the shell bearing. The joints allow the thrust faces to float but still remain attached, so there is no stress on the fillet as in the one piece flange.
3. Separate Components
   - All components are made separately and fitted individually.

One Piece Flange Three Piece Flange Thrustwasher

Bearings With no Locating Notch

There are a number of bearings sets for late model engine applications which contain bearings with no locating notch (lug).

This design is usually specified by the OEM engine manufacturer, and is in line with the current OEM design practice of eliminating this feature on bearings.

Most of the major OEM Manufacturers have specified this design on some of their engines. This 'notchless' design can be used in place of the previous notched bearings, where there has been a change to the new design, later in an engine series.

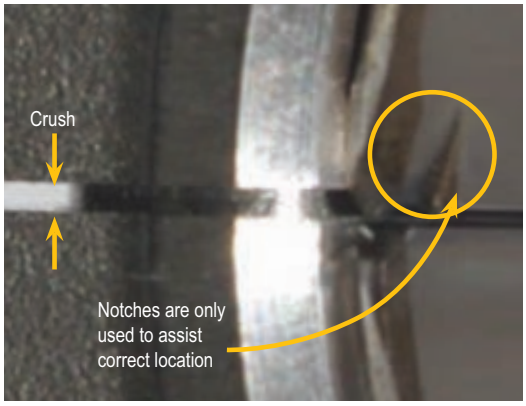
For OEMs that have the luxury of automated engine assembly, the notch has become a redundant feature. However, when assembling an engine featuring notchless bearings by hand, greater attention needs to be paid to bearing alignment and orientation.

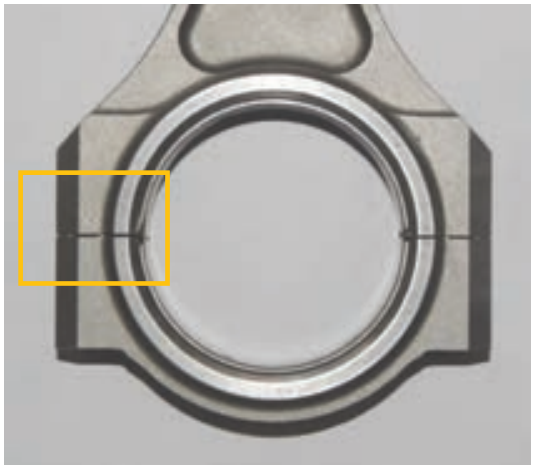
Without the aid of notches, the engine rebuilder needs to ensure that bearings are:

1. located centrally in their housings
2. located with upper and lower shells in the correct orientation
3. bearing pairs are aligned
4. grooves and oil holes are in line with oil feed galleries.

Notched bearing pair

Notchless bearing pair





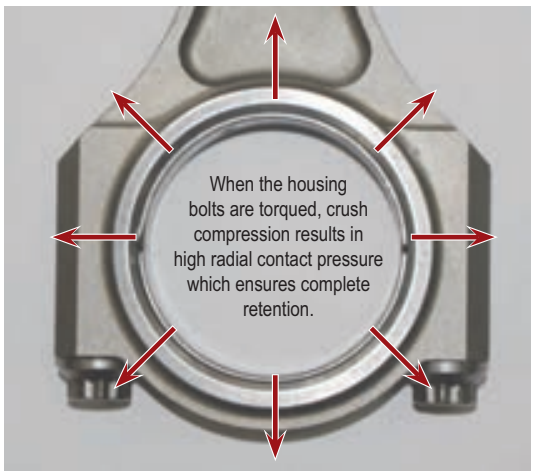
Bearing and Housing Assembly before Bolt Fitment

Bearing Retention

When confronted with notchless bearings some engine builders have expressed a concern that without the notch a bearing pair has greater freedom to move or 'spin' during use.

This is not the case as a notch is a **fitment/location guide** only and does not assist bearing retention.

It is the bearing **crush** which ensures that the bearings are held tightly in the housing. Once the bolts are torqued this sets up radial pressure in the housing binding the bearings in place.



Bearing and Housing Assembly after Bolts are torqued

FITTING INSTRUCTIONS

To ensure a satisfactory bearing life, there are certain simple but necessary rules which must be closely observed. Since extreme accuracy is built into precision insert bearings, they must not be filed, scraped or machined in any way.

They are machined to tolerances as fine as 0.004mm (0.00015") and cannot be improved upon by any hand work, however skilful it may be. Follow this procedure for a satisfactory bearing assembly.

1. Dismantle

Before dismantling the old bearings, mark the bearing housings for reassembly identification – the caps must be reassembled exactly as removed.

2. Inspect

Remove the crankshaft and bearings for careful assessment of the extent of wear or other damage. If either the crankshaft journal or bearing tunnel sizes are found to be outside the dimensions shown in this catalog, re-machining is recommended. If the used bearings exhibit signs of damage due to poor engine conditions, the source of these problems must be identified and rectified to eliminate further problems.

Common faults that can be highlighted by the old bearings include bent or twisted connecting rods, bent crankshafts, misaligned tunnel bores, poor journal surface finish, insufficient or excessive nip, poor tunnel seats, mixed or reversed caps, etc.

3. Clean

Careful cleaning of the engine block and all components must be undertaken to be sure of a successful bearing replacement. By far the best way is to remove all gallery plugs and allow the dis-assembled engine to soak in an agitated chemical bath (iron and aluminum-alloy components require different chemical cleaners). In this way, all sludge and dirt accumulations are removed. If chemical cleaning facilities are unavailable, a less thorough, and therefore less desirable method, is to remove gallery plugs and then remove all visible dirt and wash down with a solvent such as Kerosene. It is imperative to ensure that the entire lubrication system is completely clean and free of obstructions.

4. Check dimensions

a) Always accurately measure all journals, conrod and main tunnels prior to assembly to be sure they are within the required tolerances, particularly if any resizing is to be performed. Remember, the bore of the assembled bearing can only be as accurate as the housing into which it is fitted.

b) Check that replacement bearings are correct in all detail to the bearings removed i.e. oil holes, grooves, and locating notch.

5. Check crush

It is good practise to check for crush at assembly.

The procedure for this operation is:

i. Assemble the pair of bearings in their housing and tighten the bolts to the recommended torque figure.

ii. Release one bolt, and the joint face will open to the extent of the crush. Measure the crush by selecting a feeler gauge that neatly fits this gap. The value of the crush measured should be 0.075 – 0.150mm (.003 - .006").

6. Check oil clearance

With tunnel sizes correct to specification and shaft journals unworn or correctly ground undersize, ACL finished-to-size bearings will provide a correct operating clearance which can be quickly confirmed on assembly with the use of Flexigauge.

Where any doubt exists, or in special cases, oil clearance should be checked by accurately measuring and writing down each journal diameter and then subtracting this from the corresponding internal bearing diameters that were noted when checking the amount of nip or crush. The difference between the two diameters represents the vertical oil clearance and this must fall within the desired clearance range. Where recommended oil clearances are unknown, our normal recommendations are as follows:

0.019 – 0.025mm / .00075 - .001" of clearance per inch of journal diameter.

For example, given a 76.2mm/3"shaft, the clearance recommendation would be:

0.057 – 0.075mm / .00225 - .003"

These are valid for normal passenger light vehicle applications.
For high performance modified applications it is recommended to add at least 0.013mm/.0005" to the clearance figure.

7. Assemble

Assemble the bearing shells with the **SHELL BACKS AND THE HOUSING SEATS PERFECTLY DRY**, but apply a liberal coating of heavy oil between the surface of the bearing and the shaft. Apply a light tension on all the bolts before finally tightening them evenly to the vehicle manufacturer's specified tenson.

8. Check end float (thrust clearance)

The recommended end float clearance differs from engine to engine although the following table provides a good guide. It is advisable to check thrust clearances at both thrust faces to ensure an accurate measurement.

Journal Diameter	Recommended Clearance
50 – 70mm / 2.000 - 2.750"	0.10 – 0.15mm/.004 - .006"
70 – 90mm / 2.750 – 3.500"	0.15 – 0.20mm/.006 - .008"
90mm up / 3.500" up	0.15 – 0.25mm/.006 - .010"

Copper-Lead thrust bearings should be given a slightly higher clearance than bi-metal thrusts and hard working engines should have a bit more than normal duty engines, but always within the recommended figures shown.

Some thrustwasher sets and flanged mains are available in an oversize, this is normally noted in the part listing. Contact your distributor or ACL if this is not clear.

WARNING: DO NOT ATTEMPT TO ROTATE THE CRANKSHAFT UNTIL ALL BOLTS ARE FULLY TENSIONED.

FLEXIGAUGE

Flexigauge is precision manufactured plastic strip, and can be used to check the clearance of connecting rod and main bearings where there is no access to traditional measuring equipment such as micrometers. It is available in four sizes, and is suitable for Automotive, Marine and Industrial applications.

The four sizes available together can cover clearances ranging from .001" to .016", or .025mm to .406mm, sizes are as follows:

Reference:	Clearance range:
AG-1 - (RG-1) (Green Pack)	.001 - .003in or .025 - .076mm
AR-1 - (RR-1) (Red Pack)	.002 - .006in or .050 - .150mm
AB-1 - (RB-1) (Blue Pack)	.004 - .009in or .10 - .23mm
AY-1 - (RY-1) (Yellow Pack)	.008 - .016in or .203 - .406mm

Flexigauge strips – 12" long – are packed in individual envelopes, which are marked in appropriate graduations – one side in thousandths of an inch and the other in millimeters. Ten strips in their envelopes are packed in their appropriate colored carton.

Directions for use, which are printed on the outside of each carton for easy reference, are as follows:

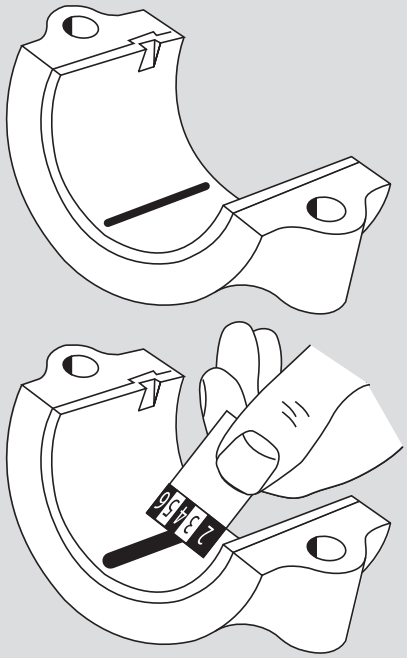
1. Remove the bearing cap, wipe the journal and bearing shell clear of oil.
2. Place a piece of Flexigauge across the bearing at the crown.
3. Install the bearing cap and using a Torque Wrench tighten the bolts to the correct tension.

   DO NOT ROTATE THE SHAFT OR BEARINGS.
4. Remove the bearing cap. The Flexigauge will stay on either the bearing or the shaft.
5. Compare the width of the flattened Flexigauge with the graduation on the envelope. The figure within the graduations indicates the clearance in thousandths of an inch or millimeters, depending on which side of the envelope is used.
6. Taper is indicated when the Flexigauge is wider at one end than the other, the amount of taper is equal to the difference in the two readings. The widest part of the Flexigauge reperesents the area with the least clearance. 'Barrelling' of the shaft is present when the Flexigauge is wider in the center of the bearing.

PRECAUTION

When checking main bearings, with the CAP supporting the crankshaft, the weight of the crankshaft and flywheel must be taken off the bearing caps to avoid inaccurate results. This can be done, for example, by 'jacking' on the crankshaft balance weight.

Main and connecting rod bearing clearances should be checked on the area of least journal wear. Main bearing checks should be made with the adjacent crankpin situated about 30 degrees after bottom dead center.



RACE SERIES

PERFORMANCE ENGINE BEARINGS

If you place demands on your engine you must demand the best!

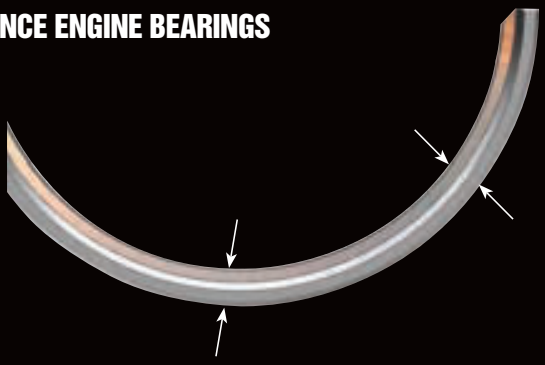
High performance driving demands that you use the best parts. So rely on ACL's Race Series performance engine bearings to perform to exacting race standards you expect. They provide the dependability it takes to hold up under higher RPM conditions. The unique combination of design, metallurgy and engineering come together to deliver what drivers expect from high performance trimetal bearings. These Race Series performance engine bearings go the distance.

So, if you're looking for the best result, demand the best - demand ACL Race Series performance engine bearings.

FEATURES OF ACL RACE SERIES PERFORMANCE ENGINE BEARINGS

Precision Manufacturing

ACL Race Series performance engine bearings are manufactured to exacting tolerances with particular attention paid to wall thickness accuracy. This ensures reliable fit and helps maintain consistent clearances.



Bearing Material Enhancements

A blend of characteristics to provide high strength and excellent seizure resistance.

No flash plating is applied to further improve bearing retention and maximize heat transfer.

ACL Race Series performance engine bearings are identified from the standard range by the following suffixes:

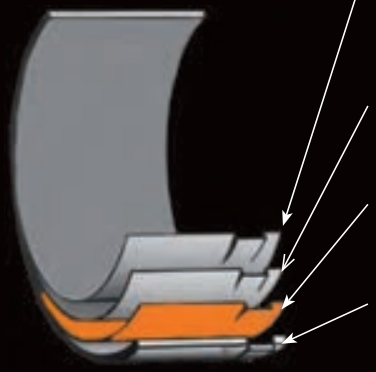
H = ACL Race Series.

HX = ACL Race Series with 0.025mm (0.001") extra clearance.

HD = ACL Race Series with location dowel holes.*

HXD = ACL Race Series with 0.025mm (0.001") extra clearance and location dowel holes.*

**Connecting rod bearing applications only.*



LAYER	ALLOY
Overlay	Lead-Tin-Copper
THICKNESS (Typical) 0.013mm* 0.018mm	
*Connecting Rod Bearings Only - Reduced for increased fatigue resistance	
Seizure resistant - Low friction and deformable	
Barrier	Nickel
THICKNESS (Typical) 0.0001mm	
Separation Layer	
Lining	Copper-Lead-Tin
THICKNESS (Typical) 0.3mm	
Fatigue Strength - Strong yet deformable	
Steel	SAE1010 (High tensile)
THICKNESS (Typical) Rem	
High Strength - supports bearing lining	

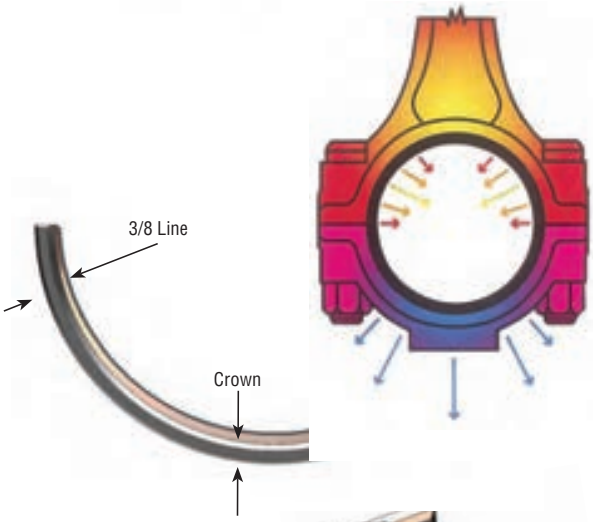
AUSTRALIAN ENGINEERING EXCELLENCE

Bearing Design Enhancements

Crush increased for:

Improved bearing retention from higher radial contact pressure. Locks the bearing into the housing.

More effective heat dissipation through improved thermal transfer.



Bearing Eccentricity

Definition: Gradual reduction in wall thickness between the crown and parting line.

Race Series performance engine bearings feature increased eccentricity to increase improve shape adaptation to compensate for bore distortion at high speed operation.

Assists in the formation of hydrodynamic oil film.

Main Bearings with Extended Grooves

Full (180°) grooved uppers with matching partial groove in lowers.

- Reduces interruption to big end oil supply.

Tapered groove run-out.

- Smooths big end supply cut-off avoiding pressure pulsing and cavitation.

Enlarged ID Chamfers

Accommodate larger fillet radii on performance crankshafts.

ACL Race Series – General Information

Set Numbering

ACL Race Series bearing set numbers carry an 'H' after the set number e.g. 8B663H-Std.

There are also sets available with the 'HX' designation e.g. 8B663HX-Std, the 'X' showing the set has .001" (.025mm) additional oil clearance than an H-Std set. This means the wall size of these HX-STD bearings is .0005" (.013mm) thinner than the H-Std, in all other ways the HX is identical to the H-Std set.

Similarly there are some selected sets (Chev and Ford V8) that are manufactured to 009 and 011undersizes, e.g. 8B663H-009 and 8B663H-011.

There are also selected con rod bearing sets that are manufactured with a dowel hole in the lower shell, to suit a dowel location in the con rod cap. These are designated with a 'D' in the set numbering e.g. 8B663HD-Std or 8B663HXD-Std.

Appearance:

Questions about the appearance of the RACE Series bearings are quite common, as this series of trimetal copper lead bearings have a very different appearance to regular aftermarket "ACL Duraglide" trimetal bearings, which have a light silver /grey appearance.

The RACE Series performance bearings as manufactured, have an appearance that is a dark tarnished coloration, which can vary from dark black/brown/blue colors. This color comes from the electroplating which is the last manufacturing process. The electroplated overlay has copper as one part of its composition, which tarnishes to the dark colors described above. This tarnish coloration has negligible thickness, so once installed in the engine, the crankshaft journal contacting the bearing, will polish the bearing surface, removing the surface color and leaving the bearings with a polished silver appearance.

Performance bearings do not start out with the silver grey appearance of regular aftermarket bearings, as there is no final silvery tin flash applied to these bearings. Not applying a silvery tin flash to these high performance bearings is a specific design feature. A silvery tin flash for appearance and long term corrosion protection, as applied to the regular aftermarket bearings, can under high loading and heat, move, with the plate migrating and causing high spots on the back of the shells, and distorting the bearing. For this reason the ACL RACE Series performance bearings do not have a cosmetic silvery tin flash applied, so there is no risk of any overlay plate movement on the backs of the shells, giving better bearing to housing contact and better bearing performance and function.

ACL Race Series Bearings and Graded OE Bearings

Most OE (original equipment) engines are assembled at the factory with graded bearings (i.e. bearings with slightly different wall thicknesses between each grade). At the OE factory bearing housings and crankshaft journals are also graded, and the combination of housing and journal sizes will determine which bearing grade (or combination of grades) will be used in the assembly. For the aftermarket, most Bearing Manufacturers supply a single grade of bearing in set form.

The theoretical oil clearance range for single grade bearings will be slightly greater than the OE specifications, but the actual oil clearance is dependent on not only the bearing wall thickness, but also on the housing and journal sizes, and material used in the engine e.g. cast iron blocks vs aluminum alloy blocks.

ACL RACE Series bearings are manufactured for high performance engine applications, where the engine output will be higher than the normal OE output. This means that engine components at these higher outputs will be subject to more stress and distortion than would apply to the standard engine, and not all components will be machined to the fine tolerances achieved at the OE factory. This all leads to a requirement to slightly increase oil clearances above the OE specifications. Oil flow through the bearings to cool the component is also important for long life and a slight increase in oil clearance will improve oil flow and the subsequent effect on cooling. The OE engines will be manufactured to very tight tolerance, and all components are measured in "clinical" conditions with highly accurate measuring equipment. Out in service workshops technicians do not have equivalent equipment or conditions to work in, and the grading on housings and crankshaft journals will also probably be different than when they were first produced at the OE factory, due to minor wear etc. So this can all lead to clearances that may be outside the OE specifications, even if the bearings are replaced with those of the same grade as originally fitted. One of the main reasons for the OE engines being built to very tight tolerances is for NVH (Noise, Vibration, Harshness). Most performance engines will be fitted with performance exhaust systems, rev higher etc. meaning OE NVH specifications will be exceeded.

Even the graded OE bearings will have a wall size tolerance, and together with the tolerance on the housing size and journal size means there can be a stack up of tolerances leading to a significant difference on oil clearance

from one position to the next. The ACL Race Series bearing wall sizing for STD bearings is usually close to the middle grade as supplied OE.

The ACL RACE Series bearings also use materials with higher load carrying properties than the OE materials, and there are other design features which make them more suitable for high performance applications. Oil clearance is only one consideration in the function and life of engine bearings.

If the crankshaft is at STD size, in the vast majority of cases, the STD bearings will be suitable and give correct oil clearances. In the unlikely scenario that due to a stack up tolerances from housing, journal and bearings, being such that clearances are too tight, then there will probably be extra clearance bearings available (HX-STD) to increase oil clearance, and if oil clearance is too high then there are H-001" or H-.025mm bearings available to reduce oil clearance.

Some High Performance engine Builders will use a combination of H-STD and HX-STD bearings or H-STD and H-001" or H-.025mm to get specific oil clearances that they may be looking for, to suit specific applications (i.e. oil clearances for a street engine will be different to a drag racing engine). Refer to the following section for further explanation of this.

Select Fitting of ACL Race Series Bearings

It is common practise to adjust oil clearances by mixing bearings of adjacent grades i.e. HX-STD with H-STD or H-STD with H- 001 or H-.025, to obtain desired oil clearance. Using the HX-STD with H- STD will give .0005" (0.013mm) additional clearance than using two H-STD shells, and similarly using H-STD and H-001 will reduce clearance .0005" (0.013mm).

Bearing shells with wall size .0005" (0.013mm) or less can be assembled on one journal. The thicker wall size bearing is fitted to the most heavily loaded position i.e. the upper half con rod shell and the lower half or cap position main bearing.

When using a crankshaft that is to be reground to an undersize, first measure the assembled bearing ID's, then have the required journal sizes ground to match the bearing measurements, with the desired oil clearance.

Installation of ACL Race Series bearings – Oil Clearances

Oil clearances are most accurately measured using micrometers and bore gauges. Bearing wall thickness measurements are taken at 90 degrees to the parting line (i.e. at the crown of the bearing) using a micrometer with a ball anvil, for use on the curved ID of the bearing.

Vertical oil clearance is best measured by assembling the bearing in its housing, with bolts torqued to specification, then using a bore gauge measure the assembled ID of the bearings at 90 degrees to the parting faces. The mating crankshaft journal size is measured, and subtracting this measurement from the bearing ID bore size, gives the assembled oil clearance.

ACL RACE bearings can be assembled with .00075-.001" per 1" of journal diameter (0.020-0.025mm per 25mm of journal diameter) plus .0005" (0.013mm).

As an example for a 2.000" (50mm) journal diameter, 2.000 x .001= .002 + .0005 = .0025" (50/25 x 0.025= 0.050 + .013 = 0.063 mm)

Bearings should not be polished with abrasive pads or paper, on the bearing surface, to change the oil clearance.

REALITY CHECK.

Look closely and you'll see the ACL logo stamped into the backs of all our performance bearings. Thus, designating them as our authentic Race Series brand.

Essentially, that symbol identifies them as providing optimum performance, endurance and durability required for high RPM engines. Race Series bearings are available for numerous American, Asian and European engines, and in a variety of sizes.

Our web site provides detailed information.

ACL RACE

PERFORMANCE ENGINE BEARINGS

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