

MAKING STEEL BRAIDED BRAKE LINES FOR THE VIRAGO

For brake lines, I use Goodridge components. I'm sure other makes (e.g. Galfer) are fine but I have a local source for Goodridge parts by way of an auto racing parts house nearby, so that's what I use and what we'll talk about. I do think you save a bit of money doing the lines yourself, as opposed to buying them ready made, but still the components are not cheap. You are looking for:

- Dash 3 600 line with a flexible plastic coating at around \$6.50 a foot. You may have a choice of colors. I generally use "clear".
- Six Banjo Line Ends at close to \$10 a piece (to make the three lines needed for double disk front brakes)
- A few extra "olives" to practice with and in case you mess up

You need to look at the banjos you have on your bike and buy ones that have the closest bend to them. Some of the ends on Virago lines are straight or very close, and the others have a bend. You may not be able to find Goodridge banjos with exactly the same bend, but close should be fine. These days I think Goodridge makes straights, 20 degree, and 45 degree banjos. You might check your supplier to confirm this. For a very mild bend (less than 20 degrees) in a stock banjo, you can probably use a straight banjo. You do not need any "side bend" banjos. The banjo in my picture is a 45 degree one.

Checking my 1985 1000 Virago, I used:

- A straight banjo at the master cylinder (but I have flat bars and you may need a different one)
- A straight banjo to the splitter
- Two 20 degree banjos from the splitter going down (to flair out the lines)
- And two straight banjos at the calipers.

Banjoes consist of three parts:

1. The banjo itself.
2. An "olive" which makes the seal (we'll see how this works later).
3. And a collar which threads onto the banjo to secure it onto the brake line and complete the seal.

Steel Braided Brake Line we will use consists of:

1. The bore tube—the plastic tube that the brake fluid runs in.
2. The steel braided sheath that surrounds it.
3. The outside soft plastic sheath that protects the steel braid.

MAKING THE LINES

1. First thing you do is cut a section of brake line to the length you want it. I generally try to duplicate the length of the stock line, keeping in mind that the banjo ends add length. To cut the line, tape in tightly with a piece of masking tape. Then cut it with a fine hack saw or some other method. The one I like to use is a Dremel tool with a fine cutting disk on it. You are cutting steel braid here, in addition to the outer plastic and the inner bore tube. Wear safety glasses since bits of braid can come flying off when using a Dremel. Cut the line at right angles, and once the cut is made be sure the bore tube end is neat and clean. Tidy things up with a razor blade if needed, and nip off any bits of steel braid that are sticking out beyond the end.

2. Now remove the tape. Take a razor blade or equivalent, and strip (cut) the outer plastic coating back, say an inch and a half, so you have the steel braid showing.

3. You are now ready to push on the collar, thread end to the outside. Don't just press straight in. Start at a slight angle and sort of twist the line through. *The thing to watch here is that once you remove the tape from the line and cut back the plastic coating, the steel braid will have a tendency to spread. If it spreads too much you'll play hell getting the line to fit through the collar. If this happens, you may have to re-cut the line and try again..*

4. Once you have the collar on, you now spread the steel braid out to where the olive can be pressed onto the bore tube. (They make a tool to do this, which is very handy, but not absolutely necessary. You can spread it with some sort of small tool.) Once the braid is spread, start the olive onto the bore tube. The tapered side goes on first. Now hold the line and press the olive firmly against some surface (work bench) to push it on *until bore tube seats all the way up in its channel inside the olive*. You can check this by looking into the olive. You'll see the bore tube coming up and it needs to come all the way until it seats. If you have trouble with this, pull off the olive and spread the braid a bit more.

5. Now take the banjo and press the long nipple through the olive into the inside of the bore tube, until the banjo is flush with the olive. You are now ready to lock it all together with the collar. Push the collar over the steel braid so that it can be started onto the banjo threads.

6. How tight is tight? Before you start tightening the collar down, do this: Take a loose banjo, put on the olive, and screw the collar down by hand until it seats. It will seat with roughly 1 ½ threads showing. *That is what you are shooting for when you tighten collars. 2 threads or a little more will be O.K., but don't go tighter than 1 ½ since you start to crush the olive at that point.*

7. Now place the banjo in a vice with soft faces (so the mating surfaces don't get scratched or marred) and tighten the collar with a suitable wrench. As the collar takes up, you will find that the line starts to turn with it. Tighten it until you have 1½ threads, or a little more, showing.

8. The first end is easy to build. You just tighten the collar down as noted above. *(If you have a line with one curved end and one straight end, **install the straight end first***. Also, if you plan to use heat shrink tube, or any other tube over the line, *now is the time to get the material on, because it won't fit over a banjo. Once you have both ends on, you're stuck*). But the second banjo is tricky, because the surface that the second banjo needs to mate up against *will not be in the same plane* as the first surface. (For example the master cylinder joint and the splitter joint). So the second end has to be turned just right to lie flat at its mating joint without any tension in the line. This is called "clocking". Steel brake lines don't have a lot of "give" and won't twist easily. *You want your banjos lie flat against their mating surfaces without any stress in the line at all.*

9. Clocking can be tedious, because not only do you need to get the correct orientation of the banjos, but also you need to wind up at roughly 1 ½ (or a little more) threads showing on this last banjo end that you are working on. I used to do this procedure on the bench, but I "clocked" the last lines I built right on the bike, and it was much simpler and easier.

10. To review, you now have one end (the straight end if you have one) which has been fully tightened to around 1 ½ or 2 threads showing. That is, fully "built". This end you leave free. Now prepare the other end for final tightening and thread the collar onto the banjo a few turns by hand or with a wrench. If you use a vise to hold the banjo, *be careful to protect the banjo mating surfaces from getting marred.*

11. Next, bolt this last end in place on the bike with the banjo bolt and washers. Now as you continue to tighten this end down, the fully built "free end" is the one that turns, and you turn it slowly and *carefully* it lies flat on the seat it will attach to. That is, get a tension free mating of the surfaces. If this free end is a straight end, you can achieve a flat "seat" every 180 degrees. But if it a curved end, you'll need to turn up to 360 degrees to get a seat. Once you get your flat seat (tension free mating of the banjo end to the caliper, master

cylinder or splitter surface), have a look at your thread count. If it is too high you may need to go around once more and until you achieve the proper mating again. To repeat, you are trying to achieve a thread count on that final (bolted up) end of the line at around 1 and 1/2 or 2 threads while at the same time achieving a proper mating of the “free” end--flat and tension free. Sometimes it's a judgment call whether to go another turn. (You'll need to observe and get a feel for how many threads a 360 turn eats up—see “Practice”, below. If you figure another turn will take you too tight in thread count, you can probably get away with a little more than 2 threads.

11. A final factor that makes this clocking tricky is: *you can't turn back if you go too far*. If you go too far (less than 1 ½ threads), you have to unscrew the collar all the way and start fresh with a new olive! That's what a few extra olives are for.

12. In the final step you remove the finished line and heat up that shrink wrap to complete the installation. A good brake line will line up dead flat at its mating surfaces and have 1 ½ -2 threads showing on each end (or a tad more). I've never had one leak.

PRACTICE

If the above description sounds a little daunting, it really isn't that tough. What you need to do is cut a short piece of line and practice the cutting, the collar placement, spreading, olive placement, and tightening sequence once or twice so you get a feel of it. A few extra olives allow you to do this, plus serve as backup in case you over tighten a banjo end. As noted above you can hold the banjo in a vise, but protect it from marring. Once you have the hang of it, go ahead and build your lines.

A NOTE ON BANJOS AND WASHERS

The stock brake lines on your Virago will have banjos that are slightly thicker than the Goodridge ones, but the stock banjo bolts and stock washers can be use with no problem. Get a few new washers (12) while you are buying your parts. For you ultra perfectionists: you can get washers of different thicknesses and a slightly thicker one between the banjo and the seat would position your Goodridge banjo about the same as the stock banjo. Not required, tho.

BEFORE RIDING

Always bleed your brakes and test them before riding. Bubbles at the master cylinder can be purged by removing the master cylinder, holding it vertically and working the brake lever.

PICTURES

Hopefully the attached pictures will put all this in better perspective.