Contents

0.060in oversize piston. Many replacement part manufactures have expanded this range and include a plus 0.040in oversize in their piston range.

The criteria for the actual piston replacement revolves around the condition of the top ring groove, the size and condition of the piston skirt and freedom from structural cracks. Cast pistons are reasonably priced and should be replaced if there is any doubt as to their integrity.

The majority of pistons fitted to production engines are cast and not forged. The average cast piston is quite satisfactory for use up to 5500rpm and will usually give very good long-term service under these conditions. Some cast pistons are stronger than others by virtue of their design and will stand higher rpm use than others, in fact up to 6500 or 6700rpm. They are usually slightly heavier and have more material around the piston pin and have noticeably thicker ribs that connect the piston pin bosses to the crown.

Typical replacement set of cast pistons.

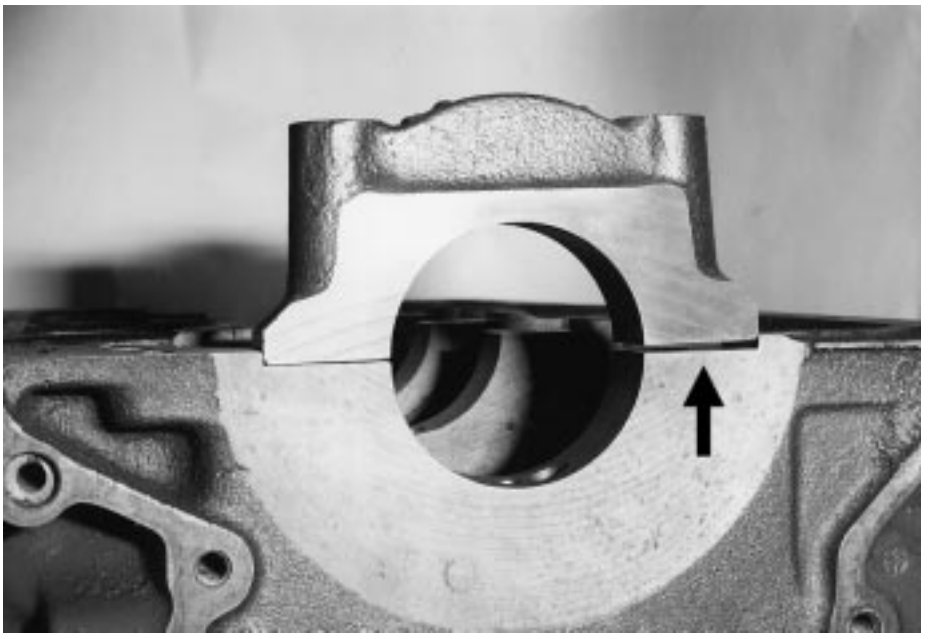
Typical nodular cast iron crankshaft.

If new cast pistons are used beyond the limit of their strength the top of the piston simply parts company with the piston pin bosses. This is usually a clean break and will be clearly visible as such, with no dark areas which would indicate previous cracks.

Forged pistons are almost always stronger than any cast piston by virtue of their design and the fact that the material used in them maintains its strength at the piston's working temperature much better than readily available standard type cast piston. Some of the more specialized cast pistons are very strong and, what is more, they will run, without seizure, tighter piston to bore clearances than their forged counterparts. Forged pistons are more expensive than cast pistons and are essential for pure racing engines frequently turning very high rpm. The application determines the type of piston to be used in most instances. Both types of piston are covered in this book.

The ability of a piston to give top performance revolves around skirt wear - which controls the piston to bore clearance and which, in turn, controls the attitude of the piston in the bore and effects ring seating. Too much clearance and the piston is able to rock from side to side, meaning the rings do not maintain correct contact with the bore surface and sealing efficiency is lost. The top ring groove in the piston wears out much sooner than the others and when this groove is no longer on size or within the permitted tolerance the piston must be replaced. There are methods of reclaiming the groove but, for a high-performance engine, machining the groove out and fitting a steel spacer to restore the groove size is not acceptable.

The crankshafts of most mass-production V8s are cast nodular iron and nearly all of these crankshafts are capable of withstanding 6500 to 6700rpm. There appears to be no standard V8 crankshafts that won't



Main bearing cap sitting on the edge of the block register. The cap should not go into the seat without being "snapped" in.

Main bearing cap properly fitted and an inside micrometer being used to check tunnel size.

be checked after the caps and registers have been thoroughly cleaned and the caps reinstalled. With the bearing inserts removed from the block and caps, start with the rearmost main and fit the cap into the register and "snap" it in. Using cleaned bolts torque the bolts and measure the inside diameters

Main bearing cap being tapped into register by a copper hammer.

of the tunnels with an inside micrometer. Compare the measurements against the factory specified sizes which are available from engine machine shops and sometimes workshop manuals.

Note that if the main cap can be fitted into the block register without being "snapped" in, the register is loose and the cap is effectively "sprung" rendering the block unsuitable for a high-performance engine unless the situation is remedied. A block like this can be used for a stock engine if there is no perceptible end clearance (cap end to register). It should not be possible to simply place the cap into the register: it's supposed to be a "snap" fit or a "tap-in" fit with a copper hammer.

Any block that is being prepared for performance use must have the camshaft bearings replaced and it is always recommended that camshaft bearings be replaced at any major overhaul on a stock engine. Camshaft bearings do not last forever and the clearances between the journal and the bearings can become excessive (another source of oil pressure loss).

Summary of checks

Check the bore size for wear and reboring within the 0.060in oversize maximum.

Check for obvious cracks in all bores

give the same reading. New camshafts are "Parkurised" (blackened appearance) while used camshafts will be partially polished via the lifter contact.

A camshaft lobe is not ground parallel to the axis of the camshaft across the lobe but at a slight angle to match the base of the lifter. The lifter is positioned in the block so that approximately half of the lifter is in contact with the lobe and this offset contact creates lifter rotation.

Connecting rod side play can be measured with a feeler gauge. This is achieved by moving the connecting rods sideways and inserting a feeler gauge between the two connecting rods.

One connecting rod bearing per

Feeler gauge positioned between two connecting rods to check the side play of the connecting rods.

journal can be removed and the journal size and surface condition checked and also what type of insert is fitted and whether it is new or not. Incidentally, two feeler gauges should be inserted in between the connecting rods when connecting rod nuts are undone or done up. This removes any possibility of bearing damage, especially when the bearings are new.

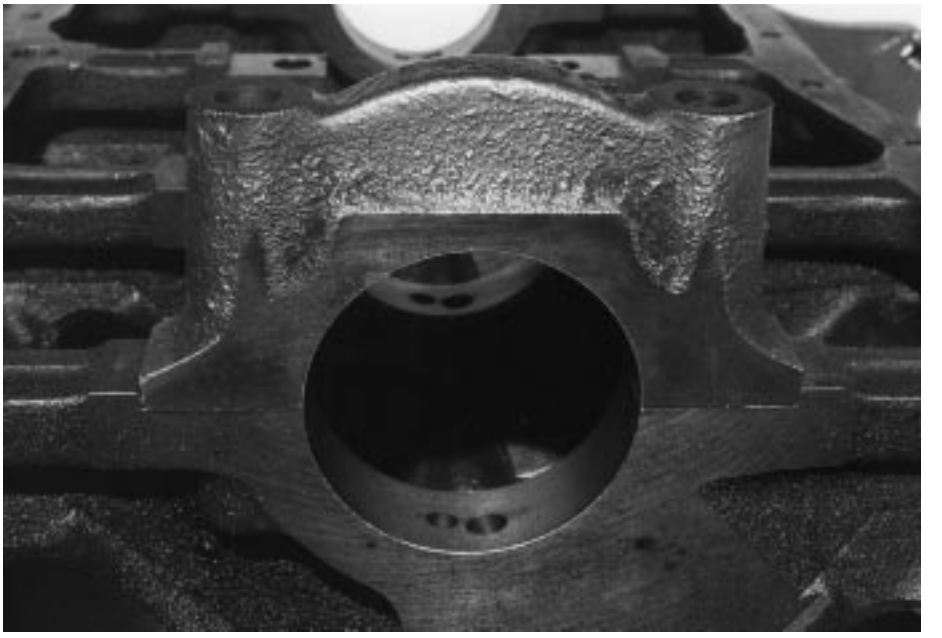
Crankshaft endplay can be checked by pushing the crankshaft backwards or forwards and measuring the gap alongside the thrust bearing with a feeler gauge. The thrust surfaces of the bearings (especially the rearmost bearing on clutch equipped

Feeler gauge being used to check the crankshaft end play (float). Lever the crankshaft forward with a large screwdriver so that the thrust face of the crankshaft is hard up against the main bearing thrust surface. The gap between the crank and bearing thrust faces on the opposite side of the bearing is the end play.

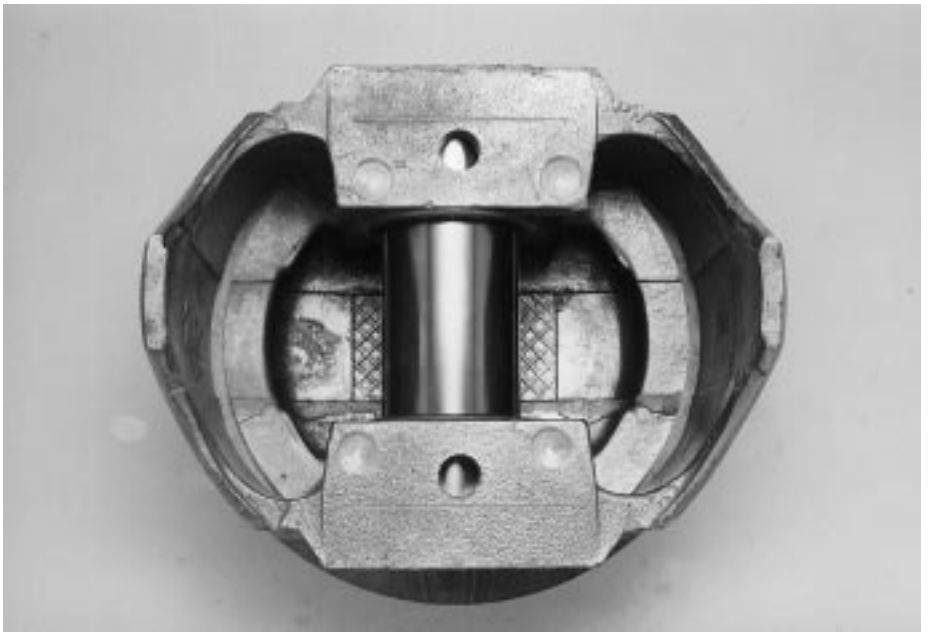
cars) do wear so the clearance may well be at, or near, the top limit of the factory clearance.

If crankshaft endplay is excessive (over the maximum tolerance) the problem will require further investigation because, if the crankshaft thrust surfaces are worn, the crankshaft is, basically, a write-off. One solution (and to all intents and purposes the only one) that may be available is regrinding the thrust surfaces of the crankshaft and fitting oversized thrust sizes on the main bearings which will restore the clearance. The only problem with this is that main bearing sizes that incorporate these oversize thrust sizes are not generally all that common. The majority of crankshafts are quite inexpensive to replace and it is normal practice to replace the shaft rather than go to the trouble of remachining, but it is an alternative. Any crankshaft thrust surfaces that are reground must be as smooth as the journal surfaces. Unfortunately, the side of the grinding wheel is not continually re-dressed like the front of the wheel is and will therefore seldom give a perfect finish. This means that the crankshaft's thrust surfaces may not be smooth enough so the thrust surfaces of the bearings will wear very quickly and the crankshaft endplay will open up, leading to many problems.

The main bearing caps can be



Main cap sitting in the register of a block. If no effort at all is required to position the cap, the fit is loose. Main caps should need to be tapped into the register.



Underside of an typical cast aluminum piston which does not have a steel strut. This piston will withstand use in an engine which will be revved to 6000rpm for short periods; it will not withstand sustained high rpm use.

Dimension "A" is parallel down to the bottom of the oil ring groove and is generally 0.020in less than the bore size. Dimension "B" (just below the bottom of the oil ring groove) is approximately 0.005in less than the bore size and dimension "C" (the base of the skirt) is usually 0.0015-0.003in less than the bore size. Most stock piston to bore clearances when new are 0.0015-0.002in - the factories make the clearances quite tight and for average street use this is perfectly correct.

View of the inside of a piston skirt showing how the edge is made thicker for strength.

connecting the gudgeon pin bosses to the piston crown and may look a lot stronger. Look at the underside of the piston check how substantial the ribbing is: the thicker the ribbing the stronger the piston (all other things being equal).

The average piston skirt is usually quite light in construction with the thickness of the majority of the skirt usually being about 0.110in while the edged band is usually 0.150in thick.

Cast pistons will only stand high rpm use for so long, and should not be expected to withstand sustained extra high temperatures for long periods of time: their strength when hot is significantly less when compared to that of a forged piston. With compression ratios of up to 10.5:1 and rpm not exceeding 6500-6700, cast pistons running with suitable piston to bore clearance can give very reliable service but frequent piston replacement is recommended.

The top area of a piston, where the rings are situated, is round but the skirt of the piston is tapered and the piston is ground oval. Pistons are measured at 90 degrees from the piston pin.

A simple rule for when to change standard type cast pistons in high-performance use is that when the crankshaft bearings are changed, the pistons should also be changed - assuming that the bearings are being changed because of normal wear rather than damage.

The compression seal is dependent on the fit of the ring in the piston groove. The side clearance between the ring and the piston is usually about 0.001in so consider that when this gap becomes 0.0025in through wear, the compression sealing part of the overall combination is lost (replace the piston set).

When the ring groove in the piston becomes worn the piston is no longer serviceable. Grooves can be restored by machining out the individual grooves to a new size that is a combination of the ring thickness, a steel spacer thickness and the running clearance. The steel spacer fits the top of the combination (nearest the piston crown). This is reasonably satisfactory for a road car but **never** for a performance engine. Once the top ring groove has lost its size, replace the pistons.

Frequently, when an engine is stripped for repair the pistons are found to be in quite good condition but the piston pin well worn where it