



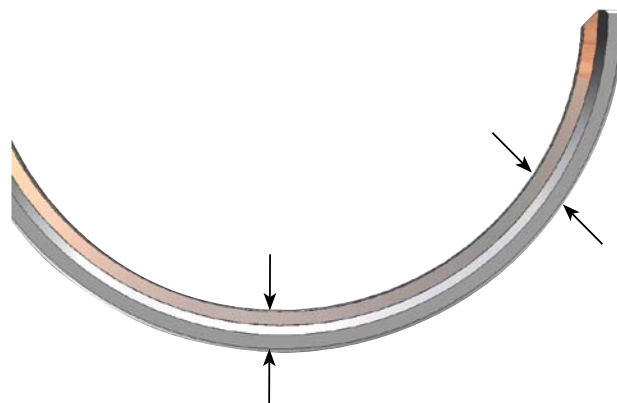
ACL GRADED RACE SERIES BEARINGS

What are Graded Race Series Bearings?

Graded Race Series Bearings have been introduced by ACL Bearing Co to provide performance engine builders with a very high precision component that is designed to enhance the build quality of performance engines. Additionally, graded bearings can extend the life of expensive crankshafts by increasing the interval between regrinding to the next undersize.

ACL Race Series bearings are precision manufactured to a wall thickness tolerance of $\pm 0.0040\text{mm}$ giving engine builders close control of vertical oil clearance. ACL Graded Race Series Bearings take this precision to a new level of accuracy with tolerances of ± 0.0015 or $\pm 0.0020\text{mm}$.

This accuracy allows for several incremental sizes (i.e. grades) to be offered allowing better fit control than 'one-size-fits-all' bearings (see table 1). Selecting from these grades allows the engine builder to match bearing size to housing and journal size in order to optimise clearance.



What is the Purpose of Graded Race Series Bearings?

Essentially Graded Race Series Bearings allow the performance engine builder a greater degree of control over bearing clearance. This in turn gives the builder greater control over key engine running conditions such as:

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

For engines working at the limits of capability the extra build quality provided by tight clearance control can make all the difference.

Table 1. Example: Main Bearing Clearance Range for a Premium High Performance Engine (Nissan VR38)

Housing Diameter Tolerance (OE Spec)	Journal Diameter Tolerance (OE Spec)	Race Series Bearing Thickness Tolerance	Potential clearance range due to tolerance stack-up	Graded Race Series Bearing Thickness Tolerance	Reduced clearance range due to selection of best fit grade
$\pm 0.012\text{mm}$	$\pm 0.012\text{mm}$	$\pm 0.008\text{mm (x2)}$	$\pm 0.040\text{mm}$	5 grades at $\pm 0.002\text{mm}$	$\pm 0.010\text{mm}$

Selection of Optimum Grades

Tables are available that split both the housing and journal specifications into 0.001mm increments (see Table 2 over page). Optimum grade selection is found at the intersection of the actual measured housing and journal sizes. Graded Race Series Bearings are sold as pairs in recognition of the fact that different grades may be needed at each journal location to maintain optimum clearance throughout the engine.



Table 2. Example: Selection Table for Nissan VR38 Graded Race Series Main Bearings

Mark	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W	X	Y	4	7
Main Bearing Housing diameter (mm)	69.993-69.994	69.994-69.995	69.995-69.996	69.996-69.997	69.997-69.998	69.998-69.999	69.999-70.000	70.000-70.001	70.001-70.002	70.002-70.003	70.003-70.004	70.004-70.005	70.005-70.006	70.006-70.007	70.007-70.008	70.008-70.009	70.009-70.010	70.010-70.011	70.011-70.012	70.012-70.013	70.013-70.014	70.014-70.015	70.015-70.016	70.016-70.017
Crankshaft main journal diameter (mm)	69.993-69.994	69.994-69.995	69.995-69.996	69.996-69.997	69.997-69.998	69.998-69.999	69.999-70.000	70.000-70.001	70.001-70.002	70.002-70.003	70.003-70.004	70.004-70.005	70.005-70.006	70.006-70.007	70.007-70.008	70.008-70.009	70.009-70.010	70.010-70.011	70.011-70.012	70.012-70.013	70.013-70.014	70.014-70.015	70.015-70.016	70.016-70.017
A	64.974-64.975	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
B	64.973-64.974	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2
C	64.972-64.973	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
D	64.971-64.972	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
E	64.970-64.971	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
F	64.969-64.970	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
G	64.968-64.969	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3
H	64.967-64.968	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3
J	64.966-64.967	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3
K	64.965-64.966	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3
L	64.964-64.965	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
M	64.963-64.964	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3
N	64.962-64.963	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
P	64.961-64.962	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3
R	64.960-64.961	1	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3
S	64.959-64.960	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3
T	64.958-64.959	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4
U	64.957-64.958	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	4
V	64.956-64.957	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4
W	64.955-64.956	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4
X	64.954-64.955	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4
Y	64.953-64.954	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4
4	64.952-64.953	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4
7	64.951-64.952	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4

For a journal of $\phi 64.967\text{mm}$ and housing of $\phi 70.012\text{mm}$ select a grade 2 bearing pair.

For clear identification ACL Graded Race Series Bearings are marked with a colour ink consistent with the grade band shown in the selection table above.

The Benefits of ACL Graded Race Series Bearings

In summary, ACL Graded Race Series Bearings provide the performance engine builder with:

- Tighter control of bearing clearance potentially leading to:
 - Improved transmission of bearing loads, and
 - Increased bearing durability.
- Improved control of oil pressure and flows.
- Additionally, ACL Graded Race Series Bearings can allow for an increase in the working life of expensive crankshafts as journals that are worn but not damaged can be repolished (with clearance controlled by the bearings replacement with thicker grade). This process can be potentially repeated many more times than the traditional approach of grinding back to the next undersize.



ACL Race Series Bearings are well proven for their toughness and dependability in the most demanding performance applications. ACL Graded Race Series Bearings come with that proven track record while additionally providing the engine builder with improved build quality.

Author
Mike Scott
Technical Manager
ACL Bearing Company

ACL Graded Race Bearings: because performance is based on precision.

ACL Bearing Company

A Division of Automotive Components Limited
253-293 George Town Road, Rocherlea,
Tasmania 7248 Australia

Tel: +61 (0)3 6324 4600

Tel: +61 (0)3 6326 6666

www.acl.com.au
www.aclperformance.com.au

