

EXHAUST PIPES

The exhaust pipes I've used on both street and race versions of my XS750s have all been copies of the pipes created by tuners who have been successful with these engines.

Every really accomplished tuner used the same basic approaches when designing an exhaust system for high performance, four stroke twins. I'm sure some guys were applying gas dynamic theory to their efforts, but mostly it was a cut and try effort combined with routing the pipes so they would miss the rider's legs and feet and fit on the bike. Eventually, everyone wound up in essentially the same place. Once again, in the dirt track wars played out over the '60s and '70s tuners simply went with what worked, and the best stuff rose to the top. Whether they were building BSA, Norton, Yamaha, Harley or Triumph engines, in the end the exhaust solutions all pretty much looked the same because the engine characteristics were very similar among the competing brands.

The tuners understood that a correctly dimensioned pipe would take advantage of the exhaust pressure wave and increase intake filling. (For an explanation of exhaust design theory that's actually understandable, see Kevin Cameron's "Sportbike Performance Handbook", Chapter 7) Their selection of the pipe's diameter, length and presence or absence of a megaphone or trumpet all related to other choices they had previously made concerning valve sizes, port profiles, cam characteristics, etc. etc. as well as rider preference and the type of track where they were racing that day. Did they need to broaden the power band slightly? Emphasize off-corner acceleration? Raise or lower the torque curve in the RPM band?

So, what were the best configurations? First of all, 1 5/8" tubing raises gas speed and seems to provide improved mid-range performance. The larger 1 3/4" tubing gives up a bit on the lower end and midrange, but seems to offer an advantage over a wider RPM range and also breathes better at higher RPM. Secondly, the tuners had to decide whether to just cut the pipe off and run it that way or add some form of a trumpet or megaphone at the end.

YAMAHA XS750 EXHAUST PIPES – WHAT WORKS

NOTE: Unless otherwise noted, all tubing is 1 3/4" and all megaphone are 3 1/2" wide. Lengths are measured from the exhaust valve along the centerline of the pipe to the pipe end.

- a) Eddie Atkins found that for his engines a 29" - 30" pipe worked best with a 15" megaphone having a 1" reverse cone
- b) Larry Kirby (who ran a very fast XS750 in AHRMA) used either 29" or 32" pipes – depending upon the track – with a 17" megaphone

- c) Yamaha Race Department XS650 dirt track tuning guide published in 1973 specifies a 29" pipe with a megaphone (which they did not provide dimensions for)
- d) Shell uses a 29" pipe with no megaphone for all forms of flat track and TT. C.R. Axtell recommended the same dimensions for TT competition only. Harry Lillie also used these dimensions for half mile tracks.
- e) Axtell/Yamaha Race Department OU-72 specification sheet published in 1976 specifies a 28 ½" pipe made from 1 ¾" tubing with a 17 ½" megaphone having a 1" reverse cone for half mile and mile tracks
- f) Harry Lillie used a 26" pipe and a 16 ½" open trumpet for mile tracks
- g) Harry used 1 5/8" tubing and a 42" pipe for TT races
- h) Roland Cushway (who tuned Louie Vallerga's Battle of the Twins XS750 winner in the early '80s and was a wrench for Kenny Roberts in Europe) used a 26" pipe followed by a long megaphone – not unlike a Ducati factory meg from the bevel-drive days – measuring 28" and having a ¾" reverse cone
- i) My favorite racing pipe of the many I've run has a 31" pipe and a 15" megaphone having a 1" reverse cone. It seems to run really well everywhere ... good mid range and a nice top end.
- j) I've run the Shell and Lillie TT pipes on the street and they both work well (that was with a 750 ... if you are running a 650 use the 1 5/8" diameter pipes). The Lillie pipes have clearly superior mid-range and partial throttle responsiveness but lose out to the Shell units when the RPM passes 7000. It isn't that the road race exhausts are bad on the street, and they do offer more power on top, but are noticeably less powerful under 5000 RPM or so. Off idle and up to 3500 RPM or so, you can really feel the difference the TT pipes offer in terms of a crisper and more precise throttle response.
- k) Michael Morse has run small diameter TT-like pipes on his AHRMA XS roadracer and having been closely behind him on a number of occasions I can state with authority that his bike really jumps off the corners. Again, these would work great on a street bike (especially a 650 – as noted above the 1 ¾" pipes are too large for a 650), but do lose something at top RPM.

Some tuners have added a cross over pipe that bridges the two pipes. The idea is that this will smooth out power delivery. I don't know if there is a real advantage, but it certainly doesn't seem to detract. Some of Ducati's factory air cooled 750 racers from the '70s had a cross over pipe located just behind the rear cylinder. Those engines regularly revved to over 9000 RPM with their desmo valve gear, so I don't know if we're talking similar circumstances with our XS engines.

Both Supertrapp and Ron Woods (see pg. 25 of their online catalog) make dirt track racing mufflers, and some users claim they actually add power because their designs maximize the exhaust pressure wave. That may be a true statement. I've never been able to do a back-to-back comparison. It is certainly

true that they would add weight, cost and make the bike a lot quieter. At least one of those things may be desirable to your race organization and/or neighbors.

Reversion is a consideration in pipe design. The idea is to have a lip or constriction that will prevent returning exhaust waves from entering the combustion chamber and upsetting the incoming air-fuel charge. Michael Morse at 650Central has some nifty bits for this and some tuners considered this in their exhaust porting schemes. Harry would sometimes incorporate a small step, with the blunt side facing the exhaust pipe, when he contoured the shape of the exhaust port wall. This blunt side would reflect part of the exhaust wave and thereby lessen some of its energy.

Some of the modern technology can apply to the XS650/750. The latest four stroke MX bikes have had a ton of aftermarket development put into them. There are some mufflers on the market that contain the absolutely latest advances in airflow management. For example, some of them have what amounts to a sophisticated megaphone inside the muffler. Each cylinder of the XS has between 325 – 375 cc, and you might consider using two of these MX mufflers for your bike if you need or want to quiet it down. Obviously, the RPM range of those bikes when compared to our XS is wider, but MX bikes must work well in the mid range to be successful, so my instinct is that these would work well for us. If AHRMA ever puts a noise restriction in place, this is where I'll be going to find a solution. There are lots of sources. As one example, White Brothers (recently acquired by Vance & Hines) has several great looking options.

As a final word, Michael Morse at 650 Central told me he is thinking about creating a street exhaust that is optimized for the hot street /Sportbike engine setup described in these pages. It would be optimized to work with the engine's torque curve, be reasonably quiet, include his anti-reversion hardware and give good ground clearance on both sides. I don't know if he's made any progress on this as I write these words, but if you want one I suggest you contact him and keep the pressure up until he at least develops the specs if not the product.

TT PIPES VS. ROAD RACE PIPES

The dyno graphs on the next page are an interesting comparison because they clearly demonstrate how cool TT pipes are on a hot street bike.

From right off idle all the way up to 6000 RPM the TT pipes are noticeably superior. At 6500 they are even, and then past 7000 the power drop off is rapid.

For street performance, when you're riding the torque curve to launch away from a stoplight, playing hooligan and popping a wheelie, or firing out of a corner when you are canyon carving, the TT pipes are flat out better. I raced them at Sears Point once and the bike almost felt like a really powerful, big single: tons of torque and not too much top end. It sure lunged out of the slower corners in a heck of a hurry! On the other hand, if you get into any high-speed stuff, expect to experience the joy of breathing other rider's exhaust fumes.

Harry's TT pipes were constructed from 1 5/8" tubing and measured 42" long from the exhaust valve along the centerline of the pipe to the end. He didn't use any megaphones or similar extraction devices for these pipes.

The particular road race pipes used in this comparison were low (under engine) pipes made from 1 3/4" tubing and measuring 31 1/4" from the exhaust valve to the pipe end. Added to the end were megaphones with the following dimensions: 15" L X 3 1/2" W X 1 1/2" meg opening.

As noted elsewhere, both Shell and Axtell recommended 1 3/4" tubing for their TT pipes and also shared a spec of 29" from exhaust valve to pipe end. The larger tubing on those pipes no doubt fall a bit short on the lower end compared to the 1 5/8", but almost match the road racing pipes over 7000 RPM. They may be the best street compromise if you run a 750. I've run both the Shell and Lillie TT pipes on the street and based upon my inexact seat-of-the-pants dyno, I recall the smaller pipes were more tractable but didn't seem to have the same top end rush as the Shell units. Like anything else with a performance engine, it is always a compromise. Where do you want your power?

TT Pipes vs. Road Race Pipes

