Around it goes

The crankshaft journal should be round without any signs of taper. This 1971 Triumph 650 rod journal measured 1.624" and showed no signs of wear. Measure the journal from side to side to detect any taper, and in several places around the bearing surface, as illustrated, to check for the journal being out of round.

Be sure to take a series of measurements around the journal and across the face of the journal to check for out of roundness and/or taper. During the process the micrometer will absorb heat from your hands. If you are not careful this will effect its accuracy from the first measurement until the last. To keep the micrometer at a consist ant temperature, hold the frame between only two fingers and use the micrometer's ratchet to get final reading. Failing to take precautions can effect the accuracy of your measurements.

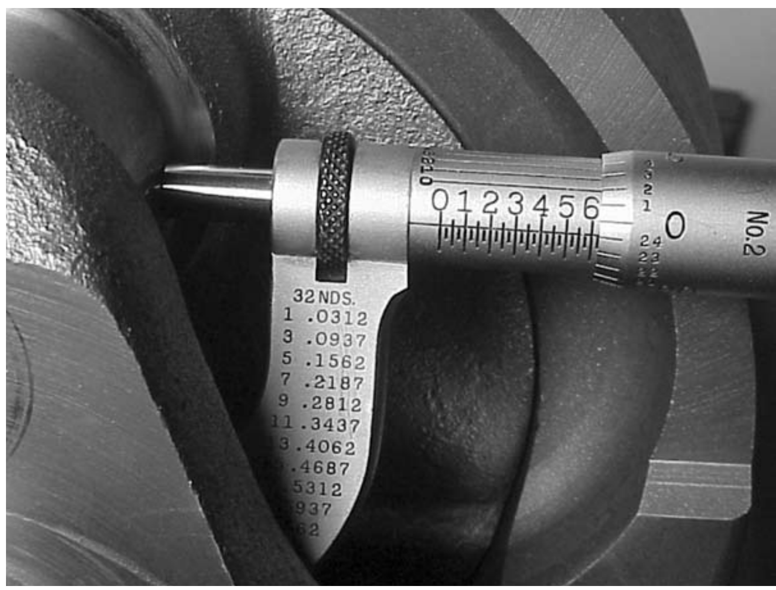
As a practical standard the crankshaft rod bearing journals can display one, maybe two, tenths of thousandths taper or out of round, if it is any more or the bearing surface displays any wear, distress or signs of corrosion, it should be reground.

Reworking the crankshaft can take the form of welding and then regrinding journals to "standard," or more commonly, ground under size. Under size bearings are widely available in minus .010", .020", .030" and .040" sizes.

When regrinding the crankshaft it is important to duplicate the radius at each end of the journal. Failing to do so will greatly increase the chances of crankshaft failure.

The factory specification for the 650 and 750 twin rod journal diameter is 1.6235" to 1.625."

There is some feel required to get accurate readings with a micrometer. More expensive micrometers come with a thimbe ratchet which make getting consistant readings easier.



I use telescoping gages a lot and find that with bit of patience I get as accurate a reading as I do with the more expensive dial indicators. But telescoping gages are not a tool where you want to go cheap. I have had my set of Starrett gages for 40 plus years and they work as well today as they did the day I bought them.

I recently bought a set of economy telescoping gages and they were all, but useless. They had absolutely no feel and you couldn’t get the same reading twice.

I use a telescoping gage to measure the diameter of the small end bushing. I compared it with the measurement of the wrist pin. In this case I had about 0.0007” clearance. With this clearance, and assembly lube on the pin, the pin will slowly slide of its own weight through the bushing. The recommended 650 wrist pin clearance is between 0.0005” to 0.0012.”

When taking measurements the micrometer or gage, and parts to be measured should all be at the same room temperature.

Aluminum rods are strong, great weight savers putting a lot less stress on the lower end, and make the motor easier to balance but they do have a draw back. Once they stretch where they become longer or the bearing housings go out of round they become great paper weights.

The typical process of grinding the connecting rod cap and re-sizing the rod’s big end, routinely done with steel rods, is inappropriate with aluminum. That little bit of stretch is the only warning the aluminum rod will give you before it breaks. If you measure the length of the rod, the big or small end eye, and they have stretched or gone out of size or round, cut the rod in half before it does the same to your crankcases.

If you are using aluminum rods in a competition motor measure and record all of the rod and rod bolt dimensions for comparison during the next rebuild.

If you are buying your first micrometer I suggest you get one with a ratchet thimble. Using the ratchet thimble will help you to develop a feel for the micrometer. Take two measurements, first using the ratchet thimble, and then with the body itself. The measurement you get by feel should be the same as you get with the ratchet. Practice!

Telescoping gages are inexpensive as compared with bore gages.but still offer a good way to check inside diameters. While you can save some money buying a micrometer, cheap telescoping gages are a waste of money.

Checking the inside diameter of the rod is important. This dimension must be round and on size (for a 650 750 twin it is 1.770 “). If the aluminum rod is used, and the big end of the rod is not round, the rod is trash and should be thrown away.

For this kind of work your 0-1” and 1”-2” micrometers should have a tenths vernier. The vernier will allow you to read diameters in tenths of thousandths. So when it calls for 0.0005” clearance you are not guessing.

The actual bearing clearance can checked by measuring the installed shell. In this case I calculated that with a 1.624” journal I had 0.0015” clearance. Take your measurement from “true” top to bottom. The fitted bearing shell is not round and has more clearance side-to-side than across the parting surface.

The outside diameter of the rod bearing shells are larger than the rod’s shell bore. With the shells in place push the rod cap onto the rod bolts as far as hand pressure affords. Here I am checking the amount of clearance between the rod and cap. This is the amount of shell crush we have. A 0.004” feeler gage slipped right in while the 0.005” offered a slight resistance.

Rod bearing shells are located, and kept from spinning in the rod, by the tang on the shell. The shells are designed to give a certain amount of bearing “crush.” To provide this crush you will find that the shell’s outer diameter is larger than the bearing housing they lay in. Properly installed, the ends of the shell will sit pround of the bearing housing. In our 650, we measured the crush and found it to be between 0.004” and 0.005”. If the shells have too little crush something is wrong and needs to be corrected before proceeding.

Don’t assume that the cut for the shell’s tang in the rod and cap is machined wide or deep enough to accept it. I have seen expensive aftermarket rods where the cut for the tang wasn’t cut deep enough and the bearing would lock onto the cranksahaft as the rod bolt nuts were torqued.

One cannot stress the importance of cleanliness when installing shell bearings, If any dirt or swarf finds its way between the bearing shell and the rod it will deform the bearing. Also any dirt or swarf on the face of the shell or crank journal will damage the shell’s soft bearing surface. This could lead to bearing heating and possible seizure.

Never put any lubricant, or anything else between the back of the shell and the connecting rod. This surface should be clean and dry.

Before final assembly the crankshaft journal and rod bearing shell wear faces should be liberaly coated with a quality assembly lube, or if none is available, use a good quality motor oil.

STP, or the like, is not assembly lube. STP can block the flow of oil during initial startup essential for lubrication and cooling during initial start-up.

To prevent the rod cap from being bent during tightening of the rod bolt nuts it is important that the shell’s mating surfaces contact each other before begining the tightening process.

When you put the bearing shell into the steel rod cap it is easy for the sharp edge to shave some material off the back of the shell. To help prevent this I like to break the inside edge of the parting surface with a little 220 wet/dry paper. Once the shell is in place check to see if any aluminum swarf has been raised and is sitting on the cap’s parting surface.
Be sure to coat the journal and bearing shells with a high pressure assembly lube. Do not use any coating that might prevent instant oil flow through the bearing. This is not a place to use STP or similar products.

For this project I was using a new set of rods which came with two sets of nuts. The ones shown and a pair of new “clevloc” nuts that will be used for the final torquing.

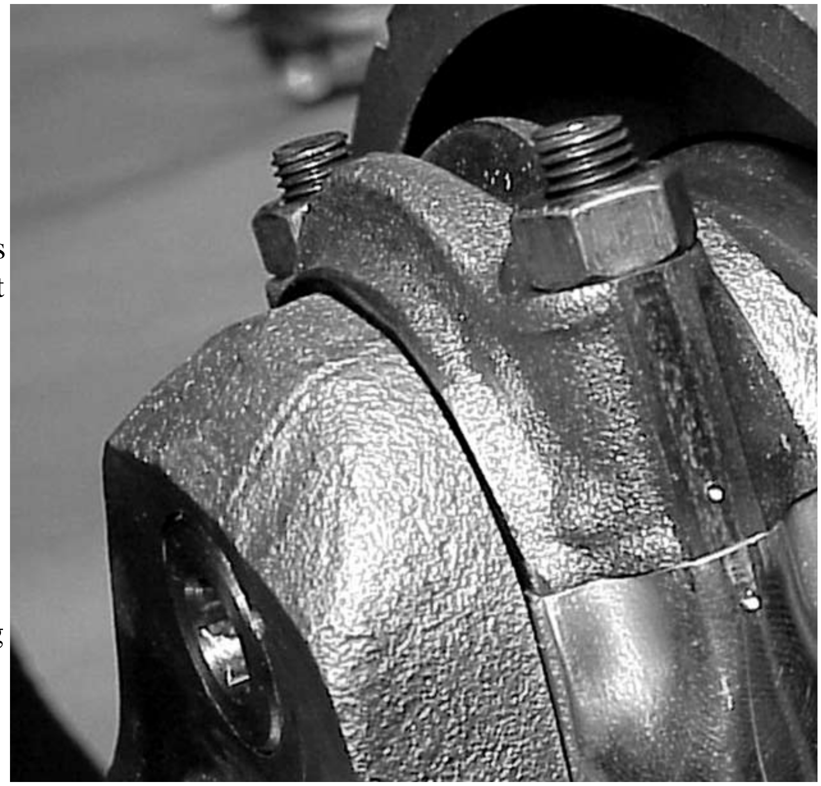
So that I would not damage the single-use Clevloc nuts I installed the new rod with the nuts used in manufacture. This allowed me check that the rod turned freely on the crankshaft journal and measure side play. When I was happy with what I saw I would replace the standard nuts with the clevloc’s and re torque to 28 foot pounds (22 if I was working on a 750 twin).

Rod bolts are torqued to a point where they stretch. This stretch must be enough to provide adequate clamping force to crush the rod bearing shell and protect the bolt from cyclical stretching (remember bending a coat hanger to break it when you were a kid), but not too much as to cause the bolt to stretch to the point where the metal fails from too much elongation, or as engineers say “beyond the material’s modulus of elasticity.” Just like a rubber band breaks if it is stretched too much, a connecting rod bolt will do the same.

Before torque wrenches were commonly available in repair shops “bolt stretch” was the norm. In fact early Triumph shop manuals only gave the bolt stretch figure, and didn’t even mention torque figures. Triumph 650 models tightened rod bolts to 0.004” to 0.005” stretch, a figure you can use today instead of the 28 foot pounds listed in the 650 manual.

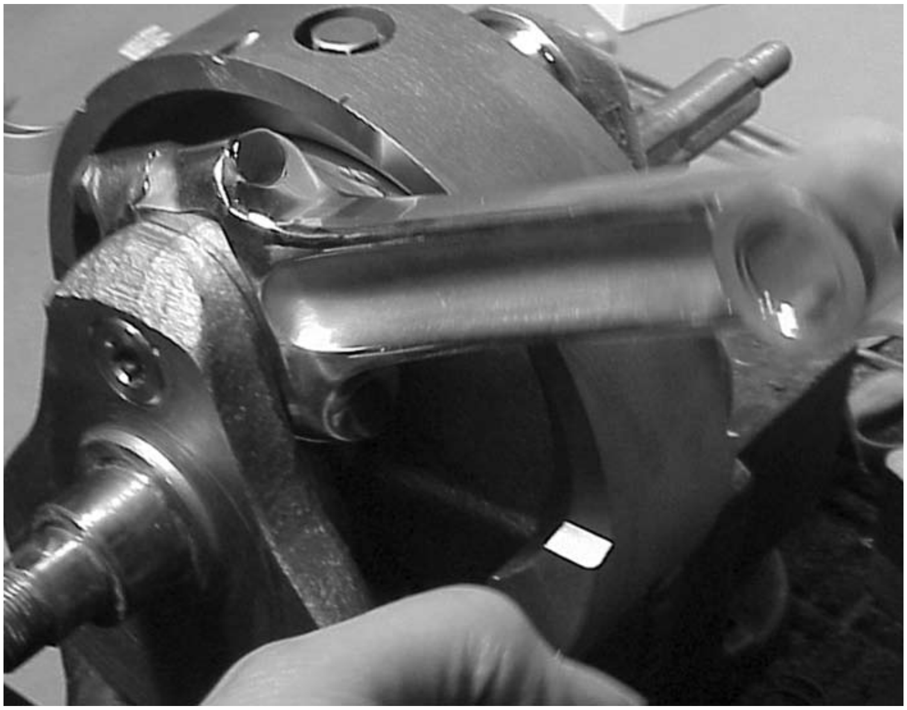
Checking the side clearance is especially important when using aftermarket or “performance” rods. The big end of the rod gets hot and expands. If the initial clearance isn’t sufficient the oil flow from the bearing can be restricted leading to more heat and possible bearing failure.

When measuring the size of a telescoping gage use the same micrometer you used to measure the part you are comparing. Don’t measure the crankshaft with one micrometer and then the telescoping gage used to measure the bearing with another.



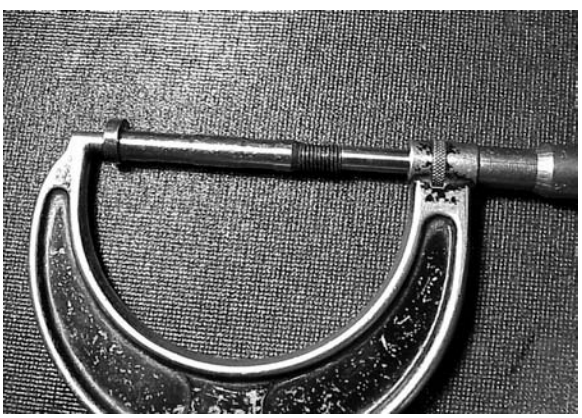
During production Triumph connecting rods are marked so you can reinstall the rod cap the same as it was when the rod was made. Note the two divots left by a center punch on the rod and its cap. I used regular 5/16 inch nuts for initial checking, These will be replaced with lock nuts during final assembly.

Checking rod side play is important. It is especially important when fitting a high performance rod that will be used in racing. Flow of oil through the bearing is important because it not only provides lubrication it also removes heat. If there isn’t enough side clearance to provide adequate oil flow the rod or its bearing could fail.



The final check. With the correct clearance the rod will be FREE to turn on the crankshaft journal with out ANY binding or ANY perceptable up-or-down movement. Here I am checking to see if the rod will fall of its own weight. If the rod shows any signs of binding the rod MUST be removed from the journal and the problem identified and corrected. While this rod falls slowly due to the thickness of the assembly lube, the rod must be free to turn. Rod bearings will not "break-in"!

ARP rod bolts are becoming more available for British bikes. These hi-tensile bolts require that you follow a rigid process during installation. The nut has to be tightened and loosened 5 times before final tightening and the proper bolt stretch confirmed by measuring. They also supply a special thread lubricant that must be applied to the threads before offering the nut. http://www.arp-bolts.com/Tech/TechInstall.html



In the days where torque wrenches were not common bolt stretch was the way to tighten rod bolts. Today it is considered high-tech to use this practice. If you are using your motor for competition I recommend that you measure, and record, the length of each rod bolt before putting it into the rod. This will give you a reference measurement that you can refer to during a rebuild to check to see if the bolts have started to fail.

Most after market rod bolts do not have end that can be used to measure the rod bolt. By facing off the end of the bolt in a valve stem refacer you can get a smooth surface that is at perfect right angles to the bolt center line.