

dave bushell

Joined: 09 Jun 2004

Posts: 112

Location: Caterham, Surrey

Posted: Fri Dec 16, 2005 9:01 pm Post subject: Small end bushes

Should small end bushes be reamed dry and if not, what lubricant should be used?

Dave

Back to top

Springming

Joined: 31 May 2004

Posts: 25

Location: Canada's Ocean Playground

Posted: Mon Dec 19, 2005 1:04 pm Post subject:

I have used WD 40 in the past, but wether this frowned upon by the guru's I don't know .No doubt we shall see... All the best to all the Club members for the festive season. Peter.

Back to top

Roger Moss

Joined: 31 May 2004

Posts: 242

Location: Leicester UK

Posted: Tue Dec 20, 2005 10:13 pm Post subject: Little end bushes

Hi Dave

The WD 40 idea seems reasonable, but it depends a bit on the condition and contour of the cutting edges. Ideally a sharp reamer with the edge just dulled a bit to deter digging in.

I do not want to play the know all, after all, there is some truth in the saying, that "Nobody loves a smart arse"

So I thought a while before deciding to throw in my two pence worth.

I am not so bothered by how you produce the hole, but am concerned about its truth.

Have a look at the section "Results of little end misalignment" on my website page

<http://www.mossengineering.co.uk/index.php?area=5&content=94>

The majority of excessive wear in engines I receive have their origin in lack of alignment accuracy in little ends. The examples shown had errors of six thou, measured on a gudgeon pin either side of the rod little end. This was measured from a good clean parallel big end side face.

If you have access to a reasonable machine tool, clamp the rod down on the big end and carefully support and clamp the little end without moving it. Check this with clocks on it while you clamp it up. You can see the general idea from the fixture I use seen on page --

<http://www.mossengineering.co.uk/index.php?area=5&content=84>

Small End Bushes.txt

I copy my operation sheet for your general interest

Small End

Phosphor Bronze from EMAM is 27 OD x 12 bore as A4358

rough to 21mm od x 67 lg x 19/32 drill bore but watch that rough bore is true.

This blank makes two bushes. Hold in 21mm collet to produce first bush, hold on first bush to make second bush, then part off, face and chamfer.

check internal bore as this is always marginal on boring

Nom bore in rod 0.8125"

Hone out to give 85% clean up

Turn bronze bush blank +0.0015 / 0.0020" OD

Bronze bush rough bore 0.593" = 19/32" drill

Length = Rod width + 1.4mm

Chamfer ends + bores

Turn lead Rod bore - 0.0005" x 1.5mm

Push in rod

Mill cutout + (side oil reliefs for racing)

Drill + Tap 2BA for security screw (Racing)

Loctite in 2BA brass cheese head screw flush to inside of bush blank (Racing)

Bore to 0.6245" dia on jig to correct centre distance

Internal oil grooves on racing engines by hand.(Racing)

Hone to loose SF on gudgeon pin 0.6262 / 0.6265" dia

Cut off brass screw (Racing)

I do realise that my methods are perhaps more "particular" than normal, but I have made many machines for car factories and note the tolerances specified. The reliability of Japanese products is, to a large extent, a result of accuracy of manufacture.

I am not looking for work and if you do not have the facilities, perhaps a local engineering shop or good model engineer can help.

Whatever you do, I do urge you to be sure that you have accuracy within two thou in parallel and twist. I aim for one thou.

I would strongly recommend that you do not resort to the trick of putting in the hole and then bending and twisting the rod till it seems to have alignment. The rod usually "unwinds" in service and reverts to its unstressed attitude. A rod that has been running will have settled into its natural attitude and will not move again in normal use. It therefore follows that the hole should be put in correctly first time.

An engine with rods in good alignment will give a good service life.

Alfred Scott knew exactly what he was talking about when he chose the logo "Made to limit gauge" Of all the components in this deceptively simple engine, the rod little end to big end alignment is by far the most crucial.

Kindest Regards and Happy Christmas

Roger Moss

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Back to top

Stan Thomas

Joined: 01 Jun 2004

Posts: 78

Location: Stafford

Posted: Thu Dec 22, 2005 8:09 pm Post subject:

Hi Dave,

Reaming is not the problem - its the steps before!!!

If you try to ream out any material from a small end bush, invariably you will end up with a bell-shaped hole, with no guarantee the gudgeon pin will be

Small End Bushes.txt

parallel to the big end eye.

So start by reaming the bushes in a lathe to size. Better still, turn both the O/D and I/D to size from stock material so the bush is parallel, allowing about 4 thou for interference fit.

What I'm going to say now will cause Roger Moss to have an epelictic (or is that epicyclic) fit.

Once the bush is in place, a small amount will need to be cleaned out due to shrinkage. Do this by tapping the reamer into the hole with a light blow with a mallet. Turn the reamer half a turn, and repeat the process. Aim to get the reamer through as quickly as possible.

DONT do the obvious trick if spinning the reamer round like a propeller - you will just get a tapered hole.

Dont worry about scratch marks from the reamer, and dont make the bush too tight otherwise it will pick up.

No need for lubricant - the object is to remove material.

Good luck.

Stan Thomas.

Back to top

Roger Moss

Joined: 31 May 2004

Posts: 242

Location: Leicester UK

Posted: Fri Dec 23, 2005 12:02 am Post subject: Pass the valium!

I told you I thought twice about making comment!

I think I should keep my big mouth shut, but as you have all found out by now, I never manage it!

OK

First Stan, your method of producing a bush is OK in theory, -- but--

1) The bore in the rod (parent metal) will be stretched oval about two thou in long axis.

2) I have seen many later rods where the finish in the LE rod bore looked like it had been done by a drunk with a brace and bit. ie terribly scoured and tapered, so the area in contact with the bronze bush was 20% at most. Shipley ones vary, but on balance are acceptable as regards finish.

3) You have taken no account of the axis of the bore in the rod. If you make the bush to finished size and push it in, all you will do is accept whatever alignment is there already. Perhaps turn up a piece of bar to suit the rod LE bore and check that for alignment.

You might be lucky ---

Do you have a myford or similar that you could use to set up the rods and skim out the LE bore true and round first, then make a bush like Stan says to suit? Perhaps you will let us all know how you get on and how it runs.

I for one would be very interested in final alignment figures.

Pity you dont live nearer as it only takes ten minutes to inspect.

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Back to top

Small End Bushes.txt

dave bushell

Joined: 09 Jun 2004

Posts: 112

Location: Caterham, Surrey

Posted: Fri Dec 23, 2005 7:39 pm Post subject:

Gentlemen (and Stan!)

Thank you for your considered responses to my small end reaming query.

Roger, your two pence worth is always good value for money and always instructive and informative. However, your responses always frighten me to death! They make me wonder how I've managed to keep my Scotts running for the last 49 years without a fully equipped workshop. I'm limited to a worn out Atlas lathe, a pillar drill and a bench grinder. Your methods obviously work judging from your racing successes.

Stans methods are more my style with my limited resources (blacksmith engineering) but I agree with you Roger, one needs to start with a level playing field, or rather con-rod, if one is not to compound errors already in existence.

The reason that I asked the question in the first place was that a few years before Clive Waye died, I aquired an engine from him that I fitted into my Brum Scott. The engine had silk cranks, crankcase stuffers, ported pistons and barrels. It's an absolute pig to ride in traffic and the engine performance is all revs, no bottom end torque and doesn't suit my riding style at all. I therefore thought about changing the barrels and pistons for standard ones and to that effect sent a scored cylinder block to Tim Sharp to be bored and have new pistons, rings and gudgeon pins fitted. Now it could be that the new gudgeon pins will fit my rods with no reaming required, but if they are a smidgion or a tad tight (note technical terms) then I may have to ream the small end bushes. This I will do with an expanding reamer, so the next question is - what are the pitfalls to avoid when using an expanding reamer in this situation, other than opening it up too far?

Merry Christmas to one and all (even Stan)

Dave

Back to top

Stan Thomas

Joined: 01 Jun 2004

Posts: 78

Location: Stafford

Posted: Wed Dec 28, 2005 4:29 pm Post subject:

Hi Dave,

Are you sure it's the lathe that's worn out, not the operator's brain?

It now appears you've changed the goal posts - given you only want to "ease out" tight small end bushes.

Be very very careful if you are using an expanding reamer, as they tend to do nothing at all, then suddenly cut out too much material.

However, do like I say - expand the reamer no more than one-eighth of a turn of

Small End Bushes.txt

the adjusting collars at a time - and tap the reamer in lightly with a mallet.

Hope everything goes O.K I'll look out (or listen for you) coming to the A.G.M. given the noise emanating from your small ends.

Happy new ten months (I don't think we will survive another year given the present Government)

Regards,

Stan.

Back to top

dave bushell

Joined: 09 Jun 2004

Posts: 112

Location: Caterham, Surrey

Posted: wed Dec 28, 2005 11:57 pm Post subject:

Thanks Stan

I don't know anything about football, so I didn't know that you weren't supposed to move the goal posts! As I said previously, it may not be necessary to do anything at all, but as the gudgeon pins supplied by Tim Sharp are half a thou oversize, they may be a bit tight depending on how the small end bushes have worn.

Have a good new year

Dave

Back to top

Roger Moss

Joined: 31 May 2004

Posts: 242

Location: Leicester UK

Posted: Fri Dec 30, 2005 8:14 pm Post subject: Little end bushes

Hi Dave

I said that I had taken some time to think before replying to your initial question Your remark that the tolerances I quote are frightening and so how could you keep your Scott mobile for 35 years with your limited workshop resources is perfectly reasonable. Perhaps you are unduly modest about your prowess with your lathe?

As I have said many times, my main interest is in engineering.

The fact that I have lavished so much time on the Scott, is entirely due to my great respect for the inspired talents of Alfred Scott. His successors were not so blessed.

I had my first Scott in 1967 and started to hear some strange stories of problems due to "CRANK FLEXURE" This, I was informed, caused blue and dished roller plates, barrel shaped rollers, blue rollers, blue rods etc.

I thought about this and after being shown examples, could clearly see that the crank pin had run at times at a considerable angle to the rod.

Given how far the crank would have to deflect to achieve this, it would have failed long before reaching this angle. It was evident that some engines went long mileage's without problems. Was it suggested that some cranks flexed and others did not? So what was the alternative?

Small End Bushes.txt

The crank staying in line and the rod wagging--

This would explain the marking on the gudgeon pins that showed that the rod tracked sideways.

It explained how when wagging it would tighten the rollers on the crank pin bush and rotate it and wear the crank pin.

Ok let me not ramble on. It was not really important to me, as I never had an instance of such problems in 35 years, until I started to offer a service to owners. Then I saw it! Rammed down my throat, pushed up my nose etc! Please remember that the very first part of my usual service is to strip, measure all relevant components, define the wear / damage and demonstrate its cause. I have never believed in the concept of "should be good enough" I need to know that all components are accurate so that I can look a customer straight in the eye and tell him his engine is definitely good, not just that I hope it is!

It is quite clear that Shipley bored their rod little ends, both in parent metal and bush.

Matt obviously did not bore the rod LE parent metal, as the finish is very significantly degraded.

Matt did bore the bushes in situ as when I have checked unused examples, these were acceptable.

It is quite possible to bore a little end on a lathe, but however you choose to do it, let me, with greatest and kindly respect, suggest that you check the finished items before installing them.

You have a lathe. Put a piece of bar in the chuck and turn it till it will just go in the little end bush. (Even if your chuck is not true, the turned bar will be true)

Rotate the chuck by hand so the rod big end passes a clock on the side of the toolpost at about mid point to check for twist.

Now, with the clock in the centre of the big end area, run the clock in and out to check that the sides of the rod big end are true.

If you choose to rework your little ends on the "Take pot luck" basis, then if you check them in this way before use and carefully record any deviations, then you can monitor them in use.

This sort of problem is not unusual. I have a nice 250 OHC MM of 1955 that I bought some years back.

The factory shut in 1957, so there was no technical support.

It broke its crankpin, so I stripped it, only to find that it had broken before and a very poor substitute made from mild steel on a lathe and hardened but not ground. It had stripped off the hard threads and damaged the cases and wrecked the dynamo.

I was extremely lucky to have the plant and knowledge of how to utilise it, so as to effect a proper repair and rebuild.

When a factory closes and there is no longer the full technical and plant resources available, then folks must do the best they can with what they have available.

One last point. Every inaccuracy between moving parts that causes friction eats power. We take great care to get good torque and power from our engine, but having got it, we try our very best not to waste it before to gets on the road.

I send my most kind regards

Roger Moss

ps give me a ring if you need help

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Last edited by Roger Moss on Tue Jan 03, 2006 9:25 pm; edited 2 times in total

Back to top

dave bushell

Joined: 09 Jun 2004

Posts: 112

Location: Caterham, Surrey

Posted: Tue Jan 03, 2006 8:56 pm

Post subject:

Page 6

Thank you for your latest input Roger - you must be losing your touch - you didn't frighten me half as much this time!
The method you mention, seems to me, to be a simple an effective way to check relative alignments of the big and little ends, and will be a method that I will employ in the future.

Regards
Dave

Back to top

efr215

Joined: 06 Nov 2004
Posts: 80

Posted: Thu Feb 02, 2006 9:15 pm Post subject:

Has anybody any thoughts, experience or opinions on roller burnishing as a finishing process for small-end bushes? Given that the process will tend to compress the surface of the bush and smooth out machining marks it seems attractive.

Back to top

Roger Moss

Joined: 31 May 2004
Posts: 242

Location: Leicester UK

Posted: Sat Feb 04, 2006 12:13 am Post subject: Roller burnishing

First, roller burnishing is a method of compacting a ductile material and if you want a compacted polished type finish, then it is a viable process.

I have noticed that some late Scott rods were made with a little end bush made from copper bronze. This material is quite soft and ductile and the gudgeon pin soon compacts the surface of the bush to a polished finish.

Now there is no hiding place for the oil and the result is that heat is generated from metal to metal contact with insufficient oil.

Years ago there was a myth that if you rebored an engine, you could also hone it to a mirror finish. This was proved wrong decades ago and much of the long life of current engine bores is because the bore is textured to hold oil. I use a course "Flexhone" to produce an oil retaining texture on the walls of the bore. The same principle applies to the little end bush.

There could be a great debate about what grade of bronze to use. I use aluminium bronze which is quite tough, but I semi finish it, then put in oil grooves to help spread the oil round the bush, then use a medium grit hone to take out the last thou and ensure correct fit to pin. Remember, if you make it too close a fit, you will again deny oil a good access and you will have overheating and accelerated wear.

I was involved with the design and manufacture of a very accurate transfer machine for Ford some years ago with my colleague John Underhill. That utilised roller burnishing very successfully. The technique does however need a good lubricant for production reliability

Small End Bushes.txt