

# Service-Information



Group 11 Engine	October 1980	Bulletin No. 11 018 80(2029)
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- For U.S.A. and Canada Only -

Subject: Measurements for Plain Bearings in  
Engine Block and on Crankshaft

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Apart from other factors, the life of an internal combustion engine using plain bearings depends to a great extent on the specified main and big end bearing play tolerances being maintained. These are optimized at the production stage.

If bearing clearances were to be too small, bearing seizure would occur quite rapidly and the engine would break down. If the clearances on the other hand were too large - particularly at the main bearings - there would be an immediate risk of damage to the big end bearings on account of oil starvation.

In view of these facts - and circumstances indicate that we must remind you of this - much more care and accuracy is called for when repairs involving these bearings are undertaken on behalf of customers.

A series of checks have shown that the factory too must urgently modify its procedure when supplying the parts for "crankshaft/bearing shells". In repeated cases, unacceptable shifts in tolerances have been detected after bearing shells were installed in the block or the bearing caps, although original parts sets consisting of crankshafts with bearings matched in color were used. The cause: overlapping tolerances which cannot be influenced, since they are caused by extremely small individual variations in the dimensions of engine block, bearing caps and bearing shells.

#### Measures now to be introduced:

1. The factory has deleted the paired sets of parts (crankshaft/main bearing shells) and is gradually replacing them by individual parts. Until the new Parts Microfilm is issued, all parts references (order number, designation, color matching) should be taken from the accompanying list.
2. If it is necessary to renew the crankshaft with main bearing shells, the correct pairing of items must be undertaken by your qualified workshop personnel. Measurements must be taken conscientiously and a measurement report - see appendix - drawn up, using the following procedure:

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Crankshaft Main Bearing Journals

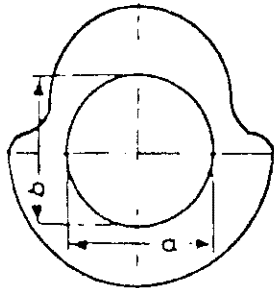


Fig. 1

Using an external micrometer, range 50 ... 75 mm, measure the main bearing journals in planes a and b (Fig. 1).

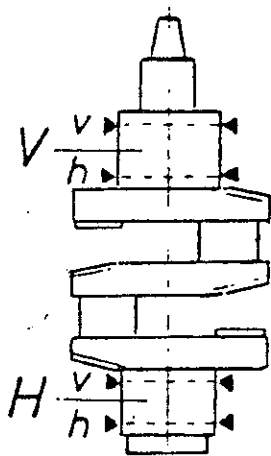


Fig. 2

As shown in Fig. 2, take measurements both at the front area of the journals - coded Vv or Hv in the table - and at the rear area of the journals Vh and Hh.

At least 3 measurements at the same point are necessary in both the a and b planes in order to obtain a reliable mean value.

Accordingly, a total of 24 individual readings must be taken with the micrometer and entered on the measurement report, as shown in the following example.

After this, the mean values can be calculated.

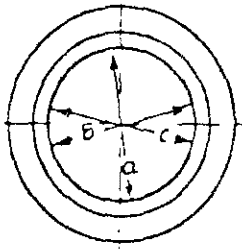
Example:

Measuring Planes	a	b	Total Div. Addition	by 6 =	Mean Diameter of Main Bearing Journal
59. ...	V <sub>v</sub>	.974 .975 .976	.976 .974 .975	5850 ÷ 6 = 975	≈ 59.975 mm
	V <sub>h</sub>	.975 .977 .978	.976 .976 .976	5858 ÷ 6 = 976.3	≈ 59.970 mm
	H <sub>v</sub>	.990 .990 .990	.990 .988 .989	5937 ÷ 6 = 989.5	≈ 59.989 mm
	H <sub>h</sub>	.989 .989 .989	.989 .989 .989	5934 ÷ 6 = 989	≈ 59.989 mm

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Important: Even if the external micrometer, as is customary, is calibrated only down to hundredths of a millimeter, determine readings as accurately as possible between the calibration markings and record them to three places of decimals, as in the preceding example. It is desirable to use an external micrometer with a working accuracy of 2/1000 mm (.002) if possible.

Main Bearings in Engine Block/Bearing Caps



Keep to the measuring planes shown as a, b and c here (mark with a felt-tip pen) and measure the diameter of both main bearings (installed and with bearing caps attached) with a precision internal micrometer (calibrations to 1/1000 mm). Proceed in general as when measuring the crankshaft main bearing journals.

Example: Align micrometer dial to 0.000 for internal diameter 60.000 mm if dial-type instrument is used in place of internal arm-type micrometer.

Measuring Planes	a	b	c	Total Addition	Div. By 9	Mean Dia. of Main Bearing Shell
V <sub>h</sub> 60.0..	+41 +42 +41	+25 +25 +25	+30 +29 +36	294	32.66	60.033mm
	+64 +65 +63	+51 +52 +51	+53 +53 +55	507	56.33	60.056mm
H <sub>h</sub>	+40 +40 +40	+25 +25 +25	+29 +28 +31	283	31.44	60.031mm
	+54 +52 +51	+49 +50 +50	+51 +52 +50	459	51.00	60.051mm

Calculating main bearing clearance - desired value=0.020 ... 0.065mm

Measured Readings	Diameter of Bearing Shells		Diameter of Crankshaft Bearing Journals	Bearing Clearance
V <sub>h</sub>	60.033	minus	59.975	= 0.058mm
	60.056	minus	59.976	= 0.080mm
H <sub>h</sub>	60.031	minus	59.990	= 0.041mm
	60.051	minus	59.989	= 0.062mm

This example shows that value V<sub>h</sub>(=0.080mm) is beyond the maximum permitted clearance of 0.065mm. Whereas bearing play at the two rear crankshaft main bearings is within the tolerance band, the bearing shell for the front main bearing ...

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Please Note: In the standard size range there are three color codings:

- Red = 1st tolerance band (wide)
- Blue = 2nd tolerance band
- Green = 3rd tolerance band (narrow)

In the example we have quoted, the following overall situation is obtained after installing a 'green' front main bearing shell:

Measuring Planes	a	b	c	Total Addition	Div. By 9	Mean Dia. of Main Bearing Shell
$V_h^v$	+10 +15 +15 +28 +25 +25	+08 +12 +10 +24 +22 +24	+10 +09 +12 +45 +45 +45	101	9	$101 \div 9 = 11.22 \approx 60.011\text{mm}$ $283 \div 9 = 31.44 \approx 60.031\text{mm}$
60.0 $H_h^v$	Values unchanged and satisfactory					

Main bearing play (front main bearing) can now be recalculated:

Measured Readings	Diameter of Bearing Shells	Diameter of Crankshaft Main Bearing Journals	Bearing Clearance	
$V_h^v$	60.011 60.031	minus minus	59.975 59.976	= 0.036mm = 0.055mm
$H_h^v$	Values unchanged and satisfactory			

The front main bearing play now obtained is within the specified tolerance band of 0.020 ... 0.065mm like the other main bearings.

This complete measuring and calculating procedure illustrates just how accurately the optimum matching of engine block, crankshaft and bearing shell dimensions can be achieved.

On completion of this work and not before, the bearing bushing can be drilled for the pin locating it to the bearing cap, by following the instructions in the workshop manual. In addition, the two holes for rocker arm lubrication must be made.

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1. For crankshaft main bearing measurement and preparation of the measurement report, 14 flat-rate units can be billed as "Associated Work", quoting job number 11 00 501. These details will be shown in the next issue of Flat Rate Manuals.
2. The job numbers listed in the table below already include main bearing measurement in some cases, but not the full range of measurements and preparation of the report sheet as now required. 12 flat-rate units may be added to these items until the amended FR figures are issued in the supplement.

Job Number	Job Description
11 00 103	Engine - stripping and assembling
603	Engine - stripping and assembling (engine removed)
11 11 001	Engine Block (crankcase) - renewing
11 12 001	Crankshaft - renewing
511	Crankshaft - renewing (engine removed)

Measuring Tools:

1. As you will already appreciate, the use of precision measuring tools and instruments requires careful attention to the correct procedure:
  - Measurements of the kind described above must only be taken at a room or ambient temperature of 20°C, and the item being measured and the measuring instrument should also have reached this temperature, or else the readings will be erratic and incorrect.
  - If engine block or bearing caps have to be heated as part of the repair procedure, they must be allowed to cool to room temperature before measurements are taken.
  - Hold the external and internal micrometers and similar instruments by the plastic handgrips to prevent body temperature from causing the metal parts to expand.
2. We are currently examining precision measuring tools and instruments as offered for sale by the trade, so that we can recommend high-quality items at a reasonable price to our dealer organization. When a set of suitable instruments can be supplied, we will inform you in a Service Information.

Additional Remarks:

1. Before and during the above work, please study and follow closely the instructions in our workshop manuals under

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2. Note in particular the instructions for heating the various items, which must be carefully complied with; use only the special tools stated in the workshop manual.
3. To prevent surface damage (in the bearing shells), apply the probes of the internal micrometer or dial gauge carefully to the chosen measuring points. Do not tilt them or scrape them over the surface. Oil the bearing shells very lightly before measuring.
4. If main or big end bearing wear is unacceptably large (with score marks, discoloration at load-bearing surfaces etc.), always renew the crankshaft. Experience has shown that the standard of quality essential for long engine life is not achieved by crankshaft regrinding firms in most cases, and they are not equipped to carry out the essential "Tenifer" treatment (surface hardening by a special nitriding process) which is needed after regrinding.

Please take the necessary steps to introduce the above procedures.

Measurement Report Sheets:

Our department, RM-K-2, can supply additional copies on request.

Yours truly,

BMW MOTORRAD GMBH  
After-Sales Service  
Munich

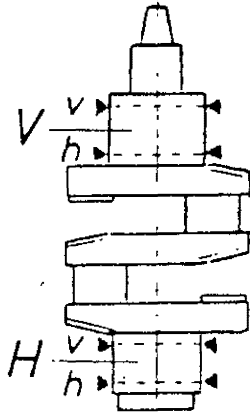
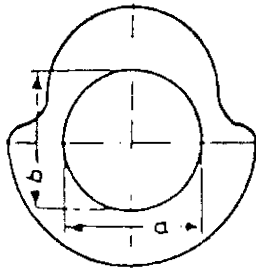
Encl. 1 list of parts  
5 copies of measurement report sheet

**MEASUREMENT REPORT SHEET FOR MAIN BEARING CLEARANCES**  
(see also Service Bulletin No. 11 018 80(2029) - Engine)

Model \_\_\_\_\_ Frame No. \_\_\_\_\_ Speedometer Reading \_\_\_\_\_

Order No. \_\_\_\_\_ Accompanying Warr.Claim No. \_\_\_\_\_

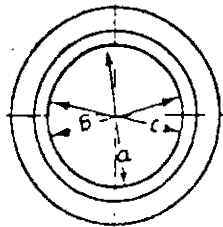
Measuring main bearing journals:



Using an external micrometer, measure front main bearing journal V and rear main bearing journal H in directions a and b (3 times at the same point) and at points Vv, Vh, Hv and Hh = 24 readings. Enter readings in table below. Calculate mean values as shown on right of table.

Measuring planes	a	b	Cross-Addition	Divide by 6	Mean Value for Main Bearing Journal	
59. ...	V <sub>h</sub> <sup>v</sup>		÷6=	≈59. ...mm	}	
			÷6=	≈59. ...mm		
	H <sub>h</sub> <sup>v</sup>		÷6=	≈59. ...mm	}	
			÷6=	≈59. ...mm		

Measuring main bearing shells:



Measure main bearing shells in directions a, b and c. Make marks with a felt-tipped pen exactly as shown here on the engine block or bearing cap. Proceed otherwise as described above. Enter the 36 individual readings in the table below, and calculate the mean values as indicated on the right of the table.

Measuring planes	a	b	c	Cross-Addition	Divide by 9	Mean Value for Main Bearing Shell	
60.0..	V <sub>h</sub> <sup>v</sup>			÷9=	≈60.0..mm	}	
				÷9=	≈60.0..mm		
	H <sub>h</sub> <sup>v</sup>			÷9=	≈60.0..mm	}	
				÷9=	≈60.0..mm		

Calculating main bearing clearances

Desired value = 0.020 ...  
0.065mm

Measured values	Bearing Shell Diameter	Crankshaft Journal Diameter	Bearing Play
V <sub>h</sub> <sup>v</sup>		minus	mm
		minus	mm
		minus	mm

## Crankshaft with bearing shells

a 11 21 1 336 770  
a 11 21 1 336 771

a 11 21 1 259 856  
a 11 21 1 259 857

b 11 21 1 262 450  
b 11 21 1 262 451

c 11 21 1 262 443  
c 11 21 1 262 444  
c 11 21 1 336 421  
c 11 21 1 336 422  
c 11 21 1 336 423  
c 11 21 1 336 424

11 21 1 335 642  
11 21 1 335 643

new part number

new part number

new part number

new part number

new part number

## Crankshaft without bearing shells

11 21 1 336 774

11 21 1 257 909

11 21 1 262 069

11 21 1 336 404

11 21 1 335 625

Enclosure

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- a) → frame numbers: R 60/6 2921610, R 60/6 USA 4920662, R 75/6 4020452,  
R 75/6 USA 4940406, R 90/6 4050186, R 90/6 USA 4960790,  
R 90/S 4080437, R 90/S USA 4980304 (flywheel bolts M 10 x 1 mm)
- b) → frame numbers: as above (flywheel bolts M 11 x 1.5 mm)
- c) → frame numbers: Model 79 R 60/6 2921611, R 60/6 USA 4920663 (flywheel bolts M 11 x 1.5 mm)

For part numbers of bearing shells with the corresponding color codings, please refer to parts microfilm.