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XPAG & XPEG rebuild tolerances and machining limits

BY THE AUTHOR

Jon Cosson

Jon Cosson is a lifelong classic-car enthusiast based in North Yorkshire, near Thornton-le-Dale on the southern edge of the North York Moors. After a career in cyber security and IT, he has returned to a passion that runs in the family, his father was in the motor trade, and now spends his time driving, maintaining and writing about the classic cars he owns, among them a Jaguar E-Type, a Jaguar Mk2, an MG TF, an AC Aceca and a Triumph Stag. This archive grows out of his own ownership and running of an MG TF.

About the archive →

Rebuild figures are a different animal from service settings. Before a block goes to the machine shop somebody has to decide which oversize, which regrind package and which shells, and get it right the first time. The tables below are the bore sizes, crank undersizes, oil clearances and wear limits for the XPAG and XPEG, taken from one consistent published source and attributed as such, with the sizes the factory itself declined to recommend marked as exactly that.

Where these figures come from

Two sources sit behind this page. The factory Workshop Manual's General Data, read at source, is the authority where it speaks. W.K.F. Wood's *The XPAG Engine: Data, Service, Supertuning*, first printed in 1968 and reprinted with club permission, tabulates a great deal the factory book never published, including the full ladder of oversizes and regrind packages, and remains the most complete public source. Where Wood records that a size was not recommended by the MG Car Company, that note is carried through here rather than quietly dropped. Where the manual and Wood disagree, which they do in five places, both are given and the disagreement is set out rather than averaged away.

Rebuild data is not the place for a confident guess. If a figure you need is missing below, it is missing because it could not be verified from this source, take it from the Workshop Manual for your engine, or ask the technical registrar of the MG Car Club T Register. The companion settings and torque figures page covers running adjustments, tappets, ignition, torque, capacities, and deliberately leaves the machining data to this page.

None of this applies to the TA's MPJG engine, which is a different unit. Identify what you actually have first: the chassis and engine number guide covers the prefixes, and the round-block change during TD2 production matters when ordering.

The XPEG crankshaft cannot be reground

The Series "TF" General Data carries a sentence the earlier revision of this page did not have. Against the crankpin minimum diameter, and again against the main journal first regrind diameter, the manual prints: no regrind permissible on XPEG.

It appears twice, in a table that is otherwise terse to a fault, which is not how a printer's slip behaves. Taken at face value it means the 1,466 cc engine's crankshaft is a replace-or-reuse item and not a machining item, and that every regrind package tabulated below is an XPAG figure with no XPEG equivalent.

This archive has not found a second source that explains why, and does not propose one. What it will not do is carry regrind tables for the XPEG as though the factory had never printed that line. If you are rebuilding a TF 1500 and your machinist proposes a regrind, that sentence is worth putting in front of him before the shaft is touched.

Standard dimensions

DIMENSION	XPAG (TB–TF 1250)	XPEG (TF 1500)
Bore (standard)	66.5 mm (2.6181 in)	72.00 mm (2.835 in)
Stroke	90 mm (3.5433 in)	90 mm (3.5433 in)
Swept volume	1,250 cc	1,466 cc
Bore/stroke ratio	1: 1.353	1: 1.25
Compression ratio	7.25:1 (TD factory 8:1)	8.33:1 (factory 8:1)
Cranking compression, throttle open	90–100 psi	145 psi
Head depth (new)	76.75 mm (3.022 in)	3.022 in
Combustion chamber, per cylinder	45.5 cc	44.75 cc
Gasket thickness,		

compressed	0.045 in	0.045 in
Firing order	1-3-4-2	1-3-4-2
Number of main bearings	Three	Three
Main and big-end bearing type	Shimless, steel-backed, white-metal-lined	As XPAG, rod reinforced
Camshaft bearings	Three: white metal front, zinc alloy centre and rear	As XPAG
Camshaft drive	Duplex chain, ⅜ in pitch, 60 pitches, endless	As XPAG
Valve timing marks	White chain links, "T" marks on the wheels	As XPAG
Tappet type	Hollow	Hollow
Valve guides	Removable	Removable

Piston oversizes and what they do to capacity

Boring is quoted on the diameter, and the piston carries its own running clearance, so the block is bored to the exact oversize, not to the oversize minus a clearance. The capacity and compression figures below are Wood's tabulated values.

XPAG bore size	Capacity	Compression ratio	Note
Standard	1,250 cc	7.25: 1	Factory piston size
+0.010 in	1,260 cc	7.30: 1	Factory piston size

+0.020 in	1,270 cc	7.35: 1	Factory piston size
+0.030 in	1,280 cc	7.40: 1	Factory piston size
+0.040 in	1,290 cc	7.45: 1	Factory piston size
+0.050 in	1,299 cc	7.50: 1	Factory piston size
+0.060 in	1,309 cc	7.54: 1	Factory piston size
+0.080 in	1,328 cc	7.64: 1	Not recommended by MG; independent pistons only
+0.100 in	1,348 cc	7.74: 1	Not recommended by MG; independent pistons only
+0.120 in	1,368 cc	7.84: 1	Not recommended by MG; independent pistons only

XPEG BORE SIZE	CAPACITY	COMPRESSION RATIO
Standard	1,466 cc	8.33: 1
+0.010 in	1,476 cc	8.38: 1
+0.020 in	1,486 cc	8.43: 1
+0.030 in	1,496 cc	8.48: 1
+0.040 in	1,506 cc	8.53: 1

The factory General Data does not publish this ladder. It names two oversizes only, a first at +0.020 in giving an actual bore of 2.6381 in (67 mm) and a second at +0.040 in giving 2.6581 in (67.5 mm), and on the Series “TF” page the second is marked maximum. Wood’s intermediate and larger sizes are real and

were supplied, but they are not in the factory's own list, so treat anything beyond +0.040 in as a decision taken with your machinist on measured wall thickness rather than as a size the works ever sanctioned.

The XPEG table stops at +0.040in because that is where the published sizes stop: the 1,466 cc engine is already a bored-out 1,250 block, so there is materially less metal left in the walls. Wall thickness is measured, not assumed, a good shop will check before committing to a size.

Crankshaft main journal sizes and regrind packages

PACKAGE	UNDERSIZE	JOURNAL DIAMETER	NOTE
Standard	-	52.00 mm / 2.0472 in	Factory regrind package
-	0.002 in	51.95 mm / 2.0452 in	Independent suppliers, not a factory package
R.1	0.012 in (0.30 mm)	51.70 mm / 2.0354 in	Wood's package. Not in the factory ladder.
R.2	0.020 in (0.50 mm)	51.50 mm / 2.0276 in	Wood's package. Matches the manual's first regrind, 2.027 in.
R.3	0.030 in (0.75 mm)	51.25 mm / 2.0187 in	Wood's package. Not in the factory ladder.
R.4	0.040 in (1.00 mm)	51.00 mm / 2.0079 in	Wood's package. Matches the manual's second regrind, 2.007 in, which the manual calls the minimum.
R.5	0.050 in (1.25 mm)	50.75 mm / 1.9980 in	Below the minimum the factory manual states for main journals.

(R.6)	0.060 in (1.50 mm)	50.50 mm / 1.9882 in	Not recommended by the factory; independent shells

The bearing shells are supplied to match the regrind package, so the shaft and the shells must be ordered as a decision, not separately. Note also Wood's observation that the recommended oil clearance is tight enough that rebuilders often take a further 0.0008–0.0014in off the diameter to achieve it in practice; that is a judgement for you and your grinder, not a figure to apply blind.

The two sources do not describe the same ladder. The manual recognises exactly two main-journal regrinds, a first at 2.027 in (51.49 mm) and a second at 2.007 in (50.98 mm) which it calls the minimum, and those are Wood's R.2 and R.4. Wood's R.1, R.3 and R.5 have no counterpart in the factory book, and R.5 at 0.050 in undersize takes the journal below the diameter the manual names as its floor. That does not make R.5 unusable, shells were made for it, but it does mean nobody should reach it believing the works approved it.

Crankpin sizes and regrind packages

PACKAGE	UNDERSIZE	CRANKPIN DIAMETER	NOTE
Standard	-	45.00 mm / 1.7717 in	Factory regrind package
-	0.002 in	44.95 mm / 1.7697 in	Independent suppliers, not a factory package
R.1	0.012 in (0.30 mm)	44.70 mm / 1.7598 in	Factory regrind package
R.2	0.020 in (0.50 mm)	44.50 mm / 1.7515 in	Factory regrind package

R.3	0.030 in (0.75 mm)	44.25 mm / 1.7432 in	Factory regrind package
R.4	0.040 in (1.00 mm)	44.00 mm / 1.7323 in	Factory regrind package
R.5	0.050 in (1.25 mm)	43.75 mm / 1.7225 in	0.050 in undersize, which is exactly the minimum diameter the factory manual gives for crankpins, 1.722 in.
(R.6)	0.060 in (1.50 mm)	43.50 mm / 1.7126 in	Beyond the factory range

The crankpins and the main journals do not stop in the same place. The manual gives a crankpin minimum for regrind of 1.722 in (43.75 mm), which is 0.050 in under standard and reaches Wood's R.5, while the main journals bottom out a step earlier at 0.040 in. A shaft can therefore be legitimately at R.5 on the pins and no further than R.4 on the mains, which is not obvious from a table that runs the two ladders in parallel.

Assembly clearances

CLEARANCE	FIGURE
Main bearing oil clearance	0.0008–0.002 in (Wood); 0.0008–0.003 in (Workshop Manual)
Crankshaft end float (thrust integral with centre main)	0.0014–0.0037 in
Big-end (crankpin) oil clearance	0.0005–0.001 in (Wood); 0.0005–0.002 in (Workshop Manual)
Connecting rod end float on the crankpin	0.004–0.006 in

Piston clearance at the thrust face	0.0021–0.0029 in
Piston ring groove side clearance	0.001–0.002 in
Piston ring gap in the bore	0.006–0.010 in
Compression ring thickness, new / minimum	0.109 in / 0.101 in
Oil control ring thickness, new / minimum	0.105 in / 0.097 in
Gudgeon pin diameter and fit	18 mm (0.7087 in), two-thumb push at room temperature
Camshaft journal oil clearance, front	0.0016–0.0040 in
Camshaft journal oil clearance, centre and rear	0.0018–0.0037 in
Camshaft end float	0.005–0.013 in
Tappet working clearance in its block bore	0.0015 in
Gudgeon pin diameter tolerance	+0.0004 to +0.0006 in on 0.7087 in (+0.010 to +0.015 mm on 18 mm)
Valve stem diameter, inlet and exhaust	0.315 in (8 mm)
Valve seat angle	30°
Valve lift, inlet and exhaust	0.315 in (8 mm)

These are XPAG figures, and the XPEG shares them: the bottom end, camshaft and gudgeon-pin dimensions are common between the two engines, with the XPEG rod reinforced for the larger capacity. Where a figure below is quoted as

a range, the middle of the range is the target and the extremes are the limits, not the aim.

Two of those clearances are disputed and the table says so. On the mains, Wood's upper limit is 0.002 in where the manual allows 0.003 in; on the big-ends, Wood allows 0.001 in where the manual allows 0.002 in. In both cases Wood is the tighter of the two, so a shaft Wood would send back to the grinder is one the factory book would pass. Everything else in this table the two sources agree on to the last decimal, which is worth knowing when you are deciding how much weight to put on a 1968 reprint.

Valve dimensions

The TF breathes through noticeably larger valves than the TD, and the springs are stiffer to match. These are factory General Data figures and they are not in Wood.

DIMENSION	TD (XPAG)	TF (XPAG AND XPEG)
Inlet valve head diameter	1.299 in (33 mm)	1.417 in (36 mm)
Inlet valve throat diameter	1.181 in (30 mm)	1.274 in (32.6 mm)
Exhaust valve head diameter	1.221 in (31 mm)	1.338 in (34 mm)
Exhaust valve throat diameter	1.024 in (26 mm)	1.126 in (28.6 mm)
Valve stem diameter	0.315 in (8 mm)	0.315 in (8 mm)

Valve spring pressure, valve shut	Inner 31 lb at 1.753 in, outer 62 lb at 1.847 in, 93 lb total	Inner 41.1 lb at 1.753 in, outer 73.25 lb at 1.847 in, 114.35 lb total
Valve spring pressure, valve open	Inner 43 lb at 1.438 in, outer 80 lb at 1.532 in, 123 lb total	Inner 55 lb at 1.438 in, outer 95 lb at 1.532 in, 150 lb total

Machining and wear limits

ITEM	LIMIT OR PRACTICE
Cylinder head gasket surface	Flat within 0.001 in surface
Cylinder out-of-round, taper or oversize	Must not exceed 0.003 in, beyond that, rebore
Boring practice	Bore to the exact oversize; piston clearance is built into the piston
Bore finish	Cross-hatch honed to a 25-microinch finish
Crankshaft scoring or out-of-round	Greater than 0.001 in calls for regrinding
Regrind accuracy	Grinding tolerance +0.0000 / −0.0001 in on the quoted sizes
Block already at maximum oversize	Sleeve back to standard, or take a banana block to 72 mm for 1,466 cc
Salvaging a badly undersized shaft	Arc-weld build-up is an expedient, not a solution; metal spraying is rejected outright on the XPAG

MG T-Series Menu

One further piece of context worth carrying into a rebuild: original crankshafts had a reputation for cracking at the web between the front main and the first throw, and replacement shafts carrying part number 168828 on the third web,

usually marked EN-16, were made in more suitable steel. If a shaft comes out of the engine cracked, that is the history behind it.

Reference dimensions for the machine shop

DIMENSION	XPAG	XPEG
Main bearing bore in block	56.54 mm (2.2181 in)	as XPAG
Main journal width, front and centre	38 mm (1.496 in)	as XPAG
Main journal width, rear	40 mm (1.575 in)	as XPAG
Journal fillet radius	2.5 mm (0.100 in)	as XPAG
Crankpin journal width	28 mm (1.102 in)	as XPAG
Connecting rod centres	178 mm (7.0078 in)	178 mm (7.0078 in)
Big-end bore diameter	48.67 mm (1.9159 in)	48.67 mm (1.9159 in), rod reinforced
Small-end bore	18 mm (0.7087 in)	18 mm (0.7087 in)
Camshaft bearing bore in block	43.5 mm (1.7126 in)	as XPAG
Tappet bore in block	23 mm (0.906 in)	as XPAG
Piston compression height	45 mm (1.7717 in)	45 mm (1.7717 in)

What this page does not give you

No verified figure could be established here for: valve guide bore, and therefore valve stem to guide clearance, though the stem diameter is now published above; valve seat cutting widths beyond the 30° angle; minimum head thickness after skimming; small-end bush finished size; flywheel run-out limit; or main bearing cap and big-end bolt torques, which belong to the settings and torque page and are given there from the factory manual. Nothing at all is published here for the MPJG.

If you hold a manual page or club bulletin that settles any of those, please write in and it will be added with the source named and credited.

Common questions

What is the standard bore and stroke of the XPAG engine?

The XPAG is 66.5 mm bore by 90 mm stroke, giving 1,250 cc. The XPEG fitted to the TF 1500 shares the 90 mm stroke but is bored to 72 mm for 1,466 cc, which the factory Workshop Manual gives as 2.835 in. It is a bored-out XPAG rather than a new engine.

Can an XPEG crankshaft be reground?

The factory Workshop Manual says not. On the Series "TF" General Data page the line "no regrind permissible on XPEG" is printed twice, against the crankpin minimum diameter and against the main journal first regrind. Every regrind package on this page is therefore an XPAG figure. If you are rebuilding a TF 1500, raise that sentence with your machinist before the crankshaft is touched.

How far can an XPAG block safely be rebored?

The factory General Data names two oversizes, +0.020in and +0.040in, and marks +0.040in as the maximum on the TF page. Wood tabulates a fuller ladder

to +0.060in as MG piston sizes, with +0.080in, +0.100in and +0.120in available from independent piston makers and explicitly not recommended by the MG Car Company. Any oversize should be checked against the actual remaining bore-wall thickness by the machine shop rather than assumed from a table. Once the block is beyond safe reboring it has to be sleeved back to standard.

What does reboring do to capacity and compression ratio?

On the XPAG, +0.020in takes 1,250 cc to 1,270 cc and the compression ratio from 7.25:1 to about 7.35:1; +0.060in gives 1,309 cc and about 7.54:1. On the XPEG, +0.040in takes 1,466 cc to 1,506 cc and about 8.53:1. The full tables for both engines are on this page.

What are the crankshaft regrind sizes for an XPAG?

Standard is 52.00 mm (2.0472in) on the mains and 45.00 mm (1.7717in) on the crankpins. The factory Workshop Manual recognises two main-journal regrinds, 2.027in and 2.007in, and calls 2.007in the minimum; for crankpins it gives a minimum of 1.722in. Wood tabulates a fuller ladder, R.1 to R.5 at 0.012, 0.020, 0.030, 0.040 and 0.050in undersize, of which R.2 and R.4 correspond to the factory's two. R.5 takes the mains below the factory minimum although it reaches the factory minimum on the pins. Shells must be ordered to match whichever grind is chosen.

When does an XPAG crankshaft need regrinding?

Any scoring, or out-of-roundness greater than 0.001in, calls for a regrind. The grinding tolerance on the published sizes is +0.0000 / −0.0001in, so the choice of grinder matters as much as the size chosen, poor grinding accuracy is the usual reason a freshly rebuilt bottom end does not last.

What are the oil clearances for XPAG main and big-end bearings?

Main bearing oil clearance is 0.0008–0.002in with crankshaft end float of

0.0014–0.0037in on the integral centre-main thrust. Big-end oil clearance is 0.0005–0.001in with 0.004–0.006in rod end float. Check with Plastigage on assembly rather than trusting shell markings alone.

When does an XPAG cylinder block need reboring rather than honing?

Cylinder out-of-roundness, taper or oversize must not exceed 0.003in; beyond that the block should be rebored. When boring, go to the exact oversize because the running clearance is built into the piston, then cross-hatch hone to a 25-microinch finish.

Do these figures apply to the TA's engine?

No. The TA uses the earlier MPJG engine, which is a different unit with different dimensions entirely. Nothing on this page applies to it, and this site does not publish MPJG rebuild data because no transcribed manual source could be verified.

Sources

M.G. Midget Workshop Manual, General Data for the Series "TD" (Issue 4, 93692—5/55) and the Series "TF" (Issue 3, 93692—5/55)

FACTORY MANUAL, READ AT SOURCE

W.K.F. Wood, The XPAG Engine: Data, Service, Supertuning (1968; club reprint, MG TABC library)

TABULATES THE REBUILD DATA MORE FULLY THAN THE FACTORY MANUAL DOES

MG Car Club Y-Type Register, the XPAG files and rebuild diaries

CORROBORATING CLUB MATERIAL ON REBUILD PRACTICE

Wood, The XPAG Engine (1968 reprint) is a club reprint of a 1968 publication, authoritative on the engine as rebuilt in period but a transcription nonetheless. It tabulates far more than the factory General Data does, which is why it remains the backbone of this page. Where the two disagree, both figures are given and the disagreement is named. The paper Workshop Manual for your model, and your machinist's own measurements of the parts in front of him, are still the last word.

RELATED

XPAG & XPEG settings and torque figures →

The tuning guides, what to do once it is together →

Parts & spares, ordering pistons and shells to size →

Reference data only, transcribed with sources named. Confirm every figure against the Workshop Manual for your engine and against the actual measured condition of your parts before machining.

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