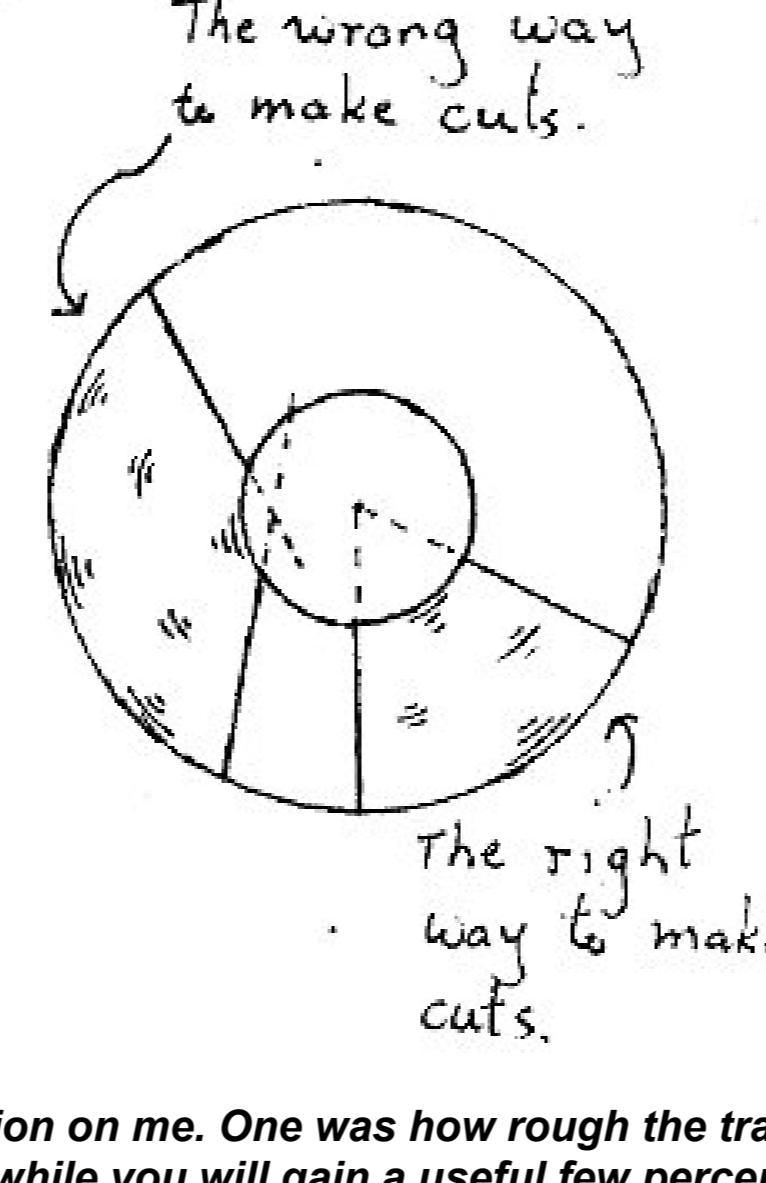


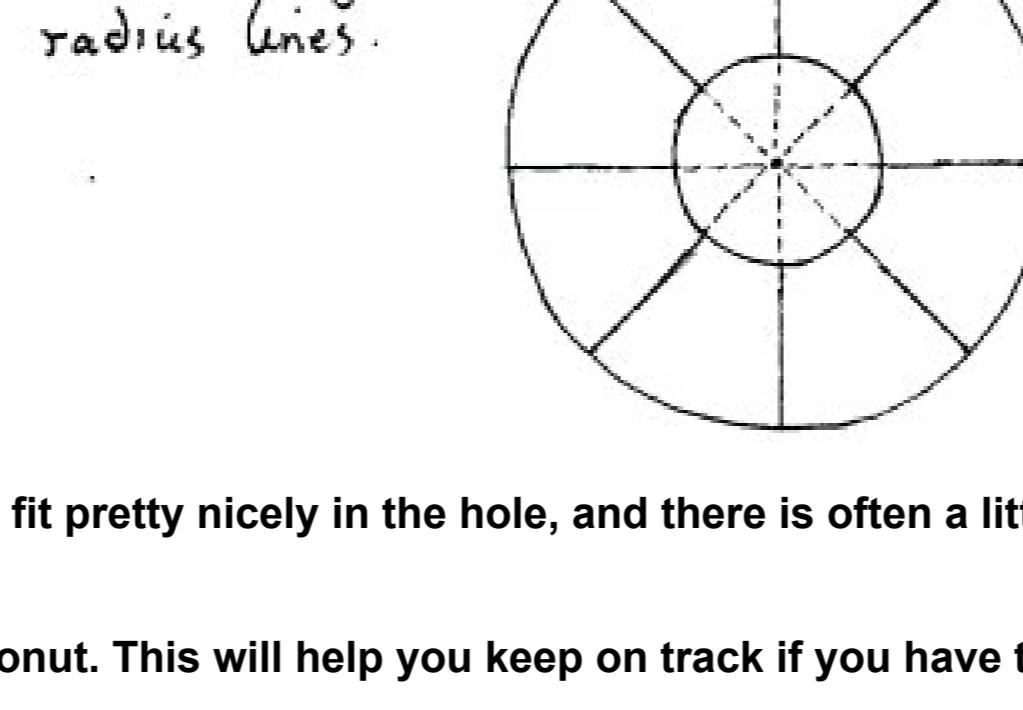
## BACK TO THE HEADER PIPE

I have seen people get in all sorts of a muddle cutting up a donut. If the cut does not go right across the centre of the circle formed by the donut, you get an oval shaped opening that does not match up well, and you get a variation in section where you don't want one.



On the subject of inaccuracy; I have drawn up pipe designs for people. Two things made an impression on me. One was how rough the translation of the design into metal often was, but the second was how surprisingly well some of these pipes seemed to perform despite the indifferent execution of the design. The point being that, while you will gain a useful few percent in performance by being meticulous, you seem to have to make a total botch of a pipe for it to work really badly. So get the pipes made and get racing. You will inevitably want to make a better set further down the track!

But back to cutting donuts: you need to find the centre of the donut with reasonable accuracy. I set a compass to the radius of the inside of the donut's bend, scribe the circle on a suitable piece of wood and cut it out on my bandsaw. I then put the circle of wood into the hole in the donut and scribe my cutting lines through the centre which is now nice and obvious.



However, I have also found that the circular lids of plastic jars sometimes come in sizes that fit pretty nicely in the hole, and there is often a little mark in their centres. This of course saves time and suggests that God and people who make jam are favourably disposed toward people who build motorcycles.

I suggest that you use a protractor to scribe lines at 10 or 20 degree intervals around your donut. This will help you keep on track if you have to trim a bit off after you have cut the donut into pieces.

At this stage my advice is going to get a bit nebulous because I don't know whether you are going to bend your pipes all over the place, or go with a less demanding option.

Anyhow, here goes:

\*\* tape the three sections of your chambers together with masking tape or some other sticky tape.

\*\* hold the chambers up underneath the motor both with the back wheel in and with it out.

I am assuming that you have trimmed all the brackets and other vestiges of road bike off already. There are the heads of bungs and other things protruding down under the gearbox on the right hand side as well. You may also need to take this into account.

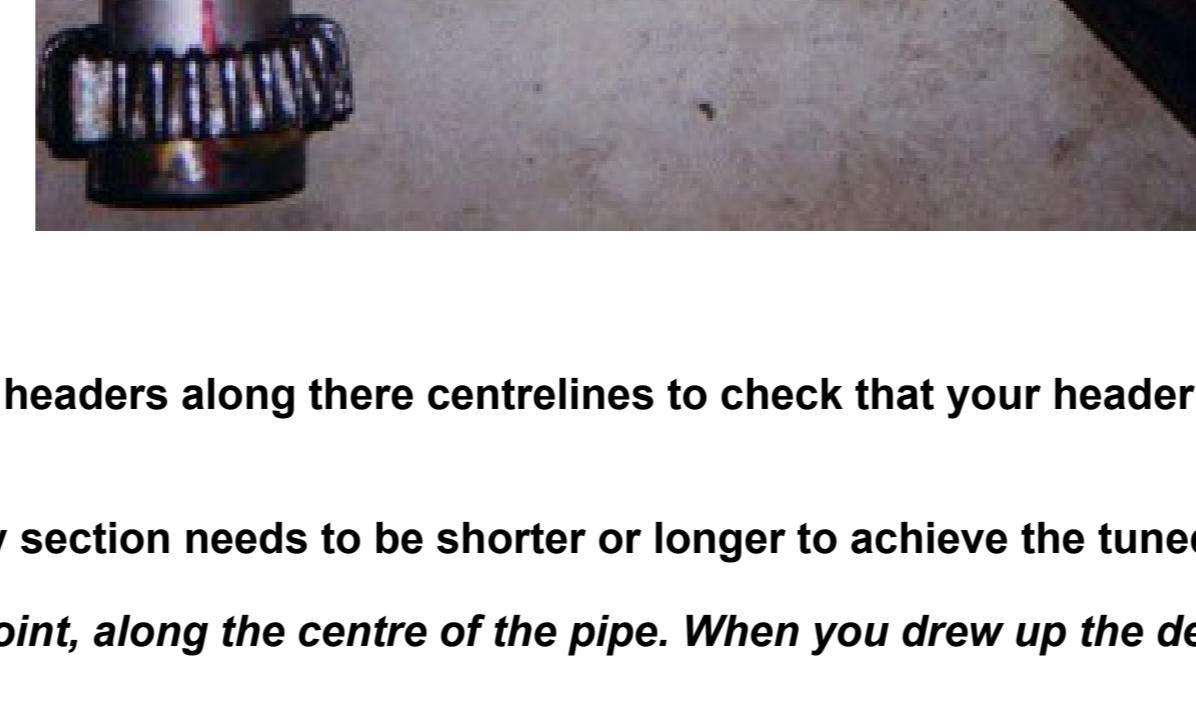
\*\*once you have decided where you are going to place your chambers (this depends to some extent on what amount of sectioning and rewelding you are prepared to undertake) I suggest that you tape or wire them in place temporarily.

If you can visualise where they will go accurately, ignore this previous advice, but be warned that things can get awfully out of shape if you haven't done this sort of thing before.

\*\*now you can start to work out where the the headers will run, what bends you need and what straight pieces you need. "TTCO" and leave a bit to spare if you are not sure about anything.

\*\*as you cut things, you can tape them together. Eventually, you will be able to bolt the taped up headers onto the barrels and see what you have got.

It's a good idea to tape parts of your pipe together at every stage to see how they fit on the bike.

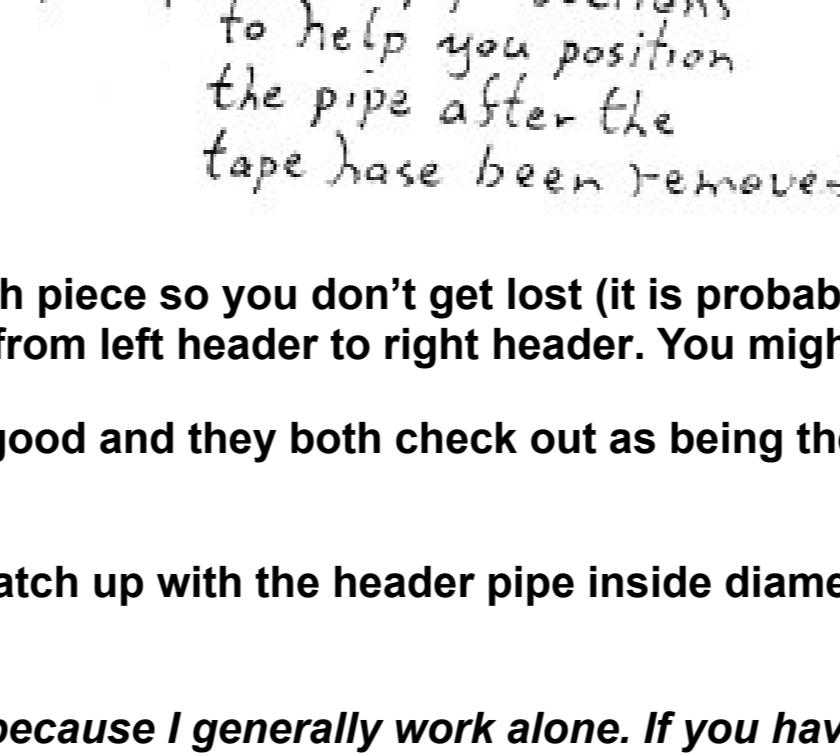


\*\*When you are satisfied that it will all fit, you should roughly measure the length of the headers along there centrelines to check that your header length is not too far outside the limits for the pipe design you are using. We will have a look at doing this a bit more accurately soon.

\*\*once you know the header length you will begin to have some idea of whether the belly section needs to be shorter or longer to achieve the tuned length required.

Keep in mind that the tuned length is from the piston face to the mean wave reflection point, along the centre of the pipe. When you drew up the design you will have marked this in (I hope!) but locating this point inside the baffle cone can be a bit of a chore. More about this later.

\*\*draw two felt pen lines from metal to metal across the tape that is holding your header pipe together, this will help you find the relationships again when you tack weld the pieces of donut and pipe together. If you use two colours, you won't get them 180 degrees out by accident!



\*\*as you peel each piece of tape off, extend the felt pen lines so that they join up, and number each piece so you don't get lost (it is probably 2 am by now and the once sharp intellect can get fuzzy after 10 cups of coffee and not much sleep). I also suggest that you un-tape and weld one header at a time so the pieces don't migrate from left header to right header. You might not be that dumb, but I have been!

\*\*tack weld the pieces together then bolt them to see how things are going. If it the headers look good and they both check out as being the same length, weld them up now, but if you are not sure about anything stick with the tack welds for now. Then with a few hacksaw cuts through the tacks you can make adjustments.

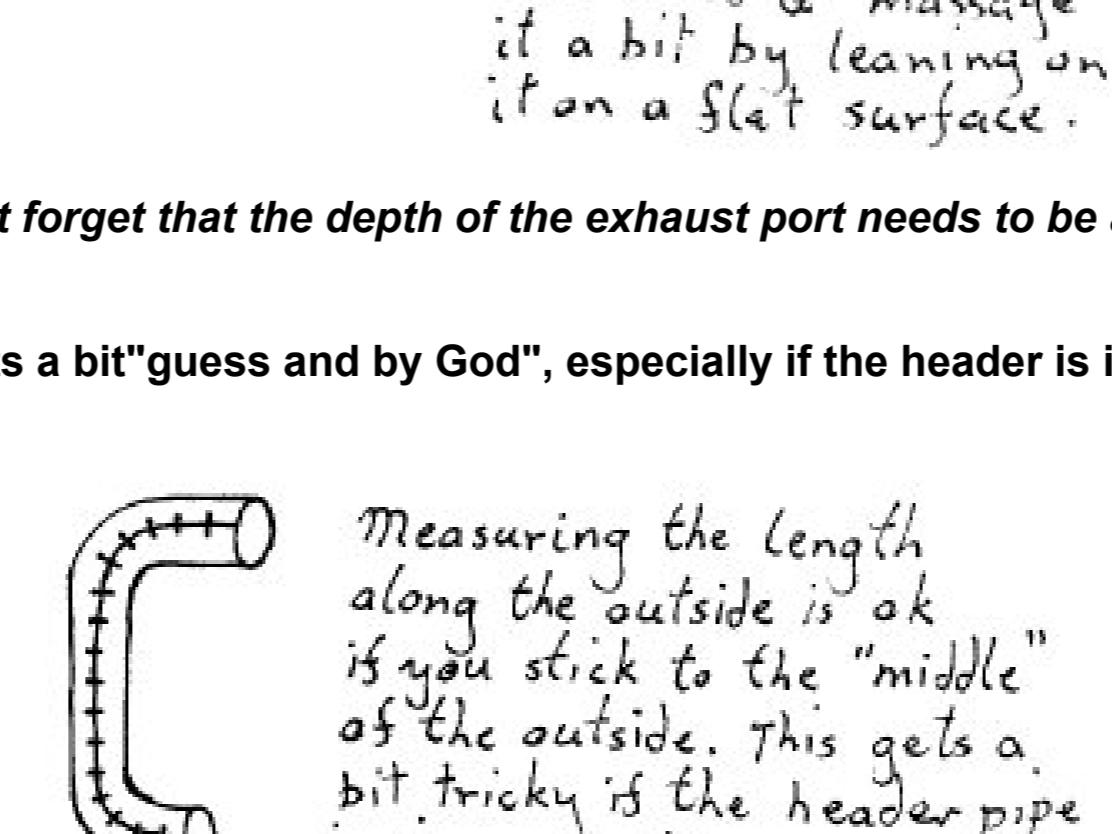
\*\* now do a final trim of the header pipe ends of the diffuser cones so that the inside diameters match up with the header pipe inside diameters. Check that it all fits again and make your felt pen marks to help you line things up for welding.

You will have noticed that I use a lot of things like string wire and tape to position things. This is because I generally work alone. If you have the luxury of an assistant to hold things in place, you can probably shortcut a lot of this. For example, you could get someone to hold the diffuser in place under the bike while you tack it to the header.

\*\* trim the outlets of the diffusers to fit the diameter of the belly sections, then stand them on end and measure their length by plumbing the centre line with tape or ruler. Don't worry if they are not exactly the same length, just write the length on them in felt pen. There is a way to compensate for small differences.

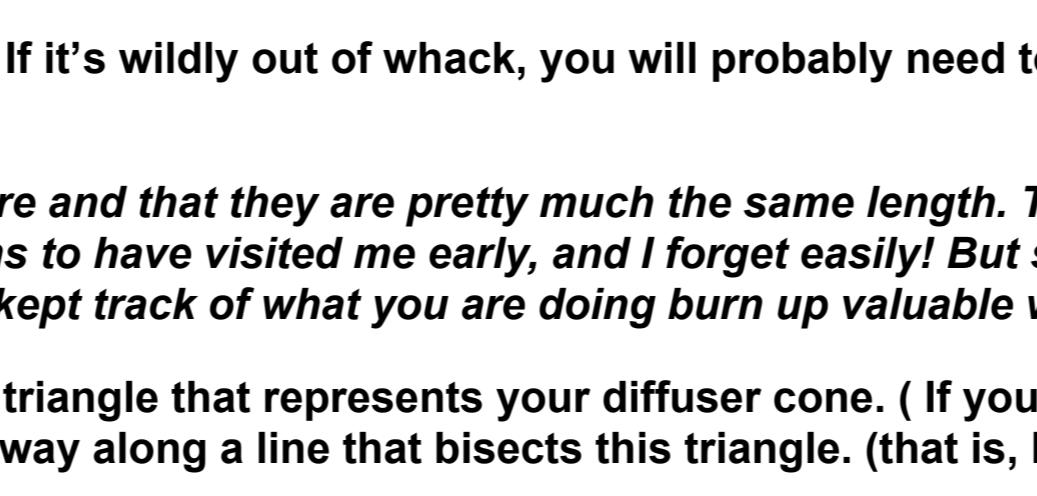
\*\*tack weld the belly sections on.

Incidentally, your chamber sections will often come out a bit pear shaped around the seam welds. Ideally you should put the cones and the belly section on the beak of an anvil and strike them flat with a hammer. You probably don't have an anvil, so put a solid lump of pipe in the vice, slip the sections over it and strike the welds flat on the pipe. This will usually go a fair way to solving the pear shaped problem. You will also often find that the sections go together better if the seam welds are lined up with each other. This also means that all the seams can be positioned where they don't show (unless you can do welds that you want people to admire, of course).



\*\* now to the thorny question of getting the tuned length somewhere about right - and don't forget that the depth of the exhaust port needs to be added to the length of the header pipe. (That tuning book that you read will have explained about this.)

\*\*draw a felt pen line along the centre of the outside of the header pipe. Yes, I know this gets a bit "guess and by God", especially if the header is in more than one plane, but its near enough and believe me you won't want to know about the other ways of doing it!

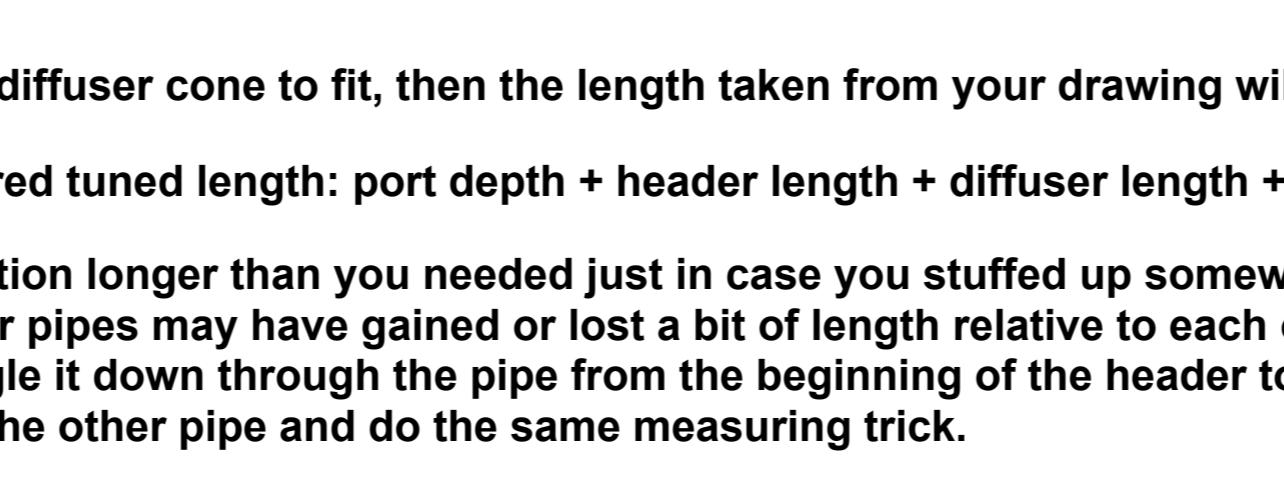


\*\*Now use dividers set at a small distance (1cm or 1/2 an inch will do and you can just use a ruler if you don't have dividers) to step out the length of the header along the line you have drawn. Both headers should come out as near as dammit the same if you have worked carefully and matched everything up as you went along.

But this is your first effort at this sort of thing, right? So don't panic if they are a little bit out. If it's wildly out of whack, you will probably need to go back and adjust one of the pipes anyhow, because they probably won't fit properly. On the positive side, this is a good thing to know before you get in deeper!

You have already plumbed the lengths of the diffuser cones, so you know what length they are and that they are pretty much the same length. The lengths of the belly sections are easy to measure because the walls are parallel. I usually write the lengths on the headers and other sections with felt pen because Dr Alzheimer seems to have visited me early, and I forget easily! But seriously, a lot of us have to get our bike work done in time that is stolen from Morpheus, because the rest of our lives belong to work, wives and kids. Stuff-ups because you haven't kept track of what you are doing burn up valuable workshop time. You do need to be a bit careful.

\*\*on the drawing (full size or scale) that you did when you planned your pipe, you will have a triangle that represents your diffuser cone. (If you haven't extended this out to a point, you should do this). The mean reflection point, which represents the end of your exhaust system for tuning purposes, is generally taken to be half way along a line that bisects this triangle. (that is, half way up the centre line of the cone) You can measure the length to this half way point on your drawing (don't forget to scale it up if necessary).



If the diameter of the belly section pretty well matches your drawing, and you trim the diffuser cone to fit, then the length taken from your drawing will be the will be pretty well right.

So now you can add the lengths to see if your system matches your desired tuned length: port depth + header length + diffuser length + belly section length + depth of baffle cone to the mean reflection point.

• REMEMBER THAT IT SHOULD BE TOO LONG because you made your belly section longer than you needed just in case you stuffed up somewhere! So now you can trim the belly section back till you get the right length. • now a sneaky little trick! Somewhere along the line it is highly possible that your pipes may have gained or lost a bit of length relative to each other, and because the T500 is a twin, we don't want this to happen. Sneak back into the house and pinch the dressmaker's measuring tape out of the sewing box. Wriggle it down through the pipe from the beginning of the header to the end of the belly section. Pull it tight and mark with your trusty felt pen where it enters and exits. Note this length. Now mark the same exit and entry points on the other pipe and do the same measuring trick.

This is NOT the length of the pipe along its centre line but it will tell how much variation in length between your two pipes there is.

\*\* trim the belly sections so that both pipes are the right length to weld up to the baffle cones and, even though there may be some accumulative variations in the pipes, they will be acceptably close to the same specified length.

\*\* if you're happy with everything, weld it all up and if you've decided on the bend-it-all-over-the-place route, go and get some sleep. You'll need to be wide awake for that part of the exercise.